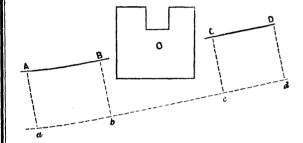
PROBLEM 107.—To make a Diagonal Scale of one and a-half inches to the poot, to show feet, inches, and eighths of inches, or the ninety-sixth part of a foot.



- 1. Draw nine parallel equidistant lines.
- Set off, on A B, the lower of these lines, a number of equal distances, each one and a half inches long.
- 3.—Through each of these divisions draw perpendiculars, cutting all the nine parallel lines, and figure these 1, 2, &c., commencing always from the second division, and mark the first A 0.
- 4.—Subdivide the first of these primary divisions, A 0, into twelve equal parts, both upon the upper and lower of the nine parallel lines; figure every third division as 3, 6, 9, 12, counting the opposite way from 0 to that of feet.
- 5.—Draw the diagonal lines from the eleventh division above to the twelfth below, from the tenth above to the eleventh below, and so on, till you get from zero above to 1 below.

These lines divide each twelfth in eight equal parts at points in the horizontal lines, or one ninety-sixth of the extent of a primary division.

PROBLEM 108.—To produce a Given Straight Line beyond an obstacle which prevents the appliance of the usual means by which Straight Lines are drawn.



Let A B be the given straight line, terminated by an obstacle O, but required to be continued on the other side of the obstacle, as C D.

- 1.—Take any two points in A B, and from them erect perpendiculars to A B, and equal to one another, as A a, B b, and of such a length that a b Produced will clear the obstacle.
- In a b produced, take two other points, c, d, beyond the obstacle, and
  draw c C and d D perpendicular to a b produced, and make each of
  them equal in length to a A or b B.
- 3. -Join C D, which is the line required.

## Another Method.

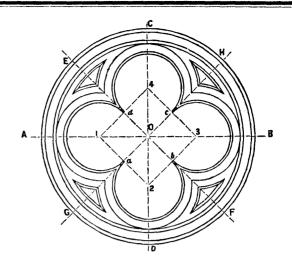
If the obstacle 0 be such, that two points in A B, as A and B, are visible from C and D (as, in case of ponds or logs), the proper position of C and D will be easily determined by placing the eye at A, so as to see B; and then an assistant, on the other side of the obstacle, places two marks or poles, C and D, moving them either to the right or left, until all four are in one straight line. In this case, C D being joined, will be the line required—that is, it will be in the same straight line with A B.

NOTE.—This Problem is very useful in Land Surveying, when you meet with buildings, bogs, ponds, &c., on a chain line.

## QUATREFOIL.

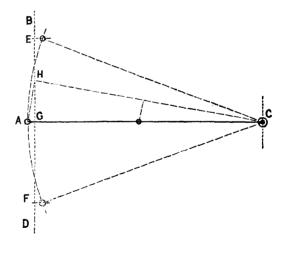
A Quatrefoil is a piercing or panel formed by cusps or foliations into four leaves or lobes. It is much used in Gothic architecture, in the tracery of window panels, &c.

PROBLEM 109 .- To CONSTRUCT THE QUATREFOIL.



- 1.—Draw the lines A B and C D at right angles to each other, intersecting in the point O.
- About the centre 0 construct the square 1, 2, 3, 4, having for its diagonals
  a part of the straight lines A B and C D.
- 3.—Bisect the sides of the square by the lines **H** G and **E** F, cutting the sides in the points a, b, c, and d.
- 4.—From the corners of the square, 1, 2, 3, and 4, as centres, with 1 a, 1 d, or half the side of the square, as radius, draw the arcs a d, d c, c b, and b a, and those concentric with them: the rest of the circles are drawn from the centre 0.

PROBLEM 129.—GIVEN THE LINE OF STROKE OF THE PISTON ROD, THE LENGTH OF THE STROKE, AND THE CENTRE OF THE WALKING-BEAM OR LEVER, TO FIND THE RADIUS OF THE LEVER, SO THAT THE END CENTRE WILL DEVIATE EQUALLY ON EACH SIDE OF THE LINE OF STROKE.



Let  ${\bf C}$  be the centre of the walking-beam,  ${\bf B}$   ${\bf D}$  the line of the stroke, and  ${\bf E}$   ${\bf F}$  the length of the stroke.

- 1.—Draw the straight line C A, indefinitely, and from C set off C G, the distance of the line of stroke of the piston rod from the centre of the walking beam.
- 2.—Through G draw the straight line B G D at right angles to A C.
- And from G set off G H, a distance equal to one quarter of the stroke, and join C H.
- 4.—From H draw HA perpendicular to CH, cutting the line CA in the point
  A. CA will be the required radius. (To be continued.)