

III. *The Description and manner of Using a late Invented Set of small Pocket-Microscopes, made by James Wilson ; which with great ease are apply'd in viewing Opake, Transparent and Liquid Objects : as the Farina of the Flowers of Plants, &c. The Circulation of the Blood in Living Creatures, &c. The Animalcula in Semine, &c.*

THE Use of Microscopes is so well known, that it's as needless to attempt their Recommendation to the Inquisitive, as it would be tedious to numerate their particular advantages in Natural Inquiries. No one who looks into the Intimate structure of the regular Productions of Nature, but must readily confess our Eyes stand in great need of these Magnifying Opticks : Nor is it a little entertaining to find the excellent Mechanism and Beauty of Natural Objects appear more Finished, by how much *They* are Magnified with good Microscopes : On the other hand, what confusion must it be to an *Atheist* (if there can be such an one) to see the most Celebrated pieces of Art appear Course, Deform'd, and altogether more Unfinished, by how much *they* are magnify'd.

The late Improvements made by *Magnifying Glasses* are not so much owing to the Making *Them* and Composing Microscopes, as the Methods of applying Objects for the advantage of *Light* ; in which I hope the following described-*Instruments* will not be found inferiour to any yet made, at least commonly sold. Experience, as well as the Authority of the Excellent † *Dr. Hook*, assures us, That † *In his Preface to his Micrographia.* Single Magnifying Glasses (when they can be used) are preferable to Microscopes, composed of two or more Magnifying

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fyng Glasses. It is far from my design to Discommend any sort of Microscopes now in Use, or to recommend those I make, any further than they are found Useful by those Inquisitive Gentlemen who are pleas'd to have *Them* of me.

This Set of Microscopes has *Eight* different *Magnifying Glasses*; *seven* of which may be *Used*, with two different *Instruments*, for the better applying *Them* to various Objects: One of these *Instruments* is represented Fig. 1. A A A, and is made of Ivory, it hath 3 thin Brass Plats, E, E, and a Spring of Brass H within it; to one of the thin Plats of Brass is fixed a piece of Cork F, with a concavity G both in the Cork and Brass to which it is affix'd: In one end of this Instrument there is a long Screw, D: with a Glass, C, screwed in the end of it: In the other end there is a hollow Screw, o o, wherein any of the Magnifying glasses are screwed when they are to be made use of. The 8 different Magnifying glasses are all set in Ivory, 7 of which are set in the manner of Fig. IV. n. 4. The greatest Magnifier is marked upon the Ivory wherein it is set with n. 1, the next n 2, and so on till n. 7: The 8th Glass is not marked, but set in the manner of a little Barrel Box of Ivory, as in Fig. II.

E E a flat *piece of Ivory*, whereof there are 8 belonging to this set of Microscopes, (tho any one who has a mind to keep a Register of Objects may have as many of them as he pleases) in each of which there are 3 holes f f f, wherein 3 or more objects are placed between two thin Glasses, or Talks, when to be used with the greater Magnifiers.

The other Instrument Fig. III. is made of Brass or Prince's Metal, with Joynts p p p p, to turn easily any way with a small pair of Tongs G G, which open at the points k, by pressing together the two heads of the Pins I I for taking up of Objects: There's a round piece of Ivory, H, screwed upon the other end of the Tongs; white on the one side for black objects that are opake Bodies; (such as Seeds or Sands)

Sands) and black on the other side for white ones of that nature.

Upon the sharp end, A, of this Brass Instrument all the 8 Glasses may be fixed, as you see Fig. IV. n. 4. there being a hole in the Ivory wherein the Glasses are set for that purpose, with a thin piece of Brass B in manner of a Spring, that holds it firmer : So when any Object is taken up in the points of the Tongs k, or laid upon the other end H, it may be very easily (as any one who sees the Instrument will perceive) applyed to the true distance of any of the Glasses by the help of the Joynts p p p p, as also the Screw C, and Wheel D, which will bring the Object to the exactness of the *Center* or true distance, being regulated by a Spring E.

The use of the first mention'd Instrument, Fig. I. AAAA is thus : Take one of your Flat Pieces of Ivory E E or *Registers*, (if you please to call them so) and slide it in betwixt the two thin Plats of Brass E E in the body of the Microscope, so that the Object you intend to look upon be just in the middle, remarking that you put that side of the Plate E E where the Ring is furthest from your eye : Then you are to screw into o o, (the hollow Screw in the end of the body of your Microscope,) the 3d, 4th, 5th, 6th or 7th Magnifying-Glass ; which being done, while y' are looking thro your Magnifying Glass upon the Object, you are to Screw in or out the long Screw D in the other end of the body of your Microscope, till you bring your Object into the true Distance, which you will know by seeing the Object Clearly and Distinctly : But seeing that in the greater Magnifiers you can see but a small part of the Object, *viz.* the Legs or Claws of a Flea ; while you are looking upon any part of the Object, if ye take hold of the end of the Plate E E, whereon the Object lyes, and move it gently, you may see the whole Object successively, or any part of the Object you please ; and if that part of the Object you design to look upon be out of the true Distance, remember your End

Screw D, can always bring it in, by screwing it nearer or farther off.

After this manner may be seen all transparent Objects, Dusts, Liquids, Crystals of Salts, small Insects, such as Fleas, Mites, &c. If they be Insects that will creep away, or such Objects as one intends to keep, they may be placed between the two *Register Glasses* f. f. For by taking out (with the point of a Pen-knife) the Ring that keeps in the *Glasses* ff where the Object lyes *they* will fall out of themselves; so you may lay the Object, between the two hollow sides of *them*, and put the Ring in as it was before: But if the Objects are Dusts or Liquids, a small drop of the Liquid, or a little of the Dust laid on the outside of the Glas f f, and applyed as before, will be seen very easily.

As to the First and Second Magnifying Glasses, being marked with a Cross upon the Ivory wherein they are set, they are only to be used with those *Register Plats* that are also marked with a cross, wherein the Objects are plac'd between two thin Taliks, because the thickness of the Glasses in the other Registers or Plates hinders the Object from approaching to the Center or true distance of these Greater Magnifyers. But the manner of using them is the same with the former. Only remember to be careful when you put in or pull out the Plate or Register E E, whereon the Object lyes, or move it from one Object to another, not to let it rub your Magnifying Glass, which is done by unscrewing a little the End Screw D, when ye put in or pull out your *Plate*, or move it from one Object to another.

For seeing the Circulation of the Blood at the Extremities of the *Arteries* and *Veins*, in the transparent parts of Fishes, Eels, &c. there are two Glass Tubes, the one bigger, and the other lesser, is designed in g g, wherein the fish is to be put; when this lesser Tube is used, ye are to unscrew the End Screw D in the body of the Microscope, until the Tube g g can easily enter into that little cavity G
of

of the Brass Plate, fastned to the Cork F, under the other two thin Plats of Brass EE: When the Tail of your Fish lyes flat to the Glass Tube, set it opposite to your Magnifying glass, and by screwing in or out your End Screw D, as is said before, you may easily bring it to the true distance, and see the Blood circulate with great pleasure.

When the Bigger Tube is to be used with a larger Fish, or Frog; then you are to take out the *Brass Plate G F* fastned to the Cork, by pressing down the other two Plates EE and the Spring H to the end of the Microscope B; and by turning the Cork and Brass Plate G F sideways, you may easily either take it out and put it in again; when the Cork-plate G F is out, the larger Tube will easily enter into the body of the Instrument, and is to be used as the other lesser one.

If you would see the Blood *Circulate* in a Frog's Foot, choose such a Frog as will just go into your Tube, then with a little Stick, &c. expand the *Hinder foot* of the Frog, and apply it close to the side of the Tube, observing that no part of the Frog hinders the Light coming on its Foot, and when you have it at the just distance, by means of the Screw D, as abovesaid, you will see the rapid Motion of the Blood, in its Vessels, which are very Numerous, in the Transparent thin Membrane that's between the Frogs Toes: For this Object the 3d and 4th Magnifiers will do very well; but you may see the Circulation in the Tails of *Water-Newts* with the 5th and 6th Glass, by reason the Globules of the Blood of those Newts are as big again as the Globules of the Blood of Frogs or small Fish, as has been taken notice of by Mr *Cowper* in N. 280. of these Transactions, pag. 1184.

N. B. The *Circulation* cannot be so well-seen by the 1st and 2d Magnifiers, because the thickness of the Glass wherein the Fish lyes hinders the Approx.

The Glass, plac'd in the manner of a Barrel Box, Fig. II, is only to be used with the Brass Instrument (or in your Hand) being the least Magnifyer, for greater Objects, such as Flys and common Insects, &c. The hole (a) in the side of this Box fig. II. is to be fix'd on the point A of the Brass Instrument, remembring to put the end (b) next to your Eye, and the other to the Object; so if you take up any Insect in the point of the Tongs k, or lay any opaque Object on C the other end, you may approach them to the true distance by help of the Joynts and Screw spoken of before C. D, P E, and see them distinctly.

In the viewing of *Objects*, one ought to be careful not to hinder the light from falling upon *Them*, by the Hat, Perruke, or any other thing, especially when they are to look upon opaque Objects: for nothing can be seen with the best of Glasses, unless the Object be in a due distance, with a sufficient light.

The best Lights for the Plats or Registers, where the Object lyes between the two Glasses, is a clear Sky light, or where the Sun shines on any white thing, or the reflection of the light from a Looking-glass. The light of a Candle is likewise good for the circulation of very small Objects, tho it be a little uneasy to those who are not practis'd in Microscopes to find out the light of the Candle.

By what is here said, it's hop'd that the use of this Microscope, easie of it self, will be much easier to those that use it; yet it cannot be doubted of *This*, as of all other Instruments of this nature, but that *Usus plura docebit*.

For the conveniency of those who would *Draw*; or make any *Sketches* or *Designs*, after Microscopical Objects, I have also made a Pedestal to fix the Two *Instruments* above described, and make them stationary to any convenient Light. This Pedestal may be placed on a Table, &c. and after the Object and Light are fixed, as many persons as please may view the Object, without any trouble or difficulty in finding the Light.

The rest of the annexed *Figures* were Drawn by this Microscope from several *Objects*.

A, B, C, D, E, F represent the Feathers of the Wings of Butterflies and Moths; A, B, are the same, but differently magnified. A, was express'd by the 4th Glass, and B, as it appear'd by the first. The rest, being taken from different parts of those Insects, C, D, E, F, were all viewed by the 4th Glass.

G is one grain of the *farina* of the *capilaments* of Maloes, by the first Glass. H, H, is the Tail of a small Fish, viewed when living by the 4th Glass, iiii is the part of the Tail next to the Body of the Fish, where the Trunks of the *Veins* and *Arteries* pass together. IIII their extremities, which appear united. kkk other inosculation, with the *Arteries* and *Veins* appearing in the transparent Membrane, between the Cartilages KK. LLLL the Cartilages composed of several Joyns, on each side of which the Trunk of a Vein and Artery passes. M an *animalculum*, whereof a great number appeared moving themselves up and down on the Tail of the Fish, while the *Circulation* was a viewing. N a side view of the same *animalculum*.

O another *animalculum* of a different figure from the former, that stuck to the Tail of the Fish by its jagged extremity, and frequently drew its long Body out and in again.

P Q one of the Lice found on that Beetle, called *Scarabeus Pediculofus* by the 4th Glass. P Its *Arms*. Q Its two Claws, not unlike those of a Lobster. rrrr the extremities of its Feet, which have a remarkable contrivance for sticking fast to the polish'd surface of the Beetle, not in the manner of Claws, as many other Insects; but divided into *Capilaments*, as express'd in the Figure.

FIG. II.

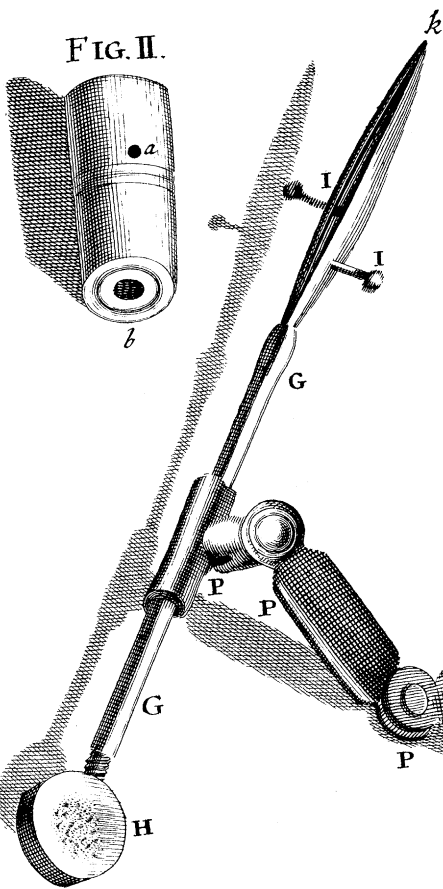


FIG. V.

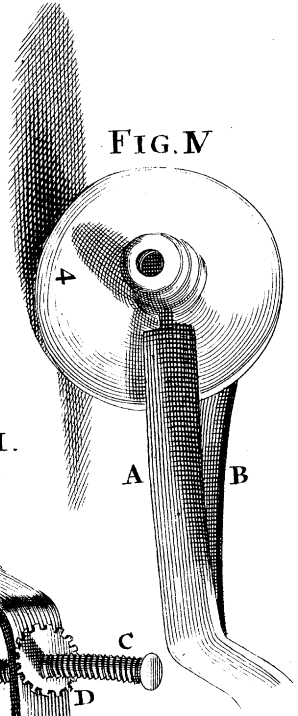


FIG. III.

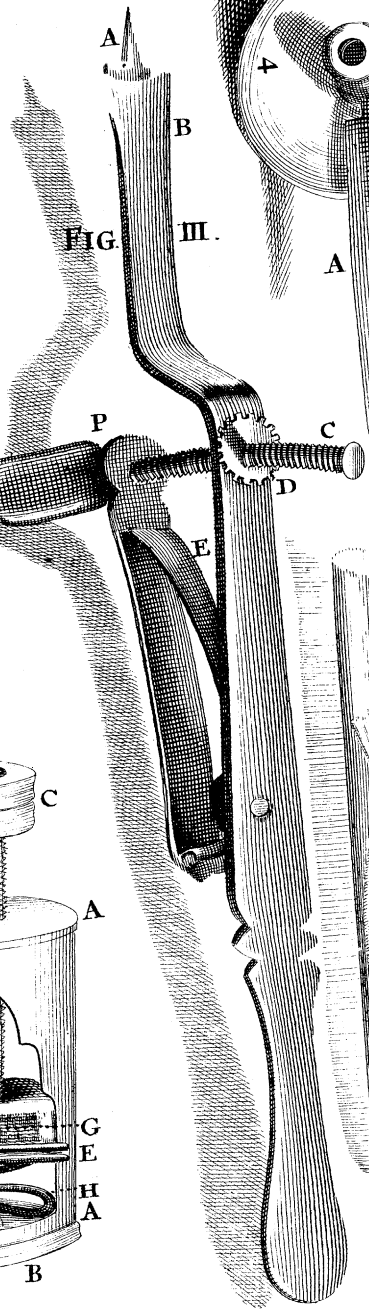


FIG. I.

