

S E C T. II.

How to measure Angles by the Chain.

TO this End provide Three round Station-Staves, four or five Foot long a-piece; and also take Care that the Ring in the Middle of the Chain, and also those at each Tenth Link be at their due Distance from the Chain's End.

1. In order to measure the Angle d, o, e , *Fig. 24*, fet one of your Station-Staves as upright as you can at o ; and putting the Ring at one End of the Chain over it, let one of your Assistants take the other End in his Hand, and stretch out the Chain towards d , whilst you standing at o , direct him to move side-ways till the Station-Staff which he has in his Hand, be brought into one Right Line with o, d , as at a , and there let him leave the Staff.

Then let him, with the End of the Chain in his Hand, move towards e ; and as before, direct him to plant the Third Staff upright in the Line o, e , at b .

Measure the Distance a, b , in Links and Tenth Parts, if less than one Chain, and enter 'em in the Field-Book $88 \frac{1}{2}$.

When you plott this Angle, take with a Pair of Compasses from a large Scale, the Distance of one Chain; and having drawn a Right-Line d, o , fet one Foot of the Compasses in o , and with the other describe an Arch a, c ; then from the same Scale take $88 \frac{1}{2}$ Links; and setting one Foot of the Compasses at a , let the other fall in the Arch a, c , and make a Mark at b : Lastly, through this Mark, from o , draw the Line o, e , constituting the Angle d, o, e .

Observe to plott your Angles by a large Scale,
as

as an Inch, or two Inches, and the Length of the Sides by a smaller, as a Quarter of Half an Inch: Also observe, that when the Length of the Chord a, b , is longer than one Chain, then 'tis best to lay out a Sextant, or two Sextants in the following Manner.

2. The Manner of measuring Angles with the Chain, by laying of Sextants, is deduced from this known Property of the Circle, *viz. The Radius of every Circle is equal to the Chord of One Sixth Part (or a Sextant) of its Periphery.*

Let it be required to measure an Angle b, a, c , *Fig. 25*: First, set up a Staff at a , and lay the Chain strait in the Direction of a, b , to i , and at 50 Links set down an Arrow at o ; then let your Assistants hold the Ends of the Chain at o , and a , whilst you with the Middle in your Hand, laying both Halves strait, set down an Arrow at e , constituting the equilateral triangle o, a, e , a Sextant.

But if you have two Chains, you may (which is better) lay out the Sextants, so that each Side of the equilateral Triangle be one Chain.

Now the Chain's End still held at a , stretch it through the Point e to d , where also set down an Arrow: Lastly, measure the Distance from the Arrow at d , to a Staff set up one Chain's Length from a at u ; so shall the Distance d, u , be 76 Links, and Four Tenths of a Link; Therefore enter in the Field-Book 1^S, 764^P, implying 1 Sextant and 764 Parts.

In order to plott this Angle, b, a, c , thus measured, chuse some Line divided into 1000 Parts, and making this Line Radius, set one Foot of the Compasses in a , and with the other describe the Arch, i, z ; and the Compasses continuing at the same Extent, set one Foot in i , and with the other,

other, cros the Arch at d , and there make a Mark.

Then take 764 Parts from the same Line, divided into 1000 Parts, which you made Radius; and set one Foot of the Compasses in the Mark at d , and let the other cros the Arch at u , and there make a Mark: Lastly, from a , draw a Line through the Mark at u , and you will construct the Angle required.

If you have not a Line (which is best) actually divided into 1000 Parts, use the largest Diagonal Scale you have; so you may take off 76 Parts exactly; and the four Tenths you must guess at by moving the Compasses near half way in the Diagonal towards 77; also observe, the 10th of a Link is measured on the Land by the Offset-Staff, having a Link or two thereon, divided into Ten Parts.

3. If the Angle be more than Two Sextants, as in *Fig. 26*; then having, as before, laid off the Sextant e, o, a , let your Assistants hold the Ends of the Chain at a and e , while you with the Middle in your Hand, set down an Arrow at x , constituting another Sextant e, a, x .

Then the Chain being held at a , lay it thro' x , and at the other End d , set down an Arrow: Lastly, measure d, u , which suppose to be 42 Links and 5 Tenths; therefore enter in the Field-Book $2^S, 425^P$, signifying 2 Sextants and 425 Parts.

And if you would protract the Angle of *Fig. 26*, then with the Length of the Line divided into 1000 Parts, describe the Arch i, y , and thereon lay i, n , and n, d , each equal to the Radius or divided Line; and afterwards lay 424 equal Parts from d , to u , and draw a, u ; which gives the Angle, as required.

Observe,

Observe, if you were about to measure the Angle, *Fig. 26*, and had set up one of your three Staves where the Station-Lines meet in the angular Point *a*, another at *i*, and the other at *u*, in the Lines *a, b*, and *a, c*; before you proceed to measure the Angle *i, a, u*, you must be sure that the Staves at *a*, and *i*, and the Mark at *b*, are exactly in the same Plane; and also the Staves at *a*, and *u*, and the Mark at *c*, in another Plane.

So when the Staff at *a*, is planted as nearly Perpendicular as you can, move yourself backwards, the farther the better, 'till you see the Staff at *a*, and that at *i*, in one straight Line with the Mark at *b*; there stand, and direct your Assistant to place his Staff, so that the Staff at *a*, exactly cover that at *i*, from the Top to the Bottom.

SECTION III.

Observations on Working with the Chain.

IF you would continue a straight Line, you may signify it, by entering in the Field-Book 3^S. 000, that is, 3 Sextants.

If an Angle be external, and so contain more than 3 Sextants, as *b, a, e, Fig. 27*, put the Ring at one End of the Chain over the Staff at *a*; and taking the other End in your Hand, stretch out the Chain at Length towards *d*, and move Sideways, till you perceive yourself in a Right-Line with *a, b*, and there at the End of the Chain, set down an Arrow at *d*, so that *d, a, b*, are in the same Plane, and then set down the other Staff at *c*, at the End of one Chain also; so that the Staves at *a*, and *c*, be in the same Plane with the Mark at *e*. Now measure the Angle *d, a, c*, in the same Manner as aforesaid, and to it add the Sextants,
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