COMMERCIAL SAIL

A.Y.R.S. PUBLICATION No. 17

THE HUMBER KEEL

CONTENTS

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EDITORIAL

February, 1958.

Brian Lello, the Editor of South African *Yachting*, is forming a South African branch of the A.Y.R.S. He thinks that some of his friends are prepared to consider the question of the academic sail and hull tests on conventional sails and hulls which we need so much. In any case, we must feel very happy that yet another branch of the A.Y.R.S. has been formed.

South African *Yachting* started off its first issue with an article about catamarans. This is interesting and it is also interesting that, while the well established British journals like *Yachts and Yachting*, *Light Craft*, *Yachting Monthly*, *Yachting World* and *The Yachtsman* give some space to catamarans, both the two recently started magazines are putting great emphasis of these craft and *Yachting Weekly* is holding a trimaran designing competition. *Boats and Boat Equipment* has taken E. J. Manners *Catamanner* under its wing. This surely indicates that the catamaran has at last become respectable (or even conventional) in Britain. *Shearwater* sail numbers were up to 382 in December 1957. *Jumpaheads*, *Mercurys* and Uffa Fox's new design should very soon produce catamarans in every port.

I think that it is not out of place here to record our thanks to the Editors of the many yachting journals throughout the world who have so kindly helped to put the A.Y.R.S. on its feet by bringing the Society to the notice of their readers. Indeed, there is hardly a yachting journal either written in English or any other language which has not helped us in this way, one or two even giving each of our publications a notice as it comes out. We owe a debt of gratitude to the rugged race of Yachting Editors which I hope that we will continue to pay by our efforts in advancing yachting.

COMMERCIAL SAIL

It must be a very remote possibility that sailing vessels will ever pay their way commercially again. This publication, however, sets out to show that the possibility exists and, by improving the rig of a sailing ship so that both windward and light wind performance is much better, the speed of the sailing ship need not be less than that of a modern motor vessel.

In itself, a publication such as this might be regarded as relatively useless because we all know that, despite our efforts, no ship owners are likely to convert to sail, if only for the reason that they are doing very well commercially at present. It might well be asked, therefore, why we are having this publication at all. The answer to this question lies in the nature of invention which, I believe, usually is simply using devices and ideas which have been developed for one set of circumstances in another field altogether. Thus, if we apply ourselves to developing sails for commercial sailing vessels, we will be thinking in terms of handling huge areas of sail and, if we can devise ways of doing this easily, we will surely have an easily handled rig for small yachts and one which is fully seamanlike. It is therefore, my editorial policy at the moment to present as many different ideas for sails and hulls to you as I can gather together and in all ways and sizes possible so that we may get by invention still more new ways of deriving power from the wind and faster and cheaper yachts.

TRADITIONAL SAIL

A future publication will be *Traditional Sail* which will be accounts of present day or recently used *one-masted* sailing ships or barges. We have already been promised accounts of the Norfolk Wherry, and the Humber Keel by members of the Trusts which have been formed to preserve examples of each. G. R. G. Worcester, the Editor of the *Mariner's Mirror*, is going to give us accounts of two Chinese Junks. We hope to get a complete description of a Thames Barge. However, we would very much appreciate accounts of other craft from other parts of the world, Dutchmen, Portuguese Wine Vessels, The St. Lawrence Trader, the Norwegian Yacht, Dhows and Lateen vessels and any other craft, with one mast.

The cover photograph shows a Humber Keel which we use by kind permission of Ernest W. Carter, commercial photographer, of Gainsborough. This was sent to me by Mr. K. W. Grimes of the Humber Keel Trust, Beverley, Yorkshire.

I want to thank all the kind people who sent Christmas cards. May I wish all our members a Happy New Year and lots of good sailing.

AUSTRALIA TO ENGLAND IN SAIL

In a publication such as this, it is necessary to study something of the sailing ship voyages of the nineteenth century to find out where they were slowest in order to appreciate the problems with which we are going to deal when considering *Commercial Sail* in the oceans. Here then is a short analysis of 420 ocean voyages by sailing ships on the run from Australia to England in the period from 1873 to 1890, 17 years. The data comes from Basil Lubbock's classic book *The Colonial Clippers* and concerns only the wool fleet, which came after the highest peak of sailing speeds had been reached, though crack vessels like *Cutty Sark* and *Thermopolae* were still sailing in it.

Size of Fleet. The fleet averaged 26 ships of various sizes and nearly all could be placed between 200 and 250 feet in length. The *Cutty Sark* is 212 feet long. These ships assembled each year at various Australian ports and loaded up with their wool cargo and left between October of one year and February or March of the next, though sometimes later. They swept across the Southern Ocean in the summer, rounded Cape Horn and came to London with their wool cargoes. Many of the skippers had been in the China tea trade twenty years earlier where a large bonus had been the reward of the first ship to bring the new crop of China tea to London and the racing between the tea clippers had been very fierce. Indeed, there had been terrific national interest in Britain in the races between the ships which was quite as great as that now produced by the Olympic games because in those days, there was not the flood of popular amusements and sports to which we are subjected.

Traditions and habits die hard. The captains of the tea clippers had driven their ships for all they knew with stunsail booms breaking in the squalls and every stitch of canvas set which they could carry. When these men switched to the wool trade from Australia because the Suez canal and the steamer had put them out of the China trade, they still drove their ships and many good passages were made.

Speeds made good

The average passage of these 420 voyages was 96 days. If we take the direct distance at 15,000 miles, this means that an average speed of $6\frac{1}{2}$ knots was maintained by all these ships in all these voyages. This figure includes ships which were dismasted or crippled in any way and ships sailing at both favourable and unfavourable times of the year to give them winds which would drive them at their best speeds.

If, instead of taking the average time of the whole fleet, we average the times taken by the fastest voyage each year, we find a figure of 78 days or an average speed of 8 knots. By the same method, the average of the last ship in, which must have included many cripples was 119 days giving **52** knots.

These speeds are very poor as compared with those of yachts which have often been able to maintain speeds across oceans of $\sqrt{L}$, knots, for example, *Myth of Malham*, Bermuda to Brixham, Devon, 22 days in 1948. This is 3,010 miles and *Myth* is $33\frac{1}{2}$ feet on the waterline. Her average speed was $5\frac{1}{2}$ knots and $\sqrt{L}$ is 5.8. There are many other examples of yachts averaging $\sqrt{L}$. What made the average speeds of these ships so poor was the square rig which did not allow them to make much progress when the wind was against them and very little in light winds. About the turn of the century, Americans went in for the four and five masted schooners and even got as far as seven masts with the *Thomas B. Lawson*. An old sea captain once told me that when the wind was light and ahead, his ship had been very quickly overhauled and passed by one of these schooners but they picked her up later when the wind came strong from astern. There is no rig which can be driven like the square rig when the wind is behind and these schooners, though they could be worked by twelve men against the thirty or so needed by a full rigged ship, never made the same fast passages as the ship rigged vessels on the ocean runs.

The Ocean Winds

The only information I have about the winds which could be expected on a voyage from Australia to England comes again from Basil Lubbock's *Colonial Clippers*. In it, he gives a summary of the winds met by the crack Mackay clipper *Lightning*, built in Boston. In her voyage from Melbourne to Liverpool of 86 days in 1855-6, her winds were :

	Fair	Light	Calm	Head
	26 days	19 days	17 days	24 days.
				Total 86 days.
and in 1856				
	32 days	23 days	4 days	24 days.
				Total 83 days.

Now, as these voyages were about average in length, one might expect that most of the Australian voyages would produce about these proportions of winds, though the meteorological conditions could have changed a little in 100 years.

These, then, are the winds any *Commercial Sailing Ship* might ordinarily expect to meet, so far as we know. Now, with any rig we could devise, we cannot improve the performance of our ship in strong fair winds above the above figures. The best we can do is to maintain the square rig performance before a gale but improve the speed in light winds, calms and head winds. Now, the speeds of yachts have increased to about double of what they were thirty years ago both by improved hull design and the Bermudian rig and this has occurred not by an increased down wind performance but mainly through the better performance to windward, and in light winds. We may therefore expect to improve our sailing ship similarly.

If, therefore, we do improve the performance by about double in light winds, calms and head winds, the figures for *Lightning* which Lubbock gives would be altered from :

	Fair	Light	Calm	Head	
	26	19	17	24	Total 86 days.
and	32	23	4	24	Total 83 days.
to :	26	9	8	12	Total 55 days.
and	32	12	2	12	Total 58 days.

Summary

The slow *average* speed of the Australian wool fleet was due to the square rig. If a rig is devised which can make the same speed as the square rig before the wind and go twice as fast in light winds, calms and head winds, the length of time taken by these ships would have been reduced by one third. This would have meant that the faster ships would have *averaged* 12 knots on the voyage which is creditable for a motor ship of the same size.

FOULING

Marine growths occur on the bottom of any ship and slow her down. Though most of the nineteenth century clipper ships were wood or composite in construction, they were copper sheathed to reduce the fouling. Copper is quite a good antifouling agent but modern antifouling paints are better. We would therefore hope to get better speeds from our modern sailing ships for that reason, as well as from improvement in hull and sail design.

Speed, too, leads to more speed because the shorter time a ship is at sea, the less is her bottom fouled and the greater her speed. For this reason, the later days of a voyage tend to be slower than the earlier ones.

METEOROLOGY

The sailing ships of the last century used well defined routes across the oceans of the world where experience had proved that the most favourable winds were likely to occur. These routes had been discovered and worked out through the studies of Lieut. Maury, U.S.N. who at the early age of 29 starting producing the study of the winds in the Southern Ocean which as far as I can gather first appeared in 1835. These routes gave far faster passages than the leisurely routes taken by East Indiamen in the eighteenth and early nineteenth centuries and the routes followed by the early sea traffic to Australia.

The routes worked out by Maury would still be the best ones to follow were it not for radio and the modern Meteorological services, which owe their very origin to Maury himself. Nowadays, full knowledge of most of the winds all over the world are sent out on the radio daily and a captain of a sailing ship need no longer follow one of Maury's routes blindly as far as the wind will let him. By an intelligent use of the weather charts which he would get daily, a captain could avoid areas of calm and head winds and thus be able to improve his voyages by altering course to pick up more favourable winds.

One year, near the end of last century, a period of calm in the Atlantic lasted for as long as six weeks and the unfortunate sailing ships caught in it just stayed there, some running out of food and water. This must have been the centre of a large anticyclone which would have been well recorded by the Meteorological services of today. Such a thing would have to be avoided by any modern sailing ship.

SAILING SHIP DESIGN

There are several methods of approach to the problem of making a sailing ship which will pay her way commercially. Commander Bowles feels that sails should merely be used to reduce fuel costs and give a little extra speed. Charles Satterthwaite, in his design, approaches the matter in a traditional fashion and produces a design which is an improvement on the traditional but with nothing which has not already be found to work well. My own approach in this article is not tied to well proven and practical devices in the same way but, as a result, the theoretical performance of the ship would be far above that of any motor ship now at sea, even the *United States* or the British *Queens*, making due allowance for differences in size.

The Catamaran

Two ex-destroyer hulls could be joined together to give a catamaran with a symmetrical wingsail with auxiliary tailplane aerofoil to Fin Utne's design as described in WINGSAILS No. 14. It will be recalled that the Prout *Shearwater* hull is a typical destroyer shape and goes at 20 knots, top speed. It is only 16′ 6″ in length so a catamaran made from two destroyer hulls of, say, 165′ in length each could be expected to do 60 knots, when unladen. At this speed, a symmetrical aerofoil would give almost as good a performance as an asymmetrical one and it would be far easier to handle. Scaling up a sailing boat in this way increases the stability enormously and relatively more sail area could be carried than in a *Shearwater*, even though the crew's weight would *not* be holding her up.

When laden, the performance would not be as good as when unladen but speeds would be very much greater thah with motor ships.

The Single Destroyer Hull

As mentioned above, increase in size increases stability. For this reason, very large ships have more or less the same shape as a single catamaran hull which would be quite unstable in small yacht size. These ships could also be rigged with Fin Utne's sail rig and would sail fast and upright and give a very good account of themselves commercially. Again, an ex-destroyer hull could well be used as a test bed. From these conclusions, it may have been a great mistake for the navies of the world to convert to steam. Perhaps, they would have still been sailing if the A.Y.R.S. had been in existence in 1857, instead of 1957.

Converting a Merchantman to Sail

Large Ship : Owen Dumpleton has given me the fact that a merchantman of 15,000 tons deadweight capacity needs a thrust of 75 tons to drive it at 15 knots. Such a ship would be 600′ L.O.A., 40′ beam and 20′ draft. Now, taking a coefficient of thrust of a sail of 1.0, which a symmetrical aerofoil would develop close hauled at a windspeed of 15 knots (17 m.p.h., approximately), these 75 tons would be produced by about 150,000 square feet of sail. Factors such as the forward speed of the ship and the improvement due to the enormous size of the aerofoil would make the sail develop more power and one cannot say at present just what size of aerofoil would finally be necessary. However, a mainsail 660 feet high by 220 in chord would have 146,200 square feet, if of a rectangular shape, and would give the ship full power under sail. Possibly, however, less sail could be used. All this assumes that all the sail area will be put in one large mainsail which would be best from the efficiency point of view. However, ships sometimes have to sail with a fore and aft trim which is not perfect and it might be better to split up the sail area into two sails (each with an auxiliary aerofoil) so that balance under sail could always be maintained. If slightly down by the bow, the full drive would not be taken up by the after aerofoil, and vice versa.

Smaller Ship : The ship described in the last paragraph is very big and though conversion to sail would not be difficult, a smaller ship would ordinarily be converted before a big one.

E. Keeble Chatterton in his book *The Ship Under Sail* describes the *Kobenhavn* a five masted Danish barque, built by Messrs. Ramage and Ferguson Ltd., at Leith in 1921. This ship is an auxiliary with a length on deck of 390 feet, breadth 49 feet, depth 28 feet 7 inches. She carried 50,000 square feet of canvas on her five masts which could be put in one aerofoil 390 feet high by 130 feet in chord. Such an aerofoil would be far cheaper to make than her rigging as a barque and she would be able to carry her 5,200 tons of cargo far more efficiently and quickly from port to port.

Handling a Sailing Merchantman

Any ship, no matter how large, fitted with Fin Utne's rig, could be completely handled from the bridge while at sea. In heavy seas, steering would have to be done by a combination of the rudder and sails but this would not be difficult. At any sign of the vessel tending to broach to, the angle of incidence of the after sail would be immediately reduced which would greatly ease the forces on the rudder. The fitting and rigging of aerofoils has now been brought to such a stage of perfection that failure of any kind is almost inconceivable. Therefore, a total crew of six men would be perfectly able to bring this ship from port to port. Thus, such a ship would run with the greatest possible economy and bring a huge profit to her owners.

PRACTICAL POSSIBILITIES

New Building

This is a remote possibility. The cost of a new merchantman is so great and the returns on her future with conventional engines is so assured that no shipowner will experiment with sails in a new ship. He has to be convinced in other ways that sails will pay him.

The Fan Rig

This rig is immediately capable of being applied to existing motor vessels. Accurate figures for the thrust obtainable from the sails should be got from a wind tunnel or open air tests and the resultant saving in fuel worked out with the capital and working costs for presentation to shipowners. If these figures are satisfactory, there is some chance of the rig being applied.

Conversions

As already suggested, an ex-destroyer could be rigged with aerofoil sails and could make some excellent passages. The cost of making a large cargo carrying catamaran out of two destroyer hulls might not be prohibitive and could well be considered but very careful design of the bridge structure would be necessary. A Thames Barge could be easily rigged with the *Fan Rig*, a Wishbone Rig or an aerofoil and this would have the advantage of there being the annual Barge Races to see the efficiency of the rig adopted.

However, the most dramatic and successful way to try out *Commercial Sail* would be to buy a steamship which was nearing the end of her career and whose engines had failed before her hull. Steamers, such as this, are often sold to the ship breakers and could be had very cheaply indeed. The engines could be taken out, the propellors removed and a small ship rigged with an aerofoil sail at small cost, even within the ability of a single man to finance. Such a sailing ship could cover her cost in one voyage and make her owner a substantial profit for the last few years of her life and still get her cost back from the shipbreakers at the end. Alan Villiers describes in his book *The Set of the Sails* how his small syndicate bought the barque *Parma* for slightly less than £2,000 with splendid rigging and three suits of sails. Their first charter was worth about £8,000 so they had all their capital back on the first voyage. Prices are higher now but the same thing could be done today.

Development

Finally, if no shipowner or private person is willing to risk his capital for what I believe are almost certainly great returns, there remains the longer way to *Commercial Sail* of slow development. First yachts, preferably catamarans, will develop these new and efficient sails. Slowly and gradually, the size will be stepped up till the largest yachts use them. Finally, some shipowner who owns one of these efficient and easily handled yachts will be prepared to try them out on a large ship. K. W. Thomas tells me that his model catamarans with wingsails are faster to windward than those with cloth sails of the same hull design. Surely, this is a pointer to where we are going.

THE FAN RIG

by

COMMANDER GEOFFREY BOWLES, R.N.

A merchant ship is, from a commercial point of view, an instrument for deriving a profit on her building costs during the 20 to 30 years of her life. Anything which will increase the rate of profit, therefore, will make a ship more desirable to ship owners and the rate of profit can be increased by reducing fuel costs and increasing speed. Both these things can be achieved by using auxiliary sails of the pattern described in this article.

The traditional square rig was larded with hard work both aloft and below and needed a large crew to keep her going. The early steamships had sails not only because of the ever present danger of mechanical breakdown but also because their coal consumption was very large and they could not carry enough fuel for any long voyage but had to refuel on the way. With more efficient engines, the sails became obsolete.

Today, it seems a pity to let the extra driving power of the wind from three quarters of the compass blow away unused, when the efficiency of sails have increased so enormously in the last few decades, and by simple expedients, the sails can be worked almost without human labour by electric winches and mechanical devices. Sails make seafaring more interesting to the sailor and relieve the boredom which is so much the modern sailor's lot.

The Thames spritsail barge survived until today by having the world's largest sail area two men can handle (often only one man during the war) because her sails are kept hoisted and are set and furled like curtains without hard labour. This rig defied steam but the compact oil engine beat it at last. The sails described in this article are even easier to handle than spritsails and are far more efficient.

The well-known yacht *Creole* and the Swedish training and trading ship *Albatross* with their triangular fore-and-aft sails are the first of what may prove to be a new era for sail but they are prototypes to improve upon. Surely, with modern materials and invention, we can do better.

Laurence Dunn, in the illustration to this article, which is reproduced by kind permission of the Editor of the magazine *Sea Breezes*, shows an auxiliary sailing ship about 240 ft. long to carry about 2,000 tons of cargo. There are five independently stayed masts, stepped on the upper deck and each would carry twin Bermudian mainsails and staysails of a distinctive pattern.

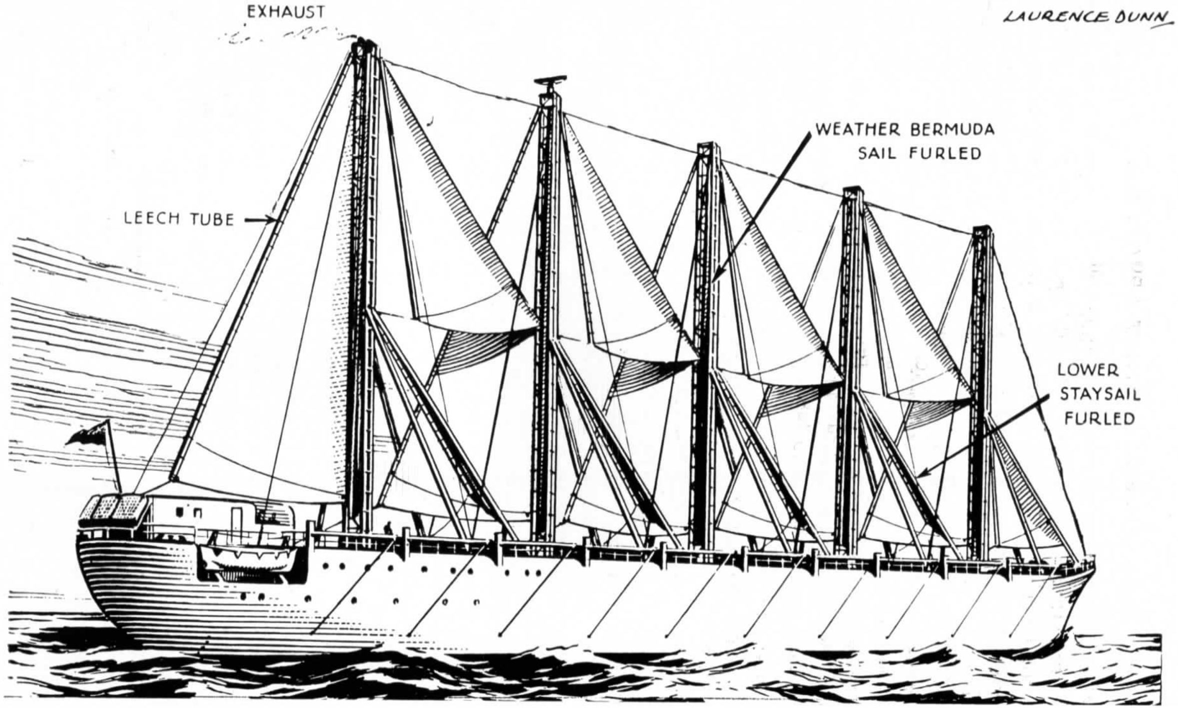

EXHAUST
LAURENCE DUNN
WEATHER BERMUDA SAIL FURLED
LEECH TUBE
LOWER STAYSAIL FURLED

FIGURE 1.

The Sails

Every sail on this ship would be of a simple triangular shape and have a light alloy leech pole and loose foot. The leech pole is used primarily to let the sail be easily brailed up to the mast by a single line and it should bring all of the sail in together as does the stick of a fan. Thus, furling the sail would be very easily done by one man turning a winch handle or, alternatively, the captain himself could do it from the bridge by pressing a button to set an electric motor in motion.

All the sails of this ship would be interchangeable with those of the other masts. Each mast would have two Bermudian mainsails, the weather one of which could be set as a spinnaker when the wind was astern but would be furled to the mast when closehauled. There are 23 sails in all ; 10 mainsails (two on each mast) and 13 staysails. The mainsails are sheeted to short outriggers which are shown in the drawing and appear to be rails along the gunwale. These can be swung out to set the sail properly when the wind is astern.

Sail Efficiency

All these sails with leech poles would be almost devoid of twist and should be very close winded indeed. If the ship has reasonably fine lines, she should often do 16 knots under sail alone and this would mean that close windedness was of the greatest value because she would be sailing with the apparent wind before the beam nearly all the time. In fact, she should be able to give a very good account of herself under sail alone when there was any wind at all. She would be faster than the crack clippers of last century both close hauled and in light winds but she could not hope to " Run her Easting down " in the same way as the clippers.

Engines

Almost full power would be used for the engines, preferably from a gas-turbine so that a good average speed could be maintained in calms and the ship could be kept moving fast at all times. The whole concept of the ship's sailing would be that a speed of, say, 12 knots had to be maintained. If the wind would give her that speed, the engine would not be used but, in light winds, the ship would be driven by the engine with the sails allowing a lower fuel consumption.

Propellors

The logical propellor is the well known internal cone type which does not drag when sailing. It derives from fuel more thrust than an external screw propellor and ropes cannot foul it. Also, it is always completely submerged and so does not race in a seaway and gives full power when the ship is light. It would be nice to have side-throsting propellors both fore and aft to realise the shipmaster's dream of complete manoeuverability, enabling him to move sideways towards or away from a dock and to turn his ship around her own centre in the middle of the dock, all without ropes or expensive tugs.

Working Comfort

It is anticipated that all the hard work aboard this ship would be done mechanically by electric winches and press-button seamanship wherever possible. However, a transparent top to the wheel house would let the helmsman see the sails in all weathers and speedometers with large repeating dials would let the crew see the result of their sail work and sail trimming.

Summary

Besides extra profit for ship owners, sail gives that extra interest to seamen, absent from an entirely power-driven ship, of turning to best advantage the frequent changes of weather with the satisfaction of cleanly, silently and easily wresting power from the forces of nature for the benefit of man. Instead of "Watching the clock," the crew would watch the speedometer.

All details are perfected. Models can be seen and full-sized gear can be tested ashore first and sailors be shown the easy working. Further information may be obtained from me at 24, Catherine Place, London, S.W.1.

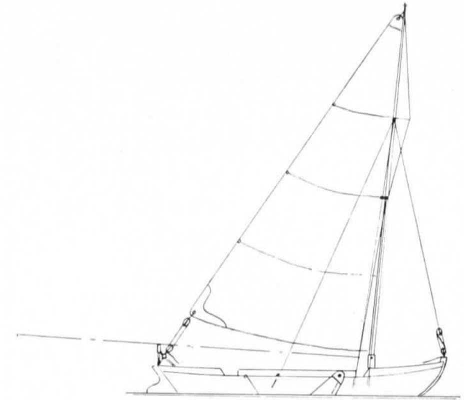
A SAILING COASTER TO CARRY 100 TONS

by

CHARLES SATTERTHWAITE

This proposal is to meet the second of a series of three suggestions of the Editor of which the first was the *River Trading Design* which appeared in A.Y.R.S. publication No. 4 and whose plans appear again in this number. The long interval between the appearance in print of the two is the result of the lack of spare time on my part and in no way reflects any inherent difficulty in the design.

She is intended to be a modern version of the Thames Sailing Barge, incorporating experience gained in yachts and motor coasting vessels. She must be a reliable craft, able to make excellent all round



PROPOSAL FOR RIVER TRADING CRAFT.

MAIN DIMENSIONS.

LENGTH OVERALL - 46 FEET.

LENGTH WATERLINE - 38 FEET.

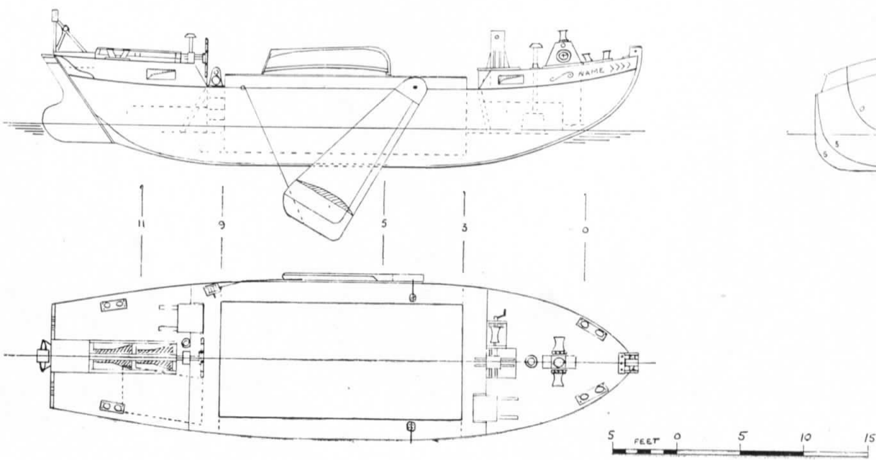
MEAN DRAFT - 3 FEET.

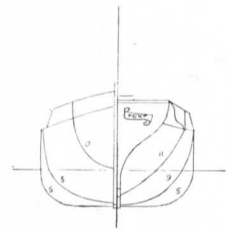
MAX.' BEAM - 12 FEET.

DISPLACEMENT - APP. 15 TONS. (AT MEAN DRAFT).

HOLD CAPACITY - APP. 1000 CUBIC FEET.

SAIL AREA - APP. 750 SQ. FEET.





C.A. SATTERTHWAITE,
"BARNCROFT", HARTLEY, KENT.

use of the wind and, in conditions of calm or adverse tidal streams, able to call on a modicum of mechanical propulsive power so that she is never completely idle. I have in mind conditions obtaining about the Thames estuary, the North Sea, English Channel and Continental Ports but she might easily make a useful short-sea trader in many parts of the world.

The traditional Thames Barge, as exemplified by, say, *Memory*, *Sirdar*, and *Sara*, is a vessel on whose design it is very difficult to improve. But on two points at least, I feel this proposal should score and these are the rig and the auxiliary power.

The great weakness of the sprit rig is the sprit itself which is liable to fail in rough, hard weather and always spoils the set of the mainsail on the Port tack. In comparison, the wishbone boom can be made a sound mechanical job and is fundamentally a more efficient device anyway. The provision of auxiliary power, although boosting the initial cost of the vessel, will save untold handling time in ports and probably mean the difference between two and three freights in a week.

She will no doubt be a more expensive vessel than the old sailing barge but she should be cheaper than a full powered coaster, be better able to operate in shallow waters and, given the right crew, she should be much more economical to run. To compete, she must always make the best of wind and tide in the true sailing barge tradition. Her skipper would need all the expert knowledge of the bargemaster together with the additional appreciation of the use of his motor in conditions of calm, adverse tidal streams and choppy seas as a true auxiliary to his sail power. In that way, she could run quite profitably.

The Hull

The hull is like that of the traditional barge but with a round bilge instead of the chines. There is a long run, a cut away forefoot and a run up aft. She has of necessity a full midships section to carry her cargo but this is no sign of lack of speed. The profile has been kept clean to allow her to sit upright and kindly on the ground as a barge must often do in the course of trade. Her maximum loaded draft of 5 ft. will enable her to go just about anywhere there is water to float a seagull ! All arc-welded steel construction is specified, scientifically designed on longitudinal framing principles for maximum strength with the very minimum of weight still acceptable to all concerned. The alternative of light alloy was rejected as being too specialised to be economical for a hard working barge in fierce comp-

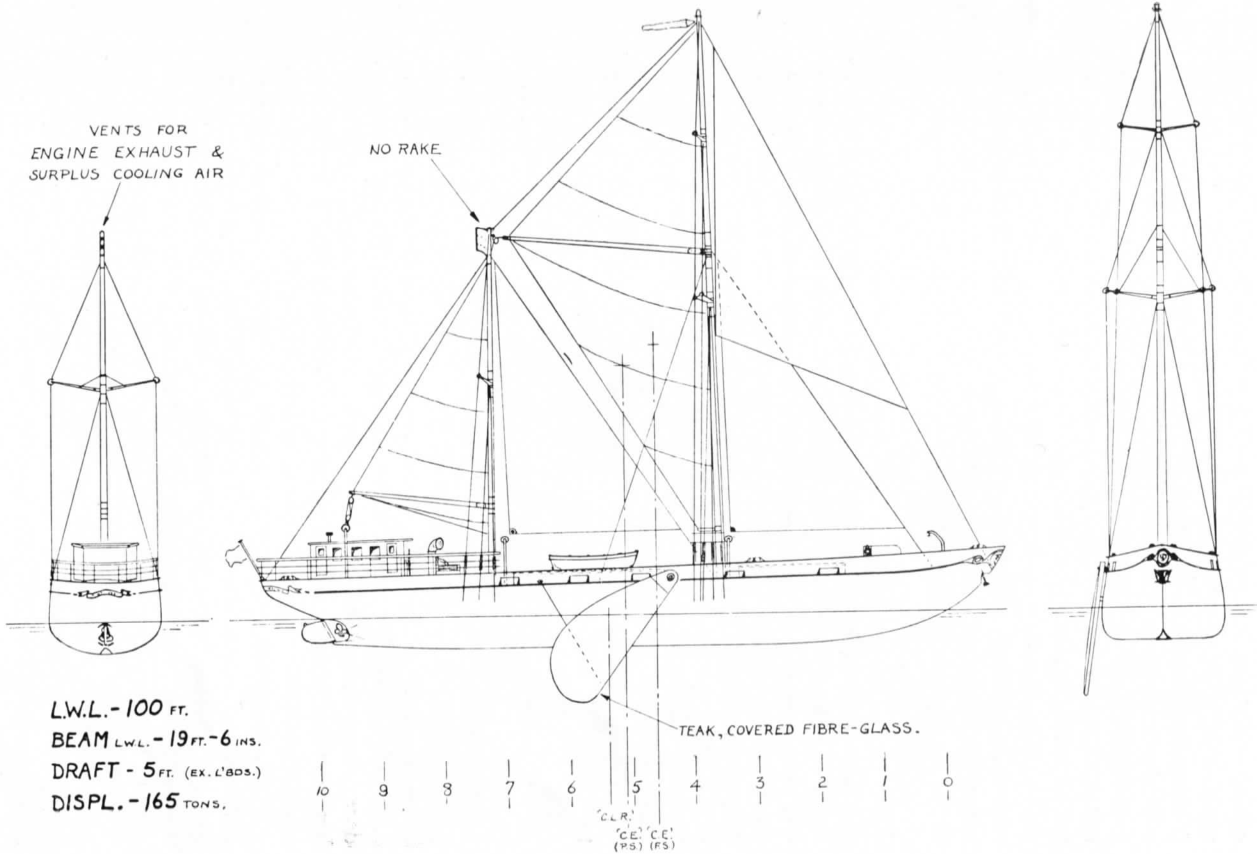

VENTS FOR
ENGINE EXHAUST &
SURPLUS COOLING AIR
NO RAKE
TEAK, COVERED FIBRE-GLASS.
L.W.L. - 100 FT.
BEAM L.W.L. - 19 FT. - 6 INS.
DRAFT - 5 FT. (EX. L'BDS.)
DISPL. - 165 TONS.
10 9 8 7 6 5 4 3 2 1 0
'C.L.R.'
'C.E.' (P.S.)
'C.E.' (F.S.)

FIGURE 2.

etition with motor vessels and probably beyond the capabilities of most ordinary ship yards when repairs became necessary. Transverse bulkheads are used as indicated.

Her form gives good initial stability and a double bottom forms part of the backbone structure and also provides some water ballast space, thus giving some control over trim and stability when light or unfavourably loaded.

Leeboards of good " Hydrofoil " section provide the lateral resistance necessary for efficient windward sailing. These would be arranged to be capable of quite extensive adjustment whilst in operation to obtain optimum performance.

Rig

The rig *must* be a lot better to windward than that of the Thames Barge as at present in use. Hence the wishbone ketch with the masts stepped on deck. The wishbone boom has been a source of trouble on the craft to which this rig has been applied in the past but this is only teething trouble I am sure and, given good mechanical design, it will prove a very reliable and efficient rig. The important thing is speed to windward as this is where the sailing vessel is at its greatest disadvantage as compared with the motor vessel.

The stay-foresail and the mizzen-staysail are identical barge type staysails, having permanent sheets to horses. The mizzen and the main wishbone sail stow by brailing in to the mast and thus are always under control and are never normally handed onto the deck. Combinations of sail to suit all conditions can be carried and the handling would be quite easy — particularly with the winches shown. Before the wind, barge practice could be followed and the main staysail boomed out or a " spinnaker " or barge type staysail set in its place. Alternatively, twin foresails could be rigged. The coaster *Cambria* demonstrated what can be set by a barge before the wind in the 1955 Medway race and there is no reason why this vessel should not do the same or better.

The mechanical design of the fittings for the wishbone boom and spars must be beyond reproach. Reliability is essential to the working vessel even at some disadvantage in weight. Rigged as shown, the coaster could be handled by one experienced man in every way as can the Thames barge and even with the main staysail set, two men could take her anywhere. It would be well worth using Terylene (Dacron) for the sails, stainless steel for the standing rigging and fittings with Terylene rope for running rigging in general use and Nylon for kedge cables and warps.

Auxiliary Power

The main engine is a *Petter* 60 *h.p.* air cooled compression ignition oil engine, driving a *Slack & Parr* 3 bladed, variable pitch, feathering and reversing propellor through a reduction gear. The idea is to run the engine at a constant speed and vary the propellor thrust by corresponding changes in the throttle setting and blade pitch. This scheme should give efficiency with maximum manoeuverability in dock basins and restricted waters. The engine is light and small for the power developed. Cooling air, and air to the engine suction would come from deck vents and provision for bilge ventilation could be incorporated. Hot air from the engine could be used to warm and ventilate the accommodation, to demist the windows and de-ice and heat water. All trunking should be in figreblass and exhaust gases and surplus air would be discharged up the hollow mizzen mast.

A generator would be coupled to the engine for power supplies for the winches etc. and provision would be made for power take off for pumps and compressors.

Deck Gear

A *Reid* electric/hand windlass forward would be used with a *Danforth* bower anchor. Two C.Q.R. kedge anchors would also be stowed vertically under the forecastle head with Nylon cables nearby. There would be electric/hand winches by the masts for the brails, the halyards and leeboards and there would be a small electric " Lo-Hed " warping capstan right aft. This is palatial for a coaster of this type but for quick turn around in small out of the way ports, such power to hand might mean an extra freight a week and more than repay the initial cost. Nowadays, too, we have to remember that we cannot get men to take on arduous physical work and we must attract a good crew.

The ordinary hand bilge pumps should be fitted as normal barge practice to supplement any motor driven pumps in the engineroom. A wind driven battery charger might pay its way. The ship's boat sits on the main hatch with spare spars, derrick, jibs etc. An RFD rubber dinghy could well be carried. Hatch covers may be the usual wooden type or McGregor patent power operated steel shutter type.

She could, of course, operate with far less equipment than I have indicated, as indeed do the remaining " Sailormen," but I feel that we should set a standard not too far below that of a modern motor coaster.

Accommodation

The deckhouse is a combined wheelhouse, chartroom, radio shack, galley, W.C. and crew's messroom. Note the provision of an outside wheel as well since one cannot steer a sailing vessel properly from inside a wheelhouse. The galley would have a small oil fired range, or perhaps a " Rayburn." A gravity water tank could go overhead. No barge of which I have ever heard has carried radio but we might well suggest it here.

Below, we have a cabin aft of the engineroom with provision for at least three bunks and *adequate ventilation.* The skipper could have a separate room of his own. We must now cater for a crew having more educated ways than those of the barge sailormen of the 19th century and standards once more have to compare with those on a motor vessel.

I leave this scheme with the A.Y.R.S. for comment which I hope will be forthcoming. Needless to say, I would love to con her out of London river with, say, 100 tons of cement for Exmouth. The Editor suggests that she would make a perfect clubhouse for the A.Y.R.S. and could be filled with bunks for members and a workshop for experimental apparatus.

A SAILING SHIP RIG

The basic nature of this proposal for a deep sea sailing ship rig is that it will have the greatest possible efficiency both in head winds and light winds because it is only then that the sailing ship is slower than the power driven ship. In a following gale, the sailing ship will usually outpace a motor ship.

The Mainsail

The main sail is a semi-elliptical squaresail with a multitude of yards so that angles of attack may be used varying from 90° to an angle of " No-lift." Col. Bowden's " Birdswing Rig " can stay set at windspeeds of 30 m.p.h. without either flogging or producing much sail force and there seems to be no reason why this sail should be at all different.

The Auxiliary Sail

The sail is a squaresail but an auxiliary sail is used which then gives it the handling properties of a fore and aft sail on each tack. This means that the sail will always maintain any angle of attack set

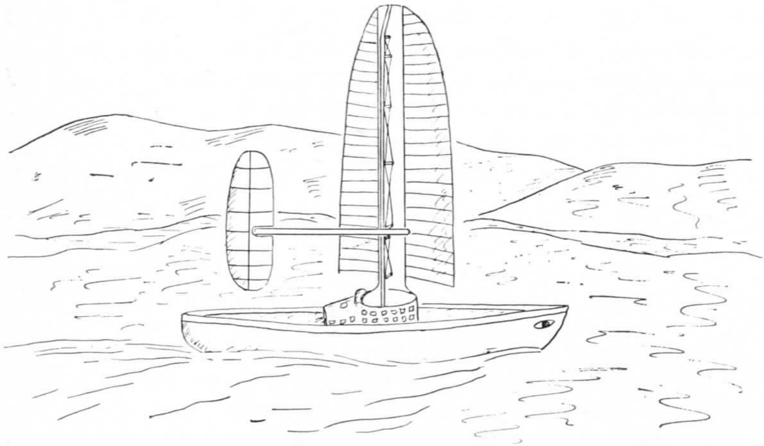


FIGURE 3.

for it by the auxiliary sail and thus will always and automatically make use of any wind shifts in direction. The auxiliary aerofoil will be controllable from the bridge and its use will remove the need for keeping the ship delicately steered to a wind direction, except for the close hauled course. As shown by Fin Utne, this will often prevent sudden heeling when the wind direction changes and make it into a sudden increase in drive. Owing to the real C. of E. of the mainsail being upwind of the axis of rotation, the auxiliary sail is set to produce a driving force, thus adding its area to that of the mainsail and not simply acting as a parasitic trimmer.

Mounting

The mainsail and auxiliary sail will be mounted on a turntable on the top of the bridge, such as is used for large cranes. The control of the auxiliary sail would have to be taken from the bridge, which would be at the after end of the turntable, through the arm on which the tail plane is mounted, to the auxiliary sail. For running with the wind aft, the turntable would need to be braked with the main sail athwartships.

Efficiency

Without doubt, this is the most efficient sail rig conceivable. The semi-elliptical mainsail should give the greatest possible thrust to side force ratio with the great thrust possible. There would be no twist, no mast interference ; the ideal angle of attack could be maintained with a greater amount of flow than is possible with soft sails. No boom flattens the sail to detract from performance. The instantaneous use of wind shifts in direction by the use of the auxiliary sail should add still further to performance.

Putting About

For this manoeuvre, the squaresail would have to be put through the wind in the manner typical of squaresails, while the auxiliary sail would come about as a fore and aft sail. The exact manner of the procedure is difficult to conjecture. It is possible that, by suitable manipulation of the auxiliary sail, the process could be carried out by the wind forces but, should this not prove possible, electric, internal combustion or even man power could be used to carry it out.

Reefing

On many voyages, reefing would be completely unnecessary. By reducing the angle of attack to a very low figure, the sail power could be reduced to as low a level as wished and the sail is unlikely to flog or tear below at least 30 m.p.h. of windspeed. However, high windspeeds might be met and the sail area could be reduced to meet these circumstances. This is simply done by lowering the peak of the sail, when the yards would drop down their attachments to the mast and reduce the sail area till, when all the sail had been dropped, the bare, streamlined mast would be all which was presented to the wind. Even then, the mast itself could be used to drive the ship and it would have no more area than the lower topsails of one of the later sailing ships and that far better disposed to beat to windward in a gale — for example around Cape Horn — because it would be vertical rather than horizontal.

Steering

On most courses, a compass course could be steered and the sails could be ignored by the helmsman, their setting being left to the sail trimmer, using the auxiliary sail. However, when close hauled, this could not be and the helmsman would have to steer by the wind direction because it is not in the interests of greatest efficiency to steer by the sails as has been done since the beginning of sails themselves. As a result, wind direction indicators would have to be placed in front of the helmsman, and instead of steering by a " Lubber line," he would have to steer by them. Automatic self steering devices such as Vane or Mill Gears could also be used and would work well enough in calm waters but, when the great seas of the Southern Ocean were met, manual steering would also be necessary.

Working the Sails

No matter what the sail area carried in this rig, all sail trimming and setting would be done by one person. Sail trimming would be a quick and easy process of altering the setting of the auxiliary sail and it would be done by hand. As already stated, even putting about might be managed by manipulation of the sail plan. However should power be needed, an internal combustion engine on the turntable would easily supply what was wanted which, at the worst, would be the revolving of the turntable. The sail would be set by the same internal combustion engine winching it aloft. Its weight with all its yards should not exceed one ton for 20,000 square feet.

Summary

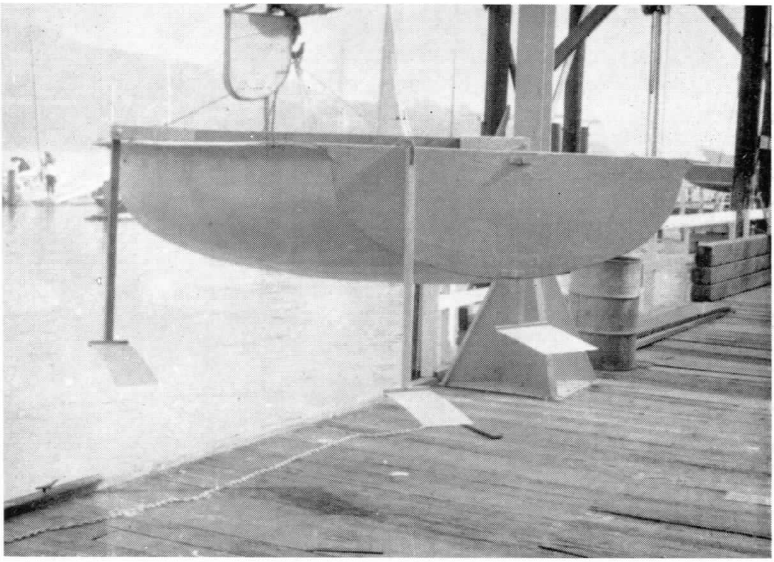
A sail rig for a commercial sailing ship is described which should more than double the close hauled and light wind performance of the traditional sailing ship. It should only employ one man to work it, no matter what the total area of canvas carried. It is extremely efficient even compared to the normal Bermudian rig of yachts and could well be adapted for use with them.

A WAVE POWER DEVICE

The photograph shows Arthur Piver's dinghy *Nutshell* fitted with fins in a preliminary attempt to produce a self-propelled lifeboat. The object is to convert rolling and pitching movements into forward motion. The account of it is included here because, if it can be successfully developed, it might enable a sailing ship to get some *natural* motive power to help it along in a calm or in crossing the Doldrums.

The Fins

There are three of these made of plastic material, square in shape fixed at their forward ends to pieces of wood which are, in turn, attached to the vertical struts. There is enough flexibility in the fins for them to move up and down as the boat rocks, thus pushing the boat along. Plastic was used for the fins because Arthur Piver was not sure of the most effective angle for solid ones and he also felt that much power might be lost as the solid fin swivelled from one pole to the other. The plastic fins are ready to work with the slightest movement. However, I cannot believe that much power would be lost during the change-over, if any, because it would only go to the natural roll-damping property of the hull.



An attempt to convert rolling and pitching movements into forward motion through the use of flexible plastic fins is shown above. Although the boat moved through the water, it was decided that too little power for practical purposes was developed using this particular system. Designer is Arthur Piver of Mill Valley, California.

Performance

When the boat was rocked in smooth water, it moved along (much to the amazement of spectators). It " Fishtailed " as it did so, incidentally, which might indicate that another fin is needed at the stern, mounted vertically instead of horizontally like the others. However, it was decided that too little power for practical purposes was developed by wave motion from the form used.

Improvements

A much higher aspect ratio could well be tried in the fins which should, in my opinion, be solid. If one wanted to avoid the " Dead point," they could be attached by a strip of spring steel and stops would be needed in the strut. With these changes, I believe that considerably more power would be developed and, of course, it would greatly reduce rolling and sea motion generally. It is too early as yet to say that the principle is useless.

THE TOP'S'L GAFF FORM OF BERMUDIAN SAIL

by

ERICK J. MANNERS

In view of the accounts of advanced and unusual sails in A.Y.R.S. Publication No. 14 some readers may be interested in a brief mention of the Wingman form of mainsail. This seems to have all the advantages of the firmly established orthodox Bermudian. The chief feature is simply that a given sail area can be set on an appreciably shorter mast. Less mast length means a proportionally much lower mast and rigging cost as well as one more readily stepped and trailed. Increased stability is another important factor when it is considered that many light displacement craft actually sink at exposed moorings during a blow because of their lofty rig — even without sail set.

In past years my further education sailing students have discussed that the narrow peak of a bermudian mainsail cannot give much useful drive and that some birds and aeroplanes do not have pointed wing-tips. I will not go into this again or the other interesting time honoured controversy, but must warn readers that before they entertain cutting down their existing rig to first make sure that their sailmaker is prepared to make-up a sail of this shape as it's " agin " the tradition of some of the older established. Perhaps the photograph which illustrates the article on the 14-ft. Catamanner designed for home building may convince them of its working. The two light full length battens in orthodox pockets take the place of the old heavy gaff spar and support the greatly increased roach. Long multiple battens may be rather a pest, but the longest batten illustrated is only 4′ 9″ and consists of an ovaled piece of clear ash or pine $1\frac{1}{4}''$ wide by $\frac{5}{16}''$ mid thickness. For mild wind conditions a thinner or more flexible set of plastic battens should be used.

Interesting results can be achieved by the degree of tightness with which the battens are tied in but two tips are to ask the sailmaker to reinforce the inner end of pockets and not to let them quite enter the luff grove. Internal hollowness of the mast itself is really a must to house all the halliard ropes which would otherwise spoil the windflow onto the sail leading edge of light craft.

The line drawings illustrate to the same unit scale : A, Bermudian triangle ; B, Typical Gaff rig ; C, Wingman design and D, the three superimposed for direct comparison. If the mast of A is say 30 ft. tall, that of C need only be 22 ft. for the same sail area. When laying-to, or prior to lowering sail, or during hoisting, the Wingman sail is much tamer having less tendency to flog than orthodox varieties.

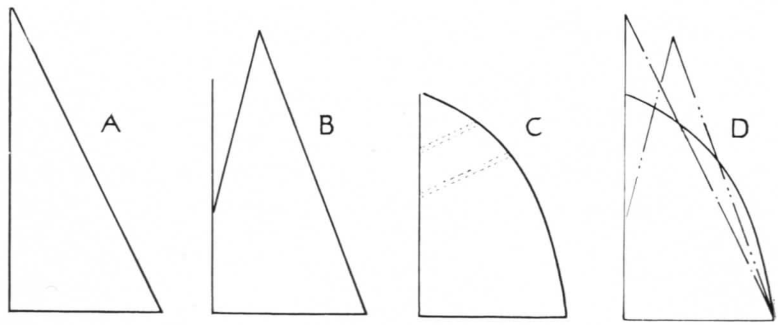


FIGURE 4.

ANOTHER " AFT-DIPPING " LUGSAIL

In publication No. 9, an " Aft-dipping " lugsail was described, in which the sail was attached to the boom and both sail and boom were pulled back and put on on the lee side of the mast on tacking. This sail, by contrast, is loose footed and its luff is taken to the lee side of the mast on each tack but the boom does not take part in this manoeuvre.

The Boom. The boom runs from the tack of the sail to its clew. The mast, which is round in section, passes through it about one third of its length from the fore end. At the fore end are two blocks through which pass running wires from the tack of the sail to a winch at the mast as low down as possible. When sailing, one of these wires will be taut and run directly from the winch, through its block at the fore end of the boom to the tack and it will keep the luff straight. The other wire will be slack and run from the winch, through the other block and aft around the mast to go also to the tack. As one wire is taken in by the winch, the other is let out. Both boom and winch would swing on pivots on the fore side of the mast, though both could be on ball races as shown in the sketch.

Putting About. When sailing casually, the sail can be left to work as a balanced lugsail. The mast will, however, interfere with the wind flow when it is on the lee side of the sail. Therefore, when racing, the winch handle would be given a few turns when putting about and the sail's luff be drawn from one side of the mast and aft of it to the new lee side.

Evaluation. This sail will be more efficient than a normal sloop rig for the reasons given in *Sails and Aerofoils*. Only a single part sheet need be used because the balanced sail will reduce the pull on it.

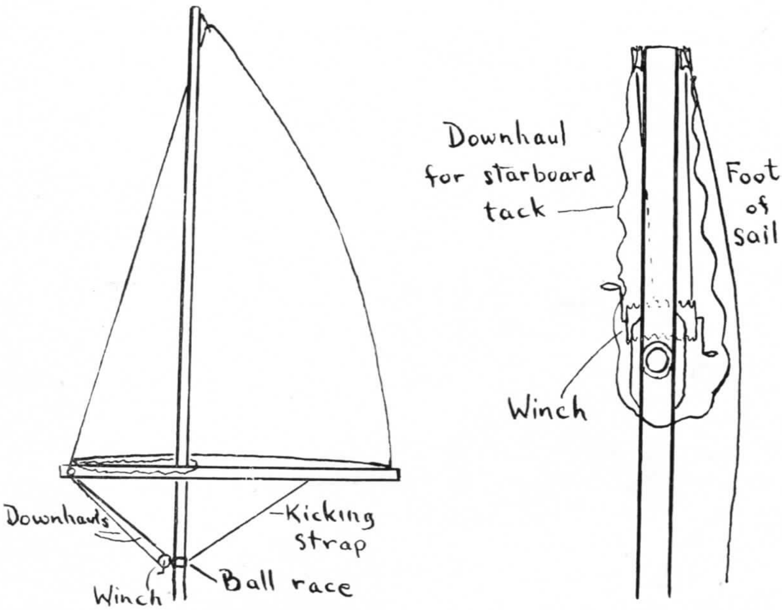


FIGURE 5.

It should be at least as easy to work with as a sloop when putting about and be easier to sail with. It should also be almost the cheapest possible rig.

TOPPING LIFTS

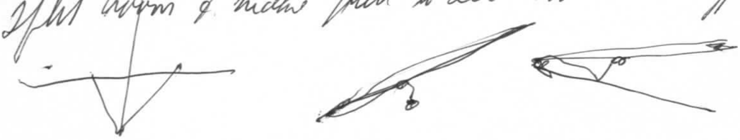
A METHOD FOR SMALL YACHTS

by

PETER C. JOHNSON

The conventional topping lift on small cruisers and racers is not satisfactory. It usually consists of a single part rope leading from the end of the boom, up to a block at the hounds, and then down to a cleat at the foot of the mast. The result is that when the main sail is hoisted on one tack the headboard fouls the lift near the block. If the lift is taken to the masthead, it means extra weight aloft, and it will tend to foul the battens and chafe the leach of the sail. In any case this type of topping lift causes extra windage, and breaks up the airflow along the sail.

2 ft boom & make pull to leeward make luff line taut



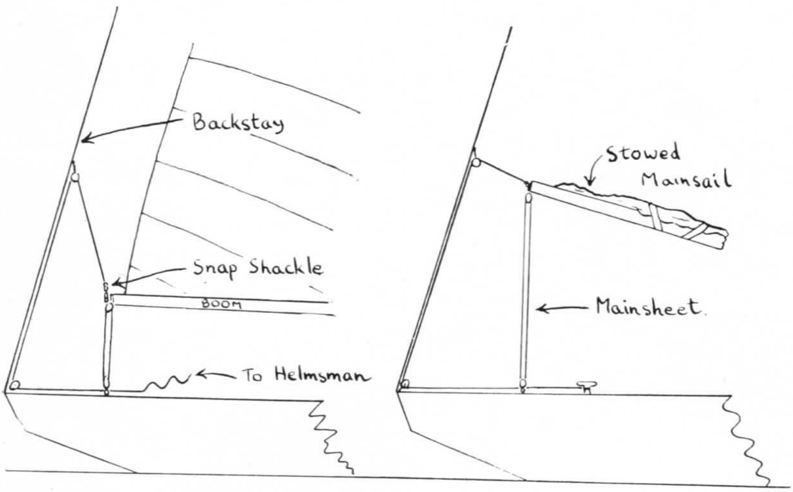


FIGURE 6.

Very small yachts with light booms could do away with the topping lift altogether, but many of them find that it is very useful, especially the ones that do any cruising.

Here is a method which takes the topping lift right away from the mast, and allows it to be operated by the helmsman. The end of the lift is connected by a snap shackle to the end of the boom. The single part rope then leads to a block on the backstay, thence down to the deck and along to the helmsman. This enables him to hand the boom clear of his own head when required.

The disadvantages of this method is that for normal sailing the snap shackle must be disconnected, and the end of the topping lift brought down to the deck, but for small vessels it is simple to snap on the lift to the end of the boom, before lowering the mainsail.

On the other hand, it does away with the boom crutch which is a nuisance at the best of times, since the topping lift can be hauled taut until the boom end is at its nearest position to the backstay. The sheet is then also hardened in and the boom is stowed securely, and without movement since it is held by tensions in three different directions.

A BALANCED " BIRDSWING " RIG

Col. Bowden has shown us a very fine sail in his " Birdswing " rig, with many very useful properties. However, it is just possible that it could be balanced in the manner shown in the drawing with an

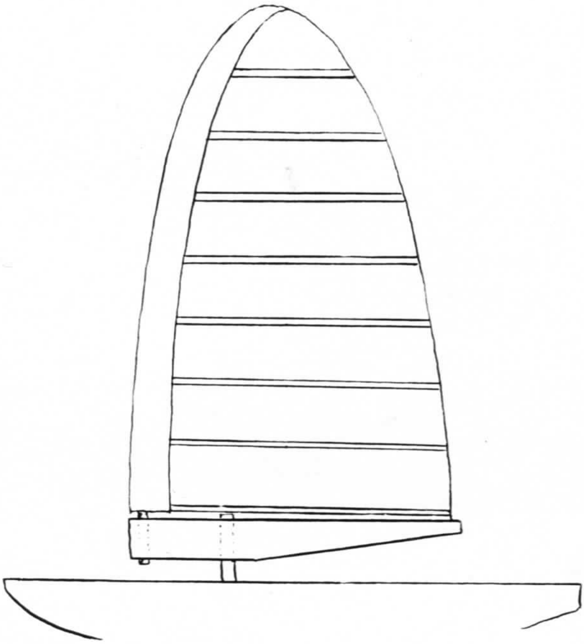


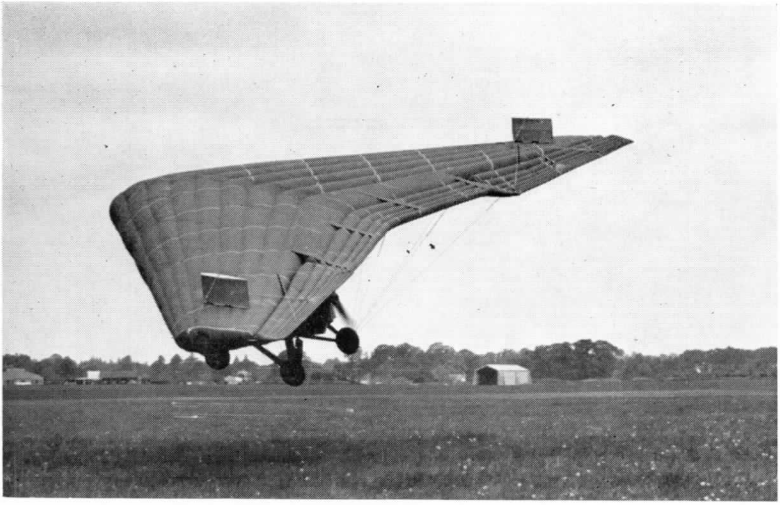
FIGURE 7.

increase in its usefulness. Besides lessening the force on the sheet, the boom can be used to make the sail sit better because it is then held by two rigid sides.

The only aerodynamic fault of the rig shown in the drawing would be a tendency to fall to leeward of the middle of the leech, giving a slight twist in the lower part and a twist back again in the upper part. However, the sum total of these two twists would be to produce an almost twistless sail. If the distortion were at all severe, a Chinese sheet could be used to prevent the twist altogether.

THE KITE RIG

This rig was fully described in publication No. 9, *Sails and Aerofoils*. In short, it is a kite which could be used to draw a yacht to windward as well as to leeward, thus removing the need for much stability in the sailing hull. The main trouble with it is that it cannot be used in light winds or when running before the wind. This could be dealt with by having the kite wing inflated with hydrogen but at the time no realistic method of doing this was seen.



The M.L. Utility Aircraft with inflated wing.

Now, however, Thurstan James has kindly sent me the accompanying photograph which we publish by his permission. It comes from *The Aeroplane* of 31st May, 1957 and shows the M.L. Utility Aircraft with an inflatable wing which can be blown up and used. When deflated, it can be packed in a small space. We are not directly interested in the whole aircraft but the wing statistics are as follows :

Surface area :	400 sq. ft.	Volume :	1,000 cub. ft.
Weight :	135 lbs.	Pressure :	½ lb. per square inch.

Hydrogen has a lift of 65 lbs. per 1,000 cub. ft. so, if such a wing were to be lifted by hydrogen, its weight would have to be halved. I believe that this could be done by making up the wing of transparent polyester resin sheet, which is extremely light and immensely strong. Seaton Sails Ltd., 7, Ballycairn Road, Coleraine, N. Ireland have sent me a sample of this material from which they make sails and I am sure that it would do the job perfectly.

The kite rig appears to me to be the greatest challenge to our inventive powers which I have met and it also holds out the hope for the great possible sail area for any craft. The ultimate in High Speed Sailing surely is a hydrofoil supported boat towed by a kite. Let us hope to see this being done in our lifetime.

LETTERS

Sir,

Would it be possible to make an aerofoil sail, with equal curvature both sides, out of rubber or P.V.C. which could be blown up with a pump (or for the lazy, a cylinder of compressed air) ? The bottom of the sail would be a flat plate with a stub axle pointing downwards and working in a bearing in the boat. Dropping the sail would consist of letting the air out. Internal diaphragms would probably be necessary with holes in them to allow the air to pass from compartment to compartment during inflation.

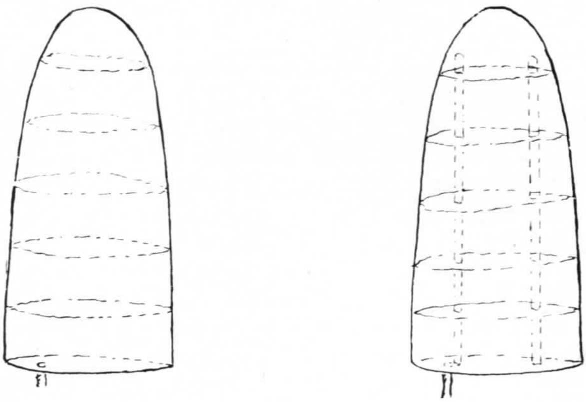


FIGURE 8.

Another idea is to put a windmill on a boat and gear it to a propellor in the water. The windmill would have to revolve so as to face the apparent wind, of course. Such a system would work with the wind astern but, with the wind ahead, would the propellor force be enough to push the boat forwards bearing in mind that the force on the windmill would be trying to push the boat backwards ? I admit that the crew would need to watch out that they did not get hit by the windmill.

F. C. DICK.

Ed.—The inflatable aerofoil sail looks excellent and, should it not be stiff enough for some reason, inflatable spars inside the aerofoil as shown dotted in the right hand drawing might be used. Transparent Polyester sheet could be used.

Lord Brabazon has used an Autogyro on his *Redwing* which is not, of course, connected to a propellor and it worked well, sailing close hauled excellently. However, it must have been a dreadful thing to sail with.

I believe a Frenchman did use the scheme suggested by Mr. Dick but was lost in the channel with it.

Austin Farrar has shown me a catamaran model he made with a tractor propellor at the front directly connected to a windmill at the stern. This, apparently, could go directly to windward in smooth water. This model at least shows that the mechanism is possible. However, the greatest " Coefficient " of sail force obtainable from a windmill is 1.0, whereas an efficiently designed sail rig probably gets a coefficient of about 2.0 and in theory at any rate a coefficient of about 6.0 is possible. This means that, while such a windmill to propellor scheme may be the fastest dead to windward, on all reaching or running courses, sails will be faster.

Sir,

Your condemnation of sloping sails is too sweeping. The *Gimcrack* tests, which you quote in support, do not in fact prove that at any given angle of incidence the horizontal component of the sail force falls to under half value as the heel increases from zero to 30°. Any validity the *Gimcrack* coefficients have is restricted to the case of the sloop rig on a keel yacht, the angle of incidence varying with heel. If the best angle of incidence when heeled to 30° were considerably less than when sailing nearly upright, this would exaggerate the apparent decrease of efficiency. There seems to be no reason to expect a real decrease of lift coefficient with heel at anything like the rate which you claim.

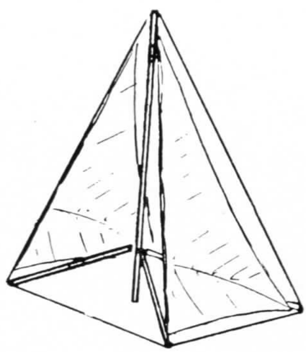


FIGURE 9.

A pair of inward-tilting staysails form a sort of biplane, slightly resembling the Irving biplane, and one can expect a decrease of lift and an increase of drag, as in normal biplanes. On the other hand, with the sails at no more than 20° to the vertical, one can have a gap/chord ratio of more than unity and still have the aspect ratio no higher than 3. These were the proportions used in the pyramid rig in the "Trion" experiment, in which a total area of 265 sq. ft. was set in a weathercocking unit which could be comfortably controlled by means of the one sheet. It had immense strength, and the forestays could be set up very taut. The expected centre of effort of the combination was only 4 feet above the foot of the pyramid, and there was evidence

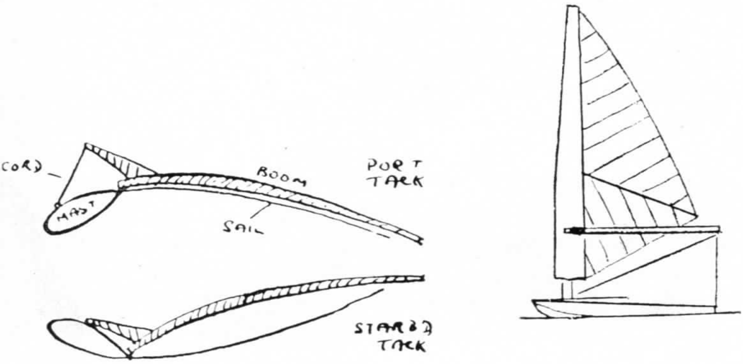


FIGURE 10.

from photographs that the resultant force did pass on average through the expected position. Only wind tunnel tests would tell us what the aerodynamic penalty really is, but the drive was impressive and the vessel pointed quite high.

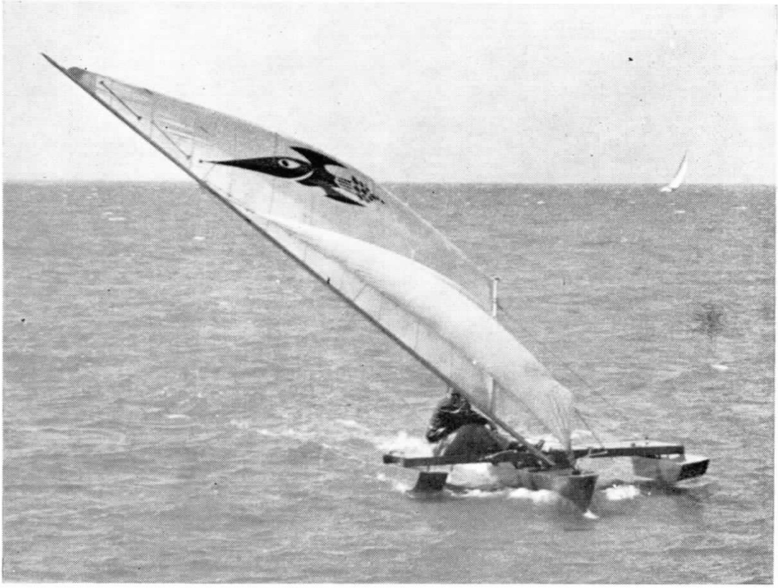
If allowed to pass unchallenged, your dismissal of any such device may deter some experimenter from using a rig of this sort in a situation for which it may be quite well suited.

H. M. BARKLA.

Mr. Barkla also sends us this sketch of a wingsail by Pat Smith, in Australia, fully described in *Seacraft*, Vol. 6, No. 4, October 1949, which he used on his Moth.

Sir,

You are right about tilting rigs losing so much power. Since sending you the picture of such a rig on the *Rocket*, we have had the opportunity of testing it, with disappointing results. It might perhaps be better on a boat which has a generous sail area, but the *Rocket*



NEW SLANT IN SAILING. Novel tilting rig, which gives lift as well as drive, is tried out on Rocket Outrigger class boat on San Francisco Bay. Designer is Arthur Piver, Mill Valley, California.

has only 130 feet of sail for its 20 foot length. However, it is a dandy method of shortening sail ; that is, if you have already gone to the trouble of installing the rig. Now that I think of it, we never do have any desire to shorten sail in our type of sailing as we are always shouting for " more wind."

I feel that we gave the rig a fair test. At first, the mast tilted only athwartships and, after the results with that arrangement seemed disappointing, I concluded that the trouble was that, because the spar tilted into the wind, the wind would blow down the mast, instead of across it. So then I rigged a universal joint at the base of the mast so that it could incline aft as well as athwartships.

The test was done under favourable conditions with smooth seas and winds up to about 30 m.p.h., but the boat did not go as well as it did with the standard rig. I concluded that the trouble was the reduction of effective sail area.

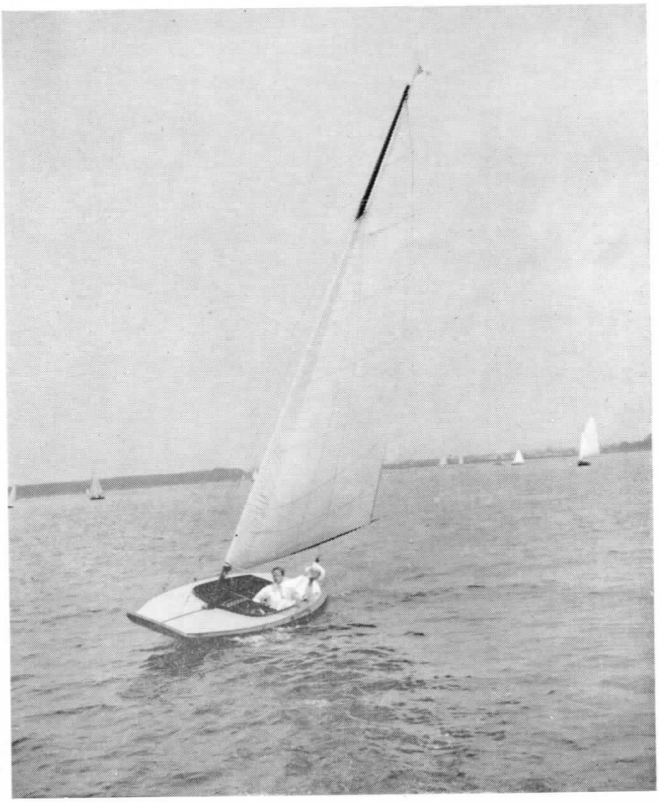
However, the experiment was not all in vain, perhaps, because as I sat under that tilted sail and looked at the beautiful airfoil overhead, I decided to invent a new kind of airplane. After all, we have wing-sails for boats, so why not have sail wings for aircraft ?

ARTHUR PIVER.

Sir,

With regard to your publication No. 9, *The Pocket Luff Mainsail*, and No. 14, Fig. 13, I enclose a photograph of my former boat, *Sirius II*, built in 1912 by Kurt Jäckel for racing on the Muggelsee, near Berlin. This boat excited great interest because it was the first boat with high sail rig, pocket luff and a scow hull.

In the first races, the pocket went to the mast top and therefore the sail could not be lowered because of the shrouds, two on either side. The mast had to be lowered to get the sail off. In the later



SIRIUS II with pocket luff sail.

races, the pocket was only 75% of the mast height, as in the photograph, and the sail could be lowered very easily, in contrast to Mr. Fenger's opinion. The sail at the boom had an incomplete pocket like Fig. 13 of *Wingsails* to give the sail a belly form. The boom eddies were therefore small.

The sail area was 150 sq. ft., the L.O.A. 22 ft., and the beam 5′ 5″. The boat was very fast, especially close hauled when it was incontestably superior to other boats. The hull had a rectangular cross section with rounded corners.

For myself, I prefer the Scowtype, for, as compared to normal hulls, it has a greater stability and better waterlines, if sailed heeled as in the photograph. It has a lower weight and deeper cockpit than a catamaran so there is less windage from the crew.

Everyone liked the appearance of the boat but I only had it 2 years till 1914 when the first world war came and I never saw it again.

FRIEDRICH SCHWEND, DIPL.-ING.
Nürnberg, Danziger Str. 21, Germany.

Sir,

You may be interested in the sketch of a model gunter rig using the yard as a leech pole. It proved to be, so far as I could judge, as effective as any other rig and might have possibilities on a full scale, if developed.

PAUL RICHARDS.

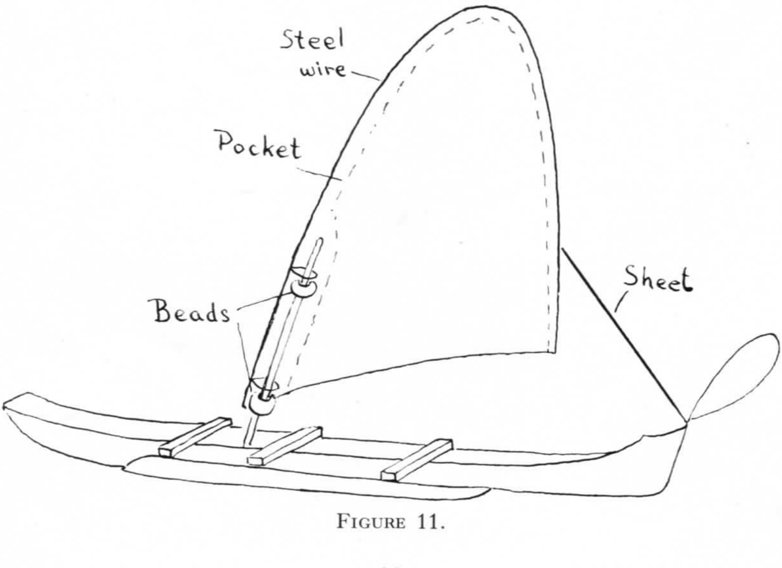


FIGURE 11.

Sir,

I was extremely interested in the A.Y.R.S. publication on *Wing-sails* which is excellent.

May I throw into the common " kitty " an idea I had some time ago and only tried out in a large model (static, not sailing). It is for the partial elimination of twist by an automatic vang.

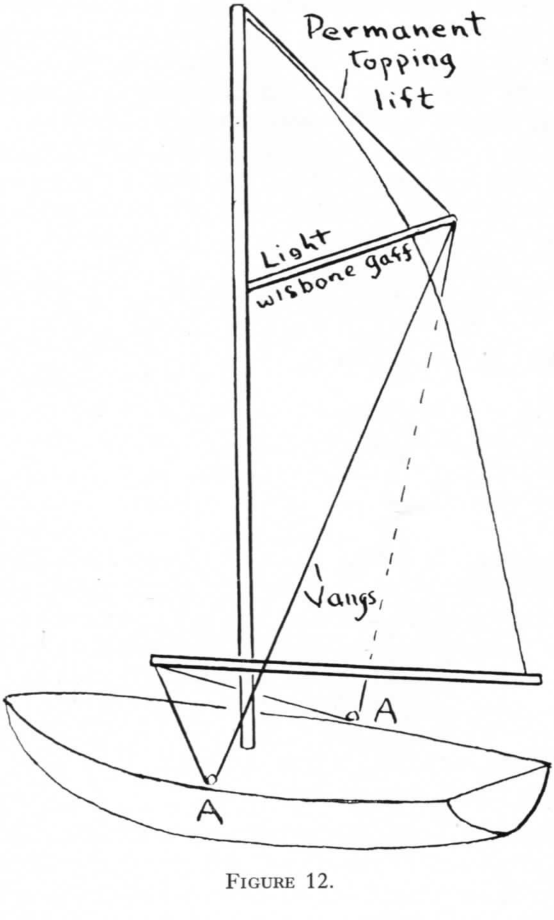


FIGURE 12.

It is possible to find a length for the forward extension of the boom and a position for the two blocks (A, A′), which allows the wishbone to lie roughly parallel with the boom over the working range of the sail. The forward boom extension can be obviated by a slightly more complicated " cross over " across the decks at A, A′.

J. H. PARHAM, MAJ.-GEN.

Sir,

As regards the planing of catamaran forms, I would like to underline Prof. Nutku's observation that the L/B ratio of catamarans does not make for efficient planing. While it is true that too beamy a bottom may decrease planing efficiency (as explained by Dr. Murray of the Experimental Towing Tank Laboratory, Hoboken, N.J. in what is probably the best treatise on the subject so far) the necessary relative beams are nowhere near those found in high speed catamarans, which are more like water skis. If one were to increase the beam of a catamaran hull to the point where one could plane efficiently, one would not have a catamaran anymore but a planing dinghy.

An efficiently shaped planing dinghy needs more energy to reach a given speed than a comparable catamaran. In a strong wind, even the best planers like the FD, 5-0-5 etc. drop astern fast. In light weather, the best dinghies may be on a par or slightly better.

One can, of course, have a catamaran which will plane on a flat bottom, like a waterski. At the given L/B ratio, however, too much force generated on the bottom would just be drained off in spray-making and eddymaking from immersed edges. Consequently, the cost one would have to pay in drag would be higher than with a fully displacing, non-lifting form. Therefore, speed would be lower for the same thrust. All this is aside from lateral force production, a requisite for every sailboat. Here too, sharp immersed corners would cause more of an eddymaking drag. I think that the catamarans will cause a revolution in that they will make us realize that the long boat, after all, is better for speed than the planer, if one goes to extremes. 1,000 lbs. raised 1 foot is 1,000 ft. lbs. work, no matter how you look at it. 1,000 lbs., left alone is 0 ft. lbs. work. The matter is not as simple as this but the general idea is valid.

As regards the value of the prismatic coefficient, I am entirely inclined to think with Commander Gandy that the Prout's catamaran has a better speed potential than *Ocelot* with her higher prismatic coefficient. It has indeed been proved by systematic tank tests that, up to very high speeds, a higher prismatic coefficient pays off. In other words, more volume in the ends and less in the middle. True enough, these tests have not been extended to include speed/length ratios of 4 and 5 so we are forced to guess a little when we get that far but I think the general direction should be towards higher prismatic coefficients. if really high terminal speeds are wanted, possibly as high as 0.75. We have to experiment and this is what Bob Harris and Ned Mullen are doing now with a new *Ocelot*.

I would like to clarify my remarks in publication 16 as they might easily be misinterpreted. I stated there that it was felt here that we should try to improve light weather performance by going to higher prismatic coefficients. What I really meant to say was " higher prismatic coefficients of the forebody." This has been found to make for a somewhat more forceful flow and thereby a delay of flow separation. But one cannot drive this too far, as then the after portion of the hull would become too fine, robbing you of some terminal speed and also causing excessive squatting under normal conditions. (At really high speeds, all catamarans dip forward due to the moment of the thrust high up).

The waterline of these hulls, it would seem, should be straight in their forefront being neither hollow nor convex carried aft to a point of contraflexure well past the middle. At the same time, however, one must try to keep the centre of buoyancy well forward, near amidships. Thus, while one would try to massage the form aft at the waterline, one would massage it forward under the waterline even to the point of some bulbiness forward. All this leads to a rather shallow but beamy run. The natural tendency of these high powered boats to dip forward at speed would improve matters still more, and without artificialities. The above are form considerations and are therefore of secondary importance. What counts most is the principal balance ; L/B, SA/WS, SA/Displacement, SA/Stability and so on.

Finally, inducing cross flow over the bottom, as with asymmetrical hulls with high and low pressure respectively at the bulbous and blat sides, may produce some lateral force, but it also upsets your flow and creates drag. A high aspect ratio centreboard or keel would do a better job but, of course, keels with their wetted surface have no place on a catamaran.

I think Francis Dealy's *Flamingo* illustrates the points given above very well. She has a L/B ratio of 17 (*Ocelot* 15), is built in plywood and has therefore a straight waterline entrance and although

I cannot be sure, I would say her centre of buoyancy cannot be far out of the middle. *Ocelot* was far too fine aft, it is known now. The new *Ocelot* is going to be a lot fuller in the ends and also a lot lighter, with somewhat more sail. It will be a terrific boat. The waterline forward is not really flat, being rounded somewhat, but then you cannot have everything. The boat is built for light weather in L.I. Sound in the first place and is necessarily a compromise. All boats are. Catamarans are no exception.

WALTER J. BLOEMHARD, *President*, A.R.Y.S.-A.S.

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