PHLOSOPHICAL TRANSACTIONS.

Munday, April 8. 1667.

The Contents.

DIRECTIONS

For Observations and Experiments to be made by Masters of Ships, Pilots, and other fit Persons in their Sea-Voyages.

THough the Art of Navigation, one of the most useful in the World, be of late vastly improved, yet remain their many things to be known and done, the knowledg and performance whereof, would tend to the accomplishment of it: As the making of exact *Mapps* of all Coasts, Ports, Harbors, Bayes, Promontories, Islands, with their several Prospects and Bearings; Describing of Tydes, Depths, Currents, and other things considerable in the Seas: Turnings, Passages, Creeks, Sands, Shelves, Rocks, and other dangers: Nice Observations of the Variations

and Dippings of the Needle, in different places, and in the ſame place, at different times: The Winds, Weather, and Tempers of the Seaſons every where: The great Depths, Ground, and Vegetables at the bottom of the Sea: The various Degrees of Saltneſs of the Sea-water, in ſeveral places, and at ſeveral Depths at the ſame place. If beſides Aſtronomical things, to be hereafter lookt into, the following Experiments be carefully made, and Directions obſerved by as many Ingenious Perſons, as have opportunity, it may fairly be hoped, that from multitudes of Experiments and Obſervations, ſuch Rules may be framed, as may be of ineſtimable uſe for Seamen. To which purpoſe the *Royal Society*, having ſome years ago, ordered that Eminent Mathematician Maſter *Rooke*, one of their Fellows, and *Geometry* Profeſſor of *Greſham Colledge* (ſince deceaſed, to the great detriment of the Common-wealth of Learning) to draw up ſome Directions for Seamen, the better to capacitate them for making ſuch Obſervations abroad, as might be pertinent and ſuitable to the purpoſes above-mentioned; ſuch Directions were drawn up accordingly, and ſoon after printed in *Num.* 8. of theſe *Tranſactions*. But, further to incourage and facilitate the Work of thoſe, that ſhall be engaged to put them into practice, it was thought fit, that what of this Kind was heretofore but barely propoſed, ſhould now be publiſht with ample and particular Explanations, and conſiderable Additions; which done, a good number of ſuch printed Copies is, by the Care, and at the Expences of the *R. Society*, to be lodged with the Maſter of *Trinity-houſe*, to be recommended to ſuch, as are bound for far Sea-Voyages, and ſhall be judged fit for the performance: who are alſo to be deſired, to keep an exact *Diary* of ſuch obſervations and Experiments, and deliver at their return a fair Copy thereof to the Lord High Admiral of *England*, his Royal Highneſs the *Duke of York*, and another to *Trinity-houſe*, to be peruſed by the ſaid *R. Society*.

The

The Particulars themſelves follow:

1. *To obſerve the Declinations and Variations of the Compaſs or Needle from the Meridian exactly, in as many Places as they can, and in the ſame Places, every ſeveral Voyage.*

AT *Land*, where by the help of good fixt Dials, and other fit Inſtruments, the preciſe *Meridian* of the place may be known, it is eaſie to find the *Variation* of the *Needle*, divers ways: As, by applying of the Needle, *&c.* to the *Shadow of a Thread* hanging perpendicular, when the Sun is in the *Meridian*; or to the *Meridian Line*; or the *Side of a fixt Horizontal Dial*, &c.

But at *Sea*, in regard the *Meridian* is not ſo eaſie to be found to any tolerable exactneſs, to know the *Variation of the Needle*, is much more laborious and difficult. The *Height of the Pole*, and the *Suns Declination* being known, a large *Ring-Dial*, truly wrought, having a Box with a Compaſs or Needle fixt to its *Meridian* below, may go as near as any other Inſtrument, to ſhew the *Variation* required. For, when it is ſet to the juſt hour and minute of the day, the *Meridian* of it ſtands juſt in its due place; and ſo ſhews how far the *Needle* varies from it, as exactly as the largeneſs of the *Card* will permit.

But becauſe theſe *Dials* are ſo rarely juſt, *&c.* though they may be uſed and taken notice of, yet are they not to be relied on. The thing therefore is to be performed, as followeth:

Find out the *Suns Azimuthal Diſtance* from the Meridian ſome hours *before*, or *after* Noon, and then its *Magnetical Azimuth*, or Diſtance from the *Meridian* pointed at by the *Needle*, and the Difference of theſe two Diſtances, is the Variation of the Needle.

To find the Suns true *Azimuth*, or by how many Degrees, *&c.* of the *Horizon* it is diſtant from the *Meridian*: its *Declination*, its *Altitude*, and the *Elevation of the Pole*, muſt all three be known.

For finding whereof, every Expert Mariner is inſtructed, or may be ſo, from his Sea-Books, and ſo it needs not here to be ſet down. Nor how by the help of theſe, the *Azimuth* required may, to Degrees, if not nearer, be found out upon a good *Globe* or *Planiſphere*, (whereof there is a deſign to have one, that is, the *Analemma*, contrived into a form of Inſtrument for the uſe of the publick, and that ere long; which will with great facility perform all that the Globe can do, with much more exactneſs and conveniency) that being ſufficiently known.

But to do it accurately, you muſt conſtitute a *Spherical Oblique-angled Triangle*, of the three Complements, of the *Suns Declination*, its *Altitude*, and of the *Height of the pole*; the meaſures of all the Sides whereof are known; One from the *Zenith* to the *Pole*; another from the *Pole* to the *Point of the Suns Altitude*; and the third, from *that point to the Zenith*, Now by thoſe you are to find out the Angle at the *Zeinth*, which being found, ſubſtract it from 180, and the remainder is the Suns true *Azimuth*, or Diſtance from the *Meridian* of the Place.

This Angle is to be found divers wayes, as by the *Tables* of *Sines*, *Logarithmes*, *&c.* the manners of doing whereof, are ſet down and demonſtrated by *John Newton* in his *Inſtitutio Mathematica*, Caſe 11. and in other Books of *Trigonometry*.

And the true *Azimuth* of the *Sun* being thus found, and the *Magnetical Azimuth* of it, according to your Needle, obſerved, ſubſtract the leſſer Number from the greater, and the Remainder is the Variation of the Needle. If the *Magnetical Azimuth* be leſs than the other, then the Variation is towards the ſame ſide of the *Meridian*, where the Sun is; if greater, on the other.

To obſerve the *Suns Azimuth* by the Needle, and the Needles Variation to Degrees, any Needle, long enough to afford upon a Card under it, a Circle divided into Degrees, put in a Square Box, after the ordinary manner of *Clinatories*, will ſerve turn; by placing the Box ſo, as the Sun may ſhine upon any two oppoſite ſides of it, at the ſame times that the *Suns Height*, *&c.* are taken: For then the Needles Diſtance from the Diameter of the Circle on the Card, that is parallel to thoſe ſides, is the *Magnetical Azimuth* required.

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The ſame may be done with an ordinary *Sea Compaſs*, ſo it have a Circle towards the Limb of the Card, divided into Degrees, by faſtening a ſmall Thread, Lute-ſtring or Wire (not of Iron) ſo upon it, as to paſs juſt over the Center of that Circle; and placing a ſtrait piece of wood or Braſs-wire perpendicular on the edge of the Box at the end of the Thread, and turning it to the Sun, till the Shadow of it fall juſt upon the Thread: then obſerve, what Degree of the Circle on the Card the Thread cuts, by looking plum upon it; and that is the Suns *Magnetical Azimuth.*

But to have the *Variation* to *Degrees* and *Minutes* (which is moſt deſirable) then the Obſervation laſt mention'd muſt be made with a *Quadrant*, *Sextant*, or ſome ſuch other Inſtrument, ſo large as to admit of the diviſion of a *Degree* into *Minutes*; which will require the *Radius* to be about three foot; the larger the bettter. If a *Quadrant*, then, it being laid flat, and the Square Box with the Needle placed upon it, move the *Quadrant* to and again, till that ſide of it, on which the Box is placed, lie parallel to the Needle, when at quiet: Then the *Sight* of the *Quadrant* being ſlid along the Rimb of it, till the Sun ſhine on both its ſides at the ſame time, the Mid-Line, that divides equally the *Sight*, when the Sun ſhines upon it through the ſlit, will mark the Degree and Minute of the Suns *Magnetical Azimuth.* All which is eaſie to be put in practice.

And if many ſuch Obſervations be made by ſeveral perſons at the ſame place, and by the ſame or other perſons diſtant from one another, 1. 10. 20. or more Years; Not only will the Compaſs become more uſeful then formerly, even to be conducive poſſibly to the finding the Lougitude at Sea, at leaſt in ſome places: but the variation of the Variation of the Needle being known in different places, all will be reduced to Rules, and ſo from hence, Philoſophical or Natural Knowledg, will probably be enlarged by a happy diſcovery of the true cauſe of the *Verticity*, or *Directive* faculty of the Loadſtone; one of the *Nobleſt* and moſt *abſtruce Phænomena*, that falls under the cognizance of humane Reaſon.

To find this variation by the Stars, is ſo eaſie, as every Maſter can do it; ſeeing there is no more requiſite, than to find out the true *North*, that is the *Meridian*, and compare the Needles poſition

on with it. By this means, the variation may be had well enough to degrees, half degrees, and ſome ſmaller parts; and if carefully and curiouſly proſecuted, even to Minutes too. But it will not be amiſs, to do it both by the Sun and Stars, that the greater certainty may be attained.

2. *To Carry Dipping-Needles with them.*

THe *Dipping-Needle* is to be uſed at leaſt as frequently as the former Experiment is made, and in the ſame places, in order to the ſame purpoſes. All that needs be ſaid of the Manner, is, that when the Dipping of the Needle is to be examined, the Circle, in which it moves, is to be hung perpendicular, and turned, till it be juſt in the *Magnetical Meridian*, where it dippeth moſt, and the degree of its depreſſion under the *Horizon* is to be noted in a *Table*. See *Figure* 1.

3. *To mark carefully the Flowings and Ebbings of the Sea, in as many places as may be.*

THe Particulars here to be regarded, are, 1. The preciſe times of the beginnings of the Flood and Ebb, in all Rivers, Bayes, at Promontories, Capes, and in all Roads, Harbours, *&c.* 2. Which way Currents run in all places, with their Times, Changes, *&c.* 3. What perpendicular Diſtance there is, between the higheſt reach of the Tide, and loweſt of the Ebb, both of all Spring-Tides and Neap-Tides, with their irregularities, *&c.* 4. What day of the Moon's age, and what times of the Year the higheſt and loweſt Tides fall out: And all other conſiderable Accidents obſervable in Tides, chiefly in and near all Sea-ports, Harbours, Roads, Iſlands, *&c.* as St. *Helens Iſland, Bermudas.* 5. The poſition of the Wind at every Obſervation of the Tides, *&c.*

4. *To*

4. *To remark curiouſly the Situation, Figures, &c. of all dangerous Rocks, Sands, Channels, Entries, and Courſes of Rivers, and all difficult Paſſages, and Courſes in all places; to meaſure and deſcribe the ſame Exactly, their diſtances, bearings, &c. As alſo the Proſpects of remarkable Coaſts, Promontories, Ports, Iſlands, &c. in the ſame manner; and make Draughts, Plots, and Maps of them, with their Longitudes, Latitudes, Scales, &c. and all Beacons, Buoyes, Landmarks, Light-houſes, &c. which ſerve for directing the Courſe of Ships through narrow Channels, over Bars and Banks, into Rivers, Ports, Bayes, &c. And to ſound Depths near all Coaſts, in all ſhallow Places, Roads, &c.*

5. *To ſound the deepeſt Seas without a Line, by the help of an Inſtrument, repreſented by Figure 2.*

TO perform this, take a Globe of *Firr*, or *Maple*, or other light wood, as A, let it be well ſecured by Verniſh, Pitch, or otherwiſe, from imbibing Water, then take a piece of Lead or ſtone, D, conſiderably heavier, than will ſink the Globe: Let there be a long

long Wine-ſtaple B in the Ball A, and a ſpringing wire C, with a bended end F, and into the ſaid Staple, preſs in with your fingers the ſpringing Wire on the bended end: and on it hang the weight D, by its hook E, and ſo let Globe and all ſink gently into the water, in the poſture repreſented in the ſaid *Figure*, to the bottom, where the weight *D* touching firſt, is thereby ſtopt; but the Ball, being by the *Impetus* it acquired in deſcending, carried downwards a little after the weight is ſtopt, ſuffers the ſpringing Wire to fly back, and thereby ſets it ſelf at liberty to re-aſcend. And by obſerving the time of the Ball's ſtay under water (which may be done by a Watch, having Minutes and Seconds; or by a good *Minute-Glaſs*; or beſt of all, by a *Pendulum*, vibrating Seconds; the which muſt be three foot, three inches, and one fifth of an inch long, *viz.* between the middle of the Bullet and the upper end of the Thread, where it is faſtned, or held when it vibrates.) You may by this way, with the help of ſome *Tables*, come to know any depth of the Sea.

Note, That care muſt be had of proportioning the weight and ſhape of the *Lead*, to the bulk, weight, and figure of the *Globe*, after ſuch a manner, as upon experience ſhall be found moſt convenient.

In ſome of the Trials already made with this Inſtrument, the Globe being of *Maple-wood*, well covered with Pitch, to hinder ſoaking in, was $5\frac{11}{16}$ inches in *Diameter*, and weighed $2\frac{1}{2}$ pounds; the Lead, of $4\frac{1}{2}$ pounds weight, was of a *Conical* (but is now uſed of a *Globous*) Figure 11 inches long, with the ſharper end downwards, $1\frac{9}{16}$ at the bottom in *Diameter*. And in thoſe Experiments made in the *Thames*, in the depth of 19 foot water, there paſſed between the Immerſion and Emerſion of the Globe, 6 Seconds of an hour; and in the depth of 10 foot water, there paſſed $3\frac{1}{2}$ Seconds, or thereabouts: From many of which kind of Experiments, it will likely not be hard to find out a method to calculate, what depth is to be concluded from any time of the like *Globes* ſtay under water: As for inſtance, if in the depth of 20 f. thom, meaſured by the Line, the Globe ſtay under water 15 Seconds; then if the Ball ſtay 600 Seconds, the depth of the Sea is 933 fathom and 2 foot, if the Ball be found to move equal ſpaces in equal time.

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In the ſame Trials made with this Inſtrument in the ſaid River of *Thames*, it has been found, that there was no difference in time, between the ſubmerſions of the Ball at the greateſt depth, when it roſe two Wherry's length from the place where it was let fall (being carried by the Current of the Tyde) and when it roſe onely a Yard, or ſo, from the ſame place, where it was let down: And that it muſt be ſo in great depths and ſtronger Currents, is as certain, as eaſie to be demonſtrated.

And if it be alledged, that it muſt be known, when a *Light* Body aſcends from the bottom of the Water to the Top, in what proportion of time it riſes; it may be conſidered, that in this Experiment the times of the Deſcent and Aſcent are both taken and computed together; ſo that, for this purpoſe, there needs not the nicety, which is alledged.

OF other Experiments of this way of ſounding without a Line, made by the Noble Lord Viſcount *Brounker*, Sir *Robert Moray* Knight, and Mr. *Hook*, in the Channel at *Sheerneſs*; the following account was given, *Vid.*

Weighed	*Ounce.*	*Grains.*
A Wooden Ball (*A*)	$32\frac{2}{16}$	00
Another Wooden Ball (*B*)	30	22
A Lead (*A*)	30	00
Another Lead (*B*)	$30\frac{2}{4}$	00

The Ball (*B*) and the Lead (*B*) were let down at 16 fathom; and the Ball returned in 48 ſingle ſtrokes of a *Pendulum*, held in the hand, vibrating 58 ſingle ſtrokes in a *Minute*.

A ſecond time repeated with the ſame ſucceſs; therefore, the motion was 4 foot every ſecond.

Again the Ball (*A*) and the Lead (*B*) whoſe Nail was bended into a ſharper Angle; the Ball returned in 39 ſtrokes. A ſecond time repeated with the ſame ſucceſs at the ſame depth.

Ball (*B*) Lead (*B*:) in which trial the Line, not being clear, ſtopped a little the motion; the Ball returned in 47 at the ſame depth.

Ball (*A*) Lead (*A*) at 8 fathom and 1 foot, returned at 20; repeated at 8 fathom, returned at 19.

Tried the third time at 10 fathom and 4 foot, return'd at 28.

A fourth Trial, at the ſame depth, juſt the ſame.

A fifth, at 10 fathom, 5 foot, returned in 27.

A ſixth Trial, juſt the ſame.

A ſeventh, at 12 fathom, 5 foot returned in 37.

An eighth Trial, juſt the ſame,

Another Day, near the ſame place.

Note, That the *Pendulum* was this Day adjuſted, and made a little ſhorter, there having been but 58 vibrations in a *Minute*, the other day.

Ball (*A*) Lead (*B*) at 14 fathom, returned in $32\frac{1}{2}$.

A ſecond Trial, a little after in the ſame place, returned in 33. In making of which Trial, the Vibrations were told aloud, and the Lead having been let down by a Line, was found to touch the bottom in juſt half the time, the Ball ſtaid under water. By a ſecond Trial, the aſcending and deſcending was found to be in equal times. And by a third Trial with another Lead, the very ſame found, *vid.* $16\frac{1}{2}$ deſcending, and $16\frac{1}{2}$ aſcending. This Lead and Ball let down without a Line, the Ball returned in 13 vibrations; a ſign it went not to the bottom.

A Trial made with a Lead, whoſe *Iron-Crook* was faſten'd at the top of it (like that in the *Figure* 3) ſucceeded very well, and the Ball returned in $34\frac{1}{2}$: But by reaſon of the Current, the Experimenters could not perceive, when the Lead touched the bottom. This Lead being let down without a Line, the Ball returned in $32\frac{1}{2}$. The depth of the water was now found by the Ships Lead, to be 14 fathom.

Another Trial was made with a Line, bowing the point of the Lead (like that in the *Fig.* 4) and the Ball return'd in 34. The ſame let down without a Line, the Ball return'd in 6 or 7 vibrations; a ſign again, it went not to the bottom.

In a Trial with another Lead, the Ball return'd in 34.

Repeated again with the ſame ſucceſs.

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In a Trial with a Lead, whoſe Nail was ſet awry (like that of the *Fig* 5.)the Ball returned in 34. After which Trial the depth was found to be juſt 14 fathom.

The laſt Lead and Ball being let down without a Line, the Ball returned at 35.

In another Trial with a Lead that never failed,the Ball returned in 34,and the Lead toucht the bottom at 17.

By a Trial with another Lead, the ſame time was found exactly.

By a third Trial with this laſt, the very ſame.

Theſe Trials were made near about High-water,at the depth of 14 fathom juſt by meaſure: And in them, the motions ſeem to be 5 foot every ſecond.

In all theſe Trials,the greateſt difficulty was,in the uſe of Conical Figures, with Iron Crooks, to bend the Iron, that it might be ſure to carry down the Ball with it to the bottom, and when come thither, to let it go: for almoſt every one of theſe Leads failed in one of theſe requiſites, till by ſeveral Trials they had been adjuſted.

It is not to be omitted, That the laſt Trials being made near High-water, the Ball was found to riſe(by the Boat,being permitted to drive) far off upon one ſide, out of the way, that any light thing, ſuffered to ſwim on the water, would be carried; which ſeemed to argue a motion of the under parts of the water, differing from that of the upper(a thing which is ſaid to beat certain times of the Tydes,both at the Mouth of the *Sound*, and of the *Streights*; which deſerves to be further inquired into.) The Angle made by theſe different motions,ſeemed to be about 40 *Degrees*.

6. *To keep a Regiſter of all changes of Wind and Weather at all hours by Night and by Day, ſhewing the point the Wind blows from, whether ſtrong or weak : The Rains, Hail, Snow, and the like ; the preciſe times of their beginnings and continuance ; eſpecially* Hurricans *and* Spouts; *but above all to take exact care to obſerve the* Trade-Winds, *about what degrees of* Latitude *and* Longitude *they firſt begin,* where *and* when *they ceaſe or change, or grow ſtronger or weaker, and how much ; as near and exact as may be.*

THe ſtrength of the winds is meaſured by an Inſtrument, ſuch is repreſented ; by *Figure 6* ; which being expoſed to the Wind, ſo as the flat ſide may be right againſt it, the number of *Degrees* upon the *Limb A B*, to which the Wind blows up, or raiſes, that flat ſide *C D*, ſhews the force or ſtrength of the Wind, in proportion to the reſiſtance of the flat ſide of the Inſtrument ; and is to be recorded.

The

The *Form* of a *Scheme*.

Which at one view represents to the Eye Observations of the Weather, for a whole Month, may be such, as follows.

Days of the Moneth, and Place of the Sun	*Remarkable hours.*	*Age and Sign of the Moon at Noon.*	*The Quarters of the Wind, and its strength.*	*The Faces or visible appearances of the Sky.*	*The Notablest Effects*	*General Deductions.* These are to be made after the side is filled with Observations, as
June 14 ☌ 12.46'	4	27	W----2	Clear blue, but yellowish in the *N E.*	A great Dew	From the last Quarter of the Moon to the Change, the weather was very temperate, but for the Season, cold; the Wind pretty constant between *N.* and *W.* &c.
	8		---------3	Clouded toward the *South.*		
	12	☌ 9. 46	---------3½		Thunder far to the S.	
	4	*Perigeum*	----------	Checkered blue.		
	8		WSW 1		A very great Tyde.	
	12		----------			
15 ☌ 13.40'	8	28	NW 3	A clear sky all day, but a little checker'd about 4 *P. M.* At Sun-set red and hazy.	Not by much so big a Tyde as yesterday. A great Thunder-Showre from the *N.*	
	4		4			
	6	☌ 24.51	N 2			
	12		1			
16. ☌ 14. 57 &c.	10	*New Moon at* 7. 25. *A. M.* ♎ 10.8 &c.	S 1 &c.	Overcast and very lowring, &c.	No dew upon the ground, but very much upon Marble-stones, &c.	

7 *To observe and record all* Extraordinary Meteors, *Lightnings, Thunders,* Ignes fatuos, *Comets,* &c. *marking still the places and times of their appearing, continuance,* &c.

8. *To carry with them good Scales and Glass-Viols of a pint or so, with very narow mouths, which are to be fill'd with Sea-water in different degrees of* Latitude, *and the weight of the Viol full of water taken exactly at every time, and recorded; marking withall the degrees of* Latitude *and* Longitude *of the Place, and the Day of the Month, and the Temperature of the Weather: And that as well of Water near the Top, as at a greater Depth.*

THe Viol is to be made with a very narrow Neck, and when it is almost full, water is to be dropt into it, drop by drop, till it can hold no more, drying well the Viol before it be weiged. The weight of the empty Viol is also to be recorded every time, weighing all to grains. And by evaporating gently the water, till the Salt be left dry on the bottom; they, who list, may have the satisfaction to know, what proportion the Salt of each water holdeth to its weight.

There is, among some other ways of finding the different gravities of Water, a very pretty one, mentioned by some Authors, as *Johannes Toldenus* (a *German* Artist) *Cabeus*, and *Kircher* in his

his *Fundus ſubterram*, and improved and firſt brought into uſe here, divers years agoe, by the Noble *R. Boyle*, who alſo, as himſelf informed the Publiſher, hath in ſome of his Writings, yet unpubliſht, ſet down a full Deſcription thereof.

It is ſuch a Glaſs-Tube as is repreſented by *Fig.* 7. blown at a Lamp, and poiſed in good common Water by putting *Quick-ſilver* into it, until it ſink ſo low, that nothing appear above the Superficies of the Water, but the Top; which done it is to be ſealed up, and to be graduated on its ſide, into what parts you pleaſe; which may be done with a Diamond. And then, being put into any Water to be weighed, it will, by its more or leſs ſinking into it, ſhew the differences of the Waters gravity.

9. *To fetch up Water from any Depth of the Sea.*

TO perform this, let there be made a *Square Wooden Bucket* (ſuch as *C* in *Fig.* 8.) whoſe bottoms *E E* are to be ſo contrived, that the weight *A* do ſink the Iron *B* (to which the *Bucket C* is faſtned by two Handles *D D*, on the ends of which are the moveable bottoms or Valves *E E*) and thereby draws down the *Bucket*, the reſiſtance of the Water keeps up the *Bucket* in the poſture *C*, whereby the Water hath a clear thorow-paſſage all the while it is deſcending: whereas as ſoon as the *Bucket* is pulled upwards by the Line *F*, the reſiſtance of the Water to that motion, beats the *Bucket* downward, and keeps it in the poſture *G*; whereby the included Water is preſerved from going out, and the Ambient Water kept from getting in.

By the advantage of which Veſſel, or ſuch like, you may come to know the *Degrees of Saltneſs* of Sea-Water, according to its nearneſs to the Top or Bottom; or rather, the Conſtitution of the Sea-Water in ſeveral Depths of ſeveral *Climates*: Likewiſe, whether in ſome places of the Sea, there be any ſweet Water at the Bottom; the *Affirmative* whereof is to be met with in the *Eaſt-Indian Voyages* of *Van Linſchoten*, who *pag.* 16 of that Work, as 'tis *Engliſhed*, records, that in the *Perſian Gulf*, about the Iſle of *Baharem*, they fetch up with certain Veſſels (which he de-

deſcribes not) Water out of the Sea, from under the Salt-Water, four or five fathom deep, as ſweet as any Fountain-water, And ſince 'tis argued by ſome, that ſuch Sweet-water proceeds from certain Sweet Water-Springs, that were formerly on the Continent, at ſome diſtance from the Sea, and came afterwards to be covered by the Sea; it may be preſumed, that in other places we may find the like. Beſides, we know not, but that there may be in many parts, Eruptions of large Springs at the Bottom of the Sea, that were never taken in by any of its encroachments.

Theſe Experiments are to be repeated every New Voyage, the multitude and frequency of them being neceſſary for finding out and confirming the truth of them; which as it will conduce exceedingly to the Enlargement of Natural Knowledge, ſo it may in time produce New and more accurate Sea-Maps *and* Cards, *than hitherto have been publiſht; and great helps and advantages to Navigation: eſpecially thoſe of the* Variation, *and* Dipping *of the* Needle; *the* Depth *and* Saltneſs *of the* Water; *the Nature of the* Ground *at the* Bottom *of the Sea; and indeed almoſt every one of the reſt; there being a Deſign to conſider all, and to draw out of them ſuch Rules and Directions, as may bring no leſs Honour, than Benefit to the* Engliſh *Nation.*

The Inſtruments, deſcribed and repreſented in theſe Papers, may be had from Mr. *Richard Shortgrave*, Operator to the *R. Society*, to be found at *Greſham Colledge*; who alſo will be ready, if there be occaſion, to give more particular Directions for the uſe of the ſame.

ADVERTISEMENT.

IT is deſired by Chriſtopher Merret M. D. *to inform the Publick, that within the ſpace of four Months, he ſhall re-publiſh his* Pinax Rerum Naturalium Britanicarum, *with many additions, and in his propoſed New Method; and that he wholly diſclaims the* Second *Edition of that Book, as being printed and publiſhed without his knowledge.*

In the *SAVOY*,
Printed by *T. N.* and *John Martin* at the Bell, a little without *Temple-Bar*, for *James Alleſtry* in *Duck-Lane*, Printers to the *Royal Society*, 1667.

Fig. 1.

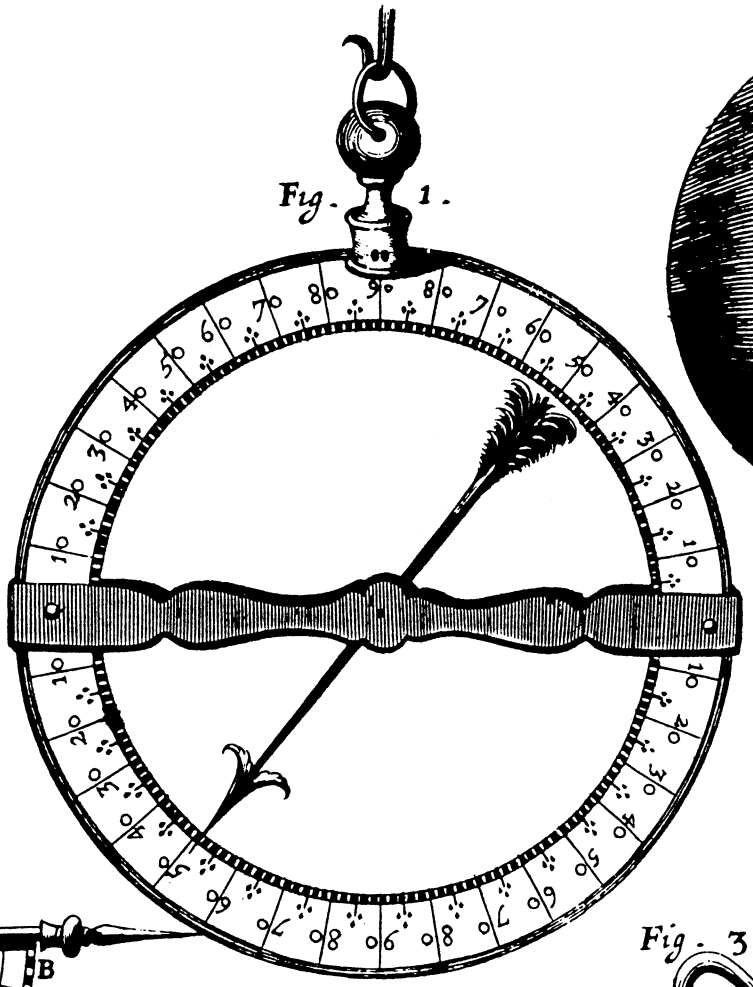
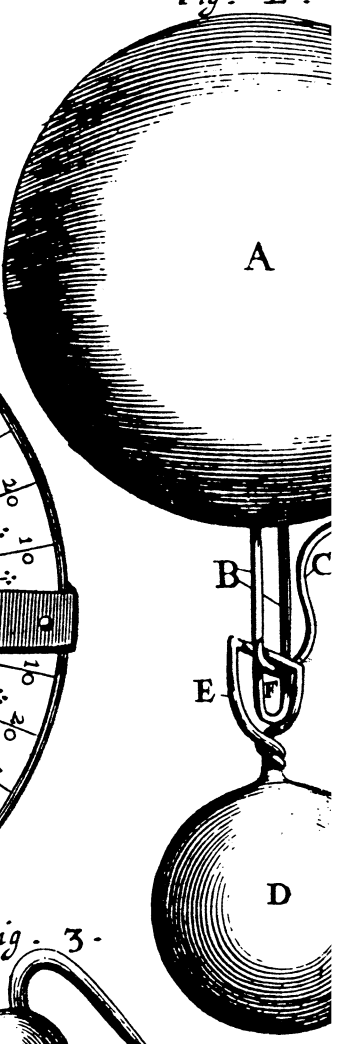


Fig. 2.



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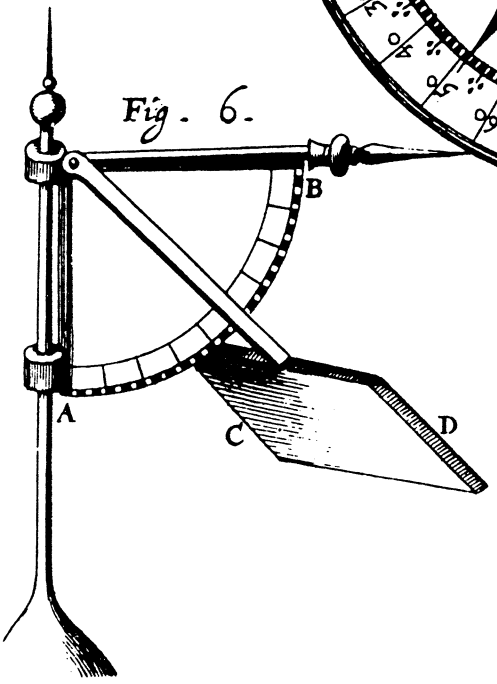

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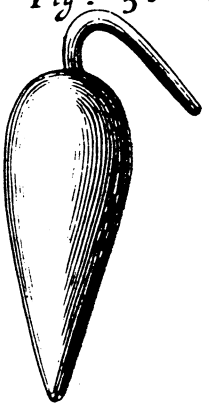

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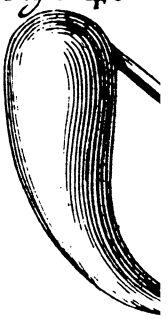


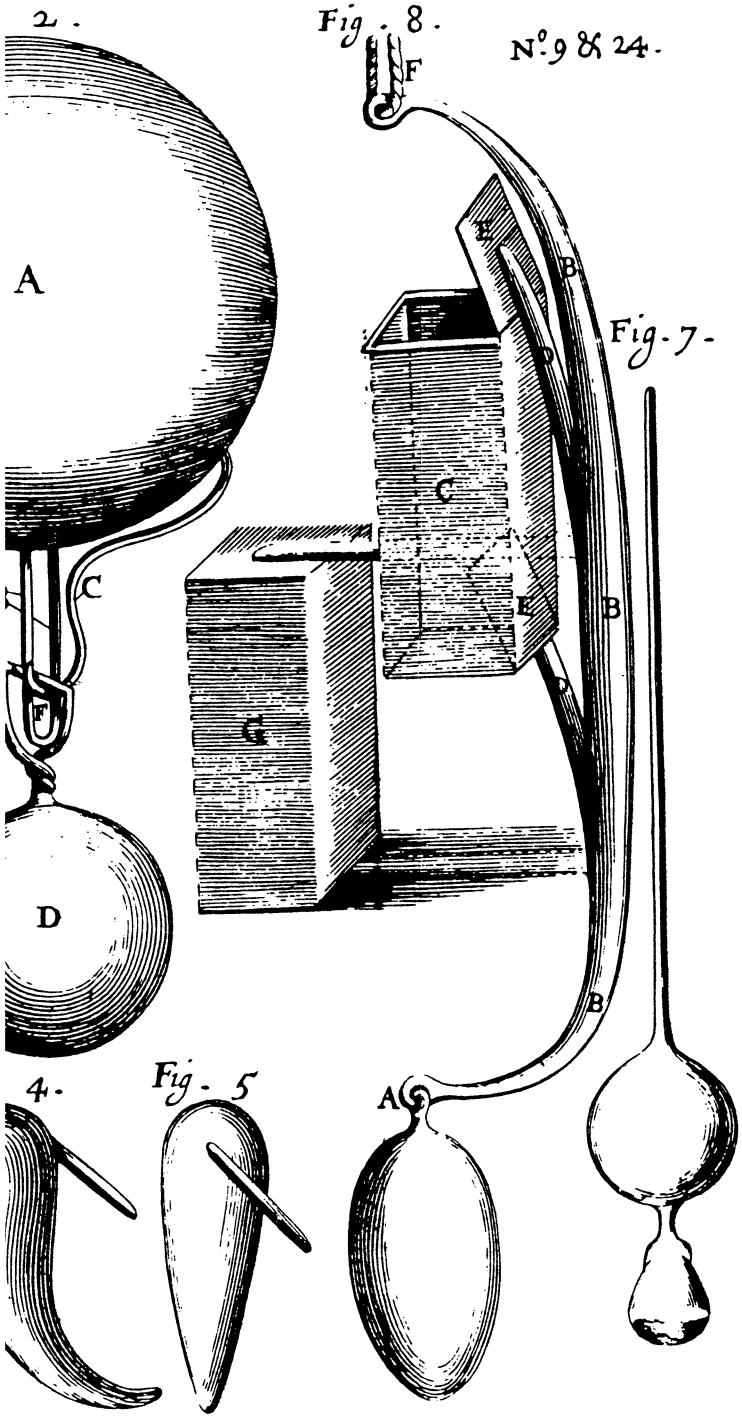

2.
A
C
F
D
Fig. 8.
F
N°. 9 & 24.
E
B
Fig. 7.
C
E
B
G
B
4.
Fig. 5
A

Fig. 1.

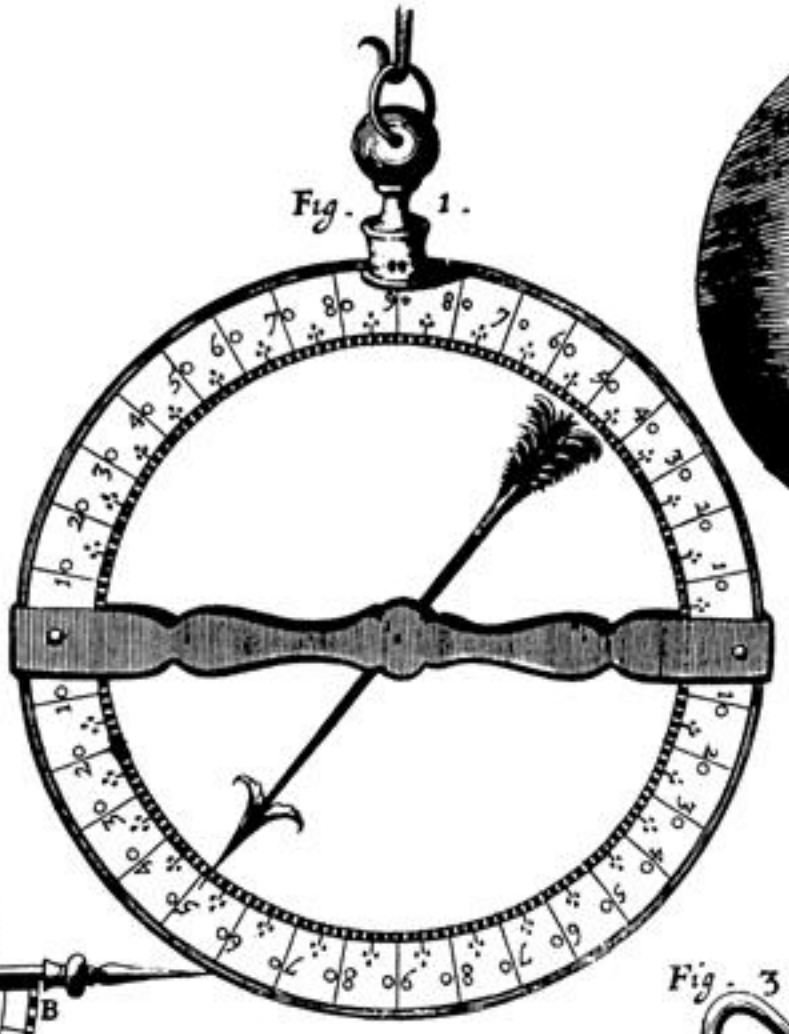
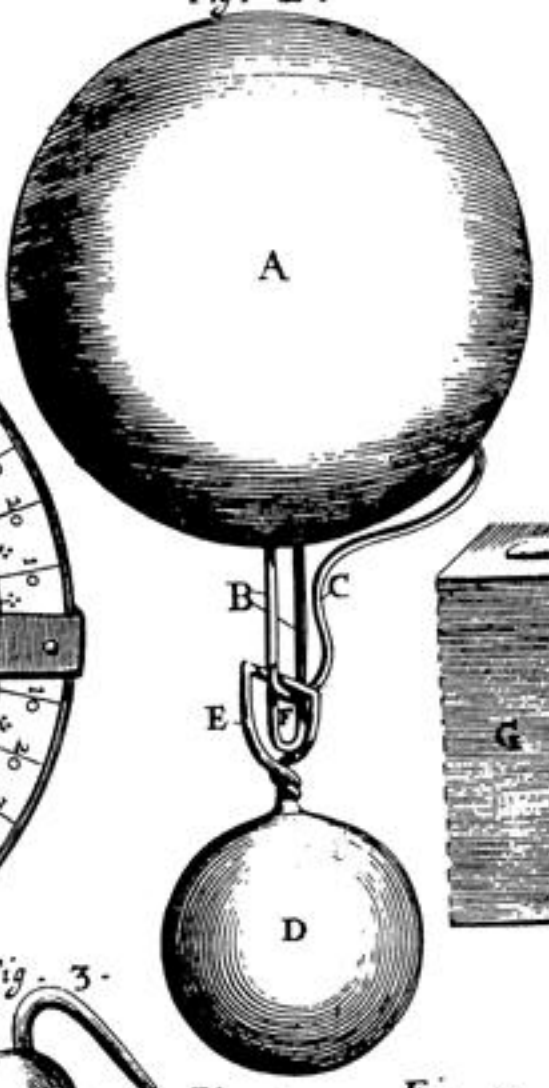


Fig. 2.



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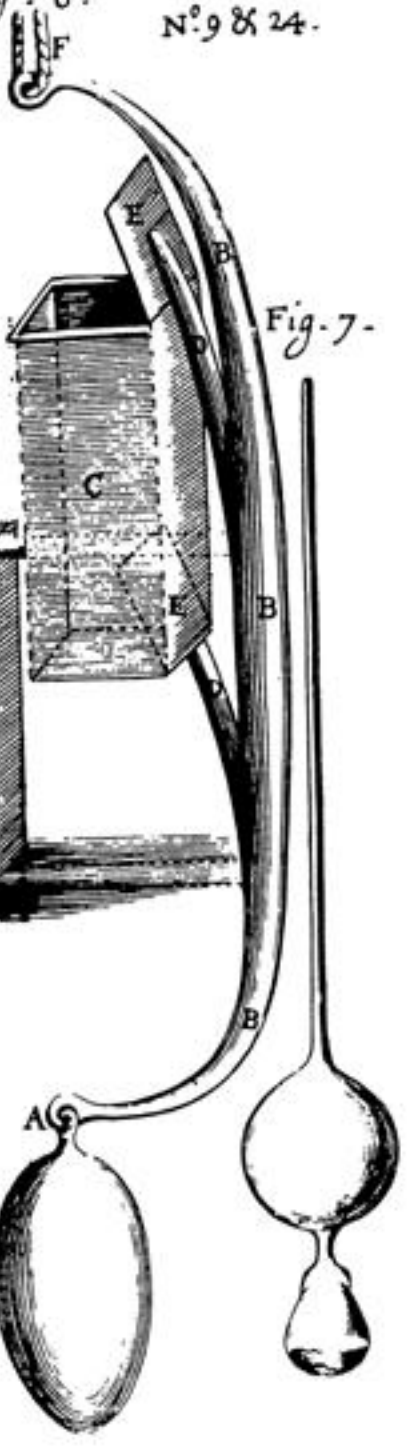

N°. 9 & 24.

Fig. 7.

Fig. 6.

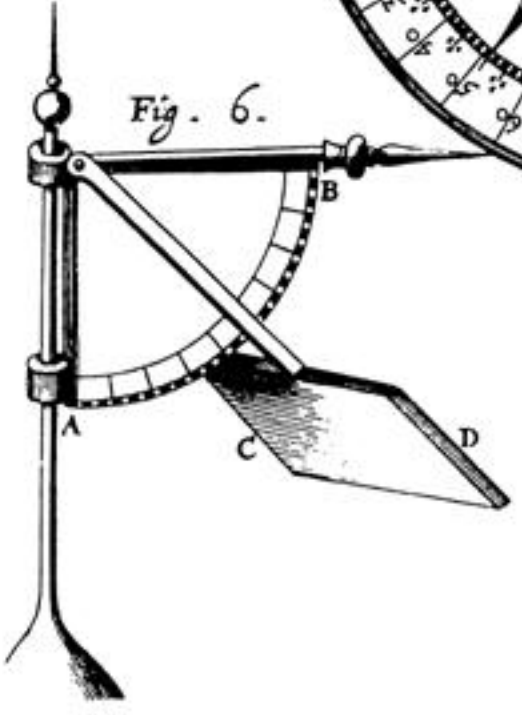

Fig. 3.

Fig. 4.

Fig. 5