PROBLEM 114.—To draw the Spiral Curve described by a point, upon a Cone, **A B C.**

If the points in the curve of a Spiral, in addition to approaching the centre in a constant ratio, are supposed also to rise above each other by a constant increase of height, a curve will be obtained, which is also called the Spiral. This Spiral may be conceived as a curve, traced on the surface of a cone. It may also be traced on the surface of a sphere.

Let **A′ 1, 2, 3, 4, &c.**, be points in the curve of the Spiral, traced on a horizontal plane, and **A B C** the given cone.

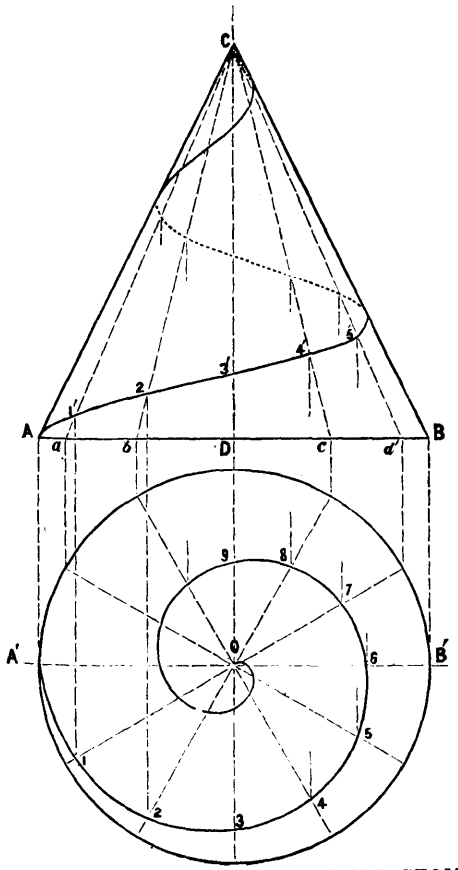
1.—From the centre **O**, describe a circle equal in diameter to the base, **A B**, of the given cone.

2.—Divide this circle into any number of equal parts, and bear in mind that the greater the number of those divisions, the greater will be the accuracy of the projection; and, through these points, draw radii, cutting the given curve in the points **1, 2, 3, 4, &c.**

3.—From the points in the periphery of the circle, draw straight lines parallel to the axis of the cone, **C D**, and cutting the base, **A B**, in the points *a*, *b*, &c., and from these points draw lines to the apex of the cone.

4.—Again, from the points in the curve where the radial lines bisect it, in the points **1, 2, 3, 4, &c.**, draw lines parallel to **C, D, O**, and cutting the lines *a c*, *b c*, &c., in the points **1′, 2′, 3′, 4′, &c.** These points of intersection are points in the required curve, and through which it may be drawn by a steady hand.

Note.—It may not be out of place here to urgently advise the student to learn and practice free-hand drawing at the same time that he studies the scientific portions of mechanical art. Many of the more difficult curves in Geometry, and numerous forms and shapes in mechanical and architectural drawing, can be far better and more neatly drawn in with the hand than by the aid of instruments or other mechanical appliances.



THE HELIX.

A helical surface is generated by the revolution of a straight *line* round the axis of the cylinder; its outer end moving in a Helix, and the *line* itself forming with the axis a constant and invariable angle.

PROBLEM 115.—To draw the Helical Curve described by a point **A** upon a Cylinder **A B C D.**

Let **A B C D** represent a cylinder upon which the Helix is to be situated, **E F** the axis, and **A 12** the pitch of the Helix.

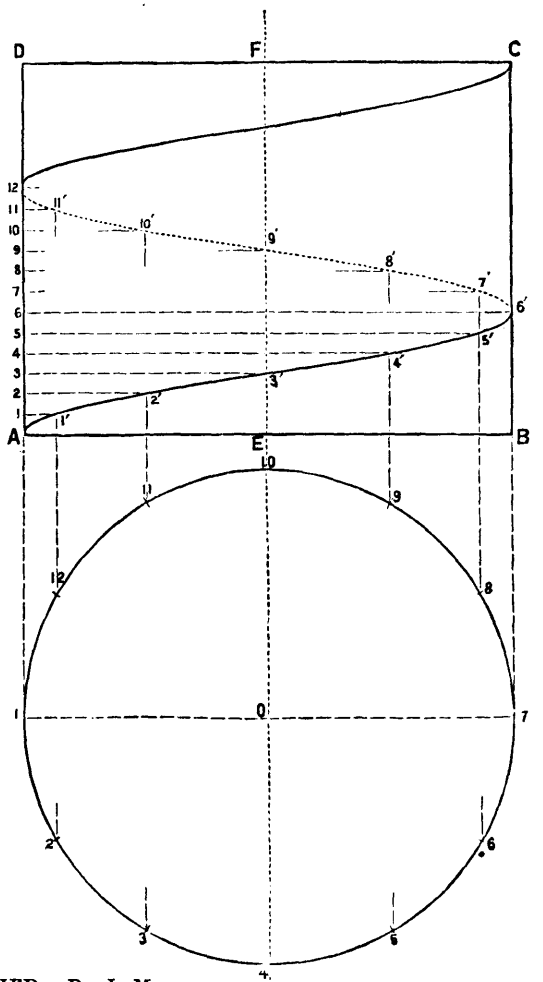
1.—Produce the line **E F**, and on it describe the horizontal projection of the Cylinder, **A B C D.**

2.—Divide the circle into any number of equal parts: the greater the number of these divisions the greater will be the accuracy of the curve.

3.—Set off, on **A D**, or any other line parallel to the axis, the pitch of the Helix as **A 12**, and divide it in the same number of equal parts as the circle is divided into.

4.—Then, through the points of division of the circle, draw straight lines perpendicular to **A B**, or parallel to the axis **F E**; and, through the points of division of the pitch, draw straight lines parallel to **A B**, or at right angles to the axis **E F**. The points of intersection of the respective pairs of these two sets of lines will be points in the required curve, as **1′, 2′, 3′, 4′**, &c., and which may be either drawn in by the hand or by means of a template.

Vere Foster's Drawing Books—R 3.



PRACTICAL GEOMETRY APPLIED.—By J. Magnell.