

**TOPOGRAPHICAL SURVEYING:
INCLUDING TOPOGRAPHICAL
SURVEYING, NEW METHODS IN
TOPOGRAPHICAL SURVEYING, GEOMETRY
OF POSITION APPLIED TO SURVEYING,
CO-ORDINATE SURVEYING; PP. 1-209**

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VARIOUS

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TOPOGRAPHICAL SURVEYING

INCLUDING

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TOPOGRAPHICAL SURVEYING,

By GEO. J. SPECHT, C. E.

NEW METHODS IN TOPOGRAPHICAL SURVEYING,

By PROF. A. S. HARDY.

Geometry of Position Applied to Surveying,

By JOHN B. McMASTER, C. E.

CO-ORDINATE SURVEYING,

By HENRY F. WALLING, C. E.

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PREFACE TO SECOND EDITION.

THE earlier edition of this series of essays having been exhausted, a new issue has been determined upon.

The methods of surveying herein described accords so completely with the latest practice, that this new edition seems quite certain to prove even more widely useful than the former one.

The text and diagrams have been revised.

GEO. W. PLYMPTON.

P R E F A C E .

THE essays republished in this little volume have already won the approval of practical surveyors, having appeared as original contributions in the **ENGINEERING MAGAZINE**.

It is in answer to an increasing demand for a good guide to modern methods of surveying areas that the articles have been brought together to form a single volume.

ON

TOPOGRAPHICAL SURVEYING.

BY

GEO. J. SPECHT, C. E.

ON TOPOGRAPHICAL SURVEYING.

THE object of Topography is to determine the relative positions of points of the earth's surface, that can be referred without error to a tangent plane, and therefore independent of the sphericity of the globe.

The operations of a topographical survey, consequently, are two—namely, to first project a system of points upon such a tangent plane; and, secondly, to find the distances of the same above or below the plane; or, in other words, to measure the lengths of the projecting normals. The first process is ordinary surveying; the second, leveling.

The results of a topographical survey are laid down in a so-called topographical map, which is a representation or complete image of the ground on a reduced scale.

Topographical maps are of the greatest convenience in locating railroads or other roads, in planning irrigation works, draining works, in mining enterprises, in military operations, &c., &c. In a topographical map the configuration of the ground is reduced to an image, which represents to the eye a large area at one glance, which in nature could not be viewed but by many separate inspections; therefore, the judgment about the relation of the different parts of the work will be a clearer and more intelligent one. This refers especially to mining work, where very frequently the problem occurs, to strike a vein with a tunnel in a certain level. In this problem a correct topographical map will often save the mining company several hundred feet of tunnel work, or, in other words, thousands of dollars.

One reason why topographical surveys are not oftener made, is certainly the slowness on one hand and the inaccuracy on the other hand of the old methods.

Two different methods have heretofore been employed; one has the great disadvantage of slowness, and the other that of being unreliable. The first is a combination of common surveying with leveling. Provided these two operations are carried out with all possible care, the work will be a very exact one; which, however, will partly be lost by the inaccuracy of the drawing. Therefore, in this method, the field-work is unnecessarily superior to the requirements of the case, as the reduced scale of a topographical map does not allow the representation of the smaller details. And as the topographical map is the first and direct object of a topographical survey, the latter ought not to be more exact than the scale of the map requires; for instance, if the map is made on a scale of 1-5000 ($1'' = 416.6'$) the distances on the map can be read or estimated with any certainty only within four feet. Consequently, the survey does not need to be more detailed than to correspond to this limit. The second method is also