*Jan Jasny, Stanisław Płocharski**

Photoelectronic Tolerator of Focal-Length

In the Central Optical Laboratory in Warsaw a new photoelectronic method for measuring the deviation in the focal length of lenses has been developed, and a prototype of the focal-length tolerator built.

Unlike in other methods, the measurement of the focal-length deviation worked out by the COL is performed in one step, without the necessity of looking for the focal plane of the measured lens in each case.

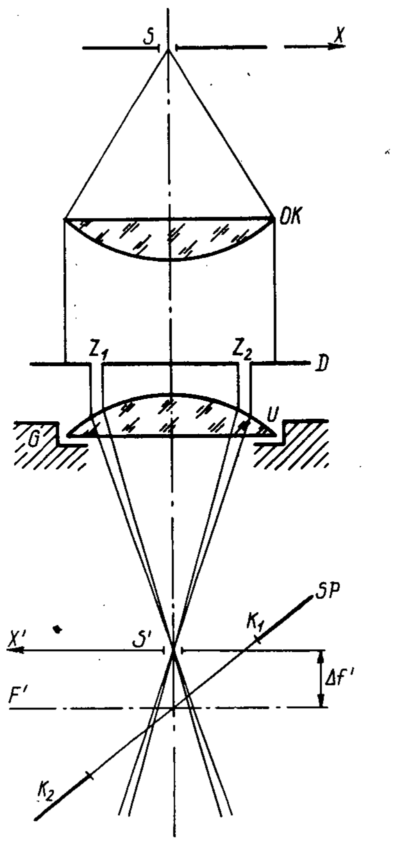

Fig. 1

Optical diagram of the instrument is shown in Fig. 1. It consists of: a collimator objective OK in whose focal plane a slit is placed that can move in the X-direction, a seat G for the measured lens U, a skew measuring slit SP and a diaphragm D cutting two beams, Z_1 and Z_2, out of the main parallel beam.

The movement of slit the S in the X-direction is accompanied by a displacement of the image S of the slit in the same direction. The distance between the image plane of the measured lens U and image plane F' of the reference lens of nominal focal-length is the sought focal-length deviation $\Delta f'$. When the image of slit S' moves, the edge K_1 of the slit SP successively lets through the beams cut out by slits Z_1 nad Z_2, and the edge K_2 stops successively, the beams coming out of slits Z_1 and Z_2.

If an optical signal passing through slit SP is directed onto a photodetector, it is converted into an analogous electric signal. The form of the electric signal in the photodetector circuit (a) and the successive phases of its transformation (b—d) are shown in Fig. 2.

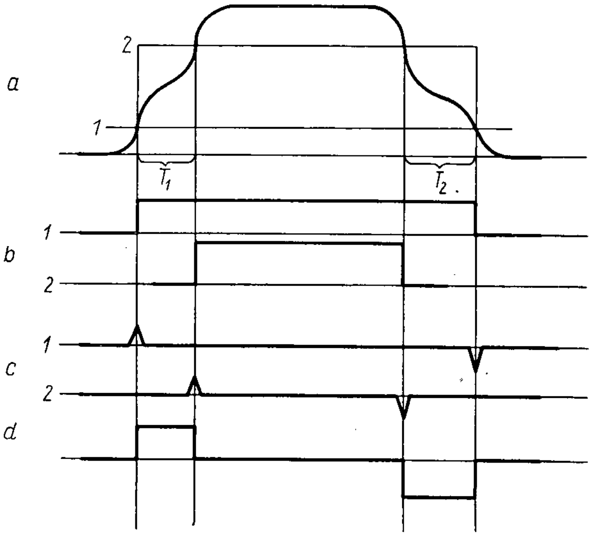

Fig. 2

The time interval T_1 (Fig. 2a) is proportional to the time that elapses between consecutive exposing of the two beams by edge K_1, whereas the time interval T_2 is proportional to the time elapsing between two successive interceptions of the beams by the edge K_2. The

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difference $T_1 - T_2$ is proportional to the distance between the image plane of slit S' and the plane F'. Since the plane F' coincides with the focal-length, the difference $T_1 - T_2$ is proportional to and has the same sign as $\Delta f'$.

After transformation the obtained electric signal, shown in Fig. 2, goes to an integrator which indicates directly the value of the focal-length deviation $\Delta f'$ expressed in per cent.

In the built prototype not a single but a number of slits S have been applied, located on the circumference of a rotating drum which moves them in the X-direction. The aperture D has been replaced by a suitable masking system placed in an illuminator, which separates two slim light beams from the pencil of rays. The distance between the beams is controlled and can be adjusted to the measured focal-length. The measuring slit SP is located in a movable head, which is to be placed at a proper distance from the seat G during nulling the instrument. The measuring slit sets automatically at an optimal breadth during the head movement. A suitable calibration system enables a precise control of the meter reading. The nulling of the instrument with the use of the reference lens lasts several minutes, while the measurement of the deviation $\Delta f'$ for each checked lens—several seconds.

The prototype of the tolerator has two ranges: $\Delta f'_{max} = \pm 0.01 f'$ and $\Delta f'_{max} = \pm 0.02 f'$, and has been designed for lenses with $f' = +10$ to $f' = 150$ mm.

As a result of tests on the prototype, it has been found that, with the optimal relative aperture equal to 1 : 4, the total error does not exceed:

$$\pm 0.01 f' \text{ for the range } \Delta f'_{max} = \pm 0.01 f'$$

and

$$\pm 0.002 f' \text{ for the range } \Delta f'_{max} = \pm 0.02 f'.$$

It is worth mentioning that the principle of measurement described above can be adopted for the construction of an instrument for measuring the focal-length deviation of divergent lenses, for microscopic objectives, for spectacle lenses etc.

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Analysis and Investigation of Frequency Function of a Dark Field Projector with the Slit System

In this article the problem of the frequency function of a dark field projector with the slit system is discussed. The frequency function of the projection lens with Schlieren bars is analysed here in detail and calculated. The calculated and measured characteristic curves are also presented.

Introduction

In the research work on the thermoplastic recording (one of the basic techniques of the recording on the deformed surfaces), we have also analysed and investigated the optical problems connected with the information retrieval from phase-modulating media.

We have employed a modified method of the dark field [1] to the readout of the relief recording.

El-Sum [2] initiated the discussion of the frequency function of a dark field projector with the slit system, the optical scheme of which is illustrated in Fig. 1. In his analysis of the methods of the information retrieval from phase-modulating media El-Sum discussed, the optical systems of the dark field in brief only. While characterizing a dark field projector

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