

- I. *A Description of a Water-Level to be fix'd to Davis's Quadrant, whereby an Observation may be taken at Sea, in thick and hazy Weather, without seeing the Horizon; by Charles Leigh, Gent.*

Nov. 3. 1737.

THE Sea-Quadrant now in Use, called Captain *Davis's* Quadrant, being invented by that ingenious Gentleman, for taking the Sun's Altitude, is an Instrument well known, universally approved, and sufficiently accurate; I say sufficiently, because it is well known to all Artists at Sea, that five or ten Minutes Error (which is generally the most, if the Instrument be good, though the Motion be great) is a Trifle scarce worth the noting, either in sailing near a Meridian, or parallel Circle. This, together with a long Use of this Instrument, has, to my Knowledge, (having had the Experience of 17 Years in the Royal Navy) occasioned such a Fondness to it, that it would be no easy matter to dissuade the Navigator from the Use of it, to any other.

It is true, that when the natural Horizon is obscured by thick and hazy Weather, (which is very frequently the Case, especially off of our Chanel, the Banks of *Newfoundland*, &c.) this Instrument, as it now stands, is of no Use; which too often occasions melancholy Consequences; such as the Loss of Ships and Cargoes, and, what is still more valuable, our Seamen's Lives. If therefore, to this Instrument, an Apparatus were added, such as an artificial or portable

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Horizon,

Horizon, that could be as effectually relied on, as that of the true or natural; and at the same time plain, easy, and obvious; I am of Opinion, it would be needless to go about proving its Usefulness.

To this End; some ingenious Gentlemen have, within these few Years, very commendably employed their Talents this way; among which, I humbly offer my Mite: And that the Partiality of a Parent to a Child of his own begetting, may not carry me too far, I shall most humbly submit it to the Determination of that venerable and learned Assembly, who are as ready to inspect, as they are willing to encourage and promote, the Inventions of all useful Parts of Mechanism.

I shall now proceed to the Principle on which this Apparatus is founded, *viz.*

That the Surface of all Liquids (when free from any external Cause) that have a Communication with each other, though divided and separated in their Surfaces, will be truly in a horizontal Plain.

The Quadrant, and its Construction, being well known, there remains but little to be said to it; the principal Parts that I shall take Notice of, are the two Sections of two different Circles that are concentrick, as *AB, CD*, (*see TAB. I. Fig. 1.*) on which the Degrees and Minutes are graduated; *E*, the common Centre, through which goes a brass Pin fix'd to the Apparatus *EF*, which is an Index or *Radius* to the Section *CD*, on which Index is fix'd a brass Tube 15 Inches long, in the Extremities of which are fix'd per-

perpendicularly two glass Tubes *Eh* and *dh*, four Inches long, with brass Ferrels on the Tops.

On the central Pin, which is fix'd in the Index, is also fix'd the brass horizontal Vane *Ez* obliquely, in which there is a Hole for the central glass Tube *Eh*, to come through three fourths of its Length, close to which, and from the common Centre, comes a white fine Thread, the End being fix'd in the Vane *Ez*; and in the same manner is a Thread fix'd close to the glass Tube *dh*.

Directions to prepare, and observe by this Instrument.

To prepare this Instrument for Observation, you must pour Water (for that is always to be had) into the Tube *Eh*, till its little Surface rises to the central Thread; then to keep it fix'd there, shut the Slide or Stop that is fix'd on the Top of the central Tube, and there it will continue; then you may at Pleasure pour or drop Water into the Tube *dh*, till its Surface also rises to the Thread fix'd there; and if too much Water is dropp'd in, dip in a Wire with a small bit of Sponge or Cotton fix'd to the End, till you exactly trim your Tubes; for in this lies the greatest Nicety and Exactness, to trim your Surfaces true to the Threads.

This being done, you are prepared for Observation; and placing yourself conveniently, where there is the least Motion, sit down on a Stool or the Deck, and having the Quadrant in its proper Position on your Lap, open the Slide on the Top of the Tube *Eh*, that the Water may have its natural Tendency, which

will be truly Horizontal, conformable to the above Principle; then keeping your Eye on the central Thread, bring that and the little Surface into one, which will be effected with the same Ease, as if you observed by the natural Horizon; then keep moving the End of the Index *F*, till you bring the *Speculum* of the Sun in the little Hole on the horizon Vane that is close to the Thread, so that you have, as it were, but one Object to look at during the time of Observation: But if you use the shadow Vane, you must bring the upper Edge of the Shadow on the central Line, drawn on the horizon Vane, as usual; remembering as often as you rest, waiting the Sun's rising, to close the Slide, which prevents the Water's running out, it then remaining immoveable. And thus continuing to do, till the Sun is on your Meridian, cast up the two Sums as is usual, that is, the Degrees cut by the shadow Vane, and those cut by the upper Edge of the Index on the greater Arch, which Sum will give what is required, *viz.* the Sun's Distance from the Zenith. On the End of the Index is fix'd a sight Vane *N*, by which you may observe by the natural Horizon, the very same way as with the common Quadrant; so that the one will be the Proof of the other.

N. B. There are of late Invention, large glass *Lens's*, very useful for collecting the weak and scatter'd Rays of the Sun into a *Speculum*; but if the Rays are even too weak to be collected by that, and that you have any Sight of the Sun, let another look through the little Hole on the horizon Vane above-mention'd, and the
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upper Edge of the shade Vane, to the Sun, and it will give what is required : The same Rule is to be observed in taking the Altitude of a Star.

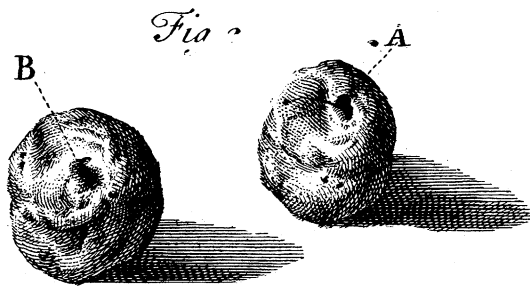
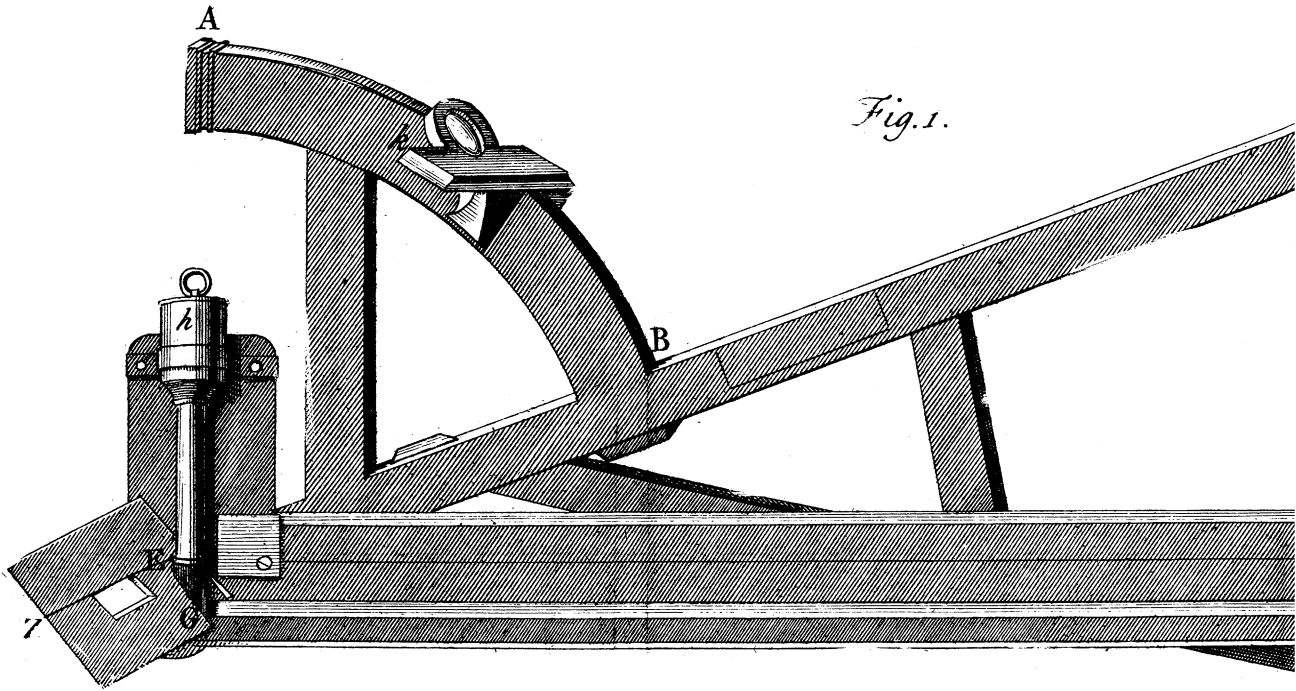
II. *The Description and Use of an Apparatus added as an Improvement to Davis's Quadrant, consisting of a Mercurial Level, for taking the Co-altitude of Sun or Star at Sea, without the usual Assistance of the sensible Horizon, which frequently is obscured.* By Charles Leigh, Gent.

I Had the Honour some time ago, [Nov. 3. 1737.] to communicate to this learned Society, an Invention much upon the same Nature and Principle with this ; since which I have made such Alterations and Improvements thereto, as have render'd it complete and perfect for the Use intended, and have been confirmed by repeated Experiments, as well on board Ships, as on Shore. An Instrument of this Nature we greatly want at Sea, and it would be a great Satisfaction to me, if any Thoughts and Inventions of mine should contribute to the removing of this grand Impediment, that so frequently happens.

To arrive to the utmost Perfection in Navigation, three things are absolutely requisite, *viz.* The Variation, the Latitude, and the Longitude ; which last is, as yet, conceal'd from us. The two former indeed,

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Tab I.



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