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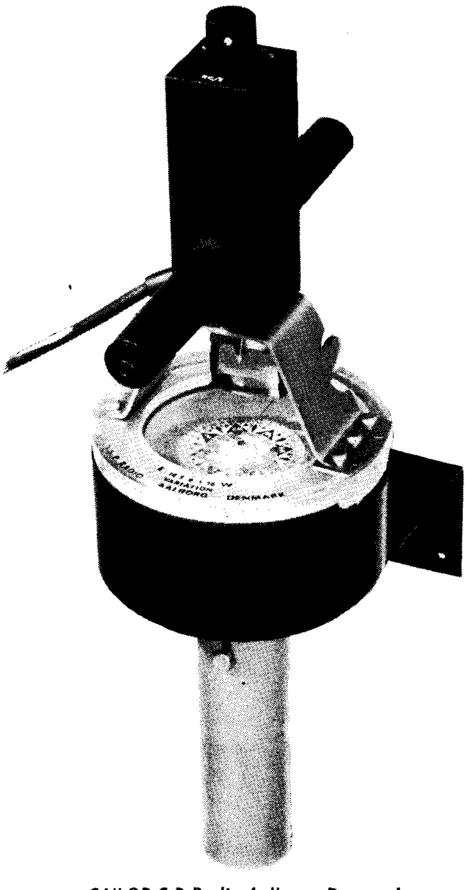
YACHT ELECTRICS

A.Y.R.S. PUBLICATION No. 48



SAILOR S.P Radio Aalborg, Denmark

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EDITORIAL

July, 1964.

LORD BRABAZON OF TARA

It is with great regret that we have learned of the recent death of Lord Brabazon. He belonged to that happy generation of inventors and developers who played with the petrol engine, the flow of air and the power of gravity.

Starting with ballooning at the turn of the century, he took up motor car racing, tobogganing, flying, photography and then yachting. In all of these, he was a great amateur expert as happy with a stick and string experiment such as his yacht wind tunnel as with the immensely complicated project of building the "Brabazon" aircraft costing millions of pounds.

He sailed the Bembridge *Redwings* which allow yacht experiments. Each season, he began by trying out some new rig or other, finally to revert to the orthodox. I don't know if he ever discovered anything startling in his life, but he must have helped progress in all the various fields in which he was interested. And he had a lot of fun.

Lord Brabazon became President of the A.Y.R.S. in 1957 and has been very interested in all our work. His opinion of yachts can be summed up by stating that he felt that the hull of conventional craft had reached finality some 50 years ago when all the major types which are present today existed. He felt that any improvement in yachts could only come from an increase in the power of sails and was the major force in having the A.Y.R.S. yacht wind tunnel built. In every way, he has been a dynamic asset to us and a good friend.

At the time of writing, the A.Y.R.S. Committee is slowly going through all the possible ways of making the Society better and more useful to members. A good deal of routine work has to be done to disengage the A.Y.R.S. from me personally and appoint officers to do all the jobs which I had taken on myself. This will all be got through in time and the British A.Y.R.S. can start having regular meeting in London. The New Zealand A.Y.R.S. has been having very successful meetings in Auckland for years and we all feel that all branches should do the same. Finally, our yacht wind tunnel and test tank must be made to produce results.

Botje III. This Micronesian type canoe which we described in publication No. 47, *Outriggers* 1963 has brought in more comments than any other craft we have ever described. Mr. Taylor's address is Morgan's Moorings, Hemmant, Brisbane, Australia. "Aerodynamic ballast," to say the least is obscure in its meaning. We have no photographs of the boat and none of my many contacts in Australia has seen it. My own opinion of the article is that it shows a very highly interesting craft which members should take as a most astute design study. There is so much interest in it that many would be built if contact could be made with Mr. Taylor.

The Commercial Contacts of Yacht Electrics. This publication puts me, as Editor in an awkward position. In order to do a good job of the subject, I have to give the names of firms making the equipment described. But my references only include the names of British firms as given in the catalogue *Boat World* (Business Directories Ltd.). I have got a few names of American firms from the *Rudder* but cannot help members in other countries much. I am afraid that they must find out their firms from their yacht chandlers.

YACHT ELECTRICS AND YACHT VENTILATION

I feel that we have got a good publication for you here. I must say that I found the job of assembling the material fascinating and, as usual, I now know much more about these subjects than when I began. Both subjects are really only applicable to habitable yachts, either cruisers or ocean racers but I suspect that every dinghy sailor hopes that he will one day own one of these types. I hope therefore that everybody will be interested.

The Choy—Seaman—Kumalae Catamarans. Ever since the earliest days of the A.Y.R.S. we have been hoping to heal the breach between ourselves and the Californian asymmetrically hulled catamaran designers. However, we have had to report that in the small sizes of catamaran, the low wetted area, shallow hulled craft has proved faster on a racing course. This is to be expected from all the theoretical and other examinations which we have learned. On the other hand, it can be equally well shown that in strong winds, a narrow hull will be just as fast, even if it has a little more wetted surface. In the open ocean, too, a narrow, deep hull can be more seaworthy and be capable of being driven faster than a shallow hulled catamaran. We have pleasure in printing a long letter from Rudy Choy which brings these points into practical perspective.

Rudy Choy points out quite correctly that his designs have improved since the original *Manu Kai* and this is quite obvious. Though no lines plans are ever published by these designers, their brochures show enough to allow one to estimate with great accuracy what their lines are. In essence, their hulls are made up of sections which are all identical in shape and approximate very closely to the " Sewer section " which is the shape giving the least possible wetted surface at varying angles of heel. It is not surprising therefore that these catamarans have been faster than the symmetrically hulled catamarans with semi-circular underwater sections in the strong Pacific winds. As for the asymmetry itself, I can only state my opinion that it would slow the boat on very many English summer days but possibly by an insignificant amount. It might well be faster in the strong winds of California. The point here is the theoretical need to have much more lateral resistance in strong winds than light ones. Asymmetry provides this.

Summary. Perhaps the matter can be summarized by saying that light racing catamarans should have shallow hulls but that large cruising catamarans should have " Sewer sectioned " hulls. At present, it is impossible to give a reasonable assessment of the value of asymmetry.

We hope that in next January's publication on catamarans, we will be able to show a good collection of the designs of these gifted and successful designers.

Perhaps, one of our mathematical readers would send us the mathematics and drawing of the " Sewer section."

YACHT ELECTRICS

BY

JOHN MORWOOD

in collaboration with : George Dibb, John Hogg and Norman Naish.

Foreword.

I suppose that this publication should have been written by an electronics engineer instead of by me whose electrical knowledge just about extends to the workings of a crystal radio set. However, if it is regarded as the requirements of the ordinary yachtsman, of my own knowledge level, I feel sure that it will accomplish its purpose of stating the problems of the subject.

Introduction

The two main problems of yacht electrics are 1) Wattage or the amount of current consumed and 2) Weatherproofing. Up to a relatively short time ago, both of these were so formidable that all forms of electricity aboard yachts were avoided by most people. Radios and depth finders used far too much current to be used for any length of time and were very expensive. Electric lighting still uses far too much current to be of real value to the long distance cruiser with the resultant use of kerosene (paraffin) with all its smell, weight and dangers. Even for coastal cruising, the light produced by the usual navigation and other lights is often not strong enough to let the yacht be seen by large merchant vessels. Weather proofing, too, used to leave much to be desired, with corrosion and failure the frequent and expected result.

Of recent years, many of the previous faults of electricity have vanished. The transistor, with its low consumption of current, has made radio sets possible which will function for months from dry batteries and depth finders can be produced for relatively little cost. Both of these are dependent on the fact that sound is cheap to produce in terms of electricity—the depth finder, of course, uses sound waves for its operation. Light and heat, on the other hand, are expensive to produce in terms of electricity. Electric heating will always be impossible for yachts until atomic reactors are carried or some better source of current appears but electric lighting need not necessarily be so because of the fact that certain forms of light can be produced without at the same time producing much heat, for instance the fluorescent type and the " gas discharge bulb "—in this a high voltage can produce an intense light for a very short time. Modern plastic insulation, too, is very durable and weatherproof.

Yacht Electrics can be examined under the following headings :—

1. Generation.
2. Storage.
3. Lighting.
4. Radio.
5. Radio Navigation.
6. Echo Sounding.
7. Radar.
8. Sonic radar.
9. Automatic Helmsmen.
10. Instrumentation.
11. Wiring.

GENERATION

The generation of electricity is done in the following ways :— 1. Mechanically through a dynamo. 2. By a chemical reaction and 3. By the direct conversion of heat in the Thermo-couple. The Thermo-couple depends on a gradient between heat and cold and, in the case of satellites in space, can provide worth while amounts of electricity from the radiation of the sun. It would do just as well on the surface of the earth if the sun always shone. Let us quickly discard this system before we get involved in a discussion of the weather.

In this year of grace, the chemical generation of electricity is only done in a practical way by dry batteries which can be so easily bought all over the world and we need not concern ourselves with it unless, as so often happens in the A.Y.R.S., someone has been producing vast quantities of electricity for next to nothing from something like old nails, lemon juice and sea water.

This means that, for all practical purposes, we have only two forms of electricity generation—1. the dry battery and 2. the mechanically driven dynamo. One can put to sea for the longest voyage in a yacht with a wind-driven dynamo charging an accumulator, with some dry batteries in sealed cases as a standby.

Power Sources and their utilisation. 1) Very small petrol-driven dynamos can be bought which will do the job excellently but there is always the danger of explosions and fire and the difficulty of carrying a great enough supply of fuel. Besides, the essence of the yachting game is that one is quite independent of the land, except for food. 2) One naturally, therefore, thinks of wind as a source of power and three ways of extracting the wind power come to mind. a) A windmill clamped to a shroud or backstay. b) A masthead windmill or revolving cups and c) A Venturi tube mounted in a fast airstream from which a pipe line would run below decks to a reciprocating motor. Venturis, are, however, pretty inefficient and losses would occur in the tube. They are unlikely to produce enough power.

Dynamos are notoriously inefficient at producing electricity unless driven at great speeds, though the modern trend in car electrics is for A.C. alternators and rectifiers which will charge at minimum r.p.m. These would be excellent for boats. Ample power must be available and, of the three methods, only the windmill on the shrouds or backstay seems to meet the bill. A mast head windmill or revolving cups have some attraction in that it is in a faster airstream and is not liable to injure the crew or be injured by them but the windage and weight aloft in gales might cause some anxiety. Also its speed might fluctuate wildly when rolling

3) The final system of power generation is to use the water-flow by the side or the stern of the yacht. This has two faults, both serious. The first is that the system would be of no use in harbour where most boats spend most of their time, even in ocean cruising. The other is that the water rotor would be vulnerable to itchy or hungry fish who appear to like their diet to contain some roughage and to like yachts bottoms on which to scratch themselves.

Battery Chargers

Clarke, H. & Co. (Manchester) Ltd.
Eastern Motors, Aldeburgh, Suffolk.
Electro Motion Ltd., Leicester.
G.M. Power Plant Co. Ltd., Ipswich, Suffolk.
Gt. Eastern Trading Company, London, E.1.
Majestic Electric Co., Ltd., Enfield, Middlesex.
Philips Electrical Ltd., London, W.C.2.
Powerco Ltd., London, S.W.18.
" Q " Service Station, Ashford, Middlesex.
Withnell, A. C. Ltd., Ashford, Middlesex.

STORAGE

The storage of electricity is universally carried out by accumulators of which there are two types 1. the lead-acid cell, the acid being sulphuric acid and 2. the Nickel-iron or Nickel-cadmium cell, where the electrolyte is potassium or sodium hydroxide.

The Lead-Acid Accumulator. The principle on which this works is that, when electricity is passed between two lead plates bathed in sulphuric acid, one plate becomes coated with lead sulphate and the other plate releases hydrogen gas. After a certain amount of the lead on the plate has been turned into sulphate, the current may be stopped and it is now found that electricity will flow between the plates if they are connected above the acid till both are once more transformed back into lead, the sulphate once again being turned into sulphuric acid. In this way, electricity may be fed into the battery and may later be taken out again, the losses in the process varying with the internal resistance of the battery and the rate of charge amongst other things.

The Nickel-Cadmium Cell Accumulator. With this cell, the active material of the positive plate is Nickel Hydrate with a conducting admixture of pure graphite. The active material of the negative plate is Cadmium Oxide with an admixture of a special Oxide of Iron. The electrolyte is, generally, a 21 per cent. solution of Potassium Hydroxide of a high degree of purity. The reaction which takes place is as follows :

$$2Ni(OH)_3 + Cd = 2Ni(OH)_2 + Cd(OH)_2.$$
$$\text{Charge} \longleftarrow\!\!\longrightarrow \text{Discharge}$$

In a fully charged battery, the Nickel Hydrate is at a high degree of oxidation and the negative material is reduced to pure Cadmium. On discharge, the Nickel Hydrate is reduced to a lower degree of oxidation and the Cadmium in the negative plate is oxidised. The reaction thus consists of the transfer of oxygen from one plate to the other and, at normal temperatures, the cell is inert on open circuit. The electrolyte acts as an ionised conductor only and, as it does not react with either plate in any way, the specific gravity does not change throughout charge or discharge.

The advantages of the Nickel-Cadmium cell are as follows :

1. All internal parts of the battery are free from any kind of local action under all conditions.
2. The plates have a very long life, often 20 years.
3. The battery may stand idle for long periods in any state of charge or discharge without damage.
4. The battery is virtually free from self discharge at normal temperatures and therefore retains its charge for long periods.
5. Frequent specific gravity readings are unnecessary.

A recent development of this type of cell is the chargeable dry cell —ideal for instruments and small equipment on board since they can be charged in situ and sealed into the apparatus. No messy " topping-up " is required. They hold their charge almost indefinitely when not in use. They are useful for hand torches, instruments, radio etc. We feel that they will become more used when the price eases, the absence of gases and wet electrolyte being a chief attraction.

Cost. This is greater than the lead-acid battery. So also is the size of the battery but the weight is less.

Nickel-Cadmium batteries are made by Nife Batteries, Union Street, Redditch, Worcs., England. Export Dept., 137 Victoria Street, London, S.W.1.

Weather-Proofing Accumulators. Accumulators are heavy and will usually be stored fairly low down in any boat. Bilge water and general damp has a rotting effect on them, however much they are made to withstand such conditions. It might therefore be wise to protect them by wrapping them in Polythene sheeting and sealing the cables as they come through it. In the process of charging and discharging, however, the lead-acid type gives off both hydrogen and oxygen which, if not allowed to escape would blow out such a Polythene wrapping with a mixture of gases which is highly explosive.

LIGHTING

Yachts are lit in order to see and to be seen at night.

Light for Seeing. This is internal and external. Internal lighting is needed in the binacle in order to steer and in the cabin in order to read the charts and anything from Aristotle to a detective novel. The current needed for the binnacle need not be great but internal lighting in the saloon which is used for reading will alone exhaust quite a large accumulator in a fortnight. If navigation lights were used as well, the current consumption would be prohibitive.

External lighting in order to see is used for picking up buoys or closing with an unlit piece of shore. To do this, some sort of " Spot-light " is necessary which will throw a beam of light. It is usual to have a hand-held torch with dry batteries for this purpose but a spotlight, using a cable to the yacht's accumulator would be more powerful. As an alternative, one can make use of the facility of the human eye of " Persistance " where an image is implanted on the brain by a glimpse of only a few microseconds—for example a lightning flash showing up a distant shore line. The artificial version of this is the photographers flash bulb whose current consumption is extremely small and the light is so powerful that clouds overhead can be illuminated.

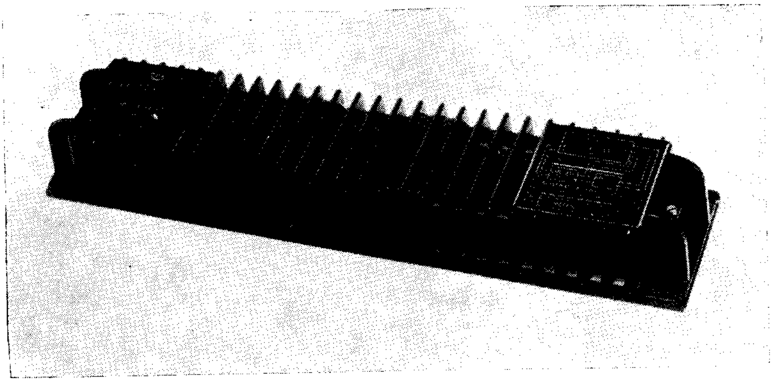
Light for being seen. The first necessity here is to have navigation lights, green to starboard, red to port. In general, these lights must lose a lot of their power from the coloured glass through which they shine and, when sailing, one is often pointed at the the sea surface and the other at the sky so they are practically useless for the purpose for which they are installed. However, they are a legal necessity and must be used. If they are to stand any chance at all of serving their purpose, they should be put as high up in the rigging as practicable and on boards to keep them in place. In order to avoid the exposure of the wiring to the elements, it could be run up inside an overlarge satnchion with a transparent top. If the stanchion tube were large enough and open to the " below-decks," the bulb and wiring could be dealt with from inside the cabin, should a fault occur at sea.

Because of the general uselessness of navigational lights on small yachts, many owners fit a mast head light which is far more easily seen, if white. This is not strictly legal, of course, but if the light can be clearly seen from a distance of two miles away, it will improve the chance of a merchant ship noticing the yacht. Even a two mile range in good visibility is barely enough for a 16-20 knot ship, she has first to judge what the " opposition " is doing before she can make up her own mind. Again, such a light will use a relatively great amount of current. A flashing light would be more economical in current but might be misleading to merchant shipping. Finally, we have the case of the long yachtsman, crossing an ocean. In general, the oceans he will cross will be empty of all shipping but he will still have to cross shipping lanes and will not be overkeen on being run down. Perhaps the best thing he could do would be to fit a " gas discharge bulb " which lets off a mighty flash every twenty minutes or so. The flash bulb in such a case could be fitted inside a bulge on the after deck so that it could be got at at all times and could be kept dry. On the after deck, the flash would illuminate the sails and thus show that he was a sailing vessel and not a shipwrecked mariner but unless the system were well known it might attract the merchant vessel rather than repelling it. In navigable waters such flashing might have to be restricted to avoid confusion with buoyage lighting.

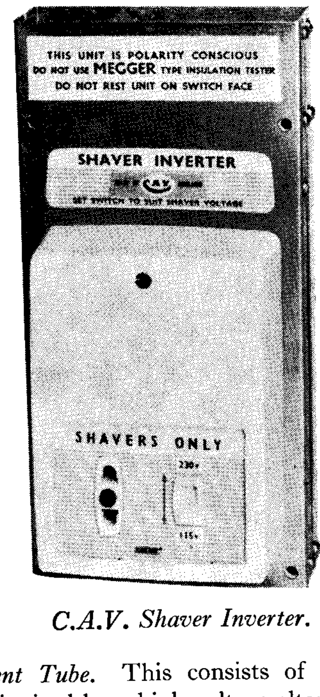
Source of flashing beacons. The McMurdo Instrument Company Ltd., Ashtead, Surrey, England. The beacon produced by this company has an output of 300,000 lumens at a rate of 60 per minute from a 12 volt supply. Their beacons for " Night rescue " attachment to life buoys or life rafts have visibilities of up to 7 and 15 miles according to type.

Fluorescent Lighting from Batteries. From what has already been written, it will be appreciated that electricity can be very useful on board a yacht and we would all like to have it, the only snag being that the accumulator cannot usually provide enough current for our needs for any length of time. A partial answer to this difficulty lies in the " Transistor oscillator " and fluorescent tubes. From either 12 or 24 volt batteries, a transistor oscillator will produce an alternating current of 200 volts and 8.5 kc/s with a 15 per cent. to 20 per cent.

loss of current. The fluorescent tube, however, only uses one third as much current as a conventional tungsten lamp for the same light output in lumens.



C.A.V. Transistor Oscillator.



C.A.V. Shaver Inverter.

The Fluorescent Tube. This consists of a tube filled with an inert gas which is ionised by a high voltage alternating current passing between heated poles. The ionisation causes an inside coating on the tube to glow.

Neon Fluorescense. Neon gas will also glow when subjected to a high voltage alternating current and small bulbs can be bought which give the same light as a 5 watt bulb with a tungsten filament but using far less current. One of these might be used as a binnacle light with a transistor oscillator. Cabin lighting of lower power could also be provided by these bulbs all through the yacht for the purpose of getting about. For chart work and reading, however, a fluorescent tube would be used and the masthead light and a combined navigation light at the stem head would also use fluorescent tubing which can now be got in short lengths. It is not known whether Neon fluorescent lighting is more economical than the conventional fluorescent. If it were, one could use up to 12 of the previously mentioned bulbs in the main cabin.

Transistor Oscillator Source. C.A.V. Ltd., Acton, London, W.3. Price £8.

RADIO

Transistors have revolutionised radio for yachtsman. No longer need the ocean voyager carry expensive chronometers or know how to work out lunar sights. His transistor radio can be kept almost perpetually on, should he want this, and he can pick up the time ticks every night to check his time so that he can work out his position. In general the radio will run off dry cells but a voyager should make it possible to use the yacht accumulators should his dry cells run out.

Not only will a transistor radio give the yachtsman his time, the weather and entertainment but it can also assist him with coastal navigation if fitted with a directional aerial, but that province is dealt with in the next section.

RADIO NAVIGATION

Several types of Marine Radio sets nowadays are fitted with a directional aerial of " Ferrite " composition which concentrates the incoming signals and thus allows it to be very small in comparison with the large ring loop aerial. The ferrite aerial is now a compact horizontal bar no wider than the set itself and with it, especially if there is a " null point " on the set, the direction of radio transmitters can be fairly accurately aligned with compass bearings. To make navigation easier, radio beacons have been stationed along the coastline of most countries where there is a lot of shipping and these are all marked on the charts. This method of navigation can be of value at any time but is especially useful in fog.

Loran and Decca Systems. These are more sophisticated methods of finding one's position whose accuracy and ease of working make them of great value to trawlers. Trawlers have to find certain banks where the fish lie in foggy northern waters and so absolute navigational accuracy is essential. The sets are very expensive and are usually hired from the makers.

BEME RADIO and direction finder.

List of Marine radio sets with directional finding aerials.

BEME, Derritron Ltd., (BEME Division) 24 Upper Brook Street, London, W.1.

Brookes & Gatehouse Ltd., Bath Road, Lymington, Hants., England.

Coastal Radio Ltd., Hope Crescent, Edinburgh 7 and 168 Regent Street, London, W.1.

AJAX Electronics Ltd., Southchurch Ave., Southend-on-Sea, Essex.

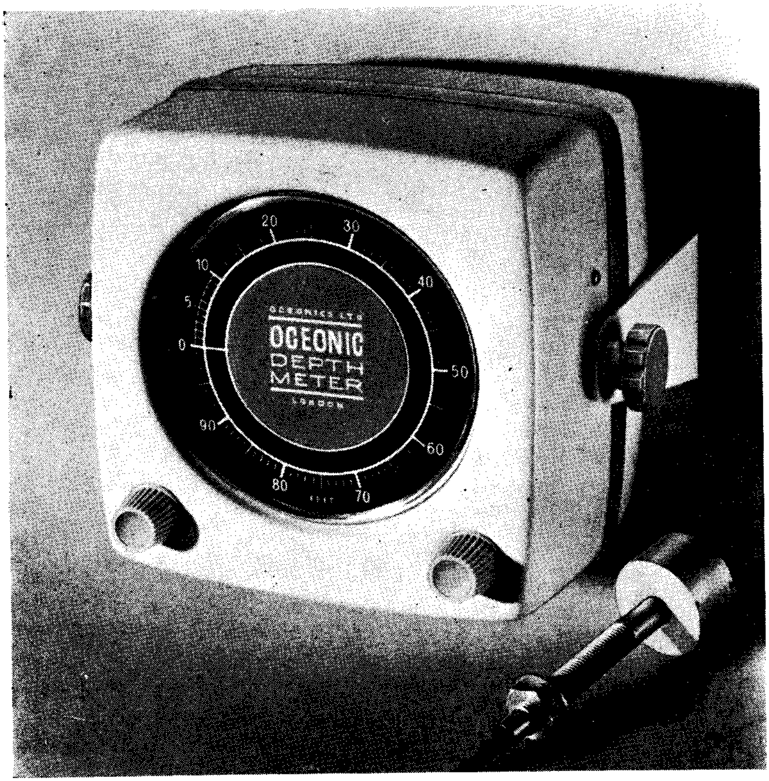
NOVA-TECH Inc., 72 Wardour Street, London, W.1.

PYE Ltd., Marine Div., P.O. Box. 18, Cambridge, England.

A/S S.P. Radio, Aalborg, Denmark.

Woodsons of Aberdeen Ltd., Greenbank Road, Aberdeen 26364, Scotland.

All echo-sounders which have been produced to date depend on a pulse of supersonic sound waves being transmitted from a fitting on the outside of the hull of a boat. This pulse is then reflected from the sea bottom and comes back to the same or a separate fitting. There is a lapse of time between the sending of the pulse and its return and this time lag is a measure of the depth of the water. The time lag



OCEONIC depth finder.

and the associated depth of water can be transferred to a gauge which will read off the depth of water in feet or meters as the case may be. Commercial, transistorised echo sounders can be bought for relatively little money nowadays and their current consumption is small. No yacht should be without one.

The use of Echo-Sounders. In essence, this is a matter of navigation, indicating one's position off shore and the distance by correlating the depth found with the soundings marked on the chart, due allowance being made for the tide. However, fishermen use their depth finders to locate schools of fish which can give a reading which may mislead the yachtsman.

List of commercial depth finders.

Brookes and Gatehouse, Bath Road, Lymington, Hants. Homer and Heron.

S. G. Brown Ltd., St. Albans Road, Watford, England. Subsig.

Derritron Ltd. (BEME Div.) 24, Upper Brook St., London, W.1. BEME.

Electronic Laboratories (Hendon) Ltd., Spalding Hall, Victoria Road, London, N.W.4. The Seafarer.

The Ferrograph Company, 84 Blackfriars Road, London, S.E.1. Ferrograph.

Marine Electronics Ltd., Endeavour House, North Circular Road, London, N.W.2. Fairway, Coastway, Shoreway.

Nova-Tech, 72 Wardour Street, London, W.1., and Manhattan Beach, California. Model FE 622.

Oceanics Ltd., 18 Turnpike Lane, London, N.8. Oceanic.

The Submarine Signal Co. (London) Ltd., Shakespeare Street, Watford, Herts. Subsig (Recorder type).

PYE Ltd., Marine Div., P.O. Box 18, Cambridge, England. Clydez, Medway.

Woodasons of Aberdeen Ltd., Greenbank Road, Aberdeen 26364, Scotland. 303.

RADAR

Radar, as we know it, depends for its action on radio waves of short length and high frequency being radiated directionally from a source in pulses. Because such waves are reflected by objects in their path, objects such as ships and the shore reflect them and they can be received by the transmitting aerial and recorded on a fluorescent screen by a rotating arm. The rotating arm only records reflections from the direction in which it and the aerial are pointing. As the arm revolves, however, the screen is made to record a picture of the adjacent shore line and any ships or reflecting objects in the water, even a small can or buoy. The fluorescent screen has only a persistance of short duration so that when the rotating arm comes over a direction, the previous recording has almost vanished. Thus one can get a continuous and changing picture of everything about one.

The uses of Radar at Sea. At sea, radar is only of value to merchant ships in fog, though it could be used to find small boats or objects in the water at night. This latter object must indeed be rare, though normal merchant ships in coastal waters are probably far more careful in looking out for yachts than yachtsmen give them credit for. We may take it therefore that merchant ships will use their radar to keep a speed of 16 or more knots in the thickest fog, but, by the same token, all the attention in the ship as far as other craft are concerned, will be centered in the radar screen. It is therefore essential that every yacht must reflect radar waves very adequately indeed. To do this, a sheet of metal is necessary, the particles of which are in electrical continuity with each other. For instance, an aluminium mast will cast a useful Shadow. So will the metal coated plywood device which is often recommended for hoisting up a wooden mast. The usual " Aluminium paint ", however, appears to be useless—probably because the metal particles are not in contact with each other. The only way in which I can at present see how wooden hulls can be made visible to radar is to glue metal foil inside or outside them. Most yachtsmen at present think that a radar reflector or metal mast is adequate.

Radar for Yachtsmen. With present apparatus, radar sets are prohibitively expensive both in capital cost and the electricity to run them. The trouble here is the expense of throwing a radio beam out ; then collecting and amplifying the reflections and recording them on the fluorescent screen. It is therefore unlikely that many yachtsmen will use radar but there is a possibility that the advent of the " Laser ", a device which produces beams of coherent light of extraordinary energy may well burst wide open the present methods of detection and communication.

A Radar Beacon. Conventional radar for yachts may not be possible as far as seeing through fog is concerned. However it seems worth while to consider the possibility of a yacht sending out a continuous transmission of radio waves on the radar frequency so that a merchant ship would " see " the yacht, which might appear as a line right across the radar screen from the outside to the centre. Because the reflected waves of radar are of such small intensity, it would not need anything like the amount of current to run which full radar would need. It might therefore well be possible and of value.

Commercial Radar. The smallest commercial radar which might be installed on a very large motor yacht is made by Raytheón A. G., Zug/Schweiz, alpenstrasse 1, Post Box 169, Switzerland.

TANNOY LOUD HAILER with listening device.

SONIC RADAR

Electromagnetic waves are expensive to produce both in terms of capital cost and for running as far as radar is concerned. Sound waves are much cheaper. Attempts have therefore been made in the past to use a system exactly like that of the echo sounder for accomplishing a similar effect to ordinary radar. A sound wave pulse is sent out in the air through something like a loud hailer and the reflected sound waves are noted by a microphone, the time lag between them giving the distance of the object from the observer.

Faults of Sonic Radar. The first fault is that the speed of sound in air is only 1,100 feet per second which means that it would take 5 seconds for the sound wave to reach an object one mile away and another 5 seconds to get the echo back to the observer. This would mean that the overall picture of objects for a shore line at sea would be relatively crude. This might in itself be acceptable for sailing boats which move slowly but the second fault of the system is that variations in the density of the air such as one gets under conditions of fog tend to bend the sound waves out of a straight line course. Thus, areas of silence exist around a source of sound at sea and false positive and negative readings could be produced. All this is not finally to condemn sonic radar for use in yachts. More work should be done on it before that conclusion is reached.

The use of transistors has enabled very compact and powerful loud hailers to be available to yachtsmen. Some makes have in addition an amplifying earpiece for an incoming shout — a super eartrumpet—of vital value, say in the case of " Man overboard." This instrument as it stands is in effect sonic radar and could be used as such.

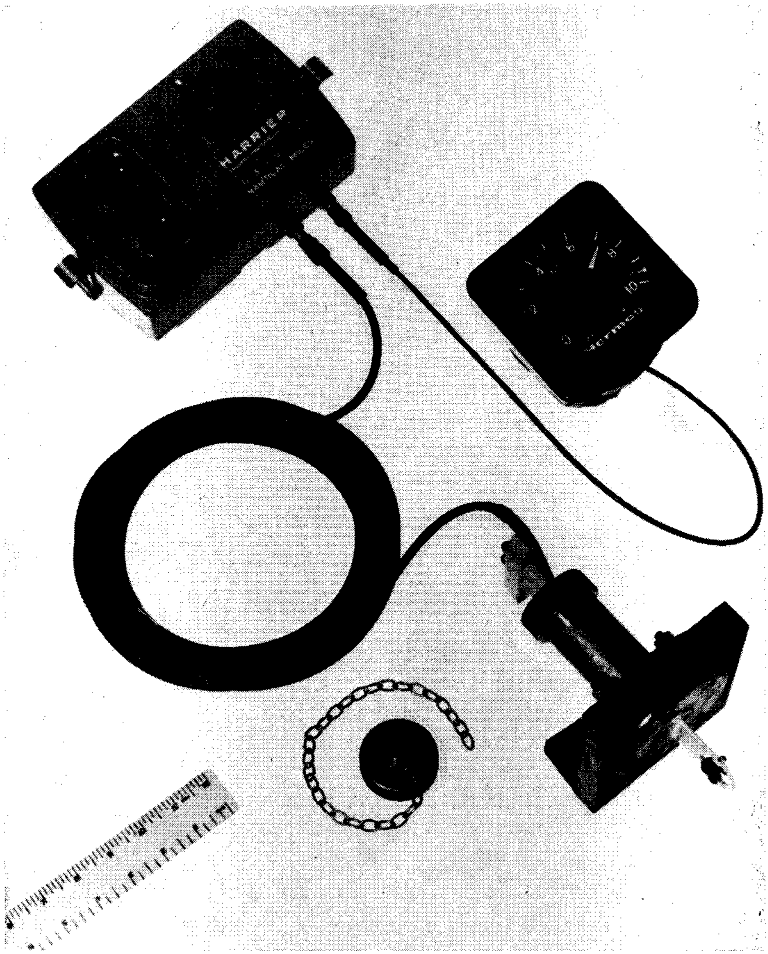
Loud Hailer with amplified Auditory Device. Tannoy Marine Ltd., Norwood Road, West Norwood, London, S.E.27.

AUTOMATIC HELMSMEN

The essential ingredient of all these is a compass, either magnetic or gyroscopic. The direction in which this is pointing in relation to the ship is sensed either mechanically, electrically or by a photo-electric cell. When the ship's head deviates from the set course, the sensing mechanism operates an electric motor which may turn the ship's wheel and thus restore the set course. Various degrees of sophistication are possible to deal with rough seas and to prevent " overshoot " where the ship oversteers and other things. All these add to the expense of an already expensive apparatus. Some versions have a hand device which can be taken anywhere about the ship so that one can steer with three buttons, one for starboard and one for port and one to restore the automatic helmsman.

Automatic Helmsmen.

Bartronics Ltd., Chatham, Kent.
Brown, S. G. and Co., Watford, Herts.
Browne, Henry and Son, London, E.C.3.
Coastal Radio Ltd., Edinburgh 7.
Marine Automatic Pilots Ltd., Hove, Sussex.
Shortis & Chandler Ltd., Beckenham, Kent.
Southern Radio and Television Co., Poole, Dorset.
Sperry Gyroscope Co. Ltd., Brentford, Middlesex.
Sharp & Co. Ltd., Sandwich, Kent.



HARRIER LOG/SPEEDOMETER
Brookes & Gatehouse.

INSTRUMENTATION

Yachts need relatively little instrumentation. A compass, a good ship's clock and a revolving log are the ones commonly used—one assumes that a sextant belongs to the crew rather than the ship. This section therefore mostly deals with the ship's log, though we should see if any other instrument might be of value.

The Yacht's Log. This usually takes the form of a spinning rotator at the end of a cord which mechanically, through gearing down, records the distance run. The mechanism is so simple and the power from the yacht's motion being able to cope with the needs of the apparatus so easily, attempts to convert the log into an electrical apparatus have not been popular. The only value in an electric log of this kind is to get the yacht's speed registered on a dial which is useful when close hauled.

Other ways of measuring the Yacht's Speed. Pitot tubes for measuring the speed of aircraft have been very successful and naturally they have been tried to measure the speeds of yachts. However, the commercial pitot tube speedometers always seem to suffer from "Flatter" or a higher reading than in fact the yacht is travelling. This gives a nice feeling at the time but has the effect that no one now believes any of them. Alternatively, some plankton or weed gets into the tubes and they have a very low reading which is no more satisfactory.

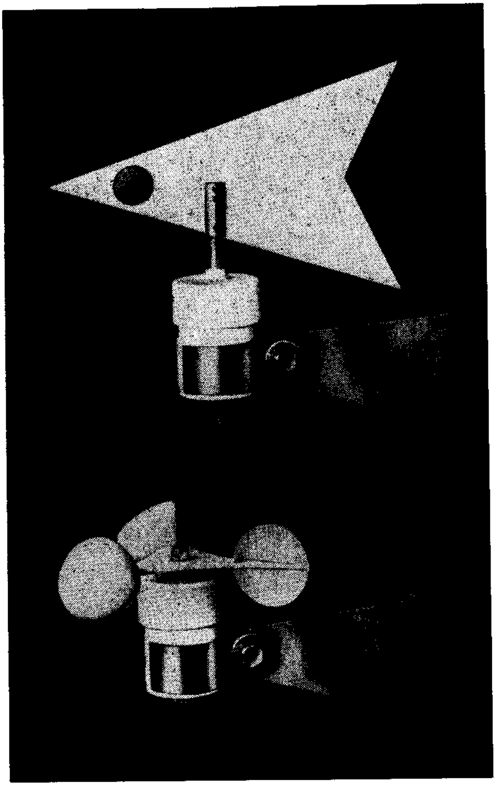
In recent years, small logs or speedometers have been produced (Walkers, Brookes and Gatehouse etc.) in which a small lightly loaded propellor attached to the hull or projecting through a special gland fitting, drives either a little generator or inductance device which produces a current (or current change) according to the speed of the yacht. This is indicated on a dial which can be mounted in any position on board. These types have the advantage that no log line is required and they can easily be withdrawn for cleaning.

Logs and Speed Indicators

Brookes and Gatehouse Ltd., Lymington, Hants.
Browne, Henry and Son, London, E.C.3.
Goads (Chandlers) Ltd., London, S.E.1.
Smiths Industrial Division, Wembley Park, Middlesex.
Walker, Thomas and Son Ltd., Birmingham 5.

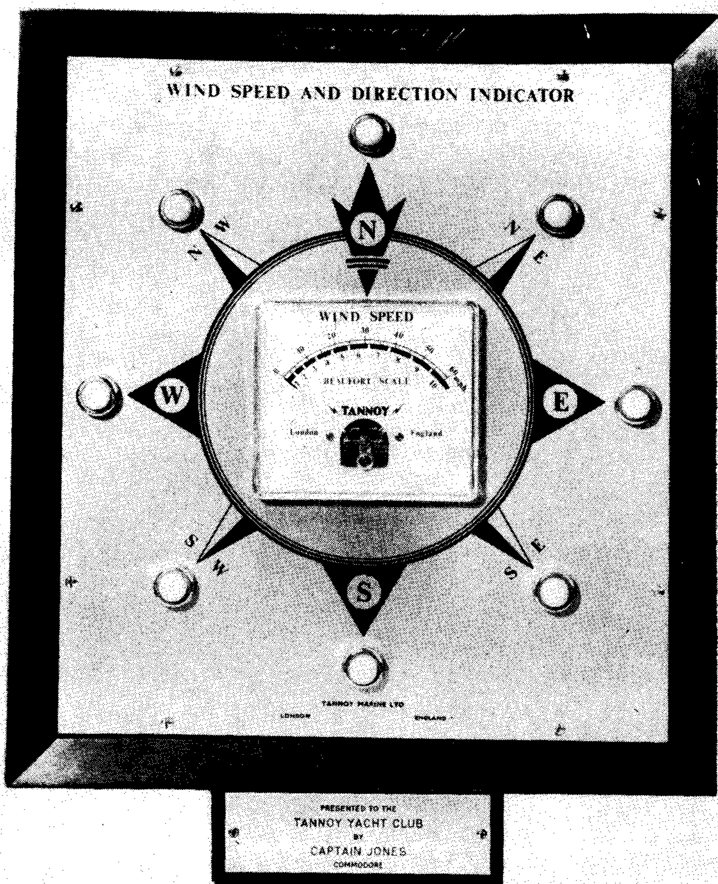
Using the Earth's Magnetic Field. My uncle, Stuart Morwood, used to be the local "Dowser" in his part of rural Ireland. This means that he was able to find springs of water with the aid of an assortment of apparatus from a hazel fork to a metal nut tied on the end of a string. But he was most fond of his silver watch and chain which he held over the ground and set it moving in a circle. It either kept its circle or, if there was a spring below, it started to swing back and forth and no longer circled. My uncle was very successful as a "Dowser" or water diviner and was greatly in demand by the local farmers. He was a strict amateur but used to appear from time to time with bottles of the best Irish Whiskey.

I used to think my uncle was an awful fraud and that he found the water because he knew how the springs ran in that part of the country, and merely used his watch as a theatrical prop. However, years later, a doctor friend, Martin Watson, showed me how to use a



TANNOY wind direction and speed meters.

piece of wire bent into a right angle not only to find water but iron pipes, sunken walls and other things. He and I studied everything we could find about the subject and even attended a meeting of the British Society of Dowsers when we heard a lecture in German and were shown an experiment which did not work. I later showed the method at Southampton University while attending a course in Yacht



TANNOY windspeed and direction indicator.

Research but found few people with the facility, Tony Marchaj—the aerodynamacist—being a notable exception.

After all our studies, Martin Watson and I came to the conclusion that the piece of bent wire, hazel twig or what have you was merely picking up the magnetic field produced by the underground spring or object, and, for our present purposes, we found that, if we were in good practice, we could actually pick up the earth's magnetic field itself. When walking along in the open country, carrying the piece of bent wire, our forearms would twist first to one side, then to the other. What this could mean is that it may be possible to erect some form of ærial on a boat which, by the motion of the boat across the earth's magnetic field, would produce an electric current. If this is so, the current to be expected would be a direct current of very low voltage. This current could then be amplified and could give the yacht's speed and even the distance run. A ferrite aerial would surely pick up far more current than our bent bits of wire.

Other Instruments. An apparent wind speed indicator can be of great value in yacht racing or even cruising while an apparent wind direction indicator on a dial in front of the helmsman would most certainly add a great deal to the course made good to windward. Ideally, one would want the information from both these sources combined by an " Optimum Course Indicator " but though I have been shown several attempts to produce one, I have never seen a perfect one yet.

Windspeed and Direction Indicators.
Tannoy Marine Ltd., London, S.E.27.
Walker, Thomas & Son Ltd., Birmingham 5.

The " Absolute Navigator ". The early Navigators used to be very interested in the " Magnetic dip " or the angle below the horizontal at which the North end of the compass pointed in the northern hemisphere. No conceivable use for this information can be given nowadays for yachts but it leads the mind to the subject of the " Absolute Navigator " using the gyro compass.

The Absolute Navigator depends for its action on the fact that a gyroscope should remain directionally stable in space. Thus, if it is set spinning with its axle at right angles to the earth's axis of rotation, it will turn over once in each revolution of the earth i.e., every 24 hours. This rotation can then be neutralised by a clockwork mechanism so that the resultant apparatus becomes directionally stable to the earth. If this happy state were to be achieved, movement on the earth's surface would cause rotation of the apparatus relative to the earth. To give a practical example, one could imagine a chart of your local waters with the apparatus shining a spot of light on your present position. As you moved your yacht to another harbour or river, the spot of light would follow your course on the chart. This sounds absolutely lovely and perfectly feasible till one learns that gyroscopes suffer from a malignant little demon called " Precession " which makes them wobble all over the place. However, the system just as I have described it is, in fact, used, but a mysterious process of "feed-backs" is used which is so complicated that it needs a room full of electronic equipment to keep the gyroscope steady, the details of which escape me for the moment. Even with all this lot, submarines have been known to come up after weeks of submersion yards out of their position. For further details, I can only recommend readers to the "TOP SECRET" files of the navies of the world. These can usually be obtained from the "Left Luggage" departments of buses, trams and trains.

WIRING

The essentials of all yacht wiring is that it must be protected from the weather at all places. Good plastic covered wire is very durable and weatherproof but any slight crack in the coating will allow the salt to get in and the wire will soon perish. Where possible, all electrical fittings and appliances aboard should be placed *inside* the skin. Even the navigation lights should be on tubes arising from the deck or combined in a single tube rising from the stemhead so that the lights and wiring can be protected from the weather and attended from inside the hull. Thus, one can make sure that everything electrical is working with the least exposure of both crew and equipment. The emergency flash bulb on the after deck or coach roof could similarly be in a bulge of the deck or roof to be easily accessible. Of all the electrical equipment aboard, only the mast head light, if carried, need be impossible to service in the roughest of seas.

Wiring Repairs. Even the best installations can give trouble but, if all the wiring and appliances are internal, wiring repairs would not be difficult. The only possible source of trouble might lie in the joins of the wiring and where the various "points" are to be found where the different appliances are to be placed. Weatherproof plugs and sockets are the answer here. These can be bought.

The ever increasing range of sealing compounds has come to the aid of yacht electrics. These can be solid setting materials such as epoxy resins which can permanently encapsulate a piece of apparatus to withstand immersion, or they can be removable, such as the cold setting silicone compounds which can be poured on to components or fittings and will set to give complete protection but, if necessary, can be "peeled off" at will. Another weapon to combat the corrosion of electrics by salt air is an oil (e.g. "Electrolube") with good cleaning properties and low conductivity which is of value in making good contacts in plugs, sockets, switches and commutators.

CONCLUSION

Yacht electrics is a fascinating subject. Electricity can be the most valuable friend to yachtsmen if properly installed but it is an absolute curse if it fails to work. In general, the answer lies in the use of apparatus with a low current consumption so that the accumulator can be kept fully charged. Dry batteries can be kept as a stand-by. All wiring should be well weather proofed and placed internally, if possible.

YACHT VENTILATION

BY

JOHN MORWOOD

In collaboration with George Dibb, James Morwood and Norman Naish.

Foreword. Though I actually had to study ventilation methods once, I find it hard to write about *Yacht Ventilation.* This is because my impression of sailing is of far too much ventilation i.e., sitting in and sleeping amidst cold draughts. I have never had the doubtful pleasure of being confined in a battened down yacht in a gale among fug and drips. Indeed, my only contact with the need for yacht ventilation was in looking over a yacht in which someone had sailed the Atlantic. The fumes of unwashed humans and damp were still coming out of the hatch, weeks later.

Introduction. Owing to the fact that the air which one wants to get inside a yacht is filled with dollops of water and is moreover fully saturated and usually bitterly cold, there is no elegant way of ventilating a yacht. An additional fault is that the devices for getting air below or letting it out must consist of knobs on deck which will foul warps.

There are three main general principles of yacht ventilation :

1. Cutting holes in the deck and roofing them as in the mushroom type. Air will then be able to wander in and out of the yacht according to local variations in pressure at the different vents, i.e., it is " passive."

2. Blowing air in to increase the air pressure inside the hull. This " active " ventilation has the advantage that it will at least *try* to prevent drips from leaks in the deck and around hatches. There is also a theoretical advantagd that the compressed air should be warmer but this doesn't seem to materialise in practice.

3. Sucking the air out of the hull, letting it enter through the crevices in the hatches and anywhere else it can find a way in. This has the advantage that the device which sucks air out is easier to make water-tight.

The general principles of yacht ventilation adopted will naturally depend on the place where the yacht is kept e.g., the tropics or what is jokingly called " the temperate zone " ; whether there is usually plenty of wind or frequent calms and light winds. It will depend on what we want the ventilation to accomplish.

The Purposes of Ventilation. These are : 1. To provide air which is pleasant to breathe. One air change per hour in a living room is considered stuffy. Three changes per hour is regarded as pleasant and good. The Englishman, however, seems to tolerate 6 changes per hour in his home without central heating. I do not know the relative figures for the smaller space of the inside of a yacht.

2. To dry and, if possible, warm the inside of the yacht.
3. To provide oxygen to the insides of cupboards to protect food.
4. To aerate unseen spaces inside the yacht to prevent " dry rot ".
5. To ventilage engine rooms.

Airflows inside the yacht. Ideally, one would like to have the air intake at one end of the yacht and have a straight through flow to the other end, with the air looking into all the lockers and dead spaces on the way. This has the disadvantage that water comes aboard more at the ends of a yacht than in the middle and the air intake would tend to take some of this below. As a result, many yachts take in their air in the region of amidships and let it find its way out where it will with a tendancy to have stagnant air in counters and forepeaks, especially where there are overhangs. This is therefore putting the crew comfort before the comfort of the materials of the yacht. In general, one should try to decide on the general airflow one wants inside the yacht before deciding on the means of getting it.

Condensation. Ventilation by itself will not as a rule prevent condensation inside a yacht unless it is very well insulated. Not only is the incoming air more or less saturated with water vapour but the calor gas stove itself produces water vapour and, of course, cooking increases the problem.

There are three effective methods which may be used according to accessibility and curvature.

Where the area to be insulated is flat or nearly so, expanded polystyrene such as Jablite which comes in a variety of sizes and thicknesses is most effective. The difficulty with this material, however, is that it has no surface strength and shows indentations where it is knocked. It makes a very good ceiling however in the form of acoustic tiles.

The second method is painting with cork paint, or if a smooth painted surface is required, with some substances such as Seculate, manufactured by Seculate Ltd., 7-9 St. James's St., London, S.W.1. This firm also provides a paint which can be painted on this material to give a standard finish.

Ventilation Devices. If powered ventilation is required commercial electrical fans can be used so, for the purposes of this article, we will only consider ventilation by the natural wind.

If there is no wind, everything can be opened up and enough air obtained for practical purposes. In the tropics, a " Wind sail " can be rigged to funnel a light air down the hatch to give some air and coolness below.

Mushroom Ventilators. These are in very common use. They consist of a short tube rising from the deck covered by a dome of metal which can be screwed tightly down to make an airtight and watertight

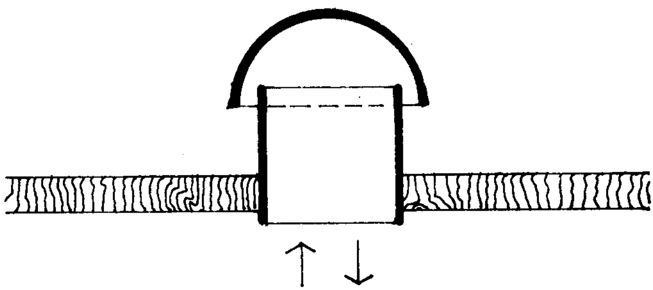


Fig. 1. *Mushroom Ventilator.*

seal. They work well at moorings and in harbour but, when spray is coming over in large lumps, they let in water and have to be tightened down, thus defeating their object of ventilation. The general shape of the mushroom ventilator is rather like a venturi tube in reverse and one might wonder if it might produce a positive pressure trying to drive air into the yacht. This effect is, however, unlikely.

The Cowl Ventilator. This is the usual type of ventilator for large ships. Its capacity for gulping in air is greater than with any other types and the narrowing in from the " Bell mouth " causes increased airspeed and cooling. Baffle plates can be put inside the cowl to prevent much water from getting down them but the *Dorade* box is far more effective. Small scuppers at the bottom of the box let out any water which gets in. Cowl ventilators are directional and have to be turned into the wind. They act as air extractors if turned the other way.

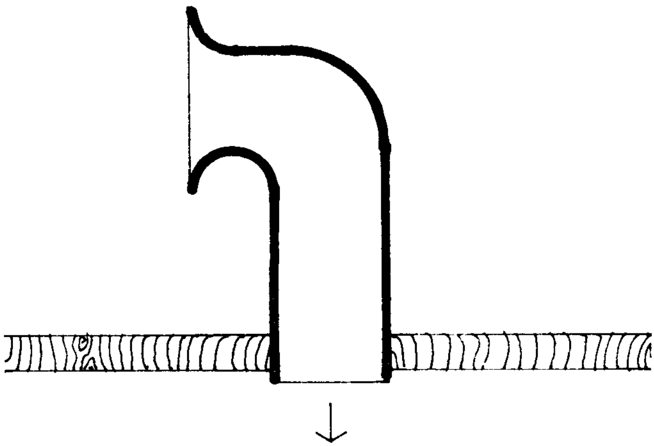


Fig. 2. *Cowl ventilator.*

One of the objections to the cowl ventilator is its capacity to foul warps. To avoid this, the cowl itself may be abolished and a box with an opening in the top of its fore surface, a baffle plate and one or two tubes down into the cabin can be used as in the drawing. If this box is built on to the forward end of the coachroof, it will hardly be noticeable. It is customary to put cowl ventilators or a *Dorade* type box at the forward end of the cabin, thus circulating the air from this point to both ends of the yacht.

The Stemhead Air Intake. Some yachts of recent years have had baffle box air intakes built into the top of the bow just behind the stem. This part of the ship only very rarely is bombarded with heavy spray and the two intakes are seldom both exposed at the same time. *Dorade* type tubes seem to me to be the best way to arrange this system. It would also be possible to take in air from the pulpit fitted around the bow but I have never heard of it being done.

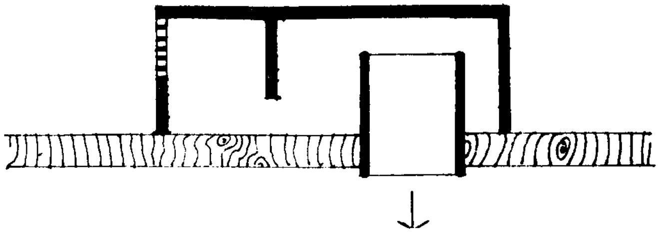


Fig. 3. DORADE Box ventilator.

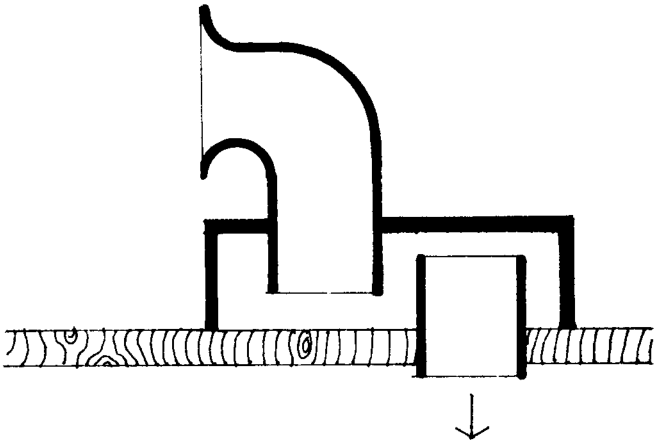


Fig. 4. DORADE Ventilator.

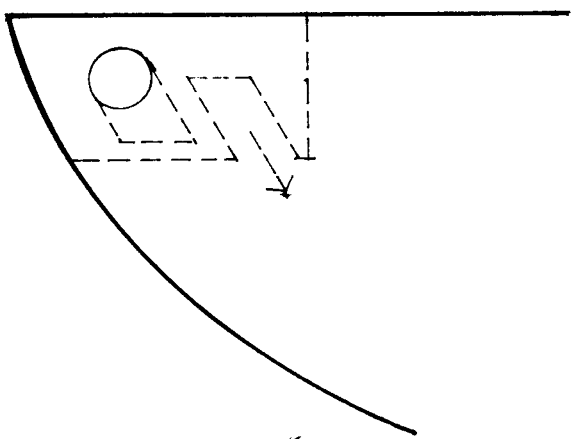


Fig. 5. Sternhead air intake.

The Swan's Neck Cowl. This is shown to complete the picture but its effectiveness is not known to me.

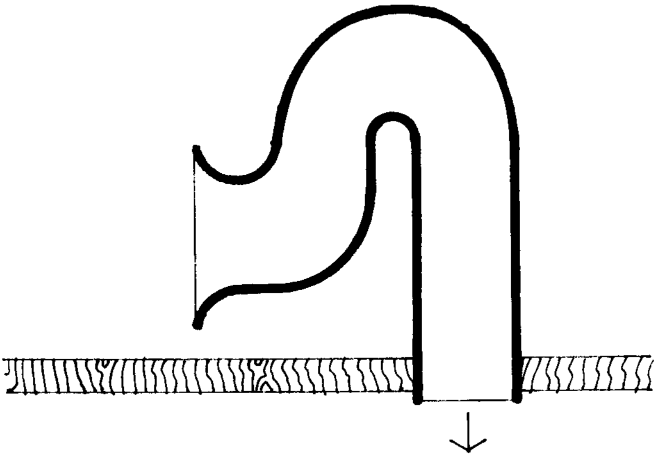


Fig. 6. *Swan's neck cowl.*

Venturi Tube Ventilators. The drawing shows a section of a " Venturi tube ". What it indicates is that, when air flows through a tube with a constriction in it, there is a fall in pressure at the con-

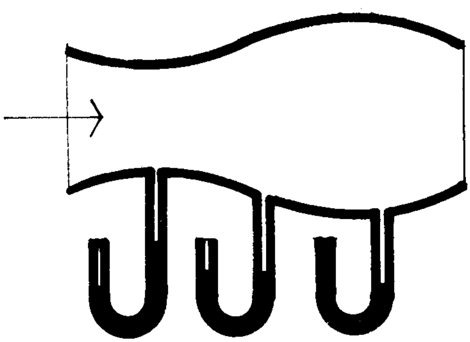


Fig. 7. *Venturi Tube.*

striction. The drawing also shows an expansion in the tube and an *Increase* in pressure above atmospheric. This condition will only vaguely appear in practice, however, because the air flowing along the tube is likely to break into eddies where it expands and, to delay this, it is not advisable to have an expansion of more than 10° at any point. However, by dividing a tube into partitions, each of 10°, a total angle of about 30° may be obtained. The venturi tube principle can be applied to yacht ventilation in several ways.

The "Dolphin's Head." Though not strictly a venturi type, this air intake could be useful at times. The nozzle is pointed into the wind and the widening tube warms and dries the air as it flows along into the accommodation. A small hole in the bottom of the "beak" will let out any water which gets in. The main two faults are the directional properties and the small amount of air which is taken in.

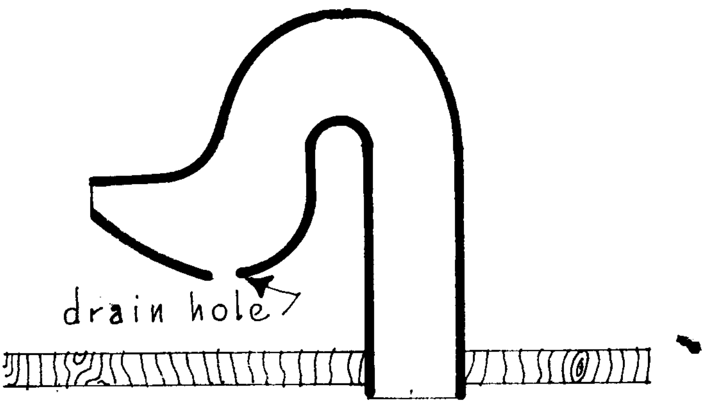


Fig. 8. *Dolphins head ventilator.*

"Megaphone" Venturi. The drawing shows a possible type of ventilator, using the venturi principle. A conical tube with the point open is put into a ring tube into which it opens at the top. The bottom of the ring is open to a vertical tube which enters the boat. If, now, the large end of the cone is pointed into the wind, air is sucked up the vertical tube at the bottom. If the small end of the cone is pointed into the wind, it is hoped that air will be driven down the vertical tube. One of this kind of ventilator placed at either end of a yacht with the smaller ends pointing outboard would give a continuous airflow through the yacht from end to end. The faults would lie in the relatively small amount of the airflow and the vulnerability of the device. However, the vulnerability could be reduced

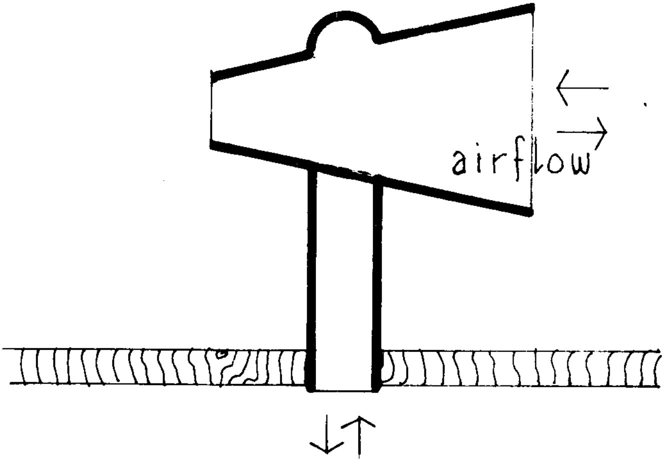


Fig. 9. *Megaphone air intake and extractor.*

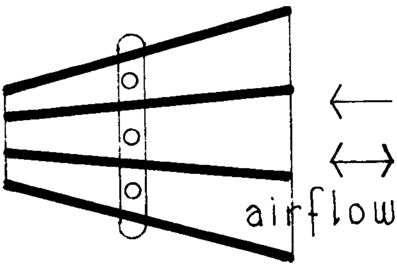


Fig. 14. *Sternhead air intake and extractor.*

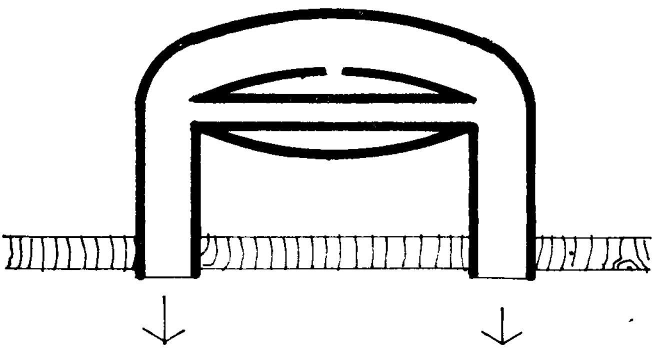


Fig. 10. *Oyster shell air intake.*

greatly by building it onto the stemhead as shown in the drawing, converting it into a triangular form to fit on top of the stemhead with fillets to ease the airflow expansion.

The Oyster Shell Air Intake. This is a positive venturi system using two shallow cups, placed with the concave sides almost touching. The airflow between them gives a positive pressure which is collected by a tube placed over the top. The lower one would have to have a small hole in its centre to let out any water which got in. This system would be non-directional.

The Reverse Oyster Shell Extractor. This is the same as the previous system but the shallow cups are placed with their convex sides almost together to give a negative pressure between them. Even a flow of water between the cups is liable to extract air so this system could be very good indeed for the non-directional type.

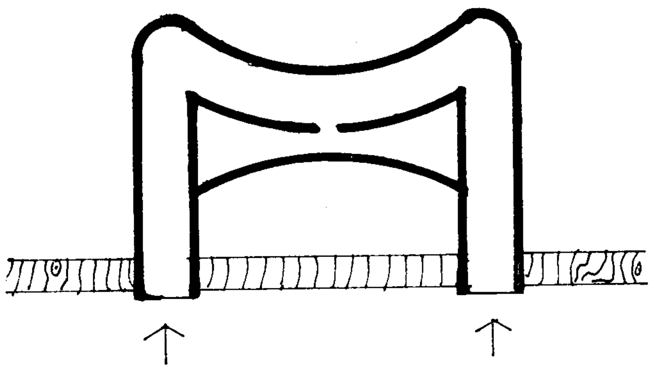


Fig. 11. *Reverse oyster shell extractor.*

A Combined Pressure and Extractor. It is not a matter of great ingenuity to combine the last two oyster shell types into a single unit which puts air into the yacht through one tube and extracts it through another. This could be useful for ventilating a closed space such as a forepeak.

The Flettner Rotary Extractor. Members occasionally write to me asking about the Flettner rotor ships. These were an attempt to make commercial sailing ships pay their way by using the so-called Magnus Effect or lift derived from a spinning cylinder. Up to three cylinders were put onto various ships from a yacht to a large sailing hull and made to spin. The value of the Magnus Effect was proved but the ships did not evoke any enthusiasm whatever and the idea was dropped. The experiments were written up in the book " *The Story of the Rotor* " by Anton Flettner.

In the rotor ships, the cylinders were spun by diesel engines, I think, but a way was found to make the wind turn the rotors and this method has been the only thing which has survived from the very interesting trials. Spinners to the design of Flettner are mounted over a hole and produce a negative pressure which acts as a very good

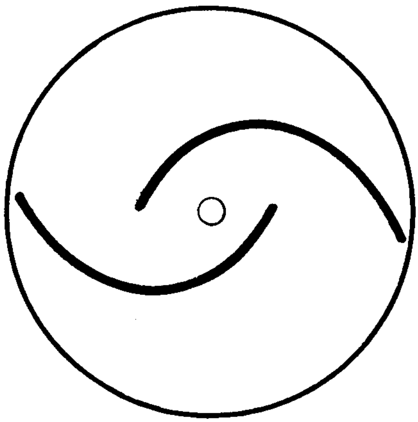


Fig. 12. *Flettner Rotor Air Extractor.*

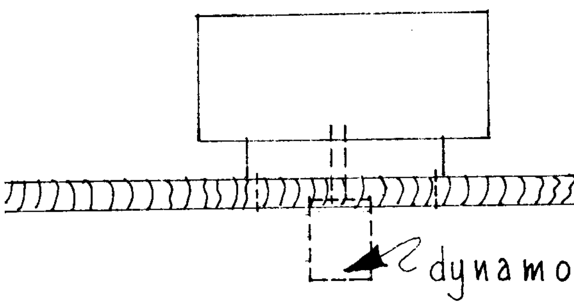


Fig. 13. *Flettner rotor air extractor and dynamo.*

air extractor. The spinning rotor keeps out the rain because of the centrifugal force and spray could well meet the same fate. They are non-directional and could well be used on yachts. The rotor might be attached to a small dynamo, if it produced enough power and thus charge the yacht's accumulators. If this were possible, it would be the ideal overall extractor device.

180 YACHTING ACCIDENTS

BY

PETER TANGVALD

Reprinted from Yachting Monthly *by kind permission of the Editor.*

The Author is a 39-year-old Norwegian engineer who gave up his profession and took to ocean cruising in his own boat. In 1957 he sailed single-handed in his 45ft gaff yawl *Windflower* from West Mersea, Essex, to Los Angeles. Two years later he bought his present yacht *Dorothea*, a 32ft 11 ton Harrison-Butler designed cutter built at Whitstable in 1934, and set out from Birdham Pool, Chichester Harbour. When he returns to England this summer Tangvald will have circumnavigated via Panama, the Torres Strait, the Red Sea and Mediterranean.

He says that *Dorothea* "has no cockpit, no engine, no electricity, no radios, no heads, no winches, no gadgets of any kind . . . I greatly appreciate the simplicity of maintenance". That the little ship can sail fast was shown by one passage he made from St. Thomas to Panama, 1,050 miles in seven days noon to noon and anchor to anchor, averaging 150 a day for seven consecutive days, a remarkable feat for a singlehander.—Ed.

Seven years ago I started ocean voyaging with great confidence and no fears, because I thought that accidents happened only to others. After a grounding off Littlehampton, a galley fire in the bay of Biscay, and a near foundering at sea close to the West Indies when my stem fastenings broke, I started to worry.

The bottom of the sea is full of sunken ships, and I realised that at the rate I was going on my own *Windflower*, 21 ton gaff yawl, ran a risk of joining that silent fleet. I then decided to do something about it and try to stay one step ahead of fate, but it is difficult to show care when we do not know what are the dangers to look out for. I started to inquire of my fellow yachtsmen, therefore, about the near-mishaps they had had. Before long I had an impressive list of real mishaps. After seven years this list has grown to almost 200, counting only the men and the ships that I have known myself in various parts of the world. The following are a few examples which show some of the most frequent causes of disaster and thus what to guard against.

On 6 December, 1958, I dropped the hook off Cedros Island in Mexico. On my way ashore in my dinghy I was hailed from an

American ketch anchored very close inshore and invited on board. They introduced themselves as the owner, his wife, a daughter and a friend as crew. *Svea*, their ship, was a 40ft schooner kept in immaculate condition, but I was so surprised to see them anchored so close to the shore and in very shallow water that I asked them if they did not worry about the possibility of an easterly gale, as from that direction the anchorage was unprotected and it would be an on-shore wind for us. They reassured me, saying that easterly winds never happened at this time of the year and that in any case their powerful motor would soon take them to safety. Twenty days later when I arrived at Los Angeles, California, I got the news: *Svea* was a total wreck among the rocks of Cedros Island. She had parted her chain in a sudden squall from the East while everybody was ashore having a meal.

The well-known Colin Archer type ketch *Viking* in which the Holmdahls sailed round the world just after the war was later sold to an American who successfully single-handed her as far as the Galapagos. There ended her trip, for one night during his sleep the anchor rope chafed through, and the ship drifted ashore where the swell soon broke her up before anything could be done. I did not see the wreck, but while I was in the Galapagos in March 1961 in my present ship, a 36ft Harrison Butler cutter, Gus Angermeyer a well-known personality there, showed me *Viking's* mast which is now stepped in his home-built sloop.

The moral would seem to be that rope is not safe among rocks, but the following story shows that chain is not always safe either : *Si ye Pambili*, a 37ft. ketch left Torquay in August 1959 with five young men headed for the South Seas. In the summer of 1961 she was anchored next to me in Papeete, and I waved them farewell when they left for Rurutu, a couple of hundred miles to the South. Six weeks later they were back on a trading schooner with just a few of their belongings. Their ship was a total wreck on the shores of Rurutu. Bill Baker, one of the owners, wrote the details of the accident in my log on 21 September 1961, and explained that their chain parted, even though it was of generous dimensions and in good condition. They had had ample scope out and the depth had been sufficient to give a good spring to the chain, and the wind had only been moderate. But investigation revealed the reason of the rupture : the chain had caught on an underwater niggerhead almost underfoot, the ship thus holding the chain tight straight up and down. In the heavy swell prevailing at the anchorage something had had to break !

If, in an exposed anchorage, we are not sure about the bottom, an anchor watch would seem desirable. Failing this I consider that a second anchor out is a good and cheap insurance. In any case, anchoring should always be done with maximum forethought.

Among the yachts lying in Papeete in July 1961 were two ill-fated yachts, yet nobody could have guessed it by their looks. The one was the beautiful 38ft double-ended ketch *Svea* (no relation to the schooner wrecked on Cedros) with owner Bob Kittridge from California. This was his first boat, but he made up for his limited experience by extreme carefulness and a meticulously kept ship so well equipped that she even floated below her marks. The other ship was the *Marinero*, also a 38ft ketch but with a counter-stern, also well kept by a careful owner and from California. On board were Floyd, the owner, and his wife, two small children and a man crew. They were both headed west and a few months later in a letter from Floyd I learned how his crew had fallen over the side in the very fresh tradewind and was lost before they were able to find him, despite the broad daylight.

Within a few weeks of this accident the *Svea* lost a woman crew over the side in the middle of the night in the Coral Sea south of Port Moresby. The woman was never found, despite Bob's searches and calls for help on a radio. He was still very upset when he told me the story himself in Rhodes in March 1963 when we were again anchored next to each other. The moral : don't fall overboard, as you might not get back.

Fire is a frequent cause of disaster and particularly so in ships equipped with petrol engines or bottled-gas stoves. On 21 September, 1961, outside of Golfe Juan, France, there was a dull explosion in the bilges of 48 ft. sloop *Corse II* as the self-starter button was pushed to start their diesel. The owner, M. A. Bonfanti, told me that the explosion was probably due to an accumulation of butagas through a minor leak which had allowed the gas to settle in the bilges. It had not been severe enough to do any real damage to the ship, but it had unfortunately smashed in the generator's fuel tank. Despite the five fire extinguishers on board, the crew soon had to give up fighting the petrol fire of the leaking tank, as the black smoke choked them. When the heat of the fire also ignited the main engine's large diesel tanks all hope of saving the vessel went and the crew escaped in the dinghy.

Jean-Pierre Leroy, lying next to me in his 40ft *Toutdroit* in July 1963 in Marseille, told me how he had lost his previous ship a few months earlier. At the very instant he had pressed the self-starter of his petrol engine the ship blew up and he found himself in the water as his ship disappeared in flames. Fortunately, a steamer, on which the accident had been witnessed, soon fished him out.

In Tahiti Danny Weil on his present ketch, *Yasme III*, told me about the three yachts he had lost in his life. *Yasme I* was lost on a reef of the Coral Sea ; *Yasme II* after running aground on Union Island (West Indies) in March 1959, and between these two he lost a yacht on which he had not yet had the time to paint her name. While refuelling at the dock barely twelve hours after the purchase in Holyhead, Wales, she blew up. Danny told me with a smile that if I insisted to have a name on her I may call her *Yasme I½*.

While everyone realises the convenience of motors and butane gas, no one should forget that inflammable fuel is a potential source of danger. The installation of fire extinguishers might look impressive and reassuring, but these can only, at best, be a cure. Prevention is far more important and no effort should be spared to have the best and the safest possible installation. If in doubt a professional survey by a firm of good reputation might save your ship and perhaps even your life.

While in Tahiti I heard about a yacht which had been wrecked for lack of an engine in the entrance pass to Huahine, an island about 180 miles from Tahiti. As I sail without an engine I was interested to see for myself exactly what had happened, so I sailed over to that island.

There was not much left of the wreck, but the local gendarme, who also served as port captain, showed me the files on the accident as he was only too glad to have company, being the only white man on the island. According to this file, the yacht's *engine had stalled* right in the middle of the pass where the strong beam wind had pushed her on the reef before they had had the time to hoist her sails. And indeed I could even see on the photographs taken immediately after the grounding, that she was pounding on the reef with her sailcovers neatly on !

Thus it was a misleading half-truth to say that she had been wrecked for lack of an engine : she had in reality been wrecked because her skipper trusted his engine too much. Had he motor-sailed in under, for example, staysail and mizzen or had at least kept his sails ready for immediate hoisting he would probably still be afloat today.

Outside of Corsica on 16 May, 1963, the engine of *Sylvia*, an ex-12-Metre, stalled. The four men and one women on board had only limited experience and were unable to hoost the sails in the gale. They tried to anchor but both anchors failed ; the kedge warp parted at deck level and the main anchor broke at the shank. As the yacht began to drive towards the shore they put on their lifejackets, and tried to reach the shore by swimming or in their tiny dinghy before the ship would be smashed among the rocks. None of them made shore alive, and the autopsy showed that death had occurred through broken skulls rather than by drowning.

We should never abandon a yacht too soon. This fact was further illustrated by fate's irony when the crossbar of the broken anchor finally caught under a rock and thus held the ship in safety away from the lee shore. *Sylvia* is now moored next to me here in Cannes, and does not even have a scratch in her poop to show for the accident which caused the loss of five lives.

On a day in April, 1958, Bernard Moitessier signed my guest book in Trinidad and made a sketch of his self-steering wind-vane. A few weeks later his boat was a total wreck among the rocks of St. Vincent Island. He had adjusted the vane for that island and gone to sleep, not forgetting to set the alarm clock so he would wake up in safe time. It is standard practice among single-handers but a dangerous one. This time the alarm clock failed to ring and Bernard did not wake up until the sickening crash of the yacht among the rocks.

Thus ended his proud little ketch *Marie-Therese II* which he had built himself to replace the original *Marie-Therese.* The latter was lost on the Chagos Islands at night when he miscalculated his longitude on a passage from Singapore to the Seychelles. However, Bernard avoided the fate of *Sylvia's* crew by staying in his ship until the breakers had pushed her so high up on land that finally he could step ashore, hardly getting his feet wet.

In Fort-de-France I also met the beautiful Colin Archer 35ft ketch *So Long II*, owned by Egil Ruud and with Ulf Brudvoll as crew. They were from Oslo on a round trip to the sun. The ship was built in 1913 and kept in perfect shape and splendidly equipped for deep sea cruising ; she was, in fact, the type of boat to dream about for making that cruise to Tahiti. Yet a few weeks later she sank in a severe gale south of the Azores. Her garboards sprang a leak and the crew was horrified to see that there was a gap almost ¼in wide for a length of about six feet. Even their large fishing-boat-type bilge pump was unable to keep up with the water coming in, so they tried to stop the leak from the inside ; but the more rags they stuffed in the slot the more they pushed out the planking where the fastenings were broken. They were in the shipping lane and were both picked up just in time. Even the strongest-looking ship would do well to have a survey at regular intervals, for often it is the fastenings that perish before the wood.

Somewhere south of Almeria in the Mediterranean, in September 1958 the 13 ton T M yawl *Eidothea* sank, taking with her my friend, Jul Nielsen, a well-known Norwegian ocean sailor. When I was in England last in May 1959 I looked up her owner to hear exactly what had happened. His story was tragic but not unusual. *Eidothea* was a Falmouth quay punt type built by Jackett at Falmouth in 1908, but was in good condition and had always been well kept. The owner considered his ship was very seaworthy and suitable for crossing any ocean as well as any other yacht. However, he said that the storm was of such violence that the yacht was constantly submerged by the seas and water was coming in through the skylights, the ventilators, the mainhatch and the 'water-tight' cockpit faster than they were able to pump out. Realising that his ship was sinking, the owner decided to sacrifice her in the breakers, hoping to save their lives rather than founder at sea. But the yacht leaked faster than he expected and sank when still a few hundred yards from shore. The owner was washed unconscious ashore in his lifejacket but no one has ever found Jul. This shows that the standard yacht is not safe in a real storm at sea unless she can be made as tight as a submarine, yet most yachtsmen are satisfied if their skylight and hatches are just rainproof.

We were three yachts together in Casablanca in October 1960, all headed for Las Palmas in the Canaries and thence on to the West Indies. There were *Volharding*, a well-found 27ft Dutch steel-built sloop, *Raider*, a salty-looking deep and heavy gall ketch from England, 32ft overall and of 10 tons T M, built in Scotland back in 1907, and my own 32ft 11 ton Bmu cutter *Dorothea*. Aboard *Raider* were her owner, Colin Gallon, and a 22-year-old American girl as crew.

We all three left at intervals during the 19th with a favourable weather forecast, agreeing to rendezvous at Las Palmss. Two days out I experienced the strongest winds of my sailing life and had a rather miserable time. One huge sea submerged my little ship completely, an uncomfortable experience, but I finally reached Las Palmas with no serious damage. A few days later *Volharding* came in, having ripped one sail, lost two sea anchors, and flooded her engine with seawater.

Raider has never been seen since, despite intensive searches. We can only guess what caused her to disappear but the story reiterates that the dangers of the sea should never be underestimated.

Today's universal use of engines, electricity, radios, electronic instruments and all kinds of safety equipment is all convenient and helpful, but the primary conditions for safety at sea should not be forgotten and they remain the same as they have always been : a good seaworthy design, strong and sound construction, and an experienced, conscientious and careful skipper.

Summary.

Of the 180 accidents to yachts investigated by the author in various parts of the world, the following is a break down of some of the principal causes :

Loss of life

Part of crew drowned when yacht is lost at sea	18 lives	5 yachts
Lost with all hands	9 lives	4 yachts
Drowned falling overboard	5 lives	5 yachts
Swimming to shore from disabled yacht in heavy weather	7 lives	2 yachts
Struck by lightning	4 lives	1 yacht
	43 lives	17 yachts

Loss of yacht, no lives lost

Failure of anchor and/or cable	19 yachts
Stranding :	
(a) navigational error	14 yachts
(b) poor seamanship	11 yachts
(c) exceptional conditions	2 yachts
Fire :	
(a) petrol or bottled gas	8 yachts
(b) electric short-circuit	1 yacht
Foundering at sea	10 yachts
Capsized stern over bows by following sea (crew clung to wreckage, saved later by passing ship)..	1 yacht
Falling over while slipping and other unusual causes ..	8 yachts
	74 yachts

Damage to yacht without total loss

Grounding after anchor/or cable failure	23 yachts
Collision or dragging in port	18 yachts
Fires :	
(a) paraffin	8 yachts
(b) cigarettes	8 yachts
(c) electric short-circuit	4 yachts
Sinking through faulty W C fittings (in harbour, each salvaged)	7 yachts
Falling over while slipped	7 yachts
Dismasting at sea	6 yachts
Run down by ships at sea	4 yachts
Collision with flotsam at night	4 yachts
	89 yachts
	180 yachts

It is interesting to note that fire was caused as frequently by paraffin (kerosene) as by petrol or bottled gas, but in all cases examined the paraffin fires were got under control, while every one of the petrol and gas fires resulted in a total loss.

YACHTING SAFETY

BY

JOHN MORWOOD.

The article in the May issue of *Yachting Monthly* by Peter Tangvald on 180 *Yachting Accidents* is the only one on the subject I have ever seen. The whole question merits a great deal of further research, not only because of the lessons we can learn from it but also because we can design yachts so that many of these accidents are much less likely to occur. In the main, Peter Tangvald deals with Ocean Cruisers but the lessons to be learnt concern every kind of yacht.

The Size of Yacht. We have two conflicting items here. In general, the larger the yacht, the faster it is and thus it escapes a few storms which a slower boat would meet. On the other hand, the smaller the yacht, the stronger it is. The larger yacht will have heavier gear and thus be harder to handle in gale conditions. Its ground tackle will be heavier and hidden parts of the hull will be harder to inspect. Its draught will be greater and, due to the extra expense worn gear will not be so quickly replaced. As a result of all these things, we can clearly state that the larger yacht is far less safe than the smaller one. This is clearly borne out by Tangvald's summary where in the section on " Loss of Life," he gives the figure of 43 lives lost from 17 yachts which, when one allows for the fact that in most cases some of the crew survived to bring the yacht into port, means that most of the yachts had 3, 4 and 5 man crews.

Conclusion. Small yachts are safer at sea than large ones. 30ft L.W.L. with short overhangs seems to be about the biggest size which is reasonable. To make a yacht easier to work, the beam may be reduced till one has a yacht like Voss's *Tilikum.*

Loss of Life. 43 lives were lost. 27 of these happened because 9 yachts sank, a further 10 yachts sank without loss of life. To avoid this, the yachts would have to be unsinkable and this could be achieved by the use of polystyrene foam built into the structure. Now, a large yacht with a large ballast keel could not spare the space for enough polystyrene foam. But a small yacht could well carry enough foam to keep afloat when waterlogged. A long narrow craft could do so better still.

5 people were drowned as a result of falling overboard. Some of these fatalities would be just carelessness with nothing to prevent them but some will be due to changing of jib on a bounding foredeck so it is no wonder that Blondie Hasler abolished the jib on his single handed ocean cruiser and used the Chinese lugsail. Other people may have been washed overboard by exceptional waves. Tangvald himself was submerged completely by a huge wave. Surely, the design feature here would be to have a turtle deck similar to Hasler's (or my *Pelorus Jack* or *Rysa*). Such a deck will keep the crew below. Or, if they go on deck, they will be sure to put on safety belts.

The 7 who lost their lives because they tried to swim ashore from disabled yachts deserve sympathy. Every yachtsman knows that this is far more dangerous than sticking to the ship but obviously it doesn't necessarily appear to be so when the circumstances arise. In general, a yacht can be pounded on rocks for quite a time before breaking up so completely that the crew would be unsafe, if still with her. Trying to get ashore through high surf on a sandy beach can be very dangerous indeed if the shore shelves quickly.

The 4 people who died when their yacht was struck by lightning were just unlucky. There is usually enough salt spray about in a thunderstorm to earth the shrouds to the sea and hence protect the yacht.

Loss or Damage to Yachts, without loss of life. The greatest single factor here is the failure to the anchor and/or the cable. This accounted for the loss of 19 yachts and the damage to 23 others. The prevention of these accidents could only have been accomplished by carrying no less than three anchors and cable on each yacht, each of which could have held on its own. In fine and settled weather one anchor could be used. As the wind freshens, a second anchor would be put out with the third ready to go over if both the others failed. It should be noted that to ride to two anchors for any length of time can also be risky as the cables become twisted by the circular action of the tides and can break them both out by a Spanish windlass effect. Now few large yachts can carry three sets of ground tackle. Indeed, only a small light yacht could do so.

Stranding. Tangvald gives the causes for this as (a) Navigational error. (b) Poor seamanship and (c) exceptional conditions. These are human failures and can hardly be avoided by any design change. However, by having a small weight of yacht and a shallow draught, more time is available in which to attempt to save the yacht. 27 yachts were lost from these causes.

Collision and Dragging in Port. This accounted for damage to 18 yachts. Again, a shallow draught would be the only way to prevent this damage though lightness in weight would allow for easier handling. Shallow draught would allow the yacht to be put out of the way of larger craft where damage would be far less likely.

Fire. 29 yachts were destroyed or damaged by fire. Those caused by petrol or butane gas were the destructive ones. Fires cause by paraffin (kerosene) and cigarettes (8 each) were got under control. The prevention here is to use electricity for lighting and paraffin (kerosene) for cooking. Electrical short circuits, however, caused 5 fires.

Falling over when slipped. This destroyed 8 yachts and damaged 7. Shallow draught would have probably prevented this cause of damage.

Sinking through a faulty W.C. Don't have a W.C.

Capsizing Stern over Bows. Dismasting at Sea. No comment.

Run Down by Ships. 4 yachts were damaged under this heading. A good radar reflector and proper lighting at night can only be suggested.

Collision with Flotsam at Night. Again, 4 yachts were damaged. A shallow draught yacht which can ride up over flotsam might be less damaged.

Overall Conclusion. Captain Voss's *Tilikum* seems to be the answer to most of the accidents mentioned by Tangvald. Personally, I would have a single lugsail and a turtle deck to get room inside. A right angled V keel angle and a ballasted centreboard would give a great improvement in windward performance. A slightly enlarged version of my *Rysa* design would be nearly what is required, though I think she would be a bit too full aft. *Pelorus Jack*, too, is nearly right.

All the yachts mentioned in the previous paragraph have the virtue of being able to have enough polystyrene foam to cover their ballast and are thus unsinkable. They are light enough to carry three sets of ground tackle and be rowed by oars so that no engine need be carried. Their shallow draught would allow them to be tucked away in harbours out of the way of danger of collision. The sail area would be small and could be kept in first class condition for relatively little money.

With a boat such as we want, we would be safe unless struck by lightning or run down by a ship or we just made some stupid mistake. As far as the design went, however, we could feel that the utmost safety was built into the yacht.

DESIGN FOR AN A.Y.R.S. HULL

BY

P. D. A. MOLE,

115 Woodwarde Road, London, S.E.22.

1. *Requirements.*

A stable day-boat was required to carry two adults and one child, but also to be easily sailed single-handed. A trimaran carrying a single sail on an unsupported mast seemed to satisfy this specification. Having seen the models and read the description of the A.Y.R.S. hull I decided that it promised an easy way to build a well-shaped hull.

2. *Geometry.*

There being no exact description of the hull I have worked out a geometry which, I think, gives a different shape to the ones described before. It is, of course, only one of many variations on the basic theme.

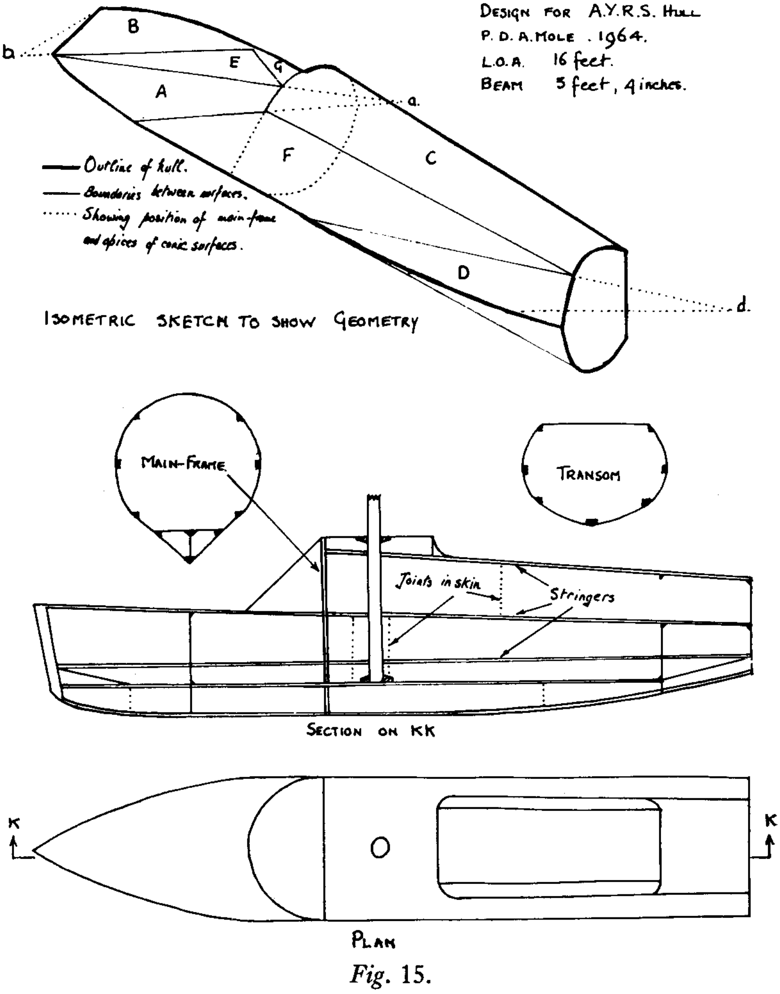


Fig. 15.

The midships section is formed by the main frame, which is a right-angled Vee underwater, surmounted by three-quarters of a circle. The underwater surface amidships is thus formed of two flat surfaces, one of which (F) is shown on the isometric sketch. Towards the stern this flat surface (F) merges into a conic surface (D) formed by projecting the lower edge of the transom from an apex (d). Above the flat surface (F) the stern portion of the hull is another conic surface

(C) formed by bending the plywood skin around the arcs of two circles, one arc at the main frame and the other arc at the transom.

Forward of the main frame the flat surface (F) merges into a conic surface (A) formed by projecting an arc (about 20°) of the main frame from an apex (a). This conic surface (A) merges into another flat surface (E) which itself merges into another conic surface (B) formed by projecting the edge of the fore deck through an apex (b). Finally there is a small conic surface (G).

Except for the deck and transom this hull can be formed from a single sheet. However the joint between the surfaces A, G and C is a curve and the sheet must be cut along this curve, in fact in this particular design, there will be a small gap left here after cutting and bending.

This particular geometry was chosen because it gives gentle underwater curves and puts the worst bends in the ply where they should cause least difficulty in construction.

3. *Construction.*

A plywood keelson and floor will be joined to make a Tee-beam. The stem, main frame and transom will be attached to the Tee-beam, then stringers will be added to make a frame for the plywood skin. The plywood skin will be attached to the frame in separate sheets and joined together afterwards. Most of the stringers have 45° isosceles triangle section made by sawing a square-section beam down the diagonal, this feature reduces the amount of shaping to be done.

I hope to finish construction in 1965, so far the floor, keelson, main-frame and transom are made I expect to have a Chinese lugsail and box section floats on the first version.

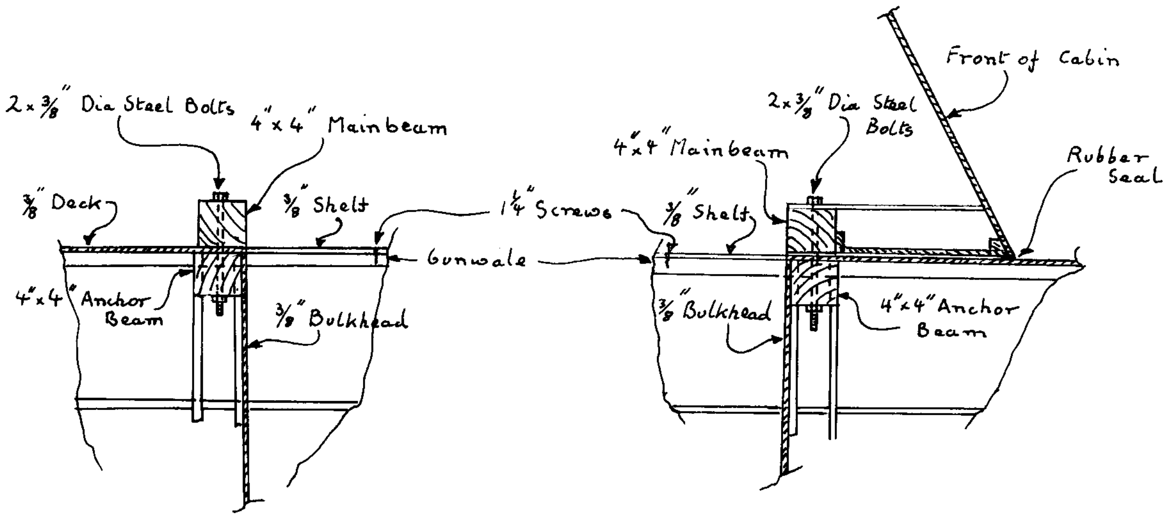
SOME MODIFICATIONS TO A NUGGET TRIMARAN

BY M. MONTAGUE-JONES

Four Winds, Walhampton, Lymington, Hants.

I built a *Nugget* trimaran from Piver's plans in the winter of 1961-62, and altered parts of it during the winter 1962-63. This article shows these alterations and modifications which have been incorporated, some essential and some desirable.

On looking at the plans, the first thing that caused misgivings were the hinges on the wings, which seemed particularly vulnerable. Accordingly the boat was built in four main pieces—a wing deck and three hulls. The wing deck was bolted on to the centre hull in the

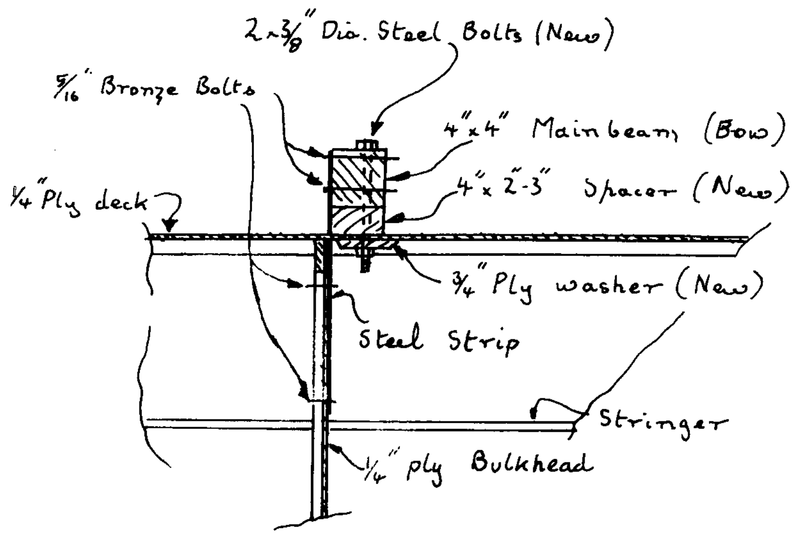


STERN BOW

MAIN HULL JOINTS

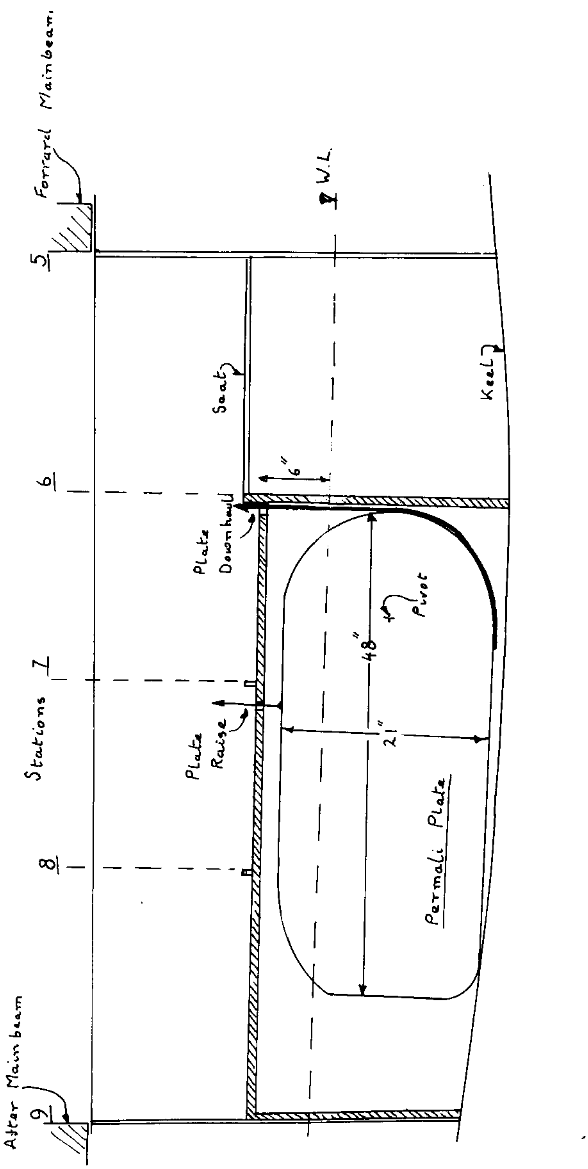
manner shown and, apart from a few leaks at the front initially (now stopped by a rubber seal) has proved completely satisfactory.

The floats were attached in the way shown in the plan but with a 1 inch by $\frac{1}{4}$ inch flat instead of angle as specified. This appeared satisfactory until on a cross Channel trip to Cherbourg in force 5-6, the attachments at the front where there is a 2 inch gap began to show a lot of movement at the bolts, the washers being squeezed into the timber and the bolts loosening until the whole of the leeward float was moving separately to the rest of the boat. This year, bolts and blocks have been put in as shown dotted which so far have shown no sign of movement.



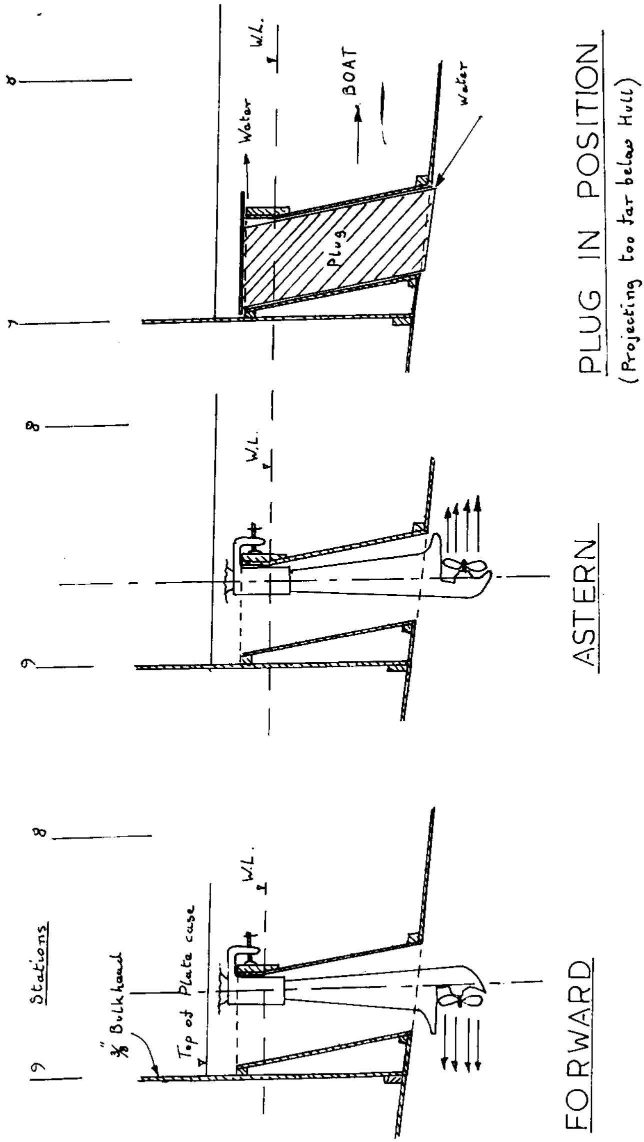
FLOAT JOINTS

When sailing in restricted shallow waters, a dagger board, despite its slight hydrodynamic advantage, gives the helmsman an uncomfortable feeling—increased as the speed of the boat rises. I have put in a conventional plate cut from a piece of 4 ft. x 2 ft. x 5/8 inch Permali, giving an underwater area slightly less than that given by the recommended dagger board. The plate is operated by ropes and care should be taken to make the front rope large enough so that it does not become jammed between the plate and the box. This system works very well, mainly because the plate is very slightly heavier than water and remains down under its own weight.

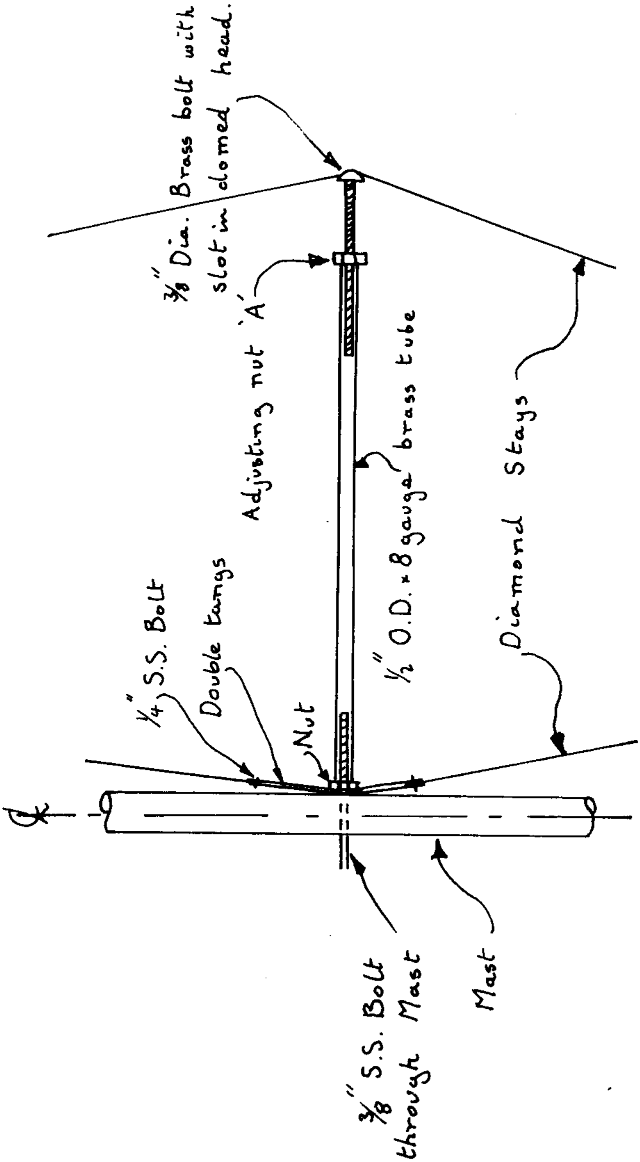


LIFTING PLATE

At the stern of the centre compartment of the centre hull, beside the plate case, I have put in an outboard motor box with an insert plug to retain the outer shape of the hull when the motor is not in use. It is then kept in one of the outer hulls.



The motor is one of the type which rotates 360°, allowing a reverse as well as forward under power which is very useful when manoeuvring a boat which is easily blown about by the wind.



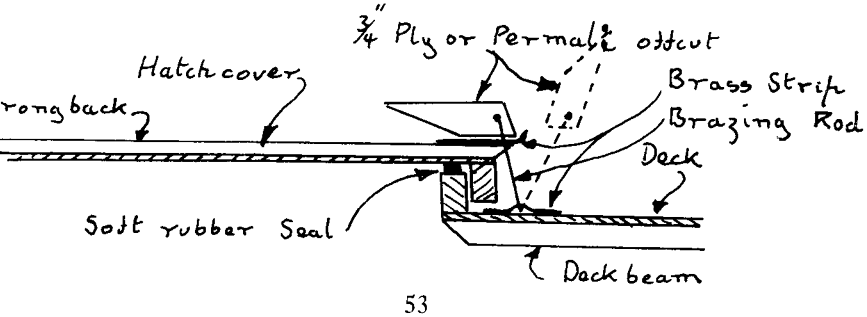
The top of the box is only three or four inches above the water level and in a swell, water comes in in large quantities if the plug is not in. This could be avoided with a long shaft motor. Care should also be taken to ensure that the bottom of the plug is exactly flush with the bottom of the boat. Otherwise, when the boat moves, the plug acts as a self bailer in reverse, sending a jet of water into the boat.

At the end of Cowes Week in 1962, we were one of the few boats to leave Cowes on the Saturday to the west. It was force 8 and we went to Beaulieu because, after a bit, we noticed that the centre set of diamond stays and the shrouds were very loose. As we went about, the mast was flapping from side to side. When we took the mast down in Beaulieu to find the cause of the trouble, we found that the main shroud bolt through the mast was badly bent (3/8th inch stainless steel) and that it had pulled down through the wood and fibreglass leaving a slot $1\frac{1}{4}$ inches long by 3/8th inch wide. We have put a large plate on each side of the mast and three other 5/16th inch bolts through 3 or 4 inches apart, put in a new 3/8th inch bolt and plugged the slot and have had no further movement.

Other than this, the mast, though only 6 inches by 2 inches spruce has been very satisfactory and quite strong enough with its rather elaborate system of diamond stays. It has been down twice involuntarily owing to a bronze eyebolt used in the forestay at the deck with no ill effects.

I have used a method of straining the diamond stays, rather cheaper than the use of bottle screws (turnbuckles), by which, instead of shortening the stay, I extend the struts as shown in the drawing, by screwing the nut "A".

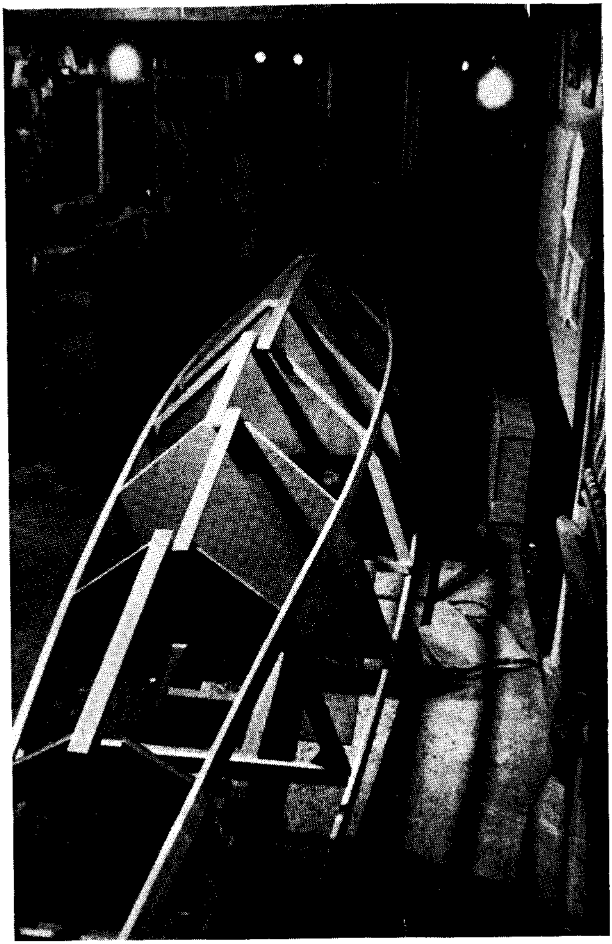
An idea for a catch for hatches, easy to use and fairly easy to make is as shown in the sketch. I use this catch in both the outer floats and they have kept water out at all times even when the floats has been continuously under water in a heavy sea.



Dear Sir,

I enclose a photo of my *Nugget* Class trimaran, Sail No. 139E, taken recently and showing her under construction. If any A.Y.R.S. members are in this district and wish to call in for an exchange of ideas over a cup of coffee, they will be made welcome.

From the experience I have had to date in building *Nugget*, I would say that this is a boat that could be built by any handyman



Peter Bailey's NUGGET.

alone, the only difficulty is in lifting the 8 ft. by 4 ft. sheets of ply, which are unweildy, rather than heavy.

Regarding the A.Y.R.S. of which I have been a member now for two or three years, I think it should remain as it is. The magazine particularly I look forward to from issue to issue, the last becoming dog eared long before the next arrives. If one issue in four proves a little heavy on the technical side, I suffer it in silence for the sake of the other three.

You yourself say that you think it is time you got your own boat and did some sailing. I have been planning to build a boat for ten years and can say that it gives a great feeling of satisfaction to be nearing my goal. I wonder how many members are like myself; full of interest but (until recently) unable to do anything practical about it. In my case, I have had to change jobs twice and move a hundred and eighty miles from Yorkshire to Essex to enable me to start building.

Since writing the previous (two days ago) I have added the keel, stem and another stringer to what is shown in the photograph. Piver certainly does not exaggerate when he says that six months is ample time in which to build a *Nugget*.

Roll on next season when I can join the others afloat.

Peter Bailey.

"Sierre," East Road, West Mersea, Essex.

LETTER

Dear Sir,

Recently, I had the occasion to read your A.Y.R.S. Publication No. 45 on Basic Research. The article which most attracted my attention was, " Catamaran Performance—Tank Tests " by Messrs. C. A. Satterthwaite and I. Quilter of the University of Canterbury in Christchurch, New Zealand.

I feel compelled to be a rather severe critic of this article for several reasons. First, it is well known that our firm has been the leading advocate of asymmetric-hull design as applied to catamarans for many years. Second, since your magazine has some influence, I feel that this article will mislead your readers into false conclusions. Third, I consider the tank testing procedure rather unscientific and quite inaccurate.

It had been my policy over the past several years to ignore the several articles I have seen purporting to prove the superiority of the symmetrical hull configuration over the asymmetrical hull. The *actual results* so far, at least in the ocean, seem to indicate that present theory is 180-degrees out of phase with reality. I will attempt to support this claim later on. Perhaps the time is past due when those of us who believe in asymmetrical hull design should submit passively to this constant denigration of the hull shape which has proved to be superior at sea over any other type to date.

Let me begin by saying that we are professional yacht designers, probably the only full-time designers of ocean-going catamarans in the world today. We could not exist without the support of the yachting public who, over the years, have acquired some faith in our designs. Because we are professional designers, rather than amateurs, our approach is extremely practical and realistic since we are dealing with private individuals who entrust us with large sums of money and because a fatal design omission or shortcoming would relegate us quite soon to the status of non-professional designers. We either come up with results or we're out of business.

Now, to get to my specific criticisms of the tank tests by Messrs. Satterthwaite and Quilter. First, the lines drawing purportedly of an asymmetric-hull on page 30 is *not* an asymmetric-hull, as we design it. This is nothing more than a " warped " hull. I am astonished that these gentlemen have ignored the first rule of deductive syllogistic reasoning : make certain that your premises are correct ! If the warped hull shown was an actual asymmetric-hull design : then what followed could have some validity. However, we never have, do not and never will design such a so-called *Manu Kai*-type hull as exhibited in your publication.

A second major criticism is that even if the lines were fairly accurate, it is unfair to compare the *Manu Kai* design of 17 years ago to the contemporary symmetrical hull. By way of comparison, it is almost similar to comparing a 19th Century mono-hull to a modern 12-meter yacht. What critics of the other school fail to recognize or realize is that there has been major, even spectacular, asymmetric-hull lines improvement since *Manu Kai*. Under the stress of competition, we have not remained static but have continued evolutionary progress.

A third major criticism is that the test tank simulates theoretically ideal conditions. Like most tank testing, this reduces the value of the results. When we design an ocean going catamaran, it is always uppermost in our minds that conditions at sea are seldom theoretically ideal. Most of the time, the wind-created waves heave, toss and undulate in dozens of different variations of conformations. How do you ease tons of displacement over and through the surface of this unpredictable and energetic medium ?

A fourth criticism is that each of the models, assuming accuracy in all other respects, should at least have the same displacement, same length overall, same waterline length and same beam. To attempt to compromise variations in model dimensions mathematically is not realistic and too likely to produce both unforeseen and unseen inaccuracies. These four points above sum up our major criticisms.

There are ocean-racing and ocean-cruising catamarans here in California that are very advanced in design about which none of you in Europe are familiar. I am enclosing our 1964 brochure so that you can see what some of these new boats are like. It is my opinion that theory must walk hand-in-hand with practice. For either theory or practice to walk along separate paths leads to the extreme danger of intellectual cloistering in an " ivory tower " on the one hand and lack of creative stimulation on the other. Though I admire the objectives of your theoretical research, I feel that at present you are out of touch with the ocean-going catamaran world, as it really is today.

If you will closely scrutinize our commercial brochure, which I am sending to you for information rather than for advertising, you should note that asymmetric-hull catamarans have a record at sea that the symmetric hull type cannot approach in any respect at present. Our catamarans hold nearly all the race course, speed and distance records for multi-hulls in the ocean today. This is pragmatic proof of some validity that there must be something in asymmetry of hulls. By the end of 1964, catamarans built to our designs will have passed the 100,000 nautical-mile-at-sea mark. This distance is at least 5½ times more than for all symmetrical hulls.

Since a defence of our design school necessarily means supporting evidence, I want to submit additional proof, *based strictly upon performance*, of the validity of our position. In the Southern California Yachting Association (SCYA) Mid-Winter Regatta held on January 21, 22 and 23, 1964, there were eight ocean racing catamarans in a fleet of almost three-hundred seaworthy yachts. Of the eight catamarans, five were of asymmetrical design and three were symmetrical hulls. The names of the asymmetrical designs were : *Pattycat II* : 44-ft. ocean racer, *Allez-Cat* : 43-ft. ocean racer, *Imua* ! and *Makai* : two 36-ft. ocean racers, and *Imi Loa* : 43-ft. cruising catamaran. The three symmetrical hull catamarans were : *Dreamer* : 44-ft. cruising catamaran, *Eunike* : 36-ft. cruising catamaran, and *La Venta* : 30-ft. ocean racer.

On all three days, the 5 asymmetric hulls finished ahead of the

3 symmetric hulls by considerable margins, both elapsed time and corrected time. On the first days, *Pattycat II* beat the first symmetrical design, *Eunike,* by 43 minutes over a 15.5 nautical mile course in 14 to 18-knot winds. On the second day, *Pattycat II* crossed the finish line 1 hour 21.5 minutes ahead of *Eunike* in 9 to 11-knot winds. On the third day, *Pattycat II* DNF-ed because of a cracked weld and *Allez Cat* defeated *Eunike* by 34 minutes over 15.5 mile course in 10 to 14-knot winds. It is also appropriate to add that the first four asymmetric-hull designs defeated, on elapsed time, the fastest CCA Class-A yacht by healthy time margins. These catamarans superiority to windward over ballast-keel yachts was especially noticeable.

In my opinion, it is a very dangerous assumption to assume that proper catamaran design is based primarily upon lines alone. We look upon the proper creation of any ocean-going design as an ideal compromise of lines, construction theory, scantlings, sailplan, rigging, and deck hardware location. By this, I mean that if one assumes perfect hull lines and the other *equally important* design parameters are ignored, the failure of the design as a seagoing yacht is predictable. An ocean-going catamaran is a complex system ; its efficiency is diminished in direct relation to ignoring even one or several of the basic design parameters.

This leads to my concluding statement. If our assumption is true that the ocean is almost never theoretically ideal (and I think that it only takes common sense to accept this premise), then the designer must always take into account the forces and contradictions which occur in every sail-boat. Ocean-going catamarans 35-ft. and larger displace several tons, and there is no way at present to avoid this problem. Displacement alone creates structural problems. Displacement creates surface entry and exit problems. Displacement creates lateral resistance problems. In my opinion, in one example out of many, the present symmetrical hull of the semi-circular hull cross-section and with shallow draft offers insufficient lateral resistance at sea to induced loads arising from both wind pressure and displacement to enable efficient weatherly sailing. The necessity for having very large centreboards, daggerboards, etc., because of this design fallacy is responsible for not less *but more* wetted surface than in a contemporary asymmetrical hull design.

The results of ocean racing here in California among the two types for the past three years seem to support my statement conclusively. No symmetrical hull catamaran has been able to beat the asymmetrical-hull catamaran in the ocean—regardless of course, sea condition or wind velocity ! Asymmetrical catamarans are beating, boat-for-boat, all competitors, and I am *not* excluding any trimarans. Their marked superiority to windward is especially noticeable.

To close for now, I must regretfully notify you once more that our lines, sailplans and construction drawings are not available except to our clients. Perhaps in the future, we will release a set of lines to your publication. Until then, for the sake of fairness as well as knowledge, may I ask that you publish this letter, without any editing, by an advocate of proper asymmetric-hull design as applied to the catamaran configuration.

Sincerely,

RUDY CHOY.

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DANGER OF BICOLOUR LAMPS

Dear Sir,

In the Correspondence columns (February Y.M., page 96) Mr. P. F. Marks suggests an arrangement for keeping an ex-Admiralty bicolour navigation light with dioptric lenses in a horizontal position on his pulpit, and I quite agree with him about the importance of this. His idea is both simple and good.

Unfortunately, there is another aspect to consider. Red and green, as used in navigation lights, are not far from being complementary colours, and when mixed together can appear *white* when seen together from a distance where the optic angle is less than 1′ (one minute). This occurs when the two images in the eye fall on the same retinal element.

Last summer I tested this with a navigation light, of the same construction with dioptric lenses, belonging to a visiting German yacht. Within 200 yards of the light the German skipper and I clearly saw the red and green, but beyond this distance they started to merge into white and farther away we only saw white.

The danger is obvious. When meeting head on a vessel with navigation lights of this type one sees only a white light and not until one is alarmingly near would one know that this ' white light ' is, in reality, a meeting sailing vessel.

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