

Royal Society, Feb. 28. last: and it was found that the Pymont Waters gave a much brighter Tincture with Galls and Tea, and had a much more exalted Chalybeat Taste than the Spaw; and a small Quantity of each being kept for some time in Bottles, to compare them, the Pymont was found to have retained its Virtues much better than the Spaw. The President, and several of the Members present, having drunk a Glass of it, found it of a very agreeable Relish, and to sit easie on the Stomach.

IV. Remarks on the second Paper in the History of the Royal Academy of Sciences, for the Year 1711. concerning the Cause of the Variation of the Barometer: to shew that the Way of accounting for it in that Paper is insufficient, and that the Experiment made use of to prove what is there asserted, does no way prove it. By J. T. Desaguliers, M. A. F. R. S.

The Paper is as follows.

‘ **I**T appears by the Barometer, that when it rains,
 ‘ or a little before Rain, the Air commonly be-
 ‘ comes lighter.
 ‘ That it must rain when the Air becomes lighter it
 ‘ is easie to imagine; for the imperceivable Particles of
 ‘ Water, that swim about in the Air in prodigious
 ‘ Quantity, not being sufficiently sustain’d when the
 ‘ Air has lost a certain Degree of its Weight, begin to
 ‘ fall, and several of them joining together in the Fall,
 ‘ make Drops of Rain. So when about half of the
 ‘ Air is drawn out of the Recipient of the Air-Pump,
 ‘ (and

‘ (and consequently the remaining Air is as weak again
 ‘ as at first) something like a small Rain falls. But
 ‘ why shou’d the Air become lighter? One might ima-
 ‘ gine that in the Place where it rains, it may have lost
 ‘ some of its Weight and Bulk, by means of the Winds
 ‘ carrying away some Part of it. but Monsieur *Leibnitz*,
 ‘ in a Letter to the Abbot *Bignon*, gives a more inge-
 ‘ nious and more new Reason for it.

‘ He pretends that a Body, which is in a Liquid,
 ‘ weighs with that Liquid, and makes up part of its
 ‘ whole Weight, so long as it is sustain’d in it; but if
 ‘ it ceases to be sustain’d, and consequently falls, its
 ‘ Weight no longer makes a Part of the Weight of the
 ‘ Liquid, which thereby comes to weigh less. This
 ‘ may naturally be applied to the abovementioned Par-
 ‘ ticles of Water; they encrease the Weight of the Air
 ‘ when it sustains them, which is diminished when it lets
 ‘ them fall: and as it may often happen that the Parti-
 ‘ cles of Water that are highest, fall a considerable time
 ‘ before they join with those that are low, the Gravity
 ‘ of the Air diminishes before it rains, and the Barome-
 ‘ ter shews it.

‘ This new Principle of Monsieur *Leibnitz* is surpris-
 ‘ ing. For must not a strange Body, whether sustain-
 ‘ ed in a Liquid or not, always weigh? Can it gravi-
 ‘ tate upon any other bottom than that which sustains
 ‘ the whole Liquor? Does that Bottom cease to car-
 ‘ ry a strange Body, because it falls? And is not that
 ‘ Body all the while it is falling, part of the said Li-
 ‘ quid as to the Weight? At that rate, whilst a Chy-
 ‘ mical Precipitation is made, the whole Matter ought
 ‘ to weigh less, which has never been observed, and
 ‘ scarce appears credible.

‘ Notwithstanding these Objections the Principle
 ‘ holds good, when more closely examin’d. What su-
 ‘ stains

' sustains a heavy Body is press'd by it. A Table, for
 ' Example, which sustains a Pound Weight of Iron, is
 ' pressed by it, and is so only because it sustains the
 ' whole Action and Effect of the Cause of Gravity,
 ' (whatever it be) to push that Lump of Iron lower.
 ' If the Table should yield to the Action of that Cause
 ' of the Weight (or Gravity) it would not be press'd,
 ' and therefore would carry nothing. After the same
 ' manner the Bottom of a Vessel, which contains a
 ' Liquid, opposes it self to all the Action of the Cause of
 ' Gravity against the said Liquid: If a strange Body swims
 ' in it, the bottom opposes it self also to the said Action
 ' against that Body, which, being in *Æquilibrio* with the
 ' Liquid, is in that respect really a Part of it. Thus the
 ' Bottom is press'd both by the Liquid and the strange
 ' Body, and sustains them both. But if the body falls,
 ' it yields to the Action of Gravity, and consequently
 ' the Bottom does no longer sustain it; neither will it
 ' sustain it, till the said Body is come down to the
 ' Bottom. Therefore during the whole Time of the
 ' Fall, the Bottom is eas'd of the Weight of that Bo-
 ' dy, which is no longer sustain'd by any thing, but
 ' push'd down by the Cause of Gravity, to which no-
 ' thing hinders it from yielding.

' Monsieur *Leibnitz*. to confirm his Notion, propos'd
 ' an Experiment. He says, that two Bodies must be
 ' tied to the two Ends of a Thread, the one heavier,
 ' and the other lighter than Water, yet such as both
 ' together may swim in Water: Put them into a Tube
 ' full of Water, the Tube being tied to one End of
 ' the Beam of a Ballance whose other End has a con-
 ' trepoising Weight: Then if we cut the Thread which
 ' ties the Bodies together (that are of unequal Weight)
 ' so that the heaviest may presently descend. He says, that
 ' in such a Case the Tube would be no longer in *Æqui-*
 ' *brio*, but its counterpoising Weight would preponde-
 rate

rate, because the Bottom of the Tube wou'd be less press'd. It is plain, that the Tube must be sufficiently long, that the falling Body may not reach the bottom before the Tube has time to rise. In Chymical Precipitations, the Vessels are either too short, or what is precipitated falls sometimes too fast and sometimes too slow; for then the little Bodies are always (as to Sense) *in Æquilibrio* with the Liquor that contains them.

Monfieur *Ramazzeni*, the famous Professor at *Padua*, to whom Monfieur *Leibnitz* had propos'd his Experiment, has made it with Success, after some fruitless Trials. Monfieur *Reaumur* (to whom the Academy had recommended it) has also made it with Success: This is a new View in Natural Philosophy, which, tho' it depends upon a well known Principle, is very subtle and far-fetch'd; and gives us just Reason to fear that in Subjects that seem to be exhausted, several things may yet escape us.

Remarks upon Monfieur Leibnitz's New Principle.

Figure 4.

LET AB be the Bottom of a Vessel full of any Fluid, whose Top is either wider than the Bottom as GH , narrower as EF , or equal to it as CD . The Pressure of the Fluid upon the Base AB will be equal to the Weight of CB , or of a Cylinder or Prism of the same Fluid, made up of the Area of the Base multiplied into the perpendicular Height above it.

If the Fluid be equally dense every way as Water, or of a Density uniformly diminish'd as you go upwards, this Proposition (call'd by Mr. *Boyle* the Hydrostatical

Paradox) will hold good. This is demonstrated by all Hydrostatical Writers.

Figure 5.

Let EF represent part of the Surface of the Earth, and $GEFH$ a Pillar of the Atmosphere, whose Height is GE the whole Height of the Air. Let us imagine the Vapours rising out of the Earth to form themselves into two Clouds A and B , and to settle in that Place where the Air is of the same specific Gravity with themselves. It is evident that they will cause the Air to rise so much higher as their Bulk amounts to, and will therefore make the Surface which was at GH to rise up to IK , so that the bottom EF which was press'd by a Pillar of Air as $GEFH$, is now press'd by an higher Pillar as $IEFK$. Now if the Clouds A, B , by any Cause soever, change their Place, so as to come downwards, (for *Exemple* to C, D) the Height of the Pillar $IEFK$ will remain the same as it was, and therefore the Bottom EF will be press'd as before: by the foregoing Proposition.

Corollary I.

If the Clouds A, B descend, and in their Descent keep the same Bulk as they had before, the Surface IK will remain the same, and therefore EF will be press'd as before.

Corollary II.

Whether a Body be specifically lighter or specifically heavier than a Fluid; so long as it is detain'd in it, it will add to the Fluid as much Weight as the Weight of an equal Bulk of that Fluid: wherefore a Body does not lose all that Weight which it added to the whole
Weight

Weight of the Fluid, when it ceases to be sustain'd in the said Fluid: contrary to Monsieur *Leibnitz's* Principle.

Scholium.

If a Cloud (by any Cause whatsoever) becomes specifically heavier than that Part of the Air in which it swims, the Excess of its Gravity above an equal Bulk of Air will make it descend, and accelerate its Motion downwards; and then indeed it will lose of its Weight by the Resistance of the *Medium*, till it comes to an uniform (or sensibly uniform) Motion: but all the Weight that it will lose will only be the Excess of its Gravity above that of the Air; for with the rest of its Weight it will still make up part of the Weight of the Air.

Experiment I. Figure 6.

Having with a Weight in the Scale *C* of the Balance *AB* counterpois'd the long Glafs of Water *EI*, with a Horse-Hair I let down the leaden Weight *W* into the Water, which from *FG* arose up to *EH*; and therefore the Water became heavier by the Weight of a Bulk of Water equal to the Lead. Having with another Weight in *C* made up the Counterpoise to the whole, with fine Scissars I cut the Thread of the Plummet; and all the while the Plummet was falling, the Water descended rather than rose; and when the Lead was at the bottom the Water overpois'd, because it had then added to it all the Excess of Weight of the Lead above an equal Bulk of Water, which by Experiment is about $\frac{10}{11}$ of its Weight. Had Messieurs *Reaumur* and *Ramazzeni* tri'd the Experiment thus, the Success had been the same; but Mr. *Ramazzeni* (as I understood from a Gentleman who was present) tried it in the following Manner, as I have since done.

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Ex-

Experiment II. Figure 7.

Making use of the abovemention'd Machine, after I had balanc'd the Water and Lead in it, I fix'd to the End of the Beam *B* the Thread of the Plummer, which in the former Experiment I held in my Hand. This added to the Weight hanging at *B*, and oblig'd me to put into the other Scale a Weight equal to $\frac{2}{3}$ of the Lead, to recover the *Æquilibrium*. Then cutting the Thread or Hair, the Scale with the Weights overpois'd whilst the Lead was falling; but the *Æquilibrium* was restor'd when it came to the Bottom. So that the Lead even then must have lost only its Excess of Weight above Water.

Experiment III. Figure 8.

I tried the Way propos'd by Monsieur *Leibnitz* in the following Manner.

I took a Cork *C* weighing an Ounce, and something more than four times lighter than an equal Bulk of Water, and a Ball of Antimony *W* about four times specifically heavier than Water, and of four Ounces Weight. The Cork laid upon the Water in the Vessel *EABD* rais'd the Water from *SS* to *GG*, and added an Ounce to the Weight of the whole Water: then suspending the Ball of Antimony by a String, and letting it hang in the Water at *N*, it rais'd the Water from *GG* to *HH*, and so added another Ounce to the Weight of the Water. Then tying the Antimony to the Cork (See the Figure of the Vessel mark'd with little Letters) the Cork had added to it three Quarters of the Weight of the Antimony which the Hand before had sustain'd, and made it sink so as to be almost cover'd, and rais'd the Water to *ik*, adding three Ounces to its Weight. Hanging this Vessel of Water upon the Balance, and a Coun-

Counterpoise at the other End, upon cutting the String the Vessel of Water was rais'd up, and the *Æquilibrium* was not restor'd till the Antimony came to the Bottom.

By observing that as the Cork (being freed from the Weight of the Antimony) arose, and that during the Fall of the Body, the Water sunk to *bb*, it appears that this is, in effect, the same Experiment as the former, and concludes no more. As to the real Cause of the Variation of the Barometer, namely, the Accumulation of the Air by Winds over the Place where the Barometer rises; and part of the Air being blown away where the Mercury in the Barometer sinks. see Doctor *Halley's* Account of it in the *Phil. Transactions*. Numb. 181.

POSTSCRIPT.

IN making the first Experiment before the R. Society, of a Piece of Lead suspended by a Thread, whilst it was wholly cover'd with Water in the large Tube in which it hung (whose Length was 4 Feet) it was observable, not only that the End of the Balance (to which the Tube of Water with the Lead in it was fixed) did not rise when the Thread was cut, (to let the Lead fall from the Top to the Bottom of the Tube) as it must have done according to Mr *Leibnitz's* Principle; but that the said End of the Balance began to descend from the Time that the Lead began to fall. Therefore to be sure that it was not the Plummet rubbing against the Sides of the Tube in its Fall, which caused that *baromenon*, I hung to the Balance a long Glass of three inches diameter instead of the Tube, and making the Experiment as before, it succeeded in the

the same manner: the End of the Balance which carried the Vessel of Water sunk as soon as the Thread of the Plummet was cut; tho' this Glass was not above half so long as the Tube.

When by holding the String I drew the Lead upwards and downwards in the Water, there was no sensible Alteration of the *Æquilibrium*. Neither was it alter'd by cutting the String of a Stone Plummet, because of the Shortness of the Glass, and the little Excess of specifick Gravity in the Stone: for the greater the Difference is betwixt the Body made use of in this Experiment and Water, as well as the bigger the Body it self is, the better the Experiment will succeed.

Hence it appears, that when a Body, specifically heavier than a Fluid, is (by what cause soever) detain'd in any Place of the said Fluid, it adds as much to the Weight of the whole Fluid as an equal Bulk of the said Fluid amounts to: And when the said Body, by the Action of its Excess of specifick Gravity above the Fluid, descends with an accelerated Motion; so long as that Motion is accelerated, the Resistance of the Fluid (which is as the Square of the Velocity) takes off something of the whole Weight of the Body; but as much as the Body loses, so much the Water gains, over and above what was given it by its rising on Account of the immers'd Body.

A Body therefore that falls in a Fluid is so far from making the Fluid lighter as it falls, that it makes it press more upon the Bottom that sustains it, when it is falling, than when it was at rest in the Fluid.

If the Vessel of Water be long enough for the falling Body to come to an uniform Motion before it reaches the bottom, the Force impress'd on the Water under the Body will make it press the Bottom, as much as if the Body were actually at bottom; the Body in that Case losing

ing all its Excess of Gravity above that of the Water, and the Water gaining it.

Hence it follows, that a falling Cloud, when it comes to an uniform Motion, will not only add to the Weight of the Air as much as the Weight of an equal Bulk of Air; but even as much as its whole Weight amounts to, tho' it be specifically heavier than the Air about it.

All the Diminution of Weight that can be allow'd in this Case is this. If we imagine the Air to have a smooth, regular Surface, as we have at first suppos'd, (or if that be not allow'd, we may take any imaginary Surface of it above the Clouds) when a falling Cloud is diminish'd in Bulk, (as when it is chang'd into Rain) the Surface of the Air will subside in proportion to that diminution, and therefore will weigh less, by so much as is the Weight of a Quantity of Air equal to the Bulk that Cloud has lost: But when the Drops of Rain after their Acceleration (occasion'd by their Excess of Gravity above that of the Air) are come to an uniform Motion by the Resistance of the Air, they restore to the Air the Weight that it had lost. Now this uniform Motion being acquir'd in about two Seconds of Time, and the Diminution of Gravity in the Air being insensible, when compared to near three Inches of Mercury (for such is the Variation of the Barometer with us) can no way be the Occasion of those so sensible Alterations in it, which happen some time before Rain or Fair Weather.

Add to this that the whole Quantity of Rain that falls in England and France, in the Space of one Year, scarce ever equals two Inches of Mercury: And in most Places between the Tropicks, the Rains fall, at certain Seasons, in very great Quantities, and yet the Barometer shews there very little or no Alteration.

Fig. 6.

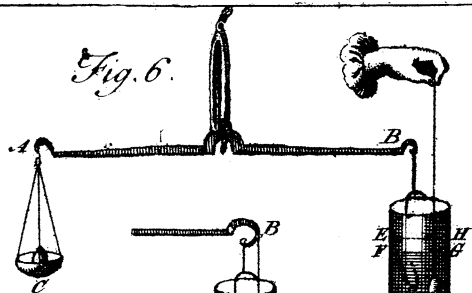


Fig. 7.

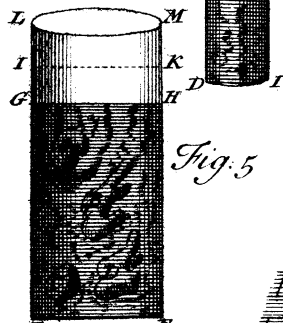
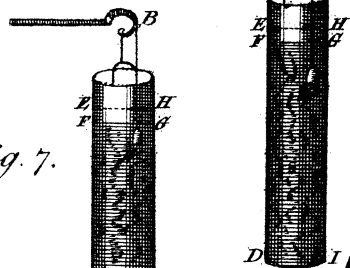


Fig. 5

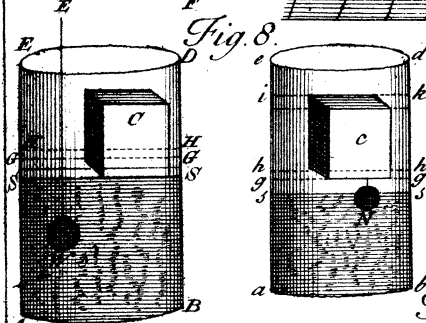


Fig. 8.

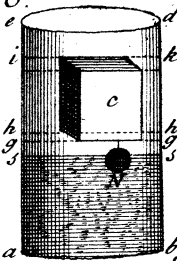


Fig. 4.

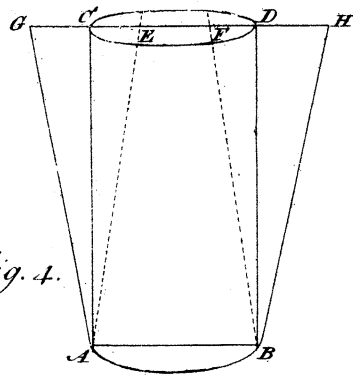
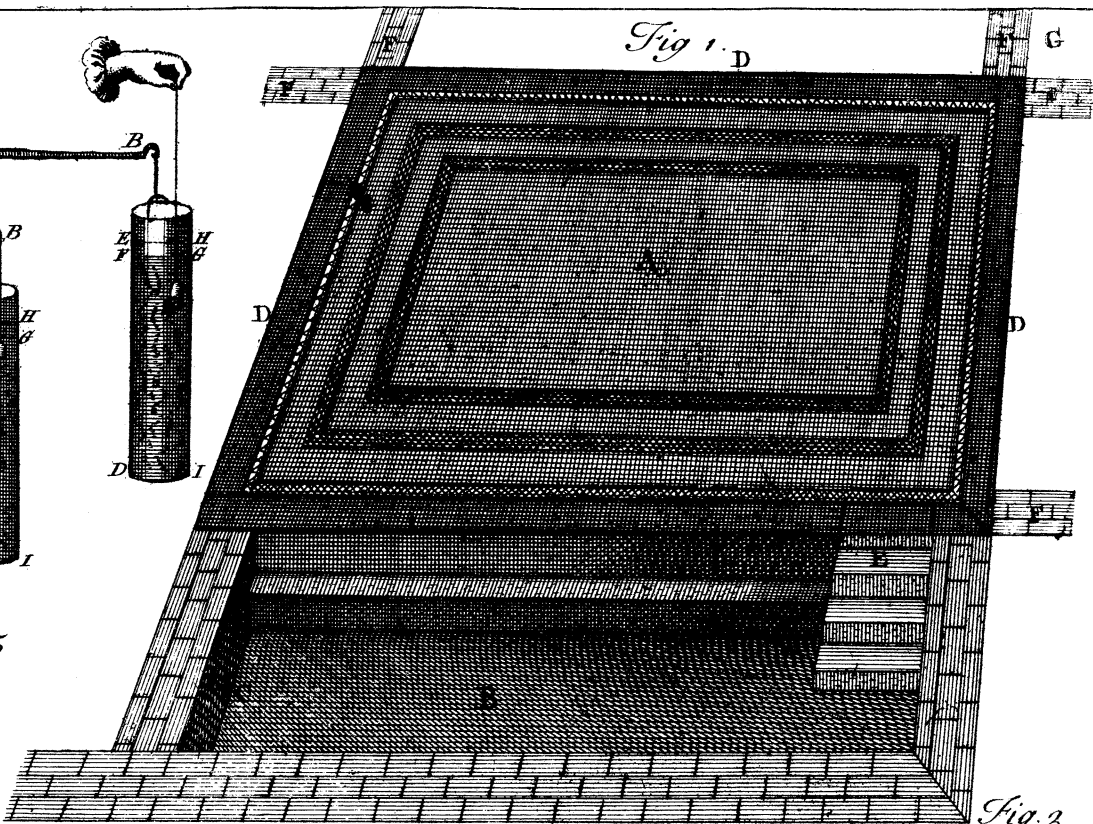


Fig. 2.



Fig. 3

Fig. 1. D



A The Pavement. B The Bath. C The Sink and the other Passage through the Wall at the East end of the Bath. D The Roman Brick wth bounded the Pavement, laid flat and covered with Terrafs. E Foundations continu'd several ways. F The Landing place out of the Bath. G The corner of a large space pav'd wth Roman Brick, and cover'd with Asphes, Coals, &c.