Process of Design

When a shipbuilder is approached for the production of a new ship, he must be informed of the requirements of the case; the kind of trade or service in which the vessel will be engaged; her speed; if she is to be a steam vessel, the distance she must run on ordinary voyages without recoaling; the weight of cargo to be taken or the number of passengers to be carried, and the kind of accommodation required for them. Very frequently these requirements will include certain limits of size, draught, cost, or tonnage, which must not be exceeded. In addition it must be stated in what society, if any, she is to be classed, as this will determine the details of the scantlings to be employed. The shipbuilder will usually have, to guide him, the details of some successful ship or ships previously built to fulfil the same or similar conditions as in the vessel required, and he will probably know what measure of success or popularity the respective features of the vessel or vessels have earned on service. The dimensions can in this case be at once fixed to provide the necessary speed, strength, stability and seaworthiness, and the cost of the vessel determined. If the departures from some similar ship of known and approved qualities are small, the details of the new ship can be inferred directly from those of the similar ship, and modified drawings, specifications, &c., can be rapidly prepared and the building proceeded with. On the other hand, the departures from previous vessels or the usual practice maý be very great, in which case much will depend on the ship- builder’s skill and judgment. Outline drawings must first be prepared to the dimensions which may be considered suitable, and the calculations are made on this assumed design. These will include estimate of the weights of the hull, of the machinery, equipment, &c.; and if it is not intended to class the vessel in some registration or classification society, questions of strength will have to be considered. If, however, the vessel is to be so classed, the determination of the structural strength may be omitted, as the scantlings required by the rules of such society are arranged to provide sufficient strength. If the calculations show that the dimensions assumed do not enable the required conditions to be fulfilled, the dimensions must be modified in the direction indicated by the calculations, and the calculations made over again. This process must be continued until a satisfactory result is obtained. As soon as the dimensions obtained for the vessel are found to be appropriate, more complete drawings are put in hand, and the final calculations pertaining to the displacement sheet, weights of hull and equipment, centre of gravity and trim, metacentric diagram and curves of stability and speed, arc made. In the design of yachts the views of the owner, especially if he is a yachtsman of *ex­perience,* must necessarily play an important part.

While the present writer was designing the Royal Yacht “ Alexandra ” he was commanded on several occasions to wait on the late King Edward VII. to take his instructions. King Edward took a special interest in the design throughout and sketched in his own hand the shapes of the knee of head and the stern. All leading details were shown to him in model and settled by him personally. At an important stage the king consulted the prince of Wales (George V.), whose views as to the principal dimensions were afterwards adopted.

In the case of the construction of large passenger ships the design often originates with the owner’s or steamship company’s staff, and in some instances naval architects are employed, completed drawings and specifications being handed over to the shipbuilder with the order for the vessel. In other cases shipbuilders work in close connexion with the steamship companies, and the business relations are of a very simple character, the company being content to send an order, with a note of the principal dimensions and type of ship required, leaving the determination of all details of the design in the hands of the builders. The general practice lies between these two extremes. In any case, complete design drawings and detailed specifications are necessary for the shipyard operations, and if not supplied must be prepared by the shipyard staff. Sometimes outline drawings of the vessel on a small scale—including an elevation or side view, one or two plans of the main deck and other parts, and a short description of the vessel—are first prepared, and are called an outline or sketch design; but usually the information which constitutes a design comprises a sheer, profile and plans of each deck on a ¼-in. scale, a midship section on a ½-in. scale, and a complete specification.

The sheer drawing gives the outside form of the ship. It consists of an *elevation* showing her longitudinal contour; the positions of the decks; the water-line or line at which she will float, and certain other lines parallel to this and equally spaced below it, which are also called water-lines; a series of vertical lines equally spaced from stem to stern, called “square stations”; and certain other details: of a *body plan* showing the sectional form of the ship at the square stations, supposing her to be cut by transverse planes at these stations: and of a *half-breadth plan* showing the form of the ship at the several water-lines, supposing her to be cut by horizontal planes at the levels of these lines. The profile and plans give all the internal arrangements of the vessel, the holds or spaces set apart for cargo, the passenger accommodation, the positions of the engines and boilers, the accommodation provided for the crew, and other principal fittings. In a warship there are no cargo holds or passenger accommodation, but the distribution of the armament and magazines, the armour, and other arrangements for the protection of the vessel against injury in action are carefully shown, and the appropria­tion of every portion of the internal capacity of the vessel is clearly indicated. The *midship section* shows the structural arrangements of the vessel, and usually the scantlings of the most important parts. The *specification* is a statement of all the particulars of the vessel, including what is shown on the drawings as well as what cannot be shown on them; the quality of the materials to be used is described, and the scantlings of the same carefully recorded; and it is clearly stated how parts not manufactured by the shipbuilders are to be obtained.

When first formed the objects of register societies were simply the maintenance of a register in which was recorded for insurance purposes the main particulars of each vessel’s hull, machinery, equipment, &c., together with the names of owner, master and builder, as well as a designation or class represented by a symbol, which was in­tended to give to underwriters an indication of the strength, durability and general seaworthiness of the ship. As a natural sequence it became necessary for the register societies to formu­late rules which would indicate to owners and builders the structural conditions that would entitle vessels to the highest class and the minimum rates of insurance. The register societies now provide the shipbuilder not only with a record of all the important features of the ships which are classed, and thus with much of the information which he requires for the design of his vessel, but they also fix the quality and strength of the material to be used, the scantlings of all the parts of the hull, the riveting of the attachments, the equipment of pumps, anchors, cables, &c., the dimensions and details of the principal parts of the machinery, and all the details of the boilers. Classification societies are thus technical bureaux of the highest value to the shipping community, whose rules are a reflex of the most advanced knowledge and whose methods encourage developments in structural design.

The principal registration and classification societies in 1910, and the number of vessels (sailing and steam) classed, were as follows:—

Lloyd’s Register of British and Foreign Ship-

ping, having its headquarters in London . 10,302 vessels.

British Corporation for the Survey and

Registry of Shipping, in Glasgow . . 710

Bureau Veritas International Register of Ship-

ping, at Paris ..... 4,626 „

Germanischer Lloyd, at Berlin . . . 2,672 „

Norske Veritas, at Christiania . . . r,56o „

Registre Nazionale Italiano, at Genoa . . 1,263 »»

Record of American and Foreign Shipping, at

New York . . . . . . 1,139 n

Veritas Austro-Ungarico, at Trieste . . 1,041 „

Great Lakes Register ..... 609 „

Of these societies, *Lloyd's Register,* as at present constituted, has existed since 1834; at that date it superseded two rival institutions having a similar object. The name is traced back to Lloyd’s Coffee­house, once situated in Lombard Street, in which underwriters met for business purposes, and from which in 1696 they issued their first publication. The first printed register was issued about 1726, a copy dated 1764 being still extant. The office of surveyors is referred