CATAMARANS, 1961

A.Y.R.S. PUBLICATION No. 38

Hellcat

CONTENTS

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(*Founded June*, 1955)

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EDITORIAL

January, 1962.

This being the first publication for the year, we wish you all a very pleasant year with good sailing in exciting new boats. On the technical side, the A.Y.R.S. yacht wind tunnel should be working and producing some interesting figures. In the course of the year, too, it is hoped that we will achieve a "Laminar Flow" test tank and some towing apparatus which has been devised by Guy Morse-Brown for taking the resistance of full sized yachts. With these pieces of apparatus, we will then be all set for doing some really useful yacht research.

Mr. Benyon-Tinker has been striving to get us a piece of sailing water and space to assemble our apparatus but the results of this are not known at the time of going to press. Our thanks are due to him for his efforts on our behalf.

The A.Y.R.S. " Research Centre and Clubhouse." We have not yet achieved the status, either by our work or financially to consider a "College of Yachting" but we could well get premises for ourselves in which to meet and, if there were some grounds, we could erect our wind tunnel. The minimum we would need is (1) a laminar flow test tank, (2) a stretch of 200 feet of water to do towing tests of full sized dinghies, (3) a wind tunnel of 3 feet by 3 feet section, (4) an 8 feet by 8 feet wind tunnel and (5) a 30 feet by 30 feet wind tunnel. A disused water mill or the lock keeper's house on a canal or something similar would do quite well. Adjacent sailing waters would be nice but are not absolutely necessary. To buy such premises should not cost more than £5,000 and with a realistic subscription rate, this should not be too much for us. If anyone knows of any place which he thinks might be suitable, either in the geographical centre of England or within 40 miles of London from N. to S.W. in area, will he please let us (or Mr. Benyon-Tinker) know ?

The Size of Future Publications. After careful calculations and consultations with the printers, we have come to the conclusion that the economic length for the publications with our present membership is 52 pages which can be increased by one page for every 20 new members. If therefore everyone will do their best to get new members, we can increase the size of our publications. As we are so restricted for space, will people kindly keep their articles and descriptions as short as possible to avoid the heavy hand of the Editor.

The New Zealand Secretary. Charles Satterthwaite has had to resign the New Zealand secretaryship owing to pressure of work (he is doing research into the resistance of catamaran hulls at the moment). T. McKnight, of Auckland, has taken over. In many ways, it will be more convenient to have the secretary where most of the New Zealand sailing is done. Charles Satterthwaite was one of the first A.Y.R.S. members and has consistently worked for our objectives during all these years, though his interests have been mainly technical, and being in touch with test tanks and wind tunnels at the University, he is more fortunate than most of us. Our thanks are due to him for all his work and for the two publications of his, *Sailing Yacht Design* and *Sailing Theory*.

The British A.G.M. will, as usual, be held on the first Saturday of the Boat Show, 6th January at 11 a.m. at the "Cedars," North End Road, near Earls Court. Matters for the Agenda can be sent to Mrs. Ruth Evans from now on. We have again taken a stand at the Boat Show at Earls Court, which runs from January 3rd to 13th. All the arrangements are being most effectively and efficiently done by A. J. Millard to whom our thanks are due for this most worrying job.

Committee Meeting 3rd December, 1961. At this Meeting the Editor was asked to request every member living West of, and not too far from London, to look up a map of his district and find where lakes and gravel pits exist and inspect them with a view to getting permission for the A.Y.R.S. to use one. If members find a satisfactory site, will they please let F. Benyon-Tinker know.

The A.Y.R.S. Tie. Tony Millard has most kindly arranged for A.Y.R.S. ties in silk to be available at £1 each from Mrs. Robson, Membership Secretary, 10 Eastvale, The Vale, Acton, London, W.3.

CATAMARANS 1961

We have some clever and astute catamaran designs in this publication but it looks as if the original configuration can only be bettered in small details. This is the first year when we have been in difficulties in filling up the publication with designs sent in by members and others. The attention of members seems to be more occupied with trimarans now and the next publication on that subject will be of intense interest.

However, the technical examinations of catamarans by members in this publication will interest all and of these, the need for a sail rig with a high aspect ratio and consequently high lift to drag ratio is perhaps the most important.

BRITISH ONE OF A KIND CATAMARAN RACES

These were held at Thorpe Bay in Essex from July 24th to 28th. From personal observation and a careful study of the results, I have come to the conclusion that there was extremely little to choose between the leading boats for intrinsic speed. On the whole, this series was won by helmsmanship, except for the outstanding 24 foot *Hellcat*, which, in some races, went nearly three times as fast as some of the better 16 foot catamarans.

Discounting *Hellcat* which won every race she entered, The *Cougars* and *Thai IV* took the second places with *Freedom*, *Shearwaters*, *Flying Streak* and *Y.W. Cat* taking third, fourth and fifth place.

The Official Race Results are misleading in some cases because, for example, the *Cougar Racer* finished well down in the list, due to rigging failures which put her out of some races, but was faster than the others (always excepting *Hellcat*). It will be remembered that the *Thai* suffered this fate in her first *One of a Kind Series.*

To me, that "Grand Old Man" of catamarans *Freedom*, with three third places and one fourth, was the outstanding craft. Built in 1957 and a very hardy perennial in the prize lists of the *One of a Kind Races*, she took third place in the Official Results—a really good show, and a first class design. Her lines and description are in A.Y.R.S. No. 22.

HELLCAT (BRITISH)

L.O.A.	24 feet	Weight	655 lbs.
Beam	12 feet	Crew weight	388 lbs.
	Sail Area 298.5 sq. ft.		

Designer : R. J. Macalpine Downie.

This is the craft which won the 1961 International Catamaran Challenge Trophy against the American *Wildcat*, from Newport Beach, California, designed by Seymour Paul, Dan Sanderson and Roy Hickok. There is nothing outstanding about *Hellcat*. She is just a beautifully made boat of what is now the conventional configuration. Symmetrical hulls of a fine entrance, a flat semi-elliptical underwater maximum section slightly aft of the mid-length and ending in a flattish transom are all features with which A.Y.R.S. readers are familiar. Twin symmetrical centreboards are used.

However, the feature which is most outstanding in *Hellcat* is the rig. This is a high aspect ratio mainsail with a slightly raked mast and a jib which doesn't overlap the main—a rig which we know has the greatest lift to drag ratio possible. If the reasoning in a later article in this publication is correct, this should have a very marked effect in improving windward performance and it was on the windward legs that *Hellcat* beat *Wildcat*. On the downwind legs, *Wildcat* was often faster, as she should have been as she weighed 204 lbs. less.

The shallow hull sections apparently make *Hellcat* fast when putting about and during the races she was able to sail on after hitting flotsam, while *Wildcat* was holed. Her hull is therefore adequately strong.

Conclusion. *Hellcat* is a wholesome conventional catamaran of *minimum but adequate* scaltlings surmounted by the proper rig. It would appear that the highly roached, low aspect ratio mainsail with overlapping jib has a lower lift to drag ratio.

STRENGTH OF CATAMARANS AND TRIMARANS

By M. F. Gunning, M.R.I.N.A.

Little Hawsted, Steep, Petersfield, Hants, England

Strength calculations are tricky, especially in fields like shipbuilding. It is, of course, easy to assume certain loadings, and then to calculate the stresses resulting from those loadings, although often renewed assumptions must be made as to what parts of the structure help to carry the load. The calculations may be all right, but they are no better than the assumptions ; calculations of this kind which are given with results in more than 3 significant figures usually merely prove that the author does not know, what he is talking about.

Consequently many designers, especially designers of yachts and the like, mainly work by feeling, i.e. accumulated experience, usually with excellent results. Nevertheless, calculations *can* be of some use, especially in cases where experience as yet is limited, and where at least part of the forces acting on the structure can be assessed with some certainty. This appears to be the case with the transverse strength of catamarans and trimarans.

We will assume, for simplicity's sake, that the craft is in horizontal position, poised with one float on a wave slope, and that the float carries the total weight of the craft, the wind force keeping the craft in this state of uneasy balance. These assumptions neglect many factors, such as dynamic loading, stresses in the rigging (we assume the lee shrouds to be slack), and, above all, slamming. The reader may rightly object, that we have by this time made so many assumptions, that any calculation must be of very limited value indeed. In a way that is so, but it will be seen that all assumptions made tend to lower the loadings, resulting in stresses which will be too low. So we must be very careful as to the stresses we will allow in our strength members.

Now Fig. 1 shows clearly, that the bending moment in the cross-beam(s) at the foot of the mast is total weight x $\frac{1}{2}$ beam. This for a

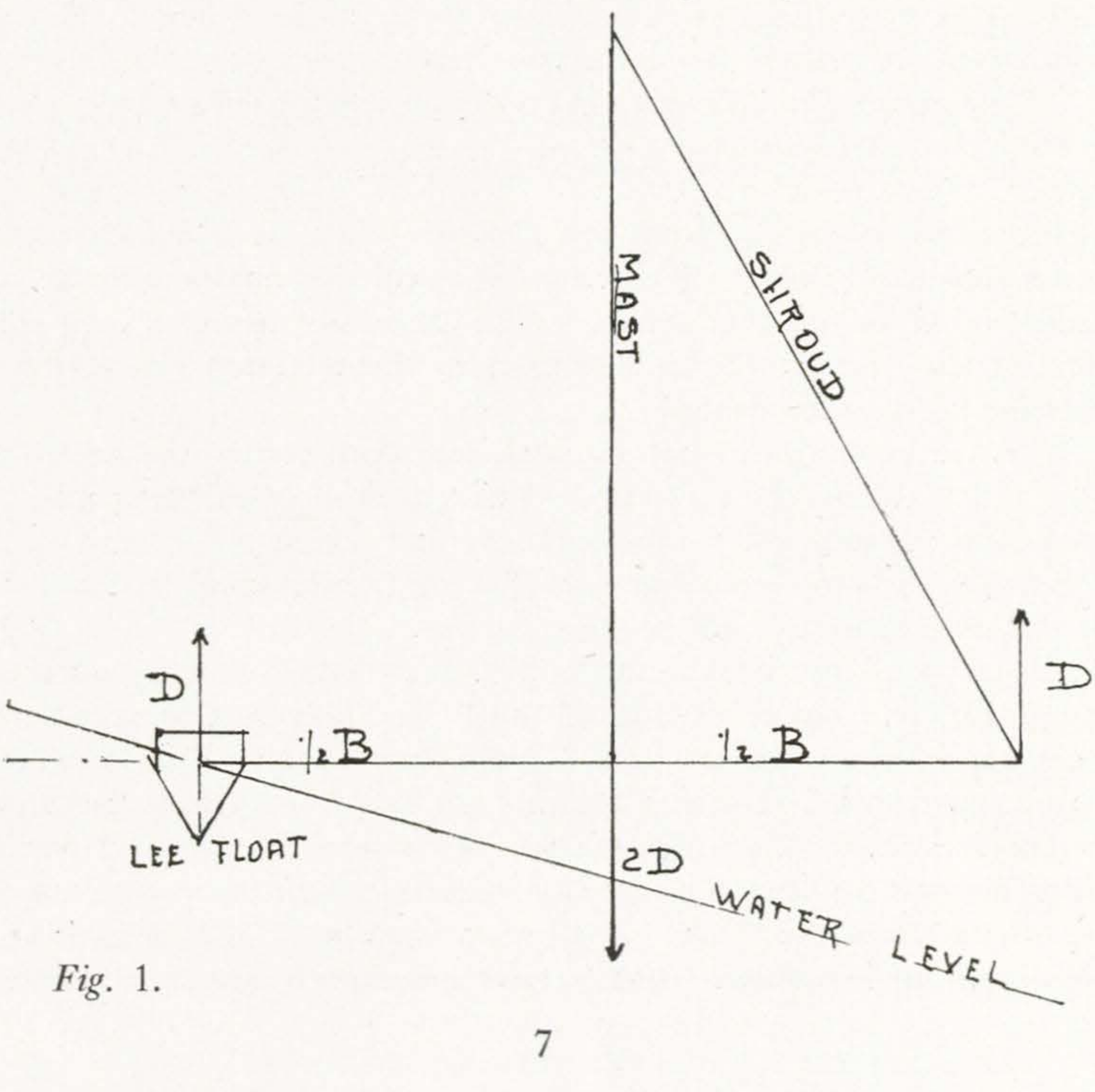

Fig. 1.

Note on Fig. 1. The stability moment is (D)isplacement x $\frac{1}{2}$ Beam, and this is balanced by the moment exerted by the wind forces on the hull, mainly transmitted by mast and rigging. If the shroud is taken out to the weather float the vertical component of the force in the shroud is again D, balanced by an equal downward force in the mast, the two between them setting up the required moment. The total force acting downward in the centre is 2 D, i.e. total weight and thrust of mast.

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trimaran or catamaran of say 1 ton weight and 16 ft. beam works out to no less than 20,000 ft. lbs. and that requires a steel channel of some 8 in. high, or else a lattice work, or box girder of equal strength. When looking at the various exhibits at the Boat Show I could not help wondering how strong the transverse connections really were. It will be said that they have stood up well in actual practice, and perhaps they are quite all right. I possess no structural details, and can but wonder. But survival in itself proves little. The various components that between them make up the final, critical loading may not have occurred simultaneously and, anyway, one never knows by what narrow margin disaster was averted.

STABILITY OF CATAMARANS AND TRIMARANS

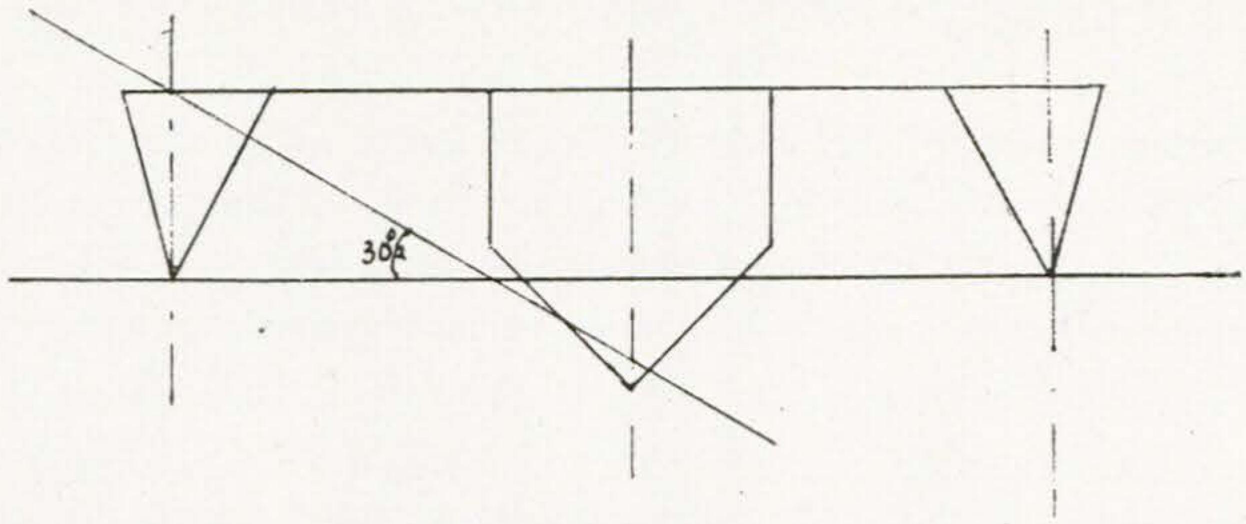
By M. F. Gunning, M.R.I.N.A.

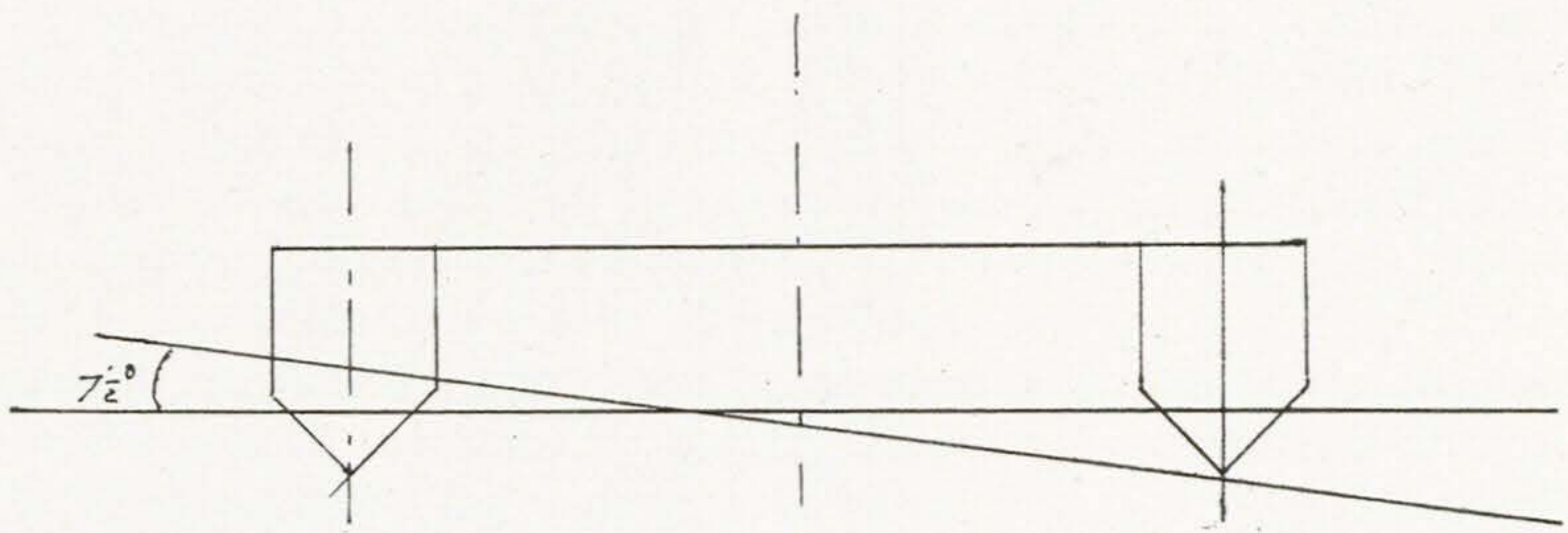
We will compare a "*Cat*" and a "*Trim*" of the same displacement, beam, height of centre of gravity. We will neglect the stability of hulls and floats by themselves. We will finally assume, that each float of the "*Trim*" will be able to carry the total displacement and that the crew sit amidships.

It will be easiest to start by assuming both craft to be heeled to 90°. In that case the stability is equal, in both cases being nil. If we now turn both craft to horizontal, we find that, again in both cases, the stability is simply a cosine curve, being D x $\frac{1}{2}$B x cos a, if a is the angle of heel to the horizontal.

This holds good, until the hull of the "*Trim*" touches water at about 30°, and the other hull of the "*Cat*" immerses at about 7½° heel. If we remember that the "*Trim*," with neither float touching water when upright has zero stability, so that at zero heel the curve is tangential to the base line, the rest of the curves can be drawn by hand, without too much danger of wide mistakes.

We see that the "*Cat*" has a greater stability, but reaches it at a very small angle of heel. The "*Trim*" has slightly less, but can heel a long way before it gets there. It gives warning. One might compare the "*Cat*" to a glass rod, and the "*Trim*" to a tough bough.





The "*Trim*" has low stability at low angles of heel, and larger stability at greater angles of heel, and this is the elementary recipe for designing a boat that is kindly in a seaway.

It might be worth while to study the effect of raising the floats of the "*Trim*" well above the main body. This might extend the range of stability of the "*Trim*" to beyond 90°, a most desirable feature. As to a "*Trim*" being uncapsizable, read Brigadier Smeetons' tale of *Tzu Hang*, a deep keeled yacht, which was turned over twice (once head over heels) off Cape Horn.

BI-CRUISERS AND TRI-CRUISERS

By Julian Allen

A basic fault of bi-cruisers is that they exert strongest resistance to heeling when it is least needed ; when most needed, with the fresh target of the under belly coming under fire, then their resistance rapidly fades out. The efforts to hide or play down this inborn unreliability are various. Some say capsize is so unlikely that it can be ignored. Others say that no competent helmsman will ever get capsized. Others say that given sufficient buoyancy—or weight—or beam—capsize finally becomes impossible. A few frankly admit the possibility and fit a sort of stork's nest to the mast head, presuming that though the crew will have to walk on the cabin walls that is better than having to walk on the ceiling! One enthusiast even claims that the exposed under-belly acts, not as a target, but that it shields the wind from the sails!

Another basic fault is that the bi-cruisers must start their deck-house 18 in. above water line instead of 18 in. below, thus giving an extra 3 ft. of windage all round. What is the great gain that overrules all these basic faults? How else can we account for the fact that our leading designers, both here and in America, stick to bi-cruisers? Not knowing the answer I shall stick to tri-cruisers.

Tri-cruisers are of two kinds, the day-sailer which includes the crew weight as one of its stabilizing factor while one of the floats, attached to out-rigged spars, gives the other half. If this float is forced under, nothing is left to stop the hull going over on to its beam ends. When this kind of "trim" was adapted to tri-cruisers, the whole of the stabilising factor was thrown on to the floats, so, they had to double their volume. Moreover, for maximum stability each float had to be big enough to support alone almost the total load. One huge float was always a passenger. Both huge floats were wasted capacity and big wind-jammers. If the consumption of stores went wrong during a voyage, or for any reason the total weight dropped to a point that enabled a single float to carry the lot, then the tri-cruiser could expose its under-belly with the indecent abandon of the bi-cruiser. It is a poor policy to pin your safety to a constantly varying quantity, and it is a pity to have "dreadnought" floats and no second line of defence, rather than moderate sized floats, with usable capacity, plus an immovable line of secondary defence. This was mooted in A.Y.R.S. Nos. 23 and 27. This wing float idea with its multiple advantages of lavish cabin room, access to the floats for storage, absolute integrity of float attachment and immunity from the beam ends attitude has long been available to our tri-cruiser designers both here and in America, yet they still prefer the layout suited to small sized "trims." I am glad to see, however, that an amateur, T. C. Burnham—A.Y.R.S. No. 36—has the right idea in the use of wing-floats.

It has been said that an L.B.C. (*Ski-Kat*) because it dips its float is only a trimaran without its main float! The idea is only half true since a "trim" dips one float and flies the other. Queer that "trim" fans accept float dipping as an essential safeguard while standard catamarans regard it as a folly. Typical loose thinking somewhere!

How much safer is wing buoyancy? Think of a winch-line run from a harbour wall to the mast of a tri-cruiser and pulled. The vessel would heel over until the wing buoyancy stopped it. Then the vessel would plough broadside on. To make it turn over it would have to be anchored bow and stern and the point of no return would be 90°.

All this being thus let us assume that wing float cruisers are the ones to consider.

Floats. Not enough heed is paid to buoyancy increment as shown by the popularity of the 90° "V" section for hulls as well as floats.

Fig. 1 shows a range of floats giving rides from smooth to rough. The distance that each has to submerge to double its displacement is a measure of its shock factor. The shorter this distance the quicker the jolt. Taking (1) as a norm, then (2) is a good second ; but has doubled the draught. Deep draught is no guarantee of softness and can be the reverse. The wetted area is also doubled. (3) is a bad third, though draught is back to normal and wetted area better. (3) faired to a semi-circle shows marked improvement for two reasons.

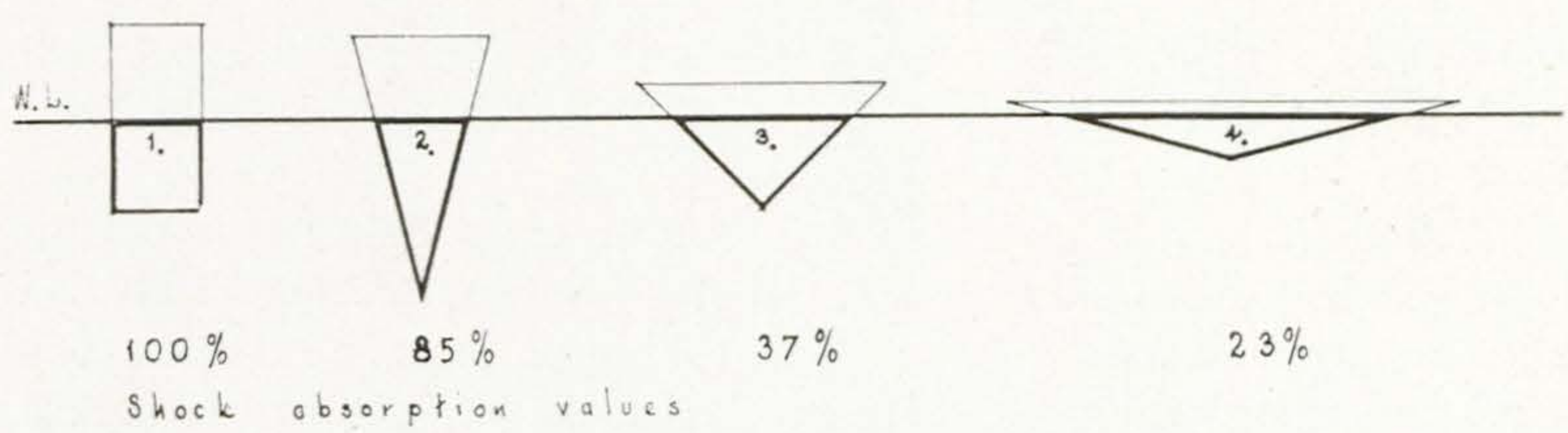


Fig. 1.

It both lowers the waterline and steepens the waterline zone. (4) is put in, as a float, to show an extreme case. In spite of its "V" bottom it would be bumpier than a flat bottom lying beneath the water.

It is the waterline zone that counts, let the shape be what it will above or below. This applies to hulls. Floats, of course, have a waterline zone from top to bottom. A deep draught boat with flare at the waterline will be rough, while a 90° "V" bottom with tumblehome at the waterline would be very soft. Designers of hard chine boats like to put their L.W.L. just below the chine to avoid eddies and so make a rough ride.

Fig. 2 explains itself up to the "improved float." This is designed to draw 1 inch and so saves wetted area, and at the same time gives a firm initial resistance. It would be given only a slight rocker at each end and yet, owing to its shallow draught, give inappreciable resistance to going about. By its slimness it would give the tri-cruiser the manners of a ballast yacht, by bowing graciously in a moderate wind; then dipping its float as a yacht dips its lee rail, and it still holds in reserve a powerful response to severe wind pressure. The time to take in sail is when the float is nearly under and the heel is spilling the wind considerably. There should be no need for Piver's safety release. The right angled outer face of this float becomes more

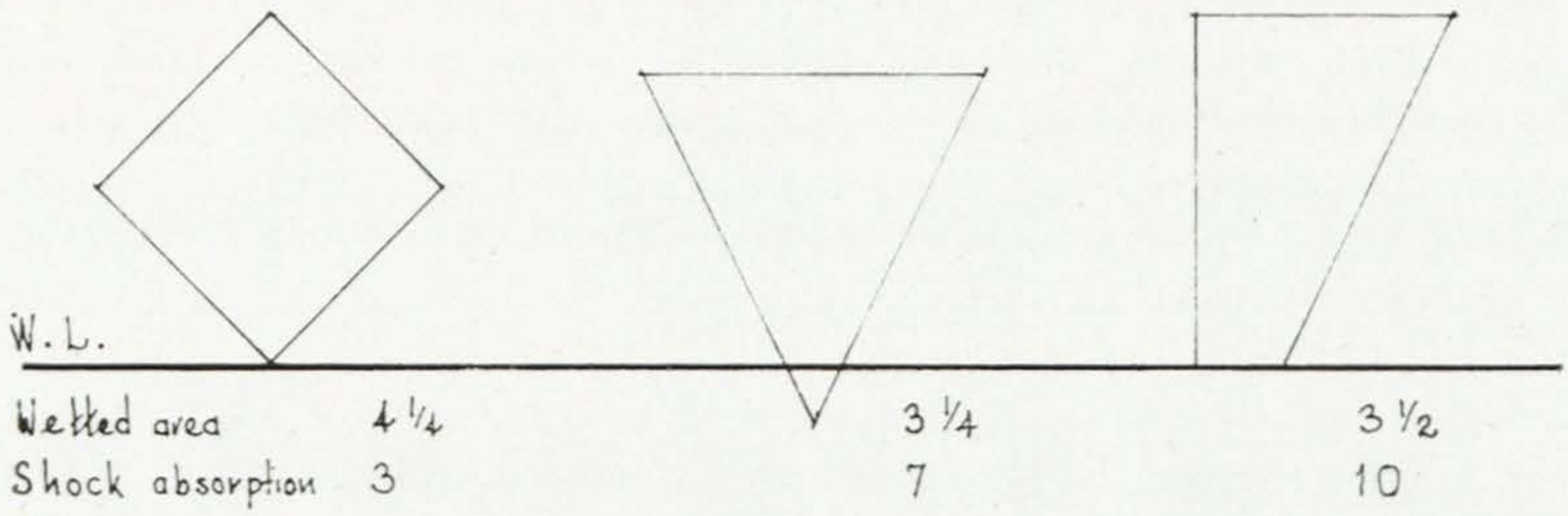
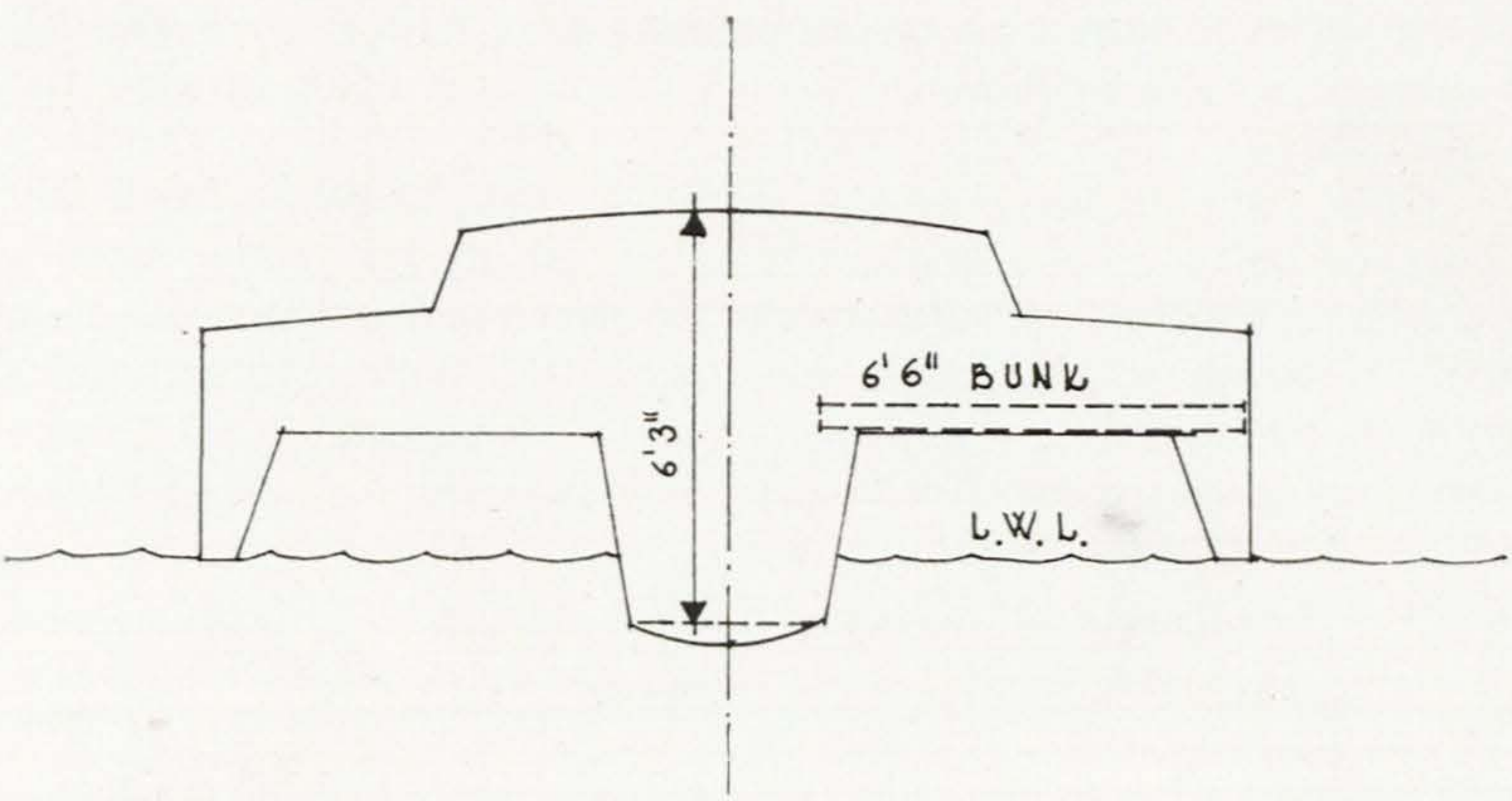


Fig. 2. "Improved float" on right.

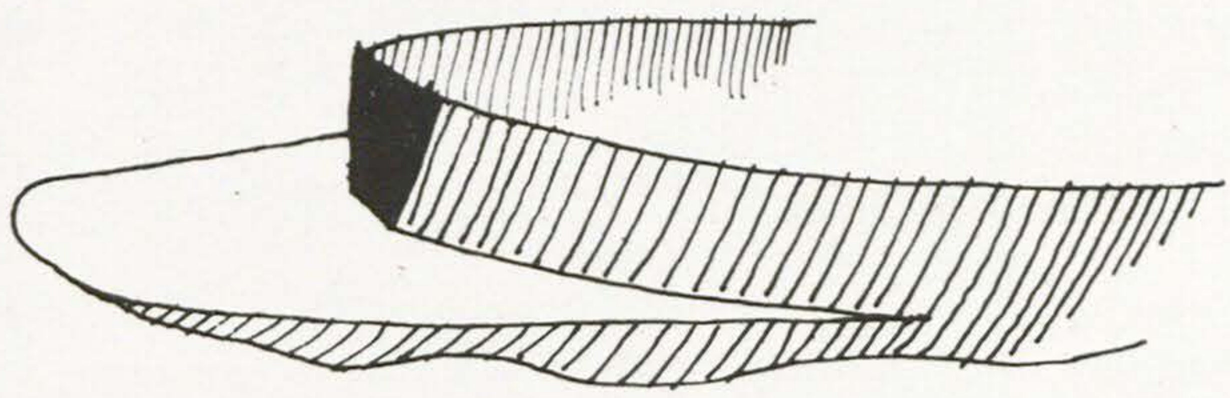
symmetrical when heeled and gives a good leeway resistance. In light winds dagger boards would be dropped down the vertical float-faces.

Main Hull. Obviously a flatish bottom gives most headroom for least windage, least bilge waste and most speed. Although flattish bottoms are universally accepted as the right thing for boats, they lost caste when our yacht designers hit upon the idea of the ballast keel. Natural stability and cargo capacity could now be swept aside and endless patterns of lovely lines, in search of greater speed, could be woven. Few today, can afford these bewitching craft. Their cost



is as breath taking as their slowness. Whatever the means of propulsion, every other type of racing craft, remaining true to a flattish bottom, beats them soundly on points. And scows and dinghys beat them boat for boat. So let us use a flattish bottom, merging either into a flattish "Vee" or else a spoon bow sliced off near to the waterline.

Bows. The vertical cut-water, adopted by our designers as a matter of course has the fault of always turning a flat cheek to the wave slaps when sailing into the wind. Thus a head sea has the opportunity to slow the boat and shower the crew. Our designers



make no attempt to alter their bad design, though they acknowledge their fault by adding useless spray deflectors.

What is wanted is an undercut surface with its edges close to the water so that waves find least resistance in passing. This type of bow divides the wave horizontally. The upper layer becomes a shallow wave with little weight and the main portion slides under the hull. The raised cut-water may either form a self-draining cockpit or be covered with a hatch.

THE PACIFIC CATAMARAN ASSOCIATION HANDICAP 1959 RATINGS

By Hugo Myers

The basic formula is : Sec./hour $= 5000 \sqrt{\frac{W}{A\ L}}$ — Sec/Hour (Scratch). The Scratch Boat is *Pattycat* at 1974.

W = minimum weight of boat plus crew ; A = maximum sail area which can be set at one time to windward plus 0.05 (spinnaker area). L = L.W.L.

The *Closed Course Handicap* for boats without boards or keels is

$$1.03 \left(5000 \sqrt{\frac{W}{A\ L}}\right) — \text{Scratch.}$$

The simplified theory of this formula is as follows :

Drag $= \frac{1}{2}\rho V^2 A\ C_D$. A in this place means wetted area of hull. Now, the drag of a catamaran is due mostly to skin friction which is proportional to the wetted area but this is hard to measure. It is therefore desirable to express $\frac{\text{Drag}}{\text{Force}}$ in terms of more measurable quantities.

For similarly shaped hulls, the C_D is the same. Therefore : A (wetted area) is proportional to L^2, or $\frac{L^3}{L}$ or $\frac{W}{L}$. Weight is proportional to L^3.

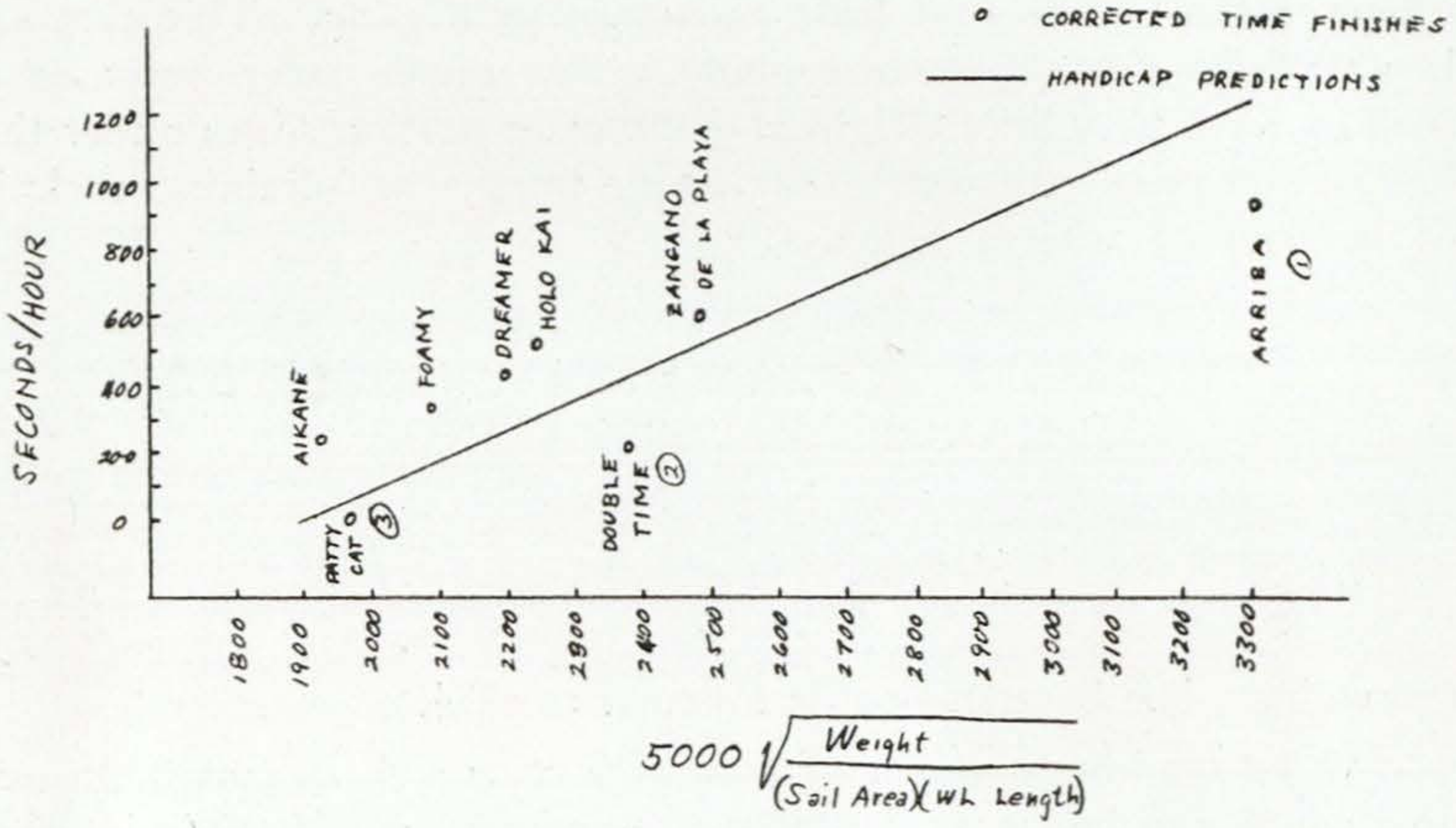
The Driving Force is proportional to the sail area.

Therefore $\frac{\text{Drag}}{\text{Force}}$ is proportional to $\frac{W}{L\,(S.A.)}$. S.A. is Sail Area.

Now, the velocity varies as $\sqrt{\frac{\text{Force}}{\text{Drag}}}$.

Therefore, the handicap rating in $\frac{\text{Seconds}}{\text{hour}} = \text{constant}\sqrt{\frac{W}{L\,(S.A.)}}$

Previous races have shown us that the constant can be taken as 5000 and the formula will give good results.



The graph shows the 1960 Ensenada Race results with the predicted handicaps to the formula. The results are satisfactorily close to the prediction. Arriba is a heavy cruiser with U shaped underwater cross sections and carries a large spinnaker which may account for her success.

RATING FAST SAILING CATAMARANS 1961

BY HUGO MYERS

Secretary, Pacific Catamaran Association

A breakthrough is occurring in sailing. High speeds and stability are provided in the new fast catamarans. In the sense that new

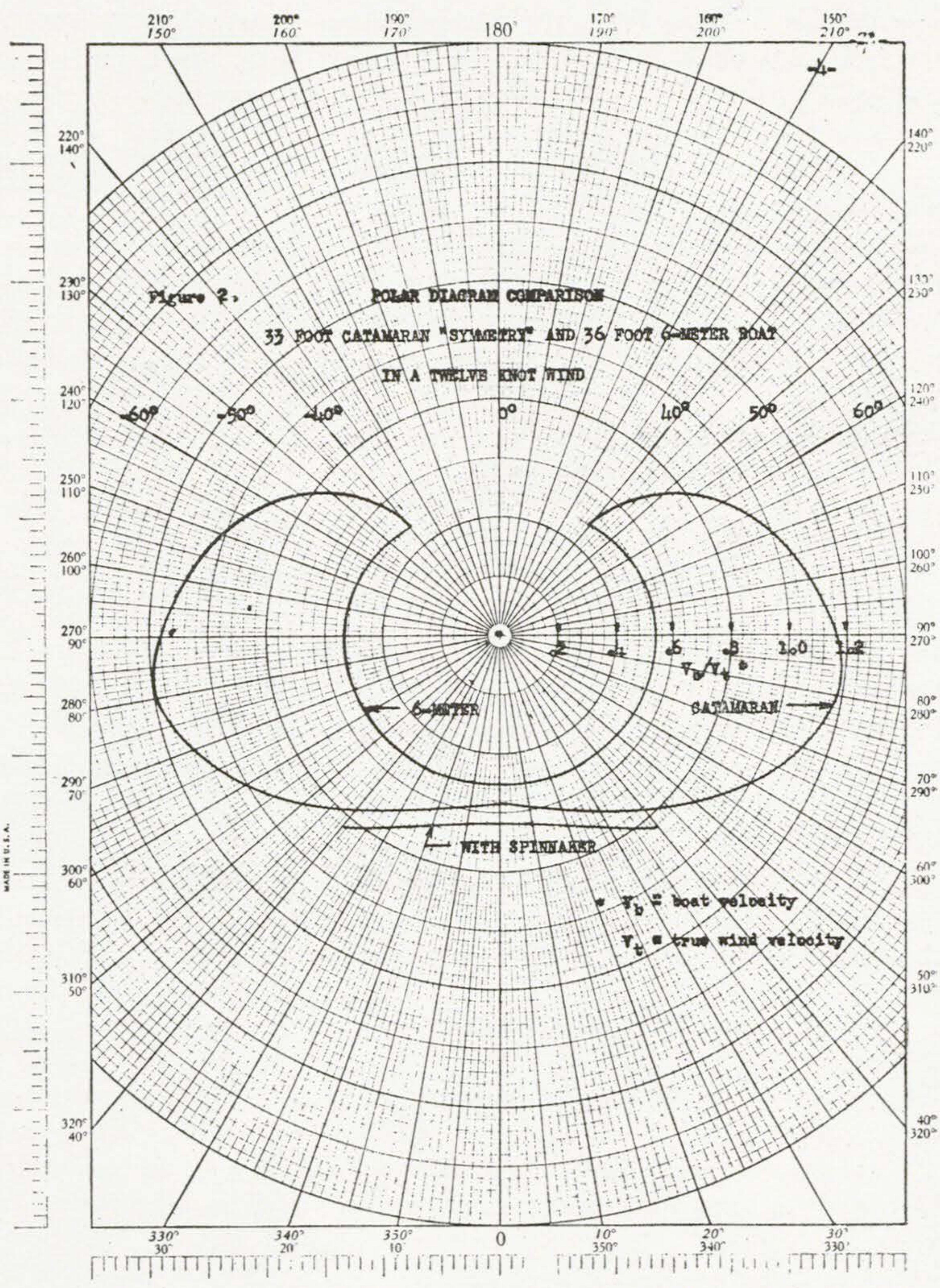


Fig. 2.

a rating system for two types of races. The first type is the usual one in which at least one leg of the race is a beat to windward. Examples are triangular, windward-leeward, and windward-reaching races. The PCA rating is a number which is proportional to the predicted elapsed time and is

$$R_1 = 3\,(-.1 + \sqrt{W/AL}),\ \text{for races having a windward leg.}$$

In this formula W is the *measured* minimum racing weight of the boat plus crew, in pounds. Racing gear is included, but water and gas are not. Crew allowances are assigned according to the minimum crew weight the owner expects to race. The factor of 3 is simply a multiplier which makes the corrected times of the faster boats approximately equal to their elapsed times.

A is the total maximum sail area carried to windward, in square feet. Usually A is the area of the main plus the largest genoa. L is the sailing (heeled) waterline length, in feet. This length is approximated as being midway between the unloaded waterline and the deck length.

For the *offwind* races, such as the Ensenada and Honolulu runs, the spinnaker area must be included. The rating for this type of race is

$$R_2 = \frac{5}{3}(.3 + \sqrt{W/A_dL}).$$

In this offwind formula A_d is the total maximum sail area carried downwind—usually the main plus the largest spinnaker. Pure reaching races are not included in these formulas, but can be treated as a special case. The formulas are valid only for *fast* catamarans, which have the ratio W/AL in the range of .16 to .25 (for R_1), and W/A_dL between .08 and .13 (for R_2).

Once a rating proportional to the predicted elapsed time has been derived, the PCA measure of performance is determined by comparing the actual elapsed time with the predicted time. Thus,

$$\text{Corrected Time} = \frac{\text{Elapsed Time}}{\text{Rating}}.$$

The boat with the lowest corrected time in a race wins the corrected time trophy.

As an example, consider two catamarans, one a racing day sailer with a low rating, and a fast cruiser, with a higher rating :

Racing Day Sailer	*Fast Cruiser*
L = 25 ft. = ½ (wl + deck length)	L = 36 ft.
W = 3000 pounds (including crew)	W = 8000 pounds
A = 750 sq. ft. (main + genoa)	A = 890 sq. ft.
$\sqrt{W/AL} = .40$	$\sqrt{W/AL} = .50.$

The day sailer's rating for a triangular race is then

R_1 (racer) = 3 (— .1 + .40) = .90.

The cruiser's rating is

R_1 (cruiser) = 3 (— .1 + .50) = 1.20.

If the racer had an elapsed time in a race of six hours and the cruiser of seven hours, the *corrected times* would be

Corrected Time (racer) = 6/.90 = 6.67 (hours), and

Corrected Time (cruiser) = 7/1.2 = 5.83 (hours).

Thus, in this race the cruiser actually turned in the best performance, considering her weight, sail area, and size ; and she would get the corrected time trophy.

Both theoretically, and in a half dozen races in southern California, these formulas have proved to be proportional to the actual elapsed times within a few per cent. The problem other systems have had is that they do not include the measured weight, which is widely known to be a fundamentally important factor.

The PCA rating system will continue to be analysed and tested in many races this year, and further comparisons of theory and experiment should be obtained. For those who are interested in the fluid mechanics of fast sailing catamarans, a 40 page illustrated technical paper* is available from the author.

* *Myers, H. A.*, " *The Fluid Mechanics of Fast Sailing Catamarans*" *Third Draft*, 1960. 2506 *Wellesley Ave.*, *West Los Angeles* 64, *Calif.*, $2.00.

THE SPEED OF MULTIHULLS

By John Morwood

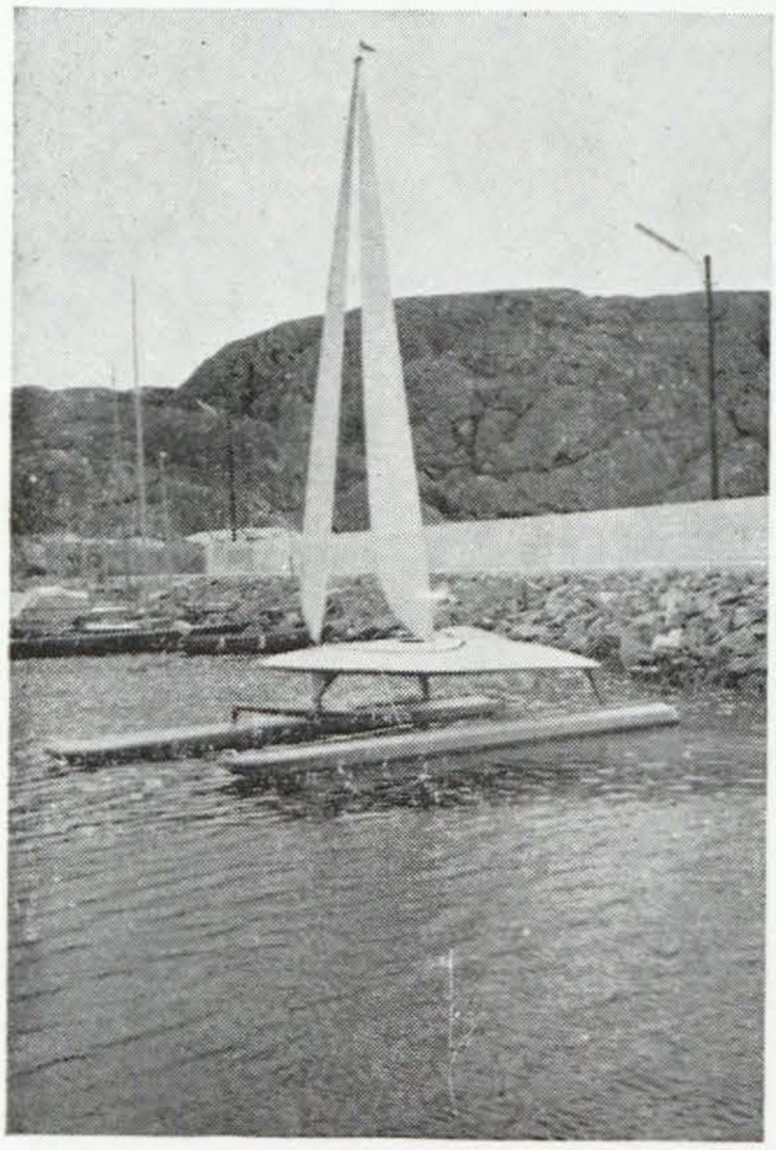
Up to now, the conventional catamaran configuration produced by Woody Brown and perfected by Roland Prout has reigned supreme for speed. Asymmetry of hulls or centreboards have not yet been shown to be an improvement nor have trimarans or outriggers ever cleanly proved faster, though they show theoretical advantages.

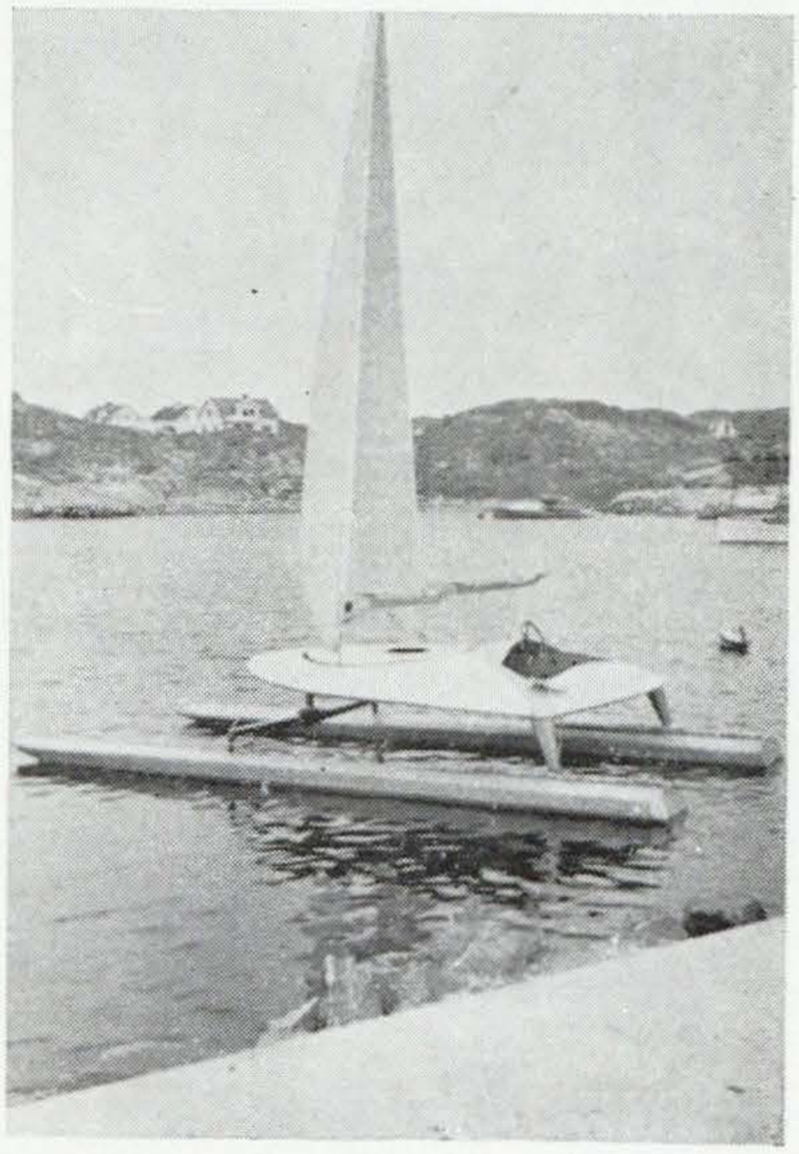
In previous publications, especially No. 35 *Catamarans* 1960, we have examined asymmetry of hull in relation to speed (and this also includes the asymmetry produced by sloping out the hulls). Let us now examine the trimaran to see if we can find out why it is not faster than the catamaran.

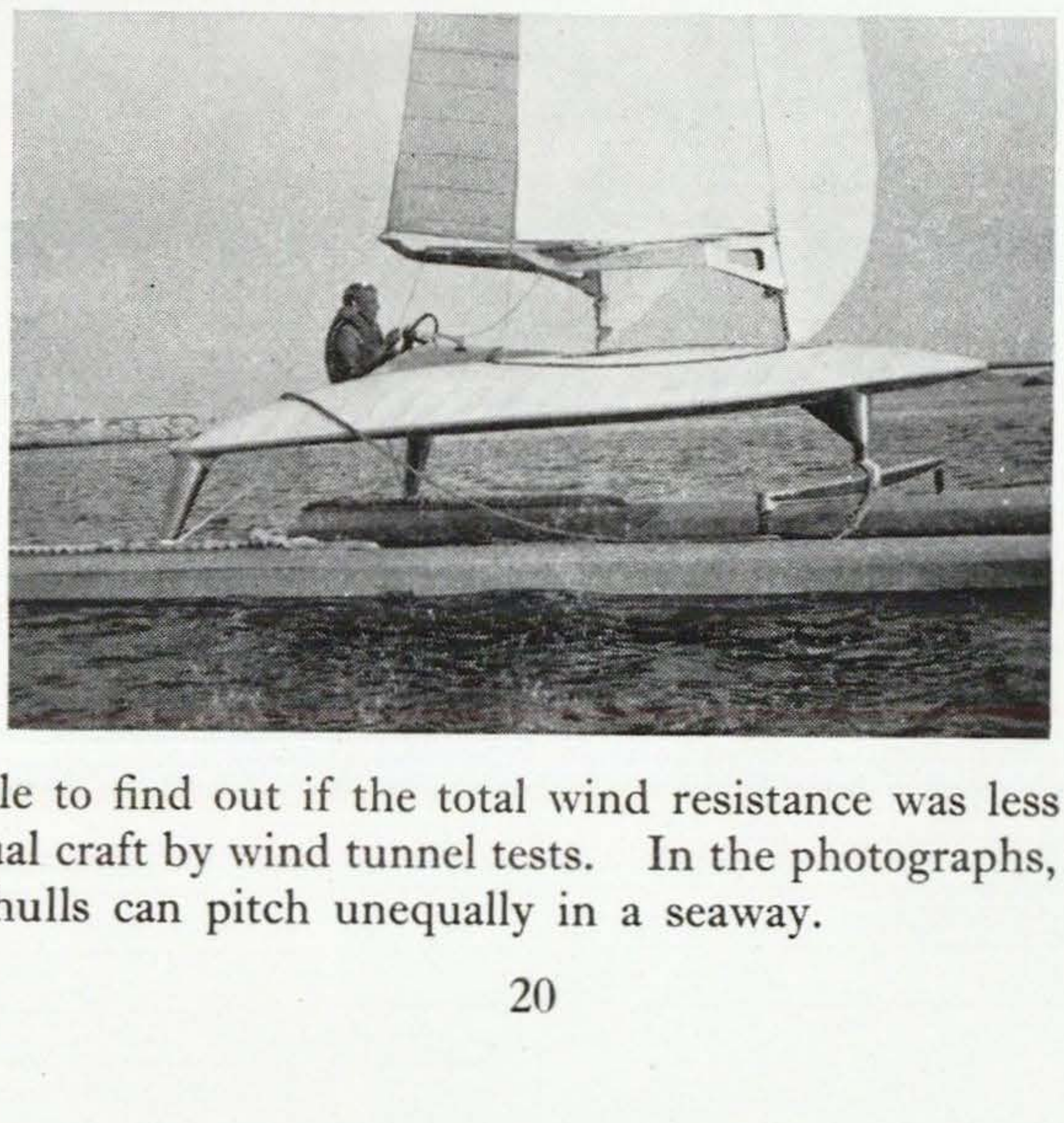
Firstly, the trimaran has less wetted surface and weight for its length than the catamaran and therefore, if other things are equal, it should be faster. However, if the stability is equal to the catamaran, the beam is considerably greater and this produces very much more windage, thus more than neutralising the previous advantages, when beating to windward. Secondly, trimaran floats tend to be shorter then the main hull, thus putting an earlier limit on the top speed than exists with a catamaran. For this reason, Arthur Piver's latest trimarans have floats very nearly as long as the main hull. The windage problem still exists, nevertheless.

Configurations which could be better than the conventional catamaran are as follows :

1. The *Low Windage Catamaran* as exemplified by the photographs showing the craft produced by Ernst Bernhard, Tjärblomsgatan 6 C, Göteborg H, Sweden. The cockpit here is aerofoil shaped and would give some lift but its wind resistance is small. It would only

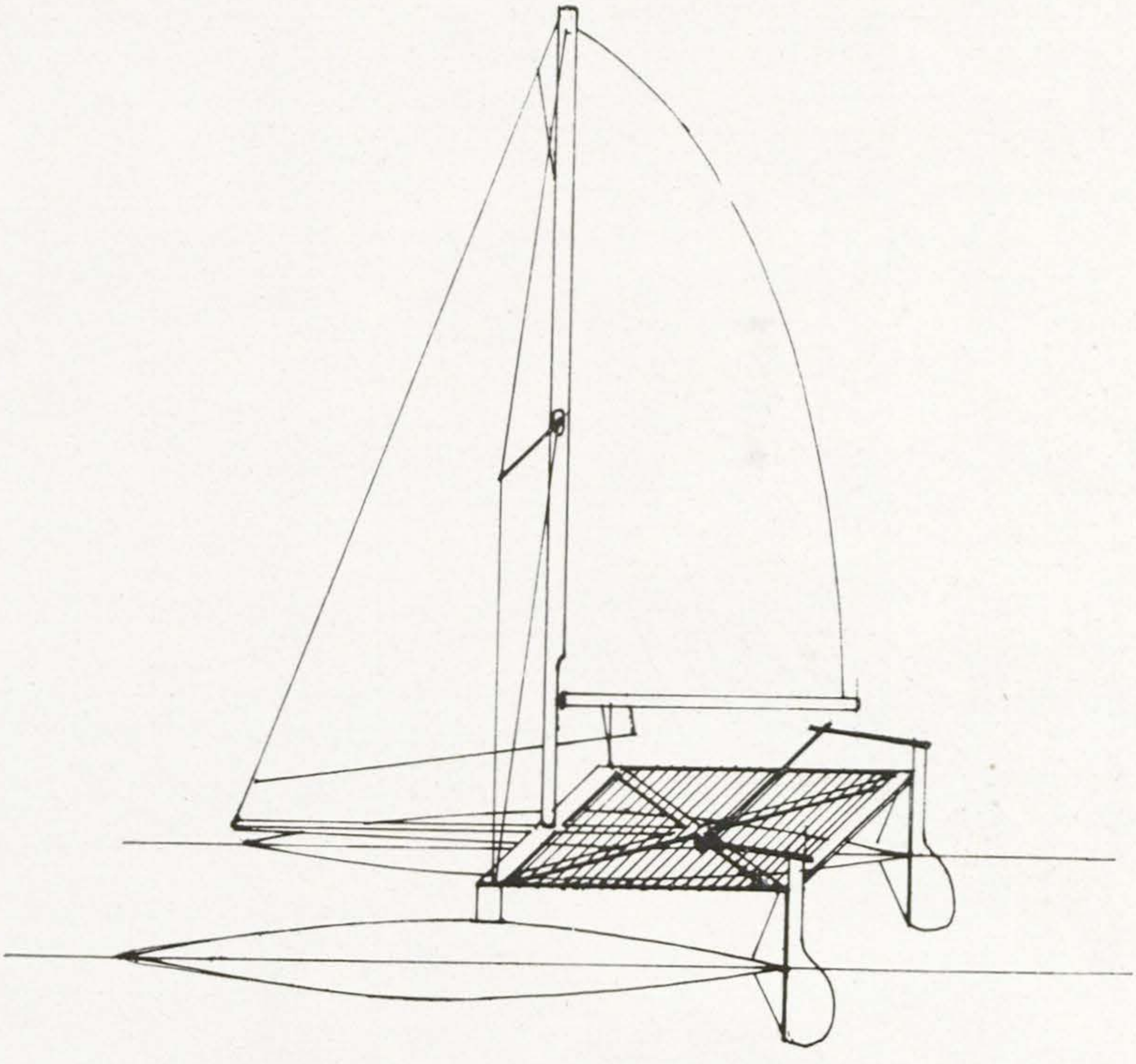




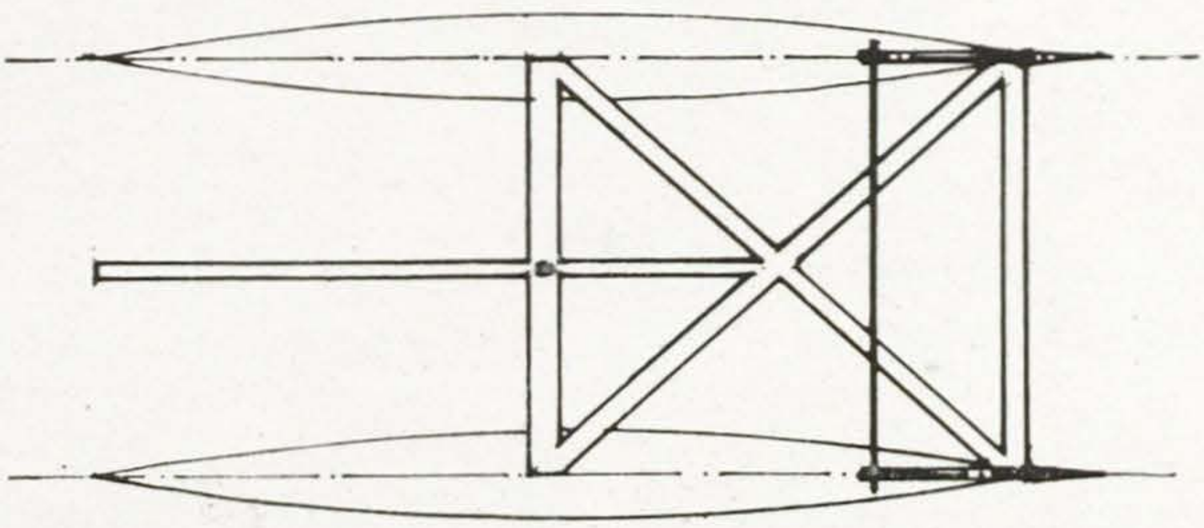


be possible to find out if the total wind resistance was less than that of the usual craft by wind tunnel tests. In the photographs, it appears that the hulls can pitch unequally in a seaway.

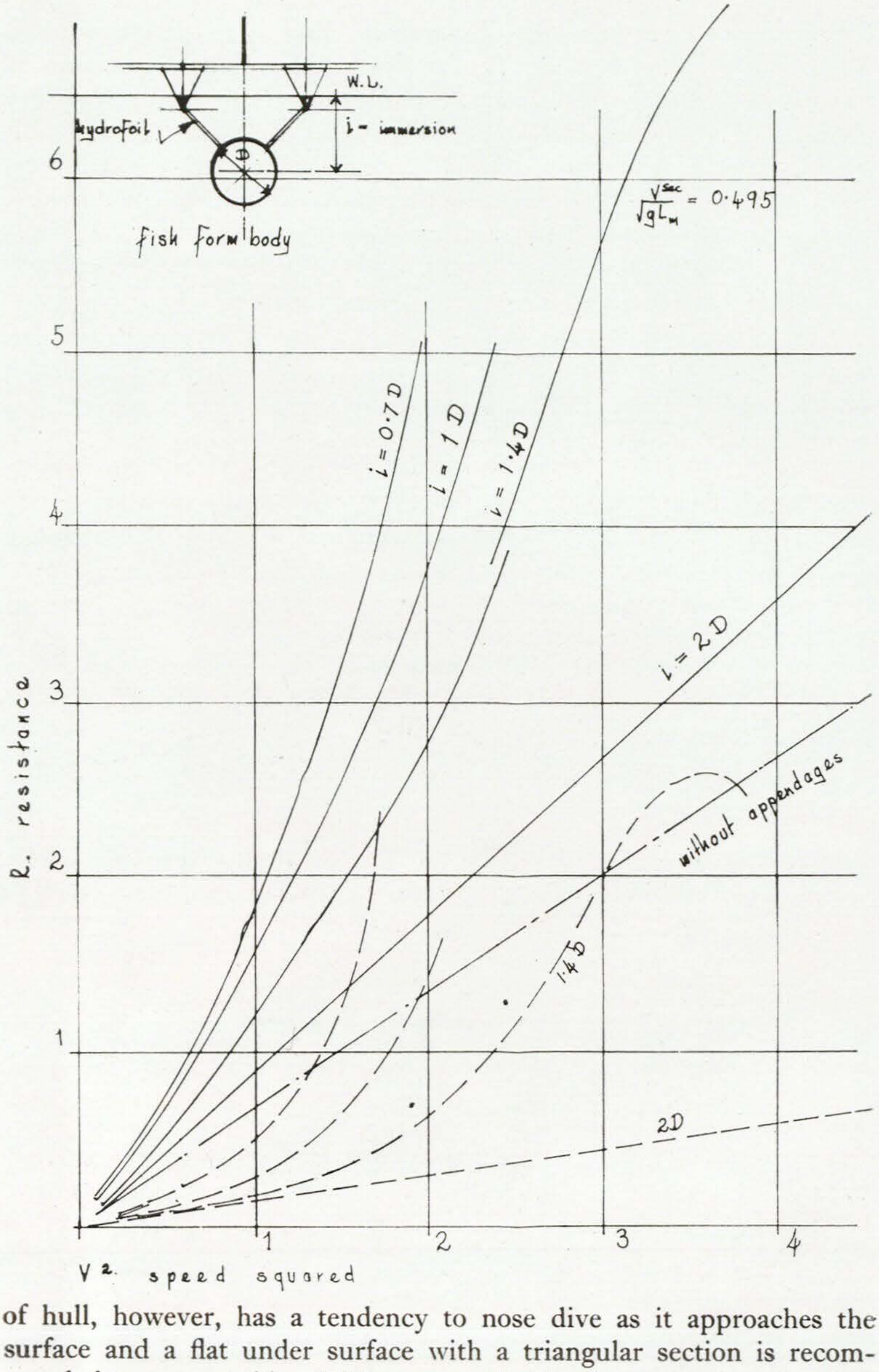
2. The *Low Buoyancy Catamaran*, first described by Julian Allen, 3 Kenystyle, Penally, Tenby, Pembs., England. A version of this has been drawn by Norman Pearce for us. This craft submerges the lee hull on heeling, instead of flying the weather one, thus avoiding



PLAN



"the second target for the wind" i.e., the underside of the bridge deck. The test tank results, kindly sent to us by Professor Nutku of Istanbul, show the enormously lessened resistance when the submerged hull's centre is two diameters below the surface. This shape



of hull, however, has a tendency to nose dive as it approaches the surface and a flat under surface with a triangular section is recommended to prevent this. This entrance is found in a species of surface swimming shark and the outrigger float's bow traditionally used in Samoa (Hornell).

3. The *Unequal Hulled Catamaran.* Very few people seem to have read the classic books on catamarans and outriggers *Canoes of Oceania* by Haddon and Hornell and *Water Transport* by Hornell, though both can be got by any local library in Britain or the U.S. In the former, it is indicated that very many groups of natives use craft with hulls of about the same length but of different girths. For us, this would give a much lighter craft than the conventional catamaran with less wetted surface and windage. One could imagine a *Shearwater* with the mast stepped on one hull and the other hull's freeboard reduced to just above the L.W.L. The stability would be equal to that of the conventional craft.

4. The *Single Outrigger* (Polynesian Canoe). This is merely another version of "Unequal Hulled Catamaran," but with "Low Buoyancy" float. A single light alloy cross beam and a bullet shaped float with stern fin and "Tailplane" such as that described on page 43, A.Y.R.S. No. 36, mounted on a joint which would allow some pivoting and pitching would give least wind resistance, but two poles holding the float rigid might prove better.

5. The *Trimaran* with two low Buoyancy floats, though possibly slower than the single outrigger might prove more acceptable to people. The reduction of windage would have to be a prime consideration.

By way of *Finale*, we show some delightful plan forms of cruising versions of a catamaran, an outrigger and a trimaran and their capsizing states, drawn by S. L. Seaton, reprinted by courtesy of *Motor Boating.*

FIG. 1 CATAMARAN

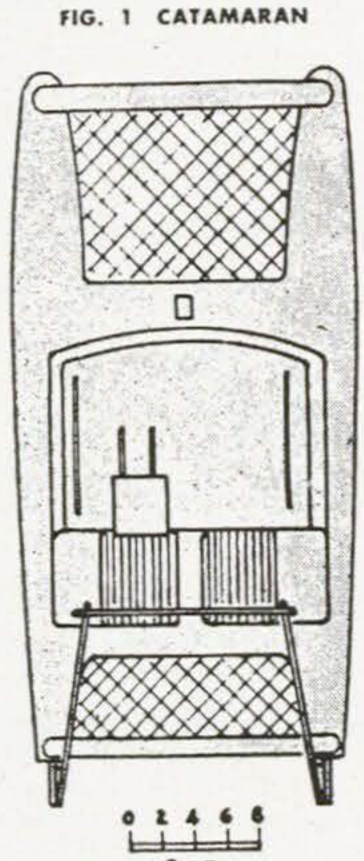


FIG. 2 SINGLE OUTRIGGER

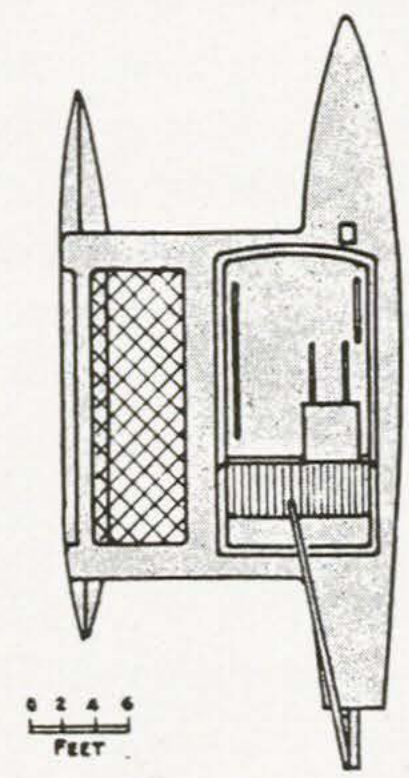
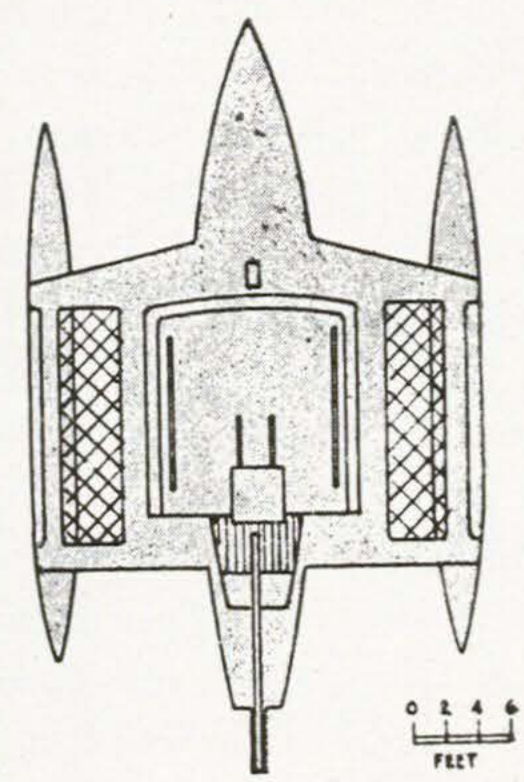
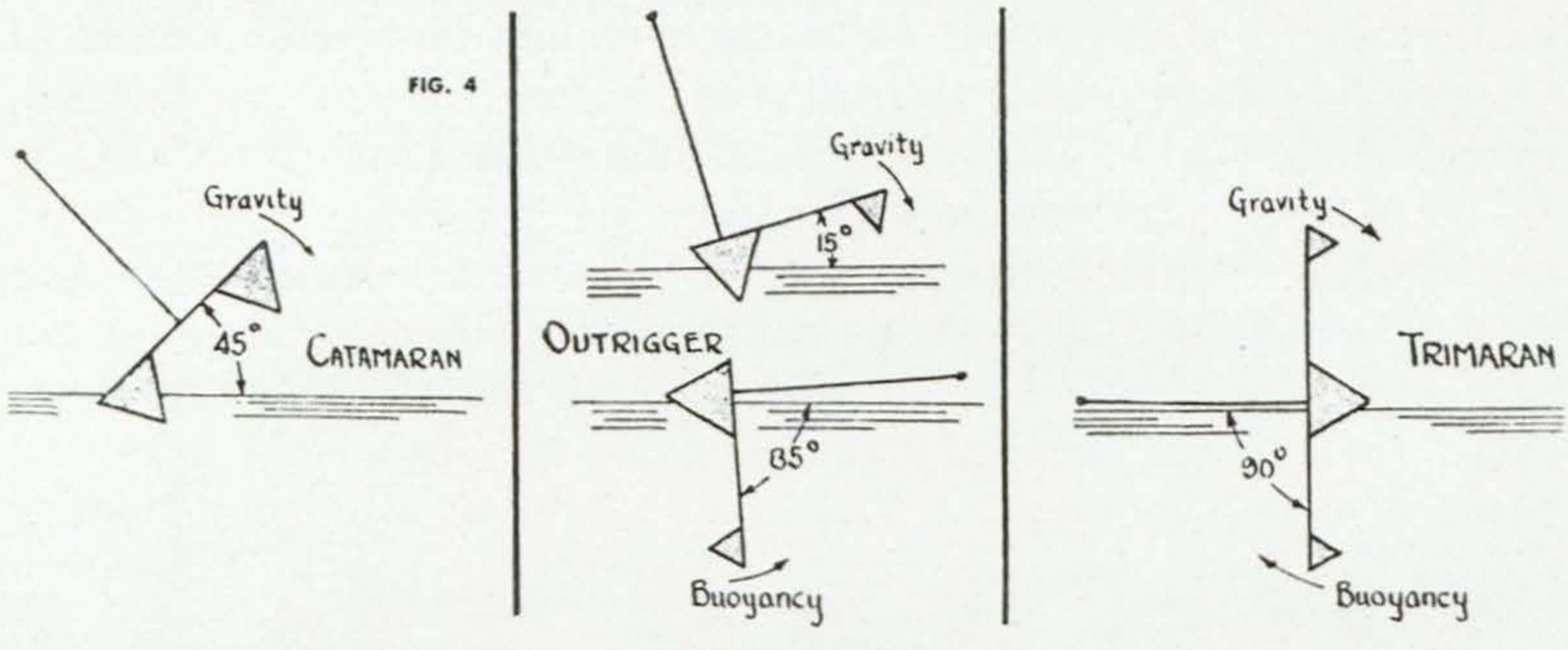


FIG. 3 DOUBLE OUTRIGGER



RIGHTING FORCES ACTING ON MULTIHULL BOATS UP TO INDICATED CRITICAL ANGLES

FIG. 4



THE LATERAL RESISTANCE OF CATAMARANS

By John Morwood

The lateral area of the hulls of conventional sailing boats is supposed to be from 1:25 to 1:35 of the sail area, the lower figure being for a hull without a saliant keel and the higher figure for a centreboard boat. However, the lateral area of my *Tamahine* design (A.Y.R.S. No. 18) which, with right angle V sections has the greatest lateral area of any modern shallow catamaran, is 9 square feet. On the rule, therefore, *Tamahine's* lateral area should be adequate for a sail area of 225 square feet.

In practice, *Tamahine* needs a centreboard for areas of about 100 square feet. Similarly, Arthur Piver's trimarans need centreboards up to and including his 24 foot *Nugget*. *Nimble*, of 30 feet has a centre-board but could probably do without it. *Lodestar*, at 36 feet definitely does *not* need extra lateral resistance. Bill O'Brien's catamaran, *Jumpahead*, is better to windward with a centreboard but, apparently, can often sail very well without it. His 24 foot *Shamrock*, however, is not fitted with boards and her windward course is good. Round bilge catamarans such as *Shearwater* and even more so *Thai* need extra lateral resistance from boards and this holds good even for the 36 foot *Snow Goose* and the larger round bilge American catamarans by Hugo Myers and Bob Harris.

Now, in essence, the larger catamarans and trimarans are scaled-up versions of the smaller ones. This in turn causes some improvement in the "induced drag" from the increased Reynolds Number and some relative improvement in the skin friction drag but both these must be of minor importance. The only rational explanation of the need for boards on *Tamahine* and the extra lateral resistance needed for trimarans as compared with catamarans is that there is far more windage from multihulled craft than from conventional yachts and more from trimarans than catamarans. If we use the principle stated by Edmond Bruce in A.Y.R.S. No. 37 *Aerodynamics I*, the lift to Drag ratio of the sails and hull taken together is less than with conventional boats so, to get an equally good course to windward, one must increase the Lift to Drag ratio of the hull, by using a centreboard.

Larger catamarans and trimarans can achieve a better lift to drag ratio of the total sail force, including the hull windage than small ones for the following reasons :

1. Larger Reynolds number.
2. Sail plan relatively nearer the deck, thus diminishing the size of the boom eddy.
3. Relatively smaller windage of crew, mast, stays and deck structures.

The reason for the ability of *Jumpahead* to sail well without her centreboard lies, I think in a large Genoa set just above the deck.

The Bruce Tests. In some sail tests done by Edmond Bruce, it was shown that the Lift to Drag ratio of a sail was 7:1, while that of the whole craft (a dinghy), was 3.2:1. If now, the total Lift to Drag ratio of a multihulled craft is much worse than that of a dinghy, the figure must be very low indeed.

Conclusion. The windward performance of our present multihulled craft, especially the trimarans, is greatly handicapped by their windage. If it were not for this windage, craft with a right angled V section would have more than enough lateral resistance without centreboards.

MORIMA II. 40 FT. CATAMARAN

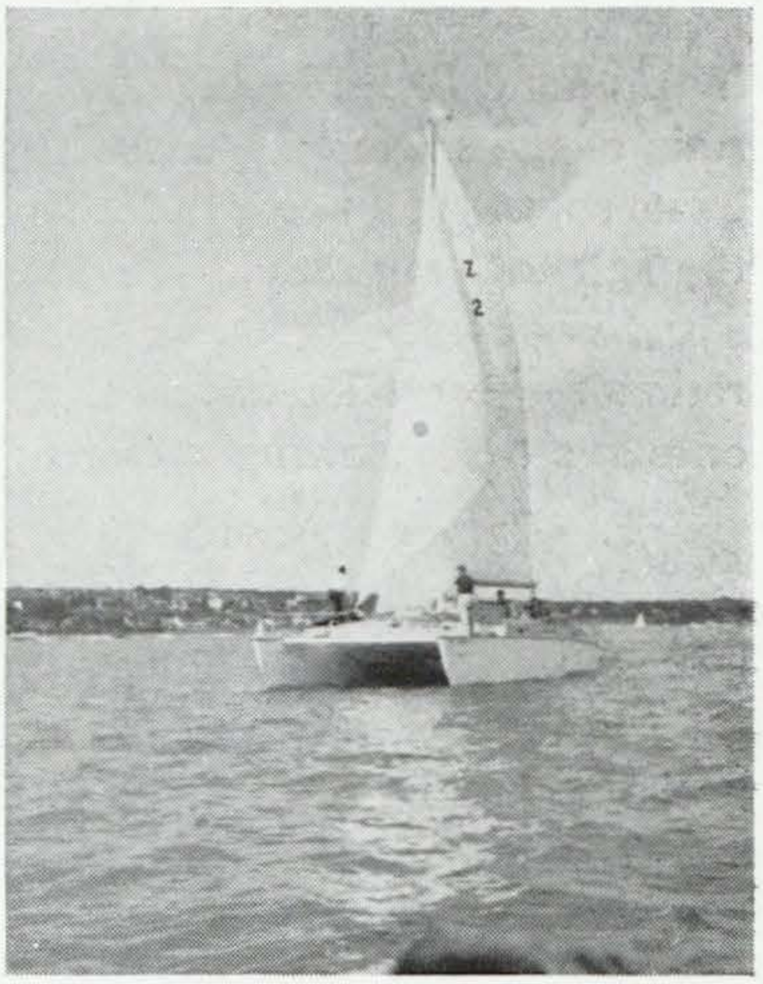
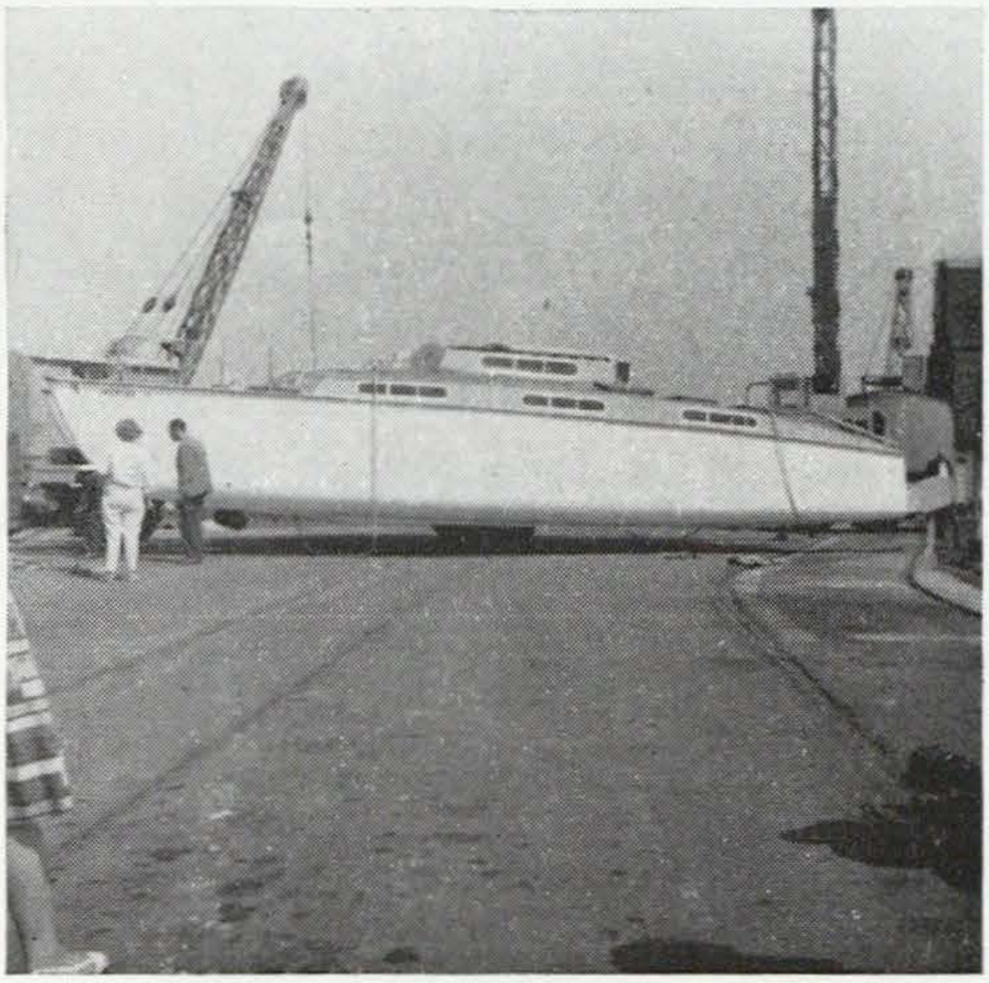
BUILT FOR FRITZ VON OPEL
St. Tropez, France

Length 40 ft. Beam 18 ft.
Sail area 1010 sq. ft., including large Genoa.

Designers and Builders: G. Prout & Sons, 1 The Point, Canvey Island, Essex.

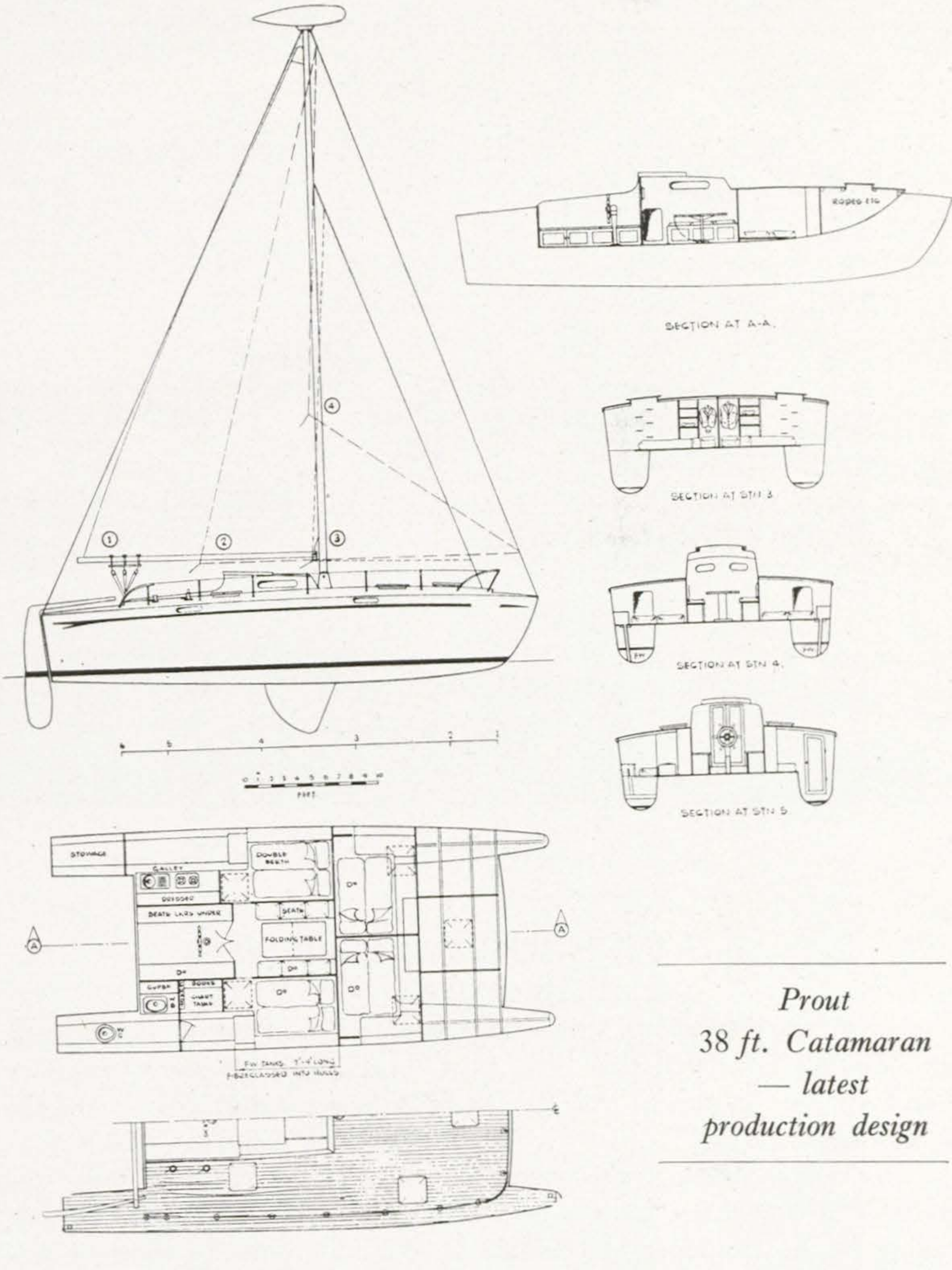
Morima II was completed and launched on June 17th, 1961 and sailed by a Mr. J. Fenwick, a professional yacht deliverer from Canvey Island around the coast, across the Bay of Biscay and into the Mediterranean to St. Tropez in the South of France. Upon arrival at St. Tropez she was immediately entered for a race from Toulon via Corsica to St. Remo in Italy.

During the passage and the race *Morima II* encountered four

Morima II

gales, one very severe, the worst encountered in the Mediterranean last year. She weathered them all very well and without trouble or undue anxiety. Jack Fenwick who has had a great deal of experience delivering many types of yacht all over the world said afterwards that he considered the cat as good in gale conditions as many boats of her own size, with apparently some comfort advantages when hove to or lying a "hull". *Morima II* during this delivery trip made some fast

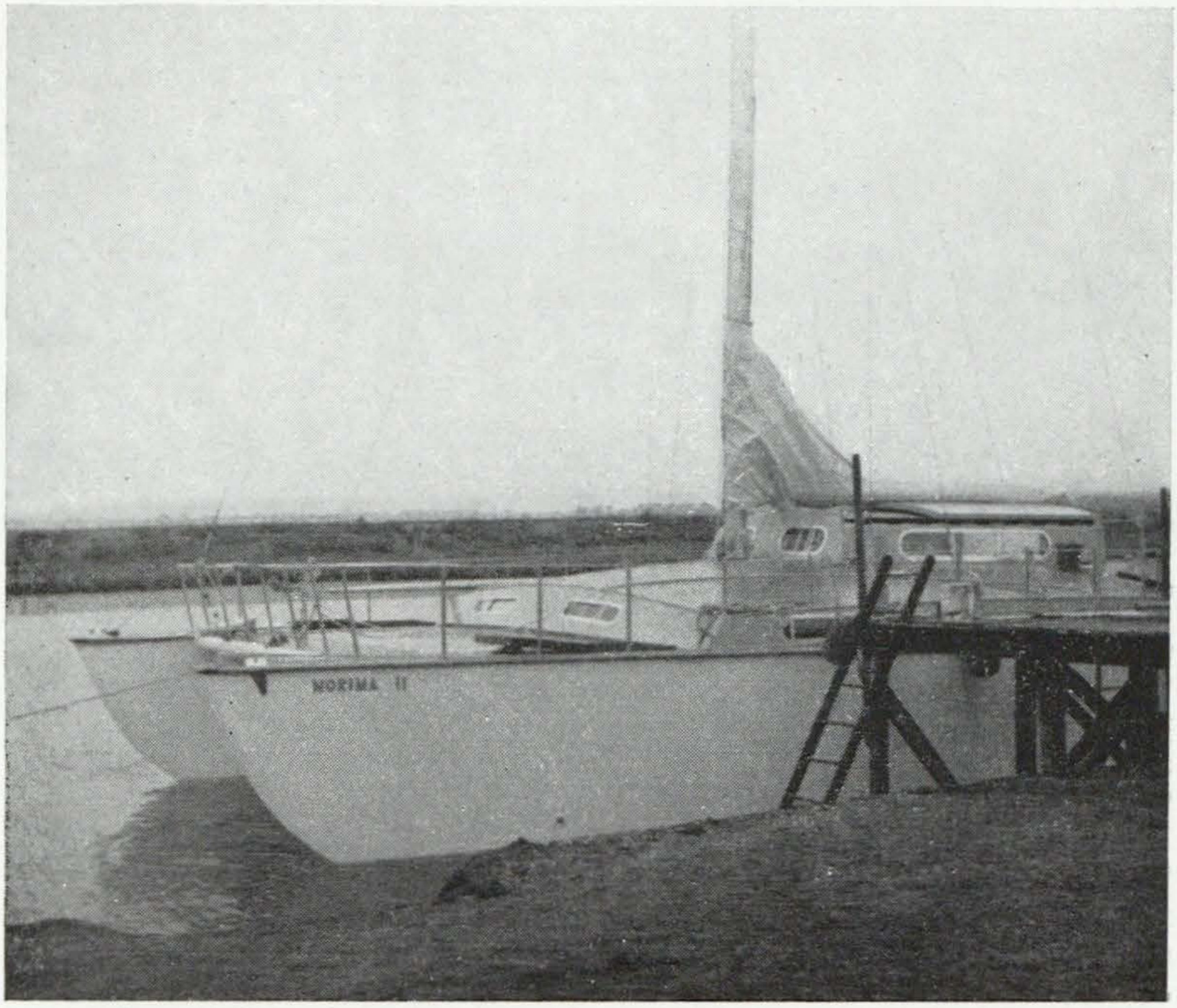


Prout
38 *ft. Catamaran*
— latest
production design

passages, the best being a 100 mile run across the bay of Lyons in 8 hours.

Morima II was designed with a very spacious cockpit measuring 10 ft. by 14 ft. wide and was fitted with a shower two toilets and two refrigerators.

Her owner, an experienced sailor, intends to race her extensively in the Mediterranean next year.



Morima II

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25 FT. POWER CATAMARAN

BY ROLAND PROUT

Ever since the launching of our small 14 ft. Panther Power cats, and finding how well this little boat went in rough water we have had it in our minds to one day build a larger cabin cruiser on the same lines.

The final push came when the *Daily Express* announced its decision to run a sea going power boat race from Cowes to Torquay, taking in the rounding of the Isle of Wight. This we thought was just such a race made for the power cat.

The Panther 25 is constructed of marine ply, with spruce and mahogany frames and stringers. She is built as lightly as possible, but great strength was put into the hulls and under bridge section. The power pack was to be two 75 h.p. Johnson outboard engines, and she carries 200 gallons of petrol in two permanently installed fibreglass fuel tanks.

Cabin accommodation is good with a large saloon table seating six people. With standing headroom at galley and sink, there is also a separate toilet and wash room. A large cockpit with comfortable seating is provided and this can be covered by an awning to form a continuation of the cabin and to prevent rain from entering the cockpit.

First trials proved most successful, and a speed of just over 30 knots was obtained with the 75 Johnson Engines.

One of the first long trips was to cruise around from Canvey Island to Folkestone to join in escort work for the Catamaran Cross Channel Cruise in June, 1961 to Boulogne, and she returned on the Sunday, when a strong west wind of about force 5 was blowing,

Prout Power Cat

making the straits very rough and stopping nearly all the small sailing cats from attempting the return crossing. This return trip was most successful, the run from Boulogne to Dover was made in 1½ hours, and we had on board about eight passengers with their luggage and gear. When we dropped our passengers, we continued from Dover back to Canvey Island in very bad conditions with wind and rain sheeting across the water making the Thames Estuary look white and angry. However a speed of about 24 knots was maintained all the way back to Canvey.

After several successful local trips, the next long cruise was made when the Panther 25 was taken from Canvey to the Isle of Wight for the *Daily Express* Power Boat Race.

Roland Prout and his family took their holidays during this week and took the boat around to Cowes.

The week proved fine, and on the first day starting from Canvey

Island at 3 p.m. they arrived at New Haven at 8 p.m. in the evening, having stopped on route for one hour for a meal. The next day they arrived at Bembridge Isle of Wight in about 3 hours motoring. This was a completely new experience in coastal cruising, and was more like flying, certainly it was both quicker and easier to get from place to place than driving a car.

There followed some pottering from Bembridge, Isle of Wight to Poole, Swanage, and trips along the Dorset coast, before returning to Cowes on the 17th August to prepare for the Race.

The boat proved herself an ideal family motor cruiser in every respect, a severe gale had to be weathered out in the open Poole Harbour, and provided due care was taken, at no time was it necessary to have anything but a comfortable safe passage.

The race to Torquay needs no further description here as many accounts have been well publicised in the Yachting press. Sufficient is it to say that the Panther 25 started off well in what were very bad sea conditions, and at times mountainous and vicious seas. The boat was leading the outboard class at the time one hull was damaged causing a leak which forced retirement. Possibly due to inexperience on the part of the drivers and a too enthusiastic will to press on regardless. However, the damage was soon repaired and Francis and family then took over the boat to have their holiday cruise, and made an equally successful passage to Canvey Island.

To sum up, the Power cruiser cat offers some added comfort and stability in certain wave conditions, it provides a roomy living space for the same weight and length of craft. The advantages in really heavy going sea conditions are probably not so apparent. The modern American deep V power hulls offer similar riding qualities, and it is early yet to say whether this is a better hull for the open sea power boat racing or whether the double hull power boat can be made to show some advantages in these conditions.

Certainly it seems the cat may have speed, and wave riding advantages in the shorter estuary and Solent seas, but possibly the single deep V hull is better when leaping through and off the larger seas outside in the open channel when pressing to maximum speed in a race. Undoubtedly the cat has advantages in comfort, stability and dryness in either conditions when cruised with a view to giving the occupants a safe day ride.

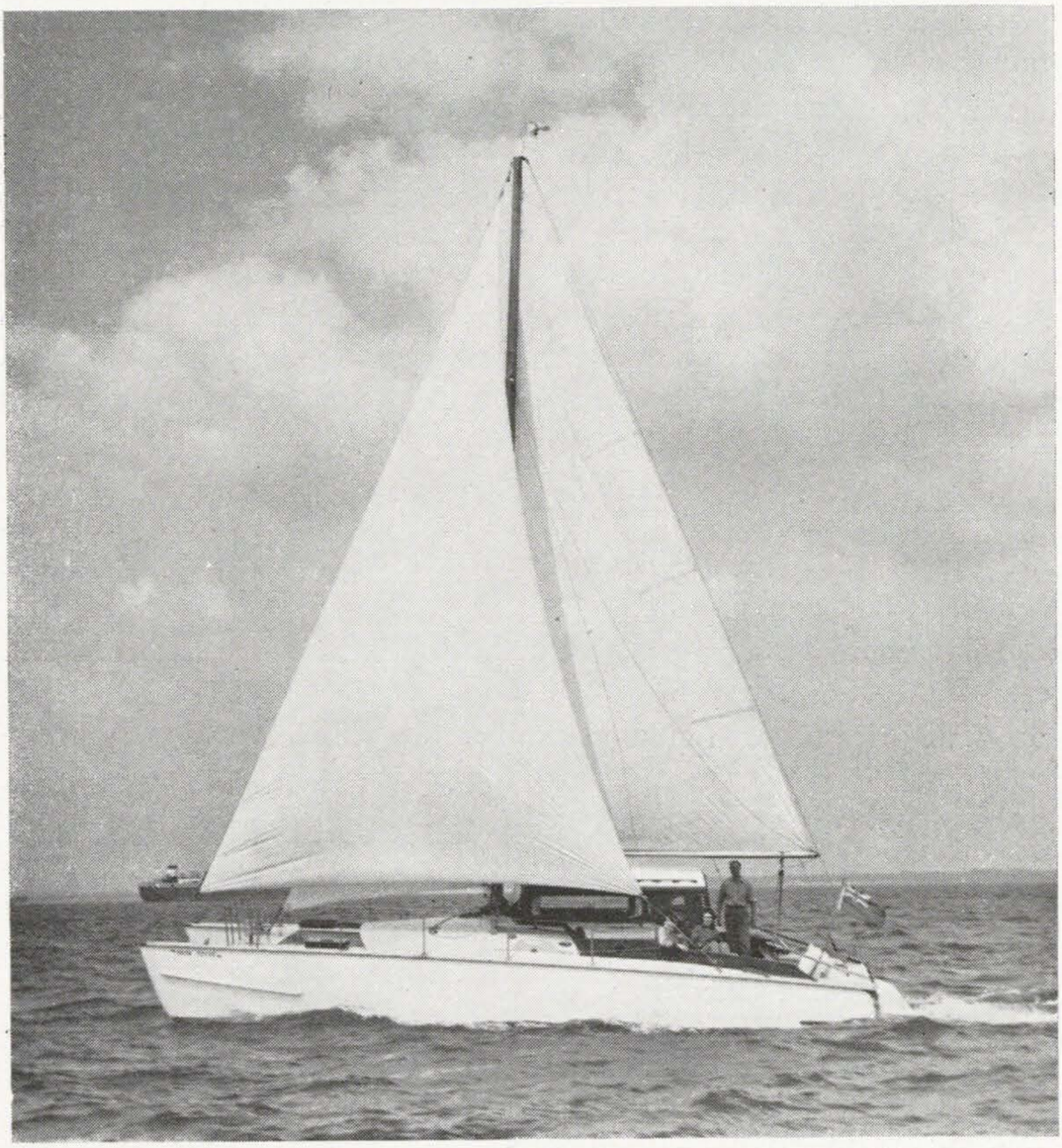
PROUT 38 FT. CRUISING CATAMARAN

G. Prout & Sons

1 The Point, Canvey Island, Essex

Hulls are moulded in six layers of mahogany, making $\frac{3}{4}$ in. hulls thickness. Hull sides above waterline, decking and cabin, are built in $\frac{3}{8}$ in. mahogany-ply. Main beams, ply with solid spruce spacing. Mast hollow spruce 39 ft. tall. Other timber, mahogany, spruce and other hardwood as required.

A double berth is situated in each of four cabins. The cabins are situated two in either hull, and there is 6 ft. headroom in each of



Snow Goose

these cabins. A door leads to a cabin on the starboard side aft where toilet and wash basin is situated.

In the centre of the craft is situated the cockpit and seating saloon. This cabin has seating for six, around a table, and commands an excellent view all around the craft while sailing.

The central cockpit is large and comfortable providing dry sheltered seating and fine visibility all round the craft. A sliding panel or window is situated over the galley cabin which leads direct to the cockpit, and can be used as a serving hatch into the cockpit.

Auxiliary power is by outboard motor, which is permanently kept in a compartment outside the cockpit, and can be lowered into the water when required. A 15 h.p. motor has been used and speed of approximately 6 knots is usual with this motor. With a Johnson 40 h.p. motor, a speed of 8 to 10 knots is obtainable. A more powerful motor could be used to give higher speeds if desired.

Drop centreboards are fitted which are easily hoisted and lowered, and provide very efficient windward sailing and manoeuvrability.

Many notable cruises and races have been achieved by our large catamarans. One has sailed from the Thames around Spain and Portugal to Corsica and Nice in the South of France, and the racing and cruising exploits of the 36 ft. catamaran *Snow Goose* are well known. Perhaps her most famous exploit was joining in the around the Island Gold Cup race when she beat nearly 300 of the best ocean racers, and came in over three minutes earlier than the 12 metre yacht *Flica* to create an all time record for round the Isle of Wight.

This craft is fitted out with all rigging and sheets. Galley is fitted with two burner Kerosene stove. Price £4,350 0s. 0d. complete, less sails.

The moulded hulls are moulded up to 7 in. above waterline and can be supplied ready for completion.

The price for each moulded hull is £180 0s. 0d.

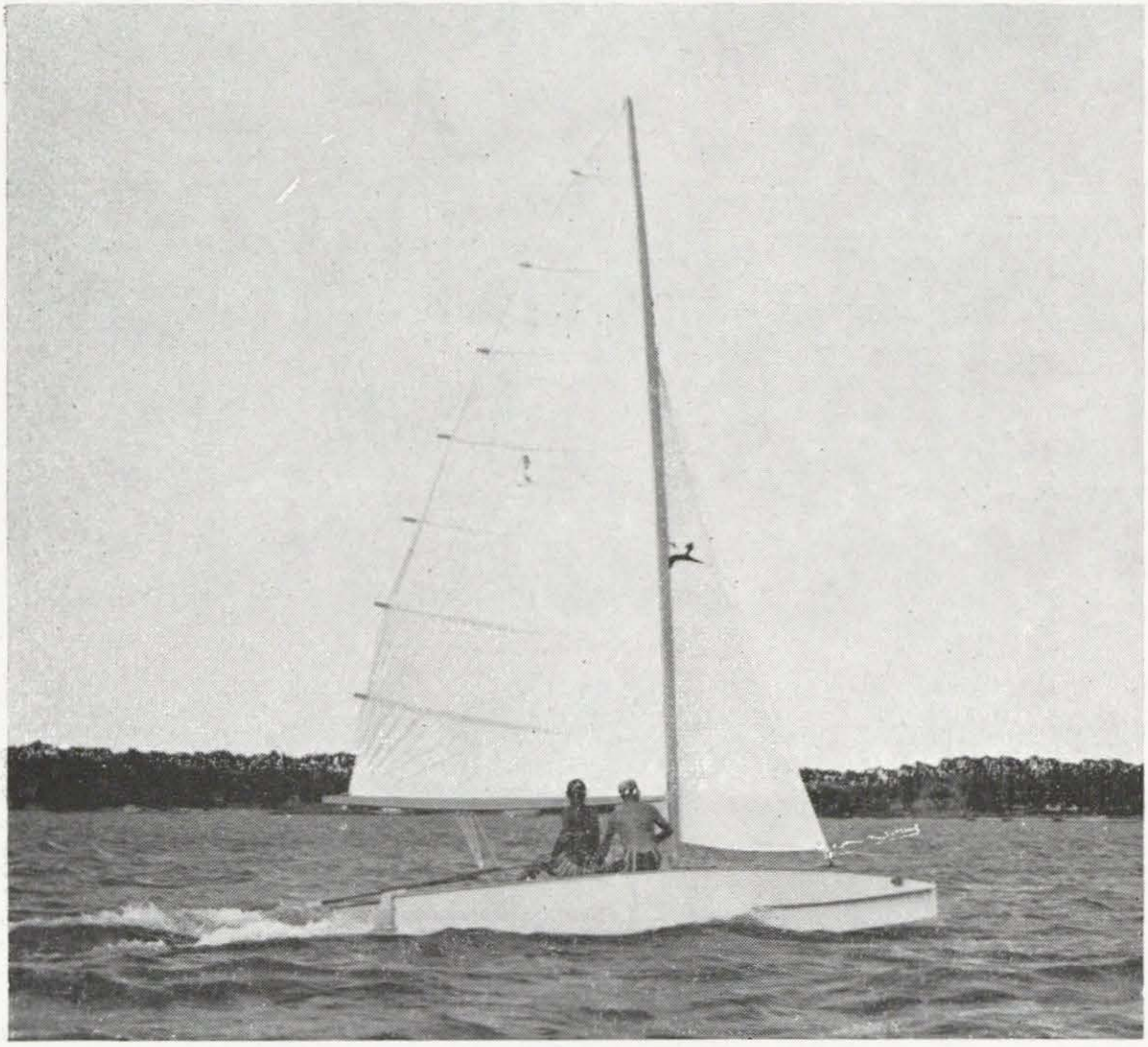
THE HELLCAT
(DALLAS, TEXAS)

L.O.A.	18 ft.	Weight	450 lbs.
Beam	7 ft. 8 ins.	Sail Area	211 sq. ft.

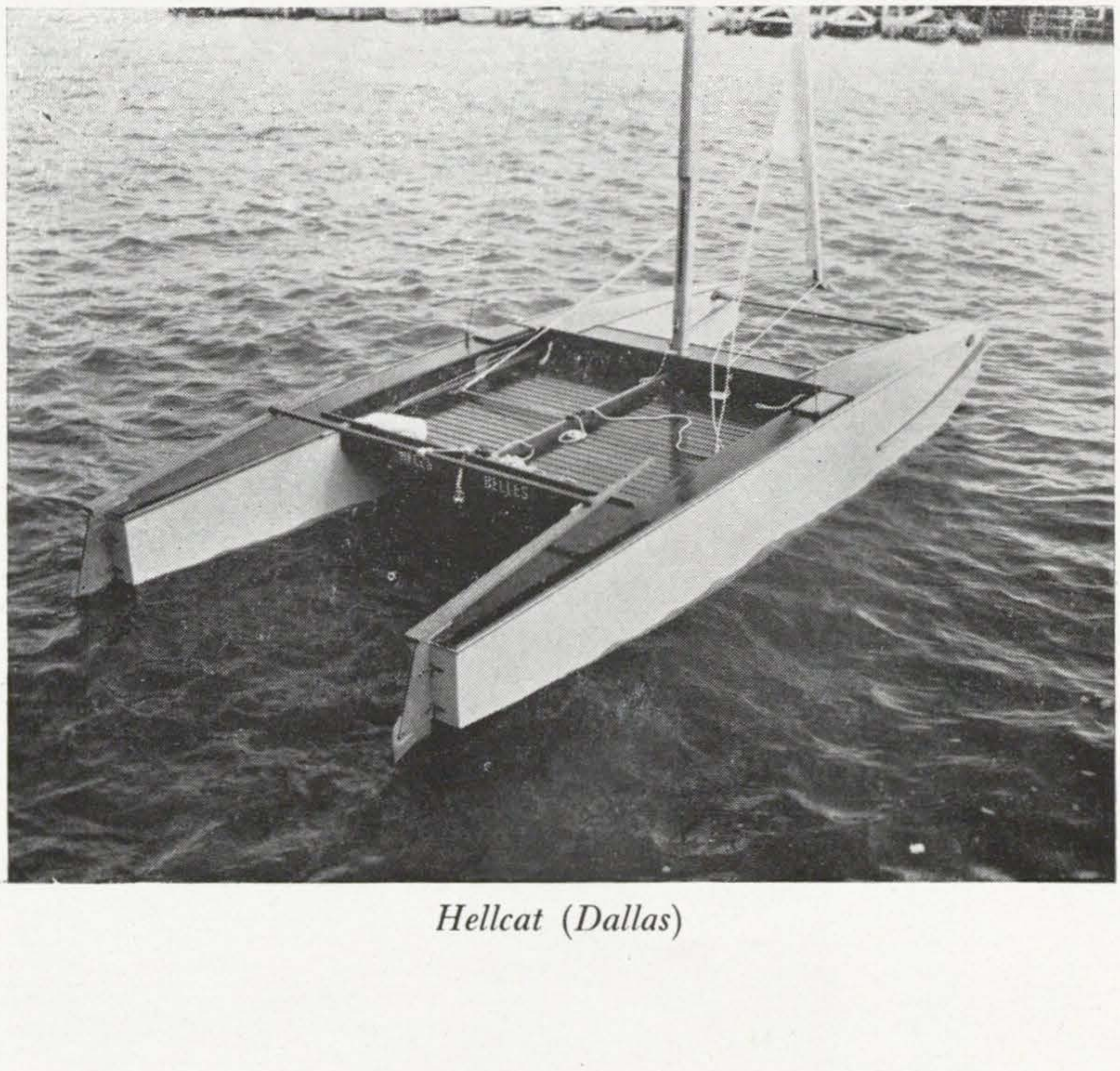
Designers and Builders: Oetking Bros., 6946, Forest Lane, Dallas, Texas.

Price: Complete, less sails: $2095.00.

This is the first catmaran with box shaped sections other than the Australian *Quickcat*, for which claims for great speeds relative to other catamarans have been made. The design of all sharpie shaped craft is very critical as regards speed, a fact which has been well known in America for very many years and it looks as if the Oetking brothers have managed to hit good proportions. The secret of this design lies in the sections each of which appears to be about half a square below the waterline or thereabouts which gives the same wetted surface as a right angled V.



Hellcat (Dallas)



Hellcat (Dallas)

In a letter from William F. Bounell, claims to speeds of 30 m.p.h. "clocked on numerous occasions" are made.

This *Hellcat* from Dallas certainly looks a nice craft above the waterline and should handle well.

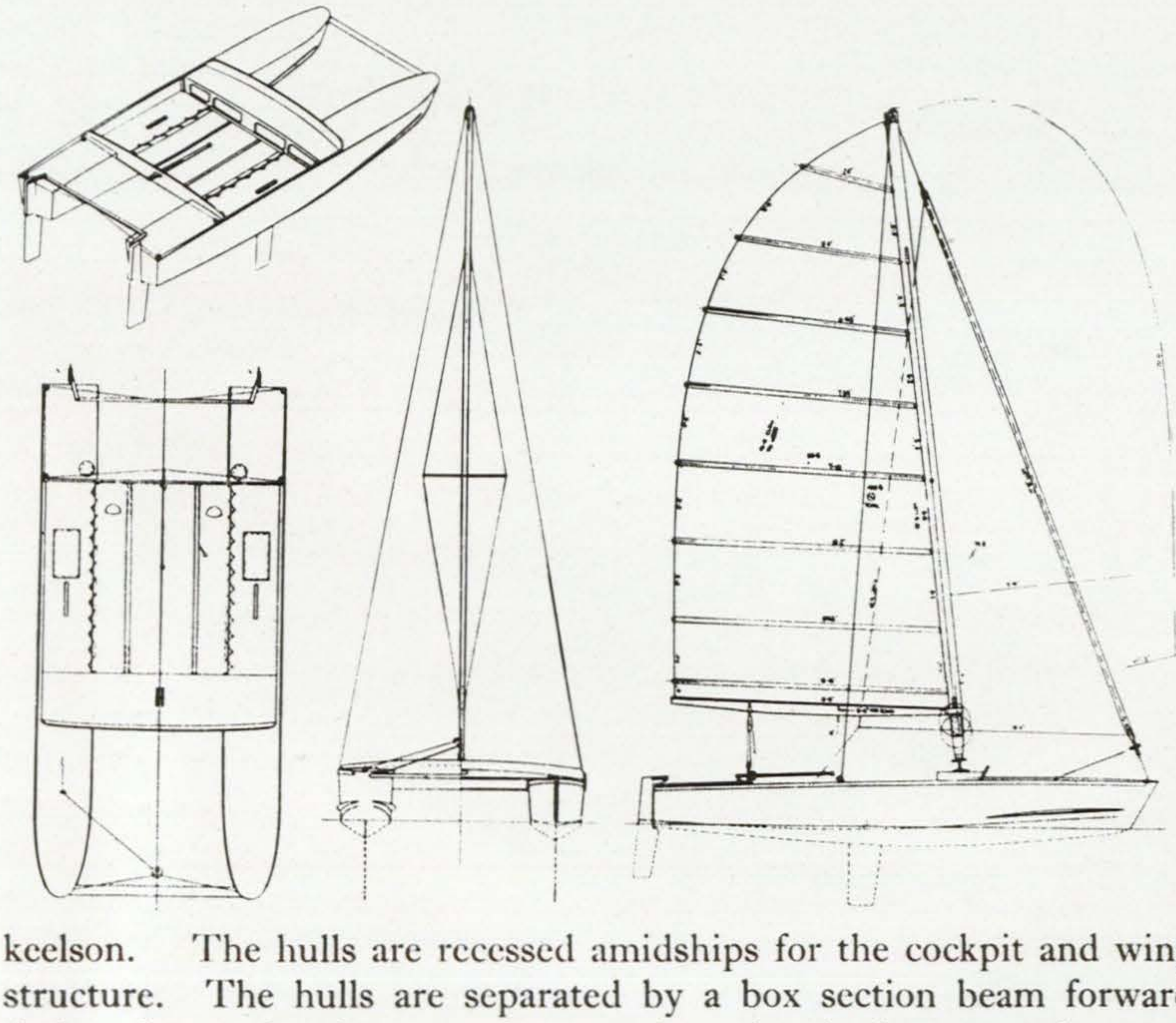
DESCRIPTION OF A 16 FT. CATAMARAN

L.O.A.	16 ft.	Beam—Hulls	1 ft. 9 in.
L.W.L.	15 ft.	Sail Area	190 sq. ft.
Beam—Extreme	8 ft.	Wt. Approx.	200 lbs.

Designer and Builder: George A. Hume, 28403 Stirrup Road, Rte. 23, San Pedro, California.

The enclosed plan shows a 16 ft. hard chined racing catamaran designed for construction in plywood.

The hulls have sharp wide-flaring sections forward, and are flattened out at the transom. Midships section is about a 90 degree "V." Construction of these hulls is extremely simple, being $\frac{1}{8}$ in. plywood laid over five bulkheads with the usual chines, clamps and



keelson. The hulls are recessed amidships for the cockpit and wing structure. The hulls are separated by a box section beam forward designed to resist the mast thrust and to absorb the torque between the hulls. It is constructed of plywood with appropriate fore-and-aft framing. All the structure is fibre-glassed.

The aft beam is similar, and is intended to absorb secondary bending due to torque, and is a built-up box section 1-$\frac{1}{2}$ inches thick. It also provides mounting for the tiller.

The center portion of the cockpit is canvas with battens sewn in to retain contour. The beams are grooved similar to a grooved mast or boom, to hold the canvas edges. Fore and aft it is laced to the hulls.

The rudders are controlled by a single tiller mounted on the aft cockpit beam. The rudders and tiller are connected with a rope and cross bar system. This eliminates the long throw required on former designs and enables the helmsman, by use of a hiking stick, to better use his weight as the situation requires.

The design of the hulls and their cross members enable the boat to be taken apart by the removal of six pins. By doing this, the entire boat may be carried car top and can be lifted up in relatively light components.

The rig is conventional. Fully battened main, furling jib, and rotating mast. The mast is mounted on a jack, and its rake can be adjusted by the height of the jack and the tension in the halyard. The mast is hollow and airfoil shaped, built from laminated spruce. The halyards are internal and are taken up by internal winches.

The center-boards and rudders are aluminium, machined to contour.

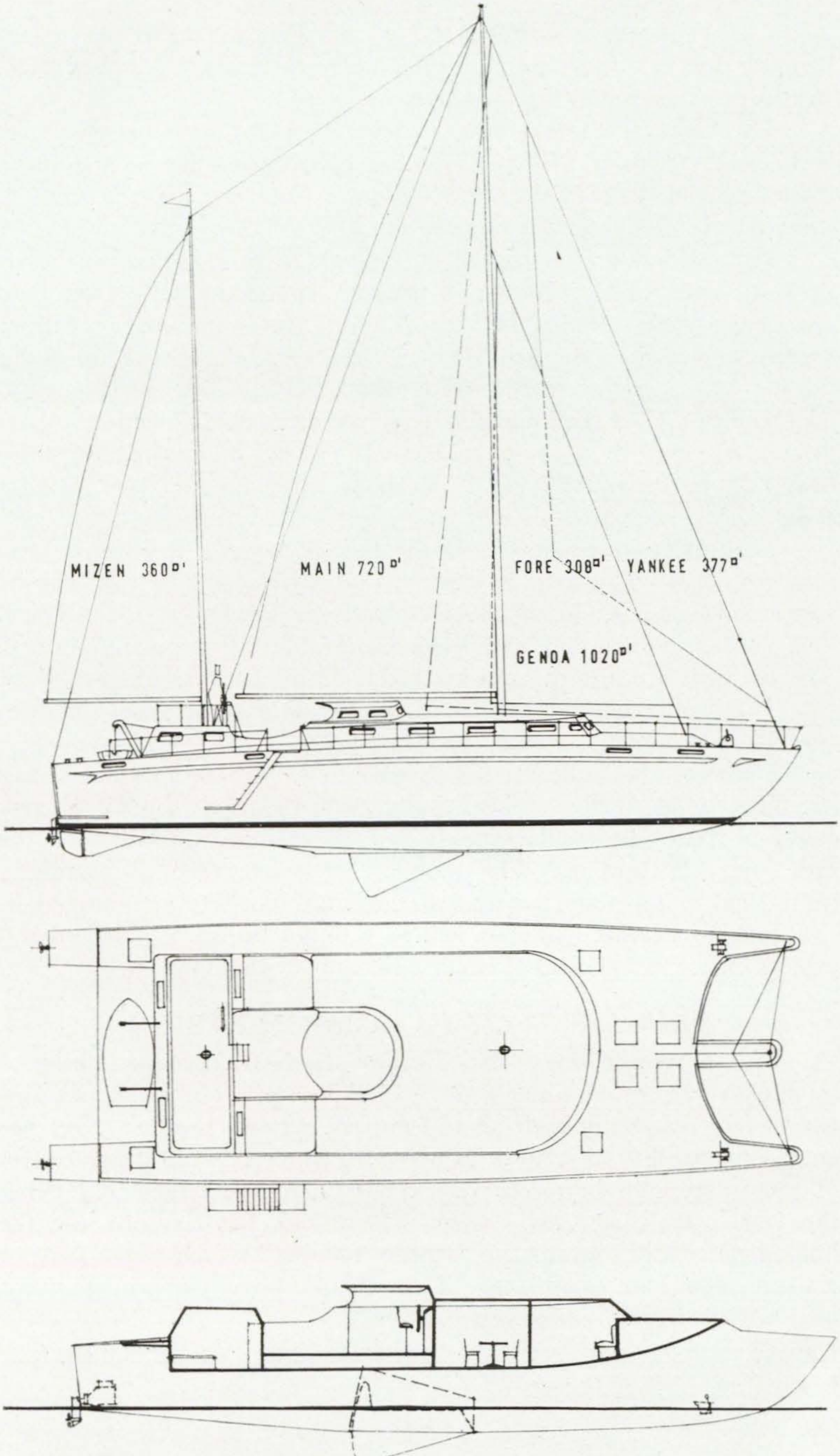
Editor : The hulls of this catamaran should be examined very carefully. The shallower keel angle than the right angled V may easily be faster and will certainly put about more quickly than the right angle V section. The parallel sided after deck is becoming more seen in the faster catamarans and has much to recommend it.

It is hoped that this craft will be brought to full racing trim and a high aspect ratio mainsail used with non-overlapping jib.

PROUT 70 FOOT CATAMARAN DESIGN

The drawings show the 70 foot catamaran being designed by the Prouts for building soon. At this size, a truly efficient and completely seaworthy craft should appear because the size gives her enormous stability in relation to her sail plan. The 2,500 square feet of sail is split up into relatively small units, the largest sail being the Genoa at 1,020 square feet. The broad, flat transom and the fine entrance will prevent the "Hobby horsing" which was a fault of Kaiser's 100 foot catamaran. This should be a truly magnificent boat with a terrific performance.

L.O.A.	70 feet	Sail area	2,500 sq. ft.
Beam	24 feet		


MIZEN 360□'
MAIN 720□'
FORE 308□'
YANKEE 377□'
GENOA 1020□'

PUSSY CAT CATAMARAN

L.O.A.	12 ft.	Sail Area	130 ft.
Beam	6 ft. 6 in.	Weight	150 lbs.

Designer: Arthur Piver.

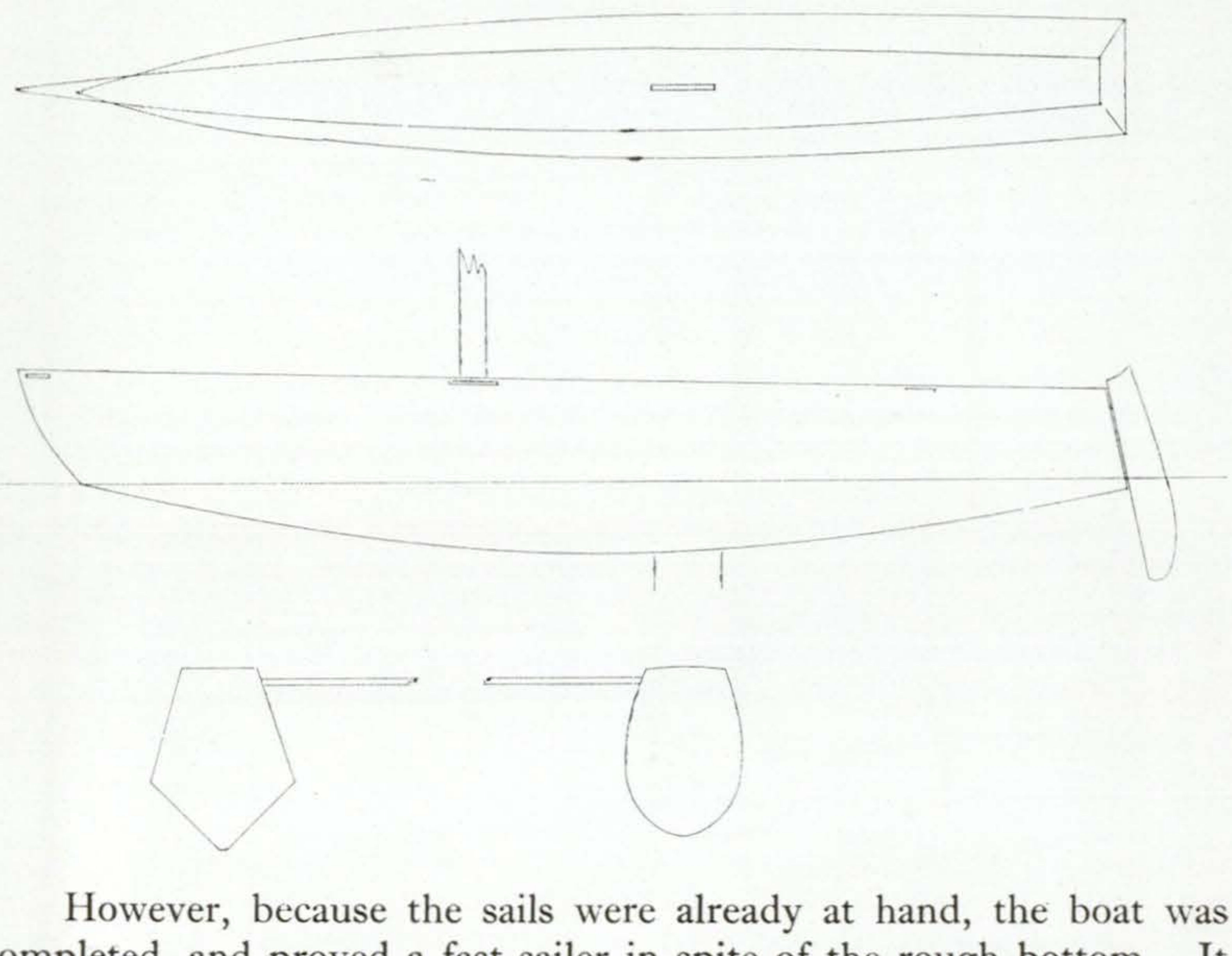
Pussy Cat

The 12 ft. *Pussy Cat* started out as an experiment in over-developed plywood—became somewhat of a nautical joke—and then caused a surprise by turning out to be a delightfully fast little boat.

The original hulls were built about six months previous, being constructed of 2 ft. lengths of $\frac{1}{8}$ in. plywood, bent easily while dry into compound curves. Keeping the pieces short in length (from shear to keel) meant that stresses opposing the compound bending would not have space in which to concentrate serious resistance to shaping.

All went well with the hulls, with but a few minor hard spots near the junction of keel and stem. They were put aside because of pressing duties with larger craft, and after a period of some months, were brought out for inspection.

They presented a discouraging sight, for the stresses which had been built in had asserted themselves, and the bottoms resembled but a slightly-eroded mountain range.



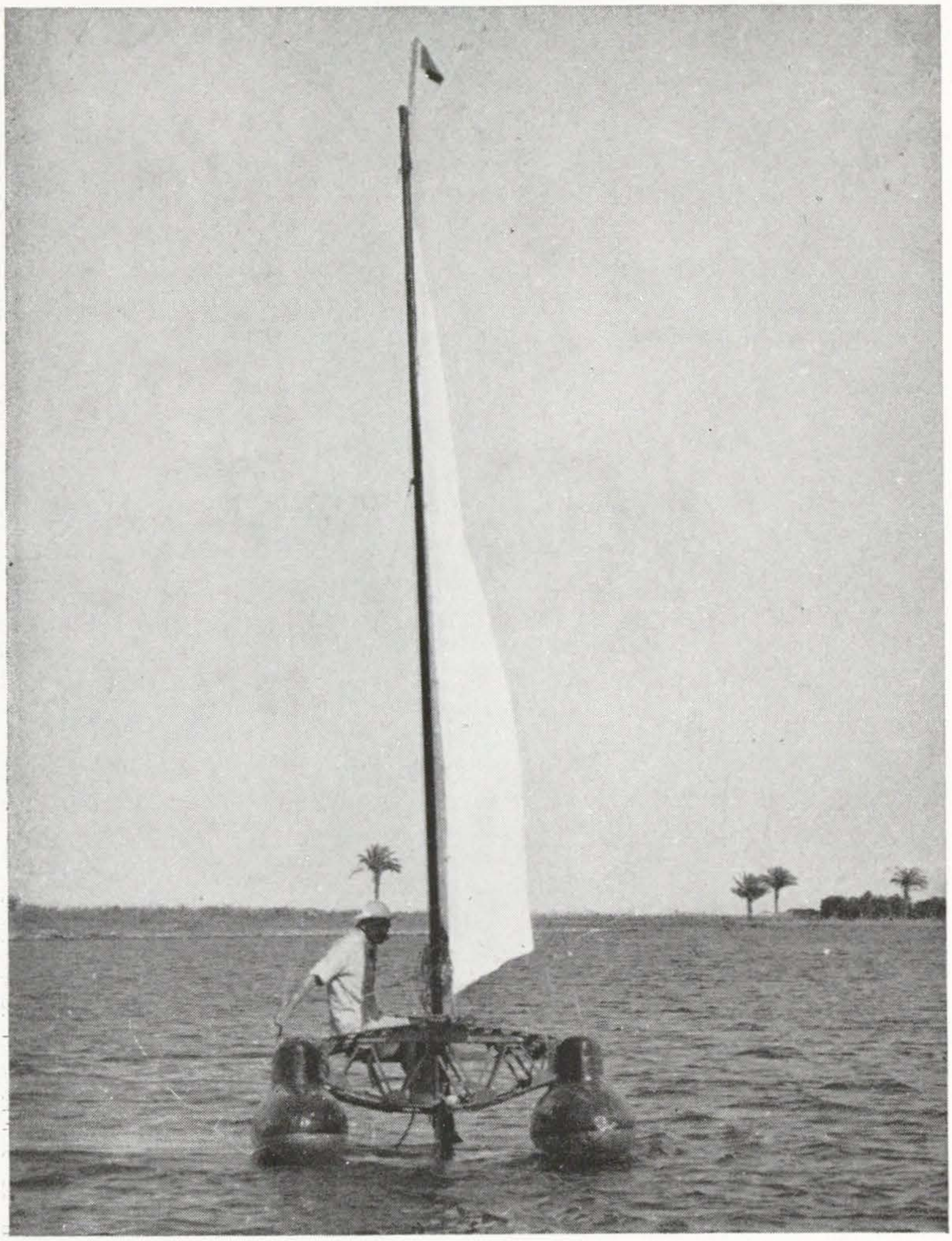
However, because the sails were already at hand, the boat was completed, and proved a fast sailer in spite of the rough bottom. It was an exhilarating feeling to have the fastest craft on a large body of water—except for the large (and expensive) racing catamarans. This was especially so because of its diminutive size and the fact that it cost (less sails) but approximately $100.

Because of the success of its performance, a fiberglas version is now being produced by a Texas manufacturer.

For the home builder, a plywood-shaped prototype is now being built. If it performs as expected, an entire series based on the lines will be offered.

Principal feature is apparently the highly developed tumble-home shape. Because the deck is usually the heaviest part of such a structure, the inward-slanting sides minimize its width.

Normal sailing lines are below the chine, so that additional buoyancy is not usually needed above. Each hull will support about 200 pounds at the chine line. Although the sides above the chines



Hi-Di-Ho

would present more wetted surface than other shapes when immersed, it is expected that the V-bottom will tend to throw spray outwards at high speeds.

The original boat performs well largely because it has a modern sail plan with a generous area. It is essentially a one-man boat, and because of its small size, is easily kept on its feet.

The sail is fully-battened with only two battens aloft and one at the boom. The upper battens are made of fiberglas fishing rod blanks, which have beautiful action—the whippy ends go close to the mast, while the stiff outer portions give support where needed. The sail is one of our forced-draft sails—without the control lines.

We now use a draft ratio of 1 in 20—having decided that fuller sails were not too successful in boating to windward.

The jib is balanced, being self-tending while tacking—a decided advantage in a one-man boat. Mast pivots.

Three solid wooden cross members are used, with a strut under the mast. Central deck is fabric.

HI-DI-HO

The photograph shows a catamaran built by Colonel Tracey, R.A. in 1950. The hulls were 12 foot long aircraft wing tanks. The W.L. was 8 feet. The hulls were connected together by scrap spring shackles from cars. The mast and sails were from a 12 foot National dinghy. There was a wooden dagger plate. She was first sailed at Lake Timsa, Suez Canal.

Wing Commander P. Henniker Heaton won the De Gaule Cup with her in 1951 and says that she was very exciting to sail. He capsized her both over the bow and stern. In spite of her small size, he could beat the *Snipes* with a wind of 10-12 m.p.h. She was, however, quite unmanageable in a strong wind and in light airs, stayed in irons.

LETTERS

Dear Sir,

A tremendous step has been taken in the San Francisco Bay area. The Multihull Racing Association of Northern California was formed on March 3rd, 1961 with a first meeting of 21 enthusiasts registered. Within the following week, we acquired 9 more members. I was elected Association Chairman after Arthur Piver had to decline the nomination because of his extensive leave this summer for Hawaii.

We have six races scheduled each month starting in May. A crash boat and a committee boat are provided for.

My latest cat, *Spindrift* is quite a sensation here. It has outsailed a *Finn*, *Star* and International 14. In two multihull races last Fall, racing against three *Frolic* trimarans, a *Shearwater III* and a *Catalina* Cat, *Spindrift* took two seconds. The *Shearwater* was leaking some in both hulls, though, so I discount a clear victory there. The *Catalina* outpaced my 14 footer except to windward. Piver was sailing one of his 16 foot *Frolics*. Wait until I get my full battened main sail!

WILLIAM M. HARRIS,
1879 Nelson Street, San Lenndro, California.

Dear Sir,

In your article "Trends in Catamaran Design" in A.Y.R.S. publication No. 35, you wrote "One must feel therefore that the empirical fact that the deep asymmetrically hulled catamarans are faster than *Dreamer* on all courses is due to the deepness of the hulls, their lighter weight, extra sail area or better handling, rather than their asymmetry."

This seems logical from the arguments you gave about resistance. However, it strikes me that you may have overlooked the influence of wave pattern. Bow waves that dissipate in the sea represent plain loss of energy, but the bow waves that stream between the hulls can pass between the hulls at the minimum interhull distance and press against the opposite hull on the inner side near the transom. A rise in water level at this point will drive the craft forward and represents a recovery of wave energy. If this theory is correct and, as the bow wave angle is $19\frac{1}{2}°$ (if my memory serves me correctly) then greatest bow wave recovery of energy will be obtained when this bow wave angle, drawn from the stem, intersects the other hull about half way between the broadest section and the stern.

I am too lazy to try this one out, but I mention it in case anyone has the incentive and facilities to prove or disprove the theory.

SQN. LDR. A. E. M. BARTON.
R.A.F. Officers Mess, Manby, Nr. Louth, Lincs.

Ed. Julian Allen has sent me these letters which may interest readers.

Dear Mr. Allen,

Your article on low buoyancy catamarans in A.Y.R.S. No. 35 was most interesting. I would like to know more about your plans and the tests of your boats.

Perhaps you might find some of my thoughts on new designs of Cats of interest. After seeing your article, I feel we are both after the same thing on slightly different paths. The general design I have in mind is as shown in the sketch of Fig. 1.

The value of the main hull being fully under water is that a given amount of lift can be provided in that way with a minimum of surface and wave resistance. The side hulls are, of course, needed to add some stability, though, when well sailed, they would only touch the surface of the water. (Perhaps they will be three surface hulls placed where the runners of an ice boat are). If the boat and

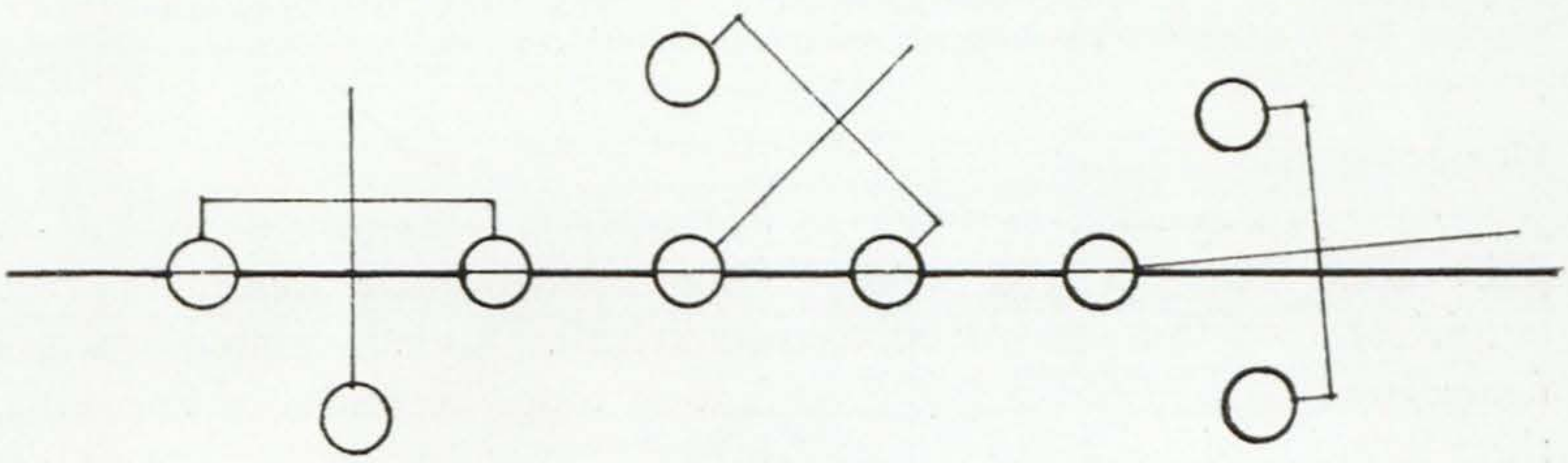
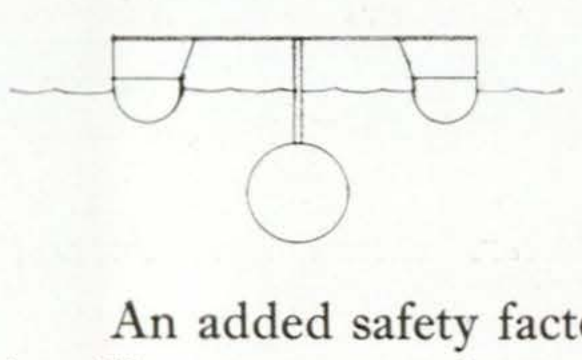


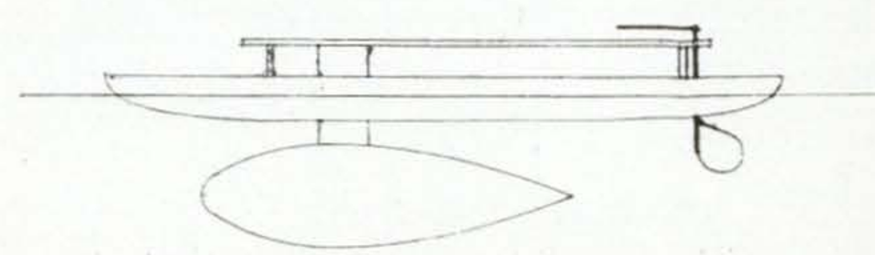
Fig. 1. *Fig*. 2. *Fig*. 3.

crew came to 400 lbs., perhaps 300 lbs. of lift would be in the main hull, thus requiring the side hulls to take only 100 lbs.

The main hull could be provided with a chamber which can be flooded when the crew weight is less or when they leave the boat. It could be blown out with air to get proper balance. A quick opening valve on the air line could quickly fill the main hull area and give a quick increase in stability if needed.

The side hulls can be made with small surplus buoyancy or with considerable surplus, which may be needed for fore and aft stability. With small excess buoyancy, the boat cannot capsize as in the Fig. 2. With large side hulls, there is considerable protection from capsize and the craft can be made free from capsize by the water weight in the main hulls as in Fig. 3.





An added safety factor is that if the crew should fall off the boat, it will go over—perhaps a nice feature when alone some miles out.

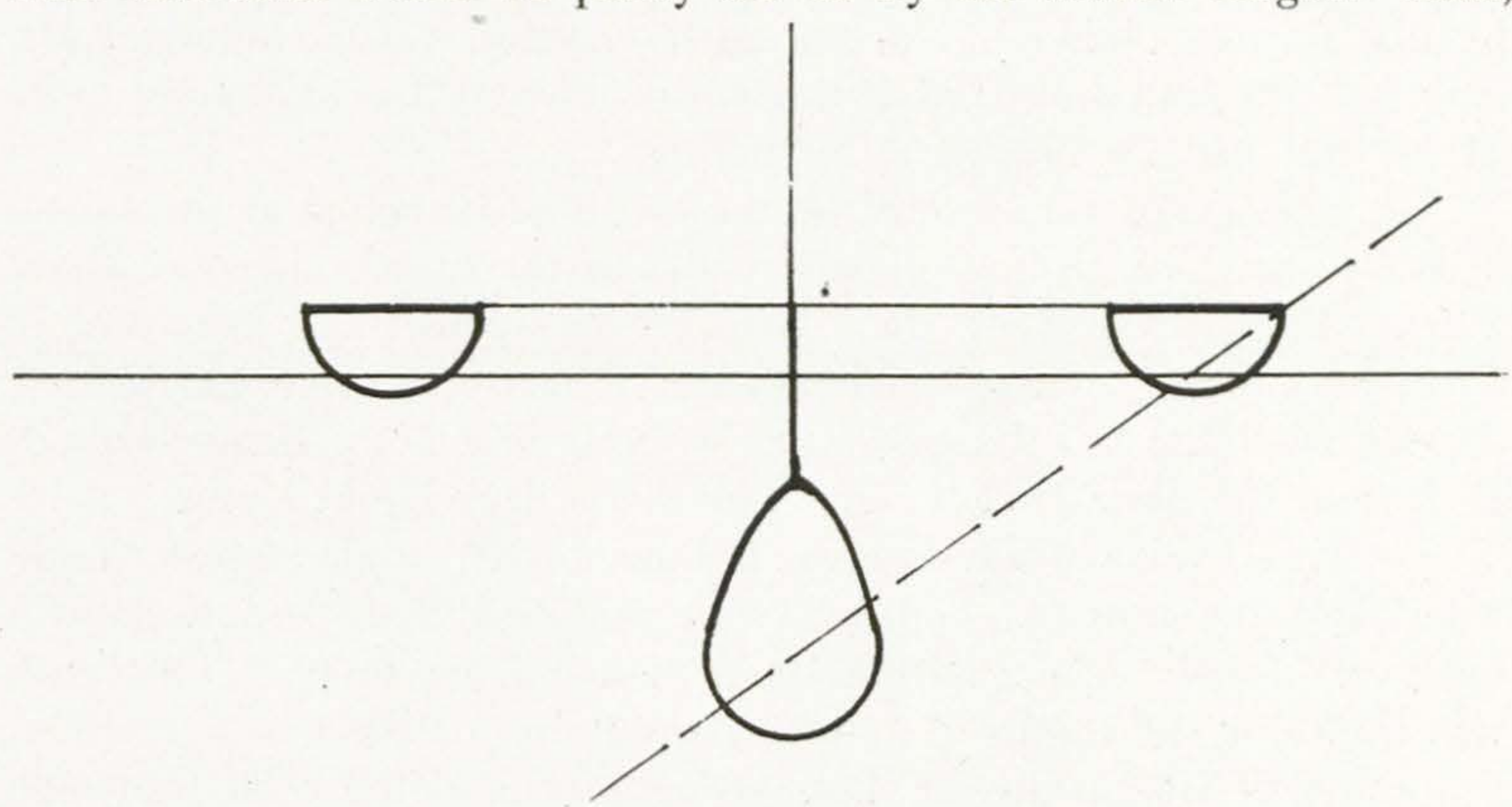
The main hull may be made to lift when the boat is taken to a beach or the crew wants to get off.

I hope you will keep me informed of your work and that of any others working in this field. I'll let you know how my ideas seem when I have a boat of this design next summer.

R. Clark DuBois,
406 Meadowbrook Road, Fairfield, Connecticut.

Dear Mr. DuBois,

Your idea is most interesting. A lot of us have hankered after the torpedo idea. In order to ease going about and to add useful lateral resistance, how would it be to use a pear section? The added skin resistance would be partly set off by the shorter length. Also,



the thin topside could be brought nearer to the surface without causing noticeable waves and so be happier on the beach.

Your idea of water ballasting the main float and increase the buoyancy of the side ones seems to work but seems a step in the wrong direction by adding weight.

JULIAN ALLEN.

Dear Sir,

THE FIJIAN BOATS

Regarding an article on the King's elegant yacht, I'm afraid I shall have to disallusion you. The unofficial King, Ratu George Cakobau, and most other Fijians now use a simple form of "flattie" (locally termed punt) for river and coastal work. These boats have a length of 8 to 10 beams, ranging from 20 to 30 feet and are of extremely simple construction. The bottom is cut from 2 planks with a batten keel covering the seam on the centreline. The sides consist of 2 12 x 1s each side and are held in shape with simple frames and thwarts. The bow is very sharp and also the stern even though it has a narrow transom to take the inevitable outboard. They are usually powered by Johnsons of 10 to 18 h.p. and make up to 12 m.p.h. While not handsome they are actually quite efficient craft considering their low cost, shallow draft, speed, and they carry a good load in smooth water. They are usually built of imported Douglas Fir because local timbers (most of which are better) are not easily obtainable in long lengths.

So far as I have been able to find out, there are no large sailing canoes left with the exception of one recently launched. There are still a number of small canoes up to 24 ft. long but I have never seen one under sail in Fiji. They are rather crude affairs compared to the canoes of French Oceania, Cook Islands and particularly Samoa. The bottom is formed of a single hollow log and the freeboard is raised by one or two planks. The outrigger is solid, usually about $\frac{2}{3}$ the length of the hull and fixed at a beam of about $\frac{1}{3}$ L. They are quite heavy and usually propelled by poling.

A large canoe was recently completed and launched at the Island of Lakemba, Lau group. I believe this is the first built since about 1910. This canoe is of the "Drua" type—something between an outrigger and a catamaran. The main hull measures about 44 x 3-6 x 6 depth (not draft) and the other hull is about 34 x 2-6. Beam is about 18 ft. and the deck 24 ft. long. There is a deck house about 8 x 10. The lower portions of the hulls are hollowed from single logs of "Vesi" wood and the topsides built up with planks and decked over with hatches. I believe a traditional sail plan will be fitted. This craft was built for the minister to travel about his parish which includes a number of islands in the Lau group. It is sailed with the small hull always to windward like an outrigger.

PAUL A. BLACKFORD,
150 Blaine St., Riverside, California.

Dear Sir,

Encouraged by your letter of January 27th, I went ahead with my plans of a cruising catamaran, which was concretised in a 1/10 scale model, whose enclosed photographs gives a better idea than many pages of description.

Basically the main dimensions are as follows :

L.O.A. 33.42 ft.	Beam total 16.70 ft.
L.W.L. 27.97 ft.	Beam hull 4.10 at wl.
Draft 2 ft. c.b. up.	Displacement 11,000 pounds

Sails—Ketch rigged—100 per cent fore triang 722 sq. ft.

Hulls—symmetrical, round.

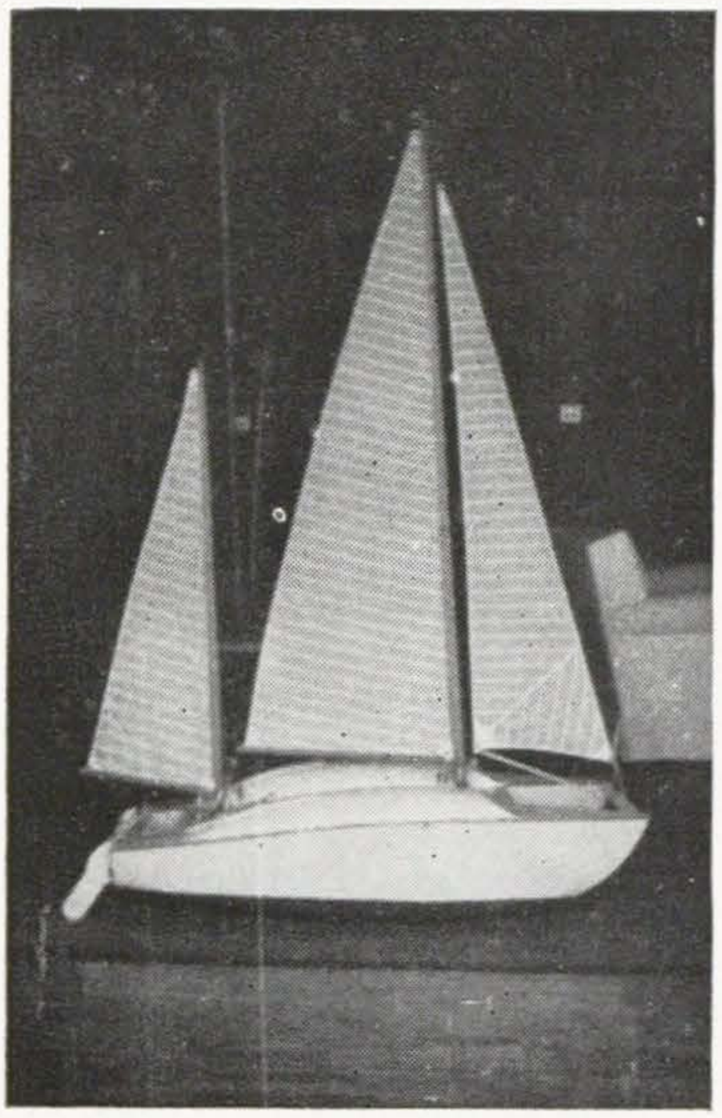
This project has been carried out having in mind the prevailing conditions of the weather around Rio de Janeiro, where the thermometer *never* drops below 60°F.!

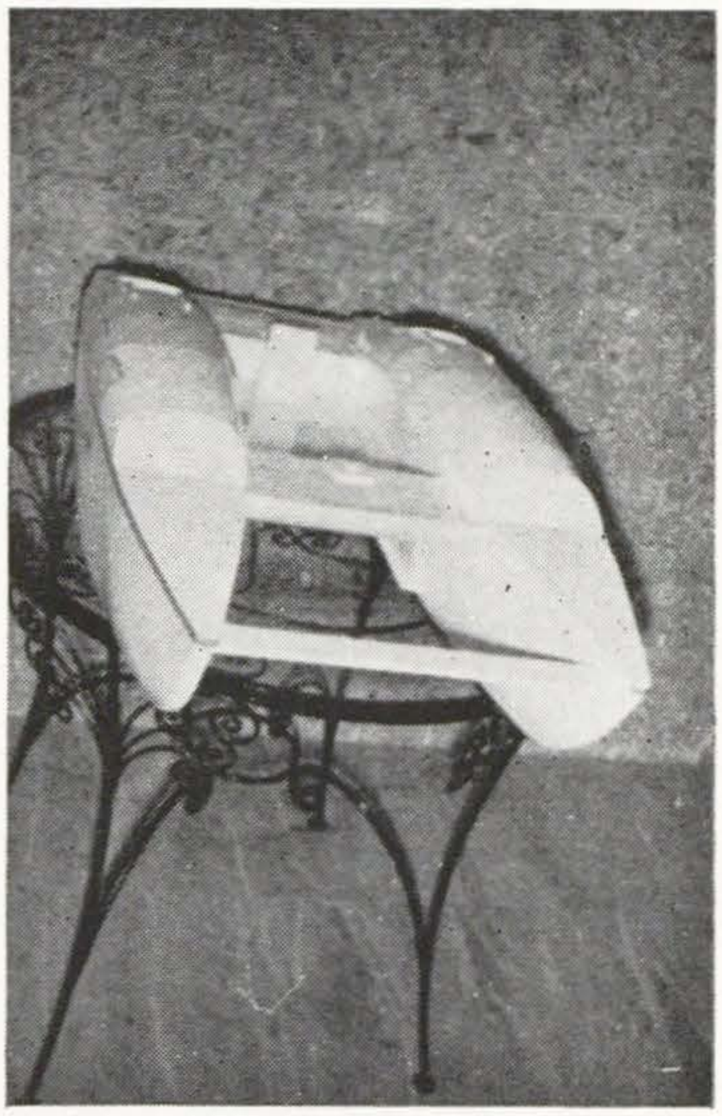
We have a large bay in the port of Rio, with some 120 sq. miles of sheltered waters, of which, some 50 per cent has less than 3 ft. deep. Outside of the bay we find some islands in the ocean and nearby bay of Angra dos Reis, 5 times bigger than Rio's bay, and dotted by an outstanding number of semi-tropical islands, most of them inhabited.

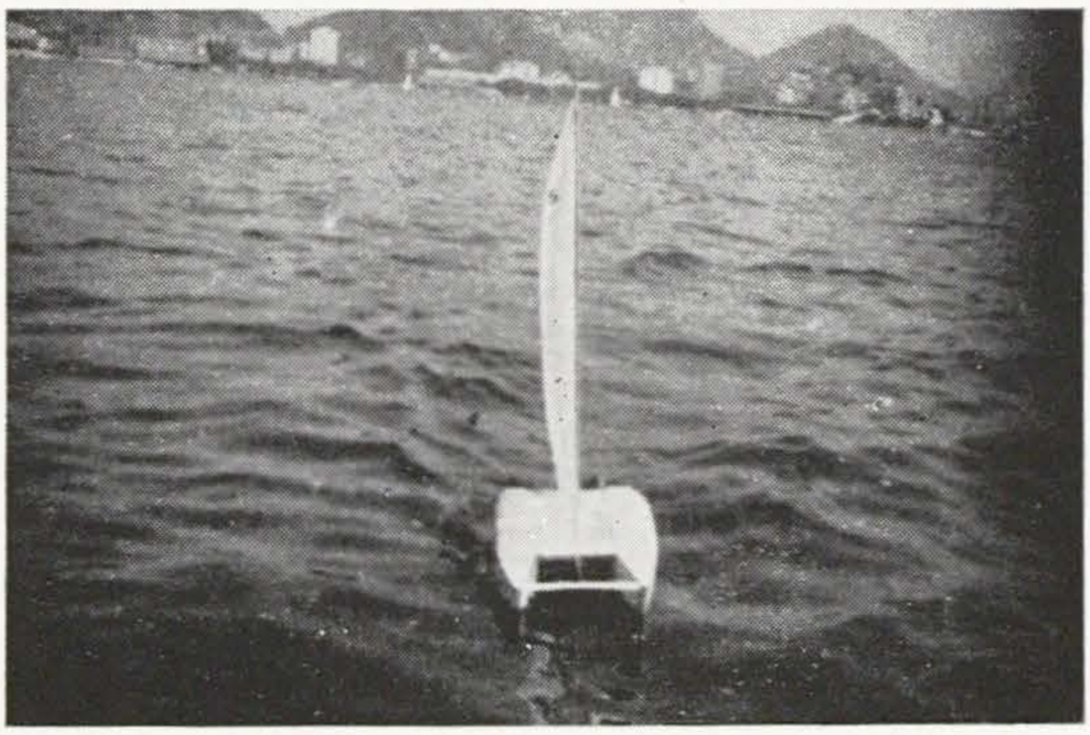
The sea is normally calm around Rio, but on occasions it may grow waves up to 10 ft. The wind never reaches more than 50 knots.

With the experience obtained in the operation of my present boat, a 30 ft. auxiliary sloop by F. Crosby—I have emphasized the deck area, which is the most used in our hot climate. Also I had in view the possibility of taking along some 20 people for pic-nics on the boat, and at the same time, be possible to crew it alone if necessary.

With those items for reference, I started to make the project,







and from the beginning, I have skipped the orthodox catamaran construction of building the cabin on the "wing."

In my case, I have used all the "wing" for deck space, which turned out to be 13.5 x 6.75 ft. exclusive of the upper surface of the main beams and of the fore and aft fairing.

The cabins being located in the hulls, imposed the increase of the individual beam of those said hulls, whose maximum value is 4.8 ft. at the sheer, reducing to 4.1 ft. at the WL. The available head room exceeds 7 ft. all the way.

To economise the available area inside the hulls, the center-boards were located in the outside of the hulls, being so positioned that, when all up it is completely out of the water. This is important here, since 3 months of exposure to the sea water is enough to show a big colony of barnacles. The same applies to the rudders.

The linking of the hulls is made by two main beams, dimentioned as indicated in Mr. P. R. Bruneau—Le catamaran, ce méconnu. The factor of safety involved was of the order of 3 in the worst condition. The 2 secondary beams were not taken into consideration in the figuring of the rigidity of the boat.

The main beams are to be made box like, with planks of 1 x 20 in. The ultimate flexural resistance of those beams is 60 metric tons.

Those beams are to be fixed on the hulls through 2 heavy bulkheads—for each beam—where it will be screwed and glued. The hulls shall have moulded frames—steam bent—spaced 18 in. The planking proper shall be made in two ; each one crossed with the other at 45° and properly glued between themselves. The finished planking will be $\frac{3}{4}$ in.

The rigging was calculated as per H. I. Chapelle—Yacht design and planning—and all wire has at least a factor of safety of 3.

Once I had finished the model, it was put on the water—and to my joy, the drawn WL coincided with the real one?

A small dynamometer was built, and with its help the stability curve of the model was determined. It showed a maximum at 10° with some 652,400 ft. pound torque. This position coincided with the lifting of the weather hull from the water. At 80° inclination it showed *zero* torque.

Towing the model behind my present boat, and applying the proper conversion factors, I have obtained :

Speed knots	Useful HP	Wind velocity knots for useful HP with 722 sq. ft.
12.94	33.5	20
19.68	70.5	23.5
21.90	87.45	24.7
23.44	121.8	28.2
23.0	128.5	28.65
22.0	100.05	26.00

Those figures permit me to estimate a maximum speed of some

20-23 knots on sails and around 12 knots with a 55 HP Mercedes Benz diesel motor. Those figures are in fair agreement with those given by R. B. Harris in Modern sailing catamarans.

Having the model outfitted with sails, it was released in the water in a morning with a wind around 7 to 10 knots, and wavelets of some 4 inches. On this sea—almost a mild tempest for the real catamaran—the model was able to maintain a steady course within 45° to the real wind direction, with a guessed speed of 4 to 6 knots (12 to 18 knots approximately at full size!)

With the rudders put at 10°, the model made circles within a diameter of less than 10 times its own length, without becoming in irons, in spite of the conditions of the "sea."

At no time has a wave struck the lower part of the "wing," even when going against waves higher than the beam of the boat, created by passing motor launches. The clearance of the "wing" from the WL at the bow is 4 ft. and reduces to 2,69 aft. The model has shown no tendency to bury the lee hull, and the area of the rudders and centerboards was more than sufficient to maintain a steady course, even with no one on board.

The results obtained with the model has encouraged me enough to advertise for selling my present boat and start looking for some one to build my catamaran.

However, I shall be very much more confident after I receive your criticism to this letter.

Incidentally, if you consider worthwhile to divulge some of my original ideas incorporated in my project, you are most welcome.

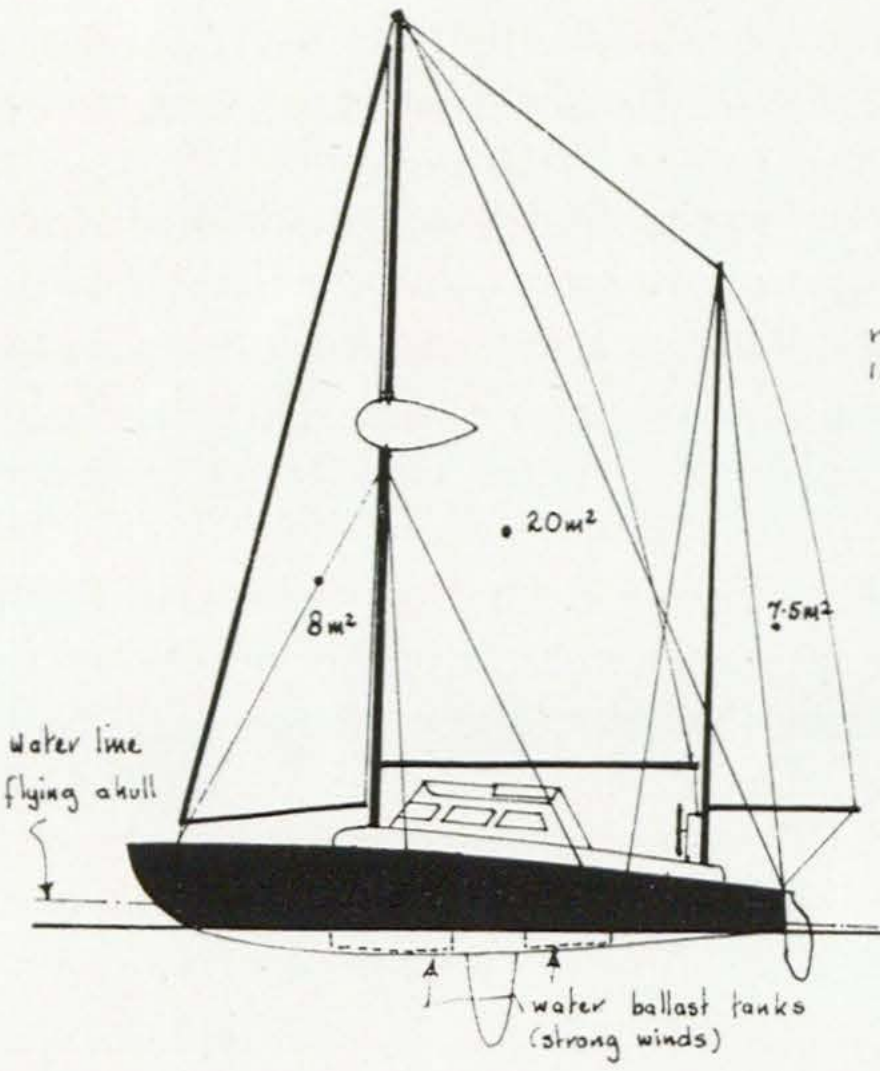
ANTONIO PORTELLA NETO,
Av. Vieira Souto 408, Ipanema, Rio de Janeiro, Brasil.

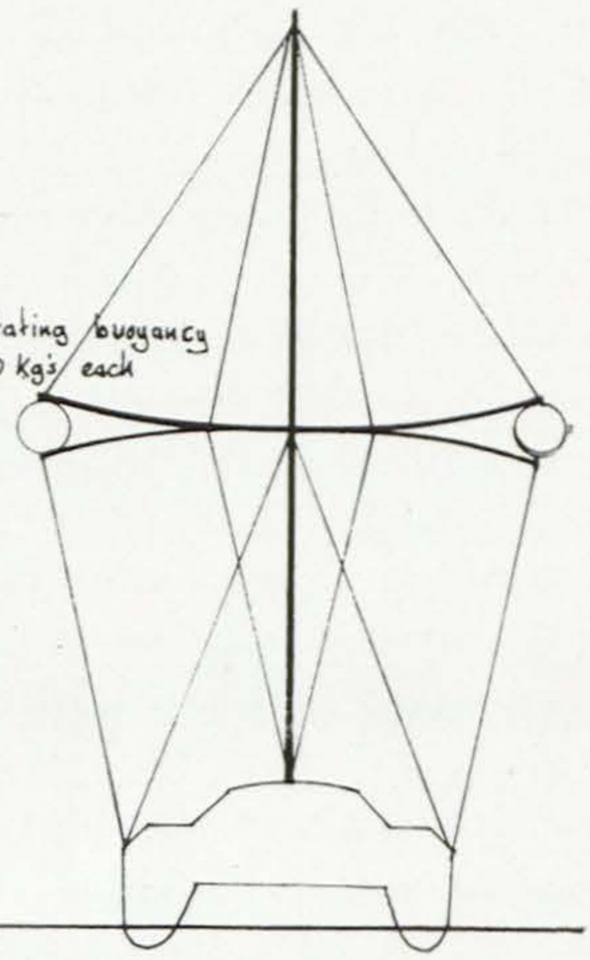
A POLISH CRUISING CATAMARAN DESIGN

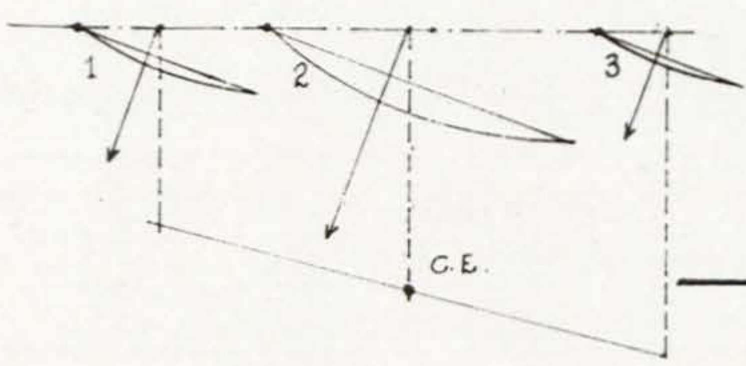
Recently, there has been considerable interest in the A.Y.R.S. in Poland. They also seem to be designing and building some fine yachts, though information is scarce.

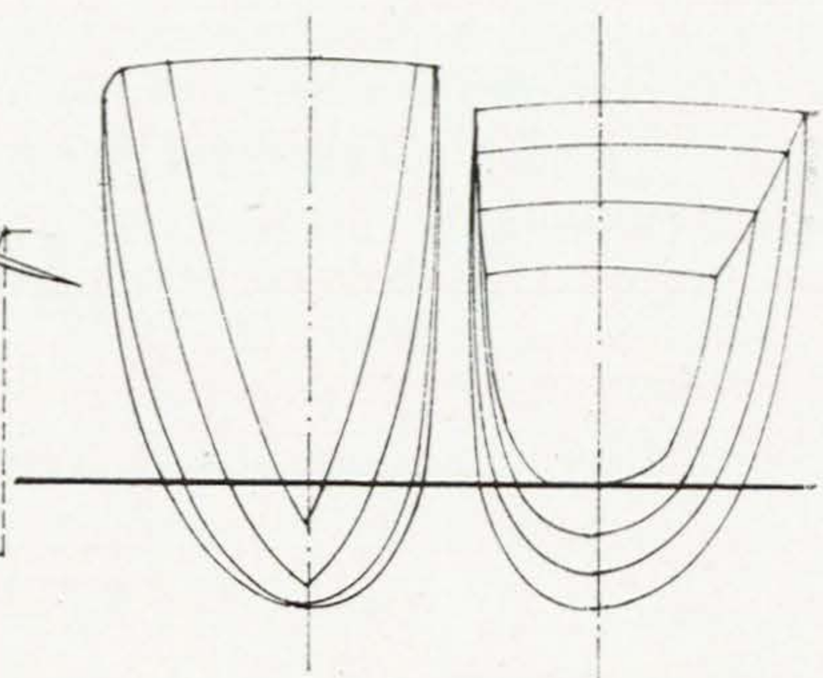
Wladyslaw Koziorowski has sent me this design for a 26 foot catamaran which looks very pleasant. The two main features which call for comment is the very small amount of asymmetry on a very fast and seakindly hull shape and the buoyant floats at the ends of the cross trees. The main dimensions are as follows :

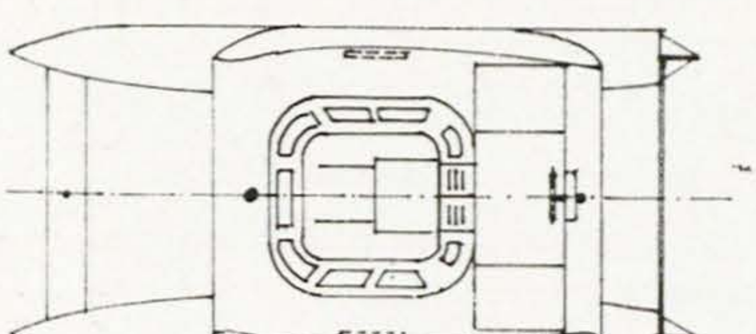
L.O.A.	26 ft. 3 ins.	Displacement	2200 lbs.
L.W.L.	23 ft. 7 ins.	Sail Area	382 sq. ft.
Beam	13 ft. 1 in.		











Dear Sir,

In publication No. 36 you make a reference to where some readers will take the inference that I hold the opposite view to Prior on the ideal aspect ratio for hydrofoils. I do not hold a contrary attitude and I would like to correct any misapprehension.

Between 1954 and 1957 I carried out many sailing experiments afloat with high aspect hydrofoils and also enjoyed the momentary thrill of being lifted up by the foils in so called flying. However, as a practical designer I then had to make the decision whether to perfect a stock design for a "Water-Skater" sailing hydrofoil, which experience indicated could only be airborne for something like half of one per cent of a sailing season in average weather and venue. Consequently, I preferred to develop the "Trifoil" which is usable 95 per cent of the time in similar conditions.

Handicapped—in all but the exceptional right conditions—the high aspect and deep draught hydrofoil is completely a lame duck in ordinary sailing, whereas my low aspect hydrofoil boat takes everything expected of it entirely in its stride. Including taking the ground twice daily, for about 1,000 times now without the slightest adjustment. Besides its high speed this boat has the deep well comfort of the traditional yacht. A glance at pages 32 and 36 of No. 36 plainly illustrates the comparative accommodation and practicability.

ERICK J. MANNERS, 93 Ridgeway, Westcliff-on-Sea, Essex.

THE 180° CATAMARAN CAPSIZE

BY V. E. NEEDHAM

69, Gertrude Rd., West Bridgford, Nottingham

The following method for righting a catamaran from the 180° capsize is mainly applicable to cruising catamarans. It is suggested

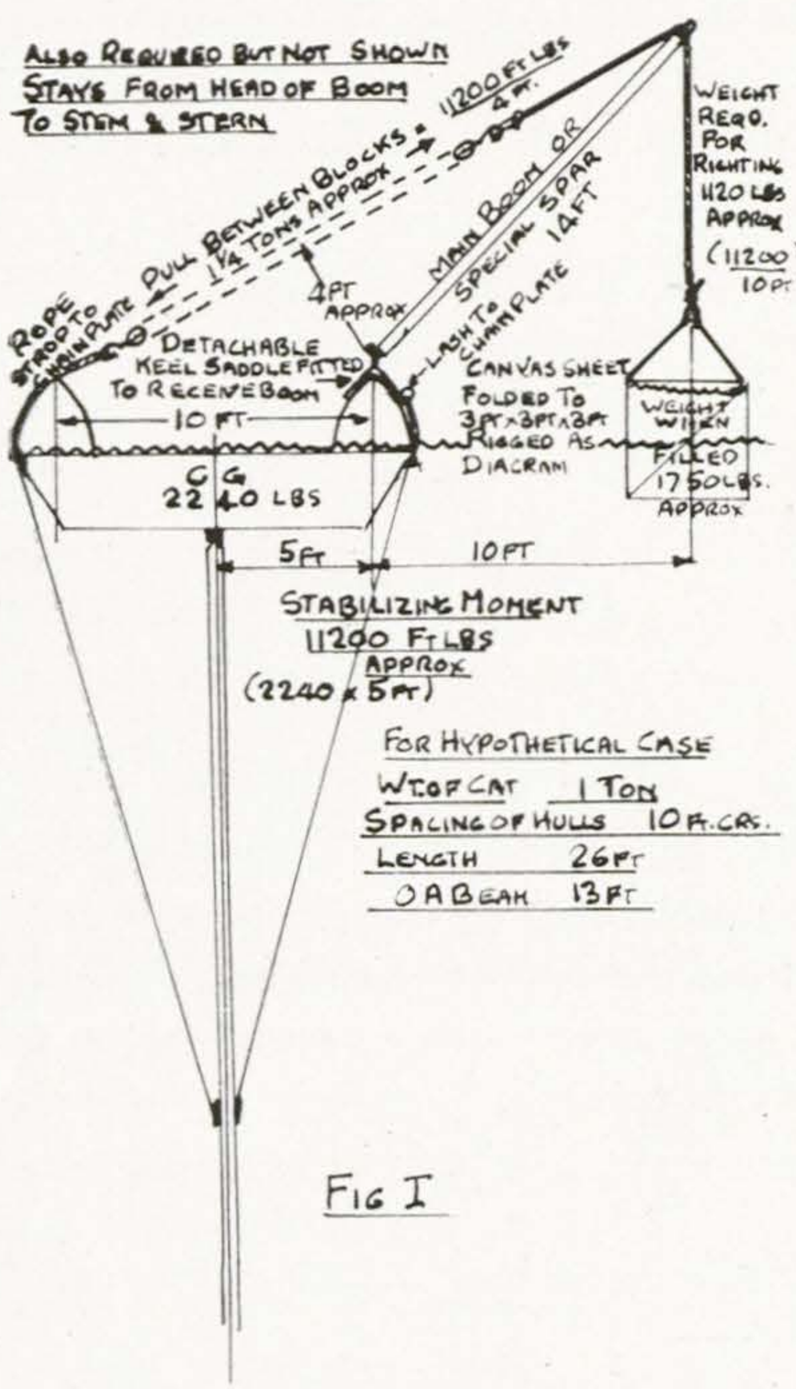


Fig I

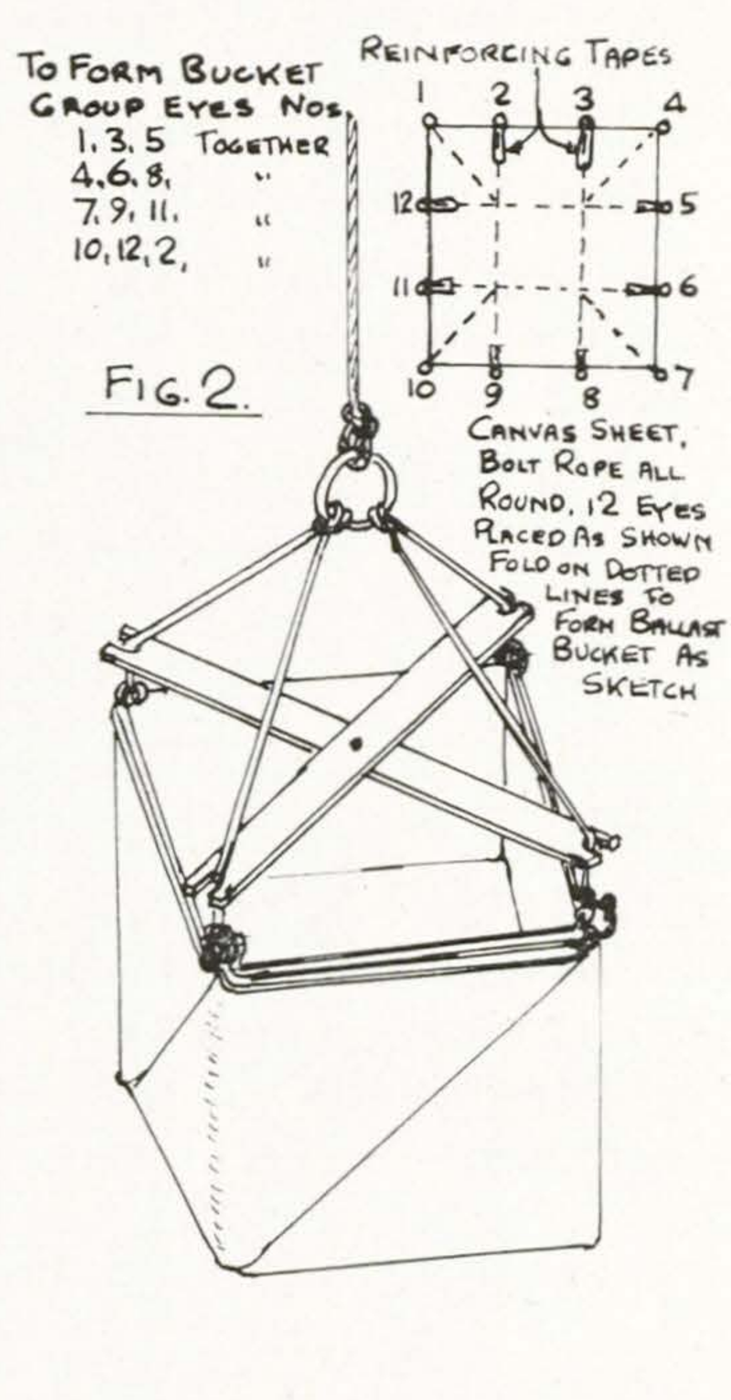


Fig. 2.

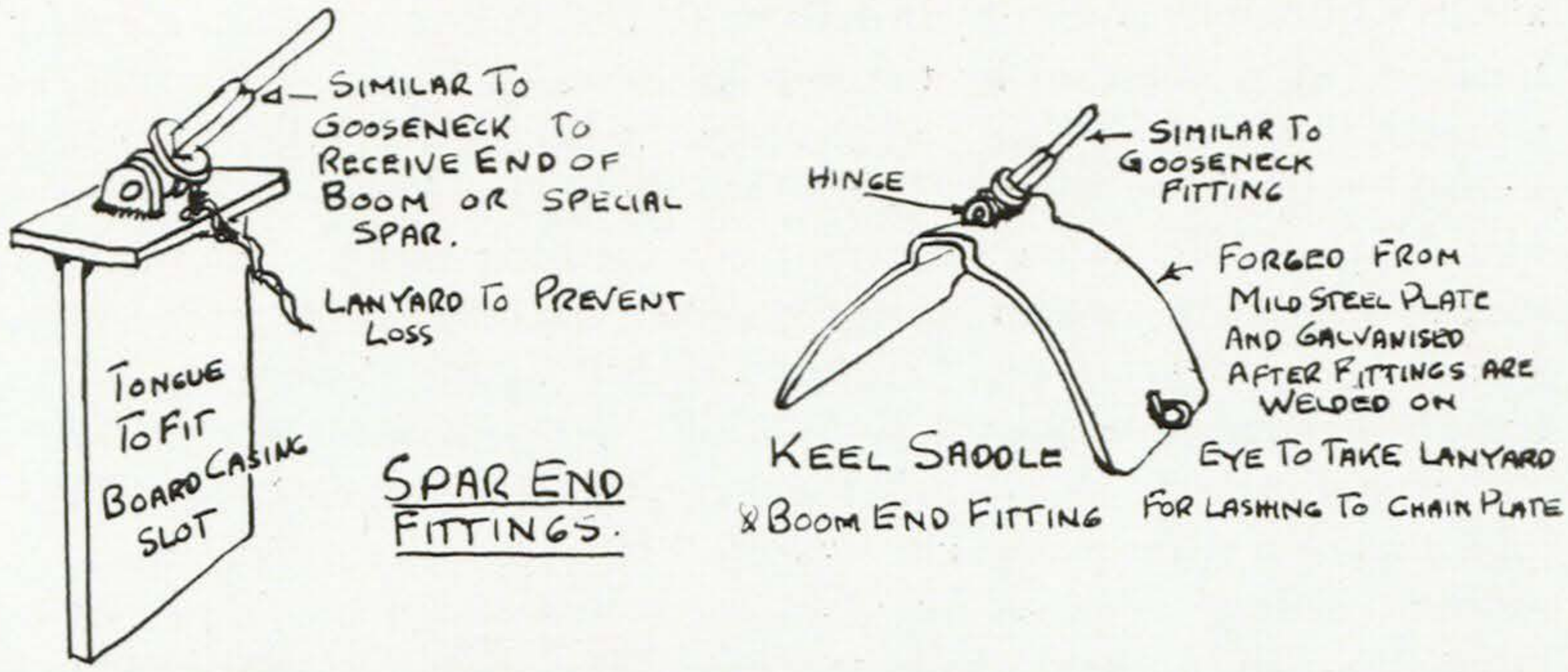


FIG. 3.

not as an easy way but as a possible one if the proper preparation is made.

Equipment required. See Figs. 1, 2 and 3.

Blocks and Tackle. Multisheave blocks could be used but a good lever operated chain block of the "Silvester" or "Yale" type would be much more practical. An indication of the strains imposed on gear is given in Fig. 1.

Spar (*to be used as a derrick*). The main boom could probably be used in this capacity and has been accommodated in the drawings. A special spar, partly rigged and permanently fixed to the underside of the bridgedeck was suggested by our able editor. Shown in Fig. 7, this spar would obviously lighten the task considerably, bearing in mind the foul weather prevailing.

Counterweight. Water would be abundantly available and sufficient weight might be obtained by filling the dinghy. An alternative in the form of a large bucket could be made by folding a canvas sheet and attaching a rope bridle as shown in Fig. 2.

Device for Fixing Boom End. The device must accept the boom end, allow pivoting movement and transfer the heavy downward thrust to the hull without damage. Two types are shown in Fig. 3.

Strut. This would be interposed between the boom and fixing device and the block chain and used to obtain preliminary purchase. Length 3 to 4 feet.

Stowage. A special locker to stow the righting equipment might be constructed in the floor of the bridge deck with a fastening lid on top (kept locked) and a detachable bottom to be used during the emergency.

After capsizing, the procedure would be as follows :

1. Unship the boom or break out the righting spar.

2. Open up the locker and rig the gear as shown in Fig. 1 but with the boom over the side and more or less flat on the water.

3. Interpose the strut between the hull saddle and the block chain to provide fulcrum and raise the boom to nearly the 45° position.

4. Fill the canvas bucket.

5. Haul in the chain block until the masthead appears above the water; position as in Fig. 4.

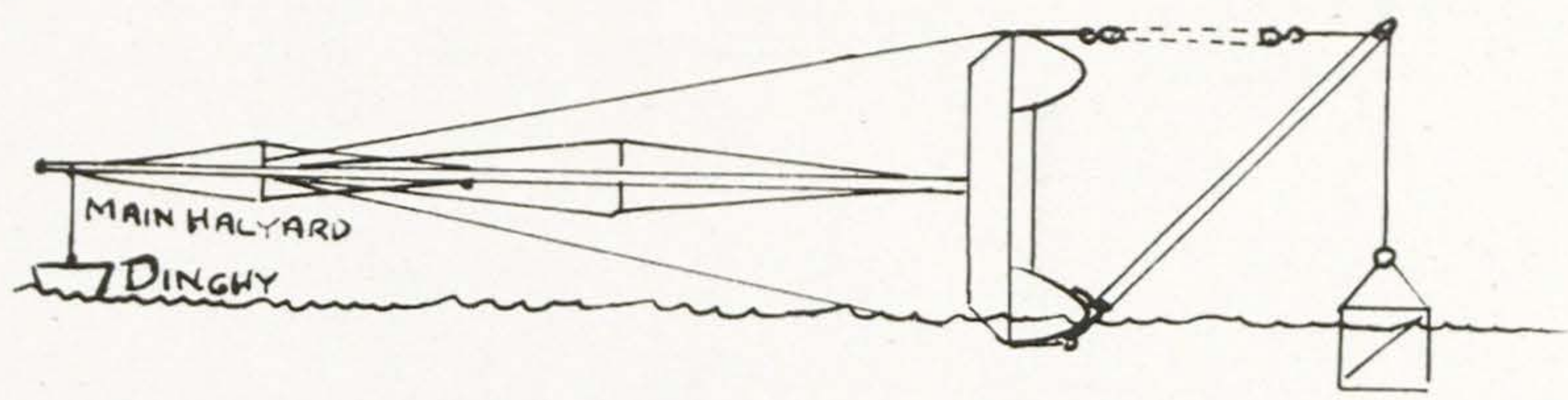


FIG 4.

6. Take off sails.

At this point, care is required as the critical angle of heel is almost reached and, if it were exceeded, the cat would come upright too quickly with the possibility of damage to the boom and gear and injury to the crew who would most likely be underneath. It would be desirable, therefore, to let the masthead come up slowly from this point and it may be controlled by attaching the main halyard to the partly filled dinghy, or the spinnaker with the head and clews gathered up to form a bag and filled with water. The halyard would then be payed off slowly while the chain block is hauled in. After the critical angle is comfortably passed and there is no danger of the cat reverting to the capsized position, the drill would continue as follows :

7. Cleat the main halyard.

8. Remove and stow the righting gear.

9. Let go the main halyard, allowing the cat to come completely upright.

10. Make ship-shape. Don't forget to wash chain blocks thoroughly in fresh water and re-grease them all over at the earliest opportunity.

Figs. 5 and 6 show a variation of the scheme which has the virtue of reducing strain on the gear and also being easier to rig. The boom with the bucket would be hoisted into position whilst empty

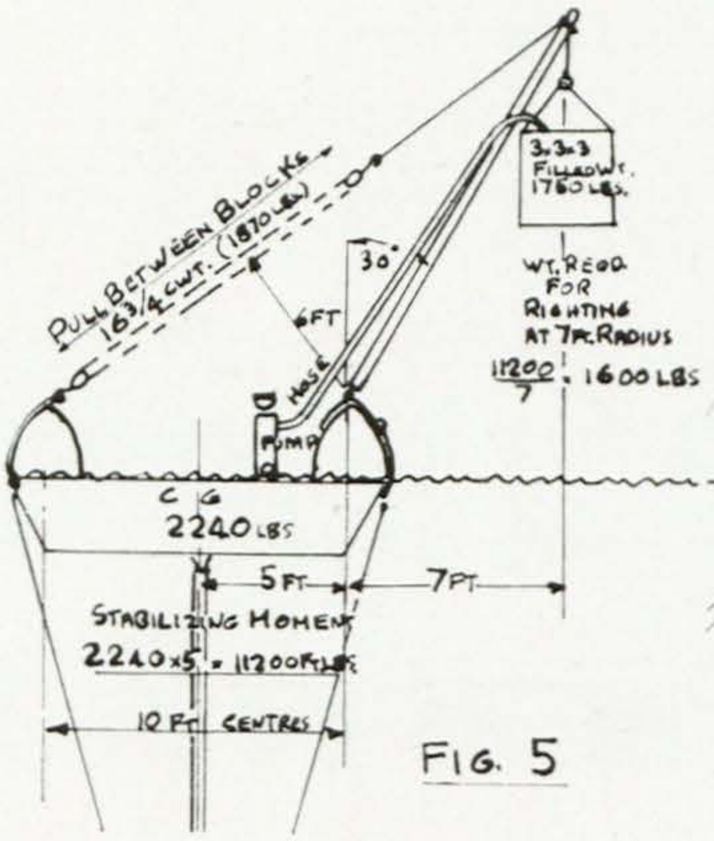


FIG. 5

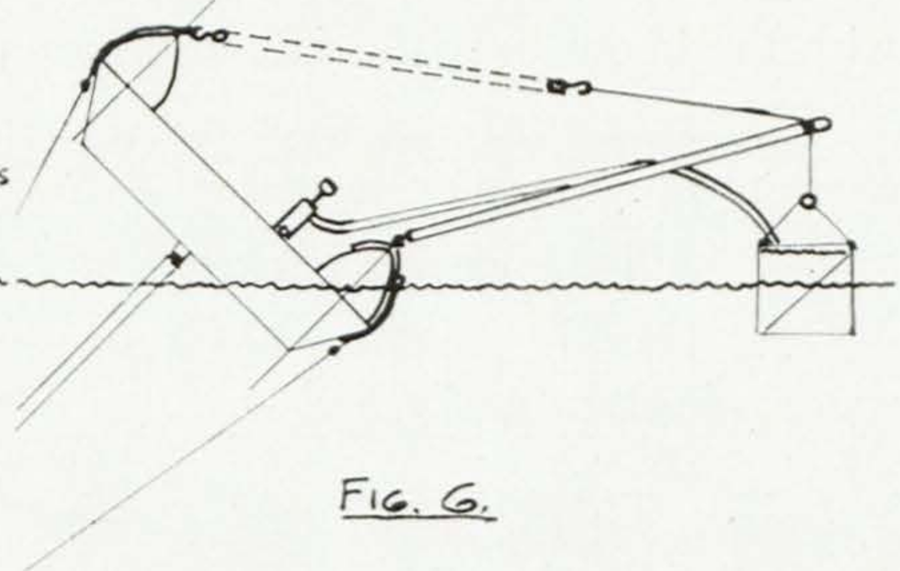


FIG. 6.

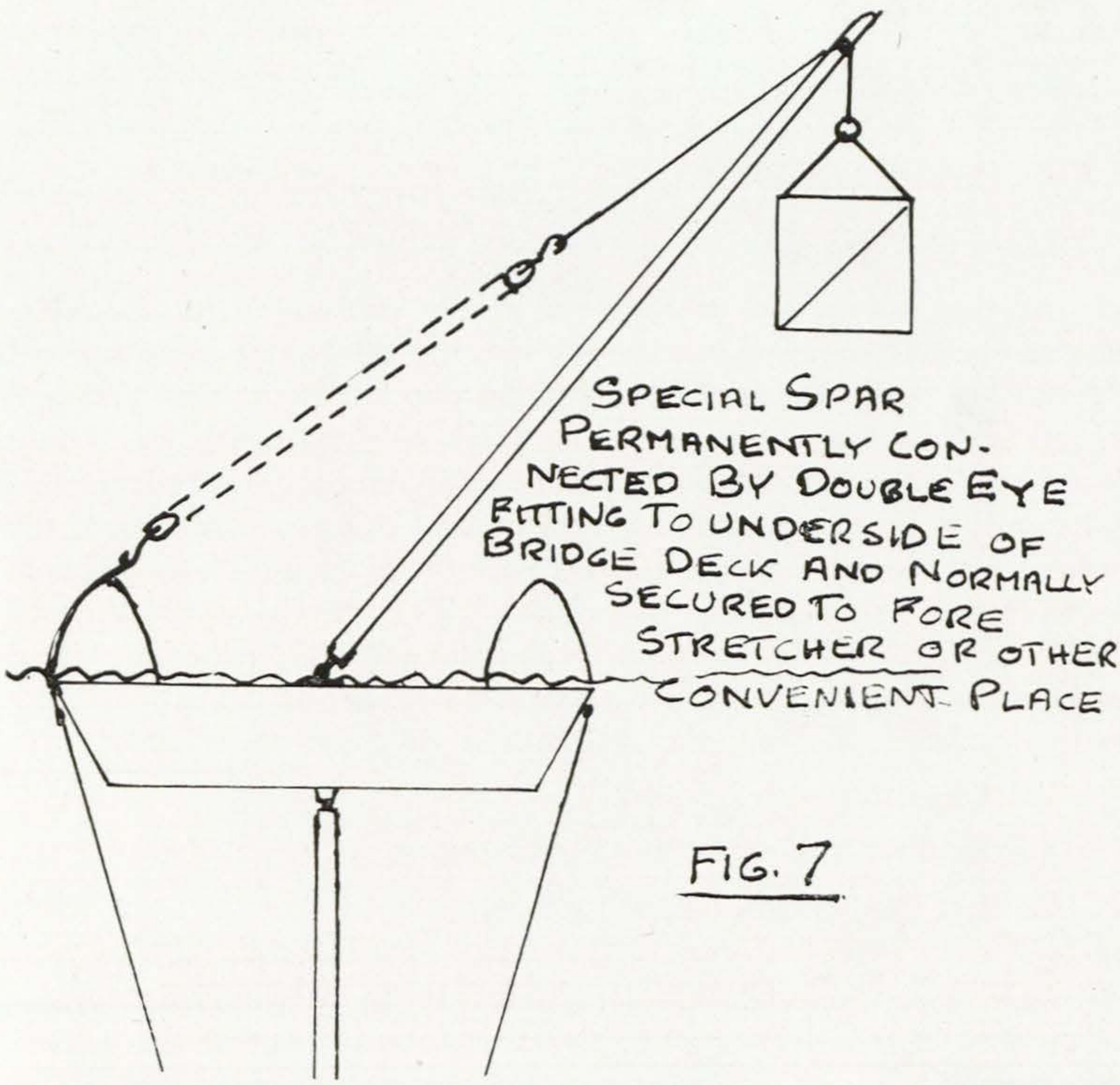
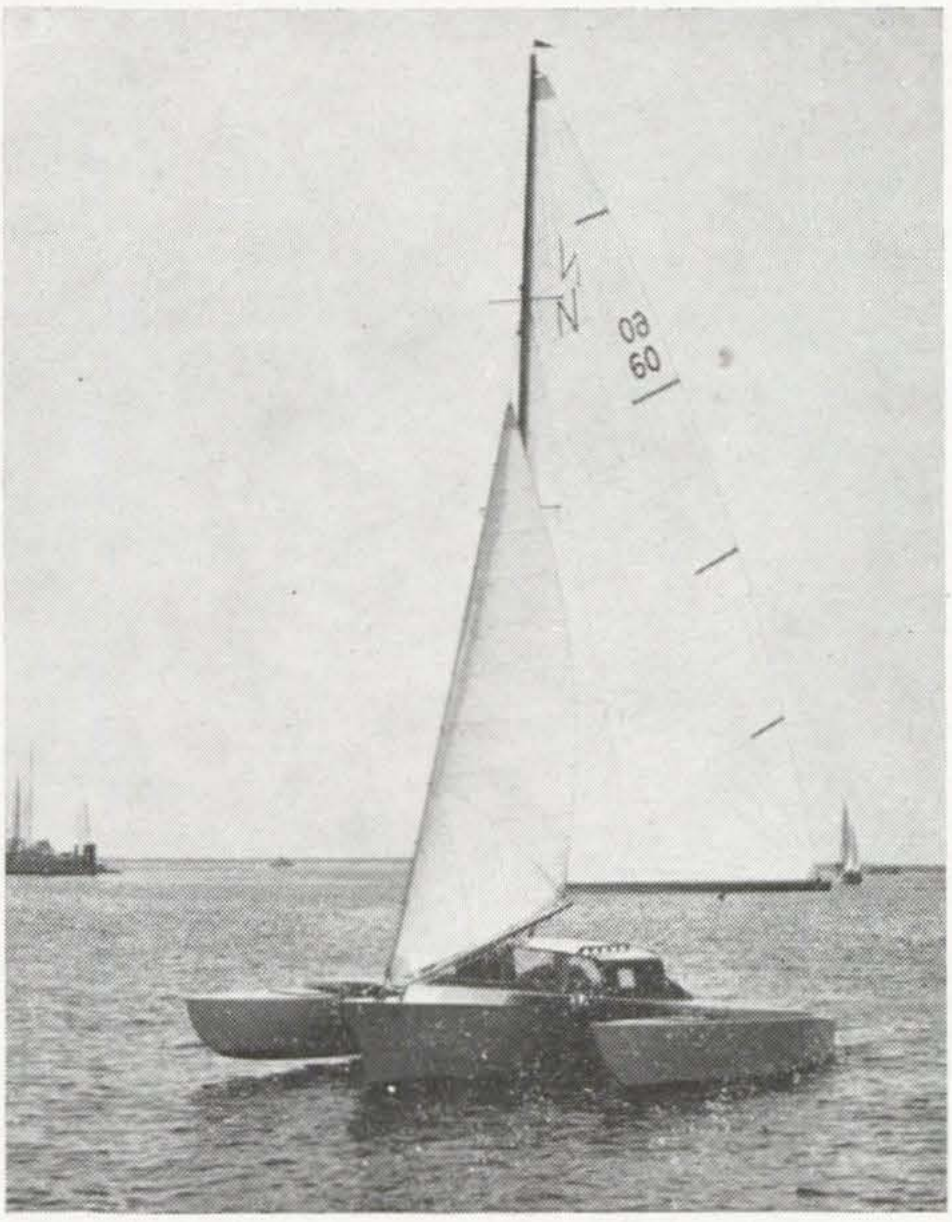


FIG. 7

and filled by means of a pump. On balance being overcome, the cat would assume the position shown in Fig. 6, after which the procedure would be as before.

F. J. Parsons (Kent Newspapers) Ltd., Printers, The Bayle, Folkestone.

PIVER'S TRIMARANS



Nugget

30 ft. x 18 ft. x 2 ft. Nimble
Crossed the Atlantic in 1961 and proved thoroughly seaworthy in spite of continued gales. She has clocked 24 knots and can sleep six. The designer built this in six months working only evenings and week ends.

24 ft. x 14 ft. x 18 ins. Nugget
Has cruised over 1,500 miles from California to Mexico with a crew of three. Maximum speed 20 knots. The floats can be made to fold for towing.

20 ft. x 12 ft. x 15 ins. Banner (trailable)
Is specially designed for racing and day sailing, as is the smaller.

16 ft. x 8 ft. x 1 ft. Frolic
Several hundreds of which have already been built in the U.S.A.

Arthur Piver is the leading American designer of trimarans and his designs are only marketed after having been thoroughly tested. He always builds a prototype and proves their worth first. The simplified building system eliminates the need of all traditional boat building skills. They are quicker, cheaper, and easier to build than any other type we know of. Virtually uncapsizable they are equipt with an automatic sheet release device. One of the most manoeuvreable sailing craft afloat.

Quotations can be given for completed craft.

In U.K. plans available from :

The Shop, Soutergate, Kirkby-in-Furness, Lancs.

In America from :

Pi-Craft, 344 Sacramento St., San Francisco II, California, U.S.A.