THE ART OF PROJECTING. A MANUAL OF EXPERIMENTATION IN PHYSICS, CHEMISTRY, AND NATURAL HISTORY WITH THE PORTE LUMIERE AND MAGIC LANTERN

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649063345

The Art of Projecting. A Manual of Experimentation in Physics, Chemistry, and Natural History with the Porte Lumiere and Magic Lantern by A. E. Dolbear

Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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Trieste

THE ART OF PROJECTING.

A Manual of Experimentation

IN

PHYSICS,

CHEMISTRY, AND NATURAL HISTORY

WITH THE

PORTE LUMIERE AND MAGIC LANTERN.

BY

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(TUFTS COLLEGE.)

New Edition, Revised, with Additions.

ILLUSTRATED.

BOSTON

LEE AND SHEPARD, PUBLISHERS.

NEW YORK: CHARLES T. DILLINGHAM.

1888.

PREFACE TO THE SECOND EDITION.

SINCE the first publication of this book the author has received so many commendatory letters from many parts of the world that he is fully persuaded that the book met a real want; and a sunbeam is now made useful in school work and in the study of phenomena in many places where no substitute is practicable. In preparing a new edition, some things have been added which it is hoped will make the book still more useful to such as consult it. Two things may be specially mentioned here: the electric lamps and lights for projection purposes, and the production and phenomena of vortex rings. Of the former there is pointed out what is at present practicable, and of the latter it may be said that the vortex-ring theory of the constitution of matter has so much philosophical as well as scientific importance, and the phenomena presented by vortex rings are so curious and unexpected, that the author has felt warranted in presenting what he believes to be the most complete series at present known, especially as he believes himself to be the discoverer of a considerable number of them.

Several small treatises on the management and use of lanterns have been published lately, and may be had on application to almost any of the larger dealers in physical instruments and lantern transparencies. It was not thought advisable to add anything on that subject. An excellent manual for experimental work with the lantern has been published by Lewis Wright, which every one interested in such matters should have, especially as many of the experiments described in it can be done as well or better by the use of a beam of sunlight, — the use of a beam of sunlight for projection being the peculiar province of this book.

A. E. DOLBEAR.

COLLEGE HILL, MASS.,
Sept. 9th, 1887.

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THE ART OF PROJECTING.

A MAGNIFIED image of a picture, or of any phenomenon, when thrown upon a screen by means of sunlight, and lenses, or with a magic lantern, is called a projection.

When sunlight is to be used for this purpose, it is necessary to have some fixture to give the proper direction to the beam. The *heliostat* and the *porte lumiere* are the devices in common use. The latter was the earliest form, and was invented by Gravesand, a Dutch professor of natural philosophy, in the early part of the last century. It was afterwards reinvented by Captain Drummond, an Englishman, who called it the *heliostat.* The latter term is now only applied to an automatic arrangement, by which a mirror is moved by clockwork in such a way that a beam of sunlight reflected from it may be kept in one direction all day, if it be needed so long. Silberman and Foucault have each devised very satisfactory instruments, but they are too costly to be owned by any but the wealthy; the catalogue price of the cheapest of these being five hundred francs. C. Gerhardt, of Bonn, however, makes a small one, carrying a good mirror three inches in diameter, for twenty dollars.

THE PORTE LUMIERE — HOW MADE.

The *porte lumiere* is made of various patterns by different makers, but the differences consist chiefly in

the devices for giving proper movements to the mirror. Their cost is from ten to twenty dollars according to their size, workmanship, and attachments. On the opposite page are engravings of several such as are in the market. It is recommended that one be purchased at the outset, if it can be afforded, but as many who would be glad to work with one may not be able to purchase it, directions will be given for making one that will enable any person who is familiar with the use of carpenters' tools to make one at a trifling cost that will answer for many purposes.

The room in which the *porte lumiere* is to be used must, of course, be one into which the sun can shine. A room having windows only upon the North side, evidently cannot be used at all for such a purpose; one having windows only upon the East or upon the West side could be used only in forenoon or afternoon; while one with windows looking to the South can be used nearly all day. Choose then that window where the sun is available the longest, and opposite to which can be stretched the screen to receive the projections upon. Next, take a well-seasoned piece of pine board a foot or more in width, and an inch thick when dressed; cut it to the length of the width of the window sash, so that it may fit into the window frame, and the sash be brought down upon it; this will keep it tightly in place. With the compasses, scratch two concentric circles in the middle of the board, one with a radius of four inches, the other with a radius of four inches and a half. Saw out the inner circle completely, and cut the other but one half through the board, and then cut away, making a square rabbet, as shown at *b b*. Next, take a round piece of inch board of the same diameter