FIG. 1.

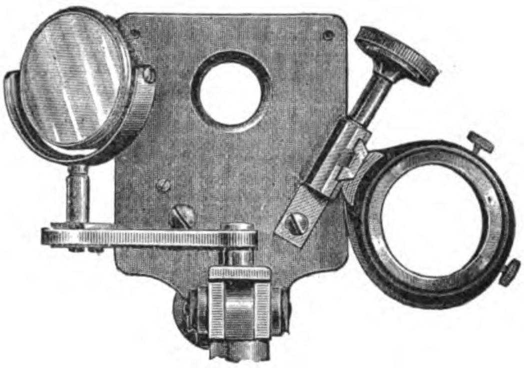

FIG. 2.

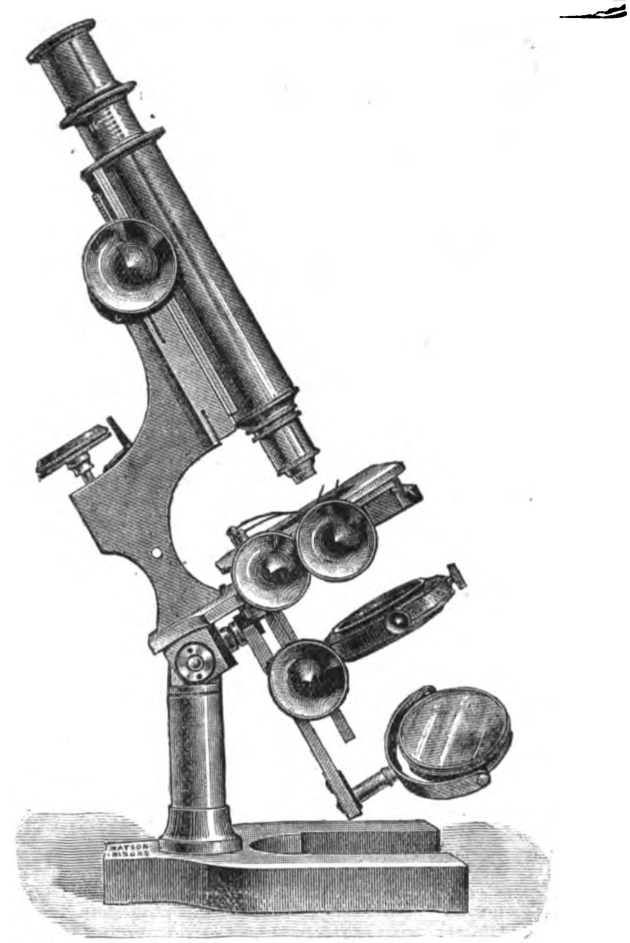

FIG. 3.

requirements—that is to say, if the oil-paste is intended for a long transport, a high percentage of the ingredients may be preferable, while in the case of this solidified oil-paste being intended only as fuel, pure and simple, for cooking, lighting, and heating, then from 4 to 6 per cent. of the ingredients are sufficient. The admixture of combustible waste with this paste for economical and other purposes is entirely optional, and may be in proportion of three to four parts of solids to one part of solidified oil-paste.

THE EDINBURGH STUDENT'S MICROSCOPE.

IN the annexed engravings we illustrate the "Edinburgh Student's Microscope," recently introduced by W. Watson and Sons, of 313, High Holborn, London, on lines suggested by Dr. Edington, Lecturer on Bacteriology, Edinburgh University. The instruments are made in several numbers, and are specially intended for students; but the amateur will also find in them a convenient and first-class microscope. Fig. 1 shows the instrument in its simplest form, with sliding body for coarse adjustment. It will be seen that the Continental horseshoe foot has been adopted; also the body tube is of the Continental size, fitted with draw-tube, which, when extended, gives the full English length of 10in. A point that specially struck us was the perfection of the fine adjustment—a part often neglected in instruments of Continental make. The rotation of a milled head acting on a lever moves the entire body, and that with no perceptible resistance. It is beautifully sensitive, and as a tenth of a turn of the milled head only moves the body the 1-3000th part of an inch, a most precise adjustment can be made. Another point is the hanging of the under-stage, fitting on a pivot so that it can be lifted aside with a condenser in it, and direct light from the mirror obtained at once. Fig. 2 is a view of the underside, and shows the way in which it is done. This is a distinct advantage, and workers with the ordinary form of instrument, in which the condenser must be withdrawn if direct light from the mirror is required, will at once appreciate it. The stage of the instrument is 3½in. square, permitting of the use of large slips. The eyepieces supplied with the instruments are nickel-plated to prevent tarnishing of the objectives, to the manufacture of which Watson and Sons pay special attention, and they are above the quality usually sold for students' purposes.

There are five different forms of the instrument—A, as Fig. 1; B, similar, but with rack-work coarse adjustment; C, fitted with a compound sub-stage, with screws to centre and rack to raise and lower; D, same as C, but fitted with an exquisite mechanical stage (Fig. 3). The fifth form is for petrological work, and is fitted with all necessaries for this department of investigation.

The idea that any microscope will do for a student is not encouraged by Messrs. Watson and Sons, and their endeavours to supply students with a really high-class instrument will, no doubt, meet with practical approval. The Edinburgh student's microscopes are throughout of the highest quality.

We have also seen a form of the Abbé Illuminator, now so popular, of Messrs. Watson's make, intended to go with these instruments, rendering them very complete, as it will work with objectives of the highest angular aperture.

THE PARIS EXHIBITION.—III.

Prof. Elihu Thompson's Experiments—The Phonograph and Graphophone.

IN a former article I have spoken of the Thompson electrical welding process. We will now examine some other curious experiments and applications of the actions produced by alternating currents, and which were repeated by M. Abdank at his lecture on Thompson's experiments.

An electro-magnet is excited by an alternating current dynamo giving about 30 ampères in the circuit of the electro-magnet, and having about 250 alternations per second. These successive inverse magnetisations give a sound which gives an idea of the period of the machine. With this electro-magnet several interesting experiments may be performed. If we hold a disc of copper over the pole of the electro we shall experience a very strong repulsion, and if we let go the disc it will fly away from the pole. During this experiment the disc gets very hot. These effects are due to the induced currents in the metallic mass. If we now hold the metallic disc of copper over the pole of the magnet supporting the disc so that it may turn about its centre, we shall experience the repulsion of the disc from the pole and the creation of heat; but there will be no rotation, because there is perfect symmetry in the horizontal components of the field. Let us now interpose a metallic screen between the pole of the electro-magnet and a part of the disc. The forces which act upon the latter are no longer symmetrical, and the disc assumes a movement of rotation. A ball of copper placed over the magnet, or in a beaker of water over the magnet, may be made to rotate in the same manner.

Prof. Elihu Thompson has employed the actions of alternating currents in the construction of a very interesting motor. The current from the alternating dynamo is sent into this motor, which begins to rotate just as any ordinary electric motor would do. The speed of rotation increases, and the humming sound of the motor gets higher and higher, the period of magnetisation of the motor getting more and more rapid. Now, at a given moment, the sound of the motor will come into unison with the sound of the dynamo; this indicates that the motor and the dynamo are working synchronously. If at this moment we remove the brushes of the motor and short-circuit the induced bobbins, the motor will continue to work in virtue of the repulsions, which have been illustrated by the simpler experiments of the rotating disc, &c.

Coming back to the alternating electro-magnet with which we began these experiments, we can make an experiment showing a very simple example of an electrical transformator. An incandescent lamp is connected to a flat spiral of insulated wire, and is placed in a beaker of water over the electro. Immediately the electro-magnet is excited, the lamp takes a fixed position in the beaker and glows. We have here a simple transformator, the first element of which is the electro-magnet, and the second the spiral of wire connected to the lamp.

Near Prof. Thompson's installation, in the American section, we shall find Edison's phonograph and Tainter's graphophone. Our readers know that in these instruments, which are perfected phonographs, the vibrations of the voice