THE

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I.—DESCRIPTION OF MR. JAMES SMITH'S NEWLY CONSTRUCTED ACHROMATIC MICROSCOPE.

THE Council of the Microscopic Society of London came to a resolution some months since, to purchase for the Society an Achromatic Microscope of the first character, from each of the three most eminent makers in this country. The first of these was delivered to their order at the meeting in November 1841, by Mr. James Smith of No. 50, Ironmonger Row, Old Street, St. Luke's, and we are now enabled to give a figure and description of it. The second microscope was received by the Society from Mr. Powell in December of the same year, and has been described, with diagrams, in No. 12, of this Journal, and the third is about to be furnished by Mr. Ross, which we hope to describe in a future number.

The present instrument stands on a stout tripod pillar and joint, and may be planted at any inclination from vertical to horizontal: its whole construction is planned with a view to obtaining freedom from tremor; this being, when the higher powers are used, essential to beauty and distinctness of picture: it is mostly used with the body sloping, as represented in the figure, and with the light on the left of the observer.

The Body slides by a rack and pinion, moved by the milled-head, *a*, on a strong dovetailed bar; and has also a slow motion for delicate adjustment of focus, given by the milled-head, *b*, which is divided from 0 to 9, and alters the distance of the object from the glass about $\frac{1}{150}$th of an inch by every revolution. It is furnished with a Sliding Tube *c*, graduated to tenths of an inch, for varying its length, and with three sliding Huygenian Eye-pieces, *d*, *d'*, *d''*, of successive powers.

The erecting (or field) Glasses, *y*, are to be screwed, when employed, into the other end of the Sliding Tube; they give the means of obtaining an extensive range of low powers, and besides rectify the image, which, when seen in the usual way, is inverted. The general view they furnish of an object, their advantage for dissecting, and the ease

Darwins copy in WSM, with his microscope

with which the power may be at once raised by them from 5 to 80 or upwards, without any change of glasses, render them an interesting addition.

The Stage has two steady rackwork motions, at right-angles to each other and to the axis of the body, given by the milled-heads, *e*, *e'*: it has also a sliding and revolving Plane, *f*, with a ledge, *g*, for resting object-slips upon, and a sliding piece, *h*, with springs for clamping them, so as to allow them to be pushed horizontally. An upright Rod, *i*, is fixed on this plane for mounting the forceps, *v*, or for the Spring Holder, *j*, when a glass trough, *u*, is used. The plane may be detached from the stage if the rod is moved round an eighth of a circle to the left.

The centre of the opening of the stage will be in the axis of the body of the Microscope, if the ends of the two traversing projections are brought to be even with the corresponding fixed parts: then, if a glass slip, or any flat body contains the object to be viewed, it is lodged on the ledge of the sliding plane set horizontally, and the sliding piece above is gently pressed down upon its edge: next, by pushing the plane upwards or downwards, and the slip horizontally, the object is brought directly under the object-glass, and is adjusted more correctly by the nuts, *e*, *e'*.

When the forceps is to be mounted on the stage, the upright rod, *i*, should be carried round rather more than a quarter of the circle to the right, which is its most convenient position, and the plane is to be slid so as to allow good room for the object to be brought into the field of view. If the centre of the stage is now in the axis of the body, the plane may be turned round, and different sides of the object be exposed to the light without taking it out of the field.

A large double Mirror, *k*, concave on one side and plane on the other, with two actions, is supported by the cylindrical Bar, *l*, and may be moved upon it vertically or sideways.

A removable Diaphragm, *m*, is fixed under the stage, with a dovetail fitting; and by the different size of the circular holes in its revolving plate, the quantity and direction of the light thrown from behind upon transparent objects, may be extensively varied: when this plate is turned so as to close its central opening, the diaphragm forms, as a dark box, a back ground for opaque objects seen by a side light.

The Illuminating Lens, *n*, with motions detached from the stage, is for condensing this side light, and a silver side reflector is for the same purpose.

The three Lieberkuhns, *o*, *o'*, *o''*, adapted to the object glasses Nos.

2, 3, and 4, are applied by sliding them in front of each respectively. When one of these is used, the diaphragm is to be removed, and the dove-tailed piece, *p*, may be slid in its place, with one of the three Wells, *p*, *p'*, *p''*, which will then make a dark background. Objects may, by moving the well aside, be viewed alternately as transparent and opaque; but should they be such as are mounted on circular disks, *q*, the well is not needed.

The Bull's-eye Lens, on a separate stand, *r*, is for increasing the illumination, if artificial light is employed.

The Camera Lucida, *w*, has its prism fixed on a short tube with a slight side motion for adjustment, and fits on each eye-piece when its cap is removed. In using it, the body of the Microscope should be horizontal, and the prism brought to that distance from the eye-piece at which the field is best seen: this is ascertained by looking perpendicularly through the opening of the prism while the tube is fitted on. If a drawing is to be made of an object in the field, the paper for it is now to be placed on the table under the prism; the image and the pencil may thus be seen at the same time upon the paper, and the tracing will be easily effected after a short practice. The size of the object traced may be found by placing on the stage in the field of view, a small graduated scale of known divisions, and marking the image of one or more of its divisions on the same paper.

Or when the magnifying power is known under which an object is seen, its measure is easily taken by fitting on the Camera Lucida, placing beneath it a scale of inches and decimal parts, at ten inches distance, and dividing the measure the object may subtend on this scale by the magnifying power; which gives the true dimensions.

One effect of the large pencil of light admitted by the object-glasses of high power is, that all parts of an object which are not correctly in focus, are indistinct or invisible: this necessary imperfection, however, gives an opportunity of estimating, by the revolution of the milled-head, *b*, the elevation or depression of the different parts that come successively into view on varying the focus.

An Achromatic Condenser, *x*, slides into the place of the diaphragm, to give the utmost refinement to the illumination of transparent objects.

A Live-box, *s*, is for observing living objects between two glass planes, and a second Live-box, *s'*, with screw collar, for objects in water. The screw is for regulating with nicety the depth of the fluid, and the degree of pressure that may be requisite to confine the object without injuring it.

A Plate of Glass, *t*, with a ledge, has a separate piece of thin glass

to lie upon it, for viewing animalcules, &c., in water; the fluid being retained between the two planes by capillary attraction.

A Glass Trough, *u*, is for larger objects in water. It is used with its thinner plate of glass in front, and commonly with a plane of glass placed diagonally in the trough as at *u'*; when, if what is introduced is *heavier than water, it will sink till stopped by the sloping plate.* Sometimes a very light folded spring may be applied with advantage behind the glass plate, and thin strips of glass at the bottom of the trough for keeping the plate in its place. The Spring Holder, *j*, should always be slid upon the rod, *i*, to confine the glass trough, and the body of the Microscope must be planted not very far from horizontal.

The Forceps, *v*, with cork at one end for such objects as are fixed on pins, is to be mounted on the rod, *i*, either in the direction as drawn, or inverted; thus providing additional means of varying the angle under which an object held by it may be seen; and giving in either way, very steady and easy motions. And a three-pronged forceps, *z*, is mounted in the same manner.

A pair of brass Pincers, steel Pliers, Knife, Point, and Scissors, three glass Tubes and glass Slips are also furnished; and all is packed in an upright mahogany Case fitted with Drawers.

The Achromatic Object Glasses provided comprise four Powers: viz.—

1st. (Fig. 1.) A Glass of $1\frac{1}{2}$ inch in focal length.

It is to be used alone only when a low power is required: when so used, the perforated cap *a* should be slid over it, the eye-piece of lowest power being applied, and the tube in the body of the Microscope little, if at all, drawn out.

2nd. (Fig. 2.) To slide upon the above instead of the perforated cap; the notch on its tube fitting to the pin on the first glass: they make together a glass of $\frac{8}{10}$ inch virtual focus.

The defining power is now much increased. The performance of this glass is little altered by covering an object with glass, or varying the length of the body.

3rd. (Fig. 3.) To slide in the same manner on the first, and with it equivalent to a glass of $\frac{1}{2}$ an inch focus.

4th. (Fig. 4.) A Compound Glass of $\frac{1}{4}$ inch focus.

Both these glasses possess great defining power, and especially No. 4, which has, at the same time, sufficient clear space in front

to allow fine illumination for opaque objects, and will adjust for such as are covered with thin window glass.

The two latter powers, No. 3 and No. 4, have the tube of their front lens moveable, and furnished with a Screw Collar, the circumference of which is engraved with ten divisions, numbered from 0 to 9, (*See* Fig. 5): this, and the graduation on the milled head for slow motion, give a means of obtaining the finest performance, under various circumstances, with great precision. For that purpose, the following directions are given :—

1st. When the tube in the body of the Microscope is not at all drawn out.

If the object is *uncovered*, screw up the collar (Fig. 5) of the object glass, till 0 stands opposite to the vertical mark on the tube, its three horizontal marks, each of which indicates one revolution of the collar, being all fully exposed. This is as far as the screw will go without strain, and is the correct place.

If the object is *covered* with glass, or talc, measure the thickness of this, taking advantage of dust or spots on the surfaces, by the milled head for slow motion: it has its circle divided like the collar of the object-glass from 0 to 9; every revolution being ten divisions. Multiply the number of divisions indicating the thickness by 0.6, if the $\frac{1}{2}$ inch object-glass (No. 3) is used; by 0.8 if the $\frac{1}{4}$ inch (No. 4). Then set the collar to the number that is the product, screwing it *down* from its former position, and pressing up the tube of the front lens; and the adjustment is made.

2nd. When the tube in the body is drawn out, increase the number to which the collar is set, with the $\frac{1}{2}$ inch glass (No. 3), as under:—

For 1 inch drawn out add ...	4	divisions.
2 inches	7.5	ditto.
3 ditto	10	ditto.
5 ditto	13	ditto.

The $\frac{1}{4}$ inch glass is little changed by lengthening the tube, but one division may be added for each of the first 4 inches drawn out.

*** The milled head for slow motion gives for the depth of $\frac{1}{100}$th of an inch in air 15 divisions, in glass nearly 10.

A Table of the Linear Powers.

OBJECT-GLASSES.	EYE-PIECES. No.1	No.2	No.3
	POWERS.		
1½ inch. Tube of body closed	26	48	67
Add for each inch of tube drawn out...	3.4	5.6	7.2
$\frac{8}{10}$ths inch. Tube closed	57	98	155
Add for each inch of tube	6	10	16
½ inch. Tube closed ...	100	170	270
Add for each inch of tube	12	17	27
¼ inch. Tube closed ...	*200*	*330*	*510*
Add for each inch of tube	21	33	51

The Erecting (or field) Glasses should only be used with the lowest eye-piece (No. 1); and in general, the $\frac{8}{10}$ths inch object-glass is the most convenient, though for some occasions the 1½ inch, with its cap slid *partly* on, is better.

With the $\frac{8}{10}$ths inch object-glass—

the tube being drawn out 0.5 inch	the power is about 1 for a distant object.
0.75 „	...power about 5
1.05 „	„ 10
1.7 „	„ 20
2.9 „	„ 40
4.1 „	„ 60
5.3 „	„ 80

each 0.6 inch of tube making a change of nearly ten in the power.

II.—ON THE OCCURRENCE OF GLOCONEMA PARADOXUM IN LOUGH ERNE, WITH REMARKS.*

By Captain J. E. Portlock, R.E.

THE Islands on the north shore of Lough Erne, are composed of a calcareous grit, which is a member of the carboniferous system, a distinct band of limestone and shale belonging to the lower portion of the carboniferous, a mountain limestone being geologically below it. Whilst examining these Islands geologically, I noticed attached to the rocks on the west shore of one of the smaller ones south of Boa Island, tufts of Confervæ, under the surface of the water. These were so lubicrous, that it was with some difficulty I transferred a few pinches to a small bottle for future examination. On placing a portion of this under the microscope, I found it principally composed of one, or probably more than one, species of true Confervæ; *Conferva zonata* being abundant. On the nature of the articulations of these bodies, I shall offer some remarks at a future time. Surrounding, however, the filaments of the Confervæ, so as to form a sort of tissue or web, were at least

* Abstract of a paper read before the Microscopical Society of Dublin, 1841, communicated by the Author.