XIV. Account of the new machine invented by the late Mr. Custance, for making vegetable cuttings for the microscope

Dr. Thornton

To cite this article: Dr. Thornton (1799) XIV. Account of the new machine invented by the late Mr. Custance, for making vegetable cuttings for the microscope , Philosophical Magazine Series 1, 3:11, 302-309, DOI: [10.1080/14786449908677000](https://doi.org/10.1080/14786449908677000)

To link to this article: <http://dx.doi.org/10.1080/14786449908677000>

Published online: 18 May 2009.

Submit your article to this journal [↗](#)

Article views: 4

View related articles [↗](#)

dered a feton in the neck, as the issue was dried up. I directed also bark, columbo, and prepared kali, to correct acidity and brace the stomach, as also to render the blood more attractive of oxygen, and the body was kept regular with aloetic pills; and this plan speedily produced the blessing of sound health, which has continued now upwards of fifteen months, without any disagreeable nervous sensations, and without a single excursion being made into the country.

Observations on this Case. In the case of Mr. Ruffel, which was melancholia, recorded by Dr. Beddoes, the cure was effected without a feton; how much are we therefore to attribute to this application in the present instance? The drying up the issue by the vital air, when employed alone, did it not denote, from the absorption of this principle, an increased energy of the absorbents? I have before noticed, that where serum was discharged, this has happened; but when matter is secreted, there is on the contrary a more abundant discharge, or the serum is converted into laudable pus. In the case of Mr. Fixsen, St. Anne's-Street, Westminster, an issue which could not be made to discharge, began immediately to pour out matter, upon the commencement of the inhalation of the medicinal air. The varicose veins disappearing was a strong mark of increased energy in the circulating vessels. The numbness of the fingers going off, shewed increased action remote from the heart; the glow, the increase of spirits, all declare in marked expressions the influence of vital air; and what makes me the more inclined to this opinion is, that *country air* before used to afford the only relief.

XIV. *Account of the New Machine invented by the late Mr. CUSTANCE, for making Vegetable Cuttings for the Microscope. Communicated by Dr. THORNTON, Lecturer on Medical Botany at Guy's Hospital, &c. &c.*

THE first idea of making vegetable cuttings to be examined by the microscope, originated from the famous
Dr.

Dr. Hooke above a century ago, as may be seen in his *Micrographia*.

“Charcoal, or a vegetable burnt black,” says this eminent philosopher, “affords an object no less pleasant than instructive; for if you take a small round piece of charcoal, and break it short with your fingers, you may perceive it to break with a very smooth and sleek surface, almost like the surface of black sealing wax: this surface, if it be looked on with an ordinary microscope, does manifest abundance of those pores, which are also visible to the eye in many kinds of wood, ranged round the pith, both in a kind of circular order, and a radiant one. Of these there are a multitude in the substance of the coal, every where almost perforating and drilling it from end to end; by means of which, be the coal ever so long, you may easily blow through it; and this you may presently find, by wetting one end of it with spittle, and blowing at the other.

“But this is not all: for, besides those many great and conspicuous irregular spots or pores, if a better microscope be made use of, there will appear an infinite company of exceedingly small and very regular pores, -so thick and so orderly set, and so close to one another, that they leave very little room or space between them to be filled with a solid body; for the apparent interstitia, or separating sides of these pores, seem so thin in some places, that the texture of a honeycomb cannot be more porous: though this be not every where so, the intercurrent partitions in some places being very much thicker in proportion to the holes.

“Most of these small pores seemed to be pretty round, and were ranged in rows that radiated from the pith to the bark; they all of them seemed to be continued open pores, running the whole length of the stick; and that they were all perforated, I tried by breaking off a very thin sliver of the coal cross-ways, and then with my microscope diligently surveying them against the light, for by that means I was able to see quite through them.

“These

“ These pores were so exceedingly small and thick, that in a line of them, $\frac{1}{18}$ part of an inch long, I found, by numbering them, no less than 150 small pores; and therefore, in a line of them an inch long, must be no less than 2700 pores; and in a circular area of an inch diameter, must be about 5,725,350 of the like pores; so that a stick of an inch diameter may containe no less than seven hundred and twenty-five thousand, besides 5 millions of pores, which would, I doubt not, seem even incredible, were not every one left to believe his own eyes. Nay, having since examined cocus, black and green ebony, *lignum vitæ*, &c. I found that all these woods have their pores abundantly smaller than those of soft light wood; in so much that those of *guajacum* seemed not above an eighth part of the bigness of the pores of beech, but then the interstitia were thicker; so prodigiously curious are the contrivances, pipes, or fluces by which the fucus nutritius, or juyce of a vegetable, is conveyed from place to place.”

He afterwards says, “ I took a good clear piece of cork, and, with a pen-knife sharpened as keen as a razor, I cut a piece of it off, and thereby left the surface of it exceeding smooth; then examining it very diligently with a microscope, methought I could perceive it to appear a little porous; but I could not so plainly distinguish them as to be sure that they were pores, much less what figure they were of: but judging from the lightness and yielding quality of the cork, that certainly the texture could not be so curious, but that possibly, if I could use some further diligence, I might find it to be discernible with a microscope, I, with the same sharp pen-knife, cut off from the former smooth surface an exceeding thin piece of it; and placing it on a black object plate, because it was itself a white body, and casting the light on it with a deep plano-convex glass, I could exceedingly plainly perceive it to be all perforated and porous, much like a honey-comb, but that the pores of it were not regular; yet it was not unlike a honey-comb in these particulars.”

This is the first rude hint respecting the mode of cutting of vegetables, since which time cutting machines have been contrived by several ingenious mechanics, that might better perform this delicate operation. In 1770 Dr. Hill published a treatise, in which he explained the construction of timber by means of vegetable cuttings examined by the microscope; and he in that work gives an account of a cutting engine, in which a spiral knife is employed; the invention, he says, of Mr. Cummings. The late Mr. Adams, optician in Fleet-street, appears to have contrived a machine for cutting thin sections of wood, in order that the texture thereof might be more visible to the microscope; and in his *Essays on the Microscope*, he says, that this his invention was afterwards improved by Mr. Cummings. Notwithstanding the application of Dr. Hill, and of others who attempted to bring this art to perfection, Cusance, a common carpenter from Ipswich, surpassed every other, and, as Mr. Adams justly observed, continued unrivalled in his dexterity of preparing thin sections of wood, having brought this art to the highest perfection. He cautiously kept his method a secret from every one, and various conjectures were made in what way he accomplished his unrivalled cuttings. When he was alive, I offered him fifty pounds for the discovery, to disclose it to the world for the promotion of science, and in order the better to accomplish my views in my *New Illustration of Linnæus*, where the organisation of vegetables is a particular object of consideration *. When pressed, he offered me the discovery for an hundred guineas, which thinking exorbitant, I gave up all thoughts of it; but, soon after dying, he left in his will, that every thing he possessed should be put up to public auction; and, among other things, his invention of the cutting engine was particularly noticed in the catalogue. They were not, however, exposed to examination, but I did not fail being at the sale to embrace this opportunity of bidding for the two engines, fearful that a mo-

* Representations of all the Cuttings of Cusance will be given in this Work.

nopoly might be made of the art of preparing vegetable cuttings, as had been successfully done by Cuslance. Although the opposition was strong, I was the successful bidder, and became possessed of both engines, which are constructed nearly upon the same principle; and I am happy to embrace the present opportunity of communicating to the public so valuable an acquisition to philosophy and science.

Cuslance's best Cutting Engine described.

Fig. 1. represents a view, and fig. 2. a section, of the cutting machine. It has the appearance of an oblong box, and the sides from the bottom A (fig. 2.) up to B are made of brass. A piece of hard mahogany, C C, is fitted into the brass box, and fills the whole cavity down to *a a*, leaving a void space at the bottom, of sufficient size to admit the parts of the machine which work there, and which are described below. From the top to the bottom of the wood there is a perforation, of which the outline of fig. 3. may be considered as representing a horizontal section, which receives easily a brass socket, fig. 3, in which the wood (*b*) to be cut is secured in its place by means of a brass holdfast *c*, grooved like a float file, and pressed against the wood by the screw *d*. This socket, with the holdfast, (which viewed in front has a fluted appearance) and the piece of wood is represented in its place D, fig. 1 and 2, where it is secured from shaking by means of the piece *e*, fig. 2, pressed against it by the screw *f*, but not so tight as to prevent its being raised when required by the micrometer screw to be yet described. The socket, which fills the perforation from the surface D down to *g*, has a horizontal division at *b*, which serves as a bottom for the holdfast to rest on; the cavity of the socket below *b* receives a piece of metal *i i*, of which fig. 4, is an horizontal section; through this piece, which moves easily up or down in the socket, is a female screw, in which the micrometer screw turns, which may be seen passing through *i i* in fig. 2. The micrometer screw, the neck of which works in a plate *m m*, made fast to the bottom of the piece of mahogany before described by means of the screws

screws *n n*, is prevented from rising or falling, when turned round, by a conical shoulder fitted into the upper side of the plate *m m*, as may be seen in the figure, and by the micrometer index wheel *o o* made fast to that end of the screw which projects through the lower surface of *m m*. Therefore, when the index is turned, the screw working in *i* raises or lowers *i*; the latter by its form being prevented from turning with the motion of the screw. The piece *i*, being thus raised as much as the intended thickness of the slip to be cut, presses as it rises against the division *b*, and by that means makes the brass socket, in which the wood is made fast as before described, to rise exactly the same quantity—care being taken to regulate the pressure communicated by the side screw *f* in such a manner as just to allow free action to the micrometer screw, and yet to prevent any lateral deviation in the ascent of the socket. A portion of the index wheel comes through the front of the machine (*o*, fig. 1.); and all that is necessary to raise the wood, the parts being previously adjusted in the manner described, is to lay hold of the knob that presents itself at the opening, and move it to the left, a half, a whole, or two divisions, according to the thickness the slip is wished to be cut. These divisions are marked on the circumference of the index, and you note the quantity that passes a stationary point marked over the centre of the opening.

The cutting apparatus is constructed in the following manner:—On the further edge of the upper surface of the box, a flat rule, *G G*, fig. 1, made of steel, is fastened down by the screws *k k*: it is more than an eighth of an inch in thickness, and the front edge of it is ground perfectly straight, and stands at a right angle to the surface on which it rests. Another flat rule, one end of which, *H*, may be seen projecting past the end of *G* towards the left, serves as a bed for the cutting knife *r r*, which is made fast to the rule by the screws *s s*. The upper and under surface of this rule are ground parallel to each other, and its back edge is ground straight to

fit against the front edge of the rule G G. The rule H, which is moveable with the knife r , is tapered from the end H, so as to be somewhat narrower at the end next to the cavity D, than the diameter of the pieces of wood that can be contained betwixt the holdfast (c , fig. 3.) and the other side of the socket. From this the wonderful simplicity and accuracy of the process, as performed by this apparatus, must be obvious; for the socket, or in other words the piece of wood from which the slip is to be cut, being raised to the desired height by turning the micrometer o , all that is necessary is to slide the rule H, with an even hand and pressure, along between the rule G G and the wood to be cut; the taper form of the knife, or rather of its bed, causing it to shave off, as the broad end comes nearer to the socket, a slip from the surface exposed to its action. It should be here remarked, that a portion of the bed (the rule H) is cut away from under the knife, from r to r , to allow the knife to pass freely over the wood as it performs its office. To keep the wood perfectly fast in its place while the slip is cutting off, besides the holdfast in the socket already described, there is the following contrivance:—A brass spur, u , a little thinner than the rule H, having a circular notch at its widest end, which may be moved or made fast at pleasure by means of the screw v , is brought up tight against the wood to be cut (the wood being embraced by the circular notch), and then screwed fast; the opening at the narrow end of the spur, through which the screw passes, is in the form of a slit, to allow it to be adapted with ease to different sizes.

As the brass socket rises as well as the wood, (and this is indispensable to secure the parallel rising of the wood after each cut,) it must be obvious, that when, by being raised to allow taking off repeated cuttings, it has been brought almost to the knife, the apparatus must be re-adjusted, and the wood raised in the socket before more cuttings be taken off.

It need hardly be remarked, that the cutting knife is
ground

ground to a perfect true and fine edge, without warp or bend, that it may move through a perfect plane. The accuracy and delicacy with which it works may be judged by fig. 5, which represents a microscopic view of a cutting made from fo fragile a substance as a *piece of charcoal*.

XV. *Remarkable Instance of a Turkey Cock hatching Eggs.*

By M. OEDMANN. *From New Transactions of the Academy of Sciences at Stockholm. Vol. X.*

MALE fowls, which associate with a plurality of females, care so little for their posterity, particularly in a wild state, that they do not seem to have the least affinity to the young when hatched, and contribute neither towards rearing nor protecting them ; on this account M. Oedmann considers the following circumstance to be very singular ; such, perhaps, as was never before observed. In the month of May 1789 a turkey-hen was sitting upon eggs, and as the cock, in his solitude, began to be uneasy and to seem dejected, he was allowed to remain in the same place along with her. He immediately sat down by the female, and people at first believed that this was only a piece of gallantry ; but they soon found that he had taken some of the eggs from under the hen, which he covered very carefully with his body. The maid, who looked after the poultry, thought this mode of hatching would be attended with little advantage, and therefore put the eggs back under the hen ; but the cock was no sooner at liberty than he again carried some of them away as before. M. Haselhuhn, the proprietor, when he observed this, resolved, for the sake of experiment, to let the cock have his own way, and he caused a nest to be prepared with as many eggs as the animal's large body was able to cover. The cock seemed to be highly pleased with this mark of confidence, sat with great patience on the eggs, and was so attentive to the care of hatching them that he scarcely took time to go in search of