

**THE METHODS OF GLASS  
BLOWING; FOR THE  
USE OF PHYSICAL  
AND CHEMICAL STUDENTS**

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The Methods of Glass Blowing; For the Use of Physical and Chemical Students by W. A. Shenstone

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BY THE SAME AUTHOR

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THE METHODS  
OF  
GLASS BLOWING

FOR THE USE OF PHYSICAL AND CHEMICAL  
STUDENTS

*W. A. Ashwell* BY  
W. A. SHENSTONE

LECTURER ON CHEMISTRY IN CLIFTON COLLEGE

*11-28*

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## P R E F A C E

THE opportunities of obtaining practical instruction in the art of glass-working are so few in this country, and the advantages to be derived from an acquaintance with that art are so considerable to those who are engaged in physical and chemical experiment, that it appears to me a treatise on the subject is likely to be useful.

I am very well aware that there are in this country several amateurs more skilful than myself in glass-working. With some of them I have the good fortune to be acquainted. But as I believe that no one has undertaken to write such a book as this, and as I am encouraged to think that it will be of real use by enabling students and others to train themselves in the art of glass-working, and thus to render themselves more independent in designing and constructing apparatus for research and for technical purposes, I have ventured to do it.

The individual operations of glass-working are less diffi-

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cult than is frequently supposed. Considerable success in the performance of most of them may easily be attained after a little persistence in the face of early failures by any one endowed with average powers of manipulation. The construction of finished apparatus frequently involves the successful performance of several operations under disadvantageous conditions, and is doubtless somewhat more difficult, frequently requiring a little inventiveness on the part of the operator. I think, however, that the suggestions given on this subject in Chapter IV. will make that also a matter of no great difficulty to those who have gained a fair degree of expertness in the performance of the separate operations described in Chapter III.

The idea of the book, as will be gathered from a perusal of the Table of Contents, and of the introductory parts of Chapter I., has been that the instruments, the materials and their peculiarities, and the individual operations of glass-blowing, should be described in succession. Then that their application to the construction of finished apparatus should be illustrated by a few examples. To this it seemed well to add the brief account, in Chapter V., of the processes of graduating and calibrating glass

apparatus intended for use in quantitative operations. In this, however, as in the rest of the book, I have thought it best to confine myself to the simple methods that do not demand the expensive appliances often necessary for obtaining results of the highest degree of delicacy.

Any one who reads the book from end to end cannot fail to observe in it a certain amount of repetition. In a book which is at least as likely to be consulted for information on particular points, as to be systematically worked through, this is quite unavoidable, and indeed, within proper limits, desirable. I have endeavoured not to exceed in this respect.

I have great pleasure in acknowledging the kind aid that I have received at various times from my friend Professor W. Ramsay, and also from Mr. W. Crookes, F.R.S., to whom I am indebted for several suggestions. I must also thank my colleague, Mr. H. Whatley, for some kind assistance in preparing several illustrations, and Mr. Eve, of Featherstone Street, London, E.C., who has been good enough to admit me to his workshop, where I have had the advantage of examining the instruments used by his workmen.

W. A. S.

CLIFTON, August 1886.

## PREFACE TO THE SECOND EDITION.

AFTER carefully considering the suggestions that have been made to me since the publication of this book in 1886, I take the opportunity that now occurs for adopting several of them. The additions I make are not numerous, but I think they increase the value of the book.

Notwithstanding the severe remarks of one of my critics, I do not think it desirable to abandon the use of the metre and its subdivisions. I would point out, however, to those who are more accustomed to the use of English measures, that on page 71 (Fig. 38) they will find a scale of centimetres and millimetres to which they can refer. These divisions are not quite accurate, and should not be used for the graduation of tubes; but for the other purposes of glass-working they will serve fairly well.

W. A. S.

CLIFTON COLLEGE,  
*August 1888.*