

**THE ANNUAL OF THE
ROYAL SCHOOL OF
NAVAL ARCHITECTURE
AND MARINE ENGINEERING**

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VARIOUS

**THE ANNUAL OF THE
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THE
ANNUAL
OF THE
Royal School of Naval Architecture
AND
Marine Engineering.



A COLLECTION OF PAPERS ON PROFESSIONAL SUBJECTS CONTRIBUTED
BY MEMBERS OF THE PRESENT AND FORMER SCHOOLS OF
NAVAL ARCHITECTURE.

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The present number of the Annual has been published under the direction of the following Committee:—

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All suggestions and contributions for the next number of the ANNUAL should be addressed to the Editor of the ANNUAL—Royal School of Naval Architecture, South Kensington, W.

ANNUAL
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MARINE ENGINEERING.

INTRODUCTION.

So many public schools have Magazines of their own, that, in publishing the present Annual, there is little reason to fear a charge of presumption, seeing that the Royal School of Naval Architecture and Marine Engineering has been in existence for some years, and constitutes one of the most important of the few establishments for providing technical education which this country possesses. The staff of Instructors attached to the School numbers many persons who are eminent in their respective departments, and whose contributions are certain to deserve and secure attention. Students trained in the School now occupy more or less responsible positions in various parts of the world, and have facts and opinions brought under their notice calculated to interest persons connected with the two honourable professions to which they belong. To place upon record such facts and opinions is the object of this Annual; and it is identified more closely with the School by the fact that contributions to the present number have been received only from instructors or from former or present students. Owing to the absence from England of many of the late engineering

students of the School, and the comparatively short interval which has been occupied in the preparation of this, the first number of the Annual, these students are not represented amongst the contributors, as would otherwise have been the case.

Had extraneous aid been accepted, the publication might have possessed better claims to rank as a literary production. It has been preferred, however, to trust entirely to the efforts of those who are, after all, most deeply interested in its success. In making this statement there is no wish on the part of the contributors to shelter themselves from criticism, and they venture to hope that the national importance of most of the subjects discussed, will, to some extent at least, counterbalance any faults of style or treatment that may exist. Their desire has been to explain, as far as possible in popular language, the professional view of the topics discussed, and to make the larger part of the publication generally readable, while at the same time they are not without hope that by devoting some space, as they have done, to the scientific treatment of the more technical subjects, they will be able to contribute in some small measure to the advancement of professional knowledge.

If the success of the present number should warrant it, it is proposed to continue the publication of the Annual, and it is hoped that arrangements may be made to produce it in future some time before Christmas. In styling the Annual "a collection of papers on professional subjects, contributed by members of the present and former Schools of Naval Architecture," regard has been had to the future rather than to the present. It is hoped that the members of former Schools, many of whom now occupy eminent positions, will sympathise with this attempt to popularise the treatment of subjects too often enveloped in technicalities, and will practically aid it by contributions which cannot fail to add greatly to the value of the Annual, as well as to its probable success.

THE RECONSTRUCTION OF THE NAVY IN THE 17TH CENTURY.

THE present century will always be distinguished in the history of civilisation for the successful application it has witnessed of philosophical knowledge and the exact sciences to the useful mechanical arts, and for the many important benefits that have resulted to mankind therefrom. We see at the present day a rapid development of new resources going on in every direction around us, and the forces of nature being brought more under our control, and made more available for our numerous requirements, according as the increasing spread and advance of scientific knowledge renders their character and mode of action more capable of being understood. In no one of the mechanical arts, however, has greater or more rapid progress been made than in that of naval construction, and none of them owe more to the growth of enlightened ideas and the application of abstract science. During the last forty years a succession of improvements unparalleled in magnitude and importance have been made in the construction of our ships of war, and although the necessity for a movement of that kind had long been felt, and great efforts made to bring it about, yet no progress of any value was effected till the Government of the country decided upon going to the root of the matter, and provided the means for naval architects to obtain as exact a knowledge as the imperfect state of the science would admit of the laws and principles which alone could lead to improvement and ultimate success in the profession.

Results have proved the great wisdom of the policy thus adopted, not only by the direct benefits that have accrued through the amount of technical education that has been

imparted to students of naval architecture, but also by the general spread of inquiry and the growth of correct ideas to which it has given rise, and the effect it has had in stimulating uneducated shipbuilders to the acquirement of a more extended knowledge than they would otherwise have possessed. The best naval architects of the present day are able to bring to bear upon the continued improvement of their ships all the vast resources contained in the discoveries that have been made in every branch of science that has any relation or connection with the profession, while at the commencement of the present century we find from an official statement by Professor Inman, printed by order of the House of Commons in 1833, "there was scarcely a single individual in this country who knew correctly even the first element of the displacement of one of our numerous ships, either light or load." Side by side with this increase of knowledge and ability on the part of naval architects, the progressive improvement of our ships of war has advanced with rapid strides, and in the course of a few years our navy has passed in quick succession through the following phases:—First, its sailing qualities became greatly improved; then, the application of steam power to the propulsion of ships of war, and the construction of a steam navy, followed; and lastly, the great change was brought about which has resulted in the production of our present formidable Ironclad Fleet.

A characteristic of this progressive movement, which is of great importance to us, is that England has been at the head of it, and that it is only the second time in her history that she has thus occupied the position which above all others it should be her aim to fill, seeing that she has a far greater interest at stake than any other nation in the efficiency and relative superiority of her navy. It was the same cause in both cases that placed her in this commanding position—the adoption of scientific knowledge as a basis for the construction of ships, instead of trusting to ancient maxims and empirical rules; and the use of accurate calculation, wherever this was possible, for the purpose of ascertaining from a design what properties it might be expected would belong to a ship

built from it. The result was, however, brought about in different ways, for, as we have already seen, the present advance has been chiefly due to the course pursued by the Government in the encouragement of the art, while the previous one was almost entirely the work of three or four men of exceptional scientific attainments, who devoted themselves to the work of the reconstruction of the navy.

The period in our history to which we especially wish to draw attention commenced with the reign of James I., and includes the time during which the construction of the navy was chiefly carried on by Mr. Phineas Pett, his son, Mr. Peter Pett, and Sir Anthony Deane. These men were possessed of education and acquirements far in excess of any who preceded or followed them in their respective positions down almost to our own times. Phineas Pett graduated at Cambridge; his son was a man of liberal education and cultivated taste; and Sir Anthony Deane was the most successful man of his day in adapting the scientific knowledge then in existence to the calculation of the elements of a ship.

Before referring to the improvements effected during this period we must state briefly what were the leading defects of the ships that then formed the navy of this country.

These were excessive topmasts in the shape of the towering poops and forecastles then in vogue, a consequent too great draught of water, a deficiency in the height of the lower deck ports out of water, an incapacity in fighting ships to carry provisions for their crews, which had to accompany them in small vessels called victuallers, excessive leewardliness, and an inability to sail, except in a very slight degree, to windward. These vessels were copied principally from the models of Italians, who were attracted to this country by Henry VIII. for the purpose of improving the art of shipbuilding, and very few improvements were subsequently made down to the time of which we speak, either in matters of construction or equipment. The whole of them are doubtless enumerated by Sir W. Raleigh in describing his experience, and he says that in his time topmasts had been introduced, also topsails, topgallant-sails, sprit-sails, and studding-sails; the chain pump