PRACTICAL PLANE AND SOLID GEOMETRY

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PRACTICAL PLANE AND SOLID GEOMETRY

Trieste

PRACTICAL

PLANE AND SOLID GEOMETRY;

EMBRACING

ALL THE BRANCHES OF GEOMETRICAL DRAWING APPLIED

IN THE ARTS AND SCIENCES.

ESPECIALLY ADAPTED FOR SCIENCE CLASSES.

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GOVERNMENT SCIENCE MASTER.

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PREFACE.

THIS work has been compiled to supply a want long experienced by science teachers and their pupils, and is published at a price within the means of the humblest artisan. By uniting Plane and Solid Geometry with Orthographic, Isometrical, Parallel, and Linear Perspective Projections, in a clear and condensed form, it will prove of great assistance to workmen in their several branches of trade, especially tin-plate and metal workers, pattern makers, fitters, smiths, engineers, carpenters, joiners, masons, and others, surveyors and draughtsmen. With the exception of the terms explained in the definitions, technical and compound words have as far as possible been avoided, in order that the subject may be easily and thoroughly comprehended by persons having no previous knowledge of Geometry.

Although there are various methods of working out these problems, the simplest and best that will apply in all cases has been adopted.

The work is *descriptive* and *not demonstrative;* long experience having proved how few students in our schools and classes have either the preliminary training, time, or application to enter into the theory: they learn rather *how* to do it, than *why* it is executed in that particular form.

The best examples in each division have been selected, so as neither to limit nor encumber the subject. It is hoped that the description to each, although brief, will be found complete in itself; but in some cases, where incompleteness may be apparent, a reference to other figures mentioned will suffice. A copious description would often tend to make it more confusing. As the great value of Geometry lies in its accuracy, it cannot be too urgently impressed upon the student, that figures should be drawn as large as possible, with neatness and care; for, without these essentials, errors will constantly occur. It is suggested that, where doubt is entertained of the truth of any solution worked out by the student, exaggerated examples should be taken, which will multiply the error, if such exist, and serve as an exercise to impress the method more fully on the mind of the pupil.

The work is divided into sections, as follows:—

PRACTICAL PLANE GEOMETRY.

Definitions. Elementary Constructions of Plane Figures. Division and Transformation of Plane Figures.

PRACTICAL SOLID GEOMETRY.

Orthographic projection of Lines, Planes, and Solids. Penetrations and Intersections of Solids. Conic and other Sections. Envelopes of Solids, with the development of Lines and Points upon their surfaces. Projection of Shadows and Cast Shadows. Isometrical Perspective Projection. Parallel Perspective Projection. Linear Perspective Projection.

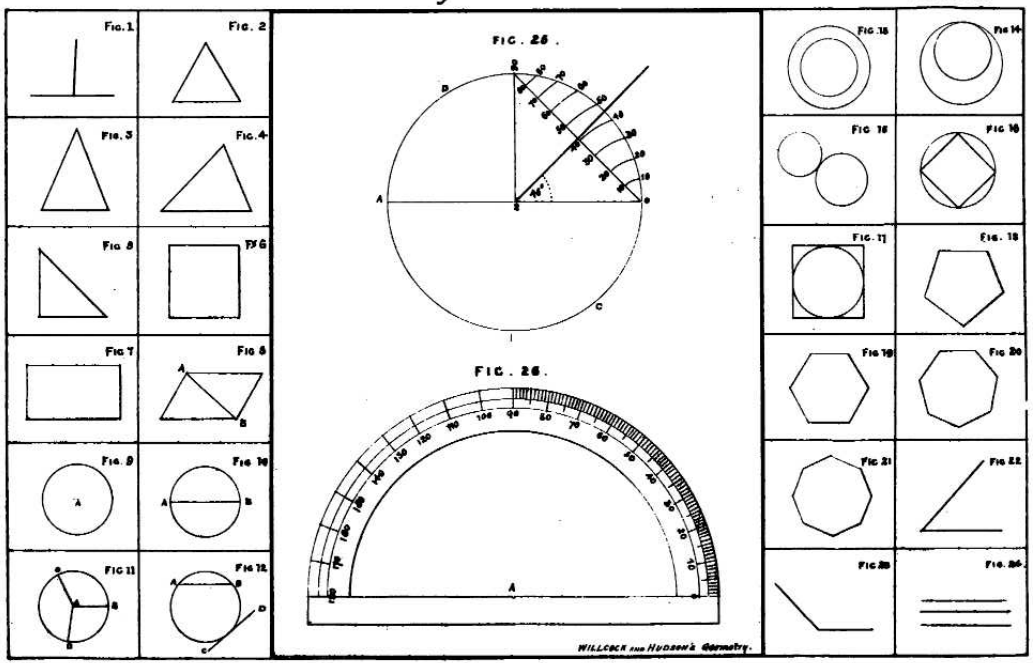
Fig. 1
Fig. 2
Fig. 3
Fig. 4
Fig. 5
Fig. 6
Fig. 7
Fig. 8
A
B
Fig. 9
A
Fig. 10
A
B
Fig. 11
Fig. 12
A
B
D
C
Fig. 13
Fig. 14
Fig. 15
Fig. 16
Fig. 17
Fig. 18
Fig. 19
Fig. 20
Fig. 21
Fig. 22
Fig. 23
Fig. 24
Fig. 25.
B
A
C
Fig. 26.
A
Willcock and Hudson's Geometry.

PRACTICAL PLANE GEOMETRY.

DEFINITIONS.

PLATE I.

FIG. 1.

A *right angle* is when one line is perpendicular to another, or contains an angle of 90 degrees.

FIG. 2.

An *equilateral triangle* has three sides equal.

FIG. 3.

An *isosceles triangle* has two sides equal.

FIG. 4.

A *scalene triangle* has all its sides unequal.

FIG. 5.

A *right angle triangle* contains a right angle.

FIG. 6.

A *square* is a four-sided figure, having all its sides equal, and its angles right angles.

FIG. 7.

A *rectangle* is a four-sided figure, having all its angles right angles, and its opposite sides only equal.

FIG. 8.

A *parallelogram* is a four-sided figure, having its opposite sides parallel. A B is called the diagonal.

FIG. 9.

A *circle* is a plane figure bounded by one continuous curve line, called the circumference, and is such that the circumference is at all points equally distant from the centre A within it.

FIG. 10.

A line A B drawn through the centre of a circle and terminating on each side at the circumference, is a *diameter*.

FIG. 11.

The line A B is a *radius* of the circle B C D—A C and A D are also radii. The space enclosed by two *radii*, and a portion of the circle is termed a *sector*.

FIG. 12.

An *arc* of a circle is any part of the circumference, as A B. A *chord* of a circle is a straight line joining the extremities of an arc, as A B. A *segment* of a circle is a space enclosed by an arc and chord, as A B. A *tangent* to a circle is a straight line which touches it but does not cut it, as C D.

FIG. 13.

Circles are *concentric* when they have the same centre.

FIG. 14.

Circles are *eccentric* when they have not the same centre.

FIG. 15.

Circles are *tangential* to each other when they touch at their circumference, but do not cut.

FIG. 16.

A square, or any other figure, with a greater or less number of sides is *inscribed* in a circle when all its angles touch the circumference but do not cut.

FIG. 17.

A circle is *inscribed* in a straight sided figure when it touches all its sides.

FIG. 18.

A *pentagon*, or five sided figure.

FIG. 19.

A *hexagon*, or six sided figure.

FIG. 20.

A *heptagon*, or seven sided figure.

FIG. 21.

An *octagon*, or eight sided figure.

FIG. 22.

An *acute angle*, less than a right angle.

FIG. 23.

An *obtuse angle*, greater than a right angle.

FIG. 24.

Parallel lines if produced will never meet.

FIG. 25.

To construct a scale of chords.

Draw any circle A C D, and find the diameter A B O. Erect a perpendicular at B, and divide one quarter of the circumference from 0 to 90 into nine equal parts. Then each of these divisions represents ten degrees; they should each be divided into ten equal parts. The circumference of a circle contains 360°, therefore the quadrant or quarter circumference will contain 90°. Draw the chord line 0, 90; and from 0 as a centre, with radii 0, 10; 0, 20; 0, 30, etc., describe arcs to cut the chord, and figure these points 10, 20, 30, etc. Then this line is called the scale of chords, by means of which any angle may be set off. Thus, for an angle of 45° lay down a line,