ELEMENTS OF DESCRIPTIVE GEOMETRY, WITH ITS APPLICATION TO SPHERICAL PROJECTIONS

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WITH ITS APPLICATION TO

SPHERICAL PROJECTIONS.

BY

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PREFACE.

THESE pages have been written and are published with the single object of presenting, in proper form to be used as a text-book, the course of Descriptive Geometry, as taught at the U. S. Military Academy.

Without any effort to enlarge or originate, the author has striven to give, with a natural arrangement and in clear and concise language, the elementary principles and propositions of this branch of science, of so much interest to the mathematical student, and so necessary to both the civil and military engineer.

Though indebted for many of the ideas to the early instructions of his predecessor and friend, Professor Davies, whose text-books on this subject were among the first in the English language, the author has been much aided by a frequent reference to the French works of Leroy and Olivier, and to the elaborate American work of Professor Warren.

It is intended to include, in an edition to be issued at an early day, the application of the subject to shades and shadows, and perspective.

U. S. MILITARY ACADEMY,
October, 1864

CONTENTS.

PART I.

ORTHOGRAPHIC PROJECTION.

PART II.

SPHERICAL PROJECTIONS.

PART I.

ORTHOGRAPHIC PROJECTIONS.

PRELIMINARY DEFINITIONS.

1. DESCRIPTIVE GEOMETRY is that branch of Mathematics which has for its object the explanation of the methods of representing by drawings:

First. All geometrical magnitudes.

Second. The solution of problems relating to these magnitudes in space.

These drawings are so made as to present to the eye, situated at a particular point, the same appearance as the magnitude or object itself, were it placed in the proper position.

The representations thus made are *the projections of the magnitude or object.*

The planes upon which these projections are usually made are *the planes of projection.*

The point, at which the eye is situated, is *the point of sight.*

2. When the point of sight is in a perpendicular, drawn to the plane of projection, through any point of the drawing, and at an infinite distance from this plane, *the projections are Orthographic.*

When the point of sight is within a finite distance of the drawing, *the projections are Scenographic*, commonly called *the Perspective* of the magnitude or object.

3. It is manifest that, *if a straight line be drawn through a given point and the point of sight, the point, in which this line pierces the plane of projection, will present to the eye the same appearance as the point itself, and therefore be the projection of the point on this plane.*

The line thus drawn is *the projecting line of the point.*

4. In the *Orthographic Projection*, since the point of sight is at an infinite distance, the projecting lines drawn from any points of an object, of finite magnitude, to this point, *will be parallel to each other and perpendicular to the plane of projection.*

In this projection two planes are used, at right angles to each other, the one *horizontal* and the other *vertical*, called respectively *the horizontal* and *vertical plane of projection.*

5. In Fig. 1, let the planes represented by ABF′ and BAD be the two planes of projection, the first *the horizontal* and the second *the vertical.*

Their line of intersection AB is *the ground line.*

These planes form by their intersection four diedral angles. The *first angle*, in which the point of sight is always situated, is above the horizontal and in front of the vertical plane. *The second* is above the horizontal and behind the vertical. *The third* is below the horizontal and behind the vertical. *The fourth*, below the horizontal and in front of the vertical, as marked in the figure.

REPRESENTATION OF POINTS.

6. Let M, Fig. 1, be any point in space. Through it draw