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THE SCIENTIFIC STUDY OF NAVAL ARCHITECTURE IN GERMANY.*

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It may sound strange if, in the land of ships—the land that has probably done the most towards the practical and scientific development of the whole domain of shipbuilding—I take upon myself to describe the aims of scientific study in Germany, and the methods which it is now adopting. If, however, we reflect that, on account of the exceptionally rapid and accurate exchange of ideas which now take place between the civilized countries of the world, every successive generation, as it springs up, finds it easy to avail itself of the whole of the material which the past and present fellow-craftsmen of all countries have collected, we see that all nations are thereby enabled to attain a similar development from the same bases, and to make similar advances in the various domains of engineering.

Apart from small unimportant beginnings, the real nursery for scientific study in the various domains of naval architecture in Germany has been the institution now known as the Königliche Technische Hochschule zu Berlin, in Charlottenburg. Since 1904 the Königliche Technische Hochschule in Dantzic has likewise taken part in this work. The naval architectural departments of both these colleges have the same end in view—namely, the training of the young men who will later in life take a successful part in the building of the mercantile and naval fleets of Germany.

In view of the high degree of interest which the Charlottenburg technical college, as a whole, has often aroused abroad, and especially in England, it may not be out of place to give a brief account of the arrangement of the course of study in ship and marine-engine building in the institution in question. In accordance with the system adopted in all the technical colleges in Germany, it is a preliminary requirement for the admission of the students that they should have passed the matriculation examination of a gymnasium, real gymnasium, or oberrealschule (establishments with the classical, classico-modern, and modern tendencies respectively, met with in English secondary schools). Also these schools comprise nine forms, it follows that candidates for admission to technical colleges must be between eighteen and nineteen years of age. Since a further qualification is a practical training of one year at a shipyard of recognized standing, the age of the candidate is increased by six months, often by a whole year. To this must be added the period of military service, which is required of every physically and mentally sound German citizen, but which, in the case of an educated man who has obtained his volunteer certificate, is restricted to one year. For those who contemplate a career in the higher ranks of the Imperial naval construction department, the period of practical work and the year of service are spent in naval establishments—that is to say, in an Imperial dockyard and on board a naval training-ship respectively, before the course of study at the technical college is entered upon.

It may thus be said that the course of study begins when the student is twenty-one, and that it has been preceded by a certain period of preparation in the practical work of shipbuilding or marine-engine building. It is with young men thus prepared that the colleges at Charlottenburg and Dantzic have to reckon. The course of instruction is arranged in the following manner:—Within the department for naval architecture a distinction is made, in the first instance, between the professions of naval architect and marine engineer. The course of instruction itself in almost all the subjects comprises lectures and tutorials, or "practices," the object here kept in view being, that what is taught in the former is put into practical shape in the latter. It is a general principle in the German technical colleges that, as far as possible, no lectures are to be delivered without the accompanying tutorials. This principle extends, not only to the main professional subject in each case, but also to the subsidiary subjects, such as pure mathematics, mechanics, physics, descriptive geometry, political economy, law and administration, etc. It is to be observed that this principle has been productive of very good results, and that its extensive application has raised very considerably the standard of the education provided.

In all the departments devoted to different professional branches the course is a four-year one. At the conclusion of the second year, the preliminary examination for the degree or diploma is held, the final examination being taken at the close of the fourth year. The first two years are principally devoted to the more general studies in mathematics and natural science subjects, although a beginning is made with the introductory lectures and tutorials in the main subjects at the outset of the first term. But whereas the general subjects at first take up much more of the student's time than the special ones, this proportion gradually alters as the course proceeds till it finally becomes reversed. Another feature of the arrangement of the studies is that the lectures are, as far as possible, delivered during the earlier terms, while the drawing-office work gradually assumes greater importance as the course proceeds. This is intended to give the student in his last year as broad a base as possible for designing and applying what he has learned from the lectures.

In following out these ideas, the preliminary examination at the end of the fourth term is principally confined to the subject of mathematics, mechanics, physics, descriptive geometry, and chemistry, the special subjects being represented by the general details of marine engines and ships, while the results of the tutorials which, together with the mathematical proficiency shown, form the basis for the admission of the student to the oral examination, comprise a considerable number of constructive applications to details of vessels, such as double bottoms, after-bodies with rudders, etc., three sets of lines with the corresponding calcu-

* Paper read at the Jubilee meeting of the Institution of Naval Architects.