

PATENT SPECIFICATION

564,816



Application Date: March 29, 1943. No. 5042/43.

(Patent of Addition to No. 522,651, dated Dec. 17, 1938)

Complete Specification Accepted: Oct. 13, 1944.

COMPLETE SPECIFICATION

Improvements in or relating to Optical Objectives

- We, KAPELLA LIMITED, a Company registered under the Laws of Great Britain, and ARTHUR WARMISHAM, British Subject, 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:—
- 10 This invention relates to an improvement in or modification of the optical objective for photographic or projection or like purposes described and claimed in British Patent No. 522651. The optical
- 15 objective of such prior Patent comprises two compound dispersive meniscus components with their concave surfaces facing one another, disposed between a front collective component and a pair of rear collective components, the three collective
- 20 components preferably all being simple elements, the refractive indices of the glasses used for the front element of the front compound dispersive component, for
- 25 the rear element of the rear compound dispersive component and for the front member of the pair of rear collective components being greater than 1.63, whilst the two rear collective components each
- 30 have their shallower surfaces facing the front. It is to be understood that the term "front," as herein used, refers to the side of the objective nearer to the longer conjugate and the term "rear" to that nearer the shorter conjugate.
- 35 The present invention has for its object still further to improve the correction of the aberrations of such objective, and to this end according to the invention the
- 40 rear element of the rear compound dispersive component and the front member of the pair of rear collective components are each made of material having mean refractive index between 1.70 and 1.80 and Abbé V number between 50 and 60. The same material is preferably used for both elements and conveniently they are both made of magnesium oxide crystal in the form known as β -magnesium oxide. As in the objective of the prior specification both rear collective components have their shallower surfaces facing the front, and the power of the collective rear component lies between 40% and 70% of the power of the whole objective.
- The radii of curvature of the rear surfaces of the two rear components are preferably both numerically less than 4.0 and greater than 1.5 times the equivalent focal length of the objective. The sum of the numerical values of the radii of curvature of the concave air exposed surfaces of the two compound dispersive components preferably lies between .5 and .7 times the equivalent focal length of the objective.
- A preferred practical example of objective according to the invention is illustrated in the accompanying drawing, and numerical data for such example are given in the following table, in which R_1, R_2, \dots represent 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, D_1, D_2, \dots represent the axial thicknesses of the individual elements, and S_1, S_2, \dots represent the axial air separations between the various components. The tables also give the mean refractive indices n_D for the D-line and the Abbé V numbers of the materials used for the elements.

	Equivalent focal length		1.000	Relative Aperture	
	Radius		Thickness or	Refractive	F/1.5
			Air Separation	Index n_D	Abbé V
					Number.
5	R ₁	+ .8081			
	R ₂	+ 6.163	D ₁	.1086	1.6135
			S ₁	.0020	53.5
10	R ₃	+ .3970	D ₂	.1692	1.6431
	R ₄	+ 7.998	D ₃	.0313	1.67605
	R ₅	+ .2737	S ₂	.2005	32.3
15	R ₆	- .3642	D ₄	.0414	1.608
	R ₇	+ 1.2627	D ₅	.1505	1.7385
20	R ₈	- .5439	S ₃	.0020	
	R ₉	+ 5.063	D ₆	.0576	1.7385
	R ₁₀	- 2.226	S ₄	.0020	53.5
25	R ₁₁	+ 3.367	D ₇	.0495	1.6135
	R ₁₂	- 2.548			59.3

30 In this example, the fourth component and the rear element of the third component are both made of magnesium oxide crystal. The front surfaces R₉ and R₁₁ of the two rear components are shallower than the rear surfaces R₁₀ and R₁₂ thereof, and such rear surfaces both have radii lying between 1.5 and 4.0 times the equivalent focal length of the objective. The power of the rear component is 42% of the equivalent power of the objective. The mean refractive index of the material used for the front element of the front compound dispersive component is greater than 1.63. The numerical sum of the radii R₅ and R₆ amounts to about .64 times the equivalent focal length. The back focal length of the objective is .5714 times the equivalent focal length.

50 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:—

55 1. An improvement in or modification of the optical objective claimed in British Patent No. 522651, wherein the rear element of the rear compound dispersive component and the front member of the pair of rear collective components are each

made of material having mean refractive index between 1.70 and 1.80 and Abbé V number between 50 and 60.

2. An optical objective as claimed in Claim 1, in which the power of the collective rear component lies between 40% and 70% of the equivalent power of the objective.

3. An optical objective as claimed in Claim 1 or Claim 2, in which the radius of curvature of the rear surface of each of the two rear collective components is numerically less than 4.0 and greater than 1.5 times the equivalent focal length of the objective.

4. An optical objective as claimed in Claim 1 or Claim 2 or Claim 3, in which the numerical sum of the radii of curvature of the concave air-exposed surfaces of the two compound dispersive components lies between .5 and .7 times the equivalent focal length of the objective.

5. An optical objective having numerical data substantially in accordance with the table herein set forth.

Dated this 29th day of March, 1943.

PULLINGER & MALET,
Agents for the Applicants.

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

