

*A new model rotating-stage petrological microscope.**(With Plate II.)*

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PRESENT industrial conditions have forced the engineering trades of the country to adopt methods of mass production, in order to cope with increases in the cost of raw materials and labour. Specialized trades such as the manufacture of scientific instruments are unable to develop quite on these lines, partly because of the limited demands for their goods, and partly because each job is largely an individual one. In the microscope trade much has been done by systematic shop organization, and at the same time an approach is made to mass production by considerably reducing the number of models made, and standardizing the remainder. Naturally the large models for special work have been most affected. Under circumstances of this kind the instrument here described was designed to produce a smaller model with as many of the advantages of a larger as possible. The following objects have been had in view throughout:—

1. To produce an instrument suitable for microphotography.
2. To provide attachment for all types of optical accessories.
3. To provide easy and rapid passage from one optical setting to any other, particularly to arrange for easy changes from parallel to light of varying convergence.
4. To provide graduated mechanical motions.

The instrument figured is by Messrs. James Swift & Son. When closed it is  $12\frac{1}{2}$  inches high. The body tube is 140 mm. long and 40 mm. diameter, so as to give a tube suitable for microphotography. It is mounted on a horse-shoe base, with the hinge above the stage to render it stable in the horizontal position. This type of base was selected in preference to the tripod so as to give complete accessibility to the substage. The fine adjustment is of the lever type, operated by twin milled heads *D*, divided for refractive index work to 1  $\mu$ .

The rotating stage is 120 mm. diameter, and provided with mechanical motions. The vertical movement by rack and pinion is operated by the milled head *G*, and provided with a clamp *H* to prevent sliding when used for photography in the horizontal position. The horizontal motion is obtained by means of a worm and collar, operated by the milled head *F*, and, therefore, requires no clamp. This movement and its operating head are removable by loosening one screw, and a plain stage remains. The stage is provided with centring screws *J*, and a clamp *K* to the rotary motion. The mechanical stage can be removed and, if required, be replaced by an ordinary plain rotating stage. The rotation is divided by vernier to read to 5' of arc, but owing to the reduction in size the mechanical stage rotates only 270°. The linear traverses are divided to 0.1 mm. and have a range 3 inches horizontally and 1 inch vertically. The incomplete rotation does not lower its effectiveness, and one soon becomes accustomed to it.

Dr. J. W. Evans suggested that the milled head to the horizontal traverse might be divided to form a micrometer for such work as calibrating wedges, but the milled head is of such a size that it could not be conveniently divided into more than fifty parts, whilst the screw of the worm has a 4 mm. pitch. This would give no greater fineness of division than the existing vernier. On the other hand, to cut a thread of say 1 mm. would give a motion to the ordinary horizontal traverse far too slow for ordinary work. However, since the horizontal traverse is a complete unit in itself and quickly removable, it would be a simple matter to fit a duplicate, provided with a fine thread and a micrometer head, for calibration purposes.

The substage is of the conventional pattern, provided with rack and pinion focusing *L*, and centring screws *N*. An iris-diaphragm and rotating cell are placed at *O*, and the lower nicol *M* is attached to the under surface of the substage by a swinging arm, so that it can be moved as usual out of the optic axis. An attempt was made to mount the condensers on a three-way nose-piece after Grabham's method,<sup>1</sup> but, without lengthening the base pillar an inconvenient amount, this could not be done. It was finally decided to mount the condensers in V-slides to provide easy and rapid means of changing. The V-slide has tapered grooves, and is fitted with a spring stop. By these means the condenser is always centred and cannot be inserted in the wrong way. The V-slide should, for ease of changing, be directed E. to W. The whole substage

<sup>1</sup> G. W. Grabham, An improved form of petrological microscope. *Mineralog. Mag.*, 1910, vol. 15, p. 335.

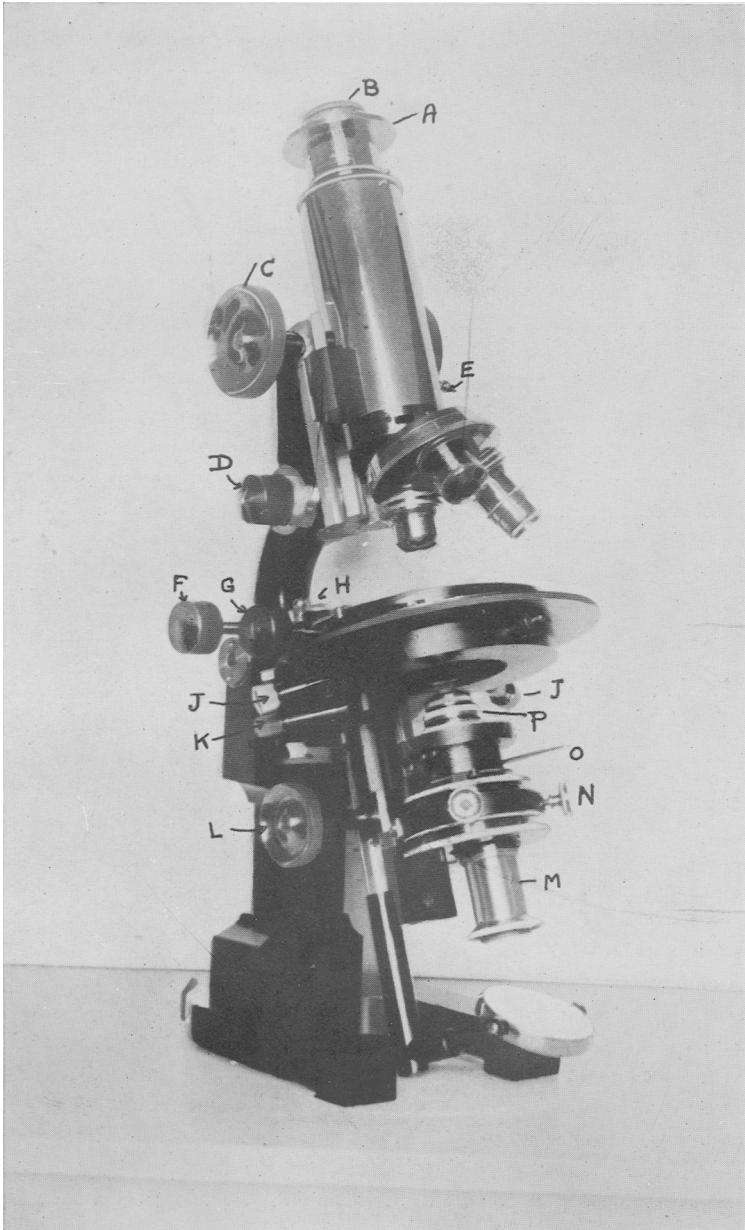
is hinged, and can be swung out of the optic axis with all its equipment in place.

With regard to optical equipment little need be said. The body is provided with the usual slots. The eyepiece *B* is not capped, in order that other pieces of apparatus may slide over it.

Two positions for the eyepiece are provided: the usual one N. to S., and one at  $45^\circ$  to this enables the cross-wires to be set parallel to the centring motions of the stages, and incidentally provides a helpful means of roughly estimating angles in preliminary examinations. One analyser *E* slides at the lower end of the body, and the upper end of the tube is provided with a graduated ring *A* for use with a cap-nicol. To avoid slotting the body and draw tubes, and so destroying the usefulness of the latter, an over-eyepiece lens of the Becke type is adopted instead of the Bertrand lens. For rough preliminary examination of interference-figures it is found that a Bertrand lens mounted to slide into the lower slot is useful.

I beg to offer my thanks to Dr. J. W. Evans and Mr. M. P. Swift for their helpful suggestions.

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PETROLOGICAL MICROSCOPE.