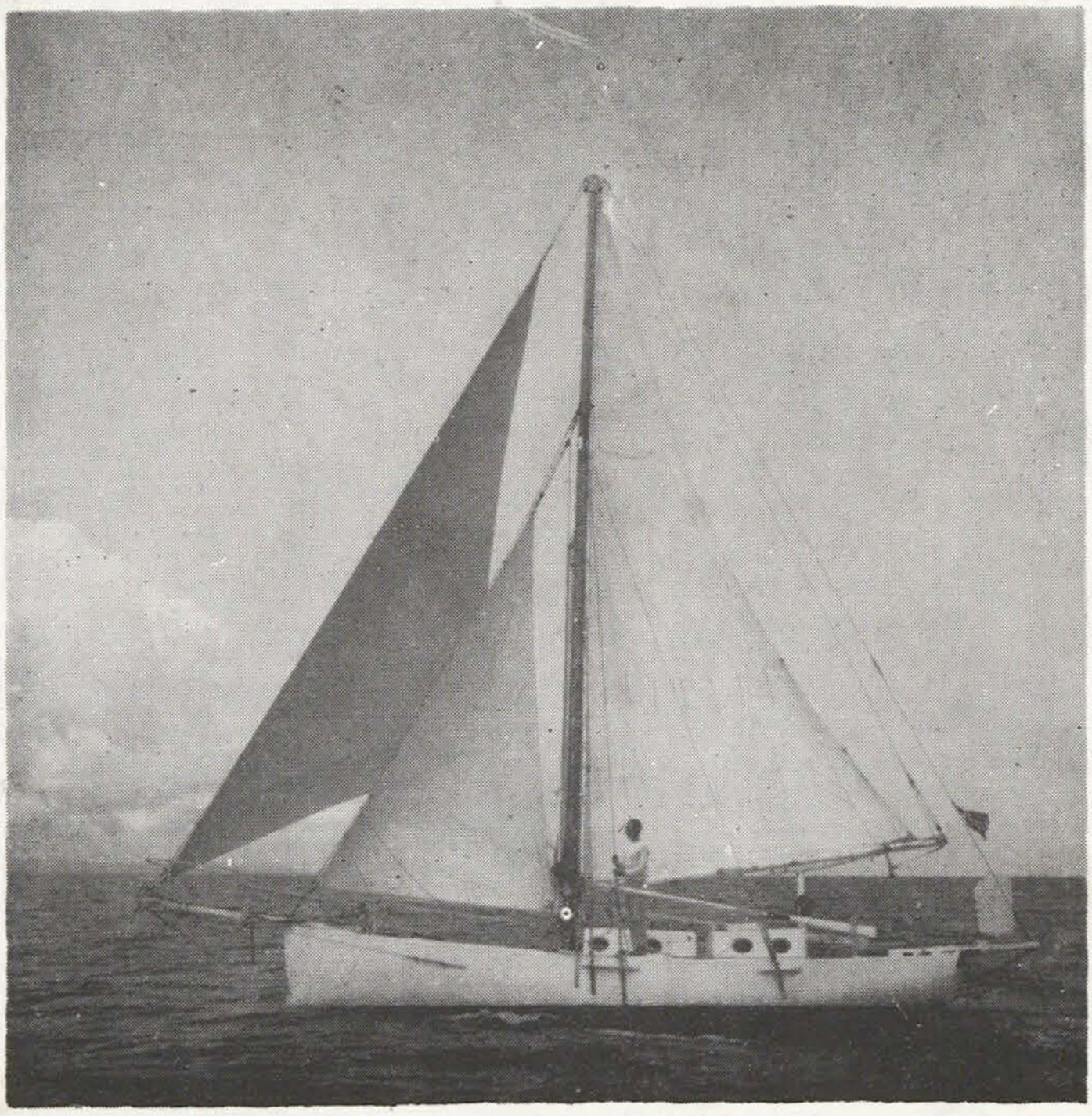
SOLO CRUISING

A.Y.R.S. PUBLICATION No. 53



Peter Tangvald's DOROTHEA

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EDITORIAL

October, 1965.

The Annual Subscription to the A.Y.R.S. is now due. It remains at £1 or $5.00 as before and should be sent to the Secretary-Treasurers, except in the case of American and Canadian members who should send it to Woodacres, Hythe, Kent, England. If not paid by January, 1966, No. 54 will fail to arrive. Every year, many people let their subscriptions run out by oversight and then write to us in a rather hurt way about it. To avoid this, bankers orders are enclosed which will make sure that the dues are paid each year without effort. There will be some startling improvements in yachts in the next few years and I feel sure that no member will wish to miss keeping abreast of them all.

If anyone has had a misbound or faulty copy of a publication or has not had his full four, will he please let me know.

The British A.G.M. will take place on the first Saturday of the London Boat Show at 11.00 in a room at Earls Court. Members can join us at the A.Y.R.S. Stand at 10.45 a.m.

THE WEIR WOOD SAILING MEETING

There will be an open air meeting of the A.Y.R.S. at Weir Wood Reservoir, near Forest Row, Sussex on October 9th and 10th. Sailing will begin at 10 a.m. on both days. These meetings have been an outstanding success in the past with members bringing their experimental boats and rigs, though conventional boats are very welcome, the object being to enjoy ourselves. It will help the organiser, Fred Benyon-Tinker, "High Fleet", Nether Lane, Nutley, Sussex to know what boats are coming.

The London Boat Show. We have again taken a stand at next year's Boat Show. Will members with models or anything else which they think could be shown please contact the Hon. Editor. The models of our model yacht competition will be on display and there have been many enquiries now but we may also show a full sized yacht. As usual, we need stand helpers and anyone who would like to assist in this interesting task by giving us a day or two is asked to offer his services so that the rota can be made out.

A.Y.R.S. Ties and Burgees. For the present, these are not available. A new tie is being designed and the supply of burgees has run out. You will be notified when these are once more in hand.

Advertisements. A full page advertisement in our publications costs £5 for an inside page and £10 for the back page, which is only given to regular advertisers. Matter for these is only accepted at the discretion of the Hon. Editor and must be in our hands at least two months before publication is due.

The Round-Britain Sailing Race. This is a race for two man crews, sponsored by *The Observer & The Daily Express.* It starts from Plymouth on Saturday, 2nd July, 1966. It also ends at Plymouth. The race will take place in a series of hops of about 300 miles each from port to port. Further information and copies of the race rules can be had from the Hon. Secretary, Royal Western Yacht Club of England, West Hoe, Plymouth, England.

A.Y.R.S. Winter Meetings. These have not been arranged so far. Lloyd LAMBLE has had to go to Australia and cannot do the organising this year. If anyone would like to volunteer, would they please write to us.

THIS PUBLICATION

Solo Cruising. The solo cruiser must be the supreme yacht. If a yacht is to sail anywhere the owner wants to go single-handed, especially across oceans, it must have all the virtues any of us want. It must be easy to handle, safe and fast, comfortable both at sea and in harbour and a real pleasure to own. This publication gives a background of information and lines of research which will improve such a craft.

The Single-handed Trans-Atlantic Race has been called "The Greatest Race in the World" and few people will dispute this. It is with this race in mind that this publication has been assembled because, being mostly to windward against the prevailing Westerly winds, it is the severest test which a yacht or yachtsman can undergo.

We have been lucky to have the views of Peter Tangvald on the yacht which he would like to have for ocean cruising and to get his experience of the sea. It is doubtful if two yachtsman will ever have the same ideas of their ideal boats but from Peter's experience, we can at least begin to form views of what we would like.

The article by Frank Robb on *Fatigue* is of more than academic interest to all ocean cruising and racing yachtsmen. We are grateful to Frank and to the Editor of South African Yachting for permission to use this article.

Hydrofoils & Wingsails. Bruce Clark's hydrofoil stabilisers on his sailing canoes are at the forefront of the development field while experiments with wingsails by George Chapman, Morris Wright, and J. J. McMurry keep a fascinating prospect of sail improvement before us.

The Light Inboard-Outboard Motor of George Chapman as a conversion from an air cooled outboard motor is a *fait accompli* and should have immediate commercial application.

Technical Studies. The articles here by Henry Morss, John Hogg and myself are concerned with getting figures from sailing boats, which is the long term project the A.Y.R.S. has pioneered right from the beginning.

A Technical Study for Every Member. Every member wno has a boat and has tidal or river currents near him can get an almost complete hull evaluation with little trouble. All he needs is a spring balance and some means of measuring the water speed. By mooring his boat to a buoy or post via the spring balance, he can get the following figures :

1. Total hull force.
2. The water speed.
3. The drag angle of the hull to the normal from the water flow.
4. The leeway angle.

These four figures on a variety of courses will give an almost complete picture of the hull characteristics, even if the water speed is as low as 1 knot. 100 studies like this, from a variety of boats, would quickly convert yacht design into an exact science as far as the hulls are concerned.

* * *

THE A.Y.R.S. YACHT WIND TUNNEL

BY

JOHN MORWOOD

The A.Y.R.S. Yacht Wind Tunnel is now giving a steady wind of 4.5 miles per hour when the outside wind is a near calm such as one often gets in the evenings. This has been achieved by erecting a 30 ft. long sackcloth screen 12 ft. high along the south side. We might make things better by raising the screen off the ground or putting up further screens because, when the wind is blowing across the screen, it produces a vast eddy which fills the tunnel. However, we have now a satisfactory instrument if one can choose one's time.

So far, no work of any accuracy has been done because I had no sooner got the tunnel right when the long grass at Woodacres with its weeds (Hemp Agemony, thistles etc. which often grow 8 ft. high) claimed my attention and so has had to be deferred till other tasks have been completed.

Edmond Bruce suggests that the whole wind tunnel be contained in a tent with closed ends, thus making the work not only immune to the weather and wind, but it would produce a recirculation wind tunnel thus saving some of the work of the fan motor. This is an excellent suggestion, but I feel that it is unnecessary in view of the almost constant evening calm which we are getting.

Further notes on 1*st August*, 1965. The sackcloth screen has now been moved to form an arc across the entrance, which converts the large eddy described above to smaller eddies and more even airflow when there is wind. I hope to get still more improvement.

YACHT EFFICIENCY

BY

JOHN MORWOOD

The need for this article appeared from the use of the A.Y.R.S. yacht wind tunnel. The sail and drag angle of our model yacht (Evans) on a close hauled course appeared to be about 15° and I was so horrified by this huge figure that I immediately wrote to Edmond Bruce to see what his figures were. His letter follows this article but the figures are as follows :

	Hull drag angle	*Windage & Sail* drag angle
12 meter	10°	8°
5.5 meter model in tank	10°	—
Dinghy (A.Y.R.S. No. 40)	16°	18°

Now, the course of the boat to the apparent wind is the sum of these two angles (see A.Y.R.S. No 41 for the proof) and the course of the boat to the true wind is double their sum, if it is travelling at the same speed as the wind, so a saving of a few degrees in either is a matter of the greatest moment for windward work. Fortunately, with such gross inefficiency, improvement should be easy.

Definition of Efficiency. Efficiency need not necessarily mean speed. A 12 meter may have an efficient hull for carrying a huge lump of lead to windward but it is not as fast as a C Class catamaran. A high aspect ratio, buoyant and vertical, ballasted hydrofoil would give a very much smaller drag angle than any boat but its wetted surface would make it very slow indeed. We can therefore only define efficiency of hull as follows :

An efficient hull is one built of conventional materials and of conventional shape for the type which has a drag angle close hauled of less than 10°, *for an International deep keeled type or less than* 15° *for a dinghy. A similar definition can be written for sail and windage efficiency but is no more satisfactory. Perhaps A.Y.R.S. members can improve on these definitions.*

Improving Efficiency. A yacht hull acts as a hydrofoil of surprising efficiency when one considers its low aspect ratio and large beam to length ratio. For instance, Thames barges will beat to windward without their leeboards and similarly catamarans. Even a dinghy can be made to do so in strong winds. However, I have never made up my mind if this is due to a true hydrofoil effect or if it is because the limiting speed sideways is so much less than the limiting speed forwards.

Let us assume that the lateral resistance of a yacht hull is due to a true hydrofoil effect. This means that the water meets with some resistance when flowing beneath the hull, rather than alongsides. In

the case of a catamaran with a semi-circular underwater section, this resistance could be due to the elliptical course which such a water flow would have to take consisting of a downwards acceleration at the lee side and a near vertical deceleration at the windward side. The result is a positive pressure on the lee side and a negative pressure on the weather side.

If now, the assumption is correct and a yacht hull is a hydrofoil, efficiency could be improved by making the hydrofoil efficient. This can be done by drawing the waterlines so that their fore ends up to the point of maximum beam are those of a hydrofoil section whose thickness to chord ratio is 1 to 12, whose sides are arcs of circles and which is pointed fore and aft. The after ends of the waterlines would be rounded in to give a beam to length ratio of the waterlines of 1 in 8 (my estimate).

The result is a narrow boat of a type which has the strongest reputation for windward sailing, though more extreme than any yachts seen since the old "plank on edge" days. Hulls of this type are now being produced by several trimaran designers for their main hulls and they seem to be fast. I have not seen the type used for single hulled yachts as yet, however.

Additional Lateral Resistance. Now that we have designed our hull, we know that, even though it may give us the maximum lateral resistance of which it is capable, this is unlikely to be enough. Two ways of dealing with this are used. The first of these is by the use of high efficiency hydrofoils. Racing catamarans use boards in each hull. Bill O'Brien uses fixed fins on his latest cruising catamarans while Arthur Piver and others use fixed fins on their floats. The theory behind such fins is that the high efficiency of the fins cuts down the leeway so that the hull hydrofoil can function at its best angle of attack. The second method, used by Cross and Macouilliard on their trimarans is to have a long, low aspect ratio keel on the bottom of the main hull. This system, which works in exactly the same way as the salient keel of a 12 meter, is based on the theory that it hinders the water flowing underneath the boat and makes the hull function as a more efficient hydrofoil.

The question of whether fins or a long, low aspect ratio keel will be better is at present open. A dinghy must obviously use a centreboard. A "beamy" conventional yacht, like *Pen Duick II*, probably benefits from a high aspect ratio salient keel. But a narrow hull, such as a trimaran main hull which has hydrofoil waterlines may well be faster with a low aspect ratio salient keel. Norman Cross claims that such a keel on his 36 ft. trimaran gives a better performance to windward and he may well be right. The International Sharpie with a quarter circle centreboard is a fast boat, while a 21 ft. boat I once built with a

3 ft. waterline beam and a fixed keel 10 ft. long by 11 inches deep could make four points when sailing to windward.

Sail Efficiency. The angle of 8° for the drag angle of a 12 meter's sails and windage is reasonably good. The dinghy, tested by Edmond Bruce by comparison is very bad, the cause of which is the absence of the jib which allows a lot of wind to escape below the boom. The 12 meter Genoa fits almost snugly down to the foredeck lee gunwale, which almost prevents this loss.

Improving Sail Efficiency. Using a deck of rounded form will cut down windage and could well lessen the drag angle by 1° or 2°. A semi-elliptical sail carried down to such a deck might lower the drag angle by a further 2° but we are unlikely to get an angle of less than 5° at the utmost, which represents nearly the full amount of possible sail efficiency.

It looks therefore as if we COULD achieve almost the full sail efficiency but, in view of the large hull drag angle, this might not be desirable because we are likely to get more sail force at the freer course which this makes necessary by using sails producing a greater drag angle. I believe that a "Brig" rig, using two semi-elliptical sails without a jib will prove the fastest rig with hull inefficiency as bad as it is at present. Such a rig would be equivalent to a cleaned-up sloop. For all round sailing, especially with the narrow type of single hull previously suggested, a three masted "Ship" rig might be worthwhile. Such a rig would be equivalent to a cleaned-up ketch rig, but far easier to handle.

Summary. The best modern yachts are very inefficient sailing machines, both in their sails and windage and also in their hulls. 12 meter yachts are more inefficient in their hulls than their sails while dinghies without jibs are more inefficient in their windage and sails. Dinghies with low cut Genoas are probably more inefficient in their hulls, than windage and sails.

The efficiency of the catamaran is hard to estimate and we don't yet know its course to the apparent wind. Oddly enough, it could be much less efficient than a 12 meter, even though it is faster to windward. We await further information.

* * *

Dear Dr. Morwood,

Your proposed article for A.Y.R.S. on yacht improvement would be timely indeed. I believe that 12-meter boats are of poor basic design. Many Class C Catamarans could beat any of them around the buoys. As to your question as to values of known drag angles of sail and hull, the following occurs to me :

You mention a hull drag angle of only 5-degrees. This has caused

me some concern. Such an angle would imply a hull lift-drag ratio of 11.4, an unheard of value. I have measured no conventional hull, including 5.5 meter, that measured L/D over 6 or a drag angle of 9.5 degrees. One must be careful not to confuse hull drag angle with the hull leeway angle which could well be 5 degrees or less.

The skipper of a 12-meter, America Cup candidate, that did well but lost out to "Constellation", assured me that his boat, under best conditions, could sail a course 18 degrees to the apparent wind. My guess on the separate hull and sail drag angles then would be:

Hull drag angle =10° L/D—5.7
Sail and windage drag angle= 8° L/D—7.1

The hull values agree with my 5.5 meter model tests of similar shaped hulls. Values for a dinghy can be obtained from my article in A.Y.R.S. No. 40. Here, the highest course was 34 degrees to the apparent wind. Hull drag angle was 16 degrees and sail and windage drag angle was 18 degrees.

EDMOND BRUCE.

Lewis Cove, Hance Road,
Fair Haven, New Jersey, U.S.A.

Dear Dr. Morwood,

I am returning your proposed writings for A.Y.R.S.

The statement that the course of the boat to the true wind is double the sum of the drag angles if the boat is at true wind speed, was new to me. I found that the proof was quite easy using the vector isosceles triangle of velocities. I am sure that many A.Y.R.S. members would be interested in the proof.

Another valuable proposition, seen from the velocity triangle, is that with the true wind at any angle of 90-degrees or less to the course, the boat speed can never exceed the *apparent* wind speed. It can exceed it in running, however. We see this in some of our recent overall performance measurements. There are now two sets of good instrumentation. We will start gathering data next month.

I agree with your appraisal of the speed of good Class C Catamarans as exceeding that of good 12-meters. As you indicate, a drag angle discussion considers only vector angles and not vector magnitudes. Attempts to handle the latter are being made by stating the ratio of boat speed to apparent wind speed at stated values of $^{V}\sqrt{L}$ and course angle to the wind.

Due to their present bad lateral plane design, C Cats are inferior to 5.5-meters, in the above speed ratio, when hard on the wind. However, except in very light air, at all apparent wind angles greater than say 40-degrees, the C Cat is superior. It is also superior at optimum

"speed made good to windward" but at higher wind angles than a 5.5-meter would use. I believe that the high pointing difficulty of most C Cats can be remedied. I also believe that, eventually, long and narrow monohulls with dynamic stabilization, rather than weight or buoyancy stabilization, will be faster still.

EDMOND BRUCE.

Editor: If the true windspeed and boatspeeds are the same, the sides of the parallelogram of velocities must all be of equal length. The diagonal which shows the apparent windspeed and direction must therefore bisect the angle between the true wind direction and the course of the boat. The course of the boat to the true wind must therefore be double the course of the boat to the apparent wind, which is the sum of the drag angles.

* * *

A SOLO OCEAN CRUISING YACHT

BY

JOHN MORWOOD

The Hull. According to the principles of the previous article, the hull should have hydrofoil forward waterlines but be otherwise of conventional shape and it should have a rounded deck. Three types of hull meet these requirements fairly well as follows :

1. A "Pelorus Jack" hull, which, though light in weight is of the "heavy displacement" type. My model for our model yacht competition is of this type but it has a deep forefoot. It should have a long, low aspect ratio fin.

2. A Piver or other similar trimaran main hull could be used onto which a rounded deck could be built. Again, the keel should be long and of low aspect ratio.

3. Two Prout or similar plywood mouldings of 36 ft. in length or more could be attached "mouth" to "mouth" to produce a single hull of the characteristics we want. Prouts are now sailing a C Class catamaran made thus from four mouldings and it looks very efficient, though the snags connected with a new boat have not yet been ironed out. With this hull, however, the waterline beam to length ratio is rather on the low side and the rounded section would not make such a good hydrofoil so I think a centreboard or ballasted fin, according to the configuration would be best.

Having got the hull, the next item is stability and this can be achieved by ballast on the fin, making a monohull of it; by floats to make it a trimaran or by a combination of ballast and outrigged hydrofoils.

The Rig. Conventional sloop, wishbone or other ketch or even staysail schooner could be used but I favour a three masted "Ship"

rig without jibs. The "Ship" rig gives lots of sail area low down. It is efficient, easy to reef and furl and with streamlined masts, one could sail without any sail set. The full rigged ship can be stopped in its tracks by backing the foresail. It can be easily made to make a sternboard under full control and is generally the handiest of rigs for manoeuvering a ship. Though the sails can be individually reefed by simply lowering the halliards, sail can be reduced by first lowering the mainsail; secondly by again hoisting the mainsail and lowering the foresail and mizzen when one has a highly efficient sail in the middle of the boat, giving what may prove to be the lowest drag angle possible.

Summary. We have all the information at our disposal to design the most efficient yacht possible whether monohull, trimaran or hydrofoil stabilised. Let us, by models or at full size get to building and trying out these ideas either in free sailing or in the test tank and wind tunnel to see if we have achieved our ideal boat.

* * *

SINGLE HANDED-SEA LORE

Letters between Peter Tangvald and John Morwood.

Members will remember the fascinating account in A.Y.R.S. 48 of an analysis by Peter Tangvald of 180 yachting accidents. He is a 39 year old Norwegian engineer who in 1957 sailed his 45 ft. gaff yawl *Windflower* single-handed from West Mersea, Essex to Los Angeles. In 1959, he bought *Dorothea*, a 32 ft. 11 ton Harrison-Butler designed cutter and sailed her around the world via Panama, Torres Straight, the Red Sea and the Mediterranean. In the summer of 1964, he sailed back to England to complete the circumnavigation and tried to sell *Dorothea* in order to build another ocean cruising yacht.

These letters show the nature of the decisions to be made by the ocean cruiser in selecting his yacht. What shows up most clearly is that the two main things which Peter wants are (1) A high *average* speed from port to port and (2) An easy sea motion.

Neither Peter nor I expect people to agree with us in our solutions for the problems of ocean cruising but Peter's views must command the greatest respect in view of the deep and incisive thought into the matters involved while actually putting them into practice. My own opinions, not constrained by practical experience, are far more abstract. I hope that I have not said anything too far from the state of practical application.

The Ideal Ocean Cruiser. No doubt everyone has their own ideas about what is best. However, I have looked over my rather extensive library of yacht designs and picked out that boat which I believe meets Peter Tangvald's requirements most fully. We therefore follow this correspondence with an account of Maurice Griffiths *Lone Gull.*

San Raphael, France,
9th October, 1964

Dear John,

When I lost hope of selling *Dorothea* at a good price, I decided to keep her for the time being and then, since it was blowing an east wind and the autumn would soon come, we ran to the grocery and left Birdham (Sussex), for Vigo. But, rounding Cape Finisterre, the wind being good, we did not stop after all and went instead to Vila Real in the South of Portugal with the thought of wintering there. I had seen an advertisement which looked good but I did not like the harbour very much.

My girl crew had to go to France as her vacation was over, so I put her on the train while I continued alone. It took me five days to get to Gibraltar with fog and headwinds. I stayed there (a most pleasant place, by the way) for 36 hours and then had a pleasant sail of 12 days to the French Riviera where I arrived yesterday, entering the port in an official wind speed of force 8/9, sailing under storm canvas. I anchored in San Raphael with no mishaps of any kind, 30 days from England, including 3 days in Vila Real, 1½ days in Gibraltar and 1½ days at anchor waiting for the contrary wind in the strait of Gibraltar to moderate. This was no record run by any means but a very enjoyable sail and fast enough to show once more that motors are not necessary, if a boat is properly rigged.

I will use the boat for short trips but will start the building of the new Dreamship with the difference that I will spread the building over a little longer period since I will be a bit shorter on money than I expected.

PETER TANGVALD.

19th October, 1964.

Dear Peter,

Your voyage from Birdham to San Raphael was extremely good in my opinion. I very much doubt if it would have been as fast if you had the weight of a motor aboard and were dragging a propellor. It is not generally known that the weight of a motor with the necessary fuel and tools adds up to a very large amount and it may well take a knot off the sailing speed at all times and even more, if badly installed. In general, weight is a speed killer and is even relevant to the weight of all stores carried.

I have listed the headings which come to my mind of things in which I am interested. I would like to know how you dealt with these problems.

1. Weather-proofing of stores and your estimate of their total weight.

2. The length of time you spent at sea doing the various long crossings. I know *Dorothea* was pretty speedy. Was this due to driving her, keeping the bottom clean or picking the right months for the trip?

3. The amount of water you carried. Whether it would be possible to reduce this and rely at all on rainwater.

4. Windward and leeward rigs. Do you believe in making headway in a head wind and sea or do you go easy and wait? This is a biassed question as I feel that if one is not going to plug as fast as possible in a head sea, a two masted rig would be better. My romantic bias here is to the full rigged ship with the modern squaresails we have developed. These will give terrific drive with the wind at all free while not being at all bad to windward. Indeed, they may even be better to windward than the normal sloop. In calm water, one makes half the speed dead to windward which one makes running. What is your estimate of the same in the open ocean ?

5. Navigation. How many position checks a day? Are you able to sense shallow water by the motion of the boat as did Slocum and others?

6. What was your storm drill? What did you do in calms?

7. My final heading is "The temperament of the single-hander". I spend all my work dealing with people and therefore they do not occupy any of my romantic thoughts. But I certainly don't know if *I* have the temperament to sail single handed. Have you any thoughts on the matter?

JOHN MORWOOD.

24th October, 1964.

Dear John,

In California, where I have lived for a few years, I met Tom Steel when he returned from a world trip in his Tahiti ketch *Adios*. I was very impressed and I swallowed ever word he said and often felt embarrassed, thinking about all the time I took from him. I felt sure that it was only modesty which made him say that I was the only one to ask him any questions. That was 10 years ago and now I know that he just told me the truth. I think that very few people want to learn from other people's experiences. Just the other day, a yachtsman told me the worst type of stern is a transom and he wished I would realise that before making the mistake of building my new ship with one. Needless to say, he had never sailed more than a few hundred miles from his home port. Personally, I think that all sterns are good if properly designed.

Another startling example is from the owner of a large ketch who told me in Marseille when I came back from my circumnavigation

that I was wrong to sail without a motor and that, even if I were willing to endanger my own life, I had no right to take chances with my girl crew's life. Almost in the same breath, he told me that he had lost his previous yacht a few months earlier when taking off for the West Indies in a fire when he pressed the self-starter of his engine just a few miles from his home port. Simonne could not help giggling but even then the man did not see that he was not being very convincing.

I am so glad to see that you dislike engines also, and your estimate of one knot checks exactly with my own opinion, even if I generally claim only ½ knot in an effort to be more easily believed. Half a knot represents about 10% in speed which on the usual 30 days crossing time of the Atlantic represents 3 days. And perhaps the greatest saving in time occurs *in ports*, repairing the monster. Several boats in Cannes have been fitting out for cruises to the West Indies and to Tahiti. The two laying next to me intended leaving in the Spring; then in early Summer. When I left on the 4th July, they were going to leave a few days after me. Today, they are still there. One had engine troubles, one after the other, and time went as he waited for spare parts from somewhere. The other decided that a gasoline engine was too dangerous and ordered a new diesel engine which gave him much more installation trouble than expected. I did not dare to say anything but was tempted to remind them that they would already be in the tropics had they sailed without any motor at all.

Now to answer your questions :

1. I might disappoint you in admitting that I never have weather-proofed any stores. Nor have I estimated their weight. I have just thrown the cans and packages into the lockers and never had any trouble. But I have the idea that no food whatever should be kept for more than a year at the very most. What has not been eaten by that time goes over the side. I know most people will disagree with me there and I'll admit that it is not based on any scientific reasons. I just dislike the thought of old food.

Only at the beginning of the voyage did I use cans and packages at all. Later, I tried salt meat, hard biscuits and dried fish like they used to in the last Century but disliked them almost as much as the modern cans. On the later part of the trip, I gradually became a vegetarian. For example, on the round trip from Cannes to England and back, I had not a single can, not a single packaged food, nor anything salted. We used about 20 pounds of *whole* rice (not the usual white rice), about 10 pounds of *black* olives and many pounds of potatoes, onions, garlic, whole wheat ; baking our own bread and grinding the flour ourselves. Sometimes we made our own yeast but often we made bread without yeast as is described in the Bible. We fried in olive oil.

We carried large amounts of fruit and vegetables which would keep. We never used vitamin tablets or any medicines. This diet has suited me and I have never felt as well as I do now.

Even on the smallest ship, food storage is no problem for there should never be any need to carry food for more than 2 months. There is no need to follow some Americans' example who start from the States with enough food for 4 years, the time they expect the circumnavigation to last, as if they were making an expedition to no man's land. It sounds unbelievable but several American yachts here in France are still eating their American tins in preference to the fresh local food. And that in a country like France!

2. My longest crossings alone were over the Atlantic : 31 days in *Windflower* in 1957 and 29 days in *Dorothea* in 1959. Then in *Dorothea* from Tahiti to Honolulu, 28 days in 1961 and 24 days back to Tahiti. With my girl crew Simonne, a French girl I met in Martinique who is always happy and loves the sea despite frequent seasickness (*Dorothea* has a violent motion), the longest trip was from Christmas Island to Aden which took 44 days. These were not very fast trips but *Dorothea* can go fast : St. Thomas to Panama in 7 days, averaging 150 miles a day; The Galapagos to Nuku-Hiva in 22 days 20 hours (a shade over 130 miles a day).

Dorothea's bottom is always clean as she is coppered (a wonderful thing which I will have on my new ship also). I never wait for the good time of the year. I always sail when it suits me and not when it is considered best to sail. This is not because I am smarter or have more courage than others but rather because I consider that a yacht is a means of transport as well as a way of life, and it should carry me anywhere I want to go at anytime. I also consider that with good luck, we can have a wonderful weather in the "bad season" and that with bad luck, we can have the most terrible weather even in the best season. Of course, this is done within reason. For example, I did not sail to England at Christmas instead of July, because obviously I have no desire to freeze solid in the North Atlantic when Summer is so much more pleasant. But, I sailed all the way from Papua to Aden at the wrong time of the year and was almost refused permission to leave by one Port Captain but I did not want to wait over a season and sailed anyway. This philosophy caused me only once to regret disbelieving the first rule of safety to most yachtsman, when I was in a force 12 hurricane off Mexico in 1958 with *Windflower* in September, which is the worst hurricane month. Thinking back at that storm, I cannot be much impressed by Robinson's "Ultimate Storm" which he describes so thoroughly in his last book "VARUA" when he says that he could not leave the helm an instant and only ate soup served to him

in a bowl in the cockpit. I can guarantee that in a force 12, any soup would be sucked out of any bowl by the wind in a second. Even if it were not, the soup would be so mixed with salt spray that he would hardly want to eat it. But I do know of many boats foundering at sea in gales in the best season. So, I think the answer is: sail when you please but have a ship able to survive any weather.

I consider *Dorothea's* hull good but not exceptional. I think her fast runs were due to always driving her to the maximum speed. I carry light weather sail at night as well as in the daytine and never reef down at night, "as a matter of course". I practically never heave-to. In gales from the wrong direction, I change to heavy storm canvas and keep going with green seas washing from forward, clear aft. It is uncomfortable but I get too bored to waste time hove-to. Possibly due to never waiting for weather nor headwinds to change, more than half the distance covered has given me winds from forward of the beam. For example, all the way from Gibraltar to Brixham I was close hauled and could hardly ever lay the course.

I cover generally between 100 and 120 miles a day when hard on the wind but make only about 60 towards my destination and make good (on the chart) about 50° to 55° from the wind. This does not sound much but let a man who claims his ship sails at 40° from the wind take a try in the *open* ocean and then lay down his actual course at the end of a 24 hours period! In fact, in my next boat I will be satisfied with 5° less weathering ability if I can get a ship with a sweeter motion. I am really a cutter man and will try the Bawley boomless gaff rig next time but sometimes I am very tempted by the gaff schooner rig similar to the old *America* with single headsail and overlapping foresail. I am also interested in the square rig but know so little about it that I don't dare to start on it.

For my downwind rig, I just use the boomed out mainsail on one side and a lug sail of the same surface as the mainsail boomed out on the opposite side. It is unusual but efficient and easy to handle and reef. The staysail I take down but I sheet the jib hard amidships to check some of the rolling. The main trouble is that these are pressing and not lifting sails so I often have to reef when I see the bow wave coming close to the deck and I am afraid of the bow getting buried and thus capsize. By that time, it is blowing hard. (This answers your fourth question as well).

3. *Water*. I only carry about 45 gallons which is rather on the short side for two people (for example on the 4,400 miles to Aden) but it is very possible to rely on rain water as there are very often rainstorms at sea which could, from a gutter under the mainsail, refill even the largest tank in a few minutes. I have never done it but I have often thought

about it and I am sure it is practical. Some salt taste might be caused by the salt encrusted in the sail but should not be bad if the first water is allowed to waste before connecting to the tank.

5. *Navigation.* I take one sight every morning which I cross off at noon. Getting closer to the landfall, I take 4 or 5 or more sights of the sun as well as of the stars. I carry no log and no electronics of any kind except a transistor radio for checking my chronometers. I can sense shallow water by the change of motion of the ship, by visual differences in the waves and by their different sounds. These senses would never be developed in a yacht with electronics and therefore no added safety would be gained. However, I don't rely on this as these changes would not necessarily always occur and I often use the old fashioned heaving line with 10 fathoms of line and also one with 100 fathoms wound on a reel (I then have to stop the ship). All this reminds me of a good friend of mine who nearly wrecked his ship while having his eyes glued on his new depth sounder, not realising the thing was stuck on 5 fathoms. Only when his crew screamed that there were breakers just ahead did he jibe but very nearly hit the rocks.

6. *Storms and Calms.* In storms, I keep on going as much as possible in the right direction. In extreme cases, I have run dead before it under bare poles (and had no reproaches to the transom stern). In calms, I also keep on going. This sounds rediculous and of course in an absolute calm I am going nowhere and just take down all the sails in order to save them but what many sailors call a calm and makes them press that button is often sufficient to let a ship under light canvas ghost at a couple of knots even if the sails are being shaken rather roughly. Across the Arafura (at the wrong time of the year) the Port Captain guaranteed me that it was not possible to get across without a motor and the sea was indeed as flat as a mirror. But, by carefully trimming the sails every time the least bit of a draft appeared, we got to Darwin in quite a respectable time. We also got to the Galapagos in 12 days from Panama despite the experts telling us we would be lucky to do it in 60 days. But of course a ship has to carry enough sail Some of the present "Snuggly" rigged boats do indeed need a motor.

7. *Single-handing.* I have always liked my own company and never get bored with it. But I still much prefer to have a girl with me whom I care for. On the other hand, I would *much* rather be alone than with a man or girl I don't get along with. But how this matter can be a problem at all I have never understood. It seems to me anyone can be happy alone for a month or so doing something he likes and knowing that he meets plenty of new friends in the next port. Yet one man I had on board as a charterer went almost out of his mind within four days "all alone and in all that water" and left in the first port, never even

sking for a refund on the $600 he had given me for a fortnight's sail. A Frenchman who crossed in 50 days to Martinique cried when he landed. Yes, cried with real tears, and never went aboard again. His boat was sold for a great bargain. You probably understand this better than I do—human nature sometimes beats me. But the fact that you sound happily married gives the odds against you. I am ivorced for the third time.

That deals with your questions. Now, I have a question to ask you as I see that you are one of the few men who like narrow boats today. A narrow and light boat is more easily driven and has greater speed than a broad beamed boat. Everybody agrees so far. But it also has less power to carry sail of which it does not need so much. Doesn't this mean that in fresh winds, making less disturbance and having a longer waterline for its displacement, it will go faster than a beamier boat despite its lesser sail area. But, when the wind gets very light and the speed necessarily slow, the beamier boat, having more sail and less wetted surface will be the better ghoster. This question is very important to me in my final choice of hull for my new ship as I am *not* interested in a very high *top speed* but I am very interested in a high *average* speed from port to port, keeping in mind that I don't want an engine and that at sea there are far more often too light winds than too heavy ones.

The next question, which I have thus far not been able to get a satisfying answer to is: what makes a sweet motioned ship? Some people will say: beam, shallow draft and internal ballast but then an experienced man like Herreshoff recommends me *not* to use his design called *Nereia* (36′ x 32′ x 11′ x 5′ 4″) because she will have an uncomfortable motion at sea due to *too much* beam! Hiscocks says beam is the first condition to easy motion! Hiscocks has possibly only owned narrow boats and Herreshoff has possibly never gone far at sea. You have studied these questions and have information from many people. What are your conclusions in this matter?

PETER.

Dear Peter,

Many thanks for your most informative letter. I feel far more of the spirit of the sea in your letter than I have ever got from any account of a cruise which has been published—and I have read most of them.

Your opinion of sterns is naturally sound, the overtaking wave crest is usually a frothy mass and will come over any kind of stern. A solid overtaking wave will slide up and down a transom without much malice. The same wave will slam a counter and (I suspect though I have

no precise knowledge) will be made to break by a canoe stern. A canoe stern has a "suck down" effect and turbulates the water flow.

I checked on the drag of the weight of an engine on speed. An engine weighing (with fuel) ½ ton will slow a boat weighing 10 tons by 6%. However, the drag of the prop and shaft (often badly fitted) can be far greater than this. An article I recently read gave the figure for the worst installations at 25%.

I must say that I don't agree with your philosophy of voyaging in the hurricane season. No yacht is so perfect that she can reasonably be built to withstand a hurricane with certainty. Nor is the human frame so robust that it can stand the resultant bashing about which it must get. One realises that there is a risk of loss of life in ocean cruising but it is very slight. Being run down by a ship or being caught in a hurricane are two things which are more likely to cause loss of life to the very good seaman than anything else.

Your heavy weather drill of keeping going sounds as if you had no fear whatever. The idea of green seas washing from forward clear aft makes me think of the little iron clippers built to the lines of the *Cutty Sark*. They used to dive under on entering the "Roaring forties" to come up off Cape Leewin, Australia. *Dorothea* must be really sturdily built to stand it.

I note that you make 50° to 55 °effectively from the wind when close hauled in the open ocean. Now *Dorothea* may be expected to do 40° from the wind in smooth water. Is the extra 10° to 15° lost from the surge to leeward in the seas or because you have to point further off the wind?

Do you use any self steering gears? I have not yet tried out the gear used to steer windmills on a yacht but feel that it could be good.

Your navigation methods appeal to me as similar to those of Slocum but he did have a revolving log. But he didn't have accurate time. I suppose it works out about the same. I also guess that you know your dead reckoning by insight as did Slocum.

Do you tow warps when running under bare poles in storms? Some do and some don't. A friend of mine, after trimaranning in a gale in the Piver fashion said that he developed what he called "Trimaran eyeballs" and "Outrigger jaw". Both ached due to the violent motion. With the catamaran and trimaran, however, there is no rolling; just violent jigging about.

I quite agree that the average speed is what matters. The old East Indiamen went fast in light winds but were slow in strong ones. The clippers, by contrast, went fast in strong winds and were slightly slower than East Indiamen in light winds. The point here is that an extra knot means an extra mile travelled whether it is done in light or

strong winds. To get a high average, therefore, one must pick up the knots at both high ends of the wind speed range.

Your Questions to Me. 1. I have done some calculations on sail area and beam and have found that a narrow boat carried relatively less sail area for her wetted surface than a wider boat. But, she will have the capacity to carry more light weather canvas and I guess that the light weather speeds will be about the same as the beamier boat.

2. *Seakindliness.* The shape least affected by waves would be circular section with the L.W.L. at the diameter. However, if this shape were to be ballasted, it would roll your teeth out. "Flats" or straight lines in the section dampen the roll, however, and yachts usually have this.

Narrow beam gives a seakindly motion and it helps if the section cuts the L.W.L. at right angles but this means a loss of stability.

Shallow draught is also a seakindly feature. The water in a wave (I don't call them seas because I don't claim to know what seas are) goes round in a circle so that it is possible for a yacht's hull to be pushed to leeward while a deep keel is being pulled to windward (or vice versa).

Seakindliness in pitch is merely a matter of the distribution of buoyancy and weight along the boat. However, a vertical stem carried deep underwater and a deep transom are seakindly features. A transom is also a help as it gives the effect of a much longer boat which pitches around an axis farther back than with a counter. If violence of pitch is a problem, placing the weights more at the ends is a help. It is generally preferred, however, to design fine ends which serves the same purpose. In general, fishing boats are built much more for seakindliness than speed and the Mevagissy luggers which are used at Folkestone are typical examples of the type. I suspect that *Dorothea* is based on a fishing boat. At least it looks so from her profile.

One may get an idea about sea motion if one tries to design for the greatest sea motion. For that, I would have long overhangs fore and aft and flare of the sections out from the waterline beam. Circular arc sections would produce pendulum roll.

In all the accounts of deep sea sailing of which I know, the only craft which was stated to be comfortable in a gale was Voss' *Tilikum*—the canoe. In an account of one storm, however, she was stated to roll violently but of course, her sections were arcs of circles, being a dugout.

My opinion, for what it is worth, is that a *Tilikum* with a transom stern, flats in her sections and a salient, ballasted keel would be the fastest and most seakindly hull. She did 177 miles in one day, a speed also accomplished by Slocum in *Liberdade* of similar design.

Please contradict any of my arguments you think wrong.

JOHN.

8th November, 1964.

Dear John,

Sterns. It might be true that a breaking sea could slam a counte while it slides under it but it is of so little importance that it can be disregarded. The slamming of the waves falling on deck or hitting the forward side of the coachroof can be terrifying at times but I have to think hard in order to even remember anything ever hitting my transom.

Dorothea is not a fishing boat but a Harrison-Butler design. It is an enlarged Z-4 tonner which had first the stations spaced out to a 21 foot waterline. Then the scale on the drawing was simply changed from 1 inch to 1 foot to $\frac{3}{4}$ inch to 1 foot.

I rather object to being presumed to have no fears. Only a fool does not recognise danger. If I drive *Dorothea* hard, it is because I feel she can stand driving; she is the strongest built vessel I have ever seen. On a 32′ length overall, she is planked $1\frac{3}{4}$″ pitchpine on double sawn frames spaced 14 inches and sided $5\frac{1}{2}$ inches moulded $4\frac{1}{2}$ inches at the bilges and tapering to $2\frac{1}{2}$ inches at the topstrake. Between those sawn frames are 2 inch by $1\frac{1}{2}$ inch steamed frames. All planking is copper riveted with 5/16 and 3/8 grooves. She also has the huge old fashioned keelson and oversized bilge stringers. Her deck is not weakened by a large cabin roof but has two small coach roofs with a strong double beam between them where the deck is flush. Her mast is a Norwegian pine tree balanced off by $3\frac{1}{2}$ tons of lead on the keel and well stayed on outside channels with 3/8 and 2 inch stainless steel chainplates.

I note what you say about hurricanes and should probably agree with you but if passing yachtsmen should wait over a season in order to avoid a region's hurricanes, what do you think about the native sailing vessels which are kept in operation 12 months a year? And what should we say about a few of my friends in Martinique who cruise only during the hurricane season as their vacation happens to be during that time? As for me, I would hate to have missed the many wonderful sails I have done in the "wrong" seasons. With care, the risks of a hurricane can be minimized.

I could not agree more with you regarding the danger of being run down by steamers, I think that today's steamship sailors make this a very great danger for the following reasons :

1. Watches are not kept with sufficient conscientiousness.
2. Many of them do not consider that sail has the right of way over steam.
3. They underestimate a small sailboat's speed in relation to theirs.
4. At night, a yacht's lights are admittedly rather too weak and too low.
5. On some ships, drinking is tolerated to an extent I would call excessive.

The other great danger I personally am afraid of is falling overboard.

Navigation. I should be greatly flattered to be compared with Slocum but I must point out that there is absolutely no comparison between navigating without a timepiece and without a log. If we are disregarding lunars, there will be an accumulating error every day if navigating without accurate time. No matter how good our dead reckoning is, we will in the end be very uncertain about our longitude. Navigating without a log, each day's noon position will have no greater error than the estimated amount of miles from the morning sight. With training, it will never be more than 2 miles in error and generally less. A log on a small yacht cannot be considered more accurate than within 10% of the covered distance because it will not take into account the current and will, at low speeds, badly under-register. Anyone with training can estimate the distance travelled closely. Simonne had never been on a yacht before meeting me yet it was not long before we had guessing competitions between us about how many miles we had covered since the last noon sight. I might say 135; she might claim only 125 and it might turn out to be 128. Another point against using a log is that it slows down a yacht. I claim that a yacht of my size (11 tons Thames measurement) will lose 2 or 3 miles in every 24 hours. In an Atlantic crossing, it could make the difference between arriving at noon instead of the following midnight. But I do think a log could be useful for the occasional week-end yachtsman who never stays long enough on his yacht to be able to estimate its speed with any accuracy.

Regarding the trimarans' violent motion, I think you have opened my eyes about a fact I have never thought properly about before. People claim that a trimaran is a comfortable ship because she sails upright. Your letter makes me realise that the discomfort of sailing at a great angle of heel and the discomfort of violent motion are two different things and they don't have to go hand in hand. Between the two, I prefer to sail heeled over; for when the interior of the ship is designed accordingly, the body does not have to suffer, while in a rough motioned boat there is no escape for the body to relax.

I am also very glad to hear you say that short ended boats have the easiest motion because I strongly dislike overhangs but have read accounts that overhangs were desirable for " easily climbing over the waves" and I sometimes wondered if my aesthetic choice were not scientifically the best.

Coppering. I must have given you an over-optimistic picture of my opinions of coppering. I do like it and will have it on my next ship but it does not stay clean for ever. The first year or two its anti-fouling properties will keep it clean but thereafter an occasional scrub is necessary. The previous copper which lasted until 2 years ago was 28 years old when I took it off. Yet some people will find it worn off

in a year or two. I believe that dissimilar metals and electricity are coppering's biggest enemies. Scrubbing even a 28 year old copper is unnecessary at sea as long as we keep moving, but in harbour scrubbing might be necessary as often as once a month with old copper. However, this is no hardship as shells cannot stick hard on copper and come off very easily. Divers are not necessary; all one needs is a long handle on the brush.

You say that an added knot is just as important at the top end of the speed range as at the bottom of it. This has made me do a few calculations and, unless I have overlooked something in my reasoning, it rather confirms what I instinctively long have suspected; namely, that a knot added at the bottom of the scale is far more important than a knot added in the higher speed ranges.

Let us imagine two different boats, one (A) going 9 knots to the other (B)'s 10 knots in strong winds and in light winds A making 2 knots when B is only making 1 knot. If A and B are making a thousand miles crossing in which the first 500 miles are done at the yachts' top speeds and the second 500 miles at ghosting speeds, A, going first at 9 knots will take 2 days 7 hours for the first 500 miles but going at 2 knots for the second 500 miles will take 10 days 10 hours, a total of 12 days 17 hours. The boat B will take 2 days and 2 hours for the first 500 miles at 10 knots but will take 20 days and 20 hours for the second 500 miles, a total of 22 days 22 hours. Boat A therefore arrives 10 days sooner.

In conclusion, a very high top speed has far less importance than good light weather speed, and I will add: and the ability to keep going under all conditions, never having to heave-to, stopping the ship altogether. *Dorothea's* best day's run has been 187 miles which is considerable for a boat of her type but I was probably helped by favourable currents. But I think that possibly the reason for her consistent good *average* speed has been her good ghosting ability and the fact that she is so strong and powerful that heaving-to is practically never necessary.

Close Hauled Sailing. Regarding sailing 40° to the wind, I can only say that I have never been able to sail that close in any of my ships when at sea. Close to land in smooth water, it is of course an entirely different thing. Even at sea, we have the *impression* of sailing much closer. In fact, should you ask Simonne, she will probably swear we are driving into the sea within 15° of head on, but on the chart the course will be 50° or 55°. In my opinion, a very close winded boat will only be useful in waters like the English Channel, the Mediterranean, the Fjords of Norway and such other places where the sea gets flat when the wind is light In the Atlantic and other big oceans, the ocean

swell never calms down, so even in light airs it is difficult to get enough drive to point up very close. In heavy weather, the waves and possibly surface current will contribute to our difficulties.

Self Steering. The *Mill Gear*, it seems to me will react too slowly. With a vane, once the wind turns it, it will transmit its action instantly to the rudder or the trimtab. The windmill will not start acting sooner than a vane but when it starts, it will only slowly transmit its action to the rudder through its gearing which I suspect will have to be geared low to overcome friction if we desire a small mill. Contrary to Francis Chichester's claim that his vane "steered such a superior course that a 12 meter was unable to pull away from him", I claim that *all* vanes and self steering apparatus on a small yacht will always be inferior to a good helmsman because they will never be able to anticipate the correction before it is needed. Once a yacht sheers off course and needs correction it is already too late; the correction should come before the yacht has started to sheer. The Mill Gear I believe to be slower than a Vane gear and therefore inferior to it, the Vane is slower than a human helmsman and therefore inferior to him. Of course, a good vane will be a lot better than a bad helmsman.

PETER.

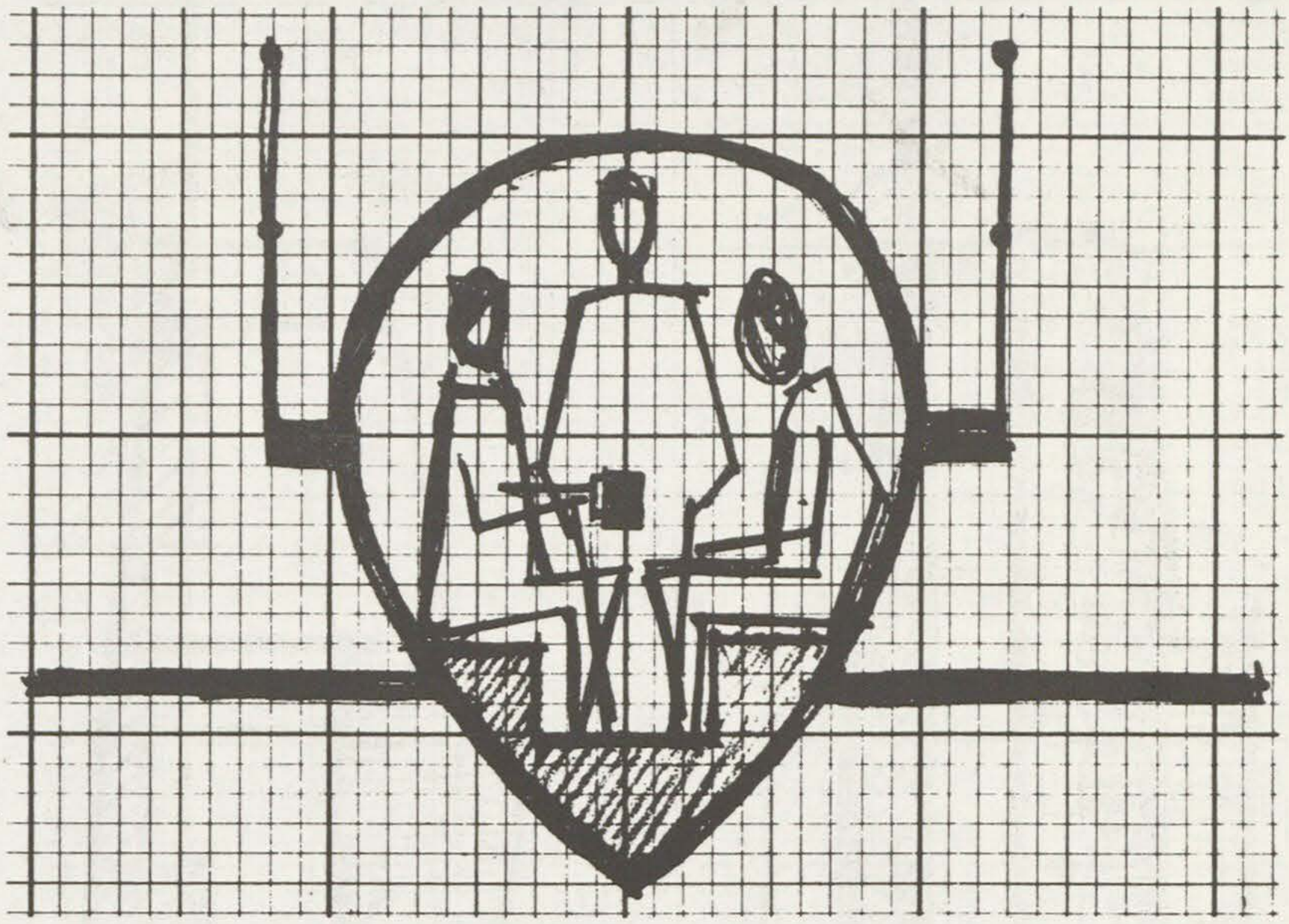
15th November, 1964.

Dear Peter,

I enclose a medical publication *Roche Image* with an article on "The Effects of Severe Isolation on Human Behaviour". It describes the effects of isolation in an enclosed space either in total darkness and quiet; or constant light and noise. On emerging, thoughts are jumbled, thinking is an effort, irritability with trivial matters occurs. Dreams are vivid and visual hallucinations appear. Several volunteers reported a strong craving to go back into the chamber for several days. I should like your opinion on this so far as it is relevant to single handed cruising.

Self Steering. I have no experience of self steering gears myself and can only quote Mike Henderson who found his "Harriet" could steer a better course to windward than the human helmsman because it followed each variation in wind direction. The human tends to steer an average course close hauled and be slow in detecting small wind shifts.

The Added Knot. Your statements about the extra value of the added knot at the lower end of the speed scale are, of course, correct. However, I made my calculations on the basis of *time*. If a boat travels 1 hour at 9 knots and 1 hour at 2 knots, it will go 11 miles, but, if a boat travels 1 hour at 10 knots and 1 hour at 1 knot, it will also go 11 miles. The point at issue is therefore whether the calm patches

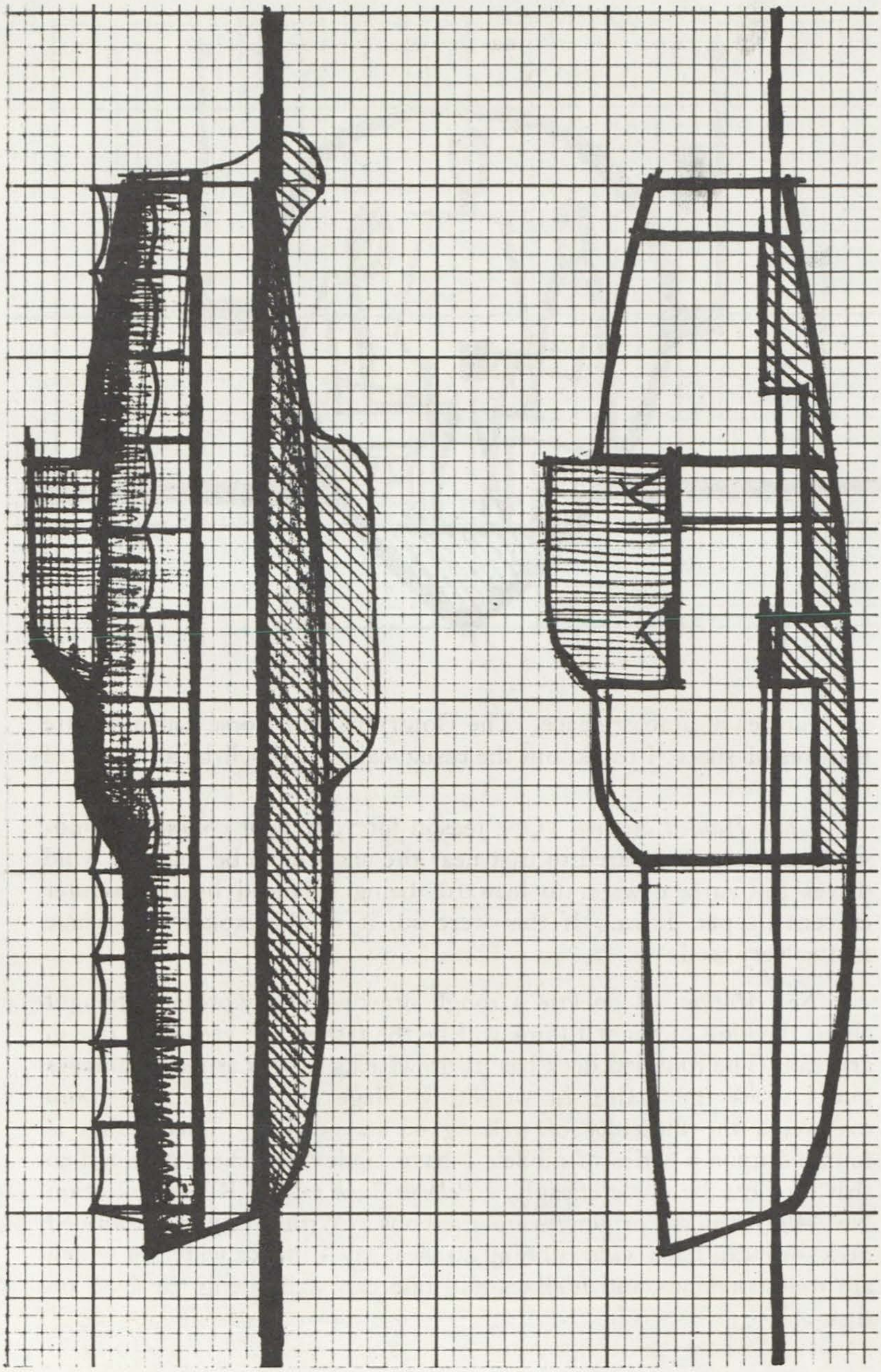


are features of time or space. The Doldrums and Horse Latitudes are features of space, I think, but the casual calm may well be a feature of time.

Close Hauled at Sea. One reason for your poor course to windward at sea as compared to that near the shore may be that the wind drives the surface water to leeward, being balanced by the counter current deeper down. If this were so, it would explain the whole matter very well.

Sea Motion. I enclose a rough drawing of my present thought about the kind of yacht I think will be the fastest and easiest to live in and sail. The rounded deck has its drawbacks as well as its advantages but I think the saving in weight, windage and extra inside room overweigh the difficulty of walking on its outside. This design is founded upon a series of models I have made from sheet plywood so that they can be made cheaply. *Pelorus Jack* in A.Y.R.S. publication No. 44 gives all the principles and methods. With this type of rounded deck, one can have wide rubbing strakes, say 4 inches wide, on which are the stanchions and lifelines and one can walk along the boat on them.

JOHN.



The cockpit has a "convertible" top.

Dear John,

Thank you for your letter and for the medical journal which I am returning.

Isolation. The journal's conclusions are not surprising. When a man has been closed up in a small space in utter boredom for a fortnight, it would be rather strange if he had not become affected. If a man stays in bed for a fortnight and has no physical exercise, when he suddenly gets out of bed, I am sure that tests would show that he, for a day or two, would not be able to run as fast as he was able to before. If the brain has had no stimulation for a long time, no wonder it does not function so well. The plain boredom must also upset individuals. I was once locked up in jail for 3 weeks during which time I thought I was going completely out of my mind. (I had been refused a leave while in the Air Force so I "deserted" in order not to miss a date I had with a girl I was very much in love with.)

Should you be alone at sea, the situation would be entirely different. You are doing something you like doing. No boredom enters the picture. There is plenty to do and plenty to see. The changing pattern of the waves; the beautiful clouds (or sometimes the ugly clouds); the changing pattern of the stars in the sky; the birds and the sea life which never stops even as far from land as the middle of the biggest ocean. The longest I have been at sea *alone* has been 31 days but I am positive that I could have stayed several times that length of time with no abnormal reactions of any type.

Self Steering. I made my own self steering gear in 1959 to the design of Bernard Moitessier who laid next to me in Trinidad in 1957 just before he lost his *Marie-Therese II* in a brilliant demonstration as to his vane's ability to take him where he wanted to go (but it showed not to trust alarum clocks). In 1960, I changed the system to the free trailing rudder actuated by the trim tab because I worried about the strains set up by the first system. (Strains do not worry most yachtsmen until something actually does break. Then they say that they have had bad luck).

Regardless of what Mike Henderson says, I'll stick to my guns: No self steering gear will ever be as good as a human helmsman. This does not mean that I dislike self steering gears. I have just noticed their short comings. It is only when going to windward that it pays to follow the changes of the wind. On all other points, it is best to follow a straight compass course. However, I very seldom steer except close to shore where the wind is too inconstant.

The Added Knot. I see your point about considering travelled time and travelled distance but the net result will still be that the faster boat in light airs will make the best crossings in the long run. When

your argument holds true, both boats will cover the same distance (the good heavy weather boat no faster than the other) while, when my argument holds true, the light weather boat will be faster (sometimes a lot faster) which means that on an average, the light weather boat will be at an advantage.

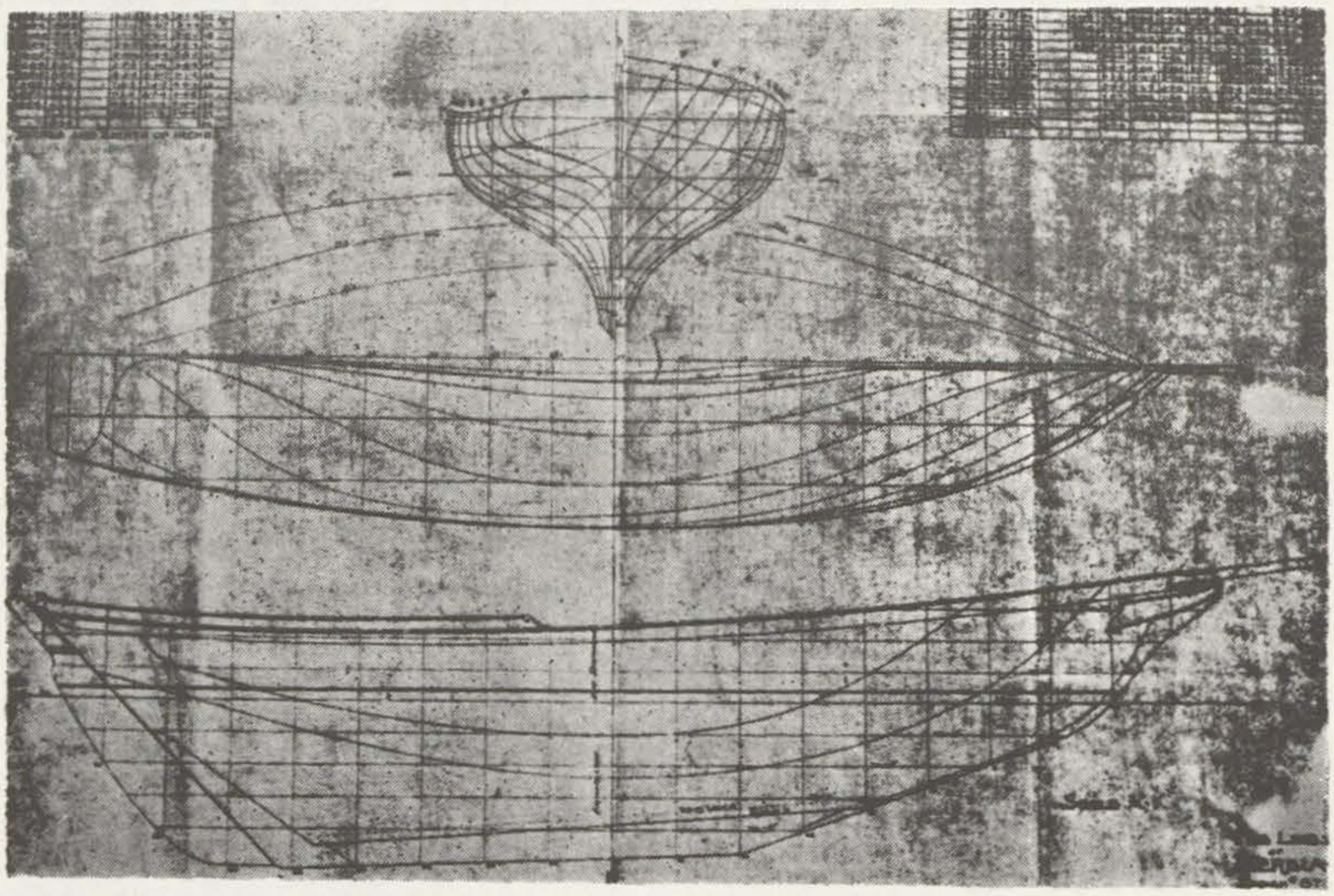
Simonne is surprising me by adding a good point (I can't get used to the fact that she no longer is the landlubber she was 3 years ago). "Half the time, we have the wind against us. I don't want to go any faster than we do now when it is rough, but it would be nice if we could go faster when the wind is light and the sea is flat. Sailing against the wind would be just pleasant". Of course, if we can get an added knot at each end of the speed scale, it would be best but is this possible? Isn't the most important feature for high low speed a large sail area and a low wetted area while for heavy weather sailing it is more important to have great stability, long waterlines and easy buttock lines? If I have to choose, I would favour the low speed range.

Close Hauled at Sea. Your theory about unfavourable surface currents sounds very plausible and I have often thought about that possibility myself, especially noticing that the first hours or even the first day after a strong contrary wind has come up, I will make more to windward than the following days when the surface might have had time to get influenced by the wind.

Sea Motion. Where the underwater lines are concerned, the best boat is the last century's work-boats as far as I can conclude from your letters and even from your sketch, for, except for her having an outside ballast shoe, her cross section resembles the work-boats. This pleases me as they are the boats I like. I strongly dislike boats like Chichester's *Gypsy Moth.* I think they are structurally weak, their ends pound, they have little room inside for their size and price, they are often hard to slip, they are very hard to steer in quartering seas, the waves tending to twist the counter around. Finally, I strongly dislike their looks.

Your sketch of your *Pelorus Jack* type shows a boat which would enter most harbours, even those barred for the usual yacht. She would be easy to slip anywhere, she is structurally strong for her light weight from an engineering point of view. Her interior is extremely roomy and well arranged. She should be extremely seaworthy except perhaps for her rubbing strake which I suspect would pound badly even if only 4 inches wide. Robinson had a similar sized strake on his *Varua* and had to take it off for that reason. On a light displacement yacht, the pounding would even be more harmful. The width is not great but on such a length it still makes a big surface. But despite all these advantages I personally would never want such a boat simply because I don't like its looks.

Beauty in Yachts. Beauty is a very personal matter and tastes do vary. I think that *Dorothea* is a very beautiful ship, yet I know most people do not share my views. In fact, I rarely dare say it because most people start laughing and think I am joking. I think the Bawley is beautiful but I also think that the old *America* is exceptionally beautiful. I have her photograph framed and it hangs right in front of me as I am writing this. I am enclosing a photograph of a plan of *Nereia* designed by Herreshoff which I purchased last year and would like your opinion about her. Not about her beauty because I have already made up my



Lines and Sections of Nereia

mind that she is one of the most beautiful ships I have seen but about her suitability in regard to sea motion, low and high speeds and also I would like to ask you why she has a 50% ballast ratio, yet only carries 674 square feet of sail. She is 36′ x 32′ x 11′ x 5′ 4″ and displaces 24,000 pounds. It seems to me that I could safely reduce the ballast ratio to about 40% and still increase her sails to about 850 square feet, provided, of course, that I am prepared to reef down in strong breezes. I wonder if the designer made her like this for the man who "never wants to reef" or whether there is some other reason.

Light Displacement. There is one thing I don't like in your *Pelorus Jack* type boat and that is her very light displacement. I realise the advantages of light displacement and I do not argue the fact that they are every bit as safe in a storm, for what they lack in brute strength they compensate for in lightness and less resistance to the sea. However,

nothing will compensate for brute strength when in a harbour squeeze between a couple of heavy and "couldn't care less" natives, or when the heavy tug or other boat used by the emigration in far away ports comes alongside with a bump. And we feel it! And worst of all, what about collision with wreckage at sea? Coming up to England this summer we felt a very heavy bump in the middle of a dark night when going about 5 knots. Ashore in England, I saw the damage. It was a deep scar about 5 inches in diameter and about 3/8th of an inch deep gouged out of the heavy pitch pine. What would have happened with a yacht of the proposed displacement of your sketch? Of course, it much depends on what use we want to put a boat to. I always speak from the point of view of living aboard and cruising anywhere in the world our fancy might take us. When, in an earlier letter I said that the weight of stores is no problem, I was thinking about a heavy displacement boat. I can see that in as light a displacement boat as you are experimenting with, their weight would become a problem.

PETER.

25th November, 1964.

Dear Peter,

Many thanks for your observations on isolation. Of course I agree with you. It is boredom that destroys the personality; not the fact that he is not seeing his fellows. The person who is interested in the sea would not suffer.

Self Steering. Frits Fenger has the idea that any yacht can be made to self steer by appropriately setting sail with or without lines to the tiller.

The Added Knot. At least we understand the propositions here. I am afraid I am at least partially influenced by the faster times made by the clippers with a higher top speed over the bluff bowed East Indiamen which were fast at low speeds.

Simonne's point about increasing the light wind speed is just a matter of cramming on sail and this means an easily reefed "Low" rig. My thoughts here always go back to the three masted square rig in the modernised form which we are developing in the A.Y.R.S. I cannot naturally recommend it for you at the moment, unless you were prepared to make a lot of models. I feel that it would give a great deal of power and be close winded as well.

Sea Motion. Perhaps I have overlooked the fact that shallow draught will make a boat hard to steer because the surface surge of a sea comes on the quarter and will take it to leeward, whereas a deep draught boat will have its rudder in the deeper water.

The Pelorus Jack Design. I quite agree that she is at present ugly but that is merely a matter of what is called "Styling". The same underwater shape could well be mated with the above water shape of the very pretty design you have sent me.

The Herreshoff Design. This certainly is a very pretty ship both above and below the L.W.L. The straight keel would make her easy to slip. She would run steadily due to her deadwood. The deep and raking rudder cuts down wetted surface and is in the deeper water to steer in a following or quarterly sea. The lines are good but a little beamy to my eyes, but this doesn't slow the boat. It only needs more sail area.

The midships section is nice and easy and reduces sail area because the wetted surface is low.

The ballast ratio certainly seems excessive but is probably necessary to put her down to her marks. I am afraid that I cannot say what would happen if you cut down the ballast. She might need the same weight of inside ballast.

The small sail area is typical for this type of American boat. I guess that one is supposed to switch on the motor when the wind fails light and the speed falls below 2 knots.

The above water shape is, of course, the main appeal of the design. However, the freeboard looks awfully low to me and this is made worse by the sweep of the sheerline.

The Light Displacement of my Design. You say you don't like this because of damage. I agree that being squeezed by a couple of other boats would be risky but in collision with flotsam, her weight of 2 tons as compared with the 12 tons of your boat would produce far less damage. Your 3/8 deep score in the planking might have been less than 1/16th inch.

JOHN.

20th November, 1964.

Dear John,

Continuing my letter of yesterday, when I said that I do not like the looks of your sketched boat, I was referring to the turtle deck. I must admit that I am very narrowminded regarding the layout of a ship's deckplan . . . I do agree that your idea has great advantages if we can accept the look.

The Boston Irish Hooker. The more I study the lines of the Boston Irish Hooker (page 279 in American Small Sailing Craft by Chapelle) the more I think it fulfills both my taste in boats and your requirements for easy motion at sea. Her cross section up to the waterline is almost identical to your sketch except that the V is slightly more open and that

she has her ballast inside. She has no overhangs to speak of, her topsides are straight, except for some tumblehome and both her ends are very fine which you consider to ease pitching. Her beam of 10′ 4″ to 32′ water line is not so narrow as you would like but it is still moderate beam. Her draft of 5′ 2″ is moderate considering that it is only aft that she will draw that much. Forward, she draws only about 2½ feet.

I very much like the idea of inside ballast for cruising to far away places as it is then possible to be completely independent and not be at the mercy of expensive or non-existent yards. I can simply heel the ship over until the keel shows above the water, all ballast having been removed, of course. I have seen natives do that with as large as 60 foot schooners. However, I am only interested in that type of ballast if the ship would still be self righting after a knockdown, presuming that the ballast did not shift and that no water entered the hull.

Another absolute condition is that she still will be stiff enough so that the first lee shore during a gale will not mean disaster. One would think that workboats which went out all the year through would have these qualities but then many people claim that fishermen disappeared by the dozen. I am also wondering about how well balanced these boats were as that is a very important condition for having any hopes to have an efficient wind vane. I know that the old British boats, built on the double wedge theory were hopeless in this respect but I am under the impression that the Americans, as a general rule, had well balanced boats.

Copper is a necessity in my opinion for outside ballasted yachts but with inside ballast, I think I would save the expense of copper. I also automatically will save the foundry charge so, if there are no faults with the Hooker, I would save a fair amount of money by choosing her design. I must also confess that it would greatly amuse me to build a new boat to a design which is 100 years old, provided that it would be a good boat. I am, as always, talking about boats on world cruises. Theoretically, a coppered boat would not have to go out of the water for many years but the possibility of hitting a reef or doing damage which needs slipping is always there. Inside ballast would relieve one's mind of the difficulty of finding a slip if this happened.

PETER.

25th November, 1964.

Dear Peter,

The Boston Hooker. I haven't got Chapelle's book but know the type. Indeed, it is possible that the boat is similar to the Galway Hooker from the West Coast of Ireland. The midships section is

rather better than mine for wetted surface as it includes more area for the wetted perimeter. I think it has a more or less vertical stem going below the surface and a long, straight and sloping keel. The Boston Hooker would doubtless sail very well and one must remember that Slocum's *Spray* was no sluggard and it was probably of the same type but of shallow draught and therefore less able to windward.

Your last letter seems to indicate that you feel you might have been a bit forthright about my design. Please believe me that I do not take offence at such criticism. Any yacht I may project (I don't design them) is only tentative and varies from time to time so I am not emotionally attached to them as you must be to *Dorothea* which has served you so well.

JOHN.

30th March, 1965.

Dear John,

I am slowly starting to be convinced that my beautiful Herreshoff clipper bowed yacht does have a bit too much beam. Beam does give more room but it also costs more money so I could get the same inside room for the same money by having more length and less beam. But so far I have stopped at the formula $\sqrt{\text{beam}} = \sqrt[3]{\text{L.W.L.}}$ which I think is a good nice average beam. But I do look forward to the next Trans-Atlantic race to see how a narrow boat will go.

If I am not yet quite convinced about the desirability of extreme slenderness, you have convinced me completely about shallow draft. Thinking back on the boats I have had so far, I most definitely think that the shallowest one made me the least seasick (and that should be as scientific a test as we can hope for).

I presume that, if we want a shallow draft without large beam we have to have a low rig; otherwise we would not have sufficient stability. In this connection, I am considering a problem which in these days of auxiliary motors does not seem to interest many people, namely the problem of a boat sailing in a choppy sea and light airs. Can I presume that a low rig, because of a shorter arm, will shake less and therefore not throw the wind out of the sails? Or should I, on the contrary, expect the steadying effect of the wind on a tall rig (and long arm) to prevent the ship from bouncing about so much. In other words, to make a practical example, how will a ship with a tall Bawley gaff cutter with a large topsail compare with a low and widespread gaff schooner (long bowsprit, long overhanging mainboom, single headsail, overlapping foresail) when in choppy seas and light airs?

Dorothea with her tall masthead cutter rig and deep heavy keel is

absolutely awful under such conditions. I wonder if a lower rig would have shaken less or whether a yet taller rig would have quietened her motion.

PETER.

3rd, April, 1965.

Dear Peter,

Beam gives far more internal volume than length. In other words, it is cheaper to build a cube than a boat. However, the narrower boats are faster and, if no limitations are imposed by the rules, the boats get very narrow.

Sea Motion. Let us again consider the absolutely circular section with the L.W.L. at the circumference. It simply *must* be the shape least affected by the sea. However, a sideways heave will set up a pendulum motion. "Flats" in the section dampen this roll and a good compromise is a right-angled V, which is the usual shape of yachts sections as an average, though there is usually a filling out at the top of the V and a hollow near the keel. This S deformity of the limb of the V gives a shade more stability.

All the arguments, therefore, point to shallow draught and narrow beam for both speed and ease of sea motion, at the expense of roominess of accommodation.

The ultimate is something like Voss' *Tilikum*, with three masts, each with a squaresail or Bermudian mainsail of about 130 square feet of sail. I once made a 20 foot by 4 foot canoe with a 1 foot draught with 100 square feet of home made sail. She could beat to windward at 4 points in calm water and in heavy and short beam seas, was only moved sideways, not rolling at all. There was no centreboard. In all ways, she was utterly seaworthy but one had to move slowly about her as she heeled with one man's weight far too easily.

The problem you raise about the motion in a choppy sea and light wind is not concerned with the type of rig at all but with the "Metacentric height" or vertical distance between the C. of G. and the Metacentre (the metacentre of a semicircular section is at the centre of the circle). The matter can be re-stated as the shape of the "stability curve" which can be "hard" or "soft". A boat with "hard" stability has lots of beam and ballast and a relatively shallow hull above a deep fin. A boat with "soft" stability is the reverse. Hoisting a heavy weight, such as an anchor up the mast often improves the motion.

A low rig with a lower centre of gravity will therefore shake a boat more than a high rig with a higher centre of gravity and greater dampening effect from the sails. However, neither will be of as much effect as raising the centre of gravity.

JOHN.

14th April, 1965.

Dear John,

High and Low Rigs for Sea Motion. I agree that, if we consider that the low rig would bring the centre of gravity lower and thus increase the metacentric height, the motion of the ship would be more violent but I should have made my question clearer as I meant to disregard the matter of metacentric heights. The lower rigged boat should have either a shallower draft or a lower ballast ratio. Let me pose the problem again.

Let us imagine two identical hulls, each rigged with a weightless rig. One boat has a tall narrow rig, the other a low wide rig. Let us imagine that the same wave hits both boats, making each take a roll. Supposing that the tall mast is twice the height of the low one. If the wind, as an example, has a speed somewhere between the two speeds induced to the mast-heads in the roll, then I would think that the sail in the lower rig would remain asleep while the sail in the tall rig would shake. This should be true if we presume that the sails will not affect the rolling. However, sails do dampen the motion of a ship at sea (otherwise why should some motor boats rig "steadying sails"). My question is whether this dampening effect would be noticeably different in the low and high rigs through the higher lever arm which the wind would get in the high rig.

In practice, this would mean that the boat with the low rig will need a slightly reduced ballast ratio to compensate for the lower centre of gravity of the rig. Since the height of windpressure effort is lower, for the same angle of heel, we should therefore be able to increase the sail surface, thus compensating for the loss of efficiency of the low aspect ratio. I am wondering if this boat would not be as fast because of the increased sail surface compensating the loss of efficiency and if its sails will not stay asleep more easily than on the tall rig.

I am wondering also if the "Efficiency" of the high aspect ratio only means "per square foot of sail area" which to a cruising man does not mean anything, if another rig will allow more square feet with no more heeling moment. In other words, if we compare the tall rig with a low one giving the same amount of heeling moment, will the high aspect ratio one still be the most "efficient". I am in no doubt that the tall narrow rig is the best, *surface for surface in smooth water* but wouldn't a larger, lower rig be better for ocean work for a man who is not concerned with rating rules.

Most new designs are developed along our shores where the water is relatively smooth and where the sea calms down rapidly after the wind dies down. They may not be the best for ocean conditions where the winds are often very light yet the sea stays surprisingly rough.

I have sailed many thousands of miles under such conditions with the sails shaking the whole boat and where I know today's yachtsmen will claim "Without our auxiliary motor, we would still be there, as sailing was impossible". Sailing *is* possible but a modern tall rig certainly suffers. Perhaps the Chinese fully battened "balanced" rig would be the best. With about one third of its surface forward of the mast, it should help to steady the sail, but then that rig has so many other disadvantages. But I would rather just take one problem at a time and for now I am trying to determine whether or not a low wide rig will stay asleep more easily than a tall narrow one.

PETER.

22nd, April 1965.

Dear Peter,

High vs. Low Rigs. With the same sail area, a rough sea and light wind, I think at first sight that the *High Rig* will be steadier (even if weightless). You are quite right about the higher rig having the greater speed at the top for the same angular velocity and this will allow the *top* of the sail to flap as it goes over. But, and here is the opposite point, as it comes back again, it will flap back again and then meet a far greater angle of attack from the light wind. This will stop the roll. If we think of the extreme of a lop in a calm, the higher the rig, the greater will be its dampening effect.

High vs. Low Rigs With Low Rigs Having Greater Sail Area. I once did the calculations on this matter (and published them in my book *Sailing Aerodynamics*). Aspect ratio is taken as $\frac{\text{Span}^2}{\text{Area}} \times \frac{3}{2}$. A high rig, up to a ratio of 9 : 1 improves efficiency on all courses. However, 6 : 1 is nearly as good as 9 : 1 and the weight and windage would be less so I think 6 : 1 is the ideal aspect ratio. When we increase the sail area of the low rigs so that all rigs have the same heeling moment, the aspect ratio of 6 : 1 gives the greatest efficiency on all courses, being better than lower and higher aspect ratios. However, I was not able to assess the value of schooners and other rigs in this evaluations so my information may be incomplete.

Sail Flop in Near Calms. In practice, complaints about sails banging in a light wind and a lop come mostly from the gaff rigged sailors—the high Bermudian rig sailors don't complain so much. The reasons for this are two. (1) The gaff "shocks" the boat when stopped in its flap and (2) The almost rectangular sail produces far more "bang" when it suddenly fills than the narrower ribbon of sail of the Bermudian mainsail.

This problem has, I think, been present from the beginning of time. Sea-going squaresails tended to get shorter on the hoist and longer on the yard even in Queen Hatshepsut's ship from Ancient Egypt. The two finally developed sea-going types were the Chinese junk and the full rigged ship. Both used multiple poles across their sails, if we can consider all the sails on one mast of a ship as one aerofoil.

My own practical solution is to use three fully battened square-sails. Nothing should swing or move as the boat rolls and they will act as excellent dampers. The best full rigged ships sailed at 5 points from the wind close hauled and I believe that, with curved yards and continuous sails i.e., not divided into main, topsail, topgallant etc, they will easily point inside 4 points in smooth water. In addition, the masts will be short and a sail can be set on any mast, thus removing the hazard from the loss of a mast.

JOHN.

30th July, 1965.

Dear John,

I am sailing tomorrow for Mallorca, though I have just been told that my recent long illness may well return. That is a great disappointment to me but I can well believe it as I don't feel at all too good. Nevertheless, I am still going to sail and I will see if I have the forces to carry on to the French Guinea as intended.

If my health stands up, I will hire three natives in Guinea to build me the following boat :
45′ x 40′ x 11′ 10″ x 5′ 4″. Displacement 37,000 lbs. Sail in three lowers: 1,000 sq. feet of heavy (22½ oz.) handsewn flax. Rig: Schooner, similar to the old *America*. All inside ballast with lead cast in 50 lb. pigs bolted around the keelson (cast in U form) so that I can careen anywhere. Very low freeboard by today's standards. Only 5′ 5″ standing headroom and a close fit for sitting headroom under the side decks. According to my calculations, she should have positive stability up to at least 90° of heel. Straight keel 6′ x 10″ on edge, of greenheart. Flat transom stern, outside rudder. A 4″ rail. Moderate sheer, accentuated by a wale whose lower edge is strongly sheared.

You will not choose this boat but you will see that I at least have followed your advice on length in relation to narrow beam and shallow draft coupled with a low rig. But I do this with a ship about 130 years old instead of one which belongs to the future. I think she will be comfortable in a seaway, fast and extremely beautiful.

I just hope my health will not ruin my dreams.

PETER.

5th August, 1965.

Dear Peter,

My patients with your illness seem to live moderately energetic lives and I wish you the same result. I take it that the present trip to Mallorca is a trial trip to see how you get on and I think it is a good idea. It can mobilise the body's curing powers.

Your new boat sounds very nice. As you will have guessed from my letters, I am a romantic who would rather sail a fully rigged ship with squaresails than a modern yacht. Obviously, you are the same. Incidentally, it is worth noting that Marin Marie had to get rid of a lot of inside ballast when ocean cruising. His weight of stores made the motion too lively.

Sailing ship and sailing boat design took place mostly from 1500 to 1850 and had the best brains of many nations applied to it. Under the circumstances, it is reasonable to assume that very good and fast boats were evolved from the materials used. The modern yacht is the product of measuring length, girth and sail area and does not take into account either the carrying capacity or the comfort of the persons who make up the crew.

However, the main thing is to be happy and proud of your ship and I feel sure that you will achieve this.

With best wishes,

JOHN.

* * *

LONE GULL II

BY

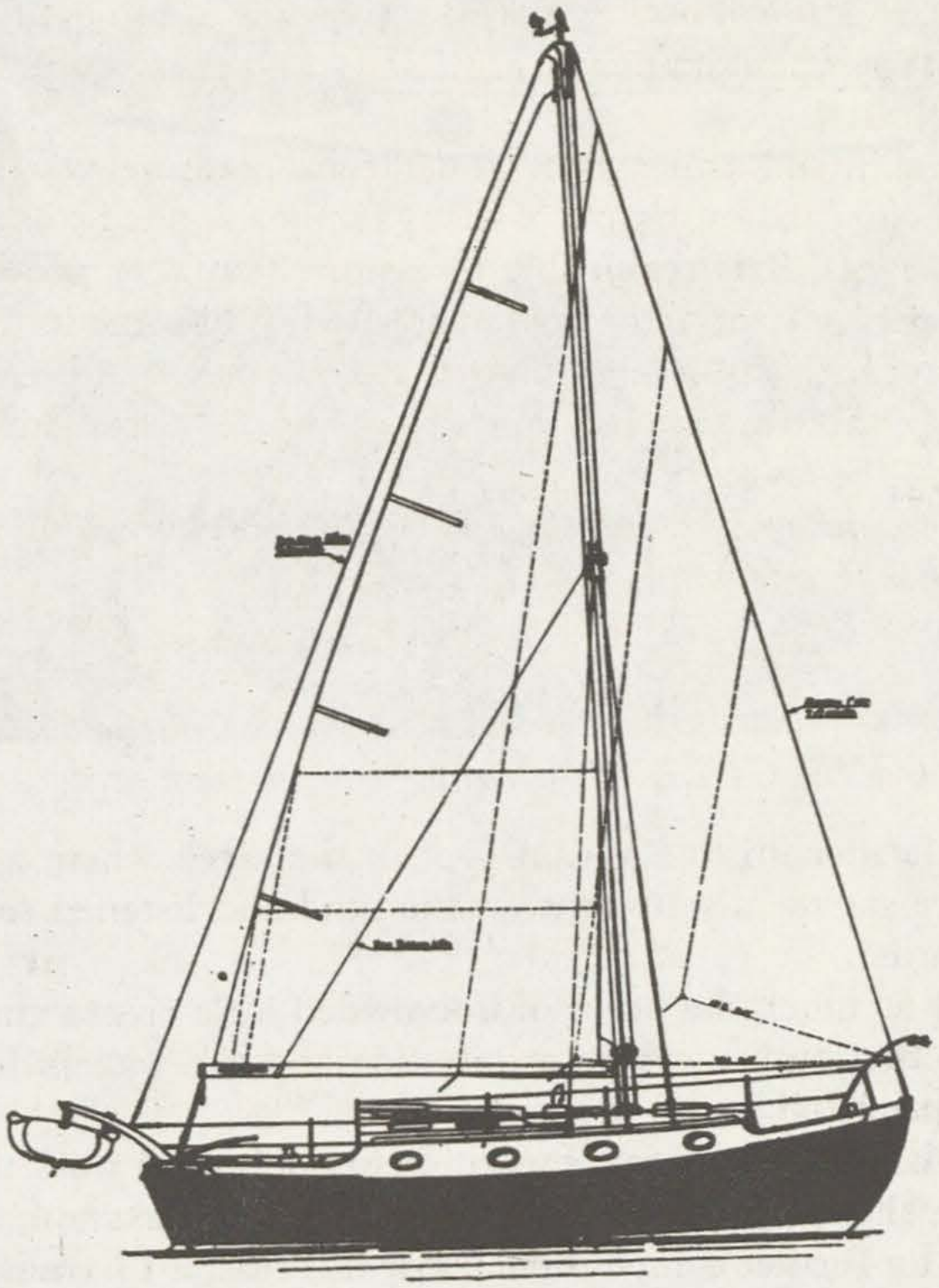
MAURICE GRIFFITHS

L.O.A. 28.0 ft.
L.W.L. 24.0 ft.
Beam moulded , 9.0 ft.
Draught, 3.3 ft.
Iron keel, 4,200 lb.
Displacement, 11,500 lb.

T.M. 8 tons.
Sail area, mainsail 248 sq. ft.
No. 1 jib, 150 sq. ft.
Power, Lister 8½ h.p. diesel.
Builders, Harry Feltham Ltd.
Designer, Maurice Griffiths, A.R.I.N.I.
Home port, Portsmouth Harbour

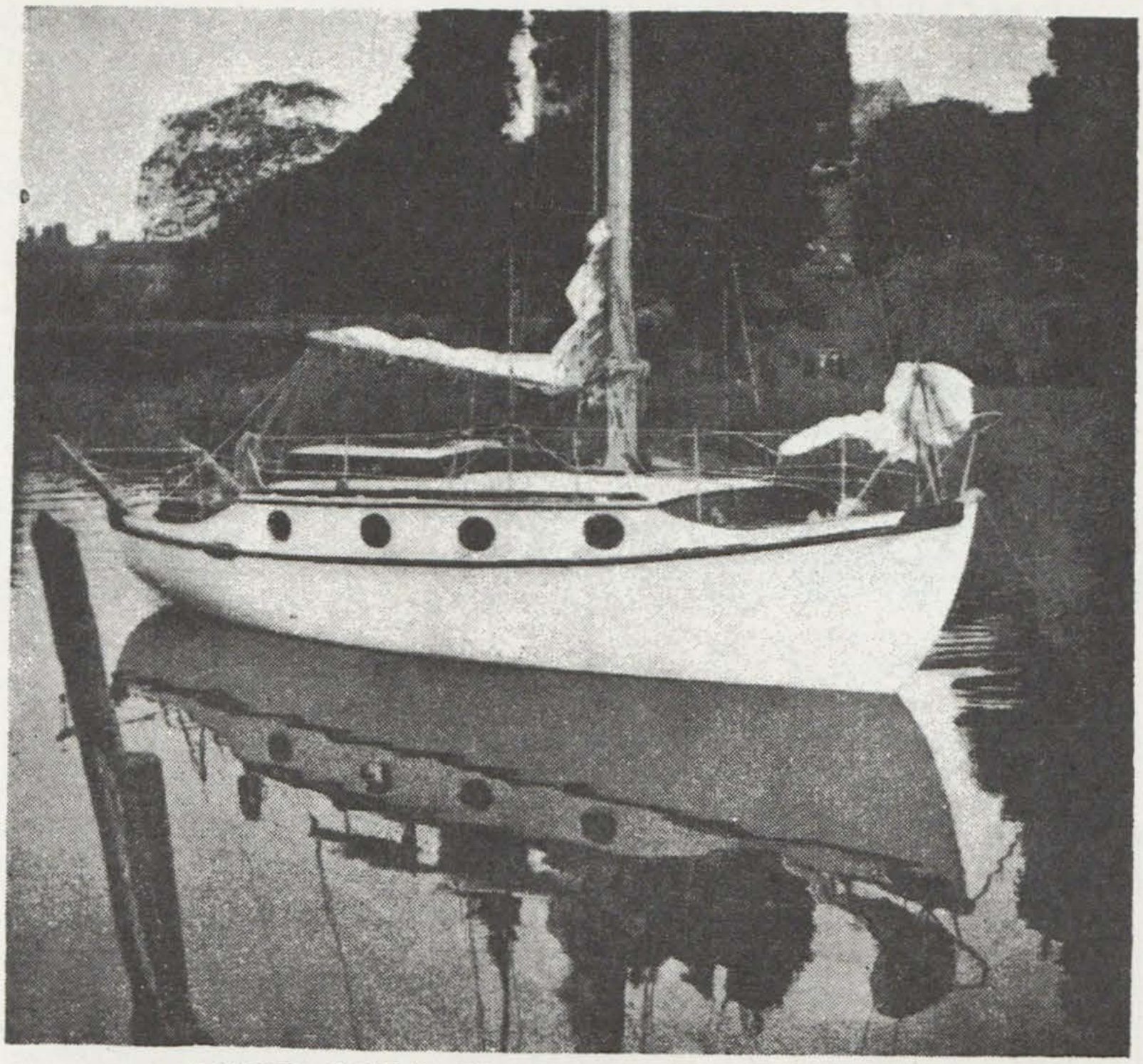
Twenty-five years have passed since I first planned *Lone Gull I*, a centreboard cutter of 10 tons T.M., 28.5 ft. o.a. and 10 ft. beam. *Lone Gull I*, as described in YACHTING MONTHLY, October 1938, was a type of boat that has long appealed to me for the sort of cruising that I like, in and out of rivers and harbours that dry out, and into places where the deep-keeled yachts never go : the plain, economical, shallow-draught boat with transom stern and simple and strong rudder mountings, a simple rig, good beam and no nonsense about her.

Lone Gull II is purely a development of her predecessor, but a little smaller with 9 ft. beam, and in place of the earlier boat's wooden centreboard she was designed with shaped oak bilge keels. She was built for me strongly and well by Harry Feltham Ltd., Portsmouth. On the all-too-few cruises we have had in her before laying up the bilge keels have shown over and over what a blessing they can be when Solent anchorages are crammed with yachts and the only quiet spaces are likely to dry out. *Lone Gull II* has sat firmly upright in Bembridge, Wootton Creek, below the bridge at Wareham, and elsewhere.



LONE GULL II—sail plan.

In one of the Solent creeks *Lone Gull II* visited the harbour-master remarked : "I wish *all* yachts that come in here could sit upright. I could find plenty of room for them. As it is, look how we have to pack in that lot—they all draw about 5 ft." He indicated a solid jam of yachts of from 6 to 20 tons or so in the only spot where they would lie afloat at low water. On the last of the evening breeze



LONE GULL II—floating low in fresh water.

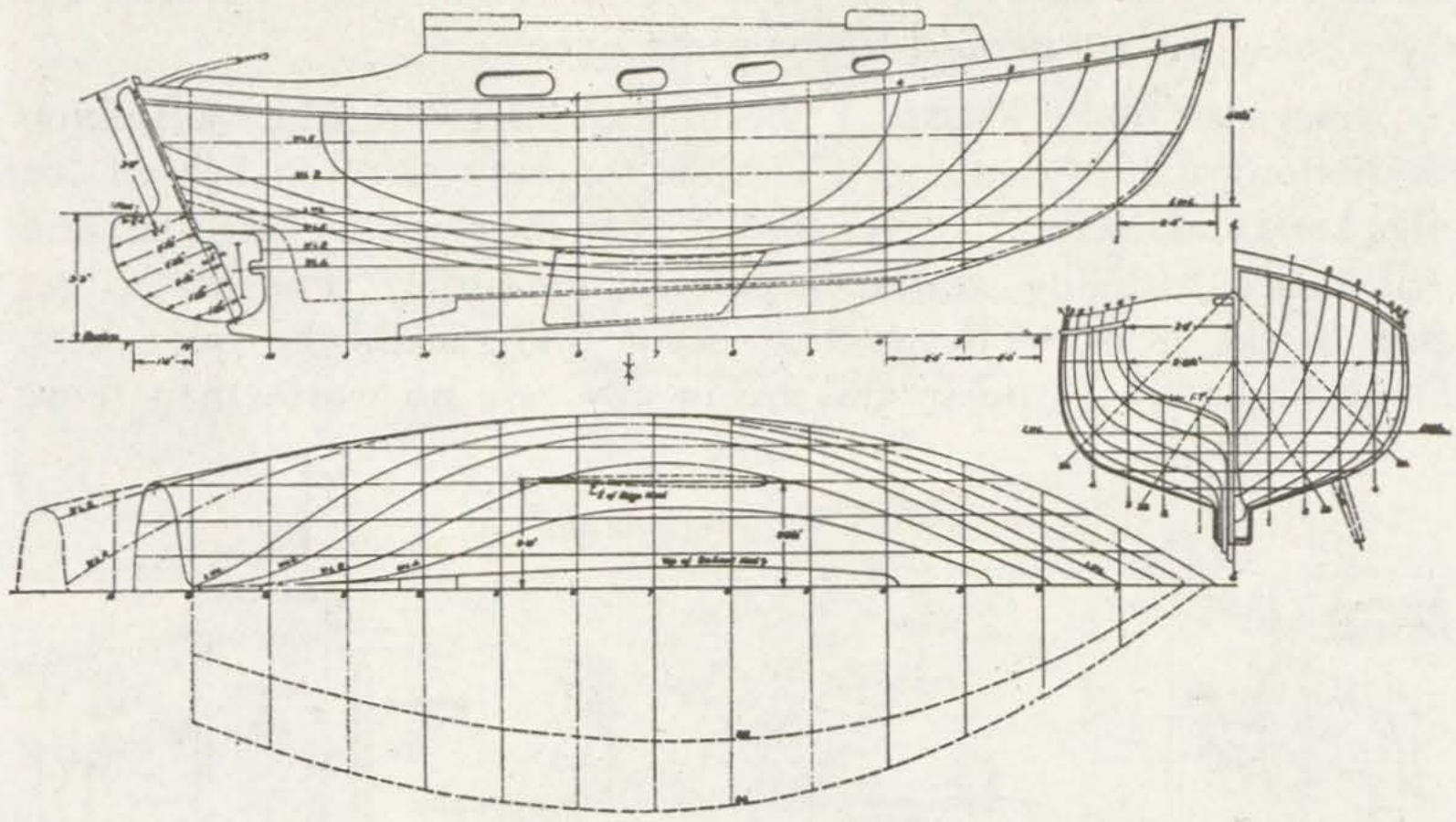
we drifted farther up to a vacant spot in the creek where an hour or two later we sat silently upright on the mud and listened to the cries of the seabirds.

I enjoy so much the peace of uncrowded little creeks and anchorages where the mud uncovers at low tide and the waders leave their dainty footprints all round the boat.

There is so much fierce competition in one's daily work that I look to my little ship as a means to enjoy peace and relaxation, not as an instrument for further competition. For this reason I have no burning ambition to keep up with the best of the ocean racing fleet, nor can I say that I ever enjoy a prolonged thresh to windward against strong winds and seas, finding it uncomfortable and exhausting. So long as my boat is no sluggard, handles well in crowded harbours, and sails to windward as well as most cruising yachts of her length, I am well content.

In windward sailing these bilge keels have shown a degree of efficiency in preventing leeway which has surprised sceptical crews. In moderate to fresh winds they appear to be better than a centreboard.

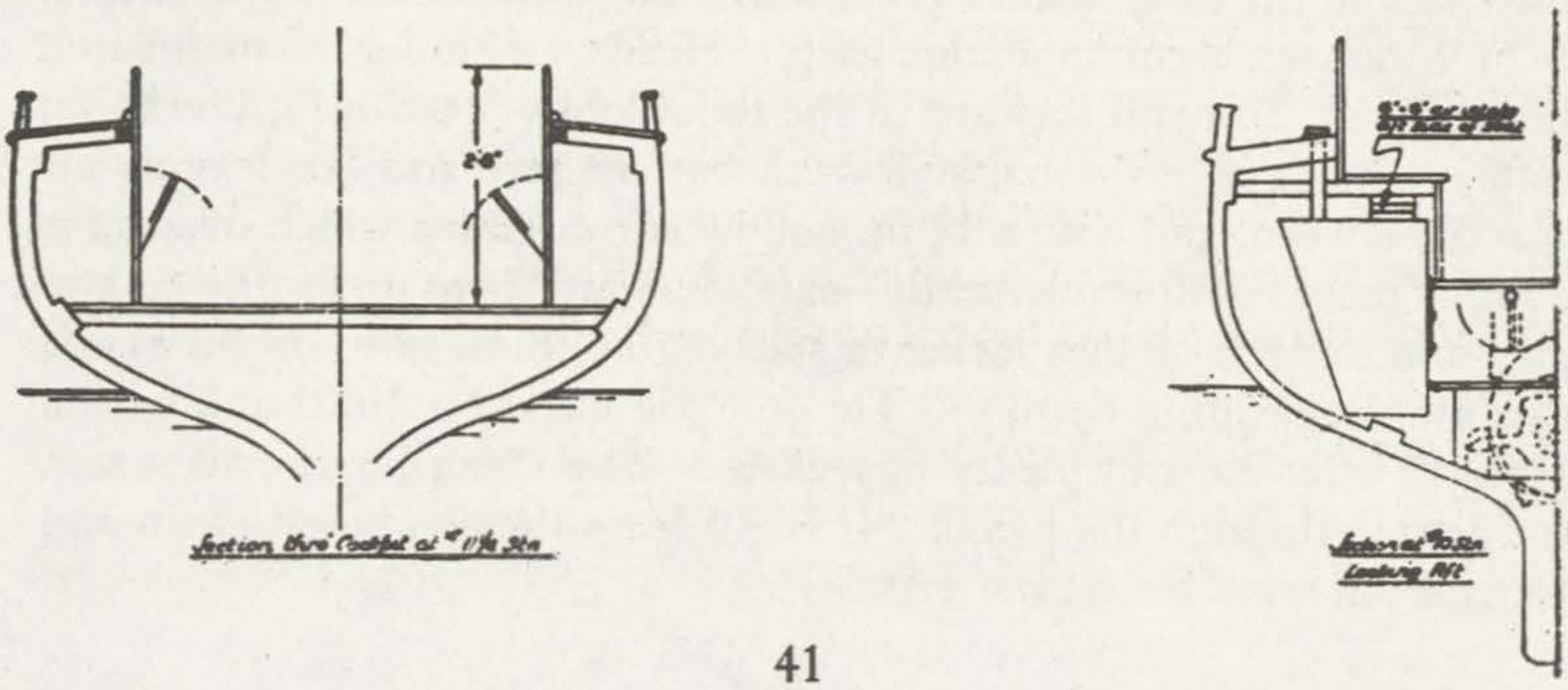
It is only in light airs and baffling head winds that shoal-draught boats of this type makes much leeway, when in fact the ratio of leeway increases as forward way through the water grows less. Then the skipper can either exercise his patience at the helm, set his biggest genoa, or run the engine at quarter speed.



Lines and Sections of LONE GULL II.

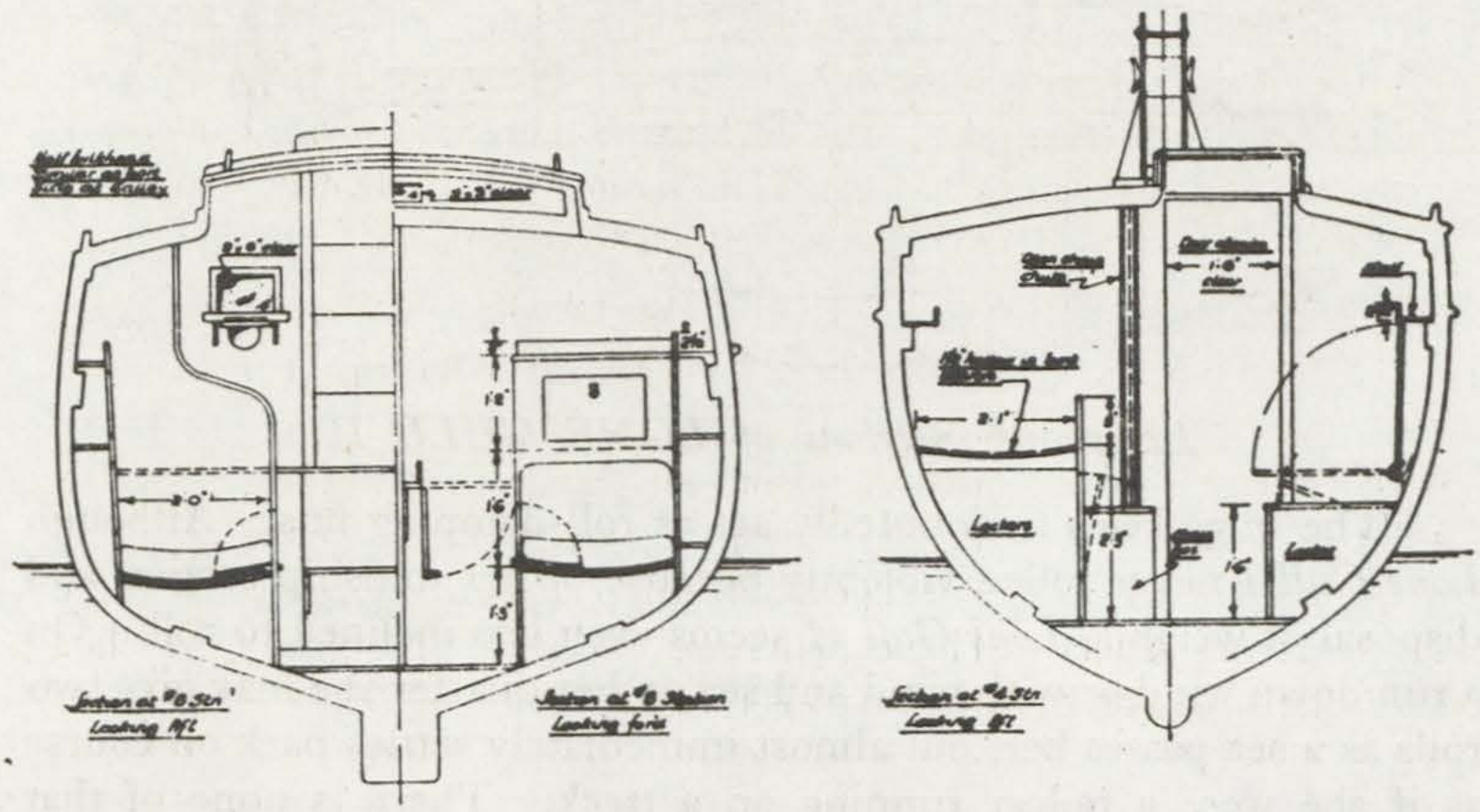
The bilge keels undoubtedly act as roll-damping fins. Although *Lone Gull I* never rolled violently because of her midship section and disposal of weights, *Lone Gull II* seems even less inclined to roll. On a run down wind or with wind and sea on her quarter she may give two rolls as a sea passes her, but almost immediately settles back on course as if she were a railcar running on a track. There is none of that ghastly rhythmic rolling of the deep-draught yacht with boom alternately skywards and sea-dipping, and queasy crews (aren't we all at some time or another?) tell me her motion is one of the easiest.

Experiments with a number of other boats built to previous



designs with bilge keels has led to the conclusion that there is no worth-while gain in toeing-in the bilge keels. Whilst a deep narrow leeboard, such as the Dutch botter's or hoogaart's, is more effective with two or three degrees toe-in, with bilge keels that are more than twice as long as their depth the effect becomes excessive and may create unwanted drag on every point of sailing. *Lone Gull II's* are accordingly exactly parallel to the centreline.

Snags with bilge keels? I can think of three : (a) when scrubbing the bottom and antifouling, it is none too easy to reach behind the bilge keels and needs a long brush; (b) when the ship is sailing hard and well heeled with the weather keel breaking surface, one has to get used to the hearty *k'flumps* that occur underneath the bilge keel. These thuds are harmless and are in any case no worse than those

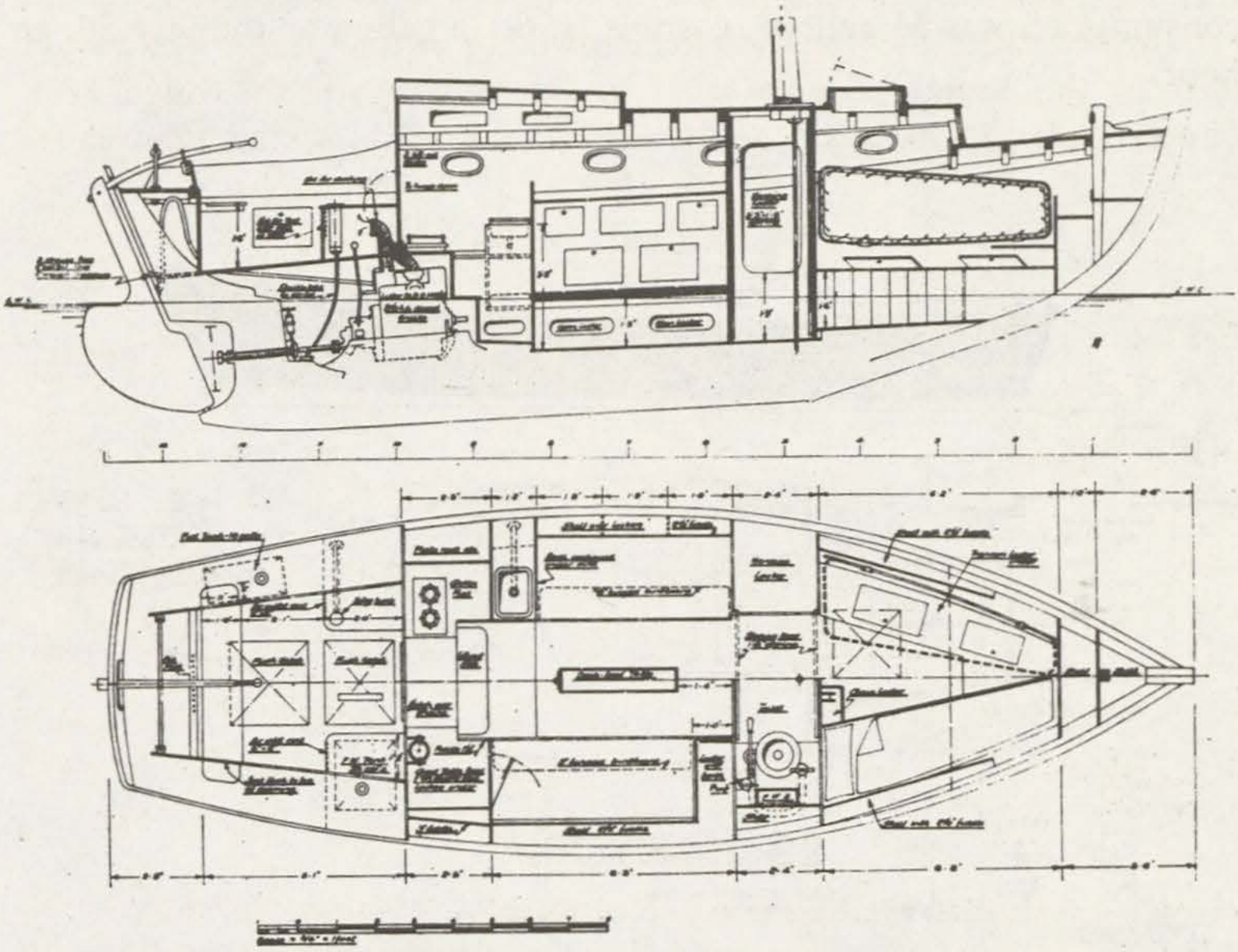


which occur under the flat of a V-bottom boat when the weather chine breaks surface; (c) Underwater ledges or sloping causeways must be watched if you are settling alongside on the ebb.

With her sizeable main hatch and built-up topsides amidships the space in the cabin makes visitors who are accustomed to the normal 8- or 9-tonner's accommodation gasp. Headroom under the mainhatch beams is 6ft. 5in. and forward in the toilet lobby 5ft. 5 in. The cabin settees—made in my usual style with battens fore and aft, leaving air spaces between, and with a 1½ in. hollow athwartships which makes for a much more comfortable berth—extend about 15 in. under the sink to port and under a clothes locker to starboard. Both form useful places to stow the bedding by day. The fo'c's'le has a 6ft 4in. bunk with a pipe-cot opposite and plenty of lockers. The chain box forms a step for getting through the hatch. It is fed from the combined chain and warp drum windlass on the mast.

There is no bridge deck. The cockpit floor slopes some 6 in. down aft to scupper drains in the transom. This puts the forward end high enough to cover the Lister diesel.

I have had second thoughts about self-draining cockpits where the cockpit is well aft, as in boats of this type. It seems that those who have never had their cockpit full of water always dread the experience and those few seadogs who *have* had their boats dragged down by aft by a sea in the cockpit say it would have been safer for the ship and

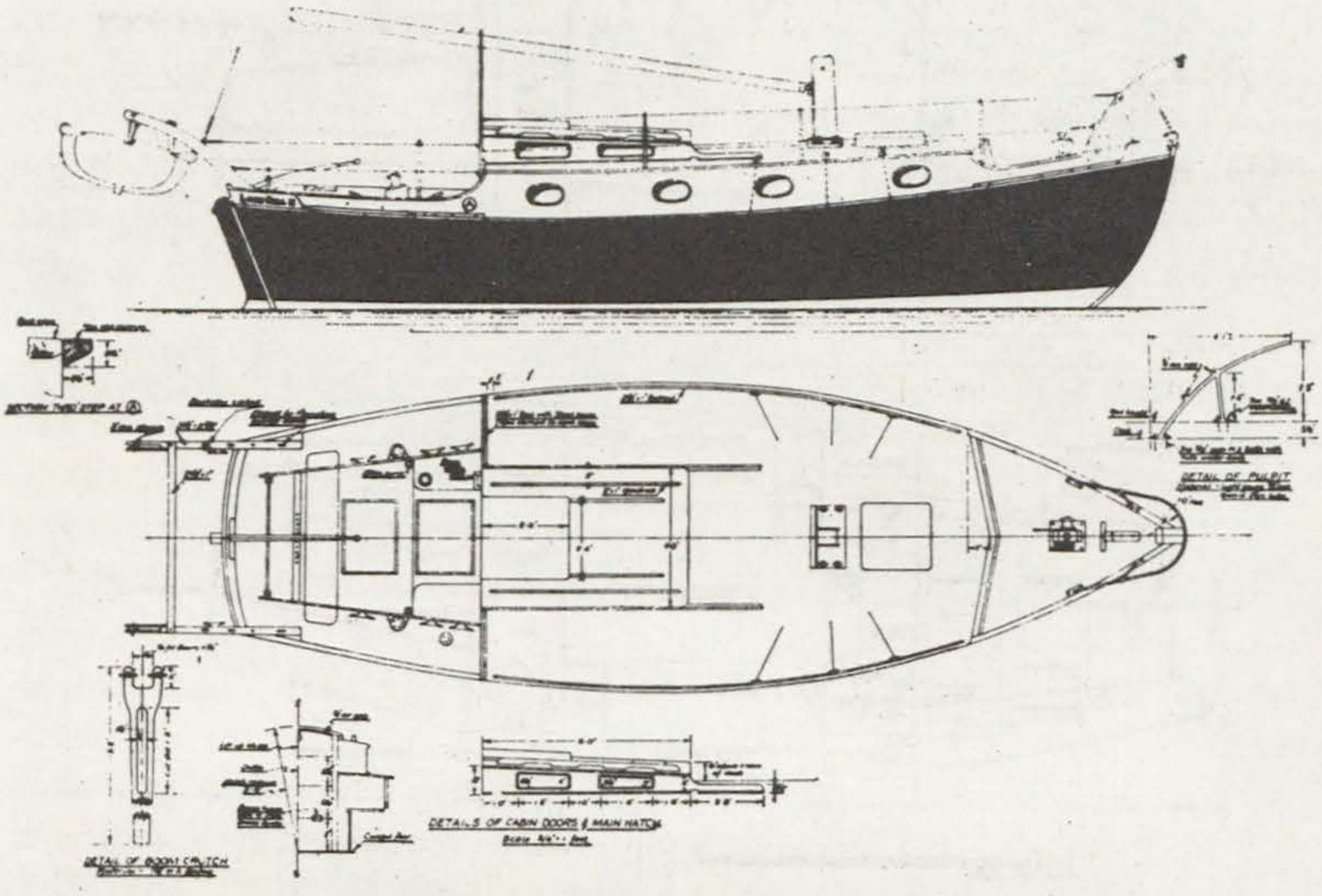


easier to get rid of the water through the bilge pump if the cockpit had emptied rapidly into the bilge. The two schools of thought do not convince one another.

What surprises most helmsmen who have sailed her is *Lone Gull's* lightness on the helm. A balance of hull and centre of effort has somehow been struck which enables one to steer her generally with two fingers on the tiller. In winds of Force 5 and above, a firm hand, or the tiller under the crook of the arm, is all that is needed. The partially balanced rudder probably takes much of the weight off the tiller, but when sailing fast the rudder is usually at less than 10 degrees angle, and under engine alone she has only the slightest torque to starboard.

The mast is stepped in a tabernacle to make for easier maintenance, and is fitted with independent warping drum and chain gypsy. The roller reefing gear was made up for me by a friend from a car steering box and has a very sweet action.

The engine is a Lister 8½ h.p. twin-cylinder air-cooled diesel which turns a 17½ in. diameter propeller through a 2 : 1 reduction at 650 r.p.m. to give a comfortable cruising speed of 5½ knots, and a maximum of 6¼ knots. The economy in running a small diesel was shown when during our shake-down cruise when we had days of calms and light airs and logged a total of 21¼ hours' engine running time, the fuel consumption was 5½ gallons, costing 1s. 6d. a gallon or roughly 5d. an hour.



I have long thought there was something wrong when a yacht is forced to carry her dinghy stowed bottom up high on the cabin top, effectively blocking the helmsman's view forward. This summer I saw the nearest shave from a collision with another boat in Cowes anchorage from this very cause. Some better way, I thought, ought to be tried, and I turned to the way the small traders in the Baltic always carried their boats—on stout wood davits athwart their sterns (see Y. M., December 1960). Thus have boats been carried since the days of the early Tudor ships, the old whalers, Colonial American trading schooners and the Baltic cutters and ketches. It is an old enough method, although passers-by have been heard to exclaim: "Oh I say, what a novel way of carrying the dinghy!" It has not been fashionable for yachts to have broad enough sterns to carry their boats like this. But

given a buoyant transom stern like *Lone Gull's* we have found this an excellent way of carrying the boat while leaving full visibility forward for the helmsman. It takes about 90 seconds for one man to haul the dinghy up and gripe it hard against the davits ready for sea, using the falls of one of the hoisting tackles for the gripes. To lower away the boat is a matter of a few seconds only, and I consider this one of the essentials to be aimed at when stowing a dinghy on board.

Does the weight of the dinghy and its davits drag her down by the stern? One is asked. It is allowed for in the design, and difference of trim aft when the pram is hoisted is only $\frac{3}{4}$ in., equivalent, say, to a 10-stone man sitting on the taffrail, or the addition of an old-fashioned counter, hardly a danger to the yacht. Does not the sea ever strike the dinghy? With a buoyant stern like this there seems no reason for alarm. So far seas have come nowhere near the boat; but a friend who sails one of my 10-tonners, a similar design to *Lone Gull II* but a size larger, took her through the tail end of a race in bad weather to test the theory (a brave man) and found that only once did a very steep crest come up and give his dinghy a slap underneath. If a dinghy cannot take that, it had better be returned to the makers.

Many yachts are awkward for the elderly and unagile to get aboard. In *Lone Gull II* alongside the gangway in the rail at the break of the deck the 2 in. rubbing strake swells out into a flat-topped teak step, 12 in. by 3 in. by $3\frac{1}{2}$ in., which appears a welcome idea to everyone who comes aboard from a dinghy, and forms a strong fender in emergency.

Lone Gull's hull is stoutly built with close-spaced rock elm frames planked with 1 in. teak to waterline and some good West African mahogany to the rail.

The bilge keels are fitted in a method I have adopted in a number of previous designs. Each is formed of three planks fully streamlined, $4\frac{1}{2}$ in. wide at the top tapering to a fine trailing edge at the after end. The bottom plank is of greenheart and fastened with socket bolts to the middle plank so as to be easy to replace should it become chaffed or damaged after many groundings. The upper two planks of oak are through bolted to heavy bilge stringers $5\frac{1}{2}$ in. by $1\frac{1}{2}$ in. with oak partners which cover three adjacent planks beneath the stringers and between the frames. These pads are shaped so as not to hold bilge water, and the whole assembly is as strong to withstand grounding shocks as most fin-keel boats' keels. These bilge keels are not weighted; the ballast of 2 tons is carried on the main keel in the orthodox manner, with some 500 lb. of ballast for trimming inside.

Decks are marineply covered with International epoxy-resin-bonded glass fibre mat, painted pale blue and lightly sanded. This makes a fine, hard deck which should stand any amount of wear.

The International 707 varnish seems to have stood the weather remarkably well, and after four months mainly in the waters around Portsmouth Harbour the Kobe Red on the bottom had hardly a trace of slime when she was hauled out in October. A patch aft, purposely left uncovered with the antifouling composition, was festooned with weed.

All in all, *Lone Gull II* has proved a very satisfactory little ship that could be repeated for something in the price brackets of £400 or so per ton T.M. She has shown herself faster than her predecessor and delightfully light on the helm, her decks are dry when beating into a steep sea, and her motion is as easy as one could wish in an 8-tonner. I feel she is a development of a type that can face almost any kind of weather offshore, yet could find her way into any harbour and creek where there is, say, 4 ft. of water.

What more could one want for anxiety-free cruising?

* * *

LONE GULL II

BY

JOHN MORWOOD

Maurice Griffiths is the editor of the British magazine YACHTING MONTHLY and has spent his whole designing life specialising in the shallow draught cruiser. His first yacht for his own use was *Lone Gull*, the plans of which were described in the YACHTING MONTHLY, October, 1938. This yacht was a delightful centreboard cruiser whose origins were the 26-30 foot Leigh cockle boats which used to have 2 ft. 6 ins. draught and a big iron centreplate under a lofty boomless mainsail and jackyard topsail rig.

The first *Lone Gull's* dimensions were as follows:

L.O.A., 28 ft.
L.W.L., 25 ft.
Beam, 10 ft.
" at water-line, 9 ft. 8 in.
Draught (ex C.B.), 3 ft.
" (with C.B.), 6 ft.
Displacement, 5.45 tons.
Sail area, 470 sq. ft.
Centreboard, wood weighted with iron.

The main principle of design of *Lone Gull* was to get the maximum accommodation per cost—a feature dear to my heart because if one has more money to spend on a yacht, one can quite simply have a bigger one. This objective was achieved by having short ends, shallow draught and a large beam. Being a specilaist in the type and skilful, the lines and sections were very pleasant, giving a very sea-kindly motion, though there was just a little too much spring in the buttock lines aft for the best speeds.

With *Lone Gull II*, built in 1961, Maurice has raised the topsides and taken the cabin top to the gunwales, thus achieving even more

room inside while the 10 foot of beam has been reduced to 9 feet. The buttock lines have now been straightened aft, increasing the speed and seakindliness even more.

Seakindliness. Not many people are brave enough to state their opinion as to the causes of seakindliness or even to define it. If, however, we define it as ease of motion, *Lone Gull II* must be a near perfect example. The reasons for this are as follows:

1. The sections show a straight line from the keel to the turn of the bilge. This dampens rolling.
2. The master section crosses the L.W.L. almost at a right angle. This reduces the roll producing action of a beam sea.
3. The shallow draught keeps the hull in the surface water which only moves back and forth in a seaway. Owing to the rotation of the water in a wave, a deep keel may be pushed to weather at the same time as the hull is being pushed to lee. This will induce a deep keel vessel to lurch to leeward.
4. The short ends will produce a boat which is more stable in pitch than a longer ended boat with exaggerated overhangs. No sea will slam her transom or bow.
5. The straight buttock lines will throw the water nicely clear at the stern and will not produce "suck down" or drag waves aboard.

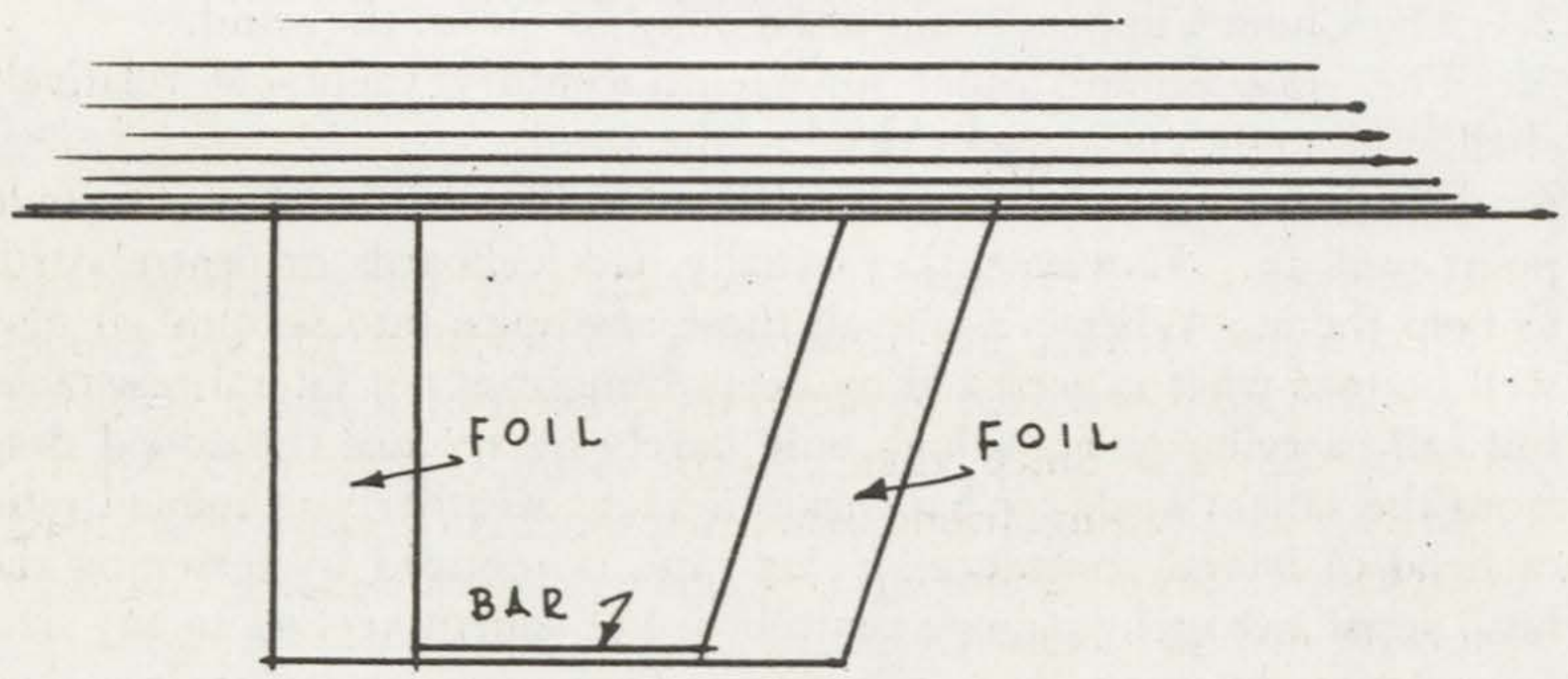
Windward Ability. It seems to be fashionable to suppose that to get to windward well, one needs a deep draught salient keel. This is not so, of course. Exceptions are as follows:

1. The course of Francis Drake's ships as they beat down the English Channel to intercept the Spanish Armada is shown as 90° tacks.
2. The China Clippers could often point 55° from the wind.
3. The *America* and other nineteenth century yachts of relatively shallow draught could point close to the wind.
4. Thames barges and traditional yachts of shallow draught could point well up. However, they usually had leeboards or centreboards to help them. When we take all these examples into account, it may well be that what is achieved by deep draught is not lateral resistance but sail carrying power which only barely overcomes the added drag from the salient keel. What makes a yacht weatherly is a small ratio of head to lateral resistance. This ratio is reduced by lessening the head resistance or by using a centreboard or salient keel up to any size. In practice, however, it is not worth decreasing leeway to less than some critical angle which lies between 3° and 5°. It is my opinion that *Lone Gull II* very nearly approaches perfection in this respect without either centreboard or bilge keels and could improve if necessary by the simple expedient of a reduction of beam. If this line of argument is correct, an awful lot of boats are carrying around an awful lot of keel unnecessarily.

Summary. *Lone Gull II* is a most delightfully designed cruising boat with the maximum accommodation for her cost. In my opinion, if she were to be lightly built with the smallest possible engine and propellor and sailed hard, she would keep up with the best of the ocean racing fleet to windward and leave them handsomely behind to leeward.

Further Developments. If *Lone Gull II's* iron keel were to be replaced by lead, her deadwood aft could be considerably cut away to give a small skeg ahead of her rudder. The reduction in wetted surface would be very appreciable and this, combined with the extra lateral resistance of her skeg would improve her windward ability still more.

The Bilge Keels. I am afraid that I believe that bilge keels mainly function as built-on sheerlegs which make the boat sit upright when the tide goes out. In light winds, I do not think they have any value at all in giving lateral resistance. At low speeds, they lie in a waterflow which rises out from the keel in the forebody and falls back to the keel in the afterbody. The bilge keels will only produce turbulence and drag by preventing this. At medium speeds, the waterflow curves along the hull in conformity with the surface waves and again the bilge keels will only produce drag. Only at the "waterline speed" will the water be flowing along the bilge keel when it can give lateral resistance but its aspect ratio is low and its efficiency poor. This theoretical evaluation is confirmed by Maurice Griffiths who describes the windward performance in light winds in terms which are descriptive of a boat with too much drag and too little lateral resistance.



The bilge keels on *Lone Gull II* remind me of a schoolmaster I used to have who taught us higher mathematics in Ireland. His language was sometimes a bit flowery when reproving us for our mistakes. On one occasion, he let loose the following masterpiece of eloquence: "You, Morwood, remind me of an old cow who, after giving a bucket full of good milk, goes and putts her futt in it". I suppose the rural

simile was designed to be most telling to our peasant outlook. Anyhow, the statement appears most apt to the present yacht for *Lone Gull II* is just about the nicest yacht design I have ever seen but quite spoilt from a hydrodynamic point of view by these bilge keels.

Improved Bilge Keels. It is possible that bilge keels could be designed to provide lateral resistance efficiently while not losing their value as sheerlegs. All that is necessary is to make both the leading and trailing edges of the bilge keels into hydrofoils with an aspect ratio of 3 : 1 and join the free ends with a metal rod which will prevent "end losses" at the after one. The drawing shows the profile shape. The four short hydrofoils will then provide a lot of lateral resistance for their area and not turbulate the water so much. It will be far easier to clean inside them, the yacht will be faster on all courses and she will still be able to sit upright on the mud.

Bilge keels were developed by the Hon. R. A. Balfour (now Lord Riverdale) for his *Blue Bird of Thorne* nearly to this suggested sytle.

Conclusion. *Lone Gull II* may be the utmost in sailing hydrodynamic efficiency and sea kindliness while at the same time giving the greatest amount of accommodation for the cost. A method for designing more efficient bilge keels is suggested.

* * *

HYDROFOIL STABILIZERS

BY

BRUCE E. CLARK

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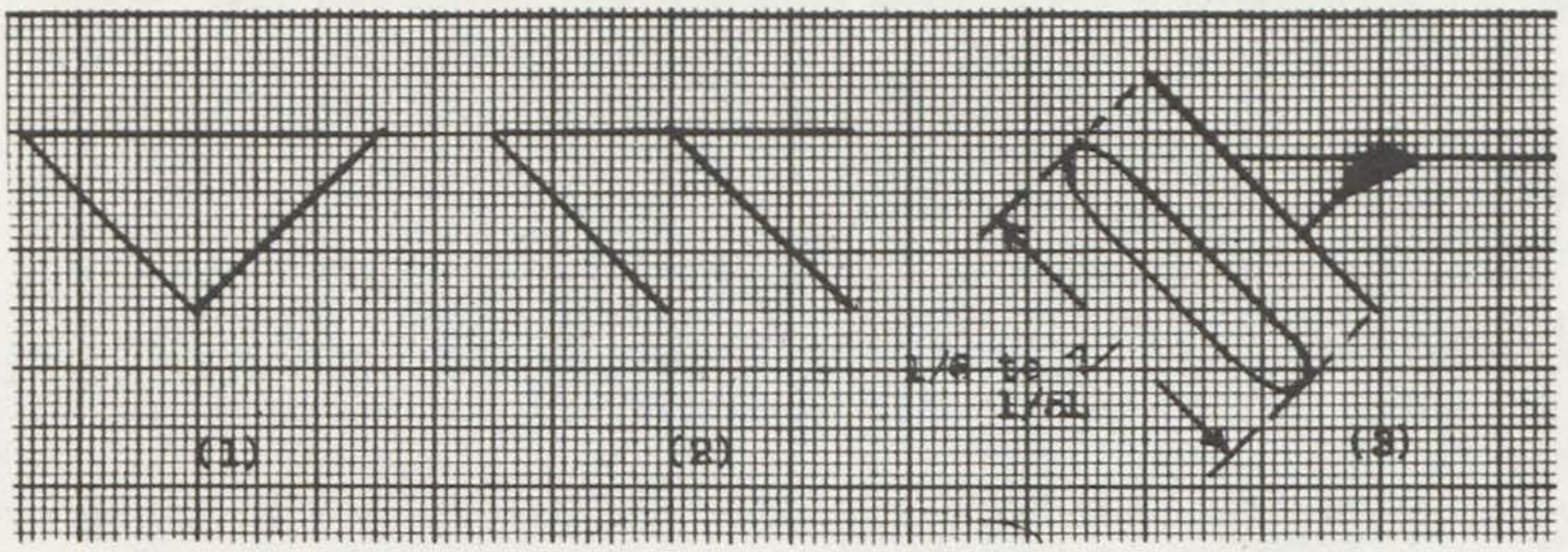
Hydrofoil stabilizers have intrigued me ever since reading about Dr. Morwood's "Jehu", but I owned a 17′ foldboat (decked canoe) for a year before it occurred to me to try converting it into a hydrofoil stabilized sailboat. Since then, Norris Van Gelderen (a Miami, Florida canoeing-sailing friend and correspondent) and I have tried 3 different foil configurations on two decked canoes and one Canadian canoe, with excellent results.

Hydrofoil stabilizers proved to be almost as easy to make as leeboards (though a little more bunglesome to transport). We used 1 x 8 ($\frac{3}{4}$″ x 7$\frac{1}{2}$″) pine boards, dressing them with a draw-knife, plane and sander to the foil section given in A.Y.R.S. bulletin No. 19. Joints were made with screws and glue, reinforced with fibreglass. A 1$\frac{1}{2}$″ x 2$\frac{1}{2}$″ cross beam was used between the foils, variously but

securely fastened to the several hulls. A pair of door hinges made a convenient attachment, as the foils could be removed by pulling the hinge pins, and adjusted by shimming between the hinge plates.

The full history of our various trials would be boring, but results were always good enough to encourage further efforts. At first, I had so little faith in foils that I put styrofoam floats on top of each foil. The floats dragged so much that it was difficult to get up enough speed for the foils to take over, in strong winds. The foil configuration (1)



was hard to tack, as it did not give as good a pivot as do leeboards (the long straight keel of the foldboat and its small rudder didn't help). Foil configuration (2) didn't have as good stability as (1), (3) proved best. A 15′ rigid decked canoe with a little keel rocker and a deeper side mounted rudder just behind the cockpit proved much better, also. However, a straight keel canoe with foil (3) will usually tack satisfactorily, if a foil is kept immersed during the whole operation—i.e. flipping quickly from one side to the other.

We were interested in comfortable sailing, with as little interference as possible with our canoe's suitability for paddling. Anyone who wants speed can certainly get it with a sailing canoe, and with hydrofoils, more speed with less hiking athletics! Any canoe can carry at least 50% more sail area with foils than with leeboards, and will be easier to sail, too. A very narrow canoe would be harder to keep upright in a calm than in a good breeze! However, I'd suggest a Beam to Length ratio 1 : 6 or more. Maximum foil beam of 2/3 Length seems about right.

All in all, I have been highly pleased with sailing canoes, and I wish I had discovered them years ago; I've missed a lot of good sailing because I hadn't! They can be lighter, less complicated, easier to transport and launch, anywhere, anyhow, than any sailboat I have had any experience with. (My foldboat travelled over 2,000 miles on the roof of my car, complete with foils and a 65 sq. ft. sailing rig, and sailed and paddled

on many interesting bodies of water). Even with leeboards, a properly rigged sailing canoe seems less tippy than a paddling canoe and sails surprisingly well. With foils, a sailing canoe seems almost as stable as an ordinary sailboat and can sail much better than the leeboard equipped sailing canoe.

The possibilities of hydrofoil stabilized sailing canoes are not necessarily limited to small craft. In larger sizes, they could be made self-righting, and much more easily and surely than cats. The foils could then be mounted a bit deeper, as might be desirable, though the weather foils should be out of the water for windward work. Foils on larger canoes could be arranged to pivot on a bearing, with a spring to hold them in proper position. This would make them less vulnerable to damage.

I do not know whether hydrofoil stabilized canoes can be designed that will beat the best cats, size for size; probably not. However, for a given amount of money, a considerably longer canoe could be built, which would give the canoe quite an edge. A hydrofoil stabilized canoe has several advantages over cats and trimarans, not the least of which is that they can be rather better looking!

To help others convert ordinary canoes into sailing canoes, (with leeboards or with hydrofoil stabilizers), I have prepared a set of plans, showing 5 rigs, with optional jib, giving sail areas of from 30 to 131 sq. ft. The short-masted luff spar Bermudian rig is featured (as being one of the most suitable for a light canoe) and directions are given for 1 piece solid or hollow masts. These plans are $3.75 postpaid, by first class mail in the U.S., or by printed paper rate elsewhere.

★ ★ ★

(Reprinted from South African Yachting)

FRANK ROBB **discusses the small boat sailorman's greatest enemy, fatigue, a spell cast over the human mind and body . . .**

Once upon a time—and this is a true story—there was a yachtsman making a single-handed passage in the Caribbean Sea. He struck a bad patch, about four days of heavy weather. When the wind moderated he was not at all certain of his position. So he took his sextant and tried to shoot the sun. He couldn't do this because:

(*a*) He was unable to hold the sextant steadily.
(*b*) He could see four? three? two? suns.
(*c*) He could not do simple addition or subtraction.

So—having no option—he carried on sailing, and within a short while sighted a lone fisherman in a dinghy. He was delighted about this, because it meant that he must be near land, and he hailed the fisherman, asking his position.

The fisherman made no response. He continued to fish without even glancing at the yacht. Evidently a surly type.

So the yachtsman sailed on—and soon he sighted land and a small harbour. From this harbour a pleasure launch put out, crowded with trippers, and passed within 50 ft. He hailed the launch. Not a soul aboard answered or showed the slightest interest in his plight.

Proper bunch of curmudgeons, he thought.

Anyway—he should worry. He had made landfall after a rough passage, and had found a snug harbour. He sailed into the harbour, and—because nobody paid the slightest attention to him (no Customs blokes, no medical officer)—he chose a clear area, got out the dead line and found eight fathoms, and anchored.

Alan Hayes

Then he dropped through the hatch, hit the cabin floor and flaked out for 12 hours.

On awaking he clambered on deck. His yacht was securely anchored. But there was no harbour, no pleasure launches, no fishermen in dinghies, no land in sight.

But—he *was* anchored in eight fathoms. He'd got that right anyway.

The rest was pure hallucination—wishful thinking—brought on by sheer overwhelming fatigue.

Fatigue is the small-boat sailor's greatest enemy, be he cruising yachtsman or commercial fisherman. Gales may come and gales may go, and a good little boat properly handled will ride them out, shake off the spray and continue on her way—because ocean cruising is statistically a good deal safer than riding round in a motor-car.

Also cheaper, less ulcer-making, healthier, more pleasant.

But at times it can be exhausting, and it is this exhaustion that leads to trouble. It fuzzes up the mind, dulls the wits. It becomes difficult to concentrate on the simplest problem—and the answer often comes out wrong. Making decisions becomes an agonising business; I have seen a chap sit for 20 minutes wrestling with the choice of opening a can of much needed sardines or getting into his bunk for some much-needed sleep.

In extreme cases—as noted above—exhaustion leads to absolute dream-land illusions.

* * *

Fatigue is a spell cast over the human mind and body by three wicked Witches of the Lack Family. The work together ,and their names are :

Lack of Food.
Lack of Comfort.
Lack of Sleep.

Lack of Food is the least dangerous of these harridans. There is, usually, bags of food awaiting a can-opener. It may not be possible to warm the food—but if you are hungry enough and shovel it in, your stomach will accept it gratefully and cope with it. The energy value is only fractionally increased by warming, and a healthy man can keep going for a long time without food.

This is not to say that I am against food. I've been eating the stuff for years, and it is my favourite dish, and—and this is important—if you and/or your crew are tired, cold, wet, miserable and dispirited, a hot meal is a tremendous morale-booster. Five minutes after ingesting the grub everybody perks up, decides that the skipper's parents *might* have been married (to each other) and the impending mutiny is postponed.

Aboard commercial fishing boats that spend days and days at sea the cook ranks high in the hierarchy, and if you were to face the skipper of such a boat with the choice of sacking a good mate or sacking a good cook he would probably burst into tears and require the services of a psychiatrist.

The second witch is the beldam Lack of Comfort. You must try to circumvent this hag, because she can be dangerous. If your boat becomes a cold, dripping, damp, soggy hell, your bunk a clammy morass, and yourself shivering/soaked to the skin, you will not be able to function with much efficiency. This witch can be exorcised by

going to great lengths to keep the interior of the boat dry by stopping deck-leaks and by muffling yourself up in layers of protective clothing while you are on watch.

★ ★ ★

You should try to ensure that you always have a change of dry clothing. In a smallish boat during a longish gale this is difficult to arrange; water is insidious stuff and it seeps up the trouser-legs and sleeves, down the neck and round the waist-bank, so that after two or three wet watches everything you own is soaked.

It is partly for that reason that the cruiser I propose to build is going to have a galley stove of the slow-combustion type—one of those elegant-looking affairs that burn continuously for months on end on a shovelful of coal or anthracite a day.

By arrangement with the cook, crew members may hang wet clothes on a drying rack in the galley.

In dirty weather comfort is almost synonomous with warmth. When steering small yachts with cruising cockpits during very cold nights I used to light the hurricane lamp, clasp it between my feet on the cockpit sole, and drape a blanket about myself from the armpits downwards. This keeps you good and warm from the waist down, but if there is rain or spray flying around and the blanket gets wet it creates a sort of a muggy "Turkish bath" atmosphere which penetrates all your clothing and makes you feel terrible when you discard the blanket.

Also you are left with a wet blanket—and at the moment I can't think of anything more repulsive than a wet blanket.

This is not a recommended practice—it can burn holes in blankets, sea-boots and clothing, and it makes you socially unacceptable for a long time because you become permeated with a distinctive aroma of paraffin, scorched rubber, burnt cloth and honest sweat.

The real answer is to keep the boat dry below, to ensure that wet oil-skins and clothing are not paraded through the cabins, to have good bunks with lots of blankets and to have several changes of warm clothing.

The worst of the witches and the one most to be guarded against is Lack of Sleep. Her spell does not operate when you are off-soundings, because no matter what the conditions, if you've got lots of sea-room and you feel sleepy you can put the yacht in a defensive position (hove-to, hulling, running or sea-anchored), curl up in your bunk and go bye-byes. And (if you are really tired) you will sleep—no matter what sort of hell is breaking loose outside.

Sleep, Death's gentle Brother—
Sleep that knits the ravelled sleeve of Care

—is a precious commodity, and old Mother Nature insists that you indulge in it. You can take all the anti-sleep pills you like and resort to all sorts of stratagems and devices—but sooner or later you will fall asleep.

Soldiers on guard duty (to avoid the unpleasantness of being court martialled and shot at dawn) adopt a practice of resting their chins on their bayonets while standing at their posts. I have on a couple of occasions come across them standing thus, chin on bayonet, eyes open—and fast asleep.

As a commercial fishing skipper I have on occasion had my cabin washed out by sea and, on coming off watch, thrown myself into a bunk that was a mass of squelching blankets, awash with sea-water (with a thick layer of drowned cockroaches)—and have slept like the dead.

For the single-hander this problem of sleep becomes serious when he is coastal cruising or wending his way through islands—in brief, when vigilance is necessary 24 hours a day. It is also serious if you happen to be the skipper and/or navigator of a crewed boat because if nobody else aboard can navigate, you have no option but to instruct the helmsman to call you up at any change of conditions—if the strength or direction of the wind alters, if he sights a light, when certain landmarks, lights, beacons and so on come on to certain bearings And etc., etc.

Which means, in effect, that you don't get much sleep.

And so, when cruising coast-wise, the navigator (who, in small boats, is usually the skipper) should not take watch. He will be "on call"—and will be called—at all times of day and night, and he must be allowed to hit the sack as opportunity permits.

As far as the rest of the crew are concerned, watches must be arranged to ensure that each man gets eight hours' sleeping time out of 24 hours. This is a minimum "time off". And the watch must be changed punctually; there is nothing more likely to cause bloody-mindedness than hanging on to a tiller on a dirty, wet, cold night for 15 minutes overtime because your replacement just doesn't feel like turning out on time.

Enforce this rule, because one of the effects of sleeplessness is irritability, and you can find yourself saddled with a snarl of personal feudings amongst your crew.

A cup of coffee—or, better, hot soup—is a great sustainer if it can be arranged, but the old tradition of knocking back quantities of rum

to keep you going is strictly for the birds. Alcohol in any form gives you a quick, short uplift—followed by a quick let-down which leaves you in worse plight. The stuff has its virtues. It relaxes tension and relieves inhibitions—but the time to take a snifter is *not* before or during a watch, but just before you tumble into your bunk.

★ ★ ★

Skippers of *successful* commercial fishing boats do not allow any alcohol aboard. The American Navy follows suit, and operates on cokes and ice-cream. The British Navy has a strictly controlled rum issue.

Getting back to the question of Lack of Sleep, Lack of Comfort and Lack of Food, I would say that the British Navy system is the best compromise. Come sun-down the crew get together for a bear and a chat—and the bar is then closed until the next sun-down.

The single hander with land close aboard faces a major problem in this business of getting enough sleep. There are a number of partial solutions.

If there is some wind he can heave-to on a tack that will take him offshore, and grab a few hours of shut-eye—but if the wind changes while he is snoozing he might wake with a bump.

If there is no wind he can let the boat drift—but here again he'll be in trouble if there is an in-setting current or if an on-shore breeze springs up. In certain circumstances he may be able to anchor for a while. Or he can trim his sails so that the boat is headed on a "safe" course and take a chance on the wind changing.

The best answer to the single-hander's predicament is a reliable alarm clock. He should assess the situation, decide on one or other of the above courses and work out how long the boat will be safe taking into account possible changes in wind strength, wind direction and prevailing current. He then sets the alarm for that period, places it in some fairly inaccessible possition and hits the hay.

The idea of putting the clock in some hard-to-get-at place is because if you put it within arm's reach of your bunk when the blasted thing goes off it is fatally easy to reach out a hand and press the silencing tit—all without waking up.

But if you stick the clock someplace—like under the companionway, for instance—where you can't reach it, then you have to get out of your bunk to stop the infernal clamour and—being now awake to some extent —you stick your head through the hatchway and peer blearily around to size up the situation afresh.

With a bit of luck you may find that you can reset the alarm and kip down for another hour or so.

Sleep is a mysterious state. It has been closely, extensively and expensively investigated for many years by doctors, scientists psychiatrists and other boffins who have written endless tomes and treatises on the subject.

One interesting feature that emerged from these experiments is that even after prolonged wakefulness—up to the point where the subjects were in the"hallucination" stage—eight hours' sleep is enough to restore normality.

If you pick the bones out of this article you will find out that this matter of avoiding fatigue boils down to:

Eating regularly and sensibly.

Keeping yourself and your quarters dry and warm.

Getting about eight hours' sleep a day.

Writing this article has really fatigued me. I have realised that I haven't had a wink of sleep for over four hours, and I can hardly keep my eyes open.

Good night . . .

* * *

MOTORISING A SAILING DINGHY

BY

COMMANDER GEORGE CHAPMAN
9, Hurst Way, Pyrford, Woking, Surrey.

(*By kind permission of the Editor, R.N.S.A. Journal*)

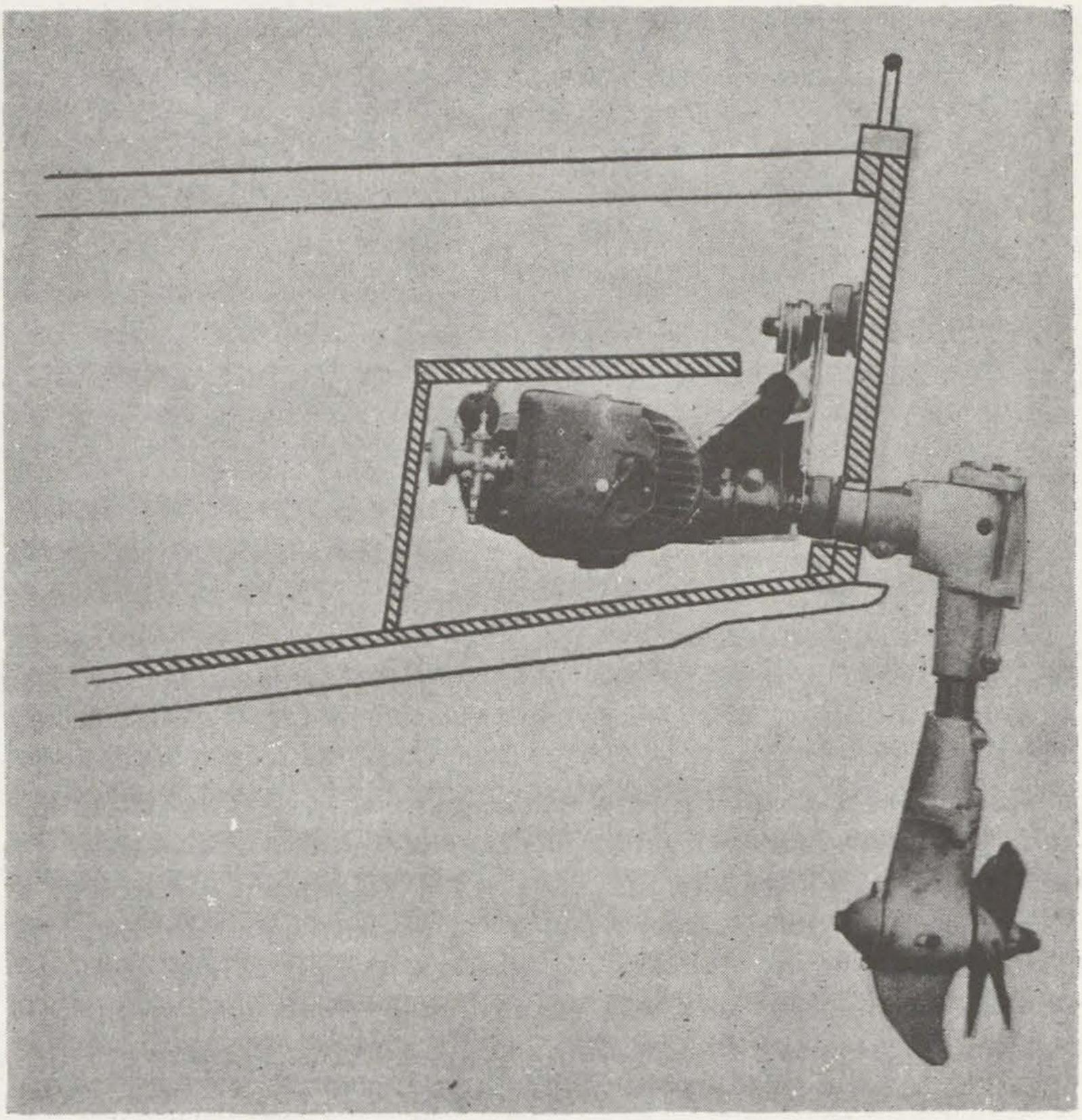
For some years I possessed a small outboard for auxiliary propulsion of my Chinese (Cheoy Lee) copy of an R.N. 14ft. dinghy, now reverted to Bermudian rig, and hence an Island O.D. The principal snags were:

(*a*) When rigged for propelling, the motor fouled the main sheet (and vice versa) : if it was rough, rigging was an effort, with the risk of dropping the machine over the stern.

(*b*) When stowed on the bottomboards, amidships, the motor got in the way, and was vulnerable to damage from (and to) the crew's feet.

(*c*) The motor was too easily stolen: so it had to be taken home every time.

The repetitious advertisements in yachting magazines for "Inboard-Outboard" units preyed on my mind to much to such an extent that I decided this was for me. (One up to the advertisers!) The result is shown in the photographs. In effect, an additional 90° gear-box has been inserted in the vertical shaft so that the engine is tipped forward and finds itself under the stern thwart: a simple winch enables one to rotate the propellor unit (the part outboard) about a horizontal axis to



put the propellor in or out of the water. So now I have the motoring capability of an auxiliary cruiser, in a dinghy—and a little more.

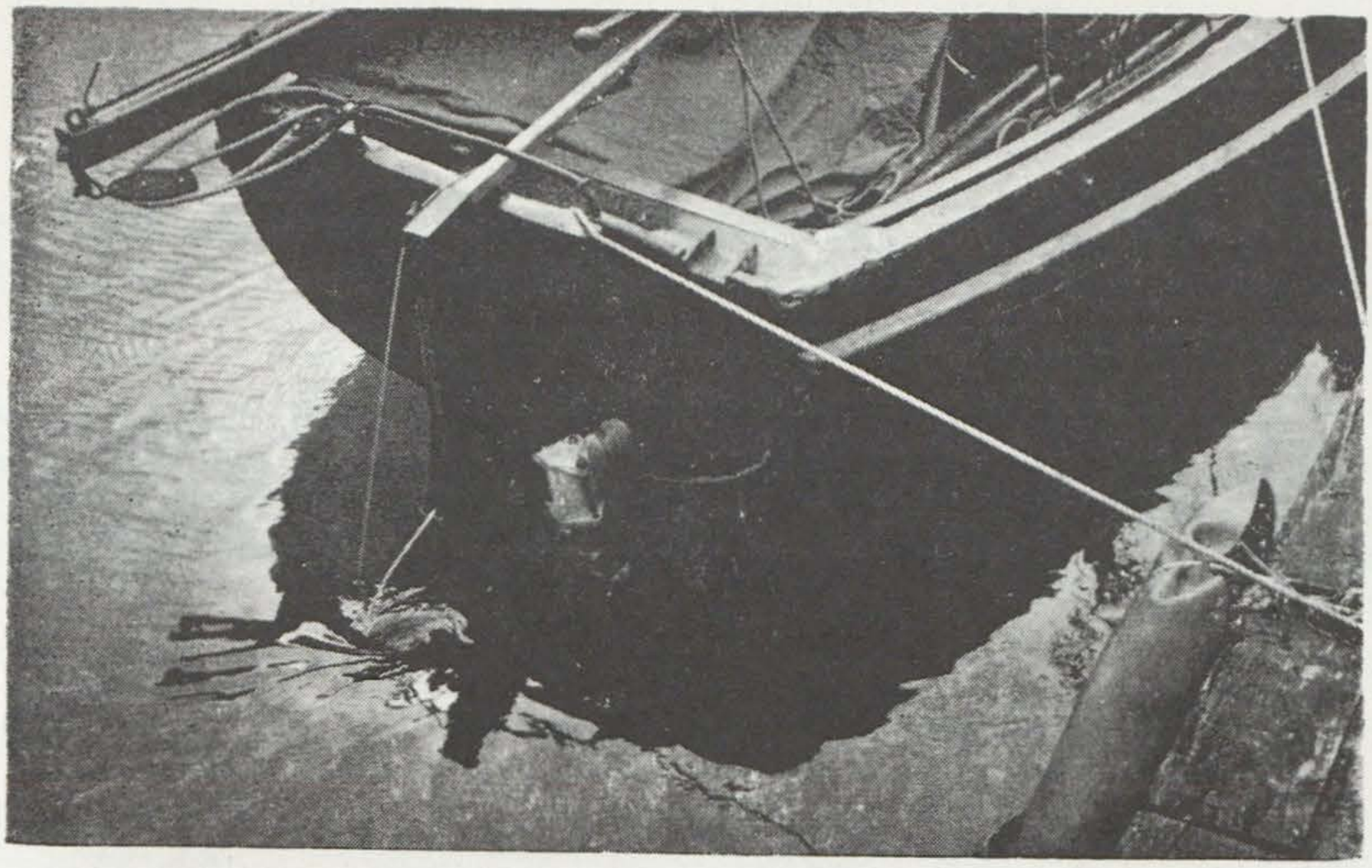
Design features are :

(1) With propellor unit raised, sailing is virtually unimpeded. The whole unit comes clear of the water so there is no drag. The rudder is not impeded at all. Nor is the main sheet except when it falls loosely. A little care obviates this.

(2) With propellor down, its upper tip is over one diameter below water level; excellent immersion, so that full thrust is developed even when pitching.

(3) A stop is fitted so that when the propellor is down it cannot foul the rudder at full port helm. The propellor is aimed to push (in azimuth) along a line through the mast so that the boat travels straight if the helm is let go. Thus the off-centre mounting is no disadvantage. The thrust line viewed from abeam is also satisfactory.

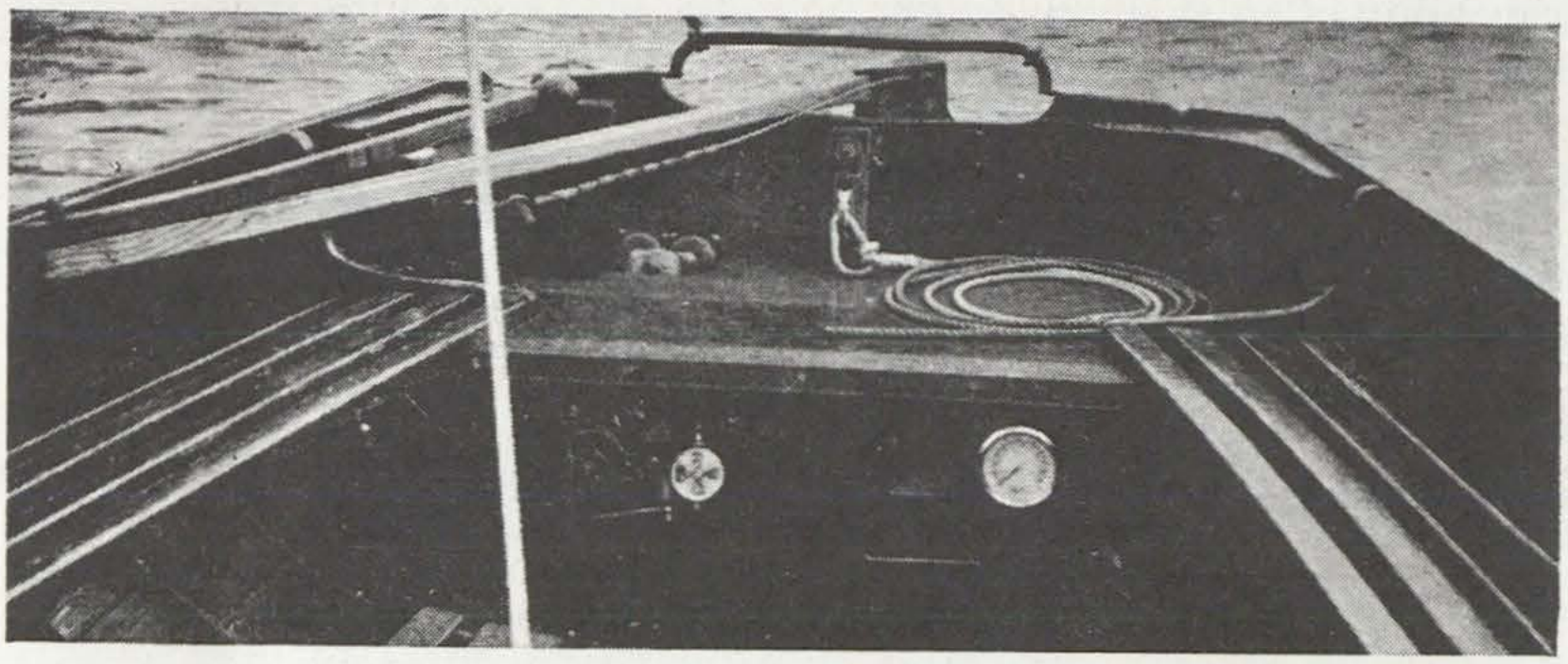
(4) The whole unit is mounted on four resilient mounts: the



Propellor in the driving position.

exhaust pipes are flexible and the silencer is also resiliently mounted. Thus there is negligible vibration of the boat—much less than before. Also since the outboard part can be removed by loosening one nut and bolt, and the engine removed by undoing five nuts, one jubilee clip, the throttle cable, fuel pipe (pull), and four screws for the thwart extension, in about 15 minutes you can remove 40 lb., and go racing. But remember to plug the transom hole.

(5) The engine must be air cooled to permit all this. Mine is; and it is not unduly noisy or hot running.



The motor position

(6) As far as possible materials are stainless steel or non-ferrous. High initial cost here always pays in the end.

(7) In my case the original petrol tank fitted in nicely : covering it with resin-bonded glass fibre has given it the best protection it can have.

(8) The silencer was designed for a racing motor cycle: connected to motor and transom exhaust pipe by flexible metallic pipe, it silences effectively and efficiently. The steel body is aluminium sprayed for protection.

(9) A small amount of joinery was required to extend the stern thwart and to case in the motor. This has improved the stern thwart, given a useful dry stowage for some small gear, and a housing for the speedo instrument.

Propeller retracted

(10) In this situation a recoil starter is a must. The terylene cord ($\frac{3}{8}$ in. circ.) has successfully withstood a season's use.

(11) A simple clamping device is fitted to hold the propellor unit up, or down, or in between. If it is not done up tight enough when the engine is running, the direction of rotation is such that the propellor surfaces in a shower of spray.

In Use :

Sailing, it pays to lower the propellor unit below gunwale level to clear drooping sheets.

Cold starting, one can get the propellor running first in air, to reduce the resistance.

Motoring, one should have the plate down to sound for obstructions : this unit does *not* tip up backwards like most outboards and large inboard/outboards when it hits something.

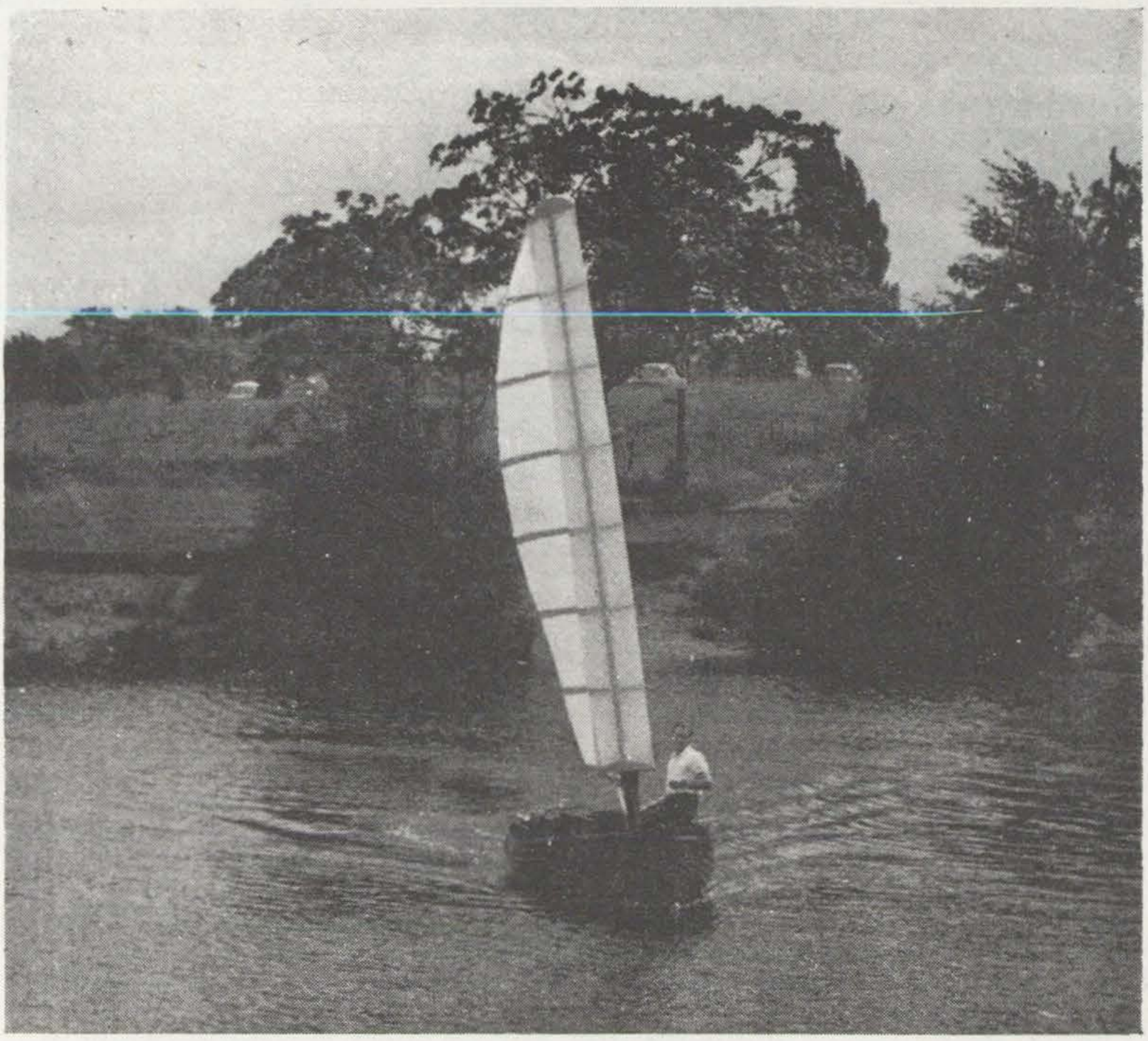
Running the motor, (even if the boat is ashore) for a few minutes once a week *every week* has preserved a satisfactory standard of starting ease throughout the season. The boat lives with a canvas cover over it, which undoubtedly helps starting. This cover is visible in one of the photos: made of canvas, with a zipp fastener, shock cord, terylene

cord and hooks and eyes in the right places it is very easily and quickly rigged and unrigged, and it stays put. No tedious fiddling with fraying bits of line threaded through eyelets!

Performance data.

The engine is rated at 1 BHP at 2500 rpm, and 1.9 BHP at 3500 rpm. With the propellor shown in the photos (4 blade, $8\frac{3}{4}''$ diam., 7.2″ pitch, developed area 24.3 sq.in.) the boat does $4\frac{3}{4}$ knots (by speedo) max: the engine runs comfortably, at I suppose, around 2730 rpm, propellor speed 1215 rpm, assuming 30% slip. By contrast, with a smaller propellor (2 blade, 8″ diam., 6″ pitch, 20 sq. in.) the top speed is about $5\frac{1}{4}$ knots at an estimated engine speed of 3450 rpm, propellor speed 1530 rpm. But at this engine speed the noise is too much for me: and even at $4\frac{3}{4}$ knots the vibration is greater than it is with the four bladed propellor. So at present I am sticking to the four blader. The top hull speed for $V = 1.5/L$ is 5.5 knots, where L is 13.5 ft., so the extra half or so knot over $4\frac{3}{4}$ is relatively expensive in power, as is to be expected.

* * *



George Chapman's Wingsail

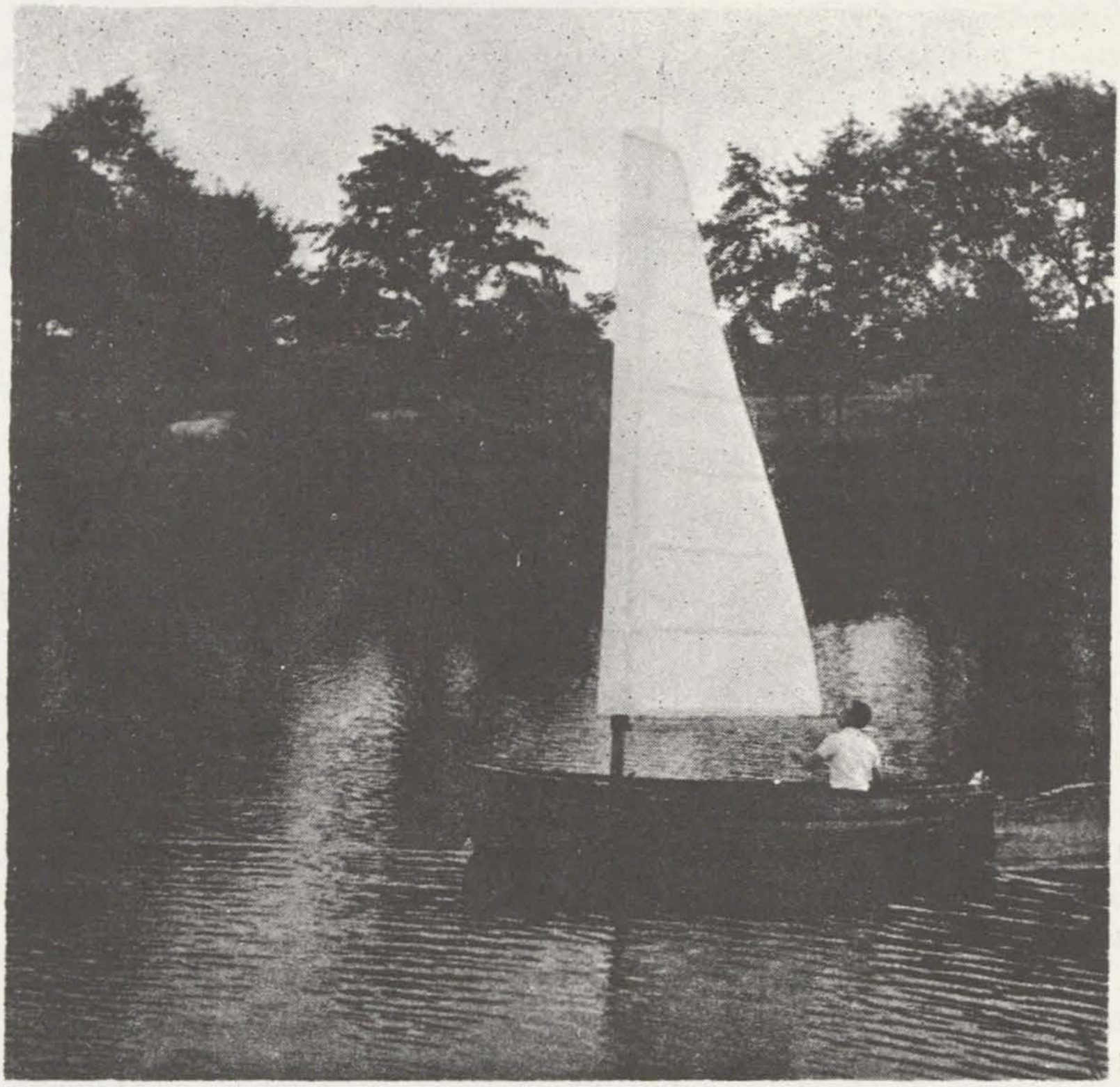
A WING SAIL

BY

COMMANDER GEORGE CHAPMAN

9, Hurst Way, Pyrford, Woking, Surrey, England.

The photograph shows my low drag wing-sail on my "test-vehicle" a 14 foot R.N.S.A./Island O.D. dinghy. I hope to have it at Weir Wood at the next meeting. I am also willing to let any member try it who has a faster boat than mine whose boat can accept a different mast thwart. It would take very little work to fit the rig to most other 14 foot boats, since the whole is supported only by the step and thwart.



On trial, I have found that the geometry of the boom downhaul is critical, so I have modifications in hand. I was out in a fresh breeze yesterday and the rig seems to push the boat at its V/nL maximum quite easily; but this doesn't prove that it is in any more powerful than a Bermudian rig with 50% more area. Perhaps the most useful

The Sail Furled.

facility on the river with so many trees around is the ease of sailing astern.

The area is 103 square feet.

* * *

A SAIL-FOIL RIG

BY

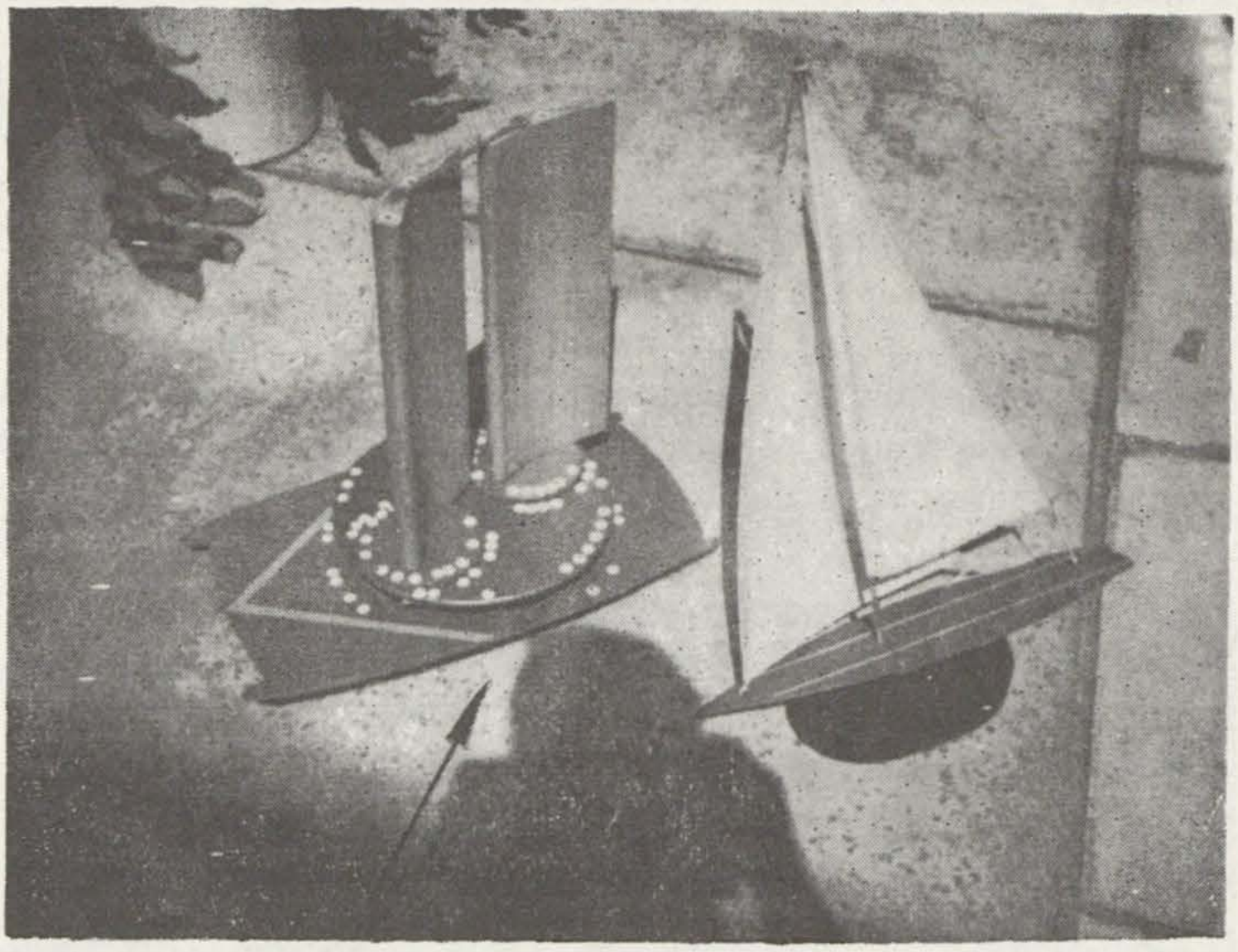
E. MORRIS WRIGHT

Apt 215, 6230 Reseda Blvd., Reseda, California, U.S.A.

In this an old and proven principle is again put to a new use in that airfoils of novel design are used to provide thrust for sailing craft. The effectiveness of these foils is so much greater than that of conventional sails that it should stimulate a quick public acceptance.

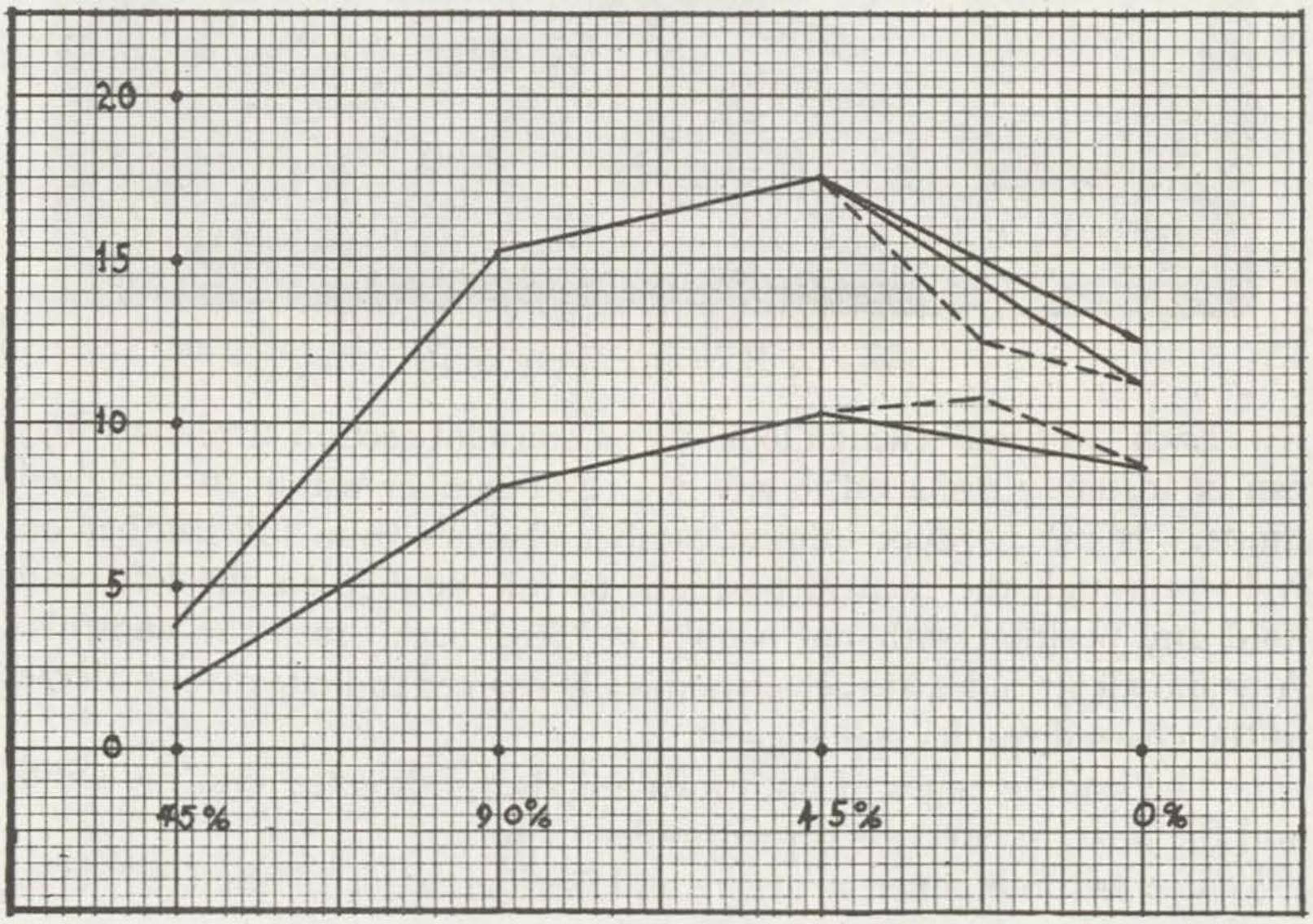
I am now soliciting the money and facilities that I cannot provide to carry the project through the prototype stage and on through the tests under actual conditions. Evaluations then would aid in determining many things pertinent to the "carry on" phase of manufacturing and sales.

In this first application of the design, two aerodynamically correct and cambered sail foils are used vertically in place of the conventional sails. They can be positioned either widely apart, or for greater effectiveness, in close combination for an additional increase of 29%



greater thrust. Their relative positions are alterable and the cambers of each foil are also adjustable and reversible under operating conditions.

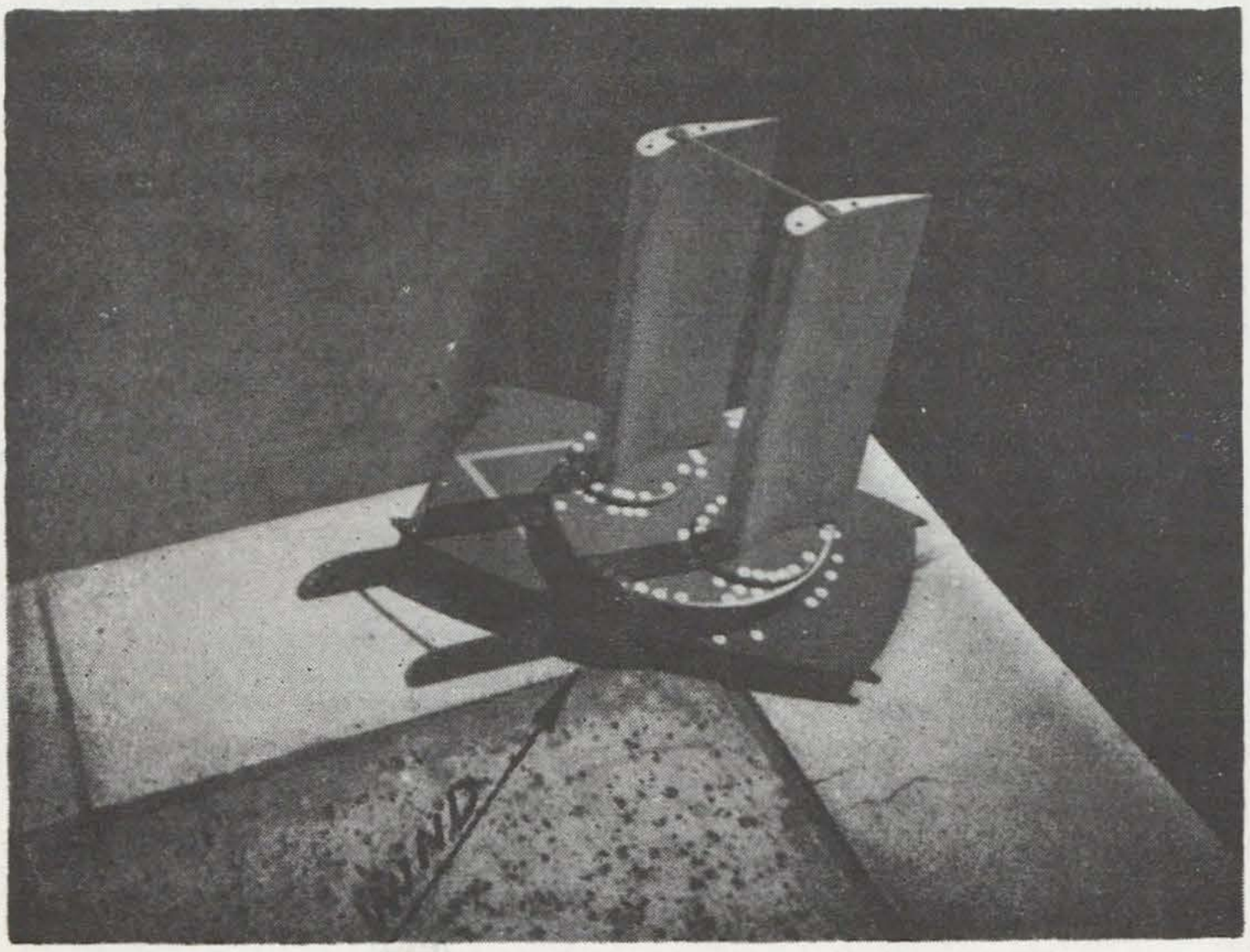
In the attached chart which summarizes results of the model wind-tests, it will be noted that the performance of the sail foils is



Upper graph: sail-foils. Lower graph: conventional sloop.

significantly greater than that of the conventional sails, in any sailing position.

In conventional sailing practice the jib and spinnaker must be interchanged frequently. In direct contrast, the same alterable and reversible sail foils are used in all sailing positions. The boat can be stopped or reversed, by reversing the sail foil cambers. It can be made to idle by neutralizing the foils or freed to "vane' with the wind by declutching their respective controls. The foils are inherently stable in either the working or declutched position. Again, in contrast, conventional sails require concentrated effort in some sailing attitudes or maneuvers to prevent damage to either the sails, the rigging, the mast or to the boat personnel.



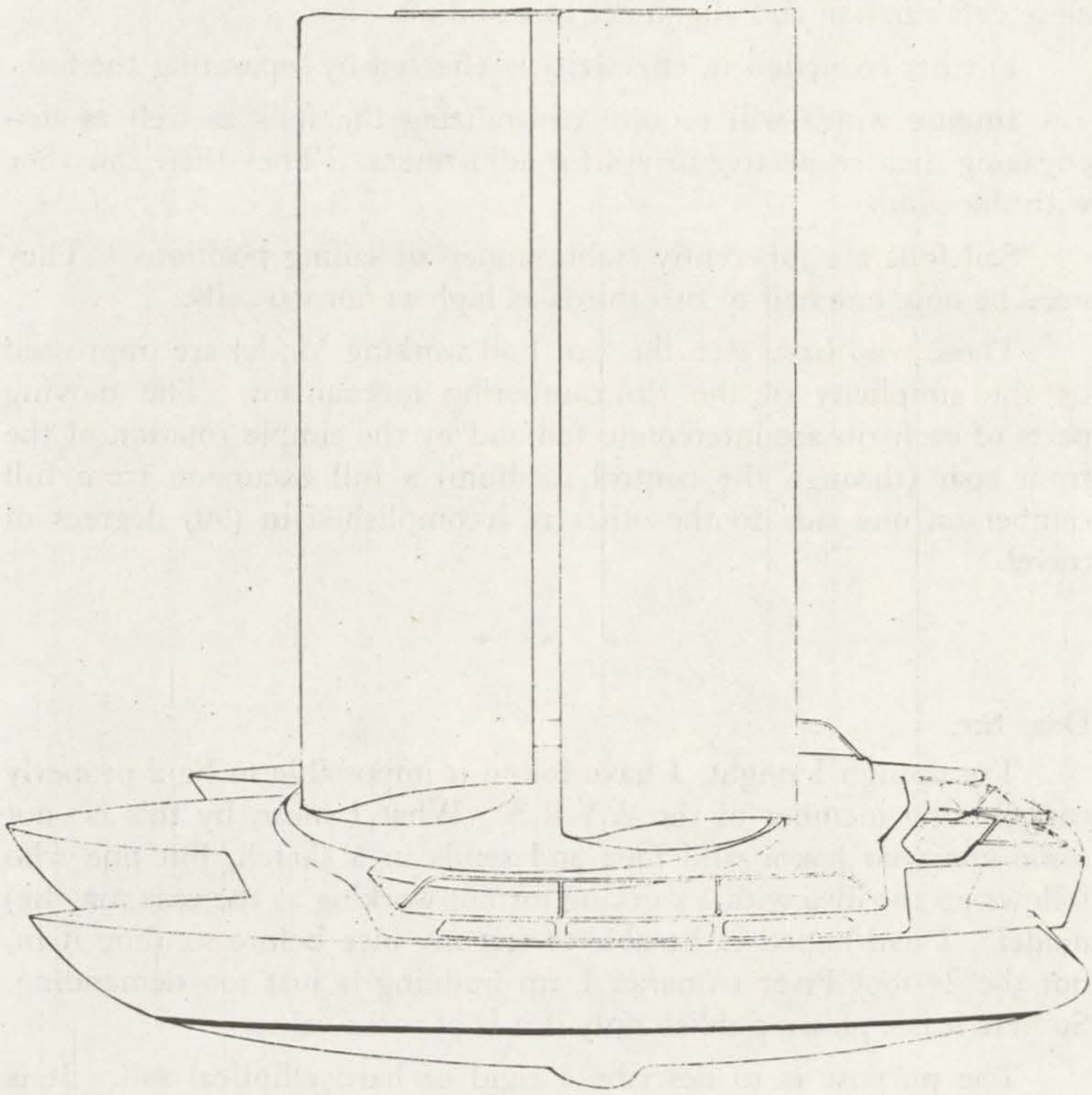
Morris Wright's Wing Sails

Each "sail foil" (which looks like a constant section airplane wing) can be instantly reshaped to any degree of camber within its designed limits. It can produce infinite camber changes from full camber on right—through the neutral position, to full camber on the left, and hold any position with no "slop" or "feed back" into the controls. Any and all attitudes are aerodynamically correct and effective in shape as the charted results will suggest.

The leading edges of both foils are always directed into the wind and the boat, in effect, is turned under them.

The sail foils inner structure and fibre glass (or plasticized) skins are impervious to weather.

I have a complete brochure containing photos of the models during tests and the test data. I also have a working model of the adjustably cambered and reversible sail foil for demonstration purposes. (Size—4 foot chord length x 30″ high with skins).



RIG OF THE FUTURE? Dual adjustable Sail Foils, each mounted on a turntable fitted to a master turntable, feature fully-controllable rig. Invented (and patented) by E. Morris Wright of Reseda, California the foils have variable camber for greatest efficiency for current conditions. They are continuously and automatically adjustable; with driving power said to be up to several times that of conventional sails. In high winds camber is reduced; while at moorings camber is at zero and foils are self-feathering. It is interesting to note in this attitude drag of foils is less than that of spars and stays of ordinary boat with sails furled. Illustration shows rig mounted on Piver-designed trimaran.

Sail foils excel in performance across the board in all sailing attitudes, to a mean average of 177% over conventional sails.

It is my intention that the initial use of the sail foil will be on a catamaran or trimaran type boat.

Sail foils can be manipulated to render them less effective with increasing wind intensities by first decreasing the cambers while in close combination and alignment fore and aft.

Further reduction in effectivity is effected by separating the foils.

Intense winds will require neutralizing the foils as well as disengaging their respective drives for adjustment. They then can vane with the wind.

Sail foils are inherently stable under all sailing positions. They need be only one half to two thirds as high as normal sails.

Those who have seen the Sail Foil working Model are impressed by the simplicity of the rib cambering mechanism. The moving parts of each rib are interconnected and by the simple rotation of the front spar (through the control medium) a full excursion from full camber on one side to the other is accomplished in (90) degrees of travel.

* * *

Dear Sir,

Try though I might, I have found it impossible to be a properly contributing member of the A.Y.R.S. What I mean by this is: not some one who has a wild idea and sends in a sketch, but one who follows up the idea with a working (or not working as the case may be) model. I had hoped to be able to test my idea before sending it in, but the 24-foot Piver trimaran I am building is just too demanding. So here it is—please publish only if it is of some value.

The purpose is to describe a rigid or hard elliptical sail. It is flexible in that the draft is mechanically controlled. Sail material should be 1/16 thick preformed fibreglass. As I show in Fig. 1, the starboard side would be a solid sheet and the port side is split. The starboard side is firmly attached to the mast. The port side is attached to the mast with a sliding provision. The fibreglass sheets will always tend to separate, so light nylon strings can maintain the proper spacing between them. The use of buttons to knot the strings on may help alleviate chafing. It is obvious to see how the sail draft is controlled in Fig. 2. Fig. 3 shows possible mechanisms for adjusting the draft. I have enclosed a small model you can use to prove to yourself how simply it works.

I had planned to construct one of these approximately 10 feet tall by 4 feet wide. Obviously, the hard part is the control mechanism. But compared to the mechanisms used in modern airplanes for flap

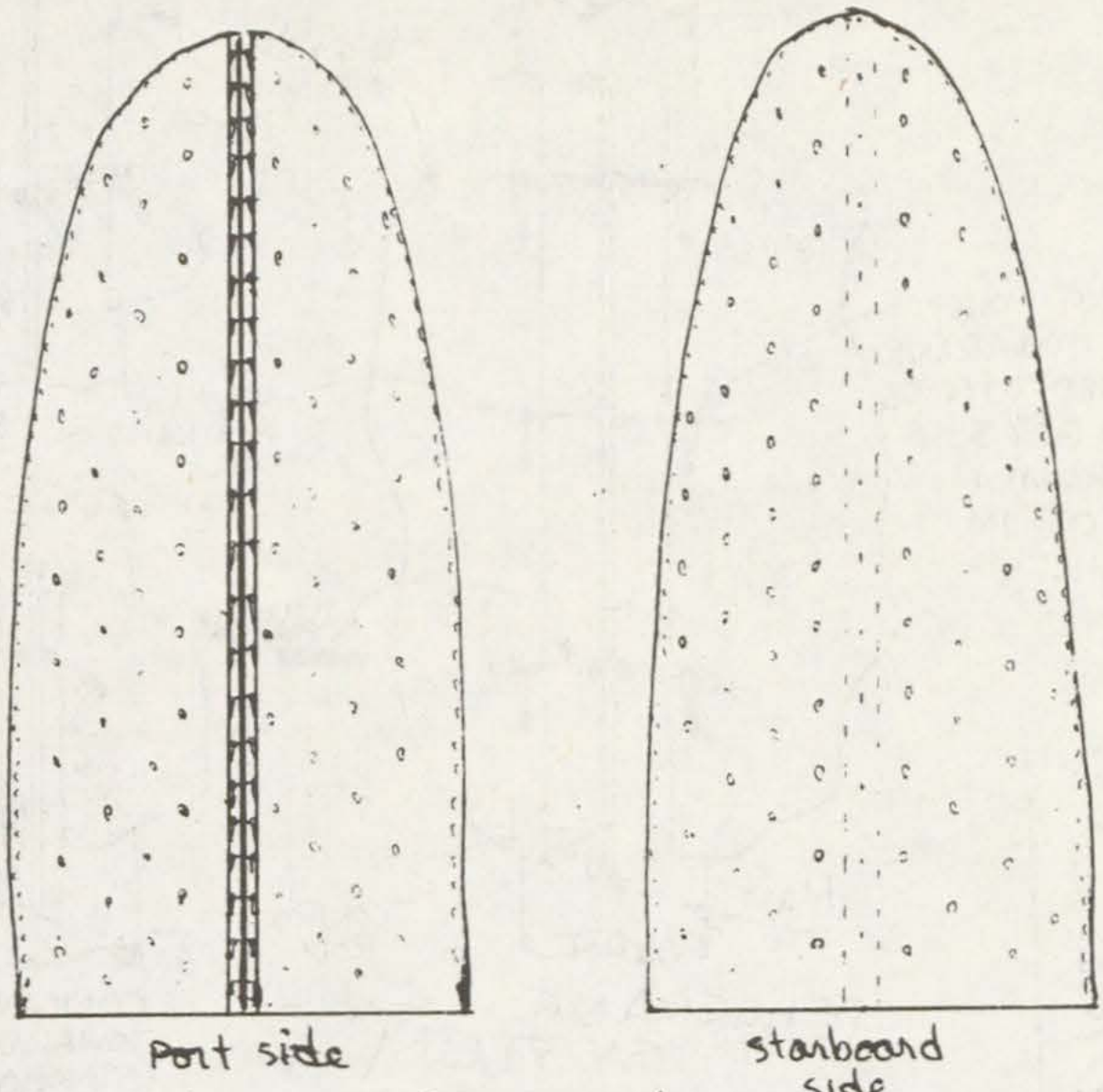


FIGURE 1

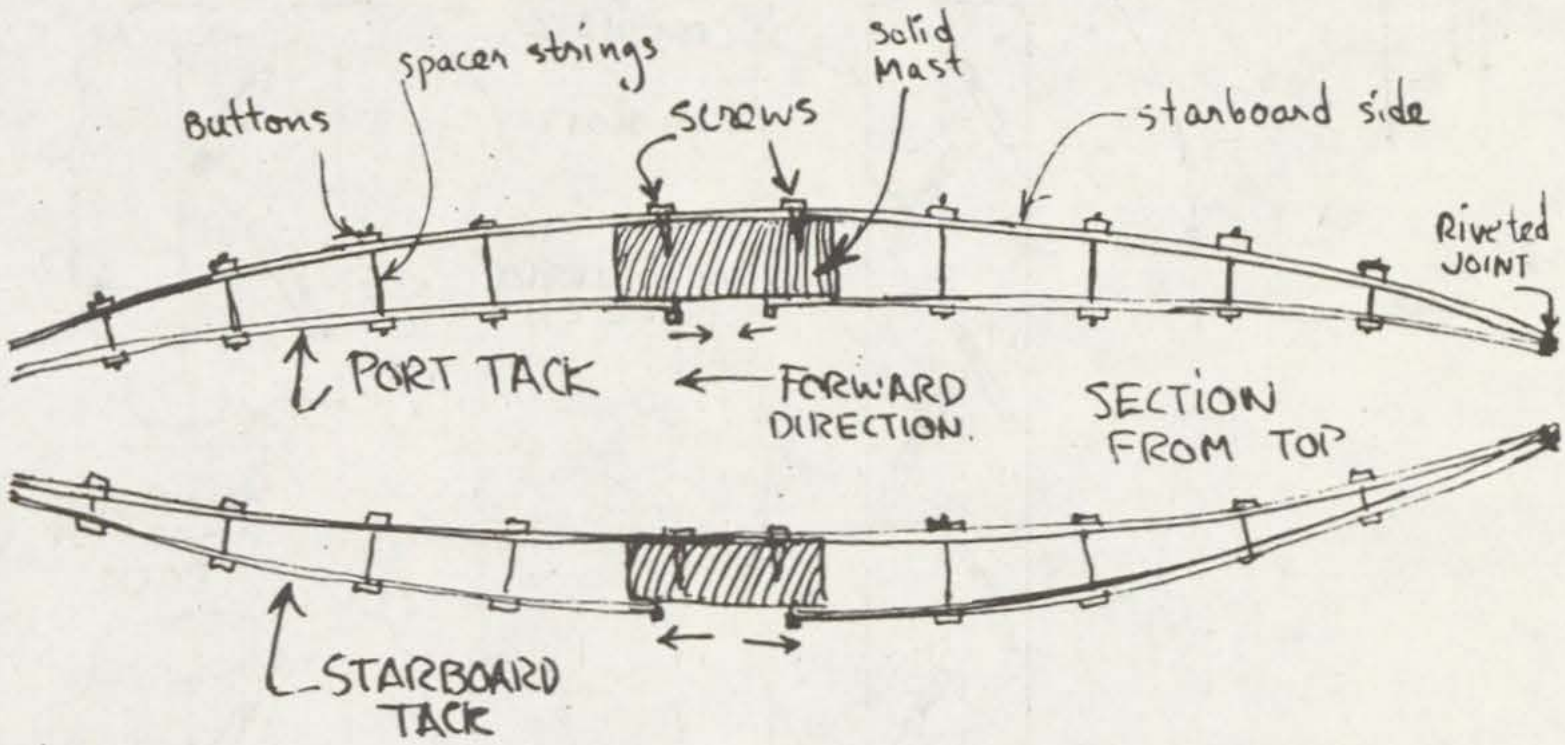


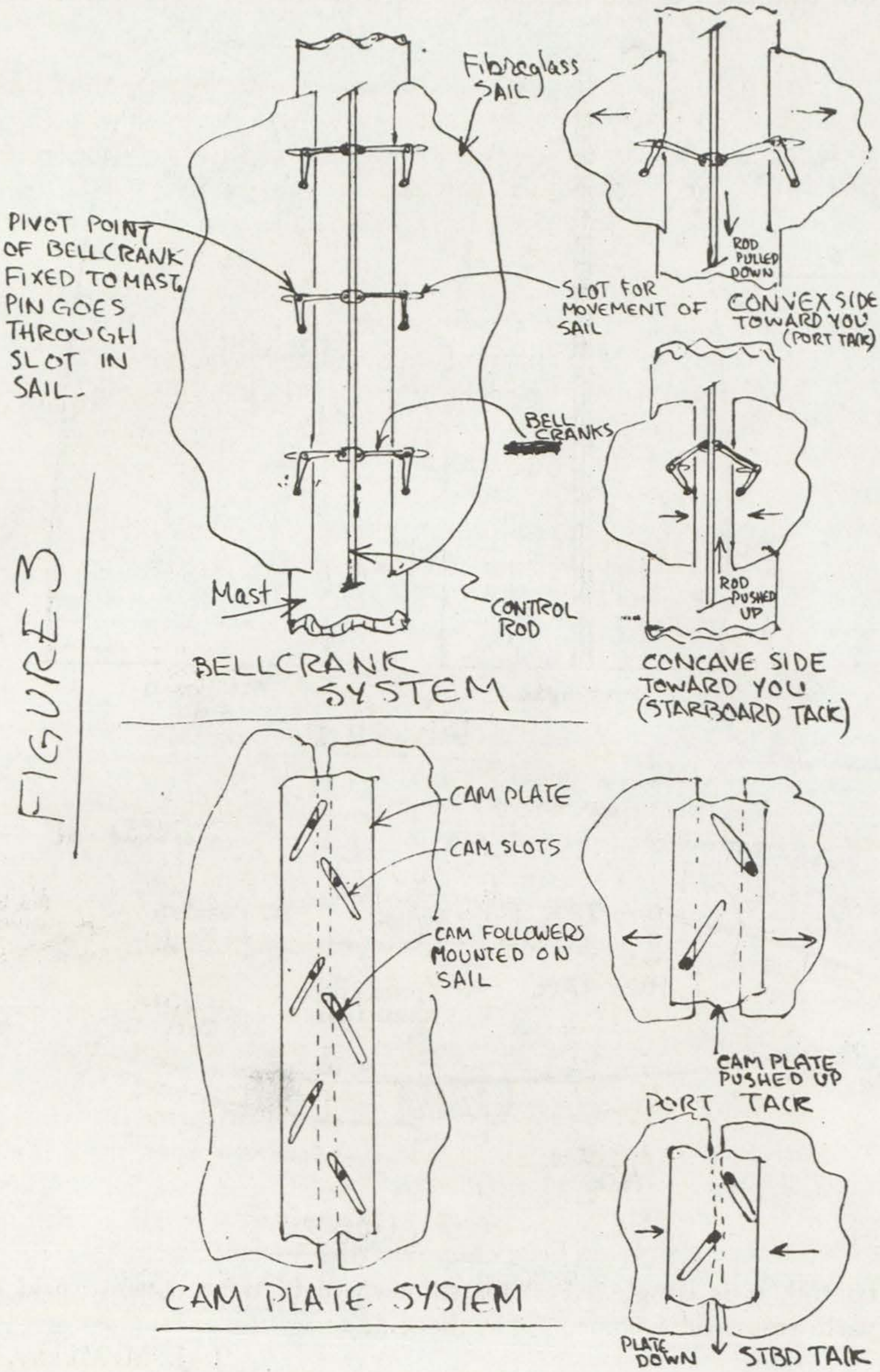
FIGURE 2

control, it is simple. Perhaps somewhere in the amateur world of yacht researchers, someone has the time to try this.

J. J. McMurry.

3122 Newell St., San Diego 6, California, U.S.A.

FIGURE 3


Fibreglass SAIL
PIVOT POINT OF BELLCRANK FIXED TO MAST. PIN GOES THROUGH SLOT IN SAIL.
SLOT FOR MOVEMENT OF SAIL
ROD PULLED DOWN
CONVEX SIDE TOWARD YOU (PORT TACK)
BELL CRANKS
Mast
CONTROL ROD
ROD PUSHED UP
CONCAVE SIDE TOWARD YOU (STARBOARD TACK)
BELLCRANK SYSTEM
CAM PLATE
CAM SLOTS
CAM FOLLOWERS MOUNTED ON SAIL
CAM PLATE PUSHED UP
PORT TACK
PLATE DOWN
STBD TACK
CAM PLATE SYSTEM

WING-CONTROLLED AUTOMATIC PILOT

BY

HENRY A. MORSS, JR.

6 Ballast Lane, Marblehead, Massachusetts, U.S.A.

Introduction. More data about the performance of sailing boats are needed to round out our understanding. As members of the A.Y.R.S., we are more aware of this than are many other sailing enthusiasts. With A.Y.R.S. communication and our varied backgrounds, we should be able to bring many talents to bear on all sorts of subjects.

For plotting on a polar diagram*, the data must include all of the following at least:

(1) Angle between apparent wind and boat's heading
(2) Leeway angle, or angle between boat's heading and course made good
(3) Speed of apparent wind
(4) Speed of boat through water.

Usually a record will also be kept of the sails set, trim, the loading or weight of the boat, the weather and sea conditions, etc.

There are problems in making tests. One is to muster the necessary patience and persistence. Another is to find suitable instruments. A third is to assure good steering.

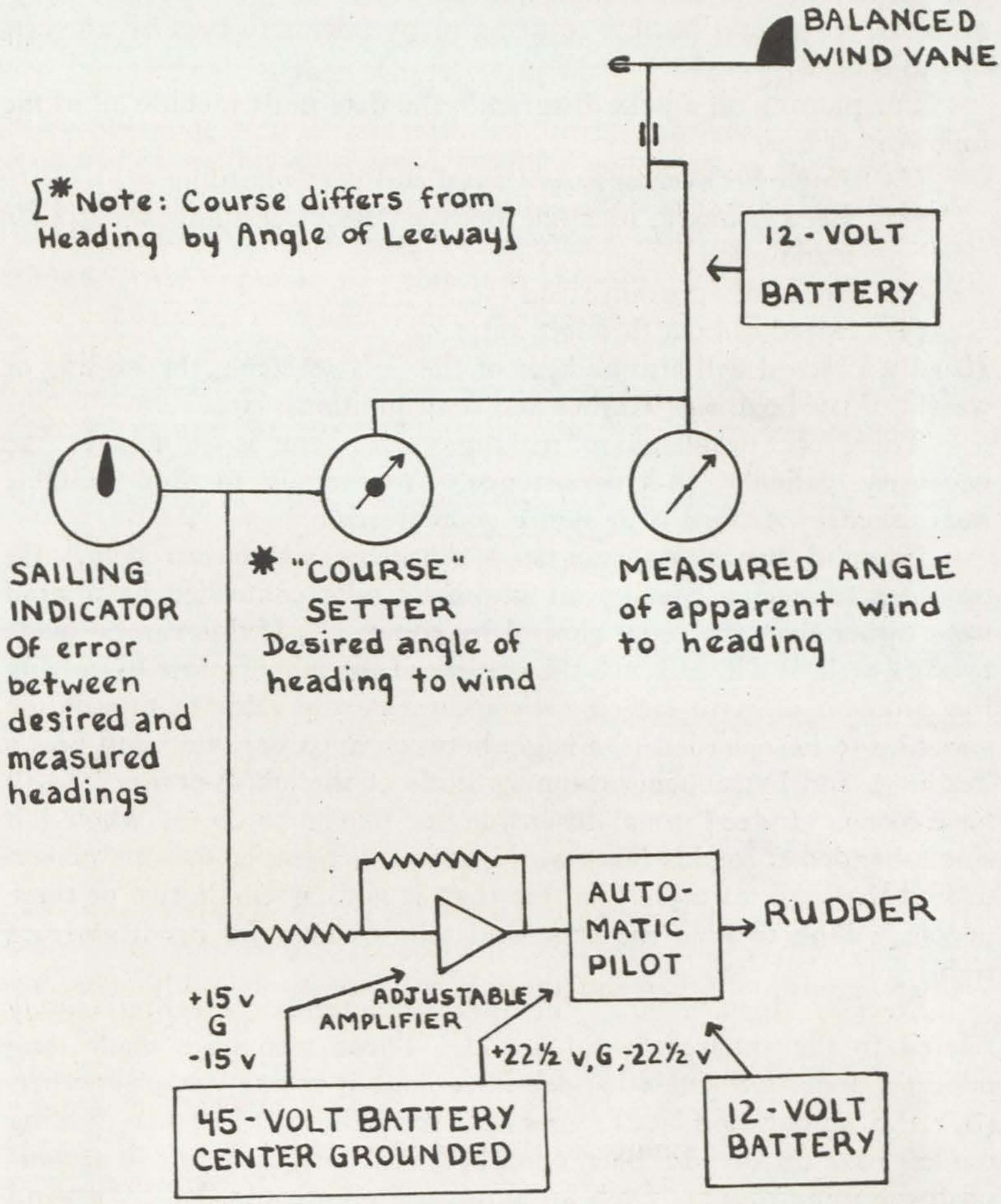
Edmond Bruce has suggested a scheme which can help. He proposes to steer a boat by an automatic pilot controlled by a wind vane rather than the usual control by compass. If this can be made to work well, it will improve the quality of the whole effort by solving the problem of good steering, by indicating the value of one of the variables to be recorded (the angle between apparent wind and boat's heading), and by reducing the magnitude of the job the observer will have to do. Indeed it should enable one person to do the whole job single-handed. In this busy world, it is much easier for one person to find the time for a job like this than it is to assemble two or three people willing to give the time and effort when the conditions are right.

Previous Applications. The idea of automatic steering closely related to the apparent wind is old. Those who have made long passages under sail single-handed have done it in one way or another. (A.Y.R.S. publication No. 13 goes in to this subject at length.) Sailing models have for decades been equipped with various means to accomplish the same result. Even an automatic pilot controlled by a wind vane is known to have been used on at least one boat as long as twenty-five years ago.

**See, for example, A.Y.R.S. No.* 38 (*p.* 17), *A.Y.R.S. No.* 40 (*p.* 50), *and A.Y.R.S. No.* 45 (*p.* 43).

The present Application. For our present purposes, a wind-controlled automatic pilot seems to be very useful. It imitates most precisely the things which a good human helmsman tries to do. If successful, it will have a steadier hand than a human helmsman over hours of painstaking work.

During the late summer of 1964, satisfactory trials were made of the following device.



BLOCK DIAGRAM OF AUTOMATIC PILOT CONTROLLED BY WIND VANE

Description of Apparatus. A "Wind Set" made by Thomas Walker & Son, Ltd., was connected through an operational amplifier with adjustable gain to an automatic pilot made by Kelvin & Wilfrid O. White Co.

The "Wind Set", which draws about 50 ma. from a separate battery, consists of four principal parts:

(1) The wind vane and transmitter
(2) A wind direction indicator dial
(3) A "Course Setter" dial
(4) A "Sailing Indicator" dial.

The wind direction dial gives the direction of the apparent wind relative to the boat's heading. The "Course Setter" dial can be set to a desired angle between apparent wind and boat's heading to give an "error" reading on the "Sailing Indicator" dial. Thus the latter dial is a very convenient steering indicator. It points to zero (straight up) when the boat is on course and swings to left or right as the boat deviates from the desired course. The "Sailing Indicator" meter is a damped, center-zero, D.C. voltmeter which reads zero when the boat is on course and reads plus or minus voltage roughly proportional to the deviation when she is not.

The automatic pilot is a transistorized, feed-back circuit which turns the rudder in proportion to the deviation of the boat's bow from the desired course. Its input is a D.C. signal matching the error in the boat's course. The required signal is substantially greater in magnitude—perhaps ten or twenty times—than is the output of the "Wind Set". This explains the need of an amplifier at the point of interconnection. The one used, made by the Nexus Instrument Co., is designed for a voltage swing in the output circuit from +10 to −10 volts.

A block diagram of the apparatus is given in the figure.

Performance. When connected and turned on, the system worked! In smooth water it controlled the course nicely. In rougher conditions, it worked hard. It then did the job, but not as smoothly. As one would expect, behaviour was most sensitive to roughness when the course was set close to the wind.

The gain of the amplifier was the one significant adjustment available. This was found to be not at all critical in smooth water. Probably the action in rougher conditions would be improved by a more careful determination of the optimum setting of the gain control.

One complication should be mentioned. It is that the feedback system described here does not really attempt to hold the boat at

exactly the preset angle to the apparent wind except in the special case where the boat is in perfect balance with the rudder amidships. If balance (and a steady course) occurs with the rudder somewhat off center, then the equilibrium established by the control system is at a point varying slightly from the preset course. The variation is a qualitative indication of the unbalance, a fact of interest in itself.

Because of this, the recorded value of the angle between the apparent wind and the boat's heading must be read from the wind direction indicator dial, not from the "course setter".

Steadiness. The principal problem with this apparatus is fluctuation due to rough water and rapid variation in wind direction. This can be smoothed out by incorporating a circuit of suitable time constant at the input of the operational amplifier. The "Wind Set" contains such electrical damping in its "error" circuit. For these experiments it proved sufficient and was used without modification.

In any case, this particular problem is not severe when the objective is the present one of getting good performance data, because to do that we must have smooth and favourable conditions. Perhaps one day in the future it will be appropriate to broaden the scope of the experiments to include performance in rougher water. (Much of this kind of work is being done nowadays in the testing of power-driven commercial vessels). When that occurs, the question of best damping of the circuit will require closer attention.

Leeway Angle. During the work described above, some attempt was made also to measure the leeway angle. This was done at the bow to assure that the reading would be taken in undisturbed water. Vanes of wood, metal, and weighted cord partly and fully submerged were tried without full success. Those partly out of water were subject to some error from wind pressure. All of the ones which relied on the motion of the water at and near the surface were troubled by the erratic water motions of even small surface waves. One attempt with deeper immersion was plagued with vibration and considerable drag. Since it would be desirable to know the leeway angle to one-half or perhaps one quarter of a degree, these difficulties must be remedied.

In A.Y.R.S. publication No. 47, Howard K. Morgan spoke of measuring leeway angle at the bow. He seems to have been more successful than the present writer. It would be helpful if he would publish a fuller description of his instrument.

Conclusion. This is a report of preliminary work only. The value will lie in getting good performance data for the boat, once all the necessary measuring instruments are available. It is hoped that the next sailing season will be productive along these lines.

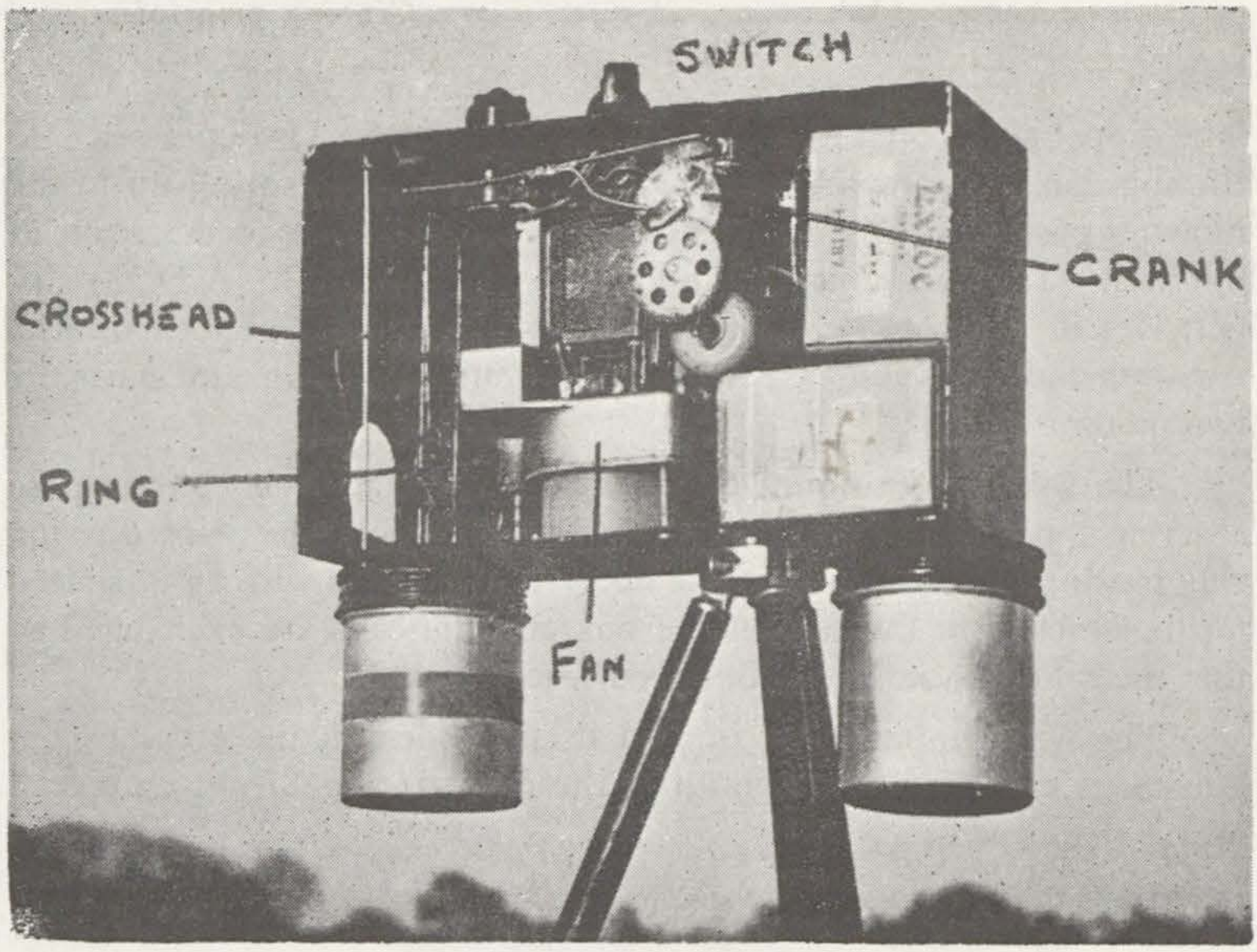
THE BUBBLE GUN

BY

JOHN HOGG

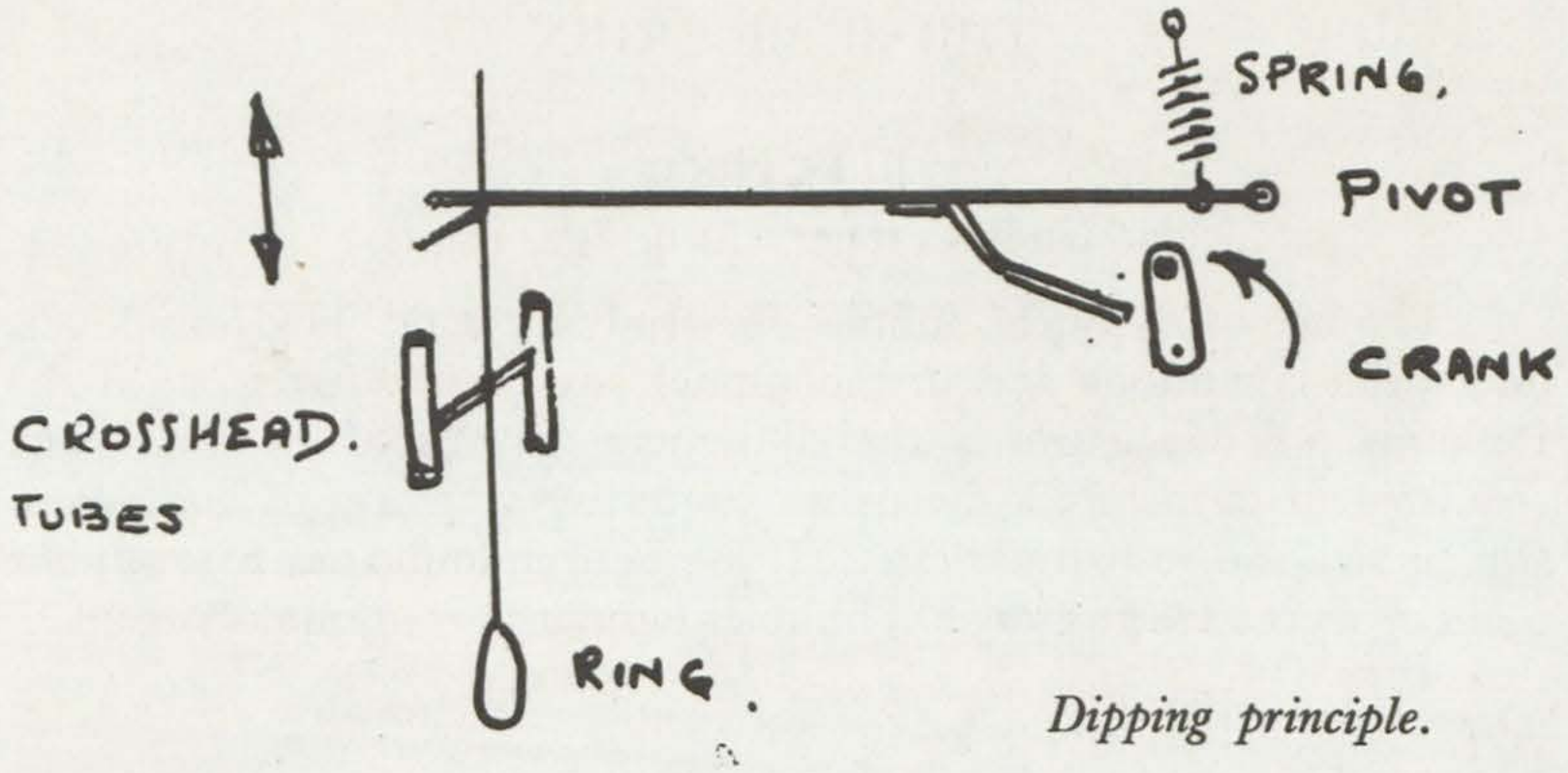
Parklands Cottage, Curdridge, Hants.

The use of chemical bubbles for studying wind flow round sails in natural conditions and in the tunnel has been referred to in the Bulletins. Some details of the equipment may be of interest. The requirement is merely a means of producing a stream of bubbles of similar size and at a steady rate. It has been found easier to study the paths of successive groups of bubbles rather than a continuous stream.



The "Bubble Gun"

The "gun" consists of a metal box which can be mounted either on a camera tripod or on an extension arm. It contains a small motor driven turbo fan and a dipping mechanism both working from batteries contained in the box. The action is simply the dipping of a wire ring into the bubble solution and drawing it across the fan outlet, the action being automatic. The principle is similar to the toy bubble kit. This method was adopted after trying several others because it is simple and reliable. The fan is a complete unit of the type used in instrument ventilation, the motor being 12-24 volt D.C. The dipper is operated from a separate motor via a 200 : 1 reduction gear train.



Dipping principle.

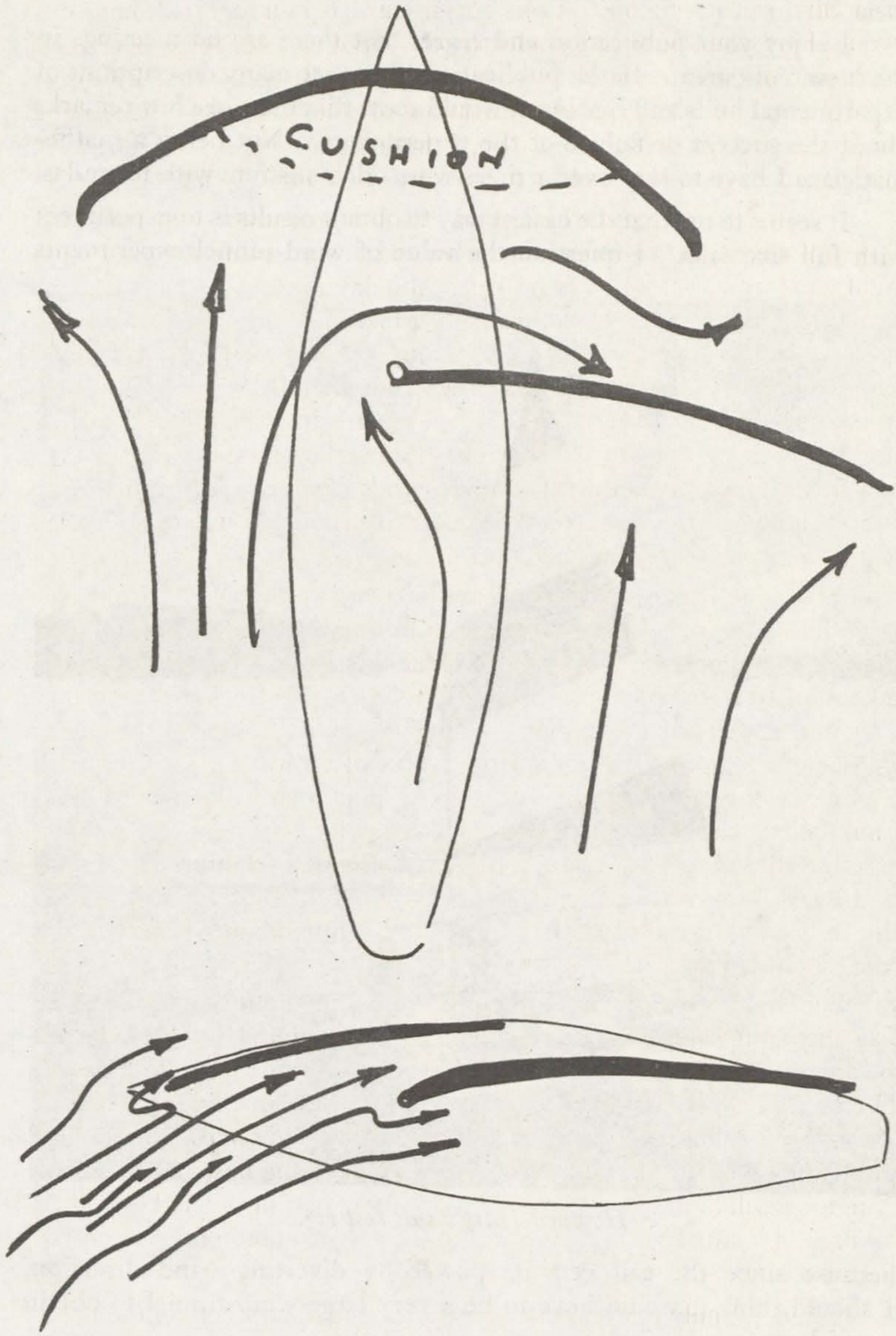
The dipper slides on a crosshead of stainless wire and is depressed into the solution by a crank lever which then allows it to spring up to the blowing position. This produces the required interrupted stream of bubbles. The fan runs continuously. Two 7.5 volt (A.D.38) dry batteries in series provide adequate power for many periods of use. A switch and series resistance controls the rate of dipping, and starts the two motors.

The solution—a liquid detergent such as Fairy—is contained in a screw top aluminium can attached to the box, the wire dipping ring passing through a slot in the lid. A second can with an unslotted top is attached to the rear of the box and the cans are exchanged so that the solution can be safely stored when carrying.

The wire dipping ring is $\frac{3}{4}''$ dia. and slides on the crosshead at a distance of $\frac{1}{2}''$ from the mouth of the fan. It should not be placed nearer than this.

The photograph shows the box with the side lid removed.

Watching. Bubble shooting on a pitching deck is something of a strain but nothing I have tried so reveals the behaviour of wind flow in its natural conditions; its constant turbulance; its viscous nature and its apparent reluctance to flow in those conventional "streamlines" so often seen in drawings. Bubbles flowing on to a jib for example are likely to pass on either side of the sail, some even "changing their mind" and turning back right round the forestay to pass to leeward of the sail.—A badly sheeted sail is very obvious, in this respect. Similarly the flow into a spinnaker can show how a cushion of dead air can build up inside, particularly if the luff is curled, or the flow is trapped by the squared off main, the effective area of the spinnaker being altered in the process. Watching a Genoa one sees the expensive

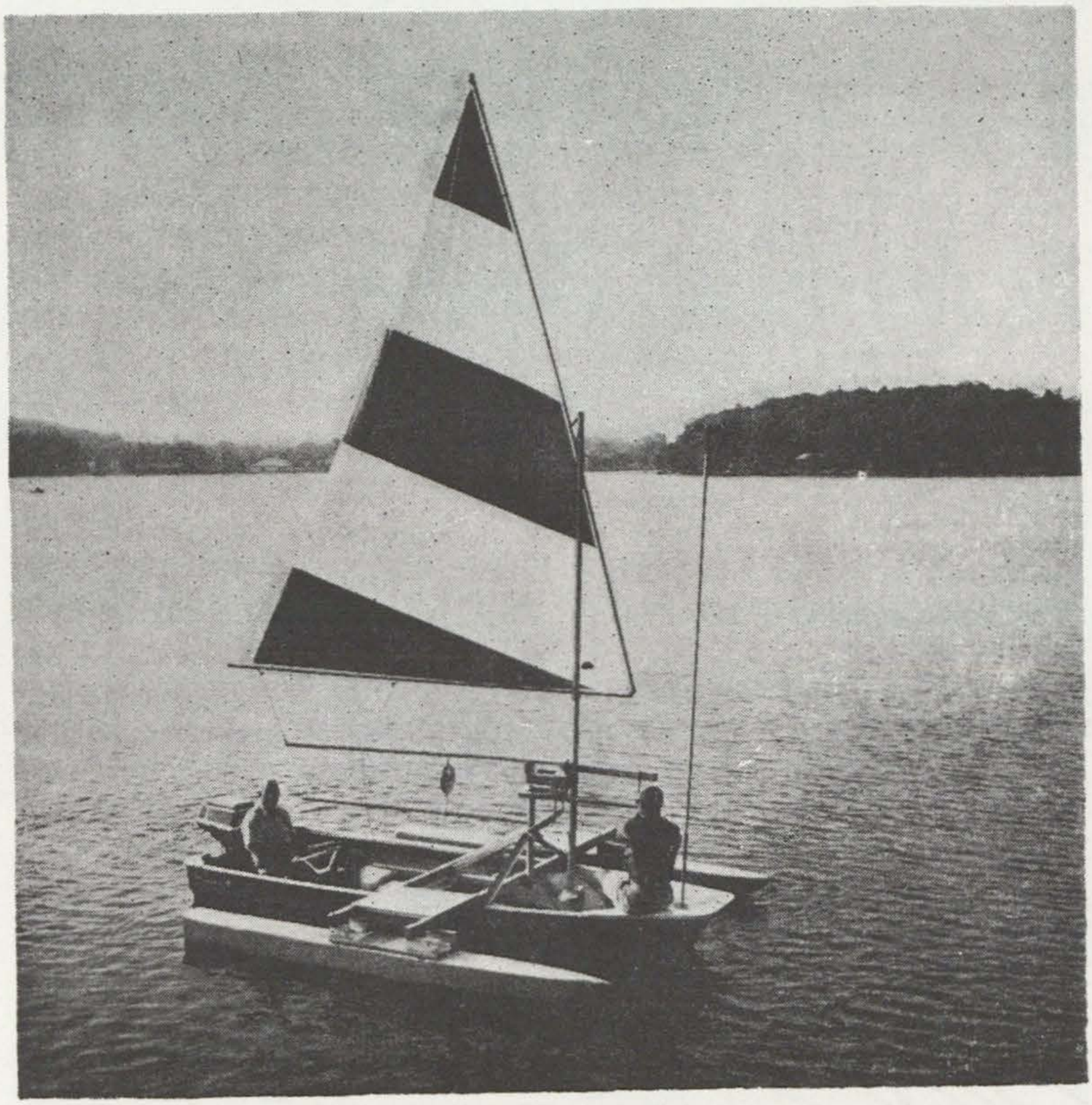


leak under the foot of the sail, if there is a gap, and the restriction caused by a—perhaps necessarily—small sheeting angle, or by a wrongly cambered main used in conjunction with it.

Dear Sir,

I enjoy your publication and regret that there are no meetings in the New York area. In the publication, there are many descriptions of experimental hulls and rigs but it would seem that there are few remarks about the success or failure of the experiments. Not being a mathematician, I have to skip over articles which demonstrate with formulas.

It seems to me that the easiest way to obtain results is to experiment with full size sails. I question the value of wind-tunnel experiments



Howard Hart's sail test rig.

because since the sail gets its power by diverting wind direction, I should think it would have to be a very large wind-tunnel to obtain normal readings.

The photograph shows the result of my development of a rig on which to make comparative tests of sails. So far, I have only made tests of Sunfish Sails and the sail shown. The results obtained give

me definitive comparisons of the various sails tested. At my limited speed of 10 mph in quiet air, my spring scale shows 12 to 14 lbs. using a standard Sunfish Sail, and 26 to 28 lbs. with the isosceles sail shown in the print. I found, for instance, that a sail read higher on the spring scale if the out-hauls were not tight. Also, a sail made by a competitor of Ratsy which was cut a little fuller, gave higher readings than the standard Ratsy sail.

There are a number of Sunfish on a small lake near here and I have observed that the sails do not fall off as the Bermuda Sail does when the sheets are started. People with Bermuda Main-sails use the boom vang to try to keep the sail in one plane.

Alcort uses what they call the top and bottom boom fastened with two small ring bolts at the tack. I believe that this rig is a development of the skate sail. This has been one element of their success.

In 1965, I hope to be better equipped. I have bought an Evinrude Sport 16 and a 55 horsepower outboard motor, which will give me much more flexibility and comfort for making my tests. You will note in the colour print, a man in the bow controls the sail. He can keep the sail at the critical angle and observe the spring scale, while the man at the wheel watches the anemometer and controls the speed.

It is much more satisfactory making tests in calm air. However,it is possible to obtain fairly satisfactory results by varying the speed as the wind velocity changes and get comparative results. Air is always turbulent even when dead calm. It is only a matter of degree. So far, I have found no stable air.

I thought you might be interested in my project. As yet, I have proved nothing but have been able to understand better the importance of the cut of the sail and of the aspect ratio.

HOWARD P. HART.

36 Buckingham Street, Waterbury 10, Connecticut, U.S.A.

* * *

"WEIGHING" RESISTANCE

BY

JOHN HOGG and JOHN MORWOOD

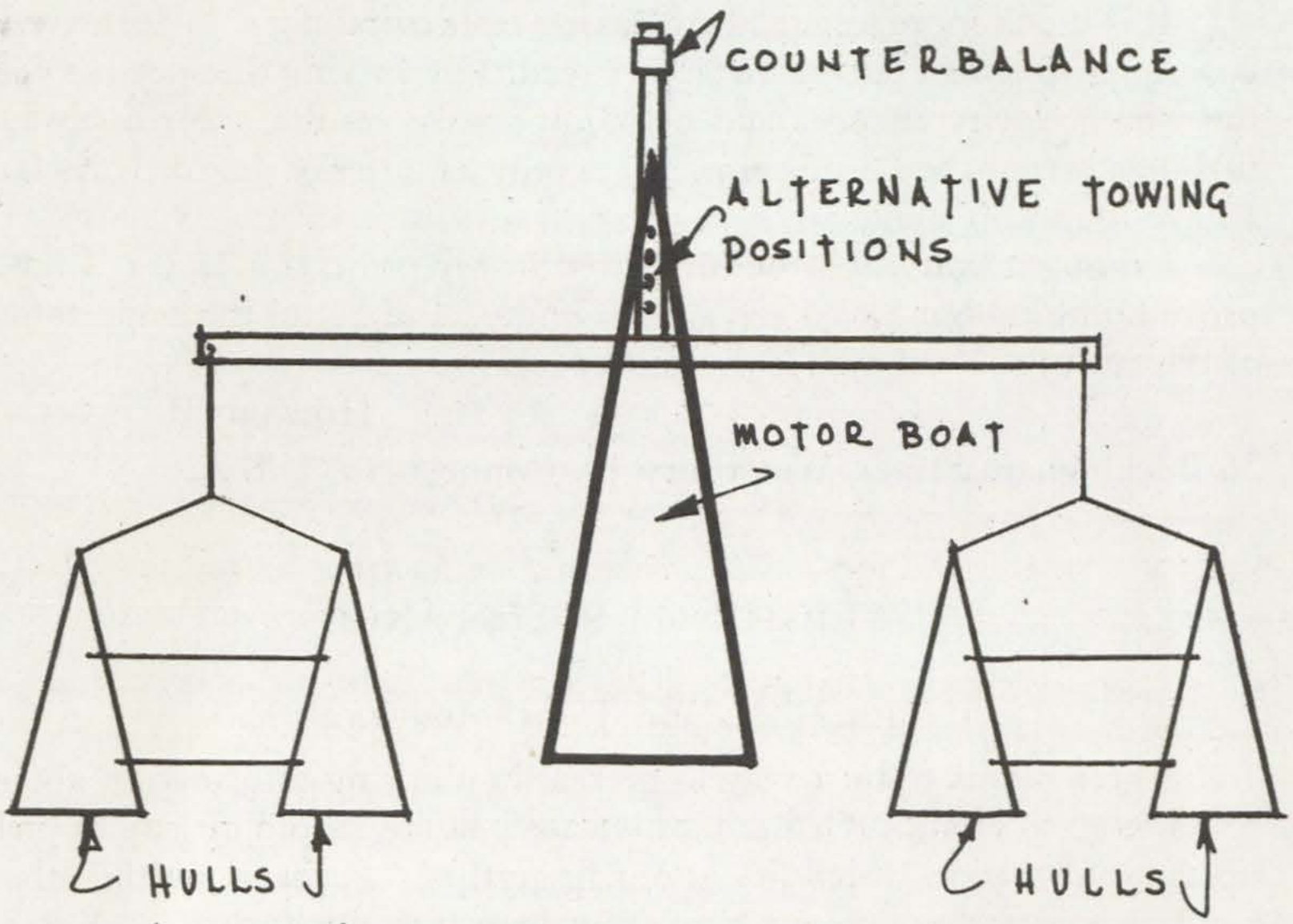
There seems to be a vested interest in allowing information about boats to go to waste. Or perhaps we are just too stupid or lazy to pick up the information which lies at our fingertips. Perhaps, on the other hand, we just don't know how. At least for the future, A.Y.R.S. members will know how from this article and it holds as good for the twelve meters as for the dinghies and catamarans.

Ideally, one would like to know the precise and exact resistance of a boat but this is rather difficult to obtain, though the methods are

well known and simple. Accurate weighing devices and water speeds are hard to get. However, for the purpose of comparing one boat with another in, for example, the selection of a challenger or defender for an international contest, comparative resistance tests of two boats can be devised which make accurate measurement of both speeds and pulls unnecessary. In collaboration, both of us have devised the apparatus which will now be described and John Hogg has had practical experience in using similar apparatus.

Full Size Boat "Weighing". All that is needed for this is a motor boat of slim form to create as few surface waves as possible with a vertical pin placed near the bow . . . A short pole with some holes in it which will fit on the pin of the motor boat is then attached to a long pole at right angles to its centre point and they can be stayed with wires to the free ends. A counterbalance weight may be used.

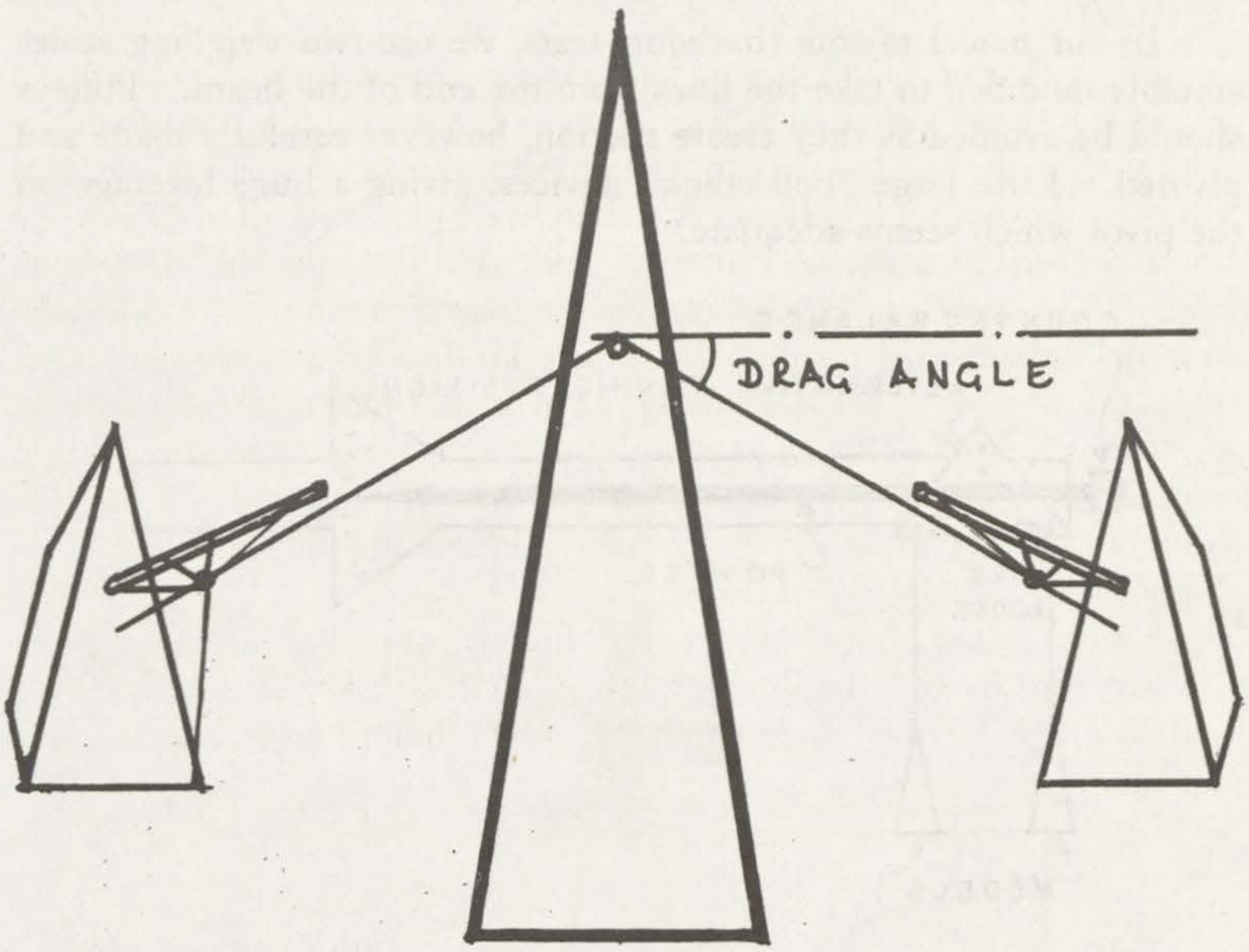
The Test. Two boats are towed from each end of the athwartships pole. The motor boat is kept at a constant speed and the pole will turn until the moments of each boat about the fulcrum are equal. The sensitivity of the apparatus depends on which hole in the short pole is



chosen. When the angle by which the pole turns has been measured, it is then easily possible to calculate the relative pulls of the two boats from the dimensions of the poles and the distance of the hole chosen from the line joining the points where the tow lines are attached. The

speed of the motor boat should be measured but extreme accuracy is not necessary.

Close Hauled "Weighing". The purist will recall that the towing tests of head resistance done, I think by Watson, in the 19th century were not good enough to produce a faster boat on the wind. One must therefore also devise a similar test for close hauled sailing. A method which might be useful is to take the tow lines from the estimated true centre of effort of the sails, using a network of ropes to spread the force



along the mast. A single line is used connecting both boats but passing through a block on the motor boat by which they can be towed.

The Test. As compared with the head resistance test, helmsman cooperation is needed. The two towed boats must be steered so that the towing force of each is equal, which is easily judged from the motor boat. The "drag angle" of each hull is then taken; which is a measure of the close hauled efficiency. In this case, the speed of the towing boat must be fairly accurately measured because "drag angle" varies quite largely with speed. The two tow lines from the yachts should come from them approximately parallel with the deck and adjustments can be made either from the towing boat (hoisting it up a mast) or from the towed boats (adjusting the length of line) to achieve this.

TOWING RESISTANCE DEVICES

BY

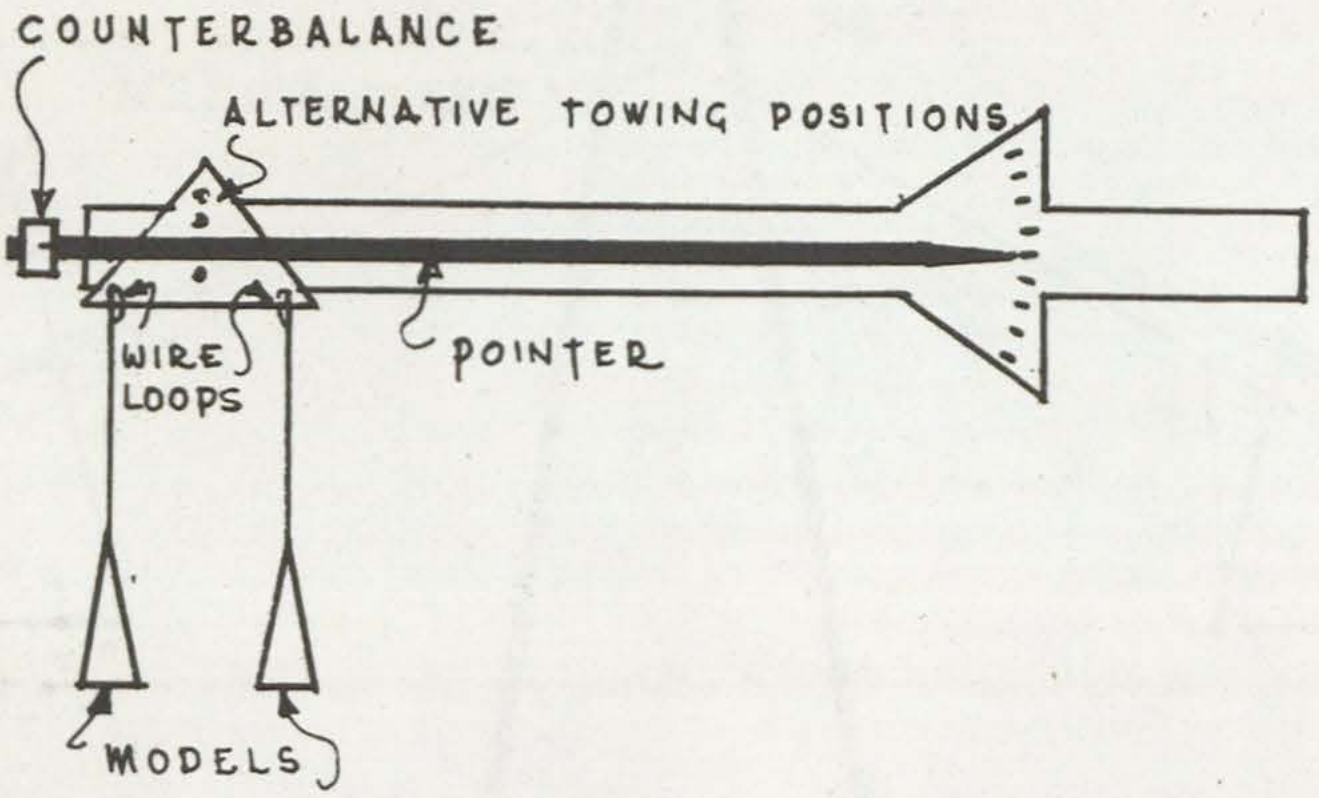
JOHN HOGG

Parklands, Curdridge, Hants.

Both the devices shown in the previous article should work and can give comparative figures of resistance. The main problems are :

1. The small differences likely to be encountered.
2. Surging.

In our model towing (harbour) tests, we use two weighing scales suitably modified to take the lines from the end of the beam. Pulleys should be avoided as they create friction, however carefully made and pivoted. I use large "bell crank" devices, giving a huge leverage on the pivot which seems adequate.



In order to magnify the difference in pulls of two small models (7 ft. 6 ins.), I use a different indicator device as in the drawing. This obviously measures only the difference between the pulls.

Surging. In the harbour, this is a problem. Both full scale and models tend to surge. We have reduced this with "bungy" springs and similar devices, but the best results are got by making the pulls operate the pen of a recorder and then integrating the resultant chart. I have been able to average up even considerable surging by this method. In calm water, surging is not such a problem, though it can be a nuisance.

I am not sure what size of models members will want to use. The tow bar arrangement shown is quite practicable for small ones, especially on a pond with steep sides. Speed is taken by timing between two marks on the pond side.

Dear John Morwood,

In your article "Racing Catamaran Design" (CATAMARANS 1964, A.Y.R.S. N.o 50, page 15), you say weight adds relatively little to wetted surface in support of which you say a C Class cat with a water-plane area of 40 square feet will sink 1 inch for an extra 200 lbs., and that this will only add about one square foot of wetted surface.

If the C Class cat is 20 feet long, the perimeter of her water planes (both hulls) will be not less than 80 feet. An inch-wide strip of this length will have an area of about *seven* square feet. This is not negligible and might be 10% of the original wetted surface and could account for much if not all of the loss of speed.

J. SIDGWICK.

Leigh Cottage, Freshford, Bath, Somerset.

Editor: I bow my head in shame, having got my sums wrong. I suppose I was carried away in trying to find something other than wetted surface to hold cats back. We know that lightness is very important for speed but in view of the above, we are left with the conclusion that weight merely increases wetted surface.

* * *

Dear Waddington,

In reply to your circular letter to A.Y.R.S. members, I have not got, I am afraid, any very helpful suggestions as to how to widen the scope of the thing to bring in more active membership.

The basic trouble is and must remain the world-wide "scatter" of members which makes it very unlikely that many can get together for meetings and discussions.

Therefore, one is reduced to the A.Y.R.S. Journal as the means of getting together and exchanging ideas and putting forth new ones. This is no bad thing—it is almost the only chance the experimentally minded chap has of getting other folk's ideas and airing his own; since the yachting papers will only publish a very few articles and letters of this kind.

As I see it, one wants to put over to members the idea that the A.Y.R.S. Journal is the equivalent of a world wide "get together over a pint of beer" and that any new idea can and should be aired in it—to start chaps thinking, if for nothing else.

Where the thing has gone astray to my mind (and I wrote to Morwood and said so) is that it has two irritating habits 1) of saying "this is the best"—whatever it is (hull, rig etc.) which is nonsense

since the actual achievements of A.Y.R.S. members are very small as regards improving the breed of boats and 2) that members often don't say whether their ideas have been fully tried out and with what result, after all, no one need be ashamed of failures—one learns a lot from them.

Maj.Gen. H. J. Parham, Hintlesham, Ipswich. JACK PARHAM.

* * *

A.Y.R.S.

Dear Mr. Waddington,

In your letter of 23rd November you ask for members' views on what the A.Y.R.S. might do. Here goes.

1. Publications. Excellent. No comment.

2. Present London meetings. Excellent, provided a supply of speakers of the standard arranged for this winter continues. It will be interesting to see if numbers drop when the lectures become a bit more specialised (e.g. John Hogg's).

3. What else? A.Y.*RESEARCH*.S? Besides publications and meetings, can the A.Y.R.S. do anything more?

My belief is that there are two kinds of progress in sailing craft :

(*a*) The breakthrough (e.g. Cats, Trimarans, R.Y.S.A.)

(*b*) Development (e.g. Fisk/Downies work on Cats in last few years.

with a hazy area in between.

4. In both these, true comparison can best be made in two ways :

(*a*) in racing—to establish comparative performance on all points.

(*b*) in prolonged use—to establish sea and harbourworthyness in all conditions.

(It is a matter of taste whether you want both, or only one.)

5. This is not to decry Hogg (who is an old friend) whose performance measurement (or comparison?) is a part of development and might be used to validate a breakthrough.

6. I suggest the need is for full size (i.e. not model, because of scale effects) comparisons :

(*a*) different sails on identical hulls.

(*b*) different hulls under identical sails.

7. Can the A.Y.R.S. organise this by specifying:

(*a*) sail plans—both conventional and "breakthrough"

(*b*) hulls—both conventional and "breakthrough"

and then prevail upon members to build them, separately or severally, and then make comparisons as in 4. above? The principal problem is that if a team make something, to whom does it belong when it is finished?

8. The only precedent I can quote (and John Hogg will confirm this, if not produce one "body"!) is the Radio Controlled Models Society whose London and Manchester Groups competed—in about 1948 or 1949—to make a radio controlled vehicle. About seven or eight of us contributed in various ways to the London DUWK, and it remained normally in the custody of the man who had contributed the lion's share of the radio and motors etc. As far as I know he still has it! None of the others ever asked for their bit back! My conclusion is that if the contributions of those who do not have custody (and/or ready access and use) are not too big, then the average member is glad to give his time/materials/facilities, and if he has a "go", or sees an expert having a "go", then he is happy.

COMMANDER G. C. CHAPMAN.

9 Hurst Way, Pyrford, Woking, Surrey.

* * *

Dear Mr. Waddington,

In your news letter, you ask for suggestions and I should like to make one.

I am sure there are many members who would like to try out many of the experiments on main hulls, floats and hydrofoils but have not the practical ability to design the actual construction of the boat e.g.,

(*a*) How to construct a frame for a float or main hull.

(*b*) How to connect in the best way a float to a cross beam.

(*c*) How to build hydrofoils.

(*d*) The design of a bulkhead, etc., etc.

I am one of those members who is having the greatest of difficulty in building an experimental trimaran. I feel sure that there are many members who have the knowledge I lack—maybe professional, maybe amateur.

I suggest that an article or two each quarter on the above lines would be of great help to many members.

TREVOR MCMULLAN.

Lt.Col. T. W. H. McMullan, R.E.,
R.E. House, Ness Road, Shoeburyness, Essex.

* * *

Dear Mr. Waddington,

In reply to your circular letter received today, I would like to make it quite clear, as a member too remote from London to take any active part in the A.Y.R.S., how much I appreciate the excellent standard of the publications. Really it is difficult to see how these could be improved for general interest and detail and we all owe a tremendous debt to John Morwood.

I wish every success to the new series of Winter meetings which I am sure is an excellent idea—I only wish I could come to some. I do not feel however, that attempts to hold any of these in centres other than London would meet with worthwhile success. Few people are usually prepared to travel very far for this sort of thing in my experience. I have been wondering, however, if it would be possible to organise more sailing meetings. The Southampton, Portsmouth or Chichester areas are possible venues other than our existing one.

I feel that we see quite a few hare-brained ideas in the journal, though there is no harm in that. I must say that the worst of the lot seems to me to be J.M's "Mill gear" automatic steering—this must surely be hopelessly unresponsive and fragile. Even if it is made very lightly, it would have to be at a large angle to the wind before it did anything and heavy construction would cause it to go on rotating like a flywheel in the wrong direction long after the wind had changed. The steering would hunt fearfully and ponderously. Its characteristics are altogether wrong and it is a horrible idea.

I was intrigued by the Downwind Sailing Club description in the recent journal. I wondered why they didn't enclose all the sides and top with glass or perspex, thereby giving themselves a constant wind down the whole length of the course. As a suggested extension of the A.Y.R.S. activity why not an "Upwind Sailing Club", i.e., miniature boats on the same sort of course, but driven by windmill actuated waterscrews or paddles. This would offer greater scope for experiment than the downwind idea.

KENNETH R. MAY.

Brook House, Middle Street, Salisbury, Wiltshire.

Dear Sir,

I am writing in response to your letter of the 23rd November. It seems to me that the most likely way in which the ordinary member can contribute something to the Society's activities is in providing data of a simple kind.

I think that the most likely field is in the study of sails. There seems little doubt that in one design classes the most important difference between the performance of individual boats lies in the differences in the rig.

It may not be easy to produce even simple data with certain craft. I am thinking particularly of my own case, my O.K. Sailing Dinghy with flexible mast which enables the camber of the sail to be altered. As a result a great many variables enter into the equation.

J. B. SMITH.

45 Wrottesley Road, Tettenhall, Wolverhampton.

* * *

Dear Mr. Waddington,

In your letter of 23rd November, you ask for suggestions so that ordinary members can develop the Society.

To advance, we must measure, and there must be many members like myself who would like to be able to help the really original thinkers by providing some of the basic data—which often has to be in sufficiently large volume to be significant.

But there is little that we can measure. It would make our sailing more interesting if we could be given advice and help in developing simple measuring instruments. For example, how does one measure speed through the water in our ranges of 0-6 knots (I have a 16 foot family type clinker dinghy). I would really prefer to measure *acceleration* but don't know any cheap way of doing this.

At present, one gauges apparent wind by a long rectangle of nylon flapping 20 feet above water level. Is there an easy reliable way of doing this. I have read John Morwood's book on *Sailing Aerodynamics* but have no idea whereabouts the performance of my own sails fits in.

A few articles in the A.Y.R.S. publication might be just the thing.

DAVID VICKERY.

35 Leasway, Westcliff on Sea, Essex.

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*13. Self-Steering (see overleaf)
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