Fig. 10. Shade or *dark lines*, will be introduced and explained at a later stage.

The following notation will be used, one accent over a number, as 2′, denotes feet; two accents, as 6″, inches; thus, 1′..0¼″ means one foot and a quarter of an inch.

CHAPTER III.

9. Scales.—In fig. 11 let *a* represent a line two inches long, *b* one an inch long, and *c* one half-an-inch long; then if *b* represents a drawing of the line *a*, the scale would be ½, or 6″ = 1 foot; if *c* represents *a*, then the scale would be ¼, or 3″ = 1 foot, and so on.

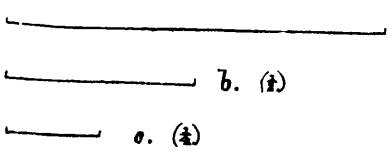

Fig. 11

10. When the scale is denoted by a fraction whose numerator is unity, as ¼, the denominator (in this instance 4) denotes how many times larger the object is than the drawing, the term larger to be used in the sense conveyed in the previous and following articles.

If the fraction is of the form ⅔, the numerator being greater than unity, then we may consider the numerator as expressing how many units of length (feet, inches, &c.) there are in each line of the drawing, the denominator denoting the number of units in the object; for example,—a circle of 3″ diameter if drawn to a scale of ⅔ would be represented by a circle of 2″ diameter.

11. The reduction in the size of plane objects, when drawn to scale, is to be made in all directions, thus the square, fig. 12, is of one inch side, a drawing of it to a scale of ½ would be a square of ½″ side, as fig. 13; one to a scale of ¼ would be a square of ¼″ side, as fig. 14.

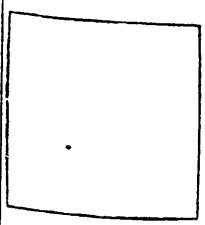

Fig. 12.

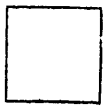

Fig. 13.

Fig. 14.

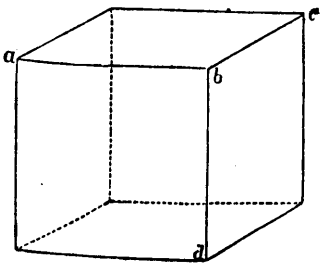

Fig. 15.

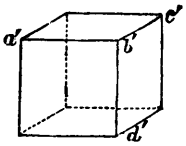

Fig. 16.

In the case of solid bodies, which is the most general one, the reduction in the size of the object, as represented in the drawing, is to be made in every direction,—for example, a cube of 1″ edge, fig. 15, is required to be drawn to a scale of ½, then every line in the drawing must be made one-half the length of the corresponding line of the object. Fig. 16 is a drawing of the cube to a scale of ½, the lines *a′b′*, *b′c′*, *b′d′*, &c., being respectively one-half the length of *ab*, *bc*, *bd*, &c., in fig. 15.

CHAPTER IV.

13. We now pass on to consider the *first lines* to be made in a drawing, whether from a copy, a sketch of a machine, or from the rough sketch of a proposed machine.

First, as to the representation of surfaces. In all cases where a plane figure is symmetrical with respect to a given line, whether the line exists in the figure, or may be considered, for convenience, as existing in it, that line must be drawn first. For example, the circle in fig. 21 is symmetrical with respect to the lines *ab*, *cd*, these lines are to be drawn first, and the point of intersection, *o*, to be taken for the centre of the circle.

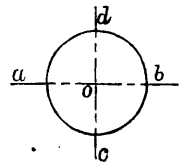

Fig. 21.

* The distance 0—12 *represents* a foot, but is really only 1½ long.

CHAPTER V.

14. A DRAWING of any solid object is the projection of that object on one or more planes, giving one or more views of it. We will state what a projection is, and what are the names given to the different views. In fig. 25 ABCD is the horizontal plane (your drawing-board, for instance); CDEF the vertical plane; let a line *ab* be held perpendicular to the plane ABCD (and therefore parallel to the plane CDEF) at a distance *bc* above it and in front of the plane CDEF. If now the line *ab* is produced to meet the plane ABCD in *c*, the point *c* is the projection of the line *ab*; * from *a*, *b*, draw lines perpendicular to the plane CDEF, meeting it in *a′*, *b′*, then *a′*, *b′* are projections of *a*, *b*; and if *a′*, *b′* be joined, the line *a′b′* is a projection of *ab*. *c* is called a "*plan*," and *a′b′* an "*elevation*" of the line *ab*. The two planes ABCD, CDEF, which are considered to be at right angles in fig. 25, are really one (the plane CDEF being turned down through a right angle), and are represented by the drawing-paper; the line CD in which the planes intersect is the "*ground line*" in our drawings, the line which divides the plan from the elevation.

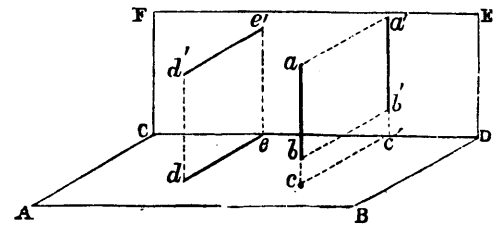

Fig. 25.

* The point *c* would be termed a "*trace*" in practical solid geometry.

(*To be continued.*)