A RACING "EIGHT."

BY

M.I.N.A.

FIRST, be it understood that the writer of these notes has never rowed in an "eight"; never moved a sliding-seat for other purposes than those of curiosity; nor, indeed, inspected a racing "eight" but the one depicted, which was placed at his service by Messrs. Sims & Sons, of Putney, for the present purpose. Further, that he is ignorant of rowing, of the science and of the sport, and that he has never considered a boat-race from any but a spectacular point of view. From these admissions it will be evident that the question of rowing must be entirely ignored.

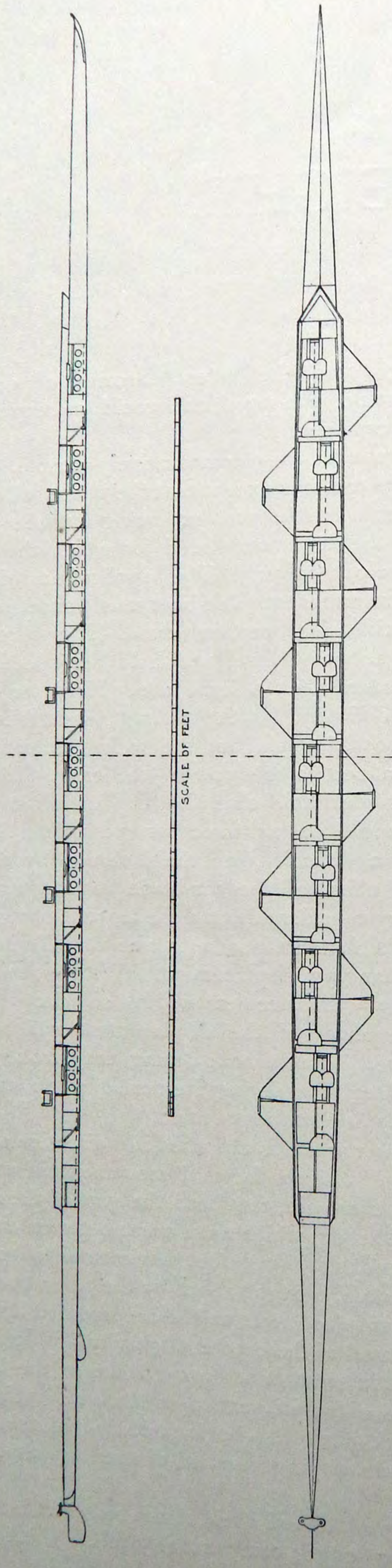
It would appear that the most suitable and efficient form of the rowing "eight" has been the subject of discussion from time immemorial. It might be hard to find any floating craft which has been the theme of so much criticism and around which has centred so much speculative controversy. For many years it has been the butt of the faddist, and to-day there is probably no man who is in any way interested in rowing who has not his pet theories as to what a boat should be and what she should do.

It is a remarkable fact that the racing "eight" has been greatly neglected from a scientific point of view, in spite of its having received the attention stated. There is practically no information available regarding the boat. For generations it has been built by eye, and experience has dictated both model and detail. Undoubtedly experience is the best and surest means of arriving at success, and the modern racing "eight" has in this way been evolved by the most searching process. It is not surprising, therefore, to find in the example discussed many excellent points, and a boat which has much to commend it. It is, nevertheless, remarkable that neither of the great universities has treated the subject from the purely scientific point of view. Were anyone to build a racing "eight" to-day from theoretical deduction he might meet with failure: but were such a boat to be constructed with the combined experimental knowledge and the latest theories of design success would be assured, and would, moreover, be assured permanently.

The proposition is comparatively simple. We have no restrictions except that the boat shall carry nine men; the sole problem being that she must travel at the maximum speed for which the crew may develop power. The application of the power is intermittent. The boat must consequently travel unaided for a certain period. It is a known fact that a heavy vessel will hold her speed to a greater extent than a light one. Here we have the first difficulty, for the racing "eight" is the lightest possible hull, but the weight is, perhaps, wisely confined to the power—the crew. In any boat it is desirable that the application of the power should be as direct as possible. Again we have a difficulty, for the leverage from the centre of effort of the oar-blade to the rigger-end is very considerable, and the amount of "give" must be a factor of some moment. Then we have a changing displacement. With eight oars immersed the displacement will be so much; with eight oars emerged the displacement will be so much more. Thus a boat during the stroke will travel lighter than during the period when she is running by her own momentum.

Any power which is absorbed in a direction other than that of a direct forward movement is waste. It follows, therefore, that both the give of the long lever and the dip which must occur between every stroke are not only waste but detrimental to speed. This latter dip, brought about by the alteration in the boat's displacement, will be accentuated by any forward travel of the centre of gravity, and it must be to the interest of a crew to obtain the least amount of extra immersion of the hull. Under waste work must also be included, of course, the raising and carrying forward of the oars at each stroke.

Turning to the hull itself, it will be seen that the underwater body is comparatively full. There are

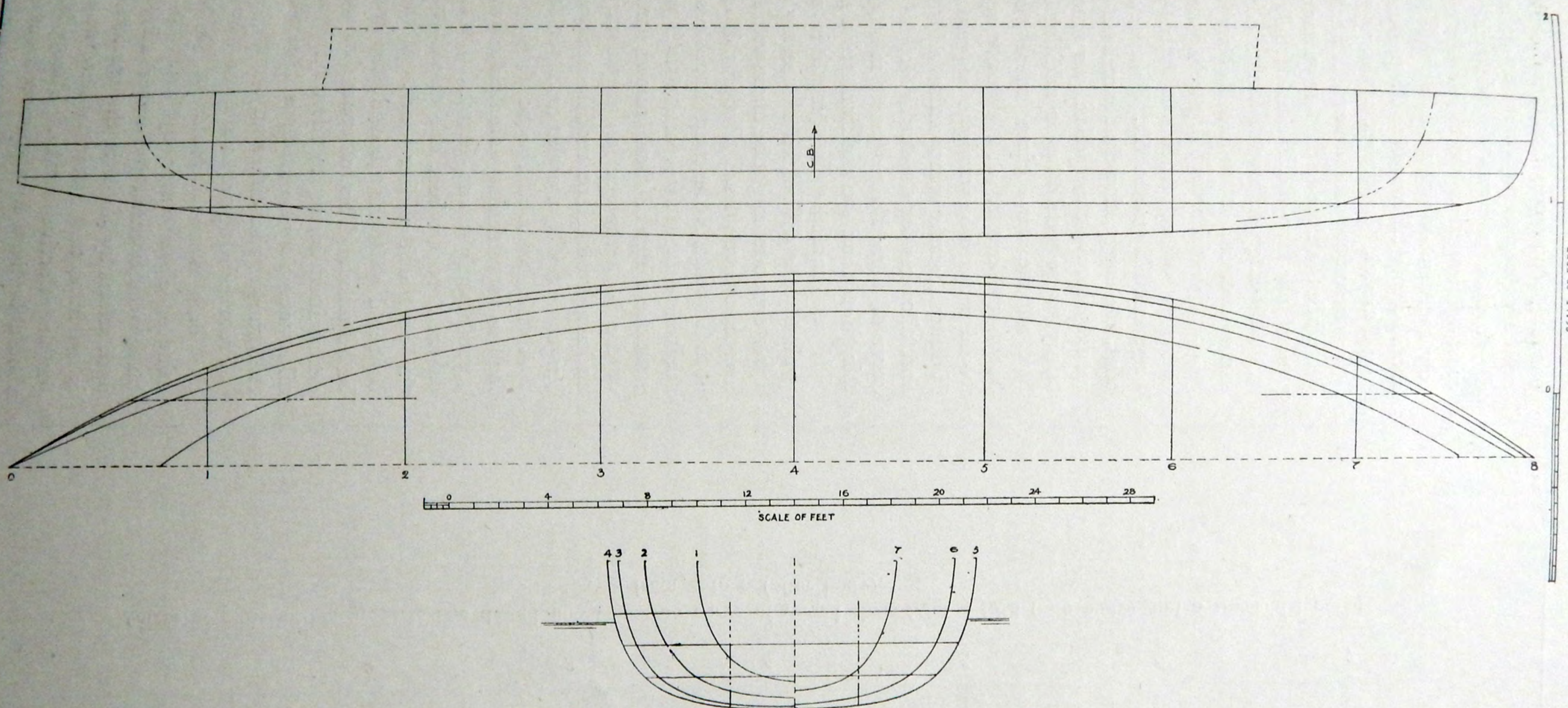


GENERAL ARRANGEMENT OF THE "EIGHT."

no hollows anywhere, and the model suggests that skin friction has been studied to the exclusion of most other questions. Doubtless this skin friction is the greatest element of resistance which has to be overcome, and the model shown is very satisfactory in this respect. The latest practice in naval architecture, however, would appear to discount somewhat the full entrance. Mr. R. E. Froude has stated that from recent investigations in the Admiralty scientific tank he found entrance waterlines of a slightly hollow nature to develop more speed than those which we consider full.

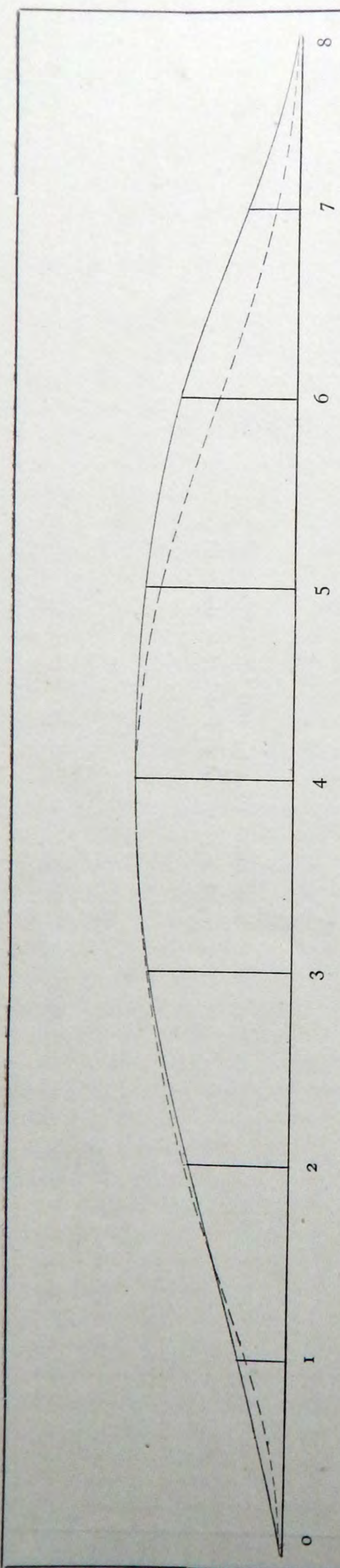
To the eye this fullness forward is remarkable enough, but an analysis of the form of the boat brings it still more prominently forward. In order that the lines of such a long boat may be focused, they have been contracted as to length in proportion—for length $\frac{3}{8}$in. equals 1ft. is to 3in. equals 1ft. for the half-breadth and sheer. This puts the curves in a more comprehensible light, and it will be seen that the drawings confirm the impression created by the boat's appearance, and that there are no hollows anywhere. It is, of course, essential that the bow oar should have ample room in which to work, and in the drawing shown he has the minimum space allotted to him. He is already indeed cramped somewhat by the side of the hull, and further contraction about the bow thwart would be impossible. Given that section, therefore, the boat has to be finished in the most efficient manner. This is done with some fullness, and, as will be seen from the forward position of the centre of buoyancy, the forward half of the boat is larger than the after part. An average crew has its common centre very near the centre of length, but it is somewhat difficult to fix a centre which moves so constantly and rapidly. Owing to the fact that the oars leave the water while the bodies of the crew are well forward it is necessary that the centre of buoyancy should be forward of the centre of the boat, for it must be remembered that when the oars leave the water the boat sinks in proportion to the displacement of the oars, and this, added to the travel forward of the centre of the movable weights, accentuates the undesirable tendency to dip.

While the fullness of the fore body is noticeable both to the eye and on the lines, it becomes still more remarkable when the cross-section areas are treated. For the approximate waterline shown at the sides of the sections the curve of cross-section areas is plotted, as shown by the solid line, while the dotted line shows a true curve of versed sines forward and a trochoidal curve aft. It



THE LINES OF A RACING "EIGHT."

(The length is contracted as explained in the text.)



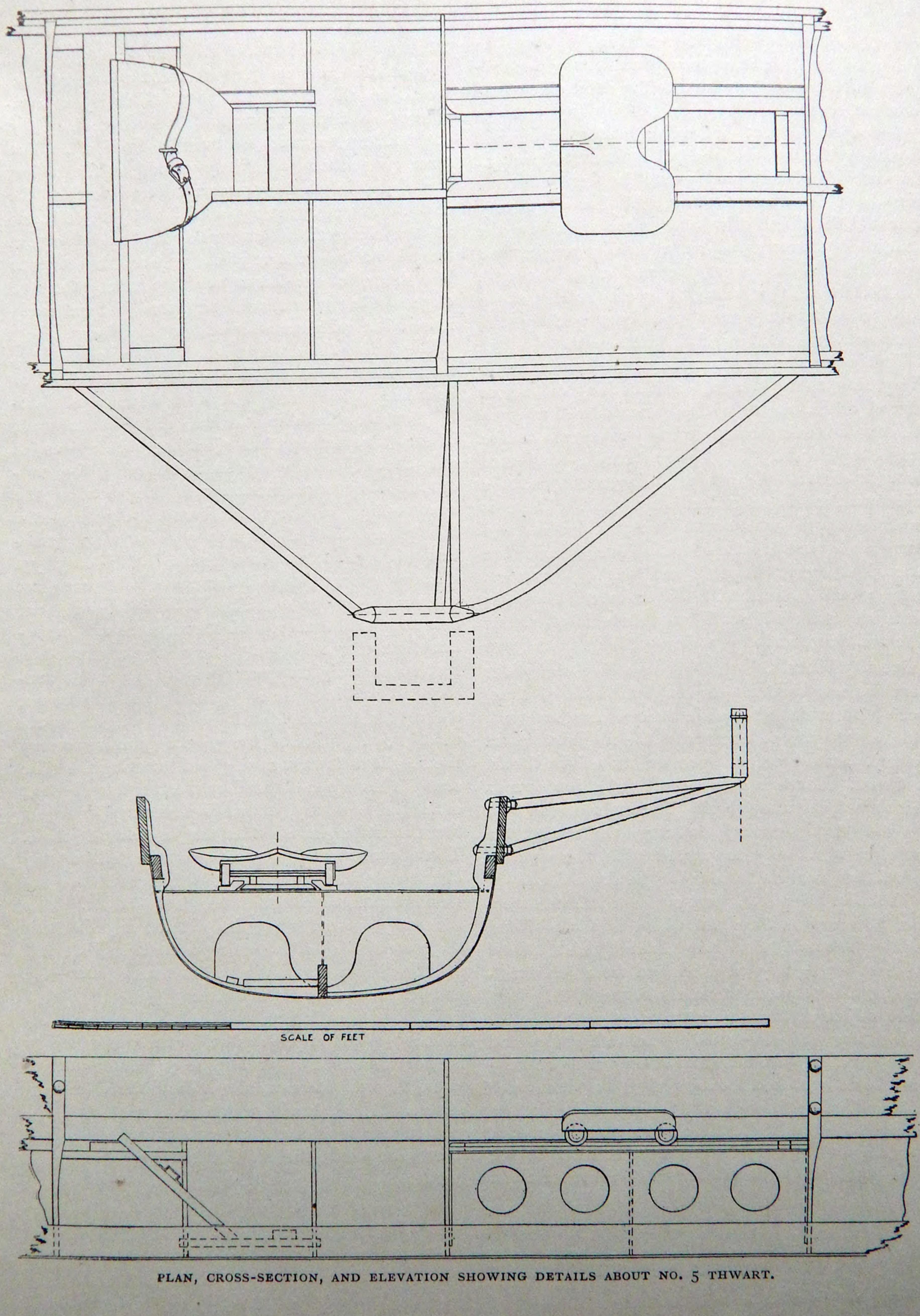
Curve of cross-section areas. The dotted line is a true curve of versed sines from 4 to 8 (fore body) and a trochoidal curve from 4 to o (after body).

has long been recognised that those two geometrical curves represent in their respective positions for the entrance and run very desirable forms for the cross-section areas to take. At the comparative low speeds at which a racing "eight" travels they should apply fairly well and represent a theoretically sound model. In the example in question there is little reason for any divergence from the theory; yet, while the after-end is fairly near the theoretically perfect, the fore-end is considerably removed from it. Allowing the bow thwart to continue with the same section, it would be necessary, in order to coincide with any degree of nearness to the curve of versed sines, that the boat should be lengthened by some 6ft. To look at the actual boat, the suggestion that increased length forward would improve the speed is very reasonable. Certainly, there would be an additional skin friction, but, at the same time, there would be greater buoyancy forward and a faster model. While it would perhaps be wrong to suggest a large increase in length, some compromise might be arrived at, and, allowing for the docking of the fore-end of the curve of versed sines usual in ship design, something less than the addition stated might suffice.

If an increase in length is undesirable—as probably the difficulties of steering may make it—a better model might be made with the same overall length, or even less. But if this is to be effected both bow and No. 2 must have less room than is allotted to them at present. If it were possible to shift the slides of those two thwarts to the centre of the boat the section might easily be reduced and a more efficient model obtained on the same length, but with a wider or larger boat.

A calculation of the boat's displacement gives for the approximate waterline shown at side about 1,720lb. weight, and betwixt that and the top one drawn across, where the displacement is 1,960lb., the boat will do her work. With 260lb. for the boat and 76lb. for the oars, the crew weight may be adjusted. This, of course, cannot be accurately determined owing to the varying weight, but any allowance may be made as it takes 500lb. to vary the draught 1in. either way.

From existing records it may be reckoned that the boat shown would, at 38 strokes to the minute, clear water by 1ft. 9in., *i.e.*, stroke's blade would catch the water 21in. forward of the spot struck by No. 2 in the previous stroke. This is an important point, as hard water is necessary for an effective stroke. Theoretically, the blade should be fixed in the water from the catch to the finish, but, like all methods of mechanical marine



PLAN, CROSS-SECTION, AND ELEVATION SHOWING DETAILS ABOUT NO. 5 THWART.

propulsion, there is a certain amount of slip. In this way the blade itself travels aft, it may be some 2in., and this must be added to the debit side of the boat's account.

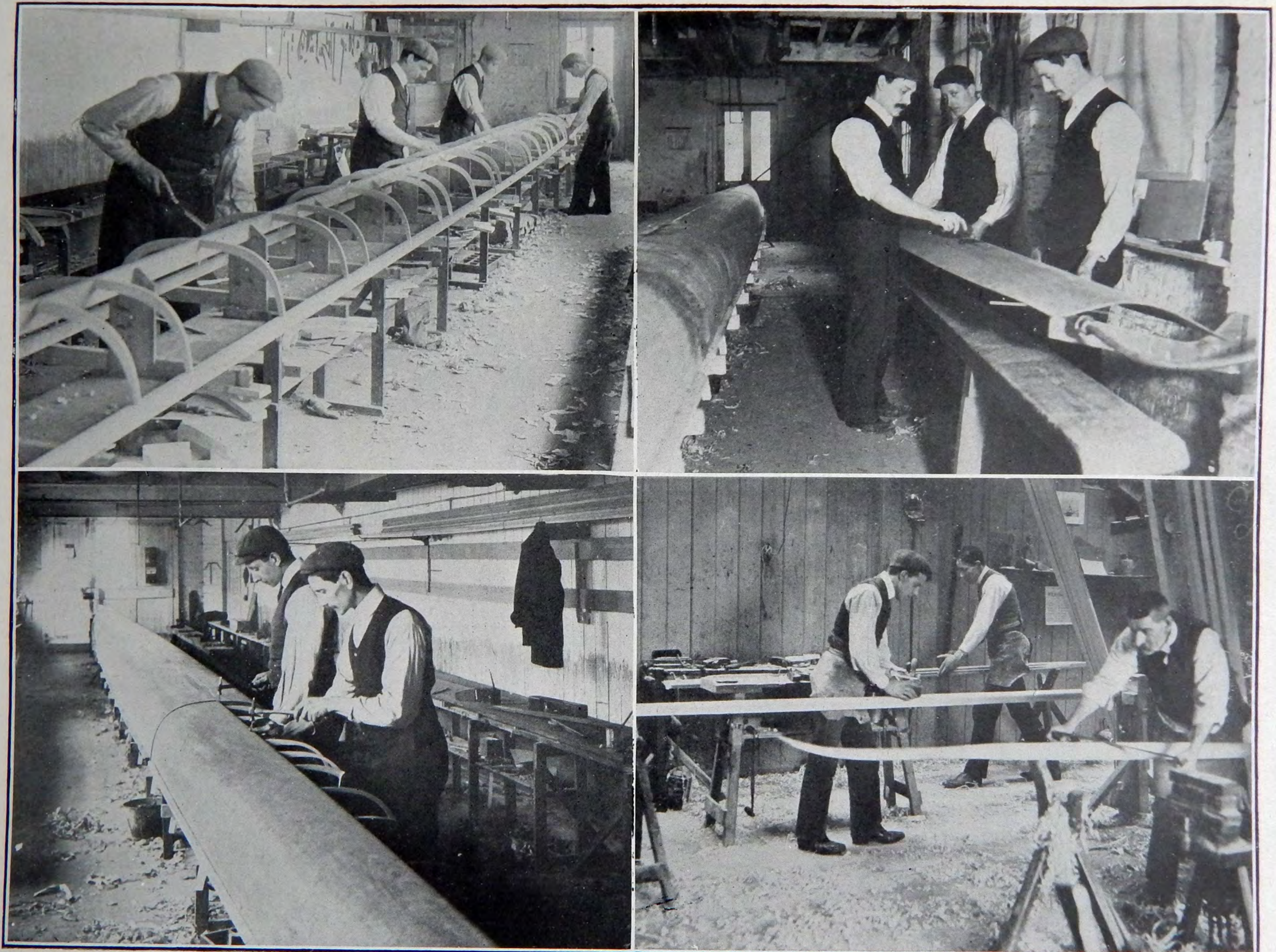
Owing to the fact that such a boat's turning will pivot very far forward, the plate fitted to prevent this is well placed, and would be less effective elsewhere. The increased draught of rudder is very essential, for it will grip hard water and allow the boat to be manœuvred at a smaller angle than would be the case were the rudder in line with the bottom of the boat. A great rudder angle is detrimental to speed, and consequently the increased draught shown is advantageous.

Turning to the construction of the boat, there is everything to be admired and nothing calling for adverse criticism. As will be seen, the well wherein the crew do their work practically takes the entire weight and strain. The high saxboard is connected throughout to all the strain, taking parts, and the adjustment of these is decidedly good. There is great strength where the weight comes and extreme lightness elsewhere. The frames are tapered wherever possible and are of sycamore, finely moulded, and with the connections neatly made with sunk joints. The keelson is of yellow pine and deep, and the stringer also. In the two University boats the thwarts on which the slides work are not solid as shown, but made of three pieces, on which the slide tracks are screwed. This, however, is on account of the rough course at Putney, and the "eight" proper has a light thwart as shown. There is only a saving of a few pounds weight in the Putney form. The ends of the boat are just strong enough to carry the model, the shape being merely supported with the lightest timbers and crossed battens for the drum deck.

The most interesting part of the whole construction, however, is the skin, which is made of the finest procurable Philippine Island cedar. Only the best wood may be used, and from $\frac{1}{8}$in. amidships to almost paper thickness at the ends. It is finely adjusted, and the butts are remarkable for their fitting and closeness. The butt straps and roove clinchings are neat and strong, and probably there is no branch of boat-building in which such skill and craftsmanship are to be found. It is a strange fact that, while these boats have a forward strut fitted to the rigger, it is more common to see them with merely the 'thwartship double strut and the after double strut. One would imagine that, the strain coming on the fore-end, the forward strut would be the most important. This is not considered so, and practice and experience have led the builders to take the weight from aft. The strut connections are finely welded to the hollow iron rigger in which sycamore is fitted to take the chafe. The strut tubing is of $\frac{5}{8}$in. light steel, and all the connections and welds are made so that there is no loss of strength anywhere. It seems to be a matter of opinion as to where exactly the fore edge of the rigger should be placed, but generally it is in line with the after edge of the thwart.

Regarding the draught and freeboard of the boat there is considerable difficulty, because the boat as built has no level line. (A point which was painfully apparent in taking the lines of the boat shown.) There is something like $1\frac{3}{4}$in. hog in the design, only about $\frac{3}{4}$in. of which is in the well, the end-drops being more pronounced. On floating the boat retains this hog, but immediately the crew take places the boat sags to a point which practically brings the saxboard level. This is largely a question of weight, and for each boat there are various adjustments. The University crews are comparatively heavy, and their boats are consequently somewhat large. There is a common belief that where weight appears in a boat there is a consequent local increase in the hull; but this is not so, for the builders distribute that weight evenly throughout. It is also the general practice to vary the height of thwart, raising and lowering the slide seat. This is necessitated by the fact that the legs of all the men vary, and it is necessary to adjust the thwart-height, so that the legs do not chafe. There remains for arrangement the 'athwartship distribution of weight, for it will be seen that the men are placed in two rows, fore and aft. It is necessary, in order to trim without any list, that those weights should be fairly accurate. Fore and aft, the weights are distributed to suit the boat—the heavier men towards 'midships.

Taking the racing "eight" as a business proposition, it appears impracticable, for the waste energy is enormous; but, regarding the question as one of strength and watermanship, it has quite a different aspect. Here, however, there is nothing to be said on that point, and, the boat and her gear having been discussed, the subject may not be taken further.



Bowden Bros.

CONSTRUCTING THE BOAT AND OARS.

(The boat at Sims & Sons' and the oars at Ayling's.)