

## IX.—A GUNNER'S COMPOUND COMPASS OR ENGLISH CALLIPERS.

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This instrument (plates xxxix, xl and xli) consists of two thin flat plates of brass jointed together at one end, so that one may move quite round the other. The head of one of these pieces is cut circular, the head of the other semi-circular, the centre being the screw pivot upon which they turn. The length of each piece of brass from the pivot is six inches, so that when the compass is opened out straight, the two branches together measure a foot long and are marked off in inches like a foot-rule.

Upon both sides of each branch of the instrument, and upon its head, are a variety of scales, lines and tables.

On one branch is engraved "R. WHITEHEAD FECIT" (plate xxxix) and upon the other "T. GREY MAR. 25 1691" (plate xl).<sup>1</sup>

The foot of each branch terminates in a curved steel point at right angles to the length of the branch. The steel tipping of these points is not unusual on gunners' compasses, for cannon-balls were frequently rough, and soft metal like brass would soon have been worn, rendering the instrument inaccurate, its primary use being as inside and outside callipers. With the feet crossed, it was placed into the bore of the gun to measure its calibre; the callipers

<sup>1</sup> According to Dalton's *English Army List and Commission Register*, no T. Grey held a commission in the English army in 1691. The only T. Grey of the period in *The Dictionary of National Biography* was Thomas Grey, 2nd Earl of Stamford 1654-1720.

were then opened to measure the diameter of a cannon-ball suitable for the said gun.

One half of the circumference of the semi-circular head is scaled in inches, to show the opening of the outside callipers for ascertaining the diameter of a shot, and upon the circular head is a scale giving, at the same time, the weight of the shot (plate xxxix). This scale commences at one pound for a 2 inch diameter iron shot and rises to a 64-pounder, i.e. the line drawn through the first finger of the hand marked *shott* upon the branch with the semi-circular head can be brought opposite the scale marked 1, 2, 3, 4, 5, 6, 9, 12, 16, 18, 24, 32, 36, 48, 52 and 64, representing the designation of the piece in pounds. The one-pounder iron shot is 2 inches in diameter,<sup>2</sup> and the 64-pounder is 7.7 inches in diameter. In plate xxxix, the line through the hand is opposite to 1 equally a one-pounder, therefore the scale of inches reads 2 and the points are 2 inches apart as outside callipers to measure a 2 inch shot.

If the instrument be now turned over, and the feet crossed as inside callipers (plate xli), upon the branch with the circular head are a number of diagonal lines marked *inches*. These indicate the diameter of the bore of the gun in inches. On the same branch, the next scale is marked *wind*, and has a number of dots, 1 to 64, corresponding to the designation of the piece by weight of shot as marked on the other side. Each dot has a dotted line leading from it to a diagonal line. The length of this dotted line is the limit of windage allowed in a worn gun, now called *Tolerance*, i.e. provided the callipers could not be opened in the gun beyond the slanting line at the end of the dotted line, it was permissible to use the gun, it not having reached the limit of score and wear.<sup>3</sup>

The maximum windage for a two-pounder is given as  $\frac{1}{8}$  inch, and for a 64-pounder about  $\frac{1}{4}$  inch. One of the

<sup>2</sup> Other callipers give a one-pound iron shot as 1.8 inches in diameter.

<sup>3</sup> I am indebted to the Royal Artillery Institute of Woolwich for this information.

most important things in gunnery was the correct windage, or clearance between the ball and the bore.

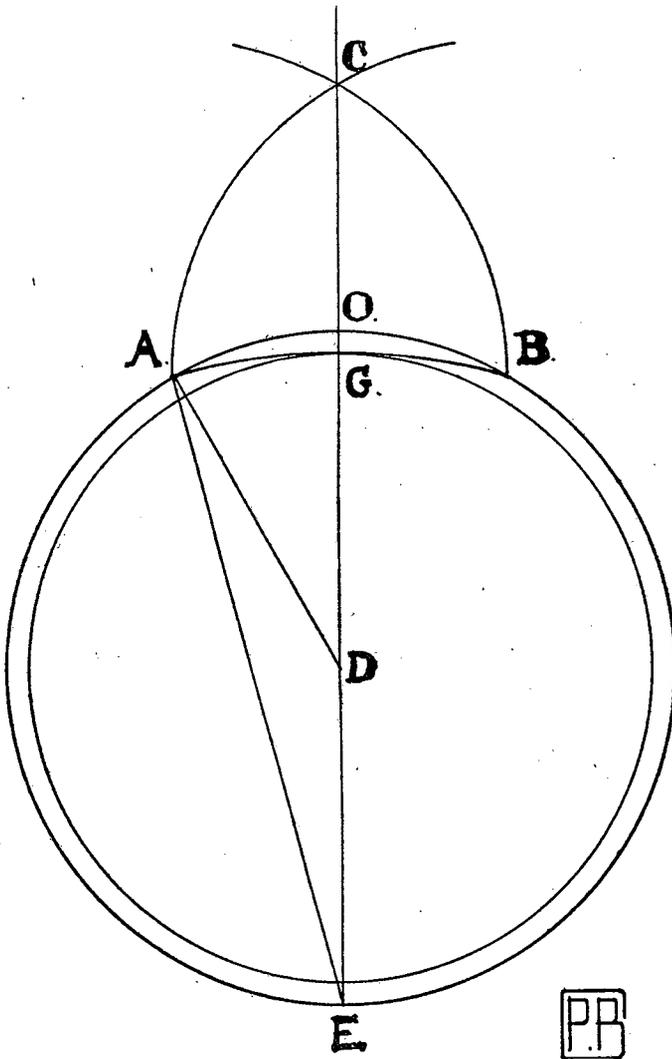


Fig. 1.

A French book on gunnery, dated 1628, gives a simple method of calculating the *wind* (fig. 1). From the centre

D draw a circle A B E representing the ascertained bore of the gun. At any point, A for example, strike off the radius A D along the circumference to B (chord A B = radius D A). From points A and B draw two short segments of circles using the same radius which intersects at C. From C draw a line through the centre D until it cuts the original circle at E. This line will also pass through the circle at O. From the point E draw a line to point A, and from point E with radius E A draw a segment of a circle to cut the line C D E at G. If this circle is now described from the centre D with the radius D G it will give the diameter of the shot to be used, allowing the correct *wind*.<sup>4</sup>

Another scale, over R. WHITEHEAD FECIT, gives the service charge of powder for various guns, viz. : 16 lbs. for a one-pounder, to 64 lbs. for a 64-pounder.

In brief, the callipers were used : first, as a shot gauge. Externally the size of the shot can be read off in designation, say a 32-pounder, etc., by the hand marked *shott*. Its diameter in inches by the pointer hand marked *inch*. Secondly, the callipers can be used internally for measuring the bore of the gun, the designation of the piece and the windage. But it has also a number of other uses. At the foot of each branch are the symbols of the sun, moon and various planets (plate xxxix). After the sun symbol, a dot in a circle, are the letters GO for gold with the number 10,000, then the caduceus of Mercury with the letters QU for quicksilver and the figures 7143 and so on. These figures give the comparative weight of a given bulk of gold, lead, silver, copper, iron, tin, etc., and above them is another table in which the comparative bulk of each of these metals is given.

Upon the circular head are engraved several geometrical figures (plate xxxix). There is a square inscribed within a circle, and again the circle in the square, and set thereto

<sup>4</sup> I am indebted to our member, Captain Swan, R.N.V.R., of Newbrough Park, for this reference.

are the numbers 100, 22, 14, 11, signifying the relative areas of the square and the circle. There is a pyramid, a cube, an orb, etc., with figures signifying their relative weights.

Some examples of English callipers have folding sights, and could be used as range-finders—in short, with the instrument all the calculations necessary to gunnery could be made.

The example under consideration has no sights, but in the sixteenth century a special instrument known as the *Familiar Staffe* was used for range-finding. No example of the *Familiar Staffe* is extant, but there is a model of one in the Lewis Evans collection at Oxford.<sup>5</sup> The *Familiar Staffe* is about a yard long, whereas the gunner's compass is a pocket instrument, and in the eighteenth century good portable cases of mathematical instruments frequently contained a gunner's compass. Such a case is now in South Kensington Science Museum.<sup>6</sup> These compasses are now rare, but there are three in South Kensington Science Museum, three in the British Museum, and two in the Lewis Evans collection at Oxford.

One of the best works on the subject is *A treatise of such mathematical instruments as are usually put into a portable case. To which is now added an appendix containing the description of the gunner's callipers*, 2nd edition by J. Robertson, F.R.S. London. MDCCLVII.<sup>7</sup>

There is also a description and engraving of a similar gunner's compass in a book entitled *The construction and principal uses of mathematical instruments. Trans-*

<sup>5</sup> *The Familiar Staffe*, 1590, and *Arch. Ael.*, LXXIX, p. 63. Ordnance officers were land surveyors, hence the official Government Survey of the United Kingdom was formerly under the direction of the Master-General of the Ordnance and is still known as the Ordnance Survey.

<sup>6</sup> Inv. 1918—13.

<sup>7</sup> I am indebted to D. Baxandall, A.R.C.S., F.R.A.S., for this reference.

*lated from the French of M. Bion by Edward Stone.*  
1st edition, London, 1723; 2nd edition, 1758.

The instrument was in the possession of a family long resident in Bamburgh, Northumberland. It was acquired by Mr. John Oxberry, our honorary secretary, who has presented it to the society, and it is now in the Black Gate Museum, Newcastle upon Tyne.



GUNNER'S COMPASS.



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