PLANK-ON-FRAME MODELS
Other Books by the Same Author:
Sail Training and Cadet Ships
Masting and Rigging: The Clipper Ship and Ocean Carrier
Deep Water Sail
Sailing Ship Rigs and Rigging
Perfectly proportioned masting and rigging on a small scale.
H.M.S. "VICTORY."
Scale 1/150 (12-5 ft. to 1 in.)
Model by
Professor H. Favez,
Switzerland.
INTRODUCTION

As mentioned in the Introduction to Volume I., this book was originally planned as a single volume, but owing to the ever increasing production costs it was decided to divide it and so keep the price within easy limits by enabling it to be purchased in parts.

This arrangement unavoidably resulted in some cross reference from one volume to the other, as for example the method of laying out and fixing the planking, which has already been described in detail for the model with scale “built-up” framing which forms the first part of Volume I. To have repeated it here would have increased the cost, the very thing I am aiming to avoid.

I have tried to divide the book in the best possible manner, but I know the arrangement will not please everyone. It may well be suggested that the obvious thing was to have placed all the hull details in one book and the rigging in the other, a suggestion with which I fully agree, but to have done so would have made Volume I. twice the size of Volume II, and so largely defeated the object of the division, namely two books of reasonable price.

Glasgow, 1960.

HAROLD A. UNDERHILL.
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Chapter I.

MASTING THE BRIGANTINE

In this, as in Volume I, I will describe the methods of construction used in my own model of this vessel, and in some cases these will not agree in minor detail with the plans reproduced. These plans are the ones from which I built the model, but I always regard such drawings, even when as in the present case, they have been produced specifically for my own use, as being quite flexible in all matters of method, providing the finished product is as designed. When making the drawings I might decide that certain fittings should be filed out from the solid, but if, when the time came to make them, I found I had no material suitable for this, then I would fabricate them from whatever I had. As I have said in Volume I, my pleasure in model work is the making, and a model in which the fittings were bought ready-made would have no appeal whatever, I would rather have a relatively crude fitting made with my own hands, than the most perfect example of the modelmaker's art supplied by someone else. I have quite a collection of really good model fittings of different kinds which have been sent to me over the last thirty years by various model making firms, and while on the strength of these I have been able to advise others where such fittings can be obtained if they want them, I have never made use of a single fitting on any model of my own. Not that I do not appreciate the value of such fittings, most of them show far better value and skill than I am ever likely to achieve, and for the man whose interest is in the finished model rather than the job of making it, they are ideal. On the other hand, and here I know that I am asking for trouble, I get very angry when shown a model which someone claims to have "made", when in actual fact all they have done is to assemble a number of parts made by someone else. That is not model building.

However to return to the differences which may from time to time appear between the text and the original plans, none of these will affect the basic design, and most of the changes in method were due to the rather unusual circumstances under which this particular model was built as described in Vol. I, but they are given here since they may help others who may also have to work under adverse conditions. I am a great believer in using
whatsoever material is at hand, providing it does not affect the general design of the finished product, much of the pleasure of model work is in making things from the raw material available at the time, and if the design says I need some 1/16 in. sq. brass rod for making a truss, then I use 1/16 in. sq. brass rod if I have it, but if I have not, well I can always cut a strip off a bit of 1/16 in. sheet, or hammer up a bit of round wire to the required size. I certainly do not dash off and search all over the place to try to buy it. If I wanted a yard or so that would be different, but in making fittings and furnishings for a model, you must have a very poor scrap-box if you cannot find all you need in one form or another.

Until quite recently, when I found that I could not long see very fine work, I made all my own chain, both stud-link and plain down to very small sizes, and when once I had got the hang of it I could turn it out at a good speed, and so I say to all model builders, try making it yourself, no matter what it is, and you will probably surprise yourself at what you can do. You will get far more pleasure out of it, and in the end you really will be able to say “what do you think of this model, I made it.”

One last word of advice, keep a junk-box. I have two, one for bits of wood of all kinds, no matter how small if of good material, and this box has often saved having to go out to buy wood when I have needed say a bit of sycamore or box about 3/4 in. long by 1/4 in. square for making some fitting or another. My other box collects all kinds of non-ferrous metal, ranging from old copper kettles and brass door locks, to cuttings off electrical cables of all sorts and sizes, picked up when electricians have been working about the place. Many of these are only a few inches long, but between them they provide a range of different gauges of wire such as one could never hope to get by buying coils of it, since few, if any, shops would stock such a range. This is not a matter of saving money, although in my Leon model the only material I had to buy new was that for the planking, but your junk-box will be able to offer you a variety of material of all descriptions. In it you will probably find hard-brass, soft brass, cast-brass, copper, and so on, each having an advantage over the other for certain classes of work, and above all, you will get a lot of pleasure out of making your fittings yourself.

Of course there are many raw materials one would buy if they are available, such as small “L”, “T”, and “Z” bars, in brass, down to 1/16 in. x 1/16 in., and very small tubes of the same material, which one could get before the war, and may be back on the market again by now. However the point is that one can often find very suitable material among the scrap.

The standard plans which the publishers can supply for the Leon model have been produced to a scale of 1/8 in. to 1 ft. 0 in., and a sheet of full-size spar details at this scale is available, but the drawings also include tables of dimensions for the full-size ship, from which anyone building to a larger scale should work. A 1/4 in. scale model for example, could be built by simply doubling the 1/8 in. scale drawings, but for the mast and spar diameters it would be better to make them from the table of sizes. All drawings made for the reproduction of a large number of copies, must be made in fairly bold lines, the very thickness of which, if scaled up to double the size, might well add an inch or so on to the diameter of a spar, which on a spar of say 8 in. diameter would look quite a lot. The length is not so important, since the increase of an inch on a spar say 50 ft. long would not be noticeable.

I think all model builders will be familiar with the points of measurement for the diameters of masts and spars, but if not then Sketches No. 1 and No. 2 will make this quite clear. One point regarding yards, captions below illustrations in the general press sometimes refer to men being seen “working on the yard-arms,” when they are in fact strung out along the yard. This mistake is quite widely made, but there is no excuse for it. A spar which crosses a mast horizontally is a “yard,” only those portions outside the outer band at either end are the “yard-arms.”

Now just one word of warning regarding the photograph of Leon which forms the frontispiece of Vol. I. Do not let the yards shown in this picture mislead you, it was taken in the Clyde when she was almost at the end of her days, and at a time when small sailing ships, particularly square-riggers, were finding it difficult to make ends meet; a period when if any spars were lost or damaged there was no money to buy new ones, and so they were replaced by anything which could be got from other old ships which had already given up the struggle and gone to the scrappers. The lower-top-sail upper-top’sl and to’gallant yards in this picture obviously belong to a larger vessel, for instead of the outer-bands being about a foot outside the heads of their respective sails, there is a space of some six feet or more on either side. Neither I imagine did all these yards come from the same ship, or if they did, then not from the relative positions now occupied in the brigantine. Other indications of old age and shortage of money have been mentioned in Vol. 1. Soon after this pictures was taken she was cut down to schooner rig.

As with the hull, the material you use for the spars will largely depend upon what you can get, but the main thing is that it have a good straight grain. I was fortunate enough to have some very straight grain yellow pine which supplied the material for most of the spars, and this worked very well. When possible I like a material which will split straight, for if you can split your timber to the approximate size required, you will be certain that the grain will run down the length of the spar, and there will be no tendency to either twist or spring. If straight sticks can only be obtained by sawing them out, then it must mean that at some points you...
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MASTING THE BRIGANTINE

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will have a short grain running across the spar. You may perhaps have to accept such wood, but avoid it if you can, you are far better to go over to sycamore or box, in which there is scarcely any grain at all, than take a timber in which the grain is going to run at an angle across the spar at some point. Do not use round dowelling rods which can be bought in different diameters in most wood shops, for the grain in such material is apt to run in any direction. I have a number of these dowelling rods in the print room for hanging prints, and in most cases they have gone to shapes rather like a dog's hind leg.

In a small scale model such as this I think it advisable to make all the spars, complete with their "ironwork," before doing any rigging, for your skill in making the "ironwork" may well decide the order in which the spars have to go aloft. For example, the three upper yards are held to their respective masts by means of hinged parrels, and can therefore be crossed or sent down on deck as required without affecting the standing rigging. When I made my model I fitted an opening parrel on the upper-topsail yard, but thought I could make a neater job of dummy hinges for the two smaller yards, which meant that these had to go on to their masts before the respective standing rigging, whereas had I made those parrels to open, the whole of the foremast could have been rigged before the yards went aloft. Just one of those points which have to be watched in all rigging work on a model.

The bowsprit has already been made, although so far it has no fittings but as these are also affected by the jibboom, we may as well make that spar next. The metal bands of the jibboom sit against a shoulder formed in the spar at their respective positions, and the depth of these shoulders is equal to the thickness of the material from which the band is to be made, which of course means that forward of the band the spar is the same as the band's internal diameter, while abaft, the surface of the spar is flush with the outside of the band. In small scale work such as this I find it best to taper the whole spar from bowsprit cap to end, then mark the positions of the two bands after which carefully file in the first shoulder, then re-taper the spar from this to the line of the next band. The next shoulder is then filed in and the spar tapered again forward of it. From the bowsprit cap in to the heel there is no taper, the spar being of equal diameter throughout, while the last 1/4 in. of the underside is left flat to meet up with a pad which will be provided on the bowsprit as shown in the plans. The heel of the jibboom is cut to the same angle as the face of the heel-chock which will be fixed to the bowsprit.

The head of the jibboom outside the first band is drilled in the vertical plane with two holes, for the fore-royal "A" and the fore-topgallant "B", stays respectively, then comes the outer band. Just inside this band is
the sheave-hole for the jib-stay “C” but on this scale I did not attempt to fit a sheave, instead I drilled a hole in line with the outboard end of the “sheave,” and then put a score in the top and bottom of the spar to represent the sheave-hole. Next comes the middle-band, followed by another dummy sheave-hole, “D.”

A model such as this requires several very small metal bands, on jibboom and yard-arms, and at first sight it may perhaps seem that a band say 1/16 in. diameter and 1/32 in. wide, with perhaps three or four eyes or lugs, is a job which only the miniaturist can tackle, but it is amazing what even a rather heavy-handed modeller such as myself can do. I would always work in 1/4 in. scale if I could, but when you have to get down to smaller scale fittings, there usually is a way round it. My method with such fittings follows the same basic principle as that used for making the frames, namely do all the jointing first, then cut to size later. The diameter of a band must be made correctly of course, but it is one thing to solder four lugs or eyes on to a band 1/16 in. diameter and 1/32 in. wide, and something entirely different to solder the eyes into a band 1/16 in. diameter and 1/16 in. wide. With the latter it is a simple matter to drill the band for the stems of the lugs or eyes, solder them all, and then file down both band and lugs to the required 1/32 in. broad. Another point is to leave the band on the end of the material from which it is made until all the soldering has been done and the band filed down to the proper breadth. However I will say more about each fitting as we come to it.

Here I would strongly advise the model builder to use hard or silver solder for all model fittings. This is not merely a matter of strength, for on those grounds soft or tinman’s solder will be amply, but silver soldering has so many other advantages. One is that the joint can be absolutely invisible, another that one can solder a small eye on a band, then follow up with another about 1/16 in. away, without in any way disturbing the first; finally there is no need to tin the faces to be joined. One may either use an ordinary mouth operated blow-pipe and bunsen burner, or a small combined pipe and burner such as I have found most satisfactory. This is merely connected to the nearest gas supply with rubber tube and used like an acetylene welding burner, without any blowing from the mouth. However in building Leos I did not wish to have to carry the “iron-work” away to a room in which gas was available, so I bought a small spirit lamp with blow-pipe attached, which I found satisfactory for the small fittings required on this model, although I very much doubt whether it would have sufficient heat for larger work. There is nothing to beat the bunsen and blow pipe or the combined gas and air in one pipe.

I have always used silver wire for soldering, and as I still have a good stock left and have always found it very satisfactory, I will probably continue to use it, but there are some hard-soldering compounds on the market which I believe simplify the work considerably. In any case my advice is, if you do not already practice hard-soldering, then get a simple handbook on the subject and take it up at once. It will give you better and cleaner results and make easy the fabrication of very small fittings which would be extremely difficult, if not impossible, with soft solder.

The two bands on the jibboom were made as shown in Sketch No. 4. First a narrow strip was cut of a piece of sheet copper of the required thickness, although if this bit of sheet had not been available I would have hammered out a piece of wire to a suitable size. The end of the strip was then bent round the shank of a drill of the same diameter as the shoulder on the jibboom. The ring so formed was closed by being silver-soldered to the “stem” from which it had been formed, after which the holes were drilled on either side for the stems of the lugs, and another hole drilled in the original stem which would ultimately form the lug on the underside of the band. The two side lugs were filed up from bits of the same sheet, then drilled and their stems inserted in the holes in the sides of the band, after which they were soldered. It is in joints such as this that silver-soldering is so valuable, for when these very fine joints have been made, not a trace of white metal will be seen anywhere, and from the point of appearance, the whole might have been filed up from a solid piece of copper. The secret is of course that the silver only adheres where the copper has been touched with the flux, and I always apply the latter with a very fine water-colour paint brush having a needle point. With this one can touch just the faces which have to be in contact and nothing more, so that not a trace of the joint will show.

When all the joints have been made, take a very fine file and proceed to file down the width of the band until there is just enough metal round the holes in the lugs to prevent them breaking away, after which the ring will be dipped in “pickle” to remove the traces of heat, from which point it can be either nickle-plated, black oxidized, or left natural copper. I prefer the latter, for I think that in time it ages a nice colour. Nickle-plating I will not have on a model if it is possible to avoid it, a coat of paint is preferable to that, but on such small fittings it is difficult to paint them without increasing the thickness too much.

The jibboom can now be lightly French-polished, not to a high gloss of course, but just enough to represent oiled timber. If you are painting the model, then the head of the jibboom outside the last band, should be painted white.

The bowsprit we made to allow us to fit its step in the hull, but we still have all the fittings to go on. The bowsprit-cap was fabricated from sheet copper as shown in Sketch No. 5. First two rings were made, one a push-
fit on a shallow shoulder on the end of the bowsprit, and the other an easy
fit round the jibboom. These two were soldered together at their joints.
Two side plates were then cut and soldered in as shown. The martingale
was made from a length of copper wire, one end of which was slightly
flattened, drilled, then filed up to form an eye. The body of the martingale
was then filed to taper to either end as shown in the large scale drawing,
and fitted with the four hook-cleats in the centre and the eye-plate at the
bottom.

In silver-soldering the most important thing is to have the surfaces
to be joined in perfect contact one with the other, for you cannot “load”
a joint to fill with solder any space there may have been left, and therefore
you must always make your fittings with that object in view. The hook-
cleats of the dolphin-striker are a good example of this, for not only were
they made in such a way as to provide perfect contact, but also to ensure
that they did not move during the process of soldering. Unless some means
are provided to keep very small fittings in place, they are apt to be blown
away by the high-pressure jet from the blowpipe. In making these hook
cleats I first drilled a hole in a tiny scrap of copper, this hole being a good
push-fit on the martingale at the point where the cleat had to be fixed. The
cleat was then filed and bent to the shape shown in Sketch No. 5a. pushed
into position on the martingale, then, having had a touch with the flux and a
scraping of silver alongside, given a heat with the burner and the job was
done. The next pair of cleats were added in the same way, then when all
had cooled the encircling portions of the cleats were filed away leaving the
finished job as shown in the lower sketch.

The bottom of the martingale was filed down to form a shoulder, and
below that tapered into a spike. The eye-plate at the foot was made in the
same way as the hook-cleats, by drilling three holes in a scrap of sheet, the
centre one being a push-fit on the “spike,” and the outer ones just large
enough to take the eyes of the chain rigging. This rough plate was soldered
in position, then filed up to its final shape, leaving little more than a shim
round the centre spike and the two holes for the chain. Watch that the hook-
cleats are soldered thwart-ships and the eye-plate fore-and-aft. For
attaching the martingale to the cap a small eye was made in the end of a
piece of hard brass wire, and after threading through the eye in the top of
the martingale, it was closed and soldered—I usually solder the closing
joint in any eye made in wire, it is so easy, just a touch of flux on the end,
and a scraping of silver on the charcoal block, a “whiff” from the blowpipe, and
you have a jointless eye, which looks, as it should, to have been forged from
the solid. I left a short tail on the eye, and this I ran up with a small jew­
eller’s die-plate, or screwing-plate, putting a very fine thread on it. When
at a later stage I finally came to assemble the bowsprit and jibboom, the eye

was simply screwed into the hole in the underside of the cap, and up into
the wood of the bowsprit, in which a smaller hole had been drilled to allow
the eye to cut its own thread.

There are two bands near the head of the bowsprit, one, just inside the
bowsprit cap, with three lugs, or eyes, and the other with only one. These
bands are made just as those already described for the bands on the jibboom,
and I strongly advise the use of lugs on the sides in preference to eyes of wire.
I find that I can make a much smaller and neater eye this way. If you take
a very small piece of the sheet-metal being used for the band, and in this
drill the smallest possible hole that will take the particular item of rigging
which has to be attached to the eye, all that remains is to file round about
that hole to form a lug such as those shown in Sketch No. 4. This lug will of
course be larger than the finished size. Next drill the requisite number of
holes in the band to take the lugs, always remembering that the stem from
which the band has been made will form one lug. File little tails on each of
the lugs so that they are a push-fit in the holes, then put just a touch of flux
on these tails and push them into position a touch of flux along where the
band bends back on to its own part, then a slight shaving of silver, a touch
with the pipe, and your band is finished. The lugs are very small to make,
but if held in a very small jeweller’s hand-vice they can be turned this way
and that, and filed up at will. When the band is cool, it can be filed down to
whatever width you require, filed down until there is just sufficient material
round the eyes to “hold the holes together.”

The inner band of the bowsprit is made like the cap, but without the
martingale, also the top band is hinged to enable the jibboom to be lifted
clear of the heel-chock when being hauled inboard during the ship’s stay
in dock. I did not attempt to make this top band to open, but soldered
two short lengths of wire on either side to represent the hinge and the lugs
through which the locking bolt passes. The timber bees-batten along either
side of the spar is glued and dowelled in position after all the bands are in
place, and has a hole against the spar, through which the foretopmast-stay
is reeved, but all these details will be clear from the drawing of the bowsprit,
while the finished job will appear as in Sketch No. 6.

The lower foremast will be the next spar to be taken in hand, and when
setting this out on the wood remember that the top of the maindeck is the
dataum line for all dimensions. It is just as well to take a thin stick and
push it down through the deck into the mast step, just to check that this
really is as shown on the plans, since any difference in this distance from step
to maindeck would of course throw the whole mast out of scale. There is
just a chance that you may have made the floors of the frames a shade deeper
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drill the smallest possible hole that will take the particular item of rigging
which has to be attached to the eye, all that remains is to file round about
that hole to form a lug such as those shown in Sketch No. 4. This lug will of
course be larger than the finished size. Next drill the requisite number of
holes in the band to take the lugs, always remembering that the stem from
which the band has been made will form one lug. File little tails on each of
the lugs so that they are a push-fit in the holes, then put just a touch of flux
on these tails and push them into position a touch of flux along where the
band bends back on to its own part, then a slight shaving of silver, a touch
with the pipe, and your band is finished. The lugs are very small to make,
but if held in a very small jeweller’s hand-vice they can be turned this way
and that, and filed up at will. When the band is cool, it can be filed down to
whatever width you require, filed down until there is just sufficient material
round the eyes to “hold the holes together.”

The inner band of the bowsprit is made like the cap, but without the
martingale, also the top band is hinged to enable the jibboom to be lifted
clear of the heel-chock when being hauled inboard during the ship’s stay
in dock. I did not attempt to make this top band to open, but soldered
two short lengths of wire on either side to represent the hinge and the lugs
through which the locking bolt passes. The timber bees-batten along either
side of the spar is glued and dowelled in position after all the bands are in
place, and has a hole against the spar, through which the foretopmast-stay
is reeved, but all these details will be clear from the drawing of the bowsprit,
while the finished job will appear as in Sketch No. 6.

The lower foremast will be the next spar to be taken in hand, and when
setting this out on the wood remember that the top of the maindeck is the
dataum line for all dimensions. It is just as well to take a thin stick and
push it down through the deck into the mast step, just to check that this
really is as shown on the plans, since any difference in this distance from step
to maindeck would of course throw the whole mast out of scale. There is
just a chance that you may have made the floors of the frames a shade deeper
than shown in the drawing, or that your keelson is a fraction larger or smaller
than originally intended, any of which could throw your mast either a little
Sketch No. 6.

Sketch No. 7.

PLANK-ON-FRAME MODELS

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high or low, if not corrected when making the mast housing—that portion between the deck and the heel, or in other words the portion inside the main part of the hull. Having selected a piece of straight grained timber a little longer than the finished mast, mark out the mast's greatest diameter, and then square the whole stick to this. On the four sides of this stick set out the outline of the mast, and taper the stick accordingly, still in the square of course, after which shave off the corners of the sections which have to be round, so reducing them to octagonal, then finally dress off the eight corners leaving you with a round spar, quite free from winding.

Sketch No. 7 shows this mast ready for the fitting of the framework of the top, and from this it will be seen that the spar is octagonal between the heel and the deck, the actual heel being round with a square tenon to sit in the mast step, although in my model I provided a round hole in the step and of course a round tenon on the heel. There should be an iron band round the heel immediately above the tenon, but this can be omitted from a model unless the heel is exposed by the omission of all planking. Above the deck the mast is round as far as the futtock-band, above which it is flattened on each side to receive the cheeks, the heels of which are checked into the mast. Above the top of the cheeks the mast is square and of the sections shown in the sketch and working drawings.

The actual masthead construction in this model is slightly simplified from full-size practice, but the external result is the same, the main difference being in the attachment of the cheeks to the spar. In full-size work the cheeks would be “coaked” to the mast by a series of mortices and tenons, whereas in the model they will be fixed with glue and dowels. Having made the mast spindle as shown in Sketch No. 7, carefully set out the levels of the trestle-trees, remembering that they run parallel to the waterline and not at right angles to the mast. Next cut out and fit the cheeks, which should be made from sycamore or box. The lower end of the cheek sits on the step formed in the side of the mast, and is then swept into the mast's diameter, while the top edge supports the underside of the trestle-trees. When satisfied with the cheeks, which should have been made as a pair held back to back, they can be glued and dowelled in position.

The trestle-trees should now be taken in hand, these should also be from hardwood, cut to the sizes shown on the plans and then firmly clamped together for final shaping and cutting the three slots for the cross-trees. In marking out these slots take great care that the forward pair of cross-trees will be a tight fit on the fore and after faces of the mast. Bevel the after ends of the trestle-trees, then cut the fore ends for the half-cheeks of the cross-member. Clamp the trestle-trees in position on the mast, then cut three lengths of the material to be used for the cross-trees and carefully fit them to their positions, after which the clamps can be removed and the
whole framework of the top glued and dowelled in position. In my own model I made a slight departure from the plans by making the after cross-tree deeper than the other two, so that it projected above the level of the trestle-trees as shown in Sketch No. 8 where it afterwards formed the after rim of the top as will be explained later. I used this method because it gave a much stronger anchorage for the after ends of the curved rim which runs right round the outer edge of the deck. In the original, and this should be followed in larger scale models, the after cross-tree was flush with the top of the trestle-trees, just as in the case of the other two, and the rear rim of the top was formed by a light member bolted to the after face of the cross-tree as shown in the lower drawing Sketch No. 8. This on 1/8 in. scale did not offer a very strong fixing for the ends of the curved rim, so I combined the rear of the rim with the after cross-tree, which enabled a good dowel to be used in the after ends of the curved member.

Take a piece of veneer a little larger than the size of the finished top, and on the face of this glue a piece of thin strong paper—good white note-paper is ideal, leaving it under a flat-iron to dry. Next set out on this paper the decking of the top as shown in the plans, taking care that the grain of the veneer runs thwartships. This should now be cut out, when it will look like the small sketch in the drawing already mentioned. Now cut a few veneer “planks,” and proceed to plank the top, on the paper side of course, so that when finished you have a form of three-ply, the lower one of thin veneer running thwartships, then the paper, and finally the top ply of veneer planks running fore and aft. The result will be a small deck which is remarkably light yet very strong. The actual size of this deck fore-and-aft will depend upon whether you are following full-size practice or my own modified top. If the former then the decking will extend over the top of the after cross-tree, while in the case of the latter it will finish at the forward face of the cross-tree, as shown in the top right-hand sketch.

If you are building a large scale model then you would of course follow full-size practice, in which case the framework of the top would include a semi-circular member running right round the outer edge of the top, half-checked into the ends of the cross-trees and into the trestle-trees thwartships, as in Sketch No. 9. This outer member takes the ends of the planks forming the decking, and on the face of this is fixed the rim of the top, so covering both framework and plank edges. However I have included full working drawings of all forms of top in my book Masting and Rigging, so there is no need to repeat them here, since we are really only concerned with the 1/8 in. scale model of Leon. Thanks to the laminated form of decking used in this model there was no need for the outer frame, although the planks should be dowelled to the under-ply in the position the framework would occupy.
When the pre-fabricated decking has had time to dry, it should be lightly French polished on both sides, after which it can be glued and dowelled to the cross-trees and trestle-trees, and the next job will be to fit the rim. This I made from a strip of veneer of sufficient width to allow it to project about 1/64 in. above and below the decking, and before fitting I held it in the steam from the spout of a kettle, then bent it round a piece of wood cut out to the shape of the decking, binding the ends with cotton and leaving it to dry out and cool. When ready it was offered to the decking which it fitted perfectly, and glued and dowelled in place, the after ends being cut off flush with the after face of the cross-tree. I dowelled it to the cross-tree on either side, but I also added a small copper angle cleat at each corner as shown in the Sketch No 8, just for a little additional strength.

When all is dry, drill the holes for the futtock shrouds in the ends of each cross-tree and up through the decking. The advantage of leaving the drilling of these holes until the top is complete is that there is now no risk of splitting the ends of the cross-trees. Holes for the bunt-line blocks should also be drilled through the decking as shown in the plans, and all that now remains to complete this particular structure is to fit the bolsters and battens for the rigging, both of which are shown in the sketches. The bolsters are half-round blocks of wood which are fixed across the forward cross-trees on either side of the mast, where they support the eyes of the rigging. The battens are small strips of hardwood nailed to the mast in way of the eyes of the rigging, to protect the mast and also prevent the eyes sitting on the sharp corners of the squared masthead. The sketches show the cap-tenon cut in the masthead, but in practice I prefer to leave this until I am ready to put the cap in position, so that the tenon can in fact be fitted to the cap.

The question of the mast "ironwork" is always something of a problem, and must be carefully considered before going too far with the final assembly of the various components, such as cross-trees, trestle-trees etc., which go to make up the complete spar, since it will be obvious that if, for example, you make the lower foremost complete with top etc., and then make the futtock-band complete, the latter cannot be got into position, for it will be too small in diameter to pass over the mast at deck level, and it certainly cannot be passed over the masthead when once the masthead structure is in place. You therefore have the choice of two alternatives, one being to make the complete masthead assembly but not to glue and dowel it in place until the futtock-band has been made and put in position; and the other, to make the futtock-band to spring round the mast and be finally joined when in position. The latter will be the most satisfactory, providing you have a suitable means of making that last joint, one which will ensure that the band will be really tight on the mast and not likely to slip. The point I want to make is that you must consider this problem for each individual spar before you start making it, for in some it will be possible to fit the ironwork after the spar is complete, in others it will not.

As far as the lower foremost was concerned, I fitted all the ironwork after the spar was completed, and therefore it does not matter in which order the items are made, so we will start with the spider-band, which includes the goose-neck of the main-staysail-boom, and is shown in Sketch No. 10. The band was first cut out of a bit of copper sheet, but left wider than the finished job. This was then offered to the mast at the correct level and bent round so that the two flanged ends did not quite meet. The positions of the lugs for the belaying pins were then set out and drilled with the band held on a stick of the right diameter. The lugs where next cut out of sheet—much over size—and drilled. Tails were filed on each lug and inserted in the holes in the band, the whole being silver soldered. The small lug for the goose-neck jaws was silver soldered on and then drilled for the pin, after which the band and all lugs were filed down to the required sizes. I had no lathe available at the time of building this model, so the belaying pins were "turned out" of copper wire by means of a breast-drill and a warding file. The goose-neck can also be fabricated out of thin sheet as shown in the sketches and will offer no difficulty.

I did not fit the band at this stage, but waited until I was ready to rig the mast, however I may as well complete the job on paper. I have some jeweller's taps and screw-plates, which enable exceedingly fine screws to be made, and under normal circumstances I would have made a very small brass bolt to pull up the flanges of the band, but although I had the screw-plates, the taps were not to be found, so I decided on an alternative method. I cut a small brass brad to the required length, so that with the band tight round the mast it just projected through the jointing flanges. The cut end of the brad was lightly tinned, and while the band was held tightly round the mast by means of a "V" slot in a piece of sheet metal slipped over the flanges, a spot of tinsman's solder was put on the brad. This obviously was one job where hard solder could not be used, since the temperature required in the metal to be soldered would have destroyed the mast. For "spotting" these small pins I made a special bolt for the electric soldering iron, this came to a long fine point and could be got into such small corners where only a very small local heat was required.

The futtock-band and truss for foreyard should be made together, since they really form one unit, therefore the foreyard should be made next so that the bands can be fitted to the finished spar, so we will assume that that has been done, although I will in fact describe the yard in context with the remainder of these spars. The futtock-band and truss I fabricated almost entirely from sheet, Sketch No. 11. The 'band itself was formed as already described for the spider-band, but with the flanges sufficiently far
apart to admit the roller "B" for the bight of the middle-stay—see rigging details. The lugs on either side were made in the usual way and provided with shackles "C". These were bent up from wire, with the eyes silver soldered, while the ends of the pins were "spotted" with tinsman's solder after being put through the shackles. These shackles take the lower ends of the futtock shrouds.

The jaws "D" were filed up from a small piece of copper, although they could have been bent from sheet, but would not have looked so sharp. However whichever method is used the back needs to be hollowed to fit the curve of the band, since it must be in good contact if it is to be silver soldered. When soldering this in position I held it in place with a small piece of copper wire through the holes and twisted up tight inside the band.

For the crane "E" I hammered up a piece of thick copper wire and then filed it to shape, while the shouldered fulcrum pin "I" was also of wire, although of much lighter gauge of course. My method of making these pins is shown in the sketch "L," from which it will be seen that an eye is formed in one end of a short piece of wire, or alternatively the end of the wire can be flattened and drilled, depending upon whether a large or small eye is required. The other end of the wire is then brought up and bent round the first to form a shoulder immediately below the eye and then soldered in place, after which the surplus—shown dotted in the sketch—is cut away. This method has many advantages, in the first place it ensures that the collar or shoulder, remains in close contact with the eye during soldering, and cannot be moved out of place, by the pressure from the burner during heating up, while secondly, it is much easier to make a very small eye on the end of a piece of wire than to make it separately.

The arm of the truss "F" was cut out of sheet and silver soldered to the bands "G," although an alternative method would have been to form an eye in either end of "F" and fix it with pins through holes in the flanges of the bands "G," as was often done in full-size practice. Lugs are fitted below the bands for the shackles of the clew-garnet blocks. A shoulder was formed on the crane "E" by soldering a small wire ring at the point where the section changes from square to round. And here again the ring, or eye, was formed on the end of a short piece of wire, the tail of which was turned down through the hole in the crane to hold the ring tightly in place during soldering, after which the tail was cut off and the shoulder filed up to shape. The round end of the crane was then pushed through the hole in the centre of the arm "F," a small ring fitted and soldered in place, after which the end of the crane was filed down to the face of the ring. This method of fixing leaves the truss free to rotate on the end of the crane, so that the yard can be cock-billed at will.

The centre-band "H" is simple and needs no description, except perhaps
to mention that the lug on top for the chain sling is slightly abaft the centre-line of the yard, as shown in the plans and sketches. The "iron" clover-leaf blocks for the chain sheets at first presented something of a problem to my limited facilities, particularly the very small ones for the upper yards, but I ultimately hit on a fairly simple solution as shown in Sketch No. 10. I first cut out a bit of thin sheet to roughly the shape shown in sketch "L," this was then folded up as "M," after which it was drilled, and filed up to its final shape as shown by the dotted lines in this last sketch, leaving a very thin web below the position of the sheaves and joining the two halves together, in fact in very small sizes these connecting webs can replace the sheaves. Even in large scale models this method of construction would have its advantages, since the webs would hold the two plates of the block in place during assembly, after which they would be filed away, leaving the plates held by the pins through the sheaves and the head. In my model the clover-leaf blocks were attached to their respective bands by short brass brads pushed through and spot-soldered on the one side. When complete the futtock-band should fit the mast at the point where it will just cover the heels of the cheeks, which are pushed down behind it when they are being fixed.

The mainmast, Sketch No. 12 should now be taken in hand. The spindle of the mast is made exactly as that of the fore, while the main cross-trees—the term in this case is used in the collective sense as meaning a full framework of trestle-trees and cross-trees, but without any decking, in which case it would become a "top"—are built like the foremast, except that there are only two cross-trees, and of course, no decking. The ends of the cross-trees are slotted to take the topmast shrouds, and should be closed with small plates as shown on Sketch No. 13. However before the masthead assembly can be put in place the timber mast-collar for the spanker boom jaws must have to be fitted and the mast-hoops put down the mast, since owing to the greatest diameter being at the deck, the collar could not be pushed up from the bottom, but must go over the masthead.

The collar I fabricated from four segments of wood, cut to form a square with the grain running along each of the four sides as shown in Sketch No. 14. These were glued to each other and then glued down to a sheet of paper, after which they were left under a heavy weight to dry. When fit to handle the top surface was cleaned up and the internal and external diameters of the collar set out with a pair of compasses, after which the centre was drilled out and the surplus cut away from the external diameter. The disc was then rubbed on a sheet of fine sandpaper to remove the paper backing, the edge cleaned up and the whole polished, to be finally glued and dovelled in position on the mast. When drilling the centre hole, keep it on the small side, so that it can be fitted to the mast by trial and error until a perfect push fit at the
correct level is obtained. The four timber brackets supporting the collar were shaped up in one piece as already described for the lodging-knees of the beams in Vol I, and when polished, were glued and dowelled in position.

The wooden mast-hoops, to which the luff of the sail would be bent, are extremely simple to make, yet they were about the only items which could not be made on my "portable workshop." In full size practice they are made very much like children’s toy hoops, and this I followed in the model. First I made a short round stick of about 1/8 in. greater diameter than the mast at the mast-collar, and covered this with a piece of paper rolled round it and held by rubber bands. I then put a small plank of straight-grained pine in the vice, and ran a fairly finely set jack plane down the full length of one edge, which resulted in a long thin curling shaving forming on top of the plane. The inner surface of this shaving was coated with thin glue and rolled tightly on the stick until the required thickness of band was obtained, when it was bound with cotton and left to set. When the glue was dry, the shaving could be slipped off the stick—the paper prevented it sticking—in the form of a short wooden "tube" with a paper lining. Using the end of the stick to prevent the "tube" being crushed, it was cut into "slices" of the required breadth, each slice representing a complete ring or mast hoop. I found that two shavings made all the rings required, and plenty to spare in case of accidents. The rings were given a thin coat of varnish, and when dry slipped on the mast and allowed to rest on the mast-collar until the boom was fitted, after which they go above the boom-jaws. Incidentally this method of making rings has many other uses, such as the rims of very small wooden steering wheels as mentioned in Vol. I, for which job the rim is left much broader than actually required until it has been drilled for the spokes and the latter inserted, in fact it should not be rubbed down until the whole wheel is complete, at which stage it can be reduced until there is only a "shim" on either side of the spokes. The shells of small wooden buckets and a number of other odds and ends can be made in this way, including the cores of small circular life-buoys.

The futtock-band for this mast, Sketch No. 15, is closed and therefore must go in position before the cheeks etc., so first make the band a tight fit on the mast in a position where it will just cover the heels of the cheeks, and when satisfied with the fit, silver solder it as a butt joint, then drill it and fit the three lugs and shackles as shown in the sketch and plans, one on either side for the topmast shrouds, and one forward for the brace-block pendants—see rigging details. When complete, push the band in position, where it should just cover the steps for the heels of the cheeks.

The masthead assembly can now be fixed, the seat on the mast being glued for the cheeks, which are pushed in below the futtock-band and then
dowelled, followed by the trestle-trees and cross-trees as before. The next item will be the crane for the throat-halliard block, and this I filled up from fairly thick sheet as shown in Sketch No. 16. The three eye-bolts for the peak-halliard blocks should also be fabricated from sheet as shown in Sketch No. 17, and in making these I put a thread on the tails, and by drilling the holes in the mast smaller than necessary, screwed them in, allowing them to cut their own threads. There is also a single eye-bolt on either side of the masthead for brace-block pendants, and as the tails of these have to be very short, I think it quite important that these should be screwed in, although if very fine screwing tackle is not available, then you will have to be satisfied with a spot of adhesive on each tail. Two small eye-bolts are also required in the after ends of the trestle-trees for the blocks of the topping-lifts—see rigging details—and these should also be screwed if possible since they have to take a direct end pull. The masthead is now complete except for the tenon for the cap, and this I prefer to leave until the cap is made, so that the tenon can be cut an exact push fit.

The foretopmast will be the next job, made to the dimensions shown on the spar detail. The heel is square—Sketch No. 18, and can either be made in one with the spar, or built out to the required dimensions by means of veneer glued and dowelled on the two sides and forward face. The after side is left flush with the line of the mast and has no projection. Whichever method you use the heel should be a good fit in the square formed by the cross-trees and trestle-trees of the lower mast. The fid-hole is cut thwartships so that the fid rests on the trestle-trees just forward of the bolsters. The mast is parallel sided from the heel to just above the level of the lower cap, from which point it tapers to the futtock-band, after which it is square to the head, as shown in the mast construction drawing and the sketch referred to.

In full size practice masthead caps are made rather larger in diameter than the upper of the two masts they connect, the topmast in the present instance, leaving room for a circle of wedges which not only grip the mast firmly in the cap, but also allow for slight adjustment in rake or plumb if required. This clearance has the further advantage of leaving the mast free to slide when being struck or sent aloft again. Incidentally it was common practice to fit a sheave in the heel of the mast immediately above the square portion for the “heel-rope” used to lower the mast when striking, but it was not found in all small vessels where the spars were relatively light and could be lowered by means of a simple whip with the end hitched round the mast just above the heel. I have not included this sheave in the plans or model, for I think the fewer holes one has in the spars of a small scale model, the less chance there is of breakage at a later date.

However to return to the lower masthead cap, I think for model work
Fig. 3.
Fore and Main Masts of the barque "FAVEL."

(Note good proportions of furled sails to the diameters of their respective yards.)

PERFECTION IN MINIATURE.
1,600 (50 ft. to 1 in.) Scale Models by Mr. Donald McNarry.

Fig. 4
Masts of a 12-gun brig-of-war.
it is better to make this an easy fit on the topmast, and omit the wedges, and this I did in my own model. It is obvious that the heel of the topmast cannot pass down through the cap, so the cap must be slipped down over the head before the topmast cross-trees are put in place. As already mentioned this lower cap was intended to be filed out of the solid as shown by "N" in Sketch No. 19, which is the method indicated on the working drawings, but in the circumstances under which this model was built it was more convenient to fabricate it as shown in the body of this sketch. First a strip of sheet copper was bent round the topmast and the two tails flanged out again "B," taking care that the distance from the forward face of this flange to the inside of the ring was equal to the breadth of the forward cross-tree, so ensuring that the topmast would run parallel to the lowermast head. The outer strap "A" was then bent so that the outer faces of the two sides were the same as the head of the lowermast before the cap-tenon was cut. This was then fitted outside component "B" with the forward ends curved to make close contact, and the whole assembly silver soldered. The cap as it now stands has a ring which is a nice fit on the topmast, and a square portion, the external dimensions of which are the same as those of the lowermast head. The tenon for the cap can now be cut in the head of the lowermast, making it a good tight push-fit in the cap.

The crane and fittings for the lower topsail yard should now be made. The crane "D" was made from a strip of fairly heavy gauge sheet, the two ends of which were first filed up to form the upper and lower parts of the crane respectively, bent round as in sketch "O" and silver soldered together. The inner of the two small rings "F" was then soldered on to form a shoulder at the point where the section changes from square to round, and the two holes drilled down through both members for the fulcrum pin, after which the unwanted portion—shown dotted in "O"—was cut away and the ends rounded. This method of making the two components on opposite ends of the same piece of metal ensures good contact while silver soldering.

In the scrap box I found a short length of 3/64 in. bore brass tube, from which I cut the boss for the fulcrum-pin, "C," which was then silver soldered to the face of the band, but had this bit of tube not been available I would have drilled a small piece of copper and filed it up to shape. The fulcrum-pin which holds the crane to the boss, I made as illustrated by "L" in Sketch No. 11. The band "E" was made a tight fit on the yard and the top flange drilled an easy fit on the end of the crane, on which it was then placed, followed by the second ring "F" which was silver soldered in place and the surplus filed off the end of the crane. Thus the band can rotate on the end of the crane, and the crane swing on the boss of the cap, giving full universal movement to the yard as in the case of the truss of the lower yard.

You will now have to decide whether you intend to make the parral...
The futtock-band is the next fitting, but before it goes in place it is as well to cut the sheave-hole for the upper topsail tye, if you have not already done this when making the spindle of the mast. I made this a dummy sheave-hole, simply drilling a small hole through the mast for the tye, then cutting a shallow score in the face of the mast to represent the sheave-hole. The futtock-band is plain like that shown in Sketch No. 15. but only two lugs and shackles are required, one on either side.

Except in the matter of size and the fact that they have no cheeks, the topmast cross-trees are the same as those on the main, Sketch No. 13, although they have the addition of the spreaders for the topgallant and royal backstays. However I think it better to omit the spreaders meantime, for it needs very little alteration in the rake of the upper masts, or additional thickness in the eyes of the rigging on the hounds, to throw the angle out slightly, so I usually fit the spreaders after the backstays have been tried in position, but before they are set up with their dead-eyes and lanyards. Therefore cut out your trestle-trees and cross-trees, and, as soon as the futtock-band is in place, assemble them as on other masts, glueing and dowelling in position as soon as satisfied with the fit. The topmast is now complete except for the cap tenon, which should be left until the topmast cap has been made.

The main-topmast, Sketch No. 20, and the combined fore topgallant and royal mast, Sketch No. 21, are both simple spars, with square heels which must be made a good fit in their respective cross-trees, and shoulders which form the hounds for the rigging. The fore topgallant and royal has a sheave-hole below each of the hounds, but in a small model scale such as this I think they are best made as dummies, with a hole through the top only for the respective tyes. The cap for the fore-topmast head is a simple band with a piece of copper soldered in the centre and filed up to shape, Sketch No. 22. The round portion of the cap fits the topgallant mast, while the square is made so that its outer faces are to the same dimensions as the head of the topmast before the tenon is cut. When the cap is complete, file down the masthead to form a tenon which will be a push-fit in the square. The main cap is made in the same way but with the addition of lugs and shackles as shown in Sketch No. 23.

The yards will now be taken in rotation for the purpose of description, although as already mentioned the reader may have had to jump ahead and
MASTING THE BRIGANTINE

In describing the yards I will also give details of such standing-rigging as can best be fitted before the yard goes in place on the mast, since I found it an advantage to rig these yards as I made them. Starting with the foreyard, Sketch No. 24, this should be made to the dimensions shown in the plans, the ends being reduced in diameter to form the yard-arms and allow the yard-arm bands to butt against a shoulder. Sheave-holes for the lower-topsail sheets must be cut in each end immediately inside the shoulder. The yard should now be fitted in the bands on the truss already made—incidentally the truss will of course be disconnected from the futtock-band by the removal of the fulcrum-pin. Next make the yard-arm bands as already described, they have three lugs, one above and below the yard respectively, and one on the after side, and see that they are a tight fit on the arms when in contact with the shoulder. It is a good plan to put such bands on with a spot of varnish inside, while with bands which do not rest against a shoulder, such as those in the centre of the yard, I usually apply a drop of thin varnish to the spar on either side of the band, putting it on with the point of a needle-sharp water colour brush. The varnish dries as a kind of "fillet" on either side of the band, and will prevent any possibility of movement at a later date.

The question of jackstays in a small scale model is always a difficult one. If they are omitted one is left without any proper fixing for bunt-line blocks, foot-ropes, Flemish-horses etc., while if they are fitted it is so very easy to spoil the whole model by their general appearance, and of the two alternatives I would rather be without them than have a model with a "young garden fence" running along the top of each yard. The stanchions supporting the jackstays are only an inch or two in height even on a large vessel, and therefore at 1/8 in. scale should not be more than about 1/64 in. high, which to the ordinary man is asking rather a lot, if they are to be properly made. Even on 1/4 in. scale models they are all too often made over scale, and so spoil the look of the yard. In my own model I included the jackstays but without any attempt to fit the small stanchions on which they would be carried, my idea being merely to suggest the jackstays and yet provide the necessary fixings for the foot-ropes etc.

In the junk box I found an old condenser coil wound with what seemed like several miles of very fine copper wire, and from this the jackstays were made. Suitable lengths were cut off and the ends turned down at right angles, then short pieces of the same wire were bent round it at intervals, Sketch No. 25. I made no attempt to place these "stanchions" at scale spacing, for I found that to do so tended to make the yard look "lumpy," instead I placed them about 3/8 in. apart, which was just enough to keep the fine wire straight along the yard. I drilled the yard to take the "stanchions"
and when fitting I pushed them right home, with a touch of varnish on the shanks, until the stay was in contact with the yard the whole way, with the result that although the jackstay is there, it is not noticeable except from close quarters, and certainly does not spoil the appearance of the yard. When it came to fitting the bunt-line blocks, or attaching the foot-ropes or stirrups, I simply pushed the point of a needle between the stay and the spar to allow a piece of fine wire to be pushed underneath, then pushed the stay flat again.

With all the bands and jackstays in position the constructional work on the yard is finished, but some items of rigging are much easier to fit while the yard is on the table than when in position on the mast, so we may as well take advantage of this. Sketch No. 26 shows the rigging on the foreyard and lower-topsail yard, but much of the gear in this sketch forms part of the running-rigging and cannot be carried out at this stage. What can now be fitted are the bunt-line blocks, foot-ropes and Flemish-horses. There are three small blocks, two bunt-lines and one leech-line, seized to the jackstay and hanging on the fore side of each half of the yard. In my own model I fitted a fine wire strop to each block, leaving a short tail which was tucked under the jackstay as already mentioned and turned back on itself, this was a more tidy job than forming a hook on the strop and then trying to seize this to the jackstay. Of course in a 1/4 in. scale model I would complete the block on the usual way and then seize it to the stay. These small bunt and clew line blocks must be made very small, and quite a number of models are spoiled by large blocks in this position. For a 1/8 in. scale model 1/16 in. square boxwood or sycamore is ideal for making these, for by the time it is shaped and cleaned up, the finished block will not be more than 3/64 in. long, however I will have more to say on the subject of block making later on.

The foot-ropes and Flemish-horses should now go on, and all these I made from the same copper wire as the jackstays. I think it much better to use wire for such items, since neither cotton nor thread will hang naturally on this scale and I hate to see foot-ropes and such gear curving upward instead of hanging in easy sweeps between the stirrups, also with wire one can make neater "eye-splices" in the ends of the gear than is possible with fine thread. To get over the colour difficulty I dipped each component in some black paint which had been dosed with thinners until it ran like a thin writing ink, after which the wire was hung up to dry.

The foot-ropes are made fast to a small shackle below the yard-arm band, although in a small scale model such as this, it could be "spliced" directly into the eye of the band. Two stirrups are provided on each side of the yard, and these have an eye in either end, the upper one being made fast to the jackstay, while the foot-rope reeves through the lower. The stirrups hang down abaft the yard, and when fitted the lower eye should be about 5/16 in.
below the centre of the yard in a 1/8 in. scale model. With the stirrups in position the foot-rope is passed through the eyes in each and finishes with an “eye-splice” which makes fast to the jackstay on the opposite side of the truss, as shown in the plans and sketches. The other side of the yard is rigged in the same way, the two foot-ropes crossing abaft the clover-leaf sheet-block. The flemish-horse has an eye formed in the eye-bolt on the end of the yard-arm, while the other end has an eye which makes fast to the jackstay, after passing abaft the yard. The foot-ropes should be adjusted so that they hang in bights between the points of suspension.

The lower-topsail yard, which is shown in both the sketches already referred to, is very similar to the foreyard except that it has no truss-span, instead it hangs by the centre band which pivots on the crane of the lower-cap. First remove the crane from the cap by taking out the fulcrum pin, then push the band on the yard and fix as already suggested by means of a little varnish. Next fit the two quarter-bands, the yard-arm bands and the dummy sheave-holes, followed by the jackstays. There is only one bunt-line block on each half of this yard, but a single block has to be shackled to the upper lug of each yard-arm band, these are for the upper-topsail downhauls. Another single block has to be fitted to the underside of each quarter-band for the clew-lines, this block, like that of the clew-garnets on the yard below, should have an eye at the heel for the standing end of the line. The foot-ropes on this yard are rigged just as those below, but there are no flemish-horses. The yard as rigged will be seen in Sketch No. 26.

With the upper-topsail, we come to a different type of yard, one which slides up and down the mast, to which it is attached by means of a parral instead of a fixed crane or truss as with the lower-topsail and foreyard respectively. The construction of the upper-topsail yard will be seen from the mast construction drawings in the model plans, and Sketch No. 27 reproduced here. When roughing out this spar, it must be remembered that the arms are longer in relation to the yard than is the case with those previously described. The first item to make and fit will be the centre band, which has a lug on top for the shackle of the tye, and one below which carries the clover leaf sheet-block. There is no need to describe this band in detail since its fabrication will be just as before. When the centre band is on, cut out the timber batten as shown on the plans, but taking the centre square across, leaving the saddle for the mast to be filed in later. 1/16 in. sycamore or other hardwood is ideal for making this batten, and when ready it should be glued and dowelled on the after side of the yard, but do not forget to cut a shallow recess to clear the material of the centre band. When the glue has set, carefully file out the saddle for the mast. In full-size practice the parral is fitted with a metal liner, as shown in the sketch, and this should be an easy
MASTING THE BRIGANTINE

The back of the parrel is closed by means of a hinged gate or strap, which, as it takes all the pull of the sail and yard, has to be very strongly attached. In practice this attachment takes the form of a strap going right round the yard and batten and forming the fixed portion of the "hinge." For the model, cut two strips of copper say about 3/32 in. wide and bend them round both batten and yard as shown, then in the two ends which project abaft the batten drill a hole down through both for the hinge pin. Remove the strap from the yard and "round" the ends about the two holes, file the rest of the strap down to 1/16 in. wide, and re-bend it to the yard, when it should look like "A" in Sketch No. 28. Now make a similar strap for the other side of the yard. Next make the gate "B" which may either be from sheet, or copper wire hammered to the required section and drilled, while the hinge pins "C" can be the tops of fine "bug" pins with the heads filed down flat. The complete unit will now appear as "D." The liners, if fitted, should be from copper shim. I had no suitable material available at the time of building this model and therefore I omitted them. The straps should be fixed to the battens by means of bolts going right through but in small scale work bits of very fine wire pushed through and lightly riveted over is ideal.

This yard has the usual arm-bands, sheave-holes and jackstays as already described, there is also an eye-bolt in the underside of each batten, and to this a single block should be shackled for the inner end of the downhaul, Sketch No. 29. A single block is also shackled to the bottom lug of each yard-arm band and takes the outer end of the downhaul. The top lug of each yard-arm band carries a shackle for the standing lift. There is only one stirrup on each half of this yard, otherwise the foot-rope is rigged as before, the outboard end being spliced into the shackle which carries the brace pendant abaft the yard-arm band, while the other end, after passing through the eye of the stirrup, is attached to the jackstay on the other side of the yard as shown. The Flemish-horse is rigged as before. There are no bunt-line blocks on this yard. The topgallant yard is really a smaller edition of the upper topsail, the main points of difference being that no Flemish-horse is rigged, and owing to the shortness of the yard, no stirrup needed on the foot-rope. A single bunt-line block is seized to the jackstay on the fore side of the yard, port and starboard, while a single block below each batten and yard-arm band serves the clew-lines. Shackles in the top-lugs of the yard-arm bands take the ends of the lifts, but all this will be clear from Sketches No. 27 and 29.

The royal yard differs only in that it has no sheave-holes for sheets, no clover-leaf block below the centre band, no bunt-line block and no block below the yard-arm bands.

Now that all the standing rigging is on the yards we may as well rig...
the brace-block pendants, after which the yards can be put on one side until required. I made these pendants of the same material as the foot-ropes, for in my view wire is better than linen thread for this purpose, since it completely eliminates all possibility of the braces twisting up after being rigged. The lengths of the pendants on each yard will have to be taken from the Sail and Rigging Plan, otherwise they are all alike. Shackles are fitted to the after lugs of all yard-arm bands, and these take the forward eyes of their respective brace-block pendants. The after end of the pendant is an eye which is "spliced" into the shackle on the head of the brace-block. These blocks will of course vary in size according to the yard they happen to serve.

The main-staysail-boom, Sketch No. 10, is a simple spar, the fore end being fitted into the goose-neck already described with the spider-band, while the after end has two bands in the positions shown in the plans, the inner one having a lug on the under side for the sheet-block, while the one at the extreme end has a lug and single block on top for the topping-lift.

The next spar will be the main, or sparker, boom which has jaws at the fore end, but perhaps the most troublesome item about it will be the twin collars which enclose the strops of the main-sheet blocks, Sketch No. 30. In my own model I made these solid with the boom, shaping them first as a single broad collar, then filing out the space between them. This I think the best way, for while it offers more trouble in tapering the spar, these collars are only about 1/32 in. square, so that it would be difficult to fabricate them decently in wood. They could of course have been made as metal rings, but as they were of wood in the original I wanted to keep them so in the model. When the spar had been formed, including the collars, the recessed flats for the jaws as shown in the sketch, were filed in the sides of the spar, after which the jaws were cut very roughly to shape and glued and dowelled in position. When dry they were finally shaped up and made a good sliding fit round the mast. The shoe was then cut out and while held in position, the hole drilled right through for the brass pin on which it is fixed. This hole was first drilled a driving fit for the wire to be used, after which the hole in the shoe was slightly opened out so that it was an easy fit on the wire. The brass pin was then driven through and hammered up on either side. The shoe is free to adjust itself to whatever angle the boom happens to make with the mast. The heel of the shoe is square to sit on the mast-collar. The next stage was to drill and clean out the slot for the "iron" strap which forms the eye-plate for the tack-shackle. The strap was of course made from a bit of copper sheet of suitable thickness, the holes being drilled first and the strap shaped up afterwards. This strap is fixed by means of a length of brass wire going right through jaws, boom and strap. A small eye-bolt is fixed in the end of each half of the jaws, and when the boom is rigged a wire parral with small boxwood rollers will span these two
PLANK-ON-FRAME MODELS

Fig. 5.

Steel 4-masted barque
"ARCHIBALD RUSSELL."
Scale 1/150 (12.5 ft. to 1 in.)
Model by
Professor H. Favez.

EXAMPLES OF WELL-PROPORTIONED RIGGING
IN MODELS OF IRON AND STEEL SHIPS.

Fig. 6.
Iron Ship "CORIOLANUS."
Scale 10 ft. to 1 in.
Model by
Mr. Harold Barnes.
eye-bolts and pass round the mast. Two hardwood thumb-cleats are fitted just inside the collars to take the eyes of the double topping lift, while at the outer end of the boom there is a band with a single shackle on top for the clew-earing.

The gaff, Sketch No. 31 will be the last of the spars, and it follows the same lines as the boom, although instead of the collars for the strops of the sheet-blocks, a number of thumb-cleats are fixed in the positions shown on the plans, and these take the strops of the peak-halliard blocks. A small eye is fixed in the end for the signall-halliard block.

All the masts and spars are now complete, but before getting them into the ship and rigged, it is as well to have a good stock of dead-eyes and blocks laid on, so that we do not have to interrupt the work to make these when once we have started. I always make more of these small fittings than are required, then if I should happen to drop a block or two during rigging, no harm is done.

The dead-eyes I have already described in Volume I and no doubt the builder will have these all ready, half of them on the chain-plates fixed to the hull, and the other half in a small jar or box all ready for picking up, so we can turn our attention to the blocks. I have tried many ways of blockmaking, but usually come back to that shown in Sketch No. 32. First cut a number of strips of boxwood or sycamore to the various sizes of block required, the smallest in case of the 1/8 in. scale Leon model will be from 1/16 in. x 1/16 in. strips, which when cleaned up will give you a block about 3/64 in. across. Clean up the strips and very slightly oval them on opposite sides as "A." Now take up one of them and round the end "B," then drill a hole in the position of the upper end of the sheave-housing "C," filing a shallow groove from the end of the block to this hole on either side, and at the same time file a small "nick" in each of the corners as shown in "D." These are for the strop. Finally part-off the block by filing in from opposite sides with a fine triangular file, "E," break off and round the end, finishing the job with two more "nicks" in the top corners for the upper part of the strop, "F." For blocks which have no external strop, the "nicks" in the corners will of course be omitted, although in small scale work internally stropped blocks are difficult to make except in the larger sizes but I will say more on the subject of strops later.

Blockmaking may appear to be a very long job, particularly when a hundred or so may well be required, but in actual fact it is like most such jobs, not nearly so bad when once you have got into the routine, and you will be surprised at just how many you have to show for an evening's work. One does get rather tired of it if all are made at one time, but it is an easy matter to count the number of blocks likely to be required, before you even start on the actual model, and the job of blockmaking can be spread over the
whole period of building. I started as soon as I had one or two frames in position, and from then on I spent an odd evening with the partly framed or partly planked model in front of me and, let it be admitted, admiring the results of my own handywork, while I put in a few hours making blocks. In this way my little glass jars of different sizes of blocks quietly filled up without any appreciable effort, and by the time I was ready to start rigging, I had quite a big margin over actual requirements, in fact when the model was fully rigging, I still had several dozen blocks in the "store." I have them yet, and they will come in handy as the nucleus of the block requirement of some future model.

For a number of years past, I have made any chain I required, partly because I like to make everything in connection with a model, and partly on account of the fact that most ready-made chain is nickle-plated, and as I have yet to meet the ship with nickle-plated chain, I do not like it. However in the case of the Leon model I found that I have now reached the stage where it is difficult to see to make very fine chain, so I felt that I must bow to the inevitable and accept what I could get. The bob-stays of the original vessel were of chain having about five links to the foot, which at 1/8 in. scale means about 40 links per inch, which was much smaller than any standard chain available at that time. The stuff I used was obtained for me by one of the leading model engineering firms, but not without considerable difficulty, since such sizes were apparently no longer in production, which they let me have.

Many years ago stud-link cable set me a problem which for a time I thought had no answer. I made the open cable alright, that was easy, but then I tried to insert the studs into each link, and the fun began, the chain was very small and the studs almost impossible to find when once they had been cut, while the least breath of air seemed to blow them away. I tried to buy a bit of cable but could not get it small enough—it was for the small scale scenic model of the four-masted barque Buteshire, which is included in the groups shown in Fig. 8, Vol. I and Fig. 20 in this—so something had to be done. It was the sight of a small pair of round-nosed pliers which set me on the right road, and in the end provided the cable I wanted. I ground down the closed ends of the pliers until they formed an oval slightly smaller than the inside dimensions of the finished link, then gripping the end of a piece of wire in these as "A" in Sketch No. 34 and filing it down at "B", slightly hollow in the case of larger sizes of chain, although dressing square will do for small stuff. The wire projecting from the other side of the tool was then bent down and the corner "C" hammered up square and sharp, after which the wire was bent right round and the end carefully cut and filed to make a good joint at "D." When the required number of links had been made they were laid on the charcoal block and the joint "F" in each silver soldered, after which they were made into a chain by opening joint "D," linking them together and closing them again. The chain was then put back on the charcoal block and the joint "D" in every link silver soldered. This makes a very good stud-link chain, and is not nearly so difficult as it appears in print, for like all such jobs, when once the first few links have been made one discovers the best routine and the work proceeds quite quickly.

The reader may feel inclined to cut off a number of pieces of wire, each just long enough to make one link, before starting work, but my own experience has been that it is better to form each link on the end of the coil or hank of wire, and to cut off after bending right round. In this way it is possible to pull the wire tightly round the tool, whereas working with short lengths means that they have to be hammered round, or bent round in the jaws of a pair of flat-nosed pliers, also for fine chain, the lengths are very small and difficult to handle.
CHAPTER II

STANDING RIGGING

The first job will be to step the lower masts, and for this the original building jig can be of service in providing a level base from which to check the rake and plumb of the masts, although it will be necessary to modify the end brackets to grip the stem and stern posts clear of the bowsprit and counter respectively. Alternatively one can fit new brackets or blocks under the bilges, the main thing being to ensure that the model sits plumb and with the bottom of the keel in contact with the base board. In my case I made another simple stand for use during rigging, although I used the modified base for setting up the masts, and arranged the blocks on it in such a way that the model could be replaced at any time for a check, and would always fall into the same position. The small temporary stand was handy during the actual rigging, since the model could be rotated easily for working first on one side and then on the other. Having arranged the base, the next thing is to make simple jigs for the rake of the fore and main masts respectively, and a third one for plum; these are shown in Sketch No. 35. In making the rake jigs, take the angle from the base of the keel and not from the waterline, so that the jig can stand on the base, also make the base member of the template for the foremast to face aft, and that of the main to face forward, so that each will have the maximum bearing on the baseboard. The length of the other leg of each of these jigs—or templates—should be long enough to reach from keel to truck with an inch to spare. The template for checking the plumb of the masts is in the form of an inverted "T."

These templates are well worth the trouble of making, since they will enable you to check instantly both rake and plumb of the masts at any time during the course of the rigging, and this is really very necessary because it is so easy to set up some stay or shroud too tightly and so pull the mast slightly over to one side, or out of rake in the fore and aft direction. This is most likely to happen with the upper masts, which is the reason for making the jigs the full height of the finished rig.

Perhaps it may be as well to say something about rigging tools before we actually start work, although no doubt each model maker will have his own ideas on this. However I will mention the very few simple gadgets I have found useful in almost fifty years spent in playing about with ship models. First the obvious, a pair of really good quality fine-pointed tweezers and the longer they are the better. A pair of small but long-pointed scissors, and jeweller's small round and flat nosed pliers. Now for the home made tools. Perhaps one of the most useful I have was made from a small pair of scissors bought in a 6d store many years ago, to the blades of which I soldered two long legs of hard brass wire, slightly flattened at the ends as Sketch No. 36A. These will not only retrieve small blocks, belaying-pins, hooks, etc. which may fall down the hatch when the model is completely rigged, but one can also feed running rigging through difficult places, or blocks which may be much too deeply buried in gear to be reached with even the longest tweezers. In making a tool such as this care should be taken that the ends really do close. My own rather rough-and-ready pair will pick up the smallest snipping of fine cotton or thread which may fall from aloft when trimming off odds and ends. They are also long enough to reach any part of a good size model without the hands contacting the rigging, and even down into the hold of a rigged model. For many jobs they are much better than tweezers, quite apart from their additional length, Another very useful form of tool can be made from needles of various sizes, with half the eyes broken off and inserted in long thin wooden handles. Sketch No. 36 B. These are ideal for belaying gear on pins or cleats, and in use they are held much as a woman holds a crochet-hook. The gear to be belayed is caught in the fork and the running end brought back along the handle to the fingers, the hook is then passed over and under the belaying pin until sufficient turns are on, then finished off with a couple of half-hitches by simply rotating the tool one half-turn each time. Sketch No. 36C is another version of the same tool but made from wire. The use is the same but the wire shank can be bent to any shape to get into difficult corners, and in Leon I belayed some of the gear on the fore pin-rail by placing a small mirror against the side of the deckhouse and using a wire tool with the jaws bent round to face me. The running end of the gear was fed across the top of the house from the other hand. One or two simple wire hooks are also very useful, while a range of simple cutting tools, made from bits of broken razor blades set at different angles in thin wooden handles can save a lot of time. There are many places where to cut off gear with the scissors would be rather difficult, but which can be reached with ease with such tools as these. Finally a few ordinary needles are good things to have in the tool box, they can be very handy for splicing and seizing, as well as many other odd jobs.

No doubt one can buy dental or surgical instruments which would do most of the jobs covered by my own rather Heath Robinson outfit, but as no doubt the reader will have appreciated by this time, I get far more pleasure out of something I have made myself, whether it be tool or model fitting,
than I would out of the most expensive professionally made article. I like to solve my problems my own way, whether it be the finished product or the tools for making it, since for me therein lies the main object in building models.

The question of the right material to use for rigging is sometimes a bit of a problem, but one thing is certain, cotton should be avoided at all cost, for it not only stretches badly, but is poor stuff to use and also lacks strength. I always make a practice of going to a fishing tackle dealer and buying the widest possible range of three-strand line, and from this it should be possible to get almost all the sizes of standing rigging required. Then from a good haberdashers get some reels of linen thread of different thicknesses, and it will be found that these will carry on from where the finest fishing line ends, and will provide all you need for running rigging. In the linen thread you will be able to get almost any colour or shade you require, but for the fishing line you will have to take what you can get. This however is not really important for you can always dye the stuff to your requirements.

When you have made up your stock, dye whatever is necessary, then arrange all your fishing line in big hanks about four or five feet long and hang them up with a fairly heavy weight suspended from the bottom of each hank, leaving them as long as possible to stretch. I make it a rule to lay in my stock of rigging material before even starting the hull, leaving it hanging throughout the period of building. In this way the line is probably stretched for the best part of a year, or even longer with some models, so that when you come to use it there will be no doubt about it being well stretched. Incidentally see that you put sufficient on stretch to do the whole model, so that there will be no risk of mixing stretched with un-stretched material at a later date. I think it as well to hang these hanks in an attic or shed if at all possible, so that they get the benefit of the atmospheric changes, but perhaps that is merely a fad of mine. Stretching the linen thread is not so important, since on this scale its use will be confined to the running rigging which is not subject to the same tension as the standing gear, and I therefore used it straight off the reels, but if it is to be used for standing gear, then stretching will not do it any harm.

On the Scandinavian barque already mentioned I gave all the standing rigging a thin coat of black varnish after this gear was in place, but before rigging the running gear. The varnish was rather troublesome to put on the inside faces of the rig, and at that time I also had some doubt as to whether it might prove detrimental to the gear. However after all these years I have never regretted it, the gear is as sound as the day it went into the ship, while there can be no doubt that the waterproofing effect of the varnish has protected the gear during its many hosings and the days when it was regularly left out in the rain for six or seven hours at a time as already men-

tioned in the first of these two books. I have no intention of treating the Leon model so roughly, in fact it has been in a glass case from the start, but I treated the standing rigging in the same way, and I think this will serve to preserve the gear of the glass case model just as much as it has done the other.

However let us get on with the model. In rigging as in building the hull, many difficulties can be avoided by planning the work ahead. For example, the most obvious start would be to get the masts in position, but the lower ends of the mainstay and middle-staysail stay both set up on the fore-lowermast and can be rigged with far greater ease while the masts are out of the ship than when they are in position. According to strict rigging sequence these items of gear will not be required for some time yet, but if their lower ends are attached to the foremast while there is no other gear on it, and more important still while the mast can be held in the hands, a much neater job will be made of it and without any difficulty. The maintopmast-stay also sets up on the foremast, so we will rig that at the same time.

The maintopmast-stay is set up to an eye-bolt in the centre of the middle cross-tree of the fore-top by means of a lanyard, Sketch No. 87, it then reeves up through the bulls-eye abaft the forecap and so to the mainmast, but it will be sufficient at this stage to reeve the lanyard. First cut off a piece of the black dyed fishing line or rigging cord of the correct size for this stay, making it about four inches longer than the length of the stay as shown in the sail and rigging plan, and form a small eye-spike in one end. There is no difficulty in making a proper splice in even the smallest of this three-strand stuff, and the only departure to be made from full-size practice is that having un-laid the end of the line for sufficient length to make the splice, thread each of the three strands on a separate needle, then proceed as in full-size material, by opening up the lay at the required point and tucking the first strand under it, using the needle, and tucking against the lay of course. Open the next strand of the lay and tuck the next free strand in the same way, and so on. Put on three complete tucks for each strand and cut off the surplus, when, in large stuff the splice should be whipped with the finest thread, but in very small stuff such as this stay I think it better to touch the splice with shellac or thin varnish, which will be ample to prevent the ends of the strands slipping the last tucks. Rub the splice between the finger and thumb to smooth it down and all is ready for setting up. In 1/4 in. scale work this eye-splice would be made round a metal thimble, and a bulls-eye would be shackled to the eye-bolt on the cross-tree, but in my own model I reeved the lanyard directly into the eye-bolt, and of course the eye in the end of the stay.

Take up about ten inches of linen thread of suitable size and hemp
coloured, and make one end fast to the eye in the stay, then reeve the other end through the eye-bolt on the cross-tree; back through the eye on the stay, and so on until you have three or four full turns complete, then set up taut so that the eye on the stay will reach about half-way to the head of the lower-mast, finish off with five or six half-hitches round the complete lanyard, cut off the surplus and then paint the half-hitches with shellac or thin varnish after which the stay can be coiled round a bit of cardboard and left hanging from the mast until required.

The middle stay will be the next, and this sets up to the after side of the fore futtock-band. From the appropriate size of black-dyed line cut off a length about 6 ins. longer than the required stay, pass one end down behind the roller on the after side of the futtock-band, Sketch No. 37, and double it back on itself for about 1/2 in. and put on three seizings, one close to the roller, one at the end of the doubled stay, and one between them. I suppose most readers will be familiar with the method of putting on a seizing but for the benefit of any who may not be, the following will perhaps help, this follows full-size practice except in the use of a needle through the standing part to start the seizing, which takes the place of the clove-hitch on larger work. Sketch No. 38 shows the method. Take a spool of the finest thread you have, or even cotton may be used for this job since the seizing will be given a coat of shellac or thin varnish when completed. Thread a fine needle on the end, pass it through the two parts of the stay at the point where the seizing is to start, and lay the end “X” along the stay as in sketch “A.” The needle can now be removed, for it has served its purpose. Now proceed to put a number of turns round the two parts of the stay and on top of the end “X,” taking care that the turns are as tight as possible. When a point equal to half the total length of the required seizing is reached, double the end “X” back on itself to form a loop along the stay (Sketch B) and continue adding turns on top of this loop until the required length of seizing is reached, then the end “Y” is cut from the spool and tucked through the loop in “X” (Sketch C). Pull on the end “X,” while keeping the turns tight with the thumb and finger, until the end “Y” appears alongside “X” in the centre of the seizing. Cut off these two ends and then give the seizing a coat of shellac or thin varnish.

Put on the remaining seizings, then wind the stay on a piece of cardboard and leave hanging from the mast until required. Next cut off a length of line suitable for the mainstay, this too will be black of course, in fact all standing rigging should come from black dyed material. On this line leave ample length for forming the eyes at either end as shown in the detailed plans of the rigging. In one end of this material form an eye of about four times the diameter of the foremost and put on a seizing, followed by another about 1/4 in. further along the stay and a third 1/2 in. from the eye, after
which the surplus material can be cut off. Pass the heel of the mast through the eye just formed which, when the mast is rigged will rest against the underside of the thumb-cleats on the side of the mast. This stay should also be wound on a bit of cardboard until required.

All we now require to complete this mast will be the futtock-shrouds. In the plans I have shown the topmast shrouds set up with dead-eyes and lanyards, for which purpose the lower dead-eyes would require to be attached to the futtock-shrouds much as the dead-eyes at the ship's side were attached to the chain-plates, in Vol. I, but subsequent examination of an enlarged photograph of the vessel's top seems to suggest that the topmast shrouds were, at least at one time, set up without dead-eyes, the lanyards being rove through an eye in the top of the futtock-shroud and an eye-splice in the end of the topmast shroud, and this is the method I followed in my own model, for it was one to be found in quite a number of small square-riggers of the brigantine and barquentine classes. Sketch No. 37 and photograph Fig. 10.

To make the futtock shrouds first, cut off six lengths of brass or copper wire rather longer than actually required, and if you intend to fit dead-eyes silver-solder one end of each length to a dead-eye stop. If you intend to rig the shrouds without dead-eyes then form a small eye in the end of each length of wire, silver soldier it, and then give the wires a coat of black as described for the foot-rope of the yards, after which they should be hung up to dry. When fit to handle, pass one of the wires down through the hole in the end of one of the cross-trees, then down through the shackle on the side of the futtock-band, and turn back to form a neat eye round it, finally cutting off the surplus wire. Rig the remaining five futtock-shrouds in the same way. These eyes round the shackles should also be soldered, but here I made a mis-calculation, for I spot soldered the pins of the shackles when I made the futtock-band, whereas they should have been left free so that the shackle could have been removed to allow the lower ends of the futtock-shrouds to be moved away from the mast for the soldering of the eyes. Of course, had the shackles been made with screw-in pins there would have been no difficulty.

We can now step the masts, but before doing so it may be as well to have a look at full-size practice in this direction, for in my opinion there is much to be said for following this in model work, since it can eliminate all the difficulties often experienced in getting a mast to the proper rake when both step and hole in deck are fixed to the correct size. In the full-size ship the hole in the mast partners and deck is much larger than the diameter of the mast at that level, and the mast is both centred and held firmly in place by means of a number of cotter-shaped wedges driven between it and the partners as shown in Sketch No. 39. These wedges have their sides cut radial to the centre of the mast, so that they can completely encircle it. The mast is first set up true to plumb and rake, and the wedges are made to suit, so that they can be driven home as shown on the sketch. When all the wedges are in they are covered by a waterproof canvas mast-coat, the neck of which is nailed to the mast and the skirt to the deck, although in vessels with iron or steel masts a suitable clamp replaces the nails in the neck.

Obviously the use of wedges in a model allows the angle and plumb of the mast to be adjusted exactly to what is required, and when we made the mast partners—and also the deckhouse top—we allowed the mast holes to be larger than the diameter of their respective masts, so that we could follow full-size practice in the use of wedges. First we must make the "mast-coats" which in our case will be from pieces of hardwood such as box or sycamore, turned in the lathe if such tool is available, and made by hand if not. The underside should be slightly hollow, Sketch No. 40, for although we will not make our wedges with heads like those in the original, there is a possibility that they may not finish exactly flush with the deck.

In the actual ship both masts would of course be wedged at the partners in the main deck, but in the model it would be difficult to do this in the case of the foremast, which comes up through the house, so we will wedge this mast in the top of the latter. Therefore the first job is to see that the deckhouse is firmly and finally fixed down to the deck. Next make a number of wedges about 1/8 in. wide by say 1/2 in. long and 1/16 in. thick in the centre of the taper, for as we have made the holes in the partners 1/8 in. larger than the masts, the wedges will be about 1/16 in. thick at deck level. If you have made the holes in the partners larger than this, then increase the thickness of the wedges accordingly. Now slip the mast-coat on the foremast, the hole in the centre of the "coat" will of course be an easy fit on this, and step the mast, making sure that the heel-tenon is properly in the step in the keelson, and that the trestle-trees are running truly fore and aft and the cross-trees thwartships. Set up the plumb template and slip a wedge on either side of the mast in the hole in the top of the house, and adjust these until the mast sits plumb. Next take the rake template, adjusting the mast to the proper angle by means of wedges on the fore and aft faces respectively. Check plumb again, and when satisfied drive in further wedges between those already in position, but giving them a coat of glue on both faces before doing so, then pull out the original four, one by one, coating them with glue and driving them home again, after which the tops of the wedges should be broken off at deck level and any roughness trimmed down with a razor blade Sketch No. 40. All that now remains is to put a touch of glue on the underside of the "mast-coat" and lower it down on deck. The mainmast will be set up in the same way.

Before starting the actual rigging it will be as well to look at the sequence
HALF NUMBER OF TURNS PUT ON TOI-' OF "X" WHICH IS THEN DOUBLED BACK (B)

Sketch No.41.

Leon has five shrouds per side on the foremast, and the first pair to go over the mast are Nos. 1 & 2 (reading from forward) on the starboard side, Sketch No. 42. Next the eye formed by Nos. 1 & 2 on the port side, followed by Nos. 3 & 4 starboard, Nos. 3 & 4 port; No. 5 starboard and No. 5 port, in that order. Finally on top of all these is the eye of the forestay, which in Leon sits on thumb-cleats halfway up the masthead, but in some ships will be down on top of the rest of the rigging.

Assuming that all the rigging material has been well stretched and that for the standing rigging dyed black, we can start getting the fore-shrouds over the masthead. In full-size practice the eyes of all standing rigging would be wormed, parcelled and served, then finally wrapped in well tarred canvas before the eye went over the mast, as described in detail in my Masting and Rigging, but on 1/8 in. scale I think this would look too heavy, although at 1/4 in. scale it can be carried out at least as far as the serving. From the size of cord needed for the lower-shrouds cut four pieces, each long enough to reach say from the keel, up round the mast head, and back to the keel on the same side, and two pieces a little more than half the length above. Take up the first of the long lengths, middle it, i.e. bring the two ends together to form a loop in the middle, seize this loop with thin thread or cotton as already described, so that it forms an eye, Sketch No. 41.A, a little larger than is necessary to go round the masthead above the bolsters, the seizing being just on top of the latter. Coat the seizing with shellac and lay aside while the remaining three pairs of shrouds are made in the same way. Next form an eye in the top of each of the short lengths to be used for the single shrouds. These eyes are made by forming a bight (loop) of the same size as the eyes in the pairs of shrouds, and then putting on two seizings as shown in the sketch referred to. In the ship, three seizings would be used, but on this scale two will be sufficient for we do not want the last one to appear below the level of the futtock-shrouds.

When the seizings are dry take up the first pair and pass the eye up through the lubber's-hole in the decking of the top, starboard side, over the head of the mast, and then press down on top of the bolsters, taking great care that it rests flat on either side of the mast and cannot possibly settle down lower, either when the tension comes on or when fitting the next eye. Before finally bedding the eye on the bolsters, offer the lower ends of the shrouds to their respective dead-eyes on the ship's side, and check that the
eye is properly placed to allow the shrouds to reach their dead-eyes without fouling any of the futtock-shrouds. If they do foul, then rotate the eye on the masthead until the shrouds do lead fair. Now take the next pair and feed the eye up through the lubber's-hole on the port side, place it over the masthead, and see it well bedded down on the eye already in position after checking the lower ends for fair lead to their respective dead-eyes. The next pair starboard and the next pair port follow in the same way, always checking the lead of the shrouds so that they will run fair of the futtock-shrouds and bedding the eye accordingly. Make certain that each eye is well pressed down all round before fitting the next. When all the pairs are on, fit the single to starboard, followed by the single to port, and the lower rigging of the foremost is ready for setting up.

All dead-eyes in the lower rigging should be at the same level above the ship's rail, and there are two good ways of doing this in a model, both employing a simple jig. One is as shown in Sketch No. 43A which consists of a piece of wire bent to register in the holes of the upper and lower dead-eyes, and moved along from shroud to shroud as the work proceeds. This is extremely simple to use, but it has two slight disadvantages, one being that it really measures the distance from dead-eye to dead-eye and not the distance above the rail, which will in fact get less as the angle of each shroud increases the further aft you go. This difference is really very slight, and in itself would hardly be worth bothering about, but this jig has one other disadvantage, and that is that it only registers in one hole of the upper eye, which can therefore turn round, and as none of the holes of a dead-eye are centrally placed, the way the eye is facing makes a difference to the distance it is from the rail or the adjoining dead-eye.

An alternative jig is shown in Sketch No. 43B, which is made up of a short piece of hardwood with two pins in it to register in two of the eyes of the upper dead-eye, while the lower end of the jig is resting on the rail. A small piece of wood on the back of the jig locates it on the rail and makes it easy to place. There are faults in this jig too, one being that it does not line the upper eye with the lower one, so care has to be taken that the jig is correctly located before turning it into the shroud. However either of these will be satisfactory in a small model such as this.

On the inboard side of each shroud and about eight feet above the deck a small hardwood bulls-eye is seized as a fairlead for the running-rigging coming down through the lubber's-hole to the pin-rail inside the bulwarks. I am afraid I cheated in the making of bulls-eyes for these fairleads, by using metal instead of wood. I made these fairleads on the shrouds out of wire and they were in position before I discovered a much better way of making bulls-eyes, so I will describe both, but I think if I were building the model again I would use the latter method, or return to my previous ideas and make them of wood, which is really the best although perhaps not quite so strong. However to take the wire ones first. I took a couple of turns of fine copper wire round the shank of a very small drill. I then placed an even smaller drill alongside the first and took one turn round both drills; gave the second drill a half turn to form a small eye, then removed it and put two more turns round the original drill, which resulted in a coil like that shown in the upper drawing of "A" in Sketch No. 44. This was then slipped off the drill, the unwanted portions sawn off with the fine jeweller's saw, leaving the finished fairlead as shown in the lower drawing of this same sketch.

Later fairleads I made out of heavier wire flattened and bent round a drill shank as shown in the upper drawing of "B" Sketch No. 44. Before bending round the drill the "flat" was touched up on the edge with a file to make a rough oval section. The joint along the face of the drill was soldered and the surplus cut off. The strop was formed of very fine wire bent as shown in the lower drawings, which was then pushed over the body of the bulls-eye and silver soldered all round, after which the surplus wire was cut off the end of the strop. This was the type of bulls-eye used for the standing-rigging of the bowsprit and the like, and would, had I thought of it in time, have been used throughout.

The wooden bulls-eye can be turned if a lathe is available, or drawn through the draw-plate if not, after which the hole in the centre is drilled by means of a simple jig as described in Vol. I for the dead-eyes. The one disadvantage of the wooden bulls-eye in small sizes and on a small model scale such as this, is that the strop has to be butt soldered, very fine wire end to end, and the whole strength of the bulls-eye depends upon that joint, whereas with the metal bulls-eye as just described, the strop is soldered to the body of the eye and cannot come adrift or break.

Now take the first shroud starboard side and thread on one of the fairleads just described, the shroud going through the small single eye of course fit a dead-eye on whichever type of jig you are using, then pass the shroud down the forward side of the dead-eye, up the after side, pulling it nicely tight, then take a fine needle and thread, pass it through both parts of the shroud immediately above the dead-eye, and proceed to put on a seizing as already described. The short end of the shroud overlap should be as shown on the plans, or about 5/8 in. On this scale, and should have three seizures in this length. However as many of these small ships served over the seizings, I only put two on each shroud and then served over the top of them for the full length of the doubling. The order for turning in dead-eyes, is that the short leg of the shroud must always be on the right-hand side when viewed from the deck, which means that the short legs will be on
PLANK-ON-FRAME MODELS

Fig. 9.
FORE CROSS-TREES.
Note Topgallant Sheet (Chain) shackled to Clew-line below the Yard.

Fig. 10.
FORE TOP.
Note "V" of Fore-stay and Chain Tye of Upper-topsail Yard.

WHALER "CITY OF NEW YORK."
Photos by Mr. John J. Flynn.
STANDING RIGGING

the after side of the shrouds on the starboard side of the ship, and on the fore side of all port shrouds.

Turn the dead-eyes into all the other shrouds, then it will be time to start reeving the lanyards. Do not make the mistake of making these too thin, remember that in the real ship the shrouds are wire, while the lanyards are hemp, and for a vessel of this size would be 2½ in. stuff. Start on the starboard side with the forward shroud, and having made a large knot in the end of an 8 in. length of linen thread of suitable size, give the knot a touch of shellac or adhesive, then draw the lanyard across a block of beeswax to make it smooth and easy to reeve through the dead-eyes. The order of reeving lanyards is as follows. The lanyard always reeves outwards through the holes in the upper dead-eye and inwards through the lower. Now assuming that you are standing on the deck of the vessel and looking outwards, pass the lanyard through the bottom left-hand hole of the upper dead-eye until the knot rests against the hole; down and in through the left hand hole—as seen from the deck—of the lower dead-eye; up to the centre hole of the upper dead-eye; down to the centre of the lower; up to the right-hand hole in the upper; down to the right-hand hole in the lower, then back up behind both dead-eyes to finish off with half-hitches round the shroud immediately above the upper dead-eye. Set the lanyard up taut, but leave it with a single half-hitch at present in case further adjustment is necessary when all are reeved, in fact it is as well to leave them on a single half-hitch until all the standing-rigging is in place, making the finishing off of the lanyards the last job. Sketch No. 45.

When the lanyards of the first pair starboard are finished, go to the other side and reeve the first pair port, and so on until the whole of the fore shrouds are on. It is quite a good idea to use your rake template from time to time, just to check that you are not pulling the mast out of true as you tighten up the lanyards

The next item will be the forestay, and the method of rigging will largely depend upon the type of anchorage you have provided for its lower end, we will start by assuming that you intend to set it up to the eye-bolts below the deck level as described in Vol. I. In this case you will already have one end seized to the eye-bolt on one side, and the other end of the stay passed through the other eye but not seized, and with plenty of spare in hand. Pass the bight of the stay over the head of the mast and bed it down on the thumb cleats provided on the sides of the mast, Sketch No. 37. Incidentally in all the sketches of the standing-rigging I have shown serving on all such things as eyes, eye-splices, doublings etc., since this would certainly be required in a large scale model. In my own 1/8 in. scale model I did not do any serving but there really is no reason why these items should not have been served, providing sufficiently fine material was used for the job, otherwise it might
well make the rigging at the masthead look too cumbersome. Perhaps this is just an excuse on my part, and the real reason for its omission lay in the fact that I plunged into this model as a form of relief and relaxation immediately on my return to civilian life, without even waiting to re-discover my tools and kit, most of which had become dispersed during my seven years away. I was not particularly interested in the result of my work, all I wanted was the pleasure of making something and using such tools as were immediately to hand. Had I even dreamed that I would later use the model as the basis for a book, I might have paid more attention to certain details particularly as I would then have photographed them from time to time for the purpose of illustration. These are little things I have since regretted but they are done, or rather they were not done, and in any case my pleasure is in the making rather than what I get when I have finished.

However I have wandered off the track somewhat, so we will return to the forestay. Having settled the bight down on the thumb cleats, take up the slack on the end which has not yet been seized, and when the stay is just taut, put on a seizing immediately above the deck, and then a second above this, cutting off the surplus. These seizures should be at the same levels as those already on the opposite side of the stay, also the ends of the stay should of course be served for the full length of their respective doublings. Next put a seizing round both parts of the stay to bring them together say about 8 ft. 0 in. in the original—above the deck as in Sketch No. 46. Another seizing is put on at the head of the stay to bring the two parts together just forward of the rim of the top, Sketch No. 37 and photograph Fig. 10, although in the latter the stay is below the top.

If you have brought the anchorage for the forestay above the deck (Volume I) then take a piece of material twice the finished length of the stay plus about six inches for the doublings. Middle it and put on a seizing to form an eye to go over the masthead and extend just forward of the rim of the top. Pass the lower ends of the stay through the eyes in the end of the anchorage immediately above the deck, then set them up with three seizures on each leg, finally bringing them together with a seizing 8 ft. 0 in. above the deck as already described. Whichever method you use, the stay should be just nicely taut after the two seizures binding the two parts together are on.

The mainmast, Sketch No. 47, has only two pairs of shrouds per side, and these are rigged exactly as those of the foremast, starting with the first pair starboard, then the first port; second pair starboard, then second pair port, all well bedded down on the bolsters. The next job will be to turn in the dead-eyes and reeve the lanyards the sequence being as already described, since this is followed throughout the ship. The lower end of the mainstay is already round the foremast, so all that remains is to set up the head,
but first see that the eye of the lower end is sitting properly below the thumb-cleats on the mast, then pass the other end up under the forward cross tree of the mainmast, round abaft the mast, back under the forward cross tree on the opposite side and back to its standing part. See that the eye so formed is sitting properly on top of the eyes of the shrouds and cannot possibly slip down and become slack, then, when satisfied, put on three seizings forward of the cross-trees, forming a "V" about 5/8 in. long on the fore side.

The standing rigging of the lowermasts is now complete except for the ratlines on the shrouds, which is one of the really tedious jobs in model work, and so there is much to be said for doing it as you go along, but on the other hand the ratlings can get badly in the way when working at other gear about the masts, and therefore I think it better to leave them until all the standing rigging is in place. Having to do the whole lot at one time is not a very pleasing thought, but in the long run I think it well worth while.

The bowsprit has two bob-stays, both of chain and set up with bulls-eyes and lanyards to the two outer bands on the spar. The lower ends shackle to chain-plates let into the stem, and in the model these should be filed up out of brass or copper sheet. In full size practice they are morticed into the stem and through-bolted, but I made them as shown in Sketch No. 48. The bowsprit-shrouds are also in chain and set up with bulls-eyes and lanyards to the first bend inside the bowsprit-cap. Sketch No. 49 is an impression of the gear on the bowsprit, sketched from the model.

The next stage will be to send the foretopmast aloft, but before doing so it will be as well to rig the futtock shrouds, these however are the same as those of the lowermast, except that there are two instead of three per side. Step the heel of the topmast in the space between the cross-trees and trestle-trees of the lowermast, and put in the fid. Fit the lower-cap on to its masthead-tenon, giving the latter a touch of shellac before doing so. Check that the mast is plumb and true with the lowermast, and also that the topmast cross-trees run square across the ship.

Now we can start rigging the topmast, Sketch No. 50, and the first item to go on will be a strop for the upper-topsail standing lifts. This strop is shown in Sketch No. 51 and is made from a grommet, (or ring) of line such as is being used for the lighter standing rigging. This grommet may either be made by splicing together the ends of a short piece of suitable line, or better still take out a single strand from a piece of this material, taking care not to destroy the "lay", then re-lay this round into its own part three times so that you finish up with a complete endless ring of three-strand "rope." Whichever method you use the finished size of the grommet should be about three or four times the diameter of the masthead. Two seizings are then put on, forming three eyes, the larger one to fit the masthead and the smaller
ones just large enough to receive a lashing. In case the reader has not had any previous experience in making endless grommets or strops, I will describe this more fully at the end of this chapter. The actual lifts will not be required until the upper-topsail yard is being rigged, but it will save a lot of trouble if they have their upper ends made fast to the strop before it goes over the masthead.

Cut two lengths of material suitable for the lifts, and splice a small eye in one end of each, and with some very fine linen thread, seize each of these eyes to one of the small eyes of the strop. The strop is now placed over the topmast head so that the lifts hang down one on either side of the mast, where they should be left until required. See that the strop is well bedded down on the bostons then proceed to rig the fish-tackle, which will be the next item to go aloft.

First make the fish tackle pendant by splicing the end of a piece of suitable material into the eye of a three-sheave block having another eye at its heel. The length of the pendant will be obtained from the plans and should have a large eye formed in the upper end by seizing the two parts together. This eye must be large enough to pass over both masthead and the forward cross-tree. Now take another three-sheave-block, this time provided with a large hook. Cut off about 30 in. of "hemp coloured" linen thread suitable for the blocks and splice one end into the eye on the underside of the block on the pendant. Pull the thread over a block of beeswax and proceed to reeve the tackle, starting first in the outer sheave of the lower block, up to the outer sheave of the upper; down to the centre sheave of the lower, and up to the centre of the upper and so on until all sheaves are taken up, which will leave the fall coming off the last sheave in the upper block. Slip the upper eye of the pendant over the topmast head and over the ends of the forward cross-trees, so that the eye actually comes down between the two cross-trees as shown in Sketch No. 50. Set up the fall until the distance between the two blocks will just allow the hook of the lower being put into a larks-head—Sketch No. 52—on the "V" of the forestay. The fall should then be hitched to one of the warping drums of the windlass and the end coiled down on deck and fixed with a touch of shellac. Photograph Fig. 11 shows the fish-tackle of the barque City of New York, although in this case a second pendant is used between the lower block and the hook.

There are three topmast-shrouds per side, which go on in two pairs and two singles, and the method of making is the same as the lower shrouds. First fit a strop for the lifts, Sketch No. 51, then start with the first pair of shrouds to starboard. Take a length of cord of the required size, middle it and seize the two parts together to form an eye to fit the masthead. Give the seizing a touch of shellac then fit the eye over the masthead, pressing it well down on top of the strop. Now make the pair of shrouds for the port
side and press that eye well down on the first. Back to the starboard side where the first single shroud is made just as the single shrouds of the lower rigging, by bending it back on itself and forming an eye to fit the mast and seizing the two parts together. Put this shroud over the masthead, then rig the single to port in the same way. Now take the first shroud starboard and offer it to the eye of the first futtock-shroud on that side, just to check that it will run clear of the futtock-shrouds of the topmast. If it fouls one of the futtocks, then move it forward or aft as necessary to clear. Next form an eye-slice in the lower end of the shroud about 3/8 in. above the rim of the top, doing the same with the other five shrouds of this mast. These eyes should of course be made round metal thimbles, but on this scale this is not very easy unless you are well provided with facilities for metal work, although it is possible to make passable thimbles from aluminium shim, by cutting very narrow strips of the latter material and inserting them in the eyes after they have been made, the edges of the metal strips are then flanged-outwards.

When all the eyes are made, eye-slice lengths of linen thread into them, and after well beeswaxing the threads proceed to reeve the lanyards between the eyes in the shrouds and these in the lower futtock-shrouds, making three full turns through each. The lanyards are finished off with half-hitches round their own standing parts, and a touch of shellac or adhesive on each to prevent it coming adrift later on. Photograph Fig. 10. However at this stage it is as well to put just one half-hitch on each lanyard and leave the spare hanging until all the standing rigging is set up, after which one can finish off all lanyards, both in eyes and dead-eyes. This will leave the way open to adjust the tension on any stay or shroud should it be necessary for the purpose of having all the gear well set up. It is surprising just how much a stay can slack off when other gear goes on higher up the mast, even though it may have been quite taut when rigged, so it is always as well to leave the final tensioning of all lanyards until all the gear is in place.

There are two topmast-backstays per side in this ship, but they are rigged just as a pair of shrouds, except that they extend from the topmast head down to the ship’s side instead of to the cross-trees. Simply take a piece of material to be used, middle it, seize the two parts together to form an eye to fit the mast, then put it over the masthead on the starboard side, bedding it down on the eyes already there. Offer the lower ends to the dead-eyes on the ship’s rail to see that the backstays clear the upper futtocks, then turn-in the dead-eyes and reeve the lanyards in the same sequence as those of the lower shrouds on that side. Next make the pair of backstays for the port side and rig them in the same way.

In many ships the headstays leading down on to the bowsprit have their heads sitting on thumb-cleats abaft the topmast head, just as that already described for the forestay, but in the present case the eyes of the headstays go on top of the eyes of the shrouds and backstays, as shown in Sketch No. 50, and the first to be rigged will be the foretopmast-stay. In my notes regarding this vessel I have a record that this stay was single with a tail spliced in the lower end for setting up on either side of the bowsprit, but these notes were made many years ago, and the more I think about it the less happy I feel, since it is most unusual for this stay to be single in a vessel of this tonnage, so when it came to rigging the model I decided to follow the standard practice and fit a double stay, which is what we will do now. Take a length of the cord required, long enough to reach from the bows, out along the bowsprit, up round the masthead and back again plus sufficient for working. Middle this and seize the two parts together to form an eye to go round the masthead and finish with the “V” well forward of the trestle-trees as shown in Sketch No. 50. Take the lower ends and pass one down through each of the holes in the poft and starboard bees-batten respectively. Take them aft below the batten and either splice or seize each of them to a bull’s-eye at a point about 3/8 in. short of the bows. In the bows alongside the bowsprit fit a ring-bolt with a bull’s-eye attached, port and starboard, and reeve lanyards between these and the bulls-eyes on the legs of the stay and set up taut. The plans and the sketch of the bowsprit, drawn from the model and shown as Sketch No. 49, will make this clear. Set up these lanyards until the stay is taut, then bring the two parts of the stay together about 3/4 in. above the bowsprit and put on a seizing, so that the two parts are in close contact from this point to the “V” of the upper eye. (Fig. 11).

Before putting the remaining fore-and-aft stays round the masthead it will be as well to completely rig the jibboom, but this requires very little description, since it is clearly shown on both plans and also Sketch No. 49. The foot-ropes will be the first item to go on, and these I made of linen thread. I would have used wire as in the case of the foot-ropes on the yards, but those on the jibboom have to have a number of small knots along their length to give the crew’s feet a grip on the inclined, and often wet, foot-rope, and these knots would have been impossible to make neatly in wire. Two lengths of thread were cut and a large eye to fit the jibboom at the bowsprit cap spliced in each. Sufficient knots were tied along each at 1/4 in. intervals after which the eyes were slipped over the heel of the jibboom and moved forward until they were just inboard of the cap. The stirrups were made of fine black wire, middled to form an eye to fit the jibboom just outside the centre band and with a small “eye-slice” worked in the end of each leg which hung about 3/8 in. below the spar. The foot-ropes were reeved through these eyes port and starboard respectively. A small eye was formed in the outer ends of each of the foot-ropes and slipped over the lugs on either side of the outer band, to be prevented from falling off by means of the shackles
of the outer jibboom-guys. Short crane-lines were rigged from each foot-ropes to the jibboom-guys—when the latter had been rigged—on their respective sides, as shown in the perspective sketch of the bowsprit.

The martingale-stays are of chain and rigged from the eye-plate at the foot of the martingale to the inner and outer bands on the jibboom. These chains have to be cut to the proper length, for they have no lanyards by which the tension can be adjusted after fitting. They should be so arranged that they give the jibboom a slight downward curve when the martingale is perpendicular to the bowsprit. This curvature of the jibboom is very important, for without it the spar will appear to cant upwards, which it should never do. The martingale-backropes are also of chain, shackled to the after side of the eye-plate on the end of the martingale, and taken aft on either side to be set up with bulls-eyes and lanyards to eye-bolts in the bow very slightly forward of the catheads. The bowsprit shrouds are chain too and shackled to an eye-bolt in either bow just forward of the catheads, with their outer ends set up with bulls-eyes and lanyards to the band just inside the bowsprit cap.

The inner jibboom-shrouds should have an eye spliced in the outer end and shackled to the lugs on either side of the inner band of the jibboom. Then they pass over the inner cleats of the whisker-booms port and starboard respectively, and set up to the ship's side with bulls-eyes and lanyards as shown on the plans. The outer jibboom-shrouds set up in the same way, passing over the outer cleats of the whisker-booms.

In full-size practice all the headstays would be put over the masthead and then the lower ends set up taut by the bulls-eyes and lanyards, but in model work it is often more convenient to work in the opposite direction, first reeving off the bulls-eyes and lanyards and finishing with the eye round the masthead, for many of the lanyards are tucked away close to the ship's side or in the midst of a lot of gear. The foretopmast-stay had to be set up in the usual way, since both its ends are down at the bowsprit, but the remaining headstays we will work from the lower end up, and the inner-jibstay will be the first to be rigged. Take a length of suitable size rigging cord and eye-splice one end to a bulls-eye, then reeve a lanyard between this and another bulls-eye shackled to an eye-bolt in the bow just forward of the cathead on the starboard side. Finish off the lanyard with the bulls-eyes about 3/8 in. apart then take the stay forward under the upper-thumb cleat on the starboard side of the martingale, up through the inner sheave-hole in the jibboom, and round the masthead at the topmast cross-trees, taking care to bed it down on the rigging already on the masthead and back to its own standing part, to which it is seized in three places, as shown on the plans and Sketch No. 50. All these headstays should be served where they pass over cleats, through the jibboom, and round the masthead, but

that is a point on which the model builder will have to use his own discretion and be guided by the scale of the model he is building. On a large scale this serving really ought to go on, as already mentioned.

The jib-stay is made in the same way but sets up to bulls-eyes on the port bow, reeves over the port upper thumb-cleat on the martingale, up through the outer sheave-hole in the jibboom and is finished off in an eye round the masthead as before, again taking care that the eye is bedded down so that it cannot slip when once set up.

The remaining headstays cannot be rigged until we have the topgallant mast set up, but we may as well describe them now while we are on the jibboom, in fact they can be rigged except for the final eye round their respective hounds on the topgallant and royal masts. The topgallant-stay sets up at the bow on the starboard side with bulls-eyes and lanyard, placed alongside those of the inner-jibstay, passes under the lower starboard thumb-cleat of the martingale, up through the inner hole in the head of the jibboom and finishes in an eye round the mast at the topgallant hounds.

The fore-royal-stay is set up with bulls-eyes and lanyard alongside those of the jibstay at the port bow, passes under the lower thumb-cleat on port side of the martingale, up through the outer hole in the head of the jibboom, and finishes in an eye round the royal hounds.

The foretopmast is complete and we can now move aft to the main. Step the topmast and fix the cap as before. The lower end of the main-capstay, or middle-stay, we have already fixed to the roller on the after side of the futtock-band of the foremast, so now take the upper end and reeve it down through the shackle on the fore side of the main-cap, set up taut and seize to its own standing part with three seizings, then shackle a small single block to the eye so formed and it will be ready for the middle-stay-sail-halliard. Sketch No. 47. I think it is a good idea to rig the brace-block-pendants at this stage while there is very little rigging on the mast, but that is a matter of opinion. I made all these pendants of copper wire, blacked of course, which prevented the braces twisting up as so often happens when the pendants are of rigging cord or thread. The lengths and positions of the various pendants can be obtained from the plans, and they should be formed with a small "eye-splice" in either end, one for attaching to the eye-bolts or other fixings at the mast, and the other to the brace blocks.

Sketch No. 58 shows the rigging on the main-topmast hounds, and from this it will be seen that the first item to go on will be maintopmast-stay, the lower end of which we have already set up in the fore-top by means of a lanyard to an eye-bolt in the centre of the cross-tree, and passed the stay up through the bulls-eye on the after side of the fore-cap, Sketch No. 37. Now take the upper end and pass it round the maintopmast hounds, back along its own standing part where it is finished off with three seizings. The
first seizing has to be hard against the mast, on which the eye must be a tight fit. When setting up this stay make it a little more taut than appears necessary, otherwise it will tend to slacken off when the main topgallant stay is set up above it. However there is one thing I seem to have overlooked, the mast-hoops for the main-topsail. These are made just as those on the lowermast, but lighter, and they will require to be slipped over the masthead before any of the rigging is set up.

There are only two topmast shrouds per side, so take a length of suitable rigging cord, middle it and form an eye by seizing the two parts together, this eye must be a tight fit round the mast and should be well pressed down on top of the eye of the maintopmast-stay. Offer the lower ends of the shrouds to the futtock-shrouds on the starboard side, then make eye-splices in the lower ends, leaving a space of about 3/8 in. or 1/2 in. for the lanyards. Reeve the lanyards as already described for the foretopmast-shrouds, but do not finish off the half-hitches at this stage. Make and rig the pair of shrouds for the port side in the same way, again making certain that the eye is well bedded down on the ones already fitted. There is a single topmast-backstay per side and this is rigged by forming an eye in the head of the stay and putting it over the mast on the starboard side, bedding it down on the other rigging, and then turning a dead-eye in the lower end of the stay and setting it up at the rail with lanyards, following the usual sequence of reeving. The topmast-backstay on the port side is rigged in the same way. That is all the standing rigging at the topmast hounds, although sundry brace-blocks will be required, but this mast is well clear and they can be fitted later.

The final stage in rigging this mast will be the topgallant hounds or, the masthead. The maintopgallant-stay is set up to an eye-bolt in the after side of the foretopmast cross-trees as shown in the plans, and its head is an eye round the maintopmast at the topgallant hounds, this eye being formed as previously, by seizing the stay to its own part close against the mast. There is a single backstay per side, and these are rigged just as the topmast-backstays below, the starboard one going first on the mast, followed by that to port. That completely finishes the mainmast as far as standing-rigging is concerned.

The fore topgallant and royal mast will now go aloft, and if you have made the parrell of the topgallant yard with a fixed hinge, it will have to be slipped over the mast before going any further, since it will not be possible to get it in position when once the mast is rigged. Step the mast and put in the fid, then the first item to go on the topgallant hounds will be a mast-strop as Sketch No. 51. In making this, see that the eye for the mast is a good tight fit, since the rest of the rigging beds down on top of it, and if the mast strop slips, then the rest of the rigging will go slack. When the strop
is made, settle it well down on the shoulder of the topgallant hounds, with the smaller eyes to port and starboard respectively. These eyes are for the standing lifts of the topgallant yard, and it is as well to rig the lifts at this point, before any further rigging goes on top. Cut a suitable length of heavy thread or fine rigging cord to make the lift and splice a small eye in one end, after which this eye should be seized to the eye of the mast-strop. In model work I think it as well to splice the eye of the lift straight into the eye of the strop, since the seizing is difficult to put on neatly and will hardly be seen in small scale models in any case.

The next item on the mast will be the fore-topgallant-stay, which we have already rigged through the hole in the jibboom head. Take the upper end of the stay and pass it round the mast at the topgallant hounds and immediately above the mast-strop. Bring it back on its own standing part and form an eye tightly round the mast by putting on three seizings, bedding the stay well down on top of the strop. There are two shrouds per side on the topgallant mast, these are made up in pairs in the usual way, a length of rigging cord being middled and seized to form a tight eye on the mast. The first pair goes on the starboard side and have small eyes spliced in the lower ends for setting up to the futtock-shrouds with lanyards, Sketch No. 50. The pair on the port side being rigged in the same way. Another method of setting up these shrouds is to omit the futtock-shrouds altogether and continue the topgallant-shrouds down through the "Vs" in the ends of the cross-trees, and end them with a small eye in each near the shackles on the opposite sides of the futtock-band, to which the shrouds are set up with lanyards. This last arrangement is that shown in the sail and rigging plan for this vessel, so that this with the perspective sketch already quoted, gives the reader the choice of the two methods most usually found in this class of vessel. In my own model I followed the plan.

There are two topgallant-backstays, put on in pairs as usual, so take a length of rigging cord, middle it and seize it to form an eye close round the mast immediately above the shrouds. Fit the starboard pair first, bedding the eye down on the other rigging, take the backstays over the two inner cleats of the spreaders, Sketch No. 50, and photograph Fig. 9, and turn dead-eyes into the lower ends, finally setting up with lanyards to the corresponding dead-eyes on the rail. Sketch No. 54 shows the rigging at the topgallant-hounds.

Now slip the royal yard on the mast, then make and fit a mast-strop at the royal hounds—or masthead—as was done in the case of the topgallant-hounds. Splice the royal-lifts into the small eyes of the strop and leave them hanging down on either side of the mast. The next item to go on will be the foreroyal-stay, which is already rigged as far as the hole in the end of the jibboom. Take the head of this stay and pass it round the mast at the royal-hounds, bring it back on itself and put on three seizings, making it a tight fit round the mast and bedded down on top of the mast-strop. There are two royal-backstays, one each side and put on as singles. Form a tight eye at the top of a length of rigging cord with three seizings, put it over the mast and bed it down with the end to starboard. Take the stay down over the outer thumb-cleat on the spreaders and set up at the rail with dead-eyes and lanyard. Rig the port backstay in the same way, which now completes all the standing rigging on the masts and bowsprit.

**Brigantine "Leon"**

<table>
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<th>TABLE OF RELATIVE SIZES FOR STANDING-RIGGING</th>
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<td>Topmast Shrouds and Fore-and-aft Stays</td>
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The above table is of course only intended as a guide to the relative sizes of the gear, and is for steel wire rigging.
CHAPTER III

RUNNING RIGGING

When the sails of a vessel are un-bent and sent down on deck or stowed away in the sail room while the vessel is in dock, the ends of much of the running-rig will be unattached, and if left so would soon be in a mess. On the square-sails such gear as bunt-lines, clew-lines, leech lines, sheets etc., if left unattached would all un-reeve and run back into heaps on deck as the result of their own weight up the mast, therefore the ends have to be made fast aloft as soon as they are un-bent from their respective sails. For the square-sails one may generalize by saying that sheets and clew-lines, and sheets and clew-garnets shackle into the same cringle in the clew of the sail, and therefore the most obvious way to deal with such items when the sail is removed is to shackle them to each other, the only difference being that they now join directly one to the other instead of meeting in a common cringle when attached to the sail. Photograph Fig. 9. In this way the weight of one is balanced by the other, since they are now the equivalent of a single line, starting from the deck, going aloft and out along one yard, down to the yard below, back along it and down to the deck, with both ends belayed on pins and therefore safe from running away.

The bunt-lines are rather different, for they have no opposite numbers to which they can be bent, so they are hitched either to the jack-stays or to their own blocks on the jack-stays. On jibs and staysails the halliard and downhaul on each sail are shackled to the head cringle, so again the obvious thing to do is to shackle them together so that both ends remain fast. As in all cases the act of shackling together the various items of gear will take place when the sail is in the most convenient position for un-bending, it will be in that position that the connection will be made. For example the headsails will of course be hauled down for un-bending, therefore the halliard and downhaul will be joined immediately above the bowsprit or jibboom.

This is the way the gear would be left if the ship was in port or dock for a relatively short time, but if laid up, say for a winter, then much of the smaller running gear would be sent down altogether, although even so, on some yards, the downhauls and sheets would be left rigged since on double topsails or double topgallants, the lower yards in each case were often without lifts, as in Leon, and the downhauls and sheets shackled together prevented these yards from canting.
A 6 FT. FULL-RIGGER UNDER SAIL.

Model by Mr. J. A. Hunt, Perth, Western Australia.

Fig. 15.

Fig. 16.

Ship "CARMARTHENSHERE" and Topsail Schooner "WILLIAM ASHBURNER."

Plank-on-Frame Models by Mr. R. C. McCormac.

Fig. 17.

Fig. 18.

RUNNING RIGGING

In my own model I have assumed that she is hauled out for repairs, but not likely to be held up long enough to justify stripping her down to "bare poles," so she has her sails un-bent and down in the sail-room, but all the running gear is aloft, including the bunt-lines, and this is the rig I have shown in the various perspective sketches of running rigging, and will describe throughout this chapter, but if the reader intends to show the vessel with sails set, or furled along the yards, a point on which I will have more to say later, then he has only to attach the various items to their respective cringles on the sail, and of course in the case of sail being set, haul in on the sheets and pay out on the clew-lines etc., so that the ends are in the proper positions relative to the sails.

The model Scandinavian barque shown in some of the pictures of my own models is an example of a model with all sails bent, but furled instead of being set. My model of the barquentine Waterwitch in Vol. I is another example, but a bad one, showing just how such sails should not look. They are too heavy and crude, but at that time I had not discovered the way to get over this, I had tried to get the right proportions by making them out of a fine silk handkerchief, but even that was not enough. I have since found that the best way to make a furled sail look about right on a spar, is to use two different scales when cutting it out, cutting the width to the scale of the model but the depth, or hoist, to 1/3 that scale. In this way it is possible to furl the sail along the top of the yard and still keep it within scale dimensions as far as diameter is concerned. If you examine close-up photographs of sails furled along the yards of a vessel, you will find that the "roll" (it is of course not really a roll, the sail actually being gathered on top of the yard) is always much less in diameter than the diameter of the yard, and it is quite impossible to get this effect in a model, even of relatively large scale, if the sail is of scale depth. The photograph Fig. 3 shows good proportion in spite of its miniature scale.

Some readers may not like the idea of having sails only about one-third their scale depth, but when they are to be furled I think it much better to do this than to have a pile of "sail-cloth" mountains high along the top of the yard. When once the sails of a model are furled, it is very unlikely that they will ever be cast-off again. If they are provided with full bunt-lines, clew-lines, sheets etc., and all the gear is taken down to the deck and belayed on the proper pins with all the other gear, it would probably take an hour or so to cast off the gaskets, throw the sheets and all the other gear off the pins, cast off the halliards and hoist the yard, then trim all the gear again, even for one sail only, so I do not think there is much fear of the shallow sails ever being seen again when once they have had their "harbour-stow."

Although this has no bearing on the subject of this book, it may perhaps be of interest to mention that in my younger days the model barque,
in spite of all her complicated gear, was several times sailed and made a
good show of it. For this purpose I made a pair of separate lower-topsails,
and also one or two staysails, all of which were set without disturbing the
furled sails already on the model. The temporary sails were provided with
hooks which went over the top of the furled sail, while the sheets were loops
which went over the yardarms below. The staysails had equally simple means
of attachment. At close quarters the whole effect was dreadful in the extreme,
but a little way out and it did not look too bad, and the arrangement served
its purpose in proving that she would sail. It would have taken too long
to cast the braces off the pins, but in my models I usually have the yards
braced up just as they would be if the vessel was alongside a quay, and this
vessel is no exception, with the result that in the water she found the point
of sailing most suitable to the trim of the yards, and having done so, carried
on until she reached the opposite side of the sheet of water, or was stopped
by the “crew” in a boat. This vessel has never had any weighted keel or
fixed ballast, and in the water a few bags of lead shot, or even stones, was
all the stiffening she needed, these were put in the main hatch.

The above brings to mind one more point regarding my model of Leon.
As will be seen from the photograph Fig. 2 she is shown as being hauled out
for repairs, and therefore I have braced her yards slightly to port. This
in my opinion has several advantages, it follows full-size practice where
the yards would be braced-in to allow more freedom for the shipyard cranes,
it enables the after sides of the yards and their gear to be seen more clearly,
and, I think, makes the full broadside view of the model more interesting.
There is also one further point, although of less importance, that is, if bracing
the yards reduces the space taken by the full-size vessel in a shipyard or
dock, then the same will apply to a model in a case, which will require less
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RUNNING RIGGING

Flying Jib (Sketch No. 49)

Downhaul. First seize a small single-block to the foot of the fore­
topgallant-stay, just clear of the jibboom, and a similar block to the head
of the stay as close to the topgallant-hounds as possible, Sketch No. 54.
Take a length of linen thread and splice a small eye in one end, then holding
the eye about 1/4 in. above the jibboom, reeve the thread down through
the block at the foot of the stay, aft along the jibboom, on the port side of
all the rigging, and belay to pin No. 1 (Sketch 88), at the break of the anchor
deck, port side.

Haliard. Splice a small eye in the end of a length of linen thread and
connect it to the eye of the downhaul, which should be about 1/4-in.
above the jibboom, by means of a shackle, or in the case of small scale models
a link of chain to represent a shackle. Reeve the haliard aft through the
block at the head of the stay, and down inside the port after topgallant­
backstay to belay on pin No. 31, port side. (See Sketches 88 and 89.)

When belaying gear on a pin, I usually take two or three turns over and
under the pin, then finish off with a couple of half-hitches, fixed with ad­
hesive, cutting off the surplus close to the last half-hitch. The coil of gear
I mould separately as will be described later, and hang it over the pin, this
I find makes a much better job than trying to form a decent coil on the pin
itself using the gear actually belayed there.

Outer-Jib (Sketches No. 49 and 50)

Downhaul. Seize a single-block on the foot of the jib-stay just clear
of the jibboom. Reeve the downhaul as previously described but lead it
aft along the starboard side of the headstays, and belay on pin No. 2 at the
break of the anchor deck, starboard side.

Haliard. Seize a single-block to the starboard leg of the eye round
the masthead (jib-stay) as shown in Sketch No. 50, and a double-block seized
to the rigging just inside the forward cross-tree. Splice a small eye in a
length of linen thread and shackle it to the eye of the downhaul, then reeve
the haliard aft through the single-block at the head of the stay; aft through

PLANK-ON-FRAME MODELS
one sheave of the double block below the cross-tree, and down to the deck inside the after topmast-backstay on the starboard side, to belay to pin No. 28.

The object of the pair of blocks at the head of each of the headstays is to keep the halliards of the headsails clear of the upper-topgallant-yard when it is hoisted. If the halliards went straight up to the blocks under the cross-trees they would chafe on the upper-topgallant, or the fore side of the upper-topgallant-yard when braced up, while if they were taken straight down to the deck from the block on the stay, they would chafe on the after side of the yard, but by taking the halliard over a pair of blocks it forms an inverted "U" and keeps clear of the yard.

INNER-JIB (Sketches No. 49 and 50)

**Downhaul.** Seize a single-block to the foot of the inner-jib-stay, then splice a small eye in the end of a length of linen thread which is taken aft through the block, along the port side of the jibboom and belayed to pin No. 3 at anchor-deck.

**Halliard.** The eye-splice in the end of the halliard is shackled to the eye of the downhaul, then taken up to a single-block seized to the port leg of the stay at the masthead, through a single-block seized to the rigging below the forward cross-tree, port side, and down inside the after topmast-backstay to belay on pin No. 27. Port side.

FORETOPMAST-STAYSAIL (Sketches No. 49 and 50)

**Downhaul.** Seize a single-block to the starboard leg of the stay immediately above the bees-batten. (Note. In Sketch No. 49 this block is shown on a short span or pendant, but this is merely "drawing licence," to carry the block clear of the "V" of the stay so that the downhaul and halliard could be shown more clearly. In practice the block would be seized close against the leg of the stay as with the other downhaul-blocks). Reeve the downhaul through this block, leaving the eye-splice immediately above it as with the other downhaws, take the end aft along the starboard side of the rigging and belay on pin No. 4.

**Halliard.** This sail is perhaps one of the most hard-worked in the ship, so the halliard will be rigged as a whip. Take a length of linen thread and seize one end to the head of the foretopmast-stay right in the "V" formed by the seizing of the stay. Now seize a single-block on the starboard leg of the head of the stay, and then shackle a single-block to the eye-splice on the end of the downhaul. Bring the halliard down under the stay, through the block on the end of the downhaul, up to the single-block on the leg of the stay at the masthead, through the second sheave of the double-block below the cross-tree, then down to the deck inside the forward topmast-backstay starboard and belay on pin No. 26.

Incidentally, I have not specifically mentioned the fact, but I think it will be understood that on all these small seizings used to attach blocks, or the ends of gear, a touch of adhesive or shellac should be added to make certain that they do not come adrift at a later date.

We have now completed the gear on the headsails, and can move aft to the yards, on which we have already fixed the blocks for such gear as bunt-lines, clew-lines, sheets etc.

FOREYARD (Sketch No. 26)

**Sling.** The centre-band of the foreyard has been provided with a large shackle just a little aft of the top centre. A length of chain is now slipped on this shackle, taken up through the lubber's hole in the top—forward of the forward cross-tree, Sketch No. 37—round abaft the masthead and on top of the thumb-cleat provided, then back to the shackle by the same route on the opposite side of the mast. This chain must be just long enough to take the weight of the yard when the crane of the truss is level.

**Leech-lines.** Three single-blocks have been fixed to the jack-stay on either side of the yard, and three similar blocks hung below the rim of the top, both port and starboard. The end of the leech-line should be provided with a knot large enough to prevent it going through the block. Put a touch of adhesive on the knot, then reeve the line through the block until the knot is in contact; take it up and through the outer of the three blocks below the top then down through the bulls-eye fairlead inside the forward shroud and belay on pin No. 9. The opposite side is rigged in the same way and belays on pin No. 10.

**Bunt-lines.** There are two bunt-lines per side and they are rigged just as the leech-lines, passing through the same fairleads and belaying on the same pins, i.e. No. 9 port, No. 10 starboard.

**Clew-garnet.** The standing end of the clew-garnet is spliced into the eye on the underside of the single-block at the quarter-band (Sketch No. 26), then through a single-block held between the finger and thumb about 1/2 in. below the yard; back up through the block on the quarter-band, down through the fairlead on No. 1 shroud, and belays to pin No. 11. The opposite side is rigged in the same way and belays to pin No. 12.

**Sheet.** The fore-sheet has a short pendant with a single-block on the end, and this pendant should be shackled to the eye of the single-block which we have left hanging on the clew-garnet. The sheet proper is spliced to an eye-bolt on top of the ship's rail abaft the backstays as shown in the plans, reeves through the block on the pendant now shackled to the clew-garnet,
back to a sheave in the bulwarks opposite the main hatch and belays on the
cavil abaft the royal-backstay. The opposite side is rigged in the same way.

**Tack.** The tack is single and has an eye spliced in one end, this goes
on to the same sheave as the clew-garnet and sheet pendant (**Sketch No. 26**) while the running ends are coiled over pins No. 5 and 6, port and star­
board respectively.

**Lifts.** The lift has an eye-splice in one end which is shackled to the
top lug on the yardarm-band. From there it is taken up to a single block
shackled to the side of the mast cap, down through the lubber's-hole and
belays on the spider-band, pin No. 41. Opposite side the same and belayed
on pin No. 42.

**LOWER-TOPSAIL YARD (Sketch No. 26 and 37)**

**Bunt-lines.** The lower topsail has only a single bunt-line per side, and
this will start with a knot at the block on the yard as with the bunt-lines
on the yard below. From the block on the yard the bunt-line is taken up
to a single block shackled to the forward topmast-shroud, midway between
the top and the cross-trees as shown in the Sail and Rigging Plan. From
this block it goes down through the lubber's-hole, through the bulls-eye
fairlead on No. 2 shroud, and belays on pin No. 13. Opposite side the same
and finishes on pin No. 14.

**Clew-line.** This is rigged just as the clew-garnet of the yard below
and will be clearly understood from **Sketch No. 26**. From the upper block
it is taken down through the lubber's-hole, down through the same fairlead
as the bunt-line, on No. 2 shroud, and belays with the latter on pins No. 13
and 14 for port and starboard respectively.

**Sheets.** All the sheets on the remaining yards should be in chain, but
I am afraid one can neither buy nor make chain small enough for this on
1/8 in. scale models, where you would require about 100 links per inch, so
I used linen thread for them all, but of this more later. The end of the sheet
is shackled to the clew-line block hanging below the yard, then taken down
through the sheave-hole in the end of the yard below, along to the "clover-
leaf" block in the centre of this yard, and belays on the spider-band, pins
No. 30 port, 40 starboard.

**UPPER-TOPSAIL-YARD (Sketch No. 29)**

**Halliard.** That portion of any square-sail halliard which passes over
the sheave in the masthead is known as the tye, and is usually of chain
but here again I decided against it in the interest of scale. The tye is
shackled to the lug on top of the centre-band of the yard, passes over the
sheave in the mast immediately below the cross-trees, and would in a larger
scale model change from chain to wire, to end in a three-sheave block at a

point about 12 ft. above the deck, *when the yard is hoisted*, but as in our
model the yard is down, the block will have risen by the amount of the hoist,
say another 14 ft. so that in our case this block will be 26 scale feet above
the deck. (See photographs Figs. 7 to 11) *This block should have an eye
on the heel and to this the fall is spliced.* Another three-sheave block is
shackled to an eye-bolt in the deck adjacent to the after topmast-backstay
port side, with a single-block shackled to a similar eye opposite the forward
of the two backstays. Reeve the fall, starting by splicing it into the eye
below the upper block, and carry on until all the sheaves are taken up, after
which it is taken through the single block at the deck and up to pin No. 25,
port side.

**Sheets.** The upper-topsail is taken in by being lowered down onto the
yard below, so that the clews of the sail can be fixed at these yardarms. Some
ships shackles the clews of the sail to the yardarm bands, in which case no
sheets are rigged, while others follow the rig shown in the Sail and Rigging
Plan, where the sheet is set up in the top by means of a tackle, or the sheet
may even be doubled back on itself at the clover-leaf block and the two
parts seized together, so the reader can use any of these rigs if he wishes,
but in my own model, in view of the fact that the sails were to be un-bent,
I decided to assume that had they been on the yards, the clews of this sail
would have been shackled to the band, and so no sheets would be required.

**Downhaul.** There are no bunt-lines on this sail in this ship so the next
items will be the downhauls. The end of the downhaul is spliced into the
shackle of the block already provided below the yardarm-band, it is then
taken down and through a single block on top of the yardarm-band of the
lower-topsail-yard (**Sketches No. 26 and 29**), up and through the block at
its own yardarm, along below the yard to the block hanging below the parral,
down through the lubber's-hole, through the bulls-eye fairlead inside shroud
No. 3 and belays on pin No. 15 to port and 16 to starboard.

**Lifts.**—The lifts of this yard are "standing," i.e., fixed at both ends.
The upper end we have already seized to the eye of the mast-strop at the
cross-trees (**Sketch No. 50**) while the other end is spliced into a shackle on
top of the yardarm-band (**Sketch No. 29**). The length of the lifts should be
such as to support the yard about 2 ft. 6 in. (actual) above the lower-cap.
When the yard is hoisted and sail set, the lifts hang in bights abaft the yard
as shown in the sail plan.

**TOPGALLANT-YARD (Sketch No. 29)**

**Halliard.** This is rigged exactly as the upper-topsail-halliard except
that the tack is rigged with two double-blocks instead of three-sheave,
and that it comes down inside the after topgallant-backstay, starboard
side and belays on pin No. 32.
**Bunt-lines.** The topgallant has a single bunt-line per side, terminating in a small bulls-eye, through which a span is reeved running from the leech to the foot of the sail as shown in the Sail and Rigging Plan. This really does not concern us if we are showing the model without sails, although instead of rigging the bunt-line with a stopper-knot at the block on the yard, it should be spliced round a small bulls-eye or thimble, which in this instance will serve to prevent the line from running through the block. From the block on the yard the bunt-line goes up to a single block seized to the head of the rigging at the topgallant-$hounds$, then down between the cross-trees, down through the lubber’s-hole, through the bulls-eye fairlead on No. 4 shroud, and belays on pin No. 17. The opposite side is rigged in the same way to pin No. 18. By using a span across from leech to foot of the sail, the bunt-line actually serves the joint purpose of bunt-line and leech-line with a common hauling part.

**Clew-lines.** The clew-line is made fast to the heel of its own single-block below the yardarm-band, reeves through another single-block held about 1/4 in. below the yard, back up and through the single block at the arm, along and through the block below the parral, down between the cross-trees, down through the lubber’s-hole, through the bulls-eye fairlead on Shroud No. 4, and belays with the bunt-line on pin No. 17. The opposite side rigged the same and belayed to pin No. 18.

**Sheets.** The sheets are shackled to the clew-line block which is hanging below the yardarm-band, then pass down through the sheave-hole in the upper-top-sail yardarm, along to the clover-leaf block below the centre of this yard, down through the lubber’s-hole, and down to pin No. 19. The sheets do not go through a bulls-eye fairlead on the shrouds. Opposite side to pin No. 20.

**Lifts.** The topgallant yard is rigged with standing lifts, which we have in fact already provided when rigging the topgallant hounds. The head of each lift has been spliced or seized to one of the small eyes of the mast-strop, so now take it forward of all rigging and out to the topgallant-yardarm, where it will be spliced into the shackle on top of the yardarm-band. The opposite lift is rigged in the same way, and when finished, they should be just long enough to keep the yard level and support its arms when the centre is resting on top of the topmast-cap, as shown in the thwartship elevation in the Sail and Rigging Plan.

**ROYAL-YARD (Sketch No. 29)**

**Halliard.** This is rigged as the topgallant-halliard but comes down inside the to’gallant backstays port side. It sets up with a tackle and belays to pin No. 38.

**Clew-lines.** The royal of this ship has no bunt-lines. The clew-line is single and has an eye spliced at one end. Holding this eye about 8/8 in. below the yard, reeve the clew-line through the single-block below the parral take it down between the cross-trees, through the lubber’s-hole, through the fairlead inside No. 5 shroud and belay on pin No. 21. Opposite side the same, belay on pin No. 22.

**Sheets.** The sheet shackles to the eye of the clew-line, reeves through the sheave-hole in the topgallant yardarm, along to the clover-leaf block below the topgallant yard, down between the cross-trees, down through the lubber’s-hole and belays on pin No. 23. Opposite side the same and belayed on pin No. 24.

**Lifts.** Each lift is rigged exactly as on the yard below, the head being spliced to the mast-strop at the royal-hounds and the outer ends to the shackles on the yard-arm bands. The lifts must be just long enough to support the yard-arms when the centre of the yard is just clear of the topgallant-hounds. The lifts on all yards must of course be taken forward of all other rigging, otherwise they would not allow the side of the yard to swing forward when being braced-up.

It will have been noticed that some items of rigging are taken down to the pins via the bulls-eye fairleads inside the shrouds, while other gear is taken to the pin direct without going through a fairlead, although it may pass right alongside one. Like everything else connected with the working gear of the sailing ship, there is a very good reason for this. The main object of the bulls-eye fairleads on the shrouds is not as their name would suggest, to provide a “fair” lead for the gear from one point to another, since the gear does in fact lead straight from the lubber’s-hole to the pin in a direct line, so no guidance is needed. The object of these particular fairleads is merely to prevent slack gear thrashing about and so causing a lot of unnecessary wear, therefore the only gear to be taken through them are such as bunt-lines, clew-lines, leech-lines etc., all of which must go slack when the ship is under sail. Halliards, sheets and the like, which are taut when sail is set, do not pass through the fairleads inside the shrouds.

In some ships the fairleads inside the shrouds take the form of a timber batten having a number of holes drilled in it at regular intervals, this is then seized to the inside of the shrouds at much the same level as the bulls-eyes described for this model. Another fairlead of this type would certainly be arranged in the decking of the top, where the running-rigging passes down through the lubber’s-hole, but I did not include it on this scale, I have however included working drawings in my Mast- ing and Rigging, which also gives the many other fairleads likely to be found in a vessel of larger type, say, barquentine, barque or ship. It was quite common practice to fit fairleads on the “V” of either the forecast or the foretopmast-stay, and bring the headsail downhauls in through them. Again fairleads were often rigged.
inside the topmast-shrouds to prevent such items as the upper-toprail, toppaulant, and royal bunt-lines, clew-lines, etc., slatting against the sides of the topmast. In fact the main aim of this type of fairlead was to prevent slack gear from damaging itself against fixed objects, and in rigging larger vessels these are items to watch. Smaller vessels paid rather less attention to these things because their spars were much smaller and the distances between fixed points correspondingly shorter, to say nothing of the fact that their gear was less complicated. The principle of a sailing ship's gear is of course the same for a small as a large vessel, but whereas Leon had a single bunt-line on some of her upper square-sails, larger ships would have three or four per side right up to the royals, which, when one replaces Leon's single-topgallant by double sails, can well mean four or five times the amount of running gear coming down each side of the mast, so steps have to be taken to prevent all such gear slatting about as the result of windage through the rigging and the motion of the ship. I merely mention this for the benefit of any reader who may be building a model of a larger ship.

Now we will move on to the staysails between the two masts, on which the halliard and downhaul of each sail will be shackled together as with the jibs, and of course at the foot of the stay in each case, since that is where they would be taken off the head of the sail when unbending.

**MAIN-STAYSAIL**

**Halliard.** Splice a small eye in the end of a length of suitable linen thread, then pass this eye up through the "V" of the stay at the main-cross-trees. Pass the other end of this thread through its own eye and pull tight round one leg of the stay [Sketch No. 55A]. This halliard is rigged as a whip, so hold a single-block near the foot of the stay, reeve the halliard through it, then up to another single-block seized to the starboard leg of the stay close up against the cross-trees; through this block and down the starboard side of the mast to belay on pin No. 60 on the main-rail.

**Downhaul.** Splice an eye in the end of a length of thread and shackle this to the single-block on the halliard. Reeve through a single-block at the foot of the stay and belay to pin No. 44, on the starboard side of the spider-band of the foremost.

**Boom-topping-lift.** This staysail has a boom at the foot, and provision has to be made to support this when the sail is furled, this takes the form of a topping-lift rigged to the head of the stay as shown in the Sail and Rigging Plan. Seize a single-block with an eye at the heel, to the port leg of the stay, close up to the cross-trees, and into this eye splice the end of the topping lift. A single-block is shackled to the top of the outer band of the main-staysail-boom [Sketch No. 10], and through this the topping-lift is reeved, then up to its own single-block at the head of the stay and down to the port side of the fife-rail to belay on pin No. 69.

**Sheet.** The sheet belays to its own block at the deck, and a special block has to be provided for the purpose, as shown in Sketch No. 10. This consists of a single-block with a hardwood cleat bolted on one side of the shell. I made this block in the usual way, then dowelled a cleat carved from syca-more on to this. The sheet is spliced to an eye in the heel of a single-block shackled to the under side of the inner-band, reeves through the block shackled to an eye-bolt in the deck, hack up through its own block below the boom, and belays to the cleat on the lower block, the balance of the fall being coiled down on deck alongside and fixed with shellac.

**MIDDLE-STAYSAIL**

**Halliard.** Seize a single-block to the eye of the stay at the shackle of the main-cap, and another block at the foot of the stay close against the foremost. Splice a small eye in the end of a length of thread and hold it about 3/8 in. from the foremost at the foot of the stay. Take it up and through the single-block at the head of the stay and down to pin No. 59, port side.

**Downhaul.** Shackle to eye of halliard, reeve through block at foot of stay and belay at spider band on pin No. 48.

**MAIN-TOPMAST-STAYSAIL**

**Halliard.** Seize single-block to head of stay close against the hounds, and another block at the foot of the stay. Splice a small eye in the end of the halliard, reeve through block at the head of the stay and down port side of mast to belay to pin No. 68 in cavil.

**Downhaul.** Shackle to halliard at foot of the stay, reeve through block at foot of stay, pass down through lubber's hole and belay to pin No. 43 on spider-band with middle-staysail-downhaul.

In describing the lead of the halliards and downhauls on these sails, I have treated each separately which may suggest that they should be belayed as rigged. In actual practice of course it is better to rig both halliard and downhaul, shackle them together and then belay them after adjusting the position of the shackle by hauling on one and paying out on the other as necessary to bring to the required spot on the stay, after which they should both be belayed. By doing the work this way, the actual shackling can be done well clear of the mast and rigging, giving one more freedom to get at the two ends. The slack can then be taken in and the gear adjusted as suggested.

I have made no mention of hanks on the various stays carrying sails, but on this scale I think they are better omitted, in any case it would all...
depend upon the type of hank used in the particular ship being modelled, for while in full-size practice some types would remain on the stays, others would be removed with the sails, so there is no advantage in cluttering the stay with a lot of small hanks which might not be there in the original ship.

**SPANKER**

*Peak-halliards.* There are four peak-halliard blocks on the gaff (Sketch No. 81), and these have rope strops made from endless grommets seized close to the block and leaving a large bight to go over the spar and rest against the thumb-cleats provided. In full-size practice these strops would be served all round before being put on the block and seized, but in small scale work this is not really necessary providing you can make a good strop. On large scale work it will make all the difference to the finished look of the job and is well worth doing, although serving can be one of the most tedious of tasks, yet, when once you get into the swing of it, even serving can be done more quickly that you would expect. For long straight gear it can of course be wound on very quickly by means of a simple gear to rotate the rigging-cord to be served, but with grommets and strops it has to be done by hand, for they cannot be rotated. However if you thread a needle on the material used for serving, holding the portion just served between the finger and thumb of one hand, and passing the needle round and round with the other, the work soon gets done.

The peak-halliards are rigged with double running parts, that is to say they start from one rail, reeve through all the blocks on the mast and gaff, and finish on the rail on the other side of the ship, so take an ample length of suitable thread and belay one end to pin No. 55, main-rail, port-side. From the pin reeve upwards and outwards through the lower of the four blocks on the after side of the masthead, down to the inner block on the gaff—which, as the sails are unbent, will be resting along the top of the boom and not in the hoisted position, for this is not a standing-gaff with a spanker which brails to the mast in furling, but one which both reefs and furls along the boom. In my model I put a lashing round both boom and gaff just to keep them together as will be seen from the photograph Fig. 2. However to return to the peak-halliard. Reave outwards through the inner block on the gaff, up and through the second block abaft the masthead and so on until all blocks on both mast and gaff have been used up, which will leave the halliard coming off the uppermost block at the masthead. From this block it goes direct to the deck on the starboard side and is belayed on pin No. 56.

*Throat-halliard.* A three-sheave block with an eye at the heel is shackled to the crane below the main cross-trees, while another three-sheave block is shackled to the eye-plate just forward of the gaff-jaws. One end of the halliard is spliced to the eye of the upper block, then down to the first sheave of the lower block, back to the upper one until all the sheaves are taken up, which will leave the halliard coming off the upper block, from which it is taken down to the deck on the starboard side and belayed to pin No. 54.

**RUNNING RIGGING**

The spanker boom is supported by a double topping-lift when not resting in the crutch on top of the wheelhouse, and even when in the crutch the topping lifts should be set up taut to steady the spar. This is how I rigged my own model, the boom in the crutch and the lifts set up taut. First take two lengths of suitable linen thread or fine rigging cord and in the end of each splice an eye just large enough to slip over the end of the boom and come to rest against the thumb-cleats provided, then splice the other ends into the eyes of two double-blocks, taking a topping-lift up on either side of the gaff, (when set up they help to control the gaff when it is being lowered, since it has to come down between them) as shown in the plans. These upper blocks should be about six or eight feet (scale) below the cross-trees when the lifts are just taut. In the after end of each of the trestle-trees we have provided an eye-bolt (Sketch No. 47) and to each of these eyes shackle a double-block having an eye at its heel. The running part of each topping lift is then shackled or spliced to the heel of the upper block, reeve through the block on the end of the standing part of the lift, back to the upper block and so on until all the sheaves are taken up, which means that it will leave from the upper block, it is then taken down to the deck, to belay to pin No. 61 in case of the port lift, and 62 for the starboard one. The blocks of the running parts of these lifts should be double as described, but I think this is a point where in small scale work one could depart from the true prototype to the extent of using a pair of single-blocks instead. It is desirable that this tackle, exposed as it is at the masthead, should not look too heavy, and in my view it is one of the places where scale appearance is more important than mathematical exactitude in the number of sheaves in the blocks. I would not belay the falls of the topping-lift tackles until the spanker sheet has been rigged and set up taut, this will hold the boom down in the crutch, then the topping-lifts can be set up without any fear of lifting it clear.

*Sheet.* The spanker-sheet, or main-sheet in the case of a brigantine, is rigged double, one belaying on either side of the vessel. Two double-blocks are attached to the boom by means of long rope strops resting between the two collars provided, as shown in Sketch No. 90. Each block is on a separate strop of course and free to rotate round the boom to any position.
according to the pull being applied at the time. Two more double blocks are shackled to eye-bolts in the deck at either side as shown on the plans, and these blocks have eyes on their heels, or alternatively, additional eye-bolts can be provided on the deck, one alongside each block. Now to reeve the sheet, splice one end to the eye at the heel of one of the blocks on deck, or to the eye-bolt alongside if that has been provided, then hold one of the blocks on the boom horizontally on the side which you are reeeving and pass the sheet up from below and through one sheave of this block, then from aft and through one sheave of the block on deck. Round again which will make the fall leave the lower block and lead forward, where it will be belayed on the timber-heads, or timber bitts, on the quarterdeck and the surplus coiled and fixed to the deck with shellacs. Remember this is a work-a-day merchant vessel, and a small one at that, with a crew having very little use for fancy ideas, so make this a natural coil of rope, not the neat mathematical “clock-spring” one would expect to find on a man-of-war or a large yacht.

The crew of this type of ship would be the absolute minimum able to work the vessel and they would have to work hard even at that, they would coil their gear so that it would run properly when needed, but without much interest in whether each turn was exactly the same as the next, or that each turn should run neatly round the previous one so that the finished coil lay flat on deck like a mat. I think it is every bit as important to have a model in character as it is to have it accurately made, which is why I have such strong objections to high gloss and polish on models of ordinary merchant ships.

I have made no mention of the rigging on the main-topsail, the jib-headed topsail above the spanker, and I did not provide the gear for this in my own model, simply because with the gaff down and resting on the boom, there is very little one could do with much of it other than coil it on deck, or leave it hanging from the gaff and trailing forward along the top of the house. However in case the reader wishes to rig it, I may as well mention the two main items, the halliard and the sheet.

Main-topsail-halliard. As the sail is stowed away in the sail-room, the best thing to do with the halliard is to make one end fast somewhere in the main cross-trees, then take the halliard up the afterside of the topmast, through the sheave in the masthead immediately below the pole, down on the foreside of the mast and belay to pin No. 71 on the port fife-rail.

Main-topsail-sheet. Hitch one end to the gaff near the outer end, reeve through a single-block stopped to the shoulder of the head of the gaff, back to a single block on the end of a pendant shackled to the gaff-jaws (See Sail and Rigging Plan), then on to the fife-rail and belay to pin No. 72. However in my opinion this is gear best omitted from a model with the gaff down on the boom.
just to check that the block will allow full travel this way too. If by any chance the block fouls the brace pendant block before the yard has gone right round then adjust the lark's-head hitch on the stay to allow a little more swing. When satisfied that the yard will swing freely in either direction cut and reeve the other leg of the brace through the starboard pendant block and splice a single-block in the end, making this leg of the brace the same length as the other side. The port whip is now spliced to an eye-bolt in the ship's side in way of the main-topmast-backstays, reeved through the single block on the end of the runner, then back to the rail where it belays on pin No. 47. The starboard whip is rigged in the same way and belays to pin No. 48.

**Fore-upper-topsail-brace.** The block on the end of the yardarm pendant has an eye at the heel. A pendant with a single-block on the end is shackled to an eye-bolt on either side of the main masthead (Sketch No. 47), while two further single blocks are provided on short pendants which may either be shackled to the main futtock-band or seized to the head of the main rigging port and starboard. First to rig the port brace, splice the end of the brace into the eye at the heel of the yardarm block, reeve it up through the block on the pendant at the masthead, down through the block on the yardarm pendant, and down through the block on the futtock-band pendant, and so to the pin-rail where it belays on pin No. 49. Starboard side rigged in the same way to pin No. 50.

**Fore-topgallant-brace.** Single blocks are provided on the yardarm pendants, and a single lead block is shackled to the eye-bolts port and starboard of the main-cap (Sketch No. 47). Take a length of linen thread, middle it, and make it fast to the head of the main-topmast-stay with a lark's-head hitch. Take the port leg of the brace and reeve it down through the block on the yardarm pendant, then down through the lead-block on the port side of the main-cap, down between the cross-trees and inside shroud No. 2 to belay on pin No. 51. Starboard side the same but belayed to pin No. 52.

**Fore-Royal-brace.** Seize two single blocks to the head of the main-topmast-stay as close to the hounds as possible, or alternatively seize a block to the heads of the port and starboard topmast-shrouds respectively, the main point being to get these blocks close to the mast. The brace, which is single, is then spliced into the eye on the after side of the port yardarm-band of the royal yard, reeved down through the port single-block at the main-topmast-hounds, down inside the main-topmast-backstay and is belayed on pin No. 57. The starboard side follows the same lead and belays on pin No. 58.

In the Sail and Rigging Plan, blocks at the head or foot of a stay, or any similar position, may perhaps be shown some little distance from the mast, as for example the lead-blocks for the royal-braces. I think the reader
will no doubt understand that in all such drawings there must be considerable licence if all blocks are to be shown, particularly in large vessels where you may have quite a number of blocks in the same plane when seen from elevation, and to make a true elevational drawing would mean showing only one block, with all the gear apparently leading into it. This would no doubt be sufficient for an experienced rigger who would know which items of gear would require separate single-blocks, and which could be put through adjacent sheaves in a double or treble block, but for the benefit of the inexperienced, it is necessary to separate the blocks as much as possible, so that each item of gear can be followed on the plan at least as far as the point where it turns down towards the deck. In a true elevation with all the blocks properly placed, much of the gear would seem to meet in various common points, and anyone with limited knowledge of the subject might well be left in doubt as to which items did in fact turn down to the deck and which went forward again as part of a tackle.

All sail and rigging plans must be a compromise between the accurate scale representation and the pictorial, since no true plan and elevation could possibly show in one drawing all the complicated gear of a sailing ship's rig. To take one very obvious example, the yards are drawn running fore-and-aft along the ship's centre line, as they must be if the plan is to be used to measure their lengths, but it is quite impossible for the yards to ever be placed in that position, this in turn means that the trusses, parrals, and slings which connect the yards to the mast cannot be shown exactly to scale, or if they are, the result will be unbalanced square sails, as in fact you will at times find in old sail plans; so to get over this, the yards, in most sail and rigging plans, are arranged on a common fore-and-aft centreline, which will agree with as many of the trusses as possible, but will very rarely agree with them all. The product is a balanced sail plan, but to get it, the centres of some yards will be shown either closer to or further away from their respective masts than they will be in the actual ship. It is all just a matter of standard drawing office practice or convention, and is appreciated and understood as such. In any case in full-size practice the accurate placing of these various independent components is not of great importance in a general arrangement drawing such as a sail and rigging plan, for there will be separate working drawings of each component anyway, and it will be from these that the fitting is made, at least as far as iron and steel ships were concerned, while in the case of older wooden ships the shipwright knew just what was required and made it so, his drawing was usually his practical experience, so in either case the exact placing of the yard centres on the sail and rigging plan was of no importance whatever.

What I am trying to point out is that in rigging a model, the positions of the blocks, and in some cases even larger items, must not be followed too
slavishly, remember that the main object of the drawing is to show that the blocks for this item of gear are at this particular hounds, or that this gear goes from this point to that and in placing the blocks in the model the builder must consider the lead the gear has to follow, and arrange them so that it will run as freely as possible. To take one last example of why blocks often have to be separated. In the Sail and Rigging Plan for Leon, the hauled block and the topping lift block for the main-staysail are shown slightly different levels on the stay. In actual fact one of these blocks is on the port leg and the other the starboard, so that in true elevation one would be directly behind the other, and to be strictly accurate both the hauled and the topping lift ought to disappear into one block on the drawing. This might be understood by an experienced rigger, but to a model builder with very little rigging experience it would not be of much help, and it is better to risk having him put two blocks on the stay at slightly different levels, than trying to make the hauled and topping-lift as one single unit.

We now have all the gear belayed, and so cannot any longer put off the evil day when we have to start rigging the ratlins. However in Leon we are rather lucky, for she has no rope ratlins to speak of on her lower shrouds. In full-size practice the fact of a vessel being rigged with metal rods or timber battens across the shrouds did not necessarily mean that the rope ratlins were not there, for in most cases the rope ratlins were there too. However I cannot imagine the model builder putting on rope ratlins and then fixing timber or iron ones on top of them! These rigid ratlins, whether iron or wood, were made a shade longer than the actual distance across the shrouds at their particular level, and fixed with a lashing round batten and shroud. For small scale model work I think it better to make the rigid ratlins of copper wire and turn the outer ends round the back of the shroud and pinch them there, but on a larger scale they should be fixed with a square-seizing.

In Leon the rigid ratlins extend over the centre three shrouds of the fore rigging, and the centre two of the main, with rope ratlins extending out to the outer shrouds at every fourth rigid one.

In full-size practice rope ratlins are clove-hitched to every shroud they cross, then have eyes worked in their outer ends which are lashed to the first and last shroud. Sketch No. 57. In model work I do not attempt to eye-splice the ends, instead I thread the ratline stuff in a needle, then pass the needle through the shroud, and afterwards form a clove-hitch on top of this, worked tight, of course. I then form a clove hitch on each intermediate shroud, and also on the last shroud, but after finishing the last hitch, I pass the needle back through the shroud, so tucking the end of the line through the lay of the rope, in fact by starting with a tuck before making the hitch on the first shroud, both ends are tucked into the rope. Each hitch is then given a touch of shellac or thin varnish, in fact as I have already mentioned I usually give the whole shrouds a coat of very thin black varnish.

When putting on the ratlins, do not forget to check that the bulls-eye fairleads inside the shrouds are at the correct level. I placed them immediately above a ratline which extended across all five shrouds, then when the ratline was fixed, pushed the fairlead down on top of the clove-hitches.

I have several times mentioned the use of grommets and endless rope stops, and as I said at the time, I expect that most model makers, at least those who have worked on fairly large scale, will be familiar with the various methods of making these, but if not I will describe three methods which are very satisfactory. Personally I like the endless three-strand ring, which is just a ring of rope without any end or beginning, and quite simple to make, in fact I have just made one while sitting at my typewriter, just to assist me in describing the method and producing the sketches which will illustrate this paragraph when once it is written. The strop I now have in front of me is 3/16 in. diameter, and made from a bit of fine rigging cord off a coil of me just happened to come out at that size, and it could have been much smaller, although on the size of cord used the thickness of the material would have looked out of proportion to the diameter of the finished strop.

It is important to select a cord with clear well defined strands, strands which are inclined to be "whiskery" are of no use for small stuff. Having selected the size of cord required, cut off a piece equal in length to about four times the circumference of the finished strop, then very carefully take out one strand. This is the most important part of the whole job, for you must not straighten out the strand in any way, you want it to come away...
with its "corkscrew" twist just as it was in the rope, so do not pull it out, instead, slowly roll the original rope and unwind the wanted strand from it. At this stage the work will appear as "A" Sketch No. 58.

When the complete strand is out, bend it round into a loop of the required diameter, still taking care not to disturb the "corkscrew," then pass the long end round and round the strand forming the loop, going in the direction of the lay, and it will be found that the second strand is automatically falling into place behind the first, Sketch "B", so that by the time you reach the point you started from you will have a complete ring of two-strand rope looking exactly like the piece of original rope from which you have removed one strand.

Go round a second time, and the third strand will fall into place behind the other two, and by the time you get round to the starting point you will have a complete ring of three-strand rope, unbroken except for two ends sticking out at one point. Sketch "D." Cut these off and apply a touch of shellac, and when you are making your mast-strop, block-strop or whatever it is, arrange this joint so that it will fall under the seizing.

I can only repeat that making these strops is simplicity itself, and the little one I have here, which is too small to go on the pencil alongside me, was made in under one-third of the time it has taken me to type the description. The most important thing in making very small strops—and it is also very necessary in larger ones, too—is not to straighten out the twist of the strand when taking it out of the original "rope." If this spiral remains unbroken, then as you pass one part round the other they will fall properly into place in spite of you. With larger size material you have something to get hold of, and if you have rather straightened out the strand you can help it into place, but with very small stuff the less you have to handle it the better.

My advice to any builder who has not made such strops in the past, is to start by making one or two with the largest sizes of rigging cord, or even practice by making a few full-size quoit-rings and then work down to the smaller stuff.

Another way to make such a strop is to cut the rope to the required length and then splice the two ends together, but it would be extremely difficult to make a neat job of this on a small scale. Another way to make these strops is to form a small coil of several strands of very fine thread, then serve them all round, Sketch No. 59. This, however, also rules out very small size work, and I do not think that such a strop could be made at anything less than 1/4 in. scale, and even then it would probably look heavy. No, there is nothing to equal the laid-up strop, whether it is to be served over or not, and on 1/4 in. scale the strops would be of fair size, and naturally, the larger they are the less trouble they are to make.

In belaying gear on the pins of the pin-rails, I do not as a rule form the...
coil from the end of the same line, since it is often difficult to do so in a vessel which is already partly rigged, instead I finish the gear with two half-hitches and a touch of shellac, and then cut it off close to the pin. The coils of gear I make later on a small wooden former, Sketch No. 60, then coat them with shellac and bend them to sit properly on the rail, with the “slack” hanging down in front of it. When all the gear is balanced on one of the pin-rails I then add a coil on each pin, sticking it to the rail with adhesive. In making these coils do not wind them tightly on the former, but allow some to form larger bights than others. Too much uniformity in the size and shape of these coils would spoil the whole effect.

Just one further point regarding the rigging of the ratlines, when the heads of the topmast and topgallant shrouds begin to get very close together, the ratlines are extended out to cover the backstays too, as will be seen from the Sail and Rigging Plan.

I have already mentioned the difficulty, or rather the impossibility of getting chain small enough to make the sheets and running gear on a model of 1/8 in. scale or under, and I have often tried to find some way of getting over this. One professional model maker I know, has tried to represent very fine chain by twisting two strands of very fine wire together until the “lay” was almost at right angles to the run of the wire instead of inclined as with rope, but I cannot say that I was altogether pleased with the result, and I certainly did not think it worth the trouble involved.

The other day while looking through one of my junk-boxes I came across a small brass roller with a milled edge like that of a coin, but much more open, and this gave me an idea. I ran it up and down on top of a rubber-stamp pad, and then along a piece of white thread, and “presto,” my white thread had turned into a lot of little white dots against the dark table! Of course there are still a lot of snags, for example only one face of the thread was dotted, and as the act of running the roller along it had slightly flattened it, it was not very ready to stand on its edge to allow that side to be done, but I still feel that this is worth further experiment, for as first seen it did suggest a very fine chain and would I think prove quite effective on small models for such gear as the sheets of square sails, where, mixed up with all the other gear, the suggestion of chain would be complete, but one would have to be able to “dot” all sides of the thread. I have not finished with this idea yet! Would it be possible to lay up a “two-strand” line of black and white thread? I do not know, but I think it may be worth a trial when I get the time.

In describing the gear in this model, I have had in mind the possibility of the same vessel being built at say 1/4 in. scale, and have therefore covered much of the rigging detail as it might be carried out on that scale, but on the smaller scale, the builder will probably want to substitute simple links instead of shackles for joining some of the items of gear, and other modifications, I know that I did in my own model, and it is much better to suggest a shackle by the use of a simple link of about the right size, than to make a perfect shackle which to get it right, has had to be made several sizes too large. I have already made the point that scale appearance is much better than out of scale detail, and it is the general effect which counts. Make your smaller details accurately whenever you can, but if they cannot be managed on the scale you are using then it is better to suggest them.

Finally, the following table will give the builder some idea of the size of running gear required. I do not suggest that at 1/8 in. scale he will be able to get linen thread to scale for each size, but the table will at least provide a comparison between the sizes used for different jobs.

### FORE AND AFT SAILS

#### Sizes of Running Rigging

<table>
<thead>
<tr>
<th>Halliard</th>
<th>Downhaul</th>
<th>Sheet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flying jib</td>
<td>2 in.</td>
<td>1 1/2 in.</td>
</tr>
<tr>
<td>Outer jib</td>
<td>2 in.</td>
<td>1 1/2 in.</td>
</tr>
<tr>
<td>Topmast staysail (fore and main)</td>
<td>2 1/2 in.</td>
<td>2 in.</td>
</tr>
<tr>
<td>Lower staysails</td>
<td>2 1/2 in.</td>
<td>2 in.</td>
</tr>
<tr>
<td>Main topmast and middle staysails</td>
<td>2 in.</td>
<td>1 1/2 in.</td>
</tr>
<tr>
<td>Spunker</td>
<td>3 in. (Peak and throat)</td>
<td>3 in.</td>
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<tr>
<td>Topping-lift 3 in., tackle 2 in.</td>
<td></td>
<td></td>
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</tbody>
</table>

#### SQUARE-SAILS.

<table>
<thead>
<tr>
<th>Halliard (Tackle)</th>
<th>Lift</th>
<th>Bunt or clew line</th>
<th>Downhaul</th>
<th>Sheets</th>
</tr>
</thead>
<tbody>
<tr>
<td>Course (Foremast)</td>
<td>3 in.</td>
<td>2 in.</td>
<td>-</td>
<td>chain</td>
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<tr>
<td>Lower-topmast</td>
<td>-</td>
<td>2 in.</td>
<td>-</td>
<td></td>
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<tr>
<td>Upper-topmast</td>
<td>2 1/2 in.</td>
<td>3 in.</td>
<td>-</td>
<td>2 in.</td>
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<tr>
<td>Topgallant</td>
<td>2 1/2 in.</td>
<td>2 1/2 in.</td>
<td>1 1/2 in.</td>
<td>-</td>
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<tr>
<td>Royal</td>
<td>2 in.</td>
<td>1 1/2 in.</td>
<td>1 1/2 in.</td>
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### BELAYING PIN TABLE

KEY TO SKETCHES No. 88 and 89

<table>
<thead>
<tr>
<th>Pin No.</th>
<th>Used for</th>
<th>Pin No. Used for</th>
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<tbody>
<tr>
<td>1. Flying-jib Downhaul</td>
<td>7. Spare</td>
<td></td>
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<tr>
<td>2. Outer-jib Downhaul</td>
<td>8. Spare</td>
<td></td>
</tr>
<tr>
<td>3. Inner-jib Downhaul</td>
<td>9. Foremast Leech-lines and Bunt-lines, Port</td>
<td></td>
</tr>
<tr>
<td>4. Fore Topmast-staysail Downhaul</td>
<td>10. Foremast Leech-lines and Bunt-lines, Starboard</td>
<td></td>
</tr>
<tr>
<td>5. Fore Tack (When not in use) Port</td>
<td></td>
<td></td>
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<tr>
<td>6. Fore Tack (When not in use) Starboard</td>
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CHAPTER IV.

CLINKER-BUILT MODELS

In many ways the apparently simple open boat requires more careful construction and greater skill than larger carvel-built vessels. In the first place everything is open for all to see, and there can be no little short-cuts or departures from the truth. The internal construction must be true to the original, not only in principle, but also in detail scale, and workmanship, in spite of the fact that all the materials will be very much lighter in proportion to the size of the model. Another point is that in a carvel-built vessel the planks butt edge to edge, and therefore if one strake is not exactly to the correct curve all the way, the edge of the previous plank will probably pull it right, but with a clinker boat every strake must be *exactly* right, since it will get no correction from the one before, instead, it will either over-ride the previous plank much too far, or on the other hand fall short and not allow sufficient material for the fastenings.

I have not built many clinker boats, some half-dozen all told and most of those very small ones, so I have not experimented as much as I would have liked, but what I have done gave me plenty of pleasure even if an occasional headache was thrown in for good measure. I still have a lot to learn on this interesting type of construction, and I offer these notes merely to pluck at a few of those very small ones, so I have not experimented as much as I would have liked, but what I have done gave me plenty of pleasure even if an occasional headache was thrown in for good measure. I still have a lot to learn on this interesting type of construction, and I offer these notes merely to

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<th>Pin No.</th>
<th>Used for</th>
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<tr>
<td>41.</td>
<td>Fore Clew-garnet. Port</td>
<td>44. Main Staysail Downhaul</td>
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<tr>
<td>42.</td>
<td>Fore Clew-garnet. Starboard</td>
<td>45. Fore Brace. Port</td>
</tr>
<tr>
<td>43.</td>
<td>Fore Lower-topmast Bunt-lines</td>
<td>46. Fore Brace. Starboard</td>
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<tr>
<td>44.</td>
<td>Fore Lower-topmastsail Bunt-</td>
<td>47. Fore Lower-topmastsail Brac</td>
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<td>45.</td>
<td>Fore Lower-topmastsail Bunt-</td>
<td>48. Fore Lower-topmastsail Brac</td>
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<tr>
<td>46.</td>
<td>Fore Upper-topmastsail Down-</td>
<td>49. Fore Upper-topmastsail Brac</td>
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<td>47.</td>
<td>Fore Upper-topmastsail Down-</td>
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<td>Fore Topgallant Bunt-lines</td>
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<td>81.</td>
<td>Fore Topgallant Bunt-lines</td>
<td>84. Fore Topgallant Bunt-lines</td>
</tr>
</tbody>
</table>

**NOTE.** Most of the above spares would of course be taken up by staysail sheets etc. in a model with sails bent.
My next effort was the experimental hull shown in the photographs of a group of models, a hull based on fishing types in general but like none in particular. It was really designed to get the maximum carrying capacity on the length of hull, and was used to "playabout" with different power plant—she is an auxiliary—and also to experiment with methods of steering under sail, but using her normal scale rudder and various rigs between the sheets and tiller. At various times she has been rigged as lugger, sloop, and cutter, fishing rig in each case, but all that is beside the point. This model was built some seventeen years after the first and proved perfectly sound except for a small leak at the stern-gland.

This hull is half-decked with a large open well and has no outside ballast whatever, yet she never gave any sign of taking water over the side decks. For ballast I used some linen bags about 3 in. × 2 in. each half filled with lead shot and this proved most satisfactory. The whole secret is in only half filling the bags, for in this condition they will cling to the sides of the hull and "stay put," whereas full bags simply roll down to the lee side when the boat heels over. I have tried rolling this boat almost on her beam ends on a table, and found that the bags remained in position. Another advantage of this type of ballast is that one can trim the boat exactly as required, and perhaps be surprised at the effect a very slight difference in trim can have on the steering. However, once more I am wandering from the real subject on hand.

Unlike the big ship the small clinker-built boat is completed before the timbers—not "ribs," please—go in, only the keel, stem and stern being fabricated prior to planking. The actual formation of the shape of the boat takes place on a series of inverted moulds, which are discarded when once the planking is finished. The boat is built upside-down, and only turned over when ready for the timbers. In cases where a large number of boats are likely to be built off one design, as for example a standard form of yachts' dinghy, the builder will make a template or pattern of each of the strakes as cut for the first boat of the series, after which all subsequent boats to this type can be built the right way up and without the use of moulds since by cutting all the strakes to the templates, the boat will take form by itself when all are in position. The timbers, which on 1/2 in. scale will be 3/64 in. - 1/16 in. square stuff, should be glued and dowelled together.

Several of the photographs in this book include one of my own smack's dinghies, built to 5/8 in. scale, while Fig. 24 shows a boat built by Mr. Ballantine to the same scale, but fitted with a centre-board and sail. However, for our example we will take an ordinary transom-stermed ship's boat as shown in the drawings on Plate No. 8.

The first stage will be to produce the building board which should be about four inches longer and two inches wider than the overall size of the boat, and on this draw in the centreline and cross-stations as shown on the lines plan, also draw in the outline of the boat at gunwale level. On the underside of the board screw two rails of say 1/2 in. or 3/4 in. square material, running thwartships at the ends. The object of these rails is to keep the baseboard off the bench so that the restraining cords, to be mentioned later, will run freely below it. Incidentally the original drawing from which Plate No. 3 has been produced is to 1/4 in. scale and was intended merely for the production of fully detailed boats for use on 1/4 in. scale ship models, but for the purpose of the present description we will assume that the builder has enlarged it to 1/2 in. or 3/4 in. scale and intends to build a model of the boat alone. I will be dealing with the construction of clinker-built boats on a smaller scale later in this chapter. I could have taken my own 3/4 in. scale dinghy to illustrate the building to this scale, but the ship's boat has rather more fittings and is therefore more suited for the purpose.

Having made the base, the next thing to take in hand will be the transom, which should be cut from hardwood such as sycamore or box. The stern-post can then be cut from similar material and glued and dowelled to the transom, taking care that the keel is cut to the correct angle. While this is drying, cut out the stem and apron. The latter may either be in two pieces, with a scarfed joint between, as shown in the plans, which show full-size practice, or, when close-grained hardwood is used, in one. The inner edges of the stem are chamfered where they meet the apron and so form the rabbet for the planking Sketch No. 61. When these two have been cut out, they should be glued and dowelled together.

The keel assembly is also in two members, the keel and the hog-piecede, Sketches No. 62 and 63 and like the stem the edges of the keel are slightly chamfered where they meet the hog. However, before actually fixing the hog-piece to the keel, the latter has to be glued and dowelled to the stem and stern-post respectively, so we will now cut the knee for the stern-post and get it fitted. It will be seen that both apron and knee of the sternpost have a small step formed at their inboard ends to receive the ends of the keelson and the depth of these steps have to be equal to the material to be used for the timbers, which on 1/2 in. scale will be 3/64 in.—1/16 in. square stuff cleaned up. The hog-piece can now be cut out, but should not be fitted yet because it simplifies matters to trim the bevels of the hog from the moulds when they are in position.

On your lines plan, rule a base line say about 1 1/2 in. above the body plan, which, when the plan is turned upside-down, will represent the top of the baseboard. Now proceed to set out the first cross-station on a piece of thin plywood, using proportional dividers if you are enlarging the plan to build a larger model, or by tracing and rubbing down if your model is to the same scale as the plans. Extend each section down to the base-line you have
drawn on the plan, and do not forget to include the centreline on the plywood. On the plywood also mark in the depth of the hog-piece on each station, then cut out the templates or moulds, including the recess to take the hog-piece, the underside—or the top when inverted in the mould—of which should be flush with the mould at the centre. Sketch No. 63. When all the moulds are ready, attach them to the base on their respective station lines by means of lengths of square stuff screwed to both mould and base. Sketch No. 64.

Unlike the timbers of a carvel-built vessel which have to be bevelled to the run of the planking, the moulds used for a small clinker-built model need not have their edges bevelled, but, instead of the moulds in the fore-body being on the fore side of the station line and those in the after-body aft of the line, the positions for the moulds is reversed, and in the fore-body they are placed aft of the lines and in the after-body on the foreside, so that the planking will in fact only make contact with the edge of the mould which is actually on the station line. When all the moulds are in place on the base, drop the hog-piece into the recess provided and carefully chamfer its sides to the slope of the various moulds, cutting away the unwanted material as shown in Sketch No. 63, after which it can be glued and dowelled to the keel, taking care to put it in the right way round, for although there may not be a very obvious difference between bow and stern, there will in fact be enough to throw out the lie of the planking if put “back-before.”

When the glue between the hog-piece and the keel is dry, drop the complete assembly of stem, keel, and transom into place on top of the moulds and fit small chocks of wood at either end, one under either corner of the transom, and one to receive the stem-head. These chocks should be slotted to grip the respective members they support, so that when the assembly is put into place in the moulds, the ends cannot twist or move while the strakes are being fitted, for there will in fact be quite a lot of tension from time to time when a plank is fitted on one side without its opposite number being in place to balance things up.

Now that you have all your moulds and chocks in place, remove the keel assembly and drill a series of holes through the base, close to the face of each frame on both sides of the hull and on the line representing the outline of the gunwale, fit cleats or screws on edge of base. These holes should be just large enough to pass fine cord or thin string. There will be considerable strain on the moulds when bending the strakes, particularly near the ends of the boat, where the tendency will be to force them back towards the midship section, and to check this, rough distance pieces should be glued between each mould as shown in Sketch No. 64. One other point I should mention, is that it is as well to see that the screws holding the moulds to the base board are outside the line of the boat, so that in event of glue getting through on to any of the moulds and sticking them to the planking, the boat can be turned over with these moulds still in place, after which they can be broken out without damage to the hull. Precautions will of course be taken against the risk of the moulds sticking, but accidents will happen in the best regulated circles, and it is better to be wise before, rather than after the event!

The building jig is now complete, so replace the keel assembly and see that stem and transom are held in their respective chocks. Now take the end of a spool of thin line or string and pass it up from below and through one of the holes in the board, up over the keel and down through the hole on the other side, then tie a large knot in this end to prevent it pulling back through the hole. Now cut off the other end leaving a tail about 6 in. long on the side at which you started, then “nip” this end in one of the cleats or tie round a screw head. Fit similar cords at each pair of holes, the object being that they will serve as additional “hands” when fixing or marking out the strakes. In operation a plank is laid along the moulds, then the cords pulled tight and nipped by the cleats so leaving the builder’s hands free for either marking or fixing the plank as the case may be. Cords will of course be fitted at both stem and transom, as well as the moulds between.

At this stage it is as well to make a few small wedges, since at certain points, such as close against the keel, or where the transom makes a reverse curve into the stern-post, the cords cannot make more than an edge contact with the plank, in which case the cord is pulled taut, then a wedge inserted below it to ensure the plank making proper contact with the mould. I have used this method of restraining cords for various types of hull apart from clinker-built boats, and in any form of construction where the hull is built upside-down, they have proved of the greatest success. There may be places where the restraining-cord tends to push a plank a little out of line due to the cord “shorting” from plank to hole, but this can be overcome by the use of a simple wire clip such as Sketch No. 65, made from a paper clip and slipped on the edge of the mould. A few clips of this type will enable you to arrange the cords to lead off the plank edges at any angle you wish.

Now all is set for the real test of skill, the planking, and the run of this will largely depend upon the type of boat being built. As already mentioned the most simple form is that of the small river skiff, long, lean, and double-ended except for the mere suggestion of a transom, rather like a double-ended boat in which a small “V” has been driven down on top of the stern-post. Such boats can be built with a single mould midships, leaving the fore and after bodies to take their own shape as the planking is run from this mould to the stem and stern-post respectively. The boat with fuller ends naturally means more shape in the strakes to provide this curvature. A dinghy with a flat transom having no reverse curves, which in effect means that the
The transom-sterned ship's boat selected for this example is I think somewhere between the two extremes, she is not "apple-checked" and so offers no difficulty forward, while the transom is fairly full and without any sharp reverse curves.

The first thing to do is to decide on the number of strakes per side to be fitted in the particular type to be built, this in the boat from which these plans were drawn was thirteen, with a maximum width of about 8\(\frac{1}{2}\) in. per strake midships, including the lands, or over-lap. Having decided on the number of strakes to be used, there are two methods of setting them out, one is to simply divide the stem, stern and each mould into that number of equal spaces and work up your strakes from that, and the other, which I prefer, particularly in transom-sterned boats, is to run a temporary strake or batten from end to end along the turn of the bilge, allowing it to find its own line, so that it rests squarely on each mould and without twist, then mark the stem, stern and each mould at the point where the centre of this plank crosses it, after which the space above and below this line on all stations is divided into the required number of strakes. I have found that this provides a run of planking with the least distortion or twisting, although the lower strakes on the stern-post will probably be wider than they would have been with an equal divide from gunwale to keel.

I used the proportional dividers for dividing out the edges of the moulds into the requisite number of strakes, but in a small boat like this it is not wise to use the points directly on the curved surface of the mould. In a larger vessel such as the brigantine described in Vol. I, the actual curvature in each section to be divided, the sections between the temporary battens, is so slight that the fact that the points of the instrument really spanned this was of no importance, particularly as the dividers actually corrected any error each time by being re-set. In a small boat however conditions are entirely different, you have to divide either the half or the full girth of each mould, according to which method you are using, and to simply place the points of the dividers on the gunwale and keel respectively, would in fact divide the chord, or the straight line between these points, and not the girth. What I do in the case of very small craft is to cut a strip of paper or thin card and lay it round the edge of the mould, then with a sharp pencil, mark the gunwale and keel on it, and, if using that method, the centre of the tem-
porary batten. Then lay this strip of card flat on the table and mark off the necessary divisions, after which the card is again offered to the mould and the pencil mark transferred to it, the opposite side of the mould being marked with the same strip of card at the same time. Do this for every mould and also stem and stern, and you have the run of the strakes laid out.

In clinker construction the strakes overlap to a distance known as the "land," which in model work may have to be increased very slightly out of scale if the boat is to be fastened and not merely glued. In full-size work, the land would be about 3/4 in. for the average size boat, but in model work, I find that about 1/16 in. is the best I can do, although more expert hands than mine may be able to improve on this. At 1/16 in. one can use fine bamboo dowels in place of clenched nails along the lands, and no doubt the same could be done with short lengths of copper wire, but I have not tried it. The thickness of planking will also depend largely on the scale of the model but for 1/2 in. upwards, I would be inclined to use 1/32 in. material and clean it down to nearer scale thickness, and for scales under 1/2 in. then one of the veneers. Whichever material is used, if it is obtained in strips then they must be much wider than the maximum width of the finished plank, for there will be considerable curvature in some of the strakes, and this must be cut to shape, it cannot be sprung or bent to it.

If this is your first boat, you may care to first plank it up in cardboard, afterwards using the cardboard strakes as templates for cutting the timber ones, but if this is done, then it is important to use cardboard of approximately the same thickness as the timber to be used for the strakes. The overlap in clinker planking makes quite a lot of difference to the shape of the strakes, because none of the planks are resting properly on the moulds, and the steeper the incline of the plank to the surface of the mould, the more curve there is likely to be in its length. As the incline is produced by the thickness of the adjacent plank, it is obvious that there will be slightly less curvature in thin strakes than thick ones, assuming all other dimensions to be the same, so that the strakes of a model planked with say drawing paper would not be quite the same shape as the same model planked with 1/32 in. material. The difference would be slight, but quite sufficient to destroy the 1/16 in. lands, in fact some planks probably would not "land" at all. It is just one of those small points which are so obvious when you come to think of them, but which are very easy to overlook.

However, we will assume that the builder is going to go right ahead and plank straight from the raw material. Take a length of the planking and feed it against the keel, at the same time pressing down the ends so that they rest on stem and stern-post respectively, hold the ends in position with clips and then with a sharp pencil, mark the plank where it makes contact with the keel, for it will be found that near the ends of the boat, the plank will

**Fig. 22.**

MOTOR FISHING VESSEL "JOAN."

3/8 in. scale Plank-on-Frame Model by Dr. A. K. Tulloch.
have pulled away from it. Remove the plank and trim it down at the pencil marks, then feed it back to the keel again, where it will be found to sit much better, but there will probably still be certain points where it is not in full contact, so again mark where it does rest against the keel, trim off and once more feed to the keel, when, if it fits properly, the ends should be marked for, and cut to, the rabbets in the stem and stern-post. When satisfied that the plank fits all along the keel and into the rabbets at either end, run a sharp pencil across it where it crosses the various moulds—the restraining cords will hold it for this—and then remove it. Now measure the width the plank has to be at each mould and mark these widths on the plank itself and run a pencil line through the points so found. This line will represent the middle of the land, so outside this, run another line equal to half the width of the land and this will be the cutting line of the plank. Lay this plank on another piece of material, and use it as a template to mark out the plank for the other side of the boat, then when this is also cut out, place them back to back and carefully finish dressing them down to the cutting line marked on the first one.

It will be obvious that if the edges of clinker laid planks were left square, there would be only a knife-edge contact between one plank and the next, leaving a gaping edge, Sketch No. 66A, which would probably split the plank from end to end when the nails were being driven and clenched. It will also be clear that the angle of this chamfer will vary according to the cross-section curvature of the hull at any one point, the angle being steeper on the turn of the bilge for example than in the more or less flat topsides. As the planks near the ends of the boat, this chamfer is increased in depth—but not in width—while a corresponding chamfer is also cut on the underside of the outer plank until by the time they reach the stem the two planks meet in a form of scarf-joint, Sketch No. 66C, and rest flush in the rabbet. The treatment of the stern is the same, both where the planks lie in the rabbet of the stern-post and also all round the edge of the transom. This change from lap to flush jointing usually starts from 12 in. or 18 in. from stem and stern-post in the full-size boat. The planks are nailed all along the lap at about 3 in. intervals, using copper nails driven right through, the end projecting inside the hull is then clenched over a roove, or copper washer.

Now back to the model, having cut your first pair of planks, cut the chamfer along the outer edge of one, or in small scale work, file the chamfer along the edge of the plank, using the angle made by the moulds as a guide to that required on the plank, remembering to make the “halved” chamfer at the ends. Along the edges of the moulds, run a narrow strip of adhesive tape or thin gum strip. This by the way is better put on before dividing the edges of the moulds, so that the markings can be made on the outside of it, and the idea is that should any of the strakes stick to a mould, this
strip of paper will allow the latter to be pulled out without difficulty. Now take the first of your two planks and feed it into position against the keel and the rabbets of stem and stern-post having first treated the edge with glue. Hold it in position with the restraining cords and wedges, then proceed to drill and either dowel or nail it according to scale, all along the keel and at either end. When the glue has had time to set, fit the plank on the opposite side in the same way.

When the glue has dried in the first strake on either side, take another length of planking material and feed it up to the edge of the fitted plank. Pencil the points of contact as before and trim as required. Feeding against the edge of the first plank will be good enough for the first trimming and to get the general curve of the second plank, after which the outer edge of this plank can be cut as before by setting out the points where it crosses the moulds and on these points marking the required width of plank at each. Do not try to cut the plank accurately at this stage, but having cut it out roughly, feed it back to the first plank, but this time letting it overlap to the extent of the land. You will probably find that it now requires a little further trimming to make it match the land, due to the fact that it now rests at a slight angle to the face of the mould. Also cut the chamfer on the inside of the plank at the ends to match up with the “halved” chamfer already cut on the plank below, so that the ends of the new plank will lie flush with the first one in both stem and stern-post. When satisfied with this lower edge of the strake, re-trim the upper edge so that it runs true to the marks on the moulds and stem and stern, then use this as the template for the similar plank on the opposite side of the boat. Match these two, then proceed to form the chamfer on the upper edge of the first of the pair, remembering the “halved” ends. When satisfied with this, put the plank back in place, having first run a fine pointed glue brush—a child's paint brush is ideal—along the face of the land on the plank below. Hold the strake in position by means of the restraining cords, with perhaps a dowel midships and bow and stern. Make quite certain that the plank is only overlapping the other to the extent of the land, or is not short of the land at any point, and when satisfied proceed to drill and dowel at intervals all along the land, except over the moulds, for you do not want to dowel the boat to those. Let your dowels go right through, they can be cut off both inside and out later. Of course if your scale will allow it you will drill, nail and clenched instead of dowelling. In the ends of the planks, drive the dowels more or less parallel to the line of the keel, as already described for the planking of the brigantine.

Fit the plank on the opposite side and then continue planking up to the gunwale level, although as soon as you get clear of the rabbet of the stern-post and run on to the transom, the planks can be allowed to overhang a little aft, to be cut off later with a jeweller's saw, and cleaned up with the

after side of the transom. Incidentally, with this type of construction it is very necessary that all materials should be cleaned up as far as possible before use, for it is very difficult to do much cleaning up, either inside or out, when the boat is completed, at least, not without rubbing some of the sharpness off the lands of the strakes, and so spoiling the whole effect.

Now that all the strakes are on, the boat can be lifted off the jig and turned over, and if your lands have been dowelled then all the dowel heads can be cut off flush with the planks as described in Vol. I, while if you have used nails then these can be roved and clenched. The next job will be to fit the gunwale round the inside of the sheer-strake, a simple task but one which requires care and patience, because it must make good contact with the strake all round, yet is bound at each end by the stem and transom respectively. On a 1/2 in. scale model of this particular boat the gunwale would probably be made from 1/8 in. square material, but its width will be cleaned down to 3/32 in.; when the gunwale is in on either side, make and fit the breast-hook at the stem and the small knees which tie the gunwale to the transom. All these components should be glued and dowelled in place, as of course will the gunwales. On the inside of the gunwales there are four pads per side for the crutches—not rowlocks please—and these should be made to the size shown on the plan and glued and dowelled in place, after which the holes can be drilled for the shanks of the crutches. I was fortunate enough to find a bit of 1/16 in. bore brass tube in the junk-box, and I bushed all the holes with this, but this is not really necessary. The breast-hook has rather narrow horns, and in making this I followed my usual practice of first gluing the wood on to a piece of paper, then cutting it out and finishing top and sides, finally rubbing the paper off the underside only after the hook had been carefully fitted to its position in the boat. This meant that the hook was strengthened by the paper throughout the time it was being worked on, the paper being removed only at the last moment when I was ready to fit the hook in place. I strongly advise this method of making any form of small wooden component.

With the gunwales, breast-hook and knees in, it is time to think about the timbers. These will be at about 3/8 in. centres on 1/2 in. scale and in my own model I made them from strips of 1/16 in. square sycamore, rubbed down to 1/16 in. × 1/32 in. (full) and at this I had no difficulty in bending them cold, but I gave them some pre-bending in my fingers before starting. Some snapped off in trying to get them into the hull, but not many. Take up a strip of the material to be used, and work it round in your fingers into a half circle roughly equal to the mid-section of the boat. You could of course steam them, but I would rather bend them cold if possible. However if you do steam them, then bend them into a “U” shape on a jig rather smaller than the mid-section of the boat, and leave them on that to dry and cool, you can also
bend some on a "V" former with a blunt point, they will come in handy for the bow sections.

Take up a length of material which you have formed into a "U" with ends which project above the gunwale on either side, then press this down into the boat until the centre rests on top of the hog. Drill this point and put in a dowel, or a small pin if you are using metal fastenings, but do not drive home either pin or dowel, they have to come out again later. Now carefully work the timber into close contact with the planks all round one side of the hull, and very carefully mark it for the under side of the gunwale. Treat the other side the same, then remove and cut off at these points. Put back into the hull and try again, and the ends should be just long enough that they have to be sprung into place below the gunwale, which will ensure that it makes perfect contact with the planks all round the hull, so the cutting at the top is very important. If it is not a dead fit the timber will ride away from the planking at some point. In large scale work the timber would probably be jogged to fit the sloping faces of each plank, and would have to be marked with a sharp pencil to locate the joggles, but on small scale work the timbers can be taken right across the strakes.

When satisfied with the fit, remove the timber, glue the side which will be in contact with the hog and planks, and the ends which fit below the gunwales, then press back into the boat and drive the dowel or pin into the hog, but if the timber has been accurately cut at the top there will be no need to either dowel or pin it at any other points at this stage, and you can continue fitting the other timbers in the same way, working on either side of the mid-section. Towards the bow the timbers will take on a "V" shape until right forward the angle on the hog will probably be too sharp to bend and it will be necessary to put on each side separately. The same will apply right aft, and here the need for accurately cut length is even more important, for in the after sections the timbers have to make a double reverse curve, and only accurate fitting for length will ensure proper contact throughout. The timbers are of course always run with the face of the planking, so that at the ends they run at different angles to the centreline, like the cant-frames of the larger vessel, and not straight across the boat, but unlike the cants of a large ship, this radial effect will be gradual, increasing slightly with each timber from about 1/4 in. of the boat's length on either side of midships. In fact you simply bend the timber and allow it to take its own line.

When all the timbers are in, they should be dowelled or clench nailed through each land in the planking, after which the keelson should be cut out of say 1/2 in. x 3/32 in. material, and will require to be shaped at the ends to suit the lines of the boat, after which a spot of glue should be applied to the tops of all timbers in way of the keelson, which can be put down and dowelled at intervals. The mast step as shown on the plans will then be glued and dowelled in place. This is a simple block of wood, with a slot in the middle to take the heel of the mast.

The bottom boards in this boat sit directly on the timbers, although such boards are often laid on spars running over the keelson so providing a flat platform instead of one following the bilge of the boat as in the present case. The bottom boards of the boat under construction should be laid on curved spars resting on the inside of the planking between the timbers, and to these spars the bottom boards should be dowelled. In the original boat they were also made in sections for lifting, but in the model I think it better to make them in one piece and glue and dowel them to the inside of the timbers, this will prevent them falling out of place when the boat is handled, as a small boat of this kind is almost certain to be. This is one job where cardboard templates can be of help, and I advise fitting the bottom boards on one side in cardboard, then when satisfied use these as patterns and make a pair of planks off each. The grating in the stern-sheets is another job for a cardboard template, for this has to sit level and fit nicely into the run of the stern as well as being slotted round the knee of the stern-post. The actual making of the grating will be as already described in Vol. I in connection with the brigantine, and this is a case where I would make it larger than required and only very roughly triangular in shape, then on the cardboard template cut to fit the boat, I would draw in the outline of the frame, which would be fabricated in mahogany or cedar, and the actual grating cut down to allow the frame to be assembled round it.

The metal work should be taken in hand at this stage, the hooks for the davit falls, and the ring-bolts for the painter but there is no need to go over these in detail, their shapes will be seen from the drawing, while their construction from metal sheet and wire will follow the lines already described for the mast "ironwork" of the brigantine. The rowing crutches can be left to the last, since they would only get in the way at this stage. The rowing stretchers should now go in, these are narrow planks running across the boat at bottom-board level, to provide a stop of the oarsmen's feet and give them the necessary purchase when pulling at an oar. The stretchers are inclined at a convenient angle for the feet and their ends, which will of course be cut to the shape of the boat, fit between rails made of the same material as the timbers, to which they are glued and dowelled.

All work in the bottom of the boat is now complete, and the next thing will be the thwarts or seats, for which we will require fourteen knees, which should be made as described in Vol. I. To carry the thwarts a stringer is run along either side of the boat, glued to the faces of the timbers and dowelled to them at intervals. This stringer runs parallel to the keel and does not follow the gunwale. When the stringer is in, carefully cut the bow thwart, which should extend right out to the planking, being notched where necessary.
round the timbers. Glue the thwart to the stringer, but there will be no need to dowel it, for it will be locked by the knees. The knees should now be fitted. They extend out to the face of the planking and should be joggled to fit closely over the strakes and laps, they should also be notched to fit tightly under the gunwale. When satisfied with the fit, glue all faces in contact with thwart, planking and gunwale, then dowel into the thwart and also through the planking from the outside. Fit the remaining three knees on the thwart.

The next two thwarts are made and fitted in the same way, except that the mast-thwart has a semi-circular socket cut out of the after side to take the mast, which is held in position by a hinged metal strap, made much the same as the parrals of the upper yards of the brigantine. The stem-sheets comprising of the last rowing-thwart, two side benches, and the after thwart is another job for pre-fabrication. I first made a cardboard template covering the complete unit and carefully fitted this to the boat, noting it where necessary to clear the timbers, I then laid this template on a sheet of strong paper and marked its outline, after which I completed the drawing by adding details of each thwart and bench, just as shown on the plans, including the knees which form the rounded corners joining the side benches to the after thwart. I then proceeded to make each component and lay it down on the drawing, which was pinned down on a board. The rowing thwart was first cut out, including the joggles for the ends of the side benches. This was then glued down on the paper. Next the side benches were cut out, followed by the knees and after-thwart, and all fitted in position against the thwart which was glued down. When everything was satisfactory these components were lifted, glued on the under side and jointing faces, then laid back on the paper. A sheet of thin paper was then placed on top and the whole job left under an old flat iron to dry. When the glue had set, the whole job left under an old flat iron to dry. When the glue had set, the whole unit was put in place. When a touch with the warding file here and there was all that was necessary to allow it to slip into position, glued on the edges to the planking and transom, and on the underside to the stringer. The knees were then fitted, glued and dowelled on the rowing-thwart as before, while a single dowel was driven through the after-thwart into the head of the stern-knee, or in boats where this knee may not reach to the underside of the thwart, then I would drive a skew-dowel into the stern-post.

One point I seem to have failed to mention in connection with the planking is that in this type of boat the sheer-strake runs at the same width from bow to stern, and this must be allowed for in dividing out the plank widths, which will in fact be divided between the underside of the sheer-plank and the keel, and not between gunwale and keel. This does not apply to all boats, my own dinghy for example, where all strakes, including the sheer-strake are tapered. One other point is that in a boat such as that under review, the sheer-strake would probably be of mahogany or teak, left natural and varnished, although the rest of the boat would be painted.

Back to the model. A timber rubber runs all round the outside of the boat, hard against the lower edge of the sheet-strake and will of course be glued and dowelled—or metal fastened—in place, the fixings being arranged to land on timbers. If this boat is being built as a ship's boat, she will almost certainly have life-lines rigged all round her sides, and for this purpose a range of small metal eye-bolts are fixed as shown on the plans. There are various methods of attaching the line-lies, or hand-lines, and these are shown in Sketch No. 67, but one thing applies to them all, and that is the lower ends of the bights are at the water-line level and do not follow the gunwale, as one sometimes sees in models. In other words the depth of the boat increases the further one moves out to the ends of the boat.

A metal binding runs all down the stem of the boat and along below the keel, being turned up at the after end as shown on the plans. This can either be cut from brass or copper sheet, or one can use a standard brass section. I was fortunate enough to have by me a length of flat brass strip, slightly rounded on one face, and as this was the right size for the job, I used it. I drilled it at about 3/4 in. intervals all along its length, then gave each hole a slight touch with a larger drill to form a very shallow countersink. The original hole was drilled a tight fit for a size of "bug-pin," and in fixing, the pin was driven until it became tight in the hole, it was then cut off almost flush with the metal and given a few final taps with the hammer, which was just enough to spread it in the very slight countersink provided. This binding should be taken right over the top of the stem and down to the top of the breast-hook.

The rowing crutches I made from the same material as the binding, first "turning" the shanks from wire, using the breast drill and warding files. The chains were made from very fine copper wire off an electric bell bobbin, and the whole fabricated as shown in Sketch No. 68. The oars were carved from the solid, and this particular boat should be provided with eight pulling and a steering oar. I "leathered" the shafts from material cut from an old leather purse, which had the advantage of being extremely thin and at the same time "weathered" looking. I bound the ends of the blades with copper shim and was always rather pleased with myself for doing so, because I
managed to get a good silver soldered butt joint which it was almost impossible to find. I first made a metal former representing the end of the oar blade, and on this I bent and silver soldered the bands, after which I finally finished the blades to fit the bands. Unfortunately I thought that the push-fit would have been good enough for this job, but I did not reckon with the fact that I would not be keeping the boat in a case, and therefore it would be subject to the regular administrations of the office cleaners. The boat has stood up to their vigorous “dusting” without damage, although from time to time I have to retrieve the stern-sheets grating—which like the bottom boards was made removable—oars, etc., from the floor, but their efforts have proved too much for the copper bands, which one by one have been “dusted” out of existence. I should have pushed them on with a touch of shellac on the blades. The boathook head was filed up from the solid, and then drilled to take the shaft.

The rudder should be built from 1/32 in. sycamore sheet, but there will be no need to describe this in detail since both it and the tiller is clearly shown in Sketch No. 69. The pintles and gudgeons should be fabricated from brass sheet and wire, and will offer no difficulty. A good long painter should be spliced into the ring-bolt in the stem, after which the masts and sails, if it is intended to stow these in the boat, can be made, and these will be as shown in Plate No. 5, although this particular drawing is for a double-ended boat. A small metal bailer, and perhaps a small bucket, will complete the fittings of this boat, and all that remains will be to paint it or give it whatever finish you decide.

In Vol. I I mentioned a number of small models made from pipe-lighters or spills while I was serving in Scapa Flow. Not much need be said about these models, for their construction was in the main, the same as that already described. A cigar box lid formed the building base, on which moulds of stout card were erected. In some boats the stem, stem-post and keel were made from cigar box lids, while in others these components were fabricated by forming laminations of layers of the thinner spills stuck together. Restraining cords were used as a means of holding the strakes during construction and proved equally satisfactory, although on this scale. They were made of thread or cotton, since string would have been too bulky.

The tools used were confined to an old razor blade, a few needles, and a nail file, and the only fixings, adhesive. This last is the only fault I have to find with these little craft, for I find that they tend to come to pieces, although so far it has only been such items as thwart knees, bottom boards and the like, but I expect that in time the planking will come adrift from bow and stern and that will be the end of the models. Up to date they have been kept in reasonable condition by the odd touch of fresh adhesive when needed, but without this they would no doubt have gone to pieces some time ago.

Of course I must admit that like the larger scale dinghy, they have not been kept in a case, but just kicking about on my desk or drawing table, to be picked up and handled time and time again, and also to receive the same administrations of the office cleaners as the larger model. I have myself seen the small boat get one mighty “flick” from the end of a duster and “fly through the air with the greatest of ease,” to land on the floor on the other side of the room, so perhaps I am expecting too much. However I do not think it is the falls or knocks which are causing them to disintegrate, but the fact that adhesive will not stand up to the changing atmospheric conditions and varying temperatures, particularly as in this class of work, one cannot apply much pressure on a joint when making it, and that I think makes a lot of difference. If one can make an adhesive joint under pressure, then I believe that its value will be greatly increased.

The larger boat I never worry about, it too is handled by almost everyone who comes into the office, and not all know how to handle a model, it has suffered from the cleaner’s most drastic efforts, and has been so doing for about twenty years or more, and but for the loss of the copper binding off the oars and a few odd scratches, has not suffered in any way. Sometimes I have had to hunt for the bottom boards, the boathook, or the stern grating because someone has allowed them to drop on the floor and stay there, but they come to no harm. The point of all this is that in my view a model which is properly fastened will take no end of punishment without damage, while one which depends upon adhesive to hold it together, will have a life equal only to that of the material holding its components. I know that a properly glued joint can be as strong or even stronger than the timber it joins, but such a joint cannot be made by simply putting a spot of adhesive on one small piece of wood and then just resting another piece on top of it, which is as rule the best one can hope to do in very small models of light construction.

The point I have in mind is that there is no difficulty in building such boats at 1/32 in. scale, so why on a ship model of that scale fit boats carved out of the solid? My model of Leon lacks many items which still have to be made, such as anchors, the odd bucket or cask, and, the boat. That model is to 1/8 in. scale, but I hope to build the boat clinker fashion when once I do get down to it. One thing is certain however, if I should find that I cannot get in sufficient dowels on that scale I will not use it, but make a “clinker” boat carved from the solid and leave it upside down alongside the berth, as I did with the small boat for the 1/16 in. scale model of Waterwitch in Vol I. However I am not yet satisfied that I cannot properly build the small boat for Leon, in fact I am convinced that I can, but time will show.
CHAPTER V.

SAILING MODELS

The true sailing model is a type of which I know very little, particularly square-riggers, for while I have in the past sailed the barque shown in some of the illustrations, a brig, a topsail schooner and a ketch, they were all fully fitted models, to scale in both hull and rig, belonging to the showcase rather than the sailing class. These were all sent afloat more or less to see what would happen, usually with more satisfactory results than I had any right to expect. The only models I ever built for sailing were the clinker hull shown in some of the pictures, a large yacht of the racing type, and of course the rowing skiff which represented my first adventure into the field of clinker planking, about which the least said the better.

However these little experiments and the models of friends have satisfied me on one point, the perfect scale model can be sailed providing the hull construction is light enough and one does not expect the impossible. Mr. Francis T. Wayne's beautiful little brigantine which forms the subject of Fig. 13 illustrates this point. This model, like the schooner in Fig. 14 which was also a good performer in the water, was to scale throughout, standing gear set up with dead-eyes and lanyards and running rigging belayed on pins. It is almost forty years since I last saw these models, but if my memory is correct, the practice was to cast off the braces when sailing, leaving the friction through the blocks to maintain the trim of the yards after they had been set by hand. This with either brigantine or schooner rig is not a big job, for the braces are limited in number, but it would take a long time to do the same for a full-rigger or four-masted barque.

It will be seen that she is carrying a spool of line on deck, and I remember Mr. Wayne telling me that this picture was taken on her first introduction to the water, so the line was provided in case salvage operations should prove necessary, which they did not. At that period the idea of sailing a scale hull was entirely new, and Mr. Wayne had sent her afloat much as I did my own models, "just to see what would happen." As it turned out she soon indicated that she was perfectly stable and sailed well, and the salvage line was left ashore.

Figs. 17 and 18 illustrate two models built by Mr. R. C. MacCormack, being the ship Carnarvonshire and the three-masted tops'l schooner William Ashburner. I have not actually seen these models, but I understand they both have scale hulls, plank-built, with a narrow lead bar-keel. My own experience has been that such ships would probably have sailed equally well with internal ballast, made up as already suggested in Chapter IV. These two models have all the deck fittings in detail, while I understand that the rigging has been modified only to the extent of fitting bowsies to certain items of gear to enable it to be handled quickly. Both these little ships have proved very satisfactory in the water.

In Figs. 15 and 16 we have another example of a full-rigger with all deck fittings in detail, and all rigging set up as in the original, and as can be seen from the pictures she behaves well even in comparatively rough water. This model was built by Mr. I. A. Hunt of Perth, Western Australia.

This type of model has the great advantage of being available as a "show piece" when out of the water, even though the scale hull and rigging may impose some limitation on manoeuvrability under sail. I think too much is usually expected from a model square-rigger, many owners appear too apt to expect them to carry their canvas like a model yacht, overlooking the fact that the latter is sailing under her designed proportions, whereas the former is not. The model yacht has been designed as a model yacht, while the square-rigger is a scaled-down version of something entirely different, and if the model builder has any doubts as to the effect of this scaling down, let him imagine a box-like hull 30 in. \( \times \) 10 in. \( \times \) 10 in., having a square-sail 10 in. \( \times \) 10 in. This gives us a hull of 3000 cubic inches and a sail area of 100 sq. inches, but let him build a model half-size of this, the hull then becomes 15 in. \( \times \) 5 in. \( \times \) 5 in. a total of 375 cubic inches and the sail area 5 in. \( \times \) 5 in., or 25 square inches. The result is obvious, in making our model half the size of the original we have reduced the cube of the hull to 1/8th while reducing the sail area to 1/4, so that we have an entirely different relation between hull displacement and sail area.

This would appear to confirm the widely held view that a sailing model must have an outsized hull, but such an assumption overlooks two important factors, firstly that the full-size square-riggers will sail light, i.e. not fully loaded, and secondly that her sail plan is designed to keep her moving, fully loaded, in light winds as well as strong, and that taking any voyage as a whole, it will be found that a relatively small portion of it was made with everything set, a point which I think many model owners overlook. However to deal first with displacement. Our model has two advantages over her big sister, she is not expected to sail light, and her full load is not, as in the prototype, distributed over the full depth of the hull, with some of it above the C.B., instead it is all concentrated at the bottom of the hull either in an external keel or, as I prefer, internal ballast. This makes her proportionately far stiffer then her prototype, in fact such stiffness in a full-sized craft would probably jerk the "sticks" right out of her in calm weather, and
most certainly weigh more, which means less of its carrying capacity. If the hull is cut from the solid or built on the laminate principle, then it will most certainly give her crew a bad time. In all this I am of course able for ballast, also that more weight will be located above the C.B. In such cases one would have either to increase the size of the hull to provide more displacement, or place the ballast lower down, say on a deep external keel, to make up by leverage what had been lost in weight.

On the point of sail carrying, one cannot scale down the elements, but one can see them in proportion to the model and give her sail accordingly. One must realize that what to the owner may be little more than a light breeze and a ripple on the pond, is to a 1/8 in. scale model a stiff breeze and a fairly steep sea, and it is all wrong to expect a model to carry royals and all staysails in weather which would have caused her prototype to take them in.

Cargo-carrying sailing ships were not designed to sail with one rail in the breeze, and a ripple on the pond, is to a 1/8 in. scale model a stiff breeze and a fairly steep sea, and it is all wrong to expect a model to carry royals and all staysails in weather which would have caused her prototype to take them in.

Cargo-carrying sailing ships were not designed to sail with one rail in the water, and it is folly to sail a model so, she should have the sail she can carry without heeling more than a few degrees, with this she will carry on quietly and without fuss, looking like the real thing, which to my mind is what is wanted and much better than “going like a train.” If speed is wanted, then the job for that is a model yacht, not a square-rigger. It may be argued that the clippers were hard pressed, and this is true, but they had a live crew aboard, always on the alert to ease the ship when she neared her limit. The model has no such crew, and if she sails out of a relative calm into a stiffer breeze, she can only lie down to it.

The amount of detail to go into the rigging and hull of a sailing model will be governed by two main factors, firstly whether it is built solely for sailing and not expected to be a “show-piece” out of the water, and secondly transport. A model intended solely for sailing can have her rig and deck fittings simplified to the point where they give the right general effect when seen from some little distance, which in turn will of course make for ease in handling, including the reduction of sail, while if she is to appear as a scale model when out of the water, then one must expect some extra trouble in handling.

On the matter of transport, if a large model has to travel any great distance to and from the sailing water, then the rig will have to be simplified to enable the model to be packed into a travelling case. These are points on which the builder will have to accept the conditions under which the model is to be sailed, and build accordingly.

The construction used for the modern racing yacht is I think most suitable for sailing models. It is built upside down with the planking on light bent timbers, resulting in a hull which is extremely strong and very light in weight, so allowing the maximum ballast to be carried where it will do the work most good. The big objection to the laminate and “dug-out” types of hull is, as already mentioned, that they carry too much weight in the wrong places, often needing deep fin-keels which are entirely out of keeping with a square-rigger’s hull. If there were less weight in the hull itself there could be more in the ballast, which would then need less leverage and could probably go inside the hull. Not only this, but much of the weight in the laminated hull is above the centre of buoyancy, and in fact above the waterline where it acts not with, but against the ballast, as an overturning-moment. The aim in designing model square-riggers for sailing should be to keep their fabric weight down to the minimum, so that as much as possible of the total weight the vessel will carry, can be in the form of ballast, placed where you want it.

Of course the model yacht with its more-or-less cigar-shaped hull, long sweeping curves fore and aft, no reverse curves in the hull proper and no tumble-home in the topsides, makes it very suitable for bent-frame construction, since there is no difficulty in lifting it off the moulds when completed, or in making the frames follow the moulds during construction. The square-rigger hull on the other hand has many reverse curves, particularly about the run, while most of such craft have ample tumble-home in their topsides, making their removal from the moulds something of a problem. However all problems are made to be solved, and I hope to have done this for the plank-on-frame model with bent frames by the end of this chapter.

We will assume that it is intended to build a sailing model about 48 in. long, and the first requirement will be a good strong baseboard of at least 3 in. wider than the model and several inches longer. It should be stiffened with battens screwed on the underside, for it is most important that it should not twist. On this board the centreline cross sections and outline of the model are set out, and holes drilled for restraining cords, for I consider that these can be just as much assistance in a carvel-built model as the clinker one, providing that it is being built upside down of course. Now on your plans draw in a base line 1½ in. or 2 in. above both Body Plan and Sheer Plan and extend all section lines down to this which of course represents the top of your base board. In this class of model the frame positions are not important providing that they are sufficiently close to support the type of planking being used, therefore it will be possible to arrange them on any convenient cross-sections in your Lines Plan. Next, at the cross-sections selected for the frames draw in on both Body Plan and Sheer Plan additional lines representing the thickness of the material to be used for the moulds, just as the width, or sided size of the frames for the brigantine were added to the Lines Drawing in Vol I. These lines will be on the fore side of the stations in the fore body of the ship, and aft of them in the after body. The next point will be to check whether your Lines Plan has been drawn to the
inside or the outside of the planking. If the former then your moulds will be to the shape of the sections shown in the Body Plan, less the thickness of the frames to be used, while if the latter, you will have to deduct the thickness of both frames and planking. This can be done either by drawing the new lines on the Lines Drawing, or by doing it on each separate tracing as it is made when lifting off the moulds. I personally favour the latter, because if you draw a new set of lines inside the original ones on the Lines Plan, you will get such a congestion of lines at certain points that it will be difficult to decide which is which, and mistakes will probably result.

The first problem which faces us is the tumble-home which our model is almost certain to have, and which would lock the hull on moulds such as usually used in building model yachts. However this difficulty can be overcome by first making the moulds easy to detach from the base after the model is planked, and secondly by making them in two halves, with a joint on the centre line. The first aim will be met by placing the screws holding the moulds to the base well outside the ship, so that these screws can be removed and the model turned over while the moulds are still in position in the hull. With the divided moulds it is only a matter of knocking one half forward and the other aft, then they will fall out of the ship in spite of the tumble-home. Nearer the ends it would be sufficient to move the moulds in towards the midship section to free them, but there is no reason why the divided mould should not be carried right through.

The size of material to be used will of course depend upon the size and type of model being built, but for a 48 in. hull, the following would probably be about right. Keel say 7/8 in. × 3/16 in. Keel-doublers, 5/8 in. × 1/2 in. with 5/8 in. as the depth. Stem and stern-posts from 3/16 in. material of suitable width to cut the shapes required by the particular model being built. Some wider 1/2 in. material would also be required from which to cut the keel-doublers between the after frames in the run, Sketch No. 70. The frames in the mid body will come out of 3/8 in. × 3/16 in., but some lengths of this same material, only much wider, will be needed for frames near the bow and stern, which will require to be sawn out as will be described later. The frame spacing for this size of model will probably be between 2 in. and 3 in. according to the most convenient cross-section spacing on the Lines Drawing, while the planking would be about 3/8 in. × 3/16 in. finished but would come from material much wider to allow for shaping, although much width could be saved by fitting it in relatively short lengths as previously suggested. The material for the moulds should have a thickness equal to the breadth of the frames.

As a square-rigger, our model is certain to have bulwarks, extending the full length in the case of a brig, brigantine or similar vessel, and between poop and fo’castle in the case of a larger type such as a ship or a barque.
Therefore we obviously cannot have the stringer, or inwale, at rail level, it must be at the deck, which it will also support. If your model has a poop and fo'castle then inwales will have to be provided at these levels too. These inwales will have to be checked into the sides of the moulds, which will add to the difficulty of removing the latter when the hull is planked, but I think it well worth any extra trouble involved to have them in place before the hull is planked. They could of course be inserted later, as was done with the beam-shelves of Leon, but with a bent-frame hull, I would much rather have the inwales in first and bend the frames on to them.

The moulds can now be taken in hand, and we will assume that the builder is working from a Lines Plan which is full size for the model being built. If the drawing is not to the required scale then it will have to be enlarged as described in Vol. I. First make a tracing of the particular mould to be made, including all waterlines, the centreline, rail level and underside of deck or decks if the station includes either poop or fo'castle. These deck levels are important since they form the top edges of the mortices for the inwales. When your tracing is finished, set out inside the thickness of the frame, or frame and planking as the case may be, and the line so found will represent the face of the mould. Now lift off the shape of the section as on the other face of the mould, just as was done when lifting off the fore and after faces of the frames for the brigantine (Vol. I). Set this new line inside the other one, and you have both fore and aft faces of a half frame on one drawing, and the difference between them represents the taper to be put on the mould.

When the tracing is ready, take two pieces of timber and plane a straight edge on each. Bring these two edges together and check that they meet properly throughout their length, then using one of the edges as a centreline, pin your tracing face down on the piece of wood and go over all the lines with a fairly hard pencil. This will transfer the pencil of the original tracing to the wood, and at the same make another reverse copy on the back of the tracing. Now lift the tracing and touch up the pencil on the wood as necessary. Pin the tracing on the other piece of wood, this time with the original tracing uppermost. Go over this with your pencil and so transfer another copy to the wood. Remove the tracing and touch up the lines as before and you have the outline of the complete mould on two pieces of timber, including the bevel. Saw out the two halves and then trim down to the bevel line as described for frame-making in the brigantine model. Now mark out and cut the mortices for the keel and keel-doublers in the top of the mould, and the inwales in the sides. These latter should finish flush with the surface of the moulds when inserted in their mortices. Some of your moulds will have hollow curves in certain parts, at such places drill a few 1/8 in. holes through the moulds about 3/4 in. in from the edge. The use of these
holes will be explained later, and the number required at any one point will depend upon the sharpness or otherwise of the hollow curve.

The two halves of the mould can now be joined together. Take one half and fix it to the bench with temporary sprigs right through it, then bring the other half up alongside it, check for position by means of a straight edge across each of the waterlines, and when correct sprig it down too, taking care that the jointing faces are in good contact and that the overall width of the mould is correct. Across the top of the two halves, near the mortice for the keel, put a rough jointing strip, any old wood will do for this and it should be tacked down, not screwed, for it will have to be split off the mould before the latter can be removed from the hull. Now take a piece of square material about 2 in. or 3 in. longer than the base of the mould and drill a hole in either end for the holding-down screws into the baseboard, then screw this batten along the bottom of the mould. When finished the complete mould can be screwed to the baseboard and should appear as Sketch No. 71. Make and fix the remaining moulds in the same way, remembering that near the ends the mortice for the keel will have to be deep enough to clear the deadwood aft and the knee of the stem forward.

The keel can next be cut out, followed by the stern-post which will be joined to it by means of a knee, glued and dowelled to it to form the deadwood. The vessel will probably have a rounded forefoot, and for a sailing model I would make this as a combined gripe and stem knee as shown in Sketch No., 72 glueing and dowelling the keel and stem into it, and arranging the joints so that they would be covered by the stem-doublers, the joints of which should be kept clear of those of the gripe. In a model such as this there is no real need to cut a rabbet in either keel or stem, since the planking has a very good landing on the doublers, and for that reason I have not shown a rabbet in any of the drawings. On the other hand a rabbet will have to be cut in the stern-post and deadwood, for right aft the planking runs almost parallel to the keel and would rest flat on the stern-post if a rabbet was not provided. Personally I would run the rabbet right round keel and stem, the trouble involved would not be much and it is undoubtedly a better job. When the keel, stem and stern-post are assembled the doubler can be fitted all round, and the best way to do this is to put the keel assembly into moulds with the doublers in either side, fix the doublers to the keel with a temporary sprig here and there, then using the moulds as a guide for angles, cut the bevels on the doublers, also mark and cut the mortices for the frame ends, which will of course be opposite the moulds, also the surface of the doublers will be the thickness of the frames above the moulds. Sketch No. 73. At first sight these perspective sketches may tend to suggest that the doublers run only between the moulds, but in actual fact they run end to end of the keel with the moulds cut to fit round them. When satisfied with
the doublers on the keel, take the assembly out of the moulds, remove one
doubler at a time, glue and replace it, locating it by the temporary sprigs,
then when both sides are on, drill and through-dowel them at intervals.
The rabbet on either side of the stern-post and deadwood will have been set
out as described for the brigantine in Vol. I, and the doublers up the stern­
post will have their outer edges lined up to the bearding line and then be
shaved off to the same angles and bevels as the rabbet in the deadwood.

It would be very difficult to frame the average square-rigger's stern with
bent frames such as used in this class of model, so I think this should be
formed as a fashion-piece carved from the solid, and joined to the stern-post
by means of two horn-timbers as shown in the plans of Leom. When the
fashion-piece is fitted that completes the backbone of the model, which
should now be replaced in the moulds and held firmly in place while suitable
chocks are fitted to the baseboard at either end to grip the stern and the cor­
ers of the fashion piece. These chocks must be sufficient to prevent any
movement in the ends of the model during framing and planking.

The next job will be to fit the inwales, and as the timbers will be glued
to these, it is quite a good idea to line the mortices in the moulds with paper
before inserting the inwale, the paper should be allowed to project on either
side and also half an inch or so up and down the face of the mould, so that
should any glue run over when the timber is being fixed, it will not stick the
inwale in the mortice. Run the inwale all round as shown in the sketches,
making the outer face run flush with the face of the moulds, bevelled where
necessary. The upper face of the wale must be level since it forms the landing
for the deck. The stem-doublers will of course be broken or morticed where
required to admit the ends of the inwales. Incidentally the form of the
stemhead will of course depend upon the particular type of hull being built,
but Sketch No. 72 suggests one way of forming the knight-heads, where they
are glued and dowelled on the face of the stem-doubler. I would give the
inwales a certain amount of pre-bending before fitting, so that they will
rest in position without being under tension. A taut cord between the
ends, with a few blocks of wood inserted at strategic points will set them
to approximately the curve required. The bevelling of the outer face will
be done by putting the inwale in place and holding it with a temporary pin
or clip at either end, then pencil marking the upper and/or lower faces at
each mould, or alternatively trimming them down to the required bevel
at each mould while in place, then removing them and trimming between
the moulds.

After the inwales have been fixed we can start working the frames, and
here again I would advise giving them a rough bending on a jig before use,
unless you have a steam chest, in which case they can be steamed, although
I am not very keen on actually fixing freshly steamed timbers, particularly
where they have to go round reverse curves. Bending straight from the box yes, but I like to give them time to settle before actually fixing, but perhaps in this I am merely expressing another of my own personal fads. Take one of the timbers and fit one end into the mortice in the keel-doubler, hold this end in place and lay the timber round the mould, mark the position of the rail—top of bulwarks, or edge of poop or fo’castle where the frame includes these—then lay it down and cut off about 2/4 in. beyond this and drill for a fixing screw to the mould. Apply glue to the end of the timber which goes into the mortice in the keel-doubler, and also to the face of the inwale where the timber will cross it, or inwales in the case of bow and stern of a big ship. Fit the end of the timber into the mortice and dowel it, then smooth the frame round the mould and drill and dowel it to the inwale, taking care not to make the dowel long enough to go through into the mould, finally put a temporary screw through the hole provided in the head of the timber and into the mould. Follow on by fitting the timber on the opposite side in the same way.

In the centre of the ship, timbers of normal width will run right round the moulds without difficulty, but nearer the ends it will be found that they start to run off at the tops—I use the word “tops” as when the boat is the right way up—owing to the increased bevel on the edges of the moulds, and this is where your wider material will come in. Take a strip of cardboard say double the width of the mould and long enough to reach from keel to near the baseboard. Cut one end to fit into the mortice against the keel, and fix by means of a drawing pin in the mould, and then smooth the strip round the edge of the mould, allowing it to take its own line but making certain that it is in contact with the full width of the mould all down. Pin the lower end and then run a sharp pencil along the edges of the mould under the card, so that when the card is removed and turned over it will carry two pencil lines much as in Sketch No. 74. Cut the card along these lines and when it is again offered to the mould it will be found to rest all down its edge without tending to run off. Use this card as a template to cut a pair of timbers, which should then be fitted as before. The shapes of the frames will of course vary as you move either forward or aft, and some near the stern may even take on a slight “S” formation, but by first cutting a cardboard template in this way, your timbers will always rest perfectly on the edges of the moulds. You could of course steam and bend the ordinary bending timber on edge is not very easy to do without getting twist as well, unless you have a means of clamping the timbers down flat during bending, also I doubt whether you would get such timbers to fit as accurately as the sawn ones.

In a hull of this type there will be hollows in certain sections in the after body, and to a lesser extent, in the fore body too of some ships. To merely stretch the timber round such moulds would of course result in it taking a straight line from the keel to the turn of the bilge, and it is to obviate this that we have drilled the range of holes round the edge of the mould in way of the hollow curve. When fitting the frames on such sections, first fix the end in the mortice at the keel, then press the frame down into the hollow of the mould and hold in contact by means of soft copper wire passed through the holes, over the frame and the ends brought together and twisted up as shown in Sketch No. 75. As soon as the curve becomes convex the frame will of course stay on the mould without assistance. In use, the wire would be thinner than that shown in the drawings, and when the planking is being laid the strakes will run over the wire, then a tap with a hide hammer or small wooden mallet will bed the wire into the underside of it. The only thing to watch will be that the wire is not cut when drilling the planks for the dowels or whatever kind of fixing is being used. When it is time to remove the model from the moulds it will be an easy matter to cut the wires and so free the latter.

When all the frames are in position, take some lengths of the same material and fit doublers all along the faces of the inwales to bring them out flush with the faces of the frames, as shown in Sketch No. 76. The planking will be set out as already described in Vol. I when building the hull of the brigantine, then laid in belts between the battens, finishing with the centre strake along the bilge. Each plank will be glued and dowelled to the frames, taking care that the dowels are not long enough to go through into the moulds, otherwise the model really will be fixed on the jig, also glue all along the edge of each plank where it butts against its neighbour, and of course along all the doublers. The surface of the inwale doublers will also be glued and the planking dowelled at close intervals all along this line to ensure a good watertight joint between the hull and the deck when the latter is laid. If no rabbet is cut in the stem or keel, then the garboard strake will require to be bevelled to sit against the latter, while the butt ends of the planks at the stem will have to be cut to provide a flush fit. When all the planking is on, the external surface can be cleaned up and given a first coat of whatever treatment is intended, then when this is dry we can dismantle the building jig.

First take out all the screws holding the moulds to the baseboard, also those in the stem-chock, lift the model off the base and turn it right way up. Next remove all the cross battens from the bottoms of the moulds, and inserting an old chisel down the face of the midship mould, split off the small connecting piece near the keel, tap one half of the mould forward and the other aft, and the two halves will come clear. Remove the remaining moulds in the same way, cutting the copper wires round the frames as those moulds
which have then come into view. When the moulds are out you will have the shell of your model complete and will probably be surprised at its light weight.

The inside of the hull should now be treated, and this I would do as previously described in Vol I., by giving it a coat of varnish—in sections—and pressing strips of thin linen into this while wet, working the varnish through the linen by rubbing down with the handle of an old spoon. Cut the strips just wide enough to butt against the frames on either side. At those points where it is not possible to get a brush, as in the lower planks adjoining the stern-post, flood in a little varnish and leave it to harden. When the first coat is hard, apply the remainder, allowing each ample time to dry, and your hull should be well preserved inside, and it will certainly be watertight.

While the first coat of varnish is drying the deck can be got ready. This in a sailing model will be put on in one piece of say 1/32 in. or 1/16 in. sycamore, or if you prefer it, three-ply. Make a cardboard template of the deck, fitting it round the frames so that it makes good contact with the planking all the way, then cut out your deck from this. In models having poop and fo’castle, carry the maindeck to just inside the bulkheads of the raised decks and fit a beam on top of the maindeck, cambered on the under side of course, and butt the bulkhead on this. To carry the maindeck beyond these points is only adding weight where you least want it. Now make a “rise-of-beam” template as was done for the brigantine and cut out the number of beams required, which should be just long enough to fit between the inwales at their respective stations. There is no real need to attach these beams to the inwales, their purpose is to give the deck the necessary camber, but if they are made a push fit between the wales, glued in and then skew-dowelled through the top and into the wale, that will be sufficient, the fact of the deck being in one piece will bind the vessel together.

When the deck has been cut out it can be ruled for the deck planking and cut for the hatches and holes for the masts, below which it should be reinforced by a doubler on the underside, glued and dowelled in place. The mast steps will also have to be fitted on the keel. When the deck is ready give it a couple of coats of varnish, then apply a good coat of varnish to the top of the inwale, inwale-doubler, and deck beams and put the deck in place while this is wet, screwing it down to the inwale all the way round with small brass screws, then dowelling it to the deck beams at intervals across the ship. Screws are better for fixing this type of deck to the wales, since being in one piece, it will require pulling down to the camber. A light veneer covering board can be glued and dowelled all round inside the bulwarks and so hide the screws.

In a sailing model the deck fittings will probably be reduced to the main
features only, such as houses, skylights etc., and in making these, they should be kept as light as possible, it will pay dividends in the long run. While the deckhouses are drying out we can finish the bulwarks, the first job being to cut off the tops of the frames to rail level, then fit the actual rail glueing and dowelling it to the tops of the stanchions. Next cut ample wash-ports through the bulwarks, in fact in a model of this kind I would be inclined to omit one strake of planking altogether, immediately at deck level, Sketch No. 77. This arrangement is not very true to type for a big square-rigger, although it was common enough in small craft, the sketch being based on a fishing vessel, but it would certainly free the deck much quicker than the scale freeing-ports in event of the model putting her rail under. By the time the rail is on, the joints in the houses should be hard and these can be fitted.

The question of what small fittings to include in a model of this kind will depend upon the aims of the builder. If sailing is the main point, as I assume it will be, then I would say fit nothing but the main features, such as skylight, companion and wheelbox on the poop, and - the house on the maindeck. It is surprising how much weight can be added in small fittings, and in any case they are likely to get damaged in handling, and also catch in the running rigging when putting the ship about.

I do not propose to say anything about the rig, I have no experience whatever in this, in any case much will depend upon the circumstances under which the model is to be sailed, such as the distance it has to go from base to sailing water, the method of transport between these points, and whether the sailing will be done on open or restricted water. Obviously a model which has to have all the masts taken out every time it is transported to and from the water, cannot have a full set of shrouds and backstays, for even though these were set up with hooks, eyes, and bowsies it would still take too long to set them up and un-rig them again each time. As to the running rigging, this must be as simple as possible, both for trimming sail and also the amount of sail to be set. The braces will be taken from the yardarm back to the mast next abaft, through an eye and then back to the yard on the other side, so that the yards can be trimmed by simply pushing them round.

I have several times mentioned steaming timbers, and while I try to avoid this as far as possible, or rather I should say try to avoid using timber immediately it leaves the steam chest, there are some jobs for which steamed timber is an advantage. The steam chest can be quite simple, and for small work it is often sufficient to hold the wood in the steam from the spout of a kettle. Where longer steaming is required, or where the timber to be steamed is fairly long, then some form of enclosed unit is desirable. I have found it quite enough to rig up a simple contraption such as that shown in Sketch No. 78, the main thing being that you want the wood to be steam treated, not soaked in hot water, therefore it is as well to keep the wood off the bottom of the “chest,” so that the condensation will run back below it. If you have a lot of steaming to do it is worth while making a simple “boiler” out of a tin can so that the steam can be taken off the top, but for limited work the household kettle will do. The disadvantage of the ordinary kettle is that the spout usually comes off the side and low down, with the result that it will only steam properly with the kettle half full or less, which means that it has to be constantly watched to prevent it boiling dry.
I mentioned sawn-frame construction in Volume I, but I am indebted to Dr. A. K. Tulloch of Dundee for details of his 3/8 in. scale working model fishing boat illustrated in Fig. 27 of Vol. I and Fig. 22 in this, a model which incorporates many interesting features and is I think the best application of this method I have so far seen. Dr. Tulloch points out that it involves rather more work than is usual with this construction, but it seems to me that it is more than justified by the results obtained, particularly in the field of accuracy. The following is written from Dr. Tulloch's own description of the work.

The model is built upside down on a "T" section base as in Sketch No. 79. The stem, keel, deadwood and stern post are from 1 in. × 5/16 in. oak, fabricated as shown in Sketch No. 83, and when finished the hole for the shaft is bored and the stern tube fitted while the keel assembly can be handled on the bench. The rabbet for the planking is also roughly cut at this stage although the final dressing to the correct bevels is left until later.

This particular model has twenty-four frames, but Dr. Tulloch says that although this number is quite sufficient from the point of strength, he would, if building another such model, double the number in the interest of scale accuracy. In this I quite agree, although light bent frames between the sawn ones, as used in one of my own models mentioned in Vol. I, would give the same effect namely that of bringing the external fastenings nearer to scale spacing.

The frames are made from plywood and first sawn out as solid bulkheads, carried up to a common base line drawn on the Body Plan some 2 in. above the finished model and representing the upper face of the building base. A shallow mortice is cut in the keel in way of each frame, and a similar mortice made in each of the "bulkheads," so that the two form an interlocking joint. A strip of ½ in. square timber is screwed along the base of each "bulkhead" for attachment to the building base, the result being as shown in Sketch No. 80.

When all "bulkheads" are ready they are assembled on the building base and the keel assembly tapped into place. If proper care has been taken in cutting the mortices in both keel and "bulkheads," all joints should be a good push-fit and quite firm without the aid of adhesive or fixings, which
cannot be used at this stage. While the “bulkheads” are held in this position the bevels on their outer faces are cut with a file, using temporary battens laid round the hull to ensure that the planking will sit properly on each.

When all are satisfactory the keel assembly is removed, the “bulkheads” unscrewed from the base, and a line run round each representing the inside edge of the finished frame, after which the centre portion is sawn away—Sketch No. 81—leaving the frame 1 in. moulded size, the inner face of which is then dressed down to the same bevel as the outer one, the importance of which was stressed in Vol. I. when dealing with the building of the brigantine.

The correct run of the inwale—or beam-shelf—is a most important feature in all “built” models, since on it will depend the true sheer of the deck and, of course, the rail. Dr. Tulloch solved this in a way which not only ensured complete accuracy, but also great strength both during construction and also in the finished hull. On the building base four or five wood blocks are fixed—the number required will depend upon the size of the model being built—their tops being arranged to conform to the sheer of the deck, less the thickness of the beam-shelf, beams, and decking, and placed between the frame stations as in “A” Sketch No. 85.

Next cut a piece of 1/8 in. plywood rather longer and wider than the overall dimensions of the model, and with the major number of plys running across the narrow way, Sketch No. 84. On this, set out the centre line and all the frame stations, also draw the level of the beam-shelf on the plans, then with the dividers measure the width on each frame to inside the planking at this level and set them out on the board just cut. Rule the outline of the vessel through the points so marked on the board, and cut it out, when it will appear as in Sketch No. 84, making what for the want of a better term we will call a temporary “deck former.” This “former” is now placed on top of the blocks, bent down at the ends to conform to the sheer and fixed with small screws, when it will appear as “B” Sketch No. 85. Screws to be so placed that they can be withdrawn before the hull is planked.

From the base board square up the fore and aft faces of each frame and mark them on the edges of the “deck former,” then cut mortices at these points to receive the frames. These mortices must be cut with great care, both to ensure that they are at 90° to the base—not square with the face of the “former”—and that their depth is exactly the moulded size of the frame, so that when the frames go into place they will be a good push-fit in their respective mortices. The inner edge of each mortice must of course be to the same angle as the inner face of the frame for which it is cut.

When the “deck-former” is complete, the frames are put back in position, being glued in their mortices in the “former” and screwed to the 1 in. square members on the building base. The keel assembly is also put
back in place, this time glued to each frame, after which the model will appear as in Sketch No. 86. Keel-doublers—or garboard-pieces—"C" in the sketch—are then fixed on each side of the keel between the frames and up either side of the stem. \( \frac{1}{4} \) in. square doublers are also fixed to the true underside—the top as the model sits on the building jig—of the "deck-former" as "D" in Sketches No. 82 and No. 86. The outer faces of all these doublers are now fairied up to conform to the run of the frames and the external curvature of the hull, while the plank rabbet in stem, keel, and sternpost is finally dressed to the true bevels, using the frames and doublers as a guide.

The hull can now be planked, a process which has been fully described in Vol. I, but in this case, being a working model the planking can be run in any convenient lengths and not cut down to scale length as with the brigantine. When the planking reaches the level of the rail it can be rubbed down and given its first coat of varnish, to be followed by two others, allowing ample time for each to dry before applying the next. When all are dry, saw through the frames immediately above the base and turn the model over, after which the tops of the frames must be cut off accurately to the level of the planking. Incidentally, in planking this model, one strake should be omitted at deck level, from the shoulders of the bow to the stern as shown in Sketch No. 87 to form the freeing-port which allows water to run off the deck, see also Sketch No. 77.

Next run a line round the "deck-former" \( \frac{1}{4} \) in. in from inside the planking, or say double the moulded size of the frames, according to the size of model, and boring a suitable hole at one end, cut away the centre portion of the "former," which then becomes the deck-shelf and will appear as in Sketch No. 87. Filling-chocks are now fitted on top of the keel and keel-doublers up to the level of the tops of the frames, or the floors to give this section of the frame its proper name, these chocks are shown as "E" in Sketch No. 82. If the frames have been carefully cut, they should all be flush with the chocks from end to end of the ship, and the keelson, or hog-piece, "F" in the sketch, can be fitted, which completes the backbone of the model.

The inside of the hull is now ready to receive whatever finish it is to have, which in the case of the model under consideration consisted of six coats of shellac, with plenty of time to dry between each. In the ends of the ship where the planking is too close to allow for brush work, the shellac is flooded in as described for the brigantine in Vol. I. The deck beams can now be fitted and the deck laid, this in Dr. Tulloch’s model consisted of planks of 1/8 in. \( \times \) 1/8 in. teak, using "Cascamite" glue to which Reeves black watercolour has been added to pick out the deck seams. Waterways and covering-boards follow, fitted as already described in Vol. I, while additional bulwark stanchions are added between the full frames to bring these up to
SCALE INTERVALS. The capping-rail is put on outside the top strake in three vertical laminations, which not only makes for easy bending and the grain carried right round the hull, but also means an extremely strong job. The final finish of this model was a further three thin coats of varnish well rubbed down between each, which not only provided a sound watertight hull, but also a very good surface. She is fitted with full radio control, and has proved a most successful vessel in the water, with ample displacement to carry all the gear on her scale waterline. The model is in fact to scale throughout, the hull having been built to the M.F.V. plans mentioned in Appendix II, one of which forms plate 7, although the superstructure has been modified to that of some new Seine Net boats recently built at Arbroath. The dimensions of this model are Length 36½ in. Beam 8½ in. Depth (midships) 6 in.

The materials used in the model just described were:

- Keel, stem, stern-post, deadwood etc. - Oak
- Frames - Hard resin-bonded plywood
- Planking - Honduras Mahogany
- Deck planking - Teak
- Spars - Hickory
- Superstructure - Mahogany

The choice of plywood is most important, which probably explains my own failure with this material as mentioned in Vol. I. Any plywood used must be good quality and of hardwood throughout, i.e., not hardwood outer plys with poor quality soft material in the centre. In model work, particularly when used for frames, it is the inner ply, or plys, which are the most important, but above all it must be resin-bonded.
APPENDIX I.

SUMMARY OF CONTENTS OF VOLUME I.


Throughout Volume I the constructional details for the full-size prototype are described and illustrated alongside those of the model, thus giving the model builder a clear picture of wooden ship construction, which he is reproducing in miniature and although the "scale-construction" model based on the Author's own model brigantine, it can be applied to models of any type of wooden ship, large or small, for where these differ, it has been covered in the text.
APPENDIX II.

SAILING SHIP DRAWINGS.

The publishers can supply sets of sailing ship plans specially drawn by the Author to scales suitable for model construction, and consisting of Lines Drawing; General Arrangement Drawing with Deck Plans; Sail and Rigging Plan including all running-rigging; and, in certain cases additional sheets providing scale details of individual fittings, masts, spars, rigging, etc.

The aim of these drawings is to provide authentic data for those interested in the sailing ship period, or desiring to build models of named ships. They are based on original drawings and specifications, from which all essential information has been condensed into three or more sheets of convenient size.

With a view to illustrating the ship as she actually went to sea, the original details have been edited as far as possible by personal survey of such vessels as were available, from the author's own records and research work, or both, but the author will always be pleased to learn of any changes which, through lack of information, may not have been embodied or noted on the drawings, so that such information can be added.

The undermentioned ships are at present available, together with a few sets for the construction of simple models not intended to represent any particular vessel.

_Acamas._—Steel full-rigged ship. A large modern ship rigged vessel of 1800 tons.

_Albert Rickmers._—Steel three-masted barque. This is a good example of the modern three-mast barque, she is perhaps better remembered as _Penang_.

_Archipal Russell._—Steel four-mast barque. A very well-known unit of the grain fleet and a frequent visitor to this country in the last days of sail.

_Carl Vinnen._—Steel auxiliary five-mast two-topsail schooner.

_Comte de Smet de Naeyer._—Ship. This Belgian training ship was one of the largest of her kind to be ship-rigged.

_Coriolanus._—Iron full-rigged ship. The _Coriolanus_ was known as "Queen
of the Jute Clippers" and is said to have been one of the most beautiful iron ships ever turned out.

Cromdale.—Steel full-rigged ship. A very fine example of one of the later-day wool clippers.

Cutty Sark.—Ship. Plans are available for a small scale model of this famous ship.

Danmark.—Ship. This Danish training ship is well known both in this country and also in America, under whose flag she served during World War II.

Discovery.—Wood auxiliary steam barque. This particular set is not claimed to be correct in detail for Captain Scott's famous ship, as at the time the drawings were compiled the actual vessel was not available.

Emma Ernest.—Wood three-mast topsail schooner. A typical coaster and a vessel well-known to Londoners as the Seven Seas, moored off the Embankment.

Endeavour.—Bark (1768) this is Captain Cook's famous vessel and these drawings are very fully detailed as the result of careful research work, and really authentic and suitable for perfect scale models.

Fame.—Composite brig. This is one of the Bengal pilot brigs. (See Hoogly pilot brig).

Formby.—Steel-full-rigged ship. Reputed to have been the first vessel to be constructed of steel.

France (II).—Steel auxiliary five mast barque. This, the second five-mast barque of that name, was the largest sailing craft ever built.

Georg Stage I.—Ship. This interesting little training ship was originally a steam auxiliary, and these plans show her as built.

Gorch Fock.—Barque. Sister ship of the American training ship Eagle and one of the fine fleet of training ships built by Germany between the two wars.

Großherzog Friedrich August.—Barque. This beautiful German training ship was built just prior to World War I, and is perhaps one of the most shapely of her kind. She is now the Statsraad Lehmkuhl, and a small scale set of plans showing her under that name is also available.

Haleyon.—Steel lee-board ketch. The Haleyon is a modern coasting ketch of the barge type.

Harriet MacGregor.—Famous Tasmanian clipper barque, well-known for her passages between Tasmania and London.

Helen Barnet Gring.—A typical American four-mast fore and aft schooner.

Herzogin Cecilie.—Four-masted barque. This vessel needs no introduction, she will be well remembered both as training ship and grain ship.

Joseph Conrad.—Ship. The last square-rigged training ship to wear the British flag. She will be well remembered for her round-the-world cruise under command of her owner, Alan Villiers, with whose assistance these plans have been compiled from the original yard details.

Juan Sebastian De Elcano.—Steel four-mast topsail schooner. This Spanish training ship was designed in Great Britain and is an extremely fine looking craft and an excellent subject for a model.

Kommmodore Johnsen.—Steel auxiliary four-masted barque, ex Magdalene Vinnen and one of the best known training ships in the last days of sail.

Lady Daphne.—200-ton Thames sailing barge. This is a typical example of the large coasting barge so well known on the South coast.

L’Acenir.—Four-masted barque. This is another beautiful vessel which will be well remembered not only as the fine training ship she was, but also for her later service in the grain fleet. This set of plans includes separate drawings of all deck fittings and mast and spar details.

Leon.—Wood Brigantine. This is a particularly pleasing brigantine of the larger class, with raised quarterdeck and trunk cabin. This set also includes a full construction plan for a Plank-on-Frame model and is the basis of Vol. I of this book.

Loch Etive.—Iron full-rigged ship. One of the famous "Loch Line" clippers.


Magdalene Vinnen (II).—Steel auxiliary four-mast barque. This is the second four-mast barque of that name and is a typical modern ship with mid-ship bridge deck.

Marie Sophie.—Wood brig. The Marie Sophie is a good example of the trading brig in her prime.

Muirneag.—Zulu type fishing vessel. These drawings consist of a full set of constructional plans for the actual vessel. The original
drawings were produced by the author for presentation to the Society for Nautical Research as detailed record of this almost extinct type, and were compiled from a full survey of the ship.

**Mount Stewart.**—Steel full-rigged ship. Sister ship of Cromdale.

**Mozart.**—Steel four-mast barquentine. A well-known and typical example of the modern steel barquentine.

**Nippon Maru.**—Four-mast barque. This big auxiliary training ship, and her sister Kaiico Maru would make fine subjects for model work.

**Oamaru.**—Iron full-rigged ship. This was one of the famous colonial clippers, and a good looking ship, with long poop and fine lines.

**Parma.**—Steel four-mast barque. Well remembered as regular grain trader to this country, and the subject of Alan Villier’s well-known book of ship photographs, Last of the Wind Ships.

**Penang.**—Steel three-mast barque. (Ex-Albert Rickmers).

**Pommern.**—Steel four-mast barque. Another old friend and regular visitor with the grain ships.

**Queen Margaret.**—Steel four-mast barque, referred to by Lubbock as “one of the fastest and most beautiful carriers of the nineties.”

**Raven.**—Wood brigantine. A good example of the trading brigantine once so common in both off shore and coasting trades.

**Ross-Shire.**—Steel four-mast barque. A well remembered member of Thomas Law’s fleet of sailing ships.

**Runnymede.**—Wood snow. This is an interesting old stager with square stern and single topsails.

**Statsraad Lehmkuhl.**—Steel three-mast barque. A typical modern training ship.

**Three Brothers.**—Rye smack. Ketch rigged.

**Timaru.**—Iron full-rigged ship. Sister ship to the iron clipper Oamaru.

**Torrens.**—Composite ship. Well-known as the favourite ship of Joseph Conrad.

**True Briton.**—This famous Blackwaller would make a fine subject for model making.

**Valerian.**—Brixham trawler. This is a very comprehensive set with a view to providing all possible details of these fine boats.

**Waterside.**—Wood three-mast barquentine. Another old favourite of the British coast, she was the last real square-rigger on the coast.

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**APPENDIX II**

**William Ashburner.**—Three-masted topsail-schooner, one of the last sailing ships in our coastal trade and still well remembered.

**Coasting Ketch.**—A full set of plans for a trader such as used to be a feature of our small ports and harbours.

**Coasting Schooner.**—This is a typical two-mast Topsail-schooner.

**Scandinavian Barquentine.**—This is one of the beautiful little Baltic barquentines which used to be regular visitors to this country.

**74-Gun Ship.**—These plans to a scale of 3/16 in. to 1 ft., are perhaps the most complete set of drawings ever published of one of these old two-deckers. The set includes profile, longitudinal and many cross sections; end views; and plans of each deck. There are also separate drawings of each component forming the various masts and spars, together with the position of blocks, rigging sequence and the lead of the gear. Alternative rigging plans are available, one with sails bent and the other for models with bare yards and the lighter gear rigged down. Details of guns boats, anchors, etc., are also available. These are plans of the actual ship, not simplified model drawings.

**Hookey Pilot Brig.**—These brigs will be remembered by all who served in the Calcutta trade in the days of sail, and the plans which are to a scale of 1/8 in. = 1 ft 0 in., are from the original builder’s drawings.

**Scottish Zulu.**—The Zulu was perhaps the finest of all Scottish fishing types, and these plans, to a scale of 1/2 in. = 1 ft 0 in. were compiled by the author for preservation by the Society for Nautical Research. They are full constructional drawings of the Muirneag, taken off the actual vessel while she was being broken up, and when many constructional details otherwise hidden were exposed. Full fitting-out specifications are included, as well as many notes and sketches. A model from these plans is included in this book.

**12-Gun Brig of War.**—This set has been produced for super detail 1 in. scale models of one of the old 12-gun brigs, which many will remember as sail training ships in the Royal Navy.

**40-Gun Frigate.**—The frigate was the cruiser of the Sailing Navy, and these plans are extremely fully detailed and suitable for the construction of a perfect scale model.

**Three-Mast Topsail Schooner.**—Drawings of a typical schooner in her clipper days.

**Elizabethan Galleon.**—Suitable for a small decorative model, typical of the Elizabethan period.
Plans of the following Power Craft described and illustrated in this book are also available.

48 ft. **Ring Net Fishing Boat**.—Scale ½ in. to 1 ft. 0 in. as illustrated in Figs., 22 and 23 (Vol. I) and Fig. 23 and 25 (Vol. II) although the model shown was built to half-size of the plans.

90 ft. **Motor Fishing Vessel**.—Scale ½ in. to 1 ft. 0 in. as illustrated in Fig. 27 (Vol. I) and Fig. 22 (Vol. II) the construction of which is described in Chapter VI although in this model the superstructure has been slightly modified as mentioned in the text.

Neither of the above sets include a plank-on-frame construction plan, but in both cases the plans are suitable for this type of construction, as explained in Volume I.

Other Power Craft plans available include Liners, Cargo Ships, Paddle and modern Tugs, Pleasure Steamer (Paddle), Trawlers, Yachts, etc., **Ships’ Boats**.—A range of details including lines, section, construction plans and details of ships’ boats as carried by the sailing man-of-war.

**Muzzle Loading Guns**.—A range of old time muzzle loading guns as carried in the days of sail.

**Masting & Rigging**.—Large scale prints of the working drawings which form many of the plates in the book *Masting & Rigging* are available. These cover mast and spar construction, fittings and ironwork, rigging details, and fairlead diagrams. The scales range from 1½ in. to 3 in. to the foot, and the average size of the sheet is about 30 in. × 22 in.

**Winches, Windlass and Steering Gear**.—Large scale prints are available of some of the plates of the above fittings as published in the book *Deep-Water Sail*.

The above list will of course be added to from time to time.

Particulars on application to: Brown, Son and Ferguson, Ltd., 52-58 Darnley Street, Glasgow, S.1.
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<tr>
<td>Yard battens</td>
<td>33</td>
</tr>
</tbody>
</table>
PLATE NO. 1.
(Reduced from 1" Scale Plan No. 917.)

SAIL AND RIGGING PLAN OF BRIGANTINE "LEON."

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PLATE No. 4.
(Reduced from 7" Scale Plan No. 631.)

RING-NET FISHING BOAT.

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PLATE No. 5.
(Reduced from 1" Scale Plan No. 941.F.)

MOTOR FISHING VESSEL

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