MANUAL OF
SHIP MODEL MAKING

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Mere are clearly explained and diagrammed the many short cuts, kinks, and time-saving methods that show the amateur craftsman how to turn out a good ship model.

PREPARED BY THE EDITORIAL STAFF
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INTRODUCTION

ALTHOUGH other books on ship models have been published, the beginner has had no real manual or handbook to guide him in his work and answer his many questions. Plans for specific ships are obtained easily, but to translate these plans into a well-executed model is another question. The amateur without experience has had to experiment to find out what materials are best suited for the work, what tools should be used, and how the construction can be simplified. At best, however, experience is an expensive teacher.

To aid the beginner as well as the seasoned old-timer, POPULAR SCIENCE MONTHLY has prepared this valuable manual of kinks, short cuts, and time-tried methods. For the first time in the history of model making, the best hints developed by experts are now available to the amateur. Instead of following blindly from stage to stage in the construction of a model, the beginner now can use the methods of the professional.

In the pages that follow you will find simple step-by-step instructions that will help you to select and make your tools, shape your hulls, build your deck fittings, and apply your rigging and sails. Finishing and decorating, one of the fine points of model making, is simple if you know how.

To fix this knowledge in your mind, you must put

it to actual use. For this reason, complete descriptions and plans for building two decorative models have been included.

One model, a beautiful galleon reminiscent of romantic Spanish treasure ships, forms a particularly graceful decoration. By building it, you can learn a great deal about model making.

The second model, a clipper ship, has all the grace and beauty of the ships that made America's nineteenth century commercial fleet famous. In the description of its rigging, the amateur will find the answers to many questions.

Finally, to make the book complete, a carefully compiled glossary of nautical terms has been included. This alone will serve to identify many of the parts used on modern as well as ancient ships.

All in all, this manual has been prepared with the hope that it will offer to the model maker the same fund of information that a scientific handbook offers the engineer. Briefly, it is a ready reference that will make your hobby of model making more enjoyable and your finished models more authentic and realistic.

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MANUAL OF SHIP MODEL MAKING

CHAPTER I

TOOLS

Unlike most hobbies, ship model making requires few expensive tools. Almost every household, no matter how small, harbors the beginnings of a fine model maker's tool kit. The rest can be made, improvised, and bought as the work progresses.

Most important of all tools to the maker of ship models is his knife. It may be anything from an inexpensive pocketknife to a high-grade wood carver's tool. Price and handle style are unimportant as long as its blade is keen and has the quality of taking and holding an edge.

Many experts rely on various types of "sloyd" or bench knives. Others use nothing more than an ordinary jackknife, while still others feel that inexpensive kitchen paring knives, ground and sharpened to convenient shapes, are best suited to the work.

For the special carving and whittling jobs that often are required on models, as well as for the general shaping and roughing, the amateur can fashion his own specially shaped knives from sections of discarded hack saw blades. Ground to shape, hardened and tempered, honed to a fine edge, and mounted in suitable

handles, they form one of the most useful assortments of tools that the model maker can own.

To make a knife similar to the one shown in Fig. i, simply grind off the teeth, and shape the end. Then, as a preliminary to the tempering process, grind one side bright or polish it with emery cloth.

While you are polishing the blade, place a flat iron bar in your furnace or forge and heat it until it becomes

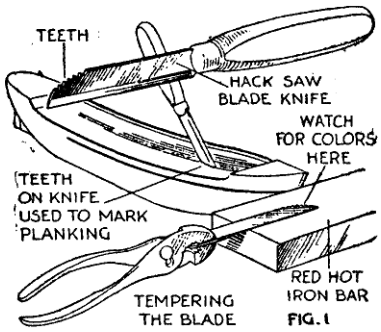


FIG. 1

red hot. Pick up your knife blade with a pair of tongs or pliers at the handle end or tang and proceed to rub the blade over the hot iron until the polished surface turns a light brown. Then quickly plunge it vertically into a pail or pitcher of water. Finally, give the blade its final grinding and sharpening.

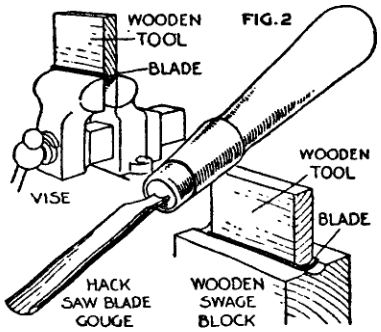
When grinding thin tools be careful not to draw the temper. If you use an emery wheel, be sure to keep the work cool by dipping it in water frequently.

If, during the process of shaping your knife, you will file a series of V-notches in the point opposite the cutting edge, you can furnish yourself with an excellent tool for marking imitation planking lines on

the decks of your ship models. Grind the upper edge of your knife to a rounded point, file in ten or twelve teeth at the highest point of the curve, and then, using a fine flat file, dull the points of the teeth slightly.

To use the tool, planking lines are drawn on the wood with a pencil and the tool moved back and forth over the lines with a light pressure. To make sure that straight lines will be true and uniform, you can guide the tool with a ruler.

Tiny gouges of various shapes and sizes also can be made from discarded hack saw blades. The blade is first softened by heating it to a dull red and laying it

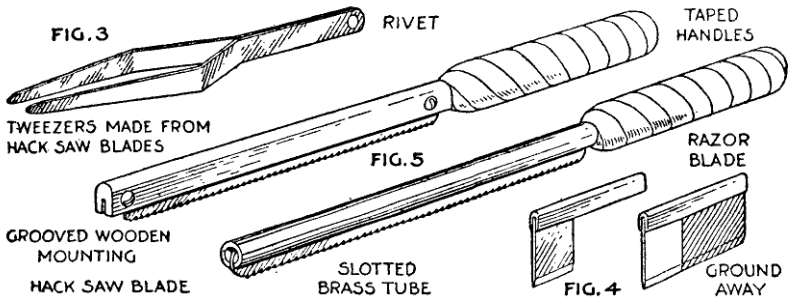


on a brick. After it has been allowed to cool, the teeth are removed with a file. The gouge shape then is obtained by setting a vise to the proper width and driving the blade into the opening by pounding a long, rounded wooden tool against it with a mallet. Another and perhaps more accurate method is to use a swage block cut to fit the desired curve of the gouge as shown in Fig. 2.

To stiffen the otherwise springy blade, the curved

channel must run the full length of the tool. The edge of the gouge, which has an inside as well as an outside bevel, should be shaped and partly sharpened before it is hardened.

In hardening the tool, heat the blade to a dull red for about 1 in. of its length and, holding it vertically, plunge it into cold water. To temper it, brighten about 1 in. at the point and hold it over a flame in such a way that the tool is heated at its middle. Watch the



polished portion of the blade and, as soon as a light brown or straw color appears, plunge it into water.

When making a flat chisel from a hack saw blade, the end of the blade is, of course, left flat while the stem is made trough-shaped for strength. Like the gouge, the cutting edge is formed by two bevels, one on each side of the blade.

Even tweezers, the model maker's extra hand, can be made from sections of hack saw blades. The tweezers shown in Fig. 3 consist of two 10-in. blades joined together at one end by a rivet passed through the holes already in the ends of the blades.

Place the riveted pieces in a vise, cut off the free

ends just above the second set of holes, and file the two sections to slender, tapering points. The two legs can be bent to the shape you desire with flat-nosed pliers. As a finishing touch, smooth up the edges with emery cloth. In making tweezers and, in fact, any tool that will not be used for actual cutting, the hack saw blades need not be hardened and tempered, merely softened for the process of shaping, filing, and bending.

Excellent miniature knives for delicate cutting also can be made by grinding and shaping old stiff-back razor blades. The blades can be formed at one end and the remaining portion of the rigid metal back used as a convenient handle (Fig. 4). A set of small knives of this type, ground to various shapes, is particularly valuable in preparing spars and other small parts.

Another group of tools important to the model maker is his saws. As in every branch of woodworking, a certain amount of cutting must be done. If the work is to be carried through right from the rough lumber, a large panel saw will, of course, be a necessity. In cutting the lifts for the hull and in shaping small parts, a coping saw will be a valuable investment; and a back saw or a dovetail saw will come in handy for the many small cuts that are required in model making.

In his assortment of saws, the model maker again can make good use of discarded hack saw blades. Mounted in a grooved strip of wood or inserted in a slot cut in a length of brass tubing as shown in Fig. 5, they form excellent wood saws for making shallow cuts. A suitable handle for your improvised saws can be made by binding one end of the wood strip or tubing with many layers of friction tape.

Aside from his saws and knives, one of the handiest

tools a model maker can add to his tool kit is a round-bottom plane. Its slightly curved bottom surface makes it easy to shape the intricate curves and twists in even the most complicated hull. Although hulls can be smoothed entirely with files, chisels, and gouges, a round-bottom plane does the work faster and with less chance of a costly slip that may ruin many hours of careful work.

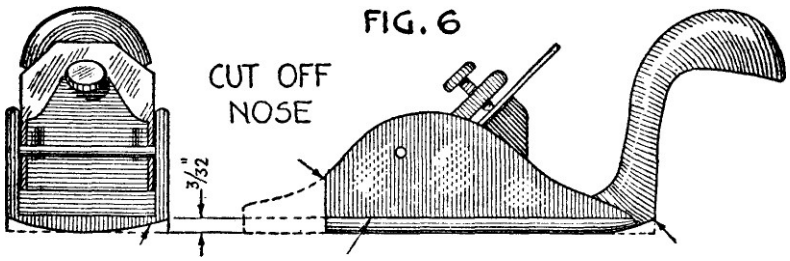
In the trade such a plane often is referred to as a pattern maker's plane. Similar tools also are used in shaping the delicate curves on musical instruments. While such planes can be bought, they are expensive and, because of the little call for them, sometimes hard to get. Besides, the ingenious amateur craftsman can improvise a tool that will serve the same purpose by revamping the general shape and design of an ordinary iron block plane costing about fifty cents. The plane that is best suited is known commercially as the No. 100 pattern.

As purchased, the plane has a flat sole or bottom. To transform it into a round-bottom plane, this surface must be ground or filed to a slight curve and the greater portion of the toe must be removed with a hack saw (Fig. 6). Only enough material should be left ahead of the cutter slot to guide the blade and prevent it from digging into the wood.

If you intend to file the bottom, clamp the plane firmly in a vise and, with a sharp-pointed scriber, scratch a line along both sides of the metal base about 3/8 to 1/2. in. above the bottom edge and parallel to it. Then, using a medium mill file, file along one edge, shaping a gradually rounding surface toward the center line. When half of the bottom has been rounded, turn

the plane end for end in the vise and complete the curve by rounding it from the other edge.

The result will be a rounded surface that can be smoothed and finished with medium and fine emery cloth. The plane cutter then can be ground and sharpened to agree with the curve of the plane bottom.



If a grinding wheel is available, the work, of course, will be simplified. When the nose of the plane has been cut off, simply adjust the cutter to take a thin shaving and grind down both the plane bottom and the cutter in the same operation. Hold the plane against the side of the grinding wheel and rock it back and forth to give the right curvature. After this has been done, the cutter can be removed and sharpened.

As a final touch, grind or file the back edge or heel of the plane to form a gentle curve. This will make it easier to follow the delicate double hull curves without denting or marring the surface of the wood.

Besides a regular vise, the model maker should have a combination notched vise and sawing block for holding stock when it is being drilled, cut to length, or

shaped with a coping saw. It will be of endless value in shaping spars and masts and in cutting hull lifts and fretwork.

As shown in Fig. 7, it consists simply of three pieces of lumber nailed together at right angles, the vise portion being nothing more than a series of notches cut into the upper edge of the vertical member. By nailing

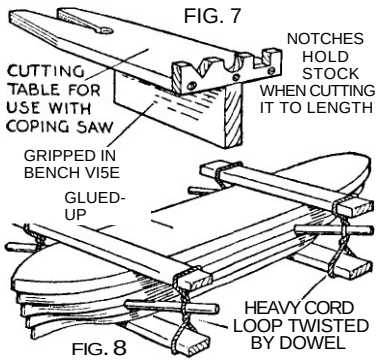


FIG. 7

FIG. 8

a narrow piece of wood to the underside of the horizontal base, you can provide a gripping surface that will allow the vise to be placed in your regular bench vise. The V-shaped cut for use in coping saw work should be at least six inches long.

Although large clamps are a help when gluing up the lifts in a large hull, the amateur can get along without them if necessary. Four loops of heavy cord, several long screw drivers or strong dowels, and four lengths of heavy lumber are really all you need to clamp a hull quite effectively (Fig. 8).

Place the four strong strips of wood on each side of the glued-up hull, locating them in pairs one above

the other. Then push the loops of heavy cord over each pair of projecting ends, insert a screw driver or dowel in each loop, and twist the loops until the hull is firmly clamped. To lock the screw drivers or dowels in place, wedge them against the sides of the hull.

Next to his knife, the pin vise is the model maker's most valued small tool. With it, he guides the tiny hair-like drills in making the thousands of small holes that are required in models. Although it does not replace a good hand drill in the ship modeling kit, it fills in where the weight and size of the hand drill is undesirable.

Most commercial pin vises, or finger drills as they are sometimes called, have small metal handles that

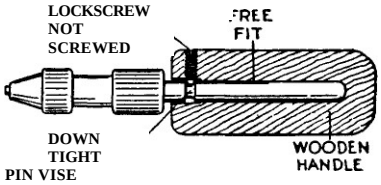


FIG. 9

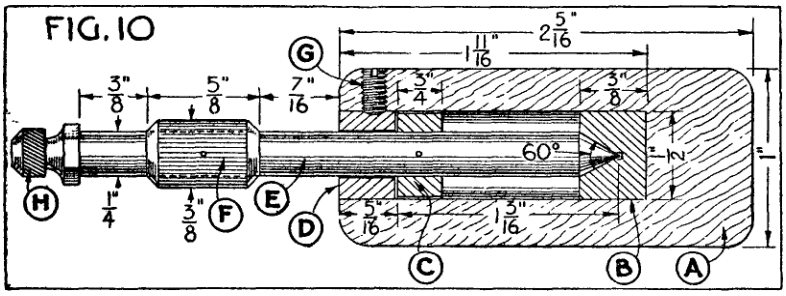
are difficult to hold and direct. To improve your pin vise, you can fit it with a removable wooden handle as shown in Fig. 9. Being large, the handle will fit snugly in the palm of your hand, give you a better grip, and be less tiresome.

Model makers who boast of a metal lathe can make the inexpensive and improved type of pin vise shown in Fig. 10. It, too, is fitted with a comfortable handle that is easy to hold.

The handle is turned from any available hard wood such as birch. The hole to take the bearings (D and

B) for the shaft (E) is bored with a 1/2-in. auger to a depth of 111/16 in. The shaft, fitted with a suitable pin chuck at its outer end and machined to a sixty-degree point at its other end, is made from a piece of 1/4-*in.* drill rod. The collars (C and F) are forced into place and then cross-pinned.

For the bearings (D and B) use brass, and drill the outer bearing (D) to be a running fit on the shaft. To



hold this bearing in place, drill a hole in the handle with a No. 36 drill and run in a 6-32 tap to take the set screw (G).

When the pin vise is completed, the shaft should rotate easily. If it is tight, loosen up the inner collar (C). Also, be sure that the bearings are well oiled.

In assembling the large number of small drills that he will use in his pin vise, the model maker can improvise still further to save money. Sewing needles, available in all sorts of sizes for little or nothing, can be made into excellent substitutes for expensive twist drills. Simply break the needle at the swell of the eye and sharpen it to a V-shaped point on an oilstone.

Tiny chisels for small carving also can be made

from needles of various sizes. Sail needles ground to a keen bevel and oilstoned are particularly well suited for use as chisels. (See Fig. 11.)

For the various delicate gluing jobs required in making deck fittings and other gear, the model maker can make good use of a half dozen or so of ordinary spring clothespins. By filing their heads to various shapes,

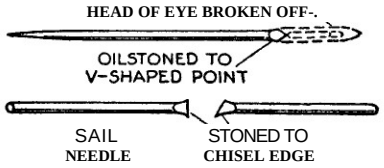


FIG. 11

you can improvise strong clamps for holding almost any kind of joint in place.

On small models, a draftsman's ruling pen forms a good clamp. Being adjustable, it can be clamped on the smallest joint until the glue sets. A ruling pen used in the same manner also is a valuable tool to be used in combination with tweezers when fastening wires in place.

Even the lowly crochet needle has a place in the ship modeler's kit. Its tiny hook can be used in tying small knots and arranging and guiding the thin lines in the rigging.

Naturally, there are many tools that the ship modeler cannot improvise or make, but these can be bought a few at a time as the demand for them arises.

When asked recently what tools he would buy if he had only a few dollars to spend, a well-known model maker listed the following:

Pocketknife, having two or three blades, one ground to a slim point.
Panel saw, 20 in. long and having approximately 9 teeth to the inch.
Block plane, small, about 31/2 in. long with a 1-in. blade.
Fret saw, 12-in. bow, and blades.
Jeweler's hack saw for cutting small metal parts.
Small spokeshave, wooden, having a square face and a 1½- in. blade.
Rasp, 8-in. half-round cabinet, second cut.
Bit brace and wood boring brace bits.
Assorted twist drills for pin vise.
A good pin vise. An extra one will be useful and worth the additional money.
Hammers, 16-oz. claw and a 3-oz. riveting (No. o).
Pliers, flat-nose, round-nose, and diagonal cutting, 5-in.
Nail set. 1/32 in. nose.
Try-square, 9-in.
Boxwood rule, 2 ft. long and having four folds.
Assortment of small size C-clamps.
Tweezers and scissors.
Oilstone, 5-in. combination, fine and coarse.
Soldering iron, solder, and flux.

Various types of saws and planes, of course, can be added to this assortment from time to time to make it more complete. But in building up your tool kit, buy only those tools that are absolutely necessary. Having too many tools is sometimes more confusing and time-wasting than not having enough.

CHAPTER II

HULLS

WHEN you have obtained the plans for your ship model, your first job will be to construct the hull.

If your model is to be a replica of the original, its hull, above all things, must be carefully shaped according to the accurate hull lines given in the drawings. To do this in the quickest and easiest way, you must follow some standard method of procedure.

Of course, the most workmanlike process would be to build the hull of tiny ribs and thin planks like a real vessel. This, however, is a big undertaking and much too difficult for the average amateur. Besides, there are other and easier ways of obtaining the same effect.

Simplest of all standard methods of model hull construction is the "bread and butter" method of lifts. This particular method gets its name from the fact that lifts of wood, cut approximately to the various horizontal sections of the hull, are placed one on top of the other and glued together. When first assembled, the side of a glued-up "bread and butter" hull resembles a series of narrow steps.

Most ship model plans provide for building the hull by this particular method, but any ship model drawings can be adopted. In either case, your first step will

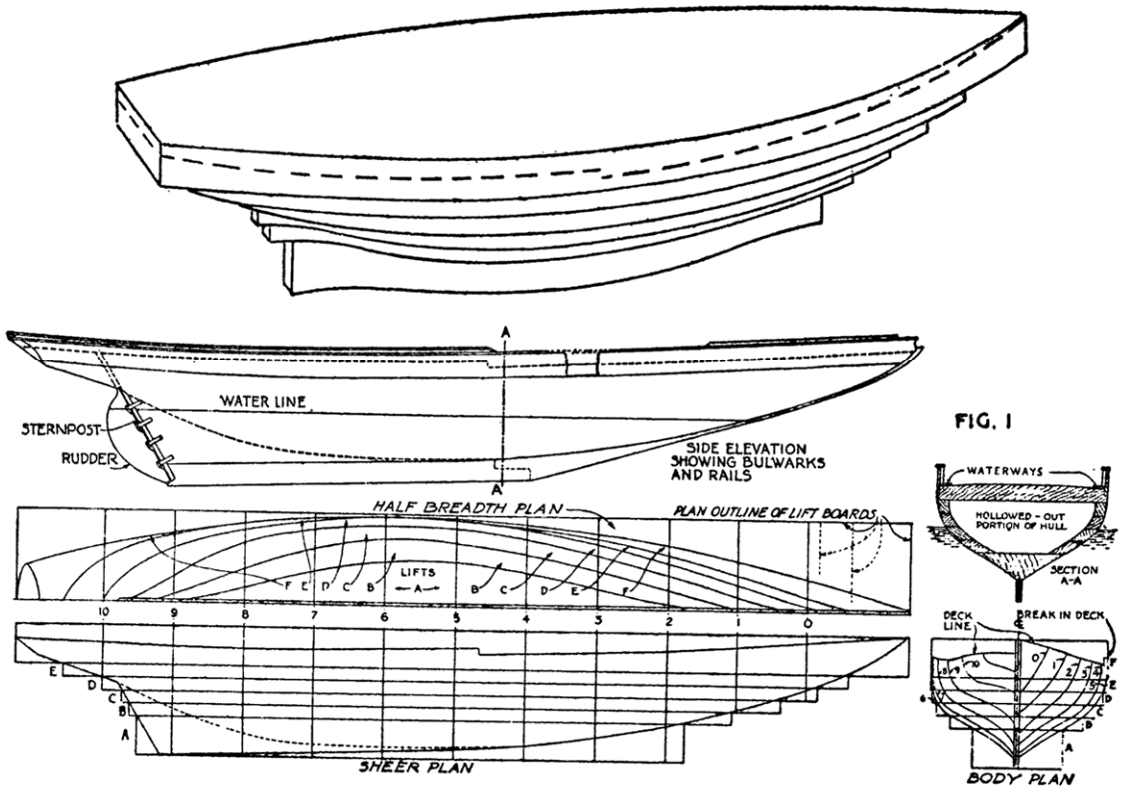

WATER LINE
STERNPOST
RUDDER
SIDE ELEVATION
SHOWING BULWARKS
AND RAILS
HALF BREADTH PLAN
PLAN OUTLINE OF LIFT BOARDS
LIFTS
SHEER PLAN
WATERWAYS
HOLLOWED - OUT
PORTION OF HULL
SECTION
A-A
DECK
LINE
BREAK IN DECK
BODY PLAN

FIG. 1

be to measure the depth of the lifts, making them all the same, and buy wood of this thickness. If wood of the exact thickness is not obtainable, take a size larger and have it planed down. What may be still easier, however, is to redesign the lifts to suit the thickness of the wood you can get. To do this, mark the desired thicknesses on the *body plan* and from that plan make a new *half-breadth plan* by marking the widths from the body plan on a new set of construction lines. These construction lines, of course, must coincide with the vertical lines on the original *sheer plan.* Just what these various plans represent is shown in Fig. 1. In any redesigning of the lifts, be sure that the deck does not cut entirely through the top lift at any point.

If the plans you have do not show the lift method of construction, this same procedure can be followed in planning the lifts and developing a half-breadth plan to agree.

With the lumber on hand, your next job will be to transfer your half-breadth plan lines to the lifts so that they can be shaped and assembled. Take a piece of tracing paper and from the half-breadth plan mark the center line, all the construction lines, and one pf the half-breadth lines (the line to which the particular lift is to be cut). This will give you one half of the curve. Then turn the paper over and, with the center line and other construction lines coinciding, draw in the other half, making a closed curve.

Do this with all of the lifts, using the same construction lines throughout. However, after each lift line is completed, pin the tracing paper to the strip of wood that is to be used for that particular lift and

transfer the outline and the construction lines by means of carbon paper. (See Fig. 2.)

Next, cut each lift to within about 1/16 in. of the outline and, finally, hollow out all but the top and bottom lifts. This can be done by marking on the bottom of each lift the outline of the lift below and cutting to within about 1/4 or 3/8 in. of that with a

FIG. 2

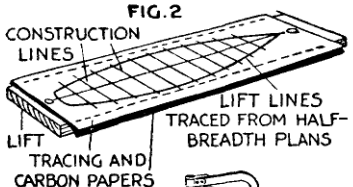
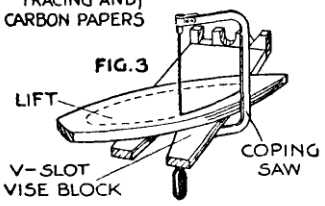


FIG. 3



coping saw as in Fig. 3. An extra allowance of wood for the final finishing also should be left at both ends of each lift. Hollowing the center lifts not only makes the hull lighter but lessens its tendency to warp.

When the lifts all have been cut to size, you are ready to start assembling your hull. Most experts work from the bottom up, placing their bottom lift flat on a bench or table, and gluing on the next lift, lightly nailing it in place from the inside (Fig. 4) to hold it. When all the lifts have been built up, one on top of the other, clamp the entire hull with hand screws or place it in the improvised clamps shown in Fig. 8 of the preceding chapter.

Once the "bread and butter" lifts of your hull have been assembled, you are ready for the roughing and final shaping. However, do not pass over the cutting of your lifts lightly. The more accurate you are in cutting them to the exact lines of your plans, the easier it will be to get the finished effect that is necessary if your model hull is to look real.

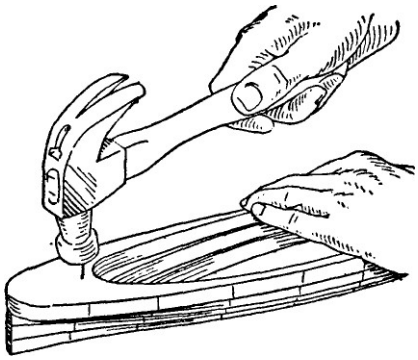


FIG.-4-

For the final shaping, you will need a series of templates cut to the shape of the lines in the body plan (Fig. 5). Cut these from cardboard, tin, or thin plywood and mark on each the exact point where the joint of two center lifts will come. This will give you a reference mark that will allow you to hold the template at the right height. Also, mark the deck line carefully at the edge of each template.

In use, the templates are placed along the hull at their respective positions at right angles to the keel. The bottom edge of each template, of course, should coincide with the center line of the hull.

If the hull slopes considerably from the water line

to the deck line, cut the templates vertically upward in a straight line neglecting the "tumble home," as this slope is called. Then, later on, when the rest of the hull

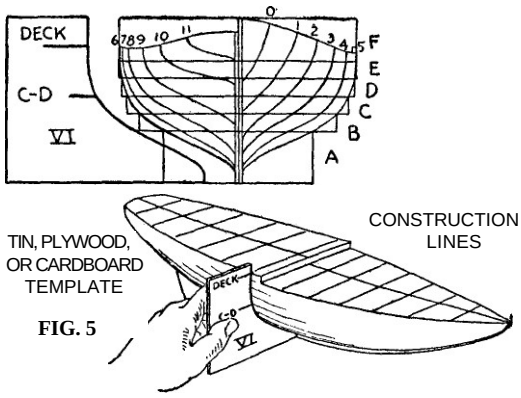


FIG. 5

has been shaped, the extra wood above the widest part of the hull can be shaved down to the deck to agree with the tumble home.

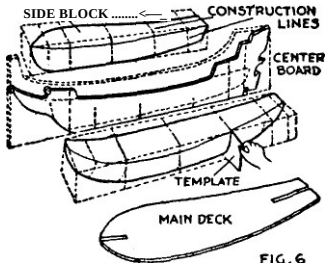


FIG. 6

Another method that is often used in making a hull, especially on models such as galleons and other older types of ships having long beakheads and high poops, can be referred to as the "half-hull and centerboard"

method. It consists of assembling the hull from two solid sides and a plywood centerboard. (See Fig. 6.)

It is merely a matter of sawing the centerboard to the outline given and cutting out the two sidepieces from either solid or built-up blocks. The sidepieces can be shaped at the start from rectangular blocks cut to the right length and width. Mark the construction lines on them all the way around. Then mark the greatest beam line on the top and cut down to this. On the vertical side, mark to the profile, including the sheer, and cut to these lines. The two sides, of course, must be cut right and left so that when they are placed on each side of the centerboard they will form a smooth, symmetrical curve. When the two halves have been completely shaped with the aid of templates, they are glued to the plywood centerboard.

Hulls for small models are sometimes carved from a single block. This method, while appropriate for anything under 12 or 14 in., is not particularly well suited to larger models. Large, smooth-grained blocks of wood are difficult to obtain and the weight of a single-piece hull would make it difficult to handle in the shaping and smoothing processes.

Although relatively new, another ingenious method of hull construction is fast gaining popularity with many model makers. Like the "bread and butter" method of lifts, it is simple and timesaving. It consists of jig-sawing all the sections or lifts from a single board, cutting them one within the other, and then telescoping them out to form a hollow hull which can be carved with the least possible work.

How this is done is shown in Figs. 7 and 8. For the purpose of illustration, a Chinese sampan or rowboat

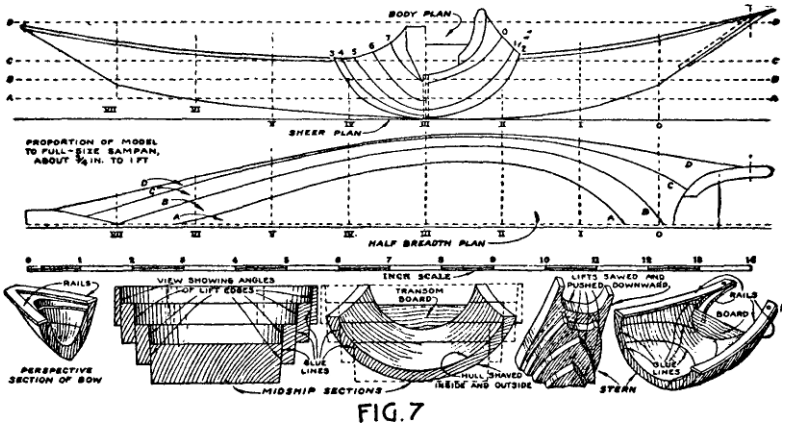


FIG. 7

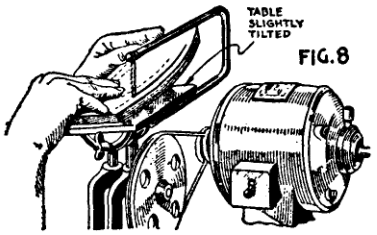
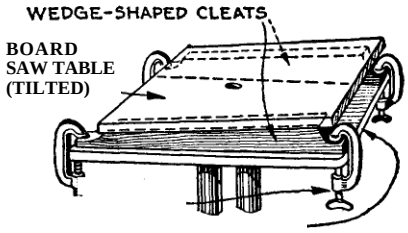


FIG. 8



PC-CLAMP

NONTILTING TABLE-

has been used as the model. The same method of construction, however, can be applied to any hull that does not require a long beakhead or a built-up poop. In this method, the hull is made almost entirely with

motorized tools, mainly jig saw, sanding disk, drum sander, and rotary file. The same work, of course, could be done with hand tools with the exception of the jig-sawing which, because of the angular cut, really requires a machine.

While the final result is not unlike that obtained with the bread and butter method, this new jig-sawing process does not waste any wood. Also, it reduces labor; a single saw cut serving for both the inside of one section and the outside of the section below. Completed, the jig-sawed hull consists of layers, but instead of being glued face to face as in the bread and butter method they are glued edge to edge, the joints running vertically instead of horizontally.

In selecting the stock for a hull to be constructed by this method, be sure to obtain wood that is at least one and one-half times as thick as the lifts specified in the model drawings. To play safe, you can obtain lumber almost twice as thick. For example, if the finished lifts are laid out as 1/2 in. thick, the wood should measure in the neighborhood of 1 in.

Since the actual sawing will be done with the bottom of the plank uppermost, the lift lines you draw will, in reality, be the lower edges of the lifts.

For the actual cutting, the table of the jig saw must be set at a slight angle to the saw blade. If your jig saw is not of the tilting variety, a supplementary table can be made from a thin board and two wedge-shaped blocks as in Fig. 8. The correct angle will be equal approximately to the thickness of a saw cut.

To obtain just the right cutting angle to allow the lifts to telescope the desired amount may require some experimenting. It best can be obtained by taking a

piece of wood the same thickness as your stock and cutting a circle in it with the table set at what you think is the approximate angle. Then, remove the inner piece and mark the required depth of the lifts. Finally, push it into the outer piece and check to see if it comes through to the mark when tight. If it does not, adjust the saw one way or the other and try again. Of course, a very slight allowance must be made for the lining of glue that will be needed in the joint. In judging the thickness of the glue, allow a very little for casein glue, a trifle more for liquid glue, and still more for carpenter's hot glue.

Any one lift can be made deeper than the rest merely by varying the angle of the saw. Simply remember that the greater the angle of the cut, the shallower will be the lift. Of course, the top lift will have the full thickness of the wood, but in the case of most hulls this will be an advantage as it will allow the additional stock needed for shaping the deck curve.

As in all jig-saw work, a starting hole will be required to receive the saw blade. However, if a jeweler's saw blade is used, the hole will be small and can be bored almost anywhere without showing in the completed hull. The hole, of course, should be drilled to agree with the angle of the saw cut.

Each lift should be completely sawed out in one cut if possible. If the wood is too long, however, for the sweep of the saw frame, bore entrance holes at each end of the curve and saw halfway along from each hole on opposite sides. Then remove the wood with the saw blade, reverse it on the table, tilt the saw table the other way until the blade is again upright and can be refastened, and complete the sawing.

When all the lifts have been sawed out, mark the desired depth on each and push them through to see if they come to the marks. If they do not, a little sandpapering here and there can be done to even matters.

When you are satisfied with the fit, brush your glue evenly on the outside edges of each lift, push them through to the depth marks, and set the hull aside to allow the glue to dry.

If the model you plan to build by this method has high-wall sides, it will be necessary to add a separate section as well as a deck to the top of your telescoped hull. Similarly, for any hull having sides that slope in (tumble home), a second series of lifts can be made tapering the other way, meeting the first at the widest water line.

With the exception of the "half-hull and centerboard" method of construction in which the hull is shaped in halves before assembling, there is one point where all other methods converge. That point is the final shaping. As already described, carefully shaped templates should be used in bringing the curves to their proper contours.

There are many ways of holding a rough hull while it is being shaped (Fig. 9). One method consists of screwing it bottom-side up to a suitable block that can be held in the vise. Another and more flexible method consists of screwing the hull bottom-side up to a separate supporting stick having octagonal ends which can be turned and clamped in any one of four positions in two vises of the machinist's type fastened to the outer edge of your bench. Or, if you have a regular wood vise, you can clamp it in that, shaping it from the center toward the ends. In the final shaping that re-

quires continual shifting, it can be held between your knees in the same way that a shoemaker holds a shoe. When the sides have been shaped with whatever tools are available—files, chisels, gouges, spokeshave, and round-bottom plane—shave down the top of the hull block to within about 1/8 in. of the deck level. Then shave down from the fore-and-aft center line to

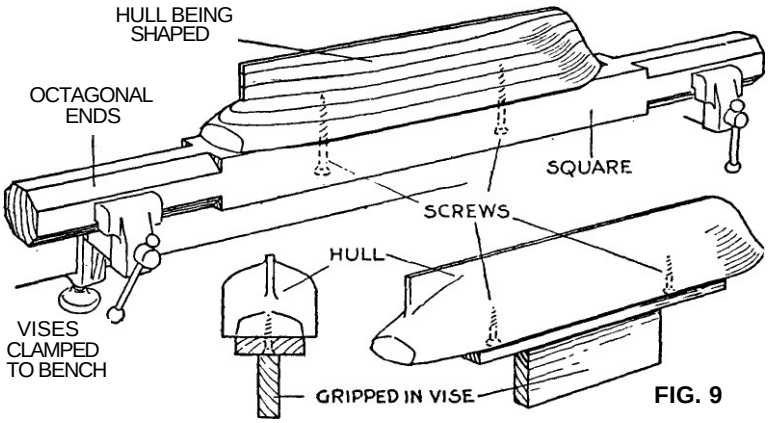


FIG. 9

the edges, giving the deck a slight, even crown. Before the hull is completely shaped, the forecastle head and poop pieces should be glued on.

The next step will be to place the stem, sternpost, and keel. These can be set in shallow rabbets or merely glued and nailed on. The important thing is to try out cardboard replicas of the pieces first to make sure that the hull sides approach them sharply and neatly. Any hollows or bumps should be removed before the actual pieces are set in place.

To make a bulwark, take a piece of thin whitewood

or white pine about twice as wide as the depth required. Lay this along the side of the hull, fastening it temporarily with thumbtacks, and with a sharp pencil mark the outline of the deck. If the forward end is to flare out, the strip should be held in this position during the marking operation.

Cut the strip accurately to this line and, measuring from that edge, mark the right height and cut down

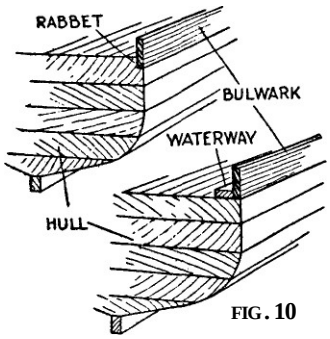


FIG. 10

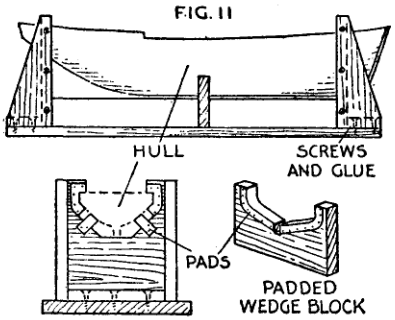
almost to it. Then glue and lightly nail it in position, either in a rabbet or against the waterways as shown in Fig. 10. In some cases, it may be necessary to steam the forward end of the bulwarks to twist them into the required flare.

If, as in many small models having no deck, the inside of the hull must be gouged out and smoothed, it will be necessary to devise some convenient method of holding the hull during the work. Of course, it can be clamped top-side up in your woodworking vise, but a better method is to construct a special jig for the purpose. Such a jig or clamp is shown in Fig. 11.

It consists of a base and two cradle-like jaws cut

from scrap lumber, 1-in. stock preferred. One jaw is attached securely with glue and screws to one end of the base, while the other, identical in shape, is fastened to the opposite end with screws only so that it can be removed easily. The jaws are padded with strips of soft cloth or felt to protect the hull.

In use, the hull is slipped under the cradles and the removable jaw tightened. Then, a third, but smaller



cradle-like block is wedged under the center of the hull to hold it firmly in place. For protection, this wedging block also is supplied with pads. The base of the clamp can be held in the jaws of your woodworking vise or braced against the bench stop.

When the shaping is completed, it will be well to make either a permanent or temporary base to hold the hull perfectly upright and horizontal before attempting to apply the bulwarks and other trim. A padded cradle support similar to the clamp shown in Fig. 11 can be used or, since a regular decorative support will be needed when the model is completed, the finished mounting can be used.

In preparation for the final painting of your hull, you can apply the ground coats and mark the water line, the latter being drawn in with pencil or scratched with a scriber (a sharpened nut pick will do) on the ground coat. How this is done is shown in Fig. 12.

First, a suitable block of wood is obtained. Since it is to serve as the supporting gage for the pencil or scriber, it should be thick enough to bring the mark-

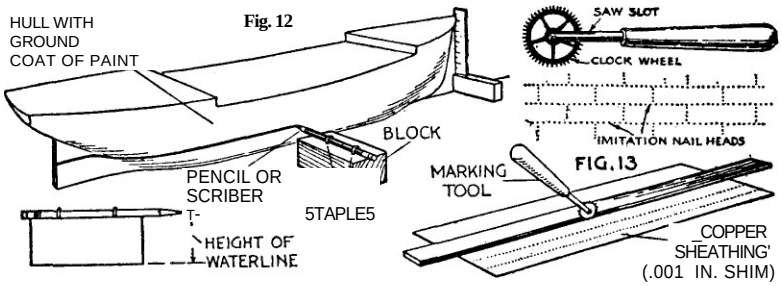


Fig. 12

FIG. 13

ing point up to the desired height of the water line. When the proper thickness is obtained by planing, attach the pencil or scriber to the top surface of the block with staples. Be sure, of course, to keep the lower surface of the block perfectly flat.

Using a square, the hull is then held in a true vertical position on a bench or table and the pencil (or scriber) and block moved around it in the manner of a surface gage. Line the square up with some true, vertical edge on the hull and hold it there during the entire marking operation. Of course, if the water line is higher at the stern, the bow of the model should be raised the required amount with a block.

If you are modeling a wooden ship of the type used

around the middle of the nineteenth century, you probably will want to obtain the effect of copper sheathing below the water line. This can be done in two ways. You can apply actual copper to the hull or imitate it with copper paint and touches of green to give the effect of verdigris. The actual sheathing, of course, gives a more realistic appearance.

Generally, shim copper about .001 in. thick is used for model sheathing. Cut in strips equal in width to about one-third of the hull surface on each side, it can be shaped to the curves and fastened in place with glue. To obtain the effect of nail heads outlining the plates, you can mark the back surface of each strip with the improvised tool shown in Fig. 13. Simply mount the sprocket wheel taken from an old watch in a fork of metal supplied with a suitable handle. Then, before gluing each sheathing strip in place, run the wheel over the copper to form tiny rectangles. Full size, most sheathing plates are approximately 1 ft. wide and 3 ft. long, so you can arrange your marks accordingly to agree with the scale of your model.

To obtain the effect of verdigris on the sheathing, rub the copper lightly with a soft cloth soaked in a solution of strong vinegar to which a pinch of salt and a little household ammonia have been added. After allowing it to dry overnight, brush off the superfluous green that has formed and, using steel wool, polish the copper slightly at the bends and high points in the hull. Finally, to preserve the final effect, apply a thin coat of clear lacquer.

Although a completely planked model is a difficult undertaking, the amateur can obtain the same effect by applying tiny external "planks" to the exterior of

an ordinary carved hull. The small stock that will be required can be secured by dismantling several Japanese wall pockets of the type that can be purchased at almost any variety or notion store. Thin veneer cut into strips also can be used.,

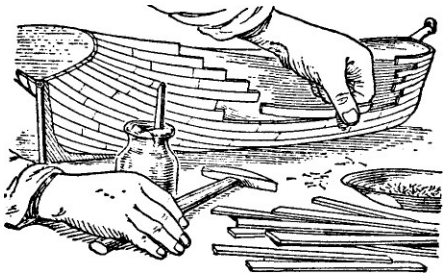
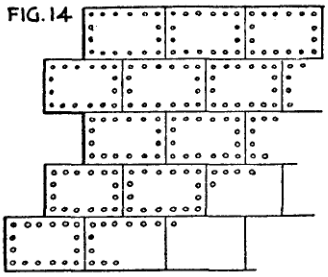


FIG. 14



The strips are glued and tacked with very small pins to the carved hull (see Fig. 14). Because of the differences in girth at the various points along the side of the hull, it may be necessary to taper the planks slightly where they approach the stem, sternpost, and keel. If the hull bends sharply at any point, it will be easier to force the strips into position if they are first soaked in hot water to make them pliable.

The steel plates of modern ships can be imitated in the same way by applying small rectangles of drawing paper to a carved hull. If small pins are used to hold the "plates" in place, they can be spaced in imitation of actual rivets.

After the hull has been painted, shallow lines can be cut in the deck with the toothed tool shown in Fig. I of Chapter I to represent the deck planking. On smaller models, the planks can be drawn in with a 4H pencil. The deck then can be given a coat of thin varnish, but do not strive to get it too shiny.

In this general description of the various methods of hull construction, little has been said about the types of woods used. While a great deal depends on what woods you have available for the work, some varieties are better suited than others.

For the hull proper, clear, straight-grained white pine free of knots will prove the most satisfactory and easiest to work. For the smaller pieces such as the keel, stem, sternpost, and bulwarks, some harder wood—gumwood is excellent—will be stronger and less likely to give way after it has been fastened in place.

When cutting wood for a hull, always save the scraps and extra pieces. They will form excellent stock for making many of the deck parts and fittings later on in your work.

CHAPTER III

MAKING SMALL PARTS

IN addition to a carefully shaped hull, a ship model requires many small parts for the deck and rigging. While the model maker can display his own ingenuity and inventive ability in making these small fittings, there are certain methods, devised by experts, that will serve as a fine starting point for the work.

Three questions confront the ship modeler as he begins each small part. What material should be used? What does the particular part look like? And how shall it be made the easiest, quickest, and best way. The answer to the second question, depending as it does on the type, period, and nationality of the ship, generally will be found on the plans detailing the model. If no complete plans are being followed, an idea of the general size and shape often can be obtained from the colored prints of early sailing ships that are on file in most public libraries.

As to material and method, the beginner can be guided by the following:

Deck Houses

Deck houses, skylights, and similar parts usually are made from solid blocks of wood. Of course, in the case of large cabins, they can be built up from plywood or stiff cardboard (see Fig. 1). If made from **a** solid

block, the sides should be finished with a file rather than sandpaper as the file will give a smoother surface. If the roof projects beyond the side walls, make it a

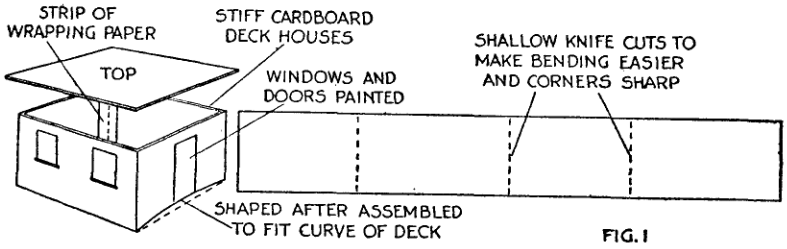
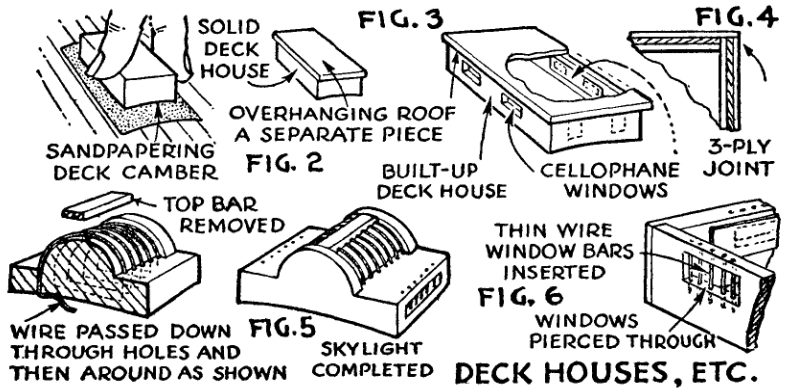


FIG. 1

separate piece. If the deck is cambered (crowned), the bottom of the deck house can be made to fit by-laying a piece of sandpaper on the deck and rubbing the block on the sandpaper until it matches the curve of the deck (Fig. 2).



Large deck houses can be built up, the windows being pierced and backed with cellophane as in Fig. 3. The walls and ends of the deck house can be made

of three-ply. By rabbeting two plies at each end of the front and back pieces, the sidepieces can be set in to make an almost invisible joint (Fig. 4). Bars can be put across the windows, if necessary, by boring down from the top and inserting thin wires as in Fig. 6.

To make a circular-topped skylight, cut away the top bar, bore down through the skylight, and thread wire through the holes as suggested in Fig. 5. Then groove the top bar to take the wires and refasten it in place with glue.

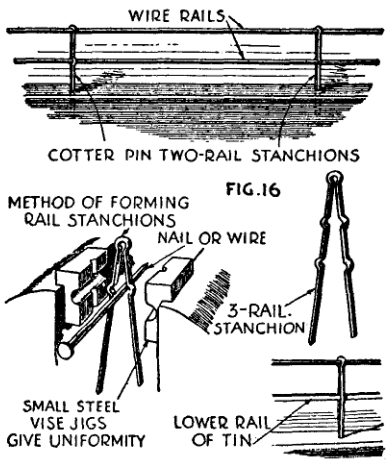
If, as in many models of early ships, the deck houses are to be fitted with leaded glass windows, these can be simulated by drawing lines with draftman's ink on photographic negatives after the emulsion has been removed. Simply soak the negatives in hot water and rub them to loosen the coating. When they are clear, hang them up to dry. To make the ink take on the smooth surface of the film, rule the lines first with a pin or other sharp point, being careful not to cut all the way through, and then apply the ink.

Stanchions

Taffrails around the stern are somewhat tricky to fit. They can be made from chair-caning spline, hard rubber, or celluloid, steamed and bent to shape, but are better when made from thin fiber board cut to shape as in Fig. 7. In either case, lay it on the poop edge and bore through for the stanchions or posts. The stanchions can be turned to shape from square brass stock with points above and below to stick into the upper and lower rails, or they can be turned from wood with a homemade forming tool shaped as in Fig. 8. On small

models, two or three beads threaded on a 1/2-in. pin will give a realistic effect.

For the stanchions of iron-bar railings, several methods can be used, the best, of course, being the process of actually turning them from brass rod in imitation of the real thing (see Fig. 13). To do this, however,

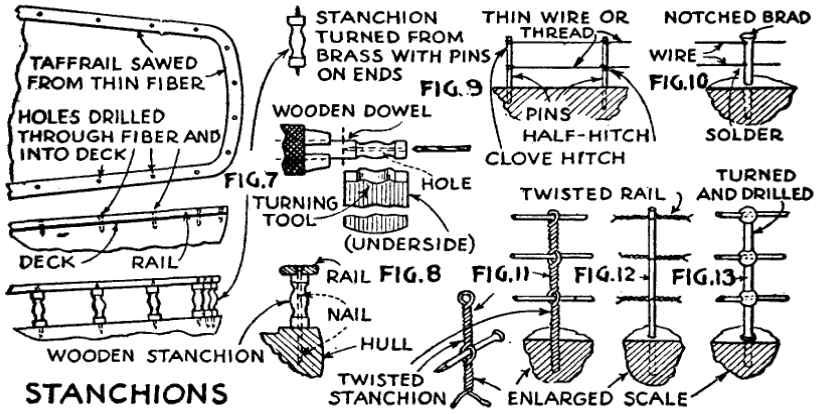


requires a precision lathe and a well-made boring jig—two tools that are not found in every model maker's tool kit.

A good imitation of turned brass stanchions, however, can be made by using spring cotter pins as shown in Fig. 16. Spring cotter pins can be obtained in a large variety of lengths and diameters so that you should have little difficulty in finding the size best suited for almost any model. If two rails are wanted, a thin strip of tin may be used to represent the lower rail. Or, if loops are bent in the legs of the cotter pin

with a small jig used in your vise, a wire instead of a strip can be used in the lower rails. Either two- or three-rail stanchions can be made in this way.

Another simple substitute is to drive 1/2-in. pins into the deck and hitch two or more plain threads along them, using clove hitches at the ends and half hitches between (Fig. 9). Another, and perhaps more real-



istic, method of rigging the rails, is to use two threads, twisting them together between stanchions as in Fig. 12. In either method, a drop of cement put on at the junctions will hold the thread in place and form a ball.

To give the effect of navy-type stanchions, you can use No. 20 brads from 3/8 to 5/8 in. long as shown in Fig. 10. File two or three nicks, depending on the number of rails desired, in each brad and set the wires in these, aligning them carefully and soldering.

Where firm support at the ends can be obtained, the neatest substitute is to take two small bights of

very small wire (30 or 32 gage), bend them over a stiff, small nail or a needle, twist them together, then carry them around another nail or needle, twist them some more, and so on until you have a twisted rod with the necessary number of holes (Fig. 11).

Steering Wheels

To be accurate and authentic, a steering wheel should have an iron hub with a brass cap. From the hub should project eight or ten turned hardwood spokes into which are mortised the sections of the hardwood rim. In actual use, aboard a ship, the rim is strengthened with brass faceplates, before and abaft.

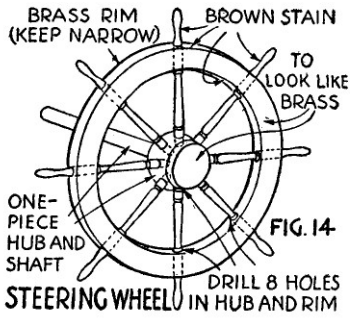


FIG. 14

As with every other part, however, the model maker can imitate and improvise. The most primitive wheel, and one that should be used only on small models, is the sprocket wheel of a watch.

To make a good imitation wheel (Fig. 14), one must turn or file a hub and axle. These may be shaped from a single piece. Then drill part way through for the spokes and make a brass rim, which is bored all the

way through to receive the spokes. Finally, turn the spokes and handles in one piece, making them a tight fit for the hub and rim holes. The wheel should hold together without solder, but for safety either hot or liquid (cold) solder may be used if applied sparingly.

When no tools are available for shaping the rim and hub from brass, thick sheet lead that can be purchased at any plumber's supply store can be used. Being soft, the lead can be cut and shaped easily, and pins or brads, cut to the right length, can be used for the spokes and handles. To hold the wheel together, simply compress the lead wherever a grip is needed.

Small steering wheels also can be cut with fine jeweler's saws from thick sheet celluloid, the edges being smoothed and rounded with small files (Fig. 22). However made, the spokes and rim edges should be finished to represent teak, and the faces to imitate brass.

One temptation in making a model steering wheel is to make the rim too large and out of proportion to the hub and spokes. On an actual wheel, the rim is fairly narrow and little, if any, thicker than the spokes at their widest part. Full size, they generally are from 3 to 4 in. thick.

Pumps

Although the actual design of pumps will vary with *the* type and period of ship, there are many general hints on pump construction that should be of value. The wooden man-o'-war style was to have the pumps on the gun deck, worked with long pump handles or brakes. On merchant ships, the outlets were on the main deck just abaft the mainmast. Since the 1850's,

or thereabouts, cranks with handles and flywheels similar to those shown in Fig. 15 have taken the place of the brakes. The crank shaft rests on the fife rails while the flywheels are almost invariably inside the pinrails with the handles, of course, outside. Full size,

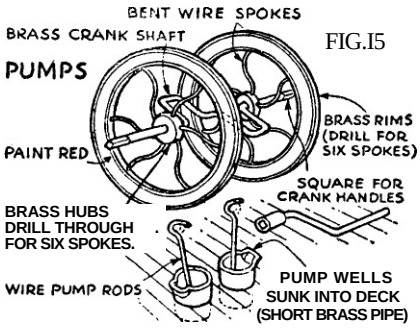


FIG.I5

the rims of the wheels are about 4 ft. in diameter, 4 in. thick, and oval in cross section. The spokes are usually curved instead of straight.

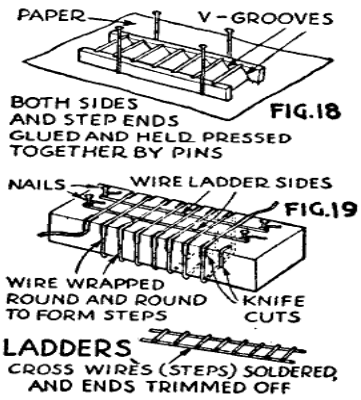
Here again, while brass is used by many experts for the rims and hubs, the amateur may have better success with soft sheet lead. The spokes and pump rods in either case can be soft wire.

Ladders

There are all sorts of ways of assembling the variety of ladders needed in ship models. Wooden ladders actually can be made of wood as shown in Fig. 18, using a simple gluing jig of four pins, or they can be simulated with stiff cardboard.

One way of making iron ladders is to take a block of pine larger than the ladder to be made and rule

lines across it at the spacing required between the rungs. Along the two top edges, make thin knife cuts where the cross lines meet the edges (Fig. 19). Along the length of the block, rule two parallel lines spaced to the width of the ladder. About ½ in. from each end, drive brads on each parallel line. Stretch wires between each set of brads, arranging them so they rest about ¼ in. above the surface of the block. Put



soldering paste along these wires. Tie a knot in one end of the wire to be used for the rungs, catch it in a knife cut, and proceed to wind the wire around the block, catching each turn in the knife cuts. Align the rungs according to the ruled lines and finally solder them in place. Then, when the solder has hardened, snip off the rung wires near the edge cuts, remove the ladder uprights from the brads, and trim them with scissors. When you are finished, be sure to save the block, as it can be used over and over again whenever ladders of that size are needed.

Spars

Since masts, yards, and booms (Fig. 17b) must stand considerable strain, they should be made of some wood that has longitudinal strength and that will not split easily. Many model makers prefer lemonwood

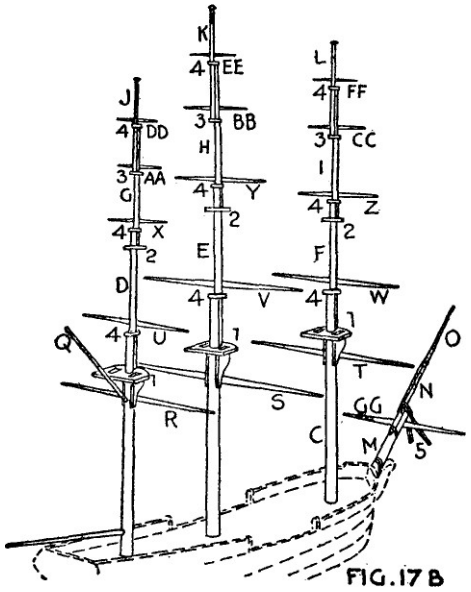


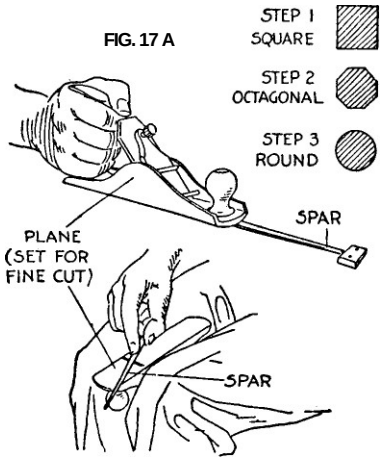
FIG. 17 B

A Mizzenmast
B Mainmast
C Foremast
D Mizzen topmast
E Main topmast
F Fore topmast
G Mizzen topgallant mast
H Main topgallant mast
I Fore topgallant mast
J Mizzen Skysail mast
K Main Skysail mast
L Fore Skysail mast
M Bowsprit (outboard)
N Jib boom
0 Flying jib boom
P Spanker boom
Q Spanker gaff
S Mizzenyard
8 Mainyard
T Foreyard
U Mizzen topsail yard
V Maintopsail yard
W Fore topsail yard
X Mizzen top gallant yard
Y Main topgallant yard
Z Fore top gallant yard
AA Mizzen royal yard
BB Main royal yard
CC Fore royal yard
DD Mizzen skysail yard
EE Main skysail yard
FF Fore skysail yard
GG Spritsail yard

1 Tops
2 Crosstrees
3 Topgallant crosstrees
4 Caps
5 Martingale boom ami cap

because of its strength and ability to take a fine finish. It is, however, inclined to split easily and for this reason many experts use birch exclusively. Birch also had the advantage of being easily obtained in dowels of a large variety of sizes. Only the best, whitest, straight-grained dowels, of course, should be used; a plane should slip easily and smoothly along all sides.

If you have the right kind of lathe, spars can be turned. However, they also can be planed and sandpapered to shape without much difficulty. Use a fine-set plane and a true surface to lay them on (Fig. 17a). Plane an entire mast or one end of a yard before cut-



ting it from the long stick so you will have something to hold.

When planing *small* spars, hold the plane, face up, between your knees and draw the spar with a diagonal cut over its face.

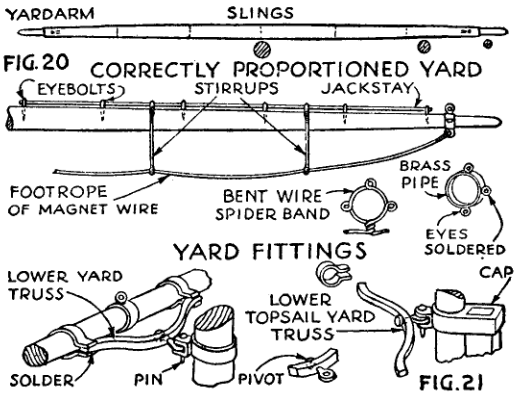
Yard Fittings

The various fittings that are required on the yards should be placed before the spars are put in position. On models of approximately 1/8-in. scale, the jackstays (see Fig. 20) can be made from No. 24 brass wire. It should be threaded through eyebolts on the yard just abaft of the center line. The eyebolts can be made

from 1/2-in. pins bent to shape or, for a neater job, they can be fashioned by flattening the pinhead and punching or drilling a hole through it.

Although cord can be used for the footropes, it will be limp and flimsy and difficult to keep in place. A good substitute that is stiffer is No. 32 or smaller silk-covered magnet wire. Just bend the ends back for the splices and wind on a little silk sizing to hold them.

The yards need eyebolt or spider bands at the ends for the braces and lifts. These can be made by twist-



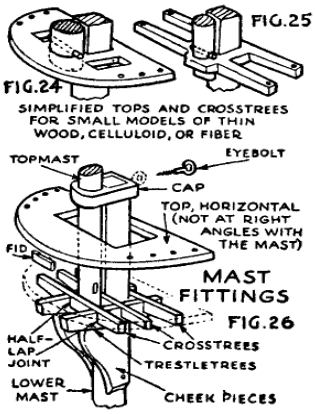
ing No. 24 wire to shape and twisting the ends tightly under the yards, finally pushing them into the wood. A neater band can be made by soldering small eyes to a section of thin brass tube. Both types are shown in Fig. 20.

Lower yards and lower topmast yards require trusses on which they can swing vertically and horizontally. Trusses of various forms are found on real ships, but the type shown in Fig. 21 will serve for most models.

The arm is No. 16 soft wire, hammered flat at the ends and slightly flattened at the middle, where it is drilled for a No. 20 escutcheon pin. This is put through and the center of the truss flattened and drilled vertically for another pin. Two bands with projecting ends are made to fit around the yard and the ends of the arm are soldered between these lugs. The fitting and soldering operations should be done on a dummy arm. Finally, a band to go around the mast is made and a U-shaped piece to hold the pivot pin is soldered to it. A lower topsail yard truss is similar, but with the smallest possible distance between the mast and yard.

Mast Fittings

Most important of all fittings for the masts are the caps, tops, and crosstrees. The caps (Fig. 26) can be



cut from hardwood, but fiber board or celluloid is more satisfactory. If the cap is inclined to split, file a groove and wind two turns of thin wire tightly around it.

Caps usually have various eyebolts in them. Drill through into the mast for these, if necessary, to gain a more secure hold.

A top on a small, simplified model can be cut from one piece of fiber or celluloid as in Fig. 24, but is better, of course, built up with regular crosstrees and trestletrees as in Fig. 26. The trestletrees lie fore and aft and are bolted to the mast, while the crosstrees lie across the trestletrees and are half-lapped into them. A rim is built touching the ends of these and the middle is partly planked in. Note that tops lie horizontal,

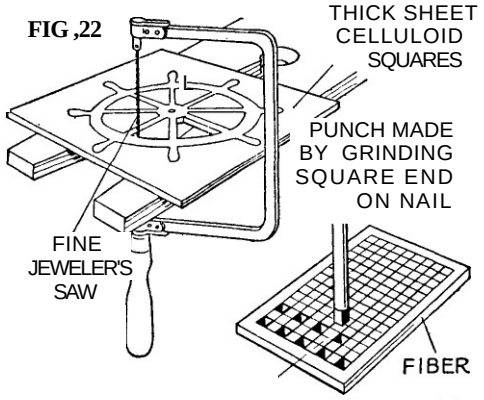


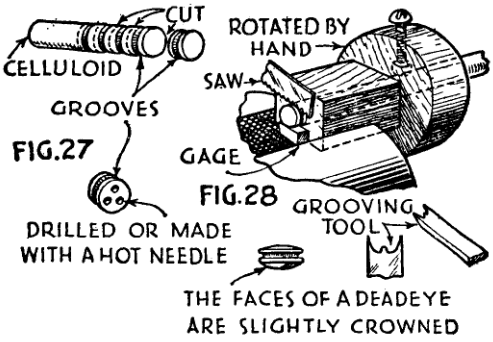
FIG. 23

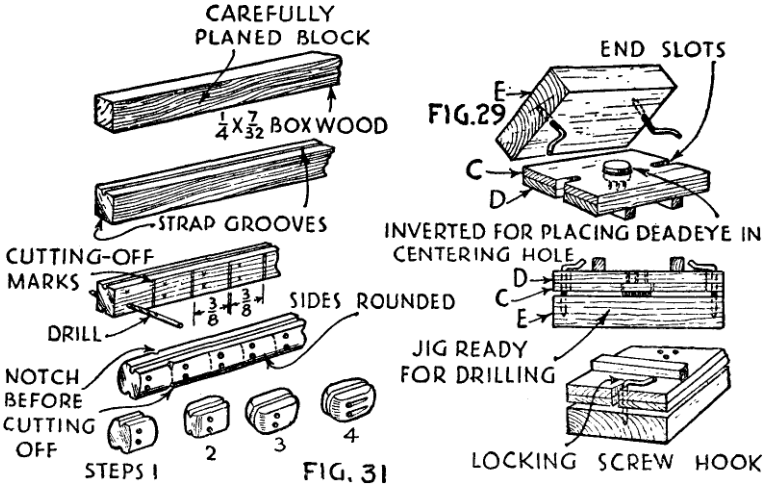
not at right angles to the mast. Crosstrees (Fig. 25) are like tops, but without the rim or flooring. Holly or gum is good for making such parts.

Almost every model requires a grating of some sort. These can be made by punching square holes in a sheet of fiber cut to the desired size (Fig. 23). The fiber should be placed on the open jaws of a vise and a large nail filed to a square point used as the punch.

Deadeyes

All sailing vessels, except the more modern type, require a great many deadeyes. Being used in large numbers, these small fittings will have a great deal to do with the final appearance of your model. To be shipshape, they must be neatly formed and uniform.





The easiest to make, but not the best, can be cut from celluloid rods such as knitting needles (Fig. 27). With a file or a fret saw, or in a lathe, cut grooves the right distance apart to give the proper thickness; then with a sharp knife slice off sections at every other groove so that each will have a groove around its middle. Although it is better to drill the holes, they can be made with a hot needle. As a finishing touch, the flat sides then should be rounded.

Although celluloid deadeyes are perhaps the simplest, those made from boxwood or hard rubber are un-

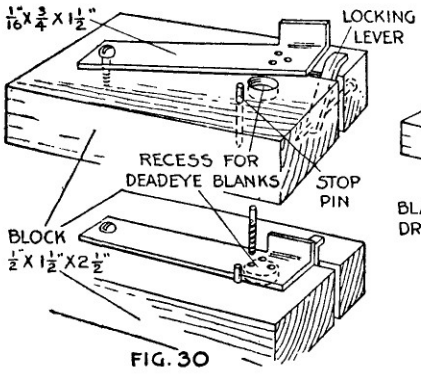


FIG. 30

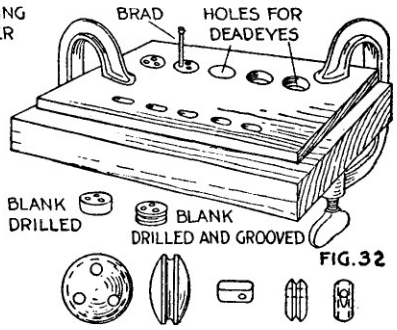


FIG. 32

doubtedly the best. If you have a lathe, it is no great task to make them. They can be shaped with a parting tool, but it is better to buy or make a special forming tool filed to the shape shown in Fig. 28 and hardened. This rounds, grooves, and cuts off the deadeyes in one operation. If the drilling is done in a jig similar to those shown in Figs. 29 and 30, you can save a great deal of time.

If you have no lathe, your boxwood deadeyes can

be made in the following manner: First, turn or cut the boxwood stock into round sticks or dowels of the required diameters. Then take a piece of hardwood not less than 3/4 in. square and 1 in. long and drill a hole straight through the center to form an easy fit for the boxwood dowel (Fig. 28). A second piece of hardwood, either round or square, also is drilled through its center to receive the dowel. Drill another hole from one edge of this second piece to take a locking screw, which is an ordinary screw filed flat at its point.

The block first mentioned is clamped in a vise or otherwise held firmly. Insert the boxwood dowel through both pieces until the end projects a shade beyond what is to be the middle of the deadeye. Fix it there by turning in the screw while both pieces are held tightly together. Now, slightly crown or round the end of the dowel by holding a file or knife to it while turning the outer handle piece with the left hand.

Then, with a knife held to the face of the stationary square block, cut the groove, not too deeply and slightly V-shaped. Instead of a knife, a very fine hack saw may be used if the set of the teeth is filed off and then the edge is honed to a V-shape.

Move the dowel along the desired amount to give the proper thickness and mark another score. This is for the cutting off, which may be done more easily after the entire dowel is marked. A block may be fastened to the face of the square block to act as a gage. The cutting off must be done very gently and carefully or the wood will chip.

Move along to the next score, and so on. When all the deadeyes have been cut off, the other faces can be

crowned, although many model makers are content to leave flat faces on the inside of the deadeyes.

The drilling comes next. As already suggested, this should be done in a jig, the drill being held in a pin vise. The finished deadeyes should have three clean holes arranged in a triangle.

Blocks

A tackle block can be made in many different ways. Most model makers use boxwood as the stock, but holly, gum, or other semi-hard woods will serve.

To shape the blocks by hand, first cut an oblong strip of wood a trifle wider than the width of the blocks and to a thickness equal to the desired thickness of the block. Remember, of course, that double blocks are about one and one-third times as wide as single blocks, and proportionately thicker.

With a V-gouge, knife, file, or woodworker's marking gage, cut a groove right down the center of two opposite edges. These form the strap grooves (Fig. 31). Then lay the strip down and mark off intervals equal to the desired length of the blocks, allowing for a thin section of scrap equal to the width of your finest saw. At one-third of the length from each mark, bore a hole or holes (one for single blocks, two for double), of suitable size. This hole should be large enough to take the rigging cord that is to be used with the blocks. For a 3/8-in. block, a No. 60 twist drill will be suitable.

From the grooves along the edges, round the faces slightly with a file or sandpaper. At each of the marks on both sides, make a V-cut with a knife and then saw the blocks apart, using a fine fret saw or a jeweler's hack saw.

Finally take each block between the thumb and finger of the left hand and with a very small file (a diesinker's three-cornered file is best) file the V-cuts at the ends into smooth curves, so as to make the faces oval in section. Using the same file, continue the score for the strap around the ends of the block. With a V-gouge or the point of a knife, make a nick in the sides of the block from the holes to the heel. This is to represent the opening or openings filled with the sheave (wheel) or sheaves.

Many model makers find that they can hasten and simplify the work of making deadeyes and blocks for ship models by molding them from plastic putty of the wood type sold in cans at hardware and paint stores for mending cracks.

As shown in Fig. 32, the mold is made by boring holes in a piece of 1/4- or 3/8 in. lumber. When the point of the drill just shows through, reverse the drill and bore from the other side so that the edges of the hole will be clean. The holes for the deadeyes are left round; those for the blocks are made oblong with a rat-tail file. When the required number of holes have been drilled, melt and pour some hot lard through them, making sure that each hole is well coated. Wipe the surplus lard from the surfaces, clamp the board tightly to another smooth board, making sure that there is perfect contact at all points, and fill in the holes with the wood putty. Scrape off the surplus flush with the top surface.

The holes in the deadeyes and blocks should be punched with a small brad while the putty is soft. When the composition has hardened, the pieces can be pushed out with a small stick. The deadeyes will

be at least twice as thick as required, but they can be cut in two or to the thickness desired with a sharp razor blade. When cut to thickness, the grooves can be filed around them.

Casting Metal Parts

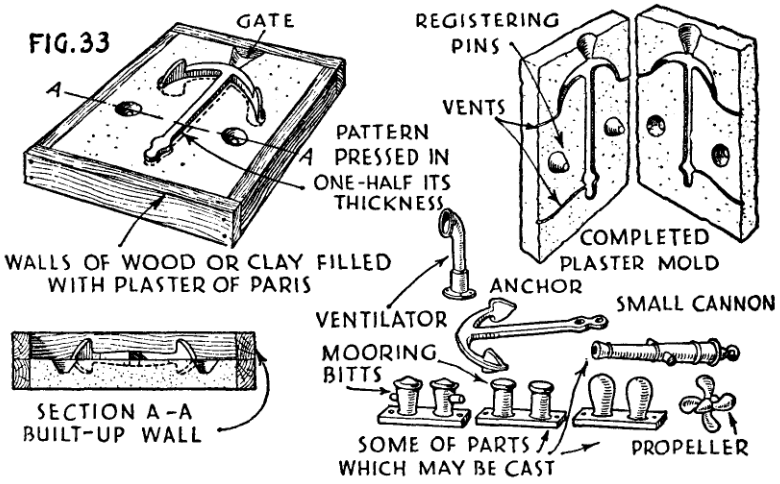
Although metal fittings, such as anchors, bollards, chocks, and propellers, can be purchased ready for use from ship model making supply houses, many ship modelers desire to make everything themselves. Of course, such parts can be cut from soft lead, but it is sometimes easier and better to cast them.

To make an anchor, for example, first prepare a pattern cut from close-grained wood. Build a 1/2 in. high wall of wood or modeling clay on a square scrap of wood and fill it with a soft mixture of plaster of Paris and water. Grease or oil the pattern, lay it on the mixture, and press it in until just one half is submerged as in Fig. *33.* Leave it until the plaster dries. Then remove the pattern and countersink several holes in the margin of plaster. Replace the pattern, build the walls up another 1/2 in., grease the top surface of the hardened plaster mold, and fill with newly mixed plaster of Paris. Place a thin piece of wood on top and leave until dry. Then carefully separate the two sections, remove the pattern, and cut a gate or spout from the crown or heavier end of the anchor impression to the edge of the mold. This will serve as an entrance hole for the molten metal. Also, make hair-line scratches from the ends of the flukes and shank to the mold edges to serve as air vents.

Finally, dry the mold thoroughly. It must be bone dry before the metal is poured in. If a number of cast-

ings are to be made, use half plaster and half powdered asbestos in making the mixture for the mold as it will stand up better under the heat.

As a backing top and bottom for the mold it is well to use two pieces of thin wood such as 1/4-*in.* three-ply not much larger than the mold, allowing the plaster to remain attached to them.



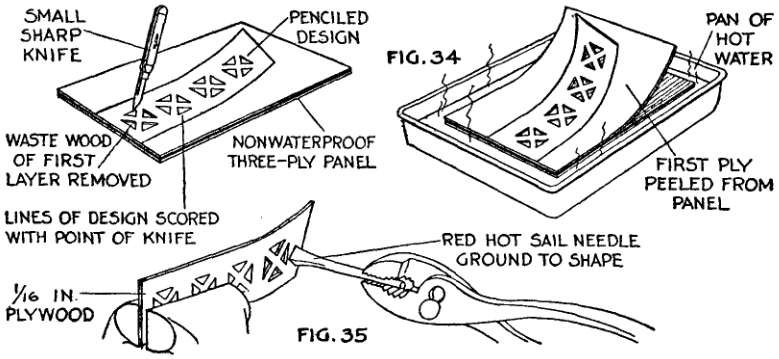
To make a casting, lightly clamp the two parts of the plaster mold together. Melt some lead in a ladle or an old saucepan and pour it into the mold through the gate. Until the mold gets thoroughly hot, the first few castings may be pitted and unusable.

Incidentally, blocks and deadeyes also can be cast from metal, if desired. A compound mold consisting of several deadeye impressions connected by runners leading to a single pouring gate will speed up the

work. When the tiny parts have been cast, they can be smoothed with steel wool and emery and finally enamelled.

Intricate Designs and Fretwork

Intricate fretwork for ship models can be cut from wood without splitting if an ordinary nonwaterproof three-ply panel is used (Fig. 34). Draw the design,



score around it with the point of a sharp knife, and remove the waste wood down to the second ply or core stock, leaving the ornamentation in relief. Then soak the plywood in warm water to loosen the glue and free the fretwork, which will require only a little sandpapering before it is applied to the model. It should, of course, be dried before applying it.

Delicate designs also can be made by burning through 1/16-in. plywood with a hot needle (Fig. 35). The shank of the needle can be ground to conform to the general shape and design of the tiny angles that go to make up the figures.

Small Boats

Many ship models require a number of small boats. Although these can be cut from solid blocks of soft wood, such a procedure requires careful, time-consuming shaping. A simpler way, that is equally effective,

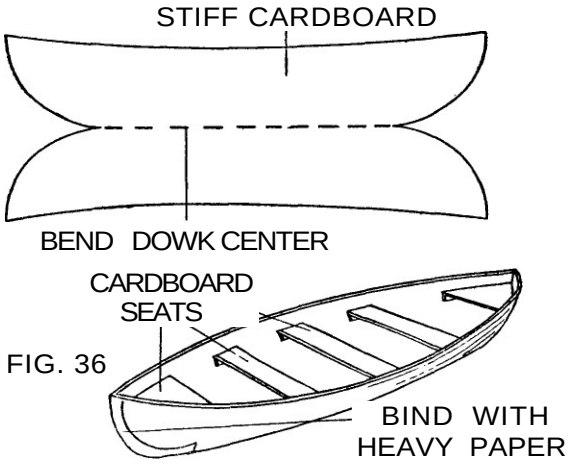


FIG. 36

is to make them of stiff cardboard as in Fig. 36. With a little practice, you will be able to cut the blanks to just the right shape to give the required length, beam, and curve. The two ends of the boats can be bound with paper, glued in place. If keels, oars, and rudders are desired, they also can be simulated with cardboard. When finished with a coat of paint, they give the effect of "in-scale" sturdiness combined with lightness that is so important in accurate models.

CHAPTER IV

TRICK METHODS AND SHORT CUTS

ALTHOUGH accuracy and authenticity are important factors in model making, many of the more difficult details in the building of ship models can be obviated through the use of timesaving kinks and simplified methods of construction.

In most cases, ship models, especially those of sailing ships, are purely decorative pieces; effect rather than workability is the desired quality. How this effect is obtained is unimportant as long as the finished product gives the appearance of life and reality.

On smaller models particularly, many of the deck fittings and pieces of rigging can be simulated with nails, tacks, wire, and other odds and ends that clutter up most household tool drawers. Small fittings can be cut and shaped from flat celluloid combs. And homemade tools can simplify otherwise difficult jobs.

For instance, chocks and bollards can be made easily without resorting to casting by cutting cardboard or thin metal to the proper shape, gluing or cementing it to the deck, and driving pins or nails in as shown in Fig. 1. If brass or other metal is used, the holes will have to be drilled exactly to size for the pins, and the pins may be soldered to the plate. In the case of bollards, it is advisable to use escutcheon pins rather than ordinary pins because their heads are a better shape.

Excellent model bollards also can be improvised by making use of the metal cases of exploded, low-caliber rifle shells. Glued, cemented, or soldered to a base of cardboard or metal and fastened to the deck, they give a realistic effect that is hard to duplicate.

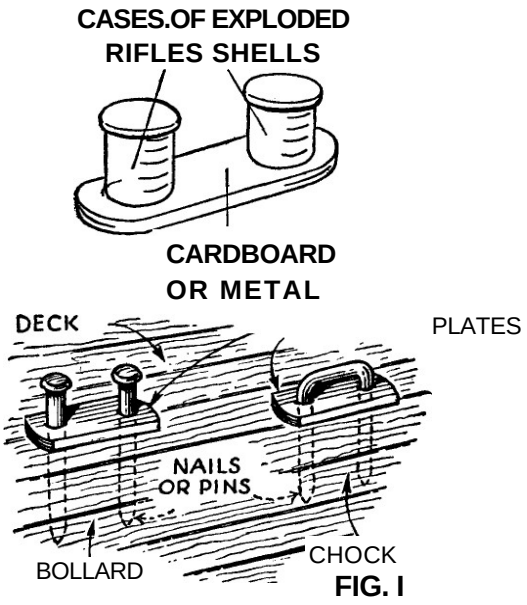


FIG. I

Imitation metal davits often can be made from ordinary fish hooks of the proper size (Fig. 2). A portion of the hooked end is cut off and the davit is fastened to the hull with a brad run through the eye at the other end. It is then a simple matter to tie and glue the threads that support the boats. The davits can be set facing either inward or outward, depending on the requirements of the particular model.

To give the effect of turned brass stanchions similar to those shown in Fig. 13 of Chapter III, an ingenious ship modeler can make use of the pins taken from ordinary hinges. The hinges can be obtained in various

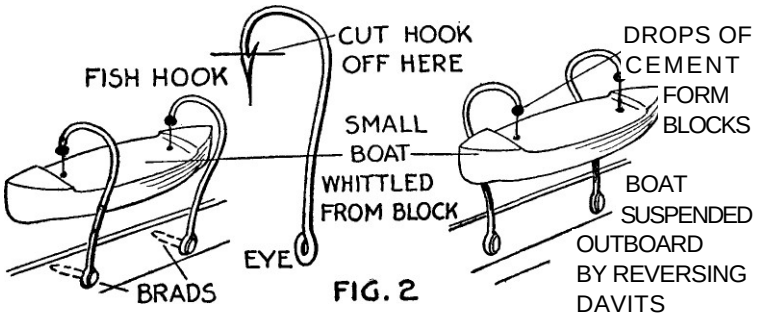


FIG. 2

sizes for five or ten cents **a** pair, sometimes for less. By selecting the right size, it is possible to make realistic stanchions for a large or medium size model.

The pins are removed from the hinges and the caps **or** knobs pulled loose with a pair of pliers (Fig. 3).

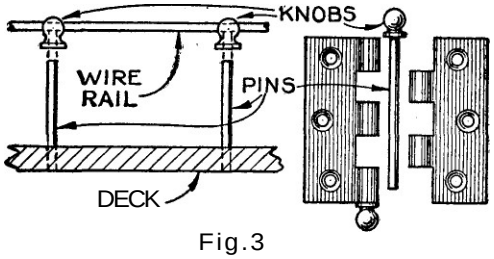


Fig.3

This is done to simplify the drilling of the holes for the top rail. The pins are then cut to the right length and inserted in holes drilled at the proper intervals in the deck. After the caps have been drilled and slipped on

the wire railing, they are moved to the correct position and the railing is bent to the required shape.

One of the most difficult jobs in the building of a small model (under eighteen inches) is shaping the tiny deadeyes that are required. Here again, the ingenious model maker can simplify the problem.

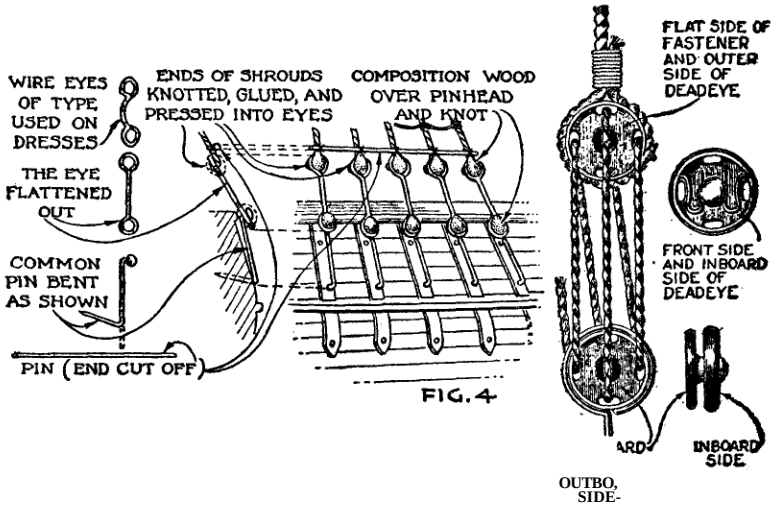


FIG. 4

A good substitute for small deadeye and chain plate assemblies can be made from pins, wood plastic composition, and ordinary wire eyes of the type that are used with hooks on women's dresses (see Fig. 4). The eyes are flattened out and applied to the rigging with knots and bent pins. After a prepared wood putty has been molded into the eyes and painted black, the imitation deadeyes and lanyards will appear quite realistic.

Although not recommended for use on large true-to-scale models, dress fasteners of the type shown in Fig. 4 also form a substitute for deadeyes. They can be

obtained at any five-and-ten-cent store, notions store, or general mail order house. The sizes range from about 3/16 to 7/16 in. in diameter.

Radio and ship model making may seem like two unrelated arts, yet your box of spare radio parts will furnish a wealth of material for ship model fittings. For example, neat searchlights for destroyer and battleship models can be made from the metal caps of

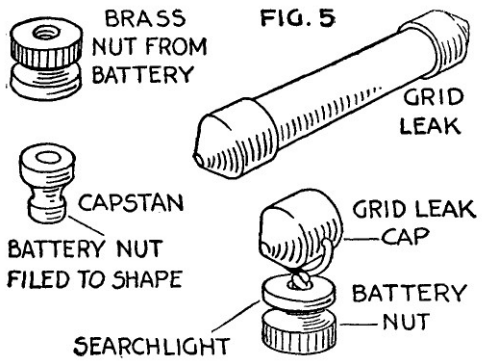


FIG. 5

discarded grid leaks. These can be mounted as shown in Fig. 5 on a small binding post by means of a Y-shaped loop of copper wire.

Similarly, the brass nuts from old dry cells will furnish excellent material for model capstans. A small amount of shaping with a file will make them look like the real thing.

The plates taken from discarded variable condensers will supply you with thin aluminum stock. An assortment of heavy copper wire can be used in making belaying pins, pintles, and many other small parts. Hard rubber panels will provide material for small fittings that must be strong and easily shaped.

Small and medium sized ship models may be simplified by making the hull in two parts. The work is more convenient to handle and the rigging can be made taut without the contortions generally necessary to tie small knots in inaccessible places.

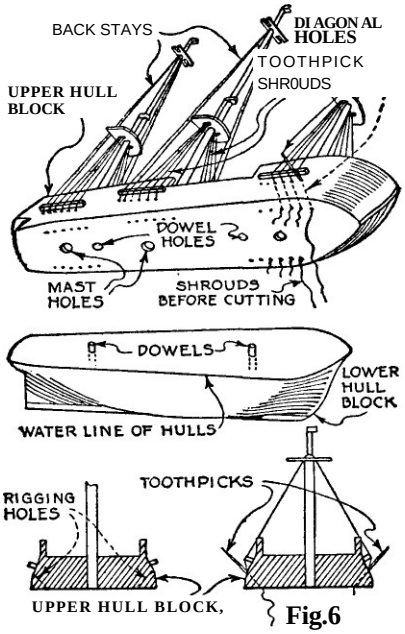


Fig.6

Two pieces of wood are selected for the hull, each one being large enough to take the deck plan of the model. As to the thickness, one should be thicker than the depth of the hull above the water line and the other slightly thicker than the hull depth below the water line. Insert dowels as shown in Fig. 6, making them tight enough to hold the hull together.

Carve and shape the hull in the usual way, pull the two parts of the hull apart, and remove the dowels. Deck fittings and other parts then can be built up, holes for the masts completely drilled through the upper block, and the two halves of the hull painted separately, making a clean-cut water line.

At the points in the sides of the upper half of the hull where the shrouds and backstays are normally attached, holes of a size a little larger than the thread to be used for the rigging should be drilled diagonally into the block and out through the bottom. The masts then can be stepped, inserted in the mast holes, and the standing rigging run right through the holes and left with long ends. The threads can be drawn taut from the underside of the upper block in pairs, one from each side of the ship, and held with toothpicks dipped in cement, pushed into the holes, and then cut off flush. To make the thread ends stiff enough to be pushed through the holes without the aid of a needle, rub the tips with a little quick-drying cement.

When the model is completed, the two halves can be redoweled and cemented permanently.

The task of shaping the sections of a mast can be simplified greatly if they are cut in one piece. Select a dowel whose length equals the sum of all the parts of the mast to be built up and whose diameter is that of the foot of the mast. Clamp a small plane in a vise or hold it between your knees as shown in Fig. 17a of Chapter III, and draw the dowel over the cutter until a good taper, from the full diameter at one end to almost a point at the other, is obtained. Smooth the resulting dowel with sandpaper and then cut the sections of the mast, starting at the large end.

On masts or mast sections that are too small to take a standard fitting, an imitation fitting can be made in the manner shown in Fig. 7. Spread a layer of cementaround the parts to be lashed, wrap four or five turns

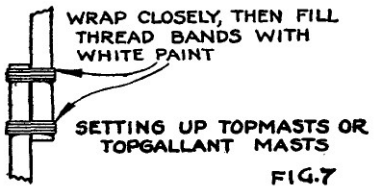


FIG.7

of thread closely together in a single layer, tie the ends tightly together, cement, and clip. When dry, give the threads a coat of white paint. Repeat the painting until the threads are well covered and the whole lashing is built up into a smooth band that resembles a genuine fitting.

An excellent simplified way of arranging the rat lines on large models as well as small ones is to resort to a

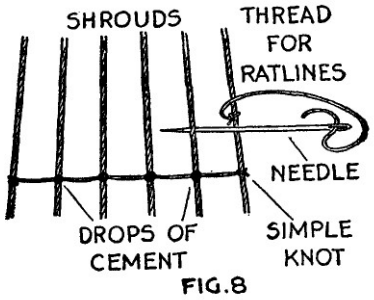
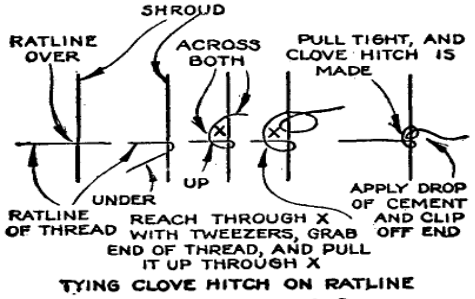


FIG.8

needle as shown in Fig. 8. Instead of tying tiny clove hitches around each of the shrouds, thread the ratline in a needle and pass the needle through the centers of the shrouds. For effect, a simple knot can be tied

at the outside shrouds. A drop of quick-drying cement placed on the joints between the ratlines and shrouds will serve to hold them in place and imitate the "hitch."

Regardless of the time required, however, many model makers look askance at any compromise as far as clove-hitched ratlines are concerned. Tying clove hitches can be simplified greatly through the use of a



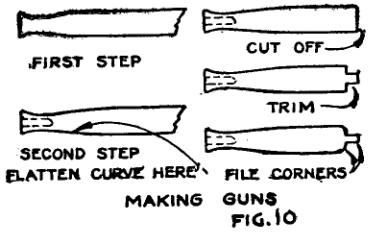
TYING CLOVE HITCH ON RATLINE
FIG. 9

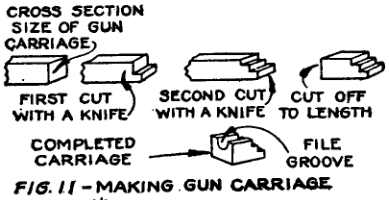
pair of tweezers (Fig. 9). Pass the ratline completely around the shroud once; then reach through the loop with a pair of tweezers and bring the free end up, thus completing the hitch. A drop of cement on the knot will finish the job.

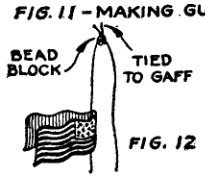
Small cannon can be simplified by fashioning them from dowel stock instead of metal. Simply place a half-round file on the bench, round side up, and rub the piece of dowel over the file, turning it in the fingers at the same time until a shallow groove is made similar to the one shown in Fig. 10. Next, with a flat file, taper the inner end of the groove and drill a small hole in the muzzle to represent the bore. Cut the gun to the desired length plus the cascabel and trim the breech

with a sharp knife. Smooth the edges of the cascabel and breech with a small spark-plug file. Paint the gun black.

For gun carriages, choose stock whose cross section is equal to that of the gun carriage and with a sharp knife cut two notches (Fig. 11). Then cut the carriage





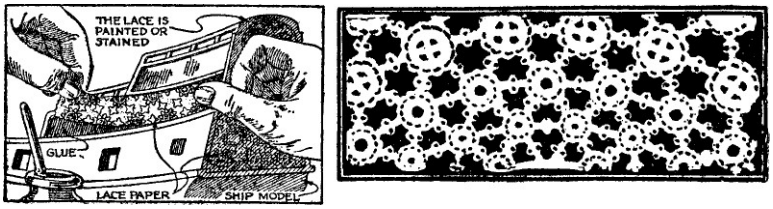


to the proper length and file a lengthwise, half-round channel as deep as the radius of the gun. The carriages can be colored with walnut stain. Finally, mount the gun in the carriage with cement.

Many models call for small sizes of chain. While these can be obtained from most ship model supply houses, the amateur often can save money by utilizing odds and ends on hand and inexpensive objects obtain-

able at notion and five-and-ten-cent stores. A short length of eyeglass chain, for instance, will serve where small diameter chain is desired. For large chain, suitable watch chains can often be purchased for as little as ten or twenty cents.

Small flags can be easily fastened to halyards if the flags are cut double as shown in Fig. 12. Fold a piece of paper and then cut the flag. The appearance of stiffness can be avoided if the flag is cut in a wavy shape as shown instead of rectangular.



F1G. 13

Ship modelers who find the decorative work about the sterns and bows of older ships such as the *Mayflower* tedious can simplify the construction by following the valuable kink shown in Fig. 13. The carving and fretwork can be simulated by applying lace paper such as is included in candy boxes or used as borders on fancy paper napkins. All that is necessary is to trim the paper to size, glue or cement it in place, and then paint over it in whatever color is desired. When finished, they will form an excellent imitation of intricate carving.

On models requiring a number of duplicate carved panels, the model maker can resort to castings made from plastic wood composition. The carving first must be made in a piece of smooth-grain wood. This serves

as the master pattern from which a plaster cast is made (see Fig. 14). Once a perfect mold is obtained, it is simply a matter of pressing the wood composition into the depressions and allowing it to harden. Like the plaster mold used in metal casting, the panel mold

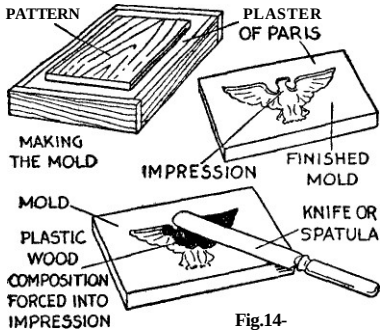


Fig.14-

also must be greased before the wood composition is applied.

Composition wood plastic also can be used for modeling figureheads. Several pins or brads stuck into the stem of the model will serve as a support to hold the composition. Apply it with your fingers and mold it into shape with pointed sticks similar to those used by sculptors. Some final trimming can be done with a sharp knife and small files. Many model makers prefer to use gesso for this work instead of the plastic wood composition.

For a large figurehead, it is better to erect a dummy stem and mold the ornament on that, gluing and nailing it in place on the model when it is finished. Figureheads also can be cast from metal or, if they are simple, they can be carved from a block of boxwood.

In cases where a number of carved duplicate panels or decorative pieces are required, the model maker also can make them of wallboard by borrowing a kink that often is used by woodworkers (see Fig. 15). If a piece of wallboard is not to be found, heavy cardboard also will serve. Even very thin cardboard may be used

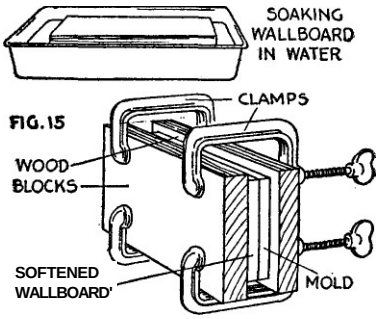


FIG. 15

provided several thicknesses are soaked in water and glued together.

A mold for shaping the wallboard is essential. This can be anything. Oftentimes, glass and metal ornaments around the home will furnish attractive designs. If a special design is required it can be carved in a piece of hard wood.

Soak the wallboard or cardboard in water for several hours or overnight until the material has swollen and become soft. Then set the mold, if it is small, on a heavy board and place on it the soaked stock in such a way that the design of the mold comes in the center. Cover the cardboard with a piece of wood and use a number of clamps to press the soft material into the mold. Tighten the clamps as much as possible and leave the mold until the next day.

When the wallboard or cardboard has dried, the design will be found firmly imbedded in it. The cast carving then can be used in the manner of a regular pressed-wood carving. It can be painted or stained to give the desired effect.

In attaching gunwales to the hulls of hollowed ships, it is often difficult to hold the thin strips in position while being shaped, glued, and fastened. For this and

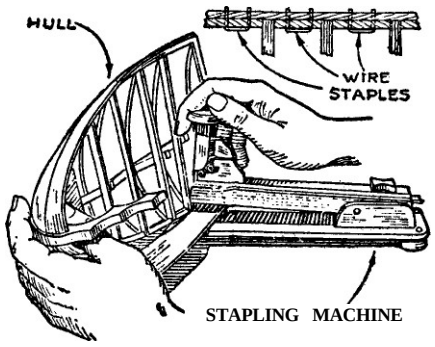


FIG.I6

similar work, an ordinary wire stapling machine intended for papers may be used to advantage. As shown in Fig. 16, it can be used to make either temporary or permanent joints in any moderately soft wood up to 1/4 in. in thickness.

As in all branches of woodworking, the work of building a model can be speeded up through the use of motorized tools. This is particularly so in the case of small parts that can be turned quickly to shape on a lathe. Of course, many model makers do not feel that they can afford a motor-driven lathe. However, a good substitute for light work can be made for very little.

If an electric motor is available, the lathe shown in

Fig. 17 can be assembled cheaply. It consists simply of an ordinary chuck mounted on the shaft of the motor. The bed of the lathe and the sliding work support and tool rest are wood. A wing nut passed through

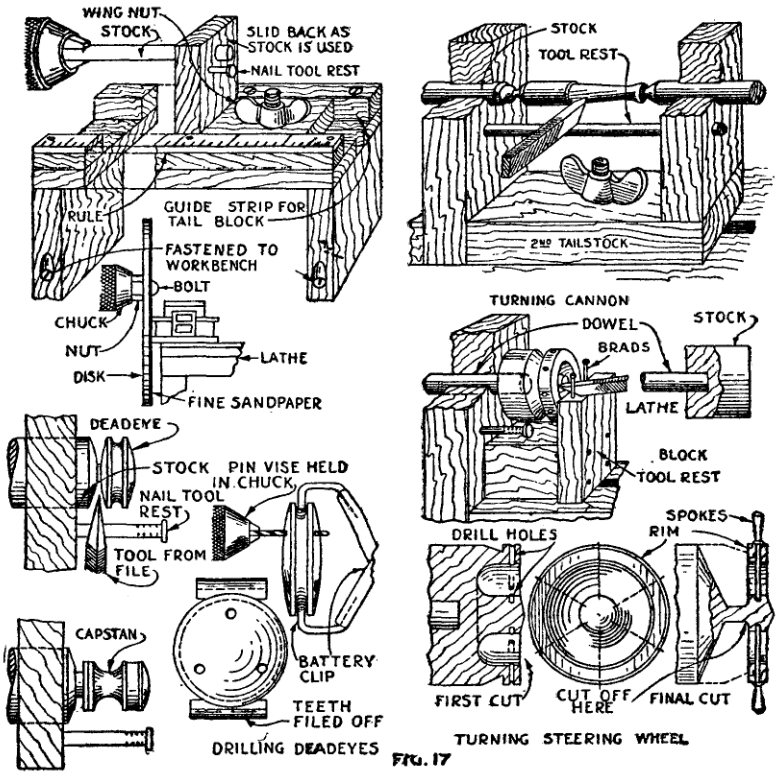
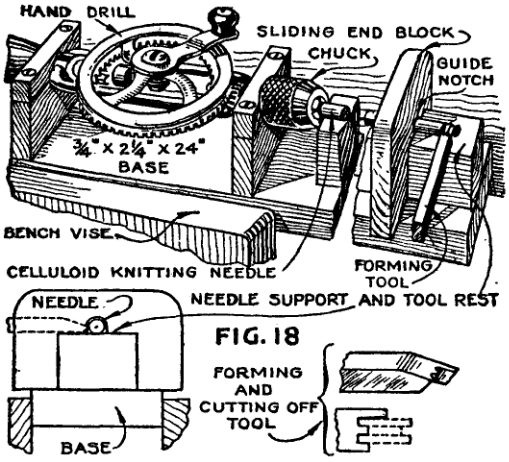


FIG. 17

a hole in the support and running in a slot in the lathe bed provides a means of locking the support in the desired position. The tool rest is an ordinary nail driven into the side face of the support below and

in front of the hole that receives the outer end of the stock. Such a lathe can be used for turning capstans, bollards, and wooden stanchions as well as deadeyes. Also, if a circular disk of wood having a piece of fine sandpaper glued to one face is fastened to the chuck by means of a bolt passed through the disk's center, the lathe can be used as a sander.

If no electric motor is available, a similar hand-driven lathe can be assembled by using a hand drill



in the manner shown in Fig. 18. Either lathe can be fastened permanently to your bench top with screws or can be held temporarily when needed between **the** jaws of your bench vise.

When a large number of square moldings must be shaped from rough lumber, you can save a great deal of time by making use of the novel cutter shown in Fig. 19. A double-edged safety razor blade is mounted on the smooth face of a flat board by means of two

blocks cut to the exact thickness of the desired molding. Screws driven through the perforations in the blade and through the blocks into the base will serve to hold the blade firmly in place. The wood, roughly cut to shape, is then forced through the opening be-

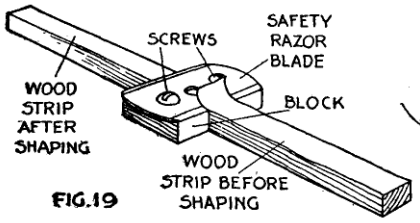


FIG. 19

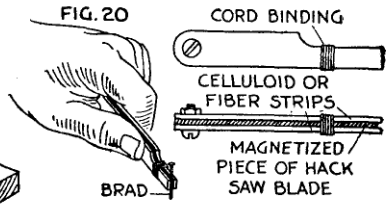


FIG. 20

tween the blocks and under the blade. The razor edge will shave off just the right amount to give the desired thickness.

If the molding is to be square, it can be run under the blade twice, once for each edge. On the other hand, if the molding is to be rectangular, a second cutter having blocks equal in height to the width of the molding can be assembled. Be sure when pushing the wood under the blade to keep it flat against the base at all times.

In almost all models there are hundreds of small brads and nails that must be driven into the hull and spars. To handle them with your fingers is a difficult feat. A simple tool that will make it easy to hold and hammer even the smallest brad is shown in Fig. 20. It consists of a short length of magnetized hack saw blade mounted between two similar strips of celluloid or fiber. A machine screw and nut hold the three pieces together at one end while a string binding serves the same purpose at the other end. The cellu-

loid or fiber strips should be slightly longer than the hack saw blade to form a shallow groove in which the brad is placed. The piece of magnetized metal will hold it in position.

Very often when you decide on a particular model you are disappointed to find that the plans you would like to use are not to the exact scale you desire. You

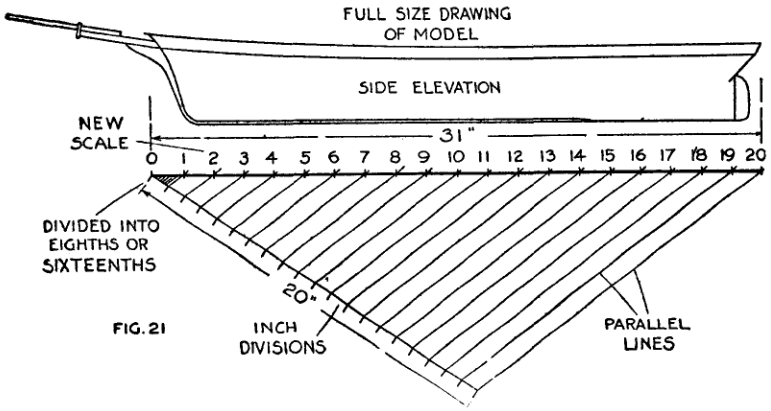


FIG. 21

may want a model for a particular place over your mantle and the plans may be for one twice that size. Such a predicament can be easily remedied, however. Plan scales and sizes can be changed quickly and easily to agree.

Suppose, for instance you have plans for a model 31 in. long but desire to build the model only 20 in. long. Directly under the side elevation of the model, draw a line AB horizontally and project the ends of the model down to it (see Fig. 21). On the full-size drawing, this line will then measure 31 in.

Next draw line AC at any angle to AB, making it

exactly 20 in. long and marking each inch as shown. Also, divide the first inch division into sixteenths or eighths. Finally draw the line BC and the nineteen other lines parallel to it, making each pass through one of the inch divisions on line AC. These parallel lines then will divide the line AB into twenty equal parts. This will be your new scale in which each division will be equivalent to 1 in. on the finished model. To make measuring easier, draw lines through the 1/16 in. divisions parallel to BC. This will give you 1/16 in. divisions on your new scale.

To measure any part or fitting on the model, set your dividers to the length, height, or width, place the divider points on the new scale line, and read off the measurement in inches. By careful drawing and measuring, you can build your model accurately to the scale you have chosen. In a similar way, other scales to give any desired overall length can be arranged. Model plans can be enlarged or reduced.

In model making, various cements and other compounds will be of great assistance in simplifying the work. While most of these substances can be purchased at hardware and model making stores, the amateur can save money by compounding his own according to well-tried and simple formulas.

One of the most useful compounds the ship modeler can make is what is known as gesso. It is particularly valuable in building up imitation carvings as already suggested.

Mixing the Gesso—First formula: Into 11/4 cups of whiting pour 1 gill (6 tablespoons) of the best obtainable liquid glue, 3 teaspoons of linseed oil, and 3 teaspoons of varnish. Mix slowly for several minutes.

If the mixture appears too thick, thin with water; if too thin, thicken with whiting. Second formula: Mix 10 tablespoons of whiting with water to a thick cream and add 6 tablespoons of liquid glue. Then mix in another dish i tablespoon of clear varnish with 4 tablespoons linseed oil. Stir the latter into the former and boil the mixture for 10 minutes in a double boiler. Both types of gesso may be applied cold and will not harden if kept in a closely corked jar.

Applying the Gesso—For a smooth surface, spread with palette or paring knife, dipping the blade into water and going over the work a second time. For haphazard patterns, especially desirable on surfaces that are to be polychromed, apply moderately thick, covering only a small surface at a time, and give a scrolled or lined effect with the point of the knife, or stipple the surface with a stiff brush. For more formal decorations, draw the design on the background and apply the gesso with a small brush, or use confectioner's icing tools or a stiff paper cone.

Finishing the Work—For a polychrome effect, gild with bronzing powder and banana oil (Roman or green gold, silver, or other colors) and, when dry, paint with artist's oil colors thinned with turpentine, rubbing off the surplus colors and blending the surface artistically with a clean cloth. A protective coat of shellac, flat or gloss varnish, or wax may be added. For an antique effect, dust the work lightly with rottenstone. The polychrome process also can be reversed by painting the surface first and then topping off lightly with rather dry bronzing colors. For colored finishes other than polychrome, use enamel, oil paint, flat wall paint, poster or water colors. Protect the

two last named with transparent shellac. Gesso also can be colored before application by mixing bronzing powders or dry colors with the paste.

Another substance that will be very useful in the model maker's shop is a quick-drying cement. To make such a cement collect old toothbrush handles and other scrap celluloid objects until you have approximately a quarter of a pound. Cut the bulk pieces into small chips and add about a quart of acetone and several tablespoons of camphor. Stir the mixture frequently until all the celluloid has dissolved. By adding about a half pint of alcohol to one-half of this mixture you can provide yourself with a second cement that will be of the slow-setting type.

By obtaining a quantity of leather dust from a neighborhood shoemaker, you can make a fast-setting plastic putty that will give the appearance of wood when it hardens. Simply add the powdered leather to 1 oz. (weight) of scrap celluloid, 1/32 oz. (fluid) of castor oil, 2 oz. (fluid) of acetone, and 2 oz. (fluid) of alcohol, stirring the mixture until the celluloid shavings dissolve and the leather is well distributed. Enough of the leather dust should be added to give the mixture the consistency of putty. If desired, a dye or oil soluble aniline stain can be added to obtain the desired color. Such a putty will be particularly valuable for hiding cracks, building up decorations, and modeling figureheads.

CHAPTER V

RIGGING AND SAILS

MUCH of the beauty of a model sailing ship lies in its sails and rigging. To give a model the desired effect of grace and motion, the spars, lines, and sails must be carefully and delicately applied with an eye for exactness and trim seamanship. Many a perfect hull has been spoiled by careless work above the deck.

Besides adding to a model the final tang of sea, both sails and rigging serve as a means of identification, classing the ship as a specific type. As shown in the sketches of Fig. 1, a model to be correct according to its type can be rigged in one, and only one, way. One of the prime requisites of a ship model maker or collector is to know and be able to recognize these fundamental riggings.

Although not every model is constructed with sails, the ship modeler, nevertheless, will be able to make a better job of the rigging if he has some knowledge of sails, their construction and function.

Actually, there are thousands of different kinds of sails, but only those of the square-riggers (see Fig. 1) are complicated. They likewise have been varied from time to time, so, for purposes of explanation, only those of the popular model period between 1850 to 1890 will be described. In fact, as far as the model maker is concerned, there has been little change be-

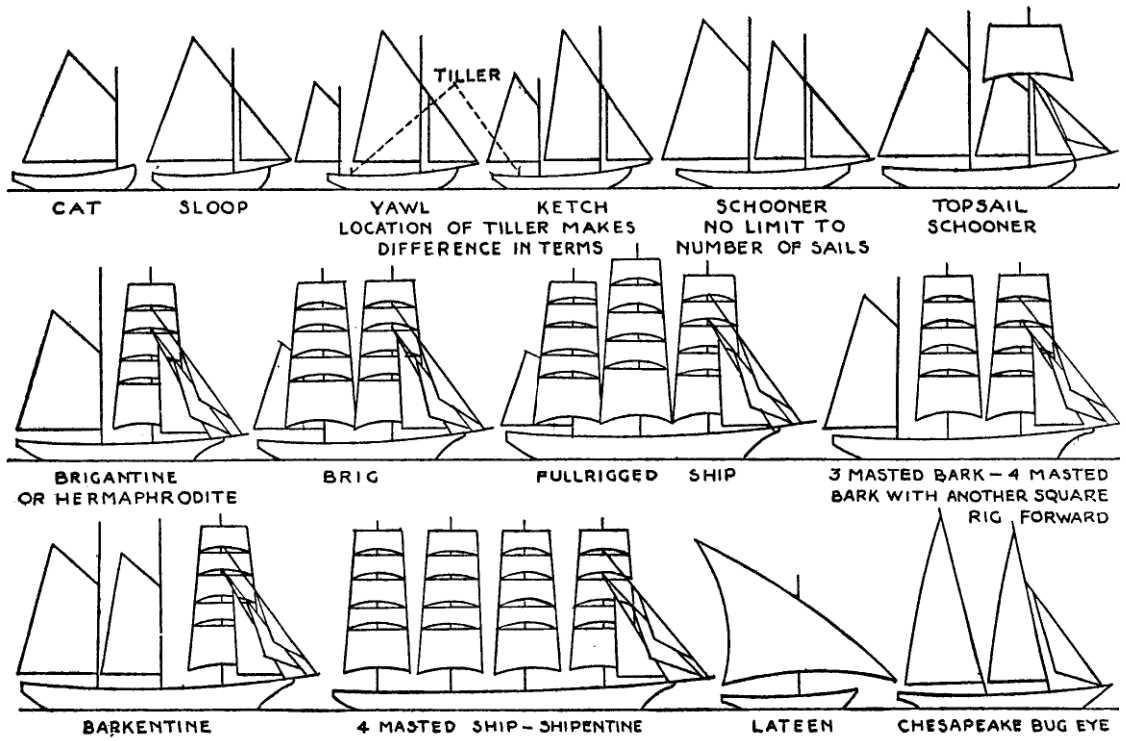

TILLER
CAT
SLOOP
YAWL
LOCATION OF TILLER MAKES
DIFFERENCE IN TERMS
KETCH
SCHOONER
NO LIMIT TO
NUMBER OF SAILS
TOPSAIL
SCHOONER
BRIGANTINE
OR HERMAPHRODITE
BRIG
FULLRIGGED SHIP
3 MASTED BARK – 4 MASTED
BARK WITH ANOTHER SQUARE
RIG FORWARD
BARKENTINE
4 MASTED SHIP – SHIPENTINE
LATEEN
CHESAPEAKE BUG EYE

FIG. 1

tween 1830 and the present day. The differences in earlier ships were chiefly in having less ironwork and baggier sails.

It was not until about 1870 that ships, especially British, began to use iron wire for standing rigging. At about 1890, flexible wire came into use for roping the heavier sails and some of the running rigging, such as braces and halyards.

Each sail that goes into the rigging of a full-rigged ship has a particular name that serves to indicate its position. Starting at the deck and proceeding aloft on the foremast, the sails are known as the foresail or fore course, the fore-topsail, the fore-topgallant sail, and the fore-royal sail. Sometimes still another sail is rigged above the fore-royal. This is known as the sky-sail. Many ships also have two topsails and two top-gallant sails. In such cases they are known as *upper* and *lower.*

In naming the sails on the mainmast, the prefix *main* instead of *fore* is used. On the mizzenmast, the sail names are prefixed with the word *mizzen.*

The yards gain their names from the sails they support. For example, the yard to which the foresail is fixed is called the foresail yard, the yard supporting the mainsail is known as the mainsail yard, and so on. Such parts as shrouds, braces, stays, lifts, and sheets also are named to refer to the part to which they are attached.

Once the model maker has these sail names fixed in his mind, it becomes a simple matter to locate the various spars and rigging. If there is any question of a doubt regarding any particular part, refer to the lettered drawing given in Fig. 17b of Chapter III.

Sails may be applied in varying degrees of completeness and exactness, depending on the type of model and its size. Decorative models such as galleons do not require a great deal of detail to give the desired effect. The methods to be given can be used in measuring the sails. They then can be hemmed, roped if desired, and finally given a few buntlines (used in furling the sails) and clew lines for effect. Then they should be hitched to the yards. The clews can be lashed to the yardarms.

With regard to the material to be used in making cloth sails, a plain white cotton will serve nicely, but many experts prefer a thin opaque linen because it can be obtained with a canvaslike texture that is a miniature version of the real thing. Although more expensive than cotton, the final effect is worth the slight additional cost.

As to the correct color, European ships use flax, which is an unbleached color when new but soon becomes snowy white under the action of the sun and salt. American ships use cotton canvas, which is white. The width of the sailcloth strips is 24 in. (full size) for flax and from 16 to 24 in. for cotton duck. For the purposes of explanation, the 24-in. width is shown in the drawings of Fig. 2.

Square sails, as the name implies, are all four-sided. On the other hand, they are by no means square, resembling more than anything else the bottom half of a triangle whose base is curved rather than straight. The top edge of the sail is known as the *head,* while the sides are the *leeches* and the bottom edge the *foot.* The strips of sailcloth are arranged perpendicular to the head, generally increasing in number toward the

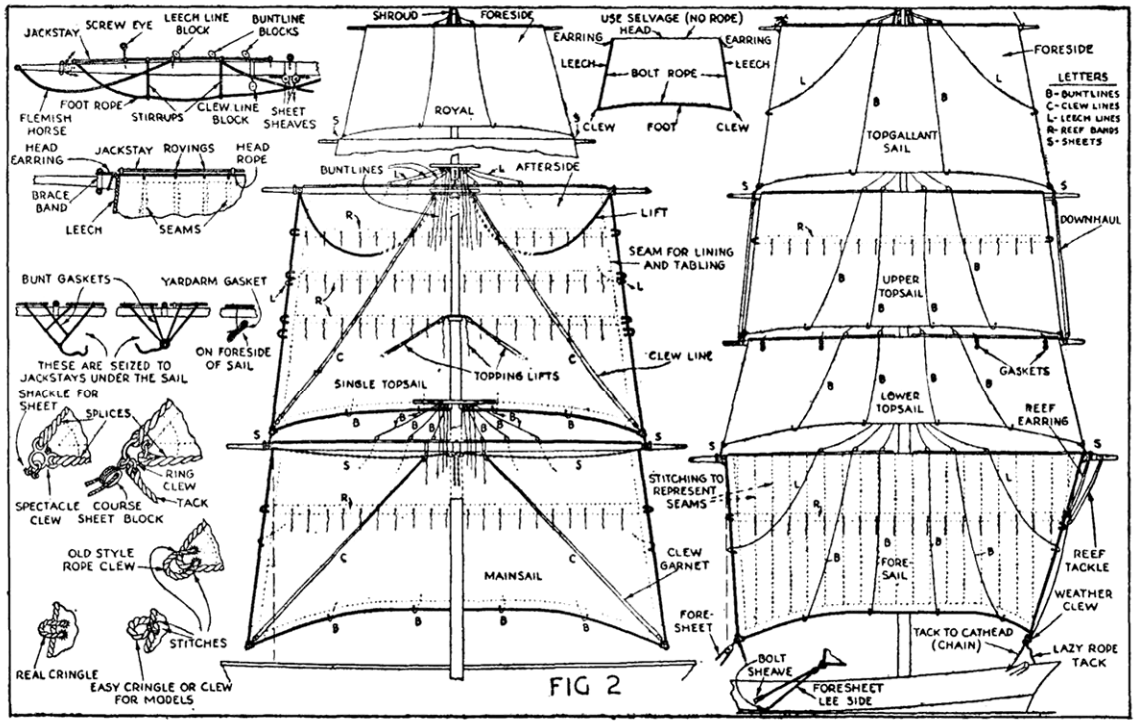

JACKSTAY
SCREW EYE
LEECH LINE BLOCK
BUNTLINE BLOCKS
FLEMISH HORSE
FOOT ROPE
STIRRUPS
CLEW LINE BLOCK
SHEET SHEAVES
HEAD EARRING
JACKSTAY
ROVINGS
HEAD ROPE
BRACE BAND
LEECH
SEAMS
BUNT GASKETS
YARDARM GASKET
ON FORESIDE OF SAIL
THESE ARE SEIZED TO JACKSTAYS UNDER THE SAIL
SHACKLE FOR SHEET
SPLICES
RING CLEW
SPECTACLE CLEW
COURSE SHEET BLOCK
TACK
OLD STYLE ROPE CLEW
STITCHES
REAL CRINGLE
EASY CRINGLE OR CLEW FOR MODELS
SHROUD
FORESIDE
ROYAL
BUNTLINES
AFTERSIDE
LIFT
SEAM FOR LINING AND TABLING
CLEW LINE
TOPPING LIFTS
SINGLE TOPSAIL
STITCHING TO REPRESENT SEAMS
CLEW GARNET
MAINSAIL
FORE-SHEET
USE SELVAGE (NO ROPE)
HEAD
EARRING
LEECH
BOLT ROPE
CLEW
FOOT
FORESIDE
LETTERS
B-BUNTLINES
C-CLEW LINES
L-LEECH LINES
R-REEF BANDS
S-SHEETS
TOPGALLANT SAIL
DOWNHAUL
UPPER TOPSAIL
GASKETS
LOWER TOPSAIL
REEF EARRING
REEF TACKLE
FORE-SAIL
WEATHER CLEW
TACK TO CATHEAD (CHAIN)
LAZY ROPE TACK
BOLT SHEAVE
FORESHEET LEE SIDE

FIG 2

foot to take care of the added width toward the bottom.

To take the measurements prior to making up a sail for a model, hoist the yard to the position it is to assume, measure along it from brace band to brace band for the head, then deduct about 12 in. (reducing the measurement to the scale of the ship, of course). Measure from the top of the yard to the top of the yard below for the drop. Measure the yard below from sheet sheave to sheet sheave for the foot, and deduct 2 ft. (to scale) from each measurement to allow for the clews. Lay this out on paper, then from the foot mark the roach or curve. This must be high enough to clear the stays passing beneath the sail when it is flat on the mast. When the sail has been drawn, cut along the lines to obtain the pattern.

Before cutting the material, test a piece of it for stretch, deducting accordingly from the pattern. Then, in turn, allow about one in ten parts extra on the leeches (sides) and foot (bottom); this will be taken in again when sewing on the bolt ropes in order to give the sail the slight belly that will make it look realistic.

This process will apply to all square sails, excepting the courses (lower sails) on any vessel. The depth of the foresail is to a line level with the cathead, less about 5 ft. (full size) in height. The length of the foot will be from the same point when the yard is braced "sharp up," less about 2 ft. (full size). This makes the foresail narrower at the foot than the head. The mainsail clew should come to about 3 ft. (full size) from the rail at the after end of the forerigging when the yard is braced sharp up. As indicated, all these measurements should be to the scale of the model.

Mark the fabric from the paper pattern you have made, allowing about 5/16 in. for the hem. If possible, use the selvage of the material for the head to save hemming. Then run very thin pencil lines up and down the sail at 2-ft. intervals, and on them run rows of fine stitching to represent the seams between the strips of sail cloth. The pencil marks should serve only as a guide for the sewing and can be erased when the work is completed. The sails also can be given a wide (half-cloth) hem to represent the lining, which is a piece sewn on for additional strength, the real hem being called the *tabling*. The leeches and feet of the courses and topsails can be roped with brown cord equal to No. 20 gage wire. On the smaller sails, thinner cord should be used. This is stitched to the edge of the sail, on the after side. Cringles (side loops) can be worked with thread as shown in one of the details of Fig. 2, but are more easily and better represented by making a small bight loop in the bolt rope (also shown in Fig. 2).

On the larger sails, spectacle clews can be made of wire with the bolt ropes spliced into them. For the topgallant sails and those above, the clews can be bights stitched into the bolt ropes.

Reef bands can be two rows of stitching spaced half of a sailcloth strip apart. The reef points can be imitated by passing a length of No. 24 white thread through the sail from the front to the back and then back just below through the sail and the first part, and then back through the first hole, forming an end on each side of the sail. Snip off the excess thread and repeat. The large clipper ships usually had one reef band on the topgallant sails; single topsails have from

two to four; double topsails have one on the upper topsail, none on the lower; courses have one or two.

Before the sails can be fixed, the necessary blocks and other gear should be fitted. The yards must have jackstays (see detail Fig. 2); in fact, they should have these even if there are no sails. On an actual ship, they generally are 1 in. diameter iron rods fastened on top of the yards with a series of small eyebolts. They can be simulated on a model with No. 24 hard brass wire held in position with eyes made by bending 1/2-in. bank pins. To prevent the wire from sliding out bend the inner end sharply and drive it into the yard. In assembling jackstays, remember that they should not quite reach the middle or the ends. They are painted, black.

To the jackstays of the courses and single topsails, three small blocks should be seized on either side for the buntlines (B) and the leech lines (L). For double topsails and topgallant sails there should be two on a side; for royals and skysails, one on a side.

To the under-fore-edge of the tops, bolt or seize three single or one double and one single block on each side, and do the same under the crosstrees for the buntlines and the leech lines. For a lower topsail and the upper sails, seize them under the shrouds.

On the yards, you may legitimately use bull's-eyes instead of blocks. These can be small beads. Since the actual running gear on a ship varies from about 1/4 to 1 in. in diameter, you are not likely to make the rigging too light or the blocks too small.

The sail is stretched to the yard with the head *earrings* of thread carried to the brace-band eyes, with a couple of turns around the yard. The rovings between

the sail and the jackstay can be imitated with loops sewed around the jackstay to the head of the sail.

Once the sail is fixed, tighten the halyards, bring the clews down with the sheets, and belay them. With a needle, hitch the leech lines and buntlines to the edges of the sail as shown; reeve them through the yard leads; through the blocks above, and down abaft to the pinrail at the bulwarks. Start the clew lines at the heel of the quarter blocks and carry them through the hook blocks hooked to the clews, through the quarter blocks, and, in the case of the courses, down through the lubber holes to the fife rail. In the case of the clew lines above, carry them to the pinrail.

The yard lifts hang down abaft when the yards are hoisted, but the topping lifts of the lower yards are tight, keeping the whole series horizontal.

The clews of the courses are tacks when to windward and forward. They have a permanent single rope (lazy tack), which, in the case of the foresail, is finally fixed with a chain and tackle to the cathead, and, in the case of the mainsail, to a bolt extending up from the deck and having an eye above the pinrail. On the lee side, the clews are sheets, which are heavy ropes hooked to a bolt in the ship's side at the deck level, outside. They pass through a heavy block at the clew and through a sheave in the bulwarks abaft the rigging, and are belayed to a pin.

If desired, the fixing of the sails and the jackstays can be simplified. The jackstay can be a straight wire with bent ends set in small holes having the sail attached to it by seizings of thread.

The wire jackstay having no eyes to hold it in place can be easily removed with the sail. When in place,

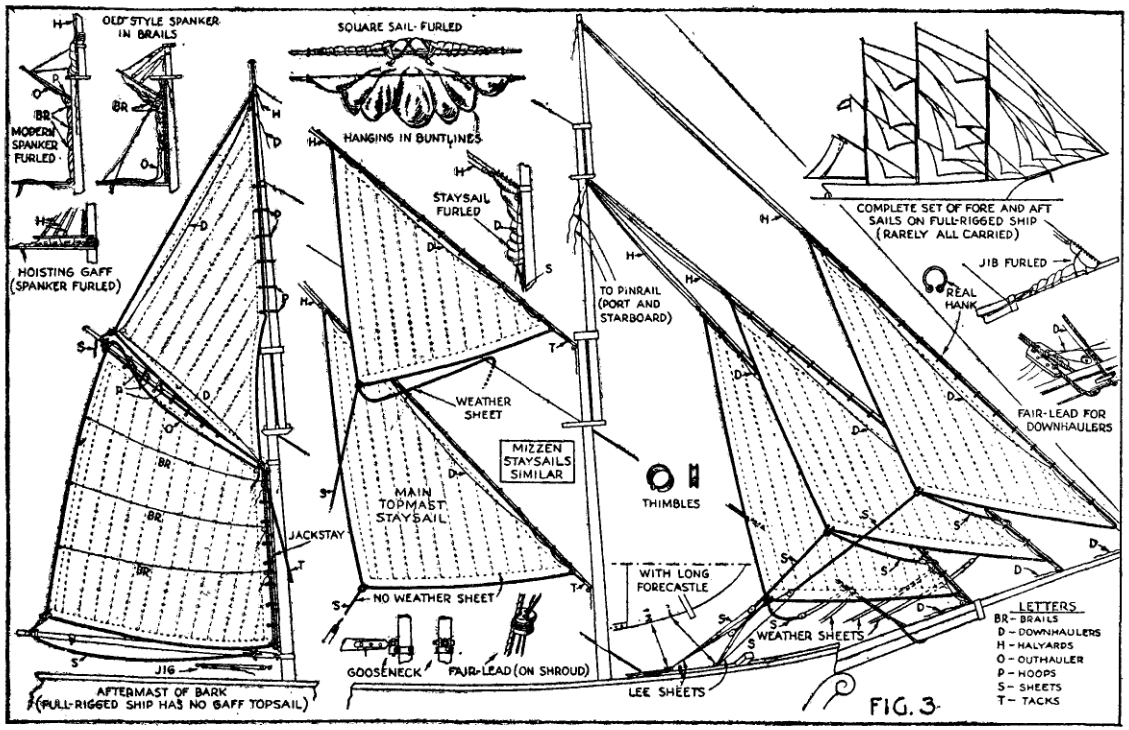

OLD STYLE SPANKER IN BRAILS
MODERN SPANKER FURLED
HOISTING GAFF (SPANKER FURLED)
SQUARE SAIL FURLED
HANGINS IN BUNTLINES
STAYSAIL FURLED
TO PINRAIL (PORT AND STARBOARD)
WEATHER SHEET
MIZZEN STAYSAILS SIMILAR
MAIN TOPMAST STAYSAIL
JACKSTAY
NO WEATHER SHEET
THIMBLES
WITH LONG FORECASTLE
WEATHER SHEETS
LEE SHEETS
GOOSENECK
FAIR-LEAD (ON SHROUD)
JIB
AFTERMAST OF BARK (FULL-RIGGED SHIP HAS NO GAFF TOPSAIL)
COMPLETE SET OF FORE AND AFT SAILS ON FULL-RIGGED SHIP (RARELY ALL CARRIED)
JIB FURLED
REAL HANK
FAIR-LEAD FOR DOWNHAULERS
LETTERS
BR - BRAILS
D - DOWNHAULERS
H - HALYARDS
O - OUTHAULER
P - HOOPS
S - SHEETS
T - TACKS

FIG. 3.

two swivel hooks indicated as A hold the bent ends of the jackstay in the holes. These swivel hooks can be formed from small brass nails. As before, the blocks for the buntlines are seized to the jackstay.

Besides square sails, a full-rigged ship also must be fitted with fore-and-aft sails. In Fig. 3, is shown a sketch of approximately all the fore-and-aft sails a full-rigged ship ever carried. There are seventeen of them in all. Under all plain sail they did not, however, often set more than the following: fore topmast-staysail; inner, outer, and flying jibs; main lower, topmast, and topgallant staysails; mizzen lower, topmast, and topgallant staysails; spanker; and possibly a ringtail. Studding sails are extraneous to the regular rig and quite unnecessary on a model.

The material and general method of making fore-and-aft sails are the same as for the square sails. To measure a headsail, the height on the stay will be about from the middle of the topmast to about 2 ft. from the jib boom. The angle of the foot is governed by the rise of the bowsprit *(steeve)* and also depends to some extent upon where the sheets are to be belayed. The flatter the stay, the longer the foot, so that the sheet will bring a fair strain from clew to stay.

As with the square sails, imitation stitching should be run in the sails to imitate the seams. However, on fore-and-aft sails these should be parallel to the after leeches. The fore leech is best if made with a selvage edge, but if necessary it can be hemmed like the others. The clews may have round thimbles stuck in them, but they are absolutely necessary only on the sheet clews. The others can be bights in the bolt ropes, which are sewn to the port side.

Eyelets, if you can find some small enough, serve well for thimbles. They also can be made by filing a deep groove in a piece of brass tubing and then cutting off the thin section.

No reefs are necessary in the fore-and-aft sails, though some of the oldtimers had one or two in the spanker.

The staysails between the masts are made in the same way as the headsails.

There are a number of different types of spankers. The one shown in the drawings is for a fairly modern bark. The fore leech is seized to a jackstay on the mizzenmast. The head has hoops to the gaff and is hauled out with an outhauler over a sheave at the end of the gaff. The sheet is a single rope or chain and sets up with a gun-tackle purchase to the mast or a cleat in the boom. This particular sail has three brails clinched to the after leech by which it is furled to the mast (see detail).

The gaff-topsail is a sail for barks, barkentines, hermaphrodite brigs, schooners, or other rigs where the mast is fore-and-aft only. It hoists with hoops on the topmast by a halyard to the masthead, either over a sheave in the mast or with one or two blocks rigged to the mast. The sheet hauls out to a sheave in the gaff, outside the eyeband. The tack is loose and has to be dipped over the span or peak halyards when the ship goes about, so that it will be to leeward of them but to windward of the gaff. The downhaul is variously rove, usually going straight up to the peak, through a block or thimble, to the clew, and clinching at the tack clew.

The jibs and staysails on a ship are seized to hanks

on the stays at intervals of about 30 in. (full size). A detail of a real hank is shown, but for a model rings will serve. For large scale models, suitable rings can be found at fishing tackle stores. For small work, cut up a piece of chain, rounding the links by forcing them onto a crochet needle or a brad-awl. If you desire, you also can make them from wire.

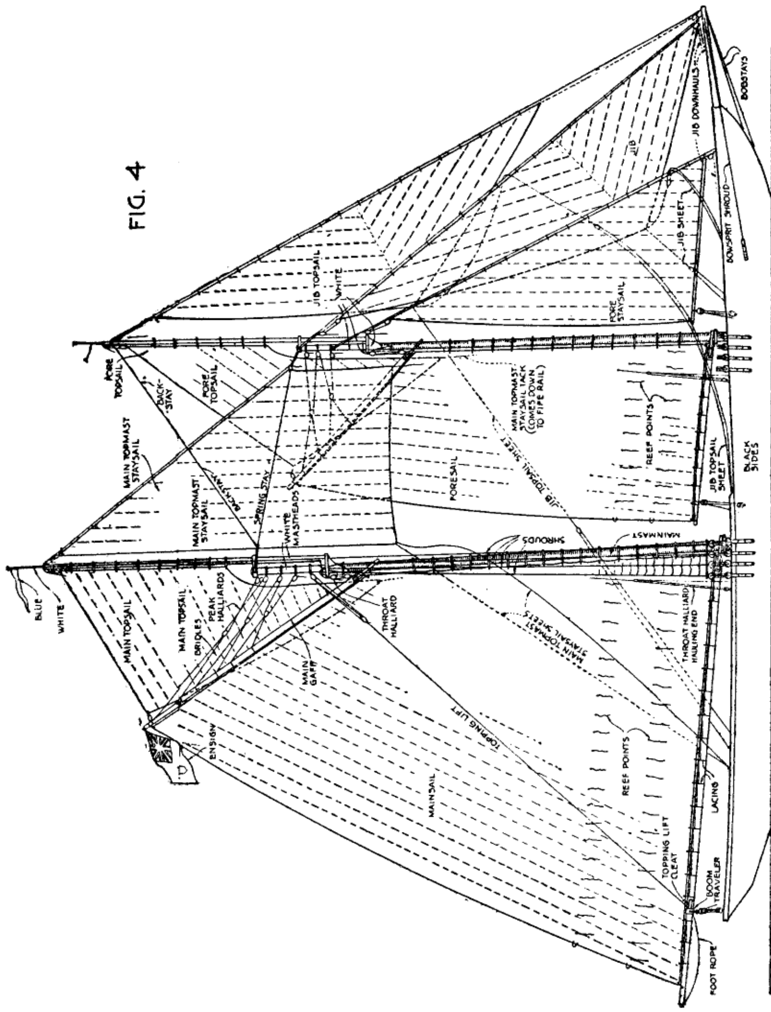
A short tack or lashing is needed to keep these sails from running up the stay. The halyards usually are a single block at the peak and another at the masthead. The fore-topmast-staysail block is to port and the others alternate.

The headsail sheets are double, with longer or shorter pendants, a heavy block, and a whip. The lee sheet is hauled tight and the weather one hangs slack over the stay, but the end is not entirely let go. One end of the whip hooks to a bolt in the deck; the other comes through a fairlead in the deck and to a belaying pin.

With a long forecastle deck, as with most clippers, these deck bolts were on the forecastle as shown in a detail, and the ends were led either to the main deck pinrail or to cleats on the forecastle. With a short forecastle, both ends come direct to the deck. The main staysail sheets usually are single and belayed under the rigging.

Many model makers prefer the sails hanging limp as in a calm, but they can be bellied out stiff as if filled with the wind. Although there are various ways of obtaining this effect, one of the best is to carve a piece of wood to the general shape of the largest sail, giving it just a trifle more belly than is desired. Put a piece of waxed paper on this and stretch the sail over

FIG. 4



SAIL PLAN

it, pinning it straight along the head but dragging it a bit to the sheet clews. Then, if you wish it to be white, rub in one heavy coat of white lacquer paint and allow it to dry. If you desire an unbleached tone, use clear lacquer.

Round the block a trifle more for the next size sail, and so on. It will help these sails to keep their belly if you run stiff wire up through the leeches before painting. Let the ends of the wire project a little at the top and bend the points down and stick them through the yards.

A model looks best with some of the sails set and some furled. If you are going to furl the sails, make them of the thinnest possible material, otherwise they will not stow neatly.

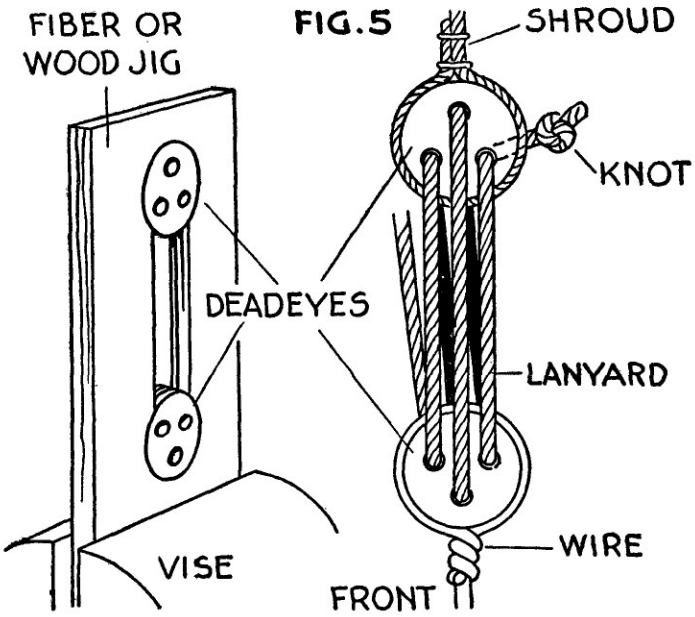
A schooner's sails (see Fig. 4), with due allowance for the difference in shape, will be much the same as those described, although always fitted with a hoisting gaff. There are no brails, but possibly lazy jacks instead.

As with the hull construction and the making of small parts there are various hints and kinks in rigging that will help the model maker to save time and obtain a more perfect job.

For example, in rigging the deadeyes and lanyards, the work can be speeded up through the use of the simple jig or rigging block shown in Fig. 5. It consists simply of a piece of fiber or wood supplied with two holes the size of the deadeyes to be used and a connecting slot. The two deadeyes to be rigged are placed in the holes, which are spaced the proper distance apart (generally from three to four times their diameter) and the lanyard is rigged as shown. When completed,

the deadeyes can be removed from the jig simply by pushing them out.

A discarded piano stool of the revolving type or a home-made turntable will be a useful aid when rigging a model. Simply place the model, supported in its



temporary or permanent stand, on the turntable or stool. It then can be turned to any position quickly and easily.

As already suggested, a crochet needle and a pair of tweezers will make the handling of the small fittings and rigging simpler. To these rigging tools you should add a sharp pair of medium size scissors, a pair of nail scissors, a bottle of quick drying cement, a sewing

machine if one is available, and a good supply of needles and thread, both black and white.

Since the rig of most ships is their characteristic feature, and since clean-cut, seamanlike rigging is always the distinguishing mark of a fine model, it is imperative that the rigging of any model be taut. Some model makers obtain this trim effect by using copper wire wherever possible. However, it should not be done to excess. Linen thread and fishline of the proper size, when tightly rigged, is hard to beat as far as realism is concerned. If it is necessary to stiffen a cord, rub some beeswax over it and pass it momentarily over a flame.

One of the greatest problems that face the amateur who is about to rig his first model is what to use for the various lines, shrouds, and stays. Most ship modelers are guided by the following general classification: Shrouds, stays, and topping lifts, thread fishline; halyards and sheets, linen cord; and downhauls and light lines, sewing thread. On models of later sailing ships, the standing rigging should be black (to represent coal-tarred surfaces) and the running rigging should be manila-colored (tan).

CHAPTER VI

DECORATING AND FINISHING A MODEL

IN applying the decorations and finishing touches to a model, the craftsman should be guided by the type, nationality, and period of the ship. If your plans do not give the exact coloring, look up a historical description of the vessel.

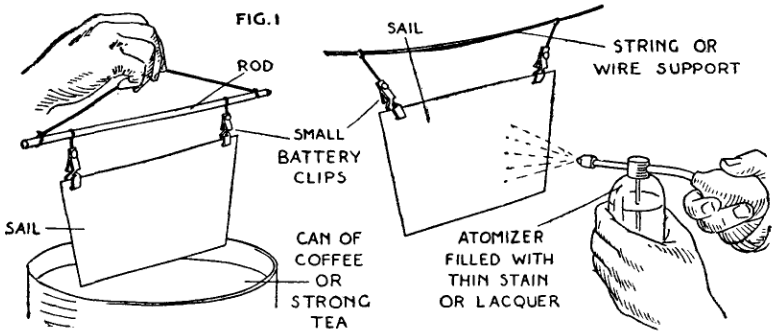
Most ships built before the beginning of the sixteenth century were made largely of unpainted wood. Presumably they had unpainted upperworks and were tarred and oiled outside, with an occasional touch of color. In this particular period, oak was the favorite wood for ship building. Since soft woods are best for model making, however, the worker can obtain the same effect by using pine and staining it. If a tarred appearance is desired, it can be imitated with a mixture of mahogany and walnut stains.

The underwater portions of ships of this particular period usually were tallowed. To imitate this, the model maker can use white paint with some blue and green rubbed in with a thumb at the bends and along the keel.

Many ship modelers antique their models of early ships. This does not mean that the model is covered with muddy paint and made old and ragged looking. A little unevenness in the staining, with some darker stain rubbed in at the corners will give just the desired

effect. Raw sienna and Vandyke brown or burnt umber are the most useful antiquing colors.

To obtain a weathered effect on the sails (Fig. i), they can be dipped in coffee or tea or they can be painted or sprayed with a thin stain or lacquer. On models of very old ships, some model makers feel that it gives the rigging a touch of realism to slit the mainsail and neatly "repair" the damage with a needle



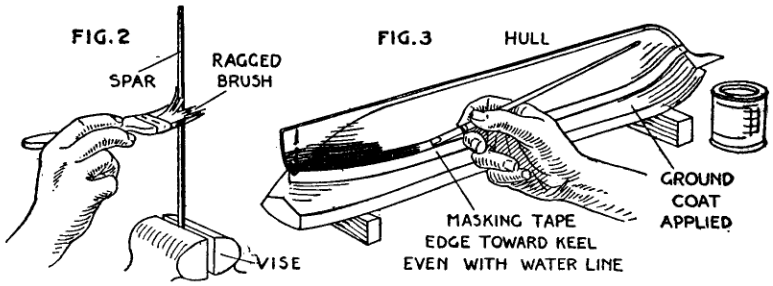
and thread. Such forms of decoration must be subtle, however, or they will ruin the entire effect of the model.

The masts on ships of any period can be assumed to be pitch pine, which is much like Oregon pine. This is a burnt sienna color and can be simulated on a model by painting the spar with a thin coat of transparent color and then, if it is large enough, by combing it down with a ragged brush to give a long grain effect (Fig. 2).

Ships of the late sixteenth, seventeenth, and eighteenth centuries were much the same as those in the earlier periods except that they generally boasted more paintwork. The Elizabethan ships were especially gay,

their fancy patterns giving way in time to red, black, yellow, and white stripes with a predominance of light blue on Catholic ships. In models of this type, several ground coats should be given the wood before the final finish is applied.

During the late eighteenth and early nineteenth centuries, ships were painted all over, except for hardwood and rails, carved work, and similar parts. Even



the masts, with the exception of the span between the doublings, were painted white or black and sometimes both white and black. To be accurate, models of such ships should not be antiqued at all. The actual vessels were always kept smart and trim, and the same neatness should be reproduced in the model. A neat but not a *slick* paint job should be the modeler's aim.

The same suggestions hold true for the clipper ships and from that period on up to the present day. To look realistic, models should have a neat, sleek, graceful, but not yacht-like appearance.

Since the modern sailing ships differ only slightly from the clipper, the amateur model maker can use the process of decorating a clipper ship as a guide for other similar models.

As already suggested, the actual painting of the hull should be completed before any of the rigging is set up so that you can rest it keel up to dry. If the hull is to have a real sheathing of copper as described in Chapter II, this should be put on first. If not, then the hull should be carefully sandpapered and a thin coat of paste wood filler applied. This will dress the surface for the ground coat of white paint. If any dents, rises, or scratches show up in the hull when the ground coat dries, they should be removed immediately to avoid future trouble.

Two or three coats of flat white then should be applied. Allow each to dry thoroughly and rub it down with No. 00 sandpaper. Following the suggestion shown in Fig. 12 of Chapter II, draw in the water line to the proper height. Then, directly above the water line and following the curve, lay a strip of decorator's masking tape or ordinary gummed paper having a smooth edge (Fig. 3). Finally, paint up to this to imitate copper, using a mixture of burnt sienna and Indian red to give the proper color. Work in some emerald green in the bends to simulate verdigris. Artist's oil colors can be used for this blending work.

When this has dried, remove the tape and place another strip below the water line, covering the paint and exactly meeting its upper edge. Then apply the color to the upper portion of the hull. Coach paints ground in Japan will be satisfactory for this work. Thin the color with turpentine and brush one coat on top of another until a good body is built up. Then very carefully sandpaper the surface and rub it down with powdered pumice stone. Finally, give it a few more coats, using less turpentine but adding varnish in increasing

proportions. The final coat should be almost an enamel. If you feel that the final gloss is too high, rub it down with pumice stone or sandpaper it lightly and apply a thin coat of dull-drying varnish. The lower part of the hull can be treated in the same way. To keep the decks clean, give them a coat of clear lacquer or varnish.

Flake white artist's paint can be used inside the bulwarks and for deck nouses and similar parts. This will have a tendency to turn slightly yellow with time, which will be sufficient antiquing. These parts and the masts should be finished as the work of assembling progresses, preferably before being fastened in place.

Although lacquer colors can be used in painting a model, most experts prefer ordinary oil paints. There are, however, some occasions when a lacquer will come in handy. Glue will not adhere to oil paint, but the cellulose type of household cements will stick to lacquer because they soften it and reach the wood below. It is therefore more convenient sometimes to lacquer any particular part that will have other parts cemented to it.

Boxwood fittings can be given a metal finish through the use of a black brushing lacquer (cellulose enamel) and colored bronzing powders. Paint the part with the lacquer, dust on the bronzing powders, and deaden the colors slightly by daubing them with a brush.

Places where rust would ordinarily appear in time on a ship can be imitated on a model by dusting a rust-colored pigment or bronzing powder onto the moist paint or lacquer. Such places as the sides of the hull under the anchor and below the scuppers can be treated in this manner.

The deck ironwork usually was black, but sometimes green. Aloft, the ironwork usually was the same color as the masts and spars, but sometimes was black on white wood. Mast bands frequently were painted in this way. The iron on natural colored spars might be either black or white.

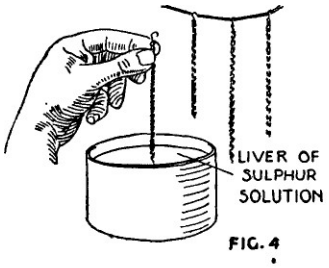


FIG. 4

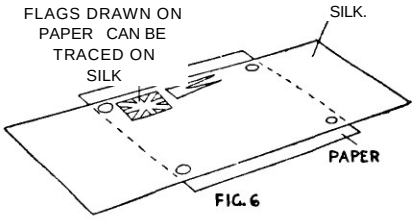


FIG. 6

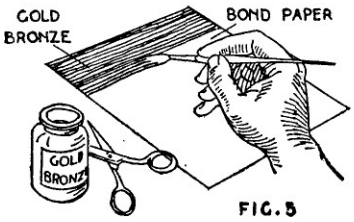


FIG. 5

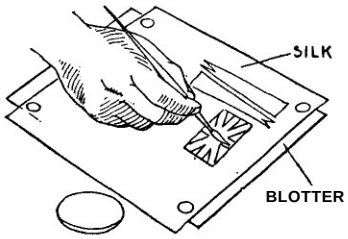


FIG. 7

Blocks on early ships appear to have been unpainted, but in later vessels they were painted to harmonize with the spars. Deadeyes should be painted black since they invariably were given a coat of tar along with the lanyards. Anchors and oldtime guns always were painted black.

Chain also should be black, never gold or silver. The best way to blacken brass or copper is to dip it in a solution of liver of sulphur (Fig. 4). If paint is preferred, there is a mat lacquer used for painting the

metal work on cameras that is excellent for model work. This also can be used for touching up the rigging where necessary.

A beautiful green patina also can be applied to brass and copper work to give the appearance of age by using the following solution: ⅜ oz. crystallized iron chloride, 2 oz. ammonium chloride, 1 oz. verdigris, 11/4 oz. sodium chloride, ½ oz. potassium bitartrate,
and 16 oz. of water. Apply the solution to the clean metal with a soft brush and allow it to dry, Several applications may be necessary. After the patina has been built up to the desired thickness, it may be stippled with a damp brush to get the variegated color that we find on old bronzes.

With regard to the gilded parts on a model, a book of gold leaf costs very little and lasts a model maker's lifetime. It can be applied easily and gives an appearance that is hard to obtain with ordinary gilt paint. Japan gold size generally is used to make it adhere, but the model maker can obtain satisfactory results by using thin shellac, varnish, or glue. Apply the adhesive and allow it to get tacky before applying the gold leaf. Cut the leaf to shape with a sharp razor blade and apply it with a dry camel's-hair brush which has been drawn over the coat sleeve or hair several times.

Many of the oldtime ships had a large amount of flat gold decoration. To bronze or gold leaf some of the tiny designs and emblems is a task that takes plenty of patience. A simpler method is to gold-bronze a half dozen sheets of high-grade bond paper and cut out the figures with small scissors and a penknife, gluing them where you wish (Fig. 5).

Almost every model will call for flags. There are

various ways of making these. One way is to use a regular textile paint, painting all of the flags at one time on a large sheet of silk. Each piece then can be cut out roughly to shape, warped to the proper shape to give the effect of realism, and then sprayed with clear lacquer. As soon as they are stiff enough to handle, they can be trimmed with manicure scissors to the exact size and shape.

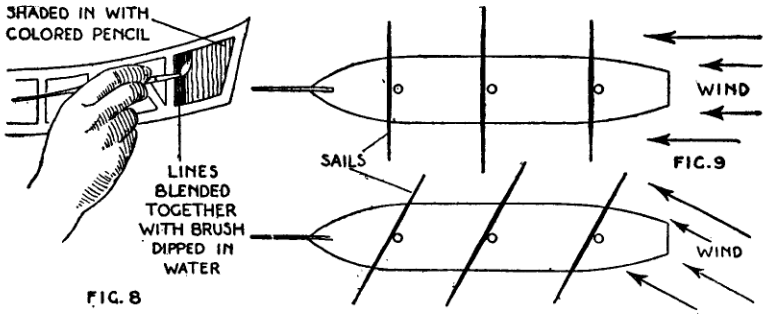
Another, and perhaps simpler way, is to draw the flag pattern on heavy paper, pinning the silk over this so that the lines show through (Fig. 6). Artist's water colors can be used by mixing gum or fish glue with the water to prevent them from running. Oil colors also can be used, if most of the oil is extracted from them by placing them on blotting paper and then mixing them with any of the liquids sold for painting fabrics. If such a liquid is not easily obtained, rub a "pounce," such as is used to prepare tracing cloth for inking, into the silk to prevent the color from spreading. Another way is to place the silk over a blotter for the painting process (Fig. 7). The absorbent surface of the blotter will take up the excess color and prevent it from spreading.

Tinted shellac of the type used to finish lamp shades also can be used for striping and decorating flags and sails. First, however, it should be exposed to the air until it has thickened to the consistency of paint. It will not run on the cloth and it will not make the cloth thick or heavy as it penetrates well.

The important thing to remember about pennants and flags is to rig them properly. Flags on sailing ships will follow the direction of the wind and not the direction in which the boat is sailing. If you wish the flags

to stand out, stiffen them along their upper edges with a short piece of piano wire.

A relatively new type of indelible pencil also comes in handy for applying delicate decorations on the model, for coloring flags and pennants, and for marking out small panels. The pencils, which are made in twelve colors including black, have thin leads so that they can be sharpened to fine points and used like an ordinary drawing pencil. They make possible the draw-



ing of the finest lines and the most elaborate ornaments.

When the decorations have been applied and shaded as desired, a fine camel's-hair brush can be dipped in water and used to blend the individual strokes together wherever necessary (Fig. 8). On woodwork and metal parts it will be necessary, of course, to apply a ground coat of flat white, light gray, or light brown paint to serve as a foundation. On cloth flags, the pencils can be used without any preparation and no further treatment with water will be necessary as the strokes will blend together very well. On paper flags and pennants,

however, the brush and water treatment will give a better effect.

Any surfaces decorated in this way can be given a protective coating by spraying on a coat of thin shellac or artist's fixative. In fact, you will find it possible to brush on a coat of thin shellac without disturbing the colors if a very soft brush is used and the work is done quickly.

In the case of a model of a known ship, its name should appear on both sides of the bow. The stern also should bear the name as well as the port of registry. If you are a neat letterer with a brush, paint these on in white. If not, make outline drawings of the three names on a piece of paper. Then paint around the letters with the desired color, leaving the printing white. Finally cut as close as possible to the letters and glue the paper "nameplate" in position.

Still another way of overcoming the nameplate problem is to letter the name neatly with a fine pen on a piece of tracing cloth. By using tracing cloth, it is possible to trace the separate letters from some piece of printing having the size and style of letters desired. From this a regular blueprint can be made by placing the tracing over a sensitized piece of paper, exposing it to the sun for the required number of minutes, and fixing the print in a fixing bath. Finally, with a fine brush, fill in the background with the desired color.

When your model is completely painted and rigged, go over it carefully to make sure that everything is neat and shipshape. Touch up marred spots on the hull and clip off loose ends of rigging. Arrange the spars and lines to give a realistic but not too rigid appearance. The rigging should be taut but not

strained, and the general effect of the model should be one of action and life.

View the model as a whole. You may find that one fitting in particular, or one line or stay in the rigging, is noticeably out of scale. Check its size carefully with the drawings and, if necessary, replace it with another of the right size. One place where the amateur model maker has a tendency to go astray is in making spars and rigging lines too large. This is one of the characteristic shortcomings of most store models and should be avoided at any cost on a handmade product.

If your model has sails, make sure that they are rigged properly. They can be set in either one of two ways—trimmed across the ship as if the wind were aft, or braced a bit for a wind slightly on the quarter (Fig. 9).

The final pruning of a model takes both care and perseverance. You will have to be both a craftsman and an artist, but the final result will be worth it.

CHAPTER VII

MOUNTING A MODEL

YOUR final job in the construction of a model will be to provide it with some form of decorative mounting.

Of course, you can use the temporary support that served to hold the model during the rigging and decorating processes; but since it is not likely to be much more than two rough cradlelike supports mounted on a plain stick or board, it may not be in keeping with the trimness and beauty of the model. The support can be improved, however, by substituting two ornamental cradles, carved to represent whales or sea horses, as shown in Fig. 1.

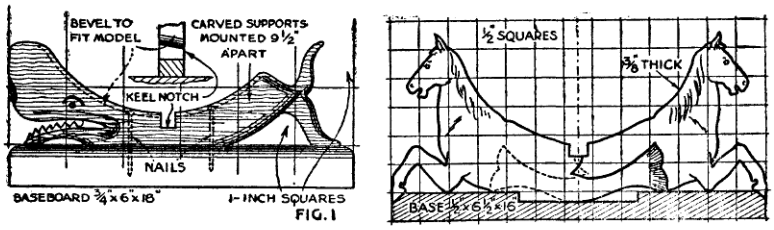


FIG. 1

Another type of mounting that is a favorite with many model makers because it leaves the hull entirely clear is shown in Fig. 2. It consists simply of two turned posts with slots in them to take the keel of the model. The posts can be separate or screwed to a base-

board. Their diameter at the widest point should not be more than half the beam of the model, nor their height more than half the depth of the hull.

If you have no lathe, the posts can be improvised from suitable turnings that may be found in almost

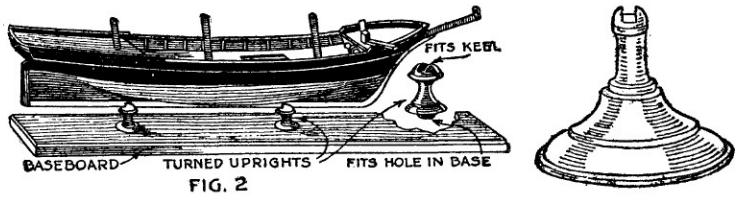
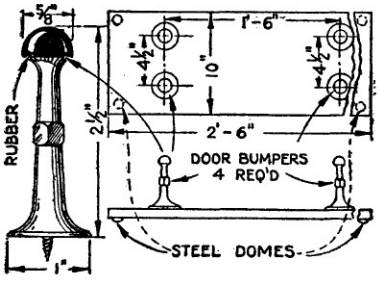


FIG. 2

any home—an inexpensive candlestick or part of a turning taken from a discarded chair. In fact, the ingenious craftsman will be able to file them to shape.

A mounting that is similar, except that four posts instead of two are used, is shown in Fig. 3. It consists



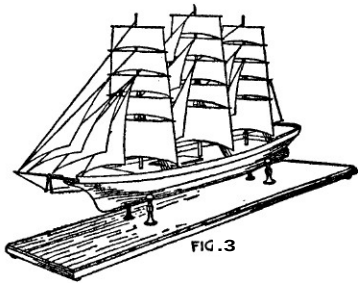
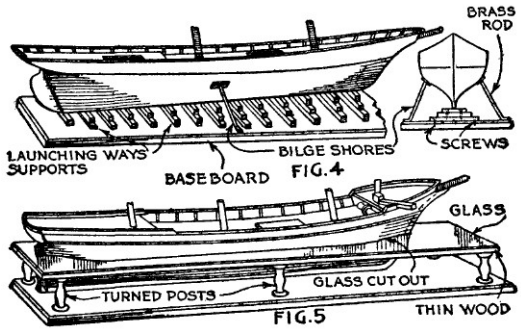


FIG. 3

of four cast bronze door bumpers (the type having rubber tipped ends), four metal domes or slides, and a piece of stock large enough to accommodate the model. The bumpers can be obtained in a variety of lengths; the 21/2-in. length, however, will be the best for the average model.

In the case of the clipper ship described in Chapter X, the base can be 10 in. wide and 2 ft. 6 in. long, and the door-bumper supports can be placed 41/2 in. apart along the width and 1 ft. 6 in. apart along the length. The steel domes can be placed near the corners on the underside to serve as feet. By varying these dimensions, however, this type of mounting can be made for any size model.

Another not uncommon type of mounting represents the shoring and blocks used to support a hull on the



launching ways of a drydock (see Fig. 4). From ten to twenty supports generally are used and they should not be higher than one-quarter the height of the hull. The top section of at least three of them should be fastened to the hull with screws and then screwed down firmly to hold the model upright. For a model of a clipper ship (Chapter X), the blocking should be uniform throughout the length, but for hulls that are deeper aft than forward, the blocks should be arranged as shown so that the water line will be level. Wood shores placed on either side and running from near the edge of the base to the bilge will complete the

illusion. If a minimum of base is desired, the large flat baseboard may be omitted and a long center bar used instead. However, in this case, it should have crossbars half-lapped into it at the points where the shores are placed.

If you desire the effect of a water-line model yet still want to retain the complete hull, you can resort to the novel type of mounting shown in Figs. 5 and 6. The hull is sunk in a hollow base, either upright if the

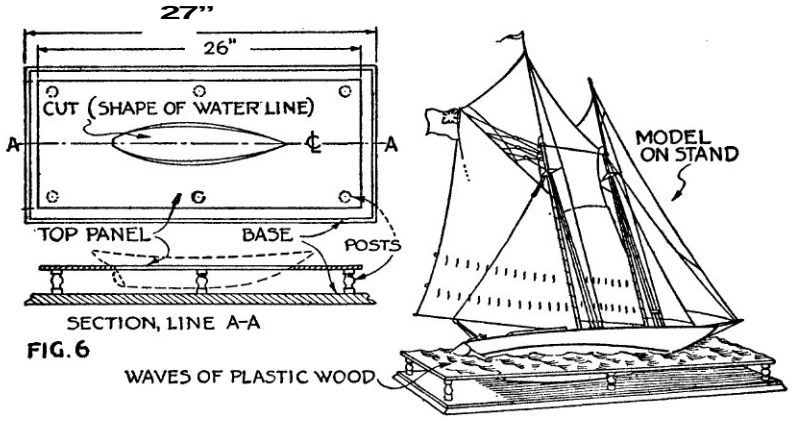


FIG. 6

yards are square or leaning over a trifle if the yards and sails are braced. The top of the mounting can be wood, smooth glass, rippled glass, or plastic wood composition modeled to imitate waves. The last type mentioned is particularly suited to schooner models as shown in Fig. 6. A hole is cut in a piece of plywood to match the water-line contour of the model, a plastic wood composition is molded into wave shapes, and artist's oil colors are applied to furnish the color. Small wisps of cotton glued around the hole at the bow of the ship will give the effect of spray.

If rippled glass is used, have a hole cut in it to take the model. For support, cement the glass to a thin hardwood or three-ply board, similarly cut out.

Many model makers prefer to house their favorites in museumlike cases of glass. This is particularly so in the case of a small model having delicate parts and rigging. A novel triangular shaped case that is easily

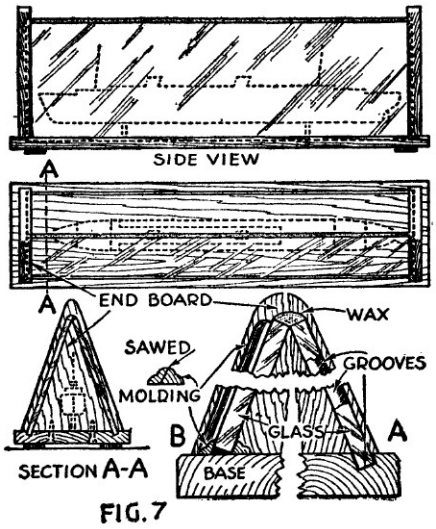


FIG. 7

made is shown in Fig. 7. Such a case can be constructed in a few hours at a cost of less than a dollar. The bottom and ends of the case are made of wood. The dimensions, of course, will depend on the size of the model. The panels of glass may be mounted by either of two methods. If power tools are available, grooves can be cut in the ends and bottom to receive the edges of the glass as shown at A. When the work must be done by hand, the glass may be held by half-

round or other suitable molding. For the ends, cut the molding in half lengthwise; but for holding the glass at the base, cut it on a slant as shown at B.

For mounting the model inside the case, the pedestal type of support shown in Figs. 2 or 3 can be used.

To make a tight, dust-proof joint at the upper edge, fill any crack that may result with wax or plastic wood composition. Also, to improve the looks of the case,

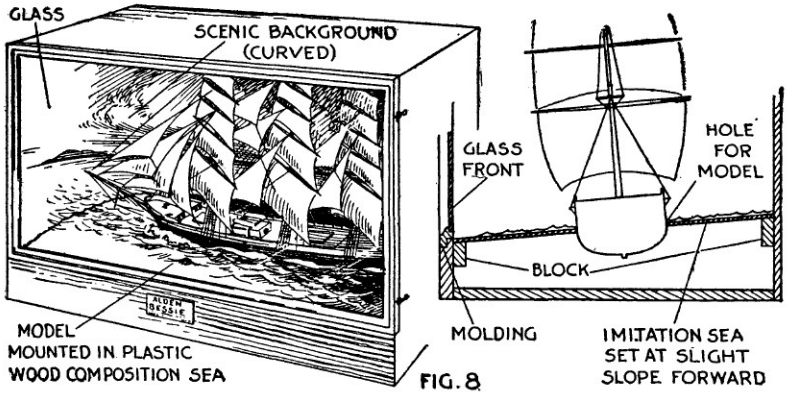


FIG. 8

add four square feet cut from wood. A coat or two of varnish or varnish stain will finish the job.

If your model is to be displayed in a large room where space is plentiful, you can mount it in a novel scenic case similar to the one shown in Fig. 8. It consists of a glass-fronted rectangular cabinet fitted with a decorative scenic background to set off the outline of the model. The hull is set in an imitation sea in the manner of the mounting shown in Fig. 6.

The first thing to do is to make the case. Any well-seasoned piece of wood, either hard or soft, will serve.

If a substantial piece, say 7/8 in. thick, is used for the bottom, the remainder of the case may be made of thin stock. A piece of fiber wall board will do for the back. The water, either rippled glass or plastic wood composition on plywood, should be mounted in the case so that it slopes forward slightly. Also, it should be arranged so that its front edge is just below the molding at the front of the case. The depth of the case, up to the glass, will depend, of course, on the depth of the hull being mounted. Incidentally, the center line of the model should come 1 or 2 in. nearer the front than the back and about the same distance forward of the middle.

Next comes the scene that is to form the background for the model. This is best painted on a prepared canvas with artist's oil colors. When the paint is dry, glue the canvas to a sheet of cardboard and then set it in the case so as to stretch across the back and down to the front on both sides. It should form a flattened cyclorama. A few small tacks or brads placed along the edges will hold the canvas firmly in place. If desired, the inner corners at the rear of the case can be supplied with half-round blocks of wood to support the canvas.

Of course, if water colors are preferred, the same scene can be painted on Bristol board or ordinary white drawing paper.

As for the scene to serve as a background, it can be anything that will form a pleasant setting—merely the clouded horizon with a few gulls spotting the sky, or the more interesting and colorful trees and hills of a distant coast line.

As already suggested, the background should extend

in a curve behind the model. If the background is to represent a coast line, a few waves and spray should be modeled along the line where the painting joins the rippled glass or plastic wood composition sea.

The front of the case will need a glass. For this, picture frame or similar molding is required. As shown in the drawing of Fig. 8, the inner rabbet is for the glass and the outer to set into the front edges of the case. Cut the molding so that when the corners are mitered together, the outside edges of the resulting frame will coincide with the outside edges of the case.

Fix in the glass, set the frame in the case, and keep it in position with side hooks. Finally, varnish, paint, or lacquer the outside.

If you cannot obtain the green rippled glass for mounting the model and do not wish to go to the trouble of modeling waves from plastic wood composition, use ordinary window glass mounted over a similarly shaped piece of plywood. The wave effect can be obtained by painting the upper surface of the plywood.

When a ship model without sails is mounted in this manner, it will be best to use the coast-line background and set the ship perfectly upright. An anchor chain leading at an angle to the imitation sea will complete the illusion of a ship riding at anchor. If your model has sails, use the horizon background, tip the model to give the appearance of "heeling over," brace the yards, and put plenty of cotton spray under the bow.

When placing a model in any type of cabinet, it is best to take some precaution to prevent the wood and rigging from drying out too rapidly. Many model makers place a small dish of salt in the case, conceal-

ing it above or below the line of sight. A dish of water will have the same effect.

No matter how you mount your model, you will want to provide some sort of nameplate giving the name of the original ship, the date the model was completed, and any other data that may be interesting to those who will admire your handiwork.

Simplest of all nameplates, of course, is a printed sheet placed under celluloid or glass in a metal frame. This type of nameplate often is used when models are displayed in museums. A better type, which is more workmanlike and more befitting a carefully built model, however, is an etched or engraved metal plate. Although engraving takes ability and experience, etching is within easy reach of every model maker.

An etched copper nameplate is particularly easy to make. The materials needed are a few strips of 16- or 18-gage soft sheet copper, 2 or 3 oz. of commercial nitric acid, a small can of asphaltum varnish, a camel's hair brush, and a sharp scratch awl.

First, carefully print the material and information you want your nameplate to contain on a sheet of paper. Make it the actual size you desire. Then completely coat the upper surface of a sheet of copper cut to the right size with the asphaltum varnish. Allow this to dry for about ten hours. Lay the lettered sheet over the asphaltum and with a hard pencil, well sharpened, go over the lines. This will form impressions of the letters on the asphaltum. Finally, remove the paper and go over the lines with the scratch awl, scratching off the varnish wherever a line is desired. Be sure to scratch down to the surface of the copper.

The etching is best done out of doors because of the

fumes that are given off. Lay the metal plate face up and make sure that it is perfectly level. Pour enough of the nitric acid over the piece to cover it completely and evenly. Allow it to remain this way until the acid stops bubbling, indicating that it has stopped working. Then plunge the plate into cold water. If the lines have not been etched deep enough, repeat the process.

The acid will eat into the copper wherever you have scratched through the asphaltum. When the etching is completed, the varnish can be removed easily with kerosene; after which it should be washed thoroughly with soap and water.

If you have a typewriter or can obtain one, you can typewrite your nameplate and then etch a reproduction

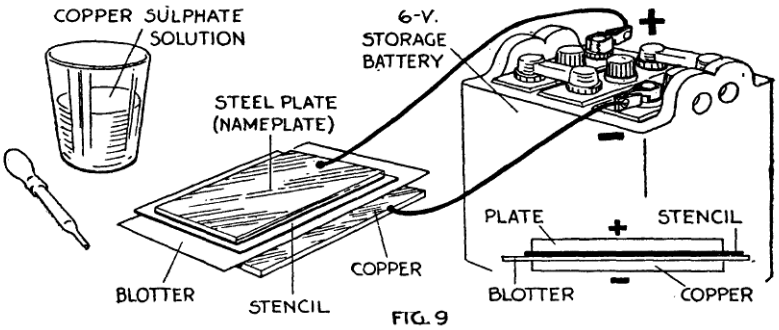


FIG. 9

of it on a metal plate by using the ingenious process outlined in Fig. 9. It is an inexpensive and foolproof method, and the resulting letters will be clear-cut and durable.

From a large commercial stationery store, obtain a dry stencil sheet intended for making regular stencils for a mimeograph machine. The typing is done in the

usual way. If you have any doubt as to the process, read the instructions on the reverse side of the stencil.

As in all stencil making, be sure that the typewriter ribbon is disengaged; the type pieces must strike the surface of the stencil. Also, make sure that the type is clean so that it will make sharp impressions. On a clean-cut stencil depends the final appearance of your nameplate. Finally, cut off the portion of the sheet containing the printing, leaving a margin all around.

Next, cut a piece of sheet copper ¼ in. smaller than the stencil. Place this on top of a sheet of dry cardboard and on top of it put a sheet of clean, unprinted blotting paper. Then mix a solution of copper sulphate, made by carefully adding copper sulphate to water until no more will be dissolved. With an eye or medicine dropper, saturate the blotting paper with this solution. Over this lay the stencil so that the typewriting is reversed or reads backwards.

Now, carefully clean a rectangle of steel so that the surface to be etched is free from grease. Center it over the lettering on the stencil and press it into contact with your hands or a weight.

To complete the etching, you will need a battery. This can be a 6-volt automobile or radio storage battery. Connect wires from the battery to the steel plate and to the copper sheet by slipping the wire from the negative terminal under the copper and touching the positive wire to the back of the steel nameplate.

Hold the wires in contact for from two to five minutes, depending on the amount of lettering on the stencil. Then disconnect the wires, remove the plate, and wash it clean.

If the contact between the steel and the stencil has

been perfect, the metal will be etched in exact reproduction of the typewritten matter on the stencil. Furthermore, the "engraving" will be of such a depth that it will not wear off.

The entire success of your "engraved" nameplate will depend on the care you exercise in preparing the stencil. Be sure that none of the delicate lines are broken or cut out completely.

What you will want on your nameplate is largely a matter of personal preference. The following, however, may offer a few suggestions:

"Name of Original Ship"
Date Launched:
Deck Length: Tonnage:
Scale of Model:
Model By:
Date:

If your model is to be displayed in the open, the problem of dusting it will present itself. To look shipshape and trim, a model cannot be covered with a gray coating of dust. For this process you had best use a syringe bulb, or, if convenient, the air hose at your neighborhood garage. Blasts of air will remove dust that cannot be reached with a cloth. A soft camel's-hair brush will help to loosen the accumulation in the corners.

Once you have completed your model and are satisfied with its appearance, keep it that way. If lines loosen up with time, tighten them. If the finish becomes marred, retouch it. And if by some unavoidable error, a spar warps badly, replace it.

CHAPTER VIII

SHIP MODEL NOVELTIES

A Ship-in-a-Bottle

SOONER or later every model maker feels that he would like to tackle the most popular and mysterious of ship model novelties—a ship-in-a-bottle.

To the uninitiated, the task of placing a tiny rigged ship in an ordinary quart bottle seems like nothing short of magic. Yet, with patience and determination, anyone who is handy with tools can make one of these interesting curiosities.

First, get a clear glass bottle (round, quart size) and clean it inside and out. If the neck is large, the work will be easier; if small, the result will be more intriguing.

Although any kind of ship can be made, this work was in fashion among the clipper ship sailors, therefore a clipper, especially as it is long and slender, is well adapted to the purpose.

The hull, as shown in Figs, 1 and 2, can be slightly more slender than the usual shape and cut off a little below the water line. It should occupy not more than half of the neck of the bottle. The top should be cut into so as to leave the bulwarks standing; this also gives room for the masts and gear. The bottom should be hollowed as shown in Fig. 2. Paint and varnish the hull to any clipper ship colors you desire; usually, just

black and white with red or green below the water line. Deck houses, lifeboats, and steering gear can be added if desired.

Since the hull later will be set in putty in the bottle, you must ascertain what the distance will be from the

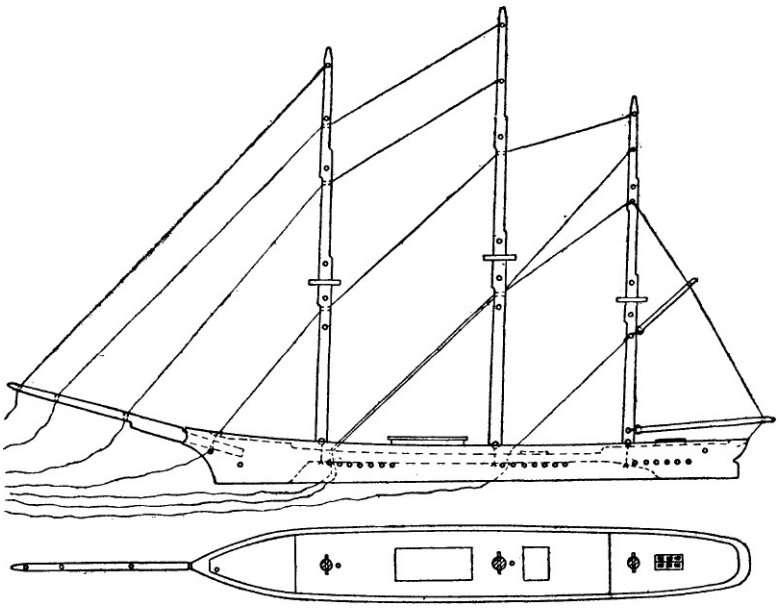


FIG. 1

deck, when in position in the putty, to the inside of the bottle, so that the masts may be as long as possible yet not too long to stand upright.

The masts may well be in one piece, with steps cut, in them to represent the lowermast, topmast, topgallant mast, and royal mast. Make them as slender as

you can with sufficient strength to allow them to stand a moderate strain after the necessary holes have been drilled. Straight-grained hickory, birch, or maple is

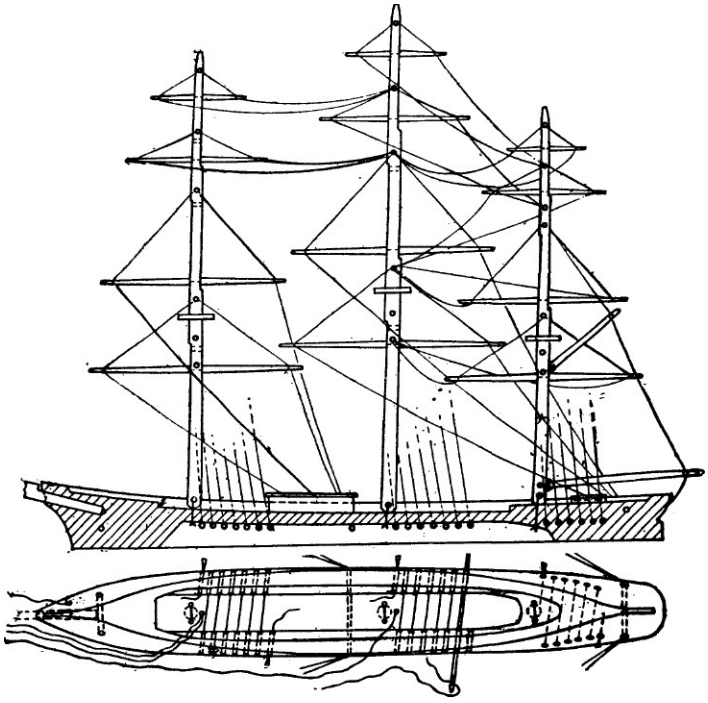


FIG. 2

suitable. These suggestions apply also to the bowsprit and jib boom.

The yards, spanker boom, and gaff are nicely rounded little sticks, tapered toward the ends.

The principle of getting the ship in is merely this: All the masts have to fold down on the deck and then

be erected when in the bottle by means of the hauling stays.

Each of the masts should have little tops and crosstrees of wood, celluloid, or fiber—and caps as well, if you like. Above and below the crosstrees of the foremast, holes pass through what appears to be the division between the lowermast and the topmast (see Fig. 1). Also drill the fore-and-aft holes as indicated for the stays, as well as a small hole for the futtock shrouds below where the top comes, and holes for the yard lifts.

The mainmast will be drilled in the same way, with the addition of athwart holes for the mizzen braces. The mizzenmast needs no holes for stays, but has to have them for the main braces, as well as one each for the spanker boom and the gaff. At the lower end each mast is slightly rounded, and a small hole is drilled for the hinge wires.

If you make the masts of three separate spars, they must be firmly joined. In that case, the shrouds and backstays will pass between them instead of through small holes as in the model illustrated.

The bowsprit has three vertical holes for the head stays, and the boom and gaff each has one hole at the mast end. All the spars may be white, black, or varnished.

The next step is to rig her up, *outside the bottle*. Two or three different thicknesses of thread should be used—say No. 50 black thread and No. 70 white or natural.

Fix the bowsprit firmly into a hole in the bow and rig it as shown in Figs. 1 and 3. These ropes can be hitched to the boom and pegged into the hull.

Fasten the yards to the masts in their correct positions by first tying a thread tightly around the center of each yard with a double knot abaft and then carry the thread around the mast so that they will remain in position, yet can be turned to lie along the masts (see Fig, 2).

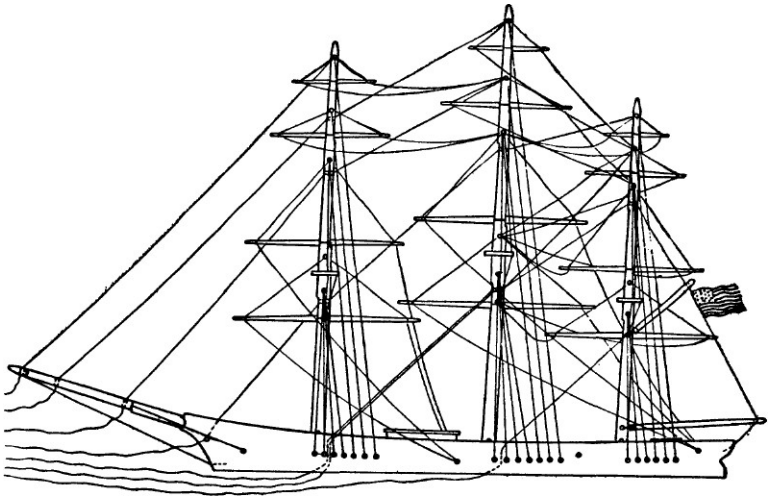


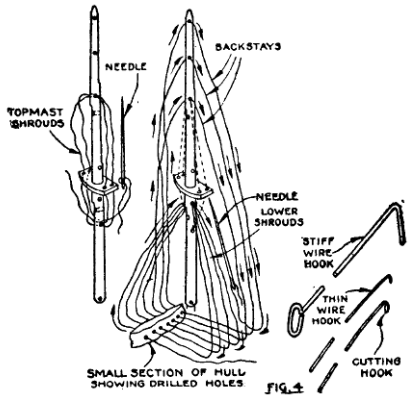
FIG. 3

The spanker boom and gaff should be tied to the mizzenmast with the thread through the drilled holes.

Starting with the mizzenmast, hinge each mast to the deck by carrying a wire through it and down through the hull, twisting the ends together underneath (see Fig. 2). You should be able to turn the masts down flat on the hull. Fasten the stays and reeve them through the hull, or through the next mast and then through the hull or jib boom, as indicated in

Fig. 1, leaving the ends long enough to pass out of the bottle with plenty to spare.

The end of the mizzen topmast stay is pegged to the deck at the stern. Then the stay is hitched around the boom and gaff and hitched again at the crosstrees. This



will prevent the masts from coming too far forward when hoisted.

Raise the masts and hold them in position by pegging the forestay where it comes out of the hawse pipe (see Fig. 3).

The easiest and neatest way to set up the rigging is to bore holes through the hull into the opening beneath as shown in Fig. 2. Thread a No. 9 needle with the heavy thread and start by pegging the thread end in the foremast hole; then reeve through the mastheads and holes until all are up and tight when the mast is in position. The lifts and braces for each yard can be rigged as one. Start at one yardarm with a knot, reeve through the masthead, and knot to the other yardarm.

Then, for the braces, reeve through the hole in the other mast or through the hull and carry the thread back to the first yardarm. The lift part of these lines should be painted black. All these threads must slide readily through their holes. Rubbing them with wax helps. The completely rigged model is shown in Fig. 3.

You may give the model topmast shrouds, rove through the top and a hole below the yard, and if you care to take the time, you may also add ratlines (steps) of very fine silk, although this is rarely attempted.

Now ease up the forestay, lay the yards along the masts, and lay the masts down on the deck. Make sure that all will go into the neck of the bottle, but do not let the model slip through. Draw it out and see if the masts will stand up again and the yards swing across. Then fold them down snugly once more.

Fasten the bottle with a clamp so that it will not slip about while you are working on it. Put a layer of blue or green colored putty in the bottle after adding a little varnish to make it more tacky and to insure that it will dry firmly.

The best way to place the putty in the bottle is to roll it into a thin "sausage," lay it on a strip of paper or thin tin, and, holding the putty in the bottle with a wooden paddle, withdraw the paper or tin. Then spread the putty in position.

Sit in a good light and slide the hull with its gear into the bottle (see Fig. 5.). With a long, stiff wire, press it into the putty sea. Untangle the ends of the stays which extend from the neck and, still holding the model down, pull them one after the other, but be careful to do all the straining on the lower stays (see

Fig. 5). At the same time, help the masts to rise with a bent wire.

When you have all the masts up, fasten the threads to the neck of the bottle, outside, and put a touch of glue where they come out of the hawse pipe and

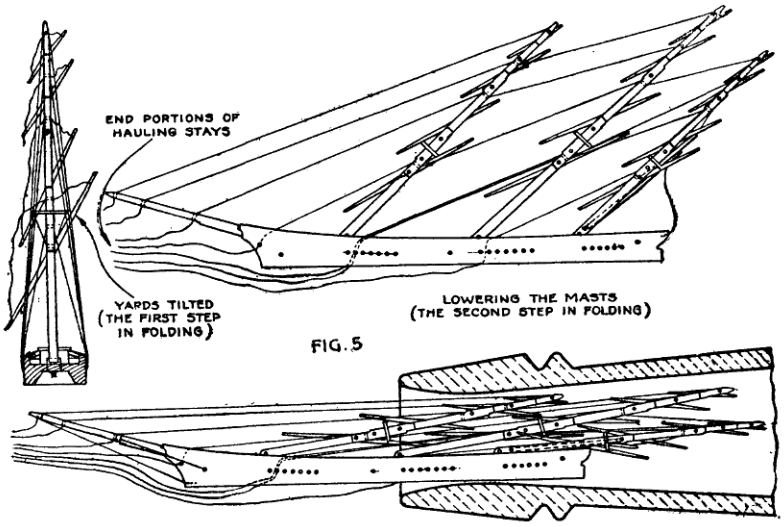


FIG. 5

through the jib boom. Next, use the wire hook to swing the yards into position.

After the glue is dry, cut the lines off close with a sharpened wire such as is shown in Fig. 4.

Additional picturesque touches can be added by inserting a lighthouse on a rock, a pilot boat or tugboats, and one or more fishing smacks in the water alongside.

As the ship is to be without sails, one or both anchor cables should come from the hawse pipes to the water.

If you desire your model to be fitted with sails, the procedure will be practically the same. When the

model is completed outside of the bottle, cut the sails from tough tissue paper to fit the yards, allowing sufficient slack for the belly, and glue them to the yards and stays. The sails then can be folded or rolled for insertion into the bottle. Later, when the putty sea has hardened, make a hook of steel wire long enough to reach the end of the model inside the bottle. Dip this hook in boiling water, and, starting with the mizzen sails, quickly insert it between the mast and the sail and pull gently with a slight up and down motion to iron a belly in the sail. You probably will be able to iron two sails before the hook cools.

Finally, heat the hook until you can just touch it without burning yourself and repeat the ironing process on the dampened sails.

Many expert ship-in-a-bottle makers prefer window shade cloth to tissue paper. By rolling each sail between your fingers before attaching it, you can form the belly.

Incidentally, not all ships are put in quart bottles. Some are made to stand upright in squat bottles, square bottles, and large and small flasks. A particularly attractive lamp can be made by mounting a ship in the base of a decorative three-cornered bottle or pinch flask and providing the open mouth with a suitable attachment.

Making a Mysterious Stopper

To make your ship-in-a-bottle model even more mysterious, you can cap the open mouth of the bottle with a novel unremovable stopper. It consists of a wooden plug having a wooden pin passing through its center and a short piece of string running through both plug

and pin. In appearance, it seems like an impossible freak of construction, but by following the simple steps outlined in Fig. 6, the model maker should have no difficulty in assembling one.

Turn a wooden plug about 1/16 in. smaller than the opening and about 3/4 longer than the neck. Make

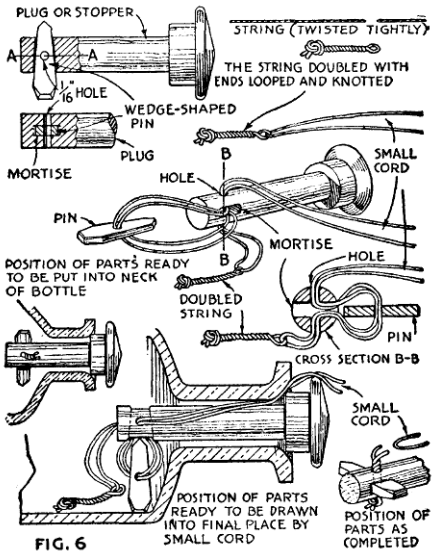


FIG. 6

the pin wedge-shaped and also tapering in width. Cut a hole for it in the plug so that it will slip in without hitting the bottle. It should fit the hole in the plug as accurately as possible. Put the pin in the hole and drill a small hole—not more than 1/16 in.—through both.

Twist a short piece of string quite tightly the way it was originally spun, catch it in the middle, bring the two ends together, and let it twist on itself. Measure

from the loop end about twice the diameter of the plug, tie a knot, and cut the string. It should be large enough to fit the small hole fairly tight. Now take a piece of stout cord such as braided fishline and thread it through the loop of the other cord as you would thread a needle. Draw the ends even and slip them through the small hole in the plug and pin, but do not pull the short string through. Next push out the pin, and put pin and plug in the bottle (see Fig. 6). Lay the bottle on its side with the larger end of the hole in the plug down. If you have made the pin correctly, it will hang with the point up. Slowly pull the string and shake the bottle, drawing the pin into the hole. When the pin is in place, pull the short string through as far as the knot will allow and saw the line back and forth until you have cut through the loop. Pull the line out, leaving the short string extending through plug and pin to mystify all observers.

Mounting a Ship-in-a-Bottle Model

The ship-in-a-bottle model can be mounted in an ordinary cradle, or the special mounting shown in Fig. 7 can be made. It has the advantage of furnishing a secure support without preventing the bottle from being rotated for inspection. In fact, by removing two screws, the bottle can be removed completely.

The molding shown can be a waste piece of foot or bed molding. The profile of the sides should be repeated at the ends by hand. Of course, any kind of molding of suitable size may be used; or two plain pieces of wood, one smaller than the other, may be glued on top of the 1/2-in. base.

The ends of the stand, which conform to the size

and shape of the bottle, are fastened to the base with mortise and tenon joints. The top bar should be slightly hollowed out on the underside to fit the bottle, and the base is hollowed out on top in a similar man-

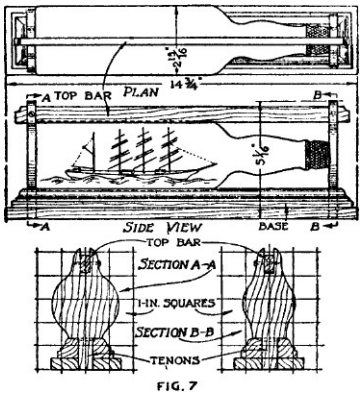


FIG. 7

ner. After being pressed down on the bottle, the bar is kept in place by two small roundheaded brass screws, as shown.

A coat of dark mahogany stain followed by a coat of shellac can be used as a finish.

A Novel Ship Model Plaque

Another ship model novelty consists of a miniature whittled ship sailing in a realistic setting of sea and sky and so mounted that it can be placed on a mantel or hung on the wall. Made in the form of an artistic plaque, it can be used as a decoration where other models would be too large.

The spherical surface which forms the cyclorama for sea and sky is a 12 or 13 in. diameter wooden chopping

bowl (see Fig. 8). These are obtainable at hardware and housefurnishing stores. First, sandpaper the inside of the bowl smooth and give it a coat of dark blue oil color of the type used by artists and sold in tubes. This will form the base color for the sky.

Although any type of ship can be mounted in this way, a long slender clipper ship in full sail is probably

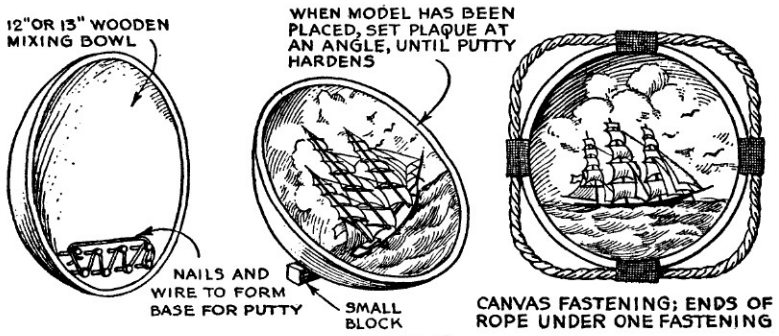


FIG. 8

the most decorative. The hull is whittled from a block of soft wood. Cut the top of the hull out to form the bulwarks and glue bits of shaped wood to the deck to represent the deck houses, lifeboats, and other deck fittings. Since the hull is to be embedded in a putty sea, it is not necessary to fashion the complete hull; a depth of 1/4 in. below the water line will be sufficient. Paint and varnish the hull carefully. For a clipper ship, black with red below the water line gives a good effect.

The tiny masts can be made in one piece, small steps being cut in to simulate the joints between the lower-mast, topmast, and topgallant mast. The masts are

glued in holes in the deck. The yards and boom are nicely rounded sticks, tapering toward the ends. Black and white silk thread can be used for the rigging, and window shade material or heavy paper for the sails.

Before placing the putty sea, drive a half dozen brads into the inside of the wooden bowl where the sea is to be, so that their heads are lower than the plane of the bowl rim (see Fig. 8). Wind wire around these brads, looping it from one to the other, to form a reenforced base for the putty. The sea material is made by mixing colored pigments—green and lampblack—with ordinary putty. Mix enough of the pigments to obtain the right tint and to bring the putty to a stiff consistency. Place the putty bit by bit, working it in between the wires and nails. At the upper edge of the putty sea, shape an almost square shelf to accommodate the model.

When the putty has been built up flush with the rim of the bowl, the surface can be marked with the fingers and a knife blade or a pencil point to represent waves. After the model has been pushed into place, the putty should be pressed up tight against the sides of the hull.

While allowing the putty to harden, place the bowl at an angle so there will be no tendency for the putty to slip out of the bowl. When hard, the putty is painted green, and the tips of the modeled waves are touched with a bit of white to simulate whitecaps. The sky can be touched up to represent clouds, and if desired, a coast line may be painted along the horizon. If much painting is to be done to the sky, it will be well to complete it before the model is set up.

To enhance the nautical effect of the plaque, a length of rope can be attached around the rim as

shown. The rope and rim of the bowl are painted white, and the rope fastenings, which are canvas, red. If the plaque is to be hung on the wall, two screw eyes and a length of picture wire must be added to the back. To support it on the mantel, a suitable wireeasel can be arranged on the back.

CHAPTER IX

A GALLEON MODEL

WITH a little skill and patience, even the rankest amateur can produce in miniature a magnificent Spanish galleon.

The model depicted (Figs. 6 and 12) is not really intended to be any particular galleon, but it is a good sketch model of this type of ship as it actually existed. Every department store is flooded with so-called galleon models; they are not models at all, but merely decorations with a ship-model motif, and bear but little resemblance to any real ship.

Here, however, is a model designed from contemporary plans and other reliable data. It is somewhat simplified and every detail is not embodied, but in general line and in such detail as appears, it is a good replica, well proportioned and sufficiently ornate.

The Hull

The center piece A (Figs. 1 and 2), is cut from a piece of 1/4-in. three-ply (or solid) wood 8 by 25 in. Use a full-size view made by transferring the outline to the board by first drawing 1-in. squares to serve as guide lines. The shape of this piece represents the outside profile of the hull, as seen in Fig. 2, except along the top, where the line has been made heavier to enable you to follow the shape more easily.

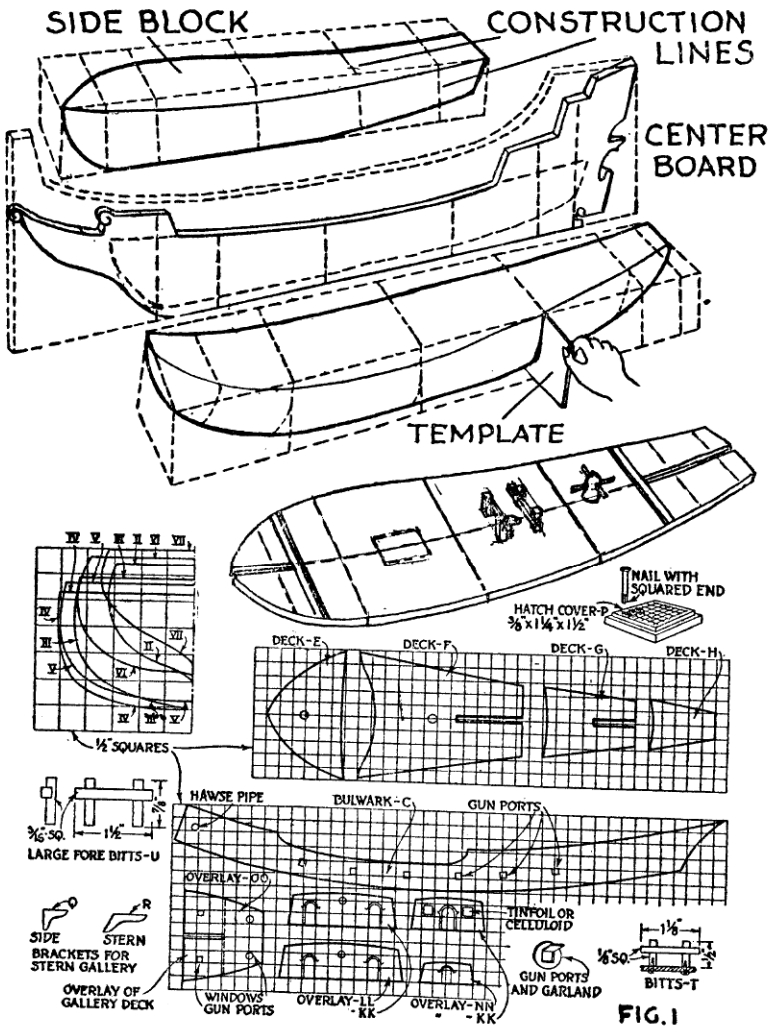

SIDE BLOCK
CONSTRUCTION LINES
CENTER BOARD
TEMPLATE
NAIL WITH SQUARED END
HATCH COVER-P
3/8" x 1 1/4" x 1 1/2"
DECK-E
DECK-F
DECK-G
DECK-H
½" SQUARES
HAWSE PIPE
BULWARK-C
GUN PORTS
3/16" SQ.
1½"
LARGE FORE BITTS-U
OVERLAY-OO
TINFOIL OR CELLULOID
SIDE
STERN
BRACKETS FOR STERN GALLERY
OVERLAY OF GALLERY DECK
WINDOWS GUN PORTS
OVERLAY-LL -KK
OVERLAY-NN -KK
GUN PORTS AND GARLAND
1⅛"
⅛" SQ.
BITTS-T

FIG. 1

The division between the rudder and the stern is merely a V-cut on either side. Round the edges of the centerboard a trifle and cut out the scrolls in the bow. Then mark the construction lines II to VII on both sides.

For the body of the hull B, Fig. 2, white pine is best. It can be obtained 13/8 in. thick (planed). Glue together, in pairs, four pieces 31/2 in. wide and 18 in.

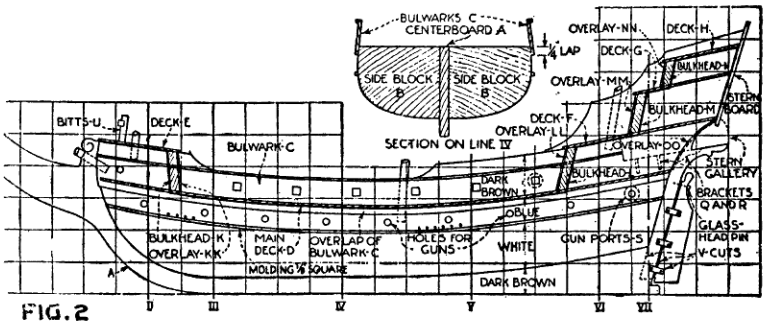


FIG. 2

long. Mark the construction lines all around each piece (Figs. 1 and 2). On the deck (upper side) mark the deck outline from part A and cut away to this. Then cut the profiles at the bow and stern as shown in detail in Fig. 2 (squares measure 1 in.).

Make cardboard templates to correspond to the six section lines in the body plan given in Fig. 1. These, of course, should be enlarged to full size through the use of the squares. Cut away the sides of the hull pieces B until they fit the templates at the six construction lines II to VII. Hold the two pieces together and see that they match. If you deviate from the actual section lines, it is of no particular importance;

the main thing is to see that pieces B are approximately alike.

Glue and lightly nail pieces B to the center piece, so that the construction lines on all three correspond.

To lighten the model it is desirable, but not at all necessary, to scoop out a lot of the inside wood, leaving at least 3/8 in. at the edges.

Bore the nine 3/16-in. holes for the cannon about 1/2 in. below the edge, so that the guns will point slightly up, and forward and aft at the ends.

Obtain, if possible, a piece of 1/16-in. three-ply wood (airplane or waterproof stock), which can be had from some veneer dealers in 2-ft. square pieces. Otherwise use heavy cardboard, several thicknesses of thin cardboard glued together, or, better still, glue together five thicknesses of thin wood veneer with casein (waterproof) glue.

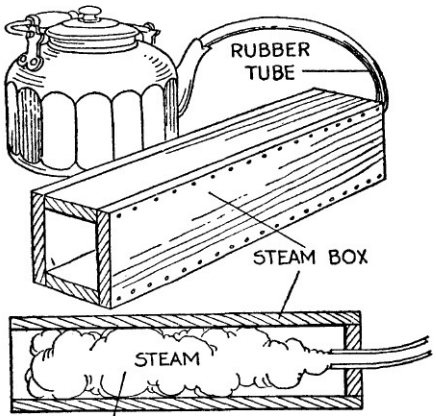
Take a piece 51/2 in. wide and 18 in. long and cut it approximately to the shape of the main deck D, Fig. 1. This, as well as two of the other decks, will need a slot at the ends to fit around the center piece, which makes the whole rigid. Glue and nail the main deck in place (after noting the suggestions given later on in regard to fastening the bitts), and trim the edges to agree with the side pieces.

Cut two bulwarks from the same material to the shape shown at C, Fig. 1, and in them cut the 1/4 in. square gun ports and the 1/4 in. round hawse hole. Bevel the forward edge so that it fits snugly against the center piece. Leave 1/4 in. extra length at the after end, to be trimmed when in position.

Steam the forward 6 in. of these pieces (unless cardboard is used) and glue and nail them to the hull,

overlapping it 1/4 in. (see Fig. 4). A rough block of scrap wood glued in the stern (Fig. 2) is helpful for nailing into. Note how this bulwark follows the "tumble home" or inward slope the hull started.

On the deck erect the bulkheads K and L (Fig. 2) of 1/4. in. plywood. K stands *11/4* in. high and slants forward a trifle; L is 13/8-in. high and leans aft. Cut



BULWARKS. HEAD BOARDS,ETC. PLACED HERE

Fig. 4 -

both to fit between the bulwarks and bevel to meet the slope to the deck.

Cut the decks E and F (Fig. 1) from the 1/16-in. plywood and glue on so as to overlap the sides about 1/8 in. If the tops of the bulkheads are rounded to about 1/8 in. higher in the center than at the ends, that will give the decks a slope or camber which is realistic and looks well.

Erect bulkhead M, deck G, bulkhead N, and deck H, in exactly the same manner.

The overlays which cover the exposed faces of the bulkheads are of very thin wood (veneer), or cardboard painted to look like it. Doors and windows are cut in these. Door paneling is painted on, and the windows are filled with celluloid or silver paper.

Sides are needed to enclose these high poop decks. Cut them from thin three-ply stock, with gun ports and windows pierced, as shown in Fig. 3. These pieces also require an ornate overlay.

When in position the poop sides should leave a promenade deck about 3/8 in. wide on either side of deck F.

As a protection for this promenade we shall need a handrail. This is a strip of wood about 1/16 by 3/16 by 61/2 in. Bore fine holes along it at 1/2 in. intervals, drive small bank pins through these, and on each drop three or four beads, with a touch of glue to keep them in place. Then bore holes in the deck to correspond. Invert the handrail and tap into position. Cut the projecting pin ends off underneath, or cut them before inserting. Small glass-headed pins may be used at intervals. The rail is to be stained and the beads painted silver, but do not put these in position until almost the last thing.

Two similar but much shorter rails will be wanted for the forecastle. Cut or bend them to suit the curve of the bow.

The stern board (Fig. 5), 31/4 in. high, is fret-sawed from a piece of thin wood, such as the lid of a cigar box. The windows are pierced and the whole lightly carved. In the center space, put a little picture of something symbolic, which you may paint yourself or find ready. It may be a sacred picture, a device from

a cigar box, or what you please. Perhaps you can touch it up with oil paints; in any case, varnish it well.

The board is glued and nailed on with 3/8-in. No. 21 wire brads, a box of which will be found invaluable all through the work.

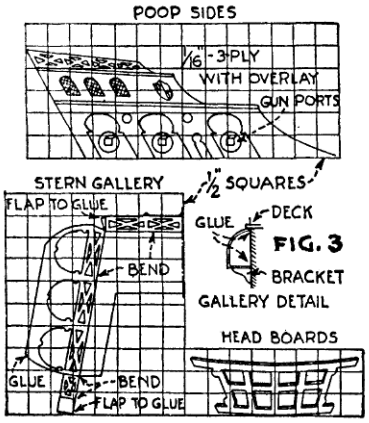


FIG. 3

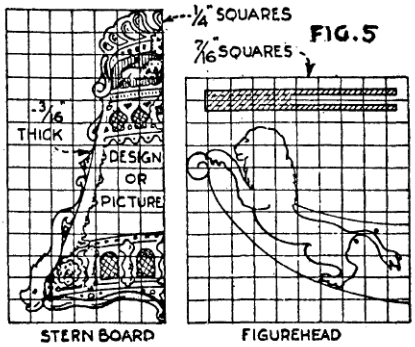


FIG. 5

The figurehead shown in Fig. 5 is cut from a piece of 1/2-in. soft wood. Before being outlined with the fret saw, it is cut down lengthwise to where the line of the stem (piece A) crosses it, so that a 1/4-in. slot can be taken out and it can be fitted over A. Lightly carve it, cut away the center with a chisel, and fit it on the cutwater.

Just behind this come the headboards (Fig. 3). These are cut from 1/16-in. waterproof, three-ply stock. The ends are beveled to fit above and below the body of the lion and to suit the cutwater, and the other ends to meet the bulwark. They will need steaming until they can be bent to the right position. Then they are

glued and nailed. Other material may be used, as previously indicated.

Across these and lying on them, comes a 1/4 by ¼ by 31/2 in. spar (an early form of cathead), over which the anchor cable passes. The spar fits close under the bowsprit, so do not place it until you have properly fitted the latter.

Before placing the headboards, bore two 1/8-in. holes through the cutwater, one under the lion's tail, the other behind it (Fig. 5).

Cut a piece of stiff, flexible cardboard to the shape of the overlay 00 (Fig. 1), pierce the gun ports and windows, paint it to look like wood, then glue and nail it on the under part of the stern to follow the lines of the after part of the bulwarks and preferably inside them. Cut it a bit large and trim to fit; this is a good rule to follow in most cases. The lower edge of the stern board overlaps it.

The Admiral's gallery round the stern is cut from thin press board, heavy Bristol board, or other good cardboard. It is rather tricky to cut, but should be approximately as shown in Fig. 3.

Try out the center cut until it fits snugly around the stern when lying on the brackets, of which one is the extreme stern projection of centerboard A, and the others, Q and R (Fig. 1), are glued and nailed in position, two on either side and two on the stern. When the gallery fits, cut out the fretted parts with a sharp knife, bend up as indicated, bend in the forward ends, glue the flaps, place it on the glued brackets, glue the top ends, and spring them under the edge of deck F. Note the small sectional view in Fig. 3.

The stern lantern is cut from a square piece of soft

wood, as shown in Fig. 6. The windows are recessed and filled with silver paper, colored a transparent blue and painted with diagonal bars. If desired, this can be electrified as in Fig. n.

The capstan is wood about 3/8 in. in diameter and 3/4 in. long, cut to the shape indicated. Drill 1/16-in.

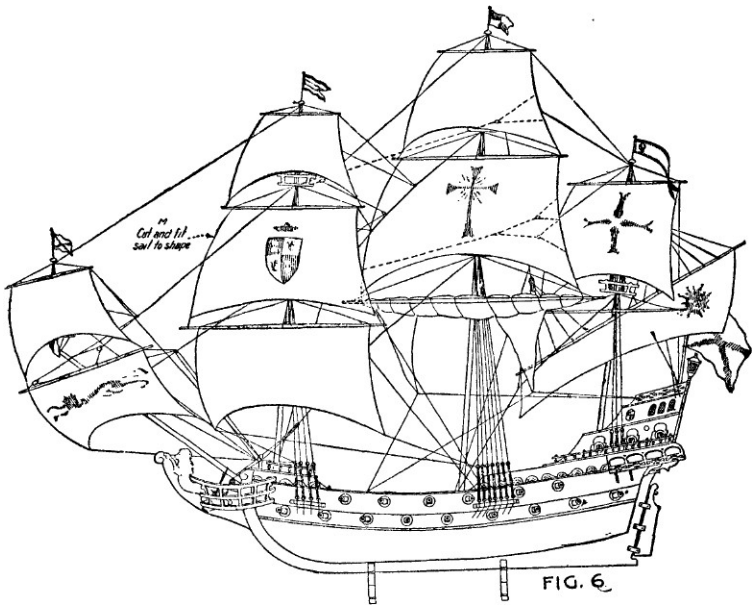


FIG. 6

holes through the head at right angles to each other and pass 11/2-in. long sticks through them for the capstan bars. A long pin or thin nail is driven right through the capstan into the deck.

The main hatch (P, Fig. 1) is a block of soft wood, 3/8 by 11/4 by 11/2 in. The top is punched with the squared point of a large nail so as to represent a grat-

ing. The holes later are painted black, as is the lower half of the hatch; the upper part is stained a dark oak color.

The six ladders are made from strips of very thin cigar-box wood glued together. The steps of each ladder must be exactly the same length. The lengths of the ladders vary with the height of the various decks. You can attach thin brass wire handrails to them, if you wish.

The bitts, one large (U) on the foreside of the foremast, one (T) on either side of the mainmast, and one before the mizzenmast, are made from square sticks either *3/16* OR *1/8* in. square as shown in Fig. 1. The cross pieces are recessed into the uprights and glued. The best way to attach the bitts is to glue them to the deck and fasten them with tiny screws from underneath, but that necessitates placing them before the decks are laid down. Another method is to cut holes in the deck and glue the bitts very firmly into them.

At the lower edge of the orlop (lower) deck, there should be fastened a 1/8-in. molding, glued and lightly nailed.

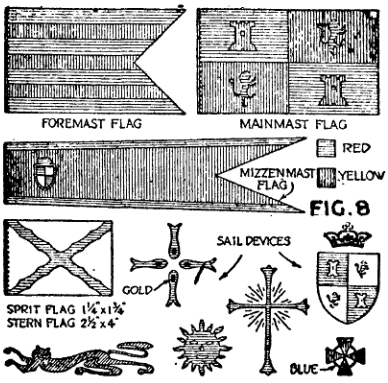
Another molding about 1/16 in. square should be glued in line with the top of the open part of the bulwark, from the stem to the gallery. Some decorations may be painted between this and the top of the bulwark, both forward and aft.

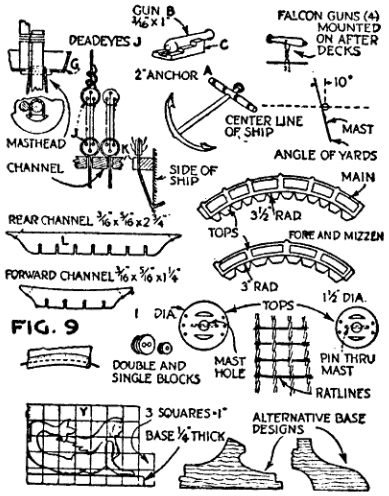
Below the lower molding, give the hull two coats of white paint; above it, two coats of light blue. The center piece and bulwarks are stained dark oak, and all the woodwork then is given one coat of varnish. The surface should not be a glossy finish (see Chapter VI).

Spars and Rigging

We come now to the pleasant work of embellishing the hull with its small fittings, and raising the billowing spread of gaily painted canvas.

Two anchors (A, Fig. 9) are needed. The shanks and arms of these may be cast in bronze, cut from lead





pipe, whittled from wood, or bought ready-made (see Chapter III). The shanks should be about 2 in. long. The stocks are about the same length as the shanks; they are wood with a hole bored to take the shank. The rings are wire. Stain the stocks brown and paint on black rings to represent the clamping bands. The remainder should be a green-bronze color.

The guns are cut from small wooden dowel sticks. Those for the main deck are 3/16 in. in diameter and

1 in. long, shaped as shown at B, Fig. 9, with a small belt pin driven in the inboard end. The carriages C are 3/4 in. long, cut with a fret saw from a square stick of soft wood 3/8 in. square. They are painted black, and all the guns are antique bronze.

The orlop (lower) deck guns are similar, but the inboard ends are not finished off. Four of the upper deck guns are longer, so that their butts can be glued against the center piece.

The falcon guns are about 5/8 in. long and thinner; a piece of copper wire is passed through a hole in each of them and brought together underneath and twisted to form a swivel stand. There also may be two long thin guns on the forecastle; and two should project from the stern gallery.

The wreaths around the gun openings and the gun ports are all made in one piece of thin, tough cardboard. The outside diameter of the circle is 1/2 in.; in the center, three 1/4-*in.* cuts are made, and the square center flap is bent up to represent the port. The rim is gilded and the port painted scarlet on both sides. These are glued over each opening.

Paint all these parts and lay them aside for the present.

For the rigging of the ship, a few additional tools will be handy: a pair of good embroidery scissors, tweezers, and some needles (No. 7 crewel are best).

You will also want some good cord, such as fishing line—some about 1/32 in. thick; some about half that, for the rigging; and some bead or purse twist of luster cotton or silk of a rich brown color (it can be dyed if necessary; see Fig. 10).

The masts and yards are made from dowel sticks,

3/8 and 1/4 in. in diameter. These are round birch rods, ordinarily 3 ft. long, which can be obtained at almost any hardware store. The lengths are given in the rigging detail, Fig. 7. The mainmast is 3/8 in. at the step (bottom), tapering to the top; the topmast is slightly thinner, and the topgallant mast still thinner. The

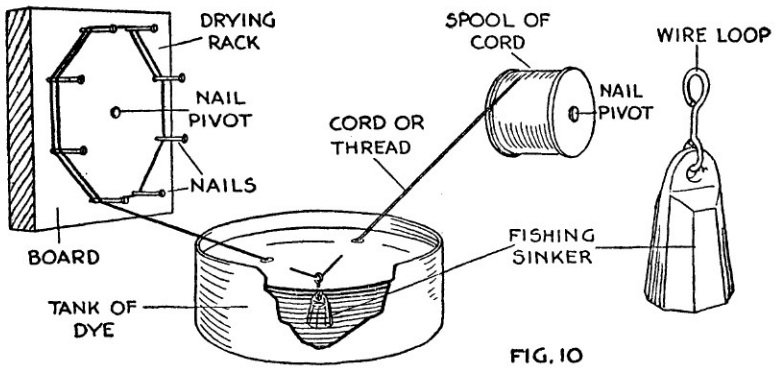


FIG. 10

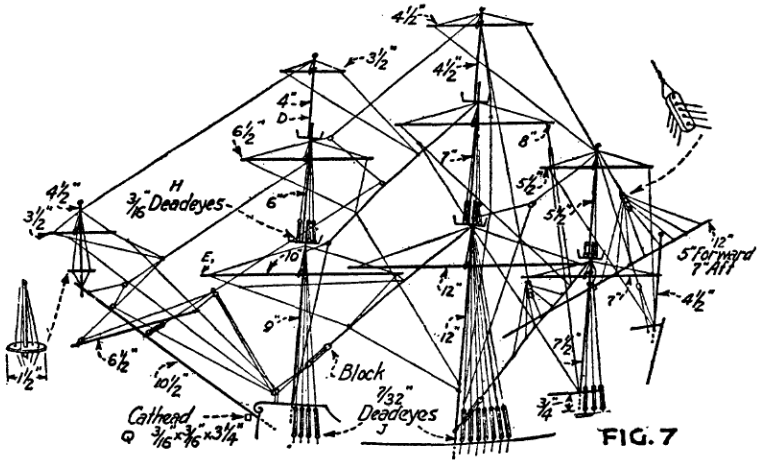
foremast is a little smaller than the main, and the mizzenmast than the fore.

The bowsprit tapers from 3/8 to 3/16 in. Cut the end of the bowsprit 3/16 in. square, and for the sprit-topmast take a piece of the 3/8-in. dowel and cut a hole to fit the bowsprit end at a slant. When the bowsprit is in position, the sprit-topmast must be upright (Fig. 7). Above this hole, shave the sprit-topmast abruptly to 1/4. in. and then taper to 3/16 in. at the top. Put a thin wire binding under the hole and cut off close.

The trucks (X) at the top of the masts are half-round 3/8-in. wooden button molds, glued on the mast heads and gilded.

The yards taper from the center toward the ends; each is a bit smaller than the one below. The flagstaff is about 3/16 in. all the way up. These spars are all stained dark oak, varnished, and then rubbed dull with pumice stone and water.

It is easiest to join the three parts of each mast together before stepping them.



First the tops will be needed (G, Fig. 9). They are cut from the three-ply wood and are 11/2 in. in diameter for the lower tops of the foremasts and mainmasts and 11/4 in. for the other four, one going on the sprit-topmast. In the center is bored a hole just large enough to take the mast under them; on each side are two crescent slots, which are the lubber holes for passing the shrouds through; and on the outside edges, abreast of the mast hole, are two holes in the upper tops and three in the lower. Around each of them,

except the one for the sprit, is glued cardboard lattice-work, painted scarlet.

To join up the masts, bore a hole in the mast under the point where the top or cap is to come, push an inch of toothpick through it, place the cap on, hold the topmast in position so that it rests on the cap, and lash it to the top of the lowermast, passing a few turns of the cord between the masts. Invert and nail through the cap into the heel of the topmast so that they will be slightly apart. A steadying nail may then be driven through the two masts. Fix the topgallant mast on in the same manner.

Insert the assembled masts in the hole in the deck, so that the topmast is before the lowermast, and the topgallant before the topmast.

From the top of the lowermast, run some cords to the ship's sides and bow, to steady it firmly in position—upright but raking slightly aft (leaning backward). The foremast is almost vertical, the main rakes a little more, and the mizzen more still.

You will now need 96 deadeyes (J) with which to set up the rigging. They can be made from boxwood, but are more easily made from celluloid knitting needles (see Chapters III and IV). They should be about 7/32 in. in diameter for the lower, and 3/16 for the upper. With a fret saw or small file, cut grooves in the needle 1/8 in., or rather less, apart; then, with the saw or a sharp chisel, cut the needle in sections between, not at, the grooves. Then bore a triangle of three holes in each with a hot darning needle. Celluloid is inflammable and, although small holes can be bored in this way without setting fire to the material, it is essential to take every precaution against a blaze.

To keep the shrouds clear of the ship's sides, channels are used as at K and L, Fig. 9. These are 3/16 in. thick by 5/16 in. deep, of wood, with seven grooves for the main and four grooves for the fore. They are glued and nailed at the lower edge of the bulwark, with the forward groove level with the mast. In line with the grooves, bore holes with an upward slant just above the lower molding.

Take No. 20 brass wire, bend it so that it fits snugly in the groove of a deadeye, then carry it down in the groove of the channel and into the hole below, the deadeye being close above the channel. Take a piece of your thick cord, tie a similar deadeye to it, pass the other end up through the lubber hole, around the lower mast and down, fastening another deadeye to the end so that they both lie even, slightly above the rail.

Next, set up the lanyards. Thread a needle with strong cotton or silk, fasten the thread to one hole in the upper deadeye, and carry it through one in the lower, and so on, setting the threads up tight together and fastening off round the shroud above the deadeye. You will find this a simple matter if you study J, Fig. 9 (also see Fig. 5, Chapter V).

Turn the model around and do this on the other side; and proceed alternately, first on one side and then the other.

At the mizzenmast there are no channels, or chain plates, so use thin wire around the lower deadeyes, pass it through the edge of the deck, and fasten underneath. Do the same with the deadeyes that come into the tops.

When all the shrouds are set up, they will need ratlines (steps). These can be thick thread, such as

button thread. Hitch a length to the left-hand shroud, pass it in and out of the others and hitch to the right-hand shroud; pull the knots tight, but do not draw the shrouds together. When all are on, give the whole rigging a coat of black shellac or enamel and when dry, cut off the ends of the ratlines close to the outer shrouds.

A needle should be threaded through each shroud above the deadeyes to keep them from twisting; this is called the sheer pole.

Next will come the stays (Fig. 7). The mainstay starts with a loop through the larger top of the mainmast and runs down almost to the foremast, where it is finished with a large deadeye. Then, from the after hole in the cutwater (behind the lion's tail), comes another loop with a deadeye to meet the mainstay. Set it up tight, like the shrouds.

The mizzen stay comes similarly to a loop around the heel of the mainmast.

The main topmast stay, of the lighter cord, comes down through a block (small wooden pulley) under the foretop, and is set up with deadeyes to a screw eye in the deck by the foremast. The mizzen topmast stay is similar. The main topgallant stay comes through a block under the fore-upper top to a block halfway down the main topmast stay, and then finishes in the foretop.

It will be noted that we have not yet shipped the bowsprit, so cannot set up the forestays. This has been left until later, because it is so much in the way.

The sails may be of silk, fine linen, or good mercerized cotton. Straight lines of machine stitching about 3/8 in. apart, made before cutting, add to the effect.

The shapes are given in Fig. 6, and the length of the yards will serve as a guide to the sizes.

They can be plainly hemmed to hang slack, or have fine copper wire stitched in the hems to belly them out. If this is done, leave a short end of wire projecting at the top of the hems, bore holes vertically through the ends of the yardarms, and through these pass the wire. Then button-hole stitch the sails to the yards. Bore other vertical holes in the center of the yards and about ¼ in- beyond the sails.

It is best to paint the devices on the sails before fastening them to the yards, and likewise to do the antiquing, if any. The antiquing may be done by dipping the sails in tea, coffee, or other stain (see Fig. 1, Chapter VI).

To get each yard in position, pass a cord through the center hole and hitch it, leaving plenty of end; then pass it through a hole in the mast under the top and down to the deck, setting up with blocks. The bead twist and both single and double blocks can be used. The lower block is fastened to screw eyes in the deck and the end of the thread to one of the bitts; then take the other end around the mast at the yard, hitching it to the halyard on the foreside to act as a parrel (the rope or chain by which the middle of a yard is fastened to the mast).

The lateen sail sets up with a similar halyard 7 in. from the after end, and is fastened with a crow's-foot to the masthead. For the crow's-foot use a celluloid block with four holes through it as shown in Fig. 7.

The other blocks are of various sizes, the smallest about 7/16 in. long and 3/32 wide. Each has a hole through it the thin way and a groove around it the

flat way. They are made of any nonsplitting wood (see Chapter III).

The yards are maintained horizontally by lifts, which hitch to the masthead and to the holes in the yardarms, leaving a few inches of end to which blocks are to be fastened for the braces.

To the lower corners of the sails, fasten light cord for sheets; these are fastened to the same holes as the lifts. The sheets of the lower sails are carried to the channels or rigging. The fore end of the lateen yard also needs a double cord to keep it in position.

The braces, of the bead cord, are rove off variously, the direction always being aft and slightly downward.

The mizzenmast has two preventer backstays, which run to holes in the rail near the stern; and the mainmast has one set up with a crow's-foot to the mizzen stay.

Now put the bowsprit into its hole in the stem, so that it passes less than an inch above the figurehead; keep it thus by jamming the cathead (Q, Figs. 6 and 7) under it; then tie it down with the gammoning (lashing) to the forward hole in the cutwater.

Set up the forestay from under the top to about halfway out on the bowsprit, and the foretopmast stay to near the end, and the fore topgallant stay to the top of the sprit topmast.

Hang the spritsail yard under the bowsprit just before the forestay. It has a forward brace and lift in one, from one third of the way up the forestay to a block at the yardarm, to another at the bowsprit end, and back to the fore bitts; and another brace from the bitts to the yardarm and back.

The sprit topsail has a halyard to the masthead and

down to the top, as well as topping lifts to the mast-head and braces from the topmast stay to the yard-arm, back to the stay, and fast to the fore bitts.

These old sails used to set so badly that they all had bow lines to pull the leeches (edges of the sails) forward. For these the bead silk is used, with beads for leads, arranged in crow's-foot form, as shown by

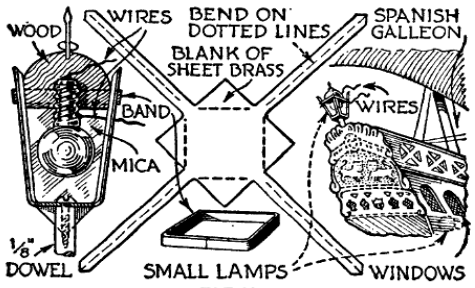


FIG. 11

dotted lines in Fig. 6. These are fitted to all sails on main-, fore- and mizzenmasts.

The yards may be trimmed to lie straight across the ship, as if with the wind aft, but they will look better if braced in a bit for a wind on the quarter.

Now lash the anchors to the fore rigging, pass pieces of your heaviest cord through the rings, twist them up, glue the ends, and pass them around the catheads and through the hawse pipes.

Place all the fittings and the handrails in position. Paint the flags (Fig. 8) on thin, starched silk, run a line of clear shellac or glue around the edges to pre-vent fraying, and cut them out. Glue each to a long gilded belt pin, and set them in holes in the tops of the masts (see Chapter V).

The base supports (Y, Fig. 9) for the model can be anything you desire, with 1/2-in. slots to take the keel. They can be fastened to a board so that the

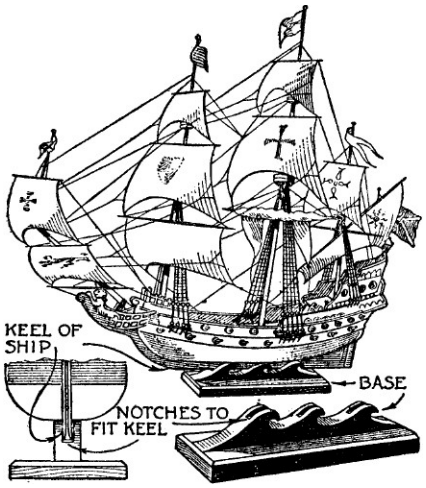


FIG. 12

model sits in them loosely, or they can be separate pieces screwed fast to the keel. Another novel suggestion for a decorative stand is shown in Fig. 12.

CHAPTER X

A CLIPPER SHIP MODEL

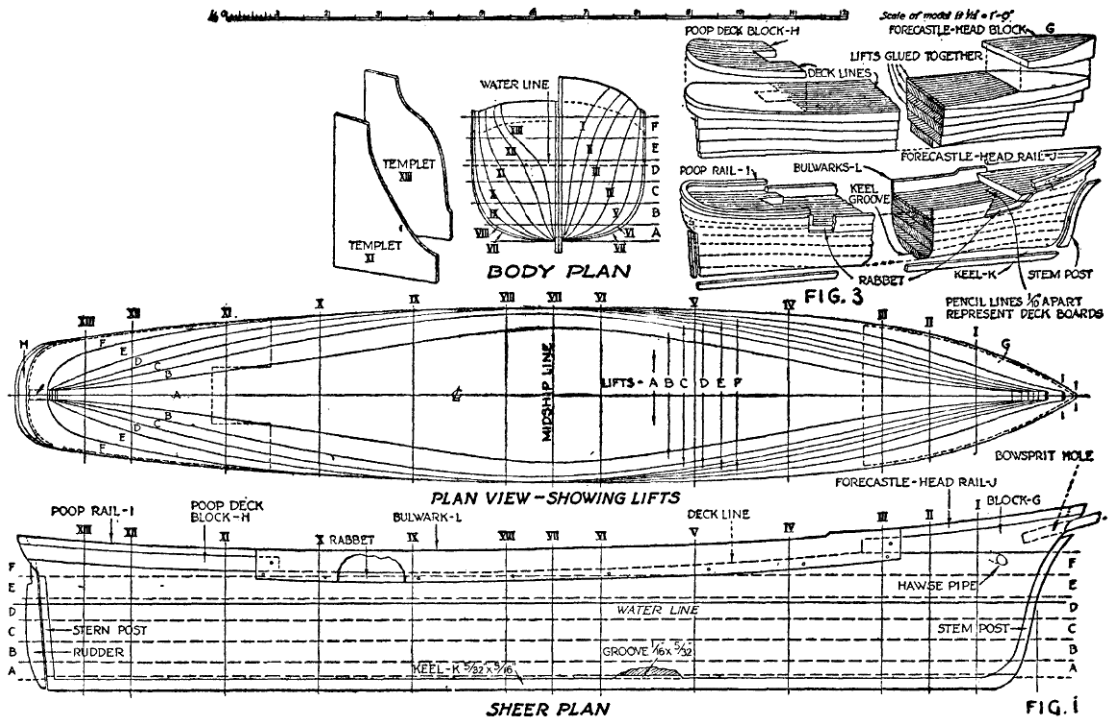
IN speed and beauty, few ships can compare with America's nineteenth century clippers. Their flowing curves and trim rigging made them the most beautiful ships sailing the seas.

It is little wonder then that they are a popular type of model. As a decoration, they embody everything that is desired—grace, beauty, and life.

The clipper ship model to be described, although simplified to make the construction easier, is an excellent miniature of the type of ship that carried American shipping to distant ports in the 1850's. Designed to a scale of 1/12 in. equals 1 ft., the completed model is 26 in. long and 161/2 in. high.

The body of the hull (Fig. 1) is constructed of six lifts or layers, each 5/12 in. thick (that being the usual thickness of planed 1/2-in. white pine). To make them, take six pieces of white pine, free from knots, not less than 31/2 by 20 in., and scribe a midship line right around the center of each. Mark one of the outlines A, B, C, D, E, and F on each, and mark at least three of the construction lines on the under side of each lift, say Nos. II, IX, and XII.

Cut these pieces to shape with the fret saw, being very careful never to come inside the lines; it is better to leave about 1/32 in. of wood outside them. Sandpaper


Scale of models to ½" = 1'-0"
POOP DECK BLOCK-H
FORECASTLE-HEAD BLOCK-G
LIFTS GLUED TOGETHER
DECK LINES
FORECASTLE-HEAD RAIL-J
POOP RAIL-I
BULWARKS-L
KEEL GROOVE
RABBET
KEEL-K
STEM POST
TEMPLET XII
TEMPLET I
WATER LINE
BODY PLAN
FIG. 3
PENCIL LINES ½" APART REPRESENT DECK BOARDS
MIDSHIP LINE
LIFTS - A B C D E F
PLAN VIEW - SHOWING LIFTS
BOWSPRIT HOLE
FORECASTLE-HEAD RAIL-J
BLOCK-G
POOP RAIL-I
POOP DECK BLOCK-H
BULWARK-L
RABBET
DECK LINE
HAWSE PIPE
WATER LINE
STERN POST
RUDDER
STEM POST
GROOVE 1/16 x 5/32
KEEL-K 5/32 x 3/16
SHEER PLAN
FIG. I

off all inequalities. The bottom lift (A) is only 4/12 in. thick; the extra should be planned off before cutting.

To make the model hollow, lifts B, C, D, and E may have their centers cut out. To do this, mark the top of the piece underneath on the bottom of each and with that side up, saw to keep at least 1/4 in. within the line (see Chapter II).

The pieces project at the ends to form the stem and sternpost; these may be cut off and vertical pieces fitted after the hull is shaped. The placing of the keel comes later.

Glue the lifts together most carefully (Fig. 3) so that the midship lines make one straight vertical line, and so that the construction lines coincide exactly. To do this in one operation, start at the bottom, lightly nailing each piece to the next, on the inside. Make sure that no nail heads project.

When this is done, put the whole in clamps or under weights and set aside to dry for at least 12 hours (see Chapter I if you have no clamps).

Next cut the sheer or curve of the deck line. This starts forward between III and IV (Fig. 1) and continues to the stern. The deck should have a slight camber or downward curve from the center line toward the sides.

This is a convenient time to pencil the lines to represent the edges of the deck planks. They are marked about 1/10 in. apart with a very hard, sharp pencil and should run truly fore and aft.

Make the pieces G and H (Figs. 1 and 3) for the forecastle and poop. G is 3/4 in. thick at the bow and 1/4 in. at its after end. The top is considerably wider than F, to allow for the flare at the bow. Piece H has

a square cut out of it to take the cabin house; it flares out at the stern. Glue these in place.

From thin cardboard cut 13 templates from the vertical profile body plan (Fig. 1). Fix the hull on its side in the vise, being careful not to bruise it with the jaws. Shave away the lower corners of the lifts until you are down to the upper joints of each. While doing this, keep trying on the templates, noting especially that the curves in some places, as at the lower part amidships and upper part aft, are convex and at the ends concave (hollow).

A chisel, round-bottom plane, flat gouge, spokeshave, and half-round cabinet rasp are all useful in this work, especially the latter, but not all are necessary. Be very careful with the hollow under the stern and the flare at the bow. You will find a very beautiful and absolutely correct hull will emerge.

If the ends have been left on the pieces, be careful with them and have a distinct angle between the end posts and what is supposed to be planking. If you have cut them off, leave the ends flat enough to take the posts—a full 1/8 in.

The bulwarks (L, Figs. 1 and 3) come next. Cut rabbets 3/32 in. into the sides of the hull and extending 3/16 in. down from the deck line. Into these fit pieces of white pine 3/32 in. thick and 5/8 in. wide. Glue and lightly nail them to the forecastle, poop, and hull sides. The forward end may need steaming to twist it (see Chapter IX); have them a shade thick and when in position, sandpaper them to meet the rest of the hull.

From a piece of pine 1/8 in. thick, cut a horseshoe-shaped piece (I) to lie on the poop, which will continue the inside line of the bulwark. It had better pro-

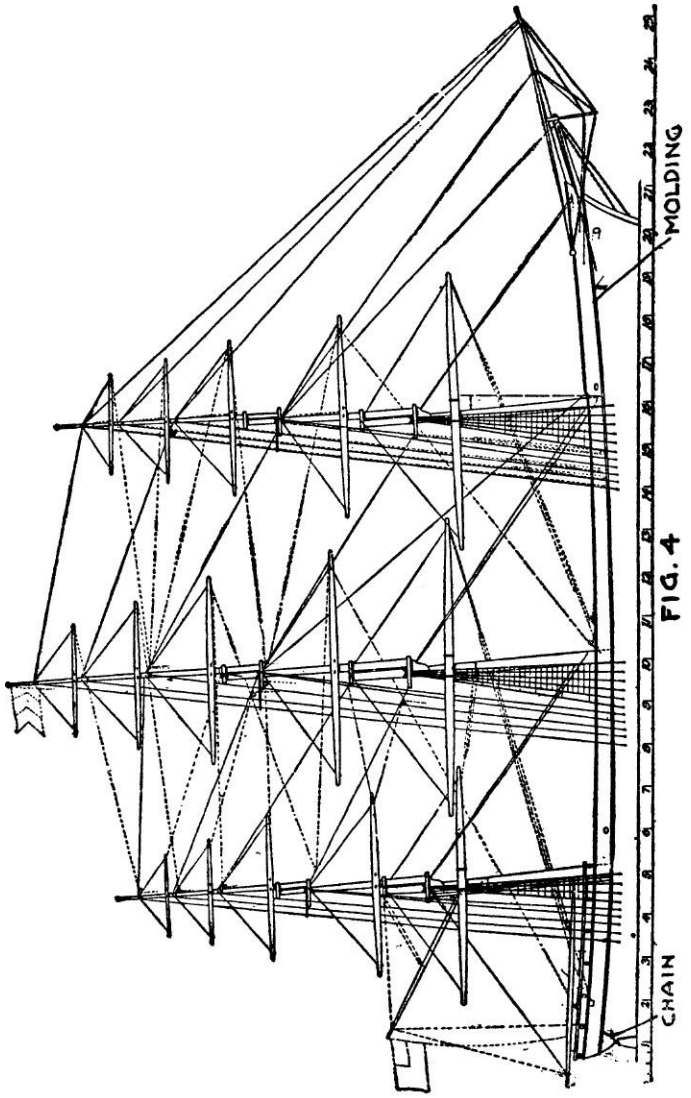


FIG. 4

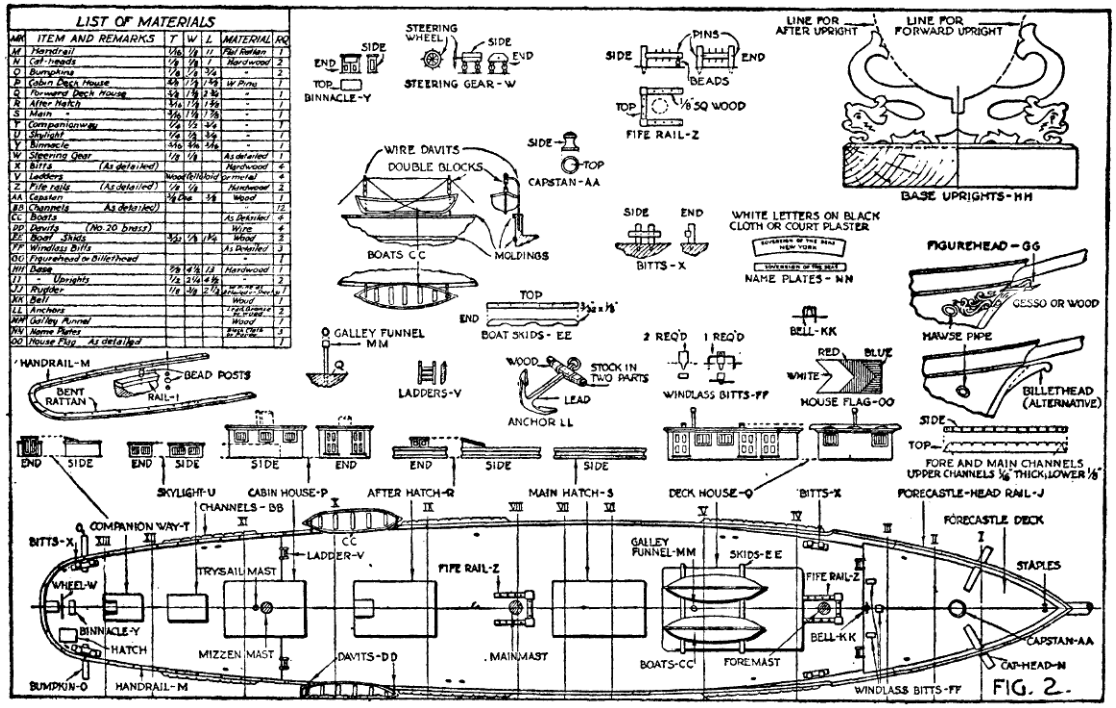
ject considerably on the outside and be shaved down to the hull lines after being glued. Make a similar piece (J) for the forecastle, which, inside and out, will have to continue the flare at the bow. These parts must be neatly joined to the bulwark pieces where they meet.

For the keel (K) cut a groove along the bottom of the hull 5/32 in. wide by 1/16 in. deep. Into this glue and nail a strip of pine 5/16 in. deep by the same width. Have it extend beyond the hull sufficiently to come under the stem and sternpost. If these are to be added, they come next; their shape will be seen in the sheer plan (Fig. 1).

The two moldings (Fig. 4) come next. They can be made from wood, but cord, such as fishing line, is easier to handle and just as good. The lower one should be about 1/16 in. in diameter. Starting at the bow, it follows the line of the main deck. Stretch and glue it along, helping to keep it in position with a few pin points. The top molding should be about half as thick and level with the edge of the bulwarks.

For the hawse pipes, bore a 3/16-in. diameter hole, 1/4 in. deep in each bow, 3/*4* in. abaft the stem, and 1/4 in. below the lower molding. Point it toward the middle of the forecastle head. It is a round hole, but the angle at which it is bored gives it an oval entrance. Paint it red inside. Carefully bore a 1/4-in. hole for the bowsprit, and then make the figurehead by building it up from gesso or composition wood (see Chapter IV). It should be white and gold, and the scrollwork design should extend back to the hawse pipes.

A handrail (M, Fig. 2) is required around the poop deck. This can be made from a piece of flat rattan


LIST OF MATERIALS
MK | ITEM AND REMARKS | T | W | L | MATERIAL | REQ
M | Handrail | 1/16 | 1/2 | 11 | Pear Rattan | 1
N | Cat-heads | 1/8 | 7/8 | 1 | Hardwood | 2
O | Bumpkins | 1/8 | 1/8 | 3/4 | - | 2
P | Cabin Deck House | 4/8 | 1 5/8 | 1 4/8 | W Pine | 1
Q | Forward Deck House | 3/8 | 1 5/8 | 2 3/8 | - | 1
R | After Hatch | 3/16 | 1 1/8 | 1 5/8 | - | 1
S | Main " | 3/16 | 1 1/8 | 1 7/8 | - | 1
T | Companionway | 1/8 | 1/2 | 3/4 | - | 1
U | Skylight | 1/8 | 1/8 | 3/4 | - | 1
V | Binnacle | 4/16 | 5/16 | 1/8 | - | 1
W | Steering Gear | 1/8 | 1/8 | | As detailed | 1
X | Bitts (As detailed) | | | | Hardwood | 4
Y | Ladders | Wood (6) Metal or metal | | | | 4
Z | Fife rails (As detailed) | 1/8 | 1/8 | | Hardwood | 2
AA | Capstan | 1/8 Dia | | 1/8 | Wood | 1
BB | Channels (As detailed) | | | | | 12
CC | Boats | | | | As Detailed | 4
DD | Davits (No. 20 brass) | | | | Wire | 4
EE | Boat Skids | 3/32 | 1/8 | 1 1/8 | Wood | 2
FF | Windlass Bitts | | | | As Detailed | 1
GG | Figurehead to Billethead | | | | - | 1
HH | Base | 1/8 | 4 1/8 | 13 | Hardwood | 1
II | " Uprights | 1/2 | 2 1/4 | 4 1/8 | - | 2
JJ | Rudder | 1/16 | 3/8 | 2 1/2 | Celluloid or Sheet Metal | 1
KK | Bell | | | | Wood | 1
LL | Anchors | | | | Tinned Bronze or Wood | 2
MM | Galley Funnel | | | | Wood | 1
NN | Name Plates | | | | Paper Parts or Rubber | 2
OO | House Flag | As detailed | | | | 1
STEERING WHEEL
STEERING GEAR - W
BINNACLE - Y
PINS
BEADS
1/8 SQ WOOD
FIFE RAIL - Z
LINE FOR AFTER UPRIGHT
LINE FOR FORWARD UPRIGHT
BASE UPRIGHTS - HH
WIRE DAVITS
DOUBLE BLOCKS
CAPSTAN - AA
BOATS CC
MOLDINGS
BITTS - X
WHITE LETTERS ON BLACK CLOTH OR COURT PLASTER
NAME PLATES - NN
FIGUREHEAD - GG
GESSO OR WOOD
HAWSE PIPE
BILLETHEAD (ALTERNATIVE)
GALLEY FUNNEL MM
LADDERS - V
BOAT SKIDS - EE
ANCHOR LL
STOCK IN TWO PARTS
LEAD
2 REQ'D
1 REQ'D
WINDLASS BITTS - FF
BELL - KK
RED
BLUE
WHITE
HOUSE FLAG - OO
HANDRAIL - M
BENT RATTAN
BEAD POSTS
RAIL - I
FORE AND MAIN CHANNELS UPPER CHANNELS 3/16 THICK, LOWER 1/8"
SKYLIGHT - U
CHANNELS - BB
CABIN HOUSE - P
AFTER HATCH - R
MAIN HATCH - S
DECK HOUSE - Q
BITTS - X
FORECASTLE - HEAD RAIL - J
FORECASTLE DECK
COMPANION WAY - T
LADDER - V
TRYSAIL MAST
FIFE RAIL - Z
GALLEY FUNNEL - MM
SKIDS - E E
STAPLES
WHEEL - W
BINNACLE - Y
HATCH
MIZZEN MAST
DAVITS - DD
MAIN MAST
BOATS - CC
FOREMAST
CAPSTAN - AA
CAT-HEAD - N
BUMPKIN - O
HANDRAIL - M
WINDLASS BITTS - FF
FIG. 2.

cane, a scant 1/16 by 1/8 in. Measure off sufficient to go
around, and, at the middle and 3/4-in. intervals, drive 1/4 in. long points (from bank pins) through it. On these drop two or three beads, fastening them with a spot of glue, to make a rail 1/8 in. high. Invert this and drive the pin points into the edge of the bulwarks.

Make and fasten the wooden catheads (N, Fig. 2)—1/8 in. square and 1 in. long—and the bumpkins (O), which are ¾ in- long. They should project through the rails.

Now draw the plank lines on the pieces H and G, if it has not been done previously, and give the entire deck a coat of thin varnish.

Give the hull a priming coat of flat white paint and scratch in the water line (see Chapter II). When this is dry, sandpaper down and fill in any inequalities with white lead or thick paint.

Sandpaper again; then give the upper part a coat of black, and the lower a coat of dark green or the color known as "light red," if you prefer (see Chapter VI). Rub this down and apply another coat, finally rubbing down with pumice stone and water to take off any shine.

The top edges of the bulwarks are black along the waist and white at the forecastle and poop. The lower molding is white. The inside of the bulwarks is white, with brown stripes to represent teakwood paneling.

While the paint is drying, one can be making the deck fittings (Fig. 2). Many valuable suggestions for this work will be found in Chapter III. The cabin house (P) is a block of soft wood set into the poop deck. It projects 1/2 in. It should have a molding around the top edge and be white, with doors and win-

dows painted on. The forward deck house (Q) is similar, only larger.

The hatches are blocks of wood, with a groove cut around them; the after one (R) has a slide opening, under which is supposedly a ladder leading to the hold.

The companionway (T) on the poop is very similar, but is white with painted doors at the after end. The skylight (U) also is a block of wood, with barred windows, recessed and painted, around the sides. The binnacle (Y) is a similar block, paneled.

The steering gear (W) is a block of wood set on pin-and-bead legs, right over the rudder trunk. The wheel can be a gear from an old watch, with every other tooth filed away, or can be cut from a thin sheet of celluloid or brass.

The bitts (X) are made from 1/8 in. square wood—two uprights set in the deck with a crossbar (bolster) recessed into them and stained brown. The after bitts are set across the inner ends of the bumpkins. The ladders can be fashioned from 1/16 by 1/32 in. cigar-box wood or cut from celluloid. They lead, one on either side, from the main deck to the forecastle head and poop deck. Two or three steps are enough.

The fife rails (Z) around the masts are made from 1/8-in. uprights, with 1/8 by 1/16 in. horizontal pieces. The after ends of the one at the main are supported by pin-and-bead posts, and have three cut-off pins through them on either side, to represent belaying pins. The after ends of the forward fife rails are merely glued to the front of the deck house.

On the forecastle a capstan (AA) is fastened to the deck with a long pin. It may be painted green or black. There are three posts for windlass bitts (FF), the

larger and forward one 3/8 in. high and the others 3/16 in. high; these extend from the windlass underneath. There can also be a bell (KK) at the front edge.

On the top of the deck house, two boats (CC) are glued and lashed to skids (crossbars); and here the galley funnel (MM) is placed. It is painted black.

Staples, made by bending over stout pins, are driven in the positions indicated on the deck plan (Fig. 2). The two pairs amidship should be firmly placed.

This completes the hull. The next step is to place the spars and rigging as shown in Fig. 4.

First, the spars must be made from dowel sticks such as are sold at hardware stores. If you prefer, however, you can make them entirely by hand from any straight-grained hard wood.

Choose straight-grained dowels of suitable size (two 3-ft. lengths of 5/16-in. dowels, one length of 1/4-in., and two of 3/16-in.). The sizes of the spars can be estimated from the scale drawing.

The main lowermast is the largest; each succeeding mast is a bit smaller—the fore, then the mizzen, then the topmasts, and so on. Each mast tapers in itself very slightly.

The topgallant, royal, and skysail masts can be a single spar, the reduction in size forming a collar at the head of each. The lowermasts are painted entirely white, and the others white at the doublings and masthead. In between, they are stained a reddish brown with thin mahogany-colored varnish stain.

The tapering bowsprit is a bare 1/4 in. at the heel. The jib boom is 3/16 in. at the heel, tapering to about half, with two collars where the stays come. A hole is bored athwart the bowsprit for a thin wire with a loop

at each side, to which are fastened the shrouds. Two vertical holes are bored near the end, and at the underside of each a small glass bead is fastened. These are for the chains that run down to the stem (Fig. 4).

The bowsprit end is cut square. The jib boom has a hole bored for each of the four outer (head) stays to pass through.

Each lowermast has a fore-and-aft hole to take the trusses of the yards and an athwart hole under this for the futtock shrouds. The fore and main have a nail driven in on the fore side, ¾ in- from the deck. The mainmast, 3 in. below its head (upper end), has a wire band with a loop pointing aft.

The lower ends of the masts should extend right to the bottom of the hull, if it is hollow, and have a headless nail driven in to steady them. The upper ends should be cut to a square tenon for the depths of the caps.

The topmasts are cut square at each end and have a fore-and-aft hole for the halyards 11/8 in. from the head, and an athwart hole for the futtock shrouds below these.

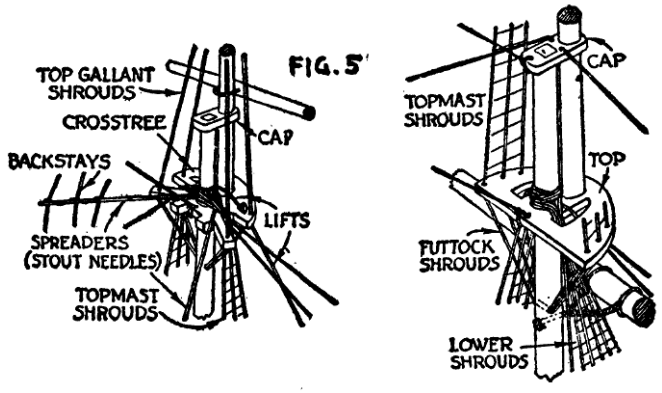
The topgallant (upper) masts are square at the heel, and have holes for each of the three halyards to the yards.

The main lower yard is the largest; the other yards decrease as they progress forward and aft, and then up until the mizzen skysail is reached; it is a bare 1/8 in. at the middle. The yards are round and tapered at the ends to about half their center thickness. The taper does not start until about halfway out.

The lower yards are supported by trusses of copper wire wound tightly around the center of the yard, then

twisted together to form an arm much the shape of a boat's rowlock, the stem of which goes through the mast and is clinched behind.

The other yards have holes through them on each side of their masts, through which a copper wire is passed and clinched on the fore side, forming a parrel which can slide up and down the mast. In the center of each yard is a vertical hole for the halyard, and near the ends of all is a vertical hole for the lifts and braces.



The hole for the mizzenmast goes right through the after deck house, and 1/8 in. behind this is another hole 1/8 in. in diameter to take the trysail mast, the upper end of which goes under the top and is held there with a small nail.

The spanker gaff and boom should be thickest about one third from the mast and should have wire eyes in the end, to slide on the trysail mast.

A top, cap, crosstrees, and another cap are required for each mast; these are shown in Fig. 5. The material from which these can be made the easiest is celluloid

about 1/16 in. thick. Such a piece usually can be found at a notion counter. A cap also is needed on the bowsprit.

Channels are necessary to keep the rigging from the ship's side (see Fig. 2). They are strips of wood 21/4 in. long at the fore and main, and *17/8* in. at the mizzen. The lower ones are a full 1/8 in. thick, and the upper ones, 1/16 by 3/16 in. wide. They are glued close under their respective moldings, with the forward ends in line with the masts.

For the lower rigging (the shrouds), get, for preference, some No. 18 linen fishing cord about 1/32 in. in diameter and stain it black. Set up one of the lowermasts and topmasts with the top and cap. On the starboard (right) side, in line with the mast, bore a hole in the hull ¼ in- below the lower channel; jam the end of the cord in this with a round toothpick and a touch of glue.

Take the other end of the cord up through the half circle in the top, between the masts, around behind and down through the top again, to another hole in the same side of the hull, in line with the first. Where the cords touch the channels, file or cut a slot the depth of the cord to take them. Pull them reasonably tight and fasten with another toothpick. Do the same on the other side until you have three pairs on either side at the fore and main, and two pairs at the mizzen. With thin cotton, frap (bind) each pair together under the top.

Next come the stays. Fasten one end of a similar cord to one of the pair of eyes at the forward end of the deck by knotting or seizing (binding); pass the other end through the top around behind the lower fore-

mast; carry the cord down to the other eye in the deck, pull tight, and finish off.

The mainstay is carried to staples just forward of the foremast. The mizzenstay comes to the nail in the mainmast instead of to the deck. These are double stays, the two parts of which are frapped (bound) together under the tops.

Now slip the topsail yards onto the topmasts, put the crosstrees in position, and set up the topmast shrouds. They can all be in one piece of cord, thinner than the lower shrouds.

Starting at the "top," reeve the end through one of the holes in the rim; carry the cord through the crosstrees, between the masts, down through a hole on the other side, through the lowermast, and so on, round and round, until you have three on either side. Then the two ends can be knotted under the top.

The topmasts have a pair of backstays on each side, set up the same as the lower shrouds.

The bowsprit and jib boom can be set up next. Ship the bowsprit in its hole in the bow. Set the two bobstays (chains) up tightly from staples in the stem to the beads under the sprit. Then fasten the shrouds (chains) from the wire eyes at the sides of the sprit to the staples under the catheads. Put on the cap and through it reeve the jib boom with the inner end, cut to a bevel, resting against the stem. Three-eighths inch above the stem lash the two together.

Make a martingale 1 in. long and 1/8 in. in diameter. Rather less than halfway from the lower end, put a wire through it. Cut a groove at the end, and at the top drive a headless pin, the other end of which goes through a hole under the cap into the bowsprit.

Now tie a chain under the boom near the end, bring it down to the martingale and up to the boom again, halfway between the first end of the chain and the cap; this should be tight when the martingale extends down at right angles to the boom. Fasten the bight (loop) of another chain to the same place on the martingale and bring the ends back to the ends of the catheads.

All this headgear can be of rope, but looks much better if made of chain. For the bobstays there should be ten or twelve links to the inch, and for the others considerably more. All chains should be painted black (see Chapters IV and VI).

Hitch the center of a light cord to the jib boom where the topmast stay comes through, and fasten the ends to the cathead. Do the same from the boom end. These are the boom guys.

Seize the bight of a cord around the boom at the bobstay, take the other end up through the fore crosstrees, behind the mast, down again, through the first hole in the boom, down under the wire in the martingale and back to a staple just forward of the cathead, hauling tight and finishing off. Put a seizing around the two under the cross trees.

A similar stay at the mainmast goes from the nail in the lower foremast around the crosstrees and down to a hole abaft the foretop.

There is only a single stay at the mizzenmast, leading from the masthead to the maintop.

Ship the topmast caps and the topgallant masts in the same manner as the topmasts. Put on the topgallant yards, set up the shrouds (Fig. 5), two on either side; fasten them to the masthead with an overhand

knot; and set up the stays, getting them tight. The one at the foremast reeves through a hole in the boom and fastens to the hull on the opposite side to the topmast stay. The lead for the other stays can be seen in the sail plan (Fig. 4).

Put on the royal yards, set up the backstays, and do the same with the skysail yards, backstays, and stays. These latter should be of a grade thinner cord, such as stout linen button thread or bead twist.

Take some stout needles about 11/2 in. long for the fore- and mainmast and drive the points in, to lie on the crosstrees under the bights of the rigging (Fig. 5). These face aft at an angle of about 45 deg. from the center line of the model. Seize the backstays to these, drawing them aft to space them evenly. Paint the needles white.

Ratlines (or steps) should be added to the lower and top rigging; No. 24 cotton thread will do for them (see Chapter IV).

The lifts to hold the yards horizontal are of cord. They are passed up through one hole at the yardarm, hitched at the mastheads, and then carried down through the other yardarm, with small knots underneath. Those for the lower yards pass through the holes at the sides of the caps.

The topsail-yard halyards (shown as dotted lines on the foremast only in Fig. *4,* but used, of course, on all yards but the lowest one on each mast) come up through a hole in the center of the yard, with a knot beneath; pass through a hole near the masthead, and go down to a double block about 1 in. lower than the top. A single block is made fast to a staple at the side of the deck under the rigging. Thin bead twist is rove

through these blocks and fastened off with a toothpick to a hole in the top of the bulwark. At the foremast, the halyard comes to the starboard side; at the main, to the post; and at the mizzen, to the starboard again.

The other halyards are similar, except that two single blocks are sufficient for the topgallant, one for the royal, and none for the skysail. They come down to alternate sides of the deck.

The blocks are made from boxwood or any non-splitting wood; holly answers the purpose well (see Chapter III). They should all be about as small as you can make them, say 1/8 in. for the larger blocks and less for the others.

The way to reeve the braces can be seen in Fig. 4. They can be of thin bead twist. Do not use cotton thread if you can help it.

The general idea of the braces is to swing the yards around on their parrel axes. They should be so arranged that if the yards were hoisted to the mastheads, they would lead slightly downward without touching one another and with as few bends as possible on their way to the deck, where they are belayed.

The lower yards should, if possible, have chain pendants (see Fig. 4). Note that the mizzen yards lead forward to the mainmast, the cross jack (lower mizzen) leading to the wire eye on the main lowermast and down to the fife rail. The main braces start from the ends of the bumpkins.

The inner ends of the spanker gaff hang by a two-single-block tackle to the top. The peak halyards start at the end, pass through a double block at the cap, through a single block halfway out on the gaff, through the cap block, and to the handrail. A single line runs

from the end, at either side, to the handrail, for the vangs (steadying lines), and another cord supports the outer end of the boom from the same place.

For sheets, the boom has a two-single-block tackle on either side, to staples in the deck. It has topping lifts from the end through single blocks hung from the top. This completes the rigging.

A boat in davits (Fig. 2) goes on either side abaft the main rigging. The davits, which can be fish hooks or stiff twisted wire, are set in holes in the bulwarks (see Chapter IV). The boat on one side should be double-ended (a surf boat), and the other should be square-sterned. They are hung with double-block tackles to small staples in the ends. The ends of the tackles are hitched to one davit about halfway down, brought up under the boat, and hitched to the top of the other davit.

The boats should have seats, and, if you like, oars. They should be white with brown gunwales.

The anchors can be cast from bronze or white metal, or cut and hammered from sheet lead (see Chapter III). The shank should be about 11/2 in. long. The stock is of wood, stained dark brown; the metal part is black. A chain should be fastened in the hawse pipe with a bent pin, and to a ring, which is hung from the end of the cathead. The crown of the anchor is lashed to a staple on the forecastle deck.

A short chain should hang from a staple in the rudder and be fastened to others under the counter (Fig. 4).

Each mast should have a small flat glass bead at the top for trucks; these may be gilded.

The house or company flag at the main has three

V-shaped stripes, blue, red, and white, the white being at the outside.

The National Ensign can be the usual one or, more correctly, with only 31 stars.

The base may be a board of any wood about 3/4 by 41/2 by 13 in., on which are glued and nailed two uprights shaped to the underside of the hull, with slots to take the keel. These may be cut from templates IV and X, but should not come so high. They can be quite plain or carved in any motif. Make sure that the ship stands upright in this and rests on a level keel (see Chapter VII).

CHAPTER XI

MODEL RACING YACHT

ALTHOUGH galleons, clipper ships, and barks serve as the subjects for most decorative models, there is another, perhaps simpler craft, that is gaining in popularity with ship modelers. Almost every ship model collection now boasts of at least one miniature of some famous racing yacht. Their flowing lines and trim expanse of snow-white canvas lend themselves well to decorative purposes.

What, for instance, could be more graceful than a carefully made scale model of *Enterprise,* the trim and speedy yacht that won the eventful races against the late Sir Thomas Lipton's challenger *Shamrock V* in the fall of 1930. Such a model can be built in a very short time from the *authentic* hull and rigging plans given in Figs. 1 and 2.

First, of course, it will be necessary to decide on some convenient scale for the model. This will depend on the amount of space you have available for displaying the finished yacht. In the drawings, the full-size dimensions are given, but by following the method of scale reduction explained in Chapter IV you will find it a simple matter to arrange any scale desired.

As given, the dimensions are in feet, but for the purpose of model making they can be considered as representing inches. Built full size to this scale (1 in. equals 1 ft.), the model will be 120 in. long and 160 in.

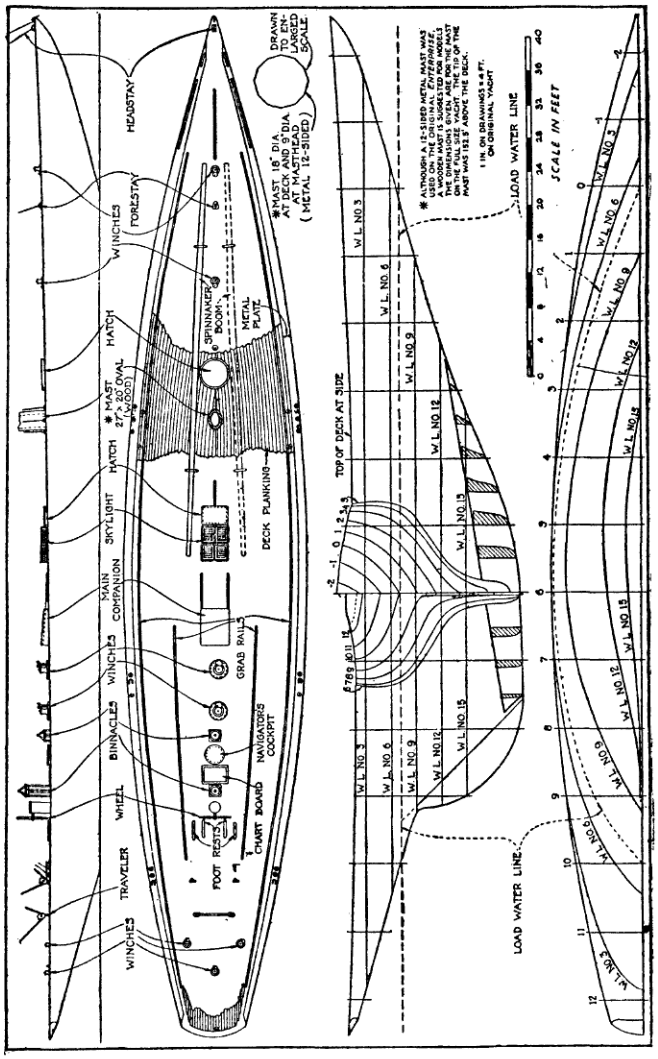

HEADSTAY
WINCHES
FORESTAY
HATCH
* MAST 27" x 20" OVAL (WOOD)
SPINNAKER BOOM
METAL PLATE
SKYLIGHT
HATCH
MAIN COMPANION
WINCHES
GRAB RAILS
DECK PLANKING
BINNACLES
WHEEL
NAVIGATORS COCKPIT
CHART BOARD
FOOT RESTS
TRAVELER
WINCHES
*MAST 18" DIA AT DECK AND 9" DIA AT MASTHEAD (METAL 12-SIDED)
DRAWN TO SAID LARGER SCALE
TOP OF DECK AT SIDE
W.L. NO. 3
W.L. NO. 6
W.L. NO. 9
W.L. NO. 12
W.L. NO. 15
LOAD WATER LINE
* ALTHOUGH A 12-SIDED METAL MAST WAS USED ON THE ORIGINAL ENTERPRISE, A WOODEN MAST IS SUGGESTED FOR MODELS AS THE FORCES INVOLVED ARE SMALL. THE MAST ON THE FULL SIZE YACHT THE TIP OF THE MAST WAS 101.5 ABOVE THE DECK. 1 IN. ON DRAWINGS = 4 FT. ON ORIGINAL YACHT
SCALE IN FEET
0 4 8 12 16 20 24 28 32 36 40
W.L. NO. 3
W.L. NO. 6
W.L. NO. 9
W.L. NO. 12
W.L. NO. 15
W.L. NO. 18
W.L. NO. 21
W.L. NO. 24
W.L. NO. 27

FIG. 1

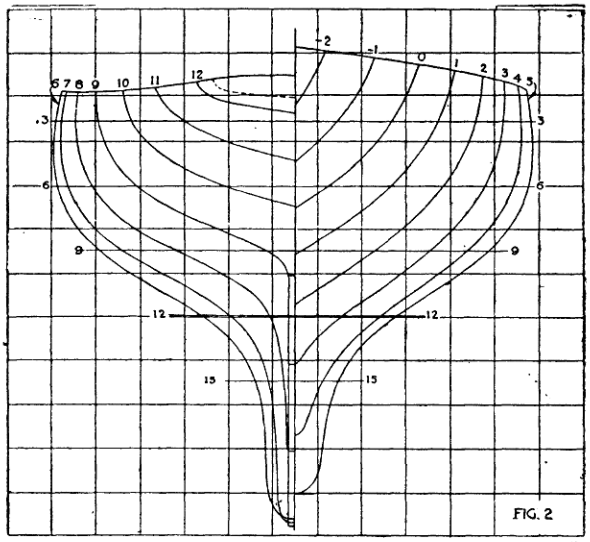
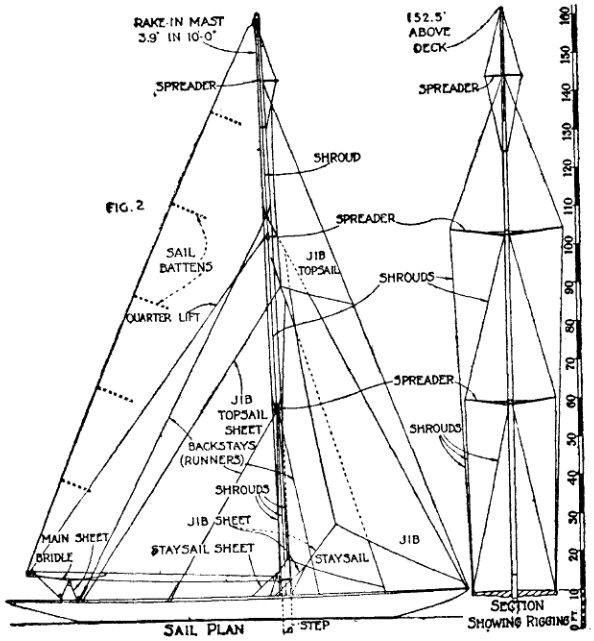

-2
-1
0
1
2
3
4
5
6
7
8
9
10
11
12
3
6
9
12
15

FIG. 2


RAKE IN MAST
3.9" IN 10'-0"
152.5'
ABOVE
DECK
SPREADER
SPREADER
SHROUD
FIG. 2
SPREADER
SAIL
BATTENS
JIB
TOPSAIL
SHROUDS
QUARTER LIFT
SPREADER
JIB
TOPSAIL
SHEET
SHROUDS
BACKSTAYS
(RUNNERS)
SHROUDS
JIB SHEET
MAIN SHEET
BRIDLE
STAYSAIL SHEET
STAYSAIL
JIB
STEP
SAIL PLAN
SECTION
SHOWING RIGGING
FT.
10
20
30
40
50
60
70
80
90
100
110
120
130
140
150
160

high above the water line. A more suitable scale, perhaps, will be 1/4 in. equals 1 ft., giving an overall length of 30 in. and a height of approximately 40 in.

Once you have decided on your scale, redraw the body and half-breadth plans full size for the scale chosen. This can be done by following the squares. Although shown as full size (2 ft. by 2 ft.) for the original yacht, they can be reduced to give the correct scale. For instance, if the 1/4 in. equals 1 ft. scale is chosen, make the squares 1/2 in. by 1/2 in. on the reduced drawings.

The hull can be built by the common "bread and butter" method of lifts as outlined in Chapter II. The sizes of the lifts can be obtained from the half-breadth plan redrawn to agree with the reduced scale. Cut away the extra stock on the glued-up hull carefully, testing the shape from time to time with cardboard templates made from the lines given in the body plan.

In studying the half-breadth and body plans, you will note that some of the original water lines have been omitted. This was done to simplify the lines for model construction.

The original *Enterprise* hull was painted white above the water line and left unpainted below. Since the hull was fabricated from bronze plates, this effect can be simulated on a decorative model by painting the hull white above the water line and bronze below. The spars and boom also should be white.

As to the deck fittings, these also are shown in the drawings. They consist principally of a wheel, two binnacles, seven winches, a skylight and hatch, and two grab rails. The mast can be oval to agree with the first mast used on the original yacht or twelve-sided

to imitate the metal mast that was substituted just before the yacht entered the races. To complete the effect of realism, scribe lines along the deck to imitate planking and apply a coat of clear varnish.

The sails can be made according to the general method outlined in Chapter V. Four sails will be needed for an accurate reproduction: a mainsail, a staysail, a jib, and a jib topsail. The sheets for these sails are rigged as shown in the sail plan. Three sets of spreaders should be spaced along the mast. These are fitted with shrouds as indicated.

A Racing Model of "Enterprise"

These same plans also can be used by the racing model enthusiast. Of course, some simplification will be necessary. The rigging can be made more conventional, the smaller deck fittings eliminated, and some of the unnecessary rigging omitted.

For a sailing model, a lead keel also will be needed. This can be the same size as that shown for the original in the reduced plans. When completed, it should bring the hull down in the water to approximately the load water line.

The process of making or casting a keel is more or less the same for any racing yacht model. First, fashion a model or pattern of the keel in white pine. As lead weighs approximately twenty-six times as much as pine, you can calculate easily what the weight of the lead will be. To make a test, float your hull model, distribute that much weight on the deck, and check to see that the hull sinks to the proper level and has the proper trim. Then build up or shave down the keel pattern accordingly. Finally, sandpaper the wood.

In order to cast the lead keel, you will need some sort of mold. This can be made of plaster of Paris. Screw together 1/2-in. or thicker boards to form a strong rectangular box similar to that shown in Fig. 3. It should be large enough to house the keel and leave at least ¾ in. in all directions except the top.

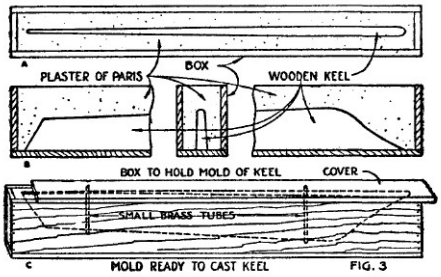


FIG. 3

With the box upside down, remove the cover (bottom) and insert the pattern as at B. Coat the sides of the wood with a soft mixture of plaster of Paris, finally packing it full. Screw on the cover and leave the box as at B for an hour or more to allow the plaster to harden thoroughly.

When the plaster is dry, remove the cover and carefully lift out the wooden keel pattern. A grip for removing the wooden keel can be made by driving screws into the top edge of the pattern near the ends. A perfect impression of the keel should be formed in the plaster. If any rough projections have been formed remove them.

To save the trouble of drilling the finished lead keel for the mounting bolts, two improvised cores should be placed in the mold before the lead is poured. These can be sections of 3/8 in. metal curtain rods or other

tubes, as indicated at C. Obtain the exact positions by placing the wooden keel pattern on the boat and marking carefully both where the bolts should go and their proper angle. The tubes or rods should be sunk at least 1/4 in. into the bottom of the mold. Also, they should project through the cover of the box to hold them rigidly in place. Be sure that they are centered accurately and stand at the proper angle.

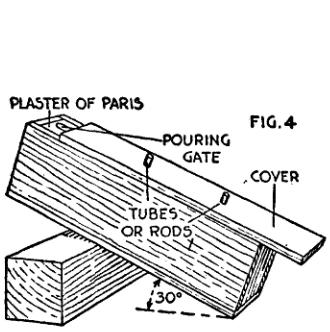


FIG. 4

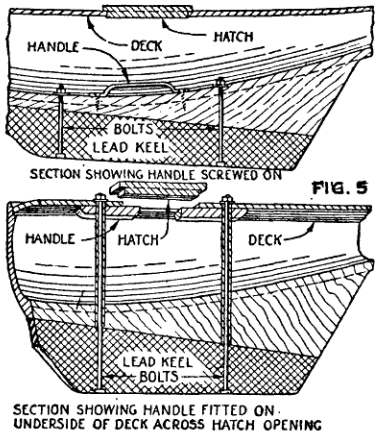


FIG. 5

In preparing for the actual pouring, the cover should be so placed that 11/2 in. of the mold is left open. This will form a gate for the lead. Set the mold at an angle of about 30 degrees as in Fig. 4.

Up to about 14 lb., it is satisfactory to bolt the lead keel permanently to the hull as indicated in Fig. 5, waterproofing the bolt holes with white lead putty. For a heavier keel, however, it will be more convenient, from the standpoint of portability, to have tubes or wells extend from the keel to the deck so that the

keel bolts go entirely through the hull. The keel then can be easily removed or attached at the deck.

The original sail plan of Enterprise can be altered easily to meet the requirements of a sailing model. For instance, if a jib, topsail, and staysail are used, it will be best if they are made narrower so that each will swing clear of the luff side of the sail directly aft of it when a tack is made. A boom also should be added at the foot of each headsail. Of course, as is the practice with most sailing models, the jib, topsail, and staysail can be replaced with a single jib.

CHAPTER XII

GLOSSARY OF NAUTICAL AND SHIP MODEL MAKING TERMS

Abaft—Toward the stern, immediately aft of.
Aloft—Above the decks.
Amidship—Toward the middle of a vessel.
Athwart—Across a ship or boat, at right angles to the lengthwise center line.
Backstays—After braces for the mast.
Beam—The breadth of a vessel.
Bees—Small cleats on the bowsprit.
Belay—To make a rope fast.
Belaying pin—An iron or wooden rod, having a handle-shaped end, to which ropes are secured.
Bending sails—Fastening them to masts or spars.
Bight—A loop, generally in a rope.
Binnacle—A housing for the compass.
Block—A pulley.
Bobstay—A stay running from the outer end of the bowsprit to the stem.
Boom—A spar at the foot of a sail.
Bow—The forward end of a vessel.
Bowline—A rope used on early ships to hold the weather edge of a square sail forward.
Bowsprit—A stationary spar projecting forward from the bow.
Braces—Part of the running rigging used for setting the yards.

Bulwark—The side of **a** ship that extends above the deck.
Bumpkin—A spar extending outboard from the stern of a ship or boat.
Cascabel—Part of the breech on an old style cannon.
Cathead—An outboard timber near the bow of a ship or boat for lifting the anchor.
Counter—The overhang of a ship's stern.
Cross jack—A square sail used on the lower yard of the mizzenmast on early ships.
Crosstree—A metal or wood fitting placed crosswise on **a** mast.
Davits—Members, ordinarily curved, used in raising and lowering a ship's boat.
Deadeye—A sheaveless block used in setting up standing rigging.
Downhaul—A rope for hauling down **a** sail or spar.
Draft—Depth of hull below the water line.
Fair lead—A guide for a rope, placed in the rigging.
Fid—A marlinespike made of wood.
Fife rail—A rail around the foot of **a** mast, generally built in the shape of **a U.**
Footrope—A rope rigged below **a** yard.
Forecastle—A forward deck compartment for the crew.
Foremast—The mast nearest the bow.
Gaff—A spar for extending the top of a fore-and-aft sail.
Gammoning—A lashing of rope or chain, used on the bowsprit.
Grummet—A flat coil of rope.
Gudgeon—A metal socket for **a** pintle.
Halyard—A rope or line used for hoisting the sails. (Sometimes spelled *halliard* or *haliard.)*
Hatch—A cover for an opening in the deck.
Jackstay—A metal rod, extending along the top of **a** yard, to which the sails are attached.
Jib boom—A spar extending from the bowsprit.

Keel—The bottom fore-and-aft member in a hull. It extends from the sternpost to the stem.

Knightheads—Vertical timbers each side of the heel of the bowsprit.

Lanyard—A rope, generally used in rigging deadeyes.

Leeches—The side edges of a square sail.

Mainmast—The second mast from the bow.

Manrope—A rope along the side of a ladder or gangway.

Marlinespike—A metal tool used in opening the strands of a rope when making a splice.

Martingale—A vertical spar bracing the jib boom.

Mizzenmast—The mast directly aft of the mainmast.

Orlop—Lower deck.

Parrel—A rope, chain, or collar by which the middle of **a** yard is held to the mast.

Paunches—Long battens over the mast bands to prevent the sails from becoming chafed.

Pintle—One of the metal pins on which the rudder pivots.

Poop—An after structure on the deck.

Port—The left-hand side of a ship, looking forward (red).

Rake—The rearward inclination of a mast.

Ratline—A crosswise rope attached to the shrouds and used as a step.

Running rigging—Ropes or lines used for controlling the sails and spars.

Shrouds—Guys, part of the standing rigging on a mast.

Sieze—Fasten.

Spencer—A trysail placed abaft the foremast or mainmast.

Spritsail—Small sail rigged under the bowsprit.

Spurling gates—Holes, generally metal-lined, in the deck for the anchor chains or cables.

Standing rigging—Fixed rigging for the masts and stationary spars.

Starboard—The right-hand side of **a** vessel, looking forward (green).

Stem—The timber that forms the extreme bow.
Stern—The after end of a vessel.
Sternpost—The vertical timber at the extreme stern that supports the rudder.
Studding sail—A small sail arranged at the end of a yard to increase the canvas area.
Taffrail—Rail around the stern.
Topping lift—A rope or cable support for the yard when it is in its lowered position. (Sometimes called *lift.)*
Topside—Above the water line.
Trestletrees—Support for the crosstrees.
Trysail—A fore-and-aft sail fastened to a gaff placed abaft the mast.
Tumble home—The slope of a hull inward from the water line to the deck.
Vang—A rope used to steady a gaff when no sail is set.
Yard—A spar used to support a square sail.

NOTE—In these definitions, the word "rope" has been used. This was done for simplicity. According to experts there are but three ropes on a ship: a footrope, a bucket rope**,** and a manrope. The rest are lines, stays, braces, etc.

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