VANE STEERING GEARS

by A. Wilcock

Reprinted from a series of articles titled 'Notes for the Novice Model Yachtsman' which appeared in 'Model Boats'

MODEL & ALLIED PUBLICATIONS LTD.
13-35 Bridge Street, Hemel Hempstead, Herts.

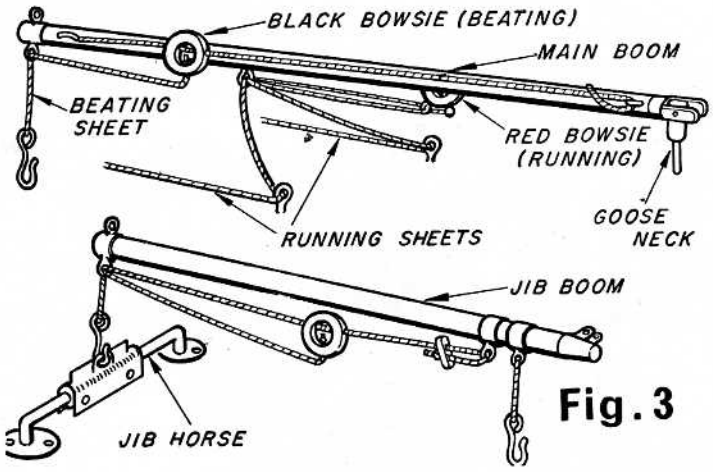


Fig. 3

This booklet is reproduced from a series of articles which appeared in Model Boats in 1965. References to "last month", "an earlier article", etc. may therefore be encountered.

Introduction

THIS is the first of a series of articles the intention of which will be to cover, as comprehensively as possible, all aspects of vane steering as applied to steering sailing yachts and in particular model yachts. It is very evident to the author from the questions he is asked at the pondside by free-lance skippers unattached to a club and just enjoying their sailing, and the more sophisticated talk in the clubhouse, that great interest is shown in the vane gear and that it still holds mysteries to many. It will be the intention to resolve these both for the novice and the more experienced. So many of the complications of the gears used by racing skippers are just devices to meet racing regulations without being impeded, or at a disadvantage, that attention will be paid to the simpler devices which can adequately meet the sailing requirements of the free-lance skipper, as well as invariably being easier to construct and therefore within the ability of many more enthusiasts. It must however be said that there is much more fun and satisfaction for even the lone sailer if he has a gear capable of executing the more complicated manoeuvres.

There are many controversial matters and opinions on getting the best both out of a boat and its steering gear. So far as practicable these will be given so that the reader may be led to try methods for himself, even if the author's own opinions are not expressed.

Later in the series designs will be given as well as considerations affecting design to enable and encourage the reader to experiment for himself. We must first, however, turn our attention to more mundane things. It is apparent that many do not realise that a yacht sails, or should sail, primarily on the "set" of its sails and that the steering gear is an adjunct; very necessary on some points of sailing but still an adjunct.

This leads us to the first instructive section under the title of 'Know the Parts', in which the various parts of the hull and rigging are described.

Know the Parts

Before trying to sail a boat it is worth while knowing the names of the various parts and what they are for. The front end of the boat is called the *bow* (pronounced bough) and the back end is the *stern* (pronounced stern, not starn). Looking forward towards the bow the left hand side is called the PORT side while the other is the STARBOARD. The cords or wires holding the mast in place are called the *standing-rigging*. The main ones, from the hounds where the jib sail is attached to the foreside of the mast (about three-quarters of the way up from the deck), to the sides of the boat are called the *shrouds*. Their point of attachment to the sides should be behind the mast by about one sixth the width of the boat. These should be very strong to stop the mast giving in a sideways direction under wind pressure. That from the bow to the foreside of the mast, to where the jib is fixed, or to the top of the mast, is the *forestay*. That running from the top of the mast aft to the deck is the *back stay*. With vane steering this stay is invariably split about a quarter of the way up from the deck and secured on the port and starboard sides so that it clears the end of the main boom and also the vane gear. It is desirable to strut the mast above the hounds with *jumper stays*. A worthwhile refinement is to fit *running back stays*; these come from the mast at the point of attachment of the shrouds and jibsail and terminate on the side decks behind the shrouds on runners so that they can be pulled tight backwards or slacked off against the shrouds when not required, a point which will be dealt with in due course. Fig. 1 shows the points already detailed.

This may seem a strange introduction to 'Vane Gears for All', but if you think so, then these introductory pages are just for you. The availability of the correct standing rigging and its correct use will make the world of difference to how your boat will sail.

The cords which hoist or hold up the sails are *halliards*, while those which adjust the swing of the foot or base of the sails are the *sheets*. These working cords (ropes in full size) are called the *running rigging*.

For the sails, the Bermudian sloop rig is now so universally used in model racing yachts that that will be the only one we will consider. This rig consists of two triangular sails. That before (in front of) the mast is called the *jib* and that behind, the *main*. The jib on its forward edge—the *luff*—is attached to the *jibstay*. The head or peak of it is secured to the mast by the jib halliard which is adjustable to enable the tension of the luff to be varied. The bottom edge of the sail is called the *foot*. The forward

corner of it is the *tack* while the back corner, the *clew*. The tack and clew are usually attached to the jib boom. This is usually made of wood in circular, oval, or rectangular cross-section. Where a radial jib-boom is used the tack is attached to the jib stay and the clew to the end of the radial jib. Both these arrangements are shown in Fig. 2. The position of the clew on the end of the boom should also be adjustable as shown.

There are theoretical advantages in using a radial jib which will be described in the next section, but the practical difficulties of a really satisfactory radial jib limit their effective use to the expert modelmaker and skipper. A simple jib boom is shown in Fig. 2 where the jib boom is hooked to the jib rack on the deck from a point (preferably adjustable) near the forward end of the boom. The after edge of the sail — the *leach* — is slightly curved, and may have *battens* — small slips of wood — in pockets to hold out the curve. The threads of the weave of the cloth must run parallel to a line drawn from the head to the clew. The mainsail is attached at its head to the mast by an adjustable halliard as for the jib. The forward edge of the main sail — the luff — lies against the mast and is attached to it either by hooks to a jack line secured down the back side of the mast, or is laced to the mast with a continuous fine cord passed round the mast and through eyelets in the luff of the sail. The author favours the latter method and finds it takes no longer to change to a different suit of sails than with hooks and the jack line.

The tack of the sail is secured to the mast immediately above the main boom either by hooking to a suitable screweye or a small tie. The boom is again made of wood and is attached to the mast at the design height above the deck by a universal joint known as a *gooseneck* which enables the boom to swing horizontally and let its after end lift. The clew of the sail is attached to the after end of the boom and, as for the jib, should be adjustable. The leach of the mainsail is invariably curved, at least in the top suit of sails, and has battens fitted to hold out the curve. This curve is called the *roach*, it improves the appearance of the sail and gives additional unmeasured sail area in the racing classes. For this reason the length and number of the battens permitted is given in the class rating rules. At the head of the sail a headboard is fitted made of light metal, bone or plastic. This helps to distribute the strain at the top of the sail and enables the sail to set better. The rating rules again specify the limiting sizes because of the way the sail areas are measured. Clearly these restrictions do not apply to boats not in a rated class and these devices should be used in these cases for appearances' sake and the normal benefits obtained.

An essential main boom fitment for really effective sailing is the *kicking strap*. This is an adjustable cord or wire from the base of the mast where it passes through the deck and directly below the gooseneck to the underside of the main boom making approximately a 60/30 deg. triangle. These various points are illustrated in Fig. 2.

Finally a word about the sheets. These adjust the angle the boom and sail make to the axis of the boat. Since this must be varied for the course being sailed, as will be described later, they must be easily adjusted. *Bowsies*, which are rings of bone or plastic, sliding on *jack lines* — tight cords stretched along the booms — are used for this. Fig. 3 shows a typical rigging of a sheet. Two are required on the main boom and one or preferably two on the jib boom. The jib sheet is attached to the deck, either to a central eye, which is quite adequate for a radial jib boom, or to a horse, which is preferable for the type of boom recommended as shown in Fig. 2. The attachment of the main sheets, one of which is called the *beating sheet* and the other the *running sheet*, will be described when we deal with sail setting.

WE saw in the introduction and rigging for plain sailing the various parts of the standing and running rigging. We can now turn to sail setting and at least start some sailing. Before we do, however, let us just go back a moment and see that our standing rigging — on which much of the performance of our boat depends — is set up correctly. This is done because if you are going to get your boat to sail well you must get into the habit of continually doing this. Racing skippers do it during a race, not only just before the start.

Start by seeing that the shrouds are reasonably taut and hold the mast upright, relative to the hull, in a sideways direction. This is best done with the hull on a stand, either on a table if your boat is small or on the floor if it is one of the larger classes and sizes. If you tighten the shrouds too much you will bend or distort the mast between the hounds and

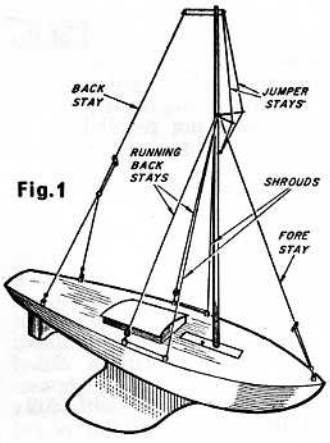


Fig.1

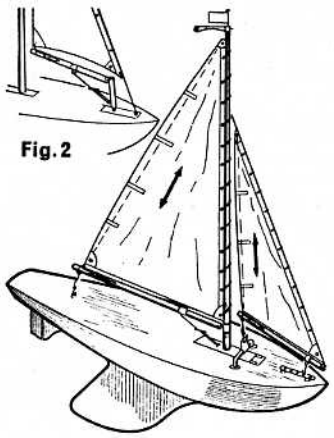


Fig.2

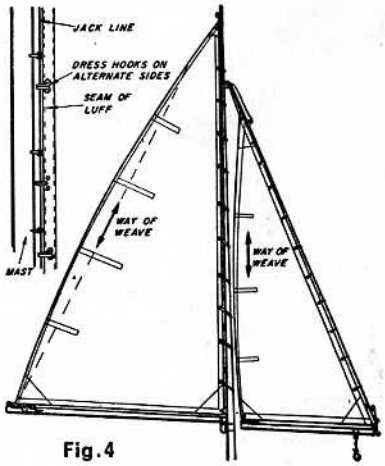


Fig.4

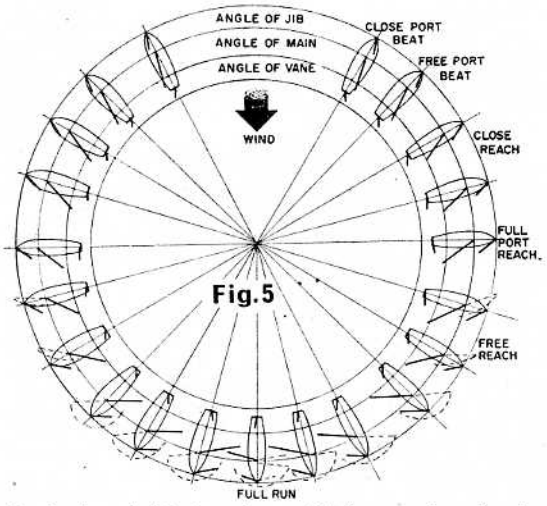


Fig.5

the deck and this is to be avoided as much as having them so that the mast can wave about. Now adjust the backstay so that the mast leans backwards slightly, say 1 in. for each 2 ft. of mast above the deck; this is called the rake. Finally tighten the forestay until it just holds the mast from being pushed backwards. Now take the boat off its stand and lay it on its side — look down the mast from its top and you should see a fairly straight mast — if not look round to see which part of the standing rigging needs adjusting to make it so. It may be that the forestay only comes up to the hounds and that the backstay is bending the top of the mast backwards from this point, particularly if the mast is light in construction. This can be corrected by fitting jumper stays which is their real purpose. It is easy to see that a main sail with a straight luff can never be properly "set" on a mast bending, as distinct from leaning backwards.

Fig. 4 shows the details of the jib sail. First notice the way of the cloth in the cut. It is important that the leach is parallel to the selvedge of the material. Do not think that the seam on the leach will give adequate strength on crosscut material because it will not. The roach on the jib is quite small, about $\frac{1}{4}$ in. per foot run. Now look at the jib stay and note this is independent of the jib halyard or uphaul and has its own adjustment bowsie — a flat one is most suitable. This separate adjustment enables the lift of the jib boom to be controlled. By putting this bowsie near the bottom it will not be confused with the bowsie near the top used for the setting of the luff of the jib which is the next point to note. Look now to the clew of the sail and see the simple means that can be adopted to set the foot of the sail. Arrange things so that the clew can be hauled back practically to the end of the boom, since the jib must be set so that the sail just clears the mast in swinging from side to side and a long unused end of the boom does not allow this. Part of the metal top to an old fountain pen or lipstick holder will be found useful material to fashion a neat strong end to the boom. The horse, where one is fitted, should allow a boom movement of no more than $12\frac{1}{2}$ deg. each side of the centre line of the boat. This is about the angle for a close beat (see later) and enables the clew to be held down fairly tight, i.e., the horse aids the tension on the jib stay.

Summing up the fitting of the jib we have (1) The way or weave of the sailcloth must be parallel to the free edge (leach); (2) The jib stay must be really tight; (3) The jib boom is hooked to the jib rack on the deck so that its end just clears the mast in swinging from port to starboard. The use of the other hook positions will be discussed in sail trimming.

Before finally leaving the jib it is appropriate to say a few words about radial jibs as mentioned earlier. Looking at the jib arrangement just discussed, two disadvantageous features should be mentioned. The first is that to hold the clew of the sail down the boom is used as a lever with the jib hook as fulcrum and the jib stay pulling on one side of it. Thus, when the jib is set for beating at, say, an angle of 15 deg. to the axis of the boat, the luff of the sail moves slightly to windward and the plane of the sails is no longer on the axis of the boat but slightly to windward at the bow, i.e., the hull is pushed slightly to leeward for a given sail setting relative to the wind. Theoretically then the boat will not sail quite as close to the wind as if the luff of the jib is anchored to the centre line of the boat, which it is with the radial jib. Experience shows that this is only marginal. The other disadvantage is that, because the tack and clew of the sail are secured to the two ends of a continuous boom, the "flow" or bagginess of the sail is final for all angles of sail setting unless one is constantly adjusting the clew. It is generally advantageous to have little flow in the beating or close hauled condition and quite a bit of flow in the reaching/running courses (see later for explanation of courses) and this the radial jib automatically gives. If you want to experiment with a radial jib these are the design points to watch. (1) See that the post on which the radial jib is mounted points towards the hounds, i.e., it is not parallel to the jib stay but is at a slightly steeper angle, and is strong. Since it may be desirable to move it nearer the mast when using the smallest suit of sails a base like a mast slide is a useful foundation. (2) That it is as tall as the sail plan will allow so that the stresses caused by the wind pressure on the sail transmitted at the clew will not cause binding. This is the greatest difficulty to overcome in obtaining a satisfactory radial jib. (3) The kicking strap which controls the lift of the boom must be of metal throughout and the bottle screw strong, as the tension in this link in a strong wind can be very considerable. (4) The distance of the radial jib post behind the jib stay is a matter of opinion but about 1 in. per 10 in. of the foot of the sail is a good starting point.

Now let us turn to the main sail, also depicted in Fig. 4. First note that the cloth runs from the head or peak of the sail to the clew, not parallel to the mast. The latter is the commonest fault noticed with novice made sails, and their baggy leaches can be seen right across the pond. The tack of the sail is hooked immediately over the gooseneck or tied to it. The clew is secured to the end of the boom in an adjustable manner similar to that of the jib. The roach of the mainsail is usually limited by the rating rule giving a limit to the length of battens permitted. Practical considerations limit the roach to 40 to 45 per cent of the length of batten permitted. Where, as a novice, you are not limited by rating rules, again 1 in. per 2 ft. run gives a nice appearance, and you may wish to experiment with fully battened sails. Whether the luff of the sail is cut

precisely straight or has a slightly outward or inward bow or curve depends on both the sail material and what you want the sail for. With the currently fashionable varnished nylon, varnished Terylene, and P.V.C. on Terylene materials, cut the luff straight. If you are using cloth an inward curve enables the sail to be trimmed flatter for heavy weather while an outward curve gives a baggy sail, more suitable for light weather. Clearly the straight cut is a compromise if you are only going to afford one top suit. The degree of curve could be say ⅛ in. per 2 ft. run of luff.

The luff is secured to the mast either by dress hooks to a jack line attached to the mast or lacing through eyelets (now obtainable with pressing pliers, quite cheaply from Woolworths). Both methods are illustrated in Fig. 4. The luff is hauled tight with a halyard and bowsie from the head and secured to the mast about the hounds. It should be only tight enough to prevent bagging down the mast, not stretched. This will of course vary slightly according to the strength of the wind.

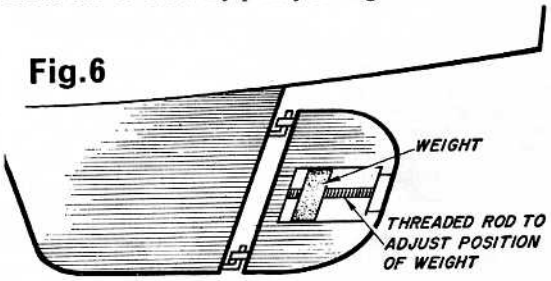
The attachment of the beating and running sheets to the deck will vary according to the type of steering gear used and will be described when we come to steering gears. In the meantime it is sufficient to say that where a horse is used it should be no longer than necessary to give a 12 deg. movement of the boom either side of the centre line of the boat. A kicking strap is essential for good sail trimming and it must be strong. Stainless steel wire or a cycle spoke with a good bottle screw is ideal. In its tightest adjustment it should hold the boom from lifting to the same extent as the beating sheet pulled home although this tightness is used more on the run when the boom is let well out and the kicking strap prevents the boom lifting and the sail bellying out forward of the mast. In the beating adjustment the kicking strap is eased slightly from this adjustment allowing the tension to come on the beating sheet, but more of that anon.

We can now turn to sail setting and trimming. As was mentioned earlier the course a boat sails should be primarily determined by the set of the sails. Fig. 5 can be called a sail setting compass and is worthwhile copying and carrying with you until practice has committed it to memory. By placing it on the ground or holding it in the hand with the wind arrow on it pointing in the direction in which the wind is blowing one can see the sail settings required for any practical course from the point at which one is standing. Let us however explain the chart in more detail. The single arrow shows the assumed direction of the wind, while between the two circles are a series of yacht hulls pointing in different directions relative to the wind. Superimposed on these are curved solid lines representing the jib and mainsail with their angles relative to the axis of the boat, for the boat can sail in the direction it is pointing relative to the wind, as shown by the wind arrow. On courses on which a spinnaker can be set this is shown dotted for both boom and sail. Note how on the broad reach and free reach it is a flat spinnaker almost like a genoa jib set inside the jib, while on the running courses a balloon spinnaker outside (in front of) the jib is carried. Note also how the spinnaker boom is always a little more forward than the line of the main boom extended forward. The short straight solid line near the stern of the boat shows vane angles and will be referred to later in discussing vane steering. Round the outside of the double circle are given the names of various courses, those on the right hand side being PORT tacks or courses while those on the left are STARBOARD. These titles are obtained from whichever side of the boat the wind is coming from.

A final note before leaving sail setting and trimming, which it must be realised has been only briefly summarised in these notes, is that while the angle to which the booms are trimmed for a particular course is as per the chart, their flatness or bagginess is adjusted according to the wind strength for optimum performance. In fresh to strong winds, i.e., those making the boat heel to the deck edge on a beat, the sails are trimmed on the flat side by having the clew pulled well back and the kicking strap, on the main boom, on the tight side, while the jib boom hook is moved back as far as possible using a hole on the jib rack on the deck which just permits the boom to clear the mast. Of course if you have a mainsail cut with an inward bow on the luff you use this as well. In lighter airs, flow is given to the sails by freeing off the clews of both sails, easing the kicking strap and having the jib boom hooked from a point nearer the tack of the sail. The point of hooking to the deck must be again chosen so that the boom just clears the mast. In between these limits there are quite a variety of adjustments which experience will soon show when to use as long as you realise why adjustment is provided.

OUR attention can now be directed to helm or rudder requirements in a theoretical way; the practical aspects will be covered in the sections on steering gears. Good model yachts have been renowned for their balance. This is a complicated subject and one beyond the intention of these articles so we must be satisfied with a thumb nail definition. It is the design property by which as the heel of the boat varies in varying wind strengths as it is sailing it maintains its trim and holds to the same course. Assuming we have a well designed balanced hull it is necessary to have the sail plan — that is the jib and mainsail attached, as described before, to the mast — correctly situated over the hull. This is usually achieved by being able to move the mast slightly in a fore and aft direction while maintaining its rake. Then with the sails set for a close beat (see chart) the boat will sail a steady course at about 30 deg. to the wind. This should be tried with the rudder held firmly central. If the mast is in the correct position it will do so. If it sails up into the wind, sails-flapping, the mast is too far back, while if it bears away as if on a free beat or even a close reach, then the mast, i.e., sail plan, is too far forward. In either case the mast should be moved to correct it. Having found this position it will be found that the courses from a close beat round to almost a full reach can be sailed by purely setting the sails accord-

Fig.6



ing to the chart. These are the courses on which the whole of the jib sail and the whole of the mainsail can 'see' or feel the wind unimpeded. As soon as the wind is striking the sail plan from abaft the beam then the mainsail 'shades' the jib to a lesser or greater extent and the driving force on the sails is no longer balanced. The pressure on the jib is lowered and the unbalance tends to move the bow of the boat round to head into the wind; it is from this point that helm is needed to counteract the unbalance and to do so the rudder blade needs to go to leeward, i.e., to the side of the boat that the booms are. This is called weather helm, since if there were a tiller projecting forward of the rudder post as on a manned craft it would be pulled over to the weather side of the boat to give this movement to the rudder blade. The angle of movement needed is only small, and increases slightly as you move towards a full run. The carrying of a spinnaker reduces or eliminates the need to carry helm because it corrects the unbalance of the sail plan. It is seen then that the spinnaker has two very beneficial effects. (1) It reduces or eliminates the drag caused by helm. (2) It adds more driving force in the nature

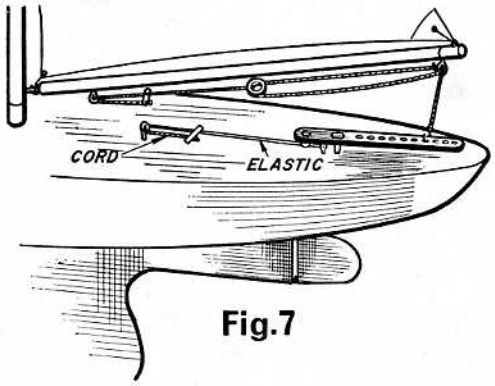


Fig.7

of square inches of sail. The use of a rudder to turn corners as in a full sized craft does not normally arise in models, although it will be seen later that it can be used for guying andgybing. This simple explanation of the need and use of the rudder with model yachts will suffice for the moment.

Having described the 'engine' of our model yacht (the sails) and its relation to the body (the hull) at some length, we can now turn our attention to steering it. It may be of some advantage here to record, or re-record, some history.

Model yachting has been an organised hobby, sport and recreation for over a hundred years. A few years ago one of the London clubs celebrated its centenary and others in the area are over 75 years old. The boats themselves have evolved almost out of recognition in this time, as well as the method of steering them, as we shall see.

Before 1900 it would appear that two basic types of steering were in common use apart from the semi-fixed rudder which is unfortunately still seen on some shop models and can only lead to frustration and disappointment to their purchaser. These were the weighted rudder and reversed tiller. A weighted rudder is illustrated in Fig. 6. Old books and articles show refinements to vary the position of the weight and therefore its effectiveness.. From what was said in the last section on the need for a central rudder it will be appreciated that a balanced boat heels most on those courses (beating and reaching) when helm is least needed or not at all. By current experience and theory a weighted rudder is therefore almost useless. No doubt at the time the sail plans of the craft were set sufficiently far back to cause the boat to head to the wind and the rudder would correct this. The successful model yachtsman was the one who could best get equilibrium and balance of the forces. Having written that, one realises how true it is even today, but in a quite different set of conditions. Unfortunately one still sees weighted rudders on quite expensive commercial products, while devices which are much more effective could be incorporated at relatively little extra cost.

The reversed tiller illustrated in Fig. 7 as the other type of steering of the time did offer more sensible control and as a really simple device for the novice, without aspirations to funny tricks, will still permit course sailing, i.e., the boat going where you want it to, as distinct from going where it wants to. With this plan, the mast position should be placed to give good beating courses without helm and with the beating sheet connected to a horse. When the desired course is a reach or run the beating sheet is detached from the horse and hooked up on the boom and the running sheet connected to the reversed tiller comes into play. Its effectiveness is determined by the point of connection to the tiller and the strength of the centring line. Note how the centring line is not pulling on the rudder post which could cause binding, but its action is obtained by passing it through a hole or eye. This feature will be found to be used whenever a strong pull could be exerted by the centring line.

In about 1904 Mr. G. Braine invented the Braine steering gear which held sway in this country till after the second world war and is still found in diminishing numbers in organised racing. It is interesting to record that the parts of the original gear are still displayed on a board in the clubhouse of the Model Yacht Sailing Association, Kensington Palace Gardens. Fig. 8 shows the final development of the Braine gear with main and jib lines and separate port and starboard stops and tension adjusters. Its enormous advantage over its predecessor was that its action on port and starboard tacks could be controlled separately and precisely. For best performance a balanced hull with the sail plan set over the hull for good beating without helm was called for. For beating courses the main and jib sheets were hooked to horses and for reaching and running, to the lines connected to the quadrant. Only top class racing boats worried about the jib lines to the quadrant but in the hands of the expert they would play a valuable part

We can now turn to vane steering gears. In spite of what has already been said, it is recorded that the idea of vane steering was first put forward by Nathaniel Herreshoff in the late 1800s in one form, from a burgee flying at the mast head, and secondly in the currently more conventional position near the rudder post. Somehow it never 'caught on' and it was not until Iverson and Berge experimented, in the early 1930s, with a non-self-tacking vane on the lines suggested nearly 40 years before, that any practical interest was shown. From what is now known about vane steering one can be amazed that 40 years should elapse between the conception and the first real practical application, and it is worth postulating a

reason. Look at any old books and photographs published before 1930 and you soon see that design was still in the era of the gaff rigged sail plan where the jib extended forward of the bows on a bowsprit and the main boom projected well aft over the stern, there just was nowhere to mount a vane and it had to wait till the advent of the Bermudian sloop rig with its tall efficient jib and mainsail which are short on the foot and are now almost universal. The problem of carrying a vane and adequate sail still tends to persist in the 36 in. restricted class. Fig. 9 shows the kind of illustration one sees of the early vane in which the feather holder could be lifted and popped into a selected hole on the scale. The realisation of the need for a counter-balance to the feather came later, as well as the friction movement which gives infinite positioning as distinct from the series of holes. The entry by Sam Berge of Norway of a boat with a vane gear in the International races held in 1935 caused a rage of controversy in the very conservative cloisters of the model yachting fraternity as to whether such a device was within the spirit of the sport or a means of obtaining unmeasured sail area. In this atmosphere little progress was made in this country before the second world war, and it was left to the Americans to develop the device while we were otherwise occupied. Fig. 10 shows a simple non-tacking but balanced gear with friction grip for the feather. This is simple and will give *plain course* sailing as adequately as the most complicated gear. Its relation to the self-tacking gears we now come to is somewhat parallel to that of the reversed tiller and the fully fledged Braine gear. A world of difference, but the simple gear is within the constructional ability of many a novice and will give good plain sailing, although it is always very gratifying to be able to emulate the manoeuvres of the racing skipper even if you are not racing.

It will have been appreciated by now that the next step in development was the self-tacking vane gear,

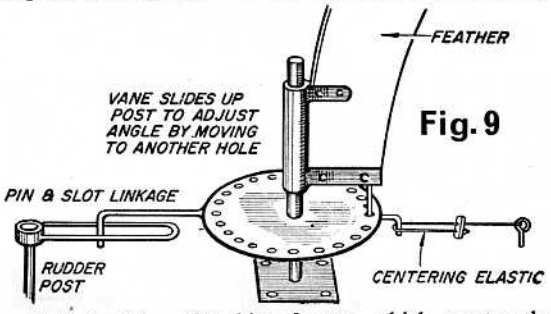


Fig. 9

and it is this self-tacking feature which creates the constructional problem rather than utilisation. The self-tacking feature and other refinements are needed to meet two basic requirements: (1) Racing rules on tacking whereby, if the boat is turned by pole from one tack to the other, touching only the hull with the pole, it may be done without stopping; (2) Varying guying conditions (these will be described in the next section).

Articles published shortly after the war show clearly three basic types of self-tacking vane gears that had been developed in the States during the war and had got their designers' names 'tacked on', i.e., the Lassel type, Ballantyne type and Fisher type. In fact it could be said that American designers were keen to publish their ideas and get their name

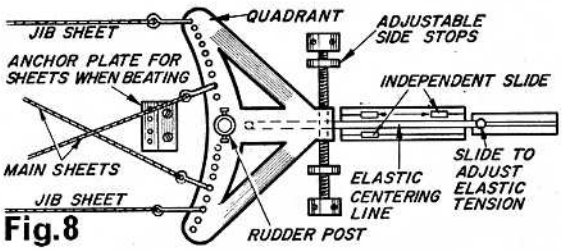


Fig.8

attached as with the Braine gear. These three types are still in very general use and their design points are described below. Before doing so however, mention must be made of a fourth type of self-tacking vane developed in this country in the 1950s and described by the author under the title "A Moving Carriage Vane Gear" in the February 1961 *Model Maker* and now being used in ever increasing numbers. It is unfortunate that this has not the designer's name attached as for the earlier types, but this must be put down to the reticence of the British model yachtsman who had a hand in it and so far as the author is aware there was more than one.

THE basic details of the four types of vane will now be described. It may involve jargon that may not be immediately understood but the terms will become clear in the next section, dealing with sailing with a vane gear. Dimensioned constructional details will follow that.

Fig. 11 shows the basic Lassel type gear which is characterised by the fact that the feather, whether the gear is 'fixed' or 'broken' for self-tack purposes, is carried on the main vane pintle. This means that the same scale can be used to compare the feather angles in the two conditions. Theoretically the gear cannot be balanced perfectly for both the fixed and broken conditions without altering the position of the counter-balance weight, but the out of balance encountered practically is probably so small as not to be noticeable. When broken lee helm is positive while weather helm is dependent on the weights of the feather and counterweight being on one side of the vane pintle brought about by the heel of the boat and a certain amount of locking action of the pin in the slot of the linkage. If the latter is too pronounced there is a prospect that the gear will fail to self-tack when the boat is put about. (Something we have already experienced with this type of gear.) Because the weather helm is not positive it is preferable to use this gear with the sail plan on a balanced hull set for neutral helm on the beating course which is when the gear is likely to be 'broken', i.e., the same sail plan setting as for a Braine gear with possibly a very slight setting back of the mast.

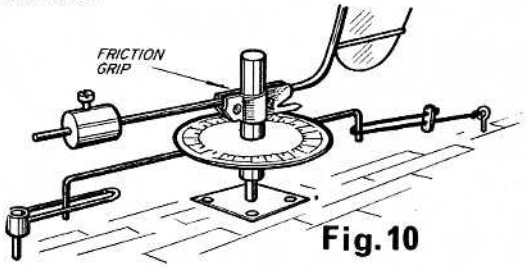


Fig.10