

The Variation of the Magnetick Needle was observ'd, this Year, to be  $7^{\circ} 20'$  West. *Philip Wells*, Surveyor General of this Province, in the Year 1686, observ'd it to be  $8^{\circ} 45'$ ; by which, it appears to decrease about  $1^{\circ} 25'$  in 38 Years, or a little more than two Minutes in a Year.

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III. *A New Contrivance for taking Levels, by the Reverend John Theophilus Desaguliers, L. L. D.*  
R. S. S.

**T**HAT the Air Thermometer is also a Barometer, has been observ'd long ago; and, because the Liquor in it will rise and fall, as well by the Change of the Weight of the Air, as by the Air's Rarefaction by Heat and Cold, this Instrument has no longer been made use of as a Thermometer, and, in its stead, Spirit of Wine Thermometers, hermetically seal'd, have been us'd ever since.

But, because the Errors of the Air Thermometer (or its Difference from the Spirit Thermometer) depend only upon the Change of the Weight of the Atmosphere from what it was, when the two Thermometers were set at the same Degree of their respective Scales; the late Dr. *Hook* contriv'd an Instrument, that he call'd a Marine Barometer, made of a Combination of the two abovemention'd Thermometers; in such Manner, that a third Scale being made use of, to observe the Difference of the two Thermometers, thereby the Change of the Air's Gravity, and consequently Storms, Rains, and fair Weather, might be foretold at Sea, where the Quicksilver Barometer becomes useles by the flaking of the Ship.

Dr.

Dr. *Halley*, some Years ago, publish'd two Tables to shew, how much the *Mercury* in the Barometer wou'd subside, when the Instrument is carried up to determinate Heights, above the Level of the Place where the first Observation was made ; but as he makes only one Tenth of an Inch of Fall of *Mercury*, to correspond with an Height of 90 Feet (which Height is rather of the least) it is evident, that only very high Hills and Mountains can have their Heights determin'd by this Method. The same learned Professor has lately, in the *Philosophical Transactions*, propos'd Mr. *Patrick's* pendent Barometer for taking the Level of distant Places, because the *Mercury*, in the Tube of the said Barometer, does sometimes rise and fall a Foot, or a Foot and an Half ; if therefore the Motion of the *Mercury* in this Barometer, be five times more sensible than in the common one, a Tenth of an Inch of Fall of the *Mercury*, will answer to an Height of 18 Feet ; and therefore such an Instrument might be of Use in taking the Levels of distant Places. But I know by many Experiments, that this won't answer in Practice ; because as the Tube of such a Barometer is of a very small Bore, the Attraction of Cohesion, whereby the *Mercury* is apt to adhere to the Tube, will disturb the Motion of the *Mercury* caus'd by the different Pressure of the Atmosphere ; so that setting up this Barometer several Times successively in the same Place, it will often differ a Tenth of an Inch, or more ; and if it be shaken, as is commonly done to set it right, the *Mercury* will sometimes part, and a Drop of it fall from the rest ; so that it is less to be depended upon for this Use, than the common Barometer.

Mr. *Stephen Gray* has often made a very sensible Barometer in the following Manner. Into a Bottle C B, (Fig. I.) he fixes a Tube A B, of a very small Bore, open

pen at both Ends, and cemented tight to the Neck of the Bottle at C ; then having warm'd the Bottle with the Hand to drive some of the Air out of it, he immerses the End A into Water, ting'd with *Cochineal*; so that as the Air cools in the Bottle C B, some of the red Water is forc'd into the Bottle ; then setting the Bottle upright again, as in the Figure, the Liquor in the Bottle will stand at B, (above the End of the Tube) and that in the Tube at D ; but if it shou'd stand higher or lower than D, it may be brought to that Place by sucking or blowing at A. The Instrument, thus prepar'd, if it be first set on the Ground, and a springing Ring of fine Wire slipp'd on the Tube down to D, by Way of Index, and then set upon any Table, or other Place, scarce a Yard higher, one may observe that the Liquor is risen sensibly. I have seen it rise a Quarter of an Inch, when the Bottle was set but a Yard higher than where it stood before ; so that the Column of Atmosphere, that press'd down the Tube, whilst the Machine was on the Ground, being shorten'd only three Feet, was so overbalanc'd by the Expansion of the Air in the Bottle at B, that the Liquor rose a Tenth of an Inch above D. There is, indeed, a great Uncertainty in this Instrument ; for since it is a Thermometer, as well as a Barometer, the Warmth of the Hand that touches it, or even comes near it, will make it rise, if the Air in the Bottle was cold before. Mr. *Gray* therefore contriv'd to put the Bottle C B, into the Vessel F E, which he fill'd with Sand ; that in raising the Instrument, and moving it up and down, the Air in C B might continue in the same State, and the Machine be only a Barometer during the Experiment.

This seems to bid fair for an Instrument, whereby the different Levels of Places may be taken ; but upon a nice Examination, it will be liable to Error. For in the first Place, tho' Sand is not alter'd in its Heat or Cold suddenly ; yet in two or three Hours, as it is carried into a warmer or a colder Place, it will become hotter or colder, and the least Degree of Heat or Cold, communicated to the Air C B, will alter the Height of the Liquor at D, when the Instrument is made so sensible as I have mention'd. Then if, in carrying the Instrument, it should be accidentally inclin'd (as in Fig. II.) so that the Liquor in the Bottle should not cover the Bottom of the Tube at B, some Liquor may fall out of the Tube at B, or some Air may get into it : each of which Accidents, will quite spoil the Experiment. But if this Machine be made portable, without any Inconveniency, and be secur'd against the Action of Heat and Cold (or, which is the same, if the Alterations by Heat and Cold be exactly allow'd for) it will be of very great Use and Certainty, in taking the Levels of distant Places, provided they be not so far distant from each other, that it requires above six Hours Time to carry the Instrument from one Place to another ; nay, very distant Places, even at two or three Days Journey from one another, may be taken tolerably well with two Instruments, nicely adjusted to each other, if they be taken notice of by two Observers at the same Hour, in fair Weather, and when there is no Wind.

Now such an Instrument, I hope, I have contriv'd, whereby the Difference of Level of two Places, which could not be taken in less than four or five Days with the best Telescope Levels, may be taken in as few Hours.

To the Ball C (Fig. III.) is join'd a recurve Tube B A of a very fine Bore, with a small Bubble at Top at A, whose

whose upper Part is open. It is evident from the Make of this Instrument, that if it be inclin'd in carrying, no Prejudice will be done to the Liquor, which will always be right, both in the Ball and the Tube, when the Instrument is set upright. If by Heat, the Air at C be so expanded, as to drive the Liquor to the Top of the Tube, the Cavity A will receive the Liquor, which will come down again and settle at D, or near it, according to the Level of the Place where the Instrument is, as soon as the Air at C returns to the same Tenor in respect to Heat and Cold. To preserve the same Degree of Heat, when the different Observations are made, the Machine is fix'd in a Tin Vessel FE, fill'd with Water up to *g b*, above the Ball; and a very sensible Thermometer has also its Ball under Water, that one may observe the Liquor at D in each Experiment, when the Thermometer stands at the same Height as before. The Water is pour'd out, when the Instrument is carried, which one may do conveniently by means of the wooden Frame of Fig. IV. which is set upright, by means of three Screws, such as *s*, and a Line and Plummet *p P*. The back Part of the wooden Frame is represented by Fig. VI. where, from the Piece at Top K, hangs the Plummet P, over a Brass Point at N: *M m* are Brackets to make the upright Board K N continue at Right Angles with the horizontal One at N. The VIIth Figure does likewise represent the wooden Frame and Screws. The Vth Figure represents the Machine seen in Front, supposing the Forepart of the Tin Vessel transparent. And here the Brass Socket of the recurve Tube, into which the Ball is screw'd, has two Wings at H. fix'd to the Bottom, that the Ball may not break the Tube by its Endeavour to emerge, when the Water is pour'd in as high as *g b*.

After I had contriv'd the Machine, as above mentioned, I consider'd, that as the Tube is of a very small Bore, if the Liquor shou'd rise into the Ball A, in carrying the Instrument from one Place to another, some of it wou'd stick to the Sides of the Ball A, and that upon its Descent in making the Experiment, so much might be left behind, that the Liquor wou'd not be high enough at D, to shew the Difference of Level ; therefore, to prevent that Inconveniency, I have contriv'd a blank Screw to shut up the Hole at A (Fig. IV. and V.) as soon as one Experiment is made, that in carrying the Engine, the Air in A may balance that in C, so that the Liquor shall not run up and down the Tube, whatever Heat and Cold may act upon the Instrument, in going from one Place to another.

Now, because one Experiment being made in the Morning, the Water may be so cold, that when a second Experiment is made at Noon, the Water cannot be brought to the same Degree of Cold that it had in the Morning ; therefore in making the first Experiment, warm Water must be mix'd with the Cold ; and when the Water has stood some time, before it comes to be as cold, as it is likely to be at the warmest Part of that Day ; observe, and set down the Degree of the Thermometer, at which the Spirit stands ; and likewise the Degree of the Water in the Barometer at D ; then screw on the Cap at A, pour out the Water, and carry the Instrument to the Place whose Level you wou'd know ; there pour in your Water, and when the Thermometer is come to the same Degree as before, open the Screw at Top, and observe the Liquor in the Barometer.

My Scale, for the Barometer, is ten Inches long, and divided into Tenths, so that such an Instrument will serve for any Heights not exceeding ten Feet, each  
Tenth

Tenth of an Inch answering to a Foot of Height. *NB.* I have not made any Allowance for the Decrease of Density in the Air, because I don't propose this Machine for measuring Mountains (tho' with proper Allowance for the decreasing Density of the Air, it will do very well) but for Heights to be known in Gardens, Plantations, and the Conduct of Water, where an Experiment, that answers to two or three Foot in a Distance of twenty Miles, will render this a very useful Instrument.

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IV. *Intestinum Parturiens, seu Casus oppido rarus de cranio & costis Fœtus per anum ejectis, descriptus a Johanne Lindestolpe, M. D. & Reg. Colleg. Medic. Stockholmensis Assessore. Ex Actis Literariis Sueciæ, An. 1723. Trimestr. 1.*

**J**ohannes Hesselius, M. D. & Westro-Gothicæ Medicus provincialis, Vir sane doctissimus, & Historiæ Naturalis, ut Pliniana utar phrasi, peculiariter curiosus, scripsit ad me Scaris d. 20 Sept. præterlapsi anni, transmisitque literas *D. Bernhaldi Shiever*, Chirurgi muneris fungentis in Legione Rosenstierniana, ad Magistrum Equitum Nobilissimum *D. Cederberg* perscriptas, in quibus refert casum, in hisce sane terris rarissimum, quod mulier quædam, postquam per septem menses gravida fuisset, evanescente tumore omni abdominis, per anum peperit cranii humani particulam, duasque costas. Sed cum multa desiderari viderentur, quæ lucem fœnerari possent tam miro phænomeno, dignum putavi, amicissimum *Hesselium* per literas denuo compellare, vellet ulterius in eam rem inquirere, mihi que communicare, quo possem tam mirandam rem ceteris meis inferere.

