

How a Racing Boat is Built.

By S. J. HOUSLEY.

[From Photographs specially taken by George Newnes, Ltd.]

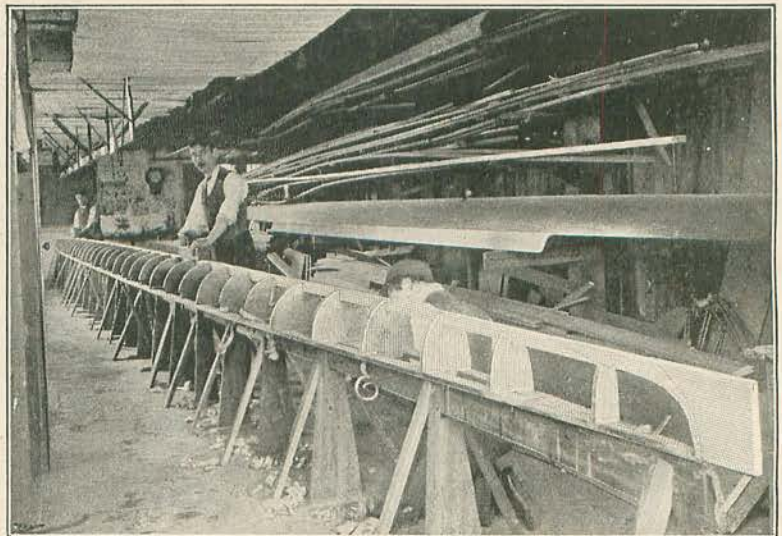


IN the early stages of practice a crew uses what is known as a "tub-ship," as distinct from the racing eight, or "light-ship," known to Americans as a "shell." Though in their actual proportions there may be but little difference between the two vessels, the difference in structure is very great. The tub-ship is built in "strakes," planks overlapping each other and nailed together by their edges—the most familiar form of construction in rowing-boats. Such craft are technically described as "clinker-built," or, more shortly, "clinkers"; whereas the light-ship presents an absolutely smooth surface, unbroken even by a keel. Either vessel will be from 58 to 60 or more feet in length, and from 2ft. 2in. to 2ft. 5in. in extreme width, according to the weight of the crew.

The "stocks" upon which the boat is to be constructed run almost the entire length of the workshop, and consist of a plank set on its edge, sustained at a convenient level above the floor, about 2ft., by a series of props and shores. In the early stages of her building, a keel-less boat, of whatever size, is laid bottom up. The first operation is to lay down the "frame." This is only a temporary construction, and does not ultimately form any part of the boat. It is an outline in wood of the "deck-plan," and is carefully arranged on the top of the stocks, being supported in its proper position by struts fastened to the stocks. On this frame the "moulds" are screwed at proper intervals. These also are temporary, and do for an eight what

the ribs do for a big ship in building—they give her shape. For the ribs of a racing eight are of such slight material that their place has to be taken for a time by the moulds, which are cut from stout deal, and removed ultimately as the ribs are inserted. This method is employed in the case of any rowing-boat, whether clinker or keel-less.

When the moulds are all in position, a very fair idea may be formed of the lines of the future boat, as a glance at the accompanying illustration will show. Each mould has a slot cut in the part which corresponds to the bottom of the boat. The slots are sufficiently deep to admit the "keelson," the backbone of the craft. Every boat has a keelson of some form or other, which is the interior portion of her backbone, the keel, when there is one, being the outside portion. When the keelson is set in the slots it is planed down flush with the moulds. At either end are fixed the stem and stern posts, made of spruce or white cedar, properly grooved so that the "skin" of the eight may be let in flush with the surface of the post. In the illustration (No. 1) the stern-post is in the foreground, and the oblique join



FIRST STAGE—THE BOAT BOTTOM UP, STERN-POST IN FOREGROUND, SHOWING THE TEMPORARY MOULDS.

where it is fixed to the end of the keelson can be clearly seen, as well as the groove for the skin.

Planking, or putting on the skin, is the next process. When planks of sufficient size can be procured, an eight is built in six pieces, three to each side. If, as is the case with most boats built for a University crew, she is 60ft. in length, each piece must be quite 20ft., and the sections which belong to the middle part of the boat must be of considerable width. Such planks, without a shake or flaw, are not readily obtained.

One wood has proved pre-eminently suited for this purpose. Cedar is easily worked, easily bent, and very light. The finest cedar comes from Havana, and is a very different wood to the product of Florida, which is used in the manufacture of pencils. Some good cedar is also imported from Mexico. Indeed, the builder of racing craft may be said to ransack the world in search of materials. The cedar planks are sawn, by veneer saws usually, to about $\frac{3}{8}$ th of an inch in thickness. They are cut to the approximate shape, and then bent to the form of the moulds. This is accomplished by holding them over an iron tube of large diameter, inside which

burns a series of gas jets, and at the same time damping the wood. When a plank is sufficiently pliable it is laid on the moulds, and bound with string. The work of fastening each piece must now be done very rapidly; for, as the wood cools and dries, it is apt to get out of shape in an extraordinarily short space of time. The

"scarves," or joints where the pieces overlap, are made by what is known to joiners as "halving"; half the thickness of wood is removed from each side, and these halves are glued and nailed together, so that the surface remains perfectly smooth and unbroken. On the inside, the scarf is frequently strengthened with an additional layer of cedar.

If anyone wishes to see the perfection of neatness and accuracy in making long "joins," let him examine the bottom of a racing eight, and not forget the adverse circumstances under which such exquisite work had to be produced. In illustration No. 2 an eight is

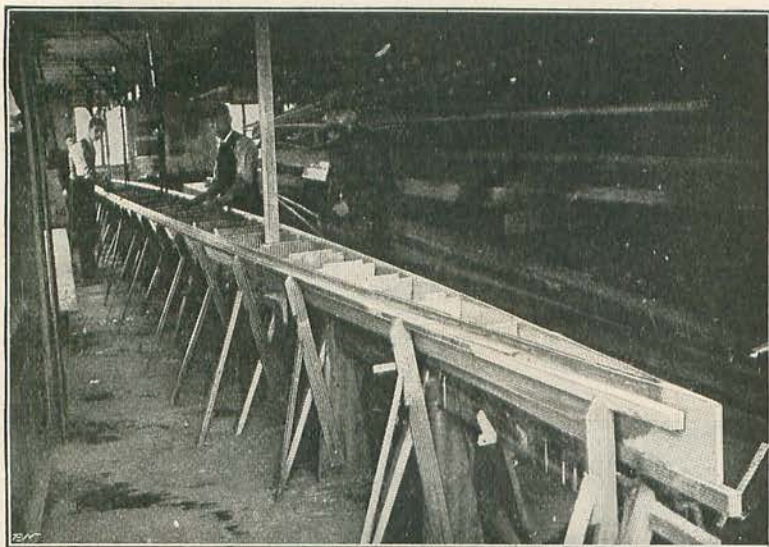
represented partially planked. One-third of her length, the stern, remains to be covered, and one side of this is in progress. When that is done the "shell" of the boat will be complete.

This stage having been reached, the moulds and frame are unscrewed from the stocks, and the boat is turned over. The frame is removed, and the "shell" held firmly in position by a sort of external frame, which is wedged against either side of the boat by the series of clips and props shown in illustration No. 3, where Mr. Clasper, the builder, appears directing opera-

tions. Then her ribs are put in, having been cut from ash or oak to the proper pattern, and meet the keelson, but are not let into it. In order to keep the "floor" or bottom of the eight as flat and rigid as possible, the ribs are joined in pairs and fastened to the keelson by "floor timbers." These are also of oak or ash,



SECOND STAGE—THE BOAT PARTIALLY PLANKED, THE SHELL NOW ALMOST COMPLETE.



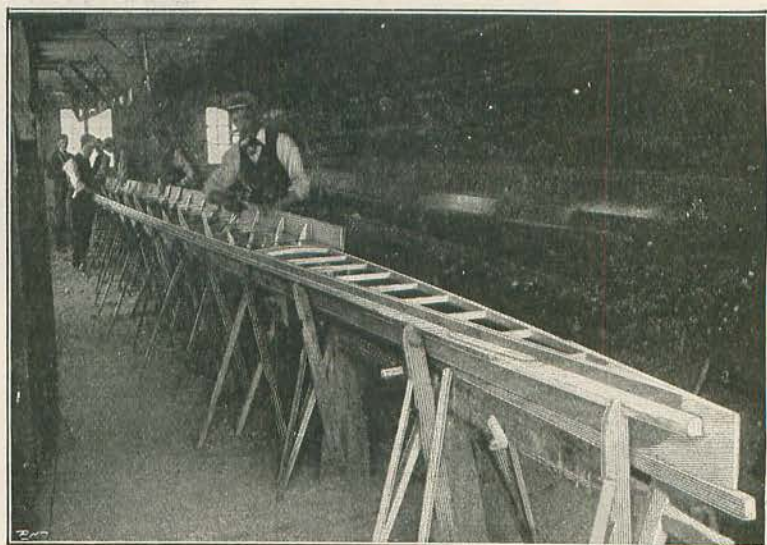
THIRD STAGE—THE BOAT TURNED OVER, WITH MR. CLASPER DIRECTING OPERATIONS. SHOWING THE EXTERNAL FRAME BY WHICH THE BOAT IS HELD IN POSITION.

of the same thickness as the ribs, not quite half an inch square in section. They pass right through the keelson, and are riveted on either side to the ribs. The skeleton of the boat is then completed by the insertion of the "inwales," which may be likened to an internal and permanent "frame." They do for the sides of the craft what the keelson does for the bottom—they supply the necessary rigidity.

In illustration No. 3 may be seen the slots at either side of the moulds from which the temporary frame has been taken. The inwales occupying this position may be seen in illustration No. 4. Gradually, as the structure grows in strength, the moulds are removed, and by the time the stage represented in this picture has been reached are entirely absent. The hull is now finished. It remains to fit the ship to receive and bear the strain which will be put upon her when the eight

athletes on board begin to "make her hum." Their power is applied at the end of the outriggers; these are supported by the "wash-boards," and the wash-boards by the "shoulders." These last are like strong ribs with a big top projecting above the inwale, and are a conspicuous feature in illustration No. 4. The extra tall ones, which are in pairs, are those to which the outriggers are fastened through the wash-boards, and are rather heavier than the others. One wash-board is just being fitted to the shoulders. It is of fairly stout cedar, or mahogany, and extends only along so much of the boat's length as is occupied by the rowers. By the coxswain's seat it ends in a slope down to the inwale; forward, it commences in the "cutwater," which is seen in illustration No. 5.

At either end the boat is covered in with a fine canvas of Irish linen. For further protection it is sometimes found necessary



FOURTH STAGE—SHOWING THE INWALES, AND WASH-BOARDS SUPPORTED BY THE SHOULDERS. THE MOULDS ENTIRELY REMOVED.

to add "sea-boards" to the wash-boards. These are strips of wood, a couple of inches or so in width, nailed horizontally to the top of the wash-boards and projecting outside. They are merely a temporary contrivance to prevent the ship from being swamped in a heavy sea, and are not an essential part of an eight.

In 1873 appeared the last great innovation in racing craft, the introduction of the sliding-seat. In rowing, the power of the stroke is mainly determined by the distance through which—within reasonable limits—the shoulders can be made to travel by the swing of the body. A sliding-seat enables the rower, while maintaining the swing which he practised upon a fixed seat, to shift his whole body 16in., and so to increase by that amount the distance travelled by his shoulders.

It is said that one oarsman, before the introduction of the new contrivance, had a seat built of extra width, upon which he slid. To him, the advantages of transferring the friction from his own person to a piece of unfeeling mechanism must have been painfully obvious. So the sliding-seat came into existence. Its primitive form was something like the lid of a cigar box, raised upon four little square blocks, which slid along two greased metal rails.

In those days, every sliding oarsman bore upon his "shorts" the marks of his pursuit, in two black lines down the back of each thigh, made by the grease from the rails. The modern seat is an anatomically constructed cup, running upon four neat little vulcanite rollers, which fit upon rails of metal

or vulcanite; while, in the latest pattern, the bearings of the wheel-axles, instead of being round holes in brass, are long slots; if the wheels by any chance became jammed, the seat would still slide comparatively freely on the bearings. The seats, with their axles

and wheels, may be seen in illustration No. 5. This picture also gives a good view of the linen covering and outriggers.

In a sea-boat, the "stretcher" is a long and stout stick fitting into slots on the floor; unless, as is often the case, the rower prefers to put his foot against the back of the opposite seat. In a river-boat it is a wide and thick plank, from which the leg drive is obtained. It should accommodate the whole foot. Two straps pass over the toes—more to give confidence at the finish of the stroke than for any other purpose; certainly



FIFTH STAGE—SHOWING LINEN COVERING, CUTWATER, AND OUTRIGGERS.

not to pull the slide up, as that will come forward of its own accord when a proficient oarsman sits upon it. The heels rest upon a bit of board placed upon the floor-timbers on the rower's side of the keelson, or upon two semi-circular brass rails screwed to the lower part of the stretcher.

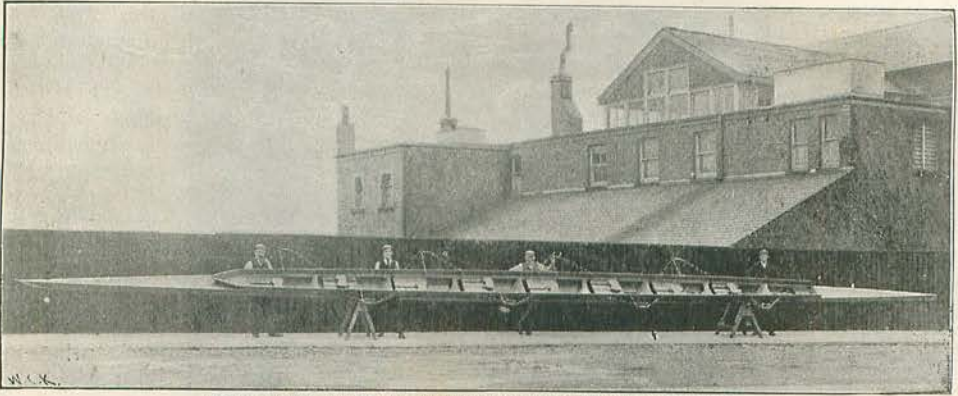
Eights have been arranged so that the crew might sit in a row down the centre of the craft, but the usual disposition may be seen by a glance at illustrations Nos. 5 and 6. "Seven" takes time from "stroke," so does "six"; "five" takes time from "seven," "four" from "six," and so on up either side of the boat. The thwarts, upon which the runners, or rails, for the seats are screwed, are well shown in illustration No. 6. They are fastened to the inwale at the sides, and

supported at either end on bulk-heads, which are usually pierced or sawn into a shape like the pier of a bridge. True bulk-heads, which are quite watertight, inclose the canvassed ends of the boat; so that it is difficult to sink an eight, and impossible to sink a sculling-boat of similar construction without breaking her. The shaped bulk-heads, which support the thwarts, may be seen in illustration No. 4, as well as the little ledges by which the thwarts are fastened at their sides to the inwale.

When the eight has been thus built, her shell carefully smoothed and varnished, and

prevent the oar being displaced by a blow from a wave. To catch a "crab" with a rigger so tied is a fatal error, and results in a breakage of something, or somebody. Illustration No. 5 shows the eight having the last riggers fitted to her, and No. 6 shows her complete and ready for the water.

Like other productions of this world, the modern light-ship has passed through a gradual course of evolution. It was not born an adult. The lines of the hull, the methods of construction, the details of outriggers, seats, and so forth, have all of them undergone modification at the hands of



SIXTH STAGE—THE BOAT COMPLETE AND READY FOR THE WATER.

the seats put in, it only remains to bolt on her riggers, finish her rudder, and add the "fin," if she is to have one. The latter is a plate of thin metal attached a little behind the coxswain's seat, and performs the office of a keel. It makes the boat run a straight course, and steadies her "swing" when the rudder has been used round a corner. For, as every coxswain knows, an eight containing a crew of 100 stone or more in weight will go on swinging for an astonishingly long time after the rudder has been "taken off." The fin remedies this, to a great extent, but is not always used.

Lastly the riggers are bolted on, with bolts which pass right through the wash-boards and the special shoulders made to receive them. Their form, with the arrangement of the stays, is seen in illustration No. 6. The rigger itself is of four rods—the single stay being regarded as an auxiliary—of which the two upper are solid, to enable the "sill," or level part of the rigger, to be forged flat, and the two lower are tubular. The "tholes," or upright parts of the rigger, and the sill are faced with wood; and the tops of the two tholes are bound together with string, to

various builders; while in the course of time the choice of the actual materials used has completely changed. In fact, the racing craft of 1897 is almost as different in structure and appearance from the vessels in which the "Fathers of the Race" rowed the first University match in 1829, as the torpedo-destroyer is different to the old-fashioned twenty-gun brig.

Until the year 1840, the race was rowed in ships which would seem at the present day justly to merit the term "tub." Up to that date outriggers had not been used; the boats were "in-rigged," the rowlocks being set absolutely upon the gunwales. A craft fitted in such style had naturally to be built with considerable beam to enable the rowers to use an oar of an effective length; and, had the sliding-seat been invented in the days of in-rigged boats, the shortness of the oars would have been exceedingly inconvenient.

Outriggers were introduced by Henry Clasper—father of Mr. John H. Clasper, to whom we are indebted for permission to reproduce the photographs which illustrate this article—in the year 1845.