VI.—*A New Form of Fine Adjustment.*

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IN the accompanying fine adjustment I have endeavoured to overcome those imperfections which proved troublesome in photomicrographic and also in visual work. The main points of its construction will be seen in fig. 103, and are as follows.

The limb, which is of the Jackson type, is prolonged into a vertical pillar P, of triangular section, placed close behind the coarse adjustment and body, so that any shake, should it exist, is not magnified by an intervening arm. The lever is of the second order, having its fulcrum F at the bottom and just in front of the pillar, and bearing on the moving part at a point exactly underneath it; this point being so near the fulcrum as to render the movement extremely slow.

The moving part, which carries the coarse adjustment and body in front of it, has a back plate attached to it by eight screws, with which, if necessary, its fit may be adjusted. It has two prolongations which pass downwards on each side of the limb, and receive a transverse steel pin in their extremities. This pin carries a small roller R, of hard steel, upon which the lever bears, downwards.

The opposing spring is in a recess at the top of the pillar, and draws the roller upwards against the lever. The action of the roller is to abolish friction at this point, and to convert the movement of the lever, which is of course the arc of a circle, into the straight movement of the sliding part, without the least tendency to the production of a shake in a backward or forward direction.

It will be noticed that in virtue of the position of the spring the weight of the body is supported by it; so that, though this weight is, as it must be, considerable, it is in practice reduced to a small minus quantity; and the pressure of the lever on the micrometer screw is thus very slight, being in fact only just enough to take up its backlash. The finest screw may in consequence be used without danger of its suffering from wear.

Further it will be seen that the weight of the body bears most upon the spring when the Microscope is in a vertical position, whilst in the horizontal position it is quite inoperative; so that for the latter position the same spring is much too strong, and by exerting an undue strain might cause lateral movement. It is in consequence of this that much of the trouble occurs in photomicrography; fine adjustments which are perfectly satisfactory in the vertical or inclined positions, sometimes working badly when set horizontally.

To meet this difficulty I have added a means by which the tension of the spring may within considerable limits be controlled. A milled

FIG. 103.

P, Pillar. F, Fulcrum of lever. R, Steel roller on which the lever bears. M, Milled head controlling tension of the spring. C, Coarse adjustment pinion.

screw M, seen just behind the coarse adjustment, passes into the hollow pillar and terminates in a plug which bears upon the spring. When

the Microscope is set horizontally this screw is run out to its full limit, leaving just sufficient tension in the spring to work the movement in this position. Also should a binocular body or unusually heavy nose-piece be in use in ordinary work, the tension of the spring may with advantage be increased in proportion, by slightly screwing it up.

It would seem that only by such means can a high degree of sensitiveness be maintained under all conditions, in movements which actuate the entire body.

Another point of importance is that the body, as will be seen, is drawn downwards by the lever, and drawn upwards by the spring; the force in each case being applied exactly in the line of motion; so that, even should the pillar fit loosely and side shake be possible, it does not for the most part occur. Arrangements (and there are several) in which the body is *pushed* against an opposing spring, tend much to increase the liability to every kind of side shake and jamming.

Also, seeing that the moving part is firmly held between the lever below and the spring above, any alteration of focus when the milled head is at rest is quite impossible; a point of great importance in photomicrography.

The movement is well protected from dust, and is of sufficient strength to withstand the roughest treatment. It may be taken apart with great ease, it being only necessary to unscrew the transverse steel pin, and remove it and the roller, when the whole may at once be lifted off the pillar.

I should add that Mr. Nelson, who saw my drawings before Messrs. Watson made the instrument, suggested that the pillar should be slightly hollowed out at the sides, so as to bear only at its edges, thus guarding against the possibility of any lateral rocking movement. He subsequently suggested that the back plate should be slightly sprung by cutting away the underlying metal in four places; also that the pillar should be made wider and considerably truncated in front, so as to form a bar similar to that in the coarse adjustment of Powell's large stand. All these three improvements have been carried out in the present instrument.

Careful trials since made have shown that with this form of pillar the strongest spring works perfectly well, without the least tendency to the production of side shake, either in the vertical, inclined, or horizontal position. The adjustment controlling the tension of the spring, therefore, loses much of its importance. Very critical workers might still, however, find it advantageous.