

1779 (Rat)

GÉOMETRICAL
AND
GRAPHICAL ESSAYS,

CONTAINING,
A GENERAL DESCRIPTION
OF THE
MATHEMATICAL INSTRUMENTS
USED IN
GEOMETRY, CIVIL AND MILITARY SURVEYING,
LEVELLING, AND PERSPECTIVE;

WITH MANY NEW
PRACTICAL PROBLEMS.

ILLUSTRATED BY THIRTY-FOUR COPPER PLATES.

BY THE LATE
GEORGE ADAMS,
MATHEMATICAL INSTRUMENT MAKER TO HIS MAJESTY, &c.

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CORRECTED AND ENLARGED BY
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DESCRIPTION OF A NEW POCKET BOX SEXTANT, AND AN ARTIFICIAL HORIZON, BY THE EDITOR.

Fig. 11, plate 10, is a representation of a very convenient pocket sextant, and contains a material improvement on the reflecting cross staff before described, see *fig. 4, plate 14*. In military operations, as well as trigonometrical ones, it has been found of very essential service. AB a round brass box three inches in diameter, and one inch deep. AC is the index turning an index glass within the box. *a, a,* are the two outside ends of the screws that confine an horizon glass also within the box. An angle is observed by the sight being directed through an hole in the side of the box about D, upon and through the horizon glass and the second opening at E, and the angle is read off to one minute by the divided arc and nonius F, G, H. By sliding a pin projecting on the side of the box, a dark glass is brought before the sight hole, not shewn in the figure; by pushing the pin at *b*, a dark screen for the sun is interposed between the index and horizon glasses. I is an endless screw, sometimes applied to give a very accurate motion, like the tangent screw to the index of a sextant. Or a racked arc and pinion may be applied at about *c, d*, which I think in some respects better.

The following table is sometimes engraved upon the cover that goes over the box when shut up. By the sextant being set to any of the angles contained in this table, an height or distance of accessible or inaccessible objects is obtained in a very simple and expeditious manner.

Mul.	Angle.	Angle.	Div.
1	45° 00'	45° 00'	1
2	63 26	26 34	2
3	71 34	18 26	3
4	75 58	14 02	4
5	78 41	11 19	5
6	80 32	9 28	6
8	82 52	7 08	8
10	84 17	5 43	10

Make a mark upon the object, if accessible, equal to the height of your eye from the ground. Set the index to any of the angles from this table, and walk from the object, till the top is brought by the glasses to coincide with the mark; then, if the angle be greater than 45° , multiply the distance by the corresponding figure to the angle in the table; if it be less, divide, and the product, or quotient, will be the height of the object above the mark. If the object be inaccessible, set the index to the greatest angle in the table that the least distance from the object will admit of, when by moving backwards and forwards, till the top of the object is brought to a level with the eye, and at this place set up a mark equal to the height of the eye. Then set the index to any of the lesser angles, and go backwards in a line from the object, till the top is made to appear on the level with the eye, or mark before set; set here another mark, measure the distance between the two marks, and this divided by the difference of the figures in the last column, against the angle made use of, the quotient will give the height of the object above the height of the eye, or mark. *For the distance*, multiply the height of the object by the numbers against either of the angles made use of,

and the product will be the distance of the object from the place where such angle was used.

If the index is set at 45° the distance is the height of the object, and *vice versa*. The index set to 90° becomes a reflecting cross staff, and is used according to the directions in page 282.

The sextants, as before described by the author, of the best kind, are made of brass, or other metal. The radii now most approved of are from six to ten inches, their arcs accurately divided by an engine, and the nonii shewing the angles to 30, 15, or even 10 seconds; but the fine divisions of the latter are liable to be obliterated by the frequent cleaning of the instrument.

THE ARTIFICIAL HORIZON.

In many cases it happens that altitudes are to be taken on land by the sextant; which, for want of a natural horizon, can only be obtained by an artificial one. There have been a variety of these sort of instruments made, but the kind now to be described is allowed to be the only one that can be depended upon. *Fig. 12, plate 19*, represent the horizon fixed up for use. A is a wood or metal framed roof containing two true parallel glasses of about 5 by $3\frac{1}{2}$ inches, fixed not too tight in the frames of the roof. This serves to shelter from the air a wooden trough filled with quicksilver. In making an observation by it with the sextant, the reflected image of the sun, moon, or other object, is brought to coincide with the same object reflected from the glasses of the sextant; half the angle shewn upon the limb is the altitude above the horizon or level required. It is necessary in a set of observations that the roof be always placed the same.

