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XIII.—A NEW TYPE OF PORTABLE MICROSCOPE.

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THREE TEXT-FIGURES.

A PORTABLE microscope, to justify its existence, should have the following qualities: It must be light; it must occupy little space; and at the same time must be sufficiently robust to meet the extra strains imposed upon a

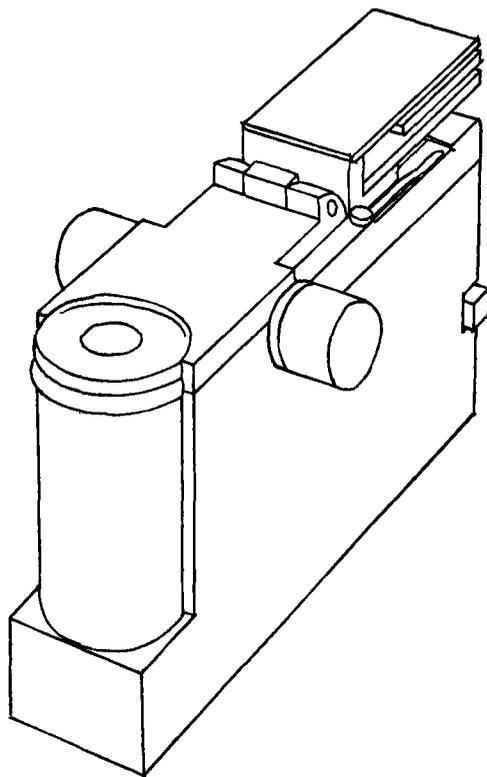


FIG. 1.

portable instrument. It should, if possible, be operable in the hand without a table; it must be ready for use without a great deal of setting up and adjustment, and it must be capable of the same quality of work as the large model.

This cannot be achieved satisfactorily by modifying the conventional microscope, as that can only be done by making it collapsible, a compromise between rigidity and lightness, with the inconveniences of setting up, and of packing away after use.

The instrument described is an attempt to achieve these qualities by a radical departure from the conventional design ; a departure which at the same time opens up possibilities of further advance in microscope design along lines which are impossible with the older model. It is a microscope which has the abilities of a large stand instrument, but with greater rigidity, greater simplicity, and a number of other advantages ; but although carrying three standard objectives, it is small enough to go into the pocket, and weighs proportionately little.

The following diagram will illustrate the principle of the design :—

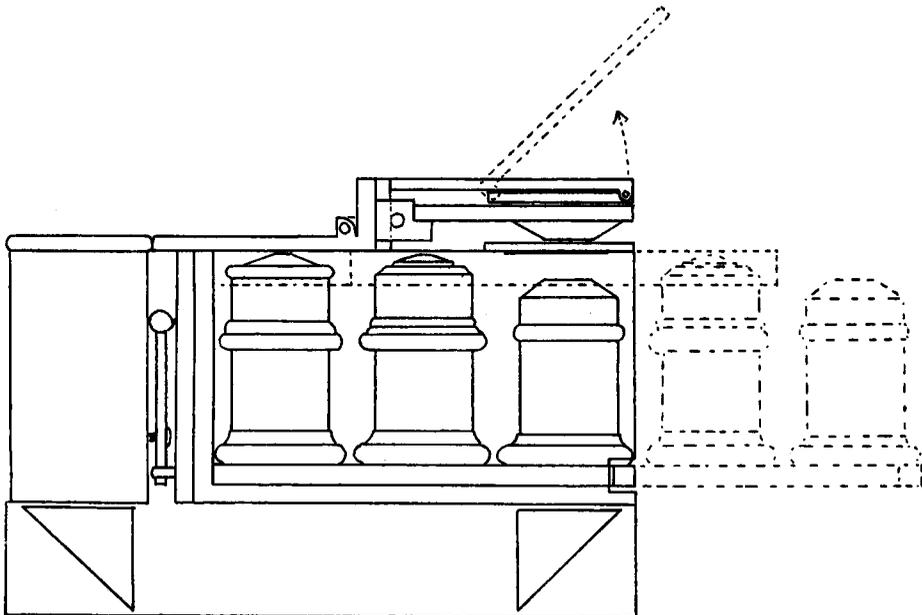


FIG. 2.

The instrument consists, essentially, of a standard objective, looking upwards, an eyepiece looking downwards, and two reflecting surfaces which will pass the light from the objective into the eyepiece. The slide lies above the objective, and face downwards ; and focusing is achieved by moving the objective up and down.

In practice, three objectives (say, two-thirds, one-sixth, and one-twelfth) are mounted on a sliding plate, in such a way that each may be brought in turn into position beneath the slide. Focusing is achieved by mounting

this plate for the objectives upon an L-shaped bracket, which moves up and down upon a sliding dove-tail. Movement is actuated by a screw and lever.

This arrangement is enclosed in a casing consisting of a single casting; the objective plate is operated by two lugs which project through the side walls of the casing, and a mechanical stage may be built into the top of the instrument.

A condenser and iris diaphragm, together with a metal mirror, are mounted above the slide in such a way that they may be swung clear of the stage for

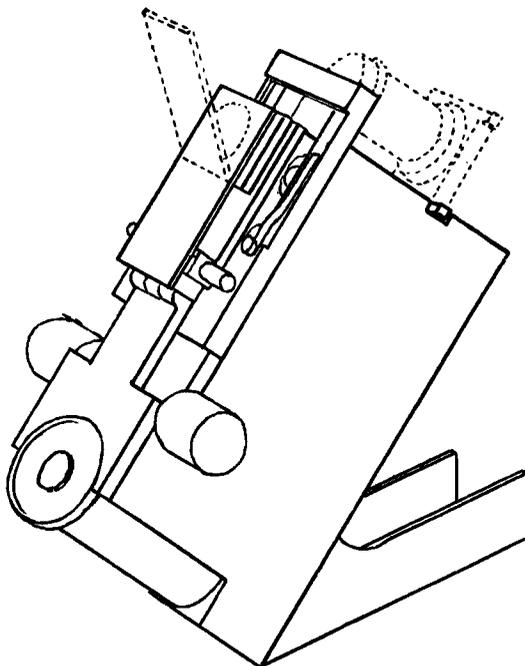


FIG. 3.

access to the slide. This attachment may be removed and replaced by a small electric illuminator, entirely self-contained, and using a small dry battery.

In the bottom of the casing, alongside the light-tube, and occupying the only remaining space in the casing, is a hinged horse-shoe base, upon which the instrument may stand and incline to a convenient angle.

The value of the instrument is not limited to its portability, and it has advantages which might recommend its use as a students' microscope, for laboratory work and research.

In virtue of the inverted slide we have the following advantages:—

Coarse adjustment is abolished, and fine adjustment is reduced to a minimum,

as the object always lies in the same plane, and will not be affected in any way by the thickness of the slide.

The cover-glass of the slide will not be broken by careless focusing, because if the objective is raised too far the slide will be merely lifted from the stage without damaging either slide or objective, although since focusing is minimized the possibility of even this occurring is unlikely.

The object is fully visible to the naked eye, even with an oil-immersion objective, thus parts of a specimen may be picked out by the naked eye and then examined microscopically by the highest powers without removing the slide from the stage.

Lying-drop preparations may be used, in which bacteria are in a flat stratum, and not subject to the same amount of movement as in a hanging-drop preparation.

Micro-dissection and other manipulations can be made under an oil-immersion objective.

An oil-immersion objective may be used with a live-box.

Vertical and unreflected lighting may be used, as well as any other.

The condenser is very accessibly situated. It can be very simply used for oil or water immersion, its aperture is visible and conveniently adjusted, its top lens can be readily removed, and the condenser itself changed with a minimum of trouble.

Further advantages that may be claimed for the instrument are :—

Greater rigidity even than in the conventional model, as the parts are totally enclosed in a single casting.

Less wear and tear on the focusing adjustment, as this is protected by the casing, has a very small excursion, and supports only the weight of the objectives.

The objectives can be more accurately centred, and in better alignment, on a flat surface than on a revolving nosepiece ; and a sliding dove-tail has a greater degree of accuracy than a revolving disc.

More convenient change of objective, as it is unnecessary to take the eye from the eyepiece in order to ascertain the position of any particular objective.

The instrument is quicker and simpler to use than the conventional model in virtue of :—

1. Quicker change of objective ;
2. The elimination of coarse adjustment, and the reduction of fine adjustment to a minimum ;
3. The fact that the slide is more readily grasped than on the conventional model.

The design of the instrument is readily adapted to the making of a binocular microscope, with every refinement which might be required in a large laboratory instrument, as well as being equally applicable to a simple botanical microscope, cast in bakelite, carrying one objective, and made at a very low cost indeed.