PART II
Building the Hull

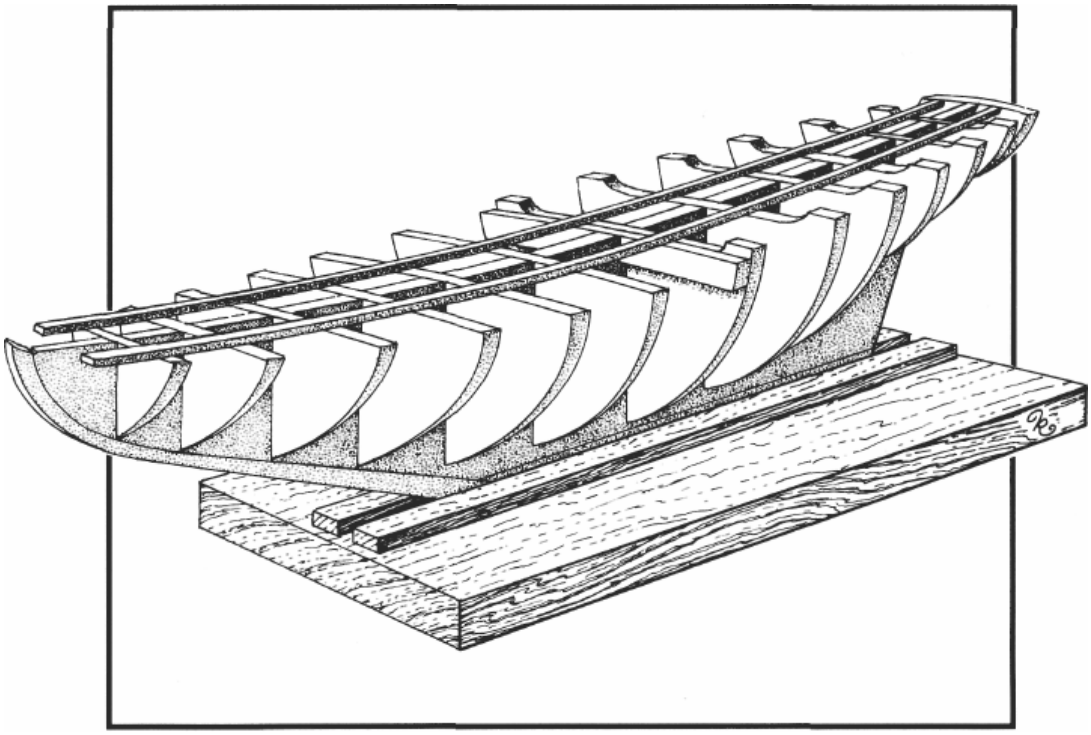
"The Topmast Studding Sail is bent to a Yard, with Knittles and Earings, and frequently laced to it. This Sail has sometimes a Reefband in it. It is gored in the outer Leech, according to the Length of the Boom, and the Squareness of the Yard, and also at the Head from the outer to the inner Earing."

—The Young Sea Officer's Sheet Anchor, *1819*

The language of the sea has a life of its own, developed over hundreds of years. Someone just learning English and a Ph.D who's studied the language for 30 years are on an equal footing when they begin their first models. At times it can be intimidating: Just what the heck are the instructions talking about?

Before we start assembling our first model, here are some simple things to visualize. We start with the *keel,* the ship's main structural member. The keel runs longitudinally down the ship's centerline, from *stem* (or *bow)* — the front — to *stern* — the rear. Everything is built up and out from the keel.

Next we add other pieces at right angles to the centerline formed by the keel. These pieces will run *athwartships* and will add strength and stability to the hull. These are *bulkheads,* the bases of which you're going to attach to the keel. For the purposes of this book we'll call them *bulkhead frames.* (On a



real ship, frames are rib-like girders that run athwartships from the keel to the deckline. They stabilize the hull and provide shape and a base for planking.)

If you can picture this simple assembly, you'll have no problem as we move into our construction phase.

The trick to assembling plank-on-bulkhead models is patience. You'll be assembling a lot of often rough-cut wooden pieces — frames, keel sections, decks — into what is supposed to be a very precise, symmetrical hull. One piece out of kilter can throw the entire model off. And then you can throw the entire model out.

On your first run-through everything should be assembled, piece by delicate piece, without going near the glue. I have developed several methods that will teach you how to check symmetry, and how to make sure that when you're finally ready to assemble everything, it will fit.

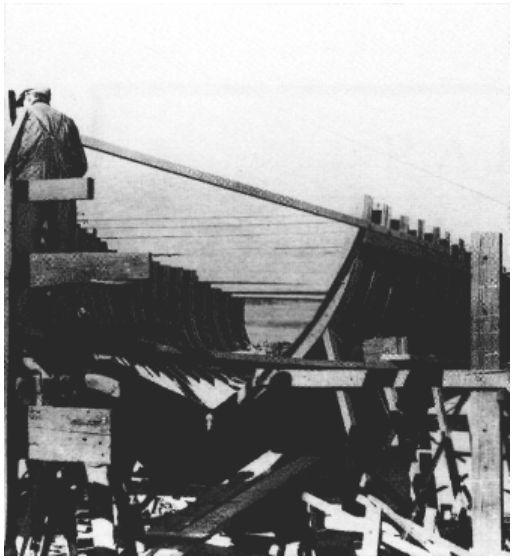


PHOTO 18. *Real-life construction techniques may vary from those of models, but once the hull is planked and decked the result looks the same.*

Keep your hands off the glue until we're ready. I'll give you a nudge now and then while we're checking things to make sure you don't just say: "Well, it looks good to me, let's glue it."

Don't.

In building any ship model it's essential that the work follow a known, logical pattern. Otherwise it's all too easy to feel overwhelmed. And it's all that much harder for beginners, who have not yet developed a sense of procedure and may make things much harder than they have to.

Read through the following steps to get an idea of how we'll proceed. The approach I've outlined here has proven its effectiveness over the years. The details for each step of the process are covered more thoroughly later as we make our way through the construction. Let's get started.

SEQUENCE FOR BUILDING THE HULL

Step 1: Check your kit. Open the kit box and look through the contents; get an idea of what each part looks like. Almost every kit contains an instruction booklet with a checklist of all the parts. Make sure that all the parts are there, that the wood strips are intact, and that all the plastic envelopes holding small, loose parts are sealed. Also, check to make sure that *all* the plans are in the kit. If they're not, call your mail order house or retailer immediately.

Step 2: Assemble the keel. Remove the keel parts. (Some kits have a one-piece keel, others may have more than one piece.) Take the assembly drawing and tack or hang it up over your workbench. That way you'll be able to see it easily while you're assembling the framework.

Step 3: Fit the frames to the keel. Check again that the frames are not broken

or distorted and mark them for symmetry. File all the inserting cuts in the frames until they fit hand-tight in the keel.

Do not glue the frames on the keel until the assembly is completed.

Step 4: Check and fit the decks. This operation is extremely important because the decks will straighten the keel and help align the frames. Decks in kits are generally made in two different patterns. The false decks (like a subfloor in a house) used on models of single-deck ships such as schooners are generally made all in one piece and have no grooves to fit on the frame's bulwark extensions; while the decks used on multiple-deck ships do have precut grooves along both sides to fit around the bulwark extensions. Both these types must be centered on the keel and aligned with the frames. Never force the deck into place around the frames; that will buckle the decks and distort the hull.

Step 5: Put in wood blocks for masts. The method of installing masts varies with the manufacturer and the model. On some, wooden blocks are installed below the deck to provide a solid support for the masts. Other plans will show how to insert the mast through holes in the deck to the keel. I prefer to install wooden blocks on all models because it provides a more stable mast footing.

Step 6: Tack in the deck. Once you've fitted the decks, tack them in place *without gluing* using the pins supplied in the kit. If you need extra pins, sequin pins from a sewing shop are excellent; hobby shops will have them too. Make sure that the centering lines you have marked are aligned with the keel and the frames.

Step 7: Assemble and fit the bow and stern pieces. These solid wooden pieces will help give the proper shape to the model and provide a solid base for the ends of the planking. Pay careful attention to shaping these pieces; they must be symmetrical and follow the shape of the hull.

Step 8: Glue the frame assembly. After a final check to assure yourself that your framework is straight and your decks are not twisted or buckled, you can proceed to glue the framework. Let it dry at least 24 hours.

Step 9: Taper the frames. Once the glue is dry, you can begin to taper the front and back frames. Use a planking strip to check that the planking will sit flat against the bow and stern frames. File the frames until the strip rests flat against them.

Step 10: Install the gunport frames, if necessary.

Step 11: Plank the deck. If your model has no bulwark frame extensions, you can now plank the deck. If your model does have frame extensions, you will plank the deck when the

hull planking has been completed and the extensions are removed (Step 15).

Step 12: Plank the hull. You can now begin the first layer of hull planking. When you plank the bulwark extensions be sure to install pieces of tape on the outside of the frames above the deck line so that the planks will not be glued to the extensions, which have to be removed later.

Step 13: Cut the gunports. If your model has posts that support dummy guns, you will have marked the position of these posts on the planks as you went along. If your model uses gunport frames, these will have already been installed before planking. This will enable you to locate the gunport's position correctly in front of the posts. When the first layer of planking is done, cut the gunports before sanding the hull so you don't erase your markings. When the second layer of planking is installed, you can cut the gunports as you plank over them. With other models, the gunports are cut into the completed planking.

Step 14: Install the second layer of hull planking, sand it smooth, and varnish.

Step 15; Plank the deck. If your model has bulwark frame extensions, remove them with an X-Acto saw blade and plank the deck. Varnish the deck.

Step 16: Plank and varnish the bulwarks.

Step 17: Install the wales, the channels, and the deadeyes.

Step 18: Put waterways and timberheads into place, if required.

Step 19: Paint, apply copper plating, and do ornamentation. If your model calls for the hull to be painted or coppered, you can do that now and then set your hull on its permanent base to avoid unwanted marks or scratches. If your model requires ornamentation of the bow and stern, finish that before installing the hull on its permanent base.

ASSEMBLING BULKHEAD-ON-KEEL HULLS

Very often the precut bulkheads — the solid athwartships pieces — found in plank-on-bulkhead ship models are out of symmetry and off center. If you assemble them without correcting the imperfections, you end up with an uneven hull profile. Figure 5 shows the method I use to check the frames.

Place a bulkhead frame from your kit on a sheet of thick paper (manila folders work best) and trace its outline **(1).** Remove the bulkhead frame from the paper, and cut around the outline with a pair of scissors to create an exact paper pattern **(2).** Next, fold the paper pattern (3), making sure that the upper

outer edges are matched and clipped or stapled together before you crease it in the middle. The crease will produce a true centerline and show if the lower outer edges are cut unevenly or if the keel slot in the frame is off center.

If the outer edges are misaligned, remove the excess on the pattern with scissors to even out the edges of the two halves. Return the folded pattern to the bulkhead frame (4), mark and file off the excess on the frame itself, and draw the centerline (C). If the keel slot is out of center with the pattern, mark it on the bulkhead frame.

Now repeat this on the other side of the frame by just turning the pattern over and aligning it on the previously drawn centerline (5). Next, correct the bulkhead frame's outer profile by filing off any excess you have marked. If the center slot is out of alignment with the centerline, glue on thin strips of wood to fill one side and remove the excess on the other side. Finally, draw the centerline on the top edge of the bulkhead. This mark will help line up the frame with the keel during the actual assembly. Repeat this procedure with every bulkhead and you'll have a symmetrical hull profile.

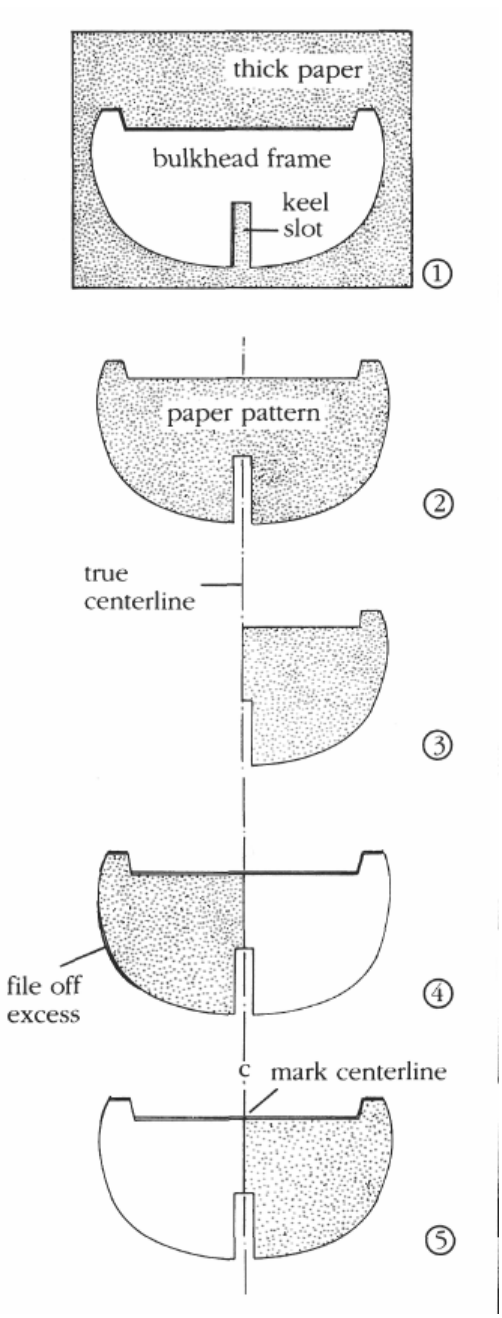


FIGURE 5. *Checking symmetry on bulkhead frames.*

ASSEMBLING THE KEEL

In the types of models I've suggested for beginners you'll be asked to assemble keels that come in two, three, or four sections. It is extremely important that you do this job as close to perfectly as possible to get a symmetrical, straight hull. Figure 6 shows how I attack this problem. Get a flat, straight piece of wood, such as a shelving board, and nail a 1-inch by 3/4-inch strip of wood along its length to form a baseboard on which the keel can be assembled. Each of the keel sections is notched where it keys to the next section forward or aft; these notches must be filed with *extreme* accuracy to allow the sections to fit smartly into one another. Make sure that the base of the keel is snug against the wooden baseboard for exact alignment.

Reinforce the joints with some small pieces cut from a sheet of 1/16-inch plywood. These pieces become a permanent part of the hull, so make sure they don't cover the bulkhead slots or extend below the keel on the bottom. To prevent the glued seams from sticking to the work surface, insert file cards between the keel and the board behind it. When everything is ready, glue and assemble the keel, applying pressure to the joints with clamps.

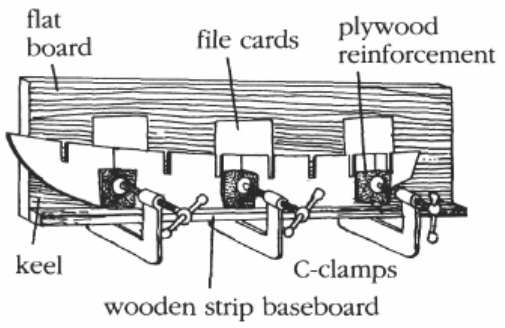


FIGURE 6. *Aligning the keel.*

ALIGNING THE FRAMES WITH THE KEEL

Here's another reminder: A very common mistake, and a very tempting one that I've seen a lot of people make, is to glue each bulkhead on the keel before checking the entire frame assembly. You've placed a bulkhead on the keel and it looks pretty good. Why not just glue it on?

Let me repeat: *Don't do it yet.* Doing so can lead to costly and frustrating delays. As the glue dries it will distort the frame, and the entire hull will be useless and have to be scrapped.

The proper method is first to assemble the entire frame, fastening the deck, the provided strengtheners, or both temporarily using small pins. Once you've checked the entire assembly for alignment and symmetry, glue it together and remove the pins.

VARIATIONS ON CONSTRUCTION

FALSE DECKS. Plank-on-bulkhead kits require a range of assembly methods, but

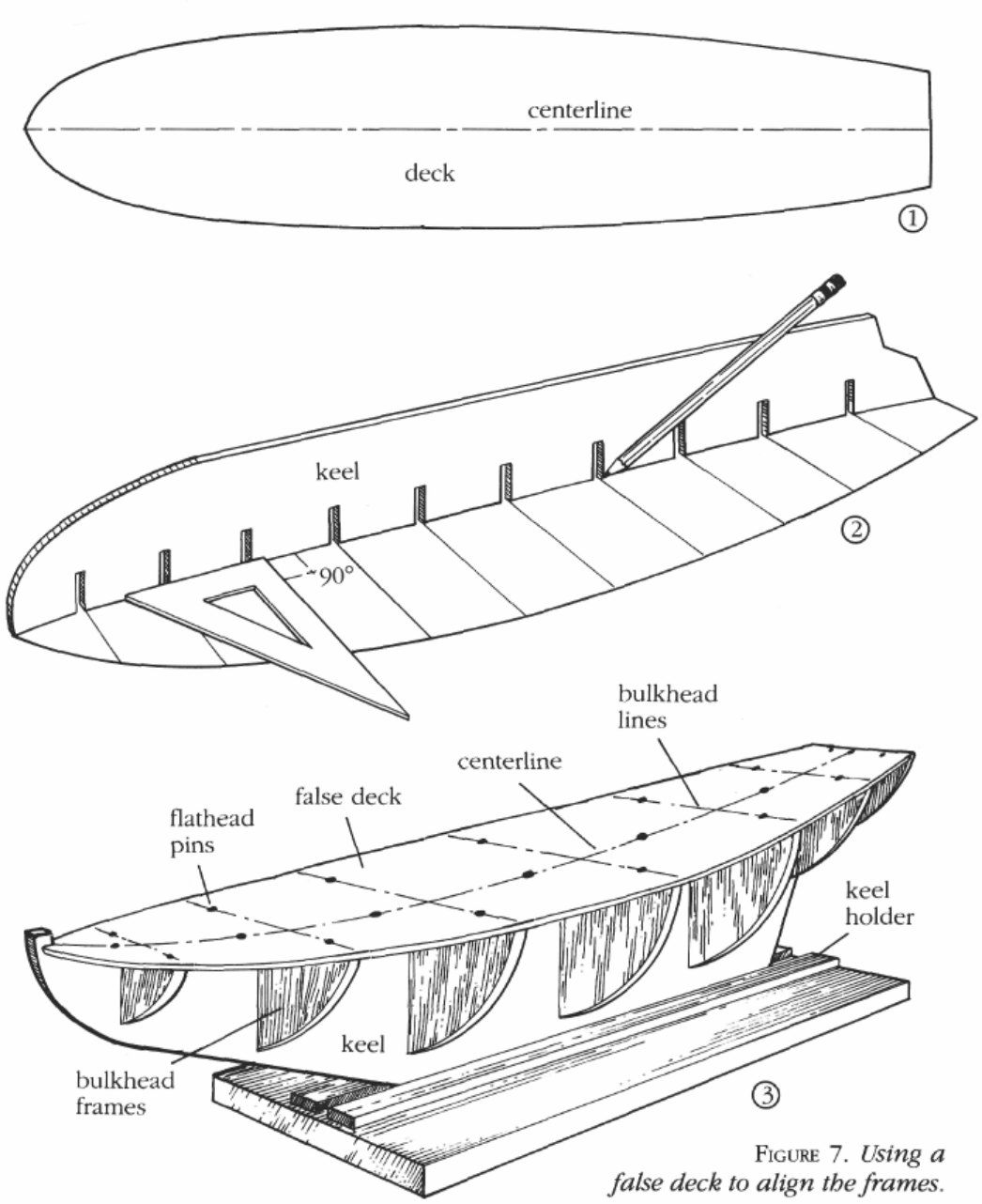


FIGURE 7. *Using a false deck to align the frames.*

in all cases success begins with a straight symmetrical hull.

The first and simplest technique uses the false deck itself to properly fit the frames. This system is found in Artesania Latina's *Swift* kit and in most other schooners. To begin, check the bulkhead frames and assemble the keel as we discussed earlier.

Figure 7 shows how we can use a false deck to align the frames. With a pencil, mark the centerline on both the top and bottom of the false deck **(1).** Place the keel on the deck **(2)** and mark the outline of each of the frames' slots on the deck line. With a square, mark the bulkhead lines on both sides, and top and bottom, of the false deck. Next, assemble the bulkhead frames on the keel **(3).**

Step 3 also shows a keel holder, which will hold the assembly in position and ensure that the keel is straight. Your keel holder will come in handy for more things than checking alignment — make one and hold on to it. The keel holder is made of flat scrapwood and two 3/8-inch by 1/2-inch strips as long as (or preferably a little longer) your hull. Sandwich the keel between the two strips and nail them to the board.

When assembling the bulkhead frames to the keel, make sure that:

- the center of each bulkhead is aligned with the keel.
- the tops of the frames are flush with the upper edge of the keel.
- the frames are neither too tight nor too loose in the keel notches.

Keep your hands off the glue, we're not ready yet.

Place the false deck on top of the frames and align its centerline with the keel **(3).** Pin the deck to the top of the keel along its centerline, using flathead pins to avoid problems later with deck planking. Never force the deck onto the bulkheads, since this will produce distortions and buckling. Check the precut slots and file them to fit, as necessary. Pin the deck to the frames, following the bulkhead lines you marked in Step 1. Make sure every frame is exactly on its line under the deck; use two pins on each side of the centerline. To make this operation easier, clamp each frame in a vise as you drive the pins on top of it so that it is supported.

Now you're ready to glue the frames to the deck and keel. I use carpenter's glue right from the container. With a 1/4-inch brush, apply a bead of adhesive on the bow and stern side of each frame where it meets the deck and keel; every joint should be glued. Return the assembly to the keel holder to let the glue dry for at least 24 hours. The keel holder board will prevent distortions while the glue is curing.

FRAMES WITH BULWARK EXTENSIONS. Here's another type of construction, this time involving frames with bulwark extensions. Once you've assembled the

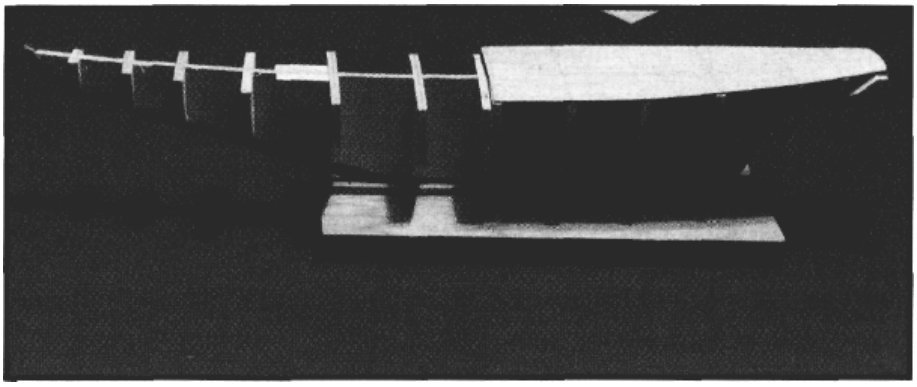


PHOTO 19. *The false deck will help align your framework. Note the blocks on the fifth bulkhead and how the tops of the bulkheads are flush with the top of the keel. Also note the keel holder, a piece of simple carpentry that will prove invaluable.*

keel and the frames — perfectly, of course — we are ready to proceed. In this case it would be very difficult to use the false deck to align and support the frames because most of these kits have precut frame slots that do not align perfectly.

Here's how I prefer to do it. Place the keel in the your keel holder board (see Step 3 in Figure 7) and check the frame to make sure that:

- the frame tops are flush with the upper edge of the keel.
- the frame bottoms are properly aligned fore and aft with the keel bottom.
- the frames do not fit too tightly on the keel
- the frame centers are exactly on the keel.

Next, remove all the frames from the keel. (No glue until everything is checked.)

Figure 8 illustrates what to do next. Set the midship frame in place and secure it with two square-edged pieces of scrapwood — glued to the keel on opposite sides of the keel against the midship frame (1). This will ensure that the frame sits squarely on the keel and can serve as a guide for all others. Insert all the other frames in their slots and proceed as follows:

Take two strips of 3/8-inch by 1/8-inch scrapwood, lay them on top of the keel, and mark on them the center of all the keel's frame slots. Place the two strips on top of the frames as close to their edges as possible and pin the strips to the center frame. Now pin the strips to the rest of the frames following the frame

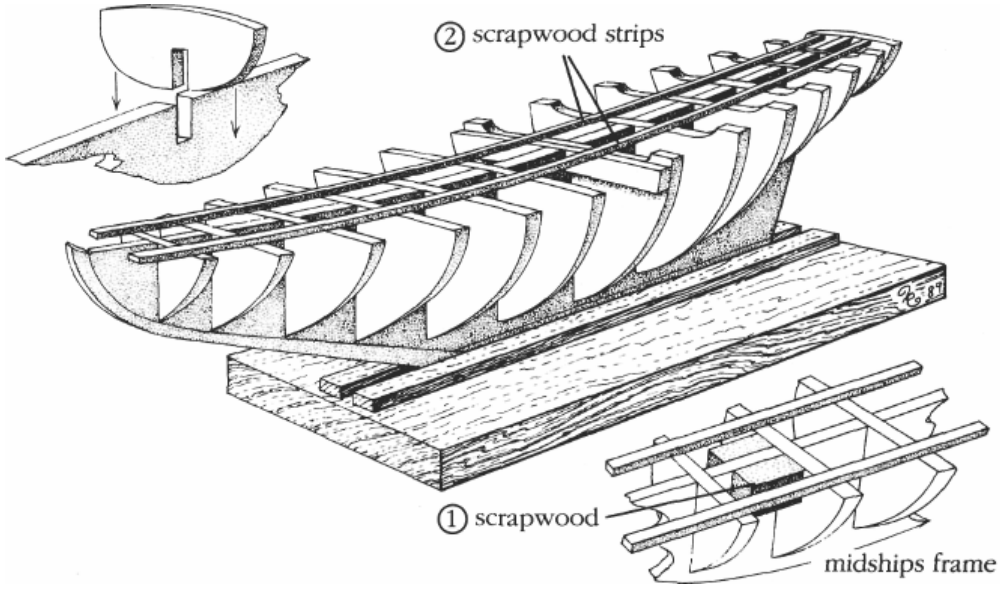


FIGURE 8. *If the frame that will eventually become your hull isn 't aligned properly, you might as well stop—nothing else will fit. There are a number of ways to make sure the frame's two components, the bulkheads and the keel, are fair and symmetrical. Fitting the bulkheads squarely into the keel slots might require blocks on the midship bulkhead and reinforcing strips pinned to the bulkhead tops.*

slot marks you just made (2).

The distances between the marks will be exactly the same on both sides, so all the frames will be aligned and squared with the keel. Run a bit of glue along the joints where the frames meet the keel, set the assembly on the keel holder board, and let it dry thoroughly. The strips will be removed before installing the false deck.

KITS WITH PRECUT REINFORCING PIECES. Kits by Pan Art and Mamoli use precut reinforcing strips that drop into slots cut in the bulkhead frames. This approach ensures a stronger hull and easier assembly. Figure 9 shows the method used by Pan Art in the *Amerigo Vespucci* kit. Here two precut reinforcing spacers running the length of the hull and fitting snugly into the frame slots do a nice job of holding the parts together (1).

You'll still have a number of things to do to make sure the final assembly is distortion-free. A keel holder is once again the key to success.

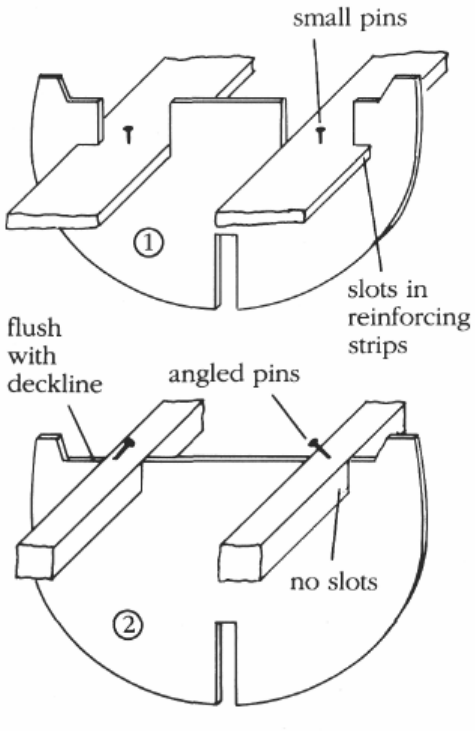


FIGURE 9. *Aligning frames with precut reinforcing pieces.*

First, check all the bulkheads to make sure they fit properly in their positions on the keel. Next, set the midship frame on the keel and square it by installing two square-edged corner pieces (or right-angled triangular gussets, if you prefer), one on each side of the keel. Glue the corners and the bulkhead and keel and let them dry.

Now comes the task of checking that all the other bulkhead frames are fitted parallel to the midship frame. This is best accomplished by installing the frames one at a time. Add the next bulkhead on the keel and insert the two reinforcing spacers. The distances on each side of the keel between the midship frame and the new bulkhead should be the same. If they are, you know the two bulkheads are parallel. As you add more bulkheads, the distances should remain the same.

If this isn't true, or the spacers won't fit easily, proceed as follows:

File the slots in the spacers until the frame sets parallel to the center one, then fill in the gaps with thin wood strips until the fit is perfect.

Don't glue anything yet.

Now proceed with the rest of the bulkheads as previously explained. Everytime you check the next bulkhead, you will most likely have to remove the spacers and check how the cutouts fit on the bulkhead. It takes a little time and patience, but the final result will be worth your trouble.

When the bulkheads all are set in their stations with the spacers installed, you can drive in small pins to make sure everything stays in place. Now, with a thin brush, run a bit of carpenter's glue in all joints where the frames meet the keel and spacers. Install the assembly on the keel holder and let it dry.

The next method, illustrated in **(2)** and used by Mamoli for the *Constitution* kit, is similar to that shown in **(1),** but is a little easier to work with. Start by checking the bulkheads and setting the

midship bulkhead with the square reinforcing corners. The reinforcing strips in this method have no slots to fit the frames. Only a little filing may be required on the bulkhead slots to ensure that the reinforcing pieces fit into them. In this case it is most important that pins be used to keep the other bulkheads aligned with the midship bulkhead.

The reinforcing pieces in these kits are 10 mm square and it may be difficult to drive in the pins. Use a small bit to drill holes into the strips at the angles shown in (2) to make things easier. Make sure that the upper edges of the pieces don't extend above the deckline of the bulkheads. Once you're satisfied that all is square, glue away as we discussed previously.

GuNPORTS

Manufacturers use a lot of approaches to cut and finish gunports. Some kits use precast frames, as shown in steps (3) through **(6)** in Figure 10; these are installed before the hull is planked. On other kits you'll simply cut through the planked hull, as in steps **(1)** and **(2).** It's really a simple process once you understand how your kit addresses the problem.

I'll explain the whole process now, before you start planking. Gunports follow the rake of the deck, so while their upper and lower edges may be parallel

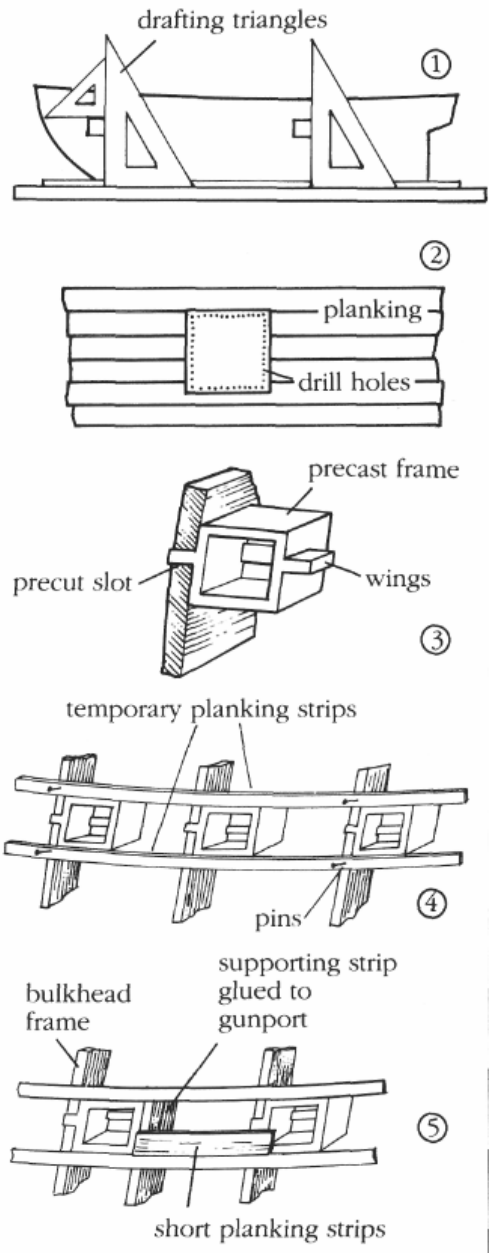


FIGURE 10. *Cutting the gunports.*

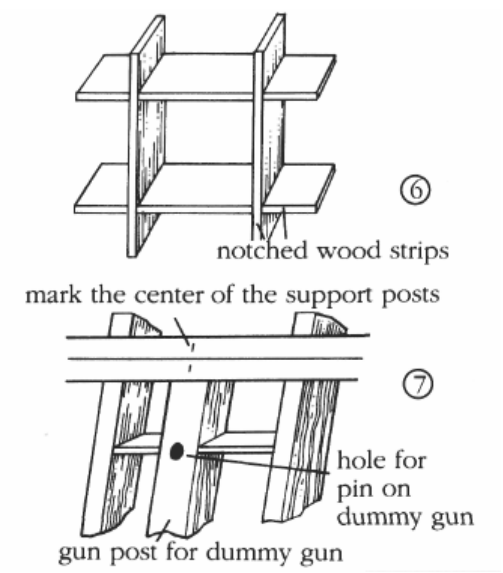


FIGURE 10, CONTINUED. *Cutting the gunports.*

to the keel, their distances from the keel will vary: Make sure you consult the plans frequently and carefully.

Without frames:

The sides of the gunports must be square to their upper and lower edges. To do this, place the planked hull in your keel holder and set a drafting triangle alongside it **(1).** Run the square along the keel holder and mark the sides of the gunports according to the plans. You can determine the position of each gunport by measuring the distance from the caprail to the upper side of the gunport on the plans. The gunports' upper and lower edges must be parallel to the base of the keel. Do this by placing a second square against the first one as shown in Step 1.

To make the opening, drill a series of holes inside the lines you marked in Step 1 and cut across them with a sharp knife (2). (When cutting and drilling gunports, it's a good idea to tape the inside of the bulwark so that the planking doesn't splinter.) A scalpel with a #11 blade works best. Rubbing the blade on a piece of wax will help ease the cut. Make several light cuts until the blade goes through, but don't use too much pressure or you'll crack the planks. Next, carefully file the edges to remove the drill marks.

Frame the sides of the gunports with wood strips (check your scale). I pick a different wood from what was used for the hull planking to obtain a contrast and bring out the framing.

With frames:

Mamoli kits use precast white metal gunport frames (3). These have two wings: One, depending on where the gunport is located, is inserted and glued in a precut slot in the bulkhead. The other wing is then cut off.

There are some problems with this system. The slots in the bulkheads don't always line up, and their angle doesn't permit you to align the gunports with the hull. To overcome this I suggest the following: Pin a planking strip to the bulkhead frames in line with the bottom of the gunports **(4).** Set each gunport frame on the strip; if the slots don't match, recut them and fill in with wood strips. Install another planking strip even with the

upper edge of the ports. Now check that the ports will set flush with these two strips and glue the ports in place.

The plank ends at the gunports must be supported by a wood strip glued vertically just inside the port between the upper and lower planks (5). The short planking strips between the gunports then can be glued to the supporting strip on one end and the bulkhead frame on the other. All this must be done carefully and with precision in order to preserve your smooth hull contour at the gunport level.

Movo uses wood strips notched into each other to form the gunport box (6). This method is very accurate and easy to work with. The gunport frames are glued on precut bulwarks which are installed inside the bulkhead frames as each deck is built up. The outer edges of the gunport framing then must be faired and shaped to the contour of the two bulkheads on either side so that the planking between gunports can rest evenly on gunport frames and bulkheads. The best way of shaping the frames is to lay a file over their edges lengthwise along the hull and spanning the bulkheads. File gently to pare back the gunport frames. To be safe, apply a strip of masking tape to the edges of the bulkheads. When the file cuts the tape, it's time to stop.

On other models, you'll have to cut the gunports around the posts that will be used to support the dummy guns. The kit supplies a pattern with centerholes for the gunports' locations. Most of the time, the pattern isn't accurate and consequently, if you follow it, you'll end up with the ports in the wrong places. To avoid this problem, mark the center of the support posts **(7)** on the planks while you're planking. When you've finished the hull, you'll see where the posts are located.

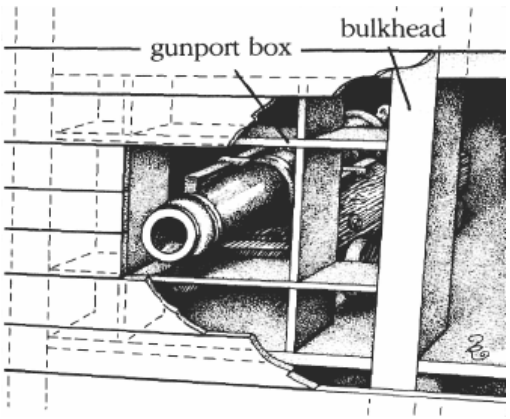


FIGURE 11. *Gunport frames must be cut and aligned with the bulkheads and the deck or you'll face the troubling possibility of skewed gun barrels and a cockeyed show of force.*

PLANKING THE HULL AND DECK

PREPARATION

Now it's time to start planking the hull. While we're talking here about plank-on-

bulkhead models, the same technique in a simpler form applies to solid hulls.

You'll need a six- to eight-inch high container filled with water, a plank bender (the electrically heated one made by Aeropiccola is very good. If you don't have a plank bender, you can use a hair-curling iron, although it won't work as well), an X-Acto knife with a *#11* blade or a scalpel, a small hobby-type plane, a small hammer, a pair of needlenose pliers, a box of 1/2-inch brass pins, a drill with a bit slightly smaller than the diameter of the brass pins you're using, a small vise with a vacuum-type base, a metric ruler, a 12-inch steel or aluminum ruler, a block of wood 4 inches by 3/4-inch by 12 inches, white carpenter's glue, and ACC glue.

Scale will obviously affect the size of the planking you'll be using. Most 19th century ships rarely used deck planks wider than six inches; hull planking was wider, from eight to perhaps 12 inches on the real thing. At modelbuilding scale the difference is minuscule, but important. Maintaining authenticity means that you're going to be working with some very thin strips of wood.

Most kits contain two layers of planks: the first, or base planking, and the second, or finish planking. The first planking is generally light wood varying from 1 to 2 mm thick and 5 to 6 mm wide. The finish planking is generally walnut or oak, although occasionally it includes mahogany or other dark woods, or lime, which has a light yellow hue.

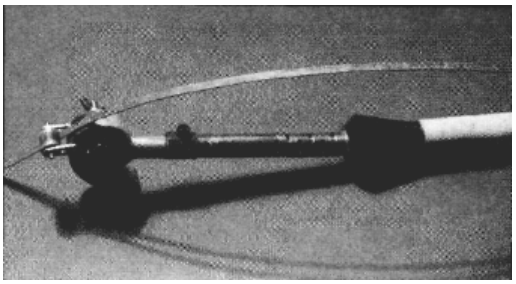


PHOTO 20. *An electric plank bender can make an exacting task a lot easier.*

Finish planking runs from 0.5 to 1 mm thick and from 3 to 5 mm wide. Make sure you're using the right planking. I've seen beginners install the finish planking as the base planking. The thinner finishing planks will not be strong enough to form a smooth, solid surface, and your efforts end up a big — and useless — mess.

Figure 12 will take us through the preparation stages. Follow these preparations meticulously before proceeding with the planking; the final outcome of the job will depend on it.

Before you begin actual planking, once again check the alignment of the frames. Step 1 shows the best way to make sure that the frames will provide a smoothly curving hull without unsightly humps or hollows. Temporarily pin three planking strips to each side of the hull assembly. When they are in place on three different levels (near the bulwarks, the waterline, and the keel), you can tell if some of the frames are too big or too

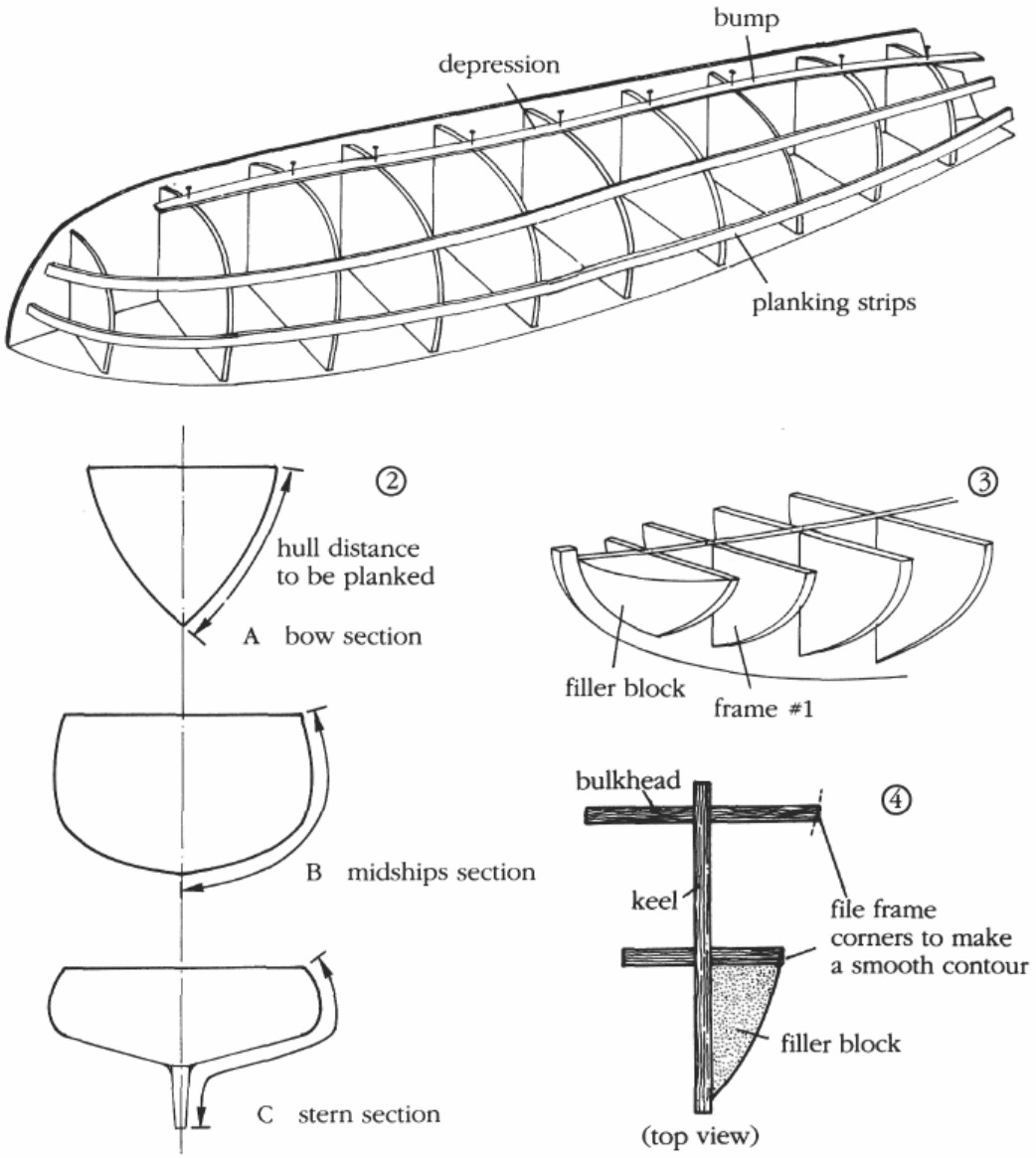


FIGURE 12. *Preparing to plank the hull.*

small by the bumps or depressions in the strips. Fill the depressions by gluing O.Smm-thick filler strips on the frame edge. Shave or file down the bumps until the strip runs in a smooth, fair curve over the frames. Shipbuilders call this "fairing" the frames; nowadays the process is aided by computer-generated patterns, but the old-timers always did their fairing by "rack of eye" when the frames were set up on the keel, much as we're doing it here.

Next, secure the hull in the vise by inserting the bottom of the midship frame in the vise jaws, and measure (2) the distances A, B. and C. Generally, A equals one-half of B, and C equals B plus a small amount.

Now it's time to take a deep breath and get ready for a little arithmetic. How do you get enough planks to cover B without creating a big jam at A or gaps at C?

The answer is tapering and filling.

The measured differences between A, B, and C will vary with the hull's shape, and will determine how to cut and install the planking. For example, if B is 140 mm, you would need 28 planks 5 mm wide (140 / 5 = 28). In order to fit them all at A on the bow, you must consider the A measurement. If A equals one-half of B, then every plank must be tapered to end with one-half its original width, which, in this case, is 2.5 mm.

The taper on the forward end of the planks depends mostly on the shape of your hull; the measurements will vary slightly depending on the distance between A and B. Planks need to be tapered at the bow because they otherwise would ride up on each other and bulge as they follow the contour.

It's important that a filler block (3) be installed between frame #1 and the stempost to provide a solid surface for the end of the planks. Some kits include a small plywood piece you can glue against the keel and contour to the stempost, but in most cases it's too small to fill the gap and too thin to do any good. The filler block will provide a solid base on which to glue the planks. Saw a small piece of wood (pine is good) to roughly fit the gap; glue it in place; and file it down until it matches the contours of the edges of frame #1, the outline of the stem, and the outline of the deck. In addition, the edges of the forward frames must be filed (4) to follow the deck contour so the planks will lie on a flat surface and not on the corner of the frame.

The same procedure must be applied to the end frames of the stern. Here again, I prefer using a filler block to provide support for the planks.

Resist the urge to plank away and take the time to prepare the hull. Believe me, it'll make a major difference.

Now let's consider the stern measurement C. If C is bigger than B, you may need each plank's full width plus spacers inserted as wedges. Sometimes, paradoxically, you will need to taper the

after ends of the planks *and* insert wedges, for reasons we'll examine later.

PLANKING THE HULL — THE FIRST LAYER OF PLANKING

Before you do anything else, soak the planks for a couple of hours to make them more pliable and infinitely easier to work.

Figure 13 takes us through the proper planking procedure. Whether your kit has bulkheads that extend above the deck (to receive the bulwarks) or terminate flush with it, you must start the planking about one-half plank width below the deckline **(1).** This will provide a firm hold for your bulwark, as we will see later.

Before we get going, remember that when first fitting the planks to check the hull contour, we'll be pinning them to the frames temporarily. When everything checks out we'll use a gluing method that I'll explain shortly.

The first three or four planks (just how many will depend on the shape of the hull) will be pinned to the hull without tapering (temporarily, remember). On the bulkhead frames mark the distance down from the deckline where the first plank will be pinned. This will give you a clear idea of what's going to happen as the planks are fitted. You'll be able to see first, that all the planks extend the entire length of the hull, and second, where each will begin to twist upward as it adheres to the hull's contour.

All planks should be adjusted to the one immediately above it. Be careful: if the first plank isn't true, none of the others will be. Once that's in place, lay in the second plank with its top edge resting tightly against the bottom of the first, and pin it in place. Likewise for the third plank. On some models you may find that only one or two planks can be installed without tapering; it depends on the hull's contour — the rounder the shape, the more tapering you'll need.

Now we'll have to begin tapering. Position the fourth plank along the bottom edge of the third, starting from the middle of the hull and running toward the bow. You will notice that at Point X, the bottom plank will start to overlap the upper plank because of the bow curve. Mark that point (X) on the bottom plank and bend it over until it reaches the bow. The amount of overlap at the forward end will show how much this plank must be tapered. Mark the overlap and remove the plank from the hull.

Place your presoaked plank on a smooth wooden board (2) and lay your steel ruler along the line of overlap, beginning at Point X. I use an X-Acto knife with a #11 blade or a scalpel to cut the wedge of overlap. If the plank has been soaked awhile, the blade will cut into it quite easily. Never apply too much pressure by attempting to cut

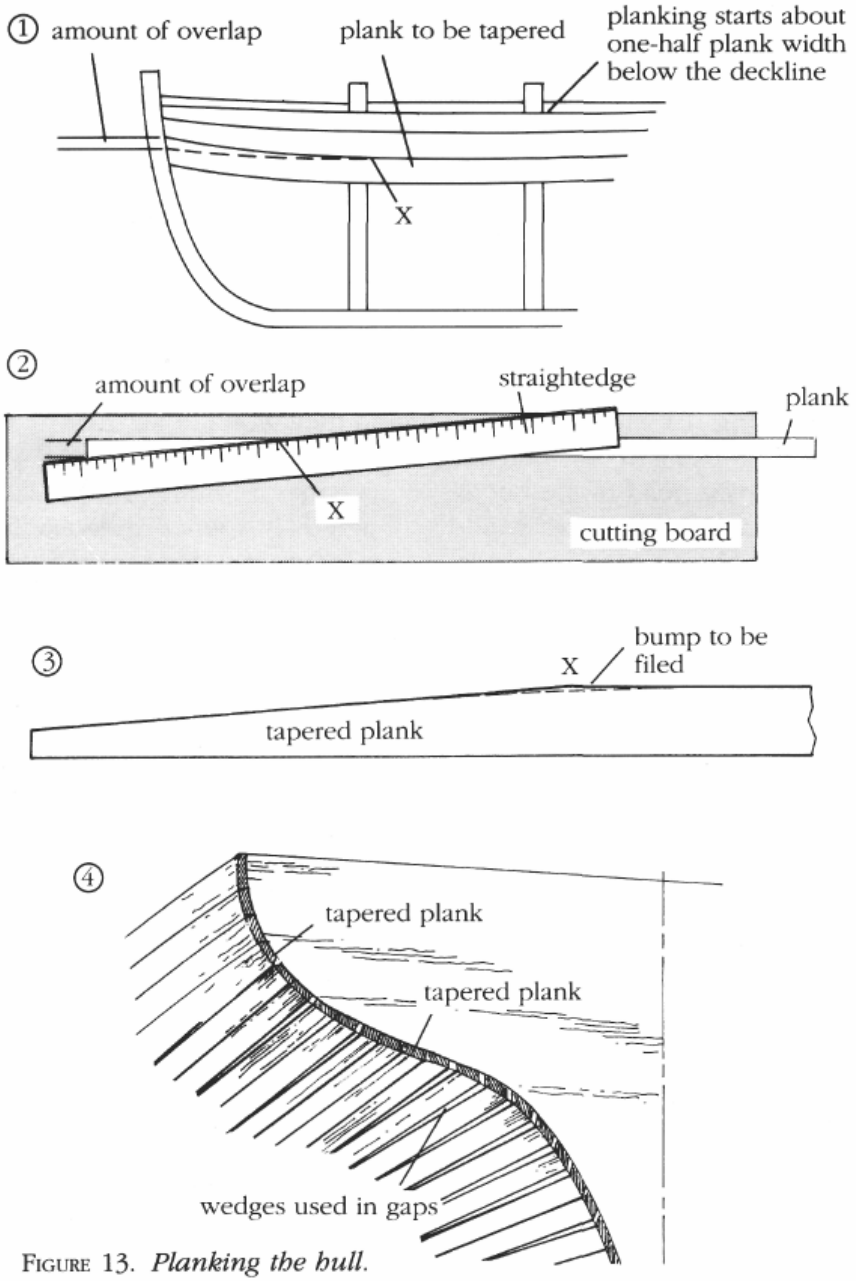


FIGURE 13. *Planking the hull.*

through in a single stroke. This will cause the plank to split. Instead, go over the cut a few times, gently applying pressure on the ruler. You will notice that after you cut the plank, there will be a bump (3) that must be filed down a bit. Save the wedges; they'll come in handy later, when we move to the ship's stern.

All planks must be bent. Next we will bend the tapered plank — and the first three untapered planks — to fit the curve of the hull. Using an electric plank bender, insert each plank in between the roller and the curved head of the bending machine and wait until the water turns into steam. Then gently bend the plank until the desired curve is obtained and the plank is dry.

To glue the first plank to the frames, mark the spots where the plank meets the frames. Drill small starter holes in the plank for the pins you're going to use and press one pin into each hole, but not all the way. With a small brush, apply a bit of carpenter's glue on the frames and on the filler block where the plank will rest. Apply a dot of ACC on the inside forward end of the plank and set the plank in place. Hold for about 15 seconds, and the plank will be anchored on this spot.

Next put some carpenter's glue on the upper edge of this plank. Leave a 1/2-inch glue-free gap in the center of each frame (Figure 14). Put a little ACC in these gaps. Then press the plank against the one above with your finger and push the pins partway in. The trick with this is to do one space at a time: carpenter's glue, gap, ACC, press and pin, then move on. The ACC will hold the planks together until the carpenter's glue is dry. The two planks will become firmly bonded without having to use clamps — and then having to wait as each plank dries. It's neat, it's easy, and it saves a lot of time.

Once the carpenter's glue dries, remove the pins. You can reuse them, and they won't be in the way when you sand the hull.

Some stern planks won't need to be tapered. But when they do, follow the procedure we used for tapering planks at the bow. Never force a plank out of its natural line; let it fall as it will over the frames, and taper as necessary. Check how the planks fit at the stern before gluing them in place. You will often find that you must leave a space [(4) in Figure 13] now and then, depending on the shape of the hull at the stern. These spaces will be filled with the wedges that you cut off at the bow end.

BULWARK BUILDING AND **DECK** PLANKING

Before we discuss planking decks or building bulwarks in detail, let's review the false deck installation. Earlier we discussed the basics of putting on the false deck in terms of using it to check the symmetry of the hull. Here's a re-

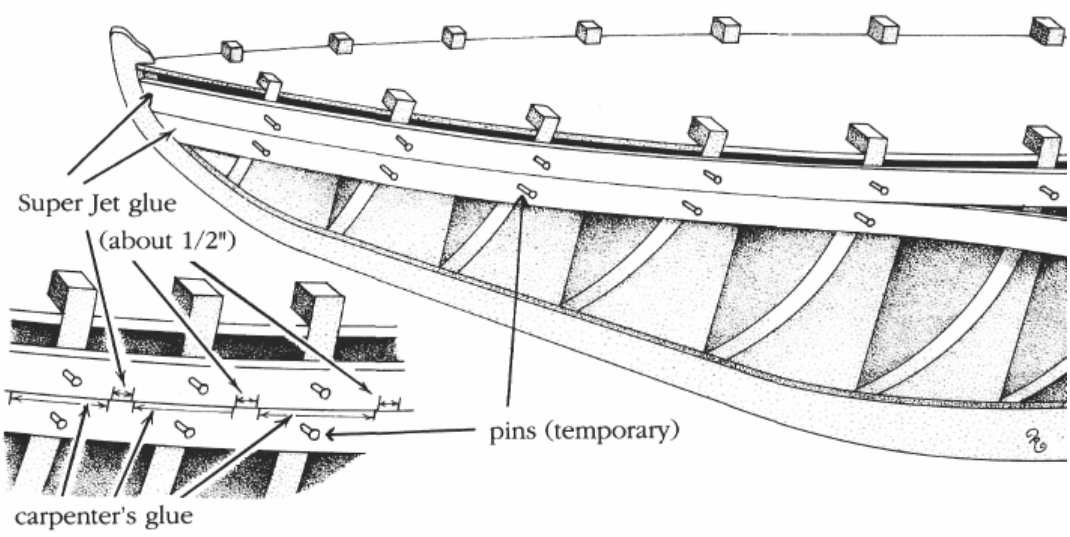


FIGURE 14. *Stan planking the hull by temporarily pinning the upper plank just down from the deckline, not flush with it; this will give the bulwarks more purchase later. Spread carpenter's glue along the top edge of the second plank before fitting it, but leave a space midway between each bulkhead for strong Super Jet glue (ACC) for extra grip. The ACC will hold until the carpenter's glue kicks in: no clamping, no nailing, no fuss.*

minder, since this is an important process.

After all the bulkheads are glued in place, install the false deck (Figure 15). The precut slots must be checked and filed to fit as necessary. Never force the deck onto the bulkheads, since this will produce distortions and buckling. Once you've established that the fit is right, pin the deck across the tops of the bulkheads. Use flathead pins so that they won't interfere with the planking. After pinning down the deck, brush

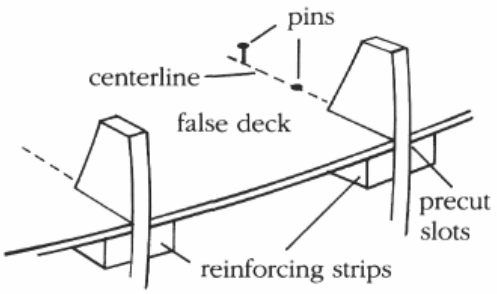


FIGURE 15. *Bulwark building and deck planking.*

carpenter's glue into the joints where the deck meets the bulkheads. Then secure the edges of the deck slots to the bulkheads. Use 3 rnm by 3 mm reinforcing strips fastened with ACC. This will prevent the deck edge from bending.

THE BULWARKS. Plank-on-bulkhead kits use a variety of approaches to planking decks and building bulwarks. One bulwark method, used mostly by Artesania Latina, uses two precut strips of 3-ply sheet. Each strip is bent over the bulkheads then pinned to them along the deckline and glued at the sternpost, the bow, and along its lower edge to the first plank, which we installed below the deckline for this purpose. The problem with this is twofold: First, these bulwarks aren't planked inboard or outboard and simply don't look at all authentic; second, the bulwarks are too thin and will not cover the edges of the deck planking.

In this case my suggestion is also twofold. First, you can cover these plywood bulwarks using your own strips. (Check your scale; in most of the kits I've recommended, use 1 mm by 3 mm strips inboard and 1 mm by 4 mm outboard.) Second, you can discard the plywood bulwarks and build your own.

Here are two alternatives for building bulwarks — and either works quite well. The first one — if your model has bulkhead extensions — calls for first installing outboard planks horizontally following the above-deck extensions of

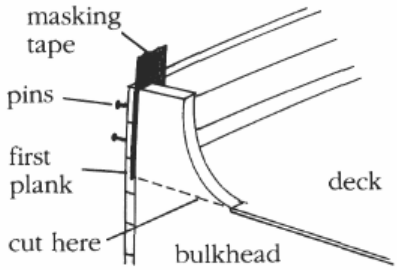


FIGURE 16. *Bulkhead extensions provide an excellent base for bulwark planking.*

the bulkheads. Then the bulkhead extensions are cut off at deck level and the inside is planked with horizontal strips overlapping the outside planks (see Figures 16 and 18). As an alternative, you can install outboard planks horizontally as in the first method, then cut off the bulkheads' extensions, and install inboard vertical planking to be sandwiched between another set of inboard horizontal planks. This makes for a very solid bulwark. Let's detail the procedure, which is similar, in both cases.

Start by covering the edges of the bulkheads above the deck with masking tape (Figure 16) to prevent the planks from being glued to the extensions (which we'll want to remove later). The first plank must follow the deckline and be pinned and glued to the bulkhead below the tape. Install it half the width above the deckline to receive the lower half of the first inboard plank. Glue the

next three outboard planks to each other using the clamp-free method I discussed on page 38. Don't glue them to the tape on the exterior face of the bulkheads; just pin them there temporarily. Remember *not to* push the pins in all the way; you're going to pull them out later. After everything is set, cut off the bulkhead extensions above the deck. I use my X-Acto minisaw here, bending the handle upward slightly for convenience as I cut. Now you can plank the deck before planking the bulwarks inboard.

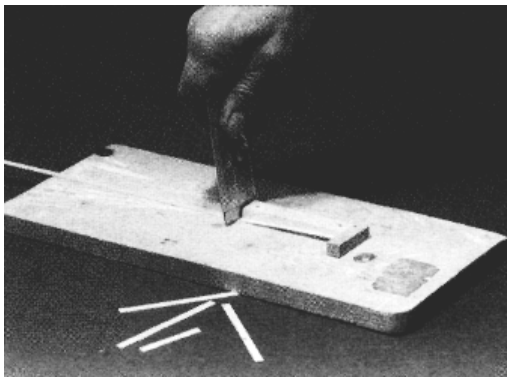


PHOTO 21. *Cutting your own deck planks can be a breeze if you 've got five minutes to put together a jig: no need for time-consuming measuring or marking; just slip in a plank and cut away.*

THE DECKS. Kits will contain strips for planking the deck, but if you'd like to improve your model's finished appearance, use your own stock — like 1 mm by 3 mm boxwood or a similar, good-quality wood. The strips are generally cut in two lengths: 80 mm and 40 mm. If you're going to supply your own stock, here's a quick way to get out those lengths from longer strips. The jig shouldn't take more than five minutes to build.

Find a flat, square-edged board, a foot or so long by 4 or 5 inches wide — it doesn't have to be precise. On the face of this board, near one end, tack a short strip of scrapwood. This strip should be straight, true, and square-edged but needn't be any particular size; a strip 3 to 4 inches long tacked across a board 4 to 5 inches wide would work fine. This will become the base of your plank-cutting jig. Now find a thin piece of scrapwood with straight, flat edges. From that cut a 40 mm strip and an 80 mm strip. Be accurate; the ends must be cut squarely and cleanly. Erect these two strips side by side on your base, making sure their ends are butted squarely against it, and pin them to the board. The result is an inverted "T" with two stems. Butt the end of a planking strip against the T's base and edge-set it against the 80 mm stem, grab your knife, and cut: You have a quick and clean 80 mm plank. The same for the 40 mm side.

Once you've built up a supply of planks it's time to begin. Draw a line in the center of the false deck from bow to stern. Starting at the stern, glue a 40 mm strip along and to one side of the centerline, then continue that row of planking with 80 mm strips glued end to end

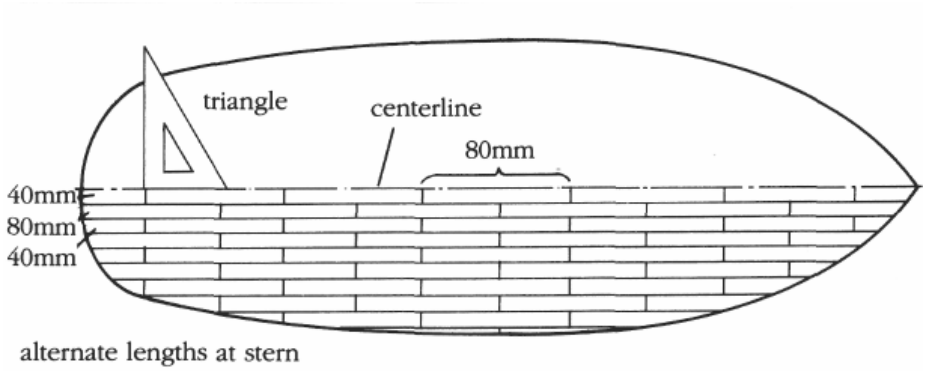


FIGURE 17. *A properly planked deck calls for a staggered look.*

toward the bow (Figure 17). The forwardmost plank will have to be cut from either a 40 mm or 80 mm strip, depending on its length. Plank subsequent rows from stern to bow moving toward each bulwark, alternating 40 mm and 80 mm strips at the stern to achieve a staggered look in the finished planking. If the stern is curved, cut the aftmost 40 mm strips so their forward ends are aligned with one another across the deck, and do the same for the aftmost 80 mm strips. I usually draw a line with a triangle where the ends of the first row of planks must stop.

To add authenticity to the deck use a small nail or tack to make two indentations at the corners of each plank. Smooth the deck with fine sandpaper; the sawdust will collect in the indentations. Apply a coat of acrylic matte varnish (Liquitex is good). The sawdust collected in the indentations will darken, simulating nail heads in the deck. When the varnish dries go over the deck with fine (0000) steel wool to finish things up.

Once you've laid the deck you can start the inboard planking for the bulwarks. There are two ways to install the inboard planking. The first is to lay horizontal strips as we did on the outboard side (Figure 18). The lower end of the first plank will rest on the deck planking, giving a perfect finish to the job, and it will overlap the outboard planking, providing structural strength. Since we started a half plank higher on the inboard side, the final inboard plank will have to be sliced in half lengthwise to even things out.

Step 2 shows an alternative. Two rows of planks are installed inboard of the bulwarks; the first row runs vertically, adding more strength to the structure. Be sure that the lower ends of the planks are also glued to the deck. The second

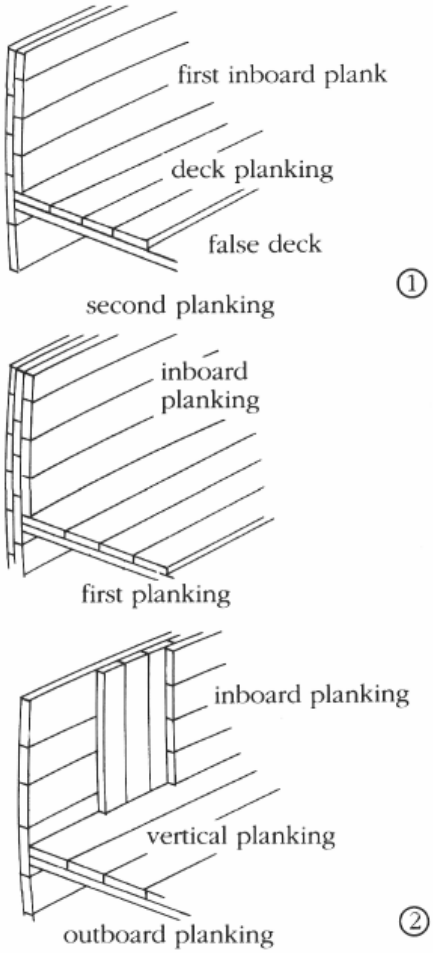


FIGURE 18. *The inboard sides of the bulwarks can be planked in a number of ways for both strength and attractiveness.*

row of planks runs horizontally. This system is also used when gunports must be cut through the bulwarks.

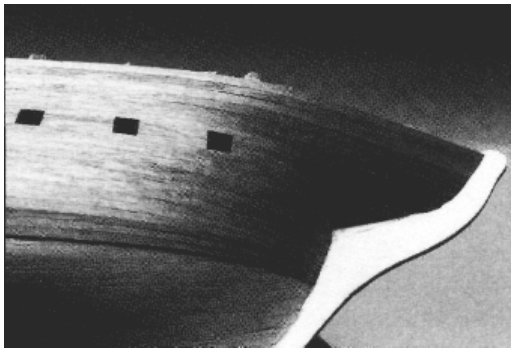


PHOTO 22. *Tapered, snug, and smooth, the half-completed layer of second planking on this model of the* Constitution *shows how exacting a process is involved.*

SECOND LAYER OF HULL PLANKING

The second or finished planking is generally done with the 0.5 mm by 3 mm or 0.5 mm by 4 mm walnut strips supplied in the kits. Some manufacturers include two kinds of wood strips to give the model a more attractive look. On some kits, you'll want to paint the hull below the waterline and leave wood natural above it. Whatever the case, the method of installing the planks is the same.

The first planking must be finished and treated to ready the hull for installation of the second planking. Check that the plank edges are even, and use a wood file to level any rough spots. Next, sand the entire hull surface, then apply a coat of modeling paste (Hyplar or Liquitex are two good products), which you can buy at any art supply store. This will

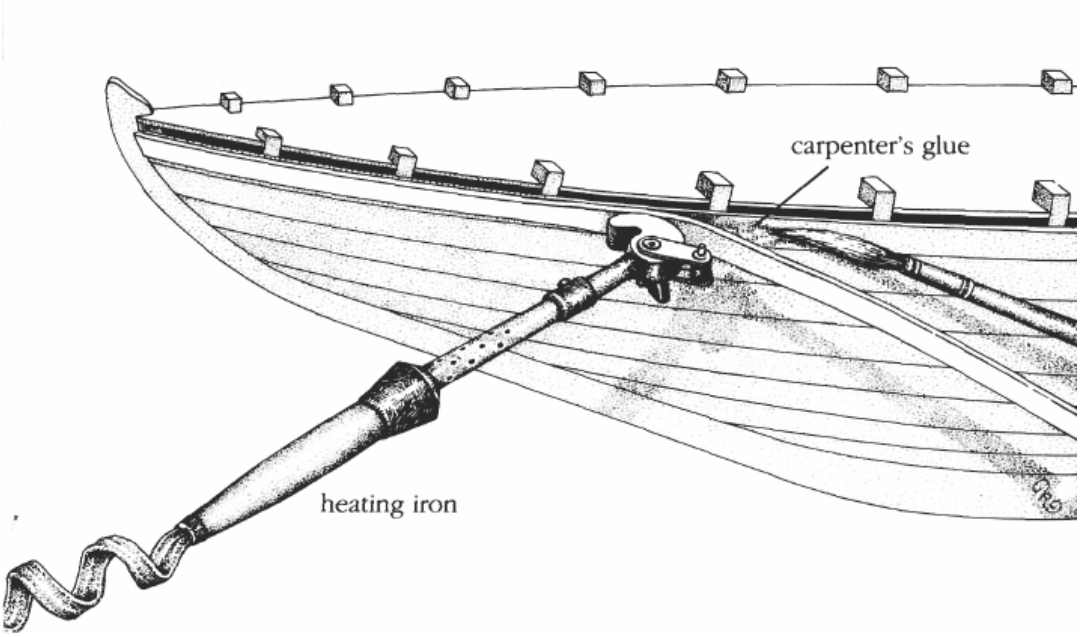


FIGURE 19. *An electric plank bender supplies the heat, a paint brush applies the glue — the hull begins to take shape. The second layer of planking can be applied more easily using the heat of the plank bender, though not its bending capability. While not illustrated here, the second planking is best applied after the bulwarks have been built.*

give the hull a smooth, tough coat to hold the planks together. It will also provide a good base for your second planking and won't absorb the glue, thus making it dry too quickly. Once the paste is dry, sand the hull and you're ready to begin.

As with the first planking, the second planking must be tapered. Start at the caprail and proceed all the way to the keel. This time you'll have the experience of the first planking to guide you. You'll be able to tell where and how you made mistakes and correct them. There is one difference, though: *No nails orpins are used on the second planking, even temporarily.*

Figure 19 shows how to apply the planking by using glue and heat. Taper and bend each plank as you did with the first layer, checking that the plank fits tightly and smoothly on the hull — no bumps. With a brush, dab a bit of white carpenter's glue as wide as the plank and

no more than 4 or 5 inches in length on the forward end of the hull where the plank will sit. Next, apply about 1/2 inch of ACC to the tip of the plank at the bow, position it, and hold it for about 15 seconds until the adhesive sets. Now place the plank in the carpenter's glue. Push up with one thumb to make sure it's a very tight fit and that no cracks are left between planks.

At the same time, apply heat to the plank by using the plank bender in a back-and-forth motion with your left hand. This evaporates the water in the glue for a faster set, steams the plank, and forms it to the curve of the hull — everything you need to ensure a perfect bond. Do only a few inches at a time; otherwise the carpenter's glue will dry before you can press the plank to it. Continue gluing toward the stern, where you must finish at the end of the plank with another 1/2 inch of ACC. Leave the plank ends extending past the stern; you can cut them later. Any fillers should also be applied using heat from the plank bender.

When all the planking is finished, check for any small cracks or spaces left between the planks. Apply a little carpenter's glue to these places and smooth with very fine sandpaper. The sanding dust will stick to the glue and cover every small imperfection. Sand the rest of the hull and finish with a coat of acrylic matte varnish, just as we did with the deck. When it's dry, rub it gently with a very fine (0000) steel wool pad. The process will leave a luster-free natural finish.

HANDLING ITEMS ON DECK

GUNS

INSTALLATIONS ON OPEN DECKS. The guns supplied in kits for open decks normally are installed on wood or metal mounts of the truck or sled type, as in Mamoli's *Constitution*.

Because of the intricacy of rigging guns — breeching ropes, side and train tackles, all with accompanying blocks — the process of gun rigging can be quite tricky, tedious, and time-consuming. Figure 20 illustrates the end result of a method that will make this job simpler. The trick is keeping the gun away from the model until the more delicate rigging is finished.

To start with, you must use very small blocks, single or double as called for in the plans. Most kits don't supply blocks small enough for this job — 1/16 inch or 3/32 inch for most of the models I've suggested — but you can buy them; some are already *stropped* (banded by rope or iron). Install one block on each side of the carriage for the side tackles and two on the back for the train tackles. Put the gun aside for a minute and tie a block to a ringbolt; the ringbolt will be installed on the bulwark. Next, tie the

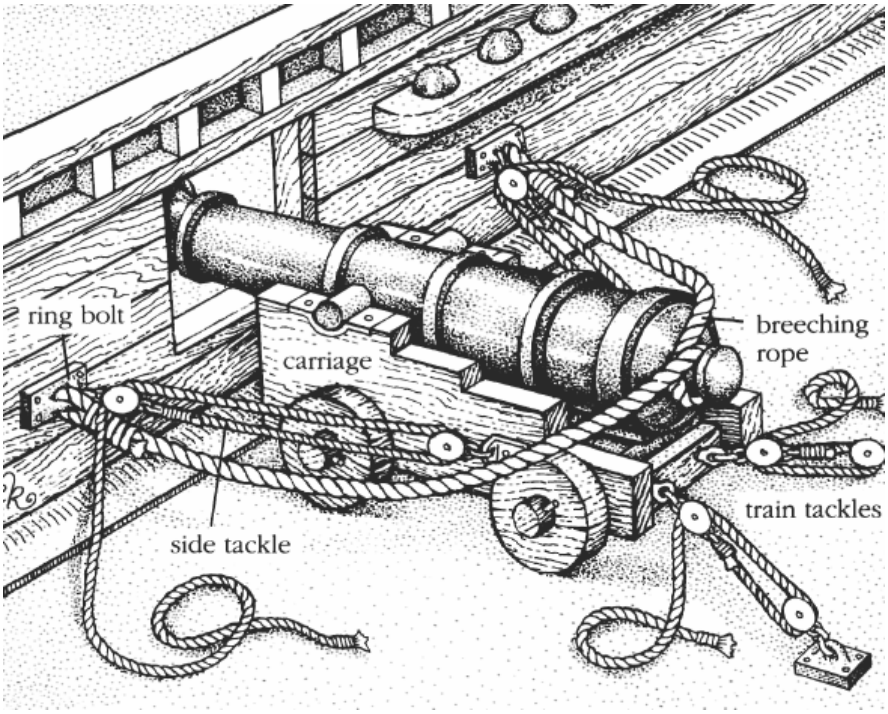


FIGURE 20. *Guns on open decks will present your first shot at rigging and handling blocks—a tricky, and tension-inducing interlude. Don't worry, there are ways to make it easy. Separate your tasks into stages that will allow you to rig small blocks before the gun is installed on deck.*

side tackle rope to the block's *becket(the* eye on the bottom). Repeat for the other side tackle. Also tie the breeching rope to one ringbolt (it doesn't matter which) and leave the other end loose for the time being. Now install the ringbolts with the blocks and the ropes on the bulwark as shown in Figure 20.

Next install the gun on the *carriage* (the bed for the gun), place some glue on the bottom of the wheels and on the front of the carriage, and set the gun assembly in place against the port. After the glue dries, you're ready to rig the tackles.

Start with the side tackles. Thread the rope through the block on the gun mount and back through the block on the bulwark. Let the end of the tackle coil on the deck and secure it with a bit of glue. Use a needle threader to feed the rope through the blocks. Next, secure the

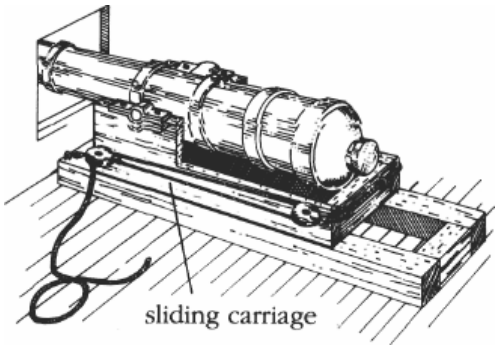


FIGURE 21. *A gun on a sled carriage — easier to rig than others.*

breeching rope — a heavy rope that absorbed the recoil of the gun — by using a pair of tweezers to twist the rope around the back pin on the gun barrel while pulling it through the opposite ringbolt; then apply a dab a ACC on the ring. Now rig the train tackles as shown.

This procedure simplifies the gun rigging operation because it eliminates the need to tie ropes to ringbolts on the bulwark after the gun is set in place. There is no room to work in those very tight spots.

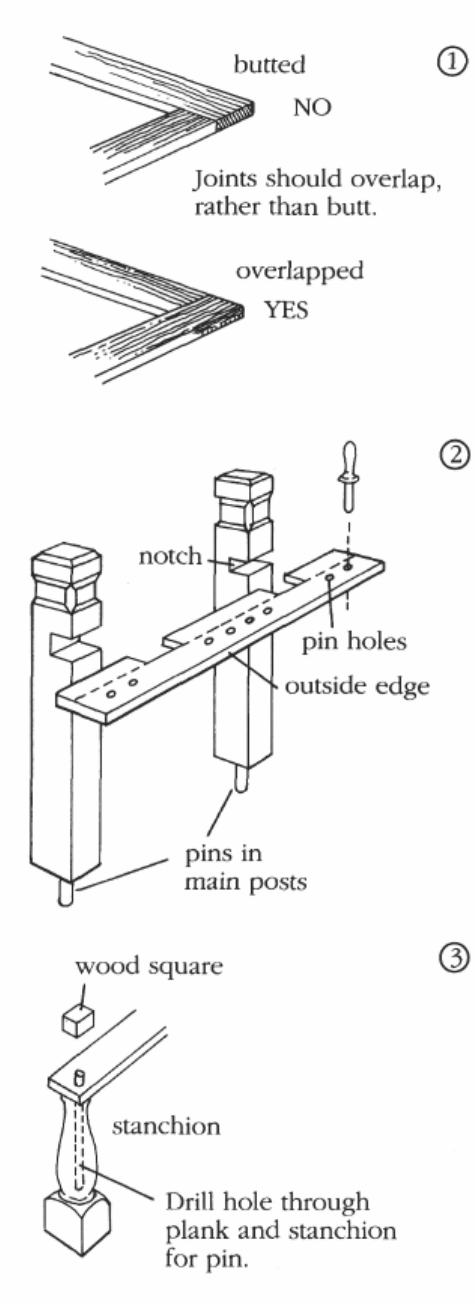
The sled-type carriage is simpler to rig because the side tackles aren't mounted on the bulwark rings, but on the front of the sled train. These tackles can be rigged on the gun mount before it's glued in place (Figure 21). The breeching rope is installed following the same procedure used for the truck-type gunmount.

COVERED DECKS. For the covered decks, the guns may be full-length barrels or dummy types. The dummy guns are pinned on the posts installed in the framework during the hull assembly (see Figure 10), and the full-length ones will be set with glue on their mounts, which are installed with glue and pins on the lower decks during the hull construction. In both cases, the guns are worked in place through their ports. It's a good idea to tie a temporary string to the end of each barrel, so that if the gun falls inside during installation you can get it back.

PIN RACKS AND **PIN RAILS**

There is nothing more frustrating than a rack that splits open or pulls off the deck or bulwark when you're belaying a line. At that point in construction, it's nearly impossible to replace or repair the broken part. That's why it's very important that these racks be made of strong wood and installed solidly. Here's the rub: most of the wood strips supplied in kits are weak and inadequate. To overcome this, and to be on the safe side, I normally use either boxwood or holly (which you can buy from hobby mail order catalogs). These woods are practically grainless and very strong. Stain them as needed. As a second choice you could use maple or oak. Figure 22 shows some tips for ensuring solid construction.

The fife rails located at the bases of the masts should have overlapping and notched joints; they should never be



butted (1). Make sure the corners are square.

The notches on the headposts of the belaying pin racks **(2)** must be cut precisely so that the planks fit snugly into them. A loose joint will break easily when you belay the lines to the pins. The holes for the pins should be drilled close to the outside edge of the plank to make it easier to belay ropes.

Most kits supply wooden belaying pins. Even if they look more authentic, generally they're too thick and out of scale. Since there is rarely enough space on the rack to accommodate the number of pins required, you'll end up setting the pins too close to each other and you won't be able to turn your lines around them. You can overcome this problem by using brass pins, available from hobby suppliers.

When installing the pins in the holes, make sure to apply a bit of glue to their stems. This practice will prevent the pins from popping out when you try to belay a rope.

The short posts or stanchions must be drilled through. Insert a brass pin through the plank, through the stanchion, and down into the deck (3). Apply glue to the top and bottom of the stanchion and on the pin. You can glue a small square of wood over the head of the pin to hide it. I also drill up into the bottom of each main post, cut the head off a

FIGURE 22. *Building pin racks and pin rails.*

brass pin, apply some glue, and insert the pin in the hole. This pin will puncture the deck to secure the post.

DECKHOUSES

Deckhouse walls are made mostly of thin plywood, which doesn't provide enough surface for gluing at the corners. This can lead to an out-of-square deckhouse. Figure 23 shows how to correct this.

Along and flush with the ends and top edges of the two side walls glue three strips of 3 mm by 3 mm wood (1). These will strengthen the plywood and provide a good surface for gluing the forward and after walls (2). Next, cut a scrapwood block to fit snugly between the end pieces. This piece should have square corners, which will ensure that the house is squared. Temporarily pin the side walls to the block, check for squareness, then glue and pin the end panels onto the reinforcing strips we installed in **(1).**

When the adhesive is dry, remove the pins and the wood block and finish the roof and sides as needed. Since the deck is cambered athwartships with its crown along the fore-and-aft centerline, it's necessary to introduce some concavity to the bottoms of the forward and after walls of the deckhouse (3). One way to do this is to pin a piece of sandpaper to the deck over the site on which the house will sit. Rub the house lengthwise back and forth over the sandpaper until its bottom edges match the camber of the deck. Now remove the sandpaper and

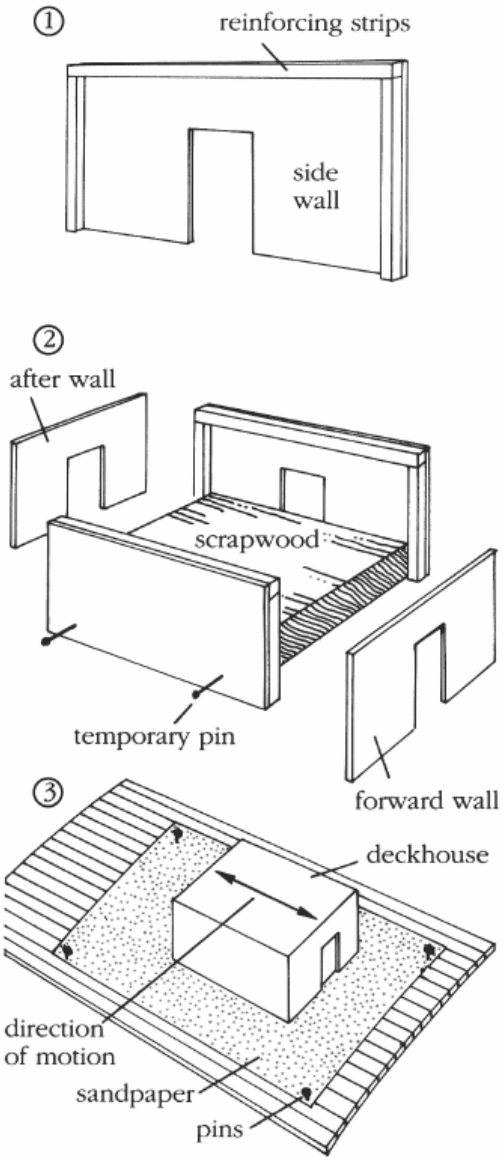


FIGURE 23. *Building deckhouses.*

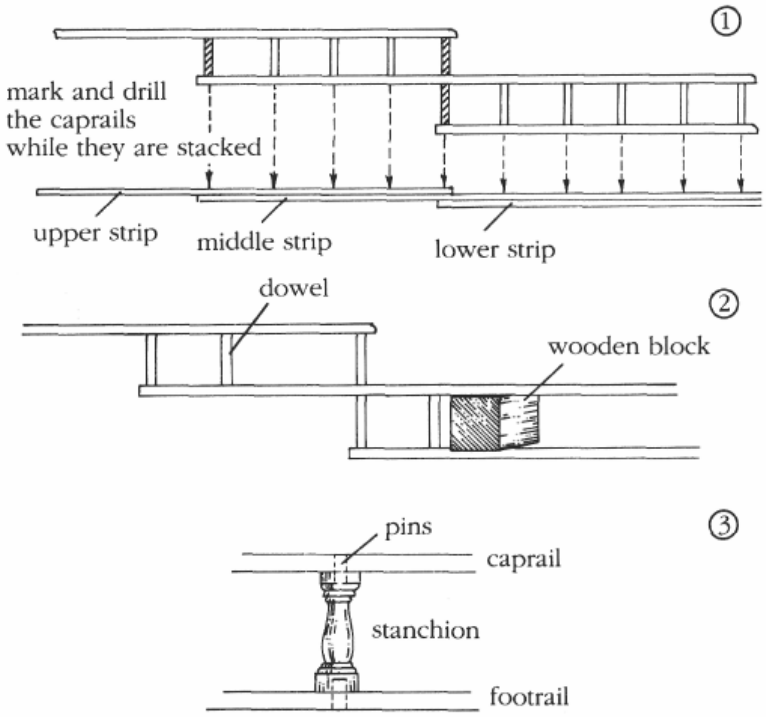


FIGURE 24. *Producing strong handrailings.*

glue the house to the deck. The same procedure can be used when building companionways, skylights, or other parts that must be fitted to a curved surface.

RAILINGS AND STANCHIONS

Bulwarks and handrailings on period ships built from kits are mostly made of wood strips and wood *stanchions* — the vertical supports. The most challenging part of this construction is to produce a strong, well-aligned finished product. Figure 24 illustrates a few methods to simplify this important task.

The railings with straight stanchions are made by using thin dowels inserted in holes drilled through two rails. You can see a stepped combination of railings running from stem to stern in (1). This type of railing is found on more ornate ships such as the *San Felipe.*

To ensure an accurate alignment of stanchions, it's necessary to drill the holes in the strips while they're stacked together in the position they'll assume on

the bulwarks. To do this, cut the lower or shorter strip to fit its position on the model, then cut the middle strip and mark on both strips the vertical axes along which the lower and middle strips will connect. Hold the two strips together with an alligator clip, aligning the mark. Next cut the upper strip, set it on top of the middle strip, and align its end with the connecting axis for all three strips. Clip the middle and upper strips together. Now the point at which all three strips will be connected has been located and marked.

Next, mark the hole centers for the stanchions on the upper and middle strips and drill them. Separate the strips and glue them in place where they overlap the bulwarks, making sure they are properly aligned at their free ends. To do this, insert one dowel for each strip while gluing them in place (2). When the adhesive is dry, affix the rest of the stanchions in their holes. To ensure accurate vertical spacing between the rails, use a block of wood cut to the correct height to check for discrepancies.

In another type of railing, the stanchions aren't set in predrilled holes. Using the method explained in (1) and (2), drill pin holes in the strips. Next, drill pin holes on both ends of the stanchions and glue pins into them (3). Cut the pins to the rail's thickness. Now install the footrail on the ship. Place a dab of glue on the bottom end of each stanchion and insert the pin in the appropriate footrail hole. When the stanchions are in position, apply glue to their tops. Using a pair of tweezers, line up the pins with the handrail holes and set the handrail in place.

Some railings can be assembled off the deck and then installed in one piece. You can cover the handrail with a thin strip of the same kind of wood as the railing, or with a different type for contrast.

CHANNELS (CHAIN WALES) AND DEADEYES

Chain wales (pronounced and referred to henceforth as "channels") and deadeyes secured the shrouds to the hull. Your kit should contain the materials needed to make and install these fixtures, which will vary in size, shape, and arrangement depending on the model you're building.

It makes the most sense to install the channels and the deadeyes before setting the hull on its permanent display base. This allows you to tilt the hull to one side and work more easily. (See Figure 26.)

You'll find that some channels have holes for the passage of the chainplates (1); some have notches cut along the edges and covered with wooden strips (2); some ships will have double channels (3); and some will have segmented channels to straddle the gunports **(4).** Some ships will have wider channels, while others, such as schooners, will have none at all.

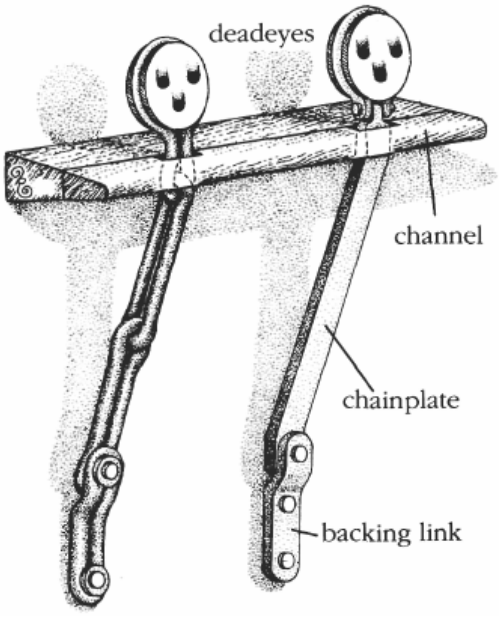


FIGURE 25. *Deadeyes, channels, and chainplates: simple, succinct, and functional engineering. Shrouds supporting the masts are belayed via lanyards to the deadeyes, which are secured to the outboard surface of the hull by chainplates. Channels prevent the shrouds from chafing the side of the ship and provide an extended base of support for the masts.*

Install the channels using both glue and pins (5). Drill the pin holes *(very* slow speed, with the channels in a vise or drill stand) through the channels between where the chainplate rods will pass, insert the pins, put the channel in

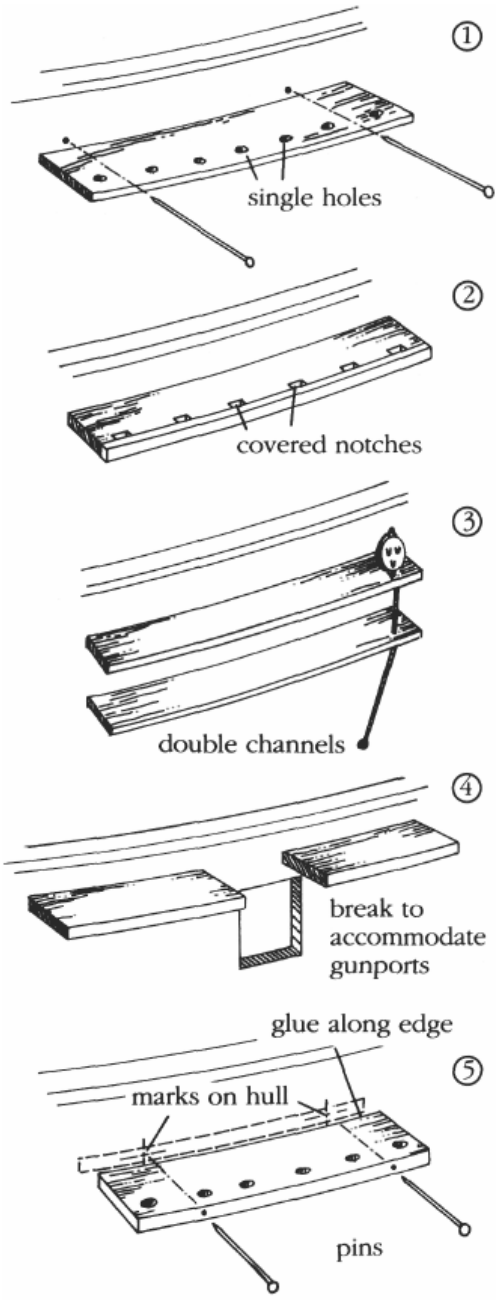


FIGURE 26. *Installing channels and deadeyes.*

its position, and tap the pins gently to mark the hull. Remove the channel and drill small holes at the marks. Apply glue to the edge of the channel, line up the pins with the holes, and tap down the pins. Cut off the pinheads for a better look.

When positioning the channels, make sure that neither the shrouds nor the chainplates fall in front of your gunports (Figure 27). Hold the channels in place temporarily and study the gunport pattern so that you can mark the chainplate holes in their proper location (1 and 2).

The chainplates must be aligned with the shrouds. To accomplish this properly, insert a dowel in the mast hole. Mark the height of the masttop (your plans should indicate the mast's height) on the dowel and tie a string to it. Run the string through each of the chainplate holes and mark the spot where the chainplate will be pinned (3). You can use a strip of tape to mark the horizontal line along which the pins will be positioned. The height of the tape will depend on the length of the chainplates, which varies from one kit to another.

Some chainplates can be made by wrapping a wire around the deadeye as you would a block and twisting the wire until the proper length is obtained (Figure 28). Then you cut off one end of the wire and wrap the other around the pin **(1).** With other kits, you make the chainplates from preshaped wires. Be aware that with this type of chainplate, the ends

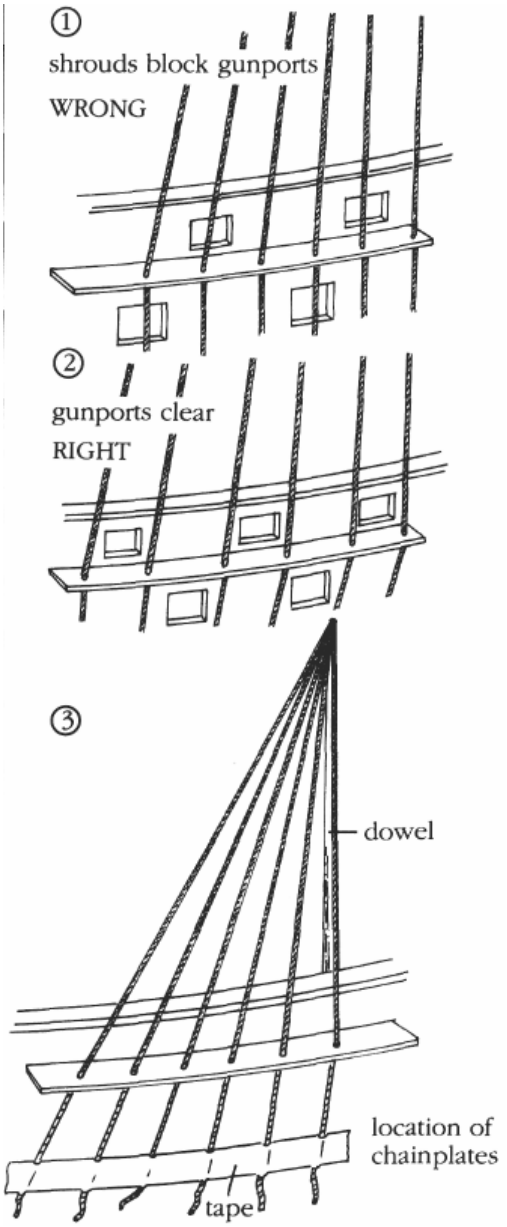


FIGURE 27. *Carelessly installing channels can come back to haunt you later.*

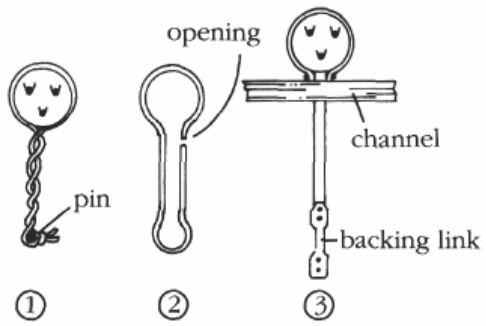


FIGURE 28. *Different types of chainplates, not all of them useful.*

that wrap around the deadeyes are open and will lose their grip when you adjust the shrouds. Maybe a dab of glue will help, but I don't suggest using these chainplates (2) — the potential for a mess is high.

On some models the chainplates end with a backing link. This is a brass plate installed on the hull to strengthen the anchorage of the chainplate (3).

Some kits supply chainplates made from tempered brass strips. The tempering makes them very hard to bend without breaking, and very difficult to drill. One handy trick is to place these strips over a gas flame until they turn red, then let them cool. This will soften the brass and make it much easier to handle.

MARKING THE WATERLINE

WATERLINE MARKING JIG. One of the things that really can make you stop and scratch your head in puzzlement is marking the waterline. Any number of methods have been suggested in books and kit instructions — you can even buy a factory-made jig in hobby shops. Here's a way to save yourself some money by grabbing a few scraps of wood and quickly building a jig. And it works great every time.

To build the jig shown in Figure 29, all you need is: one 26-inch-long strip of wood 1/2 by 2 inches, and one 6-inch-long strip 1/2 by 3-1/2 inches; any type of saw; one 1/4-inch by 1-1/4-inch bolt with a wingnut and washer; your drill; some #4 finishing nails; a piece of felt; a fine-point marker; soft wire; and a half-hour of your time.

Cut the 26-inch strip into five pieces in the lengths (A, B, C, D, E) shown in Figure 30. (The extra inch allows for cutting waste.) Cut a 1/4-inch-wide slot on piece C as shown. Drill a 1/4-inch hole in piece D, 1 inch from its end. Mark a centerline on piece A and drill four 1/32-inch holes, two on each side of the line and parallel to each other. These holes are needed to insert the soft wire to hold the marker in place. The wires are then twisted on the other side with pliers as shown in Figure 29.

Take a look at Figure 29 to see how it all fits together. You can raise or lower the marker to match the height of your model, and its base will slide easily.

MARKING THE WATERLINE. Now let's move on to marking the waterline, which

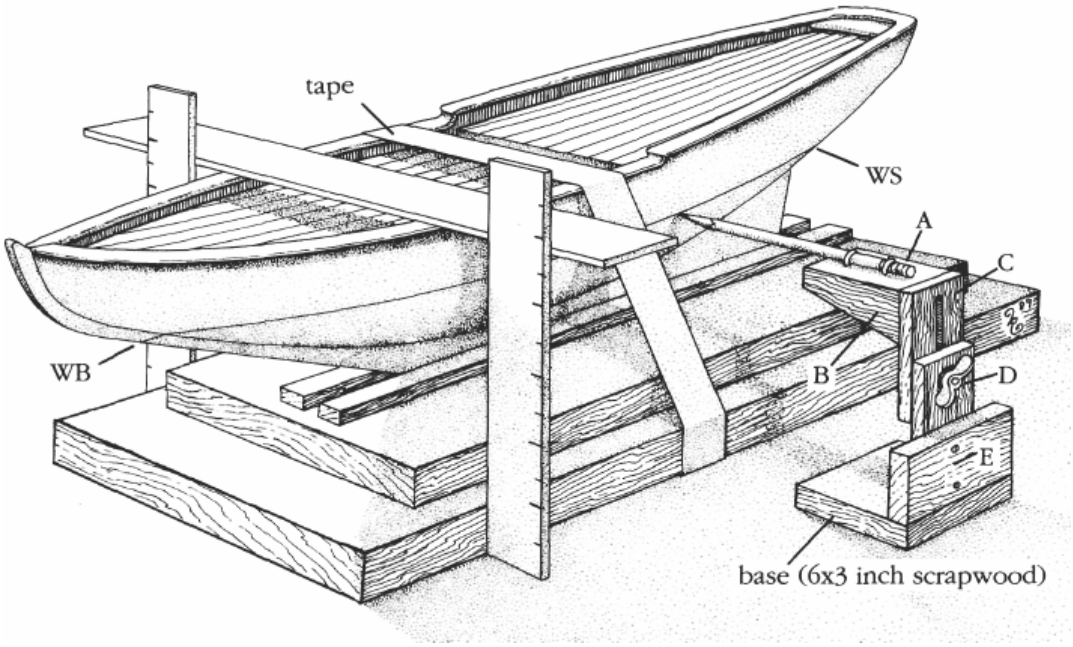


FIGURE 29. *Waterline marking jig.*

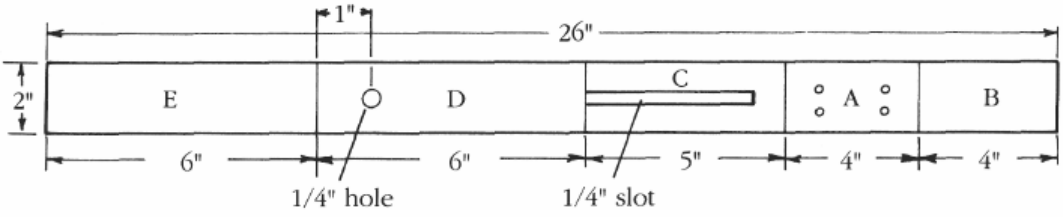


FIGURE 30. *Proper cuts for the waterline marking jig.*

calls for some more construction as we can see in Figure 29. To ease the strain, find a base to raise your model and the keel holder about 5 inches above the table. I flip over an empty cardboard box for my base. You'll also need two rulers, a straight wood strip, and tape.

Set your model on the board and base as shown in Figure 29 Set the wood strip across the bulwarks and measure

the height on either side with rulers placed directly across from one another to port and starboard. Level the hull until the measurements are equal. Tape the hull to the base and recheck the measurements.

Next, find the height of the waterline above the bottom of the keel. This distance (measured upward from the keel) is either given or can be measured from the profile view of the ship on your plans. Assuming the keel bottom of your model parallels the waterline, simply adjust your jig to the waterline height and run the marker along both sides of the hull. It's as easy as that.

On many hulls (Baltimore clippers and fishing schooners, for example), the keel doesn't run parallel to the waterline, but rather is deeper aft than forward (the keel is said to have "drag" in such instances). The long, sloping forefoot running from stem to keel on the fishing schooner is a further complication. In such instances you'll have to raise the model at the bow to obtain the proper position the waterline there.

To determine the exact position of WB (waterline at the bow) in such an instance, proceed as follows: On your plan, draw a line along the keel bottom (this represents your keel holder), extending it forward. Measure the distance from WB to the line. Note the distance, move to the model, place the square on the keel holder, and mark WB. Move back to the plans and do the same thing for WS (waterline at the stern).

Now that we have WS and WB marked on the model, take the jig and set it on WS. Move the jig to the bow and raise the bow until WB matches the height of the marker. Slide a spacer under the hull, tape the hull down as we did in Figure 29 before, and run the jig along both sides. You'll have a beautiful waterline.

SETTING THE HULL ON THE DISPLAY BASE

When you've finished the hull — planking, decks, deck fittings, channels, deadeyes, railings, deck blocks, waterline — it's time to install it permanently on the display base. We do this before stepping (setting) the masts and the bowsprit. Leave the boat davits for later, or they'll get in your way while you're rigging.

Kits supply several types of display bases, including wooden cradles set on

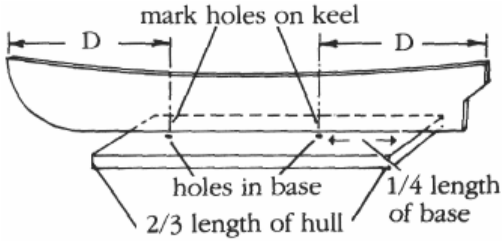


FIGURE 31. *Setting the hull on the base.*

a precarved wood base and brass stanchions set on a wood base, or launching ways on a wood base. The choice is yours, although some bigger models are steadier on solid wood cradles than on brass stanchions. In any case it is important to secure the bigger models with screws.

The base should be approximately two-thirds the total length of the hull, with the supports set about one-quarter of the way in on each end. Mark, then drill the holes for the base, using a drill bit the exact size of the screws. (Use *#6* wood screws.) Turn the base over and countersink the holes in its bottom. Set the hull in place with the keel near the holes and make sure that the distances (D) are as equal as possible (Figure 31). Now mark the holes' centers on the side of the keel.

Set the hull on its side, mark the hole centers with an awl under the keel, and drill pilot holes for the screws up into the keel. Keep the drill bit square with the keel while drilling.

You will need help to set and fasten the hull on the base. Set the base on the corner of a table with its end hanging off. Have someone hold the hull while you set it on the stanchions and screw it in place from below. If you decide to use a wooden cradle instead of brass or wood stanchions, refer to the bulkhead shapes from your drawings.

If you wish, you can make launching ways from square wood stock or buy them from your distributor, but again you must secure your model to the base with wood screws.

When the hull (with its decking fixtures such as belaying pins, cleats, ringbolts, guns and their rigging) is finished, put it aside and cover it with plastic to keep it safe and free from dust until you're ready to install the completed masts. Do not fit the masts or the bowsprit until later.