TOPAR LENS 1 : 4/f = 210 mm for 18 × 18 cm AERIAL CAMERAS

by Dr. Robert Richter, Zeiss-Opton, Oberkochen, Germany.

Zeiss' first new creation after the war in the field of photogrammetric survey objectives has now reached a stage of completion that we may venture a forecast on the results that can be obtained with this objective.

This lens is the *Topar* 1 : 4/f = 210 mm for a picture size of 180 × 180 mm. The objective has been developed by the author in collaboration with Mr. F. Koch on the principles of the Topogon lens in an effort to replace the pre-war objectives

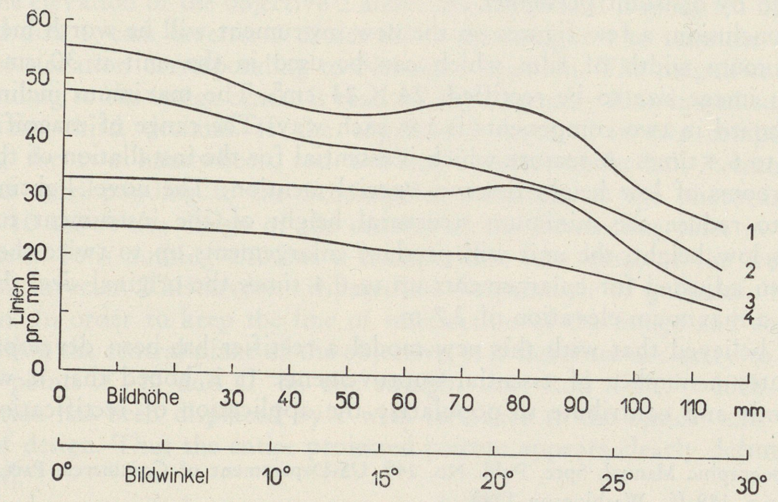

Fig. 1

Resolving power of Topar 1 : 4/f = 210 mm for grid test at full aperture, in lines per mm.

1. K = 1.6 Perulith Pan without filter
2. K = 1.6 Aviphot Pan 30° Sch. Filter D
3. K = 0.25 Perulith Pan without filter
4. K = 0.25 Aviphot Pan 30° Sch. Filter D

by a better one. The results are up to our expectations; it has been possible to reduce all image errors discussed in the theory of geometrical optics to two fifths of the former values. In particular, this applies to spherical aberration, curvature of the image field, and distortion. The decisive test at the photographic laboratory of Zeiss-Opton was performed by Dr. H. Sauer.

It is a well-known fact that we have always declined to give data on the resolving power in catalogues which are destined for a larger public. In this matter, we are in full agreement with opinions which have recently been voiced in the United States. As a matter of fact, we have used the measurements of the resolving power for our own information, where all chemical and physical factors bearing on the accuracy of the measurements as well as the dependability of the laboratory personnel are known. However, we omit on general principle to publish these values, for it may always happen that other data obtained under different conditions may undeservedly be given a higher or lower rating.

The graphical data in Fig. 1 must therefore be evaluated with this reservation. The test objects were radial and tangential grids which were exposed on the panchromatic Perulith plate by Perutz, which is frequently used for tests, and on a highly sensitive emulsion for aerial photographs, namely the Aviphot Pan plate

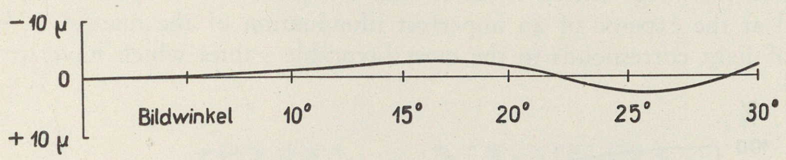

Fig. 2

Distortion of Topar 1 : 4/f = 210 mm in 1/1000 mm = 1 μ

30° Sch. by Gevaert. In the former case, the development was made with the Perutz fine-grain compensating developer for a period of 6 minutes, and in the latter case in Final with a developing time of 10 minutes at a temperature of 20° C. The grids showed the logarithmic contrasts $K = 1.6$ and $K = 0.25$ which were measured by us photoelectrically. The lighting was supplied by a nitra lamp. The exposures on the Perulith plate were made without filter, whereas the exposures on the Aviphot plate were made with the yellow filter D (Schott glass OG 1).

The figures given in Fig. 1 represent the number of dark lines resolved per mm. They apply to the objective with the focal length $f = 210$ mm at full aperture. If a shorter focal length were used, these figures would be improved, whereas a longer focal length would give less favourable results. The definition in the centre extends to an extraordinarily large range and remains practically undiminished over a distance of the length of the picture size. Aerial photographs confirmed this uniformly sharp definition of the commonly used image field and showed that the slight deterioration of definition toward the corner of the image has no importance.

The distortion of the objective, that is the displacements of the image points with reference to the correct location they would have if no distortion were pre-

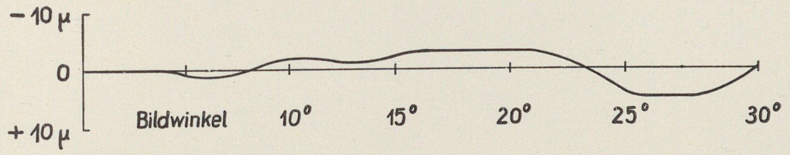

Fig. 3

Distortion of Topar 1 : 4/f = 210 mm in 1/1000 mm = 1 μ (measured values).

sent, is illustrated in Fig. 2. The displacements are less than $\pm$ 3 μ.

The curve in Fig. 2 is the exact result of the optical computation, which also showed that the values are not affected by the diaphragm settings of the objective. However, we wish to point out in this connection that we would not use a diaphragm with a high-grade objective of this type; it may be advisable to use the illuminating power of the objective for a reduction of the image movement (blur).

Fig. 3 shows measured distortion values of the lens. The curve proves that in accordance with the computed values the lens is practically free from distortion.

The distribution of light of the objective at full aperture is illustrated by Fig. 4, which shows the path of illuminating power E in percentages of the value obtained in the image centre. It shows that the quality of the picture has not been obtained at the expense of an imperfect illumination of the margins. The distribution of light corresponds to the most favorable values which have so far been

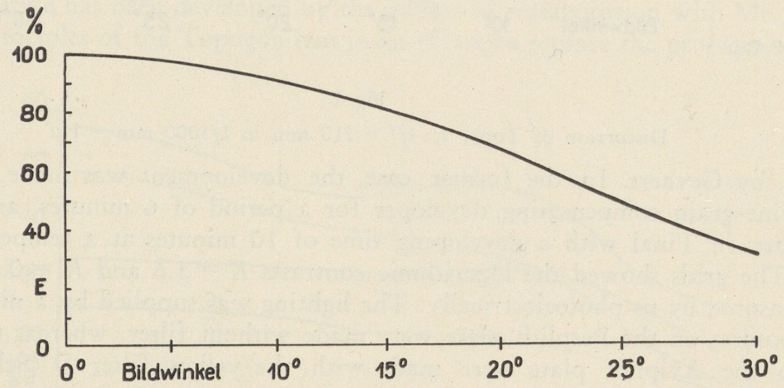

Fig. 4

Illuminating power E of Topar $1:4/f = 210$ mm at full aperture in percentages of the value in the image centre.

achieved with well corrected objectives characterized by the same picture angle and ratio of aperture. As a result, no decrease of luminosity is evident on the photographs taken from the air.

During the correction of chromatic errors allowance has been made for the fact that colour photographs will play a major role in the future. The objective may be used without hesitation without a yellow filter, provided that the transparency of the air permits taking colour photographs.

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