

**A MANUAL OF ELECTRO-
METALLURGY: INCLUDING THE
APPLICATIONS OF THE ART TO
MANUFACTURING PROCESSES**

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A Manual of Electro-Metallurgy: Including the Applications of the Art to Manufacturing Processes by James Napier

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JAMES NAPIER

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GLASGOW:

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41 MITCHELL STREET.

PREFACE TO THE FIRST EDITION.

THE author of the following Treatise was engaged for several years in the application of Electro-Metallurgy to the purposes of manufacture. His operations were performed with solutions of all the metals, and upon objects of every size and form. They commenced when the art was young, when its practical applications were speculative, its advantages and disadvantages equally unknown; when difficulties of all kinds, such as beset every new art, had to be met, and considered, and overcome.

The course of his daily proceedings threw him into the way of observations much more extensive and much more diversified than could possibly have occurred to any amateur of the art. Where large operations in an extensive business were concerned, it was necessary to attend to details that some would have considered trifling, and to overcome obstacles that others might have deemed insurmountable. Under the pressure of these circumstances, all means were employed to procure information. Innumerable electrotype processes were repeated as soon as they were published, and original experiments were made in a variety of forms, and frequently on an extensive scale, with a view to the removal of particular difficulties, or to find the means of accomplishing certain desirable ends.

These proceedings and inquiries afforded numerous results, not only useful in the manufacture in which the author was engaged, but interesting to the man of Science. And it is because of their general utility to all persons engaged in the multifarious processes into which the art of Electro-Metallurgy has ramified, that he has been induced to throw them into the form of the following Treatise.

While, however, he can state, that what is collected here is derived from extensive personal experience, he by no means

ventures to assume that the work is free from deficiencies. He has too frequently had to deplore the effects of his processes, and to point out the desirableness of others of greater certainty and economy.

Neither can the author presume that this work will be a *standard* on the subject to which it relates. Arts and Sciences, like kingdoms and nations, have their several periods of rise, prevalence, and decadence; and nothing can be more unstable than descriptions of an art like Electro-Metallurgy—an art that must fluctuate with the course of experimental discovery, that has rapidly attained a distinguished eminence, and that promises to extend its utility still further over regions now unthought of. The superb specimens of its products, which were displayed to the admiration of the world, at the GREAT EXHIBITION OF THE INDUSTRY OF ALL NATIONS, prove at once the immense importance of Electro-Metallurgy, and how much may yet be expected from one of the most ingenious of those modern applications of Science, which subject the powers of Nature to the use and pleasure of civilised man.

GLASGOW, *May*, 1851.

NOTE TO THE THIRD EDITION.

The rapid sale of the two editions of the *Manual of Electro-Metallurgy* has afforded great gratification to the author, and he has embraced the present opportunity of revision, to include every approved novelty, so as to bring the work down to the present state of knowledge on this most valuable art.

GLASGOW, *February*, 1857.

PREFACE TO THE FIFTH EDITION.

THE art of Electro-Metallurgy may, in a manner, be said to have passed from the hands of the experimental philosopher into those of the manufacturer; and when at any time the former announces anything new in the art, the latter generally looks upon it from a business standpoint, and asks, "Will it pay?" It is, therefore, not to be wondered at that the manufacturing electro-metallurgist overlooks or forgets many important and interesting phenomena which do not directly affect his manufacturing interests, and that he fails to be sufficiently observant or interested in the theory or science of his art.

It may appear a matter of small consequence to the manufacturing electro-metallurgist whether the electric force which performs his work is composed of two distinct forces—termed a positive and a negative—having, when separated, a strong re-uniting attraction; or one single force, and what are called the negative and positive, simply the possession of more or less of it. I have always held an opinion in favour of the single force, and have, I think, pretty clearly proved that dynamic electricity, at least, is one simple and undecomposable force, by the discovery that when it passes through a fluid in sufficient strength to decompose it, the elements of the fluid are not mutually transferred from one electrode to another, which the compound theory would necessitate, and which is asserted by electricians to take place. I have also shewn that when the electric force passing through any fluid is too weak to decompose it, there is produced a current of the fluid in one direction only, not in opposite directions, as the two and equally-powerful force theory would necessitate. Although upwards of thirty years have elapsed since these facts were made known, subsequent books and lectures on the physical and chemical sciences have