

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

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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

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**A. E. DOLBEAR**

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# THE ART OF PROJECTING.

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*A Manual of Experimentation*

IN

PHYSICS,

CHEMISTRY, AND NATURAL HISTORY

WITH THE

PORTE LUMIERE AND MAGIC LANTERN.

BY PROF. A. E. DOLBEAR,  
TUFT'S COLLEGE.

ILLUSTRATED.

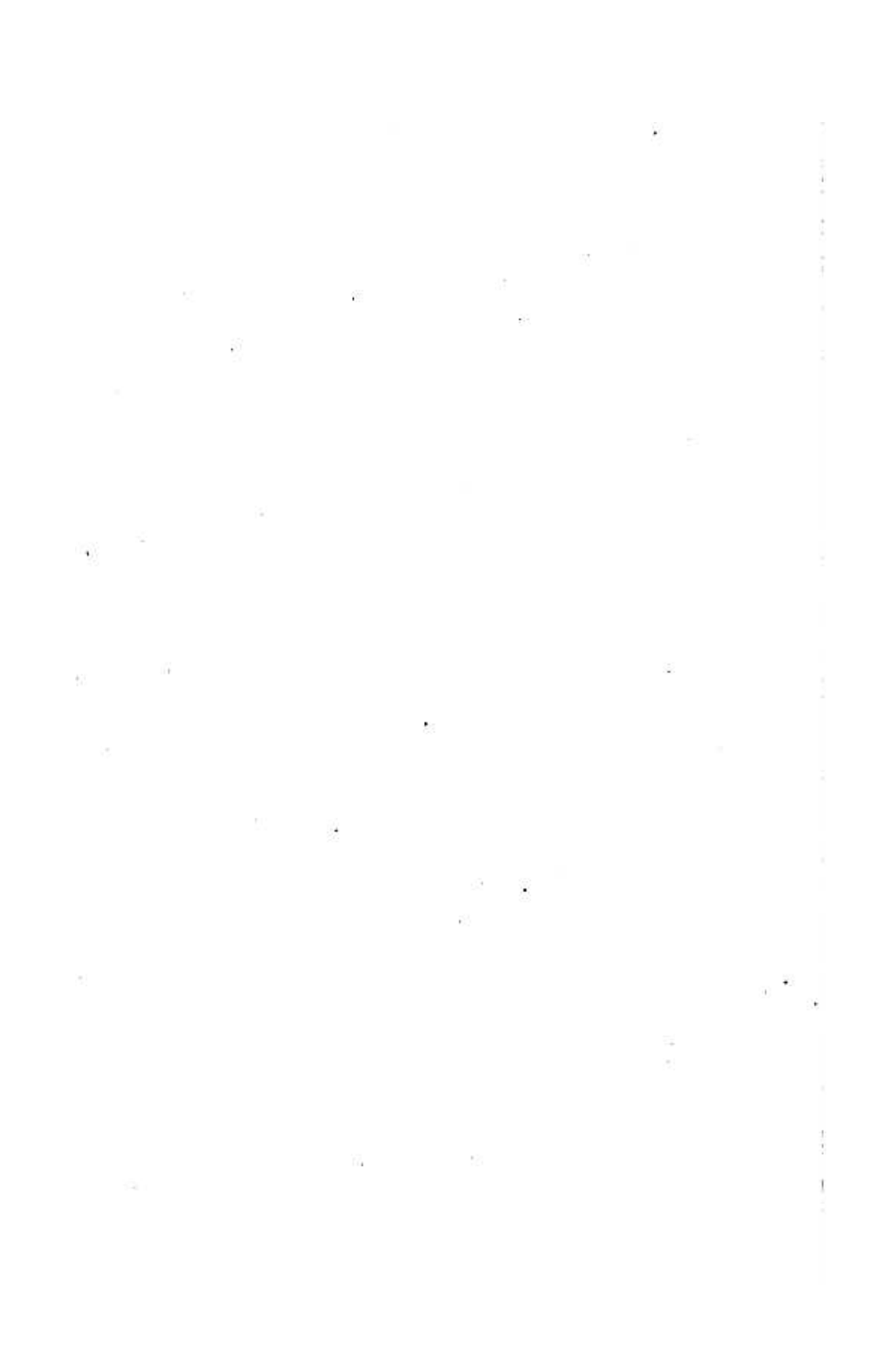
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## P R E F A C E .

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THE object of this treatise is to point out to teachers of physical science, and to others who may be interested in experimentation, the usefulness of the Magic Lantern, and especially of the Porte Lumière, and a few other pieces of apparatus which can mostly be extemporized. With these a surprisingly large number of experiments in every department of physics may be performed, and every department of science and art may be illustrated; and the illustrations may be upon a scale of magnitude which will surprise one who has never witnessed them. The manipulation of the apparatus is not at all difficult, and no one need fear he will not succeed in doing anything described in the book, provided that at first he masters the simple conditions of projection with a single lens and with a condenser.

The simplest fixtures have been described, and a cut has been inserted wherever it could make more intelligible either the forms of the apparatus or the necessary conditions. No attempt has been made to explain phenomena, — other books do that; but it is hoped that a sufficient number and variety of experiments are plainly described to make any one thoroughly familiar with the art of projecting.



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## THE ART OF PROJECTING.

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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, and its movements are directed by turning milled-head screws. Ritchie makes an excellent one with three and a half inch aperture, for about twenty-five dollars, and it is recommended that such an one be purchased at the outset, if it can be afforded, but as many who would be glad to work with one cannot 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 every purpose.

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