Properties and Principles of Application of Lenticular Plates in High-Speed Photography

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DURING THE TIME which has elapsed since the Fourth International Congress on High-Speed Photography, the All-Union Scientific Research Institute of Cinematography has conducted further studies of the optical properties of lenticular plates with different parameters, for use in high-speed photography, and has attempted to perfect the technology of their fabrication.

In the usual arrangement the photographic objective gives an image of the object to be photographed in the plane of the lencicular plate. Each lenslet of the array images the iris or aperture of the photographic objective in the focal plane of the lenticular plate and forms an image of the photographed object in this plane, dissected into image elements.

The formulas for determining the diameter of the image element in every practical case have been established, taking into account aberrations, diffraction phenomena, scattering of light in photoemulsions, etc.

When the photographic plate is displaced in relation to the lenticular plate during the time of exposure, the complete plate is covered with dissected images of successive phases of the event. Lenticular plates of different designs and parameters are applicable in high-speed photography. Lenticular plates have found many applications in the U.S.S.R. In order to raise the optical capacity (i.e. the number of pictures) of the image dissection system, the array of lenslets must be turned at a certain angle, relative to the direction of movement of the photographic plate. The angle of rotation of the lenticular plate which provides maximum optical capacity, the length of the trace of the image element, and the optical capacity have been determined for all practical cases. The pitch spacing of the lenslets can be increased in order to increase the number of pictures. However, to retain the original resolving power of the complete system, the overall dimensions of the lenticular plates must be increased in proportion to the increase of the spacing of the lenslets.

The use of lenticular plates in photographing high-speed processes also makes it possible to obtain color photographs by a number of different methods. In some cases, for a more detailed analysis of high-speed processes, stereoscopic photography is required. Lenticular plate image dissection cameras can easily be arranged to permit such stereoscopic photography. Stereographic pairs of every phase of the event can be obtained by unscrambling the composite record, and can be observed stereoscopically by any conventional method. Lenticular plate cameras for photographing high-speed processes, with speeds up to 100,000,000 frames/sec, are currently in use in the Soviet Union.

A contribution submitted to the *Proceedings* of the Fifth International Congress on High-Speed Photography, in summary form, by B. T. Ivanov, All-Union Scientific Research Institute of Cinematography, 47 Leningradsky Prospect, Moscow, U.S.S.R.