

SURVEYING FOR AREA WITH A SURVEYOR'S STAFF.

In the last issue of the *Gazette* instructions for making and using a simple plantation level were given. In this issue the surveyor's staff will be similarly dealt with. This particular staff and the method of using it were first described by Alexander Gordon, of the University of the Philippines.

Construction.

A round block, 2 inches thick, was made. The block was sawed across the centre to about half an inch in depth, then resawed across the centre at right angles to the first cut. These cuts serve as sight lines. The block is set on a staff by means of a peg so that the block may turn about its centre. (See Figure 1.)

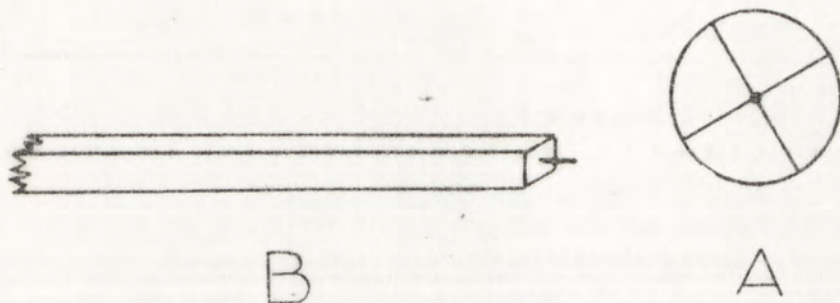


Figure 1.—The Surveyor's staff taken apart. (a) a wooden block; (b) wooden staff showing peg for block attachment. Note the saw cuts on block.

How to use a Surveyor's Staff.

Set-up.—The surveyor's staff is divided into two parts, the block and the staff. In setting up, the staff portion is first stuck in the ground at the point desired. Then the block is set on the staff. It is important that the staff be vertical. This may be accomplished with the help of a plumb bob.

Erecting Perpendiculars.—To erect perpendiculars with the staff is not a complicated job. The first thing to do is to set the staff on the course at any desired point, say *O*. When stations *A* and *B* are easily accessible, locate *O* by sighting from either one of the stations towards the other and keep *O* in line. When *A* and *B* are inaccessible, however, locate *O* by one of the following methods:—

First Method.—Set two rods, *a* and *b*, at some distance apart, between *A* and *B*. (See Figure 2.) Sight *A* from *a* and bring *b* in line. Then sight *B* from *b* and bring *a* in line. Continue the process until *A*, *b*, *a*, and *B* are all in line. Now set the staff on the course *AB*.

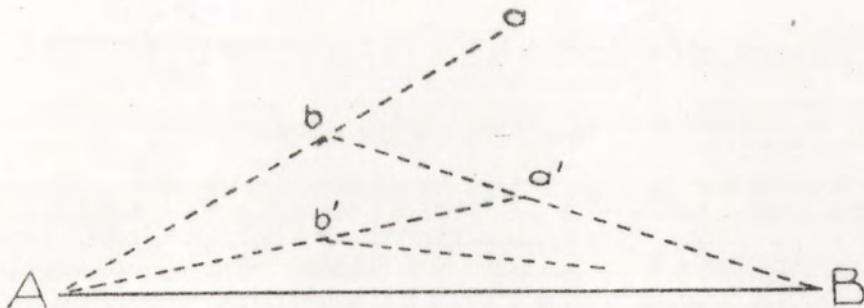


Figure 2.—Locating an accessible point between two inaccessible points.

Second Method.—Set the staff as nearly as possible on the course, AB , at O' . (See Figure 3.) From O' sight B through one of the slits, then sight back through the slit. If, on sighting back through the slit, A is not seen, transfer position of staff, say, to O'' . From O'' sight B through one of the slits, then sight back through the slit. If, on sighting back through the slit, A is not seen, transfer position of staff and continue process until O' is in line with A and B .

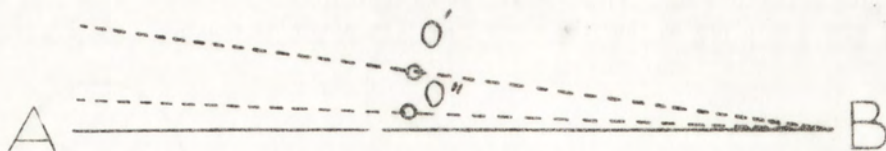


Figure 3.—Locating a point between two points by the use of the surveyor's staff.

Suppose now that the staff is set at a point O , on the course AB . (See Figure 4.) Sight B through the slit $m-m$ of the block. Then sight to a point C through slit $n-n$ (Figure 4a). Turn the block so that B is sighted through slit $n-n$. Then sight through $m-m$ to a point D (Figure 4b). The line bisecting angle COD is perpendicular to line AB .

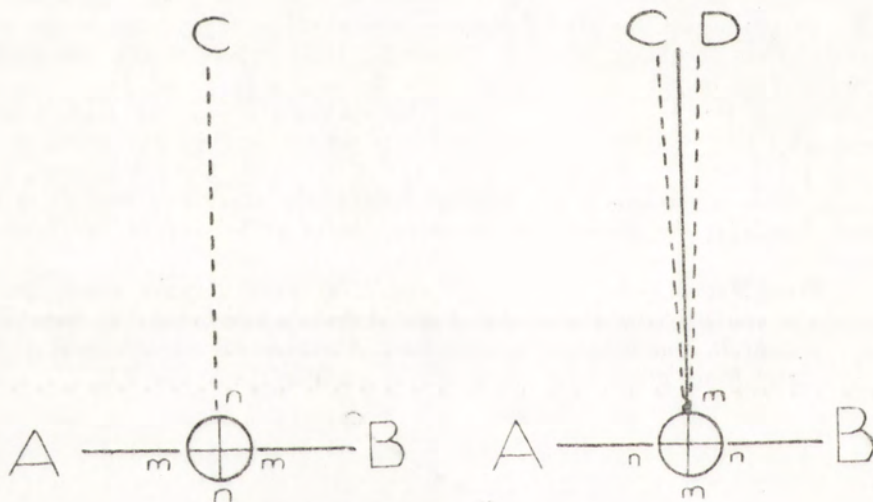


Figure 4.—Erecting a perpendicular.

Finding Areas: A Triangle.—The area of a triangle may be found by multiplying one half of the base by its altitude. The measurement of the altitude is the problem. Suppose we have a triangle ABC . Then guess approximately point O on AB so that CO is almost perpendicular to AB . (See Figure 5.)

Set the staff on point O . Erect a perpendicular to AB from O towards C . If C is not on the perpendicular, correct the point O by moving it by the distance d between C and the perpendicular.

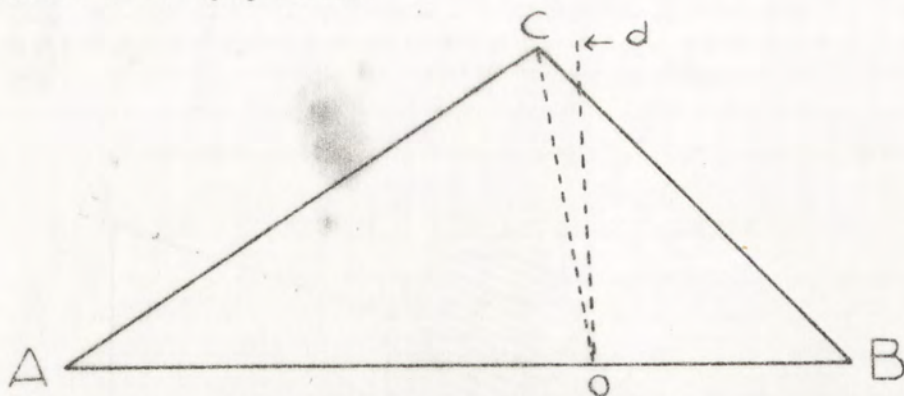


Figure 5.—Determining the altitude of a triangle.

An n-sided Polygon.—The area of an n -sided polygon is the sum of the areas of the triangles into which the polygon may be divided.

An Irregularly Bounded Figure.—The area of a figure with an irregular side may be found by summing up the areas of the trapezoids into which the figure may be divided.

Set a base line through, or by the figure. From the base line erect perpendiculars to the bending points of the boundaries of the figure. Following the course of the boundaries of the figure in a clockwise direction, and supposing all courses due west as negative and courses due east as positive, the areas of trapezoids formed by the base line, the two adjacent perpendiculars, and a course shall be positive or negative depending on the sign that the course carries. The difference between the negative and positive areas is the area of the irregularly bounded figure.

Extension of Lines.—The extension of lines through an obstacle when (1) the two known stations are visible from each other, and (2) the two known stations are not visible from each other, are common problems in fencing, lining and orchard work.

1. *Stations visible from each other.*—Suppose A and B are the known stations. (See Figure 7.) Erect perpendicular BC on AB from B . Then erect perpendicular CD on BC from C . Produce CD until the obstacle is passed. Then erect perpendicular DE on CD from D . DE must be made equal to BC . From E erect a perpendicular. This is the required extension of AB .

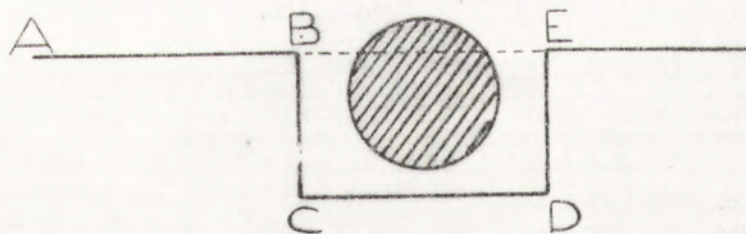


Figure 6.—Extending a line through an obstacle when known stations are on the same side of the obstacle.

2. *Stations not visible from each other.*—Suppose *A* and *B* are the known stations. (See Figure 7.) From *A* project a line, *AC*, passing by the obstacle. From *AC* erect a perpendicular to *B*. Then from a point *D* on line *AC* erect perpendicular *DE*, so that AC/CB equals AD/DE . Then erect another perpendicular from a point *F* on line *AC* to *G*, so that AC/CB equals AF/FG . Points *A*, *G*, *E*, and *B* are then all in line.

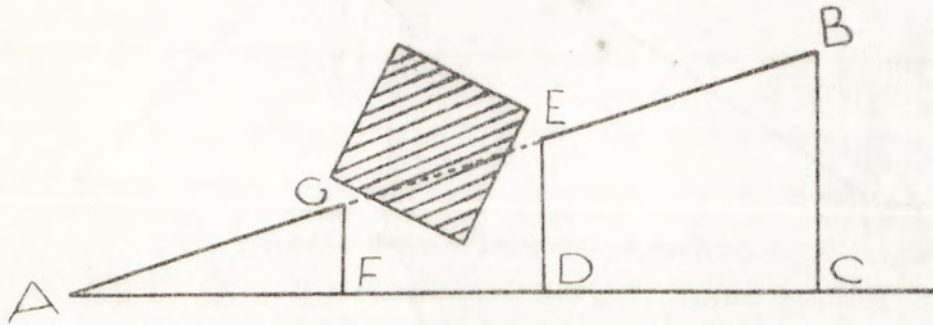


Figure 7.—Setting a straight line between two stations with an obstacle between.

A GATELESS OPENING.

In many places it is desirable to have an opening in the fence that a man can easily slip through without bothering with a gate, but through which horses or cows cannot pass. Four posts are set as shown—two in the fence line, which should be braced, and one each side of one of the centre-line posts. Branch wires are carried from the other centre-line post to the two side posts. These should be made of wire without barbs to catch on the clothes, as it is not desirable to make



the openings larger than necessary. If the centre posts are long enough—say, $5\frac{1}{2}$ or 6 feet above the ground—they can be braced to each other by a piece of strap iron across the top. If this is possible, then the other braces will not be necessary.