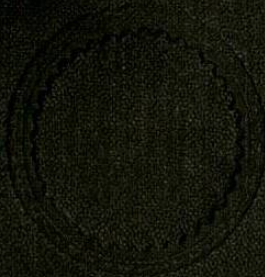


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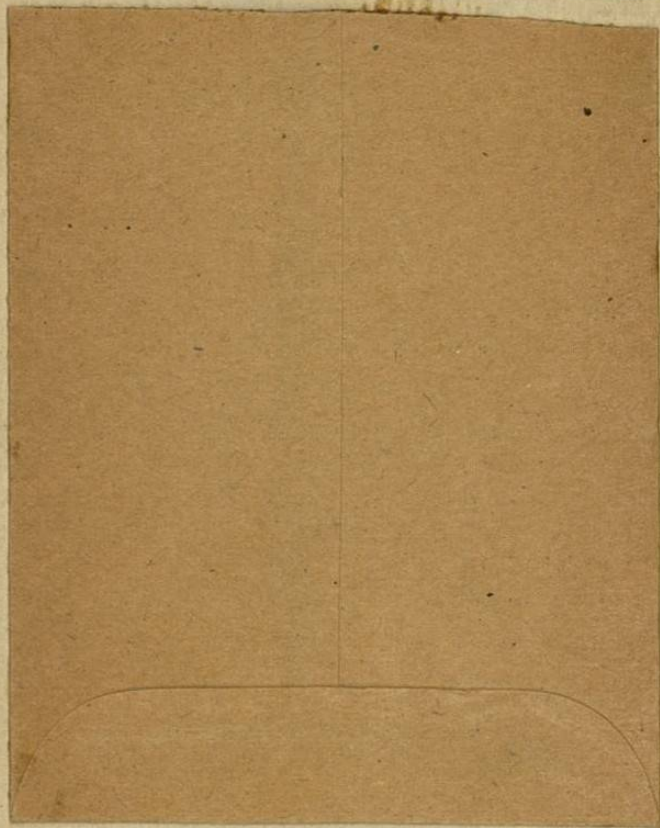
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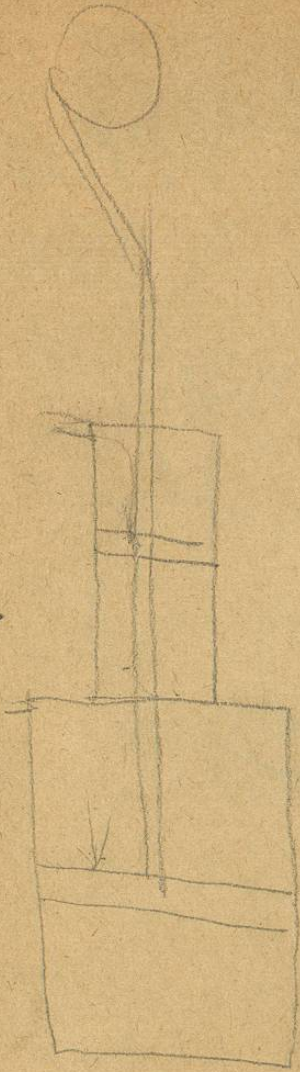
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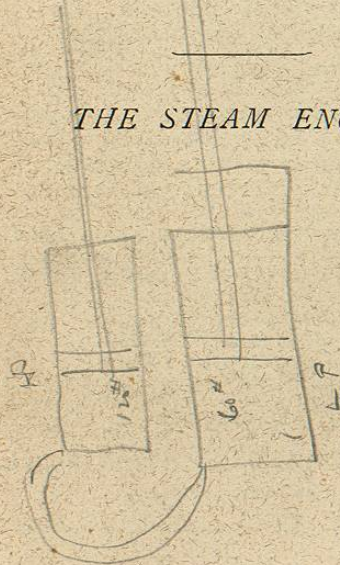


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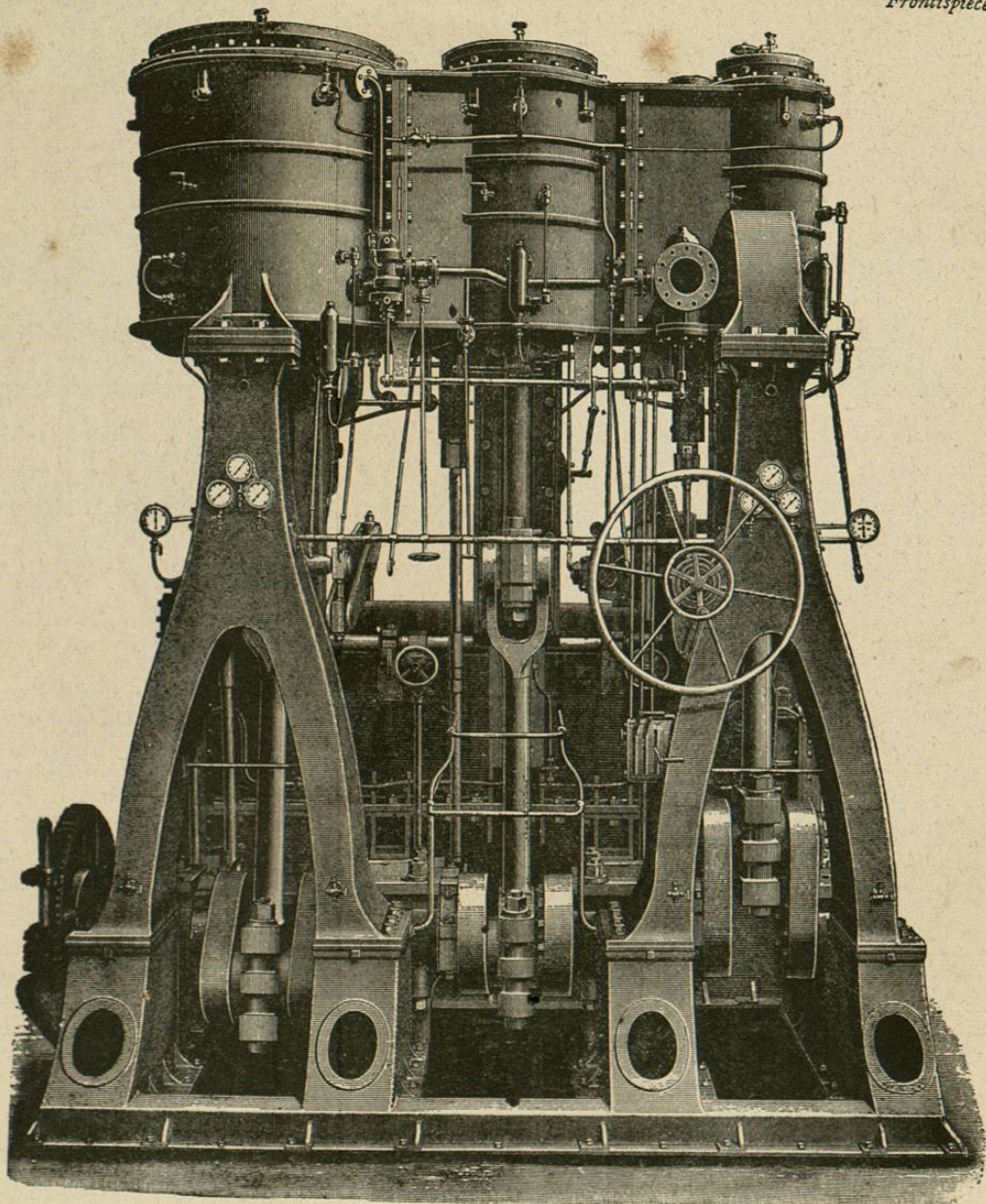


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TRIPLE EXPANSIVE ENGINES OF THE STEAMSHIP 'COOT'

Frontispiece



THE
STEAM ENGINE

BY

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PREFACE.

THE progress of technical education in this country during the last few years has rendered necessary the production of an elementary text book on the Steam Engine, containing information upon branches of the subject which have hitherto received but scant notice in works of this nature. I have endeavoured, as far as the limits of space in this small volume permitted, to make good these deficiencies, which were for the most part brought under my notice by engineering students.

There are four important points in which I venture to hope this book will be found to contain information, put in a form suitable for beginners, which has hitherto only been accessible in works of a more advanced character or in those which only profess to treat special branches of the subject.

They are as follows :—

1. The modern science of thermodynamics, which is the foundation of all knowledge of the steam engine considered as an apparatus for converting heat into mechanical work.
2. The very important effects exercised on the motion of quick running engines by the inertia of their reciprocating parts.

3. The geometrical methods of fixing the dimensions and the setting of slide valves.

4. The investigation of the methods in use for diminishing the losses of efficiency in expansive engines, due to the cooling of the cylinders by the expanding steam, the principal of which methods are, superheating, steam jacketing, and compounding.

The space required for even an elementary treatment of the above subjects could not be gained without a certain sacrifice, and after full consideration I came to the conclusion to sacrifice altogether the historical part of the subject, partly because there are already in existence many elementary works full of historical information, and partly because I doubted whether a history of the steam engine has any legitimate place in a text book for students. I have endeavoured throughout this work to make the descriptions as simple as possible, and their sequence as systematic as the nature of the work allowed. I believe that fully one half of the difficulties experienced by students in mastering new subjects is due to the want of system which characterises too much of our older technical literature. It is the rule rather than the exception in many books to present to the student ready-made formulæ without indicating the steps by which they are reached. I have carefully avoided this source of difficulty to beginners, for I conceive it to be the duty of all who attempt to teach even the most elementary subjects to husband the powers of their readers by saving them all unnecessary trouble.

I cannot claim anything original in the book, but I do claim that I have endeavoured to render the information which it contains very easy to understand, so that it can be

followed from first to last by any student who possesses a slight acquaintance with elementary mathematics. Wherever it has been advantageous to do so I have used geometrical instead of analytical methods of demonstration. I have not assumed the slightest acquaintance on the part of the reader with the sciences of heat or of motion, and have consequently devoted many pages to the explanation of such parts of these sciences as are necessary for the proper understanding of the working of engines. In this I have followed the precedent set in many excellent works included in this series.

If I were to acknowledge in detail all the sources of information from which I have freely drawn, I fear this Preface would run to an inordinate length; but I cannot forbear to express my deep obligations to my old friend and private tutor at Cambridge, Professor James Stuart, M.P., who has kindly revised the proofs of the entire work, and to the Editors and Proprietors of 'Engineering' and the 'Engineer,' who have allowed me free use of many of the illustrations and of the inexhaustible stores of information which have appeared in their journals. Students of thermodynamics would be in a bad way without the writings of the late Professor Rankine, F.R.S., and of Professor Cotteril, F.R.S., and I have availed myself freely of the information contained in their invaluable books. I have also found much that was valuable in the published papers of the Institutions of Civil Engineers, Mechanical Engineers and Naval Architects, and am greatly indebted to the Councils of these Societies for permission to make use of many drawings which are reproduced in these pages. Among the other authors whom I have consulted, I may mention Mr. Arthur

Rigg, whose very ingenious system of circular diagrams of twisting moments on crank-shafts I have adopted in Chapter V. ; Professor Zeuner, whose invaluable system of valve diagrams is explained in Chapter VII. ; Mr. Cowling Welch, Mr. Porter, Professors Galbraith and Haughton, Clerk Maxwell and Cawthorn Unwin, Mr. A. E. Seaton, and lastly Mr. R. Sennett, to whom I am indebted for several illustrations and for much valuable information on the subject of the distribution of the steam in Compound Engines.

GEORGE C. V. HOLMES.

5 ADELPHI TERRACE:
December, 1886.

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THE STEAM ENGINE



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THE complete study of the steam engine is, in its nature, somewhat complex, involving as it does an acquaintance with the sciences of heat, of chemistry, and of pure and applied mechanics, as well as a knowledge of the theory of mechanism and the strength of materials. It is proposed, therefore, to begin this work by showing, in a very simple case, how steam can be used to do work, and then to proceed to describe an actual steam engine of the most modern construction, but one which at the same time is remarkably free from complexity. When studying this description, the student will soon find out how it is that the perfect knowledge of the steam engine involves an acquaintance with so many branches of science; and the order in which these subjects must be studied, so far as they bear on the matter in hand, will naturally be suggested by the description.