

## PREFACE TO THE SIXTH EDITION.

It was with considerable diffidence that, at the request of the Publishers and various friends of my old Professor, Sir Wm. Roberts-Austen, I undertook to prepare a new Edition of this work. It is now eight years since the last edition was published; and although I have endeavoured to preserve the general scheme of the work and to make as few alterations as possible, the results of recent research and general Metallurgical Progress have made certain revisions and additions inevitable.

Some additions have been made to Chapter II., the table of Physical Constants has been revised in accordance with the latest available data, and it has been thought desirable to transfer all matters relating to Alloys to Chapter III., which deals specially with this subject. Chapter IV., which was confined almost exclusively to the thermal treatment of steel, now includes the thermal treatment of certain industrial alloys.

Such rapid progress has been made in pyrometric work that it has been considered necessary practically to rewrite the Chapter on Pyrometry, and a new Chapter on Metallography has been prepared to replace Chapter XI. on Microstructure in the last edition.

The subject of Fuel has been given a chapter to itself instead of being discussed in connection with thermal measurement, and this chapter is illustrated by types of modern Coking Ovens and Gas Producers. In the Chapter on Furnaces, sketches of typical Furnaces used in modern metallurgical practice have been introduced as illustrations to replace those of furnaces which are no longer in general use, and sketches of some of the principal types of Electric Furnaces have also been added.

I am greatly indebted to Mr C. O. Bannister, Head of the Department of Metallurgy, Sir John Cass Institute, not only for most valuable assistance in revising the proofs and seeing the book through the press, but also for many suggestions and criticisms, and he is entirely responsible for the Chapter on Metallography, which he very kindly undertook to prepare during my absence in South Africa. I also desire to thank Professor Gowland for the sketches of different furnaces with which he supplied me, and various friends to whom I am indebted for information and assistance.

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## PREFACE TO THE FIRST EDITION.

THE literature of metallurgy is rich, but those who are beginning to study it need guidance to a knowledge of the principles on which the art is rightly practised. It depends, as is well known, on the application of chemistry, physics, and mechanics; but the methods of metallurgists vary greatly from those of chemists, who, however, frequently fail to appreciate the nature of the difference.

Ten years' experience has convinced me that it is more important at the outset for the student to know what was the scope of mind of the early practisers of metallurgy, and to see what kind of aid the art may be expected to receive in future from the sciences, than to acquire familiarity with complicated details of processes and appliances. In this little volume I have, therefore, devoted four chapters to these branches of the subject, embodying in them portions of lectures which I have delivered from time to time.

In all English works on metallurgy, the important metals are dealt with separately and in detail. In this, however, an attempt has been made to treat the subject as a whole, giving no minute descriptions of processes, but choosing typical appliances and indicating their use in connection with groups of metals. Such a method was adopted by the late M. Gruner, Professor of Metallurgy at the *École des Mines*, Paris, to whom I have reason to be grateful, for I have closely followed him in my class lectures.

The student will, I trust, be led to study the works in which the extraction of metals from their ores and fitting them for use are fully discussed. Such are the classical treatises of Percy, the

monographs of Sir Lowthian Bell, and the manual of Phillips and Bauerman, from which volume a few illustrations have been borrowed. The literature of the subject has been enriched by Howe, of Boston, who has collected a store of facts in his elaborate and recently published volume on steel.

In the preparation of a portion of this little work, I have been aided by my colleague, Mr Bennett Brough, whose help has been specially useful in passing the work through the press.

I hope that the book will be found useful to my own students, for whose progress I feel sincere solicitude.

CHILWORTH, SURREY,  
December 23, 1890.

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