A MICROSCOPE PLATE MICROMETER.

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IN the plate micrometer due to J. H. Poynting, for use with microscopes or telescopes, a plane parallel glass plate is tilted between the object and the eye-piece, shifting the image on the eye-piece cross-hairs in a direction perpendicular to the axis of rotation of the plate. By a suitable calibration, the angle of tilt necessary to place the images of two points in succession on a cross-hair parallel to this axis gives the distance between the points in the object. Poynting's adaptation of this micrometer to the microscope is described by A. H. R. Buller.¹ A plane parallel plate was inserted through a hole cut in the microscope tube. A rigid pointer gave the angular position of the plate on an attached scale.

The modified form of instrument to be described possesses certain advantages, and is especially adapted to the measurement of small objects or distances when a large number of such measurements is required.

The plate *A* of plane parallel glass is set just above the objective *B*, in the short tube *C*. To the ring *D* in which the plate *A* fits are attached the trunnions *E*, *E*, turning easily in bearings *F*, *F*, which are screwed into the sides of the tube *C* until they just touch *D*. At one end of the rotating system is the lever *G*, and at the other, the galvanometer mirror *H*. Both of these are carried on short sleeves adjustable about the axis. A counter-weight *J* serves to balance the moving parts so that the system remains in any position. The mirror *H* reflects light from a circular scale into the telescope *K* fastened to the barrel of the microscope by the rigid clamp *L*. The eye-piece of this telescope is conveniently near to that of the microscope. The circular scale is attached to the wall and the microscope stand is fixed with reference to it by guides or blocks, so as to be easily replaced in position. This scale should

¹Researches on Fungi, 1909, p. 158.

be so far from the mirror that tenths of scale divisions need not be estimated.

A calibration curve or table giving the nearly linear relation between scale reading and displacement of object can be made for one magnifying power by direct measurement of a standard, and used for any other power by changing the scale of lengths.

The advantages of the plate micrometer thus improved can be summarized as follows:

The device can be attached to any microscope tube threaded for standard objectives, without marring the instrument.

Fig. 1.

Any objective can be used with any eye-piece, giving a wide range of magnifications.

Different thicknesses of plate can readily be interchanged.

Back-lash, so troublesome in screw micrometers, is entirely absent.

The moving system is so light that its motion does not set up vibrations.

The use of a telescope avoids parallax and greatly increases the accuracy of scale reading. This would also be advantageous in the

ordinary form of plate micrometer where the plate is between object and objective.

Readings can be taken as rapidly as the accuracy of contact can be judged, since the plate can be tilted through its whole range in a fraction of a second, and the scale can be viewed by a slight motion of the head to one side.

The adjustment of telescope, mirror, and scale, is not affected by focusing the microscope.

Time is saved because it is not necessary to estimate tenths of scale divisions.

The instrument used in this laboratory has a glass plate 6 mm. thick, a circular scale of 131 cm. radius and 150 cm. long. Using Zeiss C objective and no. 5 eye-piece, giving a magnifying power of 325 diameters, the probable error in a single setting of the cross-hair on the edge of a small object was found to be 3 mm. on the circular scale, corresponding to .000003 cm. in the object. The maximum length measurable at this magnifying power is .0015 cm.

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