

On the
ECONOMY OF MACHINERY

(AD)

MANUFACTURES

By

CHARLES BABBAGE, ESQ^{RP} A.M.

*Lucasian Professor of Mathematics in the University of Cambridge,
and Member of several Academies.*



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THIS VOLUME

IS INSCRIBED

AS A TRIBUTE OF RESPECT

AND GRATITUDE

BY

THE AUTHOR.

P R E F A C E.

THE present volume may be considered as one of the consequences that have resulted from the Calculating-Engine, the construction of which I have been so long superintending. Having been induced, during the last ten years, to visit a considerable number of workshops and factories, both in England and on the Continent, for the purpose of endeavouring to make myself acquainted with the various resources of mechanical art, I was insensibly led to apply to them those principles of generalization to which my other pursuits had naturally given rise. The increased number of curious processes and interesting facts which thus came under my attention, as well as of the reflections which they suggested, induced me to believe that the publication of some of them might be of use to persons who propose to bestow their attention on those inquiries which I have only incidentally considered. With this view it was my intention to have delivered the present work in the form of a course of lectures at Cambridge; an intention which I was subsequently induced to alter. The substance of a considerable portion of it has, however, appeared among the preliminary chapters of the mechanical part of the Encyclopædia Metropolitana.

I have not attempted to offer a complete enumeration of all the mechanical principles which regulate the application of machinery to arts and manufactures, but I have endeavoured to present to the reader those which struck me as the most important, either for understanding the actions of machines, or

for enabling the memory to classify and arrange the facts connected with their employment. Still less have I attempted to examine all the difficult questions of *political economy* which are intimately connected with such inquiries. It was impossible not to trace or to imagine, among the wide variety of facts presented to me, some principles which seemed to pervade many establishments; and having formed such conjectures, the desire to refute or to verify them, gave an additional interest to the pursuit. Several of the principles which I have proposed, appear to me to have been unnoticed before. This was particularly the case with respect to the explanation I have given of the *division of labour*; but further inquiry satisfied me that I had been anticipated by M. Gioja, and it is probable that additional research would enable me to trace most of the other principles, which I had thought original, to previous writers, to whose merit I may perhaps be unjust, from my want of acquaintance with the historical branch of the subject.

The truth however of the principles I have stated, is of much more importance than their origin; and the utility of an inquiry into them, and of establishing others more correct, if these should be erroneous, can scarcely admit of a doubt.

The difficulty of understanding the processes of manufactures has unfortunately been greatly overrated. To examine them with the eye of a manufacturer, so as to be able to direct others to repeat them, does undoubtedly require much skill and previous acquaintance with the subject; but merely to apprehend their general principles and mutual relations, is within the power of almost every person possessing a tolerable education.

Those who possess rank in a manufacturing country, can scarcely be excused if they are entirely ignorant of principles, whose development has produced its greatness. The possessors of wealth can scarcely be indifferent to processes which, nearly

or remotely, have been the fertile source of their possessions. Those who enjoy leisure can scarcely find a more interesting and instructive pursuit than the examination of the workshops of their own country, which contain within them a rich mine of knowledge, too generally neglected by the wealthier classes.

It has been my endeavour, as much as possible, to avoid all technical terms, and to describe, in concise language, the arts I have had occasion to discuss. In touching on the more abstract principles of political economy, after shortly stating the reasons on which they are founded, I have endeavoured to support them by facts and anecdotes; so that whilst young persons might be amused and instructed by the illustrations, those of more advanced judgment may find subject for meditation in the general conclusions to which they point. I was anxious to support the principles which I have advocated by the observations of others, and in this respect I found myself peculiarly fortunate. The Reports of Committees of the House of Commons, upon various branches of commerce and manufactures, and the evidence which they have at different periods published on those subjects, teem with information of the most important kind, rendered doubly valuable by the circumstances under which it has been collected. From these sources I have freely taken, and I have derived some additional confidence from the support they have afforded to my views.*

CHARLES BABBAGE.

DORSET STREET, MANCHESTER SQUARE,]

June 8, 1832.

* I am happy to avail myself of this occasion of expressing my obligations to the Right Hon. Manners Sutton, the Speaker of the House of Commons, to whom I am indebted for copies of a considerable collection of those reports.

PREFACE TO THE SECOND EDITION.

IN two months from the publication of the first edition of this volume, three thousand copies were in the hands of the public. Very little was spent in advertisements; the booksellers, instead of aiding, impeded its sale; * it formed no part of any popular series,—and yet the public, in a few weeks, purchased the whole edition. Some small part of this success, perhaps, was due to the popular exposition of those curious processes which are carried on in our workshops, and to the endeavour to take a short view of the general principles which direct the manufactories of the country. But the chief reason was the commanding attraction of the subject, and the increasing desire to become acquainted with the pursuits and interests of that portion of the people which has recently acquired so large an accession of political influence.

A greater degree of attention than I had expected has been excited by what I have stated in the first edition, respecting the "Book-trade." Until I had commenced the chapter, "On the Separate Cost of each Process of a Manufacture," I had no intention of alluding to that subject: but the reader will perceive that I have throughout this volume, wherever I could, employed as illustrations, objects of easy access to the reader; and, in accordance with that principle, I selected the volume itself. When I arrived at the chapter, "On Combinations of Masters against the Public," I was induced, for the same reason, to expose a combination connected with literature, which, in my opinion, is both morally and politically wrong. I entered upon this inquiry without the slightest feeling of hostility to that trade, nor have I any wish unfavourable to

* I had good evidence of this fact from various quarters; and being desirous of verifying it, I myself applied for a copy at the shop of a bookseller of respectability, who is probably not aware that he refused to procure one even for its author.

it; but I think a complete reform in its system would add to its usefulness and respectability. As the subject of that chapter has been much discussed, I have thought it right, to take a view of the various arguments which have been advanced, and to offer my own opinion respecting their validity:—and there I should have left the subject, content to allow my general character to plead for me against insinuations respecting my motives;—but as the remarks of some of my critics affect the character of another person, I think it but just to state circumstances which will clearly disprove them.

Mr. Fellowes, of Ludgate-street, who had previously been the publisher of some other volumes for me, had undertaken the publication of the first edition of the present work. A short time previous to its completion, I thought it right to call his attention to the chapter in which the book-trade is discussed; with the view both of making him acquainted with what I had stated, and also of availing myself of his knowledge in correcting any accidental error as to the facts. Mr. Fellowes, “differing from me *entirely* respecting the conclusions I had “arrived at,” then declined the publication of the volume. If I had then chosen to apply to some of those other booksellers, whose names appear in the Committee of “The Trade,” it is probable that they also would have declined the office of publishing for me; and, had my object been to make a case against the trade, such a course would have assisted me. But I had no such feeling; and having procured a complete copy of the *whole* work, I called with it on Mr. Knight, of Pall Mall East, *whom until that day I had never seen, and with whom I had never previously had the slightest communication.* I left the book in Mr. Knight’s hands, with a request that, when he had read it, I might be informed whether he would undertake the publication of it; and this he consented to do. Mr. Knight, therefore, is so far from being responsible for a single opinion in the present volume, that he saw it only, for a short time, a few days previous to its publication.

It has been objected to me, that I have exposed too freely the *secrets of trade*. The only *real secrets of trade* are industry, integrity, and knowledge: to the possessors of these no exposure can be injurious; and they never fail to produce respect and wealth.

The alterations in the present edition are so frequent, that I found it impossible to comprise them in a supplement. But the three new chapters, "On Money as a Medium of Exchange;"—"On a New System of Manufacturing;"—and "On the Effect of Machinery in reducing the Demand for Labour;" will shortly be printed separately, for the use of the purchasers of the first edition.

I am inclined to attach some importance to the new system of manufacturing; and venture to throw it out with the hope of its receiving a full discussion amongst those who are most interested in the subject. I believe that some such system of conducting manufactories would greatly increase the productive powers of any country adopting it; and that our own possesses much greater facilities for its application than other countries, in the greater intelligence and superior education of the working classes. The system would naturally commence in some large town, by the union of some of the most prudent and active workmen; and their example, if successful, would be followed by others. The small capitalist would next join them, and such factories would go on increasing until competition compelled the large capitalist to adopt the same system; and, ultimately, the whole faculties of *every* man engaged in manufacture would be concentrated upon one object—the art of producing a good article at the lowest possible cost:—whilst the moral effect on that class of the population would be useful in the highest degree, since it would render character of far greater value to the workman than it is at present.

To one criticism which has been made, this volume is perfectly open. I have dismissed the important subject of the Patent-laws in a few lines. The subject presents, in my opinion,

great difficulties, and I have been unwilling to write upon it, because I do not see my way. I will only here advert to one difficulty. What constitutes an invention?—Few simple mechanical contrivances are new; and most combinations may be viewed as species, and classed under genera of more or less generality; and may, in consequence, be pronounced old or new, according to the mechanical knowledge of the person who gives his opinion.

Some of my critics have amused their readers with the wildness of the schemes I have occasionally thrown out; and I myself have sometimes smiled along with them. Perhaps it were wiser for present reputation to offer nothing but profoundly meditated plans, but I do not think knowledge will be most advanced by that course; such sparks may kindle the energies of other minds more favourably circumstanced for pursuing the inquiries. Thus I have now ventured to give some speculations on the mode of blowing furnaces for smelting iron; and even supposing them to be visionary, it is of some importance thus to call the attention of a large population, engaged in one of our most extensive manufactures, to the singular fact, that four-fifths of the steam power used to blow their furnaces actually cools them.

I have collected, with some pains, the criticisms* on the first edition of this work, and have availed myself of much information which has been communicated to me by my friends, for the improvement of the present volume. If I have succeeded in expressing what I had to explain with perspicuity, I am aware that much of this clearness is due to my friend, Dr. FITTON, to whom both the present and the former edition are indebted for such an examination and correction, as an author himself has very rarely the power to bestow.

* Several of these have probably escaped me, and I shall feel indebted to any one who will inform my publisher of any future remarks.

PREFACE TO THE THIRD EDITION.

THE alterations in this Third Edition are few, and the additions are not extensive. The only subject upon which it may be necessary to offer any remark, is one which has already, perhaps, occupied a larger space than it deserves.

Shortly after the publication of the Second Edition, I received an anonymous letter, containing a printed page, entitled "REPLY TO MR. BABBAGE;" and I was soon informed that many of the most respectable houses in the book trade inserted this paper in every copy of my work which they sold.

In the First Edition, I had censured, as I think deservedly, a combination amongst the larger booksellers, to keep the price of books above the level to which competition would naturally reduce it; and I pointed out the evil and oppression it produced. Of the numerous critics who noticed the subject, scarcely one has attempted to defend the monopoly; and those who deny the truth of my conclusions, have not impeached the accuracy of a single figure in the statements on which they rest. I have extracted from that reply the following—

“ List of the Number of Copies of the First Edition, purchased by a few of the Trade on speculation.”

As stated by the Booksellers.	—	Number really purchased by the sums on speculation.
“ Messrs. Simpkin and Co. 460 ”	—	100
“ Messrs. Longman and Co. 450 ”	—	50
“ Messrs. Sherwood and Co. 350 ”	—	50
“ Messrs. Hamilton and Co. 50 ”	—	8
“ Mr. James Duncan 125 ”	—	25
“ Messrs. Whittaker and Co. 300 ”	—	50
“ Messrs. Baldwin and Co. 75 ”	—	25
• “ Mr. Effingham Wilson 6 ”	—	6
• “ Mr. J. M. Richardson 25 ”	—	25
“ Messrs. J. and A. Arch 12 ”	—	6
• “ Messrs. Parbury and Co. 12 ”	—	12
“ Mr. Groombridge 25 ”	—	6
• “ Messrs. Rivington 12 ”	—	12
“ Mr. W. Mason 50 ”	—	25
• “ Mr. B. Fellowes 25 ”	—	25
Total	—	425

The author of the Reply, although he has not actually stated that these 1977 copies were “*subscribed*,” has yet left the public to make that inference, and has actually suggested it by stating that this number of copies was “*purchased on speculation*,” a statement which would have been perfectly true if the whole number had been purchased in the first instance, and at once. On reading the paper, therefore, I wrote to my publisher to obtain a copy of the “*subscription*” list, from which the column annexed to the above extract has been taken.

After the day of publication, the demand for the “*Economy of Manufactures*” was rapid and regular, until the whole edition was exhausted. There can, therefore, be no pretence for asserting that any copies, taken afterwards, were purchased

"*on speculation*,"—they were purchased because the public demanded them. The two first houses on the list, for instance, *subscribed* 150, and if they will publish the dates of their orders, the world will be able to judge whether they took the remaining 760 "*on speculation*."

I have put an asterisk against the names of five houses, whose numbers taken "*on speculation*" are correctly stated.

It is right that I should add, that the delay which many have experienced in procuring the volume, has arisen from the unexpected rapidity of the sale of both Editions. I have made such arrangements that no disappointment of this nature is likely to arise again.

The main question, and the only important one to the public, is the COMBINATION, and the Booksellers have yet advanced nothing in its defence. The principles of "free trade," and the importance of diffusing information at a cheap rate, are now too well understood to render the result of that combination doubtful; and the wisest course in this, as in all such cases, is—timely concession to public opinion. I shall now dismiss the subject, without fear that my motives for calling attention to it can be misunderstood, and hoping that the facts which I have elicited will advance the interests of knowledge.

DORSET STREET, MANCHESTER SQUARE,

February 11, 1833.

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