

PHOTOGRAPHIC OBJECTIVE OF THE TRIPLET TYPE

The invention relates to a photographic objective of the relative aperture 3.5 and the focal length 35mm of the triplet type with rear shutter, which is provided particularly for photographic compact cameras.

There is known from DE 24 24 343 C2 a photo objective of the triplet type with rear shutter, which contains three lens elements of which the front one is a convex positive meniscus lens at the side of the object, the middle lens element is a biconcave lens and the rear lens element is a biconvex cemented element consisting of two elements of opposite refractive power.

From DE-PS 544 329 a photographic objective is known which consists of a divergent lens and a respective collecting lens element arranged in front of it and behind it, of which the lens element at the side of the object is constructed as a cemented element with positive total refractive power. This known objective has a focal length of 100mm; data about the position of the shutter is not present.

There is known from JP-A-59-121014 a wide angle objective of the "Tessar" triplet type with rear shutter, which objective consists of a cemented element of positive total refractive power at the side of the object, a biconcave centre lens element and a biconvex rear element. The objective has a relative aperture of 3.5 and a focal length of 100mm.

The invention is based on the object of stating an extremely compact photographic objective of the category mentioned in the introduction with trimmed monochromatic correction and a reduction in chromatic magnification difference, colour coma and colour astigmatism, which altogether has better imaging properties than known systems of this kind.

According to the invention this object is achieved by a build-up of the objective according to the characterising part of claim 1.

An advantageous embodiment of an objective according to the invention is stated in claim 2.

In the case of objectives according to the invention the compactness is described by the condition (I) set out in claim 1. For correction of the monochromatic image error a high refractive number in the first lens group in accordance with condition (II) of

claim 1 has proved favourable. So that the desired balancing out between the lens surfaces 2 and 7 is achieved with avoidance of image errors of higher order, a large difference $\nu_1 - \nu_2$ according to condition (III) in claim 1 is essential. Finally, the effect of the cemented surface in the first lens group is described by the condition (IV), wherein the last surface 7 is compensated for the error F_2 (chromatic magnification difference) by this cemented surface. In addition, a stress relief of the second lens element is thus produced, so that a larger ν -value and a lower refractive number suffice here, which has a positive effect on the Petzval sum. Moreover, a reduction in the surface element coefficients of third-order is achieved, which favourably influences the monochromatic and chromatic image errors of higher order.

The invention is explained in more detail by reference to the drawing, in which:

Fig. 1 shows a sectional view of an objective according to the invention,

Figs. 2A-D show the correction state of the objective according to the invention with the data set out in claim 2.

Apart from the numeric data set out in claim 2 the objective according to the invention has the following paraxial data:

f' = 33.6323
 S' = 26.7165
 β_{ap}' = 0.7290
 SS' = 10.800
 Z' = 1.2000

wherein

S' signifies the intercept length,
 f' signifies the focal length,
 β_{ap}' signifies the pupillary magnification of the exit pupil,
 SS' signifies the constructional length between the first and the last lens apex, and
 Z' signifies the spacing of the rear shutter from the last lens apex.

Resulting from the correction curves is that the objective according to the invention exhibits, with extremely compact build-up

notwithstanding use of a rear shutter, a favourable monochromatic correction, particularly an exceptional reduction in chromatic magnification difference, colour coma and colour astigmatism.

It is understood that the numeric data can vary with the scope of customary variations.

Patent Claims

1. Photographic objective of the relative aperture 3.5 of triplet type with a rear shutter, consisting of a cemented element (L_1, L_2) of positive total refractive power at the side of the object, a biconcave centre lens element (L_3) and a biconvex rear element (L_4), wherein the ratio of the constructional length to the intercept length of the objective is smaller than 0.6 and the refractive number n_e and the difference of the Abbe number ν_e of the lens elements L_1, L_2 are relatively large, characterised in that the lens system in the case of a focal length of 35mm fulfills the condition

$$0.7 \times F_2(7) < F_2(2) < 1.3 \times F_2(7),$$

in which

$F_2(2,7)$ = Seidel values for the chromatic magnification difference of the lens elements with the lens surfaces 2 and 7.

2. Photographic objective according to claim 1, characterised by the following numeric data:

	r	d	n_e	ν
1	11.0297	2.7300	1.808109	46.34
2	39.1519	2.0219	1.812640	25.23
3	19.1519	0.7000		
4	-40.8013	1.0051	1.652230	33.57
5	10.4692	0.8000		
6	20.7116	3.5430	1.716700	42.89
7	-24.0136	1.2000		
8	shutter	24.5165		

wherein

- $r(1-7)$ signify the radii of curvature of the individual lens surfaces 1 to 7,
- $d(1-8)$ signify the spacings and thicknesses of the same,
- $n(1,2,4,6)$ signify the refractive index of the lens elements with the lens surfaces 1, 2, 4, 6, and
- $\nu(1,2,4,6)$ signify the corresponding Abbe numbers.

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ABSTRACT

The objective, which is provided for photographic compact cameras, of the relative aperture 3.5 and the focal length 35mm is of the triplet type with rear shutter, wherein the lens element (L_1 , L_2) at the side of the object is constructed as cemented element. Four conditions are stated for attainment of an extremely compact constructional form and a trimmed monochromatic correction as well as a reduction in chromatic magnification difference, colour coma and colour astigmatism.

FIGURE 1.

Fig.1

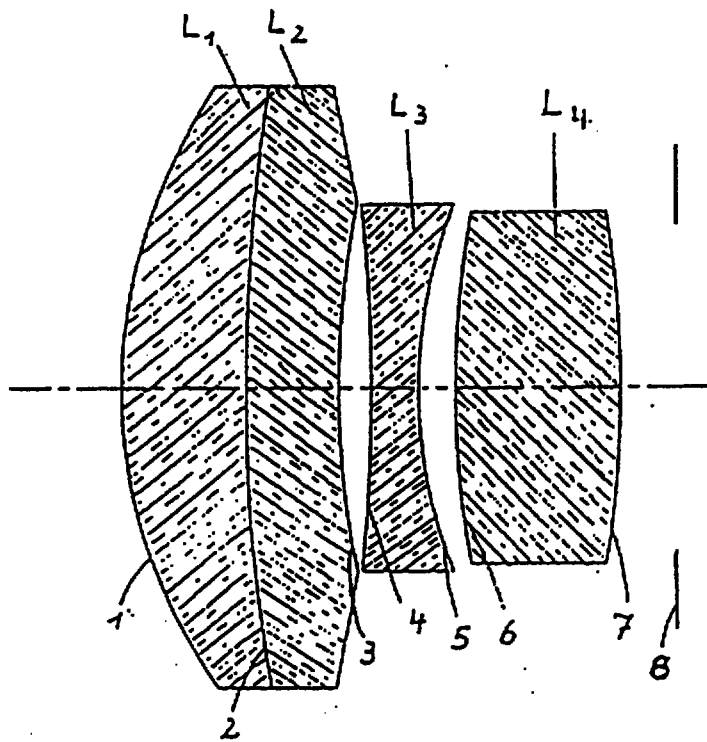


Fig. 2a

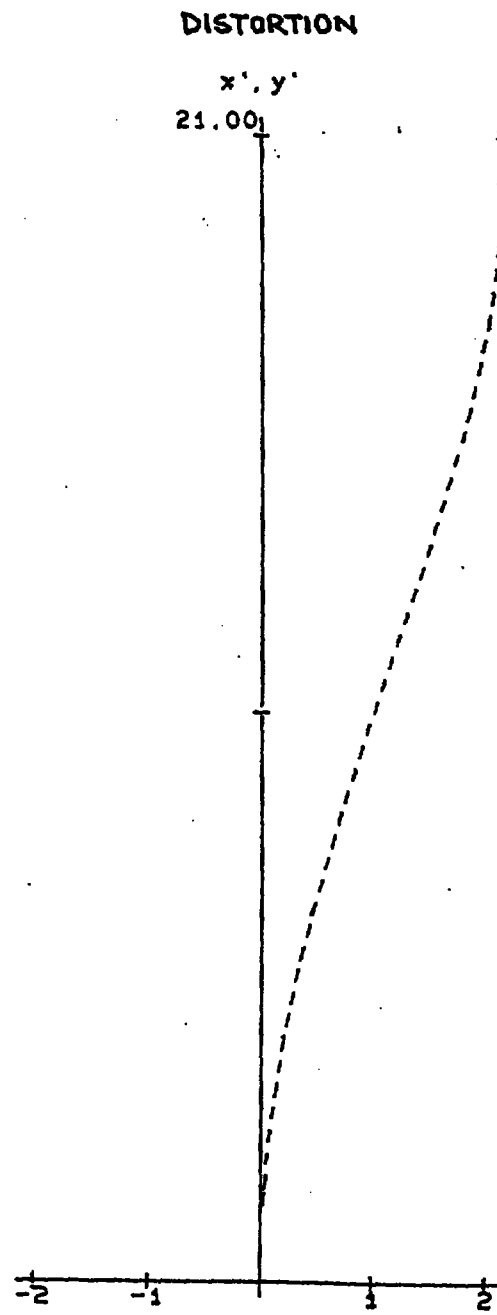


Fig.2b

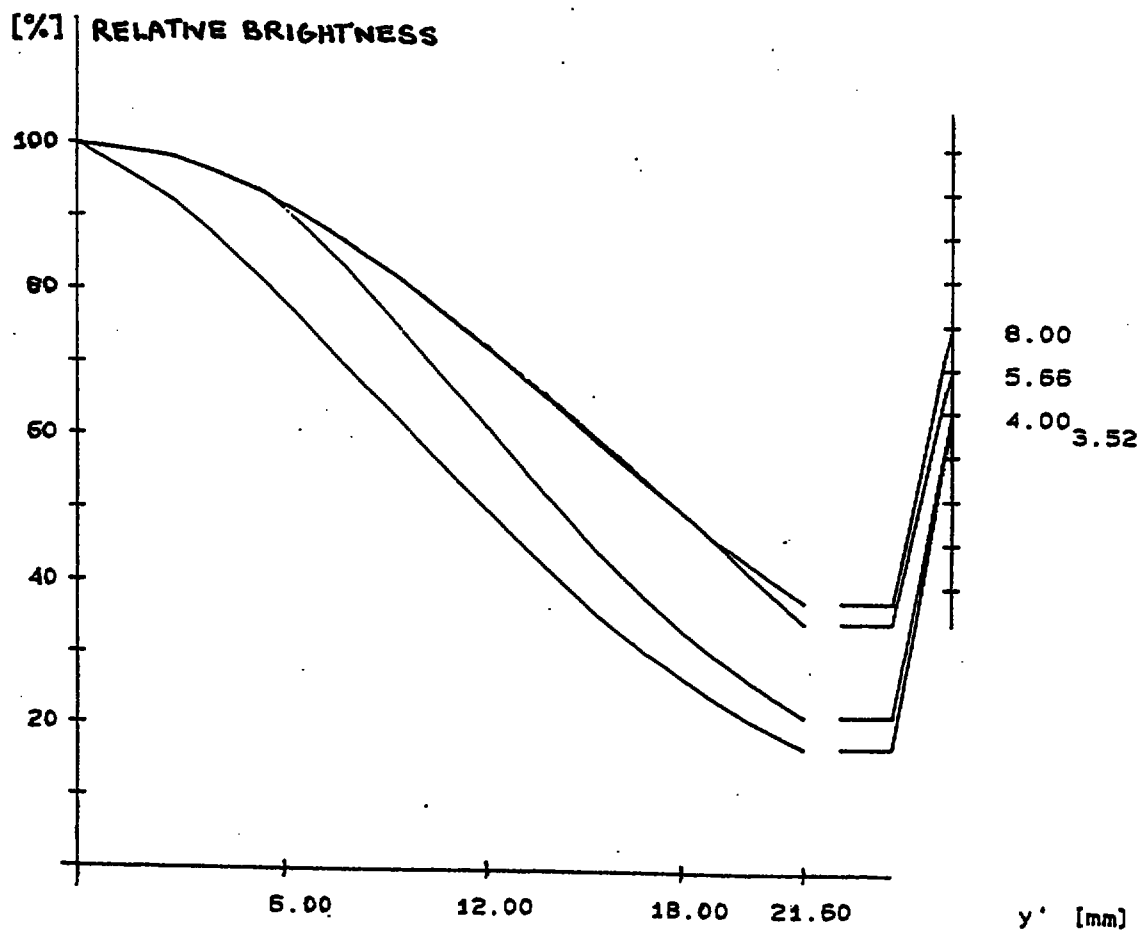


Fig. 2c

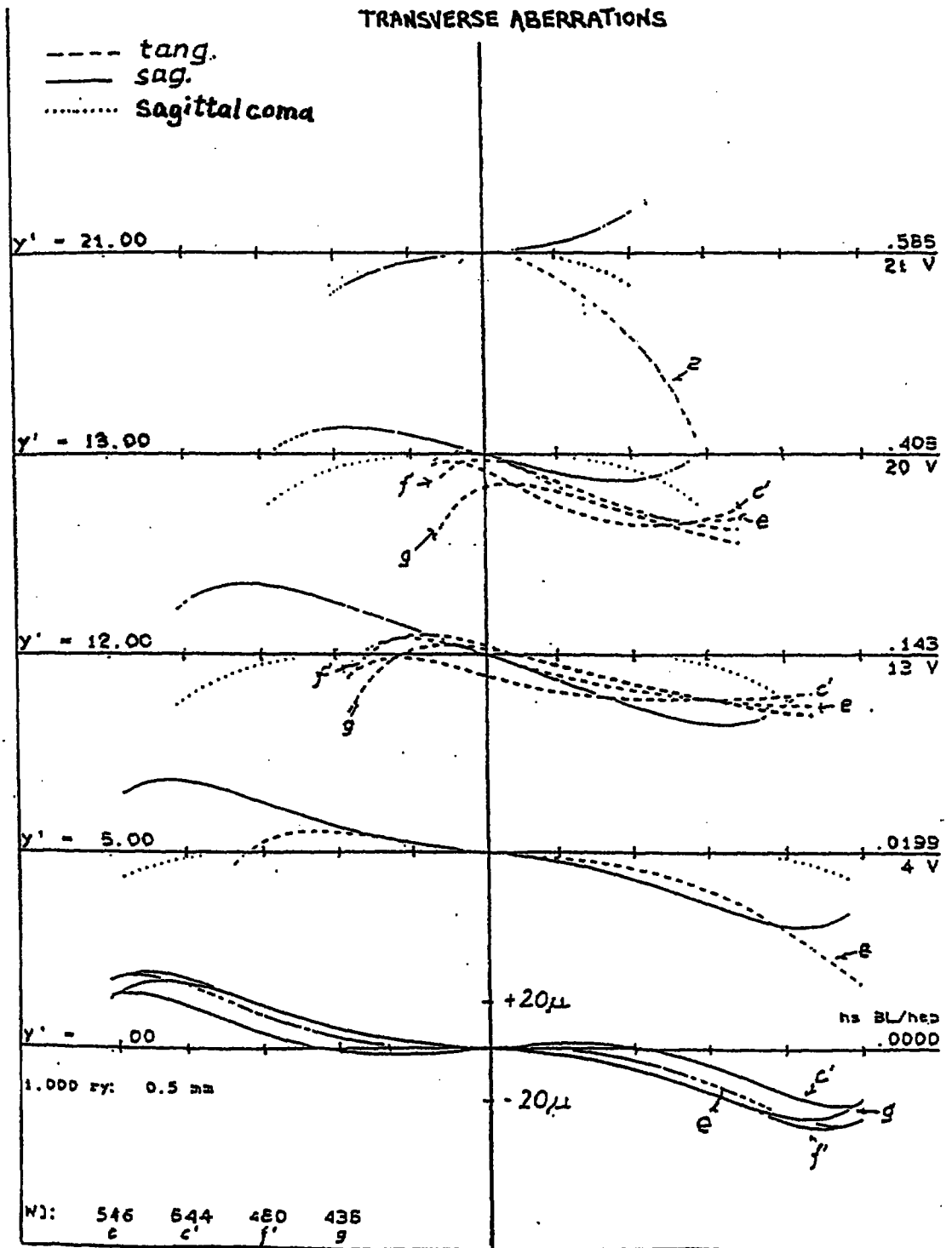


Fig. 2d

