WORKING DRAWINGS AND HOW TO MAKE AND USE THEM: DESIGNED FOR INDUSTRIAL, TECHNICAL, NORMAL, AND THE HIGHER GRADE GRAMMAR SCHOOL

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649348497

Working Drawings and how to Make and Use Them: Designed for Industrial, Technical, Normal, and the higher grade grammar school by Lewis M. Haupt

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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WORKING DRAWINGS

AND

HOW TO MAKE AND USE THEM.

DESIGNED FOR

INDUSTRIAL, TECHNICAL, NORMAL, AND THE HIGHER GRADE GRAMMAR SCHOOL; ACADEMIES AND NIGHT SCHOOLS; AND ARTISANS DESIRING A KNOWLEDGE OF THE PRINCIPLES OF PATTERN AND TEMPLATE MAKING

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JOS. M. STODDARD & CO.:
727 CHESTNUT STREET, PHILADELPHIA.
1881.

STEREOTYPED AND PRINTED
BY INQUIRER P. & P. CO.,
LANCASTER, PA.

PREFACE.

The large number of pupils of the public schools who are removed, by necessity, from their studies at the end of the grammar school course, and who are sent into mills, factories and shops as apprentices, seldom become more than a part of the machine which they are required to attend and operate, from lack of instruction in the one element which forms the basis of all constructive development, namely, the *science* of drawing.

It is true that, of late years, the *art* of drawing has been taught in the schools; that is, the manner of handling and using the necessary instruments to enable the student to copy from the flat or from models; but all of this may be done mechanically, and is almost entirely destitute of intellectual culture.

It is believed that there is but little in the present course of instruction that tends to develop the imagination to such an extent as to enable a pupil to form a mental conception of an object from a mere verbal description, and yet every new invention is but the fruit of such a process. It must first be clearly conceived in the mind, thence transferred to paper in the language of the artisan, and finally reproduced in substance out of appropriate materials. The inventor cannot convey, nor

the workman interpret his idea, unless both are familiar with the conventional language which must be employed to represent objects, not as they appear to, but as they do actually, exist, according to their true dimensions, relations and proportions.

The present system of teaching drawing is useful only in so far as it cultivates the faculties of observing the form and position of objects, and the manual skill of representing them, requiring the exercise of the judgment and memory; but is comparatively worthless for all practical purposes in the trades, except, perhaps, for the designer of free-hand patterns for tapestry, carvings and similar applications. The mere copying of pictures or models, or the construction of perspectives by rules-of-thumb, whose principles are not understood, is no more able to produce a draughtsman or artisan than would the copying of any number of sheets of music be able to make a musician, or the reproduction of hieroglyphics, a linguist. Any one who can handle a pencil may soon be taught to make a copy, although the characters so duplicated may be unintelligible.

To represent any object so that it may be constructed from the drawing, requires that it should be dissected and its several parts so projected on the plane of the paper that the artisan shall know just where to find them and what they represent; in short, a knowledge of *projections*, *scales*, and the *conventions* used in working drawings must be understood.

This is the missing link between theory and practice,

which it is the effort of the author to introduce. Without it all attempts to coördinate the industrial school features with our common school system must fail. The principles employed are as simple and readily understood as those of elementary Geometry, upon which they are based; and it is believed there is nothing in this Elementary Treatise on *Working Drawings, and How to Make and Use Them* that is beyond the comprehension of the average intellectual capacity found in the higher grades of our grammar schools.

Whoever can make from his own working drawings a model of an object, should also, with appropriate tools and materials, be able to construct the object itself, or in other words, become a practical artisan so far as the general principles of framing and construction are concerned.

In other countries numerous texts upon the subject are in use, but in America very few, and those only in our higher institutions of learning; hence, one reason why many of our draughtsmen, designers and most successful artisans are foreigners.

The plan of this work is to state the general principles involved in any theorem or problem, giving in the same connection its analysis, construction, and one or more of its numerous applications when practicable, thus fixing the principles much more efficiently than can be done by the ordinary methods of proceeding

By this means it is hoped that the mental training resulting from a study of this subject, will greatly assist

in qualifying pupils for the more useful occupations in life, and reduce the number of graduates who are incompetent to perform any other than clerical service, and who spend a large portion of their lives in seeking office.

The application which may be made of such information is very extended. As a disciplinary study it is one of the first order, developing the conceptive faculties and enabling one to grasp an idea readily. It has its application in nearly all manufactured articles and in all constructions and designs, in wood, iron, stone or other materials. It is used constantly by the engineer, architect, builder, pattern-maker, iron or sheet metal-worker, stair-builder, stone-cutter, designer and many others. It is the basis of all perspective drawings, which are generally made by rule and without reason, and is essential to a correct interpretation of all suggestions relating to constructions of any kind. It is used to explain and reinforce verbal language, and should be so used whenever possible.

One of its most important applications must not be overlooked. To the statistician as well as the merchant it is valuable as furnishing at a glance information which, if expressed in a mass of figures, would be unintelligible. It cannot be surpassed as a method of exhibiting rapidly the distribution of population, of products, of poverty or wealth, of crime or morality, of vital, or in fact any statistics which may be expressed numerically. To the physicist it is also particularly useful in investigations into the properties of molecular or mass physics, and

enables him to discover almost immediately many of the laws governing the motions of matter.

Fluctuations of prices, in the market values of daily commodities, may be more intelligently expressed by this means than any other, and can be compared at a glance. In short, the number of intelligent and eminently practical applications that may be made of projections is almost limitless.

Its introduction into the grammar, normal and other schools would supplant a certain amount of mnemonical by rational and manual development, and would thus be a relief to a system already overtaxed with memorizing.

In this brief treatise the consideration of the subject is limited to straight lines and planes; but enough is given to enable the teacher to measure the capacity of the student, and to determine whether he has the elements necessary to continue the subject with profit, in its application to curved lines, curved and warped surfaces, and solids.

Those students who may be incapable of developing the imagination to such an extent as readily to understand this part of the subject, should be allowed to stop here; but all who desire to become successful engineers or artisans must pursue the course still further, and take up the various subjects of intersections and developments of surfaces and solids, as applied to pattern-making, machine-drawing, stone-cutting, and many other of the useful arts. These the author hopes to provide in subsequent numbers. This number is only intended to