

INSTRUCTION MANUAL

UNITED STATES FRIGATE

USS Constitution

★ 1797 ★

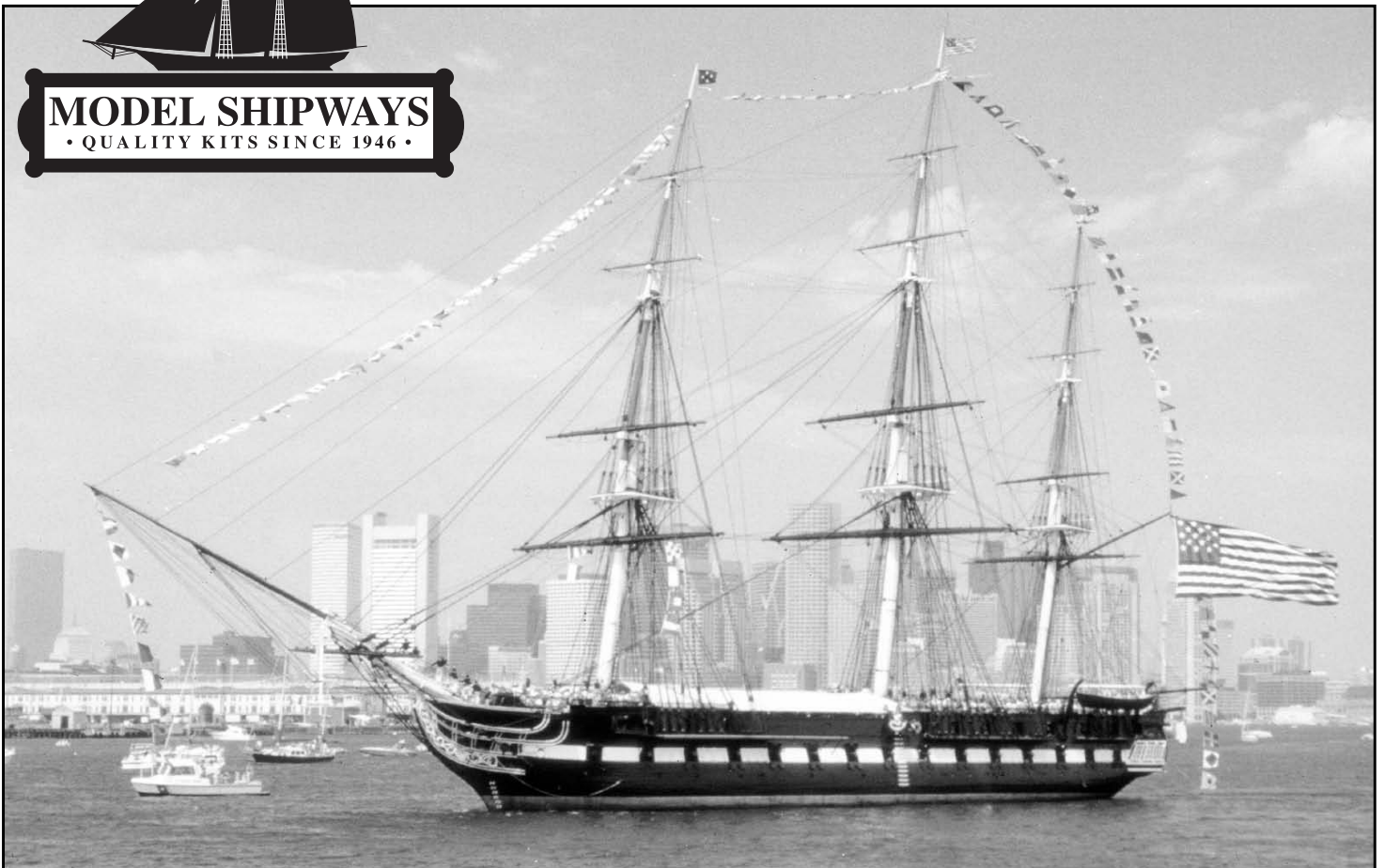


SCALE: 5/32" = 1'-0" (1:76.8)

Overall length: 48" (1220mm)

Overall height from keel: 32" (813mm)

Overall width (across main yard with stowed studding sail booms): 16" (406mm)



USS Constitution in her home port of Boston

Photo by Alan Klein

Manufactured by Model Shipways, Inc.

Sold and distributed by Model Expo

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HISTORY

USS *Constitution* hardly needs an introduction. “Old Ironsides” is the oldest commissioned warship afloat. Although George Washington commissioned her 27 March 1794, *Constitution* was built during the administration of our second president, John Adams. Her keel was laid in the spring of 1795 at Edmond, Edward, and Joseph Hartt’s Naval Yard, located across Boston Harbor not far from *Constitution*’s permanent berth today. Records credit Joshua Humphreys with her basic design, but Josiah Fox and others assisted him. Launched 21 October 1797, *Constitution* set sail 22 July 1798 under Samuel Nicholson’s command.

Constitution was restored in 1833-’34, 1855-’60, 1874-’76, 1906-’07, 1927-’31, and 1973-

’76. In 1993, a major restoration based on Navy drawings developed in 1927-’31 prepared the frigate for her 200th anniversary. (*Constitution*’s configuration has remained the same since 1927.) Workers restored the thick deck strakes and diagonal riders to strengthen the hull and make it seaworthy. They fitted fore, main, and mizzen topsails, jib, flying jib, and spanker sails for the day when *Constitution* moved again under her own power. Until that historic moment 21 July 1997, *Constitution* was towed into Boston Harbor each 4 July for a “turnaround cruise.” Refer to the bibliography or visit *Constitution* at www.ncts.navy.mil/homepages/constitution for more information.



CONSTITUTION AS SHE APPEARED in 1997 during her restoration in Charleston Navy Yard. On 21 July, she set sail from Marblehead Harbor and headed north to journey’s end, a point one mile short of Halfway Rock. The five-mile cruise took one hour.

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Instruction Manual

United States Frigate *USS Constitution* 1797

Plans and Instructions by
Ben Lankford

Model by Bob Werner

Model Shipways developed its *Constitution* kit between 1994 and 1998. Plans are based on the 1927 Navy drawings, photographs, and other documentation used during the frigate's 1993-'97 restoration at Charlestown Navy Yard, Charlestown, Massachusetts. Consequently, this kit reflects Old Ironsides as she existed in 1998. Ben Lankford made no attempt to revise any details based on his research.

A complete sail plan is provided. However, *Constitution's* current six-sail configuration is the one she normally used in battle.

A few items on the ship are not historic features. Modern additions include hull fenders, a lookout platform at the bow, and awnings to protect visitors from the elements. Although shown on the plans, they can be omitted for historical accuracy.

Model Shipways thanks Technical Writer Patrick Otton and Chief Rigger Dave Mullen, from *Constitution's* Maintenance and Repair facility, for supplying specific information. Thanks also to Jodi Kaufman, Jim Krauzlis, and Don Bienvenue for providing many of the photographs reproduced in this manual. Finally, thanks to members of *Seaways-Ships In Scale* magazine's Shipmodeling E-mail List for their answers to questions about *Constitution* and her general design.

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Before You Begin

Constitution is an interesting ship and makes a splendid model due to the amount of detail on it. At $\frac{5}{32}" = 1' - 0"$ scale, it's one of the largest model ship kits on the market. Plank-on-bulkhead hull construction with laser-cut parts offers a unique building method. It assures an accurate hull form, while developing an understanding of how historic sailing ships were constructed.

Britannia, brass, and wooden fittings eliminate creating the parts from scratch. However, many require final finishing before they are suitable for the model. This is especially true for the britannia fittings and will be discussed later.

Although intended for the advanced modeler, beginners or intermediate builders can complete *Constitution* if they take their time. Always finish one construction stage before moving to the next. When things go awry, consider doing them over.

Necessary Construction Tools

The following items are recommended for building *Constitution*.

A. Knives and saws

1. Hobby knife
2. #11 blades
3. Razor saw or jeweler's saw

B. Files

Set of needle files

C. Clamps

1. A few small C-clamps
2. Wooden spring-type clothespins (craft shops have small versions)
3. #16 and #33 rubber bands

D. Tool Set

Small carving tool set or individual gouges and chisels for carving keel rabbets, bow and stern filler blocks, stern counter block, and tapering the stem, sternpost, and rudder.

E. Sharpening Stone

Keeps tools razor sharp.

F. Boring Tools

1. Miniature bits sizes #60 to #80
2. $\frac{1}{16}"$, $\frac{3}{32}"$, and $\frac{1}{8}"$ bits
3. Pin vise

G. Miscellaneous

1. Tack hammer
2. Tweezers (a few)
3. Small, fine pointed scissors
4. Miniature pliers
 - a. small round
 - b. flat nose
5. Small bench vise
6. Soldering iron or torch
 - a. solder
 - b. flux
7. Beeswax block
8. $\frac{1}{2}"$ or $\frac{3}{4}"$ wide masking tape
9. Wire cutters (for cutting fine wire and strip metal)

H. Sandpaper

1. Fine and medium grit garnet or #100 to #220 aluminum oxide
2. #400 wet-or-dry sandpaper

I. Sail cloth

Light weave cotton or linen cloth for sails. Model Expo sells a suitable cotton cloth.

J. Finishing

1. Paintbrushes
 - a. fine point for details
 - b. $\frac{1}{4}"$ to $\frac{1}{2}"$ flat square for hull

K. Supplies

1. Paints
2. Primer
3. Stains and varnish
4. White or woodworker's (yellow) glue
5. Cyanoacrylates (generic name is Super Glue)
6. Five-minute epoxy
7. Wood filler

Note: White or woodworker's glue in yellow or tan will suffice for most of the model. Five-minute epoxy provides extra strength for affixing fittings. Cyanoacrylates such as Jet, Flash, or Zap, produce quick adhesion. For most applications, the medium viscosity gap-filling variety is best. The thin type is recommended for filling a narrow crack or tacking hull planking to the bulkheads.

Working with Parts and Plans

Before starting the model, carefully examine the kit and study the plans. First, determine if all the listed parts are present. Handling them will produce a better understanding of the kit's requirements. Try to visualize how every piece will look on the completed model. Also, determine the building sequence – what must be done first – ahead of time. The instructions will help, but a thorough knowledge of the plans at the outset is essential.

To avoid losing small fittings and hardware, sort them into labeled boxes or compartments. These should have lids to keep out dirt.

1. Constitution's Eight Plan Sheets

- 1) Laser-Cut Keel and Bulkhead Patterns
- 2) Hull Framing
- 3) Hull Planking & Coppering
- 4) Inboard/Outboard Profiles & Spar Deck Plan
- 5) Hull Details, Ship's Boats, & Guns
- 6) Mast and Spar Details & Belaying Plan
- 7) Rigging Profile
- 8) Rigging Sections

The letter "L" in a circle denotes laser-cut wood patterns. Sketches throughout the manual illustrate various construction techniques.

Model Shipways' *Constitution* kit is manufactured to a scale of $\frac{5}{32}'' = 1' - 0''$ (1:78.6). Each sheet is drawn to that scale except areas enlarged to show detail and the half scale rigging plans. Most dimensions can be lifted directly off the plans by using draftsman dividers or a "tick" strip (piece of paper such as an adding machine roll). Lay the paper strip over the plan, carefully mark the item's length with a sharp pencil, then transfer the marks to the wood. The rigging plans are drawn to half scale, so double the tick marks for the correct dimensions.

Because these are modelbuilding plans, actual measurements were converted to model inches. For comparison, $\frac{1}{64}''$ on the model is equal to 1.2" on the real ship, $\frac{1}{32}''$ is 2.4", and so on. The table on Sheet 7 compares scale with full-size dimensions and converts imperial numbers to metric.

Try to be exact when following the plans, but use common sense and be prepared to make allowances along the way. Adjustments may be necessary to compensate for small differences in how your model is shaping up; i.e., perhaps one mast has too much *rake* (its angle to the perpendicular). Lines should not drape over fittings or conflict with other lines when *belayed* (secured). If necessary, move a belaying point or fairlead. Put yourself on the ship, imagine performing the task, and use logic.

COVERED COMPANIONWAY. Note the kickplate on the coaming and the cannonball rack on the right-hand side.

2. Understanding Hull Lines

Beginners may not be familiar with the following hull lines:

Buttock lines are vertical longitudinal planes cutting through the hull.

Waterlines are horizontal planes.

Sections are transverse vertical planes.

Diagonals are planes cut almost perpendicular to the station lines.

The above lines define a hull's shape. Draftsmen use them to *fair* the hull (create even curves). A complete set of hull lines is not needed for this model, because laser-cut bulkheads and the center keel define the hull's shape. Sheet 3 shows the bulkhead lines. They are similar to a ship's *body plan* or sections, and illustrate how the hull curves from top to bottom.

3. Kit Lumber

Basswood comes in $\frac{1}{32}''$, $\frac{3}{64}''$, $\frac{1}{16}''$, $\frac{3}{32}''$, $\frac{1}{8}''$, $\frac{5}{32}''$, $\frac{3}{16}''$, $\frac{1}{4}''$, and $\frac{1}{2}''$ thick sheets and strips. Strip widths are in the same increments, while sheets may be 1", 2", 3", or 4" wide.

Model Shipways occasionally substitutes lime (*Tilia vulgaris*), a European wood, for basswood (*Tilia americana*) in its kits. Both have a fine, uniform texture and straight grain, but limewood has superior steam-bending qualities.

Occasionally, a strip must be thinner than the supplied size. To maintain scale, sand the strip to the required thickness before making the part. One way is with a sanding block. Another is with a hobby sanding thickness planer (sold commercially). If you don't own one, chuck a sanding drum into your drill press, then clamp a block alongside the drum to act as a fence. This makeshift tool works quite well.

Sorting the wood in the kit by thickness will save time. After selecting and cutting what is needed, return the re-



maintaining stock to the proper thickness pile. Don't worry about using a piece for one item intended for another. Model Shipways supplies enough extra wood to complete the model before running out.

4. Britannia Metal Fittings

Britannia metal has replaced white metal in most wooden ship kit fittings. White metal contained lead, which caused parts to disintegrate. (A fitting with a high lead content has a dark gray color and cuts easily with a knife.) One solution was to double prime the casting before painting it. This sealed the part and increased its longevity. Britannia is a tin, copper, and antimony alloy. Although some manufacturers add a small amount of lead to this mix, no one so far has reported signs of the fittings corroding.

As mentioned earlier, britannia fittings will require final finishing before mounting on the model. First, remove mold joint flash with a #11 hobby blade, then file or sand with fine sandpaper. Second, wash fittings in dishwashing liquid and warm water to remove traces of mold release agent and the body oils your fingers deposit. Allow to dry thoroughly before applying primer and paint.

5. Soldering and Working with Brass

Extensive soldering isn't required to assemble *Constitution*. However, here are a few tips:

Cut brass sheets and strips with a small pair of tin snips or heavy scissors. Thicker brass will require a jeweler's saw. After cutting, smooth the edges with needle files followed by wet-or-dry fine sandpaper used dry. Cutting slivers from brass sheet curls and bends it sideways. To straighten, grip the ends with a pair of small pliers and pull in opposite directions. Thin brass sheets can be scored with a utility knife and metal straightedge, then snapped off. Use two or three light passes, cutting against a maple chopping block, birch board, or glass.

Drilling holes in brass with a pin vise is a slow process. The solution is to mount a handpiece for flexshaft machines in a hobby drill press. Several companies manufacture this tool and it is worth the cost. When working with brass, use a 1/4" or thicker piece of maple or birch for backing. (Avoid softwoods, as these flare the exit hole.) To prevent the bit from wandering, mark the spot with a small center punch. Lubricate the bit with light oil and drill slowly to avoid breakage. The brass will become hot, so clamp the pieces to the drill press table or hold them down with a wooden stick. Do not touch the brass! If possible, keep the RPM below 2000. Anything higher will generate enough heat to break small drill bits.



SAILORS LEARNING to handle the main topsail while balancing on the footrope. Unlike their 18th century counterparts, these men wear safety harnesses. Oceanus, a synthetic closely resembling natural canvas, was used to duplicate *Constitution's* original flaxen sails. The main topsail is *Constitution's* largest sail, measuring 56 ft. wide at the head (top), 50 ft. high at the leeches (sides), and 74 ft. wide at the foot (bottom). It is approximately the size of a regulation basketball court.

Until recently, modelers used pure silver solder to avoid the corrosive qualities of lead in soft solder. Today, many lead-free solders are composed mostly of tin, but are nevertheless strong. Some are mixed with 3% or 4% silver. These melt at around 430° F. Consequently, no reason exists to use pure silver solder, which melts at 1300° F. For applications where limited heat is desired, use Tix solder. It contains bismuth and melts at 275° F.

The key to soldering is keeping the brass clean. Apply a solvent, sand lightly, or both. If using cider vinegar to cleanse the brass, slosh it on, then rinse thoroughly with water. Once the parts are clean, don't touch them. Your fingers will leave greasy spots.

Soldering is easy if your work is set up properly. First, immobilize the parts in a fixture or other holding device, then add just enough rosin or acid paste flux to the joint to do the job. Although rosin core solder is effective, it's better to use a solid solder and separate flux for more control over its application. Remember, solder flows wherever there is flux.

Next, heat the joint with a small torch or pencil soldering iron. This sequence is important. The larger the parts, the longer it takes to heat the brass and melt the solder. Remove excess solder with needle files. The joint should look like the real thing, not a big fillet.

Painting & Staining the Model

Beginning this manual with directions on applying finishes may seem strange. Not so! Much time and effort are saved and more professional results obtained if the finishing process is carried on throughout construction. Proper timing in applying finishes and using masking tape to define painted edges should eliminate unsightly glue marks and splotchy, stained surfaces. Take advantage of these general suggestions:

1. Preliminaries

Sanding and cleaning: Rub down external surfaces with 220 grit sandpaper, then wipe off every speck of dust. Give untreated surfaces two light coats of primer. Sand lightly after the last application. Don't sand down to bare wood. After washing your hands, gently dust the hull with a soft brush and clean, soft cloth or tack rag. Use a spackling compound, such as Model Magic or DAP, to fill any scratches and defects, then sand and prime again.

Choosing paint: Glossy surfaces are not desirable on ship models. A flat finish or one with a slight sheen is best, because it doesn't reflect daylight or artificial light. Consequently, details show up better. However, the undercoat or primer should be dead flat. A primer gives the surface a little tooth and helps top coats adhere better.

Model Shipways, Testors, Humbrol, or Tamiya manufacture quality hobby paints. Jo Sonja artists' paints (used by bird carvers) or Holbein Acryla Gouache also are acceptable. They are a combination acrylic-gouache.

Hobby paints have a variety of reflectance levels. When using a mixed group of reflectance levels, finish the com-

pleted model with a flat, clear coat. It provides durability and seals any decals or dry transfer lettering. Spraying on a coat of flat finish blends colors and subdues a gloss to almost flat. Resins in the flat finish raise the reflectance level of subsequent applications from flat to about semi-gloss or satin finish. Consequently, use one coat of flat finish for nearly dead flat. Apply several coats for a little more sheen. If you start with flat paint and want some gloss, finish with a crystal or high gloss coat.

Jo Sonja paints are dead flat. To finish, use either a flat acrylic varnish for durability or a gloss varnish to increase reflectance. Other manufacturers have similar paint mixes and flat or gloss finish coats. Always read the manufacturer's instructions.

Brush painting: Many skilled modelmakers prefer the brushed-on technique, because its subtle imperfections impart a more lifelike appearance to the model. Brushes must be soft and of the highest quality. Artist grade sable or synthetics are the best. Use wider brushes for painting broad surfaces. If too narrow, the bristles will cause excessive streaking.

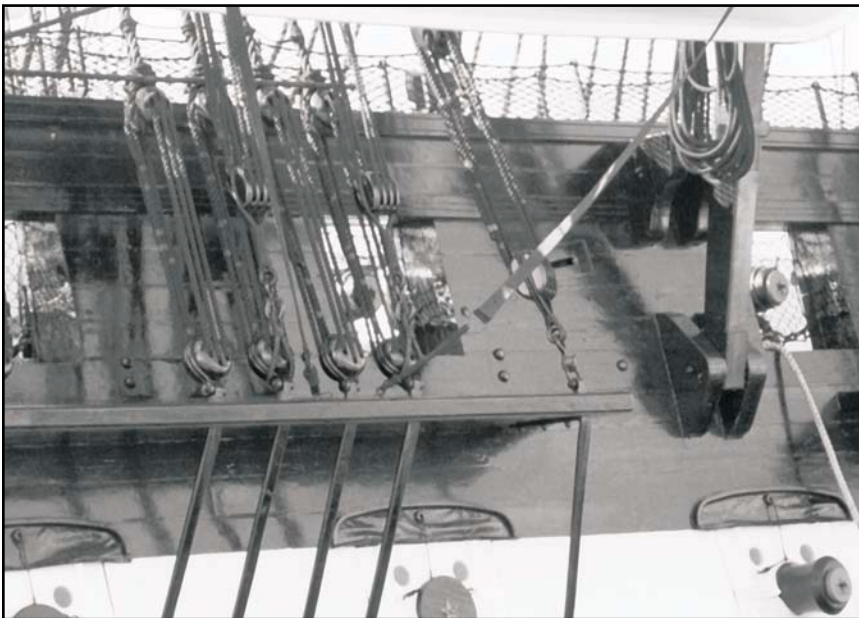
When brushing on paint or stain, lay down one thin coat in a single stroke, then move to an adjacent area and repeat the process. Never go back over fresh paint. That will tear up the surface. Wait until it has dried to a hard finish before applying a second coat.

Spray painting: Although slightly expensive, a Badger, Testors, Paasche, Revell-Monogram, or similar airbrush will produce a first-rate job and is worth the investment. Airbrushes are either single action (trigger controls only air-flow) or double action (trigger controls air and paint) and

easy to use. Spray patterns vary from thin to about 1/2" wide by either adjusting the needle or installing a different sealed nozzle. In some brands, paint travels through the airbrush body to the needle. These require disassembling to clean. Other designs bypass the body and bring paint directly to the nozzle. These clean by simply spraying solvent through them.

Paints are either water (acrylic) or solvent based. The latter spray best, but their fumes are toxic, so work outdoors or equip your shop with a spray booth. Acrylic paints are difficult to spray and must be diluted with the manufacturer's special thinner or ordinary rubbing alcohol. Thinning water-based paints with water creates surface tension problems, resulting in poor coverage and spray atomization. Experiment when using acrylics. Some modelers have success with them and others don't.

Many brands of aerosol paints produce good



MIZZEN CHAINPLATES and, to their right, one of the quarter davit hinges. Notice carvings just below each gunport's rigol (eyebrow).

results. However, test them on scrap wood before spraying the model. Aerosols put out a lot more paint than an airbrush, so spray on several light coats to avoid runs. The best way to achieve a dripless, consistent spray pattern is to buy the inexpensive CAN-GUN® at Wal-Mart. Snap the pistol-grip onto the can, squeeze the trigger, and CAN-GUN'S actuator maintains a constant pressure on the valve. The volume of spray never alters, so coat after coat goes on without mistakes.

Mixing brands is not a good idea, because they may be incompatible. Sometimes, however, no other option exists. If so, apply each brand separately and allow to dry thoroughly before adding the next. Always test to make sure the final flat or gloss finish is compatible with the paint it will cover.

Masking surfaces: Masking can be a tricky process. Some brands of masking tape are worthless, because they allow paint to seep underneath their edges. For masking fine stripes or straight and curved lines, use a graphic arts tape such as Chart Pak. It comes in widths as fine as 1/32" and 1/64". Chart Pak tapes have superb adhesion and won't bleed when firmly applied (burnishing is recommended). Black plastic electrician's tape and Scotch Removable Magic Tape are also excellent. Scotch's tape has the same, low stick adhe-

sive as its famous Post-It pads. In fact, Post-It tape flags can be used for masking.

Scribing the copper line: Mount the hull with the copper line parallel to the bench top, then mark the line using a height gauge and sharp pencil or scribe.

2. Constitution's Color Scheme

The basic color scheme, as shown on the plans, is black, white, dark green, and dull red. These Model Shipways' acrylic marine paints approximate them:

Black	Hull/Spar Black, MS4830
White	White, MS4831
Bulwarks	Bulwarks Dark Green, MS4801
Gun carriages	Bulwarks/Gun Carriage Red, MS4802

Bright means a varnish finish. Most oak or ash on *Constitution* is bright, so mix light maple stain with a little sheen for the model equivalents. Use a mahogany stain to duplicate the finish on the thwarts and gratings in the captain's gig, and the skylight on the aft spar deck. To re-create the deck's weathered look, apply a light gray wash with no sheen.



MIZZEN AND MAIN TOPMAST, TOPGALLANT, AND ROYAL MASTS. A hurricane in 1998 broke the foremast's topgallant and royal masts. View looks from the stern forward. Spanker was bent to the gaff on the mizzenmast. Sailors went quickly aloft using the ratlines on the shrouds and topmast shrouds.

Stage 1: Framing the Plank-On-Bulkhead Hull

Fig. 1-1 Center Keel Assembly

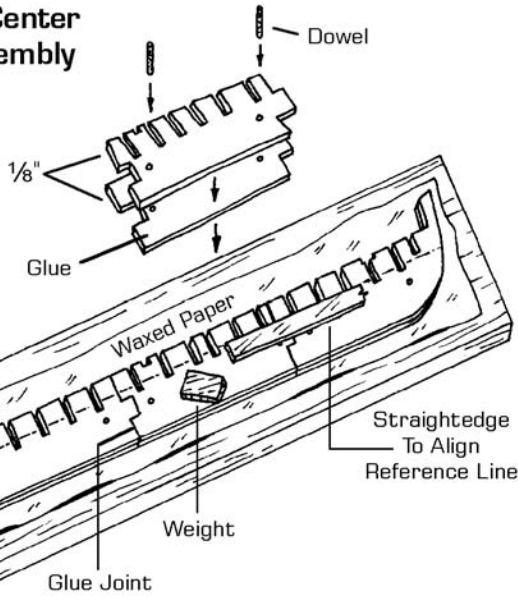


Fig. 1-2 Adding the Keel, Stem, and Sternpost

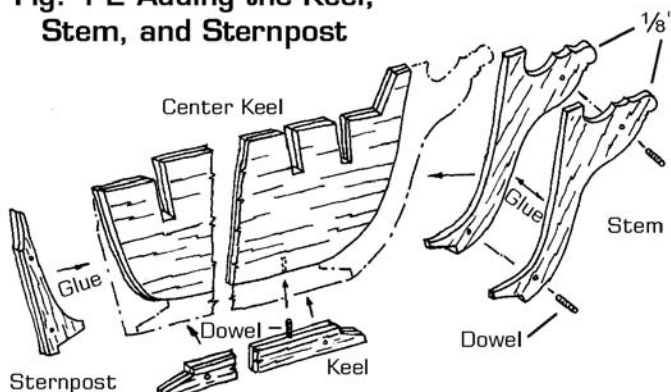
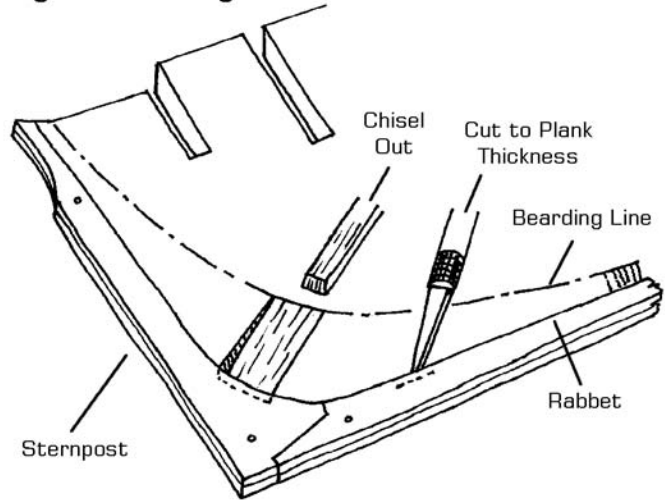


Fig. 1-3 Cutting the Rabbet



1. Bending Wood

Building a plank-on-bulkhead hull requires bending some wood without distorting it (doing so stresses glue joints and fasteners). Wood is bent by:

Steam bending: Hold the plank over a kettle of boiling water, bend to the desired curve, then maintain that position until the wood cools. The plank should remain in this shape, but could spring back slightly.

Microwave steaming: Wrap the planks in a wet paper towel before heating. Since microwave ovens differ in wattage, experiment to determine what power level to use and for how long.

Soaking: Submerge the plank in warm water for several hours. Try adding a little household or pure ammonia to speed up the process. This makes fibers slippery and the wood bends more easily. After soaking, place the plank in a fixture until completely dry.

Soldering iron: Large soldering irons with a tubular end are ideal. Clamp the iron upright in a vise. While the iron heats, soak the strip of wood in tap water. Some modelers prefer bending around the tube near the handle (it's not as hot), while others use the shank. Move the strip back and forth against the iron. Its heat turns water into steam and drives it into the wood. The trick is to wait until you feel the wood wanting to yield before starting the bend. Begin too soon or apply too much pressure and the strip will break. The wood dries rapidly, so take care to avoid scorching. Resoak and reapply the plank to the iron until the desired shape is achieved. Once the piece is formed, it can go directly on the model. Because the wood's memory has been permanently altered, it will never spring back, meaning no stress on any timber or fasteners. Spend some time acquainting yourself with this method and you'll never bother with fixtures again.

Another soldering iron approach is to turn a tip from aluminum alloy, then file a 45° angle on one end. Insert the tip in a standard 20-30-watt soldering iron and heat it. Don't use an iron with higher wattage, because it burns the wood. Soak the planks in cold tap water for three to five minutes. The ideal time depends on the hardness of the wood. Air dry the pieces for the same time. Since wood takes on water faster than it is released, the planks won't dry out completely. Tack or pin the end of one plank to a board, then press the tip down firmly onto the wood and move it along as your other hand slowly bends the wood. This can be done directly over the plan or using a fixture. Those without a lathe can purchase a Kammerlander turned aluminum tip in hobby and woodworking stores or from Across the Pond, P.O. Box 153, Marblehead, MA 01945.

(Gebhard Kammerlander, a professional German model-

builder, developed this method and the aluminum alloy tip.)

Commercial plank benders: Model Expo sells an electric plank bender designed for controlled heat. Amati's Form-A-Strip (also from Model Expo) bends planks without soaking or heating. It looks like a pair of pliers with one flat jaw and a chisel for the other. When squeezed on a plank, the chisel depresses one side of the wood, causing it to bend. Repeat the process along the plank until it assumes the correct curve. However, squeezing too hard will cut the wood in half. This tool bends planks in only one direction, so it's good for bow planks, but not those at the stern.

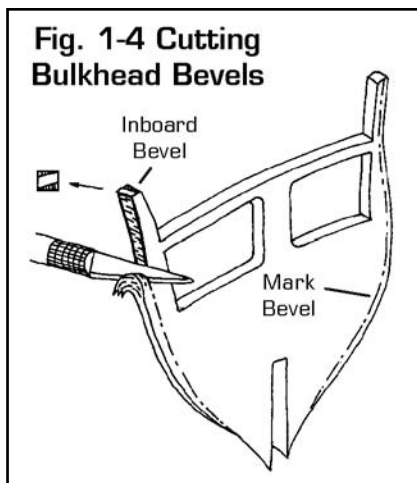
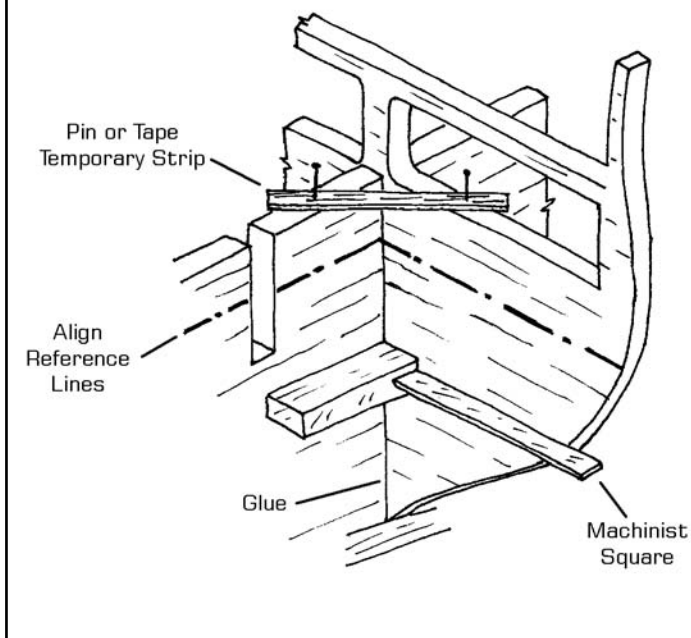


Fig. 1-5 Gluing Bulkheads to Center Keel



2. Center Keel Assembly

Model Shipways' lasers can cut materials up to $\frac{3}{16}$ " thick; otherwise, excessive burning occurs. Therefore, the $\frac{1}{4}$ " thick center keel, keel, stem, and sternpost are supplied as two $\frac{1}{8}$ " thick parts. Align them using the $\frac{1}{16}$ " guide holes, insert a dowel, and glue the pieces together. Clamp all around or lay the pieces on a table and add weights.

The next step is to assemble the three center keel sections. With a sharp pencil, tick off the bulkhead stations below the slots, then the reference line. Mark on both sides of each center keel piece. Be critical and measure from several points on the plans when marking the reference line. It is a key to proper alignment and locates **Bulkheads A** through **R**.

Lay a sheet of waxed paper or plastic wrap over a flat building board or table and place the center keel pieces on top. Affix the joints with white or woodworker's glue. Use a steel or aluminum straightedge to align the reference line. Place a weight on each piece to hold it down while the glue dries overnight (Figure 1-1).

3. Installing the Stem, Keel, & Sternpost

Add the assembled two-part stem, keel, and sternpost. Taper the stem and sternpost as shown on the plans. Align and hold the pieces with dowels (Figure 1-2).

Option: Cut the rabbet before adding the keel.

4. Cutting the Rabbet

The *rabbet* is the glue line between the stem, keel, and sternpost and the center keel. The *bearding line* is the intersection of the center keel with the planking's inner face.

Fig. 1-6 Temporary Battens for Hull Alignment

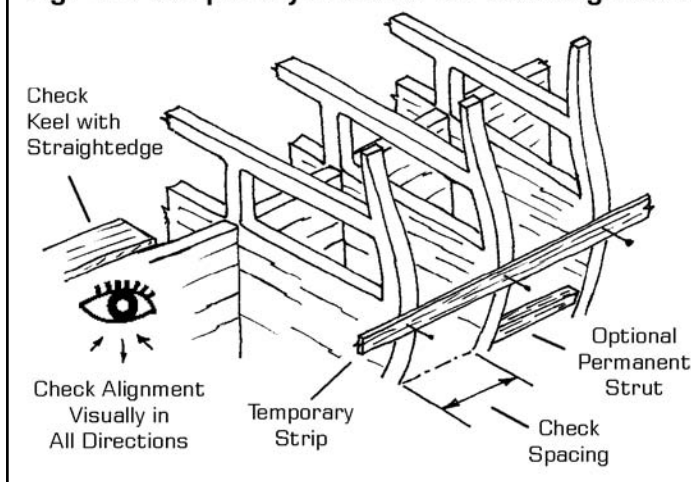


Fig. 1-7 Correcting Bulkheads at Bearding Line

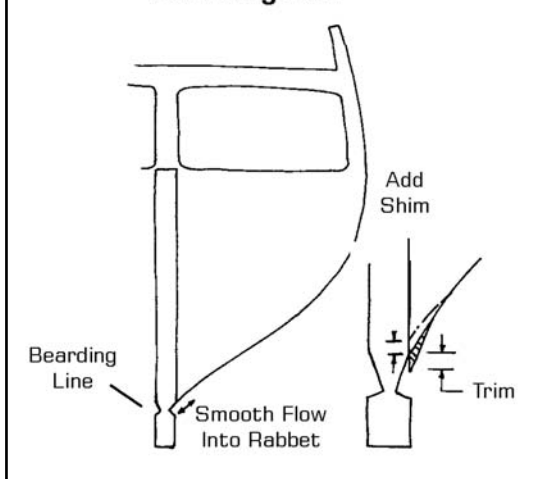
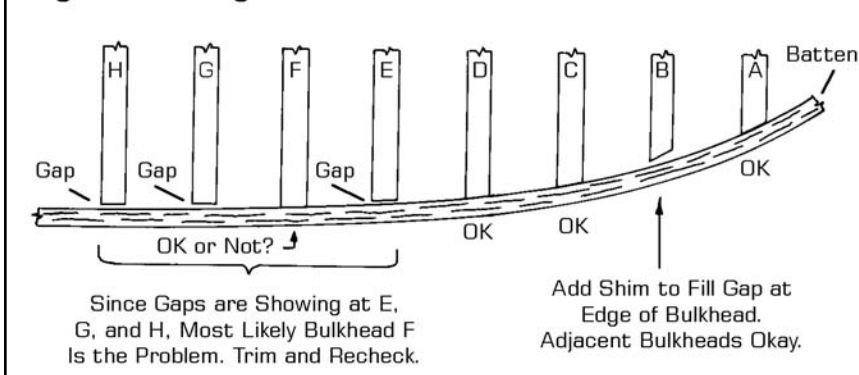


Fig. 1-8 Fairing the Bulkheads



Measure the bearding line's location from the plans, then mark it on both sides of the center keel. Note: The rabbet varies depending upon its location. Using a $\frac{1}{8}$ " wide chisel, start the rabbet cut at the bearding line and cut toward the rabbet. To judge its angle, position a scrap plank against the keel as you carve. When the hull is planked, these timbers

must lie flush on the cut portion from bearding line to rabbet (Figure 1-3).

5. Installing the Bulkheads

Laser markings on the wood identify bulkheads A through R. Test each one to make sure it slides into the correct center keel slot. If the fit is too tight, sand the slot. Bulkheads should fit snugly with a little tolerance for glue.

Using a pencil, mark the reference line on each bulkhead. It must align with the reference line mark on the center keel. This assures an

accurate hull, because each bulkhead is correctly related to the others.

Next, use a tick strip to transfer the bevels from the plans to the bulkheads. Mark them in pencil. Cut the bevels with a #11 hobby blade per Figure 1-4. Deck bevels and side bevels amidships are hardly measurable. Sand these in after the bulkheads are installed.

Glue the bulkheads in place. Make sure each bulkhead's reference line matches the one on the center keel. Use a small machinist square to set each bulkhead perpendicular to the center keel, then tack a temporary strip to the top of the bulkhead to hold it in place while the glue dries (Figure 1-5).

After installing all the bulkheads, tack or tape a temporary batten on each side of the hull just below the gun deck (Figure 1-6). This is a critical step. Measure the spacing between each port and starboard bulkhead and retack the battens until the hull is aligned. Although the center keel was assembled flat, it could warp and produce a banana-shaped hull. When it looks correct, check it again. Be certain the bottom of each bulkhead feathers out at the bearding line. Trim as necessary to line up. Bottoms on most narrow bulkheads will be slightly above the bearding line (Figure 1-7).

Option: Once the hull is aligned, add permanent struts between each bulkhead as shown on the plans.

Next, sand in the bevels that were not precut. Lay a $\frac{1}{8}$ " square basswood batten against the bulkhead edges at various locations to check the hull's fairness (Figure 1-8). Sand or add shims to correct bumps and dips. This is an important check. Hull planks must lie flat against the bulkheads. Due to *Constitution's* numerous bulkheads, manufacturing or assembly errors can occur.

6. Installing the Counter, Bow, & Stern Filler Blocks

Note: Filler blocks must be cut from larger blocks supplied in the kit.

Carve the counter block per the plans. However, leave the rounded ends a little oversize until the filler block is added,

Fig. 1-9 Bow Framing

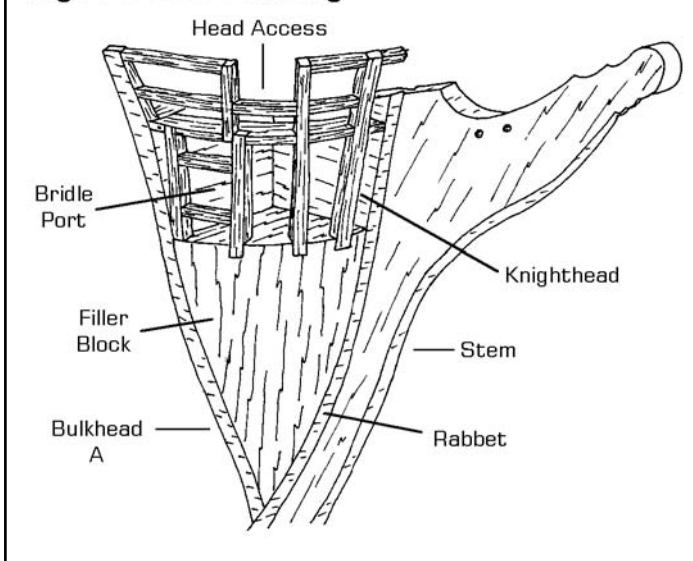
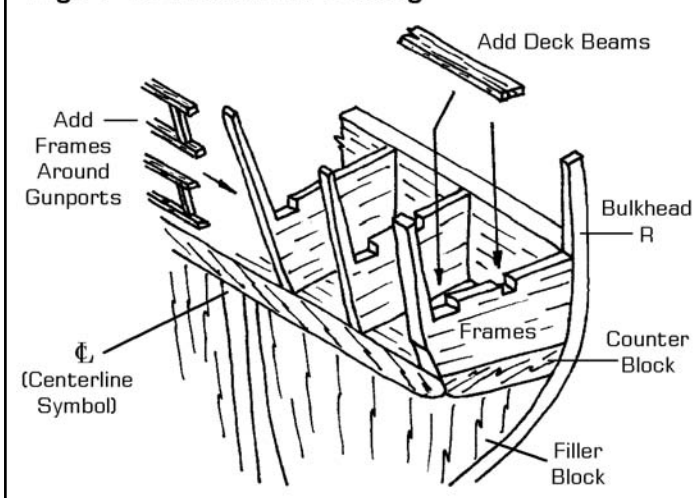


Fig. 1-10 Transom Framing



then shape both of them. Don't forget to drill the rudder stock hole in the center. Glue this block to the aft side of **Bulkhead R** on top of the center keel.

Carve the bow filler block to fit forward of **Bulkhead A** and the stern filler block to fit aft of **Bulkhead R** under the counter block. Waterlines on the plans will aid in carving them to the correct hull shape. Filler blocks provide a solid base for timberheads, knightheads, and hull planking. Planks will still require steam bending at the bow and stern, but are less likely to crack with the blocks in place.

7. Installing Bow Knightheads & Timberheads

Mount the timberheads and knightheads at the bow. They fit into notches in the bow filler block. Figure 1-9 shows the bow framing.

8. Installing the Transom Framing and Back of Quarter Galleries

Add the laser-cut transom frames. Don't forget to bevel the outboard frames. Slip the two deck beams into their slots. Figure 1-10 illustrates the transom framing.

Install the laser-cut back on each quarter gallery (Figure 1-11). They and the transom will be planked later.

Note: A cap strip covers the back edge of the quarter galleries and the ends of the transom planking. Add it now or after planking the transom.

9. Covering the Mast Slots

Glue the pieces on both sides of the center keel's mast slots (Figure 1-12). Notice how they form a mortise. Attach them securely, because they are inaccessible once the deck is installed. Lastly, cut a tenon in the heel of each mast to fit these slots.

10. Framing Around Gunports & Anchor Ports

Upper port sills align with and become part of the main rail, while lower sills align with and become part of the planksheer. Usually a bulkhead frames the vertical faces. It's easier to make the framing even with or slightly thicker than the bulkheads, then sand it flush. Remember, hull planking must lie flat against this framing, so lay a plank over it to check (Figure 1-13).

11. Installing Boxes for Dummy Gun Deck Cannon

The model's gun deck is bare except for dummy cannon

Fig. 1-11 Installing the Back of a Quarter Gallery

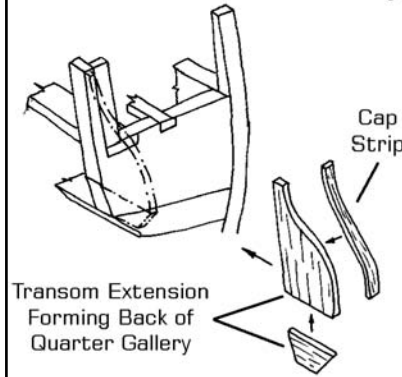


Fig. 1-12 Covering Mast Slots

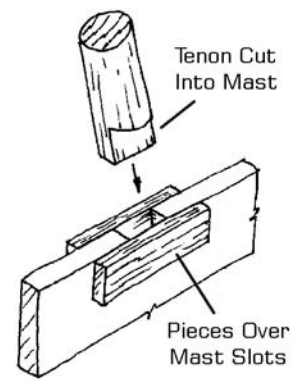


Fig. 1-13 Spar Deck Gunport Framing

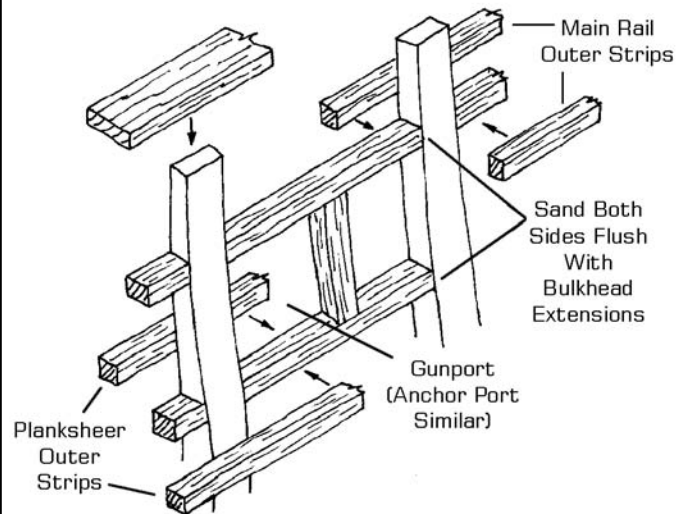
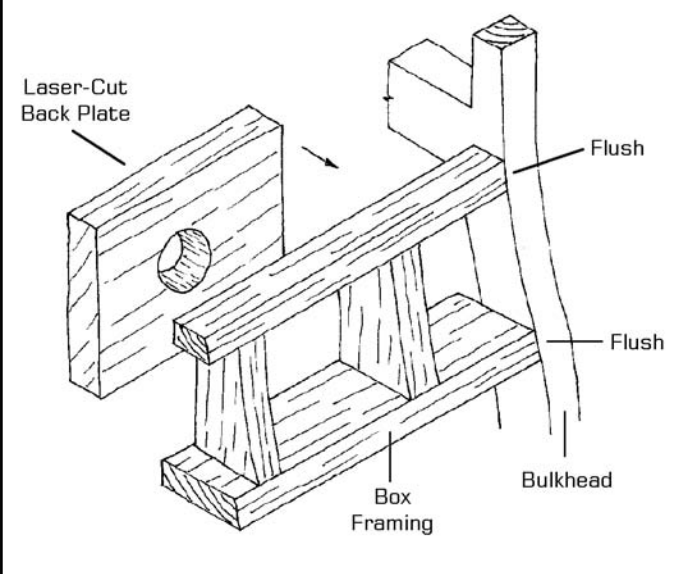
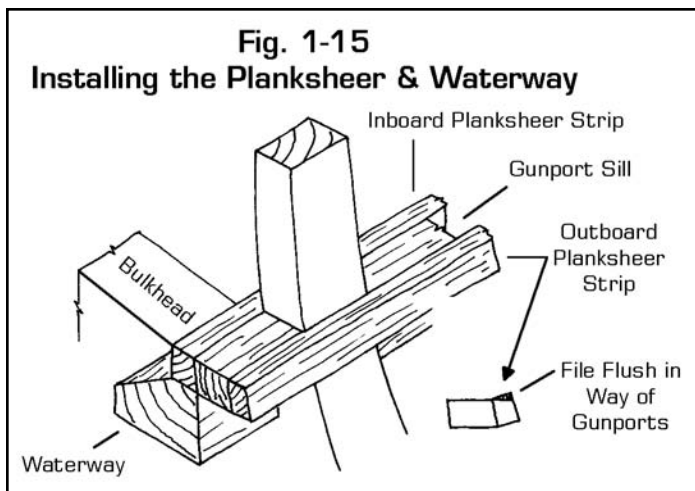


Fig. 1-14 Dummy Cannon Box on Gun Deck





The planksheer is comprised of an inboard strip, an outboard strip, and the lower gunport sill. The $\frac{3}{64}$ " x $\frac{3}{32}$ " exterior strip must lie flush with the planks above and below it. However, when it encounters a gunport, file the strip level with the lower sill (Figure 1-15). Install the outboard strip now or later with the hull planking.

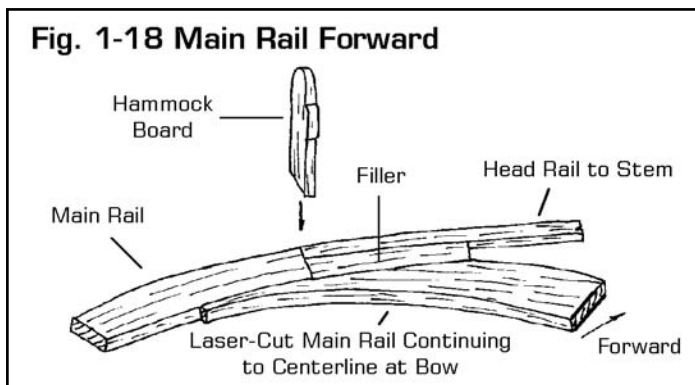
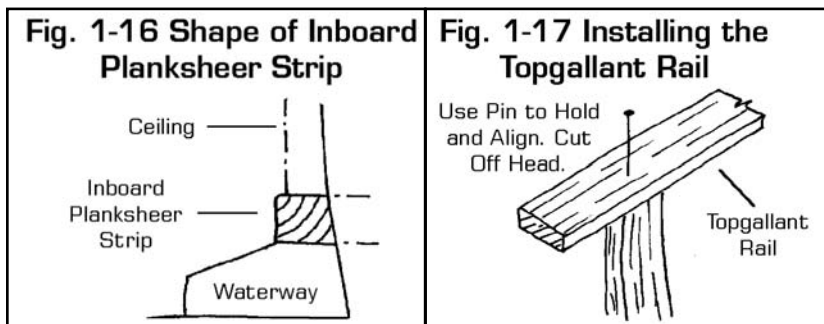
Shape the inboard planksheer strip so it is slightly wider than the bulwark plank above (Figure 1-16).

13. Installing the Main Rail, Topgallant Rail, and Gangway/Hammock Boards

A one-piece topgallant rail overhangs the bulwark and hull planking. The edge of the rail has decorative grooves, but this can be omitted on the model. The stern topgallant rail is laser cut. Make its other segments from stripwood. Use pins or dowels to align and hold the rail in place (Figure 1-17).

The main rail consists of an outboard and inboard strip added over the upper gunport sill. Both sides of the rail overhang the planking and, like the topgallant rail, have decorative grooves along the inner and outer faces. Add the laser-cut corner knees at the stern.

The main rail is one piece from Bulkhead E to the gangway rail. It continues as one piece forward of the bow hammock board where the topgallant rail ends. At this



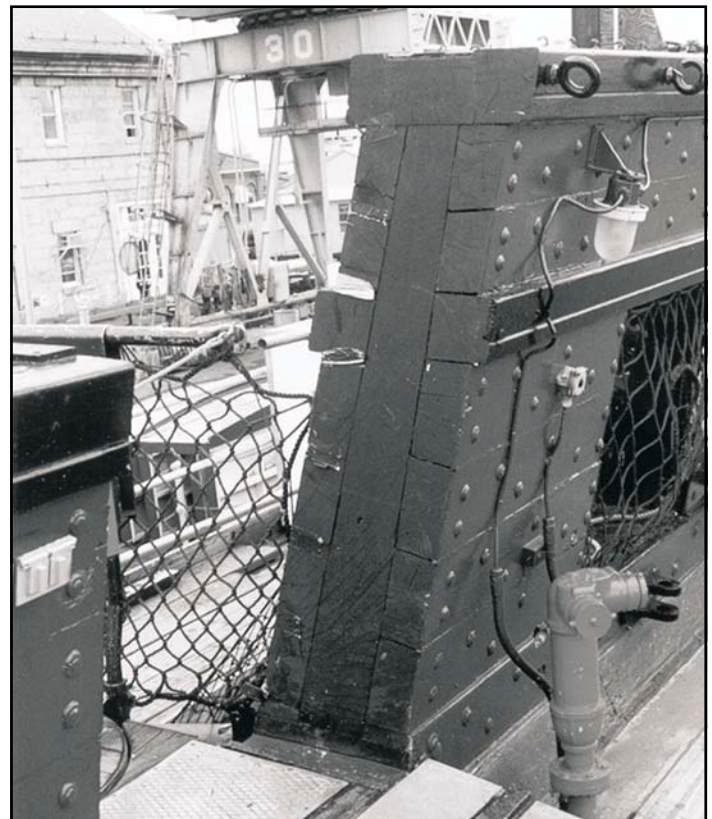
barrels fitted at the port and starboard gunports. Stern gunports, called chase ports, have none. Make a box at each port to replace the gun carriage. Each box has a laser-cut back plate with a hole to accept the barrel. Slide it in or out of the hole to align it. The back plate must be vertical. Consequently, the boxes are all different (Figure 1-14).

If the gunport lids are left open, the boxes block anyone's view inside the hull. Paint the inside of each box flat black.

Option: Install cannon on carriages (not included, but available from Model Expo). The bulkheads are cut out below the spar deck to accept deck planks or a solid sheet at gun deck level. Although the cannon won't be visible, installing them is great experience for the day when they will be.

12. Installing the Waterway and Planksheer

Install the spar deck's waterway. Notice how it varies in shape from bow to stern (see Sheet #2).



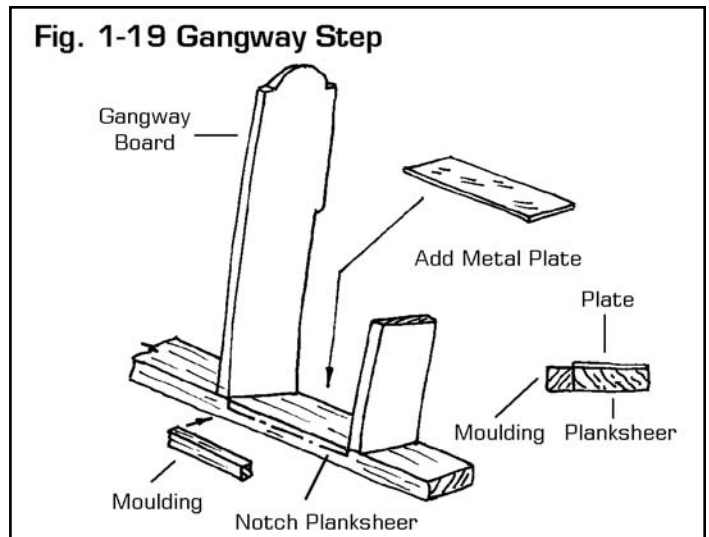
GANGWAY BOARD removed. Note bulwark construction.

point, the main rail splits and goes to the head rails and stem. The curved stem portion is laser cut (Figure 1-18).

Fancy scrollwork adorns the laser-cut gangway and hammock boards. This is shown on the plans. At least try carving the patterns in scrap wood. Most beginners' third attempt is good enough for the model, but effort #4 made on the laser-cut pieces will be even better. Yes, these carvings can be omitted, but don't give up without trying to do them. At the gangways, notch the inboard and outboard plank-sheer strips, then add a plate (Figure 1-19).

14. Installing the Bow Rail

Make the bow rail (sits on top of the main rail) from planking or a solid piece. The knees are laser cut. On top of the rail is a strip with fairlead holes for head sail rigging.



Stage 2: Planking the Plank-on-Bulkhead Hull

Some common shipbuilding terms used in the planking process are:

Plank: A single length of wood fastened to the outside of a ship's frames or to beams to form decks. A planking *strake* is a continuous line of planks butted against each other from bow to stern.

Garboard strake: Planking strake adjacent to the keel.

Sheer strake: Uppermost line of planking on a hull.

Wale: Heavy layer of strakes below the sheer strake.

Belts: Group of planks along the hull. Belts are laid out using *battens* (temporary strips of flexible wood). A *ribband* is also a batten. It holds frames in position during planking. Ribbands are removed as planking progresses.

Spiling: Marking and cutting a plank's edges to a given shape.

Edge bending or springing: To bend a plank edgewise.

Fair: Straight, smooth hull curves.

Nib: Pointed end of a tapered plank. Because nibs rot first, shipwrights squared them off, then notched the margin plank (covers outer edge of deck) to accept the butts. Consequently, they called the margin plank the *nibbing* plank.

Nibbing: Process of seating the squared, tapered end of one plank into the edge of another. Nibbing generally applies to decks, but sometimes hull planks, especially at the bow, are nibbed. The British call this procedure *joggling*.

Stealer: Plank inserted into another plank or between two adjacent planks to reduce their width. Or, when two planks taper toward a narrow end, both may have to be cut off and

a wider plank substituted to leave enough wood for fastening to the frames.

Counter: Underside of the overhanging portion of a stern.

1. Getting Started

Most modelers find planking tedious. Work slowly and think of each plank as a project unto itself. Since hull sides are identical, simultaneously cut one pair of port and starboard planks to shape. Fit the plank on one side, then the other. Don't rush. Speed results in frustration and a poor job.

Before starting, secure the hull upside down in a vise or cradle. Something portable that rotates is ideal. Model Expo sells a planking vise for this purpose.

2. Planking Battens & Belts

Hulls are easier to plank when divided into belts. They flow along the hull in smooth curves. Each is designed to lay the planks against the frames without excessive edge bending. They sweep gently up at the ends like the deck sheer. Planks within a belt are usually evenly spaced, tapered, and fitted. Belts prevent errors from accumulating.

When selecting a belt width and the number of planks it contains, consider how the planks taper and lay against the frames. If the planks are too wide, they won't lie flat against the bulkheads. Taper them too much and insufficient stock is left for fastening. Should this happen, a larger plank must be substituted for two planks to increase the width. In some areas, the distance between planks widens rather than tapers. If it becomes too wide, a stealer must be added. While these alterations are acceptable and em-

Fig. 2-1 Stealers

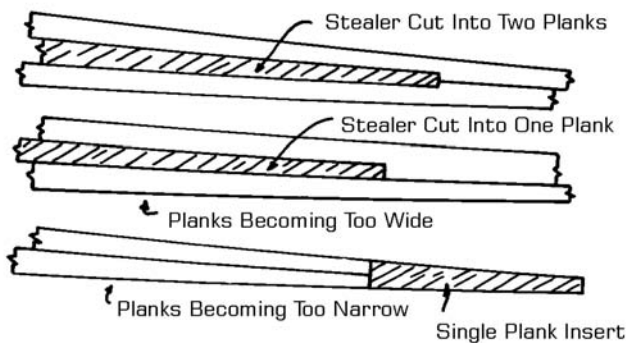


Fig. 2-2 Planking Butts

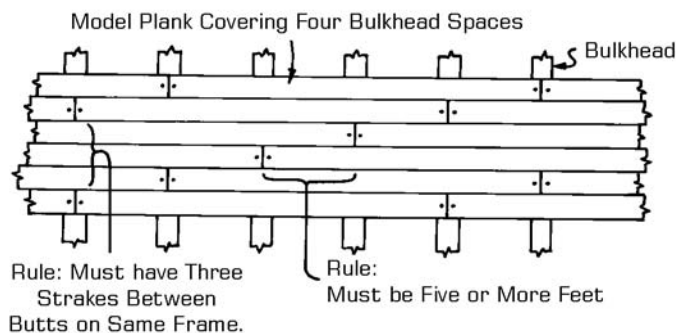


Fig. 2-3 Spiling Planks When Edge Bending Is Impossible

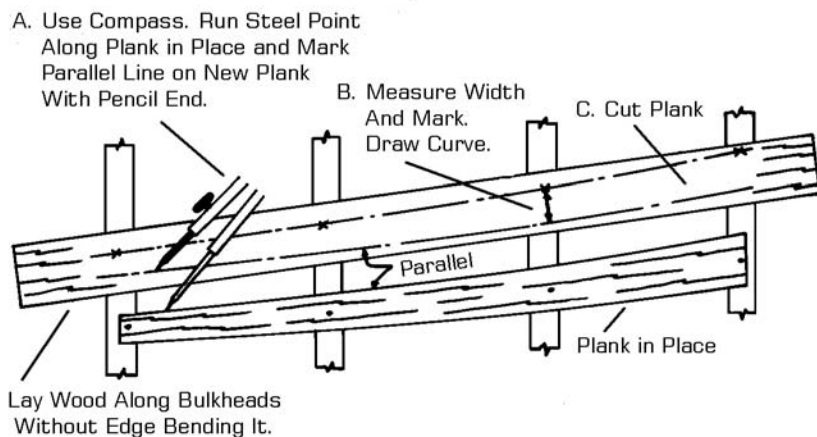
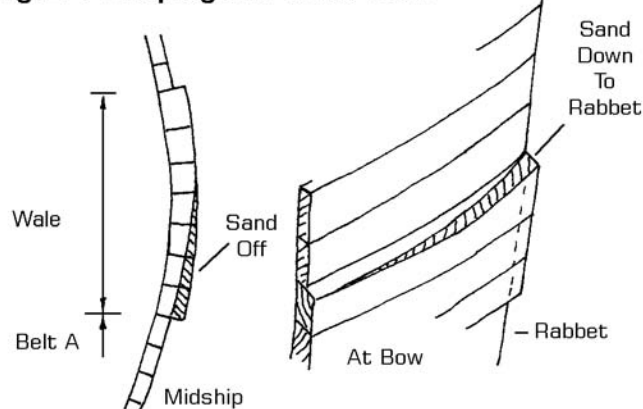


Fig. 2-4 Shaping the Main Wale



ployed on many ships, the best run of planking limits the number of stealers. Figure 2-1 illustrates some inserts.

Sheet 3 provides in-depth details on how to lay out the planking. Study the fore and aft views plus the profile view to gain a complete picture.

3. Planking Butts

Few trees grow as tall as ships are long. Consequently, real planks were generally 20 or 30 feet in length. Some modelers think a plank as long as the hull is easier to use. They scribe in fake butts or omit them. Although this can be done, working with shorter planks has advantages. For example, tapers mark quicker and planks are easier to hold and fasten. Should a mistake occur, only a small piece is affected. So, the following is based on scale-length planks.

Because this is a plank-on-bulkhead model, planking butts must occur on bulkheads and won't simulate shipwright practice. Therefore, cover four bulkhead spaces with one plank. To avoid stubby pieces at the bow and stern, use a longer or shorter plank to complete the run.

To emulate shipwright practice, stagger the butts (Figure 2-2). This also applies to deck planking. Covering four bulkhead spaces follows the rule of three full plank widths between butts on a single frame (or bulkhead, in our case).

One plank covering three bulkhead spaces won't work, because that leaves only two full planks between butts.

4. Spiling

Edge bending planks on real ships occurs on a limited basis. Wood is rigid, so many planks must be cut to shape. Spiling (Figure 2-3) is simply a matter of transferring curves to a straight plank, then sawing them out. Usually, the basswood planking strips are flexible enough to edge bend in place.

5. Fastening the Planks

Avoid the commercial plank clamp that screws into the edges of bulkheads. This leaves a big hole to contend with when installing subsequent planks. Instead, hold short pieces and use aluminum-head push pins to position them. Be careful not to split the wood. If necessary, drill a pilot hole first. Smear a light film of white or woodworker's glue along the edge of the plank, then touch each bulkhead with thin cyano to affix the plank quickly. Be careful not to glue your fingers to the model.

Another approach is to apply cyano to the edge of a plank already in place and to the bulkheads above it. Spray or brush the cyano's accelerator on the plank to be installed, then hold it in place. The glue sets instantly and no clamps are necessary.

While glue alone will secure a plank, small brass brads or wooden treenails provide additional holding power and duplicate shipwright practice. If using brads, hammer them in after cutting off and discarding their heads.

Treenails are commercially available, but making your own is easy. Buy a package of long bamboo skewers, strip off short lengths, and pull through a drawplate to the desired diameter. Drill holes through the plank into the bulkhead, dip the treenail in white or yellow glue, and drive in place. Nip the dowel flush with the planking or buy a treenail cutter. (This expensive accessory mounts in a hand-piece.) For more authenticity, add treenails where each frame is on the real ship. Although time-consuming, it is visually correct.

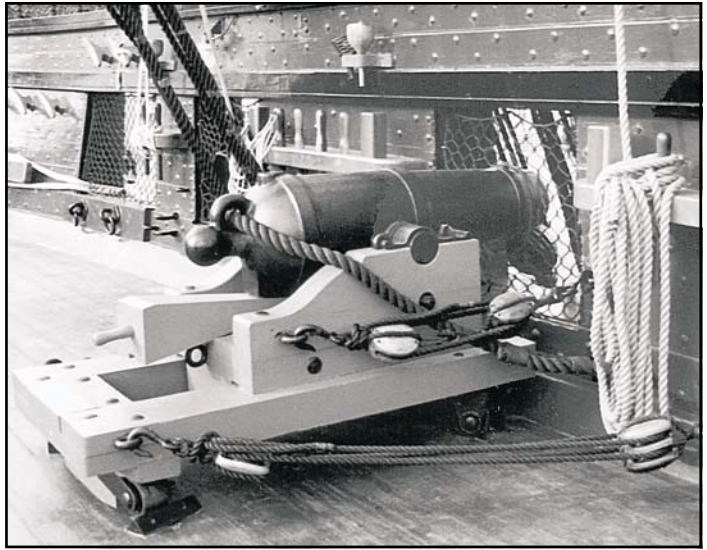
Another alternative is to whittle flat toothpicks (round ones don't work as well) to a point. Place the entire toothpick in the hole, rap sharply with a 10-inch bastard file, and break off the remaining portion. A file works better than a hammer, because its serrated surface catches and firmly holds the head of the toothpick, permitting it to be driven in tightly. Exterior stubble is dressed and sanded smooth when treenailing is completed.

6. Planking the Outer Hull

The planks from the topgallant rail down to the bottom of the main wale have little or no fore and aft taper. These areas are easy to install. Notice the planking belts on the port and starboard hull. One is between the topgallant and main rail, more are above and below the gunports, and several are in line with the gunports. All the planks within a belt are the same width, and their number matches that on the real ship.

Rails, wale lines, and gunport belts are preset lines that can't be modified. However, some liberties with the planking layout are possible below the wale, since it doesn't affect the plan. One unknown is how wide are the plank runs beneath the copper plates. The only clue to their widths is deduced from a Navy midship sectional drawing.

Planking from the bottom of the wale to the keel requires



32-PDR. CARRONADE. Carronades were smaller and lighter than cannon, and required less men to fire. Range was about 300 yards. Note how the muzzle protrudes only slightly beyond the bulwarks. When firing into the wind, the lower rigging faced going up in flames as the occasional red hot wad flew back inboard. By 1815, carronades were out of fashion.

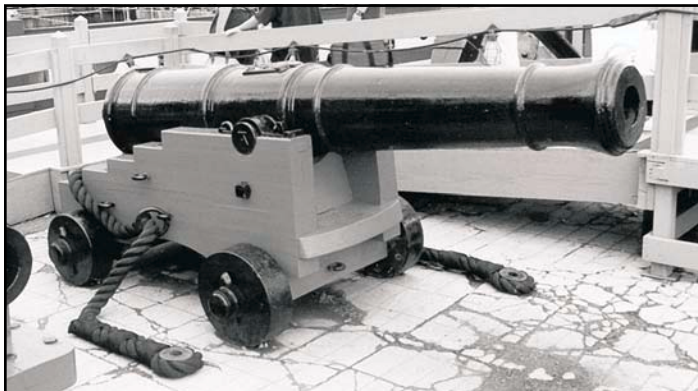
tapering fore and aft. Consequently, the hull below the wale is divided into **Belts A** through **D**.

Referring to Sheet 3, lay a tick strip along each bulkhead and mark the bottom-of-wale location and the belt seams below. Transfer these points in pencil to the model. Now temporarily tack four, $\frac{1}{16}'' \times \frac{3}{32}''$ basswood battens along the port and starboard belt lines. Battens assure an accurate run of planks by correcting errors in drafting, tick strip marking, or transferring. Remember, the wale line is a given and should follow the plans.

Once the eight battens are in place, check their flow. Look at the model from the side and from the bow and stern. Do the battens have a pleasing, smooth curve? Are they symmetrical? If necessary, adjust the lower battens referring to the planking profile on Sheet 3. When everything is fair, make sure the belt seams are clearly visible. Remark those that aren't. Now, either remove the battens or leave them in place until they interfere with installing a plank.

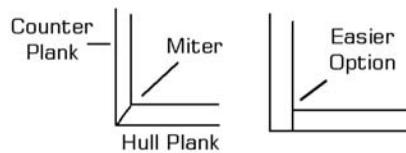
Tapering Plank Edges: As planking proceeds, the edges of a particular plank may require tapering to butt flush against its neighbor. Properly machined planks have square edges. Butting them together on a hull may produce small gaps. Most are sealed with glue or wood filler, or caulked on a real ship. Plank edges are often deliberately tapered to ensure they butt against each other, while providing a sufficient gap for caulking. To create a perfectly smooth hull without gaps, trim each plank edge as it is fit. The decision to taper or rely on filler is yours.

Planking Above the Main Wale: Install these planks first. Notice that the planking stops $\frac{1}{32}''$ short of the gun deck



24-POUNDER (PDR) long gun on Constitution's gun deck. The long gun on the spar deck is called a bow chaser.

Fig. 2-5 Counter to Hull Plank Intersection



gunports to provide a back ledge for their lids. The spar deck ports have no lids, so trim the planking flush with the openings. Planks are $\frac{3}{64}$ " and $\frac{1}{16}$ " thick just above the wale.

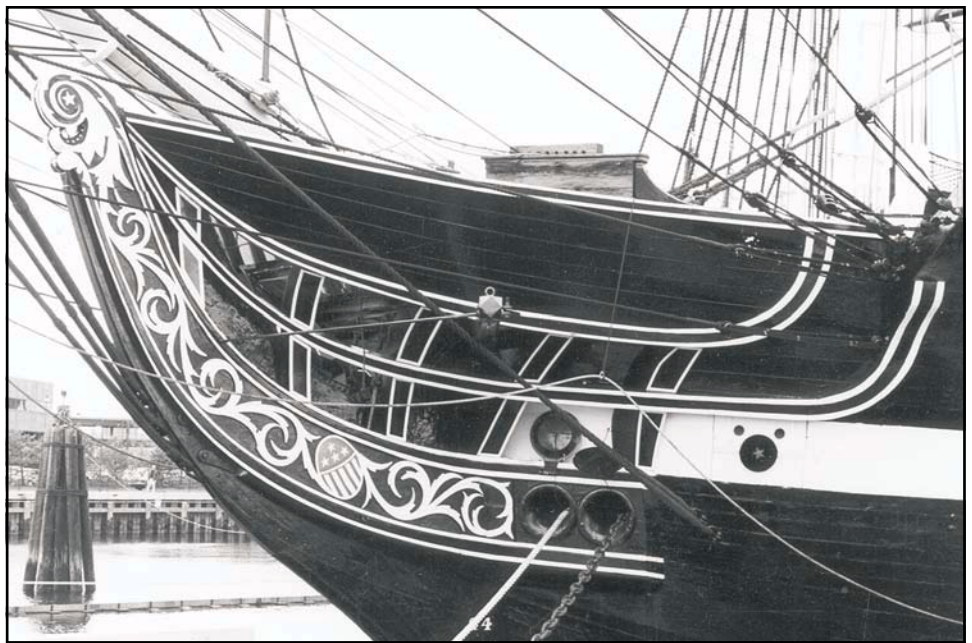
Planking the Main Wale: The main wale has seven $\frac{3}{32}$ " thick planks which, at the bow and stern, taper to $\frac{1}{16}$ " thick at the rabbet. Carve or sand this taper either before or after mounting the planks (Figure 2-4).

Planking the Transom: The $\frac{3}{64}$ " thick transom planks extend to the cap strip on the quarter gallery back. Add the moulding (discussed later) once the transom planking is completed.

Planking the Counter: The $\frac{3}{64}$ " thick counter planks intersect with the port and starboard planking. This can be a miter joint (difficult), but an easier method is to cut the hull planks flush with the counter, then plank the counter out to the edge (Figure 2-5).

Laying the Planks in Belt A: Planks below the wale are $\frac{1}{16}$ " thick. Each belt is done separately, so planking can start with any one. However, it is logical to begin at the top and work down. **Belt A** has nine, $\frac{1}{16}$ " thick strakes. At **Bulkhead I**, the maximum plank width is roughly $\frac{1}{8}$ " on the model (10" on the real ship). Use $\frac{1}{8}$ " wide strips for the midship area and $\frac{3}{32}$ " strips where the planks taper fore and aft.

Lift the plank widths from the hull planking layout with a tick strip. If any batten locations were changed, divide the space on each bulkhead into nine equal plank widths. Set the slide on your proportional dividers to the number of planks in **Belt A**. Span the width of **Belt A** with the long



USE THIS PHOTO AS A GUIDE for painting the head rails and scrollwork. *Constitution's* original figurehead was a carving of Hercules. A cannonball ruined it during the siege of Tripoli, and a figure of Neptune replaced it. This gave way to the plain billet seen today. It's called a fiddlehead, because it resembles the end of a violin.

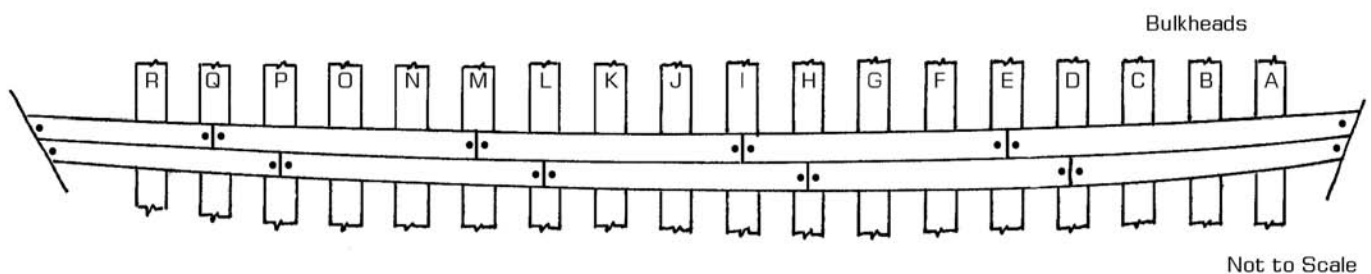
legs. The distance between the points on the short legs is the width of each plank in the belt. Mark these lines on the bulkheads in pencil. **Belt A** is now completely marked.

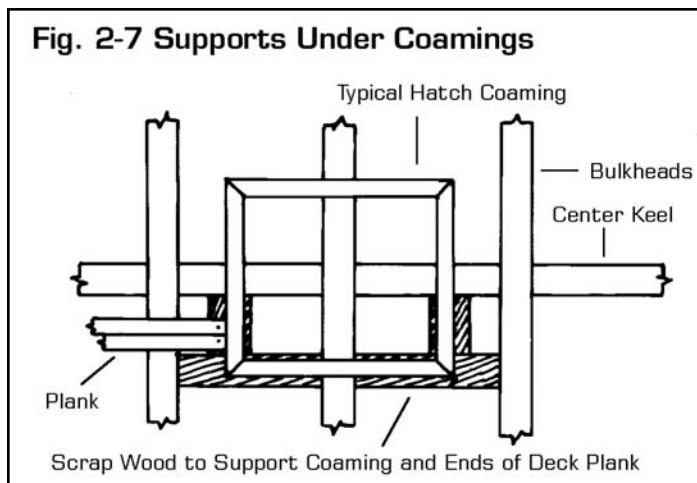
The next step is to cut planks to fit between the marks. **Belt A** doesn't require spiling, so make straight tapered planks. Start at **Bulkhead I**. Use five planks: one from **Bulkhead I** to **Bulkhead M**, another from **Bulkhead M** to **Bulkhead Q**, **Bulkhead Q** to the stern, **Bulkhead I** to **Bulkhead E**, and **Bulkhead E** to the stem. This last plank is longer than four bulkhead spaces to prevent having a stubby plank.

First, lay a piece of planking stock over **Bulkheads I** through **M**. In pencil, mark their overall length on the plank, then the position of each bulkhead. Next, using a set of dividers or tick strip, lift the plank widths from the marks on the bulkheads and transfer to the stock. Draw a line through the points and cut the plank. Trace this tapered plank to obtain another for the other side of the hull. Repeat for the remaining planks in **Belt A**.

Install these planks. Repeat the process for the next strake, but stagger the butts (Figure 2-6). Install a plank

Fig. 2-6 Installing First Two Strakes in Belt A





from **Bulkhead H** to **Bulkhead D**, **Bulkhead D** to the stem, **Bulkhead H** to **Bulkhead L**, **Bulkhead L** to **Bulkhead P**, and **Bulkhead P** to the stern.

Moving to the next planking strake, stagger the butts starting at **Bulkhead G**. Continue until this run is finished, then complete the others in **Belt A**. Steam bend the planks where they curve sharply at the counter. Once **Belt A** is planked, sand the bottom of the main wale flush with it (Figure 2-4).

Laying the Planking in Belt B and Belt C: These belts have nine strakes about the same width as those in **Belt A**. The planks widen at the stern in **Belt C**. If the temporary batten is still in place, remove it. Lay the planks for **Belts B** and **C**, but remember to stagger the butts.

Laying the Planking in Belt D: This belt contains the garboard strake (next to the keel). It also has nine strakes that widen at the stern, but not so much as to require stealers. Use the planking profile on Sheet 4 to determine the plank widths in **Belt D** aft. Sheet 3 can't show all the planks aft, so this view is necessary.

Plank Variations within a Belt: Suppose a belt has eight planks the same width, but the eighth plank must be wider to complete the belt. Cause for worry? Certainly not. No planking job, even on real ships, is that precise. After all, these are hand-cut planks and slight variances do occur. The important thing is to keep their flow smooth.

Side Moulding: A moulding runs from the gangway forward to the hammock board along the planksheer. Apparently, it belongs to a time when this area had no bulwark (added during the 1927 restoration).

7. Hull Planking Options

This model is designed to be planked just like a real ship; that is, with a single, outer layer. Sheet 3 shows the scale plank widths on *Constitution*. However, many modelers may not want to follow these procedures.

Wider Planks: Beginners (or even experienced builders) may want to take some shortcuts. Substituting wider planks, especially under the copper sheathing where it doesn't show, is one. Most planks are about $\frac{1}{8}$ " wide, but those at the keel are wider. For the upper areas, it's permissible to use $\frac{3}{16}$ " or $\frac{1}{4}$ " wide planks. The easiest approach is to replace two planks with one. This way, the tick marks on the planking layout are retained and the strakes don't have to be redone.

Note: If this option is selected, purchase wider stock or cut your own.

Double Planking and Using Exotic Hardwoods: Many modelers prefer the foreign kit designers' double planked approach. They lack planking experience or want a solid foundation for the second layer. Double planking also gives the modeler a chance to make mistakes, then correct them. Furthermore, many prefer to use natural, more expensive woods for the final surface.

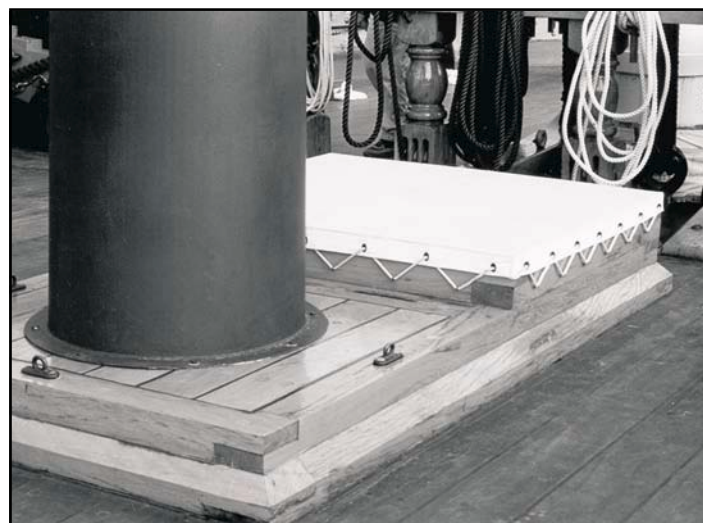
Double planking can be approached two ways. Apply the first layer to exact scale to gain experience. Or, forget scale and apply the first layer without tapers and close-fitting seams. Fill gaps with wood filler, then sand the hull. As long as it is smooth, the first layer provides a solid foundation. However, lay the final planking with care.

This model's basic hull plank thickness is $\frac{1}{16}$ ". If double planking, use $\frac{3}{64}$ " basswood for the first layer with $\frac{1}{32}$ " basswood on top. Another option is 0.021" walnut for the final layer. It bends easily. (These woods must be purchased separately.)

Those who desire a natural finish should consider replacing rails and other prominent areas with an exotic hardwood. Or, stain the kit wood to suit your fancy.

8. Ceiling Planks on the Spar Deck

Inboard, the transom and bulwarks are covered with $\frac{3}{64}$ " thick planks. Their spacing duplicates the exterior planks.



HATCH AT GALLEY STACK

9. Deck Planking

Hatch and Companionway Coamings: Before planking the deck, decide how to treat the coamings. The recommended approach (follows shipwright practice) is to install the coamings first, then plank around them. Doing so saves some work and material. Glue and pin $\frac{1}{8}$ " thick scrap wood underneath each coaming prior to installation. This takes the place of deck beams and provides a permanent landing for the planks (Figure 2-7).

The alternative approach is to glue the coamings and completed hatches on top of the deck planks.

Deck Planks: The spar deck planking is $\frac{1}{16}$ " thick with some thicker planks in line with the masts. Insert these reinforced timbers as thicker deck planks or add a second plank over the first one.

Deck planks taper fore and aft and usually follow the curve of the bulwarks. Consequently, mark the top of the bulkheads beforehand for the planking runs. This model requires no nibs. Planks butt into the waterway fore and aft.

After tapering, paint one plank edge black or dark brown to simulate deck caulking. Be careful! Too much paint will penetrate too deeply with unsightly results. Do a test first. If it doesn't work, edge glue the planks with brown woodworker's glue. This adhesive dries dark enough to replicate caulking.

Procedure: Start planking the deck at the centerline and work outboard. Scrape off any glue that squeezes out before adding the next plank. Planking butts are optional. On the real ship, they don't show up as readily as the seams. Butts also can be scribed after the plank is laid. If desired, fasten planks with brads or trenails (refer to Step 5).



MAINMAST CHAINPLATES. Notice the portlights in the hull at berth deck level. Just visible is the decoration scrollwork on the gangway board. Hammock netting projects above the cap rail. Each morning sailors' hammocks were brought up from below, aired, and stowed. During battle, they could plug holes in the side of the hull or, when left in the netting, protect the men from antipersonnel shot.

Stage 3: Completing the Basic Hull Form

1. Correcting and Sanding

After installing the planking, examine the hull for starved glue joints. Fill these with wood glue and, if necessary, wood filler or model spackling compound, then smooth the hull and deck with sandpaper.

2. Coppering the Bottom

The underwater hull can be either painted to look like copper or covered with the supplied copper plates. While the latter may seem a difficult task, it isn't. All it requires is time and patience. The biggest headache is drawing the plate lines on the hull.

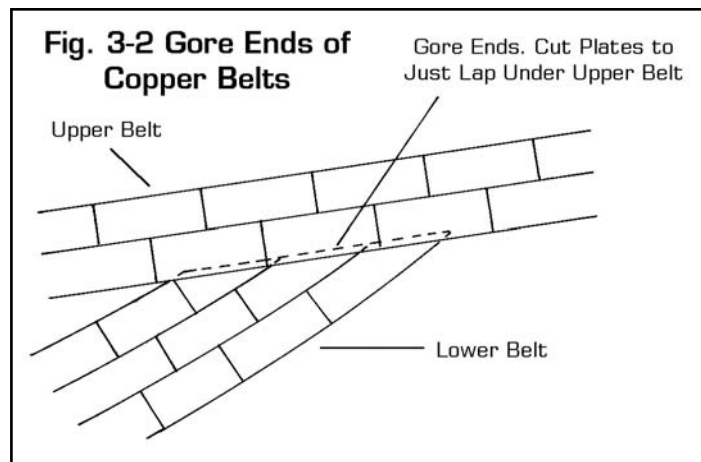
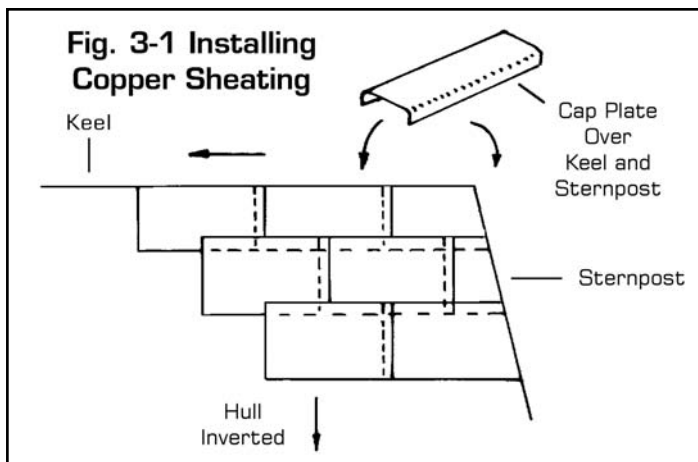
The plating diagram on Sheet 3 was developed from photographs of *Constitution*. However, they are hard to inter-

pret, so deviations could occur. Nevertheless, the diagram is reasonable. If you simplify it, keep everything in scale and the plates flowing in smooth curves along the hull.

Study the plating plan. Notice how some plates run parallel to those in an adjacent belt. These belts may overlap other belts and create *gore* ends (ends of plates go under others.) At the stern, the lower belts spread out into what I call a filler plate, but it's really another type of gore end on the belt below.

The kit contains self-adhesive copper strips. Although using long strips and scribing in the butt laps is possible, the hull's curves determine each strip's length. Following shipwright practice looks best and is authentic. Cut the strip into individual plates, then lap them like on the real ship. It's an exercise worth the effort.

The copper plates are a scale $\frac{3}{16}$ " x $\frac{5}{8}$ " (14" x 48" full size)



and overlap $\frac{1}{64}$ ". Well, this is difficult to do. The plans show some options using the $\frac{1}{4}$ " wide copper strip in the kit. Either trim $\frac{1}{32}$ " off the edge and lap it $\frac{1}{32}$ ", or use the $\frac{1}{4}$ " width, but lap it $\frac{1}{16}$ ". This produces a more reasonable overlap for the model.

The first step is marking the seams in pencil following the layout on Sheet 3. With the model inverted, start laying the copper plates at the keel and stern. Looking at it upside down, forward plates overlap aft ones, and lower plates overlap over upper ones (Figure 3-1). Position the plates *precisely* on the pencil lines to keep the seams straight. If they are wavy, the effect is awful.

Copper plates aren't tapered like the hull planking, so some strakes cross other strakes. While a gore end can pass under the covering strake, its square corners might show

through the thin copper. Consequently, trim the ends of the gore strakes flush (Figure 3-2). Plate the rudder before installing the pintles.

Nailing: Some modelers simulate the nails in copper sheathing by indenting the plates with a sharp point. However, at this scale, any attempt will probably ruin the coppered effect.

Coloring: Plates will corrode naturally or can be chemically weathered using Patina-It, which turns them bluish green. However, one school of thought believes salt water washes away copper sulfate when the ship is underway. Patina forms only if the vessel is in dry dock for a long time. The choice is yours, but I believe patina gives the model a salty look. Furthermore, if the model is mounted on pedestals, any copper exposed to air will automatically develop this sheen.



CAPTAIN'S 28-FOOT GIG is suspended above three chase ports with the bottom of their half lids lowered. Beneath the ship's name on either side of the rudder are the berth deck port lids.

Stage 4: Mounting the Hull

Mounting the hull now prevents damaging it when handling the model. Proper mounting is important, because future alignments will require a true waterline. No baseboard is provided, but the kit's two brass pedestals have a $\frac{3}{16}$ " slot to accept the keel. Since this is the only size available and *Constitution's* keel is $\frac{1}{4}$ " wide, either file the slot larger or trim the keel accordingly.

One pedestal is $1\frac{1}{8}$ " long, the other $1\frac{3}{8}$ " long. Position them on the keel so the copper line is horizontal to the baseboard. (Buy a finished baseboard or make your own from cherry, walnut, bubinga, or rosewood.)

Models should be cased to protect them from dirt and damage. Furthermore, most competitions require entries to be cased. A case is a cheap insurance policy. Those who

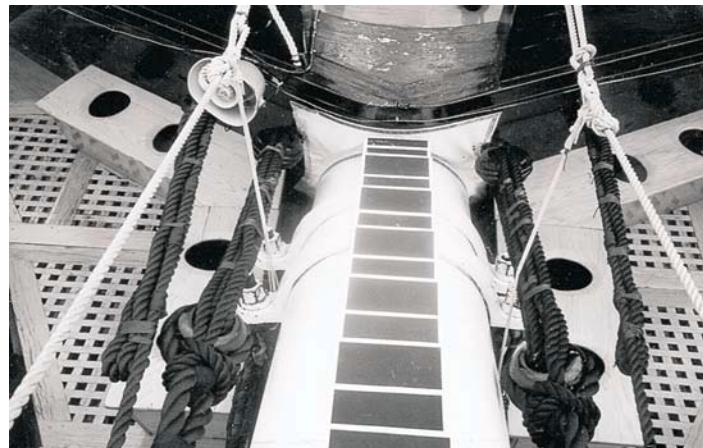
wish to follow this route should use the baseboard as the bottom of the case. A case's outside dimensions are 4" longer than the model (2" fore and aft), 4" wider (2" port and starboard), and 2" higher. Therefore, *Constitution's* baseboard is 52" long by 20" wide.

For the gamblers who don't want a case, round the baseboard's top edges or cut a simple chamfer. Those with access to a router can cut mouldings along the edges. Paint or stain the baseboard.

Mount the model with the copper line parallel to the baseboard. Drill pilot holes in the keel/hull and baseboard to accept the pedestal screws. If something went awry and the balance is off, add a brass shim beneath one pedestal to correct it.



FOREMAST FIVE RAIL undergoes restoration. Note the triple sheaves in the base of each stanchion. Three levels in the bulwark are normally used for belaying large lines.



STAYS SETTING UP AT THE BOW. On either side are the seats of ease. Vertical wooden conduits underneath carried waste safely through the head rails and into the sea.

Stage 5: Adding Hull Details

The sequence is up to the modeler, but I recommend starting with the major structures (head rails and quarter galleries). When working on the deck, progress aft and outboard to avoid reaching over installed furniture. Each item below is listed alphabetically.

If hatch and companionway coamings were not installed while planking the deck, lightly mark their positions in pencil along with the five rails, pin rails, boat davits, galley stack, capstan, skylight, steering wheel, and ammo passing scuttles. Measure from a known benchmark such as the centerline or center of a mast.

Although installing eyebolts and cleats can wait, doing so now means they'll be ready when rigging commences. Once they're mounted, clean and varnish the deck.

1. Ammo Passing Scuttles

Install these simple round covers per Sheet 4, spar deck

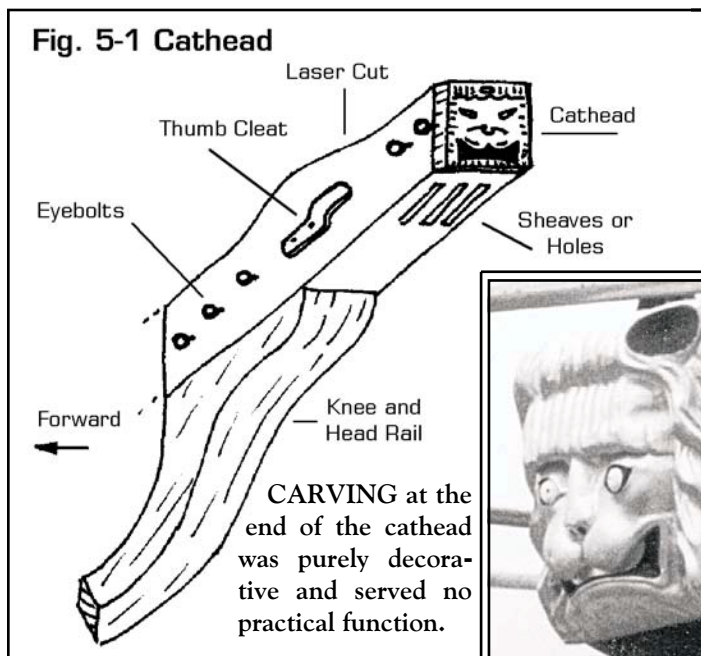
plan. Scuttles are brass on *Constitution*, so paint the britannia castings appropriately before gluing. Don't paint their undersides or the adhesive won't stick.

2. Anchors, Catheads, and Anchor Stowage

Assemble the laser-cut bower anchor stocks, then insert their britannia shanks.

Add the necessary eyebolts to the laser-cut catheads, drill holes to represent sheaves, and install them through the hole in the forward bulwark (Figure 5-1).

At the bow, the port and starboard anchors stow on a platform. Make this from basswood (Figure 5-2). Another anchor platform is starboard amidships. This one has a hinged cover and chocks to secure the anchor to the hull (Figure 5-3).



5. Ship's Boats

Constitution carried port and starboard whaleboats slung outboard forward of the quarter galleries, the captain's gig suspended from davits at the stern, and a pinnacle on the main hatch. Instead of the usual britannia castings or solid blocks found in many kits, Model Shipways supplies laser-cut lifts for bread-and-butter hull construction (Figure 5-5). The challenge here is to carve the hull as thin as possible without breaking through the wood.

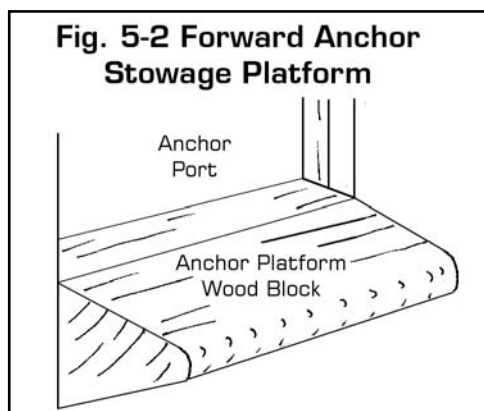
End tabs on each lift facilitate alignment. The wide tab is the stern, the narrow one the bow. Each lift from tab end to tab end is the same length. When assembling, keep the tabs in line. Use only a thin coat of white or woodworker's glue or cyano. Too thick a layer will affect the hull's overall height.

Carving a small ship's boat requires patience. Hollow its hull with chisels or a ball diamond cutter in your handpiece, then carve or sand the inside corners to the intersection of two lifts. After smoothing with sandpaper, the shape should be correct. Next, cut off the tabs and carve or sand the exterior to its correct profile. Be careful. The hull is becoming thin. One way to check its thickness is shown in Figure 5-6. This is a homemade double-ended caliper. Most commercial calipers are too large for model work. However, Woodcraft sells one made in Canada (stock #127931) that is just right. (Order a catalog from: Woodcraft, Customer Service Dept., PO Box 1686, Parkersburg, WV 26102-1686.) Make templates from the body lines to fine tune the hull's shape. Adding the keel completes the basic hull.

Option: Temporarily omitting the bottom lift might make it easier to hollow the hull. Carve the inside close to what is

3. Berth Deck Portlights

Drill holes in the hull (see Sheet 5) and affix the britannia portlights with cyano.



4. Binnacle

Assemble the sides from wood and stain them mahogany. Make the top from brass; or, carve it from wood or transparent plastic and paint it brass with a simulated window (Figure 5-4).

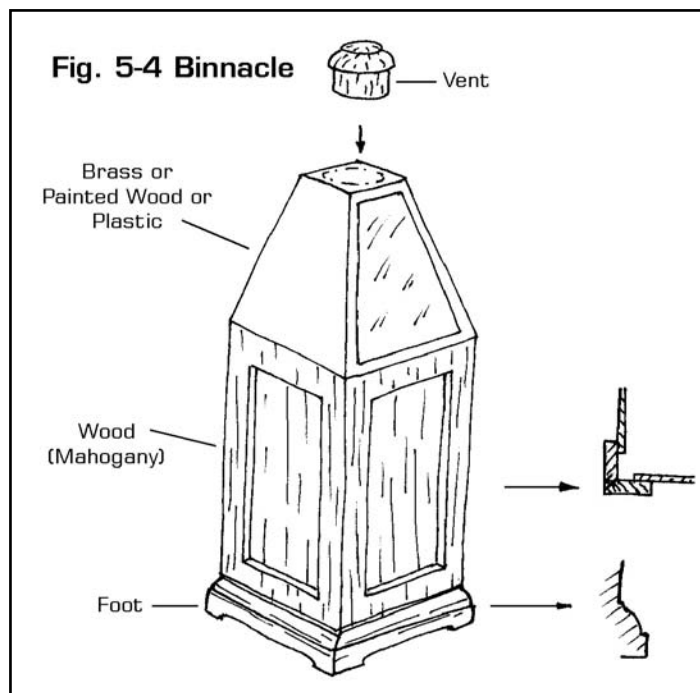
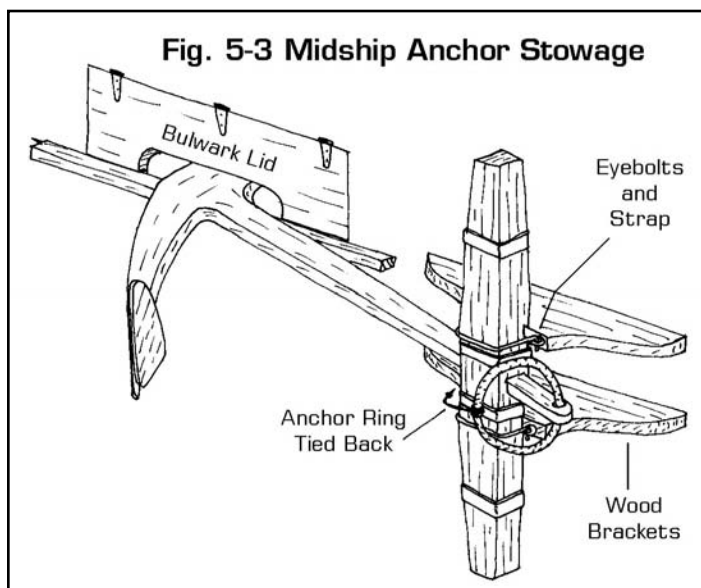


Fig. 5-5 Building the Ship's Boat Hull

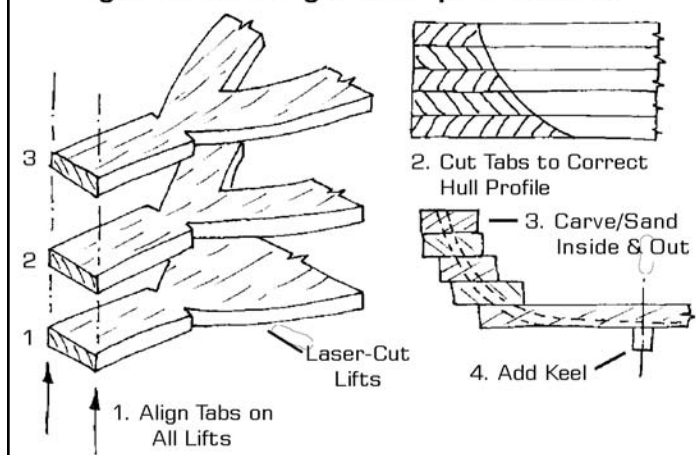
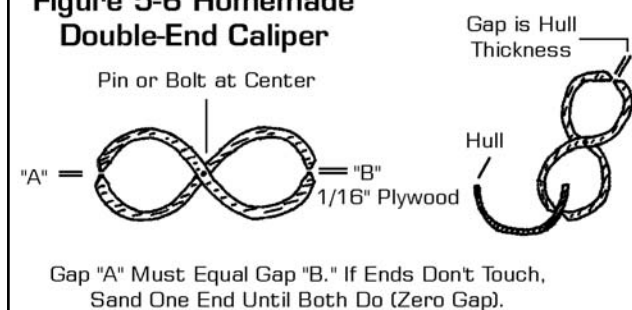


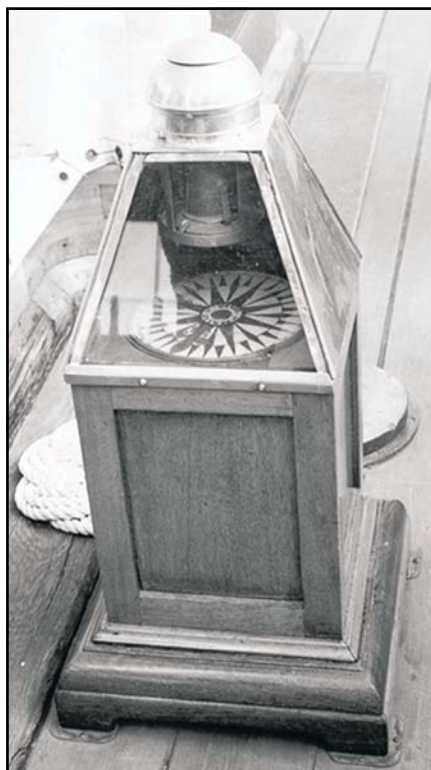
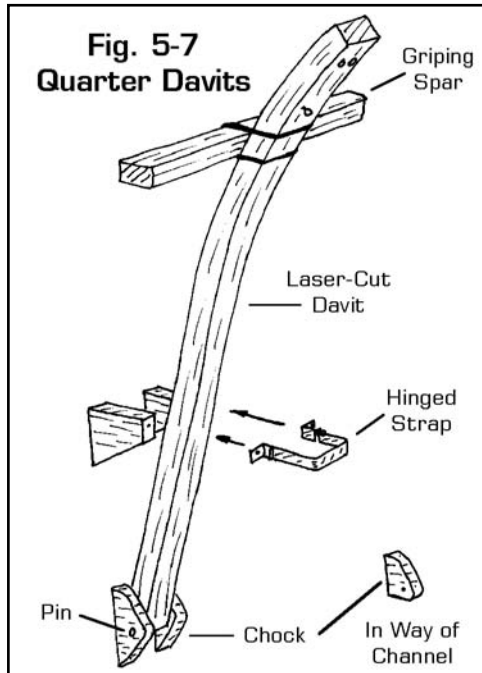
Figure 5-6 Homemade Double-End Caliper



required, then glue on the bottom lift and complete the carving.

How much detailing to include is an individual choice. Frames, floor boards, thwarts, thwart knees, moulding, and other items shown on the plan add to the model, but might be difficult to make. Don't be afraid to try. Just keep scale in mind.

Fig. 5-7 Quarter Davits



Each small boat has a photoetched brass grating.

Colors: See the plans.

Boats slung in davits: Sheet 5 show the whaleboats suspended from davits and the gripes for holding the boats in place. One option is to omit the gripes and hang the boats from the davit tackle. Davits are laser cut, but make the other parts from stripwood (Figure 5-7).

Pinnacle stowage: The pinnacle is stowed in cradles on the main hatch (Figure 5-8).

6. Chesstrees

The lower sheets and some other lines are led inside the ship via *chesstrees* (fixed blocks). These can be simply holes bored in the bulwark, but a chesstree is a rectangular structure fitted with a sheave in the center. This assembly was then mounted in the bulwark.

7. Bumpkins

Make the fore tack bumpkins and aft main brace bumpkins from stripwood with brass rod supports (Figure 5-9).

8. Cannon

The spar deck carried two long guns forward and 20 carronades. Carriages and long gun trucks are laser-cut, but barrels and carronade trucks are britannia castings. Cut the trunnion straps from brass sheet (Figure 5-10). Rig the gun tackle per Sheet 5 and Figure 5-11. Each cannon has numerous tackles, so keep them in scale or the mass of lines will detract from the model. *Constitution* currently has no train tackle.

Mount the dummy britannia cannon

Fig. 5-8 Pinnacle Stowage Cradles

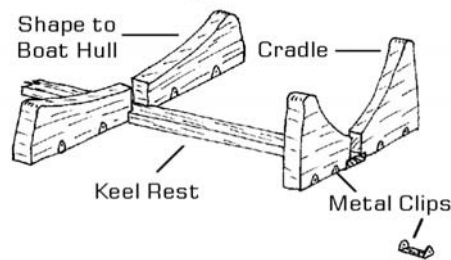
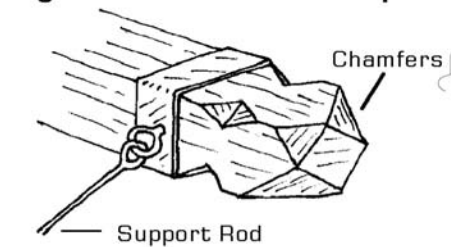
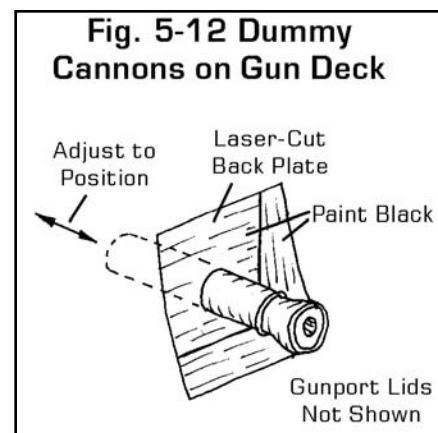
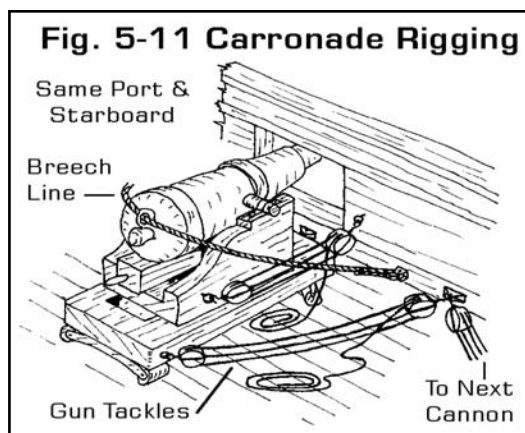
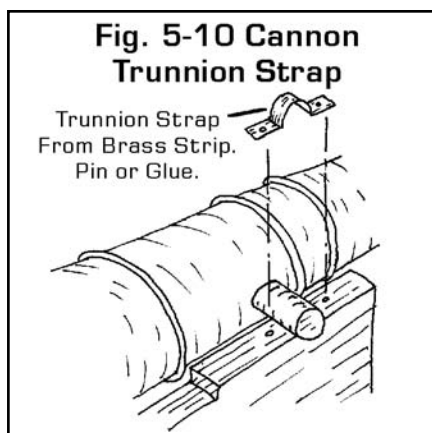


Fig. 5-9 Fore Tack Bumpkin

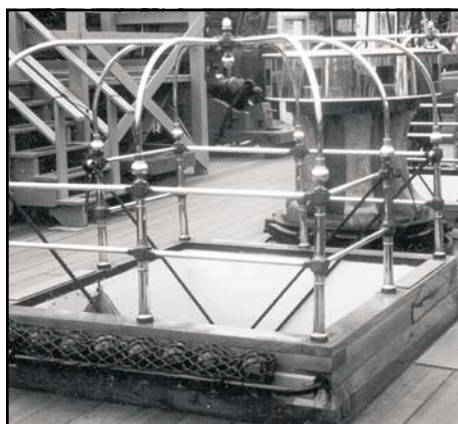
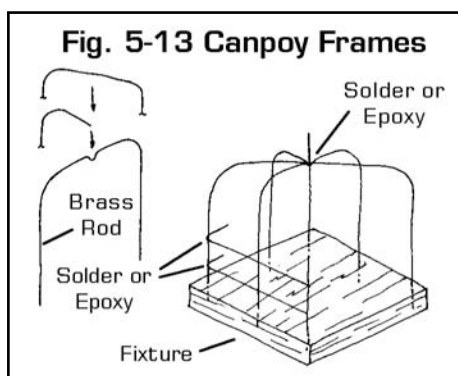




barrels on the gun deck. The hole in the laser-cut box back plate (Stage 1, Step 11) fits the back of the casting. Slide the dummy cannon in or out to position its barrel (Figure 5-12).

9. Canopy Frames

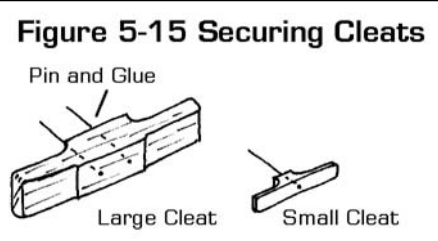
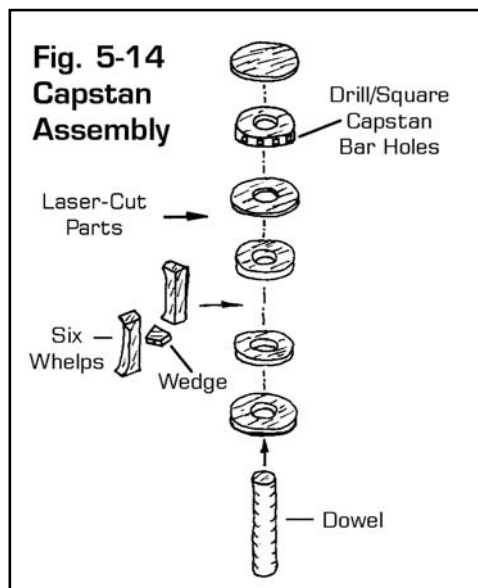
Each companionway has a brass frame for a canvas cover. These shiny frames are historic, being installed early in *Constitution's* career. They also are an interesting feature on the hatches. Modeling them, however, is another story. If this fitting proves difficult, omit it. Fashion the frame from fine brass wire soldered or glued together. Use a fixture to hold the rod steady during assembly. Figure 5-13 illustrates one approach, but feel free to devise others to suit your skills.



AFT COMPANIONWAY with canopy frame. Note cannonball rack on coaming.

10. Capstan

Assemble the laser-cut capstan. A dowel serves as its spindle (Figure 5-14). Install the capstan on top of the doubler between the hatches.



11. Channels

Cut channels from stripwood and install; or, wait until it's time to make the chain plates. Consult Stage 8 for chain plates and channel details.

12. Eyebolts and Cleats

Sheets 5 and 6 show all the eyebolt locations. Drill a hole wherever one is required. Using a toothpick or Microbrush, spread a thin film of cyano on the bolt, then insert. Don't overdo the glue. When mounted, tug on each eyebolt to test the bond.

Eyebolts are simply brass wire bent into a loop. To close the loop, touch with a little solder or epoxy glue.

Make cleats from stripwood. When installing, pin and glue each so tensioning the rigging won't pull it out (Fig. 5-15).

13. Fenders

Vertical fenders along the copper line aren't historical and can be omitted.

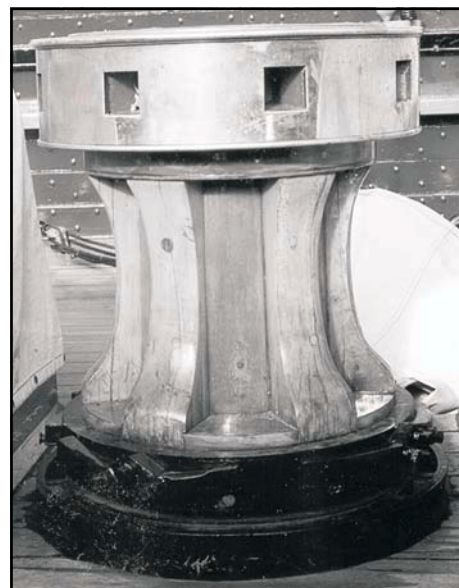


Fig.5-16 Building Fife Rails

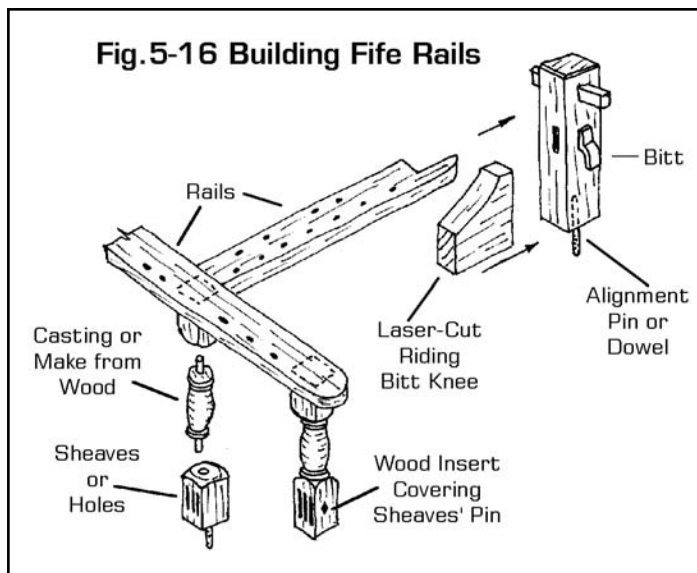
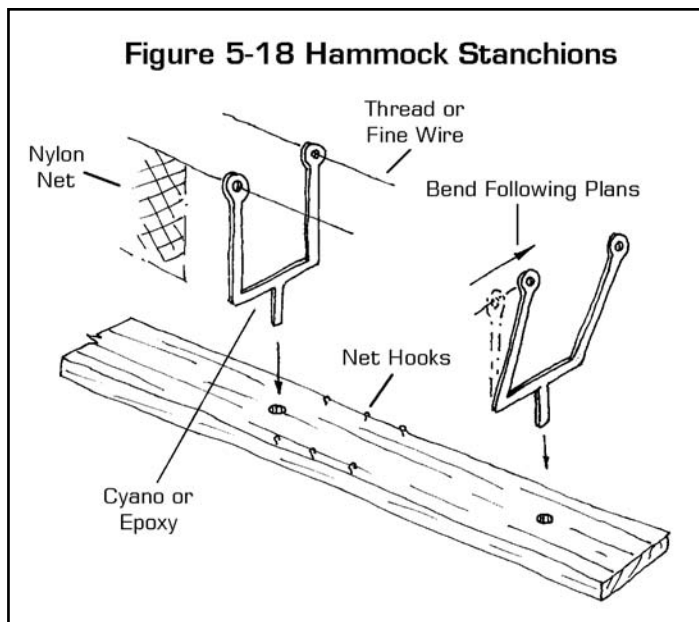


Figure 5-18 Hammock Stanchions



14. Fife Rails and Riding Bitts

Cut the fife rail (horizontal bar) and square bitts from stripwood (Figure 5-16). For the bitts' center sections, either use the round britannia castings or, because fife rails are left bright, turn these from wood. Use a lathe or chuck a dowel in a drill. The foremast riding bitts have laser-cut knees.

15. Galley Stack

Drill a hole for the britannia galley stack and glue it into position.

16. Gangway

Make the inboard gangway from wood. Since it is most likely portable, the ramp could be omitted. *Constitution* has a *brow* (gangplank) for ship-to-pier access and boarding at sea, but it isn't included on the model.

17. Gunport Lids and Decorative Carving

Split or half ports were a common American shipbuilding feature. The laser-cut gunport lids have photoetched hinges. Above the gun deck ports are britannia decorative carvings.

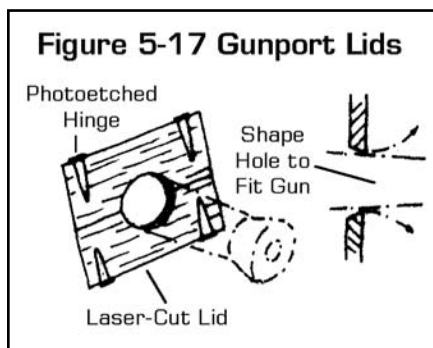


Fig. 5-19 Awning Stanchions

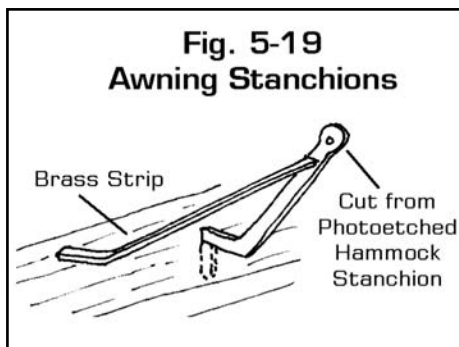
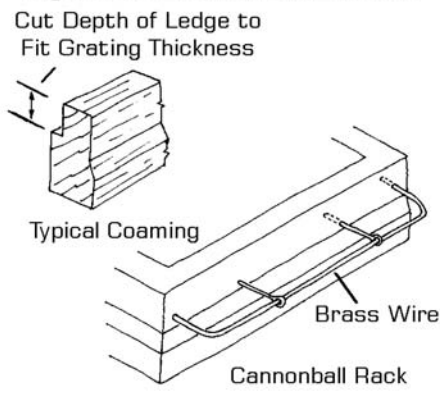


Figure 5-20 Hatch Details



Constitution's half port lids have a rubber ring around the hole. When the lid is closed, the rubber seats around the muzzle and creates a watertight seal. On the model, test fit the half port lids to see if they require shaping and tapering to close over the muzzle (Figure 5-17). Display the lids opened or closed, but realize that open lids are prone to damage and being torn off.

18. Hammock and Awning Stanchions

At the base of each photoetched hammock stanchion is a pin (Figure 5-18). Refer to Sheet 5, drill holes in the topgallant rail, and affix the U-shaped stanchions with cyano. Bend them per the plans to the angles shown. Lastly, duplicate the wire rails with polyester thread (included). *Constitution* has hammock netting between the top wire and hooked to the topgallant rail. To add this feature, use fine nylon net available at any florist shop.

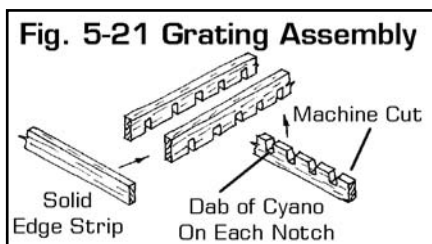
Make the awning stanchions at the waist from brass and the extra hammock stanchion parts (Figure 5-19). Use polyester thread for the wire rails.

19. Hatches, Gratings, and Cannonball Stowage

Figure 5-20 illustrates hatch details and a cannonball rack. (Black plastic shot is included).

Companionways have brass kick and step plates. These can be included or omitted. Leaving several companionways open adds a lived-in touch to the model. If taking this route, be sure to add a ladder (not provided) and fashion a box below the opening to block anyone's view of the unfinished gun deck.

Assemble the machine-cut, 1¼" long boxwood grating strips like an egg crate. Cut the strips to length for each hatch or other area, glue together, then add a 1/32" thick moulding (Figure 5-21).

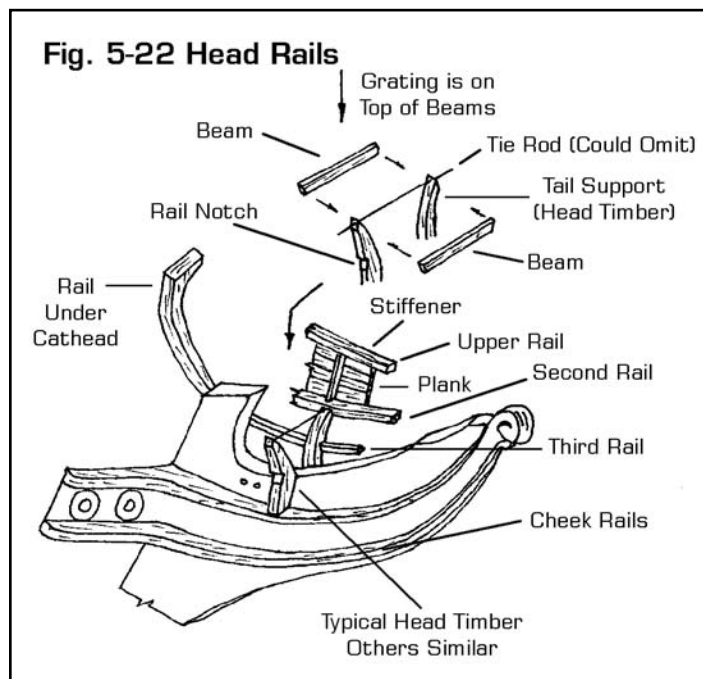


20. Hawse Pipes

Hawse pipes are britannia castings. Make their covers from wood or omit them.

21. Head Rails

Any ship's head is a difficult but interesting area. Take your time. None of the parts are laser cut due to all the curves, so fashion them from stripwood and sheet (Figure 5-22). Start by adding the upper and lower cheek knees, then fasten the trailboard between them. *Constitution's* trailboard is decorated with a carved shield and scrolls. Carving these designs into the basswood trailboard is not



recommended. Newcomers are encouraged to paint on the details, while those with carving experience (or want to try their hand at it) should carve an applique from applewood. However, the *billethead* (replaces pretentious figureheads) must be carved into the knee of the head.

Now add the port and starboard middle rail (second from the top). Next, install the head timbers (curved vertical rail supports) between the upper cheek knees and middle rails. Add the crossbeams (supports for the grating) on each side of the head timbers. A tie rod goes across the head timbers between the crossbeams, but this can be omitted. The crossbeams will space the port and starboard middle rail accurately. Next, add the main rail (third from the top). It begins as a knee under the catheads and notches into the side of the head timbers.

Glue the grating on top of the crossbeams, then mount the seats of ease. Finally, add the uppermost rail (comes off the main rail), the stiffeners between the top and middle rails, and plank the outside of this area to enclose it. Option: Plank the outside of the upper and middle rails before adding the grating and seats of ease.

22. Ladders and Steps

Unless some companionways are left open, this model requires no wooden ladders. Make the port and starboard boarding steps from wood.

23. Lookout Platform and Horse Block

The forward lookout platforms are not a historic features, so can be omitted. On the other hand, the horse block is an important feature. This is where the officer of the deck stood when issuing orders (Figure 5-23).

24. Pin Rails

Attached to the bulwarks and abreast each mast is a pin rail. Another is at the bow. Make them from 1/16" thick



HEAD RAILS. Notice covers over hawse pipes.

Fig. 5-23 Horse Block

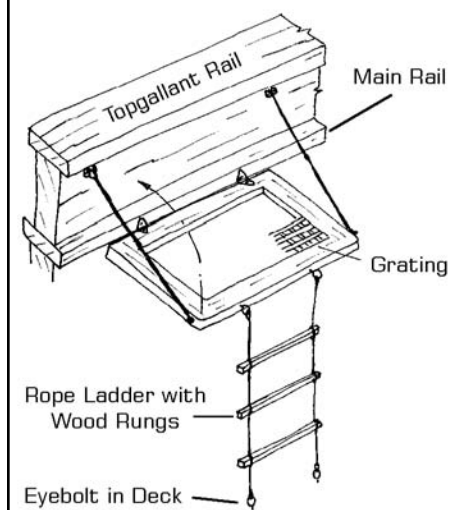
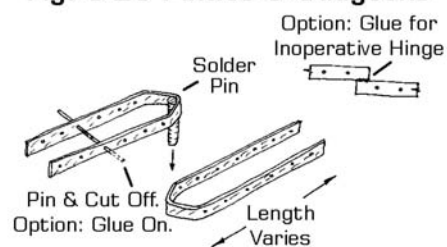


Fig. 5-25 Pintles & Gudgeons



eyebolts in the counter, and the preventer.

27. Scuppers

Following the plan, drill holes in the spar deck close to the waterways to represent scuppers (drains). *Constitution's* scuppers are lined with pipes. Those on the spar deck descend to join those on the gun deck, then discharge through holes in the hull just below the gun deck. A spring-loaded steel plate on the external end prevents water from surging back up. These flange fittings are supplied as britannia cast-ings. Drill holes for them as shown on the profile view, smear on some glue, and insert.

stripwood, then drill holes for the belaying pins. Some pins, depicted on the plans as square, were used more like cleats. However, the kit contains only round belaying pins.

25. Quarter Galleries

Quarter galleries, like the head rails, are a little difficult to assemble. The backs are already installed. Carve the top and bottom blocks and fairing block according to the patterns on Sheet 5. Use plastic sheet or microscope slide covers for windowpanes and wood strips for their frames. If installing transparent windows, paint the inside of the galleries black so no detail (or lack of) is visible (Figure 5-24).

26. Rudder

Shape the laser-cut rudder according to the plans. Fashion pintles and gudgeons from brass strip (Figure 5-25). Make the *preventer* (chain) brace from brass, then add it, the

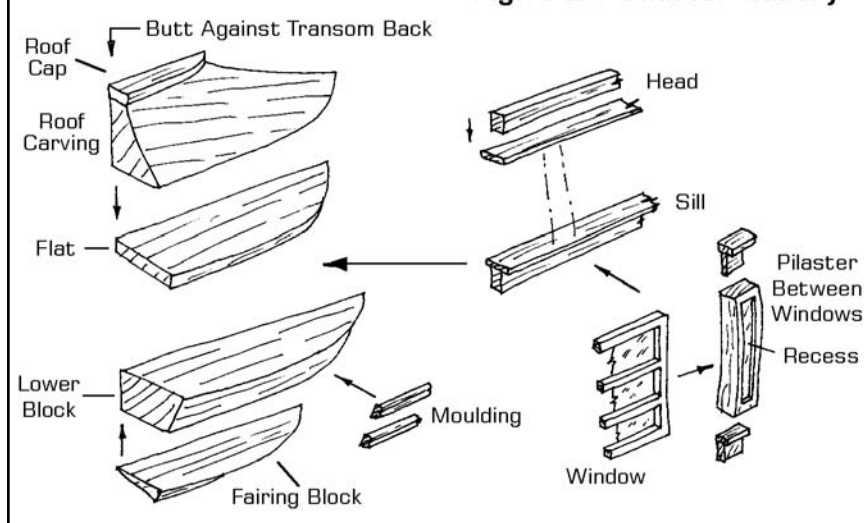
28. Ship's Name

Constitution's name is spelled out across her stern. The best way to add this detail is with dry transfer lettering (available at art and office supply stores or model railroad shops). Or, rub dry transfer lettering on a transparent decal sheet to make a decal. After applying, give the letters a coat of flat varnish.

29. Skylight

The mahogany skylight is a questionable historic feature, but it's there. Make it from

Fig. 5-24 Quarter Gallery

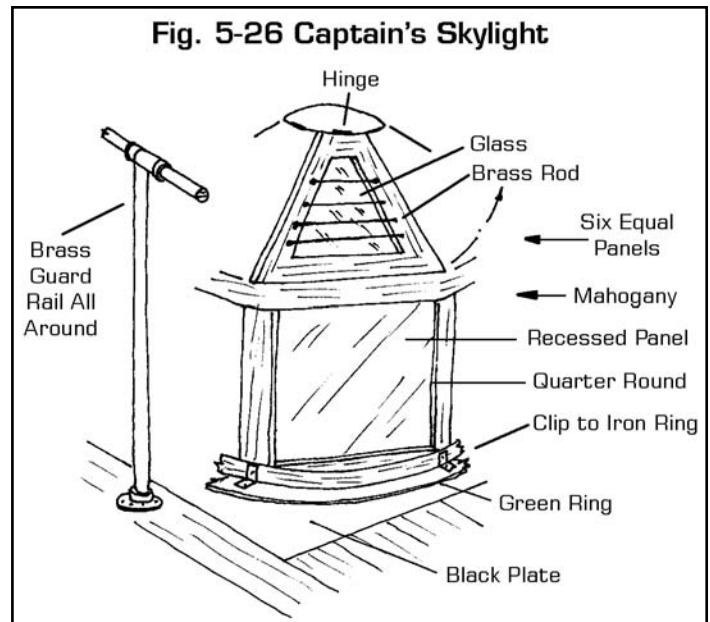


wood. Simulate the panes with transparent plastic sheet or paint the area light blue. Cut brass rod for the bars or paint lines to represent them. Make the guard rail around the skylight from brass rod (Figure 5-26).

30. Stern Details

If the stern mouldings haven't been installed, do so now. Affix the britannia eagle and pilasters with cyano, then paint on the white stars. Stern chase ports have half lids similar to those on the gun deck. The small lids for the berth deck also are laser-cut parts.

At this point, your model has a considerable amount of deck furniture on board. Take another look, correct mistakes, and touch up paint blemishes. Go over the plans again. Was anything overlooked? When all is well, get ready to tackle the masts and spars.



Stage 6: Mast and Spar Construction

1. Shaping & Tapering Masts & Spars

Dowels are provided for the masts and spars, but require shaping and tapering. Main spars are illustrated on Sheet 6, but length, maximum diameter, and dimensions at the ends are provided for all spars.

Being round, a dowel is difficult to taper. The best approach is to first cut, plane, or file the dowel from round at maximum diameter to square at the ends, then to eight sided, and perhaps even 16 sided. Now sand or file it round. This approach prevents turning a dowel into an oval (Figure 6-1). Although a little tricky, another way is to chuck a dowel into an electric drill or lathe and sand in the taper.

Dowels are sized to a mast's or yard's round section. If the spar has a square or octagonal section, add wood to increase

the distance (Figure 6-2).

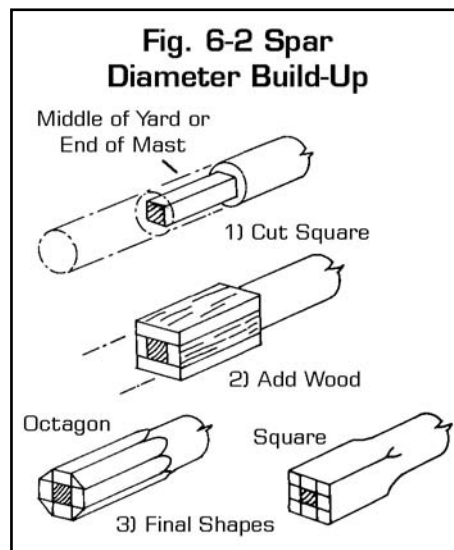
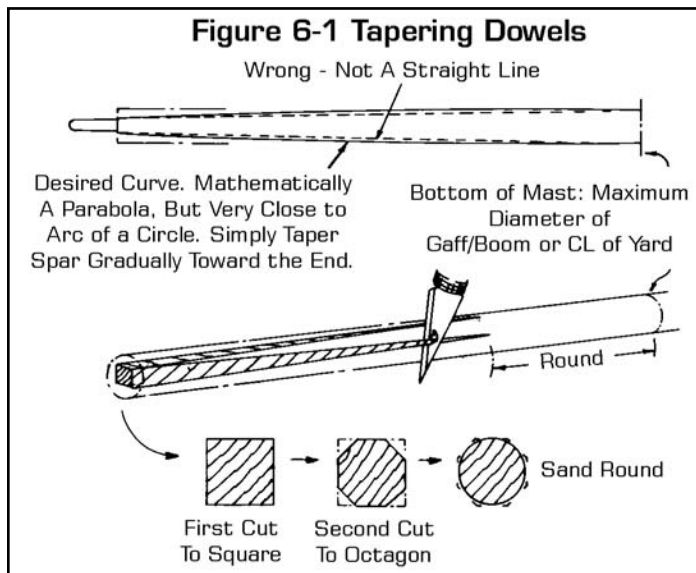
Option 1: To avoid adding extra wood, use larger dowels sized to the corners across a square or octagonal. However, be sure to reduce the rest of the dowel to its round diameter after cutting the square or octagonal.

Since the upper masts and some yard centers are octagonal or square, start this way. Shape the entire spar eight sided, save the octagonal where required, cut the remainder 16 sided (optional), then sand round. Sounds a little difficult, but Figure 6-3 will make matters clear.

Option 2: Experienced modelers fashion spars from square stock. Doing so allows them to select and cut their own wood, and marking octagonals and tapers is easier.

Option 3: Ignore the squares and octagonals. Not recommended, because the model's scale warrants this detail.

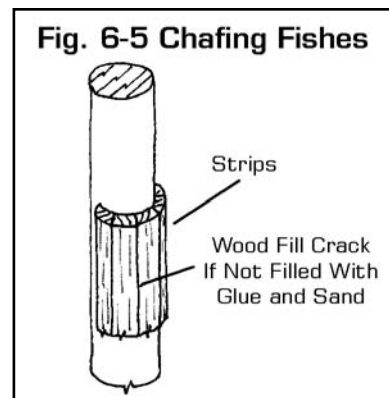
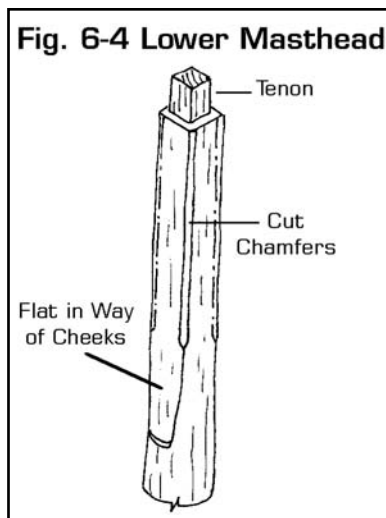
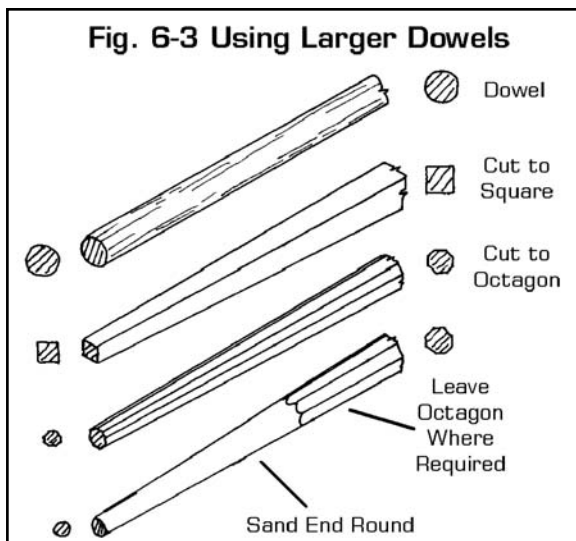
Note: Larger dowels and square stock are not included.



However, the kit may have enough extra pieces in the required sizes to do the job.

2. Building & Installing the Masts

Fore, Main, and Mizzen Lower Masts: Lower masts are round with a square head. After squaring the heads to their proper width, cut the



tenon for the mast cap. File a chamfer into each corner of the head (Figure 6-4). Cut a tenon into the heel of the masts to fit the slot in the center keel.

Real masts were constructed from a series of square timbers. Iron hoops fitted around the masts held the component timbers together. Cut the hoops from brass strip or sheet or, as an option, use paper.

Add the chafing fishes by gluing small strips to the masts, then closing the gaps with wood filler (Figure 6-5). Cheek knees are laser cut.

Topmasts and Topgallant/Royal Masts: These begin square at the heel, then octagonal, round, and back to octagonal at the head (Figure 6-6). The topmast heel has a rectangular slot for a *fid* (iron bar preventing the topmast from sliding through the top). Drill a hole and shape it with a file. The fid should be a press fit.

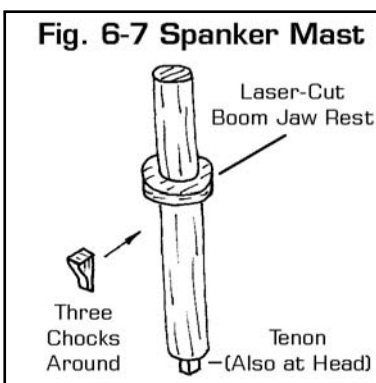
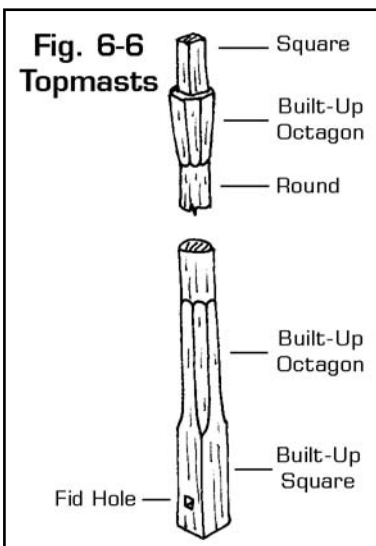
The topgallant/royal masts are similar in shape to the topmasts.

Affix eyebolts, fairleads for truss lines, boarding spike

racks, jeer lashing chocks, and other attendant fittings to the masts.

Spanker Mast: The spanker mast has no taper, but it does have a tenon to fit a block in the top. A second tenon at the bottom fits a mortise in the wedge/boot around the mizzenmast. Add the chocks and laser-cut boom jaw rest (Figure 6-7). Caution! Before installing the spanker mast, slip on the laser-cut wood mast hoops.

Mast Caps, Tops, Trestle Trees, and Crosstrees: The kit has laser-cut mast



DETAIL UNDER FIGHTING TOP.

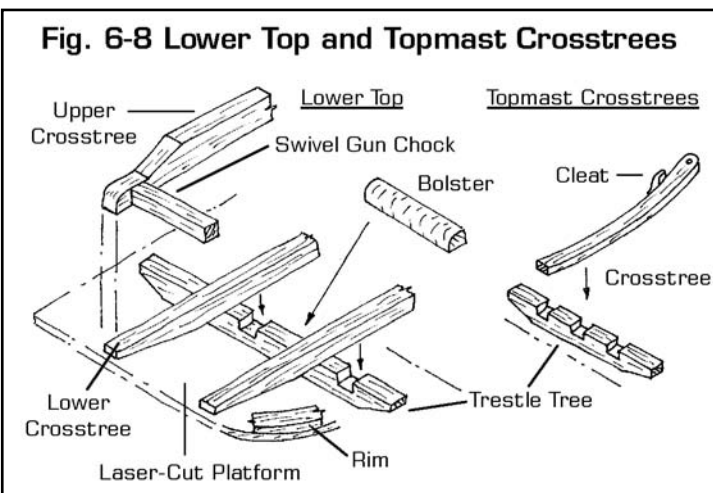
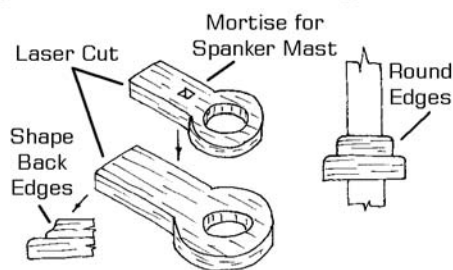


Fig. 6-9 Mizzenmast Wedge/Boot



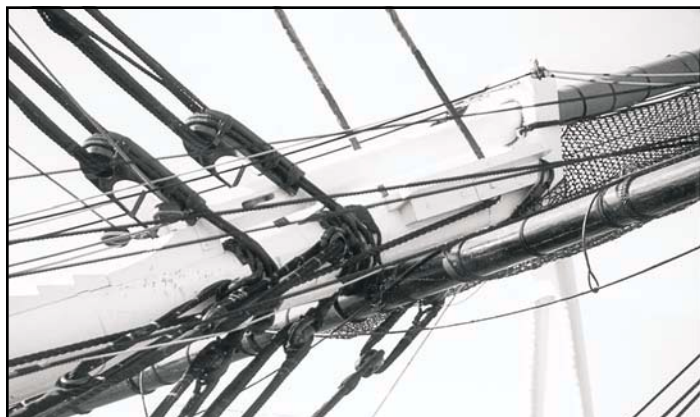
caps, lower mast tops, and cheeks. Make all other parts from stripwood. Figure 6-8 illustrates a lower mast top and topmast crosstree assembly.

Mast Assembly:

After prefitting all the parts, glue the tops, caps, crosstrees, and trestletrees to the lower masts, topmasts, and topgallant/royal masts. Make sure these three masts line up properly. Check port and starboard views and fore and aft. If necessary, adjust the upper mast heel holes.

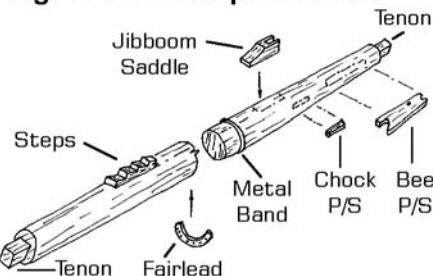
Option: Some modelers prefer to build mast assemblies as they rig; i.e., install lower masts, rig shrouds and lower stays, add topmasts, etc. Just be sure to constantly check the alignment.

Mast Wedge/Boots and Mast Installation: Wedge/boots are laser cut (Figure 6-9). File the edge and angle the hole to match each mast's rake. Slip it on the mast, then insert the mast through the deck hole. Check the fore and aft alignment and athwartships. Masts must rake at the angles shown on Sheet 6. If they don't, file the offending deck hole to its correct slant, then wedge the mast in place with wood slivers. Finally, secure the mast wedge/boot to the deck with woodworker's glue.



BOWSPRIT with steps, starboard bee, jibboom, jibboom saddle, cap, and topmast stay hearts.

Fig. 6-10 Bowsprit Details



from stripwood (Figure 6-10).

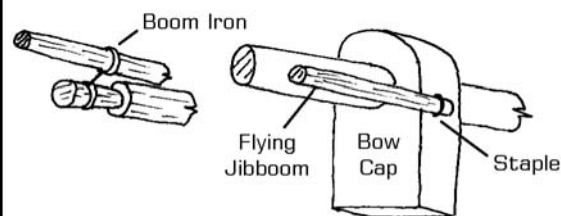
Enlarge and angle the holes in the laser-cut cap, and taper its top and bottom edges.

The jibboom begins octagonal and becomes round. Drill the required sheave holes. The jibboom passes through a hole in the cap, then a metal band lashes it to the saddle on the bowsprit (Figure 6-11).

The flying jibboom is round. A staple secures it to the port side of the cap, while an iron angled to port holds it to the end of the jibboom (Figure 6-12).

Dolphin Striker: Staple the dolphin striker to the cap. Mount the chocks and drill holes for rigging lines.

Fig. 6-12 Flying Jibboom



TOPMAST CROSSTREES.

3. Building & Installing the Bowsprit, Jibboom, Flying Jibboom, Spritsail Yard, and Dolphin Striker

Bowsprit, Jibboom, and Flying Jibboom: Add the bands, chocks, bees, and jibboom saddle to the bowsprit. Cut a tenon for the cap and another at the heel. Make the steps

Spritsail Yard: A sling secures the spritsail yard under the bowsprit (Figure 6-13).

4. Building the Lower, Topsail, Topgallant, and Royal Yards

Some rigging is included, because it's easier to do while holding the yards. Footropes are a prime example. These yards are installed once rigging commences.

Course and topsail yards have octagonal centers, but topgallant and royal yards are round. The lower yards also have battens on the center octagonal sections (Figure 6-14).

Add chocks, studding sail boom irons, and jackstay eyebolts. Eyebolts are included in the kit, but fashion the studding sail irons from brass (Figure 6-15).

Reminder: Paint and detail yards before setting them aside. Once rigging commences, they must be ready to install on the masts.

Fig. 6-14 Yard at Center

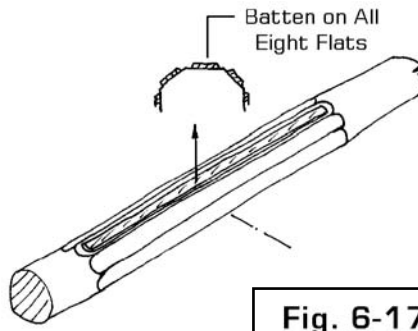


Fig. 6-15 Studding Sail Boom Irons

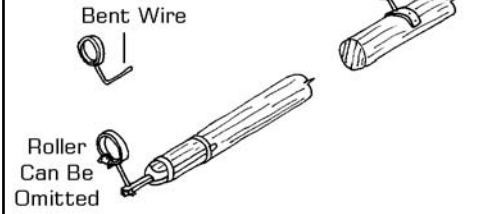


Fig. 6-13 Spritsail Yard Sling

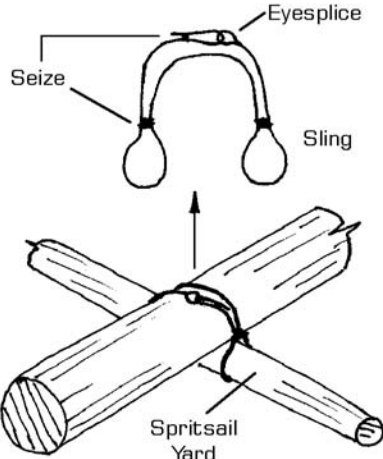


Fig. 6-17 Swinging Studding Sail Boom Stowage Fittings

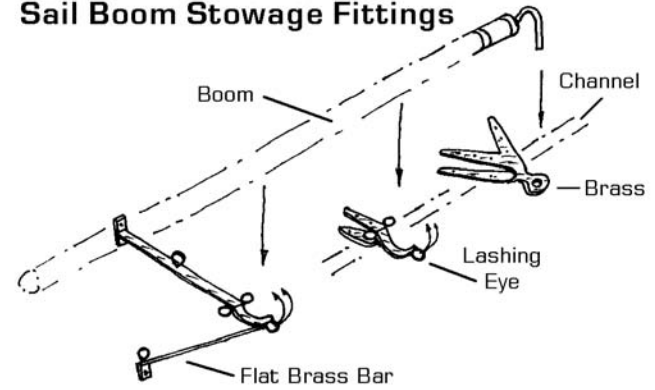
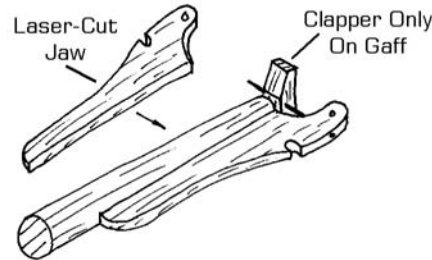


Fig. 6-16 Spanker Boom and Gaff Jaws



5. Building the Spanker Gaff and Boom

Complete these spars in hand as much as possible. They will be installed later.

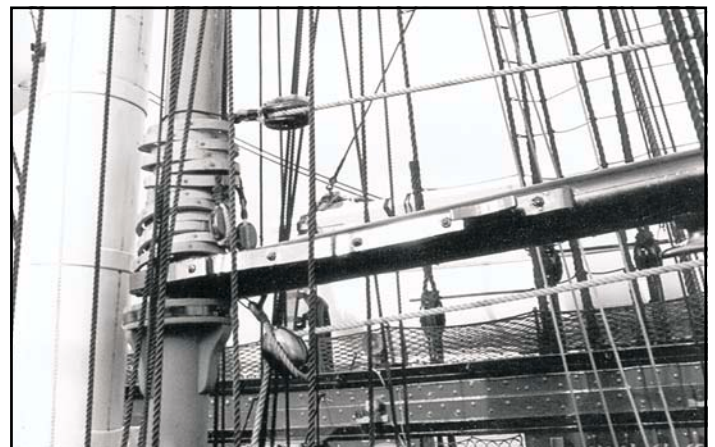
The spanker boom and gaff have laser-cut jaws (Figure 6-16). Drill sheave holes, then glue and pin the chocks.

6. Building the Studding Sail Booms and Yards

Those displaying *Constitution* without sails can omit the studding sail yards. However, install all the booms, because they enhance the model's appearance.

Make and mount the additional fittings that attach the fore lower swinging studding sail boom permanently to the hull (Figure 6-17). To stow the booms, pull them inboard and lash to the yards.

SPANKER GAFF



SPANKER BOOM and boom jaw rest.

Stage 7: General Rigging and Sailmaking Information

Newcomers to the nautical world should learn the following rigging terms. Old salts can skip this part and grab a mug of grog.

Each edge and corner of a sail has a name. On a square sail, the top is the *head*, the bottom is the *foot*, and sides the *leech*. The lower corners are the *clews*. On a fore and aft sail, the top is the head, bottom the foot, aft side the leech, and forward side the *luff*. The lower forward corner is the *tack*, aft lower corner the clew, upper forward corner the *throat*, and the aft upper corner the *peak*. A triangular sail is similar, but the upper corner is called the *head*. It has no throat or peak.

Blocks: Wooden or metal shells with *sheaves* (pulleys) for handling lines. The oval *clump* block is used for staysail sheets, because it won't tear a sail if it rubs against it. A *purchase* (tackle) consists several blocks and a line to provide a mechanical advantage for handling sails and spars.

Bobstays: Support the bowsprit from upward loads. *Guys* support the jibboom and bowsprit from side forces. Bowsprit guys are sometimes called *bowsprit shrouds*. Bowsprits occasionally have a vertical strut below the jibboom cap to increase the stays' downward pulling force back to the hull. This strut is the *martingale* or *dolphin striker*. *Head stays* go through the jibboom, down to the dolphin striker, and back up to the bow. *Martingale stays* are separate and start at the jibboom rather than continuing from the head stays. *Backropes* continue from the stays back to the hull after the stays pass the dolphin striker.

Braces: Lines attached to *yardarms* (the ends of a yard) for directing a yard's angle and holding it taut. *Lifts* are standing or running lines for holding yards when lowered or tilting them. A *topping lift* is a line holding up the end of a boom when the gaff is down or absent. *Vangs*, port and starboard lines, prevent a gaff from swinging sideways.

Chain plates: Iron bars or rods holding shroud deadeyes along the hull. Topmast shrouds have no chain plates. Instead, rods or lines run from the deadeye or bullseye to the mast band. These are called *futtock shrouds*. If they go just to the lower shrouds, they generally tie into a wooden or metal rod called a *futtock stave*. *Catharpins* are short lines fastened between shrouds to take up the slack. They are generally at the intersections of the futtock staves.

Deadeyes are wood and have three holes for reeving the *lanyards* (lines used to tighten shrouds, stays, and other lines). Metal turnbuckles replace deadeyes on modern ships. A *heart* or *bullseye* is similar to a deadeye. The heart is heart-shaped and has a heart-shaped hole with grooves for the lanyards. It is used for more permanent installations. The bullseye is round with a round hole.

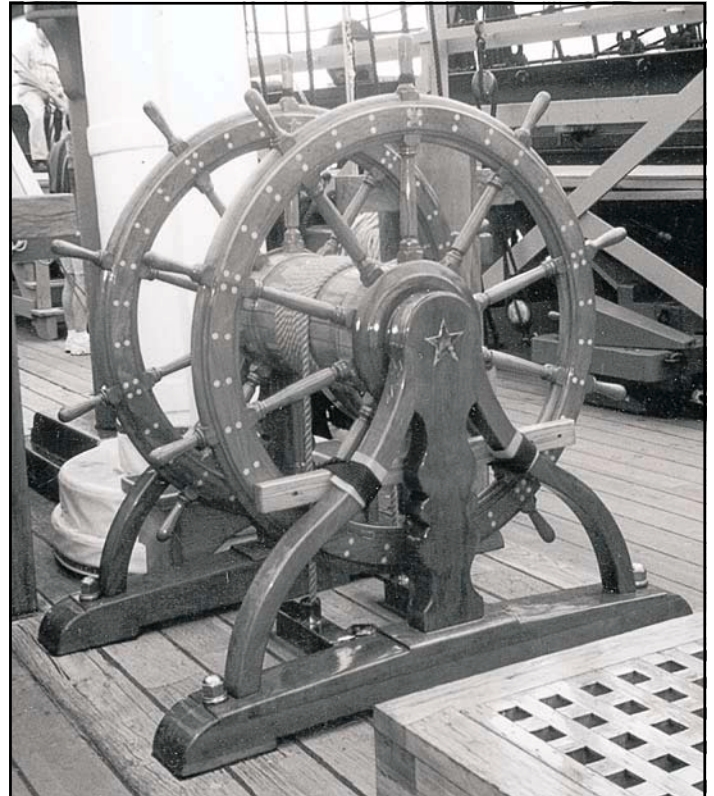
Footropes and manropes: Lines on yards, booms, and bow-

sprits on which seamen stand while working and furling sails. *Stirrups* hold the footropes, which are sometimes called *horses*. *Cranelines*, footropes running across the lower shrouds, are used to furl the main staysails and spanker. They are a recent development and usually weren't rigging on early ships. *Ratlines* are the footropes on shrouds. A *sheer pole* is a round or rectangular iron or wood bar seized to the shrouds just above the deadeyes. It maintains shroud spacing and can serve as a belaying point.

Halliards or halyards: Lines for raising and lowering a sail, yard, boom, gaff, or flag. The part of a halliard attached to a yard is the *tye*. For gaffs, the outer halliard is the *peak halliard*. At the gaff jaws is a *throat halliard*, named for the part of the sail it operates. *Downhauls*, *outhauls*, and *in-hauls* drag a sail along a boom or up and down a stay.

Parrels or parrals: Lines or devices like ribs and trucks for holding yards, booms, and gaffs to their respective masts and spars. A *truss*, *jeer*, and *sling* are similar to a parrel. These are lines or iron fittings holding a yard up and against the mast. They are most common on stationary lower yards.

Reef bands: Horizontal reinforcing bands on a sail. They have short lengths of rope called *reef points*. In heavy



IN A HEAVY SEA or in battle, the double steering wheel forward of the mizzenmast allowed four men to hold the ship on course. The tiller rope, wound on a drum between the two wheels, led below to a watch tackle on each side of the tiller.

weather, sailors tie the reef points to a yard or boom to shorten the sail.

Running rigging: Lines that move, *reeve* (go) through blocks, or operate sails and spars.

Sheets: Lines holding the lower corners of a sail or boom. When not in use, sails are *furled* (bundled on the yards, booms, or masts). *Clewlines* pull up the corners of a square sail, *leechlines* pull up the side, and *buntlines* pull up the belly for furling. *Brails* are like buntlines, but they pull loose-footed fore and aft sails toward the mast for furling. *Bowlines*, attached to the sides of a square sail, pull it forward. These are used primarily on 18th century and older ships.

Shrouds: Transverse lines supporting the masts.

Standing rigging: Fixed rigging supporting masts and yards. Generally, standing rigging is tarred; hence, it is black or dark brown.

Stays and backstays: Lines supporting the masts from fore and aft forces. A *running backstay* has a movable tackle on deck.

This covers most of the important terms for the model. However, purchase a nautical dictionary for your growing reference library.

1. Rigging Options

The plans show the ship with a full set of sails. However, the model can be rigged four ways.

Full set including fore and aft sails and square sails: Not many modelers go to this extreme, because the mass of sails obscures most deck and spar details. Sails look better on a ship at sea.

Sails furled, yards lowered on their lifts: This is a pleasing compromise. Reality is maintained without sacrificing detail.

Some sails furled, others hoisted: This creates the illusion of a

ship in port with some sails still drying after a day's run. Mix furled sails with open ones or sails half up. Possibilities abound, so look for a pleasing effect. Study marine paintings for ideas. Marine artist John Stobart's work is an ideal reference.

No sails, yards lowered on their lifts: Now the ship is in port with her sails removed for repairs. Most modelers choose this approach, and beginners should definitely select it.

2. Rigging Plans

Sheets 7 and 8 show the masts and spars with attendant rigging. They are drawn so every line is clear and its belaying point known. Sheet 7 shows the standing and running rigging for the fore and aft sails, and the yard braces. Sheet 8 shows how the square sails are rigged. Study the plans and have a complete picture of each rig before starting. Do this and everything will proceed smoothly.

To save plan space, the rigging plans are drawn to half scale. For sail shapes, double the given size. Many details are drawn to the correct scale.

3. Rigging Line and Block Sizes

Because more line diameters are shown on the plans than provided in the kit, use the following guide:

Lines on Plan	Lines in Kit
Less than 0.009"	0.005" thread
0.009" to 0.015"	0.008"
0.016" to 0.026"	0.021"
0.027" to 0.036"	0.028"
0.037" to 0.046"	0.040"
0.047" to 0.055"	0.051"

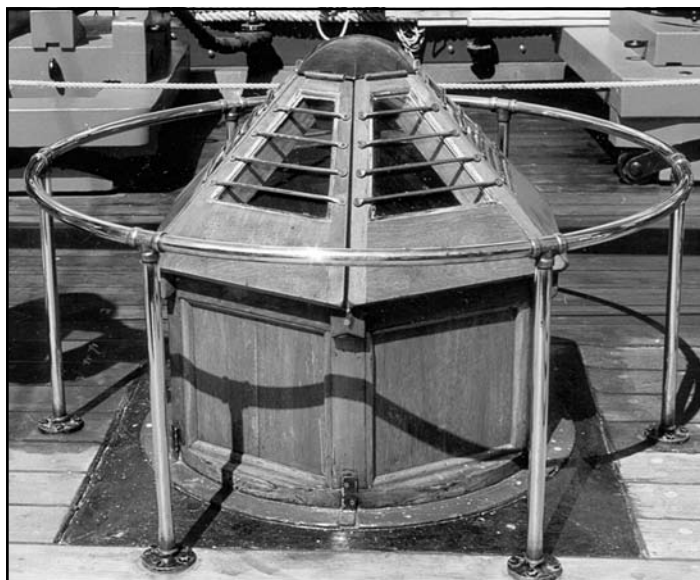
To enhance the model's scalelike appearance, use every available diameter or purchase more separately.

Blocks on *Constitution* are in 1" increments, but shown on the plans in scale inches. However, not all block, deadeye, and bullseye sizes are available, so follow this guide:

Block Sizes	Blocks in Kit
Single $\frac{1}{16}$ " to $\frac{3}{32}$ "	$\frac{3}{32}$ "
Double $\frac{1}{16}$ " to $\frac{3}{32}$ "	$\frac{1}{8}$ "
$\frac{7}{64}$ " and $\frac{1}{8}$ "	$\frac{1}{8}$ "
$\frac{9}{64}$ " and $\frac{5}{32}$ "	$\frac{5}{32}$ "
$\frac{11}{64}$ " and $\frac{3}{16}$ "	$\frac{3}{16}$ "

Options: Sand a block to more closely match the plan size.

Deadeyes & Bullseyes	In Kit
$\frac{1}{16}$ " to $\frac{7}{64}$ "	$\frac{3}{32}$ "
$\frac{1}{8}$ " to $\frac{9}{64}$ "	$\frac{1}{8}$ "
$\frac{5}{32}$ "	$\frac{5}{32}$ "
$\frac{3}{16}$ "	$\frac{3}{16}$ "



CAPTAIN'S SKYLIGHT.

4. Treating Lines

Worming, parceling and serving: Lines on ships were wormed, parceled, and served wherever chafing might occur. Shrouds are a prime example. Worming inserts thin pieces of line (worms) between the strands. Parceling winds canvas strips saturated with tar around the wormed part. Then the wormed and parceled area is *served* (bound in the opposite direction with spun yarn). Serving is the only procedure recommended for the model. However, most modelers omit it, preferring to use the line as is after applying a heavy coat of beeswax. Those striving for authenticity should serve only the largest shrouds and stays with the kit's polyester, fine silk, or linen thread. Avoid unwaxed cotton if possible. It's too fuzzy.

Seizings: Seize lines with the supplied polyester thread, then touch with diluted white glue or thin cyano (Figure 7-1).

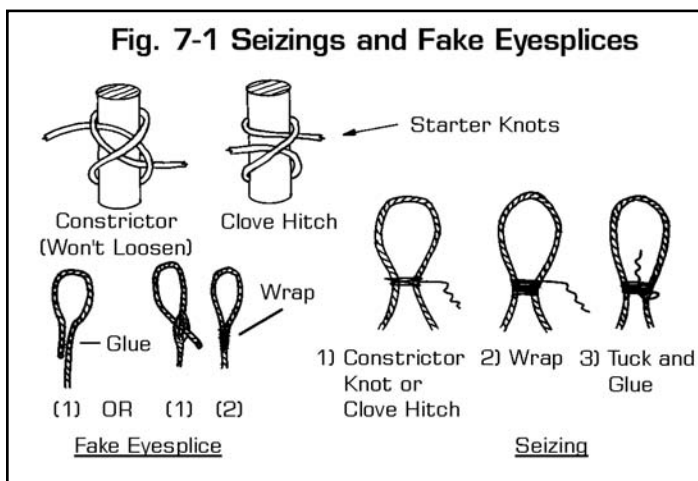
Beeswax: Protects lines against moisture and lays down fuzz. To soften beeswax, hold it to a light bulb. Run the line across the beeswax, then through your fingers to soften and smooth it. Do this several times to thoroughly coat the line.

5. Belaying Pins, Cleats, and Their Lines

Sheet 6 includes a complete belaying pin plan based on photographs and the author's educated guess. The Navy didn't prepare such a plan, since each captain has his own ideas how lines are belayed. Because no set rules exist, it's permissible to alter the plan's belaying points. Just use sound judgment. A logical run becomes easier to detect as rigging progresses. Also, installing only a few or no sails opens more suitable pins or cleats and the opportunity to alter belaying points.

6. Rigging Tools

Some homemade tools are essential for the rigging process (Figure 7-2). Similar shapes are commercially available.



7. Blocks, Hearts, Bullseyes, and Deadeyes

The kit may substitute a deadeye for a bulls-eye. If so, ream its center to a single hole.

The largest hearts are laser cut. Cut or file the stropping groove around the heart, and round the inside hole a bit.

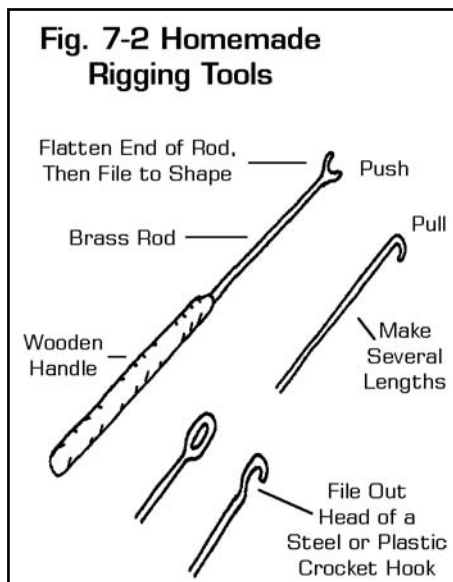
Most blocks are *stropped* (encircled with rope). Stropping blocks at $\frac{5}{32}$ " scale is difficult, so Figure 7-3 shows alternatives.

8. Sailmaking

Choosing the proper material is critical. Sailcloth for models must be

lightweight, yet fairly opaque. Tightly woven cotton fabric is acceptable and available from Model Expo. Although linen is ideal, most is too heavy for $\frac{5}{32}$ " scale models.

Wash the sailcloth several times to preshrink it. When dry, iron the fabric, being careful not to scorch it. Lightly pencil in seams, *tabling* (hem) lines, and other reinforcements, then sew the seams using light tan cotton thread. A sewing machine makes fast work of the project. Practice on scrap fabric and balance the needle thread tension so it doesn't pucker the material. Instead of reinforcement patches, stitch two lines to represent reef bands (Figure 7-4).



DOLPHIN STRIKER.

When done, iron the sails. Be careful not to scorch them. Next, cut the sail shape using Line A in Figure 7-4. Fold the hem, iron it flat, and sew as close to Line B as possible. Tuck the ends and hand stitch the corners. The sail is ready for stretching.

Stretching Sails: This assures the sail's proper shape,

since sewing may have altered it. Using the original pattern, trace the sail's outline onto a piece of paper. Place the paper on a solid but porous backing, such as a wood or cork board. Now wash the sail again and lay it over the outline. Stretch the wet material to the sail's outline's, then secure with stick pins through its outer edges. When dry, the sail will have resumed its proper shape. Iron it one more time.

Boltropes: Although *boltropes* (rope sewed to the edge of a sail to give it strength and prevent the fabric from ripping) can be omitted, they add quite a bit to the model (Figure 7-5).

Sewing Aids: Visit a fabric shop and purchase a squeeze

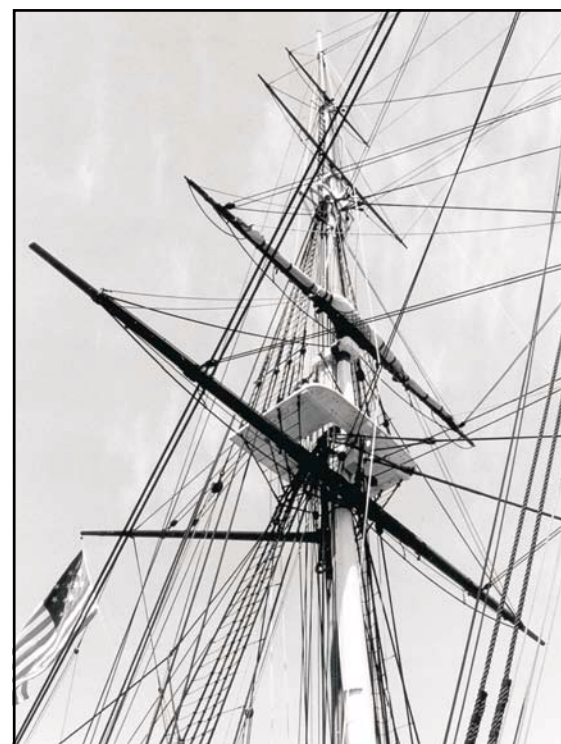
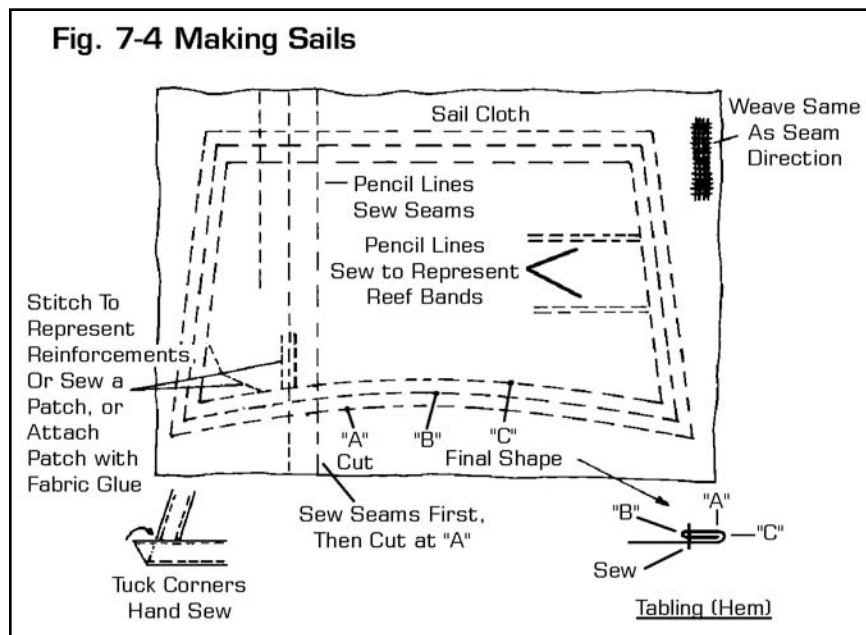
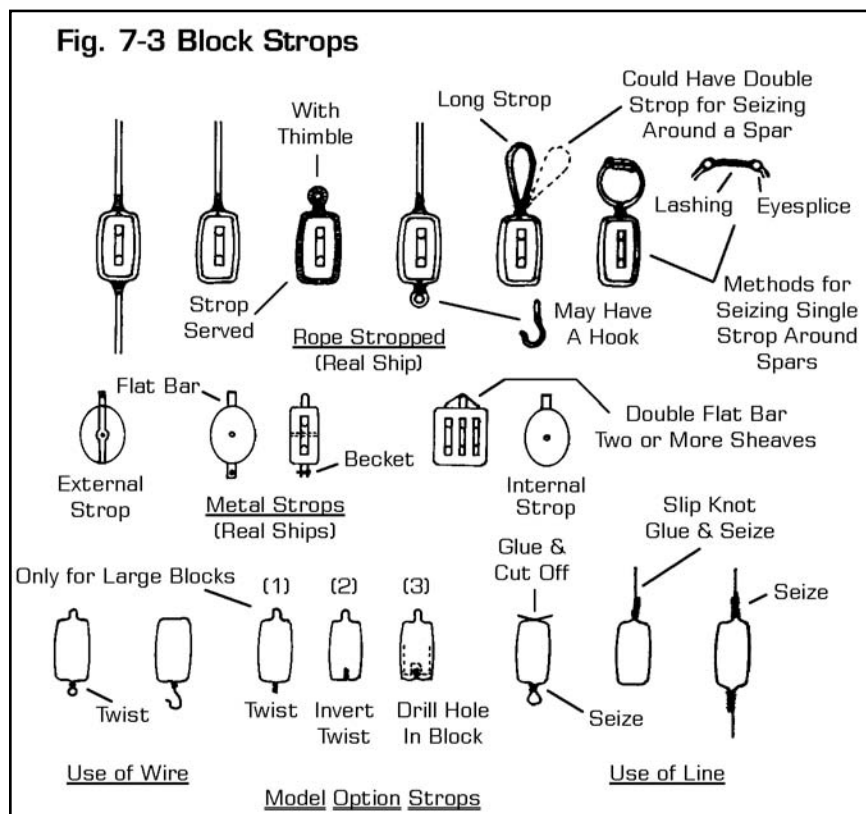
bottle of *Fray-Chek*. Running or brushing a bead of it along the edge of a sail prevents the material from unraveling. Do this before attempting to roll the hem. Painting Fray-Chek on untreated fabric makes cutting easier and produces a crisp edge.

Stitch-Witchery and *Wonder-Under* are heat-fusing bonding tapes that resemble thin mat fiberglass. *Stitch-Witchery* comes in a roll and is bond-sensitive on both sides. To join two clothes, simply place a strip between them and iron.

Wonder-Under comes in sheets with a thin paper backing on one side. It's useful for bonding letters and numbers to a scale sailboat's sail. First, buy the colored fabric for the numbers. Place the *Wonder-Under* sheet on the cloth with the paper backing up. Iron the sheet to bond it to the fabric. Next, cut out the letters, numbers, logo, or whatever with scissors or a sharp blade. Peel off the paper backing, position the letter on the sail, and iron. This technique also works for making flags from colored fabric.

Constitution has no numbers, but *Wonder-Under* is one way to make hems without sewing them.

Furled sails: A sail cut to the original's scale size is impossible to furl. The fabric is usually too heavy, resulting in a bulky furled sail. To solve this problem, either buy a lighter material such as *Silkspan* (model airplane covering tissue available from Model Expo) or proportionally reduce the size of a sail by one-third when using sailcloth (Figure 7-6). Depending on their size, even *Silkspan* sails may require reducing by one-



MIZZENMAST

third. Test the percentage reduction to determine how much fabric is needed for a tight furl.

Even furled sails need some seams and hems, as these details are visible.

9. Rigging the Model with No Sails or with Furled Sails

No Sails: Include the lines attached to the sails; i.e., clewlines, sheets, buntlines, leechlines, and fore and aft sail halliards and downhauls. These are shackled together, tied off, or secured to some other stowage point. While they can be omitted, more lines mean greater realism.

Furled Sails: Attach most lines even though the sail was proportionately reduced or cut from Silkspan.

Stage 8: Installing Standing Rigging

Before beginning to rig, sort the lines by size, coat with beeswax, and keep them handy. For seizings, use the prewaxed thread in the kit (applying beeswax won't hurt). Keep white glue or cyano nearby for dabbing on a seizing if necessary. Usually sewing through a shroud followed by a half hitch prevents the seizing from unraveling. Remember, standing rigging is black.

Note: The following assumes the shrouds were rigged first, then fore and aft stays. However, one option is to rig the lower shrouds and stays, then the upper shrouds and stays. Don't forget to fit the stays over the shrouds at each masthead.

1. Runner Pendants

Fit the runner pendants over the mastheads (Figure 8-1).

2. Shrouds and Bentinck Shrouds

Begin with the lower shrouds. The lower deadeyes have

Fig. 7-5 Adding Boltropes and Reef Points

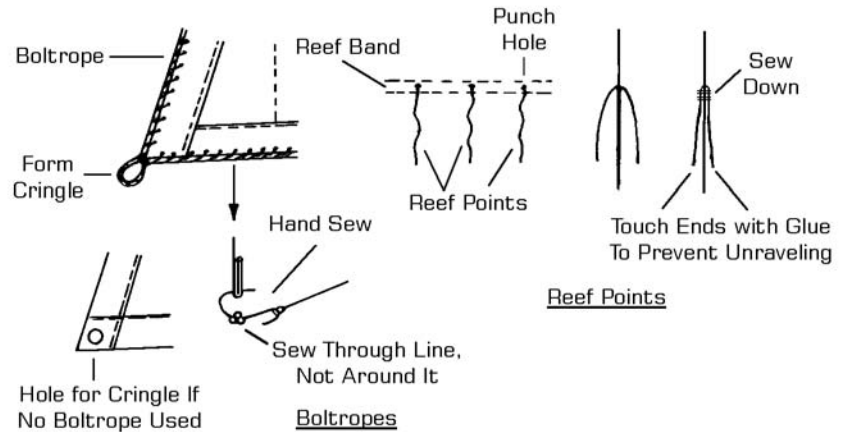
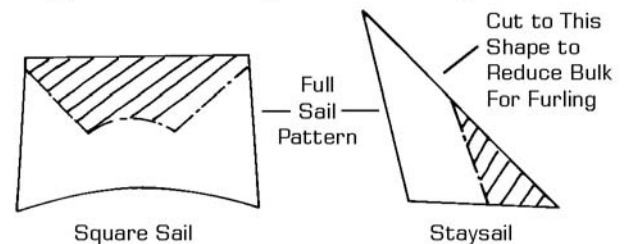


Fig. 7-6 Sail Shapes for Furling



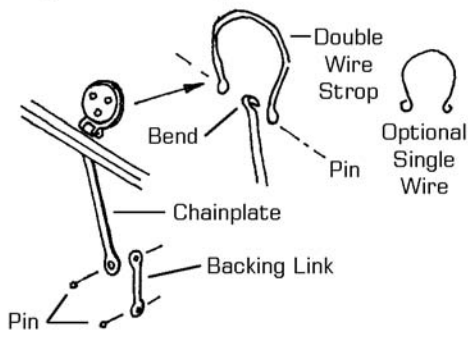
steel chain plates and deadeye strops. Assemble these from the photoetched parts and brass wire (Figure 8-2).

To set up the shrouds, make a temporary brass wire fixture to space the deadeyes as seizing progresses (Figure 8-3). The fixture should be longer than the final spacing of deadeyes. **Reeving** (to pass a rope through a block or hole) the lanyards will tighten the shrouds to their final proper spacing. Make a test shrouds first to see how much it stretches.

Figure 8-3 also shows the sequence for reeving lanyards. When looking outboard at any deadeye, always start the knot in the upper left-hand deadeye hole. Consequently, port deadeyes have the knot aft and starboard deadeyes have it forward. Rigging shrouds can pull the masts out of alignment, so keep checking the on them.

The foremost lower shroud is a swifter with blocks instead of deadeyes (Figure 8-4).

Fig. 8-2 Chainplates



When fitting shrouds over a masthead, shift the seizing aft after each pair to avoid a pileup (Figure 8-5).

Topmasts have deadeyes and futtock shrouds. Strop the deadeyes as before.

Fig. 8-3 Spacing the Deadeyes

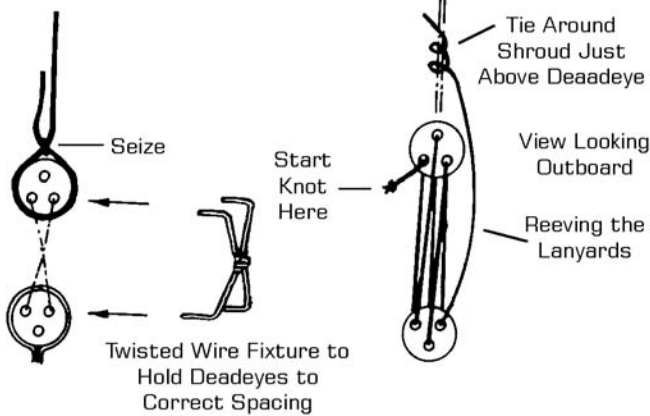


Fig. 8-4 Swifters

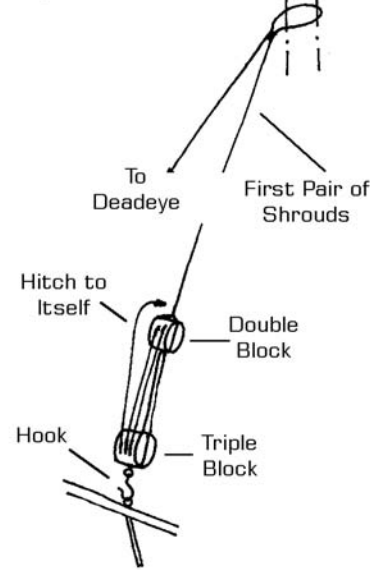


Fig. 8-5 Shroud Pairs at Head

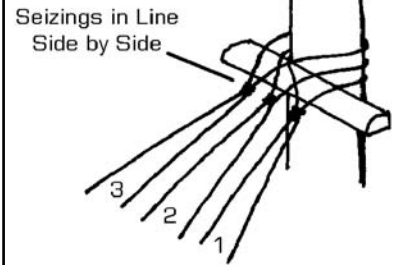
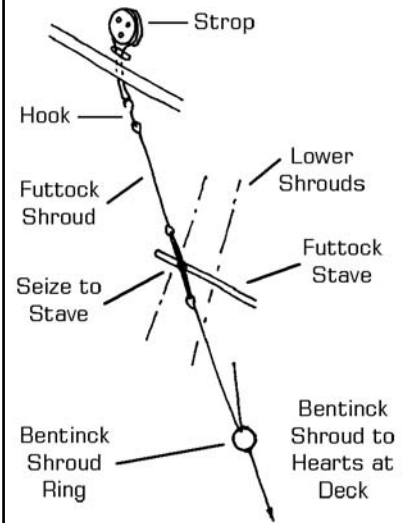


Fig. 8-6 Futtuck and Bentinck Shrouds



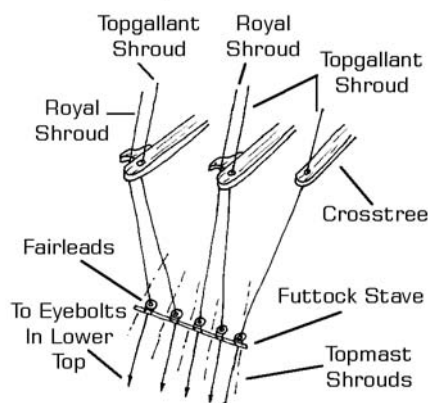
Seize the futtuck shrouds to the futtuck stave on the lower shrouds. At each seizing point, the futtuck shrouds continue down to a large ring. Rig the port and starboard bentinck shrouds to this ring, then seize them to hearts at the deck (Figure 8-6).

Topgallant shrouds have no deadeyes. They go through the crosstrees, through a fairlead on the futtuck stave, pass down inside the topmast shrouds, and seize to eyebolts in the lower top swivel gun chock. Royal shrouds are rigged in a similar manner (Figure 8-7).

After the shrouds are in place, mount the sheer poles. Make them from brass rod and paint black. Next, add the ratlines. Figure 8-8 shows several methods. The lower mast shrouds, topmast shrouds, and futtuck shrouds have rat-lines. They go all the way to the top, spaced as indicated on Sheet 7. Topgallant and royal shrouds have no ratlines. Instead, a rope ladder with wooden rungs hangs aft of the mast. See Sheet 7.

Use the kit's black polyester thread for the ratlines. Even though prewaxed, give them a generous coat of beeswax before installing. This will help hold the ratlines in a slight downward curve. If the ratlines tend to bow upward, tug them gently into position. Touching the loops with cyano or white glue will "freeze" them. Ratlines are difficult to do if tied with clove hitches, so attach them to the shrouds with a half hitch. Try holding a group of shrouds between your fingers so as not to alter their spacing while tying the knots.

Fig. 8-7 Topgallant and Royal Shrouds



3. Backstays and Breast Backstays

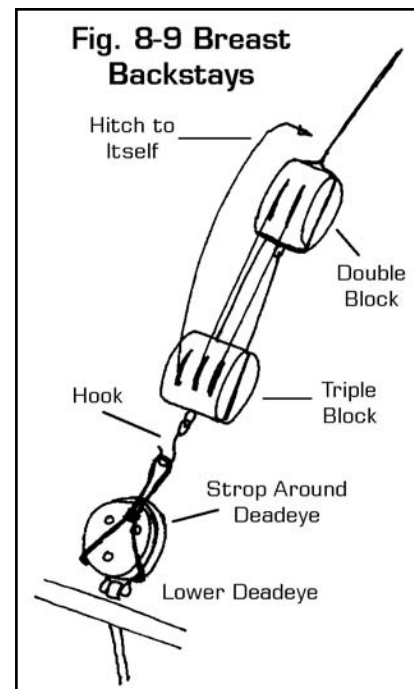
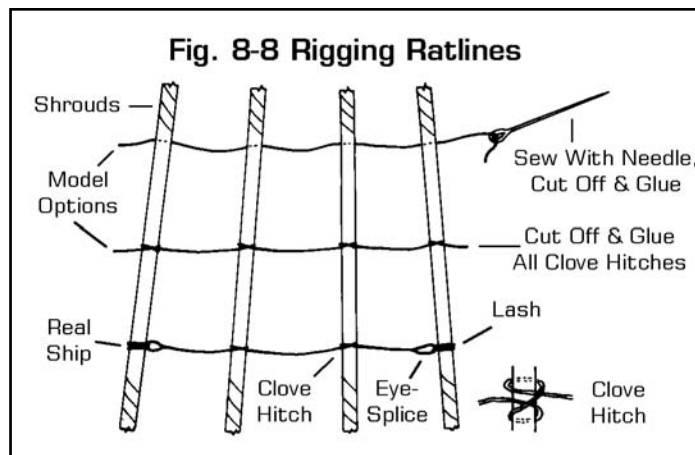
Topmast, topgallant, and royal backstays are similar to shrouds, but have no ratlines. Rig them after the shrouds are up. Note: Topgallant and royal backstays have no deadeyes, and the fore and main royal backstays, mizzen topgallant, and mizzen royal backstays have no chain plates. They seize to an eyebolt in the channel. Use a fixture to space the deadeyes on the backstays, and set them up like shrouds.

Breast backstays: Fit breast backstays to each set of lower



TOPMAST with rope ladder on topgallant/royal mast.

shrouds. The upper eye is at the topmast head. They reeve through blocks and hook around the lower dead-eyes (Figure 8-9). Breast backstays are supplemental supports for the masts and can be positioned where needed. However, position them as shown, because that's where they are on *Constitution* today.



4. Fore & Aft Stays

Unless using an alternative method, install the fore and aft stays after the shrouds and backstays are up. Be careful not to pull the masts out of line when tensioning the stays. Begin with the forward lower stays and work aft and up.

Forestay and Fore Preventer Stay: Both set up to laser-cut open and closed hearts at the bowsprit (Figure 8-10). The seizing around *Constitution's* masthead has a fancy eye with a raised mouse. For the model, substitute a simple eye splice seizing. Snake the two lines together with polyester thread as shown on the plans.

Fore Topmast Stay and Fore Topmast Preventer Stay: Both reeve through holes in the port and starboard bowsprit bees, then seize to bullseyes in the bow.

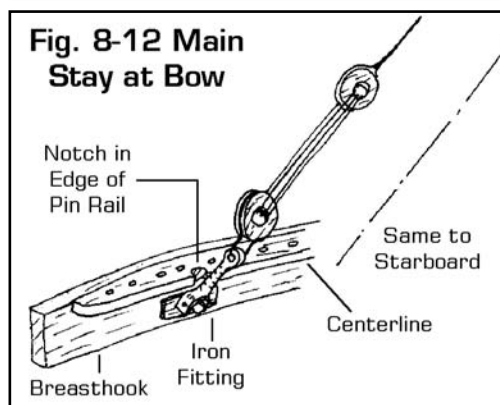
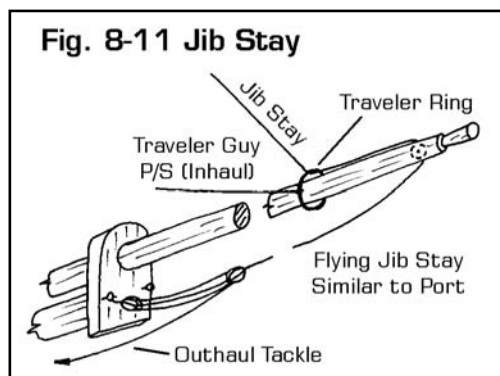
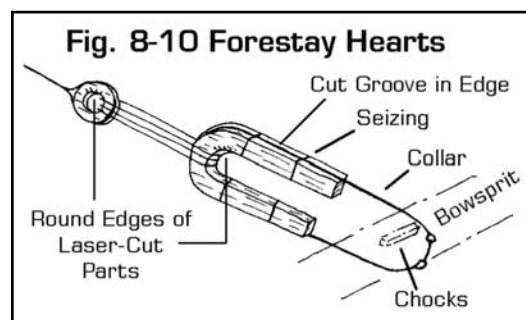
Jib Stay and Flying Jib Stay: Both reeve through a traveler ring on the spars, through sheaves in the spars, then back to outhaul tackles fixed to the bowsprit cap. The fall of the tackle seizes to the bow pin rail (Figure 8-11).

Outer Jib Stay and Fore Royal Stay: The outer jib stay reeves through the jibboom, through a hole in the dolphin striker's port side, back through a fairlead under the bowsprit, and seizes to an eyebolt in the bow. The fore royal stay seizes with an eye splice at the forward end of the flying jibboom.

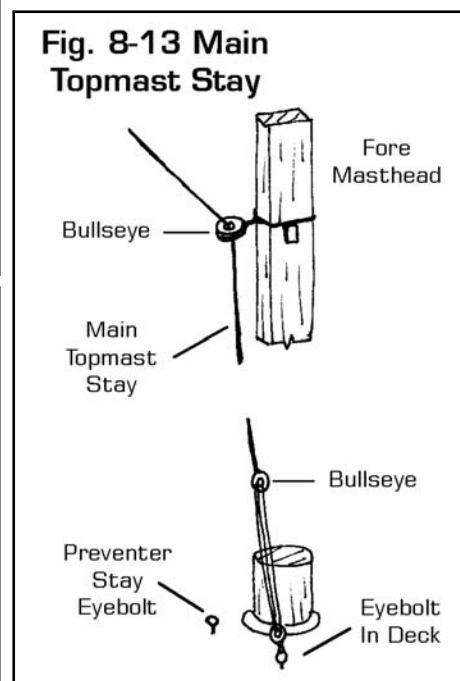
Main Stay and Preventer Stay: Both seize to hearts attached to iron fittings at the bow rail (Figure 8-12). These stays, like the forestays, are served (wrapped) with the polyester thread.

Main Topmast Stay and Preventer Stay: Both reeve through a collar on the foremast, then seize to bulls-eyes and eyebolts in the deck behind the foremast (Figure 8-13).

Main Topgallant Stay and Preventer Stay: The topgallant stay reeves through a collar on the fore topmast, then down to an eyebolt in the fore top. The preventer stay



seizes in a similar manner, but passes through a small sheave aft of the lower mast cap (Figure 8-14).



Main Royal Stay: The royal stay is similar to the topgallant and seizes to an eyebolt in the fore top.

Mizzen Stay and Mizzen Preventer Stay: Rig these like the main topmast stays.

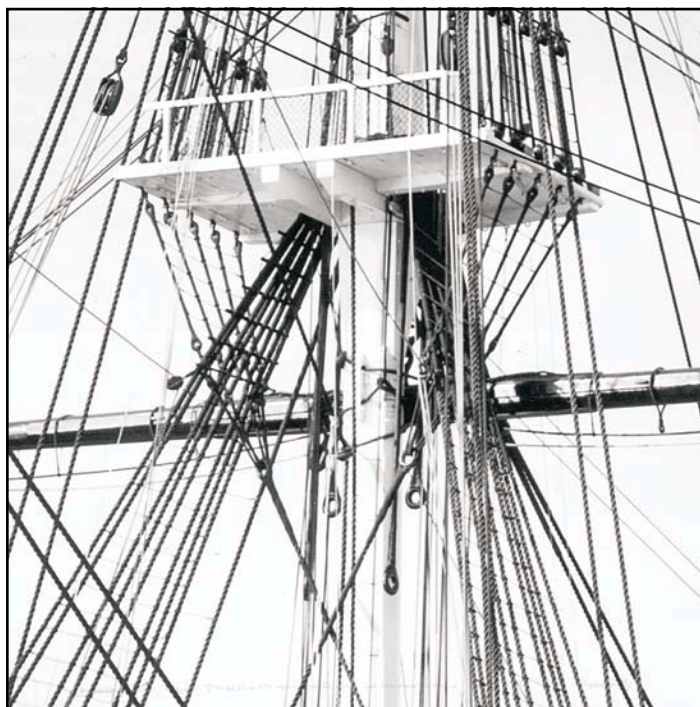
Mizzen Topmast Stay and Mizzen Topmast Preventer Stay: The topmast preventer seizes to the deck like the lower stays. However, the topmast stay seizes to an eyebolt in the main top.

Mizzen Topgallant and Royal Stays: These set up similar to the main topgallant and royal stays.

5. Bowsprit Rigging

Bobstays: The three bobstays seize to bullseyes and a collar around the bowsprit. Bobstays are double lines seized together (Figure 8-15).

Outer Martingale and Outer Martingale Backropes: The port and starboard outer martingale stays act like a backup to the royal stay. Seize the line at the dolphin striker. Then reeve it through a single block at the end of flying jibboom, back through a hole in the dolphin striker, through the fairlead under the bowsprit, and seize it to an eyebolt in the bow.



FIGHTING TOP AND SHROUDS. Note the runner pendants inside the shrouds.

Fig. 8-14 Main Topgallant Preventer Stay

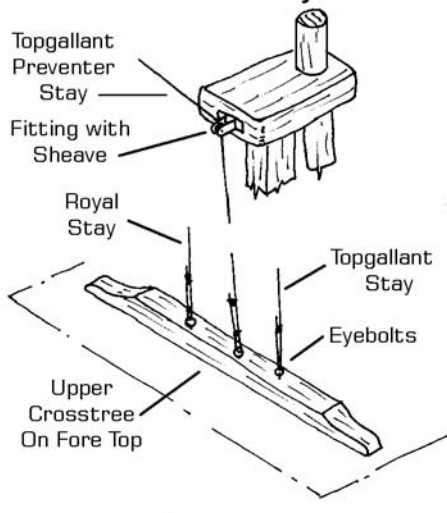


Fig. 8-16 Outer Martingale And Backrope

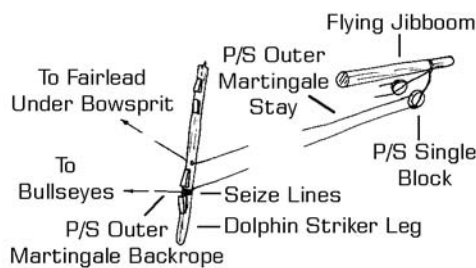


Fig. 8-15 Bobstays

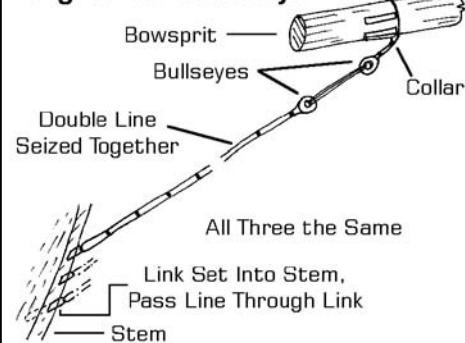


Fig. 8-17 Inner Martingale Stay

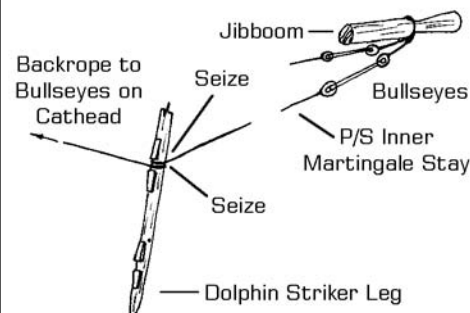


Fig. 8-18 Bowsprit Shrouds

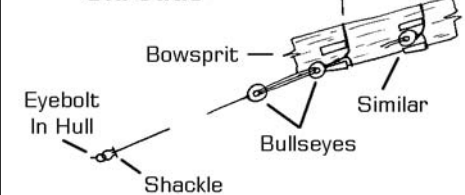
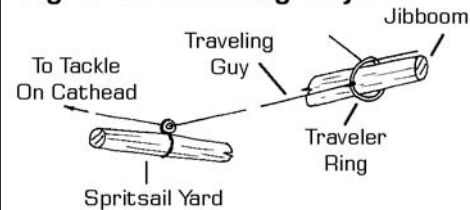


Fig. 8-19 Traveling Guys



Rig the port and starboard back ropes on the dolphin striker at the same point as the outer martingale lines, and seize to bullseyes at the rail below the catheads (Figure 8-16).

Inner Martingale and Inner Martingale Backropes: Rig the port and starboard inner martingale with bullseyes at the end of the jibboom. The line seizes between the upper chocks on the dolphin striker. From there, seize the backrope running to bullseyes on the cathead (Figure 8-17).

Bowsprit Shrouds: These lead to port and starboard eyebolts in the hull, then to bullseyes in a collar around the bowsprit (Figure 8-18).

Jibboom and Flying Jibboom Guys: Fairleads are fitted on the

spritsail yard for leading the jibboom guys. Rig two port and starboard guys. They seize to the jibboom and flying jibboom, then to bullseyes on the catheads. The jibboom and flying jibboom lines are traveling guys. They are used as inhauls for the jib and flying jib traveler rings. Rig them to the traveler rings. They seize to a tackle on the catheads (Figure 8-19).

Footropes: Rig port and starboard footropes on the jibboom and flying jibboom.

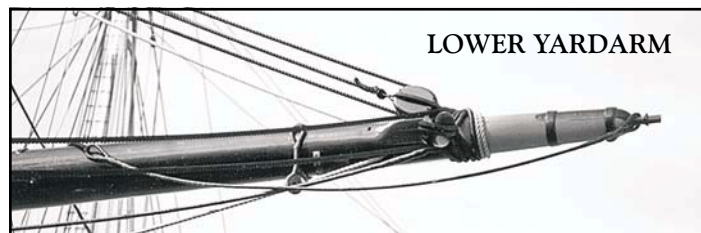
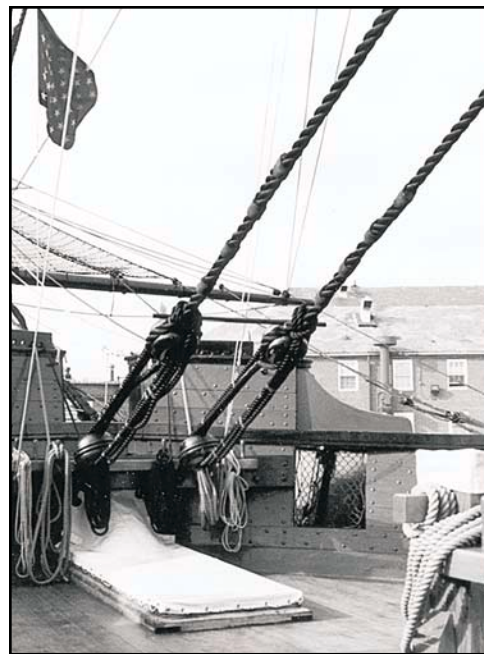
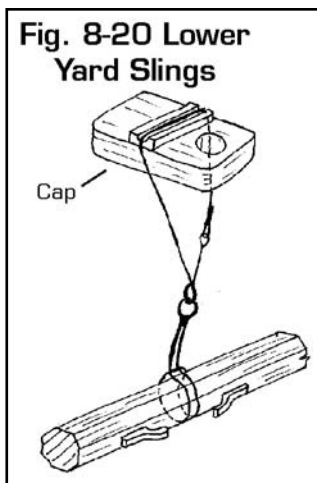
6. Footropes

As noted earlier, footropes for yards and the spanker boom are more easily installed while the spars are still in hand. Footropes may require some adjusting before they hang naturally.

7. Lower Yard Slings

A permanent sling supports the three lower yards (Figure 8-20). Jeers and trusses also support them, but are discussed under running rigging.

This completes the standing rigging. All lines should be black. Check for shiny glue spots and touch up with black paint or shoe polish.



FORE YARD. Note sling detail and how the futtock shrouds lead down to the bentinck shroud ring.



BENTINCK SHROUDS AT MAINMAST. Note how the mizzen stays lead through the fairleads.

Stage 9: Installing Sails and Running Rigging

Decide whether to rig with or without sails or with some furlled and some set. The following paragraphs discuss the choices and how to rig them. Seize blocks in place before adding sails and rigging. Each sail and its spar is presented separately. Finish one sail group before moving to the next. Although the rigging sequence isn't critical, starting at the bow and working aft is recommended. Do the fore and aft sails first, then add the square sails.

1. Fore Staysails (Head Sails)

For simplicity, the fore topmast staysail, jib, outer jib, and flying jib can be called head sails. If using sails, add their halliards, downhauls, and sheets. Play out enough line for reeving, handling, and belaying. Don't be in a hurry to snip them flush. They may need retensioning as rigging progresses. To finish each line, coil it at the belaying point. An easier approach is to belay the line, then add a separate coil.

Constitution has wooden hanks to *bend* (secure) the head sails to their stays. For the model, use brass split rings.

Pull sheets taut on the sail side. Loosely drape the other sheets over the stays to their belaying points. Tacks seize near the downhaul blocks on the spars.

No Sails: Attach halliards to the downhauls and lead them to the end of the spars (Figure 9-1). Halliard runs are identical to a rig with sails, but the head block is in a different location. Remove sheets with the sails. If left on deck, they make it look cluttered.

Fig. 9-1 Jib Rigging Without Sail

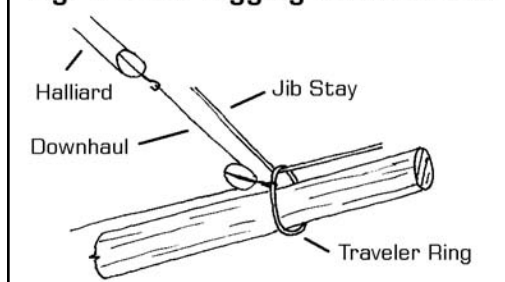
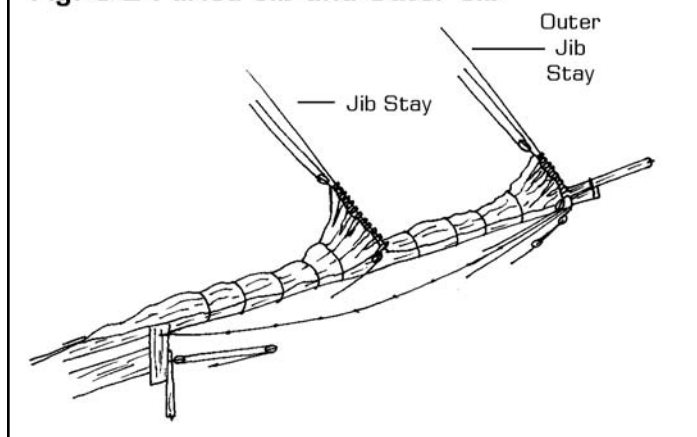


Fig. 9-2 Furled Jib and Outer Jib



Also, don't put hanks on the stays.

Furled Sails: Figure 9-2 illustrates some furled head sails. Notice their diminutive bulk and how hanks are gathered together. This is the reason for reducing sail material or using Silkspan. Pulling up the halliard will loosen the furl a little, but bulky furled sails are not realistic and detract from the model's appearance.

2. Main and Mizzen Staysails

Rig the staysails between the fore and mainmast and the mizzen and mainmast with hanks, downhauls, halliards, and sheets. Staysails have an upper and lower tack. The upper tack is seized to the stay. The lower tack reeves through a fairlead on the mast, then down to its belaying point.

Staysails have several brails. Upper sail brails belay to the fighting top rails.

No Sails: Omit the sheets, brails, and tacks. Hook the downhauls and halliards together (Figure 9-3).

Furled Sails: Figure 9-4 illustrates the main topmast staysail pulled up to the stay by the brails.

Fig. 9-3 Staysail Rig Without Sail

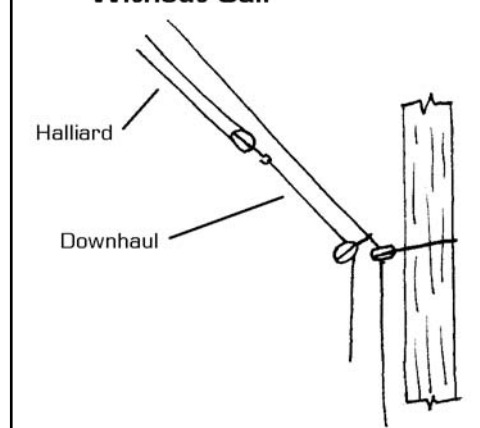
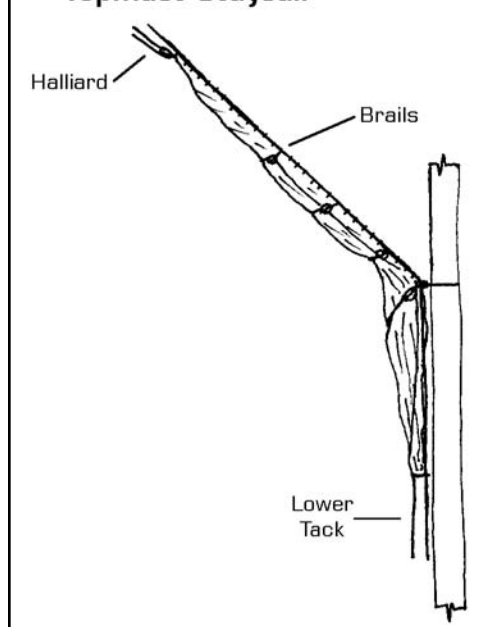


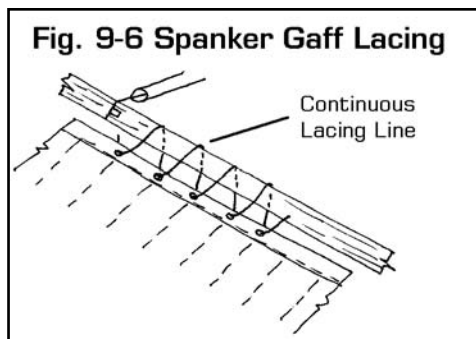
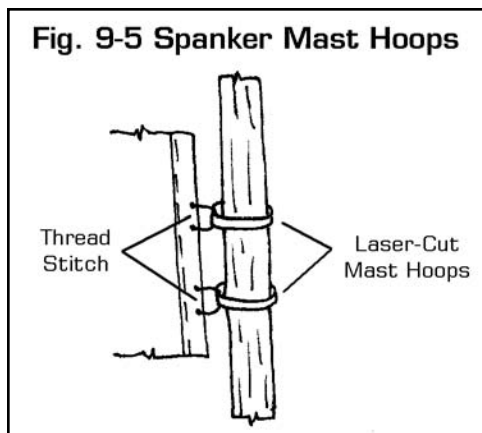
Fig. 9-4 Brailed Main Topmast Staysail



3. Spanker

Do as much work as possible with the boom and gaff in hand. When installing them, the most difficult task is sewing the spanker mast hoops to the sail (Figure 9-5).

Reeve lines, but leave them loose. Set the boom sheet, then tighten the peak and throat halliards. Fit the brails,



followed by the topping lifts and vang. Add the flag halliard after making the flag.

Lace the spanker to the gaff, but leave it loose footed at the boom (Figure 9-6).

No Sail: The most accurate approach is to lower the gaff on top of the boom. However, some modelers prefer leaving it up, since it fills the space aft of the mizzenmast. Use the vangs to position the gaff and prevent it from swinging.

Remove brails with the sails, but rig all blocks attached to the gaff. Pile mast hoops at the boom. Topping lifts hold up the boom. Other lines remain in place.

Furled Sail: Figure 9-7 illustrates a furled spanker. Pull the clew up to the middle brail block at the mast and lead the clew outhaul to the boom end.

Boom Guys: Boom guys steady the boom when the sails are furled or removed. However, they could assist the boom sheets in heavy weather.

4. Gaff Topsail

When compared to the more conventional sail found on schooners, the gaff topsail is unusual. It has brails and secures to a tricing line rather than to hoops around the mast.

No Sail: Remove the brails. Connect the halliard to the downhaul. Locate the halliard block near the fighting top. Pull in the sheet and tie it around the fighting top's rail.

Furled Sail: Bundle the sail at the masthead.

This concludes the fore and aft sails. March on to the square sails.

5. Fore & Main Course Yards

Mount blocks to their yards and reeve as many loose lines as possible. Lace the sail to the jackstays, then attach sheets, tacks, buntlines, leechlines, and clew garnets. Footropes and yard tackles should already be installed. Remember, leechlines and buntlines go on the sail's forward side of the sail; all others are on the aft side. Rig the lifts after the yard is in place.

Hang the course yards from their slings. The truss has a tackle above the fighting top to pull the yard tightly against

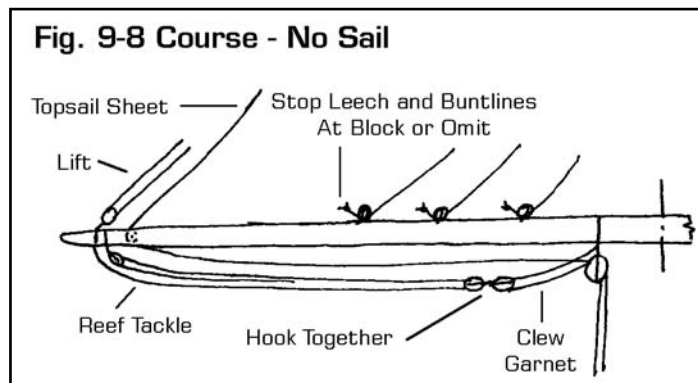
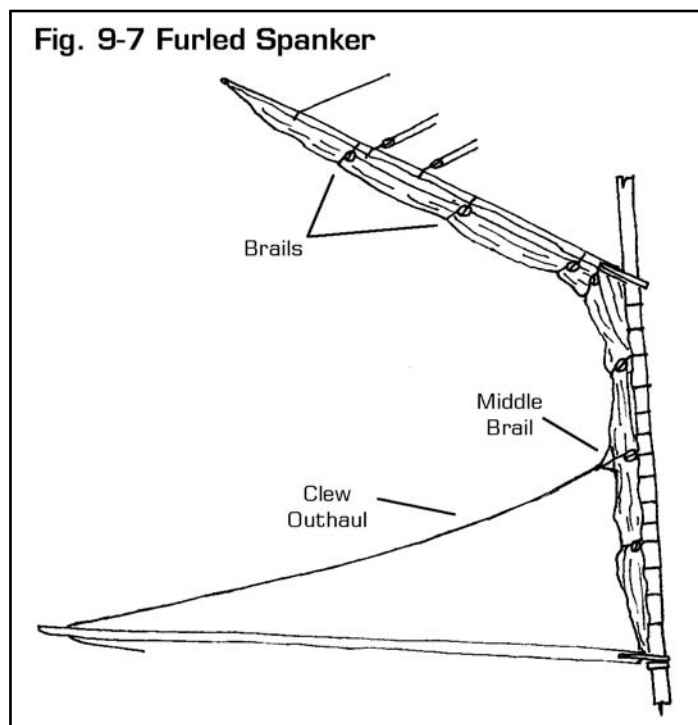
the mast. Jeers can hold and lower the yard. See Sheet 8 for details.

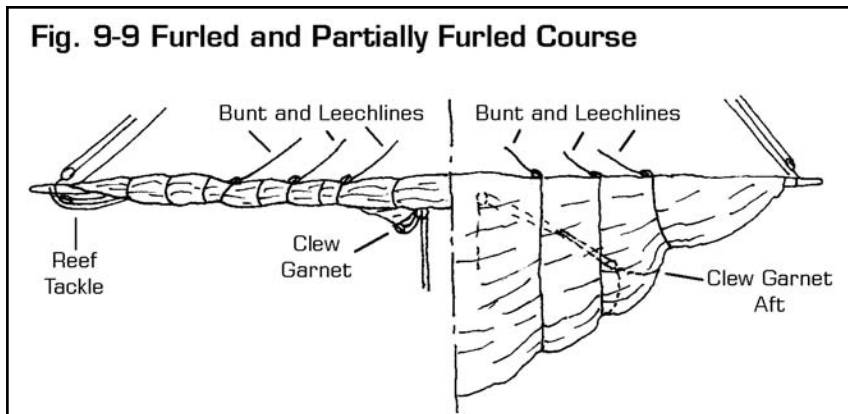
After a yard is in place, reeve and belay its lines. Install the braces. Seize most brace blocks to shrouds or stays. Brace the yards at a pleasing angle or set them perpendicular to the centerline and level. The choice is yours.

Run course sheets outboard, reeve through the sheaves in the bulwarks, and belay to an inboard cleat. The fore course tack runs to the fore tack bumpkin at the head. The main tack leads inboard.

No Sail: One option is to omit the sheets and tacks. Another is to hook them to the clew garnet and pulled up to the yard. However, this is clumsy. A better alternative is to omit the sheets and tack, then hook the clew garnet to the reef tackle. Stop buntlines and leechlines at the yard fairleads (Figure 9-8). Another option is to omit the bunt and leechlines, but install the blocks.

Furled or Partially Furled Sail: Figure 9-9 illustrates a furled





course sail and one partially pulled up by buntlines and leechlines.

6. Fore, Main, and Mizzen Topsail Yards

The difference between rigging courses and topsails is in their sheets and lifts. If sails are bent, hoist the yard by the



SPANKER BOOM SHEET AND GUYS.

halliard and droop the lifts. Reeve sheets through blocks on course yardarms and crossjack yards.

Topsail halliards are a hefty rig with tackles in the port and starboard channels.

No Sail and Furled Sail: Figure 9-10 illustrates the yard without a sail. Lower the yard and let it hang on its lifts. A furled sail would look similar to the furled course; i.e., neat and compact.

7. Fore, Main, and Mizzen Topgallant and Royal Yards

This rig is essentially the same as for the topsails, but with a little less rigging.

8. Spritsail Yard

Although the spritsail yard has no sail, it does have lifts and braces. Lifts reeve through holes in the bow fairlead, then belay to pins. Braces lead to the foretop, then reeve through blocks on the shrouds.

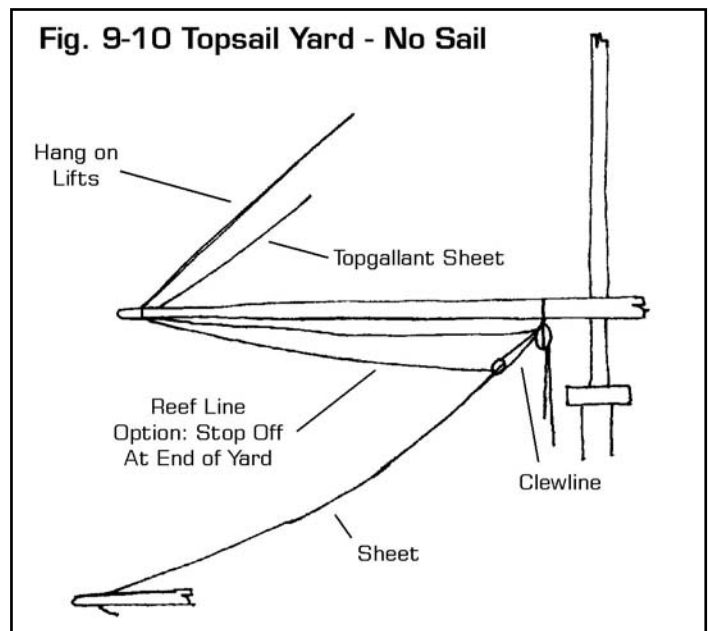
9. Studding Sails

Rigging studding sails on the fore and mainmasts adds substantial width to the model. Is there room to display it this way? Only the foremast has a studding sail on the course yard. The plans adequately describe how to rig them.

No Sails: Only install the booms. Pull them in and lash them to the yards. Hinge the fore lower boom back and stow it on an iron rack (refer to Stage 6, Step 6).

10. Miscellaneous Rigging

Flags and Flag Halliards: Flag halliards are a single line



rove through a small block on the fore, main, and mizzenmast poles and at the spanker gaff. Substitute an eyebolt if rigging the block proves difficult.

Quarter Boat Davit Lifts: Each davit's lift line joins a single line, reeves through a block on the mizzen shrouds, and belays to a jig tackle on deck.

Final Touches

When the model is rigged, recheck every line. Be certain seizings are sound. Add another dab of glue if they aren't. Touch up shiny spots on standing rigging with black paint or liquid shoe polish. Use a tan stain or brown liquid shoe

polish for running rigging. Check if any painted wooden parts were fouled during the rigging process and make repairs.

Congratulations

Constitution is finished! Take a moment to revel in your accomplishment. You've persevered when the going became rough and your effort has produced results. You've developed skills you never knew you had, increased your vocabulary, and become a time traveler. We hope you've enjoyed your voyage and look forward to sailing with you on your next shipmodeling project.

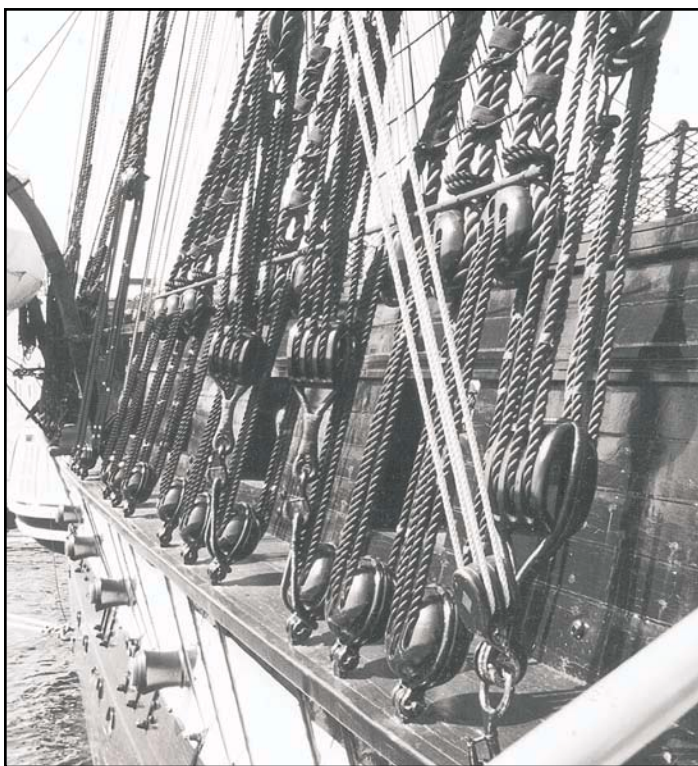
Bibliography

Old Ironsides - An Illustrated History of USS Constitution by Thomas P. Horgan. Third Edition, 1983. Yankee Books, Camden.

History of *Constitution* with a description and excellent photographs, mostly recent (1980-90), but a few historic ones.

USS Constitution - Old Ironsides. Edited by James B. Patrick and Richard E. Harding. 1991. Fort Church Publishers, Inc., Little Compton.

Superb photographs of *Constitution* from 1980 to 1990. Closeups of deck, hull, and rigging details. Sold by the USS *Constitution* Museum.



MAIN SHROUDS.

Old Ironsides - The Rise, Decline, and Resurrection of the USS Constitution by Thomas C. Gillmer. 1993. TAB Books, Blue Ridge Summit.

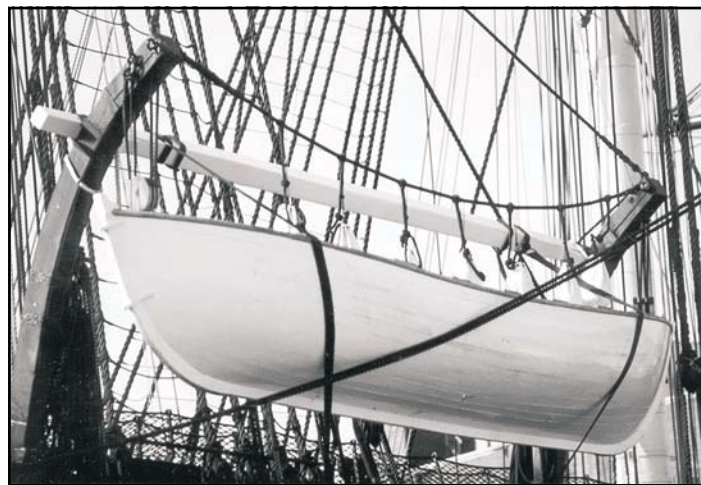
History and account of Mr. Gillmer's survey for *Constitution's* recent restoration. Illustrates recommended hull strengthening. Several plans of the ship as she looked during different periods. Some great dry dock photos showing coping.

The Frigate Constitution and Other Historic Ships by F. Alexander Magoun. 1928. Bonanza Books, New York.

Description and history of the ship with plans based on the Navy's 1927 reconstruction drawings. Several lists of rigging sizes from Navy documents.

The History of the American Sailing Navy by Howard I. Chappelle. 1949. W.W. Norton & Co., New York.

History with plans from the original designer's drafts. Shows *Constitution* differently than she exists today, especially the bulwarks.



QUARTER DAVITS and the 28-foot whaleboat.

Scale Conversion Tables

Rigging Line Diameters		
Full-Size Vessel	Tenths of An Inch	Converted to $\frac{5}{32}$ " Scale
$\frac{1}{2}$ "	0.50"	0.007" (0.17mm)
$\frac{3}{4}$ "	0.75"	0.010" (0.25mm)
1"	1.00"	0.013" (0.33mm)
$1\frac{1}{4}$ "	1.25"	0.016" (0.41mm)
$1\frac{1}{2}$ "	1.50"	0.020" (0.50mm)
$1\frac{3}{4}$ "	1.75"	0.023" (0.58mm)
2"	2.00"	0.026" (0.66mm)
$2\frac{1}{2}$ "	2.50"	0.033" (0.83mm)
3"	3.00"	0.039" (0.99mm)
$3\frac{1}{2}$ "	3.50"	0.046" (1.16mm)
4"	4.00"	0.052" (1.32mm)

Blocks, Deadeyes, and Bullseyes	
Full-Size Vessel	Converted to $\frac{5}{32}$ " Scale
6"	0.078" or $\frac{5}{64}$ " (1.98mm)
7"	0.091" or $\frac{3}{32}$ " (2.31mm)
8"	0.104" or $\frac{7}{64}$ " (2.67mm)
9"	0.117" or $\frac{7}{64}$ " (2.98mm)
10"	0.130" or $\frac{1}{8}$ " (3.30mm)
12"	0.156" or $\frac{5}{32}$ " (3.97mm)
14"	0.182" or $\frac{3}{16}$ " (4.63mm)
16"	0.208" or $\frac{13}{64}$ " (5.29mm)

Errata for Plans and Instructions

After the plans and instructions for this kit were completed, Model Expo purchased a new engraving laser machine. That made it possible to include additional laser-cut parts. Instructions for assembling them are described below.

Gratings

Preassembled laser-cut grating panels have replaced the wood grating strips shown on the plans and described on page 27. Gratings for the main hatch include the top of the beams between the outside coamings. Simply lower the beams and fit the grating panel on top. Holes in the gratings are a little larger than shown on the plans, but they are still scalelike in appearance.

Trailboards

Trailboards (page 27) are engraved with guidelines for carving the billet head, and painting the scrollwork and flag emblem.

Hammock Boards

The laser-cut gangway and hammock boards (page 15) are engraved with the figures shown on the plans. Stain the

wood so the engravings show up. No carving is required. However, feel free to carve the eagle on the gangway boards.

Quarter Gallery Windows

Quarter galleries (page 28) now have laser-cut windows. Since the plans show them as curved, sand in the contour before installing.

Fife Rails

The fore, main, and mizzen fife rails are laser-cut and come with belaying pin holes.

Stern Mouldings and Ship's Name

Stern mouldings (page 29) and ship's name (page 28) are now laser-cut. Use the engraved lettering as a guide for painting the name, or apply dry transfer lettering over the engraving.

Quarter Davit Support Blocks

Fit these laser-cut blocks as shown on Sheet 5.



3/14/2013

CONSTITUTION PARTS LIST MS2040

PART #	ITEM	QUANTITY	DESCRIPTION/NOTES
BRITANNIA CASTINGS 10 pcks			
WP7801	Anchor shanks	3	
WP7808	Galley stack	1	
WP7802	Berth deck portlights	34	
WP7803	Carronade barrels	20	
WP7804	Carronade front trucks	20	
WP7805	Carronade rear trucks	20	
WP7806	Dummy gun barrels	30	
WP7807	Fife rail stanchions	15	Round portion only
WP7809	Gunport decorative boards	30	
WP7810	Gun deck scuppers	12	
WP7811	Hawse pipe lips	4	
WP7812	Long gun barrels	2	
WP7813	Steering wheels	2	
WP7814	Stern eagle	1	
WP7815	Stern pilasters	8	
WP7816	Ammo passing scuttles	4	
BRASS AND MISCELLANEOUS FITTINGS AND MATERIAL			
WP0429	Eyebolts	180	Brass
WP0410	Belaying pins	240	
WP0993	Nails	200	
WP0955	Split rings	50	
WP1181	Cannon balls - 1/16" dia.	60	Black acrylic
WP0426	Ship's bell - 1/4"	1	Britannia metal
WP0953	Split rings	25	
WP40282sec	Wire	13 ft.	For stropping deadeyes
WP0516	Chain - 42 links/inch	1 ft.	
WP0480	Chain - 21 links/inch	2 ft.	
WP0481	Chain - 14 links/inch	2 ft.	For anchors
WP150K-12	Rod - 0.010" dia. x 12"	4	
WP2806	Rod - 0.016" dia. x 12"	4	
WP160K-12	Rod - 1/32" dia. x 12"	4	
WP0887	Bar (flat) - 1/64" x 1/32" x 14"	1	
WP0888	Bar (flat) - 1/64" x 1/16" x 12"	6	For pintles, gudgeons & chain iron
WP0889	Bar (flat) - 1/32" x 1/16" x 12"	1	For gammon
WP2803	Bar (square) - 1/32" x 15"	1	

WP29137	Sheet - 0.005" x 4" x 2"	1	For making gun trunnion straps
WP29138	Sheet - 0.010" x 4" x 2"	1	For miscellaneous mast bands, etc
WP29131	Hammock rail stanchions	3	Photo etched - 3 sheets of 20
WP29132	Chain plates & backing links	8	Photo etched - 8 sheets of 10 each
WP2559	Gunport lid hinges	4	Photo etched - 4 sheets of 40
WP2526	Grating - 1-1/2" sq. 1/64" holes	1	Photo etched - 1 sheet
WP0976	Sheathing tape - 1/4" wide	108 ft.	Copper - Self adhesive

DEADEYES, BLOCKS, AND OTHER WOOD FITTINGS

Note: All deadeyes and blocks are Walnut unless otherwise noted. Some block and deadeye sizes shown on plans are not available. See notes regarding substitutions.

WP0301	Blocks - 3/32" single	150	
WP0302	Blocks - 1/8" single	175	
WP0303	Blocks - 5/32" single	50	
WP0304	Blocks - 3/16" single	40	
WP0308	Blocks - 1/8" double	200	Use also for 3/32" blocks
WP0309	Blocks - 5/32" double	15	
WP0310	Blocks - 3/16" double	20	
WP0339	Deadeyes - 1/8" dia.	60	
WP0340	Deadeyes - 3/16" dia.	70	
WP0346	Blocks - 3/16" triple	25	Use also for 5/32" blocks
WP0390	Deadeyes - 3/32" dia.	20	
WP2308	Deadeyes - 5/32" dia.	40	
WP2460	Bullseyes - 3/32" dia.	80	
WP2461	Bullseyes - 9/64" dia.	15	Use for 1/8" bullseyes
WP2462	Bullseyes - 3/16" dia.	20	Use also for 5/32" bullseyes

RIGGING LINE

Note: Rigging line is Nylon. Black is for standing rigging; Tan for running rigging. Thread is waxed Polyester in tan and black for snaking, ratlines and siezings. See instruction manual for suggested sizes related to plan sizes.

WP2589	3/0 -0.005" dia. black thread	50 yard spools
WP2587	3/0 -0.005" dia. tan thread	50 yard spools
WP1218	0.008" dia. black	30 yards
WP1210	0.021" dia. black	50 yards
WP1211	0.028" dia. black	30 yards
WP1215	0.040" dia. black	5 yards
WP1216	0.051" dia. black	15 yards
WP1241	0.008" dia. tan	120 yards
WP1243	0.028" dia. tan	50 yards

WOOD DOWELS

Note: All dowels are Beech unless otherwise noted. Dowels are supplied in lengths as noted. Cut to length as required.

WP5100-12	5/64" x 12"	6
WP5101-24	1/8" x 24"	6
WP5102-24	5/32" x 24"	2
WP5103-24	3/16" x 24"	3
WP5104-24	1/4" x 24"	2
WP5105-24	5/16" x 24"	3
WP5106-24	3/8" x 24"	1
WP5109-24	7/16" x 24"	2

WOOD STRIPS, SHEETS, AND BLOCKS

Note: All wood is Basswood or Limewood (European Basswood) unless otherwise noted. Wood strips and sheets are supplied in lengths as noted. Cut to length as required.

STRIPS

WP3600-24	1/32" x 1/32" x 24"	3	
WP3602-24	1/32" x 1/16" x 24"	20	
WP3603-24	1/32" x 3/32" x 24"	5	
WP3604-24	1/32" x 1/8" x 24"	3	
WP3607-24	1/32" x 1/4" x 24"	3	
WP3661-24	3/64" x 3/32" x 24"	50	
WP3660-24	3/64" x 1/8" x 24"	40	
WP3613-24	3/64" x 1/4" x 24"	2	
WP3618-24	1/16" x 1/16" x 24"	4	
WP3619-24	1/16" x 3/32" x 24"	30	Deck
WP3620-24	1/16" x 1/8" x 24"	150	Hull
WP3622-24	1/16" x 3/16" x 24"	35	
WP3623-24	1/16" x 1/4" x 24"	15	
WP3624-24	1/16" x 1/2" x 24"	4	
WP3625-24	3/32" x 3/32" x 24"	4	
WP3626-24	3/32" x 1/8" x 24"	25	
WP3655-24	3/32" x 5/32" x 24"	1	
WP3628-24	3/32" x 3/16" x 24"	2	
WP3629-24	3/32" x 1/4" x 24"	2	
WP3630-24	3/32" x 1/2" x 24"	2	
WP3631-24	1/8" x 1/8" x 24"	4	
WP3633-24	1/8" x 3/16" x 24"	3	
WP3634-24	1/8" x 1/4" x 24"	3	
WP3635-24	1/8" x 1/2" x 24"	1	
WP3648-24	5/32" x 5/32" x 24"	2	
WP3616-24	5/32" x 5/16" x 24"	3	
WP3640-24	3/16" x 3/16" x 24"	3	
WP3674-24	3/16" x 5/16" x 24"	1	
WP3642-24	3/16" x 1/2" x 24"	1	

SHEETS

WP4606-24	1/16" x 2" x 24"	2
WP4609-24	3/32" x 2" x 24"	1
WP4612-24	1/8" x 2" x 24"	1

BLOCKS

Size of filler blocks and quarter gallery blocks (before carving) noted on the plans must be cut from the following blocks.

WP3564-06	2" x 2" x 6"	1
WP3563-06	2" x 3" x 6"	1
WP4623-24	1/2" x 2" x 6"	1
WP3693-24	3/8" x 1" x 3"	1
WP3692-24	1/4" x 1" x 2"	1

LASER CUT AND MACHINE CUT PARTS WOOD PARTS

Note: All Laser-Cut wood is Basswood or Limewood (European Basswood) unless otherwise noted. Because of laser cutting limitations, the 1/4" thick center keel, keel, stem, sternpost, and fore and main mast caps are supplied in two 1/8" thick pieces each. Glue together per the instruction manual.

WP4620-24	<u>3/16" Thick Set</u>	<u>2</u>	
WP4620-DD	Catheads		2 parts
	Rudder		1 part
	Stern frame #3		2 parts
WP4620-M	Dummy gun back plate		30 parts
WP4620-PLY	<u>3/16" Thick Set (Plywood)</u>	<u>5</u>	
WP4620-D	Bulkheads A,B,Q,R		
WP4620-E	Bulkheads – E-H		
WP4620-F	Bulkheads I-L		
WP4620-G	Bulkheads M-P		
WP4620-H	Bulkheads C-D		
WP4616-L	<u>5/32" Thick Set</u>	<u>1</u>	
	Bowsprit cap		1 part
	Anchor stocks		3 parts
	Mizzen, fore & main top caps		3 parts
WP4629-A	<u>1/8" Thick Set</u>	<u>4</u>	
	Aft center keel		2 parts
	Stern davits		2 parts
	Mizzen topmast cap		1 part
	Fore & main mast cheeks		4 parts
	Sternpost		2 parts
	Closed hearts	2 parts	
WP4629-B	Mid center keel		2 parts
	Stern frame # 2		2 parts
	Riding bitt knees		2 parts
	Quarter davits		4 parts
WP4629-C	Fore center keel		2 parts
	Capstan part		1 part
	Fore & main mast caps		4 parts
	Open hearts	2 parts	
	Mast wedge/coats		3 parts
WP4629-Q	Whaleboat lifts (2 sets)		6 parts per set
	Gig whaleboat lifts (1 set)		6 parts per set
WP4628-I	<u>1/8" Thick Set</u>	<u>1</u>	
	Stem		2 parts
	Stern frames # 1		2 parts
WP4613-R	<u>1/8" Thick Set</u>	<u>1</u>	
	Pinnacle lifts (1 set)		6 parts per set
WP4610-J	<u>3/32" Thick Set</u>	<u>2</u>	
	Bow rail knees		2 parts
	Quarter Galleries		2 parts
	Mizzen mast cheeks		2 parts
	Mast wedge/coat		3 parts
	Carronade bases		20 parts
	Capstan whelps		6 parts
	Capstan part		1 part

WP4610-T	Quarter gallery windows		6 parts
	Quarter davit support blocks		16 parts
WP4607-O	<u>1/16" Thick Set</u>	2	
	Forward main rail		2 parts
	Aft main rail knees		2 parts
	Aft topgallant rail		1 part
	Anchor brackets		2 parts
	Boom and gaff jaws		4 parts
	Spanker boom rest		1 part
	Fore & main top mast cheeks		4 parts
	Carronade carriage cheeks		40 parts
	Long gun carriage cheeks		4 parts
	Long gun front trucks		4 parts
	Long gun rear trucks		4 parts
	Gangway hammock boards plain		10 parts
	Capstan parts		3 parts
WP4607-S	Gangway/hammock boards decorated		8 parts
	Head gratings		6 parts
	Main gratings		8 parts
	Rails		3 parts
	Stern mouldings		4 parts
WP4636-K	<u>3/64" Thick Set</u>	1	
	Mizzen topmast cheeks		2 parts
	Pinnace rudder		1 part
	Anchor side lid		1 part
	Upper gunport lids		32 parts
	Lower gunport lids		32 parts
	Upper transom gunport lids		3 parts
	Berth deck lids		2 parts
WP4602-N	<u>1/32" Thick Set</u>	1	
	Gig rudder		1 part
	Whaleboat rudders		2 parts
	Fore, main & mizzen top		3 parts
	Capstan parts		2 parts
WP4632-P	<u>3/64" Thick Set (Plywood)</u>	1	
	Spanker mast hoops		14 parts
WP4634-U	<u>1/32" x 3" Basswood</u>	1	
	Trail boards		1 part
	Name		

PLANS AND INSTRUCTIONS

FL

WP2040MB	Instruction Manual	1	
WPPL2040-A	Plan, Sheet 1 of 8	1	Laser-cut keel and bulkhead patterns
WPPL2040-B	Plan, Sheet 2 of 8	1	Hull framing
WPPL2040-C	Plan, Sheet 3 of 8	1	Hull planking & coppering
WPPL2040-D	Plan, Sheet 4 of 8	1	Inboard/outboard profiles&spar deck plan
WPPL2040-E	Plan, Sheet 5 of 8	1	Hull details, ship's boats, & guns
WPPL2040-F	Plan, Sheet 6 of 8	1	Mast and spar details & belaying
WPPL2040-G	Plan, Sheet 7 of 8	1	Rigging profile
WPPL2040-H	Plan, Sheet 8 of 8	1	Rigging sections
WPPL2040	Parts List		

MS2040 Addendum

March 14, 2013

- Drawing 6
Mast sized at lower left corner of drawing,

Fore, main and mizzen
Topgallant/royal masts
Should read:

F - 3/16"
M - 1/4"
MIZ - 1/8"

Fore, main & mizzen
topmasts
Should read:

F - 1/4"
M - 5/16"
MIZ - 1/2"