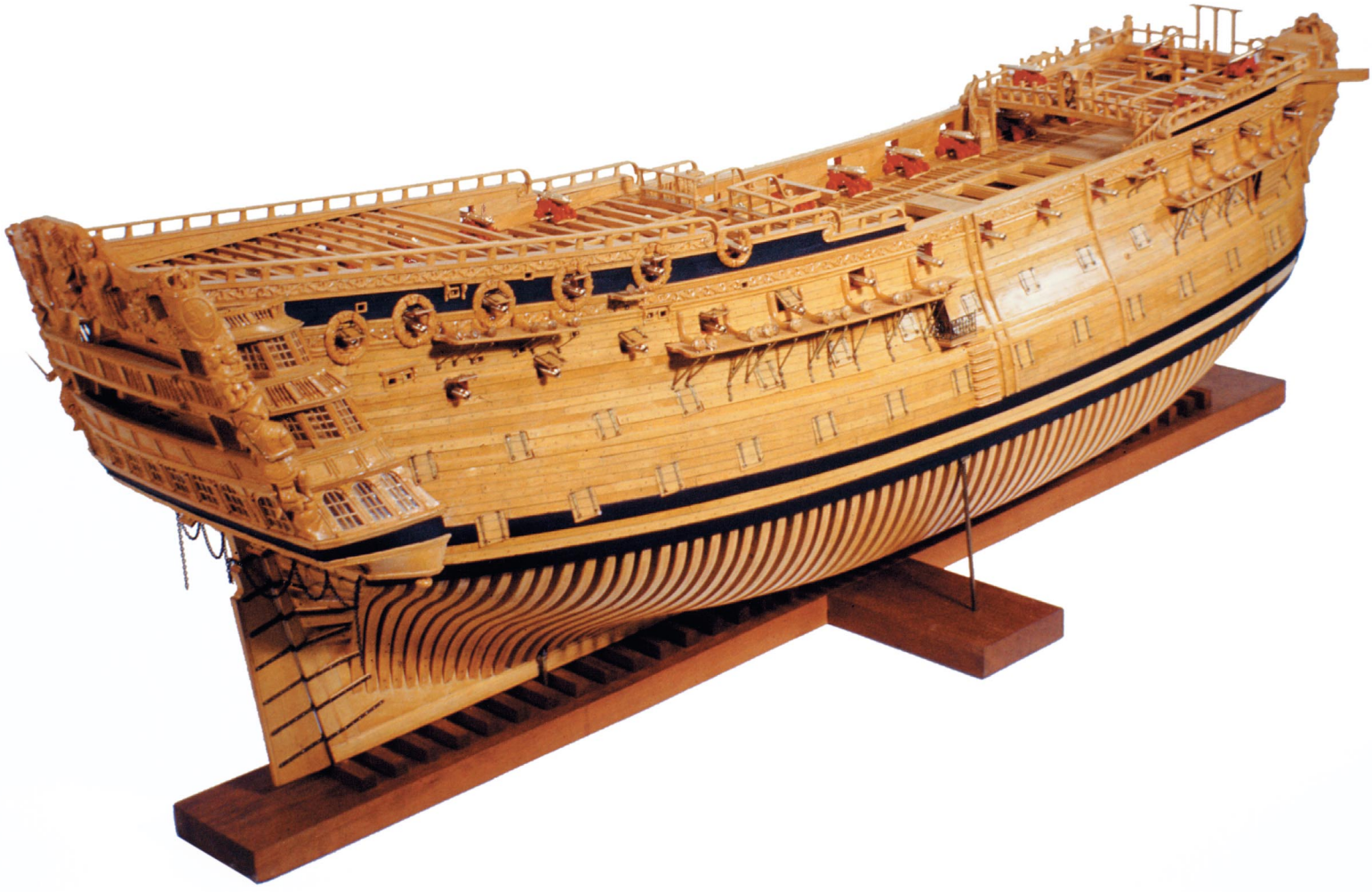
Anatomy of an Admiralty Model



by

Robert Bruckshaw

About The Manuscript

This manuscript by Master Modeler Robert Bruckshaw was discovered in the archives of the Great Lakes Historical Society Inland Seas Maritime Museum by Dave Stevens, where he has been a volunteer for years.

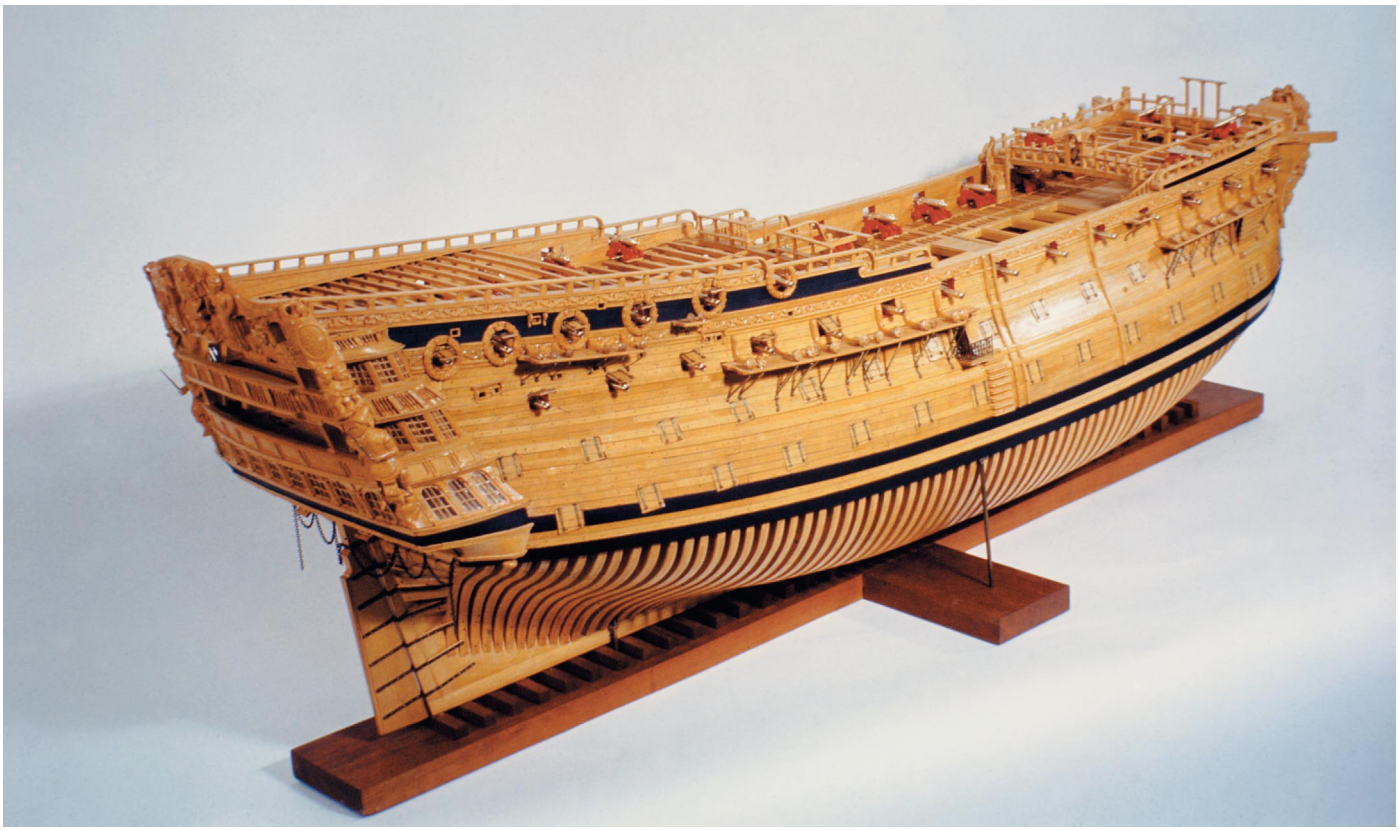
It is important to note that the manuscript by Robert Bruckshaw is a “Diamond in the Rough.” It was never completed and has been left as written, in its unedited form, with only minor changes made to the original text. It is not based on one model, but a collection of models. It is not a step-by-step guide on how to build a model, but rather the thoughts of a model builder sitting at his work bench, letting us experience his work through his eyes. It contains material on research, plans, lofting, building techniques, do’s and don'ts, cannons, shop hints, jigs, paint, rigging, and yes, even humor.

A special thank you goes to Lonnie Chadwell, Peter Constantine, David Hill, Rev. Cliff Fryda, John Kowalla, James Krauzlis, Bob Morley and William Nyberg for their time and effort in bringing this manuscript to its present form.

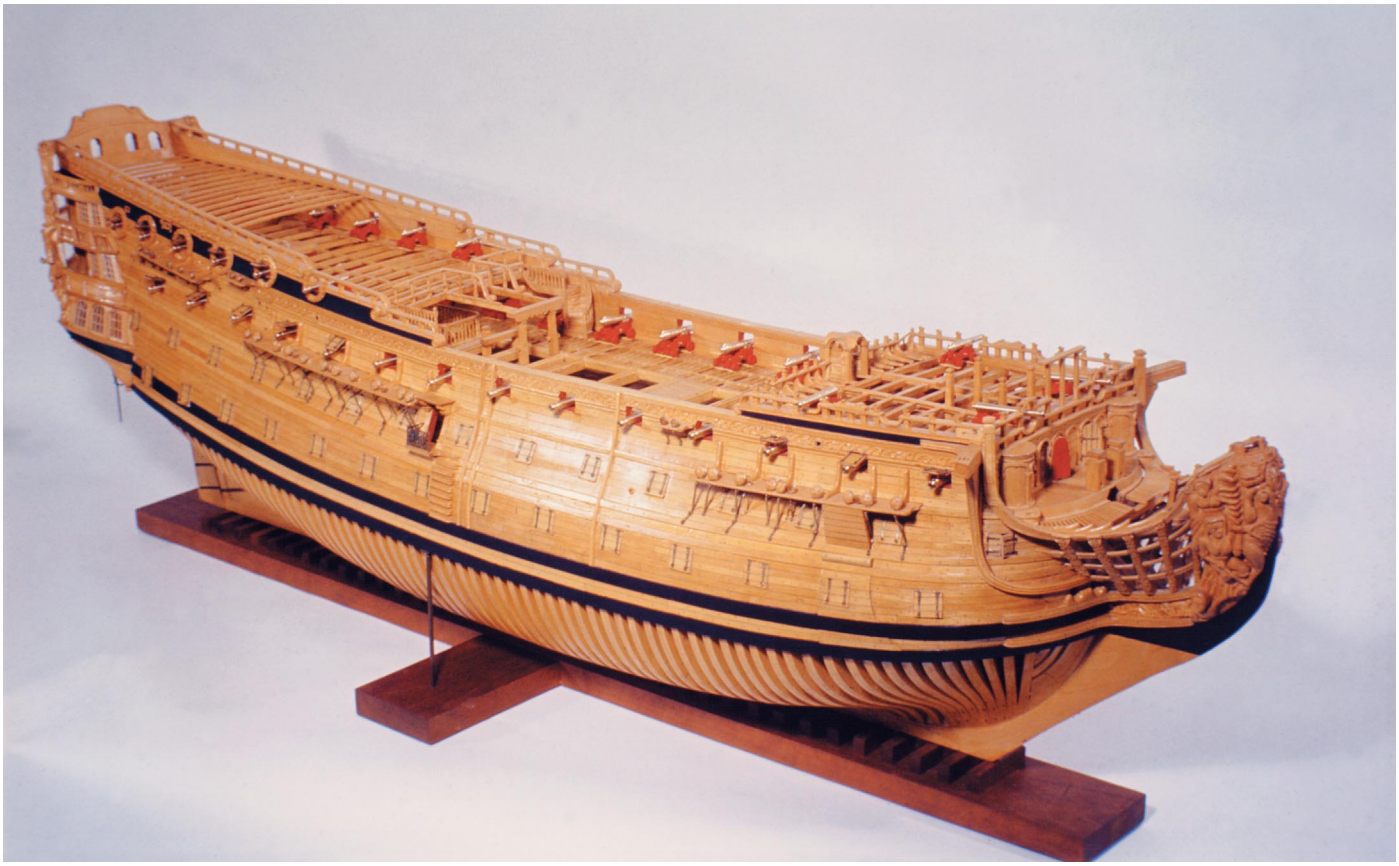
While only minor changes have been made to the original text, I have split the first chapter into 2 and reorganized the last few chapters. All photos were scanned and have been added where appropriate to illustrate the text. Scans of the original blueprints of the cannons drawn by Robert Bruckshaw have been added (see Appendix 3). These were drawn on three big sheets, but have been split to fit the page size. All original drawings in the manuscript have been scanned and are included. All photos not included with the text have been placed in a separate Appendix at the end.

I hope that as you read this manuscript, you will get the feeling of sitting in Robert Bruckshaw’s workshop, listening and watching as he worked on his models. That you come away saying: “Why didn’t I thing of that?’, “That’s a great jig to use”, “I'll have to try that on the next model” . That will be a most fitting tribute to Robert Bruckshaw and his legacy of building ship models.

Fred Verhaak



HMS Britannia of 1720 – First Rate, 100 guns
Built 1961



HMS Boston – 5th Rate, 24 guns – Built 1964

Foreword

Why build an Admiralty model? For years, I have had a model of the HMS Victory of 1765, sitting on the mantel, and then on a shelf. The most dominating feature of that model is the tallow-colored bottom of the hull. Eons ago, when I modeled the USS Preston and the USS Texas, the red bottoms of their hulls, except for the brass screws and rudders, tended to block out any view of the super-structure. On an Admiralty model, the absence of the planking on the bottom half of the hull diminishes its bulky appearance, and the open bottom is broken up by the spacing of the frames. The upper portion of the hull is separated from these frames by black wales. The open decks lead into the airy appearance of the rigging, giving the whole model a delicate, balanced influence. You can focus on the topgallant or a truck without a white hull blinding you. I find Admiralty models more pleasing to the eye and that is why I build them.

I have received calls from people about the plans that I have, and I try to tell them that my plans are simply photostats of the original drawing of the ship, and nothing more. Because photostats never accurately reproduce material, I draw only the lines necessary to make a part. I use one large sheet of paper for the sheer drawing, body drawing, and waterlines. I use 35 to 65 sheets for the frame drawings, and there is a sheet of drawings for each caliber of cannon. By the time I have finished a model, I have a file envelope full of notes and sketches on the various parts I needed. Drawings of bitts and gratings are done only to determine the space that they will require. There are no border or dimension lines.

There will not be a reference to the kind of wood used in the construction of these models. Personally, I use nothing but boxwood for the hull. The decision of using Swiss pearwood or boxwood is really up to you. I have made tests on the two woods, and found that when cutting the threads for the 6/32 screws, you get a better thread in the boxwood.

I have never had much enthusiasm about building a model of the HMS Elizabeth until I thought of her in a new light as being only a few inches larger than the 52-gun fourth rate HMS Falkland of 1720. The National Maritime Museum, Greenwich, England, had plans of the Elizabeth dated as a ship of the year 1720. Mostly out of curiosity, I checked the ship out while visiting the Navy Library in the Navy Yard in Washington, D.C. No reference of her could be found except in the description of naval engagements. Consequently, by checking back earlier, I found that an Elizabeth had been sunk in 1704 and a new one was built in 1706. This one lasted until sometime in the 1740's. The date 1720 must have been put on the plans 14 years after the ship was built.

When I got home, I checked the drawing with the "Establishments" in Derrick's Rise and Progress of the Royal Navy, 1806. Although the drawing does not have a scale, the distance between the perpendiculars checked out exactly. When you notice the crowded condition on the quarterdeck, you can understand why in 1733 or 1734, she was reduced to 64 guns.

When you receive plans, you will notice that they are rather vague in several respects, especially in the third dimension. A little foresight when ordering would have helped, as you could have ordered several plans of ships of the same rate. What is missing on your drawing may be shown on another. There are exceptions to all rules, but if an item is represented on several drawings and not yours, then you are probably safe in incorporating it into your plans. Also, to save time, when ordering plans for your next model, order a sheet of another ship and time. You never can be sure of what your next project will be.

Robert V. Bruckshaw

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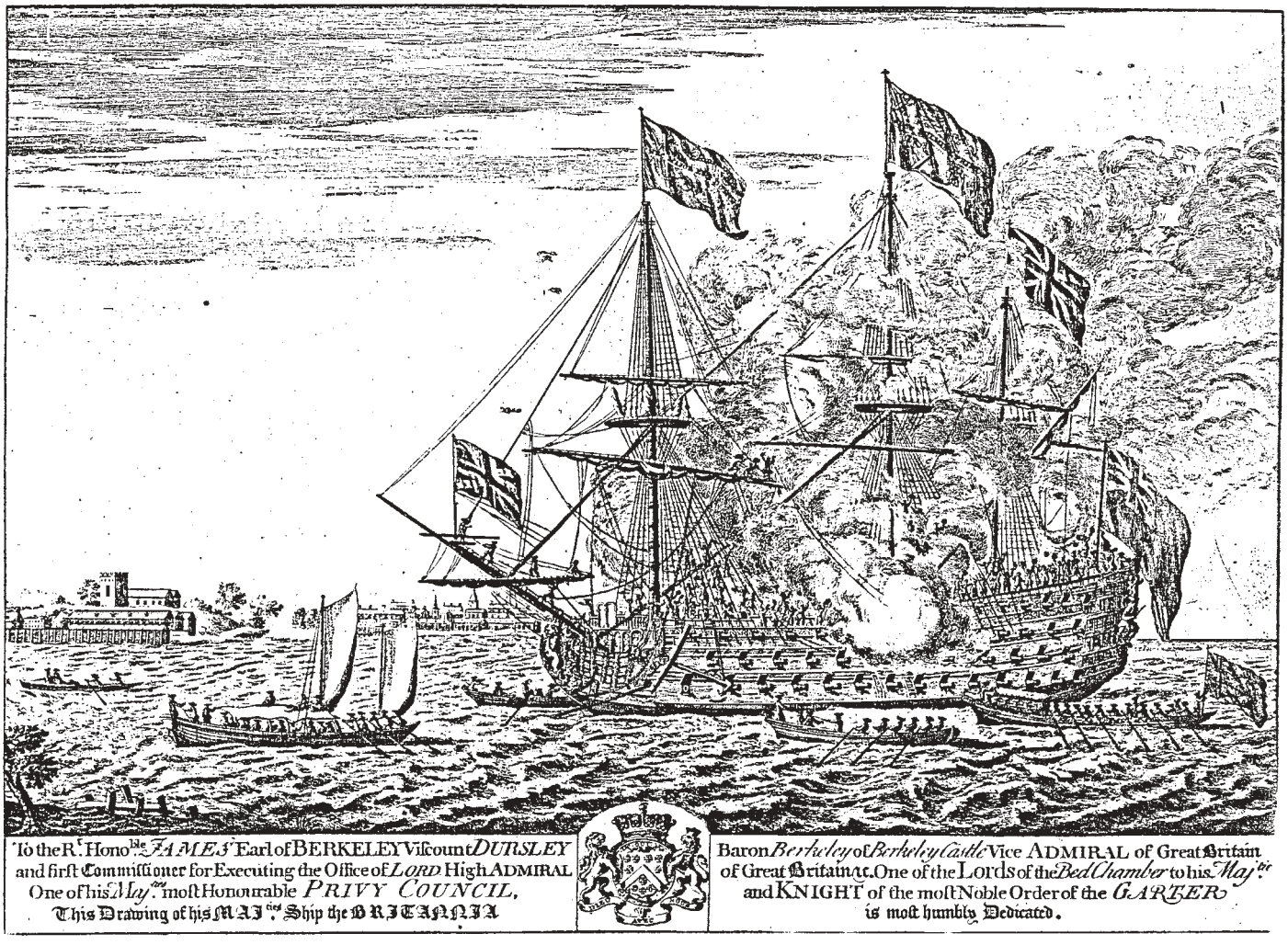


CHAPTER 1

General Information

ADMIRALTY MODELS OF SHIPS

Creating, making, or building models of ships is another form of marine art. We should think of art as the dictionary describes the word: "The human ability to make things, skill." The dictionary is careful, in further description, not to draw a hard line and say this is and this isn't. Both you and I have seen many beautiful works as well as daubery. On some of the old Admiralty models dating back to the 1600's, the carving has been reported to be the work of Grindling Gibbions.

Maybe I had better stop here and explain the difference between a model of a ship that only one person in a million has examined and knows enough about, and the ship-model that everyone thinks he is fully knowledgeable about. A ship-model is a small example of a vessel that a sailor or ship's carpenter has made. Knowing little about art, it is so far off scale that a scale equation is never mentioned. Today, we see them as something used to suggest a sea atmosphere by interior decorators. A ship-model comes in a box all researched, precut, and twenty-five percent formed. Sort of like the paint-by-number sets. Sometimes a model that is struggling to become known is referred to as a "carpenter's model." This is a little above the sailorman's model or ship-model.

Admiralty models were created by artists hired by a shipbuilder or naval architect. They were commissioned to help show a new design for a ship, possibly one carrying more cannon feet in length for an easier entry. This model is presented to the King and Admiralty Board to get their approval so money can be released for building the new ship. The planking below the wales and on the upper deck was omitted to show the construction and the lines of the hull. Also, they were fully carved, painted, and gilded to help please the eye of the King and Board.

Since rigging was only altered enough to warrant a change in design about every twenty years, it was necessary to just present the ship's hull. After approval, someone would continue on and rig the model if there was a reason. Maybe the person who ended up owning it would have it rigged for prosperity. After launching the prototype, a name would be available for the replica.

Every once in a while when a great number of suggested changes were sent to the Admiralty Board, they would publish a set of changes for that year known as "The Establishment." For example, "The Establishment" for 1720 on boats would include a list of the various sizes, or rates, showing what boats and size, etc., were to be assigned to each rate. The same was true with cannon. Their size and number for each deck aboard each rate, their weight and length, etc., were duly recorded. In the book called "The Rise and Progress of the Royal Navy" by Charles Derrick, 1806, the appendix has a number of tables showing the various "Establishments," including those that affected the length and breadth of different ships. The tables may cover seven-to-forty years. Here you can tell when the transition between brass cannon and iron cannon took place, and or which size, and when certain sizes were adopted and discarded. It will be noted that the word "gun" has replaced the word "cannon," even though they were still muzzle loaders.

"The Establishments" also helped in maintaining some uniformity in the supply department. Imagine the extra work caused when filling an order for five or six different sizes of shot plus five or six sizes of powder charges. Ships of a much later date solved this by having cannons all the same size or at least the bore size was identical. (The supply problem was a disaster for all navies, as evidenced when the La Ville de Paris ran out of ammunition, enabling the British to capture her. She was consequently lost in a storm off Newfoundland on her return to England with the British fleet.)

A very helpful book published in 1948 and again in 1962, is called "The Shipwrights Trade," by Sir Westcott Abell. Part one covers man's early shipbuilding efforts in the fourth millennium. Part two starts with the Tudors, their contribution, and a brief about the master shipwrights such as Burrell (1630), Matthew Baker, Phineas Pett, Anthony Dean, the Stuarts, and William Sutherland. Sutherland wrote the first Textbook, a product of thirty-two years of study, which is the basis in building models of ships.

Abell continues on to describe the iron and steel ship-building, but devotes over half of his book to wooden ships. Included is the use of the ellipse in locating the hang of the deck, main breadth, rise of the floor, width of floor, and other uses. One cannot emphasize too much the importance of precision drafting in laying out the lines for a model, since there are hundreds of points that must be picked off from one drawing, and transferred to another to position the lines which form the shape. Remember, the use of fillers and paint to cover them is never used. If it is a bad joint, the only thing to do is to dismantle and rebuild the section. Or maybe just that one piece. Sketches and paintings are done in complete ignorance of a third dimension. There are so many pitfalls in researching that it is difficult to forewarn you what to expect next. Remember, Sir Wescott Abell's book is also a textbook, and we intend to use the information found in the first half.

THE SEEDS ARE SOWN

In the beginning, it was just a matter of waiting until the moment before the last rain drop was about to fall, then making a mad dash to the wood lot to find six or eight sticks or chips, then down to the stream at the bottom to the hill. The amount of water from the surrounding streets and yards didn't last for more than an hour, but the small pools left behind would remain for four glorious days. This was enough to sail my supply of sticks and chips, which were really old Spanish Galleons or large battleships that I'd seen in the movie house.

The idea of placing a sucker stick for a mast and making a paper sail probably came from my older brother or some of his friends. I was making "boats" from wood shingles with a rubber band paddlewheel long before I ever saw the idea in print. I don't think I have ever built a finer model of a ship than those that were sticks and chips.

Francis J. Reynold's book "The United States Navy From the Revolution to Date" was one of my first books. It came with a magazine subscription from F.P. Collier and Son. I don't know when I began going to the public library - I was probably forced to go there for a school assignment - but it started a good habit.

I think I received a lot of encouragement from my high school mechanical drafting teacher. I was never fortunate enough to see his finished models, but he had a hull of a merchant ship, possibly an Indiaman, in his office. I never missed a chance to look in at this every time I passed his door. I guess he started me on the larger scale by explaining the improvement in scale 1/8 inch to 1 foot over 1/16 inch to 1 foot. He also stated that the better models, such as those found in museums, were built in the scale of 1/4 inch to 1 foot.

The town where this took place was in the middle of an Iowa corn field with coal mines scattered close to the railroad lines. Sort of a remote place for naval interest in those days, but I mention all this to give hope to those who are still land locked. It doesn't have to be a handicap.

Being born and raised next to a lumberyard helped in keeping my interest in wood alive. The shaft mines around the country needed a great deal of large timber for boxing in the shafts and making the elevator cage runners. As a result, I've never had a problem visualizing large timbers while planning a model.

Until the end of World War II, model makers were more or less controlled by the plans and information published in a few magazines. I was no different, and purchased a set of plans for building a model of the H.M.S. Victory, 1805, from a publishing firm in England. The hull was almost finished when I received information about a set of plans from the National Maritime Museum in Greenwich, England. Why I sent for them, I don't know, but it was a blessing. They were authentic, not the imagination of some draftsman from a publishing house. The differences were many, and I even had to fill in all the gunports, relocate, and cut new ones. This cured me of secondhand information.

When we moved to Toledo, I learned that their Public Library and Museum of Art could be an improvement in my source of information. Here I found such books as Chapelle's "American Sailing Navy," "American Sailing Ships," and "Small Sailing Craft," Clowes' "Catalog of the Models in the Science Museum, London, England," and "Old Ship Figureheads and Stearns," Davis' "Built-up Ship-model," Bowen's "Carrack to Clipper," and Vercoe's "Naval History." These were all first editions, not some-one else's interpretation. The said thing is, the books we need today are on the rare or scarce lists. My own library covers only from 1690 to 1820, centered mostly on the first half.

RESEARCH INVOLVES MORE THAN ONE BOOK

I remember my research for the figurehead for the model of the Continental Frigate, Raleigh, 1776. The figure was naturally supposed to be that of Sir Walter Raleigh. Well, the librarian found six or seven books about him, and in five of them were copies of paintings of Raleigh. Each

was so different that I am sure in real life they would have never recognized each other. So, from all five, I made a carving for the figurehead.

A book, written by David Steel, in 1794, was used to guide the details for the rigging. The twenty years difference isn't important as the idea had to have been in use for two decades before anyone had the nerve to write about the facts. The lines for the model were taken from Chapelle's book "American Sailing Navy." This plan was drawn from an Admiralty plan made after her capture. It was a practice of most navies to take the lines from any captured ship that showed good sailing qualities. The carving on the stern was taken from Clowes' "Old Ship Figureheads and Stearns."

Making my own lines and cables from linen yarn was found in a how-to book, These were three, four, and nine strand ropes, left and right twist, depending upon their specific purpose. Cannon were never all the same, as the chief requisite was that they could use the same pound ball. Sometimes, after making a foreign port, they would trade their cannon for something more uniform. The size and making of anchors can be found in Steel's book on rigging, which also covers blocks, sails, masts, and yards. However, it must be remembered that Steel was writing about English ships, and although we had the same standards, we did from time to time, vary when we thought our method was better. It is very important that the proper piece of equipment be used only for the correct time that the model represents, i.e. if the model represents the ship's hull (like mine), at the time of launch; if rigged, at the time it finished fitting out. It may very well not look the same a very short time later because some captains made changes after they were at sea, probably based on experience to improve her sailing or just a whim.

After finishing the Raleigh model, I received a listing of all drawings in the National Maritime Museum, and a small booklet containing a list compiled by A.H. Waite.

All of my life I have wanted to make a model of a battle-ship in 1/4 inch scale, but the hard fact that a replica of this size would be in the neighborhood of 20 feet long put this idea on the back shelf. After completing the Raleigh, I realized I could model a battleship if I moved the date back 200 years. I had on hand many model ship photos as well as the NMM catalog. From this I could select a subject I would like to build.

That was my first mistake. There wasn't enough information about the H.M.S. Britannia, 1682, 100-gun. The model in the museum at Annapolis shows the ship as she appeared after her rebuilding in 1700. In the book, "Van De Veld Drawings," compiled by M.S. Robinson for the National Maritime Museum by the Cambridge Press, plates 603 and 610 do not show enough detail. Mr. Arthur Tucker of the NMM suggested that I use drawing 631714 showing her as she was rebuilt in 1719. When the plans arrived, I found they were copied in the scale of 3/16 inch = 1 foot. This meant a redrawing of all lines to increase the scale to 1/4 inch = 1 foot. No details on the carving was shown on the drawing. Consequently, I wrote a letter to Dr. R.C. Anderson, a well-known top-authority on this period in England, asking him for help with my research. While waiting for his reply, I enlarged the drawings and experimented on the different finishes available.

Dr. Anderson's description of the stern, and figurehead carvings, as well as many other details was certainly an inspiration to finish the model. He sent me a photograph of Kent's engraving taken after Baston's painting, stating that Kent's engraving was very precise and authentic in detail. Here I would like to start from the figurehead and go aft in describing the detail and research.

BRITANNIA'S DETAIL AND RESEARCH

The figurehead was a carving of a double-headed beast, sometimes referred to as a lion, but whoever heard of a two-headed line with two tails? I suppose, however, it was a first cousin to the lion family. On its chest was a medallion of the Hanover family with the familiar GR for George I who became King of England in 1714, the same year the Britannia went in for rebuilding. In back of the double-headed beast, are two angels on the port side and two on the starboard, one of whom bears a sword. Below the feet of the beasts are the heads of fallen kings and other rivals, trailed by the head and shoulders of a Merboy. The deep, four rail head of this period had its timbers and rails covered with various vine work and heads. All the information I could find about this period, still only gives two seats-of-ease located on the heads. But, anyone who has been close to the British Military is familiar with the contrivance known as the "Honey-Bucket." For a crew of seven hundred, there must have been several dozen located strategically about the different decks.

The structure with three uprights crossed with a beam, was the beginning of more mail. One letter went to Mr. John M. Stevens at the Maritime Museum of Canada, Halifax, Nova Scotia. Through his research, I found out that the structure was used for hanging. The location of the deadeyes and channels were researched from various sources, and again in R.C. Anderson's book, "Rigging in the Days of the Spritsail Topmast."

Changing the date of the model from 1682 to 1719 was a good idea as the "Establishment" of 1703 canceled out almost all of the elaborate carving. Instead of the timberheads on the forecastle being carved into heads or knights, etc., they were left in a shape known as the thumb and finger style. The wreaths around each port on the upper deck were removed, leaving only the wreaths around the ports of the quarter deck. The style of Belfry, which lasted about 80 years on large ships, was introduced about this time.

It is believed that Britannia had the last of the curved stairs to the forecastle, as well as to the quarter deck. The grand staircase aft of the mainmast leading down to the middle deck was in use for almost another hundred years. Although not so grand, it was a double-width arrangement. The entry port on the port and on the starboard no longer had the usual carved brackets. They were replaced by an iron rail of a design that must have been influenced by some French ironworker.

The stern research required help from several libraries in Toledo, the librarian at the Toledo Museum of Art, and from Dr. Worfield of the Smithsonian Institution, who was very helpful on the dress of the curriersuer on the quarter pieces. His attire showed some of the change from metal armor to a tough tanned leather. It is interesting to note that the leather hat or helmet the figure is wearing, was referred to in one case as a liberty cap, not mentioned again for 70 years, and then by the French. The figures above the curriersuer are cupids, no reason given for their appearance. Above them is a shield containing the Royal Coat of Arms of the Hanover family on a shield. This had to be changed from the Stuart's Coat of Arms. The three figures on the stern are interesting. King George I is seated in the center with one of the three Furies on his right. Back again to the library for a round or two with Homer and other works on Greek and Roman Mythology. I decided the figure was supposed to be that of Tisiphone. She was the one who pulled the hair from her head, and the hair turned into snakes which she cast at anyone she disliked. On the monarch's left is a figure of Justice. It was said that George I dealt out Justice with a vengeance.

I don't know how many times this method of research has been tried, but I was getting nowhere on the next project. After sending letters back and forth for about three years, I got the idea. I made a list of the known facts, who the known facts, who the authorities were, and how many agreed on each fact. Copies were sent to all known sources in and around the area who should know about this particular ship, asking them if they could add anything more. If not, they were asked not to cause any embarrassment after the facts were published, The Cleveland Public Library was the main contributor, as they are located only a few blocks from the old shipyard. The information they sent was about a small schooner built in 1810. A model was reconstructed almost in a reverse fashion.

NEW PROJECT, OLD PROBLEMS

On my next project, plans were received from the National Maritime Museum, as well as Chapelle's plan from the Smithsonian, which is also published in his book, "American Sailing Navy". All but a few small ships of this period had a lion figurehead. The plans were detailed enough so little research was required. The search for the description of the stern carvings was as complete dead-end. Rather than design something that couldn't be proven, I decided to leave it blank.

All photostats, when taken in two parts, seldom if ever agree. Therefore, the drawings I do are never a complete set, but rather individual units such as the detailing of a window frame or how the pumps were made. Other sketches made are of the individual frames (55 to 72), keel, beams, hatch locations, and the length between perpendiculars. Sometimes, but not always, I include the length of the gun deck.

52-GUN H.M.S. FALKLAND

The next bit of research was for the first naval ship to be built in North America in 1692. She was the 52-gun fourth rate H.M.S. Falkland, built in Portsmouth, New Hampshire. So, contrary to a lot of historians, just 72 years after the Pilgrims landed, we were building ships of 128 feet in length between perpendiculars, carrying 52 cannon, a great many times larger than the Mayflower. The plans for the Falkland, 1720, had been located in the National Maritime Museum, but I had to make sure this was the same ship and not a new one. It was discovered in the margin of the 1720 tracing or drawing, a date of 1702. This was construed to be the date that the lines were taken off the ship when she was possibly being readied for the West Indies. After a meeting in the Smithsonian, it was decided to ahead on a model of this ship.

This discussion on the pros and cons on the plans, the furniture, bulkheads, etc. lasted almost six years. It must be remembered that a lot of research is done by specialists in their spare time as they (the museum) aren't being paid for the specialist's time. When the model idea was first conceived, it was thought that we could show her as she was built in 1692 with all the fancy carvings of the period. Drawings showing her in the 1962 condition were done, but after more research about the man who built her, it was decided to keep the model as simple as possible. There must have been talk about doing away with fancy work long before the "Establishment" of 1703. The only carving done on the model was the figurehead.

Another trip back into Homer's Mythology was for the figurehead of the H.M.S. Serapis, 1779, a 44-gun ship. Serapis was made famous as the English ship that was captured while the Bonhomme Richard was sinking during the Battle of Flamborough Head. According to some references, Serapis was a God of the Lower World, yet others said he was Neptune's son. I recruited Mr. Charles Child, well-known owner of Child's Gallery in Boston, to help me discover whether Serapis' right or left hand was the one to be raised. Mr. Child stated that the painting by Robert Dodd was the most accurate, as Dodd took great pains in his search for detail.

The stern was another matter. A Mr. Dupree was to have made the medallion celebrating Jones' victory at Flamborough Head. In the view of the battle, Dupree shows the stern of H.M.S. Serapis. Now in his notes you would think some sketch would have been kept, but letters to the museum, failed to shed any light. Under strong magnification, the medal's centerpiece seems to be a flower or weed. No one in this country would forfeit his reputation to tell me what the centerpiece was supposed to be. Finally, Mr. Archbald of the Department of Egyptian Antiquities in the British Museum gave me a description I could use.

I do believe the most difficult part of this research was trying to locate Serapis' hull lines. She was built in 1779, but plans were nonexistent. I had checked the period six years before this to find a plan for the H.M.S. Roebuck, 1774. Date of plan when received was 1773, and it contained a list of ships that had been built from it. In the latter part of the list, I found the name Serapis.

So, the plan was drawn in 1773, but the ship was not constructed until 1779. The habit I have formed of ordering more than one set of plans because of the time it takes to receive them, finally paid off. Eleven ships were built from this one plan!

At present, more plans and material are struggling to become a model. When finished it will be the H.M.S. Elizabeth, 70-gun, 1706. This is an interesting vessel, because she had a double open stern gallery, only two windows on the quarter galleries, and lack of any port wreaths at this date. The plans said 1720, but research in this date shows no 70-gun ships were built in this period. A ship named H.M.S. Elizabeth was lost in the West Indies in 1704, and another appears on the naval list in 1706. This one lasted until sometime in the 1740's. The date 1720 must have been scribbled on the plans 14 years after the ship was built.

MATERIAL

When I think of the wood to use in this type work or when I am asked which wood I should use, I am reminded of a little story. A friend of mine who likes to indulge in early American furniture, built a model of the U.S.S. Constitution. From what I remember, the work on her was excellent. Being left in natural finish, the fitting of the joints were always visible. My friend told me that the only mistake he made was in the choice of wood. He used a maple, grown locally. His reason was that maple furniture was lasting 250 to 300 years, so why not a model? Well, Admiralty models are not made of maple. They are made of Swiss pear or boxwood.

Several years ago I attended several national conventions that were concerned about the woods use in modelbuilding. While there, I tried to get an idea on what they thought about the use of maple, cherry, hawthorne, and other hard, dense woods. Because these didn't have a history like the boxwood or pear, no one would venture an opinion.

The boxwood mentioned above can come from Southeast Asia, Europe, or South America. I believe that the Asian is more dense, and the South American is clearer than the European. The purchase of the wood by a log will give you more freedom as to size. Cost is by the pound, so you may buy some water. Boxwood can also be used for masts and yards, as well as any other woods. For myself, I have elected a wood for masts and yards known as Sitka spruce. The growth rings will vary from 20 to 38 per-inch which makes a string yard when reduced to a size necessary for the model. The fineness of the growth rings will insure at least two rings or grain in the small yard arms. This will reduce breakage in the handling received in maintaining such a model.

Another reason for selecting boxwood came to light when I was experimenting with different woods. Some parts are more solid when brought together by the use of a machine screw. After drilling and tapping holes in sample pieces of boxwood and Swiss pears, I found the boxwood still had about 30% more threads intact than the Swiss pear. For a qualified finish, we can use Ralph Mayer's book, "The Artist's handbook, and select one of the formulas. Or, we can buy one already manufactured and sitting on a dealer's shelf, which everyone suggests. Naturally, a natural finish is a must. The only paint required is the touching-up to highlight various pieces. The black wales help separate the upper and lower halves of the hull.

Which brings me to a point about the difference between modern models of modern ships and modern models of old ships. When I stand back and look at a battleship of today's size, the detail of the superstructure is overwhelmed by the massive plain hull. On an Admiralty Model, the absence of the planking on the bottom half of the hull diminishes the bulky appearance. The area covered by the rigging, which is almost twice the size of the hull, also helps reduce the hull's size. We are not trying to cover the details of the hull, only to balance the whole model so it is pleasing to the eye. The amount of gold leaf used on the model is minimal, but most exacting. Although the drying time is too long, I have always used an oil color.

SOME BUILDING MATERIALS

Bleached linen yarn is used in the manufacture of the various sizes of ropes, lines, cable, and other cordage. Sometimes three strand cord can be purchased in the correct size, but never plan on this happening. The yarn is laid up in three, four, and nine strand lengths long enough for the model. The machine for doing this can be found in articles published in journals and magazines dealing with model ships.

All rope sizes are given in circumference, if you are using Steel's book, I have found this more convenient, especially when the size is scaled down. Sizes can range from 5/8 inch to 24 inches. Actual scale diameter equates out as 0.0041 inch for the 4/8 inch and 0.1591 inch for the 24 inches. Knots are kept to a minimum as to practice. Splices are worked in with the use of a crochet needle. What is to be spliced, is spliced and what is to be tied, is tied. Coloring the rigging can be done with various natural stains, and should be as new rigging as the model most of the time represents the ship at the time of launch. Black rigging came about at about the same time as the copper bottom. After the line is made waxing is done to control the fine fibers that will raise above the lay of the cordage.

Glass is used in all lights and windows. Microscope slides are used because of their non-fogging qualities and I have found out that fingerprints clean up easily. The cover slides have the same qualities and are better if you are going to mortise the glass in the frame. Might mention here that a small circular saw is needed so you can cut pieces .010" in thickness by .020" to .025" in width. Glass used in old models more often than not was mica. Window frames were sheet brass with the panes sawn out.

Brass is the most accepted metal. There are times when restoring an old model the artist will find that pewter was used. Even in thin sheets for the hinges and strapping. What I have used and found in old models is brass with hard solder for connecting the ends and etc. This is the acceptable metal as described by museums. Of course, exotic metals can be used, but at today's prices, I don't think there will be an order for gold cannon.

Because of the small scale, natural building methods cannot be used. But, by the use of metal fastenings that can be hidden, greater strength and more permanency can be built in to ensure longevity. Super detailing depends upon how much time an artist has to spend on a model. Maybe he has only a year because of today's prices and if he is very fortunate, he might land a commission for two years. There still is not enough time in two years to really detail to model.

Chalking is done with the use of a hard black paper. Planking on the ship is finished so that a beveled edge will leave 1/8 inch space for caulking between planks for each 1 inch in the thickness of the plank. So, a plank 3 inches in thickness would be beveled to have a 3/8 inch space, when .020803" equals 1 inch, becomes .0076". About 1/4 inch of the caulking is left sticking out, then later is beaded over. This would make the visible caulking look like 1/2" or maybe 4/8" .0404015" or maybe .013015". The paper measures .008".

The use of tools is as different as the person that is using them. When my wife and I paint the house, I use a 3-1/2" brush and she uses a 1-1/2" brush.

CHAPTER 2

The Hull

The period we will investigate will be the period between 1700 and 1775, or the period between the fancy carvings and the copper bottoms. For convenience, we will assume that the plans you have are complete down to the carvings. An example of this kind of plan would be the 74-gun HMS Alfred, 1778. The photostat of the HMS Elizabeth was minus the stern carving drawing, and gave only an indication of a lion or beast for the figurehead. An indication like the top of a crown was shown just below the bowsprit. The stern carvings were indicated only by the outline of the amount of wood allotted for them.

After you have placed the photostat on the upper half of your drawing board with the bottom of the keel riding the centerline of your board, place a sheet of tracing paper over it. The paper should be at least 3x6 feet for a third or fourth rate ship. Now draw a line over the bottom of the false keel, extending five or six inches beyond it in both directions. Draw a perpendicular to this line, touching the point where the main deck touches the rabbit in the stern post. Next, draw another perpendicular forward to where the main deck touches the rabbit in the stem. These lines are known as the forward perpendicular and the aft perpendicular. The distance between these perpendiculars is 150 feet or 37-1/2 inches, measured in the 1/48th scale. One of the many reasons for building the Elizabeth was that among the many drawings that I have, this was the only one which actually measured 1/4 inch = 1 foot. In other words, 40 feet on the drawing board actually measured 10 inches.

Due to the shrinking of the paper during the process of developing or because of the paper's age, the points where the stations are located on the keel will have to be laid out. Some drawings from the National Maritime Museum do have a scale along the bottom of the keel showing the length from the forward perpendicular to the aft perpendicular. With this scale's help, you can transfer the distance between stations to your drawing. Sometimes the photostat will be short, even with the scale. One of my photostats was this way because the person who trimmed the paper cut off too much between ports six and seven. This was on a British ship built in North America. Like most ships built in this country, the ports are evenly spaced (a French practice). Sometimes the photostat will be made of three sheets of paper and you may end up with three different scales. When using the scale beneath the drawing, use only the part of the scale that is on the same sheet of paper. With careful measuring and picking up points, the distance can be easily transferred.

If you have a copy of the Elizabeth drawing, you will notice the regular scale under the keel is missing. In this case, a scale will have to be drawn to match the photostat. We will need to draw another line which represents the top edge of the keel. This is our base line. In the center of the lower half of your drawing, draw a centerline the same distance as the lines above. At this time, extend the perpendiculars down past the centerline. Then set up station locations on this centerline, and connect the stations above with the stations below. Now we move over to the body line drawing as seen through the tracing paper. Establish a vertical centerline through this, and also a base line at the bottom of the frames or body lines.

I don't know why, but it seems that there wasn't a set system for the distance between waterlines. Therefore, you will draw lines every 3 feet from the base line up to cover the last body line. If the drawing extends a little higher, draw another line, and extend the body lines up to it so you will be able to transfer points. Label your waterline A, B, C, etc. to O if need be. On a three decker, it would go higher than that. If you are working on a first rate, then you don't need this information. Ink in all lines except the station lines, which should be left in pencil.

Now we come to what might seem to be a tedious chore – transferring points on the body plan to a new location on the waterline drawing. It can be quite a job remembering what point you have picked up from the body plan, and where it goes on the waterline drawing. I don't think it is necessary to tell you that the body plan should have the same letters as on the waterline drawing. The use of French curves is a no-no, as the radius is too small. A set of six ship's curves should be purchased for this task. They are excellent tools. Later on, in some of the tight curves of the head and such, the use of French curves will come in handy.

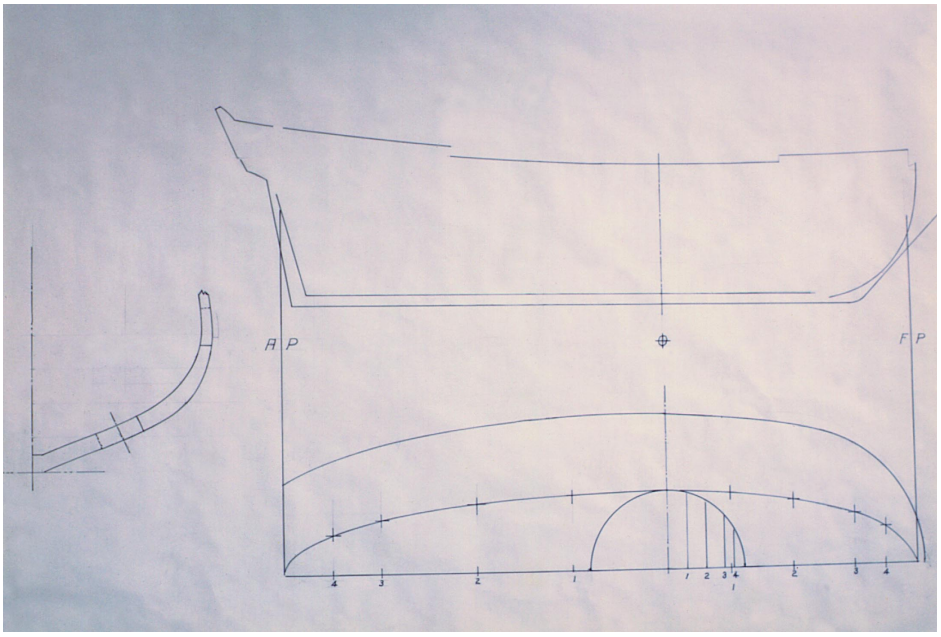
Many times on drawings that I have received from England, I have had difficulty with the waterlines at about body line 14 and waterlines B or C. When the waterline is drawn, there seems to be a small bump in it. This was caused by someone that didn't line up his curve properly at the point picked up between the original waterline and the new one. Consequently, strike a line through this bump. This is not a problem in Chapelle's plans because he took them out during redrafting. Ink in your waterlines, but do not ink in your station lines, because they will later be erased.

Figure 1 shows an outline of the sheer, the fore and aft perpendiculars, and a half of a frame. The drawing is exaggerated to simplify the operation. The waterline in the lower drawing is to show the molded breadth of the ship. This line represents one-half of that dimension. The location for the center of the position where the floors and first futtock are lapped together has always been a problem for me. To get it too close to the keel would produce the same problem. Realizing that the old timers tried to stick to ratio and proportions, I decided to try this method: A small half circle is drawn at the center of the main frame, its radius being one-fourth of the molded beam. The right-hand quadrant of this half circle is divided into four parts. The fourth part is divided in two. Lines are drawn to divide the quadrant into five parts. The distance from the center of the half circle to the forward perpendicular is divided into four parts with the last part being divided into two. When the points of this extended quadrant are connected, we have an ellipse.

Now repeat this same procedure for the aft. This line can be seen on the half frame, on the outside surface, as a centerline for the lap joint between the floor and first futtock. I have decided that the length of the joint for a ship of 100 feet or less should be 1 inch, 1-1/4 inches for ships up to 140 feet, and 1-1/2 inches for ships above 140 feet. This is a matter of opinion. Maybe you would like to have a larger lap, or a smaller one. The reason for this will be discussed later.

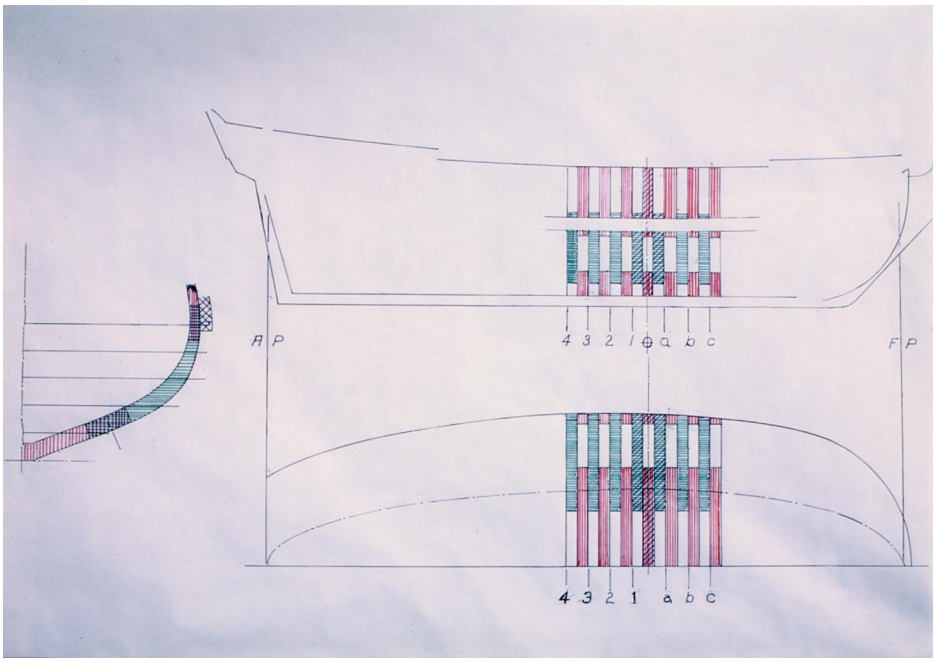
Figure 2 shows the shape of each individual frame. The thickness was always a problem until I built an experimental model. The thickness has nothing to do with the distance between ports. You will find on most English drawings that the ports are not equally spaced. Whether it is due to the spacing of the deadeyes on the channels or for some other reason, I have never found out. Even models that are unplanked have frames that are shifted even when the ports aren't equally spaced. The French? This is another story. But again, it is a matter of taste, or artistic license.

Make the frames 1/4 inch thick for ships up to 130 feet, 9/32 inch thick for ships between 130 to 150 feet, and 5/16 inch for anything above 150 feet. These fractions are never used in the actual measurement. The 1/4 inch frames are measured as .250", the 9/32 inch as .281", and the 5/16 inch as .312". All decimals are plus or minus .002", so the frames will have to be sanded down to their proper thickness. One quarter inch should be .448" to .502", and 9/32 inch should be .560" to .564", etc.



The main frame located at its centerline is composed of seven pieces: one floor, 4 first futtocks, and 2 second futtocks.

Now is the time to locate the main wale on the sheer drawing. The bottom edge is for locating the second futtock. You can transfer the location to the body plan, or keep track of its movement on the sheer. The bottom end of the second futtock is placed about 1/4 inch below the wale. Keep the end of the floor, and the first futtock perpendicular to the molded line, and the bottom of the second futtock parallel to the base



line. The lap of the first and second futtock should be the same as for the floor and first futtock. Now the main frame has a first futtock facing fore, and a first futtock facing aft.

Let us assume the frames are to be 1/4 inch size. The location of the screw or dowel will be in the center of the floor. This will make the face of the next frame 3/8 inch from center of the main frame. This is where you will draw your first line for aft frame number 1 and for the forward frame, as shown in the crosshatched section in the lower drawing of Figure 2. All holes on the keel for the frames will be an equal distance .500", or as near as possible. Lay out the locations by using the scale, not your dividers. The scale will correct you; the dividers will multiply your mistakes.

The lines to locate the points for each frame are drawn vertical to the centerline and 1/2 inch apart. These are numbered one to whatever aft, and a, b, c, then A, B, C, D, etc. forward. Never use the letter "I." It looks too much like the number one. Now get a sheet of tracing paper larger than each frame to keep from soiling the edges during assembly, or while handling them. I have had up to 73 frames to do plus filling pieces on some ship models!

A white card is a useful tool to help laying out the points to describe the frame. Make the card out of 2-ply Bristol board several inches larger than the size of your paper. Inking in the lines on the side and the bottom helps you to center each paper in the same location. This way it won't take so much shuffling to line up the drawing for checking. Draw a centerline down the center of the card, and several inches from the bottom, draw the base line. Every 3/4 inch up from the baseline, draw similar lines and letter them A, B, C, etc. Ink in all lines on this card. Now when you place your paper from the frame over the card, your lines will be established. Always include the centerline and the base line in every drawing of a frame. Their intersection will act as a register mark.

The upper line in the sheer drawing of Figure 1 is the line just under the cap rail. This is the top of the frame. As I said before, this book is not a primer, so I am not going to tell you how to transfer points. Always ink the lines of the frame drawings. When you have done several, stack them and hold them up to the light to see the shape the lines are taking. Also, the mistakes can be seen if one line is too far from the next.

The waterline drawing needs a few more lines between the inked-in 1/2 inch sections. This need only be done on the first and last third. On the middle third, there is not enough change in the lines to warrant the extra work. These pencil lines will show the contour and location of the first futtock. Now when you place the frame drawings one on top of the other, you will see a more graceful even rise.

The inside of the frame should always be kept in mind. Although it isn't necessary to draw this line, it is well to remember this short rule I made up. Where the first futtock laps the second futtock, the thickness should be 1/4 inch Where the frame touches the cap rail, there should be 3/32 to 7/64 inch molded thickness. From where the frame crosses the keel to where it crosses the dead-wood will be how much wood there is in this section.

The inside of the hull will always have to be finished off, because of the run of the bilge strakes, and the location of the shelves for the beams. These last items are mentioned a little ahead of time, but it is something to keep in mind. Ever since I observed a model in one of the best museums with its first futtock falling down and hanging loose from the hull, I have used the bilge strakes as an extra means to hold the frames in position.

All frames should be the full width of the hull, and extend all the way from the port side to the starboard side. When using half frames to make the cant frames, the weakness of the joint where the frame joins into the deadwood at the very tip of the half frame becomes a problem, since you have very little wood at the attachment point for strength. However, if you use a full frame, you have the thickness of the deadwood added on to reinforce the tip.

Photos of Admiralty models sometimes show the main yard. The camera angle makes the frames appear to bend

at the stem and stern. Of course if you are modeling ships from Chapman's Architectura Navalis Mercatoria, then the framing at the stem and stern is another matter. A good example would be the Hag Boat, or the Dutch Flutes as shown in M. S. Robinson's Catalog of Van de Veld's Drawings in the National Maritime Museum.

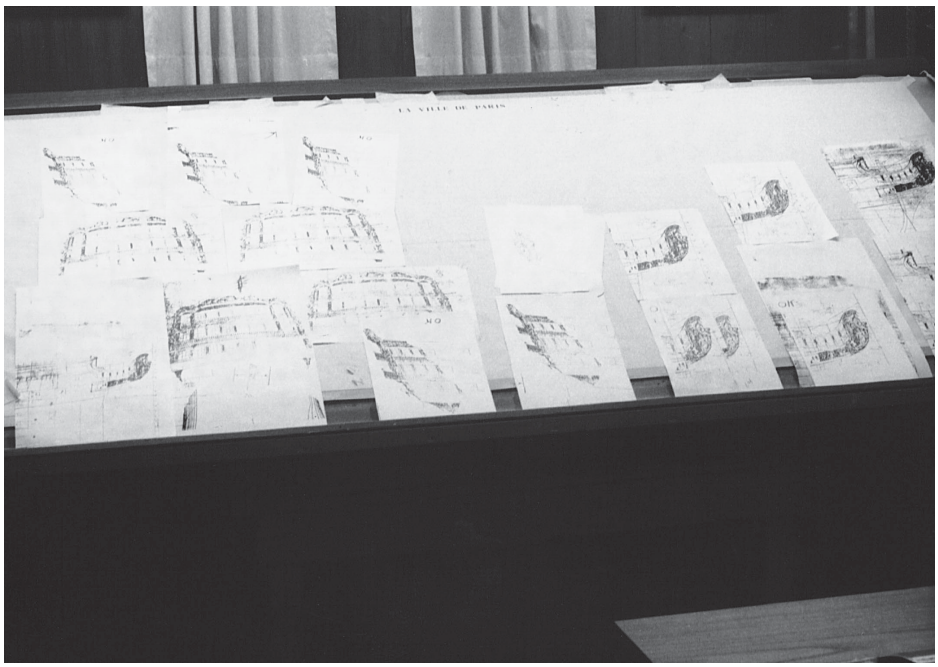
For these frames, making a notched template is unnecessary, because these frames are attached to the next frame in four places. Additional strength is supplied by the fastening between the floor and keel. Two ribbands are also tied along the sides about even with the upper deck, and another about even with the quarter deck.

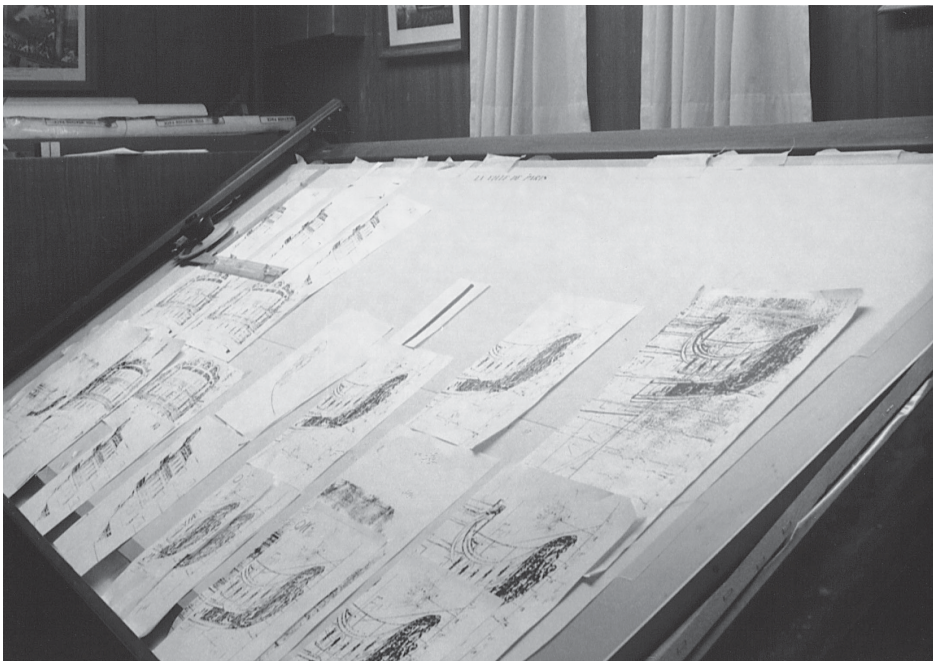
Because of the difficulty of aligning the center of these frames over the center of the keel, I made an improvement on the method that Longridge describes in his Anatomy of Nelson's Ships. I suspend a plumb bob from the center of the overhead frame. Attach to the cord is a length of calibrated cardboard which may be moved up or down the cord. The cardboard is graduated equally to the right and left of center, and the cord is passed exactly through the center mark. That way, when the bob comes to rest, one of the card's graduations will align with the center of the keel and show you how much to the right or left the top of the frame needs to be adjusted. When a new frame touches a frame already in position, there will be a layer of glue, don't forget to allow for it.

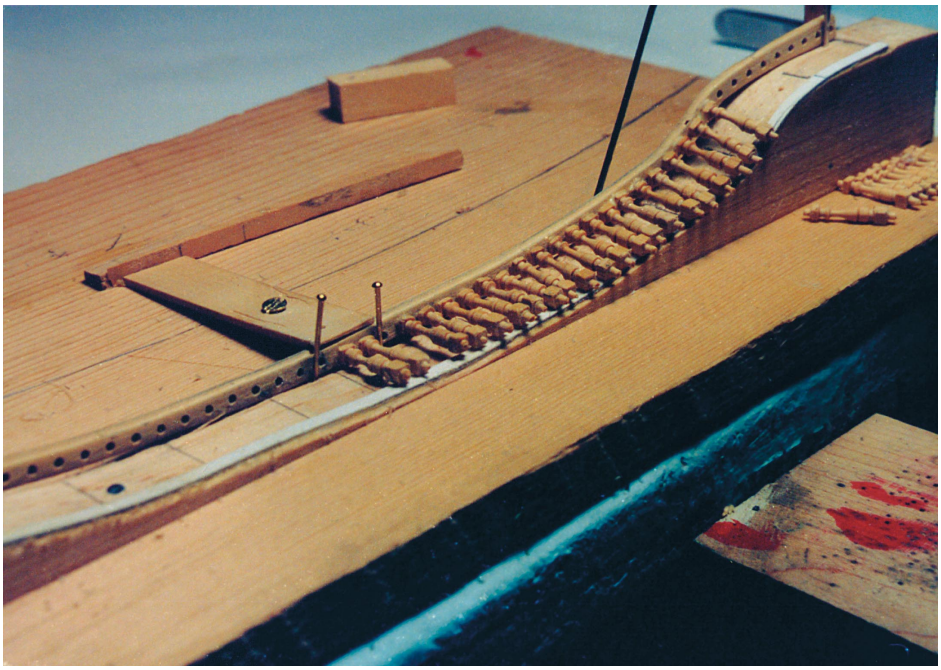
The after deadwood seems to start someplace in the vicinity of the mizzenmast or a little further aft. The width of the deadwood that I have been making lately has the wide part being the forward end. To find the width of this deadwood you will need to find the distance between the bottom edges of the first futtock and the first frame set into the deadwood. On the Elizabeth, that came to 4 inches. I found that the size of our deadwood should be 56% of 4 inches, or 2-1/4 inches. I am not sure how I got that figure, unless it was through trial and error, but that percentage seems to hold true from model to model.

The curved line where the frames diminish into the deadwood is at about the same place where the line diminishes in the body plan, which is 3/4 inch in 1/48 scale or 3 feet Otherwise, above this curved line is another curved line from the top of the block. This block is milled out every 1/2 inch with a 1/4 inch end mill from the top curve to the bottom on locations for the frames. Be sure everything is a good fit because this block takes a lot of punishment when being shaped down to conform with the lines. The block could be made up using not more than two pieces, so the seam would be on the centerline. Of course, if you are going to paint, anything goes.

The wooden dowels I used in my first models have been replaced with machine screws. Wood screws are not a good method of holding, as they are holding on a taper.





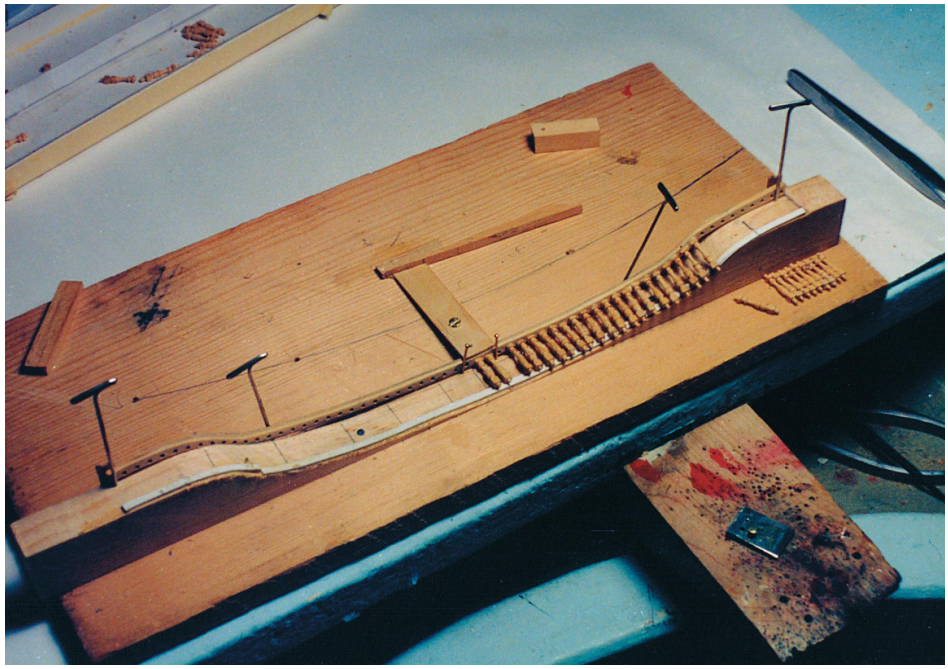


between the knightheads. The thickness of the stem is generally the thickness of the keel amidships. The difference between the knightheads and the stem will be the thickness of the aprons. Next to the knightheads are the hawse pieces with a futtock separating them from the next hawse piece. This makes the line of the lap joint of the floor and first futtock, line up with these two hawse pieces. Don't throw away scraps from your frame cutouts. These can be used as spacers, and later on as fillers, for location of the ports.

At a point between the main frame and the position of the mainmast, there should be a block, the bottom of which should be shaped to fit the inside of the frames, and the top is left flat. On centers are two holes placed 6 inches apart. The block should set down over the keelson and be fastened with several escutcheon pins, as the strain on the block will be downwards. The holes should be large enough for a 1/8 inch brass round or square rod threaded for a 6/32 machine screw nut. The block should be counterbored to receive the nut, which will be glued into the counterbores. These rods will be used for securing the model to the base, whether you use an oval or a cross. While you are making this block, you may as well go ahead and make the mast steps. Better make a set of lower masts, preferably from scrap, as they will be used for alignment should you get a beam in the wrong location.

Drilling and tapping for a machine screw will do for most frames. However, when you set the last frame aft and the first frame forward, the amount of material isn't safe for a machine screw, so this joint will have to be glued. This forward deadwood is a curved line from the top of the keelson to the backside of the stem.

Starting with the last frames forward, touching the base line will be either P or Q. The location for each floor forward from here will have to be laid out. You must be very meticulous in this, as the slots for the floors will have to be sawed out. The saw I use is available from most hobby shops. The back has been removed and placed so it covers only the last half of the blade, then it was riveted in place. This exposed end is necessary, because some of the cuts will be too deep for the back to enter the cut. If the slot is tight, try the frame to see if filing should be done on the fore or aft side of the slot, whichever has the most material.



The floor will join the keel at the rabbit line. Notice that this line changes from a V-shape to a "L", then back to a "V." This takes place while rounding the curve just aft of the gripe. There will be a frame that will come close to being used for a corner post of the beakhead bulkhead. This will be the last frame forward. Set up the hawse pieces on this frame.

Now you will need to know the diameter of the bowsprit. This dimension will show you the distance

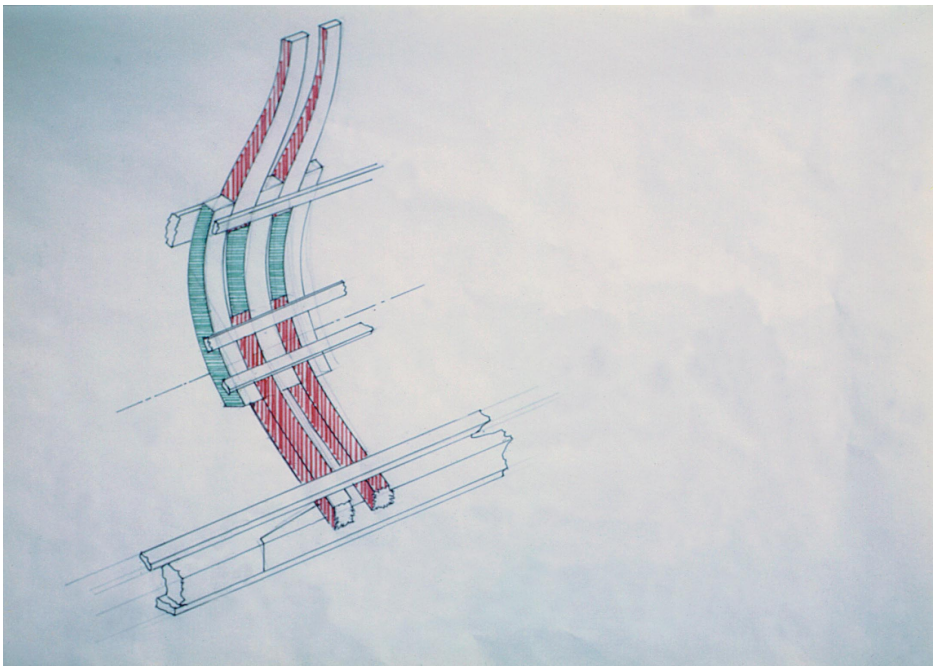


Figure 3 shows the schematic location of the lower deck shelf and two bilge strakes. The keelson is shown as an undersized piece. It is fastened by use of a larger machine screw in every fifth frame. Like all machine screw holes, this one is counterbored to conceal the head. Counterboring is necessary because of the fillister head used on the screws. This is not a standard fillister head, but a round one turned down to about .160" diameter. The drill used for counterboring should be about .180" to .190". This is large enough to allow for the shifting of the frame. Use a standard-size drill for the body of the machine screw holes. Standard countersinking wastes material on the sides and forms an ugly hole.

The ports are cut through the frames as shown on the photostat. Follow the photostat for their size. The tables vary so much, I feel that the photostat should be the best authority. If the photostat shows a port to be 3 feet wide by 2 feet 6 inches in height, and remembering what you have read in the past about port lids being let into the sides of the port a “couple of inches,” then this will make the port lid 3 feet 4 or 6 inches in width by 2 feet 8 or 9 inches in height. To form this letting into, keep the plank away form the edge of the port by 2 or 3 inches The lid is the same thickness as the planking on the sides of the hull.

Plank thickness including the wales are as follows: The main wales are 7-1/2 inches. The material between the wales is 4-1/2 inches thick. The plank above the wale is a little heavier than the other planking and measures 6 inches. There is only one run of this plank the length of the wale. If you paint the wales black, this plank does not get painted. The next planking is 4-1/2 inches up the chain wales, which are 5-3/4 inches in thickness. The next planking is 4 inches again, then some molding comes into use, and above this, planking 2-1/2 to 3 inches in thickness. No plank is over 9 inches or 3/16 inches in width. Deck planking is most 8 inches plus .008" is allowed for caulking material.

In a way, there isn’t much to say about the keel, but in another there is a great deal to be said. I found the width or vertical thickness of the keel from drawings of other ships of her weight and class. For the height of the keel, one must keep in mind that the false keel has a line on the plan as well as the rabbit for the bottom planking. The keel is made up in short pieces of about 10 inches in length, which represents 40 feet, I don’t think a sound piece could be found any longer. Eight feet on each end is used for the scarf. This makes the actual keel only 24 feet in length. The scarfs are made vertically on the ends of the pieces. If you will envision a schematic view of the scarf, there will be only a small amount of the seam showing, which would be the ends. If the scarf was made horizontally, the whole length, even the ends, would be exposed. As it is, the only part of the scarf showing is from the rabbit for the planking down to the false keel.

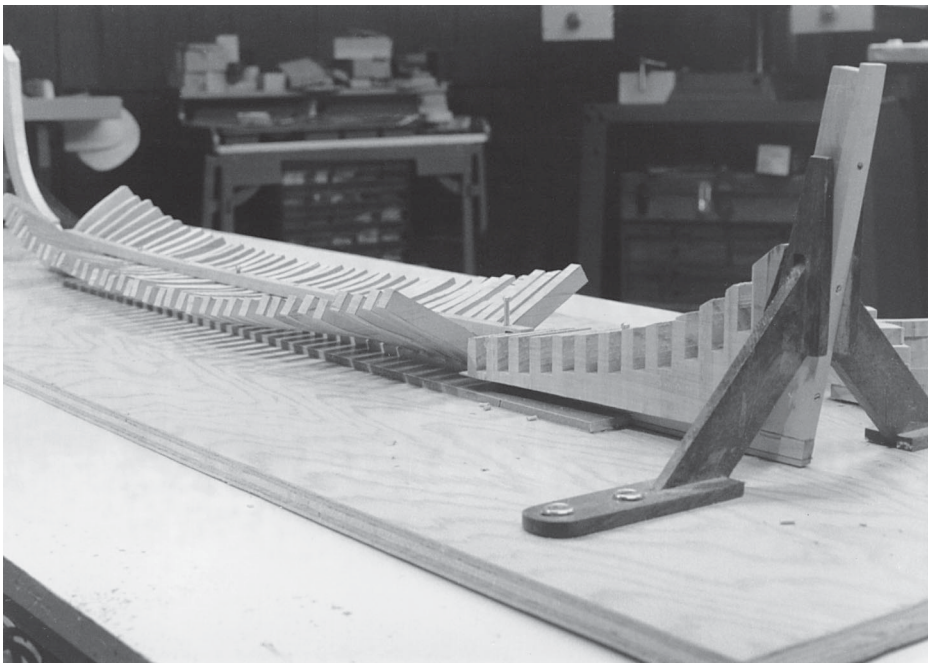
The height of the keel is not the same size from stem to stern. The normal dimension would be from the mizzenmast to about the foremast. The forward end (including just behind the gripe) tapers from a dimension 85% of the amidship to a dimension that would be 76% of the dimension amidship. The portion of the gripe that is tapered from the joint with the keel forward to the piece that seems to come up between the figurehead’s knees, is a dimension of about 4 to 6 inches. The stem maintains its size as it rises from the keel to the head or gammoning knee.

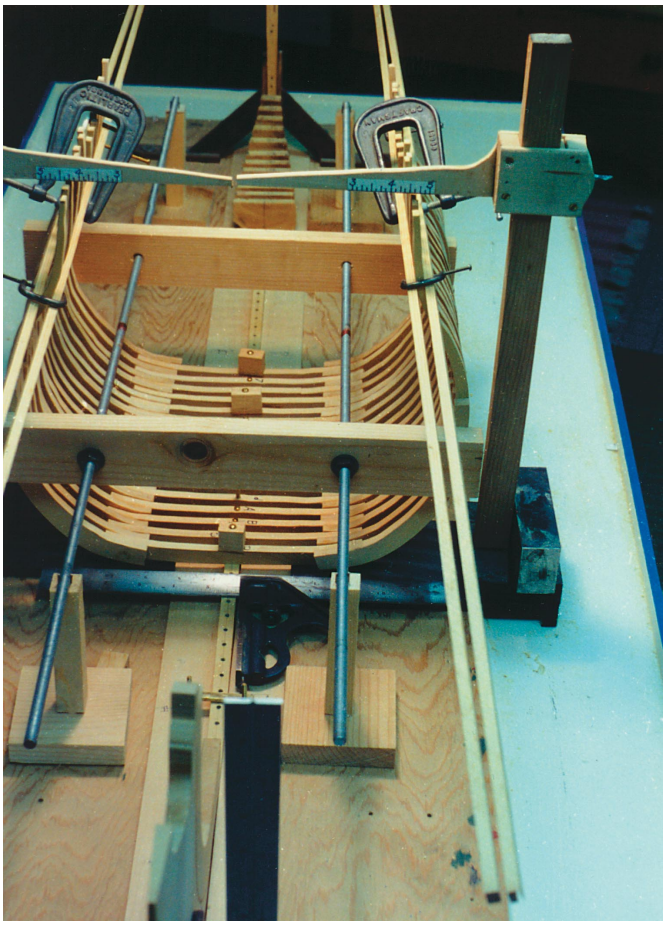
Most models have the whole stem assembly in one piece. It is possible, but not probable, that many would go to the trouble to build a stem up from the many pieces which should be used. The main problem is the many bolt holes to be drilled and the clinching. One piece glued up from several would make the stem as well as the deadwood, but watch your date when it comes to drilling the holes for the bobstays and gammoning. If you feel that moving the placement of the breasthooks are necessary, then that is up to you. The area above the knee of the head above the bottom of the wale is painted black, the same as the wales, so this allows a little liberty.

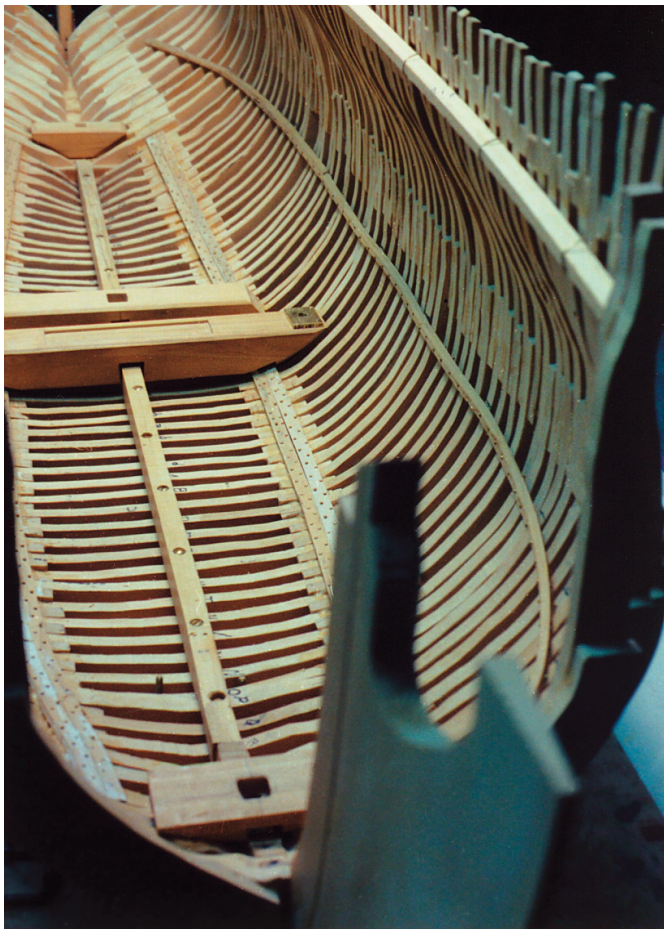
MICROMETERS

A micrometer is sometimes called a C-clamp, a measuring device, a hindrance, a method of confining your talent, or something to talk about. However, it really

is a useful tool, showing you the limits of work to be done. I doubt 50 or 60 percent know how to pick up a "mike." However, it is an important safety measure that leads to proper holding. To keep within the limits, will make the work simpler, as different items go together. If one item is smaller, and since this work is only designed to please you, the next part can be made to fit by being larger. Who in this world will remove a beam from your model to see if it is molded and sided to size and what kind of roundup did you employ and how much rise or altitude of the curve? It may help to know the number of planks that will fit into a space and that it's easier to keep them an equal size. Being equal in thickness will aid in the scraping down for the finish. It is not a work or tool to scare you. It is an additional helping hand to make you feel better about your modeling.







CHAPTER 3

Cannons

Ever since I told several people how to make cannons so the seventh one looks like the second, I have been going to write an article on how to make scale model cannons. In the year of 1756, William Mountains wrote a book called "The Seaman's Vade-Mecum and the Devensive Was at Sea", London. In this book, along with the rigging, he discusses the parts of the cannon that were of concern in those days. The tables he sets up bring a lot of room for discussion. It has recently been brought to my attention, the writing of William Mountains has been copied in part from writing of the 1600's, i.e. the closed bottoms of the gun carriages.

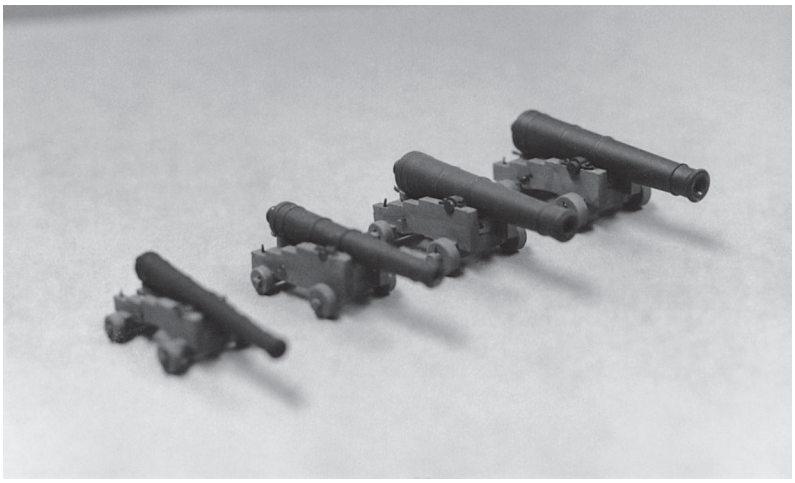
In a section he call VII, he states, to find what ball is fit for any cannon. If a ball is too little, the powder has too much vent. The force is therefore diminished, and it will not fly so far, and if it be too big, it endangers the spitting of the piece. The rule therefore for fitting a ball is this, viz. Divide the diameter of the Chafe into twenty parts, and take nineteen of said parts, which will be the diameter of the shot required. Chafe is another word for bore. Now this brings in many thoughts as to what kind of iron was used. Disputing old authorities?

Lets take a case of the forty-two pound cannon. Diameter of the bore is 7 inches Seven divided by twenty is 0.35 inches, nineteen times .35 is 6.65 inches. Today's tables in Machinery's Handbook on page 1580, show case iron to have a weight per cubic inch of only .2600 pounds. Now, all the claims about "Bog Iron" being a sponge mass, thus light in weight. It seems that the iron that was poured in those days was as good as what is poured today. There are so many problems that could and would affect the weight of any casting, the fact that the placing of the header in the mold and the height and weight of the header will affect the interior of the casting. I can remember when I worked in a foundry, high school summertime job, castings that were hollow due to gas pockets. So, an iron ball 6.65 would only weigh 40.035 or .953% or 42 pounds.

The breech, the area around the touch hole, between the base ring and the first reinforcing ring, the circumference is in proportion to the metal used to cast the cannon. If the cannon is cast of bronze, then the circumference would be eleven times the bore of the cannon. If the cannon is cast of iron, then the circumference would be thirteen times the diameter of the bore. Their belief that the bronze was stronger than the iron was undoubtedly formed by split and destroyed cannon after test firing with larger amounts of powder used for proof fitting. Now, if the breech diameter result of the circumference times the bore eleven times, then the base ring will or should be 1 or 1- 1/2 inches larger in diameter.

Now, here is the sad part. Just as in Steel's book on rigging especially the length of the yards and mast tables. If you are going to checkout the dimensions of Longridge's drawing in his "Anatomy of Nelson's Ships," forget it. His book does tell you it is about 1805 and Mountin's book is 1756. I don't remember reading anything exciting about changes in design during that period. But, like modern times, every manufacturer makes articles a little different just to show it is his. This does give you an idea on how to determine the diameter of the stock to use for the cannon you wish to make. This is important but not as important as the bore size and the correct length. Don't exaggerate, all dimensions are important. I know that the length of some cannon when placed on board look too long, but referring to the establishments for that period will settle all questions. Some seventy gun ships were built in the early 1700's wee later changed to 64's because of the crowding especially on the quarter deck. Cannon may have had a similar design on board ship but, who is to say the same design for the poundage would be found on other ships.

The copy of Mountaines's book I have is a, I believe, Xerox copy of the small book. This was on sale by the Nautical Research Guild twenty years ago. I don't know if it would



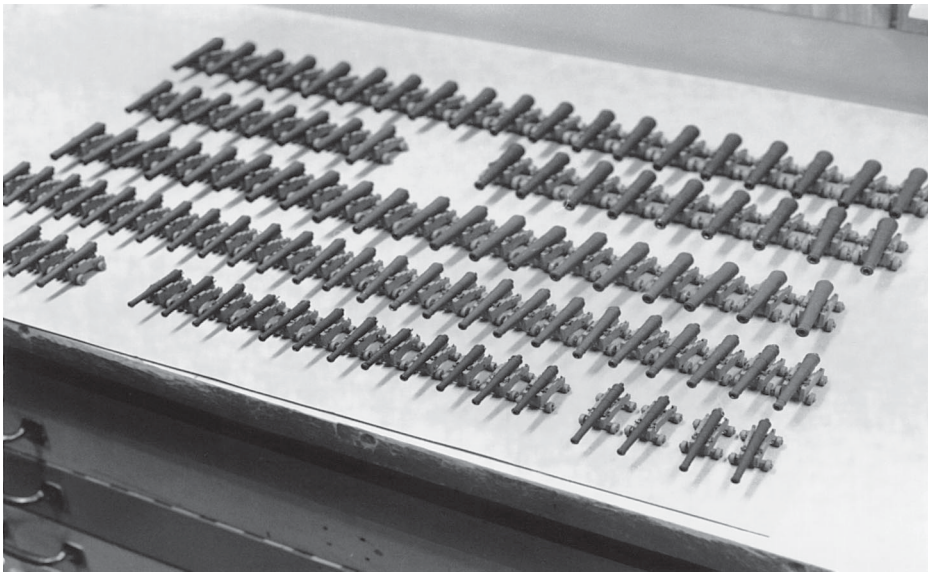
be available today or not. In the tables that are given, the length of cannon are from eight to ten feet. Nothing shorter. The best source of material on the size of cannon and how many were used on what deck of what rate can be found in Robert Gardiner's article in #20 Model Shipwright's magazine.

The next time you visit a park to measure a cannon, be a little broad minded. The weather and probably other unknown reasons will deface the weapon. The first time I measured a twenty-four pounder setting outside the naval Armory in Toledo, Ohio, I measured the bore at the face of the muzzle. I thought it was a thirty-two pounder until I measured the I suppose to. At least six inches in from the face of the muzzle. This is where the heat from the explosion first meets the waster vapor in the air. As any artilleryman will tell you, the muzzle really gets hot Before I continue, I would like to make a change. At .2600 pounds per cubic inch for iron a 42-pound ball in the cubic inches are 161.53" is 161.03. I figure this is about a 2-ounce difference. So, with a 6- 3/4" ball is divided by 19 times 20 equals a bore that measures 7.1. Please remember there wasn't a standard length of measurement when you measure anything. This insignificant difference, though monumental to some, when reduced to 1/4" equals 1' scale ends up using the same size drill. Because the size above and the size below would be too much out of size.

It seems that the main problem in telling how to make cannon is the different styles, types and makes of lathe owned by everyone. It might be interesting to know just how many different makes and styles are being used. This is what makes it difficult. The tool post used for each. My method required a turret holding four tools. If the piece of brass used for the cannon is about 1 half-inch longer than needed, then a regular post will do. Going through all the blanks with one operation then changing tools for the next and going through all the blank for the second operation. A couple of extra blanks might come in handy. After a while, the only paper you will need by your lathe is a list of numbers showing the different stops.

The drill used for drilling the bore should have the cutting edge flattened to keep the drill from digging in and enlarging the bore, especially at the muzzle where is would be very noticeable. Might center drill before drilling the bore just to be safe. Drill the bore to the full depth as I will explain later, it has its reward. I don't know how you will hold the blank in your lathe. If you are well equipped, collets are best. Drill chucks on the spindle nose tend to give you a three sided effect to your cannon. More noticeable on the muzzle. Three jaw chucks have the same effect. Grinding the proper shape to your turning tools will have been covered in your operation manual. Remember keep the top of your tool flat for cutting brass.

The size of tool bit I use is a quarter-inch, which I have to build up with a piece of 1/8" stock as the turret is made for 3/8". The distance from just aft the muzzle to the first rung, I have agreed it should or cold be 12". This being 1/4" means the forming tool for the muzzle can be make from a quarter-inch tool bit. The excess material under the face of the tool should be ground off as in Figure 1. Exact radius isn't necessary and the 1/16" dimension could be less. The under side could be ground as indicated by the dotted lines. Which, probably would be better when it comes to grinding the form. There will be three of these so grind three blanks the same. Grinding the forms may be done with a larger wheel and then finished with a high speed cut off disc. They measure 1" x .022". The wheel will grind a little over size, which will make the reinforcing band about right.



Grinding as form tool isn't as easy as it seems. The clearance under the cutting edge must be present at all curves, steps, and flats. Do your forming up close to the chuck to keep from hossing caused by vibration in the main bearing and the chuck. The position of the tool bit in the turret will make a difference as to whether the reinforce band is larger than the muzzle. This will have to be worked out by cut and try. The difference in diameter between the molding on the muzzle and the base diameter of the reinforcing band will be about 2-1/2" or .052", minus the height of the band (.015). This does not change too much ass the caliber changes. I think this is the place to discuss the different moldings on the muzzles in the changes from the early 1600's to the 1780's. A Mr. Edwin Rich was a good authority on cannon some years ago. His description of the various muzzle moldings would suggest a double molding was used on brass guns maybe because the bronze muzzles were a little tender. I think most of you will be concerned with the cast iron cannon, so we will stick to the single molding we know so well.

The next form tool is the one that forms the Cascabel. This will be shaped to include the base ring, the coyl, and the pummel. To keep the blank strong so it won't break off the Coyl is not cut but is left the size of the pummel. Whether the base ring has one or two moldings will be according to the cannon your are modeling. The length of the Cascabel depends, I suppose, on the size of the caliber (bore). For a twelve pounder, it is generally nine inches. Scale 3/16". This can also be roughed out with a larger wheel and finished with a cutoff disc. Your third bit is ground to a shape to cut the pummel and the coyl. Do not cut the pummel complete. Enough so when you saw off the finished cannon, there won't be too much to file down. The fourth tool bit is ground to a point. More like a small cutoff tool the end being flatted to where the width of the flat will measure .015" or .020". This is measured so it can be figured on the lengths of cut and allowance for the different steps.

Now to follow the directions we have to identify the movements and what will be going to move.

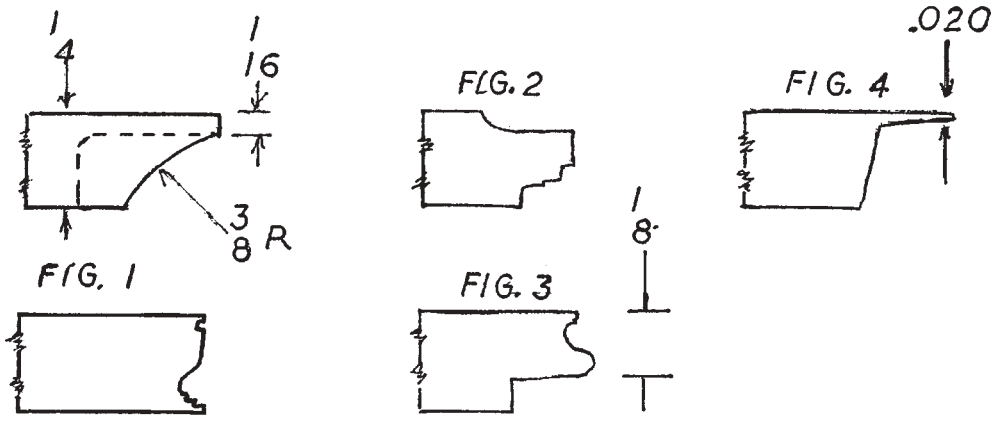
(A) will designate the compound rest. This is the part the turret is bolted to and rotates 360 degrees. This will, for now, be set at two degrees taper away from the center from right to left.

(B) will designate the cross slide. The dial of the cross slide will be read as adding to or reducing the radius. Some lathes have direct reading dials and the old ones do not. In other words, to reduce the diameter of a piece .004" on the old machines, you set the dial for .002". Again, for new machines set for full and for old machines set for one-half. Make sure the collars are equipped with screws that will set the collar tight. We will try to hold all dimensions to a plus .002" and or minus .002"

I have picked the size that with a little imagination we can go up or down in size. The twelve pounder is an average size. All of my plans and setups for the machines are set to 1/4 inch equals 1 foot scale. Location of reinforcing molding or rings follow a general pattern, but not a specific one as there are so many.

All machines have backlash in their hand fed slides. For example, if you wish to back out eight- thousands, you will have to turn past the free part of the turn, then back to your setting minus the eight-thousands. I did not want to write a manual on a lathe operation, but I felt some was needed for orientation.

First, let's check out the form tool for the muzzle. Using 3/8" brass, take one of the blanks, chuck it up, leaving enough to clear the tool holder to make the form for the muzzle. When you first get a full form on the piece, check to see if you have the forty-thousandths difference between the muzzle and the reinforce ring. Adjust tool until you are satisfied. Run tool in until the .262" is



A General Idea of the Shapes Needed
In Figure 1, clearance ground to the dotted line is preferable.

reached. Like I said before, .260 or .264 is OK. Now adjust the stock in the chuck so you will have at least 2-1/2" clear. Make a few runs to make sure the piece is running true. If not, bump it around until it does run true. Do not use a center in the muzzle end as even the anti-friction center will make a taper in the bore.

With A all the way to the right, set its dial at zero. Without the backlash. Run B in until the turning tool (Fig. 4) just touches the cannon, just in front of the ring. Set the dial on B at zero. Back out B and try a few cut mostly to get rid of the excess metal on the left. Now set the tool behind the ring to zero so that both sides of the ring are the same size. This station will be known as original zero. If the collar on A is an old collar, it will read 100 per revolution turn to 900. If it reads 200, turn for 1800. The length of cut should be .009:, almost 29/32". To keep it simple, we will use the 100 per rev. Now back out B .008 and move A to 920. Back out B .008 more and move to 960. Move B into 0. Move A to 1360. Back out B .010 and move A to 2000. If the angle was set correctly (it could only happen by accident) the last .010 backout should be just touching the original diameter. If not, change your angle by bumping the slide after you have loosened the set screws a touch. Now you can move base forming tool (Fig. 2) in to form the base. You have to go by eye as the shape of the base if your own design. Before you form the base, it would be a good idea to file down all the little ridges that will appear where you were moving A along the length. Small files, kept clean, will do nicely. The only way to get the moldings to show on the rings is to make the rings wider. This would not look good either. So, some of the decoration is going to disappear. Now you can run in tool (Fig. 3) and saw off the cannon.

If you are worried about oxidation and finger prints discoloring the finish, you can take a few precautions. I have never had a chemical makeup to where any piece of steel I would touch would be the first to tarnish where I touched the piece. Maybe that explains why none of my brass cannon have tarnished. That I know of. I think this is much more accurate than trying to scale the various dimensions. After you have made a half a dozen, you will note it takes little time to form a cannon.

There has always been conflicting ideas on how a cannon should be hung. On center or by the thirds. By the thirds is locating the trunnions so the center is or forms a tangent with the lower side of the bore. This will, in most cases, set the upper edge of the trunnion with the center line bore. By the thirds made for a lower gun carriage, which tend to lower the force of the recoil more near the deck. I guess it would be liable to flip. This could be argued from now until then. But providing for a lower carriage is a point we will stick with in this set of plans.

The fixture for drilling the hole for the trunnion is quite simple. A steel block measuring 2 x 1 x 1/2 inches is large enough to use for another setup or in case of a

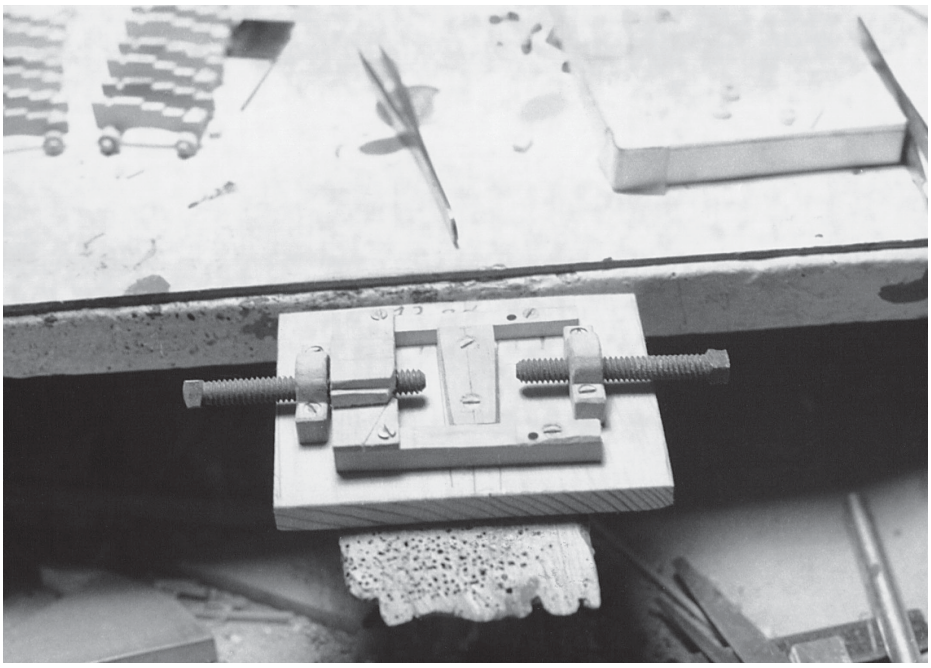
mistake. Hole A is, as close as possible, to the size of the reinforce band in front of the trunnion and the hole B is the size of the cannon 1/2” aft. The location of a 6-32 machine screw below the cannon hole if for locating a measuring stop to locate the cannon in the same position every time. I have not shown a location for a drill bushing. I know it is according to good practice but for only twenty-four or so holes, I have another way. The trunnions will be made of a 3/32" rod because it is available. After drilling the fixture, take the drill and grind off the edge about 1/16" from the point. This will keep the drill from enlarging the hole because there is a lot of side pressure on the drill while drilling. I have tried to use an end mill but there was too much vibration which gave me a large hole. Do not grind too much off the slide, just enough to dull the edge. Too much will change the size of the drill. Making the 6-32 winged screw and stop I don’t think it will be necessary to explain how to make them. The length of the trunnion will have to wait until the carriage has been reviewed to determine the length. I don’t think it is necessary for trunnions to be exactly the diameter of the bore in model making. I should think the nearest 1/32" on the larger side would suffice.

Because of their location, vents are, in a way, an important part of the cannon. Not that they can be used, but they are large enough to be seen. The nearest dimension starting about one-inch below surface. For some reason, some vents have a small funnel shaped

hole for about an inch. It is large enough so one can place the end of his finger in the hole. About five-eights of an inch. The general dimension of the “pad” surrounding the hole is three inches long by two inches in width,. If you are going to paint your cannon, this pad can be made with a drop of solder, a file and a chisel. The method I have been using to form the pad is to drill a #55 hole just in front of the base ring. Enlarge this with a #55. this will make a small arc in the base ring or should. Next cut the point off of a #16 by 1/2” brass escutcheon pin and force the pin into the #55 hold. Cut off excess and file down to the base ring. By using a chisel, you can cut away the round sides using a direction towards the base ring. This will cause the burr to meet the base ring making a square corner. Most of the time, the vent is in the center of the pad. I don’t know if it was moved intentionally or if it moved during the pouring. Later on, the vents were drilled. In 1/48 scale a number 80 drill will do nicely. For scale smaller than 1/48, drill of a smaller size can be had. They are called pivot drills spiral. Size ranges from .004 to .013. The length of the spiral or drill size is seven times the diameter. Then they must be ordered by the dozen. In a ten year old price list, they are from $7.00 to $9.00 per dozen.

Cap-square are broad circular pieces of iron, fixed to the cheeks, and serve to lock the trunnions into the Trunnion Hole. (Mountaine’s definition) I have tried several ways to make this piece only to end up with something that looked like it had been made with a pair of pliers.

To get the square corners on each side of the half circle, can only be done with a stamping method of forming. As it seems to take a force to set the metal into the corners, we will again use mild steel because of the short run. If you wish, the surfaces that will wear can be case hardened by someone that knows what he is doing.



The size of carriage we will get around to building will be for the twelve pounder. So, the cap square will be for that carriage. The thickness of the material used for making the cap square is .125 of the shot diameter. According to Robertson, 1775. Shot diameter being 4.4026 inches. The diameter of the bend is 1.082 times the shop diameter. For our purpose this converts to a material thickness of .01146 and a bend with the diameter of .09922. For your convenience, we will use a material thickness of .015. For the diameter of the bend we will use .09375 or 3/32".

My forming device has gone through many changes, and the end result is a lot of unnecessary refinements.

The device I will describe here is, I believe, simple enough to be easy to make and not take you too far astray from the ship. The main piece, A, is the back plate. A piece 2” X 2 1/2” X 1/4" in thickness. The two holes on the left are drilled and tapped first. The material to be used for the upper piece, B, is placed next to the screws and the location of the holes on the other side can be spotted with a #29 drill. This will result in a better fit than trying to layout all four holes. The upper B and the lower C pieces being made from a 1/4" X 1". One piece being 1/2" in length and the other 2" in length. The two pieces are clamped together so that a hole 1/8" in diameter and a held 3/32" in diameter are drilled between the two giving you two half holes in each piece. The 1/2 piece, C, is drilled 1/8" for the pins. Then C is reversed so the 1/16" radius aligns with the 3/64" radius.

A sample will have to be made by placing the shank of a 3/32 drill in the 3/32 half hole of C. Set a strip of material or a .015 wire on top of the shank. Place the 1/16" radius over the material and the drill and strike with a hammer. Secure B to A with four 6-32 round head machine screws, brass, a little filing may be necessary, on the side of two machine screws. Set C under B with sample and drill to align the two pin holes in C. After drilling the pin holes, fasten C to A with two 1/8" X 1/2" dowel pins. Drill a 3/32 hole through A so it will lay in the 3/64 radius of C. It means the 3/32" pin.

The angle of the cap square and bend for the trunnion can be made by shifting the material from one side to the other. Width of the material for use for the cap square, called breadth by Robertson, is .721 of the shot or .06617. For our purpose, .707 would be better because of the fastening method.

Screws holding B to A can be long enough for nuts to be placed in the rear to lock the screws. You will find that striking B with a hammer with set

the corners better. This edge will wear first but will last for most. Because a great deal of strength is required at the cap squares, I have used a method of fastening that I know isn't the practice. You never know what numskull will have the heel of this hand against the muzzle when lifting the model.

During the eighteenth century, there were two styles or designs of carriages being used. The open bottom as shown in Robertson's work in 1775 and the boxed bottom as in the book by William Mountaine of 1756. Nineteen years difference when it is know that no one wrote about anything unless it had been in use for years. The carriages on the WASA fit Mountaine's description.

The time that the designs for the "boxed" in carriage, the one that seems to have a floor between the cheeks, and the 8 open 4, where the axle trees are exposed between the cheeks, vary from one country to the next. I imagine as the same as whether the cheeks were made of two pieces or just one. Reliable information can be found to authenticate each method of design. But it seems that the "Open Carriage" was always used by the British Navy and the Continental Navy. Maybe I shouldn't, but I am going to assume, more of you will be wanting the "Open". For several obvious reasons, the close tolerances will be slackened. Let's not go wild. The width of the cheeks are .385 and you can get .275 wood maybe this difference will not be noticed, but you are setting the foundation for a bad habit. I know of a model maker who has slackened his tolerances especially of the beams, carlings, and ledges where if the mood continues, they will all be the same size. This is an exaggeration of course, but you get the idea. The wood for the carriages I have always used boxwood. Because of the sharp corners, when cut with a sharp tool. I will say here, milling cutters used for the machining are new. Never have they been used for metal cutting. For metal cutting, I have some old resharpened cutters. I know the saw can be used for cutting the steps in the cheeks but you can't have the control in the saw that you will have on a milling attachment for your lathe. To get everything even, control of the various sizes is the name of the game. I won't go into the cost of this or that as whatever a tool will cost you will find a way.

I know that some years ago before the inflation fit, I used to set aside a small amount each week for anything I might need. I does make a difference when it come to buying a tool that works and one that doesn't.

We have to start with the height of the port sill above deck. This can be had from the plans, if authentic. There are tables given in books about the size of port and the height of sill for each caliber. The trouble with these are the date is close enough to the ships date to be of valuable use and if this is primary information or something the author threw into fill the space at the bottom of the page. I have always gone with the height shown in the plans. Now setting off this line strike a line for the height of the port. The center of the port is drawn with a line three inches below the port center for the center of the cannon. This drop in the center allows for the elevation of the piece.

Another short line is drawn to show the center of the trunnion with vertical center line. Now draw the circle for the trunnion. The front edge of this circle or the right portion that crosses the center line is another center line vertical that extends down several inches. This will be the center of the front axle. On this line, you will describe another circle the diameter of the front wheels just touching the line first scribed for the deck. The size of the axle is the size of the bore, but I have allowed a fraction of an inch over, artistic license. The front axle is a rectangle, one by two times the size in the axles, sets on the edge with the lower half being the axle proper.

The rear axle sets back from the front axle the distance from the trunnions to the base ring center. The front axle is set into the cheeks about one and a half inches. Down from the top of the front axle a distance of one and a half inches is a line for the bottom of the cheeks. Extends past the centerline for the rear axle. The width of the axle is two times the axle diameter. The axle line is in the lower half of the axle set on its broad side. The rear wheels are three times the bore is drawn on the center of this axle. A line extending from the bottom of the fore wheels to the bottom of the rear wheels should simulate the deck line. I find a saw is a poor substitute to use in cutting the steps in the cheeks. The many trials it will take to set the saw so it will cut the required depth and also the length of the cut. Most persons that purchase a lathe also purchase a milling device or attachment to fit. I have never saw an and attachment that would do the required work that a machine was make for. But because of the tight budget that most modelmakers are confined to, the attachment that is sold for many lathes is sufficient for our purpose. The stock used will be cut into a block 1-3/8" by 3/8". The length to be the travel of the carriage.

Short enough so the cutter will clean up the ends. The grain run in the direction of the 1 3/8" so each piece when sliced off will have its grain running lengthwise.

The stock is brought up to just touching the cutter. The dial on the milling vise is set to zero. If the dial can not be set the number on the dial is taken off and added or subtracted from the dimension you will want to cut. As a checking point, the aft width of the cheek is one-half of the forward width.

Eyebolts (4). One in the foreface of the front axle and one in the aft face of the rear axle. Two others in or on the third step of the cheek for training tackle. Assembly—Axles are held to cheeks with number 74 wire brads. Be sure to countersink the heads. The wheels are held by the same kind of brad through the axle. The cap squares are drilled #34 and placed over the trunnions where they

are drilled with a #35 drill into the cheeks. Use no. 20 by 1/4" in length brass escutcheon pins with two sides cut off of the head. This will look like a fitting that is suppose to be there. This is the item I was telling you about being the strongest part of the carriage. We can try but we can't make a model klutts-proof.

The eyebolts that have the rings for the recoil cable are stationed just under the fore end of the small platform for the elevating wedge. There isn't too much to say if the plans are followed closely. The piece that acts as a transom over the front axle has two functions. First, it is a spacer for the cheeks to hole them together. Second, it becomes part of the fastening method. I believe was necessary to hold the cannon on the lower decks. Each carriage is numbered as to port and side. So, if removed for some reason, it can be located again in the same port.

Maybe I had better explain this a little further. After the framing, mast steps, lower deck beams (if a two decker), planking main wale, and the lower ports are cut in according to the height above the deck planking, the carriages are made. Each carriage is placed near a port and numbered for that port. A 1/16" drill is run through the frame or whatever in front of the port into the transom on the carriage. A short piece of brass rod is placed in the space drilled, one end being rounded or pointed. A hold is drilled through the port sill into this rod about the size of a common pin or such. This will secure the carriage to that port and that port only. When it come time to plank the outside, the planks will cover the locking device so it cannot be seen. If someone would want to change the size of the cannon that deck, he may do so. But, not the carriages. As you will notice in "*Carrack to Clipper*" by Frank C. Bowen, 1927, the bulwarks and the furniture are all painted red for the time up until 1800's. All ironwork is painted black and all brass or bronze is left bright. As to how red is the red suppose to be. Our fore fathers, back in those days, realized the use of psychology in battle. That the man could realize the difference between red paint and fresh blood, in the heat of battle, was the best reason for painting most everything red. I you had to pick up a handle that had a red splash on it, you would avoid picking the handle where the splash was and waste a few seconds changing to a cleaner spot. In that few seconds, you might be shot.

This might be a good time to clear up the size of port lids. In Mungo Murray's book of 1754, he rewrites M. Duhamel du Monceau's "*Treatise on Ship-Building*" giving the method of determining the length of a ship. In this he concerned with the framing. As so many ports of a certain size plus so many spaces in between plus space for distance for the post stern.

Now to quote several authorities. "The port lid is let into the sides and bottom of the port". Now from what I have seen this means 1 1/2" to 2". This means the lid is 3 to 4 inches larger in breadth than the port and 1 1/2 to 2 inches more in height than the port. If your plans are photostats of the original, they will show the port.

Size of Canon	Height of Port	Breadth of Port	Height of Sill
42 lb Shot Weight	2' - 10"	3' - 2"	2' - 4"
32 lb Shot Weight	2' - 8"	3' - 0"	2' - 3"
24 lb Shot Weight	2' - 6"	2' - 10"	2' - 1"
18 lb Shot Weight	2' - 5"	2' - 8"	2' - 0"
12 lb Shot Weight	2' - 3"	2' - 5"	1' - 11"
9 lb Shot Weight	1' - 10"	2' - 0"	1' - 9"
6 lb Shot Weight	1' - 4"	1' - 6"	1' - 6"

Diameter of Shot by Weight	
1 lb	1.923"
2 lb	2.423"
3 lb	2.739"
4 lb	3.053"
6 lb	3.494"
9 lb	4.000"
12 lb	4.403"
18 lb	5.040"
24 lb	5.546"
32 lb	6.106"
42 lb	6.684"
Cast Iron	0.26 per cubic inch

Diameter of Bore 19/20	Drill Size	
	1/48	1/64
2.0357"	26	35
2.0242"	58	67
2.5505"	55	61
2.94"	53	56
2.2136"	51	55
2.6778"	48	53
2.2105"	43	51
2.6347"	41	49
2.3052"	35	45
2.8378"	31	43
2.4273"	29	39

Plans may show a different size port in which case the plans will be followed if they are original.

Circumference of breech of touch hole: 11 x for brass 13 x for iron.

1670+ 24 pd 10 Foot
Bore 0.1216 #31 Drill
Muzzel 0.329

Base Ring Breech 0.464
1) 1000 2) 1020 3) 1070 4) 1510 5) 1560
6) 2000 7) 2050 8) 2140 9) 2200

5/16 stock 0.078 #47 Drill
Muzzel 0.294

Base Ring Breech 0.294
1) 890 2) 910 3) 950 4) 1330 5) 1360
6) 1750 7) 1780 8) 1920 9) 1950

12 pd 9 Foot
Muzzel 0.262

Base Ring Breech 0.464
1) 900 2) 920 3) 960 4) 1360 5) 1400
6) 1800 7) 1840 8) 1920 9) 1950

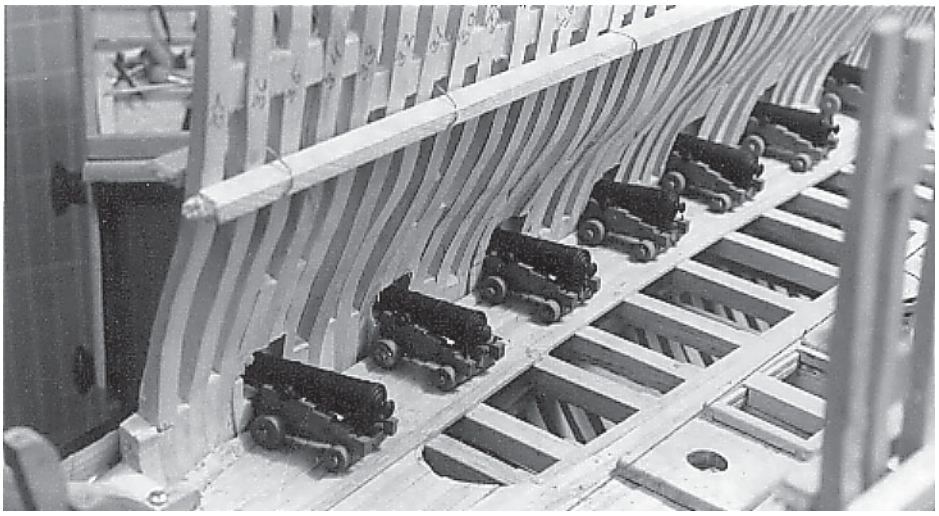
1670 42 pd 9' 6" Foot Bore 7" 0.146 #26 Drill 0.147
Muzzel 0.396

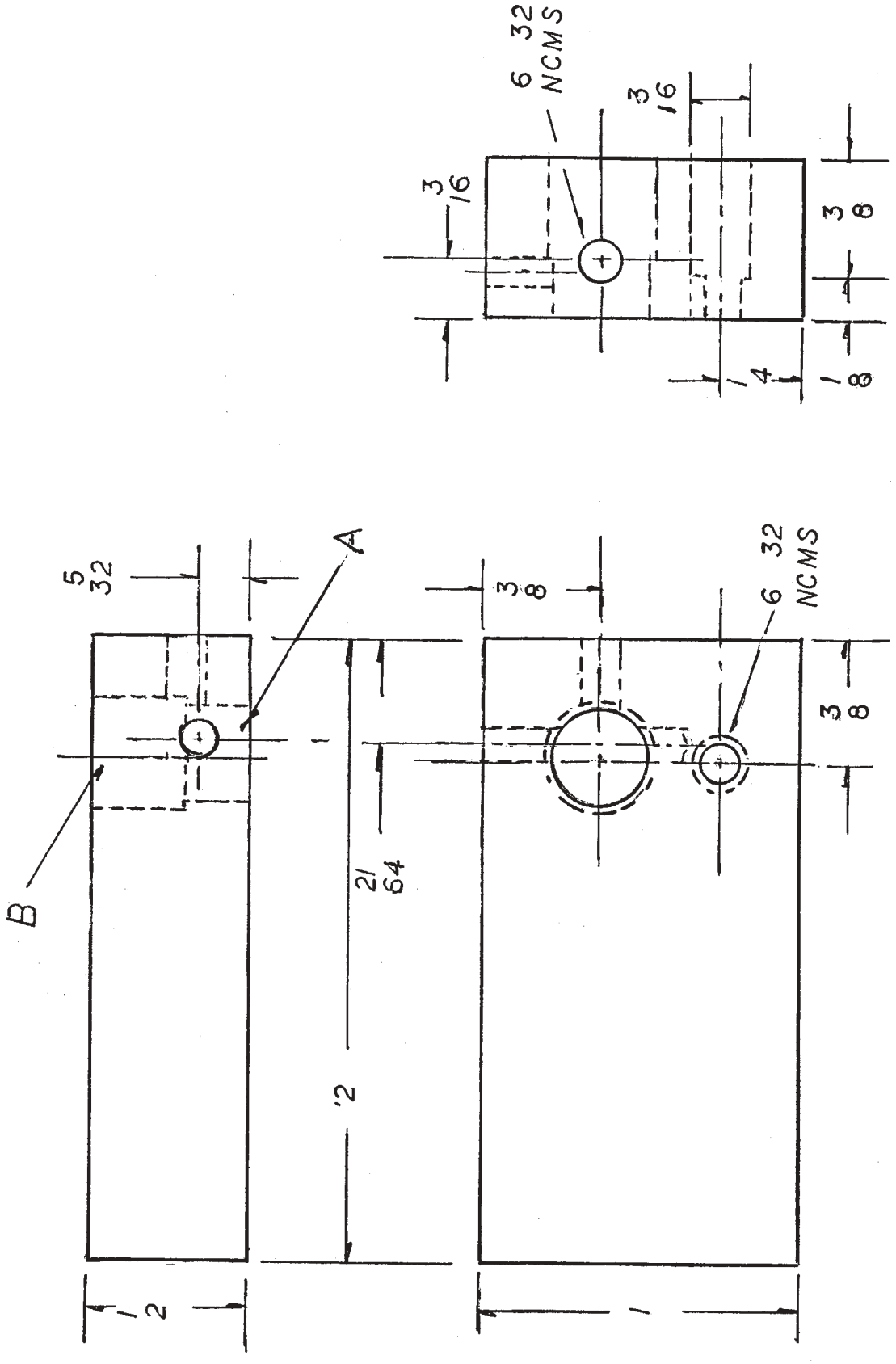
Base Ring Breech 0.559
1) 975 2) 1010 3) 1050 4) 1480 5) 1520
6) 1870 7) 1910 8) 2030 9) 2100

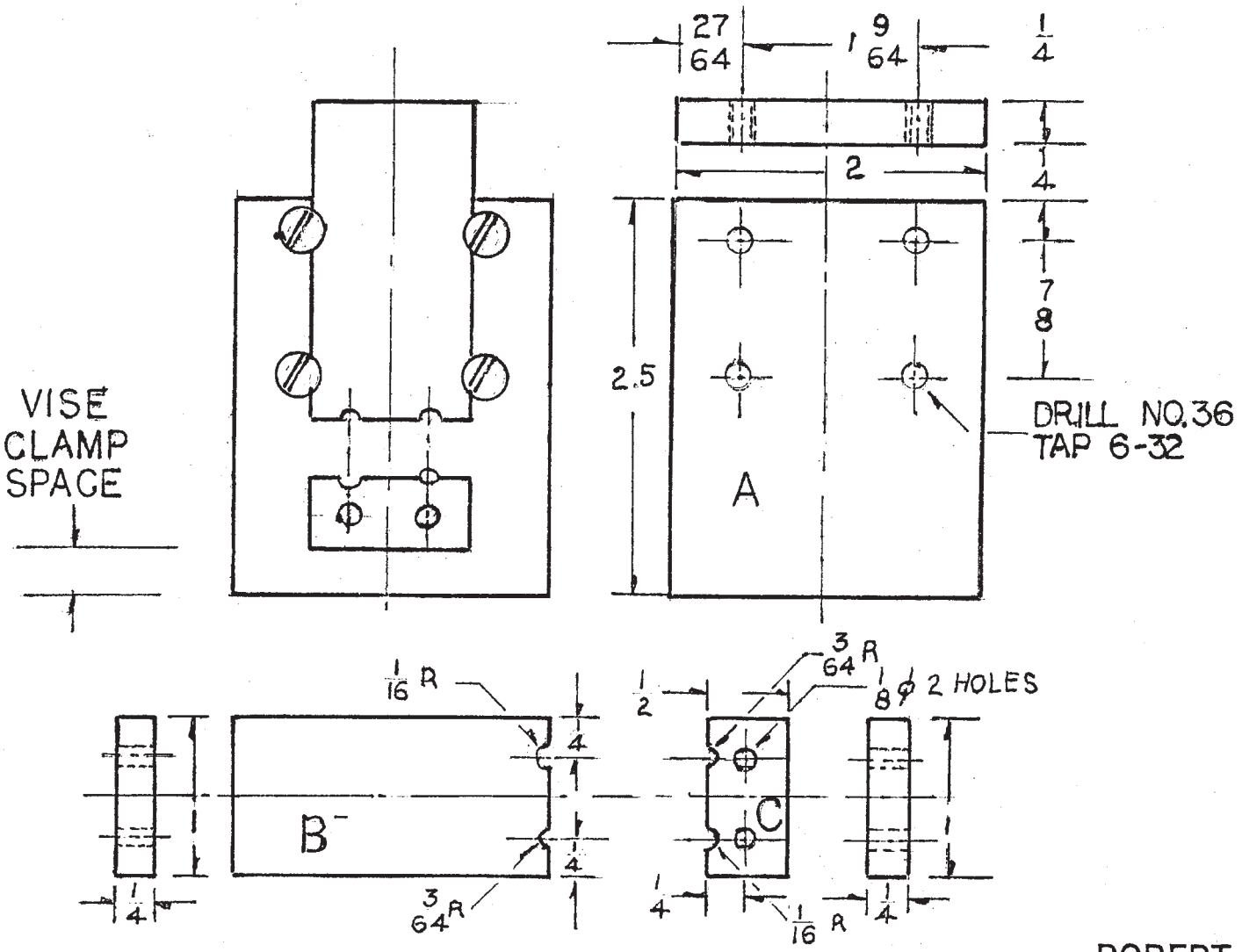
The drawing for the 42 pdrs shows a longer Cannon. The distance from ring to ring is the same as the 24's.

1840 42 pd 10 Foot Bore 7.043" #26 Drill 0.147
Muzzel 0.397

Base Ring Breech
1) 970 2) 1015 3) 1965
4) 2010 5) 2180 6) 2220




6 32 NCMS
3 16
3 16
3 8
1 4
1 8
5 32
A
B
21 64
2
1 2
1
3 8
6 32 NCMS
3 8



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CHAPTER 4
The Shelf, Scarfing of the Beams

Now we come to locating the shelf for the gun deck or sometimes called the main deck. The base of the model isn't the bottom of the false keel, in our model it goes beyond that as the heads of the escutcheon pins you used to fasten the false keel on the keel. These lines we will call the base line. From there we measure up to the bottom of the beams, this will be the tip of the shelf. We have to go a little into tool making for this. The location for the height of the shelf is behind the lap joint for the first and second futtock. Which prevents the arm of the height gauge from getting anywhere near the location. I have made a sketch in Figure 9 to show one way of getting around this problem. The figures we have gathered for the height of the shelf will have to be increased one and a half inches so we can use the top of the gauge bar to find our inches. The "hook" can be made of cardboard. I happen to have a supply that was the same thickness as the blade on the height gauge. You might give this a coating of glue, so when it dries, it will be stronger. The number of times you have to "stick" the gauge between the frames answer this question. I always use and ultra fine Flair pen to mark the location. You don't have to use the location of every beam for the shelf. Every third or fourth will be enough. The shelf will have to have one edge cut away as the shield will turn when going forward or aft. The inside edge will have to be cut away. All shelves can be fastened with 3/8" pins. A little glue placed where it won't interfere with any other construction.

I thought I went over this in the other installment, but I guess not. The curve of the beam according to primary sources of the eighteenth century was a segment of a circle. There has been too much said as to what is or was supposed to be. The difference between the segment of a circle and a parabola is too insignificant, the cost of measuring the difference would be fabulous. The radius figures out to be about 10 1/2 feet. The beams were cut out on a bandsaw using a rough template. They were fastened to a flat placed in front of a vertical belt sander and the flat having a long arm (11 feet) was pivoted at its 10 1/2 foot center. The whole thing being set up in the wood shop where I have more room. And, the dust can go well where it pleases. Maybe I will clean it up next week or so.

The whole idea is expressed in Figure 10. There should be refinements shown as support under the arm because of its length. The pivot point will eventually be moved towards the plate as the radius shortens. The formulas for figuring the radius for a given height is given on page 152 of "*Machinery's Handbook*". There has been so many reprints since I purchased mine, I suppose the page number will be different. In case you don't have a book or a source, here it is:

$$\frac{r = c^{-2} + 4h^2}{8h}$$

As C equals length of cord, and h equals the height, so r equals the radius. Whereas the radius does not have to be exact. Plus or minus an inch or two. As it works out, a rise of eight inches in a beam of 48 feet scales down to a 0.1666 rise in 12.000 inches, a radius of 108.35 inches or about nine feet. In your drawing, you will notice the detail showing the end of the beam, the bottom line is the base used for the height of the shelves, the second line is the thickness or molded part of the beam, the third line shows the rise or height of the crown, or height of the radius of that beam. Or sometimes called camber. I don't there was a set standard for determining this as it seems each drawing is different. The only thing in common is the camber increases as the decks rise such as four or five inches for the Orlop deck gradually going up to nine inches or more for the poop deck.

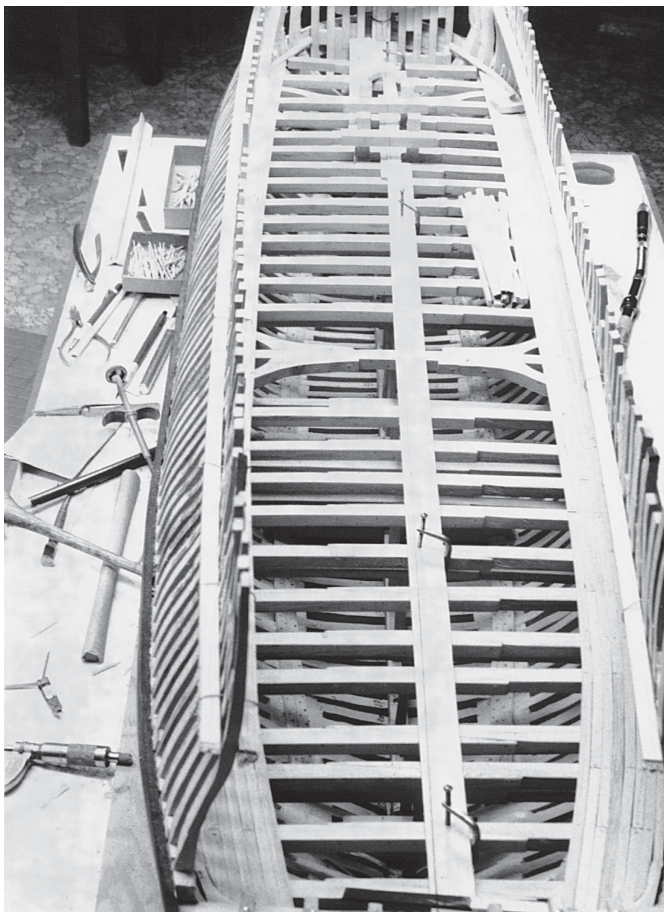
Let's get back for a moment to the scarfing of the beams. Remember I said about using a dowel .055" in diameter

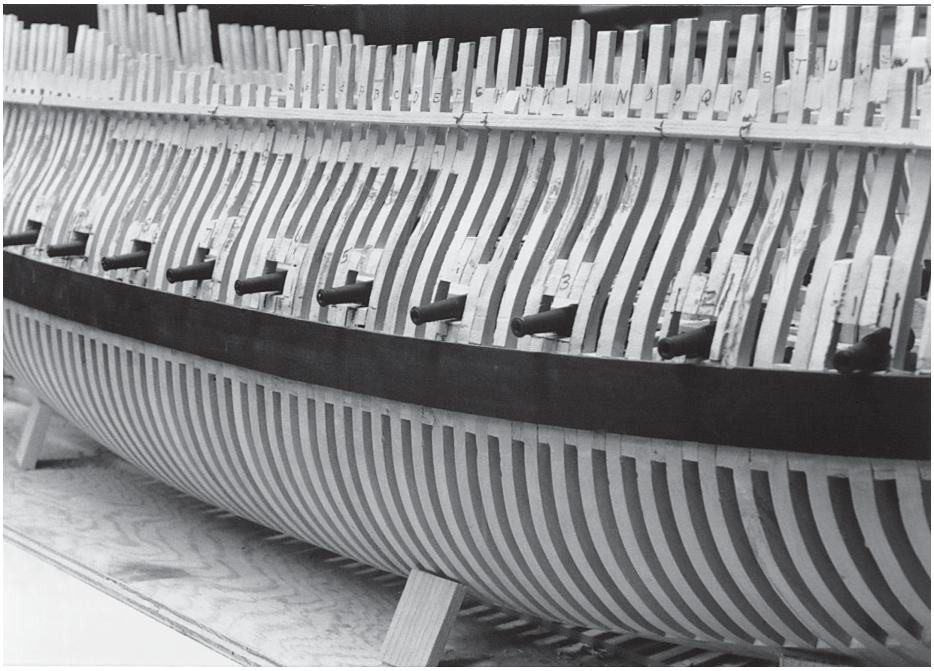
for the Orlop Deck, well I don't think this in good taste. A heavier size say about .067" would be better. Made from the wooden swab sticks. The only way I could buy those swab sticks was to buy a box. I don't remember if there was five hundred or a thousand in the box I purchased. Since they are just a few thousandth over the size, they will be easy to run down. The tool I use for this is made from a piece of 5/16" drill rod, water hardening, to make tempering easier. The end was cut to show four edges and drilled with a .067 drill. The back side of the tool drilled considerably larger. The tool is then placed in a drill chuck that is screwed on the arbor of the grinder. Maybe the drawing in figure 11 will help.

Most grinders have a little of the shaft protruding so there might be enough to screw on a chuck. The stone by the way can be used for pointing the stick you are going to push in the cutting tool to make your dowel or treenail.

I think we had better stop right here and settle a point. If the completion of this deck is as far as you are going, then by all means complete it. But, if you plan to finish this model then you had better decide to let up on some of the detail so you will have enough enthusiasm to take care of the rigging. I don't think any of your friends have a budget large enough to have an endoscope to search your model. The centermost carling will be placed to prevent any lateral movement of the beams, but they will not be mortised for the ledges. The carlings are the short pieces that run fore and aft between the beams and the ledges are the ones that run the same as the beams between the carlings, athwart.

While your are still used to handling large pieces of wood, let's go outside the hull and get a good start on the wales. Most cross sections of the hull will give you a fair idea of the size of timber used in the wales both main and channel, as well as the thickness on the planking. Only on my very first model did I use planking of smaller thickness than what was called for either in the cross sections in Mungo Murray's book. Even Longridge give a cross section that can be used to find the thickness. The thickness of the wale on the ELIZABETH was nine inches, so I used a piece 3/16" thick. The wale on the ROYAL SOVEREIGN measures 10 inches. That is a little less than 7/32". The lower edge of the wale will be taken from the drawing noted every five or six frames as to the height from the base. The wale itself will be of five pieces in width. The number of pieces needed from stem to wing transom. If the wale you need isn't wide, then use fewer pieces. The more pieces, the better control of the wale while putting in the treenails. I am starting with ten which might end up with fifteen to twenty. Solutions to use when bending wood is a highly controversial subject. One person will say use a solution of one quart of household ammonia to three quarts of water. While another will tell you to use the household ammonia straight. Using the ammonia straight will, when drying,



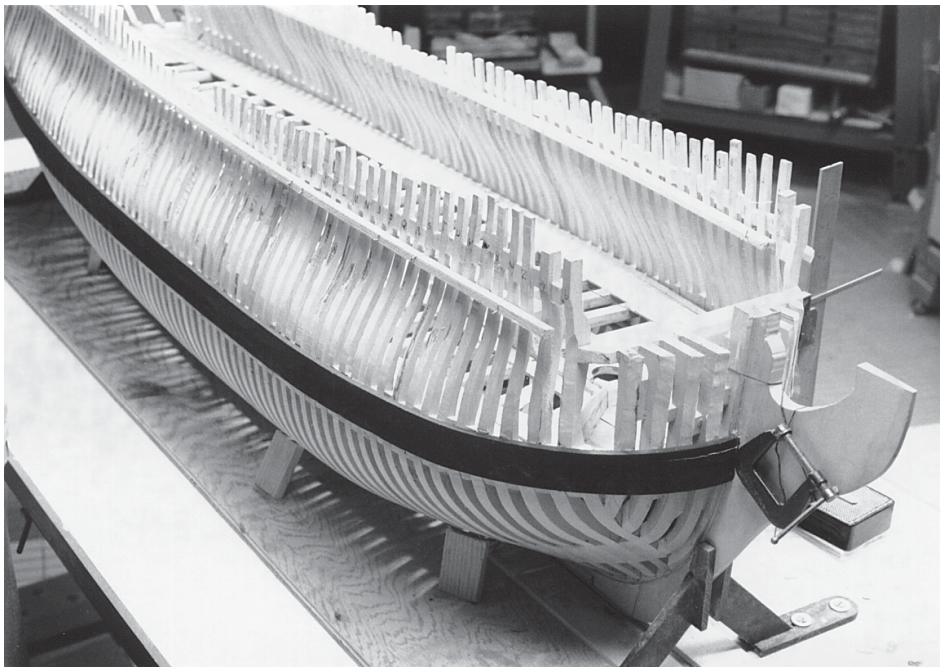


leave a residue, fine white powder which is very difficult to remove.

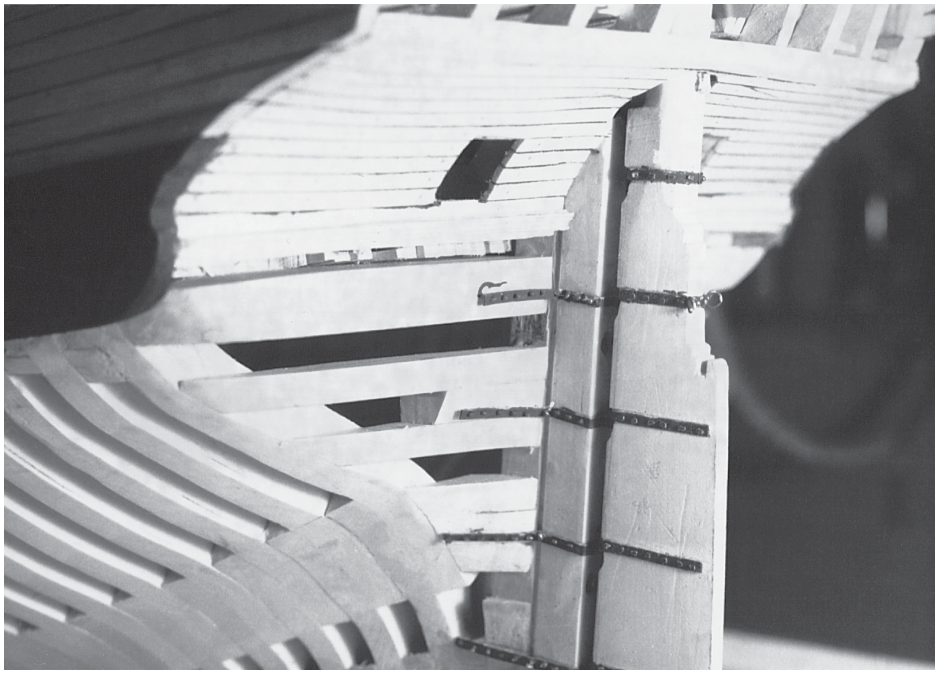
I have returned to the formula of one quart of ammonia to three quarts of distilled water. I have a clear plastic tube about one foot in length by one inch inside diameter with a plastic cap stuck in the end as a stopper. The strip measures 0.208" by 0.257" and about 24 inches in length. This would be about ten by thirteen inch timber with bent very nicely around the frames while wet. The piece will stay on the frames until dry and then treenailed. And, maybe a spot of glue. Time for the soaking should be about an hour. Because of the heaviness of the timber used in the wale, I will use a heavier treenail such as used in the beams. Some small ships such as frigates and brigs will have a rather sharp bow and a sort of flat stern, this will have to be dealt with by making the pieces for the wale thicker so you can shape the piece and still have a thickness of wale you need. On early American ships and the English ships of the eighteenth century, the wales were not a gradual change in size as the plank to wale and back to plank and then to another wale. When we have laid the 10" thickness wale, we will go up to the next plank which is 8" in thickness. I don't know the name of this plank, but I have seen this on many models and I think it gives a perfect step to the next plank which will be 6" in thickness. The painting of the wale starts with giving the whole a good coat of enamel undercoat.

Don't go out and buy a can of enamel undercoat. The paint you used to paint your ceilings will do just as good. It is a flat paint that will sand well and fill the cracks and pores as well as the undercoat. How many coats? Well this depends upon the fitting of one piece to another. But be resolved to one thing, you will put one coat and sand down between each coat the wale looks like one piece twisting from stem to stern. I never count them. The black you use for the wale, you will use what you please anyway. The section where the wale meets the counter is a moment of truth. There will not be a plank bent to the shape next to the wale in or on our model, but hold a plank of three or four inches in thickness up to the joint and see if it was bet would it lie well in this position. I had hoped you wouldn't have to, but I guess you will have to turn the model over again. Let's give everything a final check. Are the second futtocks in a fair line with one and another, has anything happened to the finish? This would be a good time to assemble the rudder and fasten it to the hull.

The pintles and gudgeons aren't too difficult to make. Using a sheet of brass .025" in thickness, strips are cut off and straightened on the bench anvil. The may be drawn through a drawplate to take out the variations in width. The pintles are made with a short piece of 1/16" brass rod in the center, crossways. The two parts are silver soldered as are all pieces in this model. Don't use too much silver as the pintle when it is bent, has to be bent against this solder to keep the shaft part inside. Both



pintles and gudgeons are fastened with number 20 escutcheon pins. To make the soldering easier, you might make the 1/16" rod longer. Silver soldering was a mystery to me until I was in my apprenticeship. There it became a simple task. We used an alcohol lamp and a blow pipe. Even if you don't smoke, the controlling of the amount of air for the blow pipe will give you a headache. A small butane torch turned down low might be the answer.

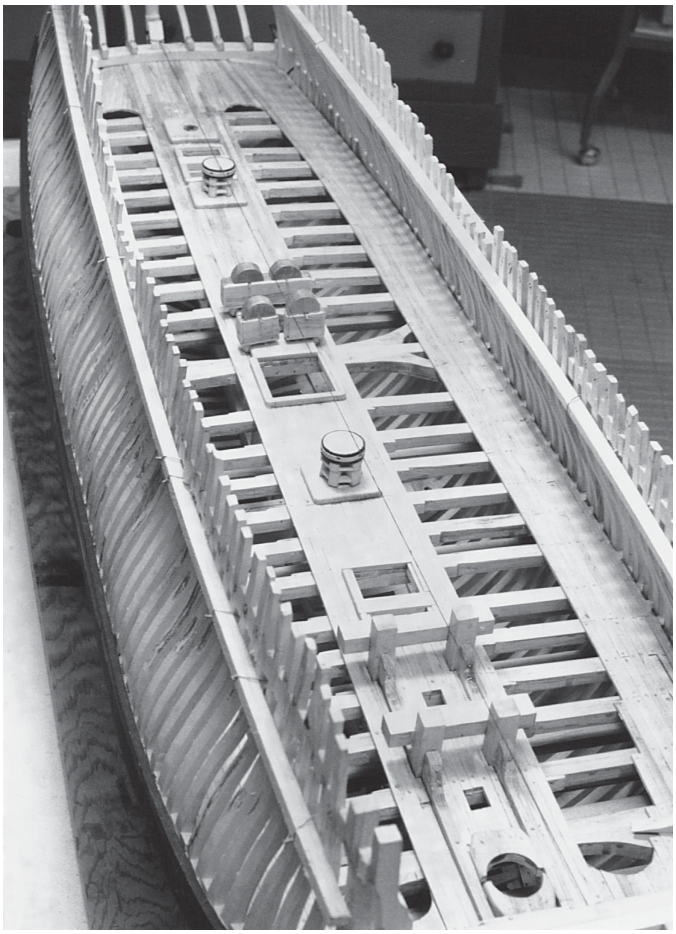


The strips of 0.025" brass are bet to shape before the piece of rod is soldered. When working brass sheet or rods always anneal them by bringing them to a red heat, especially after the second draw through the drawplate. That way you won't have to stand against the plate with your two feet to pull the brass through. Holes for the number 20 pins are drilled with a number 64 drill as the pin is a number 65 size. Layout for the drilling can be done by gluing a piece of metal and layout the distance for the holes. Then when you place the strip of brass over you can see where the center punch for the holes. Lining up the gudgeons on the hull is a little pit tedious in that the angles and to keep them parallel with one and another. The heads of the pins used for fastening the pintles and gudgeons are trimmed as the two opposite sides are cut off. Later the top is filed down about half to give a good appearance. A pair of small diagonal nippers come in handy for this job. The cutting edge of most nippers are like two inverted v's. All of my nippers are ground so the face has very little or no clearance on the forward side of the v.

I haven't said anything about the location of the tiller. I think that in order to have the tiller deck beam like it is supposed to do, we will wait until the beams for the middle deck are placed to get it done right. I don't think I will place a track for the end to work in as the blocks and the tiller rope should be enough. On of the difficulties in the assembly of the rudder is to keep it from falling off during the construction of the rest of the hull. This can only be done if the rudder is a good fit. I mean the pintles and gudgeons should be a close fit. Often I have thought of an assembly method I have only tried out today. The gudgeons are assembled to the pintles and tied with a piece of thread. The whole thing is placed on the stern post and fastened with pins. Afterwards the thread is cut off. I suppose there are other ways of doing this, but this is one of them. Don't forget to leave clearance under the gudgeons for the planking that will not be placed there, but the gudgeons don't go against the frames. Something like a two tine fork bent to shape and 1/16" in thickness. Don't forget the flutter strip.

What is a flutter strip? That is a piece that is "nailed" onto the trailing edge of the rudder. It is smaller than the edge being three inches less in width. Tapers from the rudders hance to the foot of the rudder. Sometimes it has a bit of ornamental molding on the edge. Mostly a groove going around the whole edge. The purpose of the flutter strip? Well, I have been told that its being small in size creates a turbulence that takes the shimmy out of the tiller. Sort of creates a step in the flow of water round the rudder. Now is a good time to paint the lower edge of the wale and the brass on the pintles and gudgeons. Every once in a while an article appears about the various paints and enamels that are available along with the pros and cons of why each one is better than what you used. One thing for sure, we don't have to go back to the lamp black and shellac we used on patterns back in the thirties. We used the lamp black for the casting proper with the cores showing clear shellac and when we could find some red paint, we painted the machine surfaces red. I think we mixed the red paint with the shellac too.

Now that the wale has had its many coats of undercoat plus several coats of flat black, it is time to set the hull back on it's keel. Clamping it to the board won't be necessary from now on as the hull has gained sufficient strength. Remember, none of the members assembled has been under a strain. No tight joints and no forced planks around a curve. You can give the top of the wale a coat of paint now, but it would probably be just as well to let go for now as it will get bumped and nicked during construction. You will have to remember to make sure the keel is down to the base board before making any height measurements such as for the next deck shelf and for the ports later. Always be on the lookout for drops of glue and finish that may have clung to a fare or even to the base board.



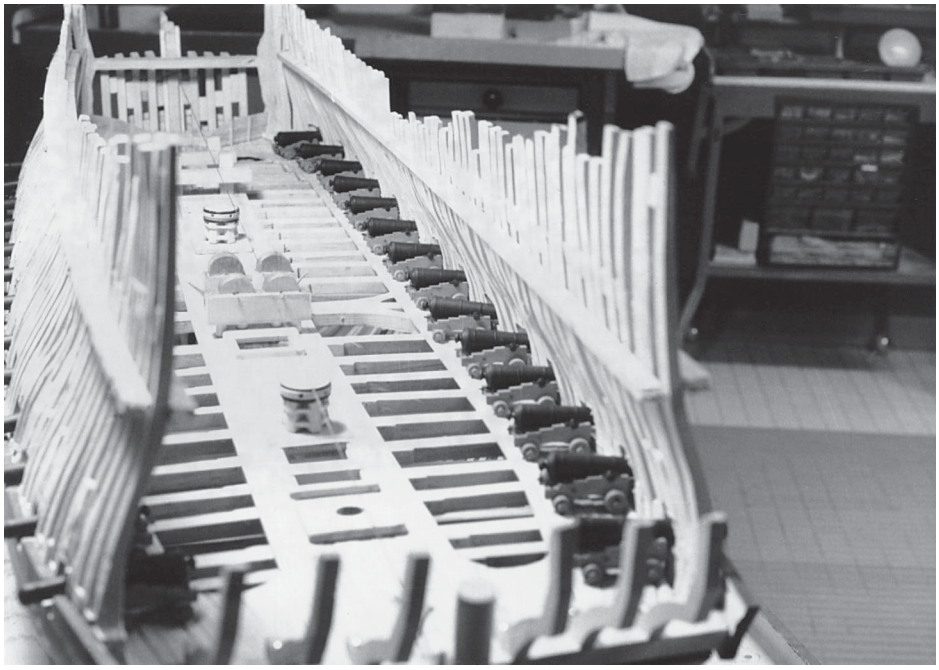
Now let's return to the gun deck of the Royal Sovereign. This is to carry 24 pounders. So, you will have to have some idea about the length of the carriages so that there will be enough supporting deck for the carriages. Remember this is a partially planked deck as all decks will be. I find making the waterway 3/16 square is ample to where the bevel is cut it gives a four inch face for the deck and a four or three inch race for the spirketing. Easier to bend and easy to pin with a treenail. Since the carriage is 6 and 1/2 feet in length, it will take about seven planks to make the supporting deck. Planks about .223 in width in this scale if you are going to show caulking the thickness of the material will have to be subtracted from the width of the plank. Here the trunnels are bamboo dowels. Old place mats or some other source of bamboo is split and drawn through a 0.035 home made drawplate. The source of supply for the bamboo if it comes to be needed is the poles or heavier pieces. Be sure to soak them before trying to split them. I don't know whether it is true or not but some say don't leave the joints in the water. I guess they will start growing.

To go back to the beams situation, in the Sovereign we have what I call a "k" beam just aft of the foremast. The beam that normally would go across at the position of the foremast is used to strengthen the beam next to it. By going aft of the foremast it strengthens the riding bitts. We have almost the same situation amidships at the location of the main hatch. Between the main hatch and the mainmast is what I call an X beam in that it has a half frame both front and back. This gives strength and also leaves openings for the main hatch and the mainmast. Some will think it isn't necessary to put in these half frames, but it does give you a little practice before you get to the upper deck.

I suppose it is about time to introduce you to my grooved board used for removing corners of most anything.

Used mostly for rounding masts and yards, but it comes in handy in making the angle of the strip you will use for the waterway. Most used groove is the small of the long one, for waterways. Blocks glued to the board are used for filing the shape to small mast and yards especially the octagon the lower portion of the top masts and the middle of yards. Cross grooves are more for working down the yards and masts but at a convenience find comfortable.

For a moment, let's change the subject to discuss something that is on everybody's mind if not now, it will be in the near future. The subject is "Standards". This is something an individual acquires and sets into his work regardless of what he is doing, whether he is a CEO or the clean up man or woman. The first or your first model is the only one that won't have standards. But your second model will. The changes are just a few at first because of what you learned in the first model. When



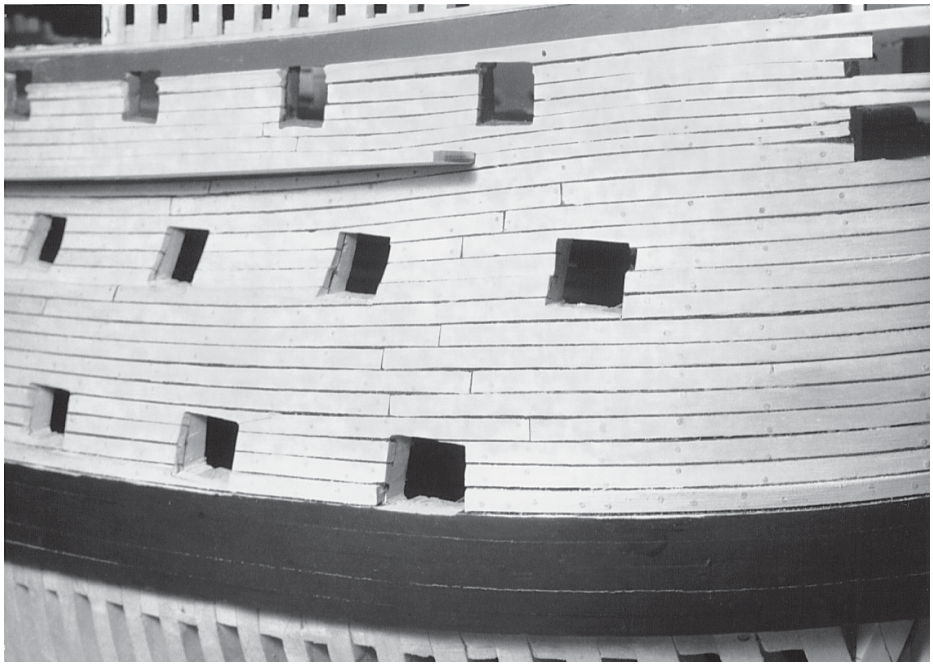
you look at a model, you don't see the whole thing as you once did and probably still do, but what to know what he did on this problem and how he solved it. A thousand other questions will give you a headache, but an enjoyable one. All of this will be stored in your memory bank and everything you do from now on will be different than your last model. Thank goodness the kits will show you an easy way out of a problem but later on you will find out that there is only one way to do a problem. That will be the way it was done on the ship. You will also find in the arts, every artist regardless of media is different. This is the way once can tell who the artist was that compiled the work he has done. Our eccentricities are as individual as fingerprints. The higher your standards, the better for you. Galleries who have models of ships for sale are beginning to realize this is as much a fact as for models of ships as it is for paintings or other art.

The amount of planking needed on the gun deck will be only what is necessary for the carriages of the cannon and the portion in the midships for the hatches and other centrally located furniture. The pumps both chain and the old style piston pump created a large problem. A great deal of research was done to find what should be done and how much, and what would be the end result. During the time of the Sovereign, the chain pumps were covered. I guess with copper plate. This sort of does away with the idea of making the internal parts such as chains, buckets, wheels, and the casings that go down into the hold. I was disappointed as I could visualize the parts and how I would make them. The amount of chain it would take and so on. Of course when the size of anything is reduced to scale size, there has to be changes made. Remember the size of the model if 1/48 is 48 cubed. So if your model weighs one pound, the ship would weigh 110,592 pounds or 55 tons plus. I bet that starts some thinking. Maybe the drums on the capstans weren't banded on all cases such as the bars weren't always pinned in some cases. While I was making the 42 pounders to go on this deck, I became aware that they were sort of large in appearance but when I placed them on the gun deck, they seemed to disappear. As shown in the photograph, the cannons had to be made at this time so the carriages could be located and the fastenings made. The underside of the rear axle is left unpainted so the location of the cannon can be noted. Because the pin locating the carriage is freehand drilled, no two locations will be the same. Take the case of the carriage located in port ten on the port side which will be numbered P10. The carriage is held in the position while a 1/16" drill is entered through the frame or filling piece into the parts on the carriage known as the axle or transom. Must be of a good fit. The length of the hole in the carriage tend to increase the fitting. The pin below the port is fastened in place by another pin, a common brass pin 0.026 in diameter. Both can be cut off with abrasive wheels or files Make sure the pins are solid as the planking on the sides will make the pins rather inaccessible.

I think I should apologize for skipping about it happens. The location of the gunports is another time consuming effort. What we are concerned about is the location of the forward end of the sill and the forward face of the port. The height from the base to the port for each port as well as the frame the forward face will be used for filling in between the frames. Cutting them all about one and half inches in length. Now the pieces can be inserted in between the frames and the profile of the inside and the outside can be drawn, and cut out and glued into position. Now if the gunport extends over to the next frame or the forward face of the gunport should come in between frames the filling piece will be there to take your mark.

The width of the port can be set off as well as the height. I always make a sort of plug gauge for sizing the ports. A piece of pine or bass wood about six inches in length will do. I used to make one end about one thirty second smaller to use first as for roughing out then the other end was the exact size. Drilling around the hole with a drill large enough to let you use a jig saw blade like a saber saw to cut between the holes. The jig saw blade is held in a small Lowell Pattern hand vise. Be sure to have enough blades as they do break very easily. The height of the sill can be constant by making another gauge as in Figure 14. The bottom of the "blade" should be blackened with graphite so when brought into the port, it will show the

high spots that need to be filed down. The thickness may be any that will give a good base. The gauge can be made of two pieces or one. Two is much easier and the height can be measured more accurately. You will find that the sill is not parallel with the base but will be paralleled with the deck.



The next time you look at a nice model, pay close attention to the ports. The thickness of the plank at the port can be seen by the amount of recess that has been allowed for the port lid. In other words, a plank from one port to another will be 3 inches shorter to allow for the recess. Port lids are three inches larger in width than the port is wide and one inch and a half larger from the sill up. The recess there being on the sill. Skimping on the thickness of planking is shoddy. Some give the reason as being easier to bend or whatever. It shows the craftsman didn't want to take the time to bend a plank that should have been used. It couldn't be because it takes more wood. The spirketting will not be put on the gundeck as I plan to build a few models of ships before I retire from building models of ships.

If you have ever had the occasion to do any heat-treating, you would have noticed along with the sound of the steel being submerged into the oil was a wisp of smoke. This smoke, hardly noticeable at the time, will become something you will hear about for a long time. It has an odor that is comparable to the skunk. It lingers and lingers, no matter how often you spray with any of the deodorant. In a factory, it blends in with the other hot oil smells and disappears. But, not at home. So use water-hardening steel and keep the peace.

The gudgeons are made with a short piece of brass tubing silver soldered to the short piece of brass strip. The hint is to use a piece of tubing about an inch in length. The length of the piece will enable you to handle the piece and also it dissipates the excess heat, otherwise it will crumble.

The drawplate for making bamboo trunnels should be hardened. The small edges of the hole must be kept sharp as the bamboo is a hardwood and the part we are dealing with has been made into knives. So, the longer the edges of the hole stay sharp the better.

As I said in a previous article, the best place to find the height of the sill from the deck is the drawing itself. It doesn't agree with any of the tables I have by various authors. The height being only 22 1/2 inches. That measurement on the plan number 124, box 3 in the National Maritime Museum's file, the profile plan.

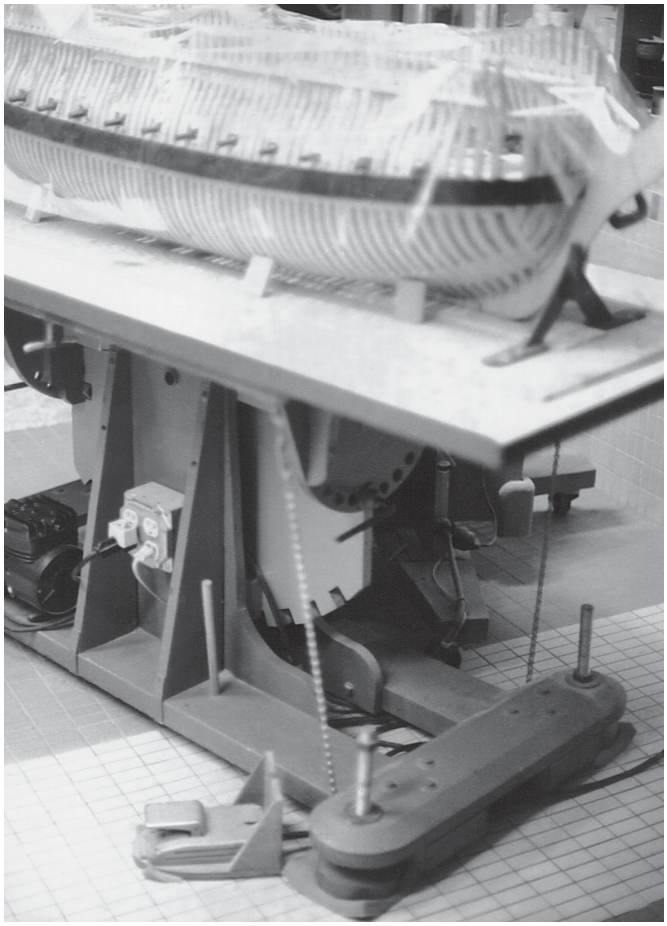
CHAPTER 5

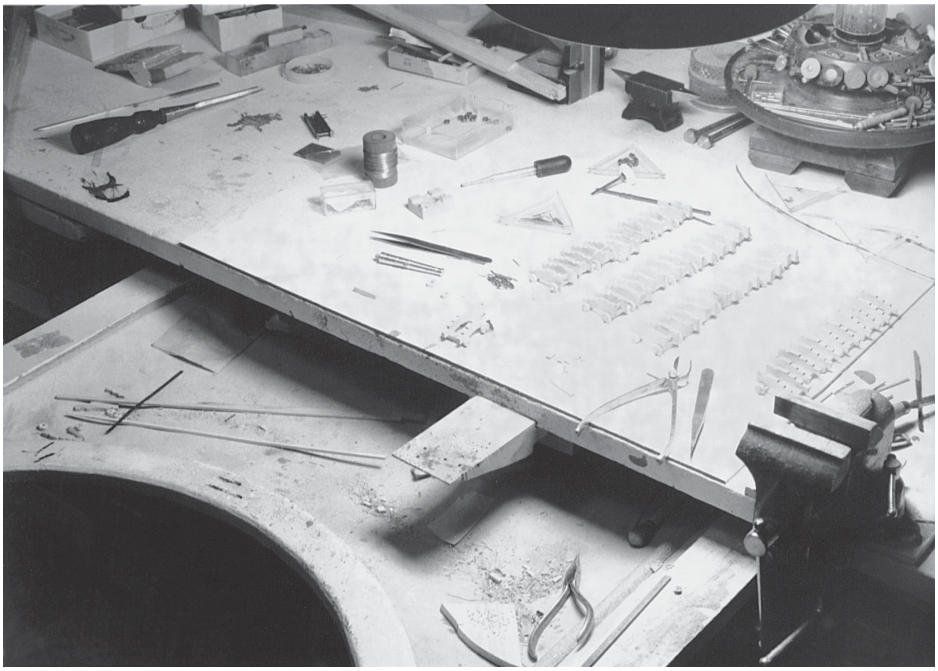
Dry Docks (Building Table)

Well, like all things written and unwritten, there are mistakes made in the finest of writing. I should have introduced you to a table that I have had requests for information. I would sell plans of this table, desk, bench or whatever but, out here in the boondocks everyone guards his blueprint machine with a surprising amount of whatever you want to call it. And, as everyone can tell you “Read the instructions before starting assembly”. So, I guess it isn’t too late to be telling you about the table I build to do my assembly work.

I built this table when I worked in a shop ten hours a day, some years ago. Coming home to stand a few hours reaching down into a hull to lay planking has a tendency to raise hell with the muscles in the back of your legs. I don’t know if this is designed after another table we are familiar with. It just seemed like a good idea, where I could sit on a stool, tilt the hull towards me, and with a little effort I could reach the planking or other needed work down in the hull. The size of the table was due to the material that was on hand. The amount of degrees in tilting both fore and aft as well as amidships was governed by the size of the platen that is the top of this giant knuckle that holds the table top. The threaded rod is a length that is equally divided in the size you can buy. The bolts that hold the platen in the amidships position were at one time called shoulder bolts. I understand that now they are called stripper bolts. For the life of me I can’t figure this one out. What is a stripper about this bolt? Must be an automotive term. Certainly not a term from Machinery Handbook. The notches in the arc that control the fore and aft tilt are held in place by a piece of hard maple that is loaded with a spring to keep the piece in the notch. To release the fore and aft tilt, one merely steps on the piece to depress it out of the notch and releasing the table. Chains and turnbuckles are secured to the end of the platen to steady same. This doesn’t not give you a solid table you can saw or other heavy work upon. The junction box was added later as it seems the cords of the hand tools are getting shorter. The tops of all benches are painted a flat called candle white, I believe. This was later changed to a chalk blue, a mix.

After many years of trying to keep a bench top looking respectable I decided this was the best solution. You see, instead of scraping the top down every time it gets all cluttered up with paints, glue, cement, coffee and others, all that is needed is to level off the spills and give





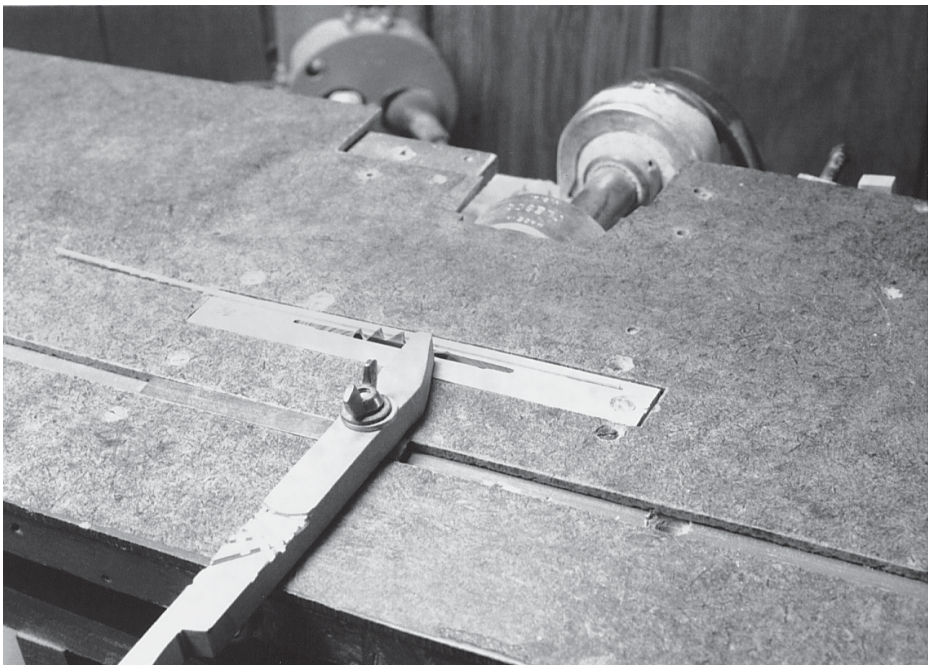
that no one has the bench for sale anymore. To me, it was a cabinet-makers dream. Some of them must have had several dozen drawers all shallow except for just a few. Generally, made of oak. Of course, the chair or stool that came with the bench seated the worker at about eye level with the top of the bench. Maybe a little higher if there was a lathe mounted on the left side. My experience on the bench wasn't anything to brag about. It seems most watches in those days had hollow balance staffs or barrels as some called them. This makes the structure of the staff very very tender. Maybe frail would have been a better word. Remember to fasten your cloth on the apron to the frame by using short battens on the underside.

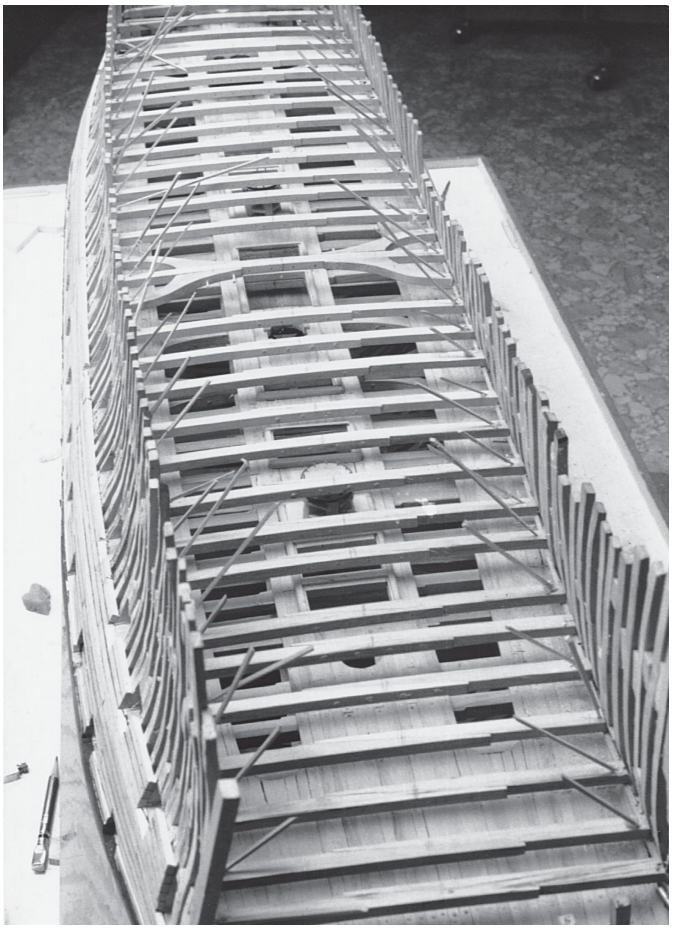
everything a new coat of paint. Dries in thirty minutes too. The edge was put on after many years of picking up from the floor and the many searches on hands and knees for a part that was never found.

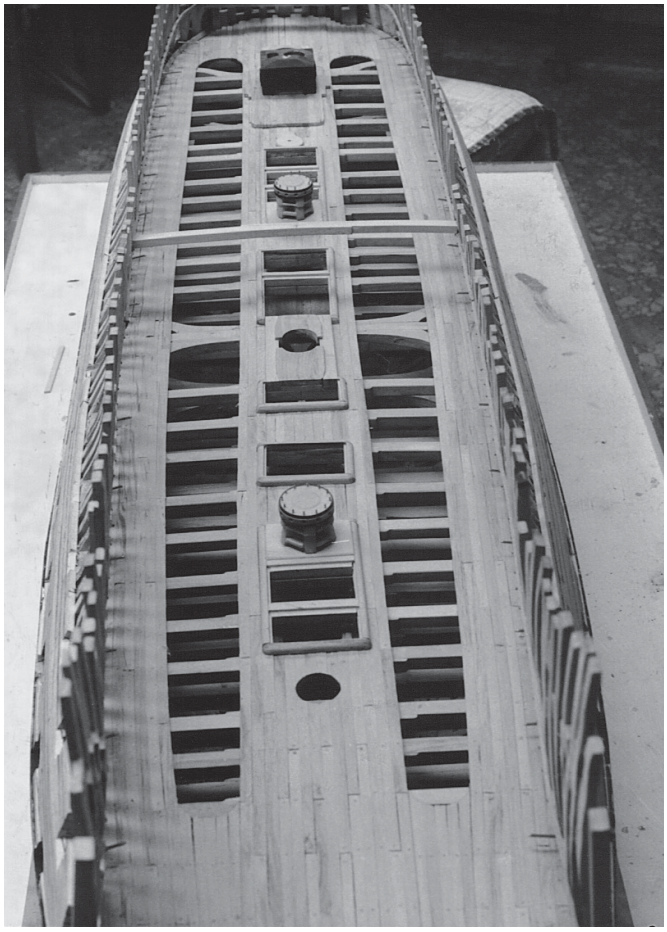
I stopped to turn to my catalogs to find a watchmaker and tool supply catalog to find out what they called a certain accessory that fits onto a jeweler's bench. Well, low and behold, they didn't even list the bench. Due to the battery powered watch toady, I guess. There are benches for Jewelers repair and such. What I am trying to find out is the name of a devise that hung below the bench top. This was just a frame with a tight cloth mounted on the underside. This was and still is wonderful for catching the many hundreds of parts and mayby thousands of parts that would be gone for good.

Wherever small pieces go when they fly out of tweezers or nippers. It is real simple to make. Mine is the same size as the desk drawer. I had to let the drawer down to accommodate the apron. This meant I had to install another set of runners for the both of them. The front side of the apron is curved to fit your waist and the sides extend far enough to rest your elbows and the pads when you are carving. The cloth material should be heavy as it does get loaded with tools when the bench is full or is too far to reach. You might give a coat of some sort of fire retardant. I have had pieces fall while silver-soldering and never even top on their way to the floor. Just a thought, don't know if it would actually help or not. I am a little disappointed

Something else I had better cover before I go too far. All power saws have the same trouble regardless of make or design. That is the opening in the table for the saw. Sometime ago, I made inserts for different situations, but even these had their faults. I have found a simple method for all saws. A sheet of plastic that you have been using for frame layout about 0.020 inches in thickness or (0.058 mm) fastened to the table when it is in the raised position. Method of fastening will be up to you. Then with the saw running the table is lowered to the depth needed and the saw is snugly surrounded on all sides so your ultra thin planks won't fall through. Be very critical about how sharp the saw blade is at the time of use. All of my saw blades are three inches in diameter more or less due to countless sharpening. I like a small blade better.





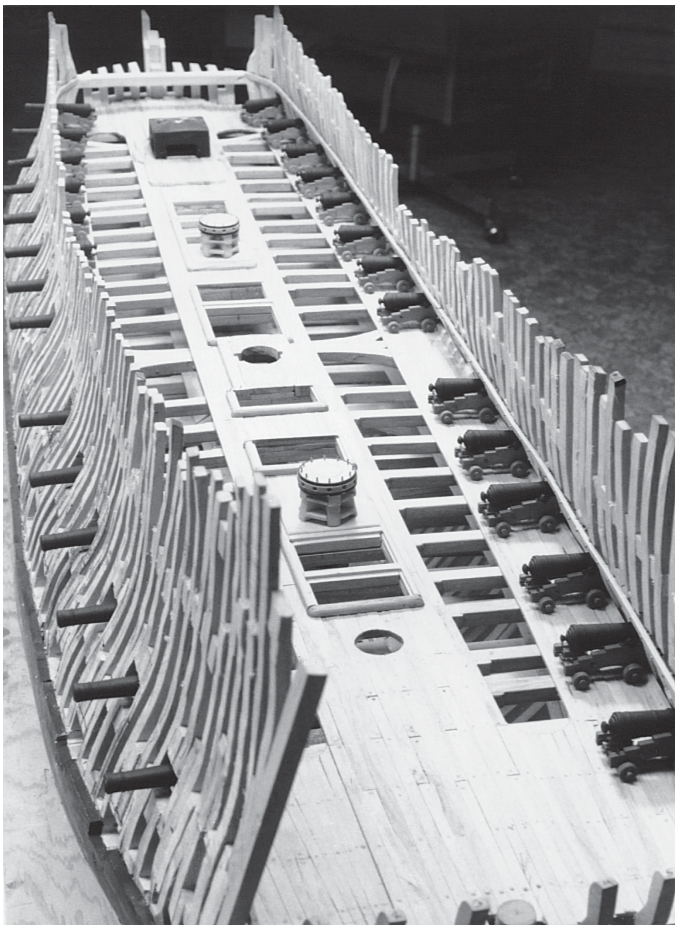


Remember the height for the gundeck shelves were located from outside. The base up to the underside of the beam. Well, on the middle deck the shelves can be located from the gundeck. The height between decks will be deck plank to the underside the beam. I measured several times to make sure as I couldn't forget the knock on my head received from the U.S.S. CONSTITUTION we were visiting several years ago. They are not as low as the one on the U.S.S. NIAGRA in Erie, PA. The plans measured six (6) feet so a block with that thickness can be scooted around the deck and height of the middle deck shelf laid out. I guess they were short people and one should shuffle around instead of taking a "Plow Jockey Step". One who walks on his whole foot but mostly his toes giving him a bounce.

When you have the shelves clamped to the frames, at the given height, check them by laying pieces of 1/2 by 1/2 inch pieces about fourteen inches in length across the shelves between the frames. Maybe eight pieces or ten equally spaced. Now sight from the stern over the tops of these pieces to see if they have a twist or wave. I don't think you will find a piece down too low. The "Hang of the Deck" shouldn't interfere with the sighting. Hang of the deck at the stem point.

The middle gundeck or the middle deck is repetitious of the gundeck. Except for some of the furniture such as different cannons 24 pounders, galley and its stove. Remember when putting in any deck always set up the masts to be sure no beam is placed where it shouldn't be. The planking will be somewhat thinner than the gundeck but thicker than the upper deck. One thing for sure, the experience gained from the gundeck such as not putting in the x beam assembled but assembling it as it goes into position. I have found that the best was to do this is by assembling the beam outside. The beam in the center is as the others but the fore and aft short beams are assembled and glued. Then the dowels are drilled but not glued. The fore short beam on the port side and the short beam on the aft starboard side are broken off. The holes you drilled for the dowels will align them again after you have the beam into position. The splice on the beams (in the middle) are not as long as the ones on the gundeck but you still have to find the center between the ends as this must be kept centered with the others. The length of the beam found on the model in the location for the beam will be figured from this centerline. This is where the line whether it be linen or steel that you have fastened to the stem and stern post's will help you to keep the center of the beam on line.

You might take a break and look at the construction of the timbers in the stern for the galleries. There are six, four on each side of the stem post. These only go up as far as the upper deck. Fastened to the beam that acts as



a sill for the stern ports. I fastened these by using machine screws as they take a lot of punishment during construction until you have them secured by othertimbers.

I think now would be a good time to start the planking on the outside. The first plank above the wale as I said before, will be eight inches in thickness, since your wale is ten inches and the planking above this will be six inches in thickness. Sort out the best of your supply of wood for this is where it all starts. Although a heavy plank, keep each piece its length to about seven inches except where it intercepts after ports.

Now comes a subject that has been argued all up and down the line of artists. The way to show caulking or not to show caulking. Some think it is a method to do shoddy work. But if put on correctly, the corner of the planking as well as other make believe faults will not appear as they won't be there. The paper or whatever you are using must be glued to the planks so when you scrape down the sides, the planing actions of the scraper will cut as a plane. You will find that when if you accidentally pull the caulking out of its seam, will have to remove the plank because it is near impossible to stuff the material back into the .008" space. Anyone that would do sloppy work on this procedure would also do sloppy work in any marquetry. I think I covered this subject before.

That black object that sits in the fore end of the middle deck is known as the galley to some and a stove to others, is another piece that one can to extremes in detailing if he want to take the time. It is supposed to be something else besides a black block of wood painted black with the doors, fireplace grates, and the kettles shown in some fashion or another. The chimney is pretty well left to the imagination. With its movable head or hood that could be changed with the wind.

A new opening, the entry port. As narrow as it is shown on the drawing one can understand how the Gam chair came into use. Then there is another opening aft of the last gunport. I don't know how some of our illustrious heroes of the past ever pulled or pushed themselves through.

I have made capstans almost every conceivable method of construction. I think I have found an easy foolproof way. First the lower half of the drum and the spindle are turned as one piece making the stem long enough to use in the final turning. The pieces that go between the square holes for the capstan bars are glued to the bottom of the drum. The pieces for the top of the drum is made a little heavy to allow for the crown shape on the top. The welps, verticals that cog the messenger, are made as a block with one edge a radius the same as the spindle. After an overnight drying the whole assembly is chucked and turned down. Now if you have made your joints as perfect as possible and your tools as sharp, your capstan should be a perfect piece to admire.

The H.M.S. SOVEREIGN has five capstans. On the middle deck there is an odd shaped piece that is let into the beams just aft of the galley and the first hatch. Maybe not let into the beams but let into the deck planking. My search has found this to be for the lower end of a spindle of a capstan on the upper deck. This upper deck capstan is a small one only 72% the diameter of the large capstans. I imagine it would or will be the same height as the others. Don't ever feel bad about your not being able to research a given subject. There are so many parts of a ship known at that time but never recorded as to what it looked like or what it did. I sometimes wonder what the future will have to say about us not recording the common what, why and how of what is common today. Such as, did you know the doors of the Notre Dame Cathedral in Paris are twelve inches thick? Well, they seemed that thick to me. The X-Ray machine at the airport got my film on this one. I can see where it would take ten men to close them.

I had thought of putting the partitions mostly around the galley and consulting a local ceramist about bricks for the fireplace and range along with tile for the floor. But, once are in, who would believe me when I told them. Especially stuck away on the forward end of the middle deck.

Before I go another step further, I think I should inform you about the health hazard of sawing any kind of wood or other material. Everyone makes a point to tell you about wearing safety glasses and/or a shield in some cases when operating a saw. You say it's only a few small pieces you are going to saw. Well, that few generally runs into many. Like when slicing the formed block to form the cheeks of the gun carriages. The few you saw will raise enough dust to dry your nose out. This is a sign you should be wearing something in the form of a mask. I don't like to recommend certain products but to keep you from running around and buying a mask you will never use.

I find that when you have a monotonous phase of the construction, do a small part or piece of it and go to something else each time you start work. I hope you get the monotonous job done before you finish what you have used for a distraction.

The upperdeck. This is the deck you will go all out on. That is to the best of your ability. The shelf is a little lower to the middle deck than you had for the distance from the middledeck shelf to the lower deck. And, the scarf on the upperdeck is slightly shorter although not much of it is enough to show on the carlings and ledges.

One thing to remember about keeping the edges of the planks true and square. This is just as important as any other part of the ship. When cutting planking, you may find it necessary to run the plank being worked is wide. One to hold during the entry and one to hold during the exit and one to hold down as close to the saw blade as possible. The gradual sawing the plank down to size is only method I have found that will control the final dimension. The ends of the plank, I would say, are the most important as they have to line up with the plank ahead, the plank above, and the plank below. If for some reason, you find a plank with some imperfection, try to use it where you need a short plank or throw it out. The piece you are going to make your planks from should be perfectly smooth on one side by planing. The other side should be marked so every plank during the sawing will show this mark. The marked side being the last side you will cut or dress down to the final size as the marked side will have ripples made by the machine used to first surface the piece. Remember to take a little time off to saw all of your scrap into pieces on sixteenth square to make into trunnels. Time taken now to do this will save a lot frustration later on. I am not able to tell you how to cure the aching back you will have. I haven't cured mine as yet.

Even if you have to find a diversion in making the masts and yards, or some of them, I am sure it will help. Dimensions for the yards and mast are found in David Steel's book on masting and rigging. Later when we enter into this subject I will have a chart showing the dimensions of the various yards and masts.

Something else we had better cover before we get too far along. That is scuppers. Ninety nine times out of a hundred they are never shown and may be considered by many to be an extreme in detail. They are located between the ports of the gundeck since the pumps are there with their cisterns and dales. The dales must go somewhere and what better place than to the nearest scupper. Even if there is a vertical knee in that location as on the U.S. CONSTITUTION. They are about a foot below the deck on the outside is where they exit. They tell of plugs much like corks for a bottle, that had a line going through them in the center and belayed inboard someplace. The CONSTITUTION has an iron plate or door hinged at the top much like the draft door on the hand fired stove, I prefer to think the scuppers had a short piece of pipe from inboard to flanged piece on the outside. Could be lead or tin. I think it must have been lead. Now comes the time to tell you it is wonderful to have a few friends that have researched this item to tell me that the dales were large pipe or hoses made of leather that led from the cisterns to the scuppers or to one of them. Some place along the way of my research I have or did make a mental note about the outside finish to a scupper was much like a flange except it was oblong in shape.

In making the scuppers I have chosen to use air ports squeezed down a little to give them an oblong appearance. The inside portion of the air port is cut down to give us two prongs to be inserted into a single hole. This is a small fitting so don't over do it. Corners of the air port should be filed away to give it a nice rounded appearance. Hole for the flange may have to be trimmed to fit the oblong shape of the flange. All gun decks should be fitted with scuppers. Of course, not the quarter or the forecastle decks. The little tool to use in deciding just where these fittings go. Make a cardboard horseshoe that will fit into the gunport and extend to the deck for one leg and to the gundeck plus one foot for the one foot drop of the pipe. Maybe I should have said a "u" shaped piece anyway you get the idea. As far as I know their location was more important than the thickness of the planking. If you are wondering if the main wale was bored to fit this fitting, we can assume that it was.

Again, I feel I should remind you about annealing all brass before you work the piece. The work you do will restore some of the hardness. If you have a hard time laying out locations of a flat black surface such as location of the scuppers on the black wale, put down a strip of masking tape. After the holes are drilled, the tape can be removed. I would think this would apply to any case there the finish is of such a nature hat it is almost impossible to make a mark that will be easy to see and not damage the surface. Don't worry about scuppers being minus when it comes to the appearance of the model. Once they are painted flat black, they disappear so as to make it difficult to focus on one of them for a photo.

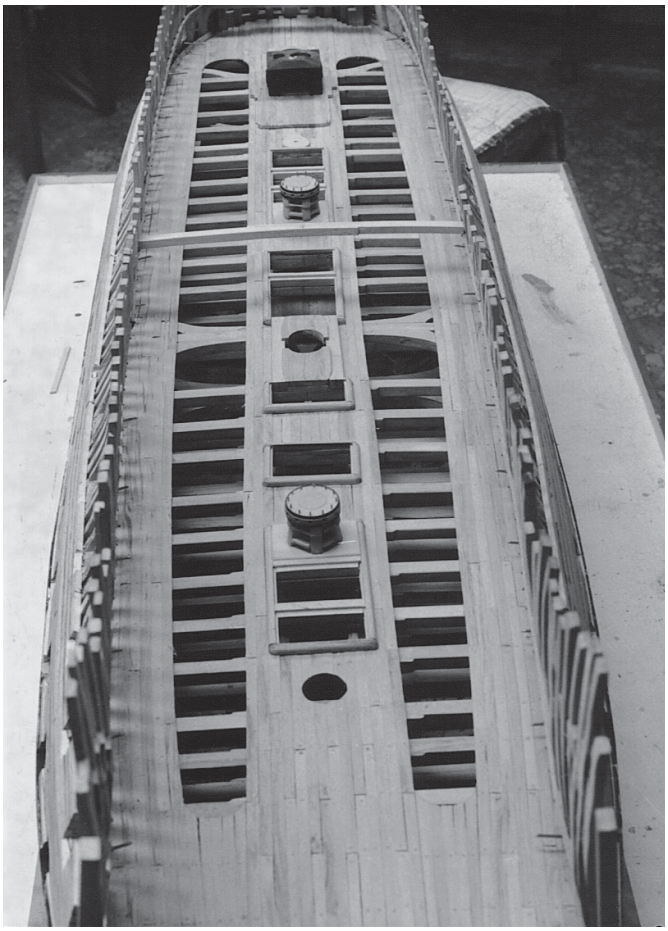
Turn the length of the air port and the diameter of the air port after you have squeezed it into an oval shape. The inside diameter. This is used in setting the scupper into the hole.

Still planking the sides? Well, remember each plank is one plank closer to the sheer. Treenails? You should be pretty good at this part of the operation by now. Maybe I didn't say anything about this before or not, but trunnels for my models are boxwood sawn to one sixteenth square and a length of whatever piece of scrap I used. They are then run down on the running down cutter for about one half of an inch. After starting them into the hole, they are cut off the length that will secure the piece to whatever you are fastening. Then tapped home. The protrusion can be cut off by diagonals so you can scrape everything flush later. You might use a Band-Aid or two on your thumb and first finger. Sometimes they break and they do hurt when they go under the fingernail. A few of the planks have to have a slight twist as they go around the hull. Be sure and soak these too. Now we have to deal with the counter. The model is released from the building board so it may be turned over. A board with two upright pieces spaced about from the back of one capstan to the back of the other, and high enough to clear the frames is mounted on the table and the model placed upside down on the uprights. A means of holding the model on this precarious position can be done by using a short piece of sash rope, one side of the table over the keel to the other side. About the only reference to your drawing you will need for this is the height of the molding that covers the lower edge of the plank and the "ends of the bottom plank". The plank for the counter is not as wide as other planks of the ship. I suppose for the convenience of fitting into the curve that changes radius as it gradually nears the top.

The ports in the counter is a little surprise, in that they are small. A ship who could fire a cannon through the stern ports must have been referring to a deck above the ports seen in the counter. According to Mountaine in his *"Vade-Mecum"*, published in 1744 a 42 pound cannon used a charge of 17 pounds of powder to push the ball to its destination. Those of you who attended the NRG meeting last September in Boston and were present for the "Colors" can remember what one pound of powder sounded like, think of what seventeen of those at once would sound like. Then there are fourteen of them to a side. Sort of gives your imagination a headache. Seems sort of inefficient for one to carry the garbage all the way to the stern when there are ports nearby. The use of them for ventilation seems a better use, since the wind was at their back most of the time.

During the construction of the counter you had cause to make a piece of molding. You and I have both read articles about how this was done by others. How many old X-acto blades do you have? This, the best material to use in making a molding cutter. Rub the surface with a felt tipped marker for laying out. The metal being very hard will be hard to mark but a few lines through the ink will help you get something on the old blade before you start to grind the shape. Once again, the cutoff wheel is used. You ask about the square corners and flats on the molding? Just make these a little oversize then finish them off square afterward. Make the shape a little deeper than needed because when the tool is in use it is tilted a little each was as you pull or push the tool across or up and down the piece. Grinding with a cutoff tool gives you two edges. You will undoubtedly have a few flaws or defects caused by the grain. File these out as soon as the are discovered then go ahead with the shaping. It is amazing about the different designs of molding that are used on ships. I have fifty-two old X-acto blades with their edges full of the different designs I have used in the models I have built. Once or twice I have found a place where an old shape could be used. My first model used eight shapes. After a while I had to make a holder to I could see what shapes I had in stock. The number 18 is the best of the selection as it is wider. I have purchased some that were not as wide. They do not have a little shoulder where they go into the handle.

Now, the piece of molding that goes on the top edge of the counter is not a straight piece bent after. It appears the molding on the upper edge of the counter is the same shaped but a little wider. To you it would be about one thirty second of an inch.



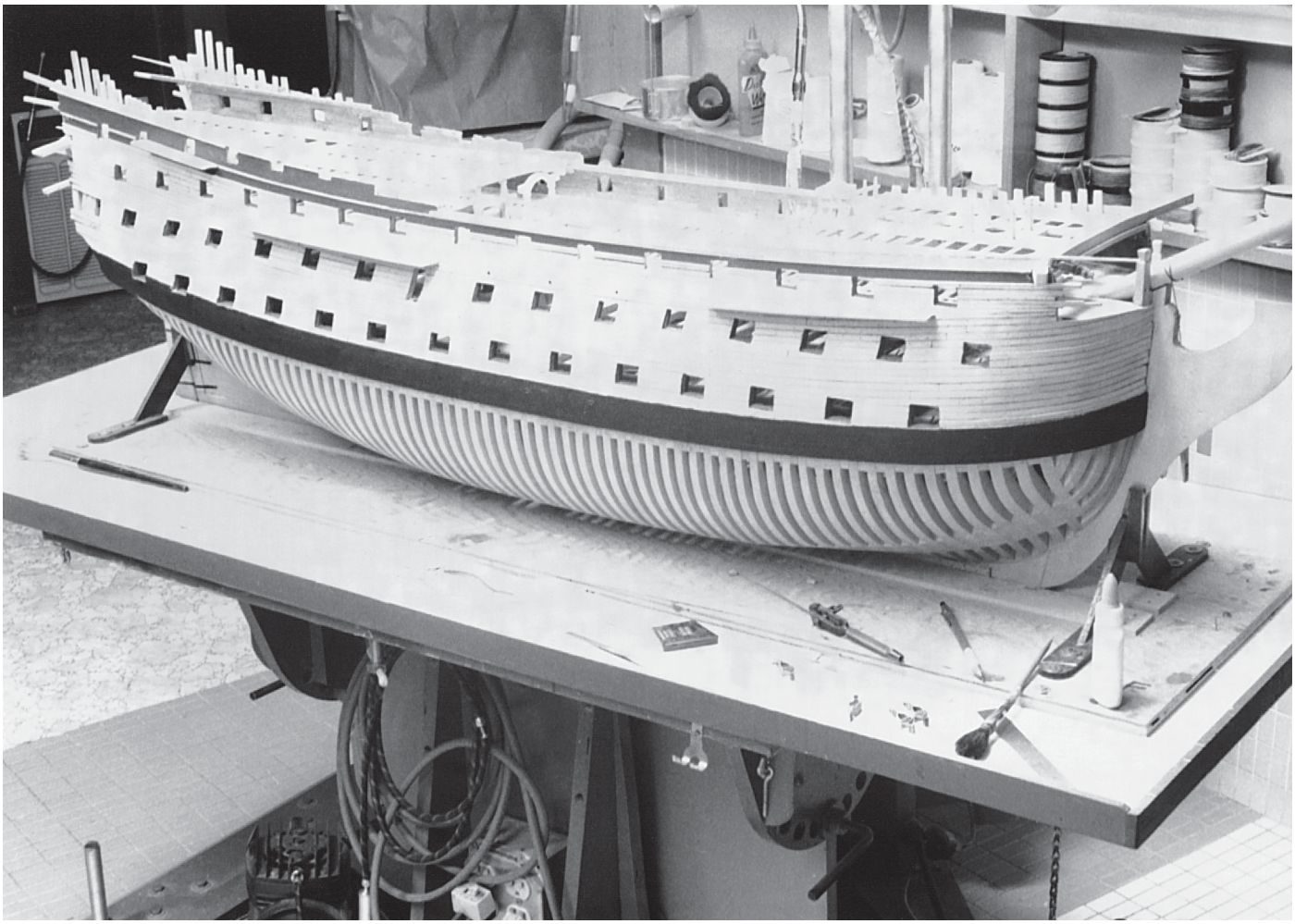
I hope you were not so busy with the counter you forgot to install the tiller. I know to some it will seem a waste as all you can see is the end and then only half of that. I don't care how good a modeler you are, there will be times you will have to add or take away a little material from one place or another to make up for some unexplainable mistake. Maybe mistake is the wrong work but I can't think of an other at this moment. I know, I know, I know!!! Changing finishing material is against all the rules and whatever but, you can use only half of a can of the polyurethane as for some reason it tends to turn a white color because of the silica over the caulking. This is cured by swabbing on a coat of turpentine and wiping it off right away. It only happens when during the last half of the can. You can go out and purchase another can of finish or you can change to Tung Oil. Be sure it is not the oil that contains a stain. After two or three coats of tung oil, it develops a real soft and dull shine. This might be good or it might be bad, depends on your taste.

Now since the hull is in this position, I think it would be a good time to give everything a thorough inspection. Don't think you have seen the last of the dried up ends of some long ago run. These will be following you around until the model is finished. Many more times you will vacuum your model along with blowing out any or all loose pieces and dust. The dust cover you have been using keeps the dust out while your not working on the model but this dust comes in while you are working on your model.

It seems that quite often I am asked about the patience required to work on models of ships. Well, my reply is always "It takes a lot of pertinacity or maybe a better work would be stick-to-it-ive-ness".

Yippeeeeee, Yahooooo, and all that other stuff. We can start on the upper deck.. It's like having the basement capped in with the first floor getting ready to raise the studding and joints. The upper deck will go a lot slower than the others because spacing between, the carlings have to be mortised in as well as the ledges being mortised into the carlings. The scarfs are a little shorter and since they are it might go well to have only four dowels in their sides instead of the eight as the others. The carlings are two thirds the width of the beam and the ledges are one half the width of the carlings. The mortise for the carlings and the ledges should be about 1/16" (1.575 mm) in depth.

Before we get involved in this upperdeck, it would be wise to plan ahead just what is going where and why or how.



CHAPTER 6

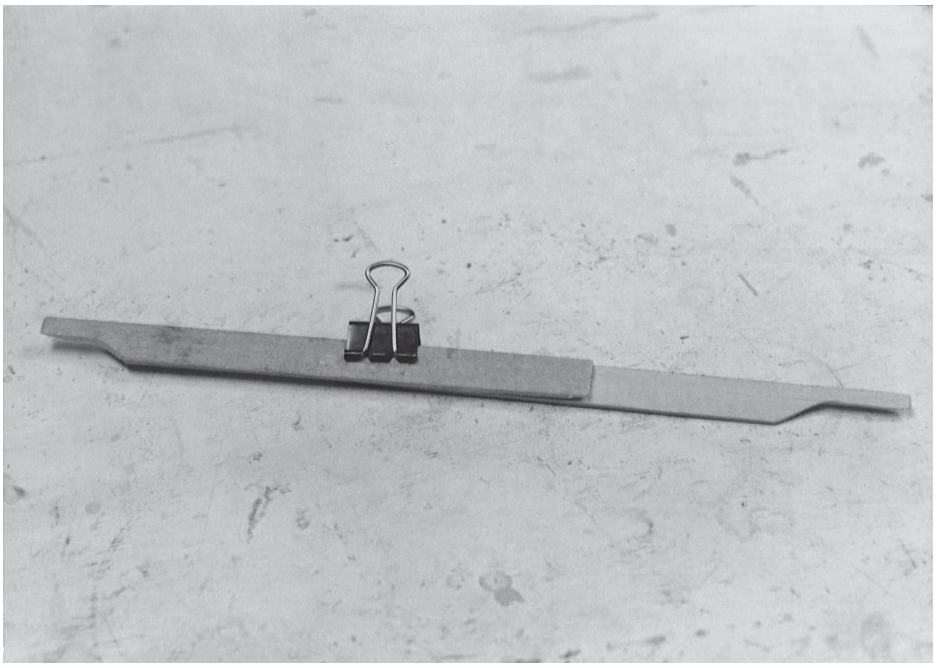
Upper Deck, Sources of Bamboo, Capstans, Hooks

Now you will notice the upper deck starts with a beam next to the stem sometimes called a “hook” that extends back to where the partition for the beakhead bulkhead, here it is joined by a beam on the diagonal that joins beam number two. This we will call beam number one. Two heavy timbers run from the “hook” to beam number two these form an opening or a place for the bowsprit. The next odd beams are sixteen, seventeen and eighteen, and other x beam. The beams are secured to the shelf by long dowels as a temporary fixed positions to be removed later for the mortising. In some ships you will find that the distance between the beams are very similar. By moving one or two most of them can be laid with a similar equal distance. This little bit of help comes in very well especially when mortising for the ledges. Careful, this doesn’t happen very often but when it does, it is nice to take advantage of the situation. On this deck we will have a fifth capstan although smaller, it is present. You should make better looking hatch coamings and we are ready for the grating.

The gratings are made of material 1/8" (3.175 mm) by .047" notched half way through by a slitting saw the thickness of 3.64" or 1.194 mm. This saw can be had at any tool supply house. It will be best if you would make a new insert for the saw blade on your table saw. Preferably one that can be glued. A small piece of material the same thickness can be glued to the insert 1/6" (1.575 mm) away form the blade. I think this will give you a better looking grate as the hole will be a little larger than the material used to make the grate. At least to me it says, this is a grate. Since your saw blade is only protruding a little for the shallow, cut the piece acting as a guide needs only to be a short piece. Make up several feet of these notched pieces as when it comes to cutting the finished grate to fit the hatch, sometimes they fit and sometimes they need a little help. After you have assembled several pieces to make up a grating large enough to cover the hatch, give it a good coat of neutral finish whatever you are using. Until it looks like you almost dipped the hatch in the can. If you are using lacquer, give the finished grating a good brush with alcohol. Leave enough for the finish. The shot racks that go around the hatches are a little vague. I have tried to find out how deep the depression is for the ball. It must be deeper than the radius in order to get the center of gravity below the edge of the rack so the ball will not come out and go rolling about the deck. I forgot to check this out the last time I was on board the U.S.S. Constitution. Can’t think of everything. Well anyway the cannon balls didn’t fit as we think of anything fitting today. A ground finish.

Something I had better mention before I get too far ahead. When placing your beams you can lay from number 15 forward but the beams aft should start from the furthermost beam. This way you have the room going forward to swing the beam into position. You can’t put them in from the top down but rather they go in from the side. Another little device that comes in handy is for measuring the length of the beam. According to the picture it is just two pieces of scrap from a recent sawing job. Can easily be shaped up to give two flat points had held together with a paper clamp. This will give you the measurement at the top of the shelf for which you will have to cut back some for the angle of the tumble-home.

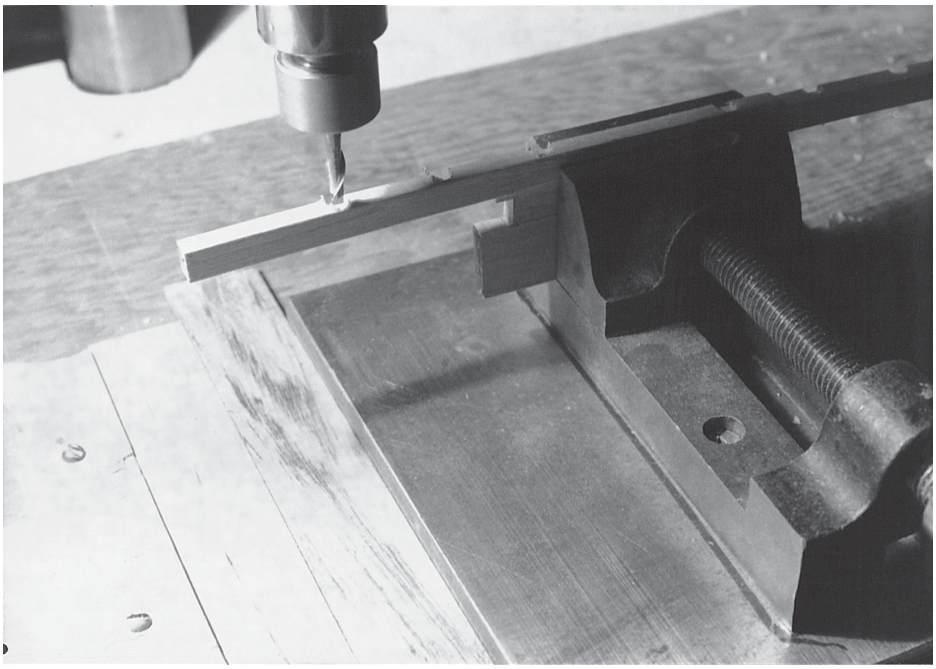
I know that there are times when placing beams you wonder if it is to short or off center. Cheer up — with today’s adhesives you simply glue the pieces back on and start again. The end will be buried under the waterway anyway. The forgiving deck planking covers up all disappointments. Sometimes I think the difference between the novice and the professional can be one who knows how to cover up. Everyone knows that it would take hours to make a new piece. Next is to make a piece that is paralleled on its edges. This is laid down the center of the deck from stem to stern to mark the edges



(inside) of the center carlings. Pieces may be laid along the edge to mark the inside edge of the next carling. Some problems take several minutes and others take several hours. When you get the feeling like walking on soft ground that is to soft, stop. Have a think period about this. I know, in my training, I was taught never to rely on a line that has been laid-out if you can move the piece mechanically from one position to another. But still, the starting point of where you are moving from always has a questionable origin. If you should end up with the carlings a little off the line, they should follow. See if they can be brought into line with a little shifting the tenon on one side or the other. Paring a little off of the tenon. You do have to leave the room for the adhesive.

I know I am writing as a guide to you, but sometimes I feel as if I am writing a guide to myself. If you are going to use a router straight bit or an end mill to cut out the mortise, be sure to cut corners with a knife so you won't tear them out with the bit. Please make several sample pieces first, to check how clean the mortise will be. The beam with a chipped out mortise will be the one that shows the most, probably in the waste where everyone can see. To keep the beams square with one and another, clamp a metal batten across the top with a clamp for each beam. The batten can be either a flexible scale (ruler) or maybe two hacksaw blades. Something that will bend with the hang of the deck solid enough to square-up the beam. This is after you have cut mortises for the carlings. Glue and trunnel the ends of the beam and cut off the extensions of the trunnel. The carlings are not placed at this time. It is more important to be sure the beams are square, with one another. I only glue five or six beams at a time because of the length of my steel batten. Photo shows the vise in use with the heavy plate to give it firmness. The spacing pieces for moving from the first mortise to the second and the third. Also, there is a spacing piece under the depth gauge for the difference between the scarf and the other half of the beam. I used an end mill as it was true to size and the router cutter was way oversize. The bottom of the mortise can be squared off with a chisel or knife, or you can round off the bottom of the carlings to fit. Not to much other wise it will be noticed. By taking the average of the distances between the frames, you can find out how many ledges should be located in between the frames. Several tries at each location will give you an idea.

By keeping the spaces as near the same at each location, gives the whole deck a more even look when it is in view before the deck is laid. The beams being scarfed on this model has given the deck another problem. The carlings will not be all the same length as on decks with beams of one piece. Therefore, the end carlings will be able to have their mortises cut equally spaced. Then they are placed into position with their mortises facing each other. A straight edge (flexible) is placed between them and the location of the mortises on the other carlings are



laid out. More caution is needed here as sharp points on your pencils. Make a mark on what side of the layout the mortise is cut. In order to keep the beams in the same location as shown on the plans, the difference between the beams are an adjustable eleven thirty seconds. What I mean is that the difference will have to be divided and the approximate difference of carlings between the beams will be the figure just given. So set your dividers and adjust a little as you form one beam to the next.

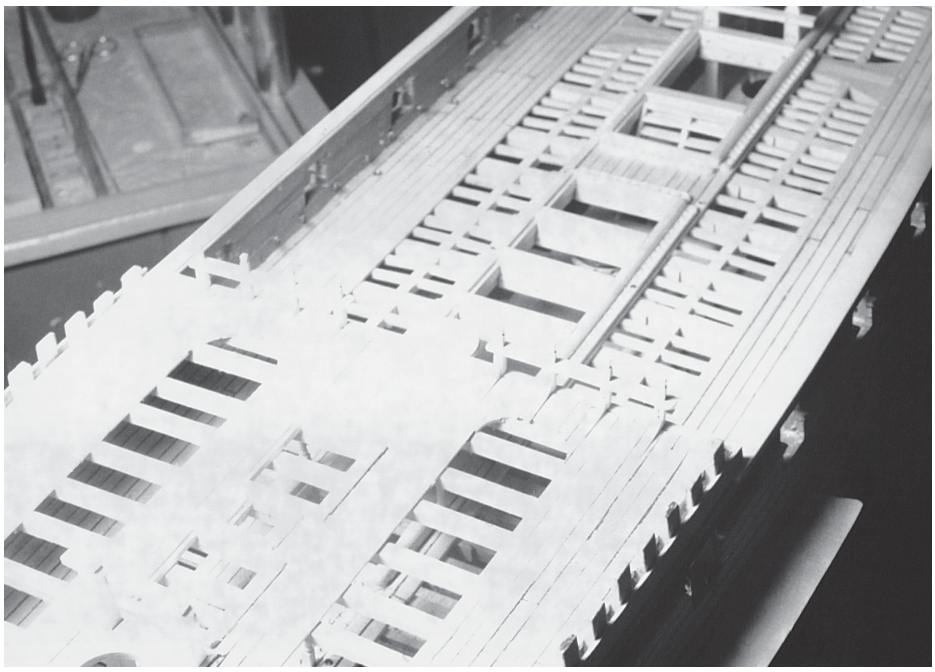
The mortises in the carlings for the ledges will figure out to be about the same except for a few exceptions. You remember the system we had in the beginning for milling out the slots for the “floors” in the stern block. The system of using pieces of exact width, removing them each time a slot was milled to the next position, well milling the mortise in the carlings for the ledges can be done the same way. With small routing cutters or end mills. The small sizes are not to expensive. Another little trick is to cut the sides of the mortise with a knife so the cutter won’t tear out the edge. This is a slow going operation. So, relax and make each piece fit. When it is done, it is very pleasing to sit back and give yourself a pat on the back for a job well done.

Next are the waterways. There isn’t too much to say except they are pegged in every beam, leaving the only bends in the fore end. The planks for the deck measure about nine and a half inches in width by three and a half inches in thickness. The length is an assortment of planks measuring from thirty two to thirty six feet. Of course, this is scaled down. The trunnels are now of bamboo. These are taken from a set of placemats declared unserviceable by you know who. You have to have an Ok for a lot of things. The holes in our drawplate should be two. Measuring one to be 0.040" (1.102 mm) and the other measurement 0.035" (.889 mm) If the bamboo is pulled through the larger first (and then the smaller), I find there is less breakage. Remember to harden this plate as the bamboo will cause a lot of wearing. When you buy your drills especially the number 65’s try to get them about five ten thousandths over size. It is a lot easier to push in the trunnel. After you have laid the seven strakes of planking on the port and the starboard sides, take a break. Go over the deck with a sheet of 0 or number 100 sandpaper to remove the paper and the ends of the trunnels, then you can finish the deck planking with something in 200 grit paper. A little early with the fine paper. A number 19, I think they call it a mat blade. Ground square and finished off on a sanding belt with a grit of about 240. To burnish the edges to give the scraper a edge maybe a waste of time. But on the other hand, it will make scraping easier. By being left square the blade can be pulled straight or diagonally and sometimes it can be pushed. Be prepared to sharpen the blade many times. If you have a two inch sanding disk, you may want to use it, but be very careful of rocking as this will produce dug in circles. I find that a good scraping in much better than sanding because it produces a hard finish.

After you have finished your scrapping of the upper deck, the locating to upperdeck ports should be next. This is to be followed by the fitting of the filling pieces where the framing doesn’t fit the ports. I think it would be a good point to cut out all the ports on this deck at this time. The main reason is so you won’t be defacing the hatch coaming with the files and saws you use to cut out the ports. Remember in all ports and entry ports the corners should be square and clean. I mean no small radius in the corners. Take it out with a knife, or a square file that has had one side ground off. Another point about filling pieces. Make them long enough, well above the port hinges and below long enough for the pins for fastening the carriage in position.

On this deck ports number 4-5-6-7 and 8 do not have portlids. The coamings are next. There isn’t a reason for why they go where, it’s just following the drawing. These are sort of massive pieces, but when located on the deck, it doesn’t appear so. The simplest method is to but the ends together at the corners and the way it should be done is sort of a lap joint see figure. This can be an upper half of a dovetail joint. Then after it is installed with the deck planking around it, the joint seems to disappear. The only pieces to be rabbeted to receive the gratings are the pieces running fore and aft.

Remember I said something about a pad on the middle



deck for a capstan. Well, I hope you will forgive me for misinforming you. As it turns out, the capstan on the upperdeck had a foot of the spindle of the middledeck is the same size as the others on the middle and lower decks. I think it has only eight holes for the capstan bars as the ten and eight on the other decks. If you think this is unusual, I think so too.

However, there are exceptions to all rules. In Lavery's *"The Ship of the Line"*. Volume 1, page 82, the plate shows an 80-gun showing the fifth capstan. Now is a good time to establish the height of the shelf's for the quarterdeck and the forecastle deck. Pieces should be heavy enough to take all of the fastenings. It seems that on a first rate the two decks are a comfortable height so one can walk under them without bumping your noggin. Under the shelf and down to the waterway of the upperdeck is the planking called spirketting. The upper strake can be the same size as the lower next to the waterway. In between is filled with planking of the same width and of course don't cover the ports. Make a nice parallelogram.

After you have trunneled the planking to the frames and filled any unwanted holes, you can give the spirketting a coat of red color. That's right RED. BLOOD RED. The name you will find it under is Hyplar Cadmuim Red Medium or in oils you will find it under Liquidtex Cadmuim Red Medium Deep. Although the oils take longer to dry, they do leave an old look. Something else about spirketting, the lower piece can extend from the waterway to the sill and the other sometimes the same width can be from the top of the port to the shelf. Two pieces somewhat thinner are used between these two. They are short pieces due to the ports. Considerable amount of bending from the first port to the beakhead bulkhead, it's quite a twist.

A while ago, I purchased a few clamps from a SIS supplier for some of the screwball clamping jobs that come up. The hole in the lower or for the lower screw was elongated somewhat to give the arms greater flexibility. This helps out when it is desired to put pressure on a small spot rather than the whole surface. The "jaws" being plastic help to reduce the weight so it won't fall over or pull on the joint. The inside edges of all ports must be round. Even the edge of the lower piece of spirketting to the next piece. All sharp corners left unrounded are a potential source of injury. I would like to suggest for filling and building up where or on the surface that will be pointed, you might use a paste made of Liquidtex. I know it is an acrylic, but it works and hardens well. The best tool for applying the modeling paste is a palette or painting knife with one inch and a half blade. I can't give you a number, as it seems every manufacturer has a different number and the art supply houses tack on or give the product a number of their own. If you think the mixture is a little thick, a little water can be puddled in the top of the mixture to form the consistency you desire. I know there are many modelers that won't think of saying anything about the fillers they use but someone uses them or else the supplier would take the product off the market.

The knightheads are not the square pieces of timber that many think they are. The shape is the old familiar parallelogram. The shape of the "castle" head is about nine inches above the top of the bowsprit. Go slow in working out the shape of this head. Make a few strokes with a file. Each tie check the appearance as it easy to get one of the angles wrong. Now we have to check for the size of the main stay collar we are going to use. Allow for a little extra when you drill the hole in the knightheads as well as the angle the collar has when it is rigged to the mainstay. Do it now as it is very difficult to do later. Might as well drill the hole for the collar that goes through the gammoning knee. Same size. Don't forget to round the holes to take the strain off of the collar the knights can be used as a tenon to set into the mortise in the hull. The knights are put in now so the deck and other planking will be easier to lay. You probably experience the difficulty of placing timbers between the middledeck and the upperdeck for or I should say to form the step for the bowsprit. It is another cut and fit operation as the difference between the drawing and the model once again asserts itself. The planking around the hatches once again call for a decimal figure as the number of planking needed. Those spaces should be watched very closely.

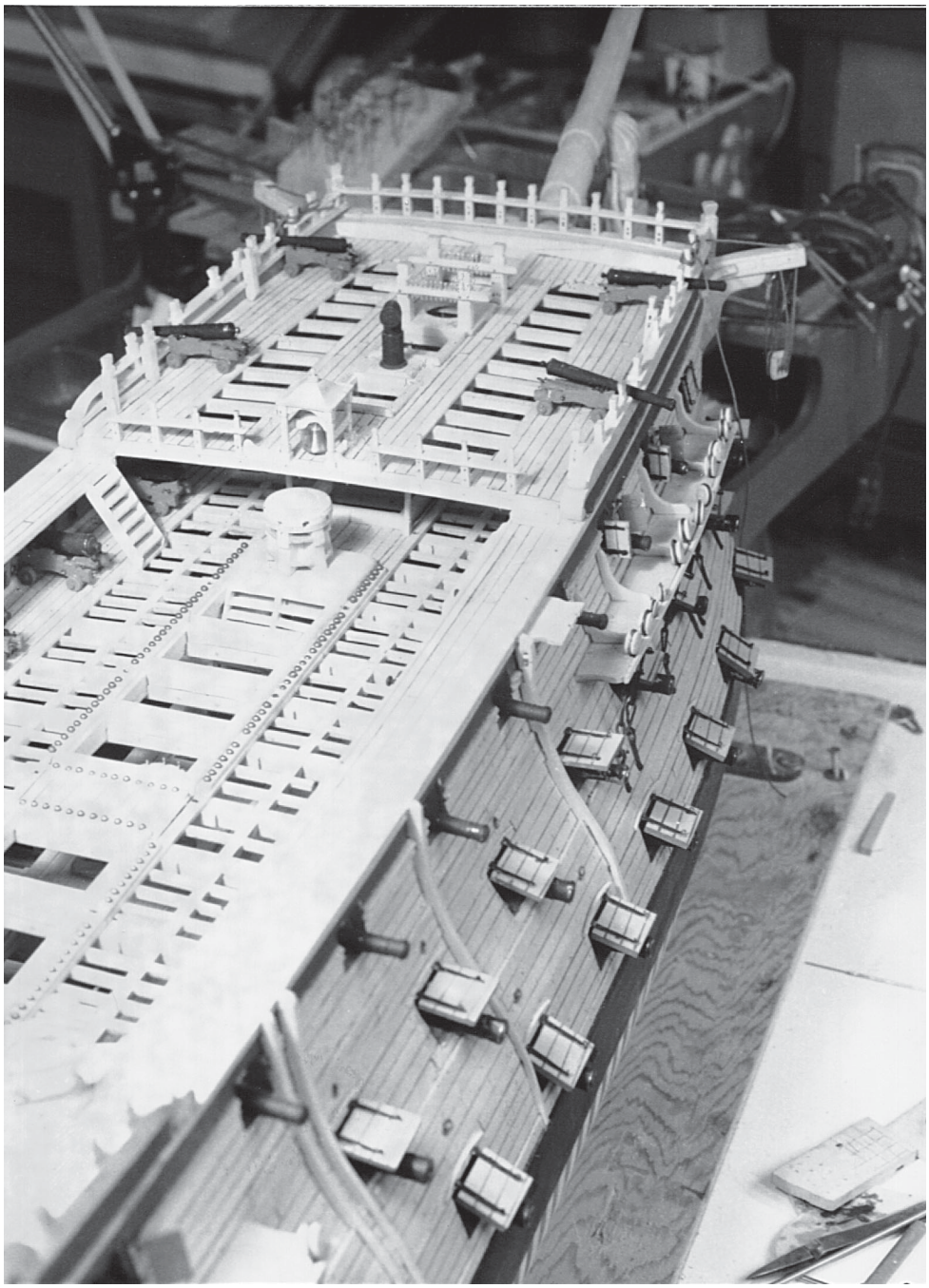
A little something to remember. Not only is it true about the problems of building models of ships but it is true with everything we do. The more you enter into a problem the more it seems to display itself for you. You say to yourself "that wasn't so bad".

The upperdeck planking that tapers aft from somewhere between the main and the mizzen masts, can or should be done as one length of planking. Cutting the correct length of each plank after the tapper has been made and tested. This way, if you number the ends of each plank, the widths will match up better.

Something else to think about. Gratings may be fine to show you can make them. Really, don't you think if you have anything to show below decks, the gratings are a way to cover-up. All that work could be just as well done away with to show the decks below you labored so hard to put in. It would be a shame to cover them up. Now that just about everything is in place for the upperdeck, you can sand down the deck again. Always looking out for bits and pieces of whatever that doesn't belong where it now lays. This deck and the decks to follow are the ones that deserve your finest expertise on finishes.

Ringbolts are a necessity although not very popular to make. The tiny critters have a way of their own for flipping out and getting completely lost. In 1/48 scale, I make them from 20 gauge wire (brass). Using a fine pair of round nose pliers (1/32" or 0.81 mm) there is a lot of

changing positions to form the eye and to get it back in line of the stem. Threading the stem is must. A number 11 of the screw plate (Jewelers) or a 0.8 mm die purchased in a jewelers supply house. Don't forget to purchase a die holder. The die is very small, too small to hang onto with your fingers. The job of threading the stems will pay off. If you don't you may look back before the model is completed and find one of them missing. Probably, from some non-accessible place. The rings are simple to make. An arbor made by chucking a piece of drill rod the size you want for the inside diameter of the ring. A piece of square rod set up close to the mandrill arbor to form the wire around the mandrill. If your deck has thirty ports, you can figure on making 112 eyebolts and 82 rings. Short of designing a machine that would make these eyebolts, it seems the old one at a time by hand is the only solution. When the thread is cut on the eyebolt it enlarges the diameter to where you can use for a pilot drill, a drill that is only three thousands small than the original diameter. The "wrench" for assembling the eyebolts to the bulkheads and the deck. A piece of tubing the size of the outside of the eyebolt with a slot cut in the end will do nicely. Make sure the slot is a good fit. Tubing can be held with a pin vise for more power. You can never guarantee that your model will never be turned upside down. To prevent this in shipping, I always make a "hip-roof" on the case. This also prevents placing anything on top of the case. Even then there is always the possibility.



CHAPTER 7

Mounting Cannons, Catheads and Tails, Belfry

For the holes you drill in the racks to take the shot, it isn't necessary for the bottom of the hole to be spherical to fit the shot. I don't know for sure if the prototype probably had flat bottoms in the holes. Anyway, it will be rather difficult to tell with the shot in place. The flat finish you will use, one coat will be all that is necessary to hold the shot in place. It isn't necessary to glue each shot in its hole.

I am going to hold off fitting the bitts on the upper deck for a while, at least until the quarterdeck beams are located. Just in case they should be an obstruction, it is sometimes very difficult to screw in one of the ringbolts. I guess it is because the end isn't square. Probably if you cut it off at an angle in order to have a square end when you made the eye. A scriber is on the market that has several extra points in the handle. One of these points can be ground down to make a makeshift reamer by starting the grinding about 3/8" (0.97 mm) back from the point and grinding towards the point. Sort of a flat reamer. Very useful in cleaning up holes and enlarging them a little bit for a cantankerous eyebolt.

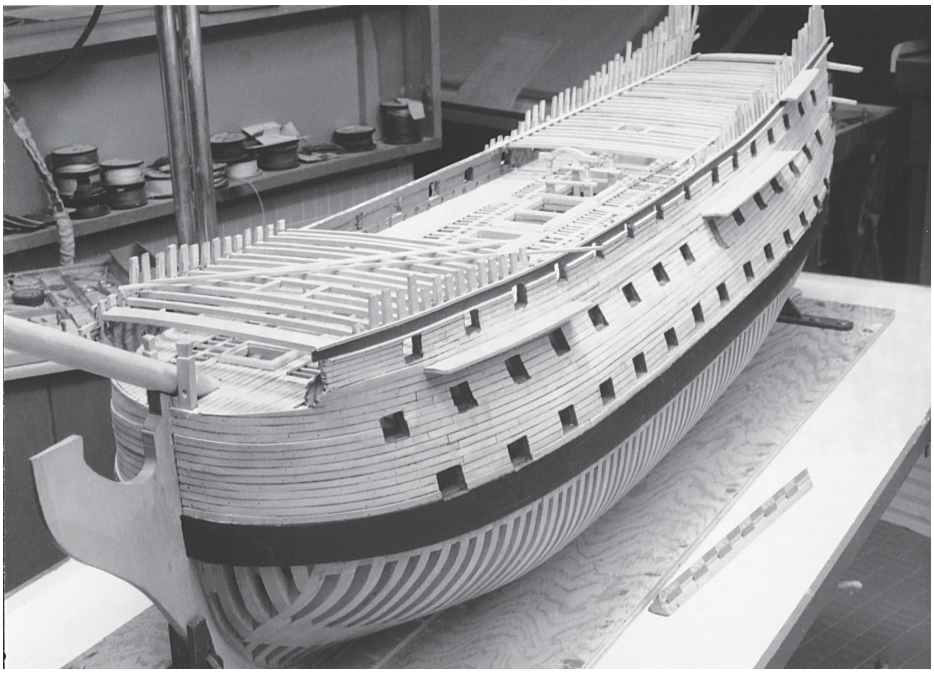
These faraway holes that have to be drilled can best be done with a drill that has a little added on for length. Such as, 1/16" (1.575 mm) tubing that has 1/32" (0.814 mm) hole running its length. Both are tinned and while hot, are joined. I know they are dissimilar, but they can be soldered. Soft solder.

The eyebolt aft of the cannon used by the tackle to pull the cannon out of battery, may be just a plain eyebolt. Countersunk into the heavier strakes of deck planking with only about one half of the eye above the deck so the hook of the tackle can be inserted. The hole or countersink for the eye is drilled with a hank drill maybe two turns of the crank will be enough. The hole for the bolt is drilled next. By drilling these holes in reverse, they stay in line better.

Mounting the cannon on the upperdeck will have to be done using two methods. The pins as used on the lower decks will be used for the cannon under the quarterdeck and the forecastledeck. Those in the waste will be pinned with escutcheon pins through the rear axle into the deck. Two of the four sides of the head of the pin may be removed to make the pin less conspicuous. A half of a drop of red will cover it up.

Have you completed the planking from the chain wale to the channel wale? Now would be a good time to do this. Give yourself a break in the monotony of the decks when you are sawing out the planks or anything else, go slow. Just because the saw is overpowered doesn't mean you can try to slow it down with heavy feed. Since the planking is thinner it will be easier to drape the ends of the planking around the ports. You probably noticed by now, the planking on the sides are very close to being similar in width. There are several planks in the run of planking that will need soaking because of the twist they will have especially forward of port two and aft of port eleven. The door for the entry port seems rather tall, but when measured it comes out to be only five feet (127 cm) in height by 2.5 feet (63.5 cm) in width. Don't forget the scuppers. There are six to a side placed between the ports that are the lowest in the hand of the deck. Remember the line drawn from the stempost forward to the center of the last beam aft.

I guess it is about time we talked about the channels. The width is very important so all shrouds and backbraces will clear the hammock cranes, when there is some, each piece has two curves. The one that follows the sheer and the one that follows the line of planking. You have to allow for the thickness of the planking and the amount you are using for the tenon that fits between the frames, when laying out the width of the channel. Now comes another use of the dummy masts you made for the location of the partners. Set off the distance of the head



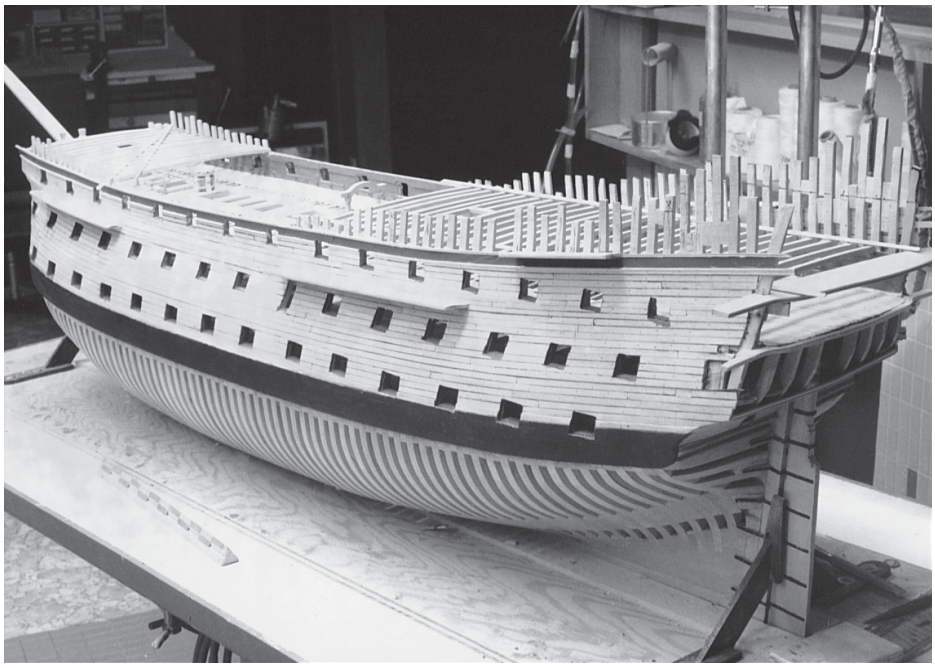
and secure a line. A piece of cord will do fine. This you can use to check the width of the channel and also use when you layout the location of or for the deadeyes so no shroud is moved back to keep in line with the center of the mast and the location of the deadeye.

In some cases in smaller ships where the sheer is not so great, if any, the channel could have only one curve, that as the planking. The notches cut into the channels for the location of the deadeye strip is covered over by a piece of moulding. This is a simple design. I suppose some smaller craft would only have a half-round piece, but on larger ships a better design as in the drawing. When the time comes to secure this piece, you should use copper nails or short lengths of copper wire. The ends of the channels generally had a double reverse curve, sometimes just rounded and I suppose on smaller craft it was square. I suppose there were braces under the channel as shown in Longridge's book *"Anatomy of Nelson's Ships"*. But the Sovereign is twenty years earlier and it may have been that the braces were above the channel as shown on many models of this period.

The braces when placed above the channels were called brackets. Prior to the refitting out in 1805, the HMS Victory had brackets above the channels. About six on the fore with seven on the main and maybe four on the mizzen.

It may be a good time to mention this and maybe not, but it could be a good time to make a strip of moulding that crosses the upperdeck ports. It is at least twice as thick as the planking on either side. This is, of course, so the design can be seen. I clamp this piece to the board by using a deep throated clamp and an eraser. The eraser is the common type about one finger in thickness by two fingers in width by three fingers in length. The name is long since rubbed off but I think I got it at the local dime store. This way you can clamp over the finished moulding without causing damage.

Cutting the inside face of the channels to make tenons that will fit in between the frames may be ok for some but then you have to plank around them and that would take a lot of cutting and fitting. Many of the models have had their channels fastened by the use of steel pins (cut off brads or nails) making sure they are clean. Set into the channel first, they will make their own mark to show you their location on the hull. Might just point them on both ends. Like all dowels, the pins may take to the hull rather than the channel. I would say the number of pins to use would be four for the fore channel, five for the main channel and three for the mizzen channel. When placing the brackets, be sure to allow for the port lids who's shape resembles a cupboard door. Keep this in mind when enlarging the rail. You have to be careful when planning the thickness of planking so you won't end up with a rail in the waste too wide for good practice. Another check point is the distance between the deck of the beakhead and the top of the moulding.



Anyone who has worked on a very old model will remember finding a loose piece and wondering where it belonged. Well after much searching, one will find it can only belong in one place. With the idea the two sides of the ship are the same has been misleading for a very long time. I remember reading about a shipyard contracted to build three destroyers during the war. All three were along side each other in the same yard. Now, when taken to sea, all three of them performed differently. So, with all the exactitude, being perfect is a stretch of the imagination. The word perfect is a descriptive word, not a fact.

Recently I purchased several small dishes for mixing colors. I never paid much attention to the sign above the display. So, when I got home, I proceeded to put into one of the dishes about an inch of oil color and added a little turpentine. A strange thing happened. The stick I was using to mix with suddenly started to drag on the bottom of the dish. In fear of what was happening, I dumped everything out. Later at the store I found I had purchased mixing dishes for watercolors.

We are about to add one more color to the model. We go to Frank C. Bowen's book *"From Carrack to Clipper"*, page 41. A page titled "English Styles of Painting Ship from the Middle of the 17th Century to the Middle of the 19th Century". Of the nine examples, I believe we should follow the figure B as the "First of June" is the port for the lid. The doors swing sideways, so the side differently than the others and allow for the hinges on the side. If by some miraculous stroke of luck you have arrived at the upperdeck ports with the same width of planking and the same number of pieces, take one long break. I know you tried to control the width of the planking, but the pressure you applied on a long run of planking on one side may not have been as much as what you applied to the other. There are other reasons, we won't go into that now. There is always something else to remember. When planking up the sides, you will arrive at the first strake of molding In this case, it would cover the upperdeck ports about halfway. Get your measurements above and below the ports and fasten the molding in place with trunnels but use only every other one and no adhesive. Measure the distance between the planking of the channel wale and the molding. Divide this by the number of planks you will use. If the number is five, remember the top plank will have two chalking strips. There will be a need for you to make a scraper having a curved edge, only slightly to fit the planks as they go around the foremost ports. Make the radius of the blade a little smaller so it will be easier to scrape. I suppose by now you have had your share of kibitzers. They are like weeds in your garden. Like a neighbor down the street. I think he plants weeds as no one has seen anything else in his garden, but he plants every year.

Now the planking below this molding was only 0.075 in. (1.905 mm) in thickness. The planking above the molding should be only about 0.045 in. (1.143 mm) in thickness. This allows for the molding under too late, i.e. 1794. Here we find the strip above the molding painted a deep blue, such as Corulean Blue. Any color you use should have a deep rich color. I believe in those days, paint and cloth were an expression of wealth, the deeper the color being more so. If you have a few pieces of wood who's color or grain isn't quite like the other wood you are using, save them for the parts you are going to paint.

If you already haven't done so, the frames in the waste can now be cut off to the top of the second molding. The second molding, being small in width, was fastened with bamboo trunnels a little larger than what was used for the deck planking. Sort of in between the size of the deck planking and the size you used for the planking on the outside of the hull. Cutting off the frames in the waste will give you a feeling of nearing completion.

The quarterdeck has an increase in the height of the segment of a circle you are using. The beams are also without scarfs. All in one piece. Proving the construction is getting easier or maybe I should have said getting less complicated. Being in one piece, you have to watch the wood you will use. There won't be much to keep them from moving fore or aft except the grain in the piece being straight. Of course, the carlings around the hatchways at various locations on the quarterdeck. Starting with the foremost beam is located from the beam just aft of the mainmast. This you should secure temporarily. The aft face of this beam is where you measure to the next beam. The distance from the mainmast to the mizzen mast may vary from the drawing to the model. So, you will have to make adjustments in the measurements in favor of the model. Keep the better looking beams forward and the not so nice ones aft to be covered by the planking of the cabins. Before this deck is finished, you will begin to know just how good you are. Especially in wood turning. I would suggest you try your hand on the balusters of the breastrail of the quarterdeck. This rail takes a lot of imagination and tender care. The pilot wheel will be covered in our discussion before we leave the quarterdeck.

I have had an itch for sometime about the height of the quarterdeck shelf. It was just a case of not seeing what I was looking for. I believe I said the quarterdeck had more clearance than the other decks, well I was wrong. It only measures about 5'8" between the upperdeck and the bottom of the quarterdeck beam. A good height for skull banging. The part about trunnels breaking and going under the fingernail should have been going under the side of the thumbnail too.

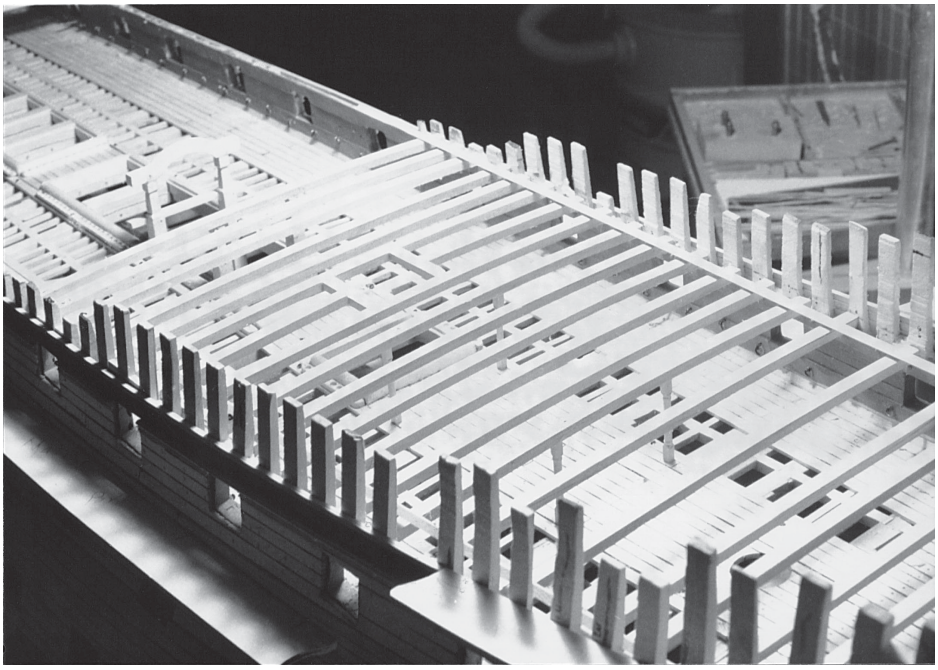
To lower the quarterdeck shelf with the least trouble was to remove the shelf only, cleaning up anything left on the frames and the top part of the spirketting. The part shown on "a" is removed from the shelf letting the shelf fit down over the spirketting. This does not come down so low as

to interfere with the top edge of the parts. I am in a way glad this happened so I could show you how this mistake is taken care of. I am also glad it didn't have to be lower as I would have had to rip out the spirketting. Now since this has been done, and the beams are trunneled down (temporarily), it does have the look of looking good. Don't forget your gauge for measuring the length of the beams. The frames may appear to be vertical but when you get down to the shelf you will find there is still some tumblehome left. The waterway on the quarterdeck is two thirds or half the size of the waterway on the upperdeck. These are fastened with trunnels about 0.043" (1.092 mm) in diameter. Bamboo was again used for this.

I think you have by now come to realize the construction of a model is a consolidation of many, many small two or three hour projects. If you think you have a problem coming up that will take more time, let it go until tomorrow then start the problem first. Don't take any drawing for granted. They made mistakes back in the good-old-days the same as they do today. The deck plan for the forecastle on this model has several major errors. Showing only two ports when there are actually three. The spacing of the beams is different. I haven't checked the location for the foremost as yet, nor the galley chimney, but will proceed slowly just in case. The shelf for the forecastle beams had to go through the same alteration. Oh well, no deadline to meet or contract to worry about. When it comes to what is more important, the spacing of the beams according to the drawing or whether the beam aligns itself with a hatch opening, always make sure the beam aligns with the hatch opening. There are a lot of cases when the model must take preference over the drawing. The recess around the ports is a decision you will have to make as to set it all off when you are planking up the sides or to wait until later and cut them out with a chisel and knife. I don't think there is much advantage one way or the other. You will have to clean them up later. I know you think it is a tedious chore, but if you only do two or three a day while you are doing something else, it will soon get done. Later on I found a better solution. I come downstairs, afternoons and evenings. Each time I come down, I do two ports and give them a coat of red paint. It really doesn't take a lot of time to do one.

In the meantime, you can work on the bitts. Start with the Jeer bitts. On the Sovereign they top off just under the first beam of the quarterdeck. Like most I have made, they are mortised into the upperdeck beam and the carling with it's coaming piece. Careful how you cut the mortises, you can't use them forward for the main topsail bitts as these are supports for the gallows.

Even with the mortise cut in for the beam, I don't think it would hurt to have a little additional security like a brass pin tying the uprights to the beam. Might use pins to fasten the cross member between the uprights with brass



pins also. In order for the rigging to look dressed, there has to be some strain on the lines. This accumulation of strains adding up to a great pull, the main topsail bitts have a little added on just under the top piece to bring the height of the gallows almost even with the rubbing pieces on the forecastle deck just on each side of the belfry. I have never heard what the purpose of these pieces are unless they are used in conjunction with the capstan. Maybe to rest the ends of whatever is being carried on the gallows. On the Sovereign I don't think this was the case since the quarter and the forecastle decks were connected by gangboards. The beginning of the full deck sometimes known as the spar deck. One of the many metamorphoses leading to the finally of sailing ships of war.

Don't forget to drill the holes for the heavy rigging going through them later on. The largest one being the Jeers measuring 8 inches in circumference or to scale 0.053" (0.346 mm) in diameter. A little larger in diameter wouldn't hurt, so it will be easier to rig. Same with any other sheave. For those who care to spend an extra effort, the holes may be elongated into slots for the sheaves if you wish. When making the slots, I find it most helpful to use the milling attachment for the lathe you have. The milling cutters are classed as miniature high speed end mills. Some are two flutes and some are four flutes. The size smaller than you wish to use can be moved to widen the slot. You will have to choose the nearest dimension to the size of the rope.

Well, how are you progressing with the recess for the port lids? Maybe later on as the planking gets thinner, you will be able to do more ports per setting. I still have to remind myself every once in a while, this is a project of projects. I hope you are reading this article before doing any work. I can't give you a blow by blow description as progressively as I would like to do. The recess at the bottom of the gun port would be best if it were tilted in. The lid does swing down in an arch. This also gives you the required depth at the port but not taking away from the outer edge of the plank. You achieve the correct depth of recess without seemingly increasing the size of the ports or the lid. If you are not satisfied with the appearance of the ports after curring in the recess, take heart, the first coat of paint will show you better where you should make corrections so you can go ahead and make them. Some modelmakers or artists make this recess larger to show up better. If sometimes you worry about a given dimension, think of it in another perspective. Take for instance the height of the port sills. If the dimension seems large or small say it is eighteen inches. Did you know chairs are a common seventeen inches? That's right, the average length from the floor to inside of the knee (with shoes) is eighteen inches. Say the height of the bore of a cannon is thirty inches from the deck (to fit the eighteen inch sill). The height of most tables average about thirty inches. Think about this when you sit down for your next meal. So, in order to work the cannon, one had to stoop. Can't blame the height of the beams for the stoop. The pillars (posts) that support some of the beams of the quarterdeck, I have found no reason for their placement. If there was a sag I imagine a pillar was placed and wedged in. If on an other set of plans the pillars are shown located, I see no reason why this plan cannot be followed. Of course, no pillars on the grates. As far as I can ascertain, the size of the pillars vary. Like nine inches on the middledeck. The length of the squared portion varies with size of the post as well as the location. The turned portion is a large bulky design. It looks as though all what was needed was to round of the corners. It might be well the best habit you ever acquired, it being the habit of pinning everything, especially these pillars. Maybe the beams won't move up and down but who knows. If they are pinned, you know they won't fall out. Pinning can be done using a number seventy-one drill for one of the electroetched nails now on the market. For drilling the lower hole in the base of the pillar, you might have to make another drill extension for this size drill.

CHAPTER 8

Gangways, Portlids

Now that you have the pillars secured, start planning the various partitions. I think now would be a good time to complete your cannon. The articles in the *"Ships in Scale"*, numbers 7, 8 and 9 covers this armament of the ship. The size of the cannon needed can be found in various publications listing the Establishments of the period. Always use the period prior to the date of the ship. Even if it is twenty years ahead of the time of the ship was built. Establishments for cannon did not change as often as the other parts of the ship. I think one could use English measurements for the ships built here in this country at about the same time. My research has told me many countries used cannon as medium of exchange when dealing with large sums of money. So, one might find cannon from one country most anywhere in their trade routes.

Cannon, if made of bronze had the circumference at the breech ring eleven times the diameter of the shot. And, if it was made of iron, the circumference was thirteen times the diameter of the shot. Iron weighs 459.2 lbs per cubic foot, while bronze weighs 552.2 per cubit foot. I don't think either was very strong for use in cannon. Those who are a little bit dogmatic in their paintings have shown foundries in operation during a battle. If the view was from the outside, they might show a large volume of smoke rising from the fortress. Of course this was only on land battles and the smoke didn't necessarily mean the fortress was on fire. Just the smoke from the foundries. I guess when a cannon would burst, they would hoist the remains back into the furnace and pour another cannon. Reading other accounts of the manufacturer of cannon, the battles must have lasted into what might have been called a siege or maybe a blockade. Believe it or not, starting too many little projects will lead you into a big problem to where you may become lost.

Don't forget when you are doing the upperdeck, to put in the inboard end of the scuppers. For this, I think I will be forgiven by the powers that be if I used on eight air ports. Yes, when they are countersunk into the first plank from the waterway, equal distance between ports, they look good. I know they aren't tin or lead as was the prototype. A dab of color called "Old Silver" would fix this. I know this may be a first but in this large scale, why not. Also when placing the position or location for these scuppers, you will have to move them to one side or the other so as not to have a scupper over a beam. A little problem may come up if the entry port interferes with the location. The solution would be depending on where you have the most room. The middle deck scuppers should be put on after you have located the backing links for the chains.

I would like to tell you about a little tool or you might call it a helping hand. It isn't something really great since you only use it once in a while, but when you need it, it sure comes in handy. It is shown in the above figure. The pencil lead is a standard size 0.078" or 1.981 mm. Don't get anything softer than H. It's only 0.0005" over the size of a #47 drill. Making a good fit. Anything tighter would break the lead. If you need a little more tension, you might attach an alligator clip to close the end together.

Never, never plan ahead too far. There is always something you will have to do first before you can start what you have planned.

BULKHEADS!! BULKHEADS!! BULKHEADS!!

To do bulkheads or not to do bulkheads. I believe it isn't necessary to show the temporary ones. The bulkheads that are stationary are the ones to show. The partitions on the upperdeck of the Sovereign do not start until the ninth quarterdeck beam. It is located so far back it will never be noticed. With the decking of the quarterdeck, it would be almost covered. Of course I know it is a no, no, but there are Admiralty models which only show the upperdeck, with nothing below. When we get the

quarterdeck planked, then will be the time to make up our minds as to whether to install bulkheads. Little hints and tips are going to pop up once in a while as we progress on this model which will be better than writing a separate article. Now take the nuisance of paint removal. Most paints for models have an alcohol or in some part of the family in their formula. A mistake like painting something that didn't turn out the way you wanted, the paint can be removed by soaking in a can of alcohol. I use the work can as it was handy at the time. For part of this experiment, I put part of the articles in pen cleaner with alcohol and turned it on to see if vibrations would help. It didn't. About a two hour soaking in the can loosened the paint enough so good wire brushing removed all of the paint. The trouble in the first place? The paint didn't have a flat enough finish.

If you are going to use paper to represent chalking, a good grade of construction paper would do. A paper known as Kraft paper is a paper a little harder showing a light sheen. If you have a cutting board, it is almost a must, you can staple the waste side of about five sheets together. This way you can get five strips at one cutting. Using a white paper, this could be the answer for those who are going to use a dark wood in their decks.

Take it easy. Some days everything looks like you have been using an axe to make your joints. Then other days everything seems to go together easily and fits like it's suppose to. Find something else to do on those bad days.

LADDERS

Once again your careful effort is called upon in the making of ladders. The side pieces are a little heavy as the extra strength is needed in handling the pieces during assembly. If you are making the ladder to fit into a companion way, figure this a little over so you can sand down the side pieces so they won't look too heavy. The angle of the steps or ladder is rather steep. The Sovereign's figure to be 50 degrees. The height from one step to another isn't like you have at home but a hefty ten to twelve inches. I guess they figured the men would respond more quickly when called to man their stations. The miter gauge on my saw is a bit lop sided, as shown In the picture. The reason for this is the extra length is needed to layout the distance of each step. It also allows for greater work space when moving from one angle to another. The angle of the miter gauge shown in the photo is completely reversed to get the other side of the ladder. The saw blade is sometimes used but more often a cutter than is one sixteenth in the thickness is used. Make the side pieces about twice as long as you will need at firsts to give you a chance to have slots that will line up better. I mean you can shift the left and right sides until you find the slots that are more across from one another. There always has been a slip when cutting these pieces so one slot isn't across from the slot it was supposed to be. The jig for assembly is nothing more than a board

with two strips of wood nailed to it, the distance being the width of the ladder. Glue in the top and bottom treads first and let dry. This keeps the assembly from exploding during the rest of the assembly if something is too tight.

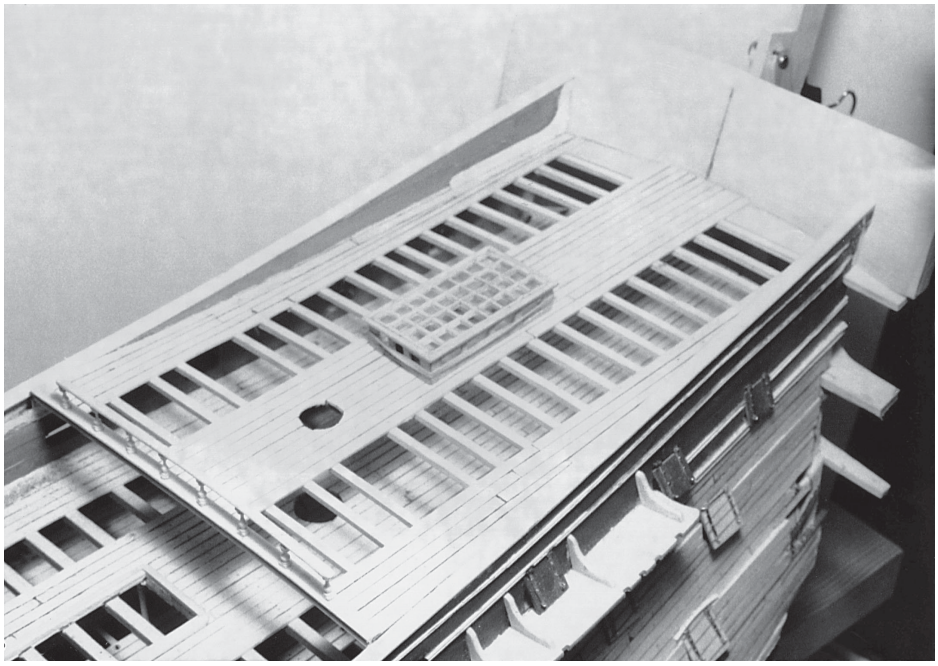
Making a saw cut above or below the step can be done after the glue is dry to enable you to raise or lower the step so it will lineup. But, then the space below or above will have to be filled with a sliver of wood and trimmed to fill the space left after moving the step. When you are planking the quarterdeck, I think it would be a good idea to draw a sketch of some kind or other showing each plank from the first beam aft to the first series and including the longest plank to show how the planks will lap. This is to insure, regardless of which side you start or if you start in the middle you won't have two planks showing at the same place. At the same time you can figure out what the plank width at the fore, the middle and the aft. This is done to get the taper in the planking.

Another little insertion in this article. Probably by now you have realized another strange thing about laying planks. It didn't show up on the outside of the model as much as it has on the decks. You can't lay many planks side by side as one would think. One has to go the whole length of the deck with one run of planking. Sometimes or maybe two In order to get the next plank up tight to the one already laid. When driving in the treenails on the quarterdeck, there will be a bouncing by the spring in the beams. This can be infuriating as you see the treenail bend and break before they have entered the beam. It may lead you to pounding the treenails into the plank and beam. Take heart. All you have to do is put a little pressure on the deck. This reduces the amount of spring upward. It isn't solid but a lot better than what you were doing. I think it would be impossible to group all suggestions on how this or that was done. So, when ever a helpful hint comes up, I will pass it on. May be a smidgen out of time or place but, it is there.

THE POOPDECK

All we need to know at this time is the placement of the shelf for the poopdeck. It is about three inches higher from the upperdeck to the top of the shelf than the upperdeck was. The shelf being about ten inches in width

leaves room below for three pieces of planking plus the spirketting. Remember the closer the planks go together even though they will be painted, the less filling between before painting. Once again the distance between the bottom of the port and the waterway can be filled with one piece. To be rounded at the ports the same as the others were. Another point to notice at this time is the extra ordinary length of the poopdeck. I believe this will be the first time I have ever made allowances for the Mizzen Mast on the poopdeck. In the set of plans purchased from the National Maritime Museum in England, the plans for the poopdeck were not listed. I guess I will have to pick my way through this by using the profile plan. Why first rates, that is 100-guns and up, were ever built is something all who built them still wonder about. But, as a vessel to make a show of strength they were considered necessary. I have found in my research many considered the 74's and the 80's a better vessel. A great deal less of timber, time and financing needs than for a first rate. Maybe they were built so the Lord's would have something to command.



The poopdeck beams being 5/32" x 1/8" (3.962 mm x 3.607 mm) it also has the highest crown or segment of a circle being 9" or 3/16" (4.748 mm). They are made of one timber rather than two as on the lower decks. The grating will be considered an extra effort unnecessary as the open hatch will give more viewing ability. There will be a lot of photos taken of this deck by others than you so, be careful.

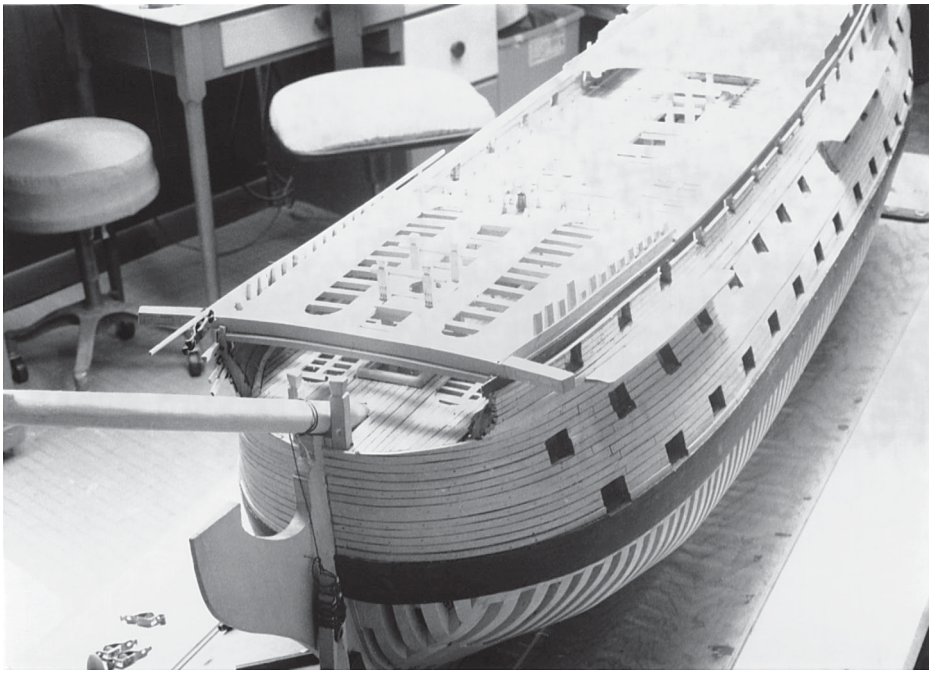
Something else, when measuring the distance between two planks, timbers, or whatever try the easy way. Make two wedges from some 1/8th scrap stock, the width should be a little more than half the distance being measured. About 70% at least, these are set into the gap to be measured and moved together. One will ride upon the other to a fit. This can be marked to show at what point they met. When removed they can be placed back in the same position and measured with micrometers or scale to find the exact distance between the whatever you measured. See sketch. If you are doing this where you will allow chalking strips don't forget to allow for them. This can be done with two long taper pieces almost the width of a small space to be measured like finding the width of one plank.

Don't ask about the two square holes in the quarterdeck between the mainmast and the main gangway. Everyone seems to detour away from any explanation about what is a exposed feature is doing on this deck. No bitts below. No railing or hatch coaming to warn one of the impending danger about the befall him if he takes another step. About the scrolls in the molding, I don't think there is an easy way out in the carving of these. I have tried using a rotary burr in my Foredom machine but the chances of running out of line are too great for me so I have resolved to using a number eleven blade in my knife. I figure it is just another one of those things that are going to consume a lot of time.

CATHEADS

I would surmise the catheads and the cattails were three pieces which set on the cat beam. Some show the tails on top of the cat beam but, others show the forecastle planking between the tails and the beam. I believe it would afford a better chalk. The cattails with there heads is made of one piece. The scarfs of the three pieces are horizontal with the treenails vertical through the tails and into the cat beam. Nowhere have I found a figure for the angle forward of the catheads or the one from the catbeam. I believe it is at right angle to the main rail is controlled you might say by the width of the figurehead. There is not a known figure for this unless you make a detailed drawing. This would show the completed head from the beakhead bulkhead forward, Of course it would come in handy but, I believe it is a little early to get into this amount of detail. The sheaves in the heads will have to be made the hard way by drilling the holes and connecting them up with a Jewelers saw, filing them true later. The most difficult part of making the catheads and the cathead tails is to get them to look alike even when you check them out with a pair of dividers and a gauge to measure the height of each. The brass sheaves aren't too difficult to make but, the aligning the sheaves to insert the pin. Now if you want to fake this, you can insert the pin as this is about all that will show anyway after the falls are rigged.

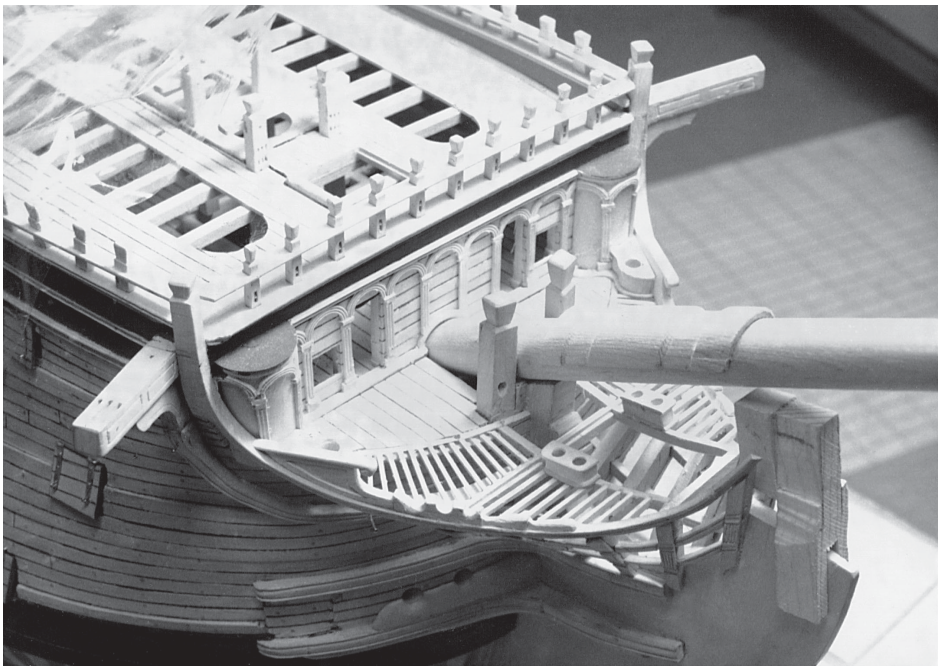
If the heads have any carvings done on them, now would be a good time for this. Carving in midair is to difficult. The height might cause you to deface the carving. If you are going for the catheads with the sheaves, you can figure about a weeks time to do so.



FORECASTLE

Now we can start planking the forecastle deck. For my purpose it will have forty two planks across. There will be a pattern of butts about half way as it's to long to lay the deck in one piece. The stock as it comes from the galley I suppose it is rectangular in shape but not it goes into a circular shape to accommodate the revolving elbow. This I believe must have a baffle as it must once in a while face into the wind and without the baffle, it would become a little exciting in the galley.

I think you should make another sketch showing the planking for the forecastle. The width indicates the size of the planks if we are going to use 43 planks across. This will be six bands of seven with the second and fifth open as on the quarterdeck. These will taper from the waist to the cattails. The planking near the cattails will cover the first three beams as the planking on the waist or near the waist will cover the last three beams. Someplace about midway of the forecastle deck you should make a measurement and divided by 42 to find the width of the planks at the area of the butts. Similar butting will be, or should be about four or five planks apart. Anymore or less just wouldn't look correct. I have many planks form decks I had laid on other models. It seems they are too narrow too thick or some other fault. Too confusing. So, I make new planks for each deck. To observe the forecastle deck when finished, it seems to comprise a lot of short planks. But, to make the butts line up in the correct location, it pays to have one or some planks that have a little extra for scrap. Here is something a little extra. When cutting the paper or card for the chalking strips, staple four or five sheets together, then with one swing of the blade you will have four or five strips instead of one. Naturally don't cut the stapled side. Maybe the bitts should be assembled and installed for the forecastle before the deck or at least the center portion is finished. The bitts are what they call castle headed about the width in height. Don't take it for granted all bitts are castleheaded. The fore topsail sheet bitts have three large sheaves near the deck for the fore topsail sheet, the clues and the fore bowline. The after bitt has only two sheaves for the Fore Jeers and the Main topbowline. Since we are bound to use commercial belaying pins, I don't see how anyone can get seventeen pins in one inch space between the uprights. It seem to me something is going to have to give, Whether it be someone's dogmatic rule or common sense. Many of you will never need so many points for belaying and if you do, double up. I am sure it's been done before.



Don't forget to pin with a good healthy pin the cross piece between the uprights and the uprights to the

beams. When working the planking around the bitts, maybe it would be a good idea to glue the chalking strips on the plank before positioning them. Don't forget to add the width or thickness of the strips when figuring how many planks will fit where you want them. Another point in the category of planking decks. The treenails that show through on the underside of the beams. A length of flat brass say about 1/8" - 3.176 mm by 3/8" – 9.527 mm is procured and sharpened as a chisel across the width. This you can insert into the portholes and knock off the protruding treenails. Ah–yes–we come to the after rail of the forecastle. These are generally a group of eight uprights with eight knees. I have always supposed each upright has a sheave fore and aft just above the knee. Size depending upon the shoulder. Sometimes there are two rails but, not very often. To make eight of these presents a problem. They are close together so any difference between one and the others is readily noticed. So, we have to make a jig or fixture to file these to shape. For the eight posts, make four pieces the size of the bottom of the post and about six Inches in length for easy handling. This way you can make all of the posts without cutting-them off. And, if you can make a mistake, you saw off the scrap and continue as before.

The upper portion being 1/32" - 0.08 mm smaller than the bottom portion is made first then the head, sometimes called a castle, is made. This is a bit tricky to get all sides equal especially in looks. Below, what I call the bottom, leave a small tenon to fir into the deck and the molding piece. Make It long enough so you can pin each one through the molding and into the tenon. A brass pin should be large enough. The sheave in the post may have to carry a line as heavy as 3-1/2 cir., or 0.023" (0.058 mm) diameter use a number 70 drill.

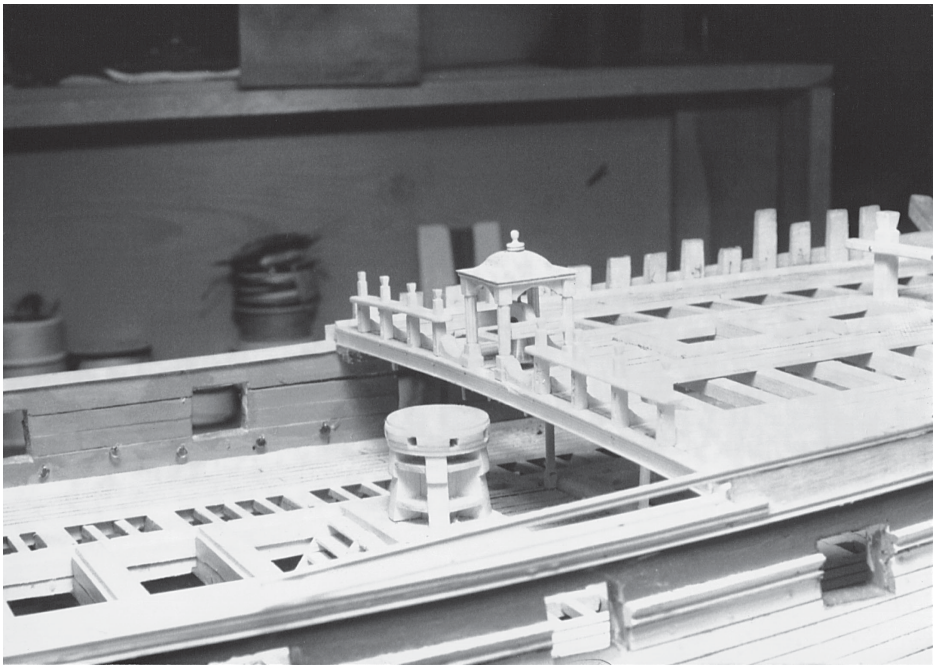
Something else again I should have mentioned a long time ago. The plastic containers (8 fl. oz.) Elmers glue to be specific, the old style I guess as I haven't purchased a bottle for a long time. But, when it comes to blowing out corners, hard to get places and blind holes this plastic bottle delivers a short but strong blast of air that is the most helpful.

Now, when you assemble the knees for the after rail of the forecastle, you may have to cut a slot in the upper part to gain access to the sheave in the post. The line of the chalking will help you to keep the knees straight and parallel I haven't applied a finish to either the quarterdeck or the forecastle deck as I will wait until the very last to do this for a very obvious reason. There may be something that needs to go on and nine times out of ten it will have to be glued to something or another.

BELFRIES

The only connection I had before modeling of ship's was during the grade school years. Other neighborhood boys and I would catch pigeons in the local church belfries. Putting the pigeons in a loft I had in my folks barn and was raising them or fattening them for the market which wasn't such a good idea. In researching the belfry, I found many different designs. Every country being very different. The progress the design made over the years warns you to be sure you use the appropriate design for the given year. There are artist drawings for different designs of the gables, mostly the ones called crossed gables. Some of these while being very pretty as a drawing are almost impossible to carve in wood. Their main reason being the amount of time one desires to spend on his model. Upon closer examination of the one drawing of one with the crossed gables shows the artist was becoming discouraged with his drawing or was facing the problem of showing the lines in the proper perspective. The bell I decided to use was one being 18 inches across the mouth (bottom). After you have shaped the outside of the bell, just before cutoff, the inside is best scraped out with a small round nose chisel. A little bit of wood turning in brass. You may wish to fasten the bell by drilling on through and fastening the bell to the beam with a pin. This pin can also be bent to hold the clapper. There are many choices of what you can do with the belfry.

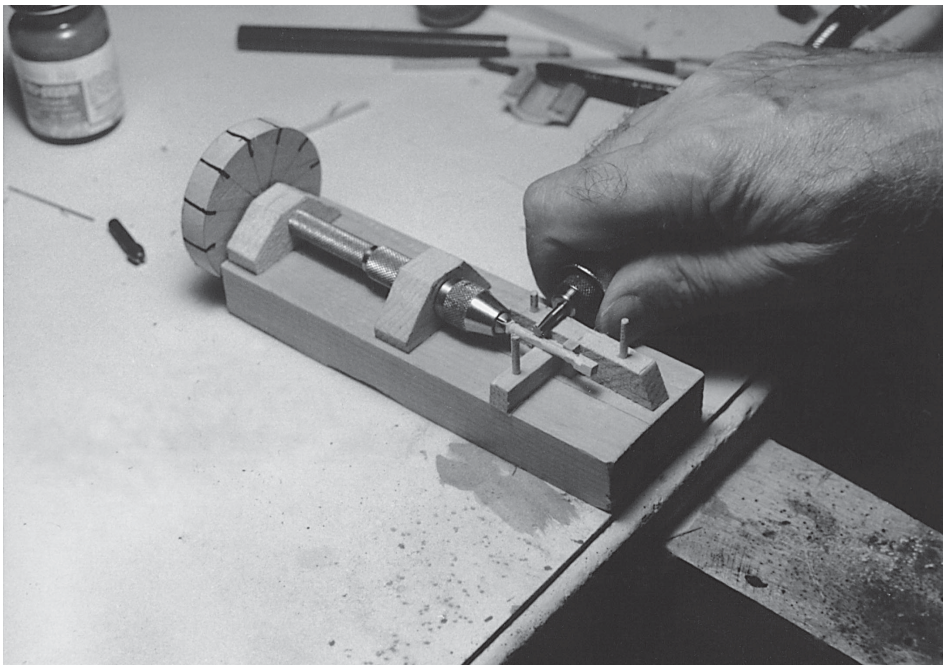
Just remember this is a point of interest and Is likely to become one of the jewels to be noticed as much as the figurehead or the stern carvings. So, If you have to make two or three belfries, I am sure the next one will be better. There is a piece on the deck between the belfry



and the afterrail of the foredeck. In fact two pieces, one for each side. These are rounded so when the spare yards are placed on them and the gallows near the mainmast, they will be easier to carry. They do support a little weight when the boats are secured on top of the yards. The two knees that support the front or forward posts of the belfry are pinned diagonally through the knee into the post and down into the deck and perhaps the beam low. The fluting of the pillars is something else. A simple Jig made up as shown in the figure would suffice if the fluting were to be simply the scoring straight lines from one end of the round portion of the pillar to the other. You might set up a small collar or disk on the pin vise scored or marked in fourths or sixths to help you divide the round portion equally. You will notice in the drawing additional pieces under the pillar and between the pillar and the guide fence. These are to make up the difference between the diameter of the pillar and the corners of the square portion at the bottom and the top. I never tried a piece to see if this would work or not, but It seems to me if one were to slowly turn the pillars while the grove was being made maybe one could get a spiral, Several times I had to make a pillar or post for the bottom of a companion way that had a spiral, I believe this was on the H.M.S, BRITANNIA I was making it appear the bottom half had been turned a half a turn. These were located on the spiral "staircase located at the four corners of the waste. You can put a lot of work into a belfry. So much so to where no one will ever notice the ornament on top of the gables looks to be a flame. Of course on these small drawings a piece of paper loosens due to age or for some other reason and the small piece of the line on top of this loosened fragment is lost forever. The line left will never be deducted as to what it might have been. Naturally the in vise holiday the whole Jig would supported on a larger board. The roof shown in the picture wasn't machined out or sawn. It took a lot of filing being careful to watch the lines going from the center to the corners. This will tell you how well shape of the roof is being equal.

Try to find a four Jaw pin vise for the fixture I described for fluting the pillars of the belfry. The ones I have are made by Lufkin and may be years old. You will find it helpful if the pin vise is a tight fit in it's wooden bearing.' Rotating the vise can be done with pliers if needed. If you can't find the correct size drill for the pillow blocks, use the next smaller size and file to the larger dimension. Don't fasten the blocks on the base until they are assembled with the pin vise. This way they will stay in line. A disk made of wood may be fastened on the end of the pin vise. This disk is divided into twelve sections so it may be used for indexing. The total length of this indexer is a little over six inches. It seems a lot of work to make such a device for fluting the pillars but for some of us, a mechanical method of cutting is the sure way to achieve a good Job.

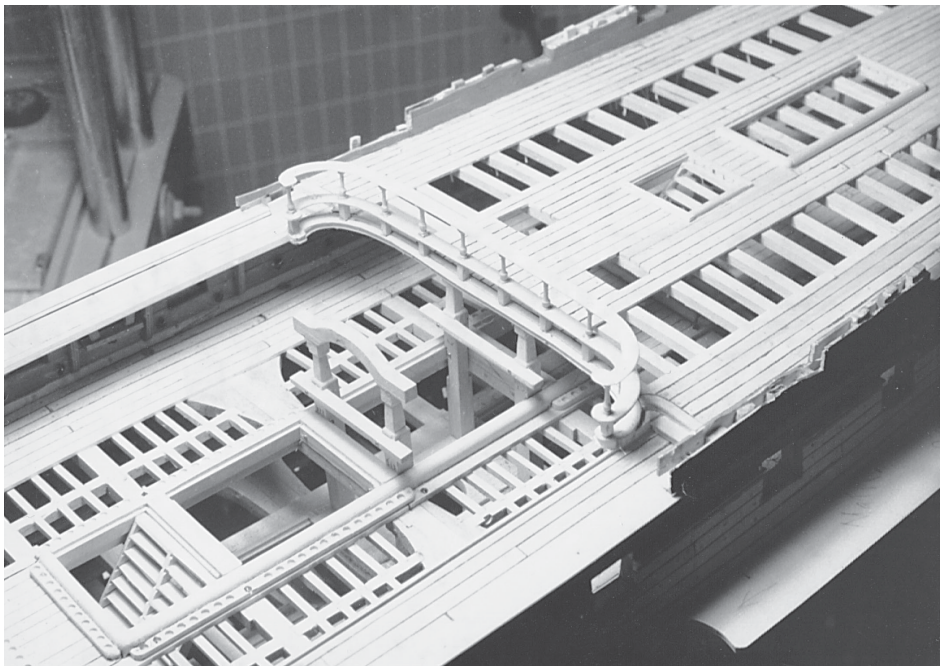
I guess there isn't much to say about the forecastle bulkworks, inside that is, except they are a silver in appearance. Tapering from above the catheads to nothing at the afterrail. Because of this taper, I think it would be a good Idea to paint them before fastening them to the tops of the frames. They are very difficult to paint, after assembled. I don't know if I mentioned this before or not. I have a pencil, a number 2, I call my half pencil. I removed one side of the wood as well as one side of the lead with a sanding belt. In using this pencil, one doesn't have to worry about the angle of the pencil especially when using the plank on the outside of the hull to act as a guide when laying out the plank on the inside. Just keep the pencil level. The sheer rail of the forecastle is in two pieces because of the "ducks bill" curve at the after end. This rail is mortised for the ten timberheads. These timberheads are not the extension of the frames as of them are above the port below. Some pictures show four sides of the head tapered and others show only the fore and aft faces are tapered. The ones with all four tapered look better to me. Care must be remembered as the timberhead seems to tilt forward due to the curving rise of the forecastle rail so the bottom of the timberhead will have to have a little removed from the fore side to straighten it up. Care must be taken to see the sheer rail on the side of the forecastle is not glued into position as it does line up, become flushed with the sheer rail above the cattails. The only break being where it meets the main rail,

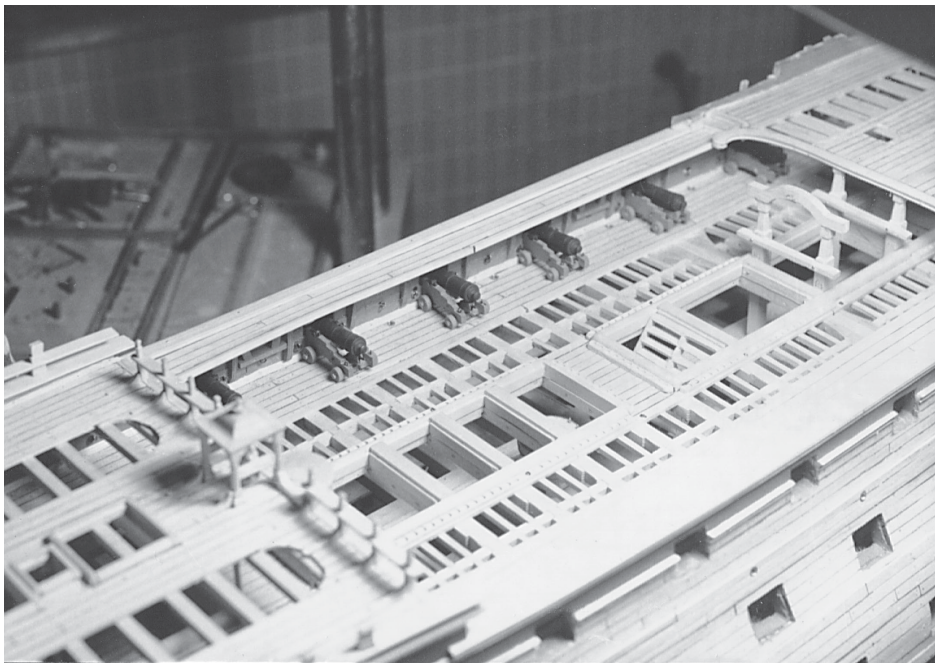


the curved rail from the cathead to the figurehead. Something to remember about the head rails. This is a slow curving structure with a grace all of it's own. Every ship is different because of different measurements from point to point.

The timberheads are fitted into the sheer rail before assembly. Loosely, as to make up for the angle at assembly. You may glue the timberheads directly to the rail or put in dowels for each one. There won't be any strain on this rail. Before everything gets attached with whatever adhesive you are using, lets look over the Plans for the beakhead bulkhead. The upright timbers will be set into the cattail beam and pined or doweled to the upperdeck.

The number of timbers will vary from one ship to another. I guess it depends on the width of the forecastle whether it will have eight or ten. All timberheads will have a sheave between the two rails large enough to handle the largest line employed. The head of these timbers has a length of about one and a half the width or thickness. Since there isn't a short deck forward, the two innermost upright timbers will have to be designed with an offset so they may fit on each side of the bowsprit. These two may also be left to last and assembled when the planking is placed on the bulkhead fastened to the spanking instead of the deck. The two rails, one that lays on top of the catheads and tail and the one sometimes called fife rail will be clamped together or temporary glued so the mortise can be cut through the both of them. The mortise is for the beakhead bulkhead timberheads.





CHAPTER 9

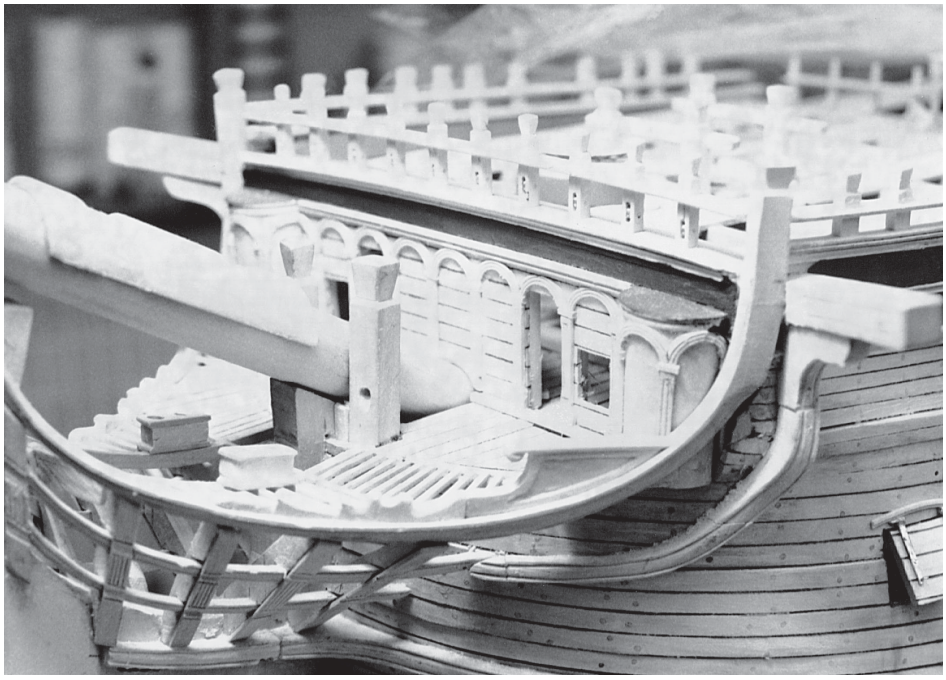
Hinges, Port Wriggles, Beakheads, Bulkheads, Bending and Molding, Separating Frames

Do you have trouble with your small square files turning while you are using them? Of course, I am assuming you are using them without a handle. A small clamp that has a small groove in it's foot should be used clamped to the small round of the file. This will give you the direction of the sides of the file. Another point of interest is don't make problems for yourself. It is very easy to do.

When something breaks you will immediately glue or get It back together again and then go set someplace and cool off. The planking on the face of the beakhead bulkhead is put on in continuous strips on the lower portion of the timberheads. The upper portion is painted, the other is broken up with doors and ports, and the whole bulkhead is covered with columns and arches and the roundhouses. It is about even as to whether to paint the beakhead bulkhead. One thing for sure, the space above the molding is painted the same as the space under the forecastle rails. In most cases the same color. There are two ports and two doors cut into this. The doors being one on either side of the bowsprit and the ports outside of the doors. The ports are small because of the timberheads and the doors are small in height as well as width. The men might have been a little heavy (fat) when they left port but according to the doors they soon lost some weight. The arches above the pillars or columns are made circular and cut in half later. The ends are worked down to fit on the piece of molding above the column.

Now is a good time to start the procedure of making. The head rails. The upper one is sometimes called the mainrail and sometimes called the main head rail. If your drawing has a side and a top view, It will be fairly easy to make a projection drawing 90 degrees from the top drawing. The side drawing can be used for the heights of the equal stations would be about six. Maybe add another station near the vertical or upright position to get the bag of the curve correct. Most rails or maybe I should say, some rails do not have a molding carving as they are left square. Large rails are tapered back because of the molding to about 2/3 of the width on top. It may appear to be in line with the angle of the headtimbers but not really.

The use of cardboard templates or patterns is a good way to go. They take less time to make than trying for a wood rail the first time. Believe it or not, this rail will probably take the largest piece of wood so far used on



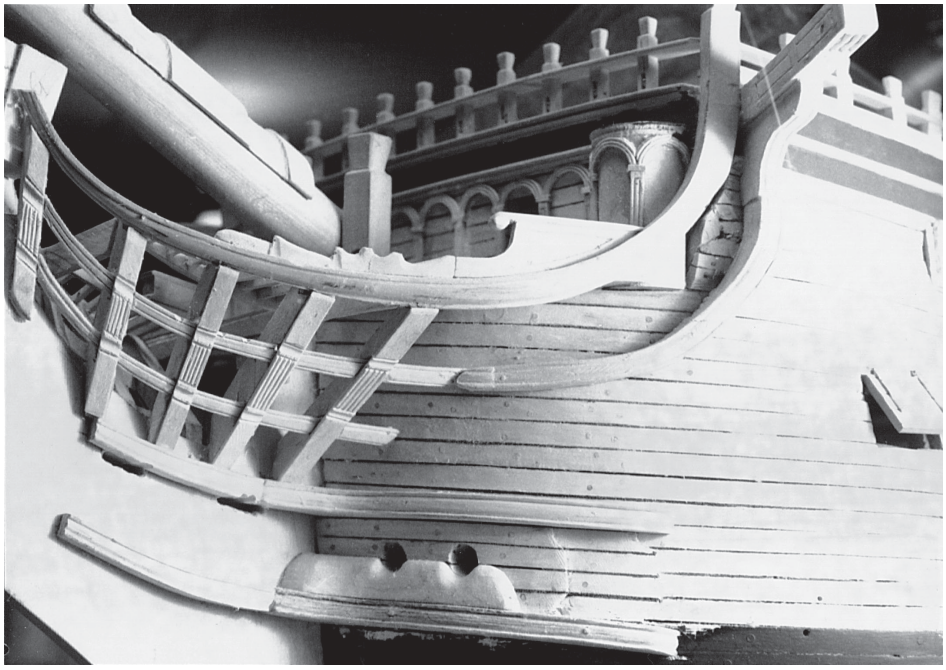
the model. Maybe I should have said, "the largest two or three pieces glued together." There is always the possibility of the pieces coming apart while they are being worked. Take heart, they can always be glued back together again. Keep the scrap pieces to use for holding the rail while working. The rail does have a lot of taper going forward, the one third cut out when you are cutting in the molding gradually straightens up when going forward and when going aft. The aft being when It works into the upright head. Might be well to make a dummy block of pine or some other soft wood to locate the forward ends of the rail. This brings us to knowing something about the design of the figurehead. If the boards you are using to make the headrails should have slight bends or curves in them soak them with the old ammonia water solution put a little reverse curve with another board and a C-clamp. On the rear half of the rail you could use a Exacto molding cutter. The time it takes to make the molding cutter could be used in cutting the molding with a knife and a chisel, which you will have to do for the forward part of the rail anyway. The ends of the beakhead bulkhead are cut away so the head of the rail fits snugly against the cathead. The height of the rail is one half of its head, the tapered part like on the timberheads of the bulkhead, above the tops of the heads of the bulkhead. Remember the head of the rail is one half its thickness for the length. The curve of the rail is best found out by drawing a projection drawing knowing the length and the drop plus the angle from the centerline of the model. I can see why it will be best to refer you to a drawing. If there is a difference between the length on the model and the length on the drawing, it is best to make this up in the lowest part of the rail.

PORT LIDS or PORT COVERS

Port Lids or Port Covers, whatever you may wish to call them, is another of the factors that discourage many modelmakers from building models of naval sailing ships. The strap of the hinge is made from sheet of 0.025" (0.635 mm) cut into strips the width of the hinge To work out any unevenness caused by the shears, I draw them through a square hole drawplate. The reduction of size will be done by the two opposite corners of the hole which will give you an edge you will have to file off after you have drawn the strip down the size you desire. Also the flat because the edges will curl. A small block of steel is next needed. Make a tapering cut on the hinge or the narrow side. If the strip fits loose, center punch the edge of the slot to fit the thickness of the strip. The length desired is noted by drilling a hole in the slot for a pin as a method of controlling the length of the taper. Next your small miter box is used to cut the strip into the correct length using a fine toothed backed saw. Don't worry about cutting metal with your saw. The brass may take a little of the edges off but it does a better job. I have waited until now to tell you just what a large undertaking this will be. For the lower deck you will cut 60 pieces all filed to shape. For the upperdeck you will only have to make 36 as many of the ports are without covers and there are ones having the cupboard type covers. After you have made the straps for the lowerdeck, the tubing is next. Don't cut this to size of the width of the strap. Cut it at least half again the width. This gives it a little weight to stay on the soldering block instead of hopping upon the end of the strap at about the same time the silver solder is beginning to flow between the two pieces. Of course this will happen, That is why you cut extra pieces.

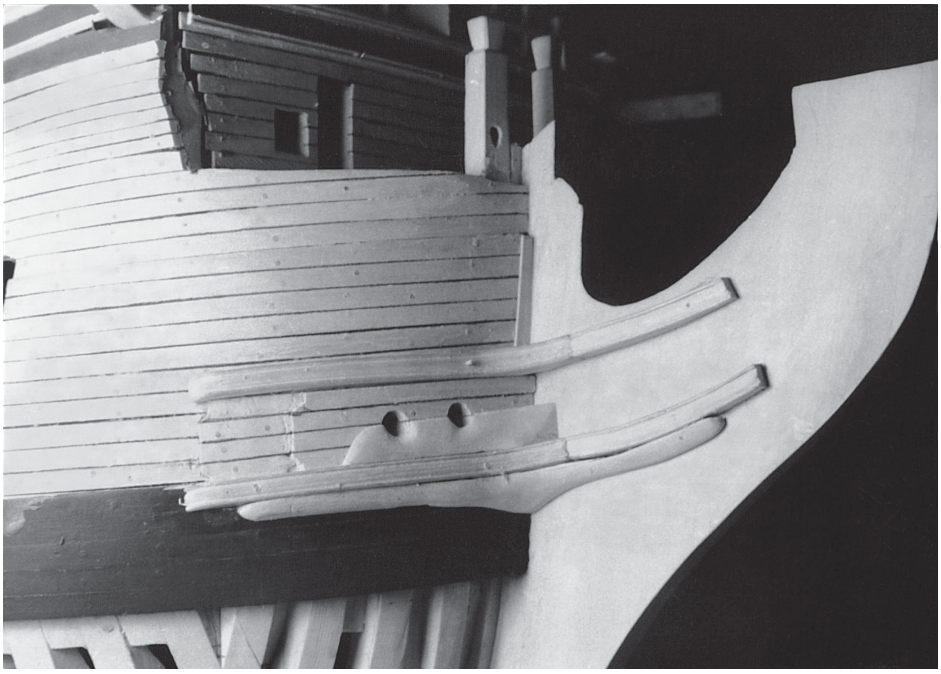
You can always file the tubing off and start over again. I don't know of any method to stop this hopping. I have tried putting a length of fine pencil lead through the tubing to help hold it down but that is another operation. After all the straps have had a piece of tubing silver soldered on the end, they are held in a small hand vise so the ends of the tubing can be cut off and dressed down with an abrasive cutoff wheel held in your flexible shaft or any other hand held machine. Next is to file down the burrs and with a drill held in a pin vise drill out the hole in the tubing as specks of brass or flux do get into places they shouldn't. Then they, one at a time, are placed on a block with two nails filed off so you can dress down the excess soldier and etc. on the strap. Drilling will come when you place the hinge on the lid. I thought the hinges I had made had their straps a little too wide for the width of the port but after scaling several photographs, I find mine are just a little bit wider. Not enough to notice but enough to be measured. Funny when you get this feeling

when you are about half way through a project since then I have measured a number of portlids and hinge straps and I have found the strap is about one ninth of the portlids width. While we are on this subject of hinges, maybe I should say something about the hinges for the “cupboard door” portlids. These are made of 0.15" (0.381 mm), brass. The tool for making the eye in the strap is made of a piece of 1/16" (1.57 mm), drill rod, A cut is made lengthwise in the end using a saw to fit the material being used. Don’t saw down any deeper than the width of the strap. The two halves remaining are filed away to make them as round as possible. It isn’t necessary to remove the corners from the saw cut but can be done with a graver. Place the end of the strap in the slot and turn the rod to make the eye. A little practice will be necessary but it does work. If you think the tool should be hardened to insure a longer life, you may but, I found it wasn’t necessary if you anneal the brass before bending, less you forget. Nothing man-made is perfect.

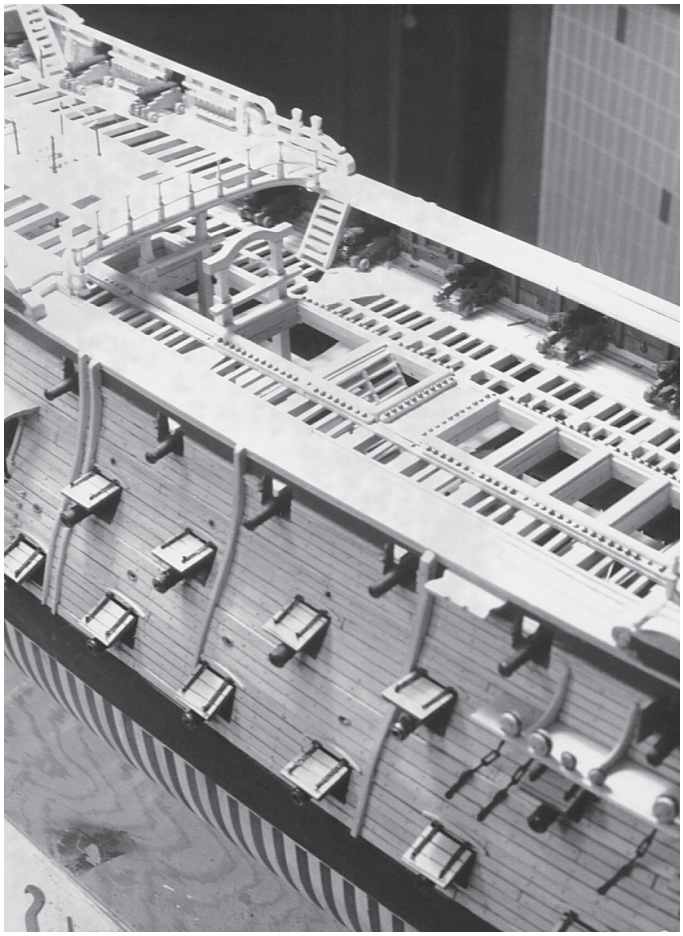


CHEEKS or CHEEK KNEES

The lower is made first. It may follow the upper edge of the main wale then curves upward toward the figurehead. Made in two pieces at just a little past the center of the curve of the rail or cheek. The molding cutting of the edge the same throughout its length. This is a good place to try, out your riffle files. Your height gauge has to be used again to locate the position of the upper end so the part of the figurehead that touches will look like it is resting on this piece. The problem here is to get the molding to look unbroken. I had an Idea when I was framing the model about how to place what for the hawse holes. Timbers were placed to allow for this so now when the hawse holes. Timbers were placed to allow for this so now when the hawse holes were cut in there wasn’t a timber behind to cut away. There location at this time isn’t all that important as there is a piece or pieces of planking to be placed over these which will have hawse holes cut into them. Then there is another piece larger to fit between the planking just put on and the edge of the cheek known as the bolster. This has two deep rounded “grooves” cut in just under the holes as a method of reducing the friction on the cables when they are run over the lower cheek. Another little project to let your freehand artistry show through. The ends of this “filling piece” or maybe I should have said the outer end is divided about half way from the outside hole to the end where half is removed in a design corresponding with the outer edge. Reducing the thickness by half. I don’t know if they were done this way for real or not as the photographs of the “victory shows them just rounded off.” One thing in our favor. The plans of the ship show no hair bracket extending from the forward end of the upper knee. It seems everything ends in the figure-head. Even the forward end of the main rail gets lost in the configuration of the figurehead. The upper and lower cheek knees are separated by a filling piece or pieces. Four to be exact. So, subtract five



times what you are using for chalking and divide by four for the width of the plank to be used. It is better to assemble the “padding” around the hawse holes after you have fixed the lower cheek. This way you won’t be confined between two cheeks. This will also give you better access to the model when putting on the bolsters. You will get a better idea of the form you should give this piece. One of the most difficult pieces to make is the filling piece under the lower cheek. You may want to leave it in it’s natural state or you may want to paint it the same as the wale. I guess what will decide this is the luck you have in making this piece. Recently, I have been using a small sanding drum instead of the knife. It seems it is easier to handle. Taking only a small amount with each pass and in this hard wood a sharp coarse drum is the answer for me. Of course, the need and use of a dust mask is always a foremost. The use of graphite sticks would be used for everything on the head to insure a good fit. Coat the position of the piece with graphite and rub the piece on this surface. The graphite that comes off is what you will have to remove. After several dozen tries, the piece will become coated all over telling you it is a good fit. It is the same procedure as when two cast iron surfaces are set up for scraping. The one thing that is suppose to do the fitting is the one that gets scraped. I think it would be better if you used two layers of planking to build out your “Padding”. It all depends upon the design at the end of the padding. The victory of 1805 uses full padding all the way from the stem to the outer edge.



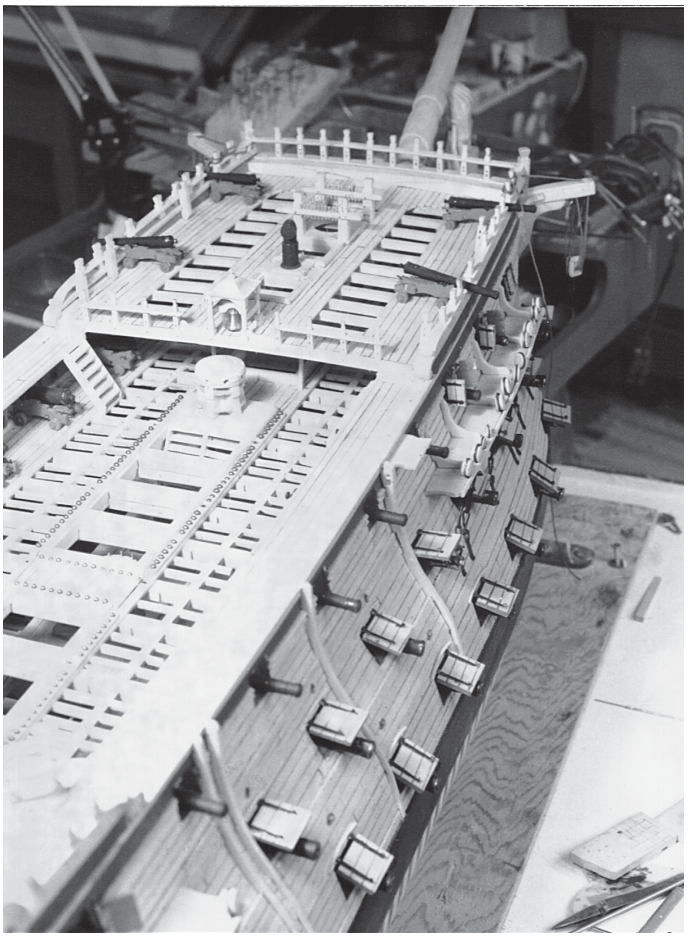
On the size of the hawse holes, someplace I read “The cables are someplace or about one half the beam of the ship”. Now I guess he means the circumference. The size of the holes themselves must be at least three Inches larger in diameter than the cable to ease the handling.

Everyone gets tired. Distracted by one incident or another, getting sleepy, bored or maybe not paying too much attention or one of those days, which results in a few little mistakes that should have been cleaned up but wasn’t. You don’t have to go over the model looking for these whatever you want to call them. Keep in the back of your mind that from now on every time you see one of these, you will have to clean it up right away, because it has been there too long as it is. I guess about now you should be very observant to what falls into the hold and removing it as soon as possible. So many objects find their way into the hold without you knowing. Vacuuming and blowing it out with compressed air for some reason never finds it all. Every once in a while make a through inspection of all decks and the hold for anything that does not belong there.

GANGWAY

Let’s take a long look at the Gangway, the bit of decking that lets you go from the forecastle to the quarterdeck without dropping down to the upperdeck for the length of the waste. The outer edge is just under the rail capping and the inner edge has a small molding like on the edge of the last plank or the main reason for chalking them is to keep them from rotting in between rains.

The planking for the gangways I would suggest it be the same thickness as for the quarterdeck. It isn’t very wide, only four planks. The plank near the center being the plank you will lay for the gangway is quite a bit thicker. To start with, it is like the other planks except it has an edge that is raised about 1/32" (0.8 mm) to act like a waterway or what we call today a drip stripe maybe you had better enlarge this to 3/64" (1.09 mm) I think it would look better. Something about the knees that support the gangway, their thickness may be reduced in thickness by appearance by scraping a bead on the Inside edge. Not too large, Just enough to break up the appearance of the width. This will reduce the flat on the inside to almost half which is what the eye picks up first when looking at something of this nature. You can paint these the same as the inside works except for the contact faces (bulwarks and the docking). The paint where the knees will be positioned will have to be scraped away so the glue will stick. I use a small squared block of Aluminum to check how square the knees are with the deck. A flat piece with the corner notched out 3/8” is used for a spacer to measure from the port to the location of the knee.



I think I have found a better way to lay the plank for the gangway. The whole section of plank is laid out as one piece and that piece will be a sheet of plywood 0.5 mm in thickness. The planks are 0.060" or 1.6 mm in thickness are glued to the plywood. The chalking is the same as on the other decks. Don't put on the past plank. What you have can now be run through the sander to reduce the thickness of the planking and not the ply, only sand this to cleanup. To about 0.055" or 1.4 mm If the planking and the chalking come out clean without fault, then you can glue on the inside plank which is totally different. It is shaped like a (T) See Sketch. The stem of the T is made the same thickness as the planking that is left on the gangway and the top of the T is or acts as a waterway and to cover up the ply. This T also has a butt joint that has to be chalked. I don't think the chalking on the gangway was to keep it from leaking but to keep it from rotting. Another little reward. When you measure the distance from the quarter and the fore decks to the gangway and find they are all the some.

The steps for the foredeck will have to cut away for the waterway of the gangway. I should have said step as there is only one. Well I have started to go too fast again. Before you place the gangways into position we should make the cheeks to be mounted in the waste. In or on small ships they are called range cleats for the main tack and the fore sheet. But on a large ship they are called, at this period of history, Staghorns. They are large timbers being fitted in between to knees for the gangway with canted uprights at fifteen degrees placed about 20% from the ends. They are about 80% the size of the ones on the H.M.S. VICTORY because she has beams to support the gangways and not knees. Drill the holes for the uprights at a fifteen degree angle so you can make the uprights a straight simple piece to make. Check your drawing to find out where to place these. Did you save the pattern for the bottom piece of the quarterdeck fore rail? I certainly hope so. This is a little tricky in as much as they all three should have been made together. Now you will have to make the middle and the upper rails together referring to the lower rail as much as possible. Especially when drilling for the locations. This will make it necessary to have all three clamped together. Very careful filling so as to not shift the location of a hole too far out of line. The balusters have a wine bottle appearance. This depends on how many wine bottles you have seen.

If at sometime you are in doubt about certain measurements, measure a railing. I am sure someone has placed one in your vicinity. Of course you can always measure the drawing but it is sometimes never shown. I don't think you want to resort to using an old idea of bow lathe. This would be using the pin vise as the lathe spindle and wrapping the bow string around the pin vise. And by moving the bow back and forth, the pin vise is rotated in two directions. I asked about the what happens to the chisel when the piece is rotating backwards, never got an answer. Maybe you are suppose to take the chisel away and use It only on the forward rotation. At the time I took my apprenticeship to the jeweler supply houses were selling what was known as Bow Lathes. They also sold the ones by Boley, I seem to remember one starting with a "W,"' Some old collets are listed a w-w. So we will deal with something that has a motor to drive the work. The most difficult part of the turning is to hold the tail end of the turning. The piece say is one eighth square so the distance across. The corners will be close to three sixteenths in the tailstock you hold pieces of brass tubing having the correct inside diameter so the piece can run inside of the tubing while the rest of the square is getting turned down to the proper dimensions. Old exacto blades make good turning tools. Especially the number 11's. Be prepared to make at least a dozen extra, counting the broken and mistakes. The bottom of the top rail is made thicker in the center to allow for the holes for the dowels of the balusters. When it comes time to assemble this railing, be sure to use a slow drying adhesive. Those metal blocks will come in handy to keep the rail straight. At least you don't have to cut the rail in the middle to do a bit of fancy railing towards the mainmast. Go ahead and stick a few cannon in the waste ports. It is slowly getting to that wonderful day of completion.

Remember when you made a number of extra balusters that what you needed? Well, when you lined them all up weren't you surprised to find it wasn't the long ones that needed adjusting, but the re were a couple of them that

seemed to short? You probably found out long ago and I have just now remembered, when filing the holes into a square shape like the middle rail of the breastrail, shape up one side of the rail but leave all of the work uncut on the other. This will act as an additional support and also give you a lot more to hold on to when filing the holes square. Your layout will show you how close you are to the edge. Do you have trouble keeping a square file in one position so file doesn't turn in your hand? Well, clamp a small clamp, say one inch size, on the handle preferably so the clamp location will show you just where the flat sides of the file are located. If you have to use another square file, mark off the location showing what part of the file is exactly 1/8" square. Measure this with a micrometer to be sure.

PORTLIDS

Not all portlids are square. A few in the waste on each deck may be but the others are the shape of a parallelogram. The sides of the lid are parallel with the frames and the top and bottom of the lid follow the line of the deck. I have made many hinges for port lids, everything from dummy cardboard strips to what I am using today. The method I have chosen may seem like a lot of work but in the long run, they not only look better but they are stronger when it comes to hanging them and the final adjustment it may need to fit the port.

The length of the strap is from a little above the top, say a thirty-second, to the bottom plank so the fastening which is an eyebolt is the center of the bottom plank of the lid. The two main fastenings go through the other two planks that form the lid.

Now for the wooden part of the lid. Its thickness is the same as the planking on either side of the port. All port lids will have to go an carry an identification number of the port in which it fits. The lid while in the port is marked to show the chalking on either side as these marks do change as they progress along the side. The markings are connected up with a saw cut made with a saw (brass backed) having a blade thickness of 0.008" or 0.2-0.3 mm. The cut is made only one thirty-second deep. A soft lead pencil sharpened to a chisel point is run in this cut for several strokes to insure it is colored completely. The lid is then scraped clean. On some lids you may have two planks the full width and two planks only half width. This is o.k. You may place them in their respective ports for a check. The outside face of the lids may now be finished with one coat of the finish you plan to use. This is done so when you paint the edges of the lid, the saw cuts will not accept the red paint in process. Do not paint the inside face of the lid as this is where you have the identifying number. This face can be painted after it is hung. Give everything two coats, if you want to wait until the hull is finished, you may paint the hinges then or at the same time they are fastened to the lid. By the way, the hinges go one the lid once its width from the edge. Two modelmakers brads hold the hinge on with an eyebolt. The ends are almost flush and peened over on the inside. Do not rivet too much as you will split the lid.

On a vessel of a hundred guns we will need 28 port lids for the lowerdeck, 28 for the middledeck, but only 8 for the upperdeck. The waste ports do not have lids and the others have the cupboard for port lids.

I am trying to keep the progress in a smooth flow so I have decided to fill all three gunport lids and mark them with their identifying numbers. Some of the lids may have a better surface on one side than the other. Be sure to place the best side out. As you fit them mark out the location of the planking. Touch up the ports where needed. Give the portlids two coats of clear finish and then paint the edges.

"Port Wriggles". This is another of those problems you wish someone would explain more in detail than the four lines in Longridge's, *"Victory"* page 93. I guess it is one of those things that get edited out. I know if everything was explained to our liking the book would be twice or three times as thick. I think it would be worth the cost. The curve at each end will have to be large enough to accommodate the hinge or hinges. They need to extend far enough for clearance. The cross section of the piece is somewhat like four inches, maybe not so heavy. Rather than explain how they are made, I guess most artists leave them off. It seems that Longridge would have, had it not been for a friend. I have a hint I would like to insert here. Whenever you can or jar of finish has the saying, "Dries to the touch in twenty minutes," you can't be sure of it because anything else does not dry or harden for twenty-four hours. Most of you won't be bothered by this as it will probably be the next day before you return to your bench.

Port wriggles can be a real pain. I have gone through the making of rubber molds and the casting of different materials. Some have a habit of sticking to the molds just enough to ruin the casting. I tried patching but that is exactly what it looked like. Thank goodness one does pick up friends along the trail. I do wish Longridge had spent more time on something like the wriggles. As it turned out, the wriggles on the Royal Sovereign were not as peaked or toed-in as they are on the Victory. I imagine they are supposed to be a very shallow ellipse but again the difference between these and a segment of a circle is hardly notices. A piece of box was turned down to a shallow dish or bowl. The edge was with a small cove on the inside then the "ring" was parted off most of the way and finished with a thin saw very carefully. Make a special miter box with a curved back to fit the curve of the wriggle. The middledeck does not have any wriggles, being shorter than the lowerdeck, does not mean you will have a chance of making more scrap. The rubber molds and the various casting materials of course were not according to "Hoyle." Since the material used

for the casting was in no way related to Boxwood, we are back to one wood only. When asked what the hull is made of, we can't say one word boxwood. If you run out of material and have to order more which always takes too much time, or broken tools that will take two weeks to replace, by now there should be plenty of other pieces that have to be made and assembled. Like you could use six more ladders and companion ways. Maybe this was meant to be. I decided there must be a better way or another method of making ladders. Every problem has to have a reason. The reason here, after a breakdown of the different operations, was the ability to space the steps evenly. The old method of matching lines on the guide was not all matches were on dead center. Like, on one step the lines might be to the right and maybe for the next or the one after the line was too far to the left. Going back to the method of making gratings for the hatches, the guide piece was the width of the thickness of the step and the height of the step or step including riser, if there was one, would be the distance from the left edge of the blade to the left edge of the guide. In this case to rise 72 inches (scale) with steps would mean dividing 72 by 7 or as it comes out 0.214" (5.432 mm), for each step.

The bottom of the ladder may extend out into the naked part of the deck, but just a tad. This can be remedied by using a short deck plank (rounded on the corners to show it doesn't belong there). Don't think this need to be pinned as the glue will hold.

THE SEATS OF EASE

This is no more than box like structure fitted between the headrail and the roundhouse. The waterway from the beakhead bulkhead continues around the roundhouses and forward around the seats of ease. This structure is not more than 16" (prototype) otherwise someone's feet will be dangling. Make it 15" in height to be safe. The hole is 12" in diameter. I remember a place in England we had to use where the facility was made of sixteen inch tile. You may paint the hole black if you wish. Another box like structure set forward between the two gammoning with two holes. The plans for the Royal Sovereign do not show this so we borrow this detail from the plans of the HMS Victory. I can't describe this piece in detail such as a sketch as we don't know for sure what it looked like. No information on the possible use of "chutes of trough." Maybe by this time they were not in use. The arched moldings on top of each pillar at the beakhead bulkhead can be made two at a time holding a piece in a chuck on a lathe to form from the outside and the inside on the arch. A tool like all of your molding cutters is made with three grooves. The inside part of this cutter has a short shoulder which rides on the inside of the piece keeping the moldings the same from the inside edge. The moldings will be made the diameter of the distance between the pillars. Face off the overlap to keep the bottoms of the arches the same width as the given width. They are very fragile, handle very gently. Now that you have the arches across the doorways and the ports, you are now ready for circling the roundhouses. Now a fixture needs to be made. It consists of two pieces which will become five when completed. The tiny and fragile half rings you made are placed in a dish of water and ammonia. The same you used for bending the planks, for about fifteen minutes. They are taken out and placed on the round mandrel, the carved surface up. Now place the forming piece over this and secure with rubber bands. If the molding cracks, use another one. You did make several extras, didn't you? Seems like a lot of fixture to make such a small operation. Since you are not in a hurry, let it dry overnight. I suppose gunport wreaths minus the carving could be formed from this method. A fixture for bending to conform with the sides would have to be made.

Between the mainrails are several cross timbers, from one mainrail to the other. What decking there is between the cross timbers and the forward edge of the beakhead, is filled with grating. Sometimes going athwart, sometimes not, and sometimes both. It appears to have been something made of three inch material. A much heavier piece or pieces form a center opening for the gammoning. Since this structure isn't discussed at any great length and sometimes not at all, you have a good change of doing what you want on what goes where and how. Of all the models, I may have built two models with a similar design, but I doubt it. Keep this whole structure clean and sharp. I suppose there will be one in a million that sees the work you have done on the head but he may be the one writing a book about your work.

Now let us feel our way through this maze of calculations needed to construct the head timbers for the middle and lower rails. Can't say which on is the most important or difficult. A slight error on any of them can prove troublesome. The only one which seems to take the most time is the Ecking rail, the one from under the cathead down and the bows to the middle rail. Some ships have their Ecking rail end in the lower rail. This depends on the period the model represents. The angle of the headtimbers, I have found, to be perpendicular to the line of the keel, or parallel to the frames. Some shipwrights show their headtimbers raking aft a little bit at the foot of the timbers, giving the head a more basket effect. I think this was done on small ships such as brigs and schooners to yachts. Personally I think the shipwright was just showing off.

To start with you will notice the thickness of the timbers vary, as the distance between them. The smaller ones forward, small in thickness. The timber does not come out at the edge of the rail. There is a cover piece which covers up the joints between the timbers and the rail. This is a thin piece for when it is cut to the angle to meet the rail, the face is sometimes too thick and has to be trimmed. Try to stay away from the massive appearance. The whole construction of the head is to have a light airy appearance. The cover pieces are larger at the top

because of the angles of the timbers. The head timbers are fitted between the main rail and the upper cheek first. Then the middle and lower rails are fitted, in this way you can see where the middle rail will touch the planking at the bow. This location is the location of the ecking rail which runs from the cathead knee down and around to the middle rail. Each piece must be treated as though it is custom made for that particular location. The differences between the port and starboard will be many so duplication is out. If you are in doubt as to whether it will be painted or not. Make all fittings and joints tight just in case. The head timbers are held in place after fitting by two or more common pins. Holes the diameter of the pin are drilled in each piece at an angle to lock the timber in place. The 0.025" (0.65 mm) hole is fitted with a treenail of the same diameter at final assembly.

The ecking rail. I have had many questions about the construction of this rail. Starting out in one angle and ending up in another has a lot of thought about just when this happens and how. To simply this construction it has to be broken up into three separate parts. First the knee under the cathead. This is a straight piece not forming a tangent with the curve but being a little short of that so the curve has what we call a landing piece. The curve runs from this knee down to a horizontal with the middle rail or whatever rail the ecking is supposed to connect to. This is about all the directions that can be given. As far as dimensions go about the only ones that can be given are to make the block you will use quite a bit larger than the rail because of the changing angles and curves will be allowed. Scrape and snap down all surfaces before you scrape in the beading along the two edges. Temporary fastening can be done by using escutcheon pins. These will be removed later to allow for bamboo treenails. Before gluing the rails on, fasten them with pins, the step back and look at the curve from all angles to see if there is a smooth run to this rail. You might end up making this rail from three pieces, counting the addition at one end or the other. Sometimes the spacing of the timbers will not agree with the curve of the bows making it impossible to place as many timbers as shown in the drawings. This of course should have been thought of in the beginning. It could need the eliminating of a timber.

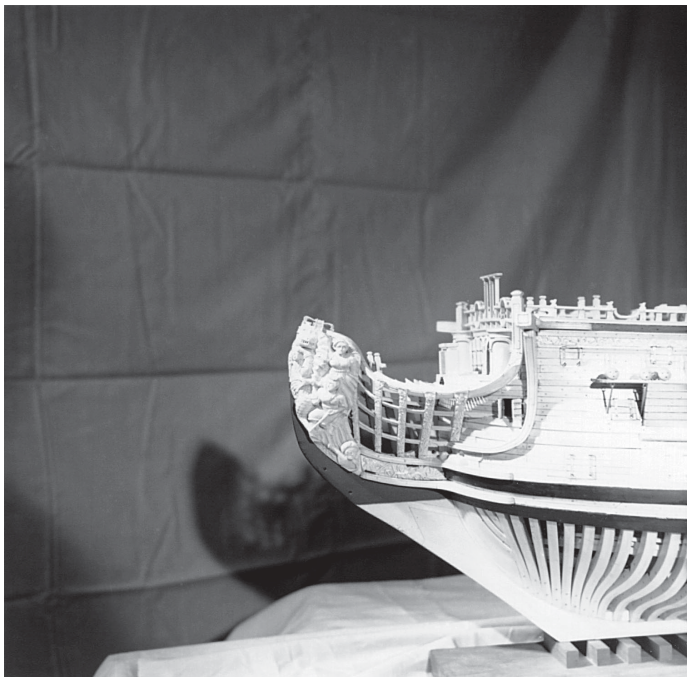
The covering planks are wide enough to cover the timbers and just thick enough to allow for the carving which is just deep enough to be seen but not deep enough to weaken the plank. Most of the carvings follow a line of the rails. I know I have seen them too. Some carvings are so heavy they seem to drip. Now will you leave the head and go to the ports. All the short pieces of brass rod you bent are now used for the hinges.

Position the lid and drill the two holes for the hinges on the outside of the hinge. I have drilled them on the inside and used other means on models for at least two years. Now you have begun to realize why Admiralty Models are difficult to build.

This is the time you have heard several large bangs in your model. On careful inspection the reason for this will show itself. Though not very pleasant, some of the frames have pulled away from each other. Sickening sight as it may seem, there is a cure. Maybe that was the wrong word, but it fits.

I don't think a failure of the wood should discredit your talent, after all you can tell what will happen to two pieces of wood joined together.

Let us proceed to solve this problem. A tool must be made as part of the cure. To find out how much damage was done you will make a wedge fit into this opening. Scribe a line where the edge of the frame and wedge meet. Measure the thickness of the wedge at this point. 0.060" isn't nothing to worry about. Since it will take three frames to even the difference, it is assumed three openings of 0.020" will take care of the main opening. I could be done with four openings of 0.015" or five openings of 0.012". The openings will be filled with shims of the same wood measuring the amount of the opening. The tool needed is shown in the drawing. A double wedge with a central acting screw. This is placed between two frames next to the fault and the two halves are brought together by tightening the screw. Tightening the screw will become difficult, so you should use a wrench. I don't remember leaving the tool between the frames overnight as the tool exerts enough pressure to separate the ones which don't have dowels in it's joint. Make sure the color in the shims will match the separated frames. If it takes three, four or five shims I think you will be satisfied with the end result. The problem can happen three times on each side, but it can be cured. I don't know who or what is to blame for such a thing.



CHAPTER 10

Some Thoughts About Rigging

Well, we finally get to do a little rigging or at least the start of the process. We are concerned with the large deadeyes for the lower shrouds. Along with these will naturally be the deadeyes for the backstays and the careful positioning of the chains for the deadeyes and to leave room for the other rigging such as the breastback stay and the falls of the yard tackle. The size of deadeyes advertised are undersized which would give us a seventeen inch, but are the wrong color and wrong wood. It is possible to use these if you bleach them out, that would bring them to about the same color as the standing rigging after the dye has dried.

As I have said before, I think it was the article about the cannon. The tool post turret is very indispensable. I have a tool for turning down the diameter, another for just touching the face to get the same thickness and at the same time cutting them off and forming the radius. Of course, you will have to sand the edges before parting. The thickness is generally about one half diameter. The hole for the lanyard are spaced one quarter of the diameter from the edge. I think if you make the hole one fifth of the diameter, the appearance of that particular part of the rigging would be improved. Make the holes a little larger than the lanyard so you will enjoy it when it comes time to insert the lanyard. The size of the hole according to the rules are a little larger than the lanyard. Let's say we make them one seventh of the diameter of the deadeye. They may be scored using a cylinder square burr, a smaller size than the hole so you can move the burr to adjust and cleanup.

It would be nice if you could remember to make half of them with a groove for the shroud and the other half grooved for the iron binding, some things are noticed and some are not.

The knot at the beginning of the lanyard for instance, I don't think anyone would notice it is a wall knot or a half hitch. Or, maybe a reverse of a sailors knot or hitch. If a hitch is too small then use the combination of two half hitches. This knot is the result of going through the loop twice to make the knot larger. It doesn't make the knot all that large, but it seems to make it large enough preventing it from entering the hole.

A fixture for drilling the hole is a must. The deadeye blanks you have formed must be a good fit. Not over a couple of thousands smaller than the hole. If you don't have a drill the correct size, find a friend maybe in a local machine shop. Be sure to grind the flats on the drill if you are using brass for the fixture. The drawing I have submitted will help you to some extent. I have removed some of the dimensions as I don't know what you are going to use or what piece of scrap you have.

To use the fixture: First place the blank into the hole and place the second piece on top. You will note the thickness of the deadeye and the boss on the top piece in the vertical space inside the hole. Drill the first hole and insert pin. This locks everything together so you may drill the other two holes knowing they will be in alignment. Drilling is not done as though you were running a punch press. Take four or five short strokes to drill the hole. This will keep the drill from breaking out the lower edge of the deadeye next to the groove. To add a pin to hold the two parts together would be superfluous. There is a lot of work in making a good looking deadeye. I don't think I need to say anything about the scoring for the lanyard. This is just a time consuming chore.

Chains and their related ironwork. Almost all dealers who deal in brass will often have a machine known as a slitter. From this machine one can get long strips of brass that are suitable for annealing and drawing.

I don't know if I discovered the fact in a book, magazine, or seen it on a model. The larger ships seem to have

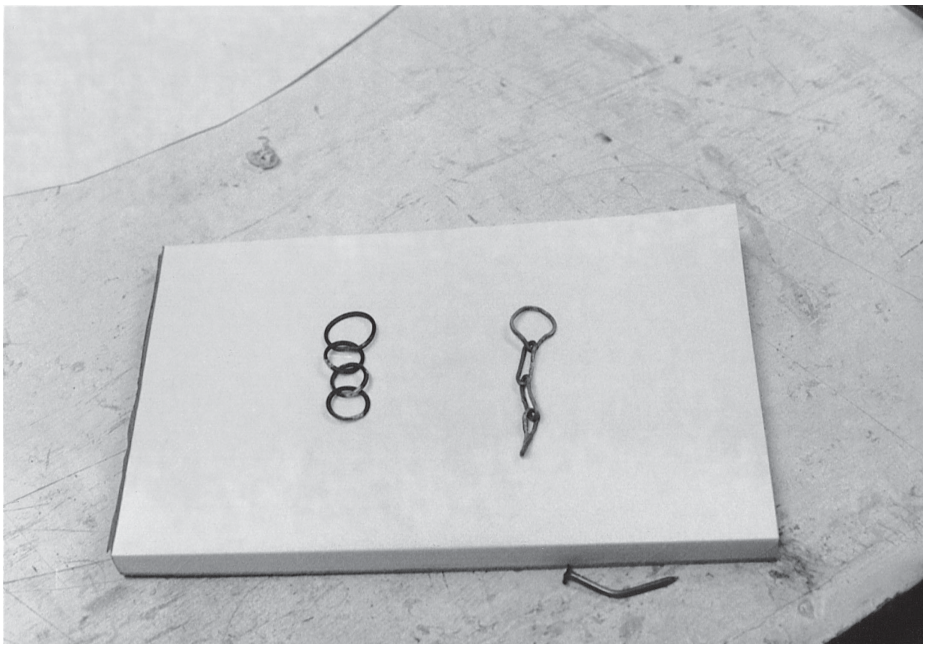
their chains made from a size that is square. Probably leaving it square save a lot of time and heating just to make iron round. Therefore, the strips of brass will have to be drawn through a drawplate. One with square holes. According to a friend of mine, these drawplates are rather expensive. If you have a friend who has one, maybe you could get him to do your drawing or borrow his equipment and do it yourself. Don't dream of this as being an easy job. Every third or fourth you will have to stop and anneal the coil of brass strip. Waxing with a candle or a cake of paraffin can ease your chore to where you might get an extra hole each time. It certainly makes the drawing easier. You don't need a draw bench as long as the wire pulling is through two feet at a time is just as. You will never know what link will melt during the process of being brazed.

The rings for the deadeyes and links can be formed on a mandrel. Form a ring of copper wire as a sample to find the length of the wire needed to form the ring. Then you can find the diameter of the mandrel you will need for each ring or link you will need. When the square wire is chucked in the lathe with the mandrel hold the wire so it will sit on the mandrel square with itself. Wire should cling close to the mandrel when released from the chuck. The whole coil may be expended a little to enable you to cut each on off. I don't mean for you to unwind the coil but to pull to make the coil longer. The HMS Royal Sovereign has only 26 what I call full length chains. Not every deadeye has a full length chain because of the gunports and other reasons. The silver solder on each link is filed down to clean up and the links are squeezed to make the links. You might place a piece of brass or steel in the link so you won't squeeze too much. After this, place them in a pickle. Pickle is sold by jewelers supply houses. It removes the dirty color and the excess flux. I suppose you could go ahead and place them in a solution for cleaning prior to painting. Of course, they will have to be touched up where crimped for the deadeye and other accidental spots. Don't have anything on the bench behind the drawplate while drawing.

I know I have written about using a blowpipe and the alcohol lamp, but it is a good source of what for small amounts of material, of a small size. Not the size and the quantity we have on the HMS Royal Sovereign. There are several good torches on the market that are faster and easier to use. It is best to solder several pieces at a time rather than try to solder them all at one sitting. Reason, the smoke alarms. It seems they are sensitive to hot gases as well. I got a lot of headaches from using the blowpipe. When you are purchasing your silver solder, get two sheets. One is called medium and the other is called easy. Medium melts at 1275 degrees and the easy melts at 1145 degrees. Solder every other link with medium, then solder the rest with easy. This keeps one from melting everything. You will need three mandrels. One for the deadeye ring, one for the backing links and one for the links of the chain. When they are assembled, they will appear like the photo. Of course, without the backing links. Another photo shows them formed, cleaned, pickled and dipped in the brass blackening solution. Naturally, they will have to be touched up because of the handling while placing the pins and other adjustments. I use the brass blackening solution because of its ability to get into the small openings like in between the links.

I probably said this before, but I will say it again. "How often have you said to yourself, now if I had taken more time to make that piece I wouldn't have to make it again?"

According to L.G. Carr Laughton's book *"Old Ships Figureheads and Sterns,"* the subject of entry ports is sort of vague. The canopy of the entry port is braced on the outer edge with a turned post in back corner. This seems to have been drawn after the original as there are two chains shown in the same location. Being under the channel sort of makes the canopy of the entry port unnecessary. I have not tried to keep in line with the port wriggles by the use of a simple arch with columns following the hull to give support to the canopy. I have tried to find out about the doors or the entry port cover that was used at that time, but since the detail would be small to show with good effect, I guess we will leave it to the drawings and the written word to explain how they were. On making the brackets for the channels, they are a thin piece. Most of their strength comes from the angle they form not in the thickness. They can be mass produced as long as the size is large enough to allow for



a custom fit later on when placing them into position and allowing for the cutout for the edge of the channel wale.

They do fit under the molding. Allow for the deadeye and the necessary rigging to follow. I haven't said much about the channel stools. What I have found out, they were about 60% of the channel before them. And a little less in thickness. The length and thickness is generally given on most drawings I think. About now would be a good time to give the outside planking a coat of whatever you have open for the finish. First you should mix up a little of the sanding dust you have been saving and mix it with your finish into a paste. Not too runny so when it dries it won't shrink so much you will have to go over the places again. Now fill all of those holes, cracks, and other mistakes. The ends of the treenails will show up what seems to be a little too much while the finish is still wet, but after it dries the contrast will even out. I choose this time to put on the book as you will find out when you start the assembly of the chains and deadeyes over the ports. It seems another arrangement could have been used but, I guess when you change one thing there is always a possibility of causing problems at the new position. You won't need to make pencil marks to the hull to locate backing links for the chains. A scriber is a good tool to use as you can push in the point for the location of the brass pins you have selected to hold the chains.

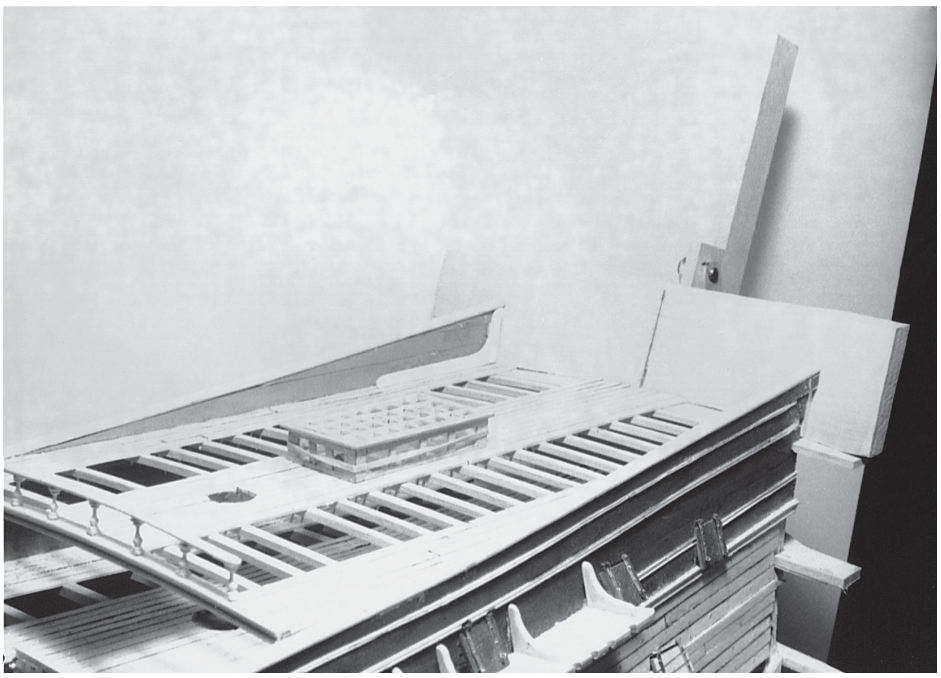
If for some reason like your household doesn't allow dangerous chemicals in a location harmful to small ones or someone who needs care, the pickle method of cleaning silver solder will have to be done some place else like the garage or shed out back. You cannot soften solder rings and expect them to stand the pressure while you are bending them into a link. Maybe I should have said squeezing them into a link. As for coloring, the coloring solutions for coloring brass are very strong chemicals. Of all the times I have used the brass blackening solution, I have never been totally satisfied with the results. Dipping seems to be the preferred method. Most painting manufacturers will have a formula for mixing. You will have to touch up afterwards anyway. Especially where you place the nippers to squeeze the rings around the deadeye. The difference between a hot pickle and a cold one is about fifty minutes. The hot taking about ten minutes. By hot I mean boiling. A small copper pickle pan holding about two ounces is large enough I think. It would be good procedure to make all of the chains for the lower masts now.

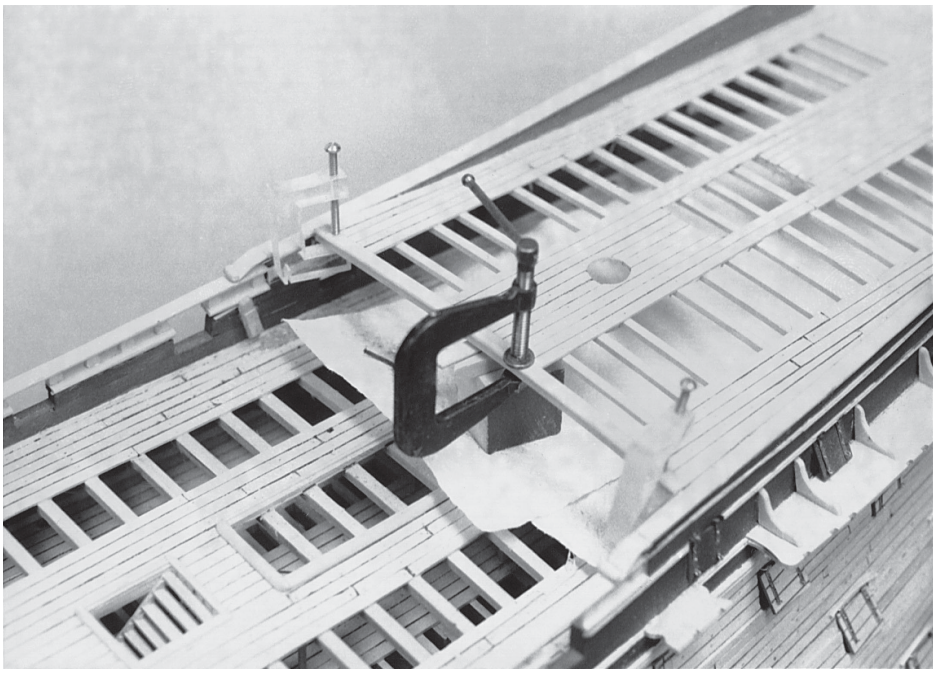
I hope the next time you look over someone else's model finding something not quite correct, is not a reason to open your mouth in criticism. Remember, the modeler or artist had to do the whole piece for you to see that one particular interpretation. By the way, what have you done lately?

Instead of going to the poopdeck, I think it would be best if we completed all of the sheer rails and moldings. Like I said before, the scrolls at the ends of the heavier moldings and the what are know as tongue scrolls at the end of the light molding rails are best done with a knife, very sharp, because of the crossing grain. Extra length of material is left on the pieces to be cut to length when setting in the plumb lines for the stern galleries. Keeping in mind the junction of the poopdeck plank and water-way with the sheer, this could be an easy joint or a complicated one.

Have you ever noticed when you are halve way completed a piece or just about finished, you realize you have in your hand a piece of scrap.

Now let's get after that poopdeck. Although their size seems small they are almost as many beams on the poopdeck as there are in the quarterdeck. They are solid beams. No scarfing of two pieces. About the only interesting piece on this deck is the skylight. This should start out with a block of wood and the inside dimension whatever the thickness of glass you plan to use. Again be sure it is coated with some sort of wax to keep the glue or whatever from sticking. Because you will be able to see the beams under the skylight, I think it would be better to use as thin of glass as you can get or handle. I wouldn't suggest cover glass used for microscope slides, mainly because it is too thin to be safely cut. Make sure to use a freshly sharpened blade in your saw when you start to cut the material for the skylight. Since this ship doesn't have a boom or gaff, I don't think it had any bitts





below the mast. Not cleats or short pin rails on the mast access to the poopdeck was made by the use of the ladder on each side between the second and third six pound cannon and port. Like all ladders, they were made as they could be removed in time of action.

The first work to be done on the poopdeck is to figure the width of the planking according to the width of the deck and the number of pieces you choose to use for the planking in the center and on the port and starboard. Always figure in the calking strips. Nothing lasts forever. My old saw blades I received from the people that make the famous Midjet Universal, have lost their kerf. I took them to a saw sharpener but he refused to put in a new set because he said the blades where hardened too much and the teeth would break. Well being desperate for a sharp blade, I decided to purchase a hand set and do the job myself. I guess the trick is not to set the same tooth both ways. I don't remember if you set before sharpening or after. I set the teeth anyway. To get that clearance was more important. The waterways are small on this deck. The thickness being only slightly more than the thickness of the planking. Just enough to show itself. The width of the waterway, if everything goes well, will be enough to let the margin plank clear the sheer rail. The difference in the width of the fore poopdeck and the aft makes it necessary to use the margin plank. At the beginning of laying the poopdeck planking, I have decided to use ten strakes down the center with four strakes of plank on each side, not counting the margin plank. The forward end of the deck is covered by what is called a waterway protruding over the first beam by about one eight of an inch with a small molding under. On this waterway is assembled a rail called the poopdeck breast rail. I was unable to locate a plan for the poopdeck, so I am not sure how many turned posts were used to support this rail. Longridge's book called for eight on the Victory. The height of the rail is about twenty-two inches. The rail is more ornamental than anything else. Don't worry about sawing your index finger lengthwise. I haven't grown another finger so I would have two. The same old finger keeps coming back the same as always. There seems to be more work on the poopdeck than at first observed. The top of the skylight is composed of thirty-two panes of glass. The framing is another grate construction but using large openings. A little tricky to assemble dry. Given a diluted glue swabbing, let it set overnight. Turn over and give the other side the same treatment. This is another fragile bit of construction. Remember to do your assembly on a sheet of wax paper. Use your finish to hold the top of the skylight together in place of glue unless you have some thin glue almost like shellac.

Another word about the skylight. The "shoe" molding going around the base next to the deck is assembled last just in case there is unevenness between the two. On the port and starboard of the poopdeck against the taffrail are two knees. They may be placed there after the planking is on if you reduce their thickness by one half. They were supposed to be placed there before the planking. Either way looks the same. The other four knees I will wait until the taffrail has been carved. Remember, you are still working in wood so you can glue on a block to take care of that mistake. Well, of course, it has to be a good joint.

Just for fun. Every once in a while place your partially completed mast into position, step back, take a look to where you are going. To do away with the time consuming movements, here is another little helper. When you are finished drilling holes for the small nails or brads you have been using, tape the drill to the package of fasteners so when they are needed again the time consuming chore of measuring drills to find the correct size won't be necessary. Copper nails might be ok for shallow holes, but not for deep ones. The deep holes build too much resistance which starts as soon as the copper nails enter the hole.

CHAPTER 11

Boarding Steps, Stanchions for Tops, Proper Rigging for Catheads

CHESSTREES

Chesstrees remind me of one of the days two or three hundred years before when what appeared to be frames on the outside when the ship was a little tender amidships. They are referred to in most books as a long tapering timber fixed to the sides. Used for parbuckling stores aboard. Larger items being brought aboard by the yard tackles. So, when they dragged a barrel or other objects up the sides they didn't have to put up with the bumping along over the port lid hinges, wriggles and other objects in their path.

There are four to the side in our model. The forward one is a little heavier to allow for the sheave for the mainsail tackle to reeve through and around the staghorn on the inner face. The face of these chesstrees is broken by the molded edges as in the brackets for the gangways. Not much of a face left down at the wale. Cardboard may be used for making the template, but an acrylic sheet would be better because of the jogs and corners around the chain wales and channel wales. They taper to about thirty-four, of their thickness of the head at the rail. With a little adjusting to shape, one template can be used for all four chesstrees. Of course, you might need another when changing from port to starboard. The centerline of these chesstrees are perpendicular to the keel. Having tapered sides will make aligning them up a little difficult. Can be fastened with pins or treenails. If you have coated the sides with something, make a series of scratches down the side so the glue will stick.

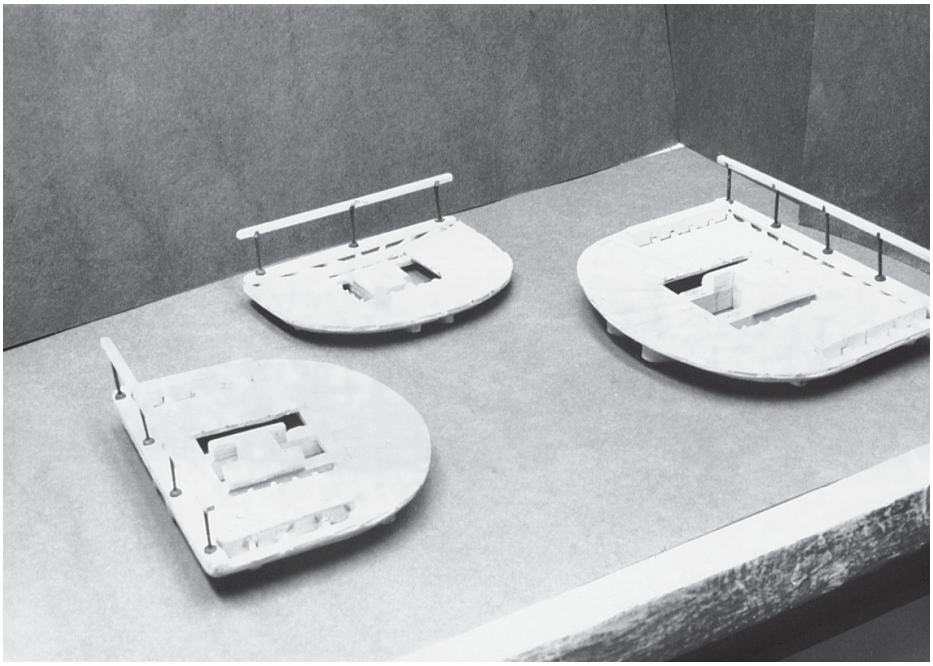
More about researching the possible figures on this conglomerate figurehead. The term conglomerate is used to help explain some interpretations of the drawing showing seventeen figures. Nine on the starboard side with the central figure and nine on the port side. The drawing I have looks to have been sabotaged. As it is almost impossible to tell what the other figures are supposed to be. I can see why a model was never made of the HMS Royal Sovereign, 1787. Now it seems we have two central figures, one being an English bulldog.

Entry port steps or ladder, whatever you may wish to call it, are not the simple addition they may appear to be. First of all it takes a very deep molding cutter to allow for the space for the handholds. There isn't a continuance of this ladder for the lesser personnel as I have seen on other ships, so I guess everyone piled through the two ports. Most other models have a set of steps all the way to the rail.

The burr used for cutting the slot for the hand holds is known as a wheel. A thickness to make a slot that would be comfortable for one climbing. Now you know why the molding was cut so deep. Like others, make a few extras Wood spacers should be a loose fit on the wheel's mandrel. Used only for keeping the wheel at the correct depth to form the handle. A short cut to fastening the steps equal distance from top to bottom would be to measure the distance from the wale which is the eight step to the sill of the entry port. This happens to measure 2 inches which gives us one quarter of an inch for each step. The thickness of each step is 0.110". Let's make a spacer of about 0.140". Maybe if it were only 0.135" it would be better to allow for the uneven pressure while drilling the treenails to hold the steps. Some of the wriggles may have to be trimmed to allow for the steps. Keep the steps flat. Do not follow the curve of the hull which would allow water to stand and cause rot.

Quarterdeck and pooprailings – As per sketch. I tried to purchase stanchions for this location. I found a few, but they were too large in diameter besides being sort of shoddy (off center). I returned them to the supplier but forgot to tell them I was returning them. Thus, no refund as I guess the stanchions were lost. Always get the supplier's permission to return the item or else you will

be out of cost. After searching through many photos and drawings, I found what seemed to be permissible and I have designed my stanchions accordingly. Tubing for the top is made as was the portlid hinges. The tube being two or three times longer than needed and ground to length with a cut off wheel after silver soldering. The rope railing was probably a safety feature as it wouldn't send flying splinters if it were hit by shot.

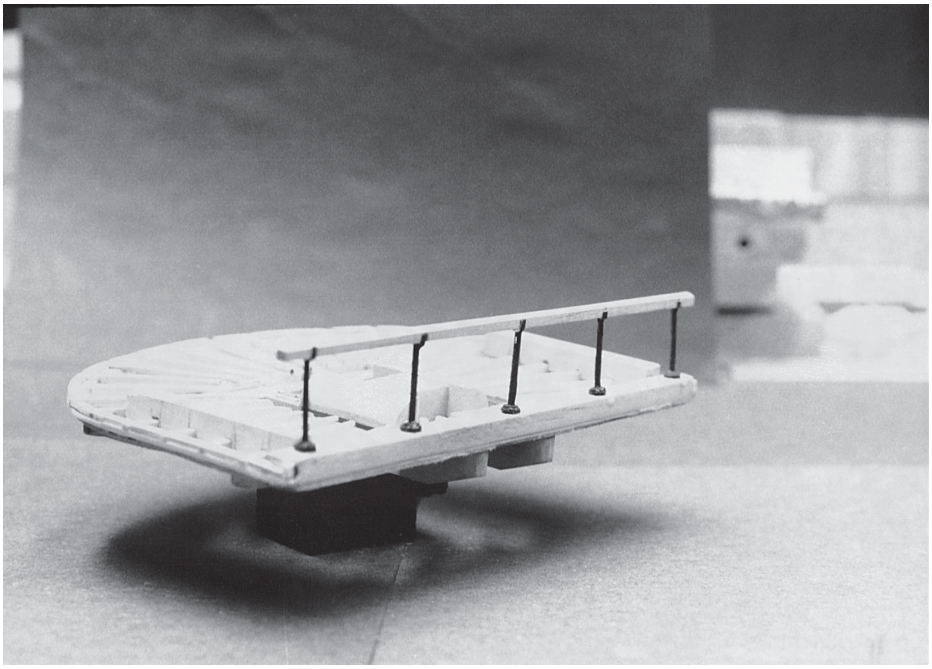


TOPS

If you have ever planked a top then you will know why I take the route in construction that I do. The foremost plan of making a top is to prevent the warping or curling of the planks. I have used both methods and find it is necessary to have several heavy steel blocks you can use to hold the top down while the glue is drying. Lapping the planks in the corners always seemed to me a lot of unnecessary scarfing. The use of a sheet of 0.040" (8 mm) plywood cut to the shape with a 0.030" (0.76 mm) planks. Placed and secured has worked out in many cases. Thin your glue about half to prevent it from pulling the top out of shape. The top for a mainmast for a first rate looks like it would take about thirty-three planks to do the job. The tressle trees are kept their distance by making a plug the size of the head both before and after. I followed Steel's method of constructing tops with a reference to Lee's book on rigging once in a while. Lee says it is up to the builder whether he wants wooden stanchions or metal stanchions. I have chosen to use the metal ones. Mine are made of brass. The base or flange will have to be turned from solid stock while the upper part is made of square brass tubing while the shank is made of round tubing. Brass rods may be substituted for the brass tubing.

Another problem is the spacing of the battens to be equally spaced but to allow for the spacing of the topmast shrouds or maybe I should have said futtock shrouds. Not too many to be crowded and yet not too few to be weak, or to look weak.

I have found a way to methodically fasten the battens to the top. Use only six clamps and a new CA that has a medium viscosity. Fasten two battens at a time gluing both then proceed around the top and glue two more. By the time you have glued all six and cut out the lap on the next six, the first two you put on will be ready to remove the clamps. Fasten the next two and then remove the second two and so on.



During this period there was a difference on that ships of this period did not have a piece called an outer rim. It does make the top more dressed up but Lees states for a larger vessel the rim was omitted. Steel's writings as of 1795 shows the other rim. It isn't a difficult piece to add on.

I have never used CA's in any model. I guess I was waiting for more trials to be made. However, on the Royal Sovereign I have found a number of places where it has come in handy.

You have to drill many holes for the crowsfeet. Twenty for the main, twenty for the foremast and sixteen for the mizzen top. Once again, a little oversize to make threading easier.

Holes for the futtock plates are drilled at this time but not slotted until you find out just what the size of the plates will be. It might be well to go over the entire top with a Klenzo eraser the regular kind. This will take off and out the dirt and the pencil marks you might have missed. You will see from time to time the top of the rail has been left square. I am sure this is an oversight so chamfer the top edges of the rail. Don't ever paint any part of the top except maybe the stanchions. The only other part of the mast assembly to be painted would be the banding. The bands above the wooldings are wood and they may be a little darker than the mast. More on this later on.

CANNONS

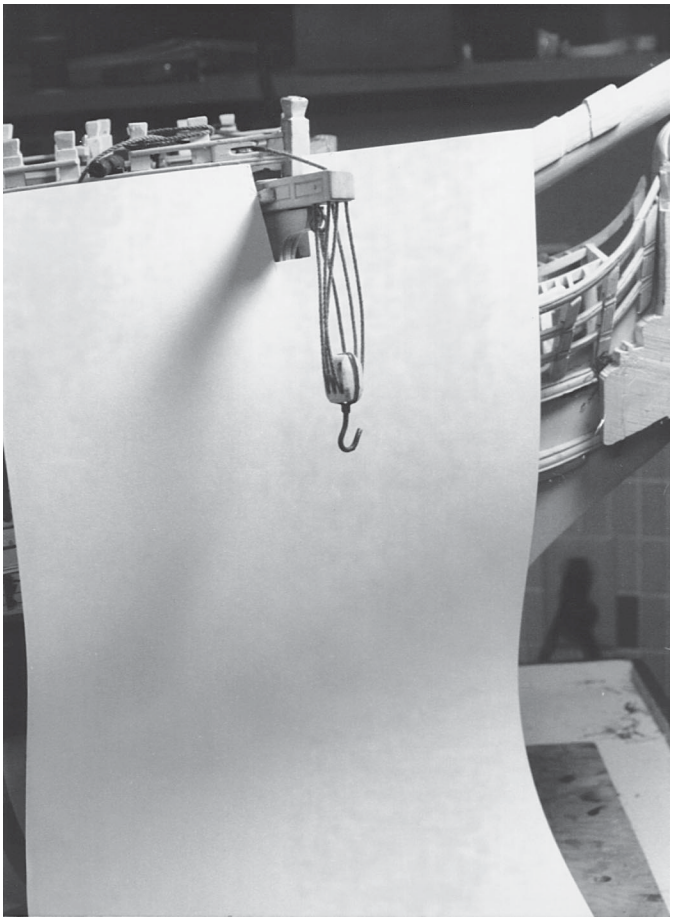
Since we are going to have a lull in the construction, I think it would be a good time to place the cannon. Let's start with the most difficult deck, that being the lower deck. The size of the forty-two pounders won't help us very much, but maybe we can use that to our advantage. The use of rods shoved up the length of the bore and then balanced and placed around on the deck may be fine for small vessels where you can reach the length of the deck from the stern, but on large vessels where this is impossible, another method must be devised. Maybe a device like a shuttle where the cannon could be loaded and pulled either towards the stem or towards the stern. Or a tool known to mechanics as a pickup, where by pushing on the plunger in the end forces four hook like prongs to protrude from the other end expanding as they come out to grab the object letting you place the object where you desire. I used two of them, one about a foot long and the other is about two feet in length. Seldom does one think of the position or angle one is working. This comes to light when placing cannon, especially the ones on the upperdeck or quarterdeck. Some of these are pinned like the middle and gundecks, but to pin the upper and quarterdecks where they are out in the clear is another matter. Lets take the ones in the waist like numbers four to eight. These are pinned through the rear axle inside the cheeks down into the deck, either by 20 gauge escutcheon pins or by using model makers nails.

The main purpose is that the pin goes through the deck. To do this from the port side to pin the port side cannon is next to impossible as besides shadows, fingers and tools find their way into your line of sight. The simple solution is to pin the port cannon from the starboard side of the hull. Touch up the heads and anyplace else you may have removed the paint. Lines for the shuttle should be from the bottom with the knots on top so the shuttle is given a lifting motion as it encounters whatever on its way to the port .

I have called several suppliers of model makers parts and I have been informed the wire brad and wire nail we have all used and needed will no longer be supplied as it is impossible to find a manufacturer. Placing the cannon into the port holes is a combination of pickup tools, bent rods to fit the bores, various shaped hooks, and a great deal of patience. When one cannon slides into position the next will surely find it's way into the hold.

ANCHORS

For those of you who would like to have brass anchors to grace your model, that is a nice thought. To make a brass anchor entails such a tremendous amount of unnecessary work. For instance, finding a foundry to cast a small item and for only four pieces. I haven't heard of a foundry that will custom mold a single pattern in the past thirty years or more. Even then they insisted on having the pattern for all four anchors mounted on a board to fit their flasks. The biggest problem with this is the mismatching of the top and bottom which would give you a seam too large to be permitted in model work. Small foundries like those affiliated with the jewelry trade have a limit on the size of pattern they can mold. Anyone who does small foundry work as a hobby keeps it so quiet like he was operating a still. It would take a large investment of time and money to go into the foundry business just for the four anchors. Getting the scrap brass to melt down



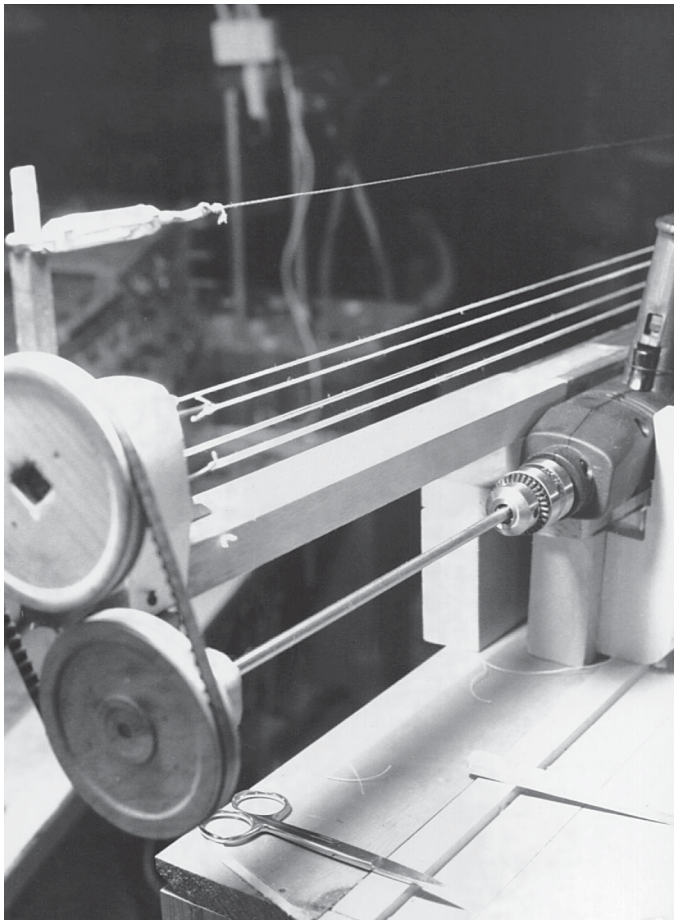
isn't a problem as you still have the large amounts of turnings left over from making the cannon. Then there is the problem of insurance. Then there is another problem with doing your own casting, that being the other half who owns the other half of what you do.

Lets make them of wood and keep everyone happy. Besides, the model now weighs 36 pounds. The best source of information about anchors of this period comes from the Nautical Research Journal, Volume 13 Number 4, page 124. The article was originally published in a book by the name of *"The Elements and Practice of Rigging and Seamanship London 1704"*. At first I was going to make the hoops for the stock out of square tubing, but ordering a variety of sizes and happening to be sized to fit their locations would take too much time. So, we use annealed strips of brass sheet about .015" in thickness, silver soldered of course. Silver solder is used for the reason you can hammer the hoop to size, to stretch the sides to increase its dimension. This brings up the subject of catfalls. A triple block in this case being 24" in size using a six inch rope and iron bound. The block is first scored to fit the band with the hook welded together. The band and the hook are soldered separately to avoid burning the block. The two halves are set together inside of the hoop and glued. To keep them in line brads of the same diameter as the block is bored are inserted through the holes. After drying the brads are removed and the holes drilled out to clear them of any misalignment and excess glue. Clean up and keep them looking like the assembly should.

BLOCKS

Rigging the blocks is not as simple as one would think. You will find when the blocks are rigged the two blocks are at ninety degrees. See diagram. This allows the running part of the tackle to come through the center sheave of the cathead. I don't know, but I may be just a little premature in bringing up at this time the subject of a rope machine. But just in case you decided to stop construction with just the hull which many have done, we need to hang the anchors. This means we have to have the cable for all four anchors.

My machine is quite old, having been through the remodeling stage several times for one reason or another. It started out with a bed made of two sections of three quarter scale railroad rail for a live steamer I once was building. There are several articles written about how to make a rope machine, but some are too light for quarter inch and one other was made for much larger scale. The one thing I have noticed is while you are buying the gears for the head, why not include one more so when it comes time to make a four strand rope, you will have four twirls to hang the yarn upon. Remember when you are making the hooks or twirls for each strand, make the head large enough to hold a three strand finished line as the cable



has to have strands and they all have to set on the larger of the four hooks for the final hardening twist after winding. My latest renovation of the machine was to give it power. An electric drill was chosen as the source of power because of the small size and the necessary power. The size of the pulleys was the result of lots of figuring from a sewing machine belt I had. Since I am the only one operating the machine, the safety standards were trashed. I have on hand several spools of 10/2, 20/2, 40/2 and 70/2 and plan on using a smaller size if it becomes necessary. But for now I would like to start and finish most of the rigging with 40/2. I have tables of how many yarns are needed for what size of line from the machine when it was hand powered. But I think I will start at the beginning and make up a new chart. I will use the purchased line as long as you can buy the linen line the size I need providing it is hard wound. Don't ask me about other material as I have always used linen. One advantage of using an electric drill is the varying of speed. The drill is stopped half speed by sliding wedges into the foot switch. The switch I was using overheated, so now I can use it as an on/off switch.

After much experience on this machine, I find a hardening twist may be done while the rope is still in the machine. Start at the hooks and turn opposite the lay. You will find the hook on the traveler will turn with you.

I don't know if I have ever mentioned about how I measure the circumference of a line in another article or not. I have an old dial indicator I mounted on a wooden base, and put a half-inch diameter foot on the end of the indicator so it would measure three to five of the turns. Finished rope is guided through to give you an average if necessary. Foot may be raised for inserting the rope by using a knife blade or you may wish to inset a lever to do this. Don't be disappointed if you have to make lines over again. By all means try to keep the same tension on the yard when you are loading the machine. If one line is loose it will raise havoc with the finished rope.

Another reason for using an electric drill is for the reversing action, useful for laying up the twist and for laying up the nine strands into one.

The combinations of various sizes of rope and cables one can make is confusing at times. What to use and how many to make what size?

CHAPTER 12

Lanterns, Pilot Wheel, Stern, Figurehead

This conglomeration of wood and glass in its many angles and shapes, will become a very beautiful lamp known as a ships lantern.

After many starts and just as many stops in making a lantern, I found the complexity of this problem was very simple. Thinking back to high school drafting class, I remembered the truncated cones. I set out to find the center of this cone shape. I suppose someone will declare it is not a true cone but I don't see it that way.

You will remember a little instance, Longridge skipped the making of the lantern in his book. I can see why. I will try to explain what I did and maybe why. There will be cases of where someone will insist on making the lantern from some sort of sheet metal and glass. I don't think he will end up with a lantern better than the one shown here.

The idea of using only six sides was strictly my own. Eight sides make for too small of a pane, so you couldn't see the candle. This candle is made from an old ball point pen sold for advertising mostly. The pen is made from a phosphorescent plastic. The companies that handle the plastic prefer to call it fluorescent. I don't know why I bothered to supply "candles" for the lanterns. It is better than electric grain of wheats. I have had this pen for thirty years, intending to someday use it for a candle.

In building up the cone, the scribing was a little deeper than I had planned resulting in the sections becoming separated necessitating gluing and what goes with it. I cannot recommend any adhesive as I have not found one that does what it or they say it will. One adhesive stinks too much containing, they say, chloroform. It takes overnight to dry.

The quickest and best way to avoid smears is to cut another segment and try not to bend each pane so much. I suppose you have an ample supply of acrylic sheet. So, we can cut segments without a thought about the shortage of material. A ring of brass wire is used to hold the segment in a circular shape. A drop of acetone on each scribing seals the bend and where the two ends meet, another drop will cement these together. It is a great deal like assembling an egg shell after it has been broken apart.

The top and bottom are wood shaped out. The framing is chart tape 0.040", 0.032", 0.015" (1.02, 0.82, 0.38 mm) in width. Small panes would probably be more authentic but the larger panes look neater. Always use paint or enamels made for the modeling world as they work better with a brush. I find that any paint on the plastic will scrape off. Maybe if you took the time to paint the lantern, you wouldn't have the smears to scrape off. Funny, I keep telling myself that very same thing but I seem to forget.

The side lanterns, make four. The worst one throw away, the next better use it for the admirals lantern. The remaining two will be separated by the center one. You probably thought I wrote a bunch of gibberish but in reality, the separation of the good and the better does have a place in this model making business.

The brackets are oversized according to the ship but if you have made brackets before, you know they go through a lot of punishment. I suppose on a ship they are made of about one and a half inch material (iron). That is a dimension I have used from time to time with always a straightening job needed almost every time you looked at the model. So, I have increased the center to two and a half and the sides to two inches square. Brackets cannot be made until the carving has been done on the taft rail. Giving each piece of square brass a little twist will help to clear up the plain look. Take a sample of material, preferably the same length as one of the arms

of the bracket, place one end in the vise and with pliers or a well closed wrench give the piece a half turn. I bet you are surprised at what one half turn can do. Don't give it too many turns as you can destroy its grace. Don't expect too much from your "candles". They won't light the room after you turn out the lights, but you will be able to see them.

Remember when sanding down the top and the bottom of the cone, the front pane is the only one which is 90 degrees to the top and the bottom, so mark it some way. I tried several ways of "squaring" these lanterns. Surgical scissors didn't work for me. The whole thing being rather fragile, I put on a new sanding disk and very gently fed the cone into the rotating disk. I used a 50 grit with a fine feed to keep the plastic cool. If they collapse during sanding, just set them back in the jig and give them another shot of acetone. Try to give the acrylic a clear coating of something as the tape has a difficult time sticking to the lantern.

There isn't different information about the exact location for the bracket on the mainmast top. I put the one on the ROYAL SOVEREIGN into the edge of the planking above the trestle trees. I gave them a little twist to kill the plain look.

PILOT WHEELS

I guess it is better to start with the making of the rim. The circular frame would be the first member to make, as there are more than one to be made. I would suggest making four for the two in need. It is very important that all the outside diameters be turned at the one time. Bore out the inside diameter during this setup. Face and cut off each so they may be turned and their backsides be faced off the same as the front. Making the "chuck" to hold these rings is a guess for each pass of the tool to see if the ring will fit snug enough to hold while facing the backside. The thickness may be judged by eye, but the thinness will be just enough to let you drill the holes for the spokes "ten". It is up to you if you want to set off each spoke with a design of gold leaf between the moldings on the wheel.

I try to write as though you have a few tools to work and a sharp knife, but I find that most of your shops and studios are better equipped than mine. You must know how to use them or else you would not have made the purchase. Photos one and two show the turning of the foreface and the backface with a holding device.

The spokes are turned with the same measuring device as are the balusters. By making the handles and the square for the rim first, this lets you keep these parts in the holding device while you are turning the spoke between the rim and the hub. Here is where you can really shine if you choose. You don't have to have spokes that look as if they were made for a wagon wheel. Take your time with the first spoke. The changes and shortcuts you can figure out as you go on to the next one. Thirty years ago a Mr. William Wild had someone making pilot wheels for him out of boxwood that were superb. I wish now I had purchased every one he had. As it was I was able to get only two.

I wonder what weakness in responsibility fails to provide talented personnel to perpetuate this talent. I guess we are getting to the point where if it doesn't go together with snaps or hooks, no one wants anything to do with anything. To make the spokes for the pilot wheel I am going back to a fixture I used before. It is the same principal in use, but the holder for the turning stock is made of a piece of one quarter by three eighths bar. The locations of the various stations are scribed on a face of the bar painted white. The scribing is done in pencil. I tried to engrave the locations but find neither last very long, so I took the easy way out. The chisels (old Exacto blades) are sharpened from underneath and the tops are given a coat of black marking ink. Be careful with the edges as a burr can turn out to be a good edge. You don't need to go into production as one only needs twenty of these spokes of the double wheel.

Another little problem that may cross your mind while turning each spoke, is that the accumulation of dust on the end of the tool you are using for turning is a nuisance, as you can't see the end of the tool. So I hooked up an air hose with a small copper pipe to blow the dust away. Unfortunately, now you can't tell how much you are removing. So it seems for every plus there is also a minus.

Be careful when cutting off the spoke. The pressure will also blow away the spoke. Some are still missing. It is quicker to make a new one than to spend the time looking for the ones that got away.

The structure to hold the wheel has always been an "A" shaped affair with the shaft at the apex. Someplace I read there was supposed to be nine turns of four inch rope on the drum. The sliding pieces on the deck, I don't see what good they are. There isn't much room for shifting back and forth with nine turns on the drum.

Well, I have used many different kinds and makes of adhesives. I can remember during the depression we heated the gluepot on top of a wood burner that was known as a space heater. Not much good when the fire bucket at the other end of the shop was always frozen in the winter time, except when the forge was working.

The one I have been using ever since it came out is Titebond. The reason, if you made a mistake, with only a few drops of water you can separate the pieces before it is trunnelled. When placing the pieces which hold the sides of the glass there is an overbalanced point if you use a small C-clamp. The clamp will act as a counter-

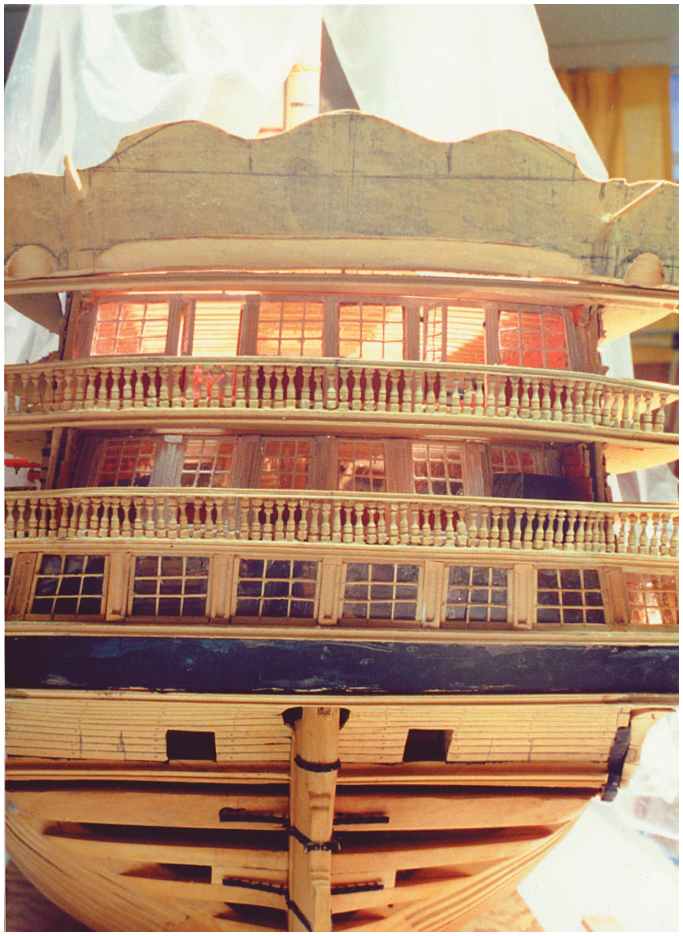
balance and will hold the piece fairly solid for placing and gluing. This came as a surprise for which I was grateful.

STERN GALLERIES

The stern galleries are a methodical, progressive construction, well thought out far in advance of cutting the first piece such as stool “A”. Something to insert here, the old timers were working sun to sun.

We had a power outage one time, I immediately got the idea to use candles. I guess it would work better if you had a candle for every watt on the bulb you were using.

The stool is also a piece having compound angles, tilting down to conform with the camber of the deck and tilting forward to conform with the “hang” of the deck. We will start with the stool just above the lower finishing and call it “A”. The next up will be “B” and so on. The filling piece between A and B is a little tricky for the curves and angles and the flat appearance in between the stools. The piece between A and B extending from starboard to port, can be somewhat of a problem, with the curve of the deck at A and the curve of the deck at B, and the flat angle between the two inside curves where they meet the vertical frames. Maybe you will make three or four pieces to get a good fit, I did. But when it is done it gives you a good foundation to build the stern upon. With all of its difficult angles and curves, the filling piece is a chance to see how you can fill and paint those blemishes we all make. Since the edge of the stools are left natural one will have to be careful in aligning the corners. Otherwise they will stick out like a sore thumb. Even if you have to move something a little, be sure the corner is perfect.



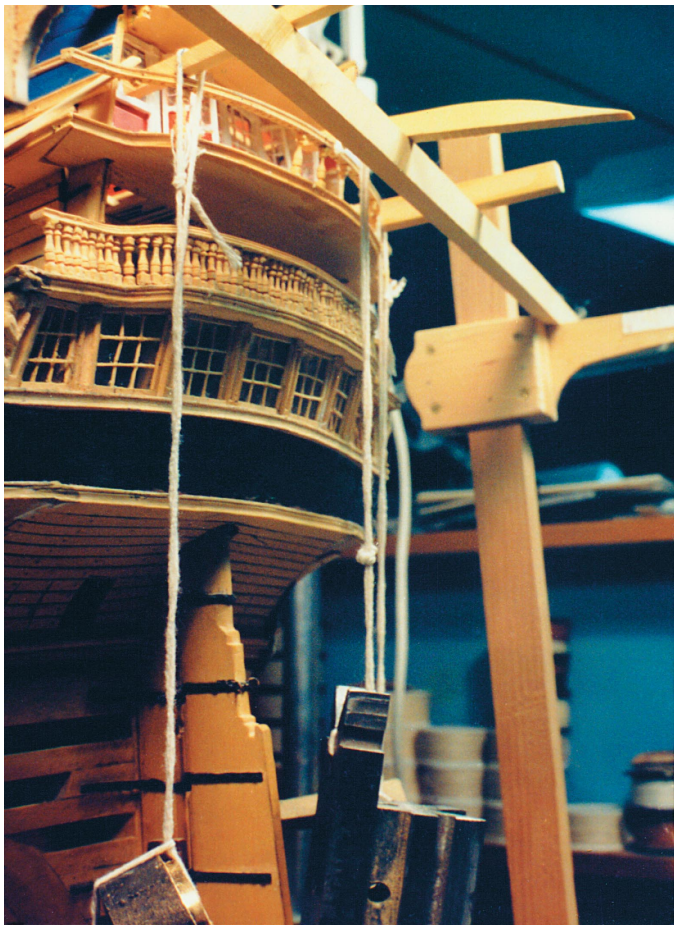
Be sure to mix a little watercolor with the modeling paste or “Model Magic” to blend with the wood. Since using “Model Magic” I like it better than those modeling pastes. Remember when I was telling you about making sanding sticks? Well, this is the time, or one of the times, when they are going to come in handy. The upper counter, the construction just below the lower row of windows, has a long flat curve that has to be sanded to an absolutely flat curve which includes the filling pieces of the galleries. The one I am using is 3/16 x 3/8 x 12" long, the sandpaper attached is 80 grit on two sides and another one is 150 grit. Keeping it painted black will show you when sanding just where the high and the low spots are located. Of course, you have to let the paint dry before attempting to sand. The windows of the middle deck across the stern set on a piece like it was a railing. This would be a good thing so one may construct the windows by fastening new timbers that separate the windows if need be. This railing is like many pieces in the stern, a curve up like the deck and a curve

across like the shape of the stern. The windows are to be made from microscope slides, 1 mm in thickness, 25 mm in width and 75 mm in length. They are sold by many different shops who deal with laboratory equipment even those who sell small microscopes. The slide is made, I guess, by Clay Adams of New York. Don't write to them for they will not answer your letters. Before I forget I had better warn you not to do this glass heating and bending in a room with a smoke alarm. Maybe pull the batteries from the alarm. Lucky for us the slides have a low melting point. The most difficult part of the operation is shaping the block to form the glass after it is hot. A piece of asbestos board one half inch in thickness is needed. I know the use of this material is not in favor with the EPA. A small piece can be found in most old tin shops, from anyone who handles furnaces, or just go on a hunting spree. Fire clay could be used I suppose. The smallest I have ever purchased was a hundred pound bag, a little too much. From one corner to the one adjacent which would be straight, the other two seem to bend down about a sixteenth of an inch. This calls for an arc with a width of the longest dimension of the pane and a height of 1/16". Go slow in filing this curve in the block. You must get this curve true and smooth. You do want to see through the glass afterwards. For heat, a small propane torch is all the heat you will need. After placing the small piece you have cut to fit on the crown of this curve, gently pass the flame over and over. In less than a minute the glass will sag. After the corners are worn don't heat anymore. Let cool. (This is the longest part of the operation.)

I was told by engineers at several glass companies I would need a furnace and all the paraphernalia one is supposed to have for a heating operation. After you have the block made it won't take over five minutes to do two panes. Cover glass can be treated in the same manner. Needless to say everything should be very dry. I guess the engineers didn't understand I wasn't going to process several tons of glass but just a small piece one inch by one inch and a quarter. I imagine this would work for making those glass tops of some hatches or companionways. I think I should tell you the glass after heating will have rounded edges. The square edges seem to melt away or in.

The pieces which form the foundations for the glass to be glued, are a hand fit and finish for everyone. The angle rise to is the same as the upper three decks. The edge of the deck below these is a little under to conform with another angle. Don't use too much glue and pegs when assembling, just enough to sort of tack it on.

After you see you are going the right way, you may go back and glue and peg for more permanence. Something to remember while bending glass – smooth edges may mean you have good edges but you have also reduced the size of the piece. Now you can start cutting out a new piece.



I believe or maybe I should say I hope you will find the first door will be the most difficult. The other three will be much easier. I am not satisfied with the adhesives we have to put up with in model making.

If you are going to install the mullions in the doors be prepared for very, very time consuming and tiring work. The larger mullions used on the windows tend to look like bars so the use of strips of wood only .015” (.4 mm) is quite a bit smaller.

To cut the lap joints a Swiss file of .030” flat in shape with cutting edges is used in the fixture in the photo. Everything is self explanatory except the mullion lies between the moving piece which is held with the index finger and the base of the Exacto blade. Great care must be taken as when you cut a mullion vertical to take a mullion horizontal you leave only .013” on the larger ones and only .018” on the smaller ones.

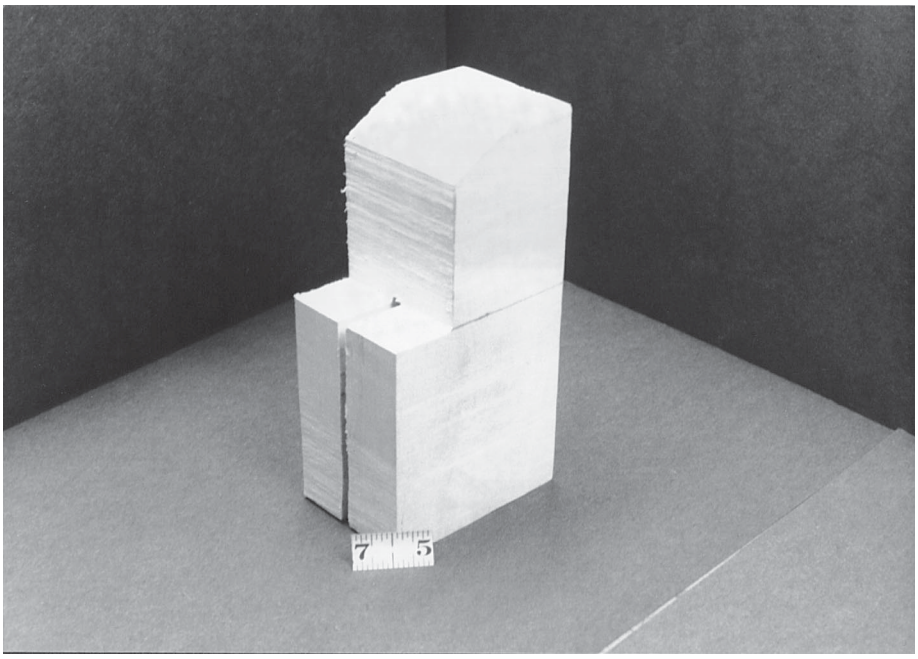
When you find the opposite corner of the piece of glass you have cut for the opening won’t touch the support, this calls for bending. Marking the corners or corner that should be bent down, say about 1/16” is misleading as you have to remember what side of the glass you marked. Best to get your curve cut out on the asbestos or whatever. Remove the glass from the frame, keeping hold of the corner that needs bending and lay that corner on the mold. Now if someone has disturbed you and unknowingly to you, you have picked up another corner, this will give you a dish effect. Don’t worry, just place the glass in the mold upside down and heat so it will bend back and down to where it was supposed to be in the first place. Glass is very pliable. It seems to me the piece of glass seems to be stronger after heating possibly because of the rounded edges.

The size of the wood used for the sides of the sash and the small pieces between each pane and the frame between each window are called mullions. These are only .025” (.635 mm) Where they cross one another they have to be recessed. I forgot if the horizontal is joined into the vertical or visa versa. The mullions are a real test of patience. Be sure to make at least twice the amount of material you will use. Once again, the mullions are a real test. Assemble the vertical mullions first keeping in mind the gradual leaning in of the stern frames. The horizontal mullions are kept to last in order for you to keep the camber of the deck in mind as you go from port to starboard.

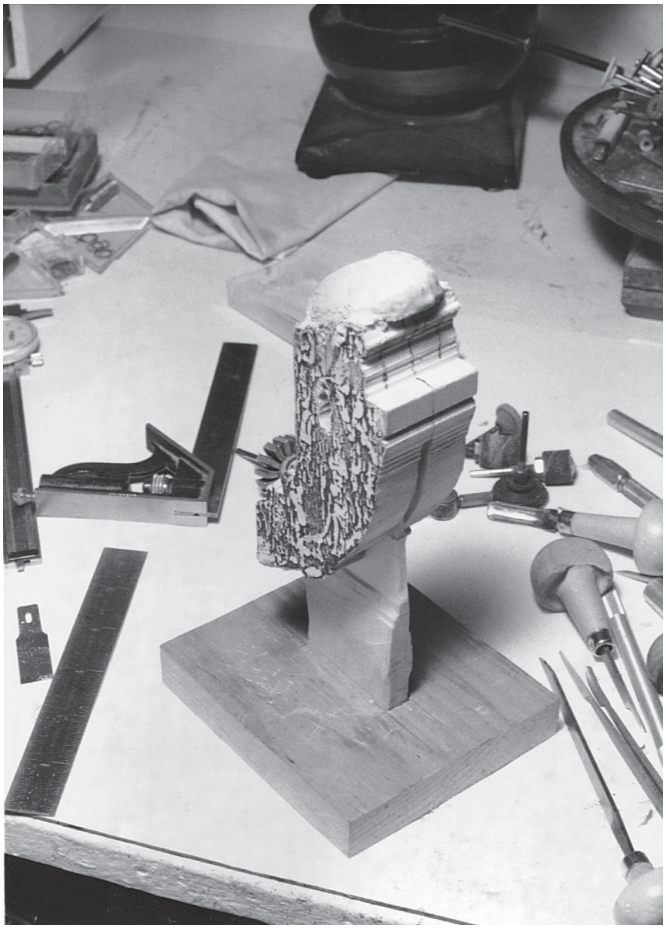
It doesn’t matter which method you use in constructing the partition at the stern of the quarterdeck. You could go into great detail but remember you can’t do such as door latches and keys for each. So, start with a pattern of 0.020" (0.5 mm) plywood and work up from there. This is a great help especially when it comes to making the raised center of the panels below the windows. The photo shows the start of the partition and the four doors. Finally clean up and remove a little of this and that. The partition has all of the wood painted white except for the red panels. This is not a practice for all ships, this is for the ROYAL SOVEREIGN only. The doors open in on some models, but it seems logical if the doors were to open out. This would create a tighter seal on the sill and the door stops the strip of wood that seals the door on the inside.

You removed the port and starboard quarter galleries for the purpose of rebuilding and refitting and alignment. Now everything has been completed stand back and see how much better everything looks. The mullions are only 0.025" but they look larger and really stand out.

FIGUREHEAD



Where do you start carving out a figurehead? Probably unknown to you, you have been storing many ideas about what should be expressed in a carving and how. When we lived in one of the nearby cities we attended the zoo once or twice a year. Sometimes I would make a special trip to clear up a thought. Well, anyway after spending several hours looking at the animals, we would find a bench near a concession stand and sit there watching the animals outside of the cages. The two legged ones. If you notice everyone is made up of a series of lines. In Tangerman’s book on carving, he spends a few pages about caricatures which after close observing are a lot more true than what some artists depict. Pay very close attention to how everyone is different. There cannot be a set of rules as to how large this is or



how small some are. Large eyes, small eyes, large noses, small noses. The differences never stop. So if your chisel slips, think nothing of it. As the modern saying goes, “GET ON WITH IT”. No one knows what these people looked like, even if they had lived in those days.

I remember seeing drawings done by an artist in the Chicago Tribune during the twenties, which I never forgot. They were the people you see on the street.

If you like to get into fights, then carving figures, especially figureheads, will be right up your alley. I have heard many artists make a remark about doing portraits, saying most everything is pretty routine until it comes to doing the face. The face does not come easy. You have to fight for everything and then there is the expression.

Well you remember the setup I had for the apron? And the drawer underneath the carving block I have is a little too tall to work on, so I fixed a place in the drawer and set the carving block down to this level. It is just right for working on the canopy. Later on for the other parts I can place it back on the bench.

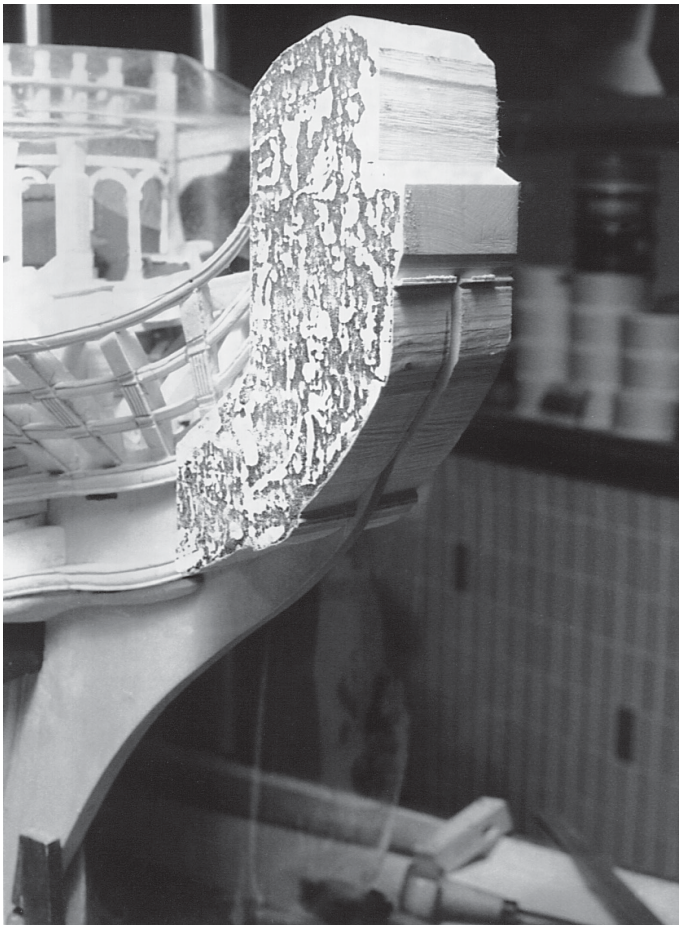
Don’t get too ambitions, you can push out the bottom of the drawer. Your ordinary combination honing stone has two sides but even this fine side isn’t fine enough to hone the edge you will need for the figurehead. I recommend you use a stone known as a Soft Arkansas stone as a final stage of your sharpening. The use of a Hard Arkansas stone is nice but it is too time consuming. Honing oil can be found wherever they sell the stones. The reason for all this preparation is almost 90% of your carving will be across the grain. About halfway through the carving you will be able to tell when your chisel is getting dull. Remember to go slow as the design will change several times in your head and the wood before it is completed.

Something else on the plus side, you have only one to make. A great burr for chewing away excess material is called by some, a Tungsten Vanadium steel cylinder square crosscut size 10, 11, or 12. It is a roughing cutter with lots of room for the wood chips to escape. Don’t put too much pressure on the burr. I know when you see it cutting you will have an inclination to do some (hopping), which can result in a broken spring in your flexible hand-piece. There are two elbow pads shown in one of the pictures. These are made of foam, pillow stiffness, about 5" square and 2" inches in thickness (130 mm x 50 mm). The covering is an old cotton undershirt. I got my grand-daughter to make them for me. It may seem like we are taking this to extremes but after a few hours you will more than understand. There is a lot of movement of the elbows. Another alternate is the use of a graver holder to sharpen your gravers and small chisels. With your index finger on top of the graver holding it down to a full contact with the stone, place your little finger under the handle to help hold the handle end clear. The cup of your hand will keep the graver from sliding back, giving you a

perfect grip on the tool. Thumb and third finger may be used to steady the handle but not so much as to turn the handle and get it out of line with the face of the stone.

Due to the need for more identification as to what the separate figures were, we have gone back into research not for pictures but for written descriptions. So we will switch to another part of the ship in the meantime.

Make a dozen or maybe several dozen copies of the drawing of the figurehead or any other carving you are about to undertake. Scatter them about so the place you are working comes alive with the theme of the carving. We are attempting to saturate your brain with the same information the carver had for the original. This way you can or will see things in the carving you missed before. When we lived in Toledo the Art Museum was available so I could visit and absorb the ideas. Maybe it is not such a bad idea to make a visit to one near you. See the time or think of the many hours the artist used to do whatever painting or whatever you are looking at.



BALUSTRADES or BALUSTRADING

Both are correct depending on which country you are in. In seems the ones we are dealing with are about five inches square and twenty-six inches in length. Short and fat balusters can be made with a form cutter which is rather simple. The ones we deal with are a slender style presenting quite another problem. Each of the balusters will have to be turned individually using small chisels. The first will be (a). The shape and sizes are shown in the sketch. This is another use for old blades. Shapes are ground from the bottom up so as to form a lip as for the gauge.

If you are using a metal lathe, disconnect the gears for the drive and the carriage. This will make the machine run quieter and easier. The piece chucked in the drill chuck in the tailstock is made of a quarter inch piece of brass rod with a hole drilled in the end the size of the baluster across corners. The blade soldered to the end is painted white and laid out according to the different diameters and the lengths of the baluster and the bottom of the next one. The reason I painted the 'blade' white is to help in making the changes by erasing the old marks or painting over for a new shape. Before you are through you will have become well acquainted with this setup. Diameter of the "pins" at the ends can be any size. A loose fit in the hole leaves more room for glue. My first drilling jig was only 1/16" in thickness, which proved wrong as it let the drill bend out of line. The next was made of what is known as round stock, heated to a bright red after drilling the holes to the exact distance apart and size. Then it was dunked in a small can of 10-30 oil. This was done in the garage, no odors in the house. Holes drilled in the lower part which we shall call the beam can be enlarged a third to align all balusters after setting in with the glue. A better way of setting the balusters is to

set in the first one then set in every tenth one. After clamping in as shown in the photos, the top pin can be removed so the glue will set on top of the baluster and also set into the hole.

I think the pictures will be sort of self explanatory. The weights can be anything heavy, even an old horseshoe.

The top of the gallery is finished off with a tapering arrangement of three pieces cut and finished for the last three moldings above the windows of the quarterdeck. In between each is a filler made to fit as shown in the photos. Carving these pieces is best done with a small sanding drum. A set from one quarter to three quarters of an inch should have been in your tool crib when you started. Using a dust mask is certainly a must when you are doing the sanding as you will be very close to your work.

Drilling holes into the railing for the balusters, do not start from one end, contrary to average thinking it is best to start in the middle. The odd spacing on the ends will be equal. The feeling when you start this drilling, because you are thinking about the time that went into making the rail.

VARIETY OF PAINTING

Everything from varnishes, waxes, lacquers, enamels, flats, wax rubbing, oils, acrylics, water paint, and today we have what they call polyurethane.

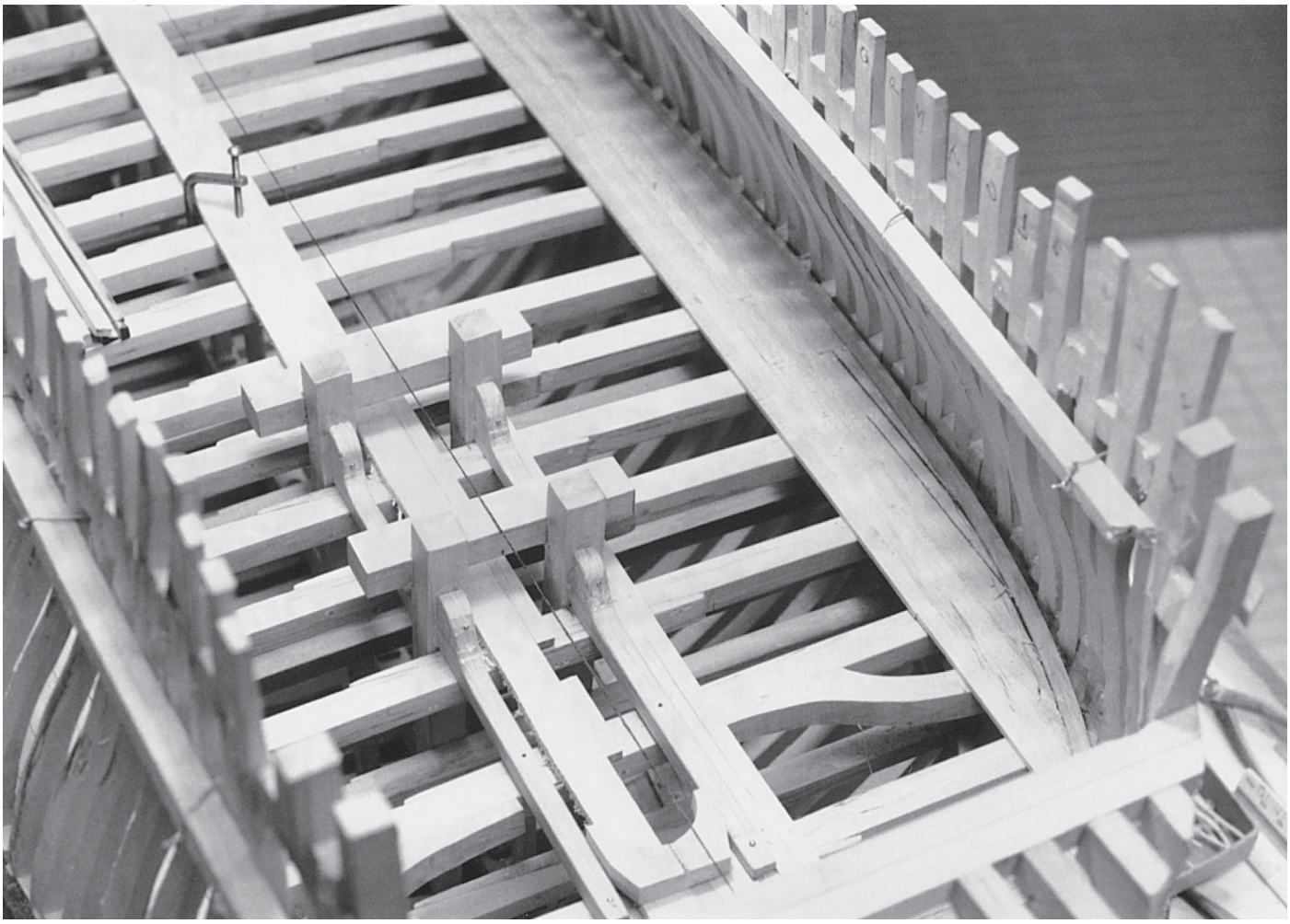
We will start at the top. Don't paint the pulleys and the truck. There has been quite a discussion on painting the yards, masts, and tops. One fellow in particular talks about painting the tops in his book, but then when you go over to see his model, you find that his tops are bare. I don't know what he used on them but it wasn't any paint. The yards being black with shoe polish, stove polish, or just a good flat paint is fine. Anytime before 1800 I suggest you use a brown shoe polish or dye. Use a tan for the running rigging, maybe it is too light for you, but you can darken it up with a dark teaspoon of dye. The dope you use to seal your knots, if it's about half and half, it will shrink into the knot and it won't leave any finish to shine on the outside of the knot. The dark brown or maybe it's the standard brown shoe dye is about the best you can get. The tar that was used on the ships during that period was a Swedish or 'Stockholm' tar they called it. They didn't go into the destructive desolation in making the tar that we did in the colonies, especially in the south where it was made. They must have known the Stockholm tar was more pliable and absorbed more readily into the rope.

We will start at the figurehead and work our way aft from there. It seems that gold was a favorite color, although on some ships you would find it painted white. But that is in the 1800 period and you want to stay away from that, we are still in the 1700's here although it is the late 1700's.

Colors on the hull it seems they were up for grabs, when it comes to the captain's choice. Either that or else the artist that painted the pictures of the battles were influenced by at least one frigate painted red. I imagine the smaller boats the schooners and so on were a variety of colors. I guess they thought that the flag or the colors on top of the mast was enough for England.

Well let's go forward to the figurehead again and start our colors from there. Gold leaf seems to have been most popular, when one could afford it. What they called poly-chrome was very popular during that time, poly-chrome means painted with many colors and they certainly did that with a few. But that's ones own choice, whether you are going to leave the figurehead natural, as the Greeks did with their statues, or paint it with green britches and white hair and so forth. The carving that follows the figurehead down into the stem is treated in the same way in order to match up I guess. The rails behind the head may have the tops of them painted black and the rest of it varnished or whatever natural finish, and that continues up to where the underside of the main rail is sort of a molding effect and the sides of the main rail are painted black. This surely brings up the question about the railing around the forecastle and you find that they

are more often than not painted black also. The beakhead bulkhead is an artist delight you might say in that you paint a group of flags in the center. I don't know but I think it was just an exercise to see how fine the artist could paint. It's generally all covered up with rigging and you can't see it half the time. Well the bulkheads after the forecastle and the quarters after the mainmast were treated in the same color most of the time as the side of the ship. This business of 4-1/2" to broad sides and port and starboard is ok for the sailor or anything connected to the sea, but the majority of people back here on the lands have to be told left and right, front, back, and bottom. So between the first two or three top side moldings on the outside of the ship, they were generally painted a dark green or dark blue almost a purple. But you have to understand that any color that was supposed to be a royal nature was darker than the general color used everywhere else. The furniture that was on the deck that you see now was generally painted red, with decorations of gold or yellow. The stern in decoration seems to try to follow the figurehead, I don't think there is any connection between the two in colors, I never noticed it, maybe there is, maybe there isn't. The figures on the stern, the corners and the ones standing above them and all the way across the taft rail there are figures of all kinds on most ships. They were poly-chrome most of the time and treated the same was as the figurehead. It seems like more often than not the figure on the left was of Neptune, I'm talking about the large figures on the corners and the figure on the starboard side was of Mars, it was a club. Generally any carving below that was half and half of what's close to it on the hull.



CHAPTER 13

Masts

Coming into this rigging, there are many authorities which can be consulted for the ways to rig a ship, but we have to watch our dates. Anderson is before 1720, so Sutherland comes up from there to about 1765. And Steel was present in 1795. Of course, you know or must know that things of this nature had to be used for twenty years to prove themselves before they were ever put into a book.

We have besides Anderson, Sutherland and I think there is one in there about 1747 or so 1755 he covers a period in here. I don't know who he is, but I know there is one. So anything written after that late 1700 we can't use that, even if the guy is still living.

So, we will stick with David Steel and his book, called *"Elements of Mast Making and Rigging"*. This covers masting, blocks, canvas on the sails and the rigging in general. Both for the man at war and merchant men, I say that because there is two separate lists of rigging in his book.

In Steel's book in the rear there are 5 plates or plans, that show the masting that was used. It does not capture all of it, but it shows enough so that you can get an idea of it. The masts in Steel's book are built up of many, many pieces. Why for the sake of strength or just because he was trying to use up scrap or who's ideal it was. You know English are very frugal.

On plate two, there are drawings, that show the construction of masts for a 100 gun ship. In the center drawing there is a layout of four masts that we can use. It shows a mast on it's back and a piece across the top where the hooks go under along till it gets to the cheeks and then the line goes up over the top of the cheeks and then there is a line goes up over the top of the cheek and back to the hounds. If you look at this one idea in mind, it's how to best represent this mast, you will come to the conclusion that the front fish with which lays on top. It would be better if this were made out of one piece.

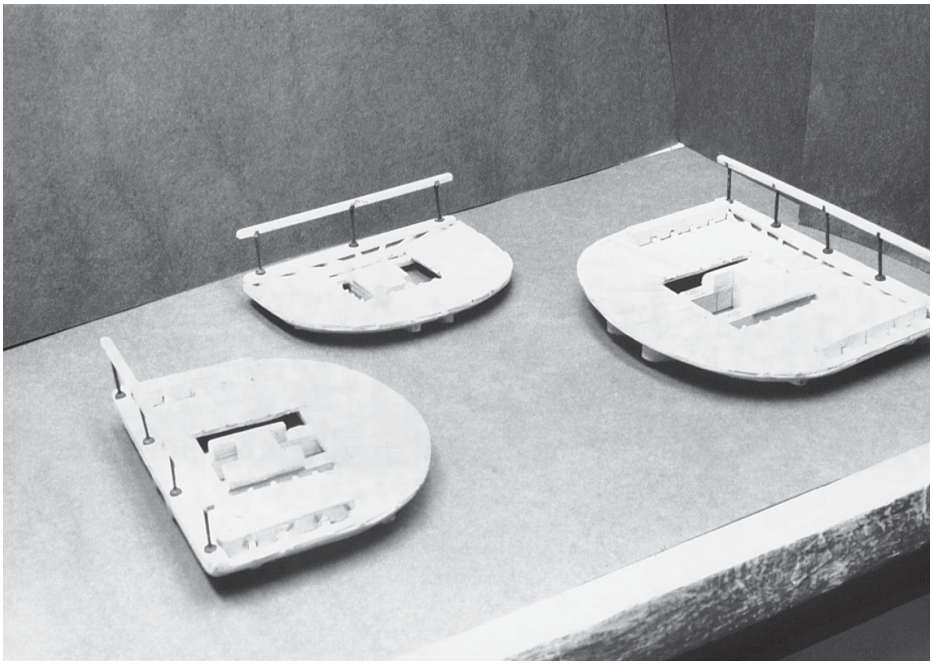
The mast is constructed just like you would as if you were going to make it out of one piece. Then it's laid out down at the bottom at about the second or third hook, there is a line that shows edge of the front fish or the finishing pieces that go up to the front fish anyway it's were the hooks disappear. This line goes up all the way up to the bottom of the cheeks and up and over and clear up in between hounds and the bibs. This portion is taken out of the masts that you have already built up and removed. This piece that measures at least 2" wider than where you finished off the mast, this will represent the outer part of the front fish that is worked down accordingly to round off. I don't see why I should tell you that a quarter of the length from the hounds down to the middle deck is divided into fours, and the diameter of the mast proper is at 60, 60, 4/5, 7/12ths and all that. If you are building a mast you know just as much as I do about it. If you are really going to build one. All my masts, yards, and booms are laid out square to begin with. The sides are planed down to the dimension of the quarters that is called for. Then it is rounded 8-16 sided and finished up. Then you can locate the front fish position and remove that part of the masts that will be in the way of putting on a square bottom fish. Draw a line from the beginning up through to the bottom of the cheeks, and it goes up over to the cheeks, you can guess at this quite a bit and finish this later. Where it goes around the cheeks it sort of gets involved with maybe being swallowed up by the mast until it gets up to the top of the hounds where a block is made to fit the distance between the lower and top masts. The ends of the mast stop where the cap goes are tapered from the bottom of the cheeks all the way up to the top under the cap and with a straight line there for the cheeks to lay against. And the thickness of the cheeks will have to be enough to take care of the trestle trees, and also what goes in between there so the end of the cheek is even with the top of the mast comes out 1/3 of the width of the dimensions under the cap. Banding can be done many ways when you use brass stock about 10 thousandths in thickness. Which is very difficult to control

because of its springiness. But if you make them a little long and tuck it under the top piece it still doesn't give a square corner that you're supposed to have under the front fish. Well, I've tried cardboard and then this guy that cuts off shavings and whittles them down to use around the masts. I saw a hint in somebody's book or magazine article, but he used chart tape. Chart tape is sort of thin and is held on with a wax. So, as soon as you get it on you better put a coat of varnish to hold it in place. Chart tape can be found in business supply stores. The wooldings in this case are 3" in circumference and I think they are wrapped on to make a band of at least 9 maybe 12" wide. On each side of this woolding you have wooden bands that are bent round and nailed and this can be best represented by construction paper, it curls readily. If you have trouble curling it you can put it around a dowel and wet it down that way it will never uncurl when you get it around the mast. Same thing goes for the banding around the head.

Some books show the sections of masts and name the parts. That would be all right if we were learning all of this, but you are supposed to be over that habit.

Mounting a lose mast head so that you can turn the top any way you want, in case you get a little out of line. This can best be controlled if the front face is covered with a piece of masking tape; it reminds you which is forward and which isn't. I used to do this on legs of a table and other round objects, especially where there was a good grain I wanted to show off. I would put that in the front where everybody could see it. Of course, the defects I would cover them too with a piece of tape and put a little note on it.

Mast caps should be made with great care. The bolts can be represented by sketching pins provided they are equally spaced.



Trestle trees and cross trees you have to keep them square because when the top goes down over them something is bound not to line up. I think the construction of the tops is pretty well covered by James Lees book. Of course, you will have to watch that you are not using the wrong period again, because the different varieties he gives for the amount of years you will find something there that mates your place and time.

The top mast isn't any more difficult to build or build up than the lower mast, it shouldn't take as much time. The lower end has it's padding on the butt end to keep it between the trestle trees and the cross trees. Two of the faces of the octagon are gouged out to allow the working of the top ropes and the position of the pulleys on the lower part of the mast is very critical. So you will come up from the mast to the hook and the cap. On the correct side of the mast. I find that you use a file to shape these masts more than anything else, I guess because of the hexagon between the cap and the trestle trees, and the octagon of the butt.

These also have to have their corners shaped while the pieces are still square and then rounded later, but when you get to the hexagons and octagons use nothing but a file. The fore top mast has blocks in the head one on each side, two sheaves in each block. Make sure you get all of the dimensions of this block so that the line that passes through this block can be done easily. This is on a down hillside of everything so make everything as easily as you can.

The top gallant mast is another top mast except on a smaller scale or size and the head is shaped to what they call a stumped head, standard head or a long pool head. The long pool heads were used when it was anticipated that they would fly Royal yards and a Royal sail. The sheave on the top sometimes has four sheaves but I have never seen this, it can be done, but it would be too small to work with. So, I think two sheaves is sufficient.

These will be used to run a line as small as a number 40 or a 70. They are used for all kinds of purposes.

On the gammoning fish don't make it quite as wide as the bowsprit. I think it would look a little better. Make your collars for the shrouds and the bow stays and other cleats and so on and go on to the bowsprit. Now before you mount it and fasten it down with a gammoning, because once the gammoning is on your bowsprit it's home you might say.

Lately these collars have been giving

me a hard time. I think it's because I have not done it for a while. As soon as that gets ironed out then we will start sailing again.

The jib boom is a simple matter, we don't have any iron piece to make for the jib boom or whatever. Right about here it seems like we should decide to do something with the mizzen mast. Instructions for this mast are, they aren't simpler in a way, and yet it doesn't contain a front face or a rubbing ponch or whatever, it contains quite a bit of banding and few moldings. The tops are the same as the others in construction except it doesn't contain as many ribs. Being smaller in size it works up faster. You don't have a gaff or a driver boom like that on this model, we have what they call a mizen yard. This was used up until about 1800. You will find it in the old references, they still talk about the mizen yard.

Now we can start on the main yard. First after getting the yard rounded the center section is lifted, so that the battens can be nailed on, so that it isn't exactly round. It tapers according to scale down to the end. Here we have two hooks over the yard arm and a strap coming underneath those and at the end of the strap the shank has a yard arm fitting for the boom. It is supposed to be fitted on around a piece fitted around the strap. The strap turns out to be 16th wide and for the sake of strength we saw a 16th slot in the end of the yard the length of the strap supposedly. Now we have a plate of 16th material that sits down in that slot and the outside of that plate is shaped as the strap would be. So all you have is that plate and two hooks on the end of the yard arm. This plate is also notched out or tended for more elasticity. So that the fixture can be welded in. I have always made my studding sail fitting with the neck just as long as the yard arm and the hook and roller are some other accessories welded to that. So when it's put together it looks the same thing except the strap is solid all the way through because of the plates that you made the piece out of.

Using that plate makes the whole assembly a lot stronger especially out there on the ends where everything that touches it will seem to bend it or get it out of line or something. I would suggest increasing the clearance on the slitting cleats as the rigging takes up a lot of space there isn't any room. Remember the battens on the yard in the Longridge book are on an 1805 version. The batten on the yards in 1787 are not filled in they are more open. Making your iron work for the yards, always remember to keep the center of the yard and the center of the arm work together on the port side and starboard side of the yard. The quarter arms aren't so bad except you have to remember that if you have a 1/2" center to center distance on the outer arm you will have to have the same center distance on the quarter boom arm. This will keep the studding sail boom parrell with the yard.

CHAPTER 14

Rigging

In Steel's book he follows a method called progressive rigging. It starts with gammoning and then goes to bobstay and the shrouds, next he goes to the jib boom. There isn't too much to the jib boom except for the traveler. And because we don't have an extra boom on top of this the rigging is a little bit simpler.

Then he goes into the spritsail yard, the spritsail topsail yard, and then he goes into the fore, main and mizen masts.

The odd shroud he calls it the swifter. If you can I think it's much easier to make your own deadeyes and hearts. The blocks, I don't know, it seems to be the small ones are just about as good as you can make or have. Anything below a twelve inch block, I don't think you have to make anything like that. I know it's nice to look at and nice to think about, by now you are getting a little aggravated by this time.

Some people claim it's the old two, three, four method of calculating the ratio and sides of the thickness and the length, but it is a little bit better if you use 1-1/2, 3-1/2, and 5. I don't know it looks better when it's rigged. These two, three, fours sample but if you take a 1/2" block that's 5/10ths and divide it by four it give you 1/8th, and two of these would be a 1/4 that would be your thickness and with your block it would be 3/8ths so a little thinner and a little bit narrower. You still divide the last figure into the sides of the block and the other figures to get your match.

If you are using store bought blocks be sure to read your envelope, so a 1/4" block has a hole for the line and it should have an empty hole below that like all blocks do. Using brass sheaves you are inviting corrosion. You will run into this no matter where you have the model parked. It's hard to get away from the corrosion, it discolors the wood and naturally coming from the inside it will some day get to the outside. This will discolor the finish on the outside. Parrels you will find that there are some beads that we can substitute for the rollers. Eliminating the necessity of making those rollers. The methods of putting them on hasn't changed, because you have to have correct appearances. When you are making your open hearts be sure you take your jib boom and see if it will go into this open heart like it's supposed to. If it is necessary to have that much space.

Parcelling and serving are nice but all this work you have put into making your rope. I don't think you should cover it up. You get the feeling somebody wants out of sight and out of mind.

Let us stop for a moment and consider the material you are using. There are a number of good reasons to be using brass wire, whether it be square or round. And reinforced parts with their skudging pin. The appearance of the model will changed because you cover this up with a little dab of paint. But the strength will be greatly increased, in case of accidents when you are rigging. Before you are finished rigging, go over your shrouds and lanyards and check all over and tighten up the lanyards. To take any sag out of them that might have become developed. Then you can say you are done.

I have never had good luck using the wooden mouse on the main stays. I don't know it was always sliding and rotating at the wrong time when you were trying to secure it onto the piece of equipment. I find that sewing this thing and wrapping it around repeatedly, will give you an underside that won't slip. You can sew through it, or what you might call putting you lines up through and over again much easier than using a piece of wood.

At the beginning of this eighteenth century they only have one stay for each mast. So there is not any snaking together in case one line gets separate the other will keep it from falling on deck. There is enough going on in battle that they don't need anything extra.

Long tackle blocks are made in one piece for our piece. I have tried to make them out of two blocks with the lines holding them together and they never came out exactly the way I wanted them to. The same way with rose lashing. I imagine it took the artist that drew this rose as long to draw the picture of it as it would have taken to make one. The only place where it could be used or be out in the open where everyone could see it would be on the lashing of the mizen stay around the main mast.

The thing to remember about the gammoning is that the eye splice is the first to go on and then it is brought through the loop and down to the slot in the knee, and back over and from the half side of the gammoning notch in the gammoning block goes from the rear to the front of the slot. It is secured by wrapping around each gammoning the same amount of turns you have going over the bowsprit. The fore stay will pull up the bowsprit so it won't be resting on top of the figurehead anymore. The top mast standing rigging has to do with the deadeyes, the lower deadeyes (which is secured with what they call a futtock plate which is a strap that is a little bit longer to allow it to go down to the top). The shroud goes from there down to the futtock stave. A lot of people that used a round piece of wood for the futtock stave, but it is supposed to be a large circumference rope. Once the shrouds are secured to the stave you won't find anything moving or out of line if it is done correctly.

The catharpins serve a very good use in that they hold the large shrouds from bowing out so that it won't look like they are bowl legged. Most of the time there is four of them and it's a short piece of line that has got a splice on each end of the thimble. These are lashed to the futtock stave to straighten up the rigging. Sister blocks, I don't know it's either between the first and second or the second and third on the top mast shrouds but they are something that has to be put in because the lifts on the top mast yard are carried through these. Back stays that come down from the top masts to the channels, one of them is called a breast back stay. This is it terminates a running back stay fitting of two blocks and a line that is secured on the inside of the ship. And neither of them have been secured around the bottom of the deadeyes.

Steel has several figures in the last part of his book that represent a 20 gun ship. On the other page it has all the lines of the standing rigging listed. If you can get a xerox copy of this you might use it as a check off list when you are rigging. Beside the standing rigging and the running rigging he goes into the sails. Which you have to go into once in a while because of the tacks and the sheets for the securing of them.

The traveler is fitted with two blocks, a couple of thimbles and naturally the hook for holding the tack of the ship.

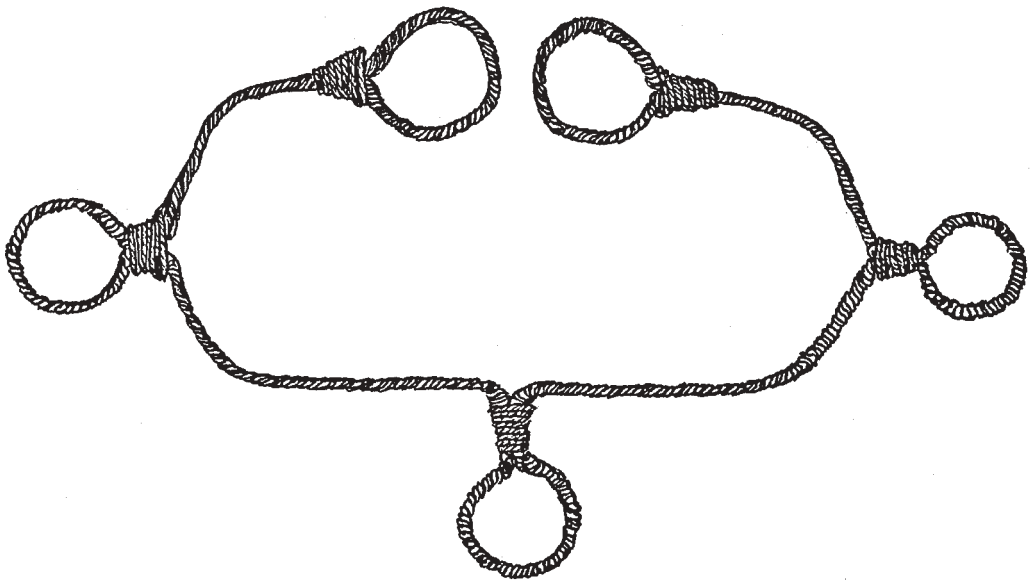
In Steel's book he doesn't give any reference to what was called a Flemish horse, which is an extension of the horse for the yard arm. If I remember right the top sail yards are the only ones that have the Flemish horse, but that's 1805, so 1787 I don't think there were any. Steel doesn't list them.

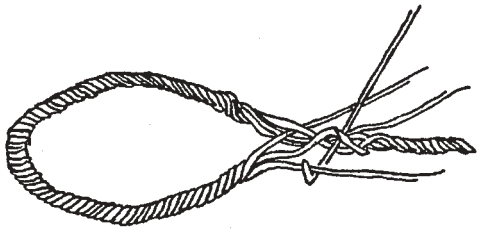
You have to watch real close in some of these books. They show a set up for tightening up the yards to the mast. But they give an idea the whole thing is left there after it is up, which we know can't be. Something else these drawings are made 5 to 8 time larger. When they are photographed they are reduced to the size they need to fit the book.

The bow lines are secured to the yards by the bridle. Each leg of the bridle is clove-hitched to the yard. Now this may seem sort of funny, but these clove-hitches since they are one sided have a tendency to come loose. So you secure some bronze wire and make yourself some small staples, about 1/16" wide and in the back you can push these into the mat of the yard and that will hold the clove-hitch from coming loose. Some books show the securing of a line around a belaying pin. But I think after five or six belaying pins you will have obtained a small rod with a single fork on the end off to one half, now on the other half you file in a hook. This is a handy tool for belaying.

APPENDIX 1

Rigging & Masting Charts





Explanation of the abbreviations in the following tables

BR.SH	Brass sheaves
D	Double Block
D.C.	Double Block, coaked
D.TH.C.	Double Thin Block, coaked
D.E.	Dead-Eyes
EU.	Euphroe
FL.Si.	Flat-sided Block
H	Hearts
I.BD.	Iron-bound
I.T.	Iron Trave
L.T.	Long Tackle-block
PAR	Parral
PL.D.E.	Plates with Dead-eyes
Q	Quarter Block
S	Single Block
S.C.	Single Block, coaked
S.H.	Single Hook-block
S.DO.C.	Single Block, double scored
S.ST.BD.	Single Strap-bound Block
S.TH.C.	Single Thin Block, coaked
S.BR.SH.	Single Block with brass sheaves
SHO.	Shouldered Block
SIS.	Sister-block
SN.	Snatch-block
ST.BD.	Strap-bound
T	Thimbles
TH.C.	Thin Block, coaked
THK. & TH.	Thick-and-thin Block
TR.	Treble Block
TR.C.	Treble Block, coaked

~ This mark denotes that the block or heart has a hook and thimble.

The following Charts are taken from Steel's *"Elements of Mastmaking, Sailmaking and Rigging"*.

A TABLE OF THE DIMENSIONS OF THE RIGGING; WITH THE SPECIES, AND NUMBER, OF BLOCKS, HEARTS, DEAD-EYES, ETC.

SIZES FOR 100 TO 74 GUNS.

NAMES OF THE STANDING AND RUNNING RIGGING		BLOCKS, ETC.		
	INCHES	SPECIES	INCHES	NUMBER
BOWSPRIT				
WOOLDING	3½	–	–	–
GAMMONING	8	–	–	–
SHROUDS	8	~H	14	4
COLLARS	6½	H	14	4
SEIZING	1	–	–	–
LASHING	2	–	–	–
LANIARD	3 ½	–	–	–
BOBSTAYS CABLED	8	H	14	3
COLLARS	8½	H	14	4
SEIZING	1½	–	–	–
LASHING	2	–	–	–
LANIARDS	4	–	–	–
HORSES	5	T	–	6
STRAPS	3½	–	–	6
LANIARDS	2	–	–	–
SPRITSAIL-YARD				
HORSES	4	–	–	–
STIRRUPS	3	T	–	6
BRACES	3½	D	12	4
PENDENTS	4	S	12	4
STRAPPING	3½	–	–	–
LIFTS	3½	S	12	4
BECKETS	3½	–	–	–
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
STANDING	4½	T	–	4
STRAPS	4½	–	–	–
LANIARDS	3	–	–	–
HALIARD	3½	~L.T.	24	1
	-	S	12	1
STRAPPING	4½	–	–	–
SEIZING & LASHING	I	–	–	–
SLINGS	6½	–	–	–
SEIZING & RACKING	1½	–	–	–
CLUE LINES	2½	ST.BD.	10	4
	-	S	10	2
STRAPPING	3	–	–	–
BUNT-LINES	2	S	8	2
STRAPPING	2½	–	–	–
EAR-RINGS	1½	–	–	–
SHEETS CABLED	5	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING		BLOCKS, ETC.		
	INCHES	SPECIES	INCHES	NUMBER
JIB				
HORSES	4	–	–	–
SEIZINGS	-	–	–	–
GUY-PENDENTS	4½	S	13	2
FALLS	3	S	11	4
STRAPPING	4	–	–	–
	3	–	–	–
LASHERS	1	–	–	–
OUT HAULER	4	–	–	–
TACKLE-FALL	3½	S	9	2
STRAPPING	2½	–	–	–
STAY	4½	S	14	1
STRAPPING	4½	–	–	–
TACKLE-FALL	2½	D	9	1
	-	S	9	1
STRAPPING	2½	–	–	–
HALIARD	4	S	13	1
STRAPPING	4	–	–	–
DOWN HAULER	2½	S	9	1
SHEETS, SINGLE	3½	S	11	2
PENDENTS	4½	S	11	2
FLYING JIB	-	–	–	–
HALIARD	2½	S	8	1
SHEETS	2½	–	–	–
TACK	2	–	–	–
DOWN HAULER	1½	S	5	1
SPRITSAIL TOPSAIL AND YARD				
HORSES	3	–	–	–
BRACES	2½	2	9	2
STRAPPING	2½	–	–	–
LIFTS, SINGLE	2½	S	9	2
STRAPPING	2½	–	–	–
HALIARD	2½	S	9	2
STRAPPING	2½	–	–	–
LASHING	I	–	–	–
PARRAL-ROPES	2½	PAR	12	1
CLUE LINES	2	S	7	4
STRAPPING	2	–	–	–
LACING & EAR-RINGS	1	–	–	–
FOREMAST				
WOOLDING	3½	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
GIRTLINES	5	2	16	2
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
LASHING	2½	–	–	–
PENDTS. OF TACKLES CABLED	11	~S.C.	24	2
STRAPPING	7½	T	–	8
SEIZING	1½	–	–	–
RUNNERS OF TACKLES	7½	D.TH.C.	21	4
STRAPPING	6	–	–	–
FALLS OF TACKLES	4	~S.TH.C.	26	4
STRAPPING	5½	T	–	2
SEIZING	1	–	–	–
SHROUDS	11	D.E.	17	20
EYE	1½	–	–	–
SEIZINGS THROAT	1½	–	–	–
END	1½	–	–	–
LANIARD	5½	–	–	–
RATLING	1½	–	–	–
STAY CABLED 4 STRANDS	18	H	26	1
SEIZINGS	2	–	–	–
LANIARD	6	–	–	–
COLLAR CABLED				
4 STRANDS DOUBLE	9½	H	26	1
SEIZINGS	1½	–	–	–
LASHINGS	2½	–	–	–
PREVENTER-STAY CABLED				
4 STRANDS	11½	H	16	1
LANIARD	4½	–	–	–
COLLAR CABLED				
4 STRANDS DOUBLE	6½	H	16	1
SEIZINGS	1½	–	–	–
LASHINGS	2½	–	–	–
CATHARPIN-LEGS	7	–	–	–
SEIZINGS	1½	–	–	–

Fore-yard

JEERS TYE	7½	TR.C.	26	2
FALLS	7½	D.C.	26	2
STRAPPING	8½	–	–	–
SEIZINGS	2	–	–	–
LASHING: MASTHEAD	4½	–	–	–
AT THE: YARD	3½	–	–	–
STOPPERS	6	–	–	–
HORSES	5½	–	–	–
STIRRUPS	4	T	–	12
SEIZINGS	¾	–	–	–
LANIARD	2	–	–	–
YARD-TACKLE PENDTS.	7	D.TH.C	17	2
FALLS	3½	~D	20	2
	3½	S	13	2
STRAPPING	5½	–	–	–
SEIZING	1	–	–	–
INNER TRICING-LINES	2½	S	8	2
OUTER TRICING-LINES	2	S	7	4
STRAPPING	2	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
BRACES	4½	S.C.	16	4
PENDENTS	5½	S.C.	16	2
PREVENTER	4½	–	–	–
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
LASHING	1½	–	–	–
PREVENTERS (IN WAR ONLY)	3½	S	13	4
STRAPPING	3½	–	–	–
SEIZING	¾	–	–	–
LIFTS	4½	S	16	6
SPAN FOR THE CAP	6½	SIS.	24	2
SHORT SPAN	4½	–	–	–
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
JIGGER-TACKLE	2½	D	10	2
	2½	S	10	2
STRAPPING	3½	–	–	–
TRUSS–PENDENTS	8	T	–	4
FALLS	3	~D	11	4
STRAPPING	3½	–	–	–
EYE SEIZINGS	1½	–	–	–
NAVE-LINE	2	S	7	1
PUDDENING THE YARD	6½	–	–	–
CLUE-GARNETS	4	S.ST.BD.	15	4
	4	S	15	2
STRAPS AB. THE YARD	4	–	–	–
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
LASHING	1	–	–	–
BUNTLINE-LEGS	3	D	11	4
FALLS	3	S	10	8
STRAPPING	3½	–	–	–
LEECHLINE-LEGS	2½	D	11	4
FALLS	3	S	10	8
STRAPPING	2½	–	–	–
SLABLINES	2½	S	9	2
STRAPPING	2½	–	–	–
BOWLINES	4½	S	16	4
BRIDLES	4½	T	–	2
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–
LASHING	2½	–	–	–
EAR-RINGS	2	–	–	–
SHEETS CABLED	7	S.C.	24	2
STRAPPING	7½	T	–	2
SEIZING	¾	–	–	–
STOPPERS	5½	–	–	–
TACKS TAPER & CABLED	9½	SHO.	26	2
STRAPPING	6½	–	–	–
SEIZING	1½	–	–	–
STOPPERS	6	H & T	2	2
LANIARDS	2	–	–	–
GAMMONING BUMKIN	4½	H & T	2	6
LANIARDS	2	–	–	–
LNRDS. FOR PUD. & DOL.	1½	T	–	4

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
SLINGS	12	T	–	1
STRAP	12	T	–	1
SEIZINGS	2	–	–	–
LANIARDS	3½	–	–	–
STAYSAIL-HALIARD	4	S	13	2
SHEETS	4	S	13	2
TACK	3½	–	–	–
DOWNHAULER	2½	S	9	1
	4	–	–	–
STRAPPING	2½	–	–	–
STUDDSL. HAL. INNER	3	S	12	6
OUTER	3½	S	12	4
SHEETS	3	–	–	–
TACKS	3½	S	12	2
STRAPPING	2½	–	–	–
Fore-topmast				
BURTON-PENDENTS	5½	T	–	2
FALLS	2½	~D	11	2
	2½	~S	11	2
STRAPPING	3½	–	–	–
SEIZING	¾	–	–	–
LASHING	2½	–	–	–
SHROUDS	7	D.E.	11	12
EYE	1	–	–	–
SEIZINGS THROAT	1	–	–	–
END	¾	–	–	–
LANIARD	3½	–	–	–
RATLING	1	–	–	–
STANDING BACKSTAYS	7	D.E.	11	12
EYE	1	–	–	–
SEIZINGS THROAT	1	–	–	–
END	¾	–	–	–
LANIARD	3½	–	–	–
BREAST BCKSTY. RUNN.	5	S	14	2
FALLS	2½	D	10	4
STRAPPING	3	–	–	–
STAY CABLED 4 STRANDS	8½	–	–	–
COLLAR	6½	S	20	1
TACKLE	3½	L.T.	24	1
	3½	S	14	1
STRAPPING	5	–	–	–
SEIZING	1½	–	–	–
	¾	–	–	–
PREVENTER-STAY CABLED 4 STRANDS	6½	–	–	–
COLLAR	5	S	16	1
TACKLE	3	L.T.	18	1
	3	S	12	1
STRAPPING	4	–	–	–
SEIZING	1	–	–	–
LASHING THE COL.	2½	–	–	–
SHIFTING BACKSTAYS	7	T	–	2
TACKLES	3	~D	12	4
	3	~S	12	4
STRAPPING	4	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
FUTTOCK-SHROUDS	7	~PL.D.E.	11	12
SEIZINGS UPPER	1	–	–	–
LOWER	¾	–	–	–
RATLINE	1½	–	–	–
TOP-ROPE PENDENTS	9	S.BR.SHI. I.BD.C.	26	2
FALLS	5	TR.I.B.C	24	2
Fore-topsail Yard				
TIE	6	FL.SI.C.	20	2
		D.C.	20	1
STRAPPING	6½	–	–	–
SEIZINGS	1	–	–	–
LASHERS: MASTHEAD	2½	–	–	–
AT THE: YARD	2	–	–	–
HALIARDS	3½	D.TH.C.	26	2
	3½	~S.TH.C.	26	2
STRAPPING	5½	–	–	–
SEIZING	1	–	–	–
HORSES	4	–	–	–
STIRRUPS	3	T	–	6
BRACES	3½	S	14	4
PENDENTS	4½	S	14	2
PREVENTER	4	–	–	–
STRAPPING	4	–	–	–
LIFTS	3½	D	12	2
	3½	S	12	4
BECKETS	4	–	–	–
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
PARRAL-ROPES	3½	PAR	24	1
RACKING & SEIZING	1	–	–	–
CLUE-LINES	4	S.ST.BD.	14	4
	4	S	14	2
STRAPPING	4	–	–	–
BUNT-LINES	3	S	11	4
STRAPPING	3	–	–	–
LEECH LINES	2½	S	10	2
STRAPPING	3	–	–	–
BOW-LINES	3½	S	12	2
BRIDLES	3½	T	–	4
STRAPPING	3½	–	–	–
LASHING	1½	–	–	–
REEF-TACKLE PENDENTS	4	~D	9	4
FALLS	2½	–	–	–
STRAPPING	3	–	–	–
EAR-RINGS	1½	–	–	–
SHEET	8	S.SHO.GTHK.	26	2
		& TH.C.	26	2
STRAPS SHEET BLOCK	8	–	–	–
FOR QUARTER DO.	6	–	–	–
LASHER FOR QTR. BLOCKS	2½	–	–	–
SEIZING	1½	–	–	–
SPAN	3½	–	–	–
STOPPERS	6½	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
SLINGS	5	–	–	–
STAYSAIL-STAY	4	S	13	1
TACKLE	2½	D	10	1
	2½	S	9	1
HALIARD	3½	S	12	1
STRAPPING	3½	–	–	–
SHEETS	4	S	13	2
STRAPPING	4	–	–	–
OUT-HAULER	2½	S	9	1
DOWN-HAULER	2½	S	9	1
STRAPPING	2½	–	–	–
STUDDINGSAIL-HALIARDS	3½	S	12	6
SHEETS	5	S	12	2
TACKS	3½	S	12	4
‡DOWN-HAULERS	2	S	9	2
BOOM-TACKLES	2	D	8	2
	2	S	8	4
TAILS & STRAPS	3½	–	–	–
	2½	–	–	–
Fore Topgallant Mast				
SHROUDS	4	T	–	12
LANIARDS	2	–	–	–
STANDING-BACKSTAYS	4	D.E.	7	4
LANIARDS	2	–	–	–
STAY CABLED 4 STRANDS	4½	S	12	1
STRAPPING	3½	–	–	–
TACKLE	2	D	7	1
		S	7	1
STRAPPING	2½	–	–	–
FLAGSTAFF STAY	2	T	–	1
HALIARDS	1½	–	–	–
ROYAL HALIARD	2½	S	7	1
Fore Topgallant Yard				
TIE	4	–	–	–
HALIARD	2	D	8	1
		S	8	2
STRAPPING	2½	–	–	–
HORSES	3	–	–	–
BRACES	2	S	8	6
PENDENTS	3	S	8	2
STRAPPING	2	–	–	–
PARRAL-ROPES	2½	PAR	12	1
CLUE-LINES	2½	S	7	6
STRAPPING	2½	–	–	–
BOW-LINES	2½	S	7	2
BRIDLES	2½	T	–	6
STRAPPING	2½	–	–	–
EAR-RINGS	TARRED LINE	–	–	–
SHIFTING BACKSTAYS	4	T	–	2
TACKLE	2	~D	7	2
		~S	7	2
STRAPPING	2	–	–	–

‡ Studdingsail down-haulers have six thimbles

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
STUDDINGSAIL HALIARDS	2½	S	7	6
SHEETS	2	–	–	–
TACKS	2	S	7	4
DOWN-HAULERS	1½	T	–	1
STRAPPING	2	–	–	–
Mainmast				
WOOLDING	3½	–	–	–
GIRTLINES	5	S	16	2
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
LASHING	2½	–	–	–
PENDTS. OF TACKLES CABLED	11	~S.C.	24	2
STRAPPING	7½	T	–	8
SEIZING	1½	–	–	–
RUNNERS OF TACKLES	7½	D.TH.C.	21	4
STRAPPING	6	–	–	–
FALLS OF TACKLES	4	~S.TH.C.	26	4
STRAPPING	5½	T	–	2
SEIZING	1	–	–	–
SHROUDS CABLED	11	D.E.	17	20
EYE	1½	–	–	–
SEIZINGS THROAT	1½	–	–	–
END	1½	–	–	–
LANIARD	5½	–	–	–
RATLINE	1½	–	–	–
STAY CABLED 4 STRANDS	19	H	26	1
SEIZINGS	2	–	–	–
LANIARD	6	–	–	–
COLLAR CABLED 4 STRANDS	14	H	26	I
WORMING	2	–	–	–
SEIZINGS	2	–	–	–
LASHINGS	4	–	–	–
PREVENTER-STAY CABLED 4 STRANDS	13	H	17	1
LANIARD	5	–	–	–
COLLAR CABLED 4 STRANDS	6	H	17	1
SEIZINGS	1½	–	–	–
LASHINGS	2	–	–	–
CATHARPIN-LEGS	7	–	–	–
SEIZINGS	1½	–	–	–
STAY TACKLE PENDENT	6	D.TH.C.	18	1
FALLS	3½	~S.TH.C.	20	1
		D.C.	14	1
STRAPPING	4½	–	–	–
SEIZING	I	–	–	–
LASHING	1½	–	–	–
FORE-HATCH TACKLE	3½	D.TH.C	18	1
‡FALL	3½	~S.TH.C.	20	1
	3½	~S.TH.C.	14	1
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–

‡ The Stay and Fore-Hatch Tackle have two thimbles

NAMES OF THE STANDING AND RUNNING RIGGING	BLOCKS, ETC.			
	INCHES	SPECIES	INCHES	NUMBER
Main Yard				
JEERS TYE	8	TR.C.	28	2
FALLS	8	D.C.	28	2
STRAPPING	9	–	–	–
SEIZINGS	2	–	–	–
LASHERS: MASTHEAD	4½	–	–	–
TO THE: YARD	3½	–	–	–
STOPPERS	6	–	–	–
HORSES	5½	T	–	2
STIRRUPS	4	T	–	8
SEIZINGS	¾	–	–	–
LANIARDS	2	–	–	–
YARD-TACKLE PENDENTS	7	D.TH.C	17	2
FALLS	3½	~S.TH.C.	20	2
	3½	S	13	2
STRAPPING	5½	–	–	–
SEIZING	1	–	–	–
INNER TRICING-LINES	2½	S	8	2
OUTER TRICING-LINES	2	S	7	4
STRAPPING	2	–	–	–
BRACES	4½	S.C.	16	2
PENDENTS	5½	S.C.	16	2
PREVENTER	4½	–	–	–
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
PREVENTERS (IN WAR ONLY)	3½	S	13	4
STRAPPING	3½	–	–	–
SEIZING	¾	–	–	–
LIFTS	4½	S	16	6
SPAN FOR CAP	6½	–	–	–
SHORT SPAN	4H	–	–	–
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
JIGGER-TACKLE	2½	D	10	2
	2½	S	10	2
STRAPPING	3½	–	–	–
TRUSS–PENDENTS	8	T	–	4
FALLS	3	~D	11	4
STRAPPING	3½	–	–	–
EYE SEIZINGS	1½	–	–	–
NAVE-LINE	2	S	7	1
PUDDENING THE YARD	6½	–	–	–
CLUE-GARNETS	4	ST. BD.	15	4
	4	S	15	2
STRAPS AB. THE YARD	4	–	–	–
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
LASHING	1	–	–	–
BUNTLINE-LEGS	3	D	11	2
FALLS	3	S	11	10
STRAPPING	3½	–	–	–
LEECHLINE-LEGS	2½	D	11	4
FALLS	2½	S	10	10
STRAPPING	3½	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	BLOCKS, ETC.			
	INCHES	SPECIES	INCHES	NUMBER
SLABLINES	2½	S	9	2
STRAPPING	2½	–	–	–
BOWLINES	4½	D	16	1
BRIDLES	4½	T	–	6
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–
LASHING	2	–	–	–
TACKLES	3	~L.T.	20	1
	3	~S	11	1
STRAPPING	3½	–	–	–
EAR-RINGS	2	–	–	–
SHEETS CABLED	7½	S.C.	24	4
STRAPPING	7½	T	–	4
SEIZING	1½	–	–	–
LASHERS	2	–	–	–
STOPPERS	6	–	–	–
TACKS TAPER & CABLED	10	–	–	–
STOPPERS	6	H & T	2	2
LANIARDS	2	–	–	–
LNRDS. FOR PUD. & DOL.	1½	T	–	4
SLINGS	12	T	–	1
STRAP	12	–	–	1
SEIZINGS	2	–	–	–
LANIARDS	3½	–	–	–
QUARTER TACK. PENDENTS	6	D.TH.C	18	2
FALLS	3½	~S.TH.C.	20	2
	3½	~S.TH.E.	14	2
STRAPPING	5	–	–	–
SEIZING	1	–	–	–
LUFF-TACKLES	3½	~D	13	6
	3½	~S	13	6
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
STAYSAIL-STAY	5	T	–	2
COLLAR	4	–	–	–
SEIZING	1	–	–	–
LANIARDS	1½	–	–	–
‡HALIARDS	3	S	11	3
‡SHEETS	4	S	14	2
TACKS	4	–	–	–
DOWNHAULER	2½	S	9	1
STRAPPING	4	–	–	–
	3	–	–	–
STUDDSL. HAL. INNER	3	S	12	6
OUTER	3½	S	12	4
SHEETS	3	–	–	–
TACKS	3½	S	12	2
STRAPPING	3½	–	–	–
Main Topmast				
BURTON-PENDENTS	5½	T	–	2
FALLS	2½	~D	11	2
	2½	~S	11	2
STRAPPING	3½	–	–	–

‡ One hook and thimble to staysail haliard and sheet.

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
SHROUDS	7	D.E.	11	12
EYE	1	–	–	–
SEIZINGS THROAT	1	–	–	–
END	¾	–	–	–
LANIARD	3½	–	–	–
RATLING	1	–	–	–
STANDING BACKSTAYS	7	D.E.	11	6
EYE	1	–	–	–
SEIZINGS THROAT	1	–	–	–
END	¾	–	–	–
LANIARD	3½	–	–	–
BREAST BCKSTY. RUNN.	5	S	14	2
FALLS	2½	D	10	4
STRAPPING	3	–	–	–
STAY CABLED 4 STRANDS	8½	–	–	–
COLLAR	7	S	20	1
TACKLE	3½	L.T.	24	1
	3½	~S	14	1
STRAPPING	4½	–	–	–
SEIZING	1½	–	–	–
	¾	–	–	–
LASHING	2	–	–	–
PREVENTER-STAY CABLED 4 STRANDS	6½	–	–	–
COLLAR	5	S	16	1
TACKLE	3	L.T.	12	4
	3	~S	12	4
STRAPPING	4	–	–	–
SEIZING	1	–	–	–
COLLAR-LASHING	1½	–	–	–
SHIFTING BACKSTAYS	7	T	–	2
TACKLES	3	~D	12	4
	3	~S	12	4
STRAPPING	4	–	–	–
FUTTOCK-SHROUDS	7	~PL.D.E.	11	12
SEIZINGS UPPER	1	–	–	–
LOWER	¾	–	–	–
RATLINE	1½	–	–	–
TOP-ROPE PENDENTS	9	TR.I.B.C.	26	2
FALLS	5	TR.I.B.C	22	4
Main Topsail Yard				
TIE	6	FL.SI.	22	2
		D.C.	22	1
STRAPPING	6½	–	–	–
SEIZINGS	1	–	–	–
LASHING: MASTHEAD	2½	–	–	–
AT THE: YARD	2	–	–	–
HALIARDS	3½	D.TH.C.	26	2
	3½	~S.TH.C.	26	2
STRAPPING	5	–	–	–
SEIZING	¾	–	–	–
HORSES	6½	–	–	–
STIRRUPS	3	T	–	6

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
BRACES	3½	S	14	2
PENDENTS	4½	S	14	2
PREVENTER	4	–	–	–
SPAN ABOUT MIZEN-MAST	4½	–	–	–
STRAPPING	4	–	–	–
LIFTS	3½	D	12	2
	3½	S	12	4
BECKETS	4	–	–	–
STRAPPING	4	–	–	–
SEIZING	¾	–	–	–
PARRAL-ROPES	4	PAR	25	1
RACKING & SEIZING	1	–	–	–
CLUE-LINES	4	S.ST.BD.	14	4
	4	S	14	2
STRAPPING	4	–	–	–
BUNT-LINES	3	S	11	6
STRAPPING	3	–	–	–
LEECH LINES	2½	S	10	2
STRAPPING	2½	–	–	–
BOW-LINES	4½	S	15	2
BRIDLES	4½	T	–	6
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–
FRAPPING AND LASHING	2	–	–	–
REEF-TACKLE PENDENTS	4	~D	9	4
FALLS	2½	–	–	–
STRAPPING	3	–	–	–
EAR-RINGS	1½	–	–	–
SHEET	8½	S.SHO.GTHK.	26	2
		& TH.C.	26	2
STRAPS SHEET BLOCK	8½	–	–	–
FOR QUARTER DO.	6	–	–	–
LASHER FOR QTR. BLOCKS	2½	–	–	–
SEIZING	1½	–	–	–
SPAN	3½	–	–	–
STOPPERS	6½	–	–	–
SLINGS	5½	–	–	–
STAYSAIL HALLIARDS	3½	S	13	1
STRAPPING	4	–	–	–
SHEETS	3	S	11	2
STRAPPING	3	–	–	–
PENDENTS	4	S	9	2
TACK	3	–	–	–
DOWNHAULER	2½	S	9	2
‡BRAILS	4	–	–	–
MIDDLE STAYSAIL-STAY	4	S	13	1
TACKLE	2	D	8	1
	2	S	8	1
HALIARD	3½	S	12	1
SHEETS	3½	S	12	2
TACKS	3	–	–	–

‡ Staysail-Brails have likewise two thimbles.

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
MID. STAYSL.-				
DOWNHAULER	2½	S	9	2
STRAPPING	3	–	–	–
	3	–	–	–
TRICING-LINE	2½	S	9	1
STUDDINGSAIL-HALIARDS	3½	S	12	6
SHEETS	5	S	12	2
TACKS	3½	S	12	4
‡DOWN-HAULERS	2	S	9	2
BOOM-TACKLES	2	D	8	2
	2	S	8	4
LASHING FOR BOOMS	2½	–	–	–
TAILING AND STRAPPING	2½	–	–	–

Main Topgallant Mast

SHROUDS	4	T	–	12
LANIARDS	2	–	–	–
STANDING-BACKSTAYS	4	D.E.	7	4
LANIARDS	2	–	–	–
STAY CABLED 4 STRANDS	4½	S	13	1
STRAPPING	3½	–	–	–
FLAGSTAFF STAY	2	T	–	1
HALIARDS	1½	–	–	–
ROYAL-HALIARD	2	–	–	–

Main Topgallant Yard

TIE	4	–	–	–
HALIARD	2	D	8	1
		S	8	2
STRAPPING	3½	–	–	–
HORSES	3	–	–	–
BRACES	2	S	8	2
PENDENTS	3	S	8	2
STRAPPING	2	–	–	–
LIFTS, SINGLE	2½	S	8	2
STRAPPING	2½	–	–	–
PARRAL-ROPES	2	PAR	12	1
CLUE-LINES	2	S	7	6
STRAPPING	2	–	–	–
BOW-LINES	2	S	7	2
BRIDLES	2	T	–	6
STRAPPING	2	–	–	–
EAR-RINGS	TARRED LINE	–	–	–
SHIFTING BACKSTAYS	4	T	–	2
TACKLE	2	~D	7	2
		~S	7	2
STRAPPING	2½	–	–	–
STAYSAIL-STAY	3	S	10	1
HALIARDS	2½	S	9	1
SHEETS	2½	S	9	2
TACKS	2	–	–	–
DOWN-HAULERS	2	S	7	2
STRAPPING	2½	–	–	–
	2	–	–	–
STUDDINGSAIL HALIARDS	2	S	7	2
SHEETS	2	–	–	–
TACKS	2	S	7	4
DOWN-HAULERS	1½	T	–	2
STRAPPING	2	–	–	–

Mizen-Mast

WOOLDING	2½	–	–	–
GIRTLINES	3½	S	12	2
STRAPPING	3½	–	–	–
SEIZING	¾	–	–	–
LASHING	1½	–	–	–
BURTON-PENDENTS	5	T	–	2
FALLS	3	~D	11	2
	3	~S	11	2
STRAPPING	3½	–	–	–
SHROUDS	7	D.E.	11	12
EYE	1	–	–	–
SEIZINGS THROAT	1	–	–	–
END	¾	–	–	–
LANIARD	3½	–	–	–
RATLINE	1	–	–	–
STAY CABLED 4 STRANDS	8½	T	–	2
SEIZINGS	1	–	–	–
LANIARDS	3½	–	–	–
COLLAR	7	T	–	1
SEIZING	1	–	–	–
LASHING	1½	–	–	–

Yard or Gaff

JEERS	6	TR.C.	22	1
	6	D.C.	22	1
STRAPPING	6½	–	–	–
SEIZINGS	1½	–	–	–
LASHING: MASTHEAD	3	–	–	–
AT THE: YARD	2½	–	–	–
DERRICK	4½	D	15	1
SPAN	4½	S	15	1
STRAPPING	4½	T	–	1
SEIZINGS	1	–	–	–
LASHING	2	–	–	–
VANG-PENDENTS	4½	D	9	2
FALLS	2½	~S	9	2
STRAPPING	3	–	–	–
BOWLINES	3	S	10	4
STRAPPING	3	–	–	–
BRAIL-PEEK LEGS	2	–	–	–
FALLS	2	S	7	6
THROAT	3	2	10	2
MIDDLE	2½	S	9	2
FOOT	2½	S	9	2
STRAPPING	3½	T	–	4
	2½	–	–	–

‡ Studdingsail-Downhaulers, in ships down to 20 guns, have 6 thimbles, besides the blocks above specified.

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
LACING MIZEN YARDS	1½	–	–	–
TO MAST	3	–	–	–
EAR-RINGS	2	–	–	–
PEEK-HALIARDS	2	~S	7	1
SHEET	4½	~D	15	1
	4½	S	15	1
STRAPPING	4½	–	–	–
SEIZING	1	–	–	–
TACK	3	–	–	–
SLINGS	6	–	–	–
STAYSAIL-STAY	5	T	–	2
COLLAR	4½	T	–	1
SEIZING	¾	–	–	–
LASHING	1	–	–	–
LANIARD	2	–	–	–
HALIARD	3	S	11	3
SHEETS	3½	S	14	2
TACK	2½	–	–	–
DOWN-HAULER	2½	S	9	2
STRAPPING	3½	–	–	–
	2½	–	–	–
BRAILS	2	~S	7	2

Boom-Driver

TOPPING LIFTS OR RUNNER	5	–	–	–
SPAN	5	D	15	1
FALL	3	D	10	2
	3	~S	10	2
STRAPPING	3	–	–	–
GUY-PENDENTS	3½	H & T	–	4
FALLS	2½	~D	9	2
	2½	~S	9	2
BOOM-SHEETS	3½	S	12	2
HORSES	3½	–	–	–
SHEET-PENDENT	3½	–	–	–
FALLS	2	~D	8	1
	2	~S	8	1
HALIARDS OR BRAILS	2½	S	9	6
LACING TO THE YARD	1½	–	–	–
TACK-TACKLE	2	~D	12	1
	2	~S	12	1
DOWNHAULER	2½	–	–	–
LASHING	¾	–	–	–

Cross-Jack Yard

TRUSS-PENDENTS	5	T	–	2
FALLS	2½	~L.T.	18	1
	2½	~S	9	1
STRAPPING	3	–	–	–
SEIZING	¾	–	–	–
SPAN ABOUT THE CAP	4	–	–	–
BRACES	2½	S	9	2
PENDENTS	3½	S	9	2
PREVENTER	3	–	–	–
STRAPPING	2½	–	–	–
LIFTS, RUNNING	2½	S	9	4
STRAPPING	2½	–	–	–
SLINGS	5½	S.DO.SC.	16	1
STRAPPING	4½	–	–	–
SEIZING	1	–	–	–
LASHING	1½	–	–	–

Mizen Topmast

SHROUDS	4H	D.E.	8	8
SEIZINGS	TARRED LINE	–	–	–
LANIARDS	2½	–	–	–
RATLING	1	–	–	–
STANDING BACKSTAYS	4½	D.E.	8	4
SEIZINGS	TARRED LINE	–	–	–
LANIARDS	2½	–	–	–
STAY CABLED 4 STRANDS	5	–	–	–
LANIARD	2	T	–	2
COLLAR	4	S	14	1
SEIZING AND LASHING	1	–	–	–
FLAGSTAFF-STAY	2	T	–	1
HALIARDS	1½	–	–	–
SHIFTING BACKSTAYS	4½	T	–	1
TACKLE	2½	~D	9	1
	3½	~S	9	1
STRAPPING	3	–	–	–
FUTTOCK-SHROUDS	6½	~PL.D.E.	8	8
SEIZING	TARRED LINE	–	–	–
RATLINES	1	–	–	–
SEIZING	1	–	–	–
TOP-ROPE PENDENTS	5	S.I.BD.	16	1
FALLS	3	S.I.BD.	12	2

Mizen Topsail Yard

TIE	4	S.DO.SC	13	1
HALIARD	2½	D.TH.C	12	1
	2½	~S.TH.C	12	1
STRAPPING	3½	–	–	–
LASHING	1	–	–	–
HORSES	3	–	–	–
STIRRUPS	2½	T	–	4
BRACES	2½	S	9	2
PENDENTS	3	S	9	2
STRAPPING	2½	–	–	–
LIFTS	2½	D	9	2
	2½	S	9	2
STRAPPING	4	–	–	–
LIFTS	3½	D	12	2
	3½	S	12	4
STRAPPING	3	–	–	–
PARRAL-ROPES	2½	PAR	16	1
CLUE-LINES	2½	S.ST.BD.	9	4
STRAPPING	2½	–	–	–
BUNT-LINES	2	S	8	4
STRAPPING	2	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
LEECH LINES	2	S	7	2
STRAPPING	2	–	–	–
BOW-LINES	2½	S	9	2
BRIDLES	2½	T	–	4
STRAPPING	2½	–	–	–
REEF-TACKLE PENDENTS	3	–	–	–
FALLS	1½	D	7	2
	1½	S	7	2
STRAPPING	3	–	–	–
EAR-RINGS	1½	–	–	–
SHEET	5	S.SHO.	15	2
	5	S	15	1
STRAPPING	4	–	–	–
SEIZINGS	¾	–	–	–
LASHINGS	1½	–	–	–
STAYSAIL HALLIARDS	2½	S	9	1
SHEETS	2½	S	9	2
TACKS	2	–	–	–
DOWNHAULER	1½	S	6	1
STRAPPING	2½	–	–	–
Mizen Topgallant Mast				
SHROUDS	2½	T	–	8
LANIARDS	1½	–	–	–
BACKSTAYS	2½	T	–	4
LANIARDS	1½	–	–	–
STAY	3	T	–	1
LANIARD	1½	–	–	–
Mizen Topgallant Yard				
TIE	3	S	6	1
HALIARD	1½	S	5	2
HORSES	2	T	–	2
BRACES	1½	S	5	2
LIFTS, SINGLE	2	T	–	2
PARRAL-ROPES	1½	PAR	7	1
CLUE-LINES	1½	S	5	2
BOW-LINES	1½	T	–	4
BRIDLES	1½	–	–	–
EAR-RINGS	TARRED LINE	–	–	–
STRAPPING	2	–	–	–
Necessary Ropes				
VIOL CABLED	14	S.C.	56	1
STRAPPING	11½	–	–	–
SEIZING	2	–	–	–
LASHING	4½	–	–	–
WINDING TACKLE	13	FOURFOLD	24	1
PENDENTS		COAK		
FALL	5	TR.C.	24	1
STRAPPING	7	–	–	–
SEIZING	1½	–	–	–
CAT-FALLS	6	TR.I.BD. BR.SH.	26	2

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
LANIARDS	3	S	10	2
	3	T	–	4
	3	S LARGE RAGGED STAPLES	–	2
STOPPERS	5	–	–	–
MASTHEAD	9½	–	–	–
GUYS FORE	9½	–	–	–
AFTER	6	–	–	–
‡FISH TACKLE PENDENTS	10	~S.C.	28	1
FALL	4½	LT	38	2
STRAPPING	7	–	–	–
	6½	–	–	–
SEIZING	1½	–	–	–
	1	–	–	–
LANIARDS	3	–	–	–
ANCHOR-STOCK TACK	3	~D	12	1
FALL	7	~S	12	1
BILL-PENDENTS	5½	T	–	2
STRAPPING	4	H	–	1
SEIZING	¾	–	–	–
STOPPERS, SHEET ANCHOR	9½	–	–	–
BEST BOWER	9½	–	–	–
SMALL BOWER	9½	–	–	–
SPARE	9½	–	–	–
SEIZINGS	1	–	–	–
WING CABLED	9	–	–	–
DOG	9	–	–	–
SEIZING	1	–	–	–
STREAM ANCHOR	5½	–	–	–
KEDGE	4½	–	–	–
DECK & BITT CABLED	12	T	–	13
LANIARDS	3½	–	–	–
SEIZINGS	9H	–	–	–
SEIZINGS	2	–	–	–
	1	–	–	–
STOPPERS PREVENTER	9½	–	–	–
DITTO	9	–	–	–
DITTO	8	–	–	–
DITTO	7½	–	–	–
DITTO	7	–	–	–
DITTO	6½	–	–	–
DITTO	5½	–	–	–
DITTO	5	–	–	–
DITTO	4½	–	–	–
SHK. PAINTERS SHEET ANCHOR, CABLED	9	–	–	–
BEST BOWER	8	T	–	1
SMALL BOWER	8	T	–	1
SPARE, CABLED	9	–	–	–
SEIZINGS	1	–	–	–
BUOY-ROPES SHEET	1	–	–	–
ANCHOR, CABLED	8½	–	–	–
BEST BOWER, CABLED	8½	–	–	–

‡ The Hook to the Fish Tackle-Pendent is to be large enough as with ease to hook the ring of the Anchor.

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
SMALL BOWER, CABLED	8½	–	–	–
SEIZING	1	–	–	–
STORM ANCHOR, CABLED	5	–	–	–
KEDGE, CABLED	4	–	–	–
ROPES, DAVIT	3½	–	–	–
BELL	3½	T	–	1
BUCKET	LASHING	–	–	–
SWAB	3½	S	12	2
ENTERING	3½	–	–	–
PASSING	5	T	–	2
LANIARD	2½	–	–	–
SLIP	3½	–	–	–
QUARTERS, POOP AND STANTIONS IN THE WASTE	3½	T	–	16
FORE, MAIN AND MIZEN TOPS	LASHING	–	–	–
WHEEL OR TILLER WHITE	4½	S	14	2
STRAPPING	4½	T	–	2
SEIZING	1	–	–	–
PUDDENING OF ANCHORS	3	OLD	–	YD
	4	CANVAS	–	20
SEIZING	1½	–	–	–
SLINGS, BUOY	4	T	–	6
LANIARDS	3	–	–	–
SEIZINGS	1	–	–	–
GUN	8	–	–	–
NUT	7	–	–	–
BUTT	5	T	–	4
HOGSHEAD	4	T	–	4
CAN-HOOK	4½	–	–	–
STRAPS FOR WOOD BUOYS	4	–	–	–
SWABS	3½	–	–	–
CABLE BENDS	3	–	–	–
RUDDER-PENDENTS, CABLED	7½	T	–	4
LANIARDS	3	–	–	–
FALLS	3½	~L.T.	28	2
	3½	~S	15	2
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–
STERN-LADDERS 4 STRAND	6	–	–	–
MIDDLE-ROPE	2	–	–	–
LASHING	2	–	–	–
FUTTOCK STAVES	8	–	–	–
	5	–	–	–
SWIFTERS, FOR CAPSTAN BARS	2	–	–	–
NETTING	1½	–	–	–
HALIARD FOR TOP LANTERN	1	S	5	1
ENSIGN	2	–	–	–
JACK	1	–	–	–

NAMES OF THE STANDING AND RUNNING RIGGING	INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
HEAD LINE	WHITE LINE		–	–
FOR ROPE-BANDS	MARLINE		–	–
COLORS PENDENT-SLINGS	¾	–	–	–
AWNINGS RIDGE AND SIDE ROPES	3½	S	12	3
STOPS	1	–	–	–
			34	1
CROWFEET	1	EUPHROE	24	1
			22	1
HALIARD	1½	–	–	–
RIDGE-TACKLE FALL	2½	D	9	1
	2½	S	9	1
FOR DIFFERENT USES	–	~SN.I.BD.	24	4
OF THE SHIP	–	HKS C.	16	4
	–		14	4
STRAPPING	4½	–	–	–
SEIZING	¾	–	–	–

Long Boat's Rigging

BURTON-PENDENTS	4	S	11	2
RUNNERS	3	T	–	2
FALLS	2½	~D	9	2
	2½	~S	9	2
STRAPPING	3	–	–	–
SHROUDS	4	D.E.	5	4
LANIARD	1½	–	–	–
STAY	4½	D.E.	5	1
LANIARD	1½	–	–	–
TIE	3	S	9	1
MAIN HALIARD	2	S	7	2
OUTER HALIARD	2	D.I.BD.	7	1
		~S	7	1
SHEET	2½	D	8	1
		~S	8	1
WOODEN HOOPS	–	–	–	–
DOWNHAULER	1½	~S	5	1
STRAPPING	2	–	–	–
TOPPING-LIFTS	2½	–	–	–
FORE-HALIARD	2	S	7	1
SHEET	2	T	–	2
TACK	1	–	–	–
BOWLINE	2½	T	–	1
JIB-HALIARD	2	S	7	2
		~	–	1
SHEET	2½	T	–	4
OUT-HAULER	3	I.TRA.	–	1
IN-HAULER	1	–	–	–
BOAT-ROPE CABLED	9	–	–	–
LANIARD	2½	–	–	–
GUEST-ROPE CABLED	5	–	–	–
GRAPNEL-ROPE CABLED	4½	T	–	1
PAINTER	4	T	–	1
STERNFAST	3½	T	–	1

NAMES OF THE STANDING AND RUNNING RIGGING		INCHES	BLOCKS, ETC. SPECIES	INCHES	NUMBER
FENDERS CABLED		6	–	–	–
LANIARDS		2	–	–	–
RUDDER-LANIARDS		2	–	–	–
Pinnace					
HALIARDS	MAIN	1½	–	–	–
	FORE	1½	–	–	–
SHEET		1½	–	–	–
GRAPNEL-ROPE CABLED		3½	T	–	1
PAINTER		3½	T	–	1
STERNFAST		2½	T	–	1
SLINGS		5½	H & T	8	12
SEIZINGS		1	–	–	–
RUDDER-LANIARDS		1	–	–	–
Yawl, or Cutter or Pinnace					
MAIN AND FORE HALIARDS (IF CUTTERS)		2	I. TRA.	–	2
MAIN	SHEET	2½	–	–	–
FORE	SHEET	2½	–	–	–
GRAPNEL-ROPE CABLED		3½	T	–	1
PAINTER		3½	T	–	1
STERNFAST		–	–	–	–
SLINGS		5½	H & T	8	12
SEIZINGS		1	–	–	–
RUDDER-LANIARDS		1	–	–	–

The following Chart is taken from Steel's *"Elements of Mastmaking, Sailmaking and Rigging"*.

DIMENSIONS OF MAST AND YARDS IN THE ROYAL NAVY

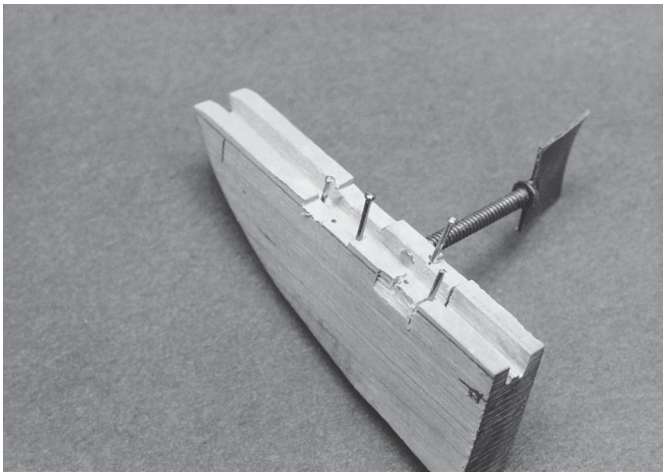
Taken at the Partners; which are at the Middle-Deck in Three-Decked Ships, and at the Upper-Deck in all other Ships.

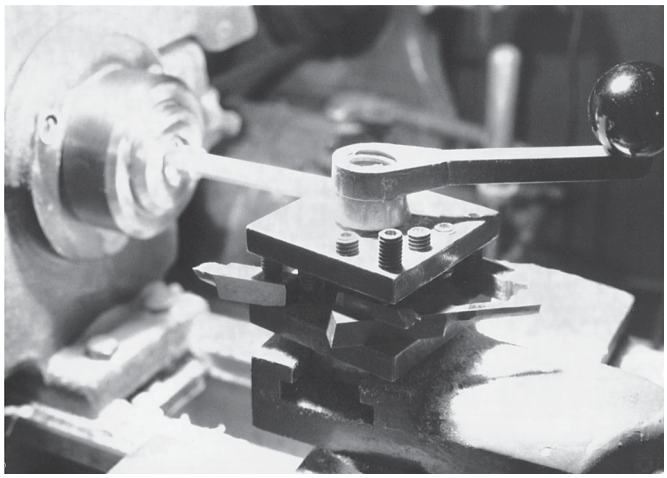
100 GUNS. 2164 TONS.

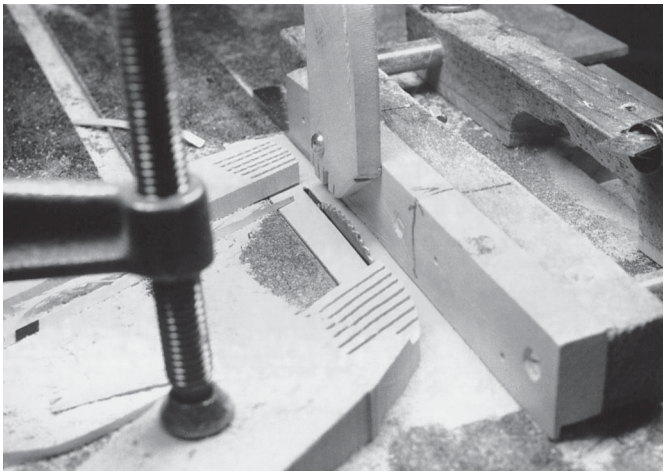
	MASTS			YARDS		
	LENGTH		DIA.	LENGTH		DIA.
NAMES OF THE MASTS AND YARDS	FT.	IN.	INC.	FT.	IN.	INC.
MAIN	117	0	39	102	4	24
MAIN TOP	70	0	20 3/4	73	0	15 1/2
MAIN TOP GALLANT	35	0	11 5/8	48	9	10
MAIN TOP GALLANT ROYAL	0	0	0	36	0	7 3/4
FORE	103	6	34 1/2	89	1	21
FORE TOP	62	10	20 3/4	64	6	13 3/4
FORE TOP GALLANT	31	0	10 3/4	43	0	8 5/8
FORE TOP GALLANT ROYAL	0	0	0	32	0	6 7/8
MIZEN	101	4	23	87	0	16
MIZEN TOP	52	0	14	49	0	10 1/8
MIZEN TOP GALLANT	26	0	8 5/8	32	9	6 1/2
MIZEN TOP GALLANT ROYAL	0	0	0	24	0	5
				SPRITSAIL		
BOWSPRIT	74	0	37	64	6	13 3/4
				SP. TOPSL.		
JIB BOOM	53	0	45 1/4	43	0	8 5/8
DRIVER BOOM	0	0	0	0	0	0
CROSS JACK	0	0	0	64	6	13 3/4
LOWER STUDDING BOOM	56	9	11 1/4	33	0	6 3/4
MAIN TOP BOOM	51	2	10 1/8	29	6	6
MAIN TOP GALLANT BOOM	36	6	7 1/4	21	0	4 1/4
FORE TOP BOOM	44	6	9	25	6	5 1/8
FORE TOP GALLANT BOOM	32	3	6 1/2	18	6	3 3/4
ENSIGN STAFF	45	0	7 1/2	0	0	0
JACK STAFF	19	6	4 3/4	0	0	0
FIRE BOOM	38	0	11 1/4	0	0	0

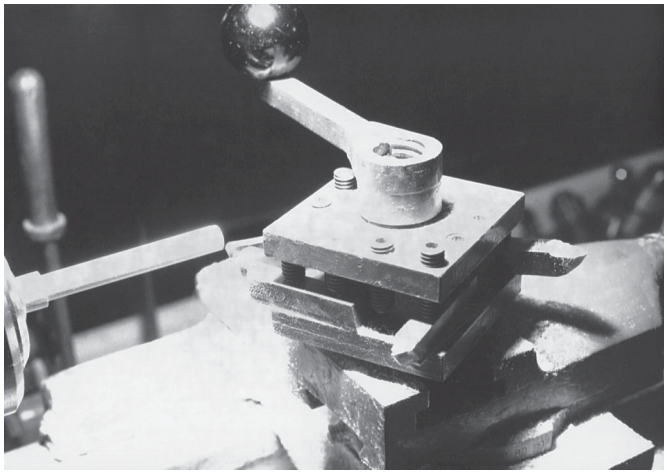
APPENDIX 2

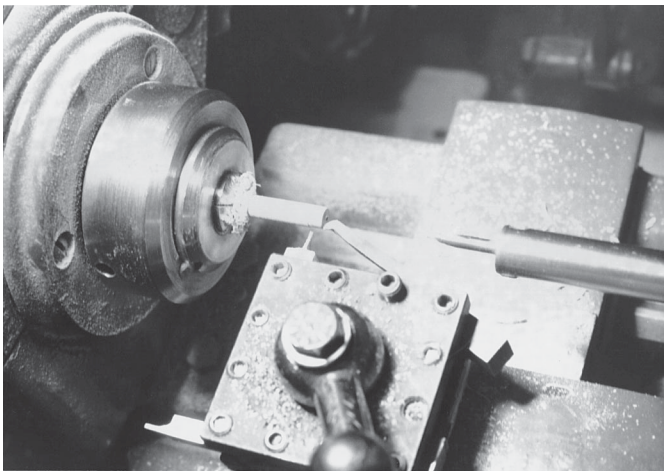
Photos

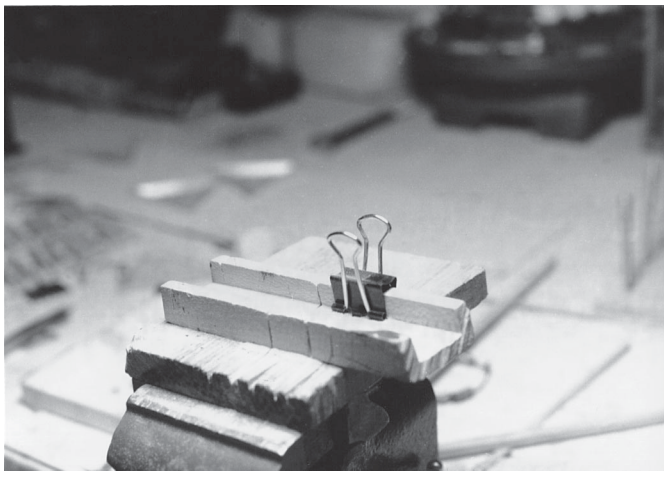


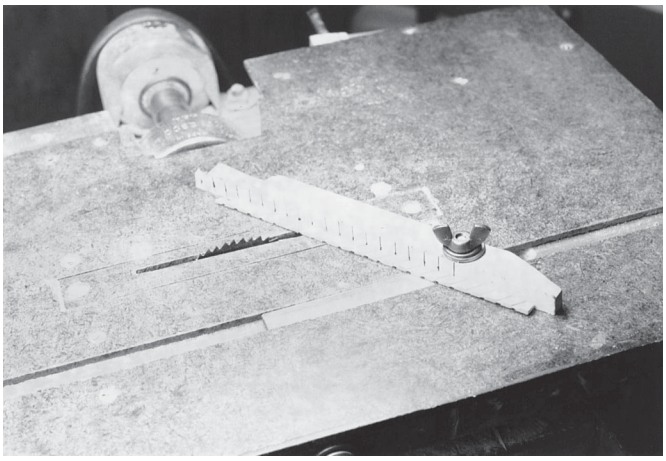


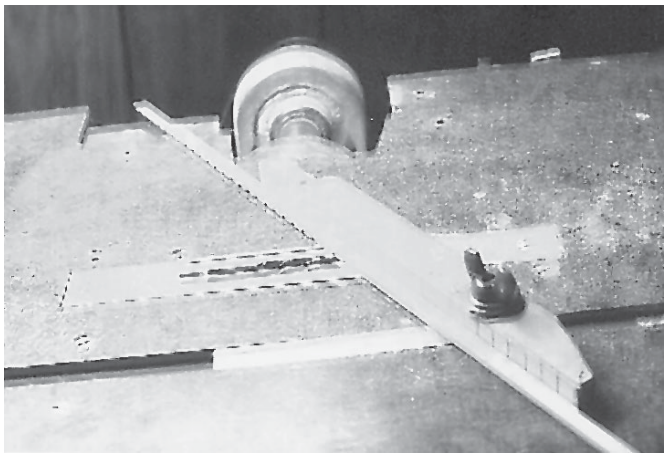


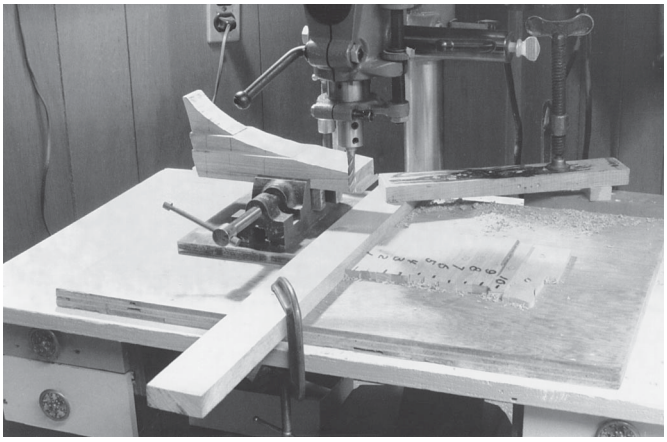


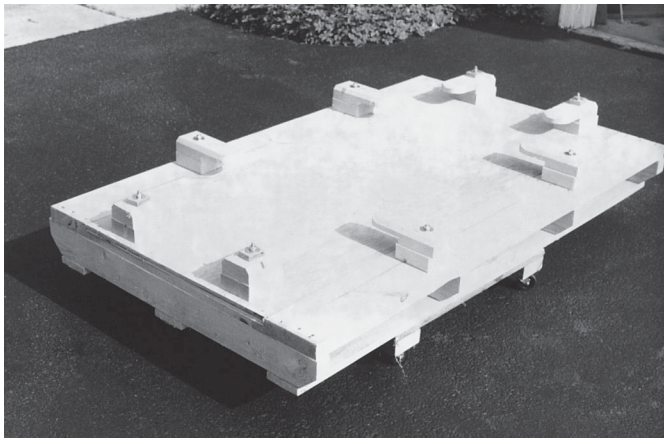


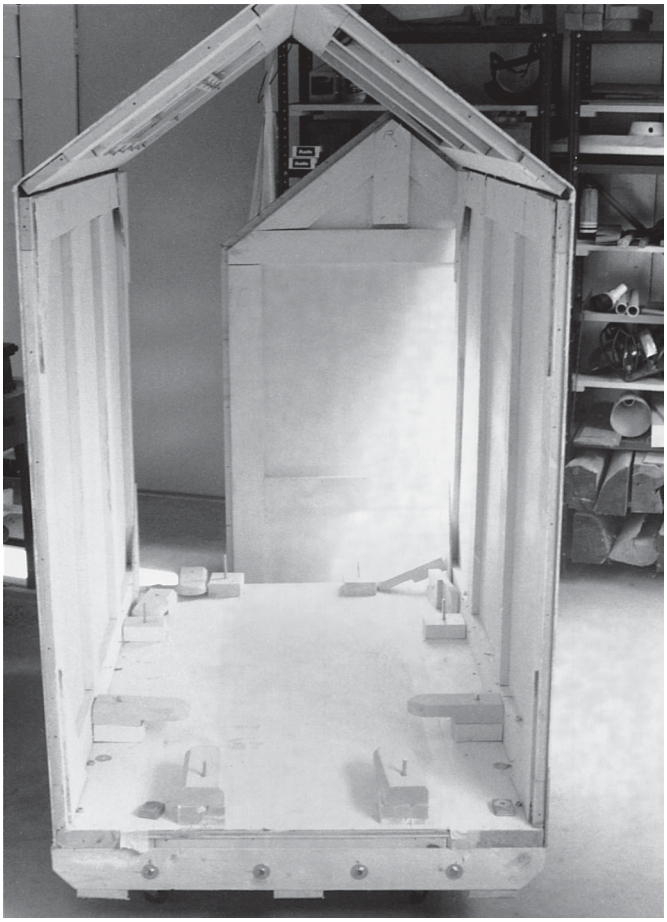


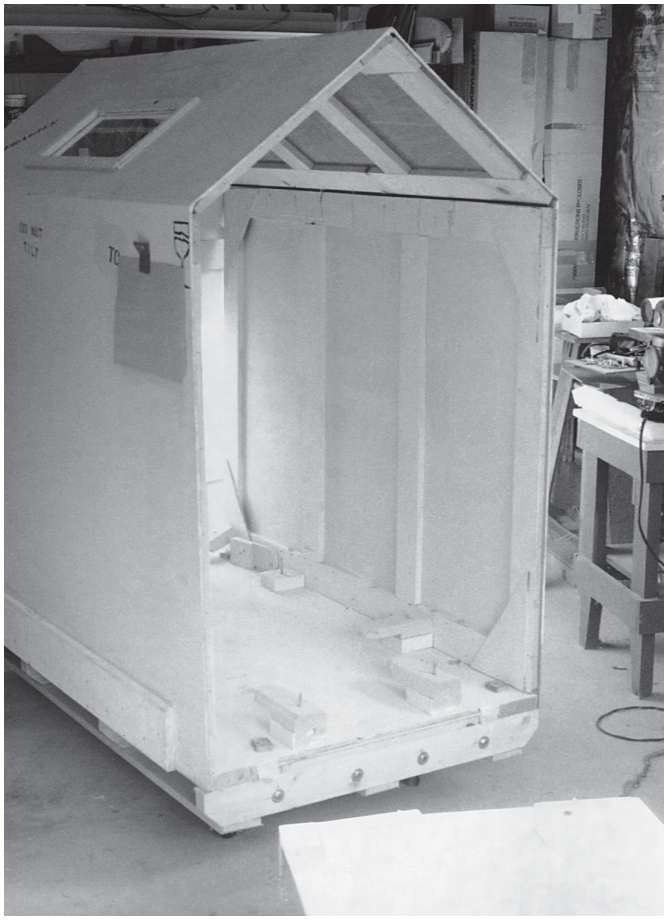


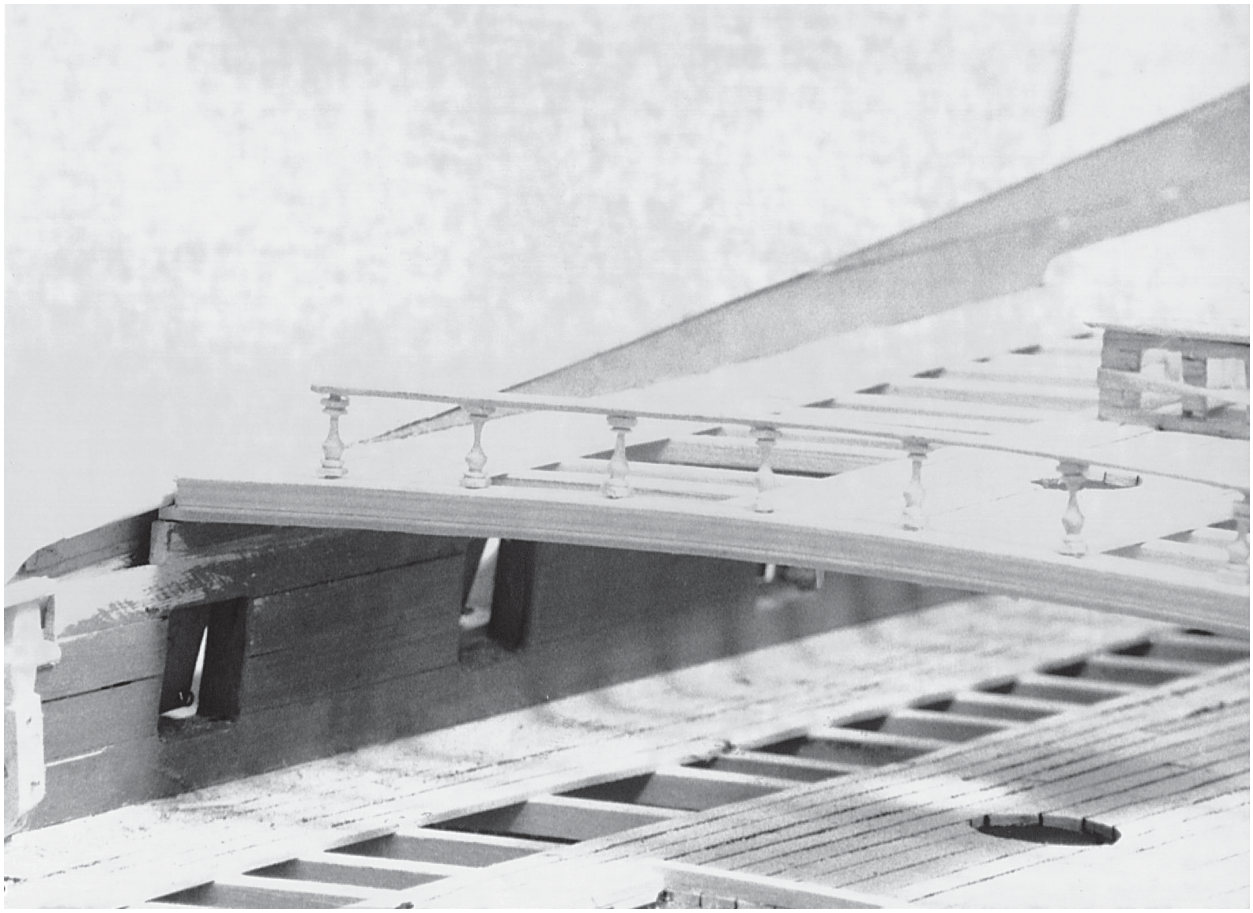


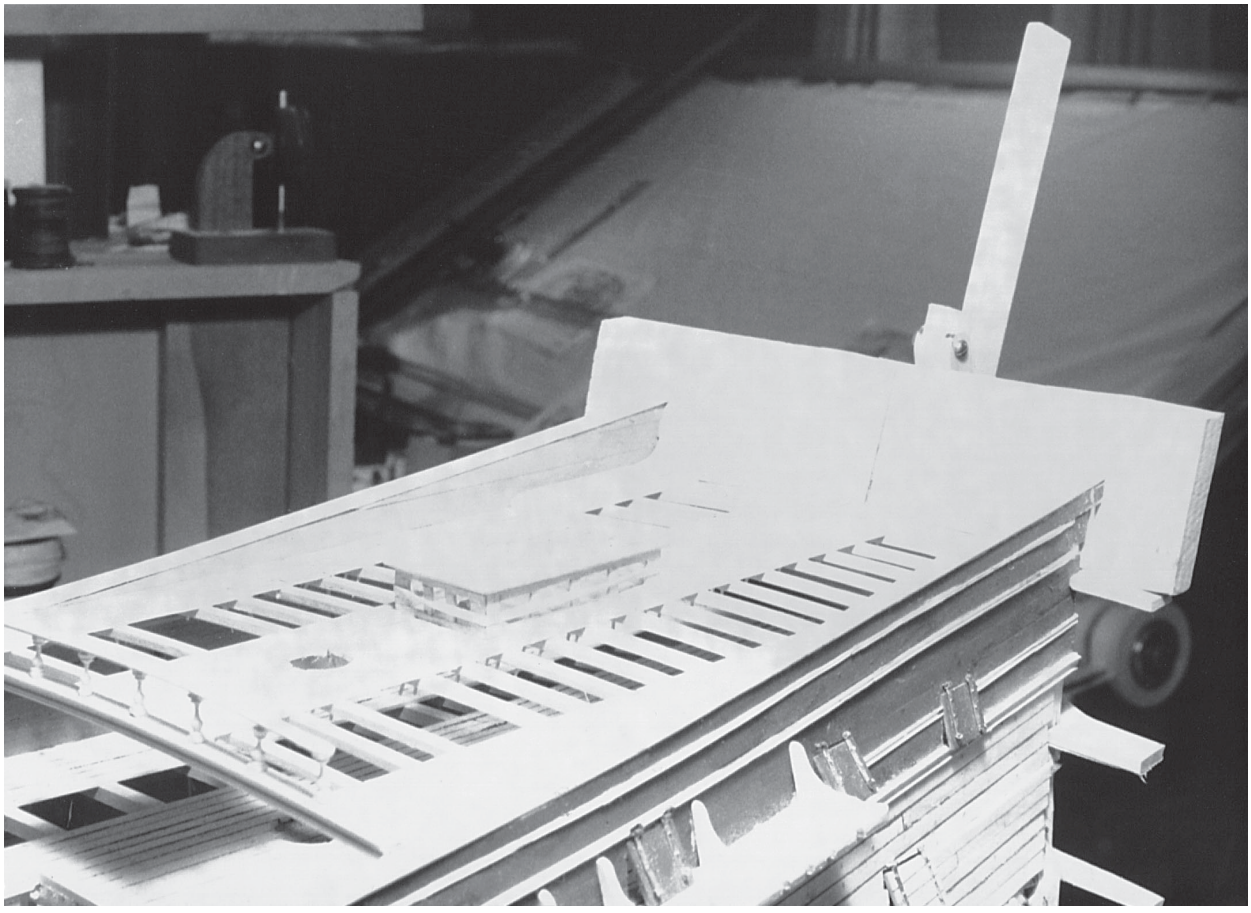












APPENDIX 3

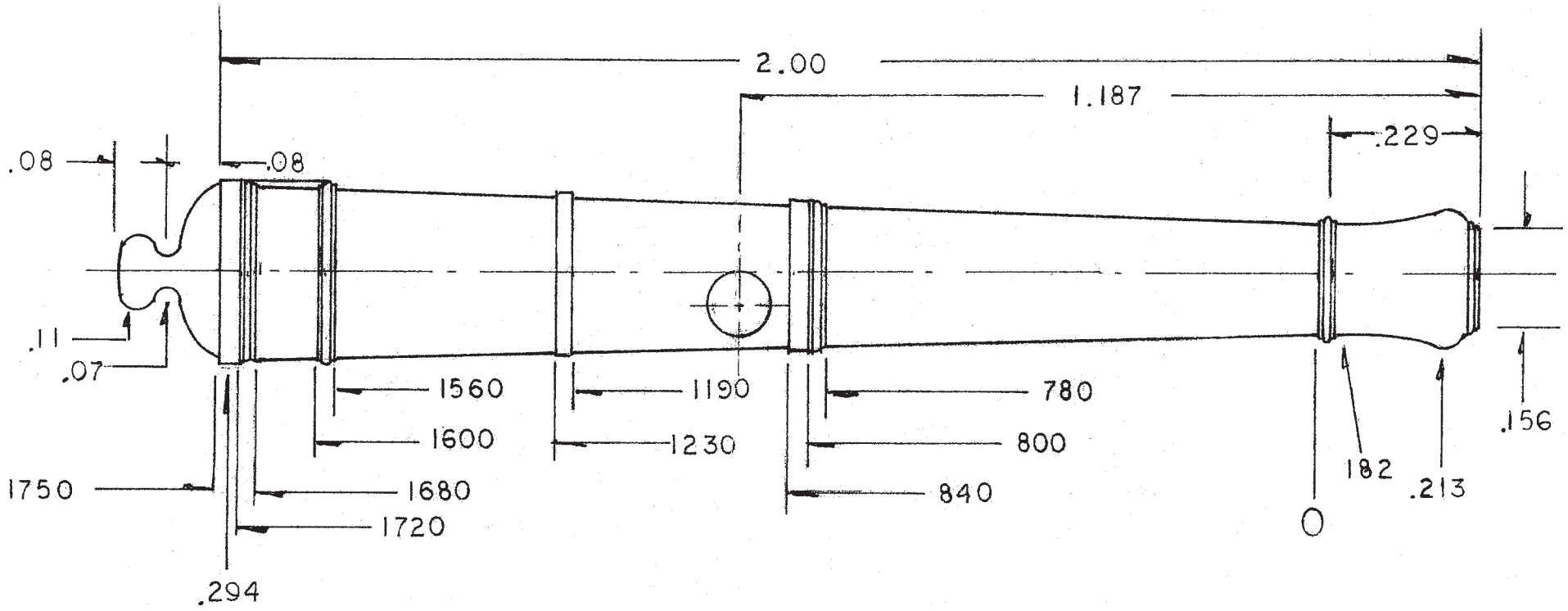
Plans of the Cannons

6 Pounder

12 Pounder

24 Pounder

6 PD CANNON $3\frac{3}{4}$ BORE .078 NO 47 DRILL



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6 pd 8'

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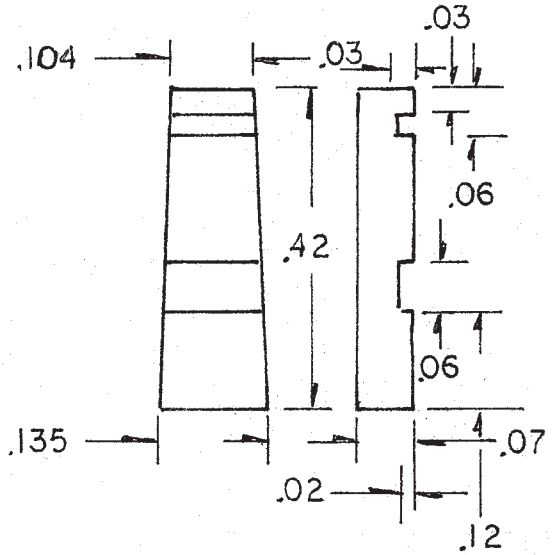
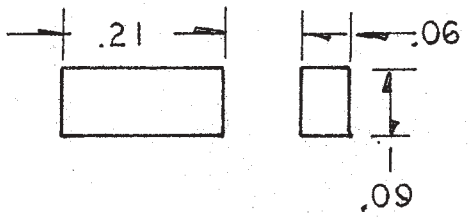
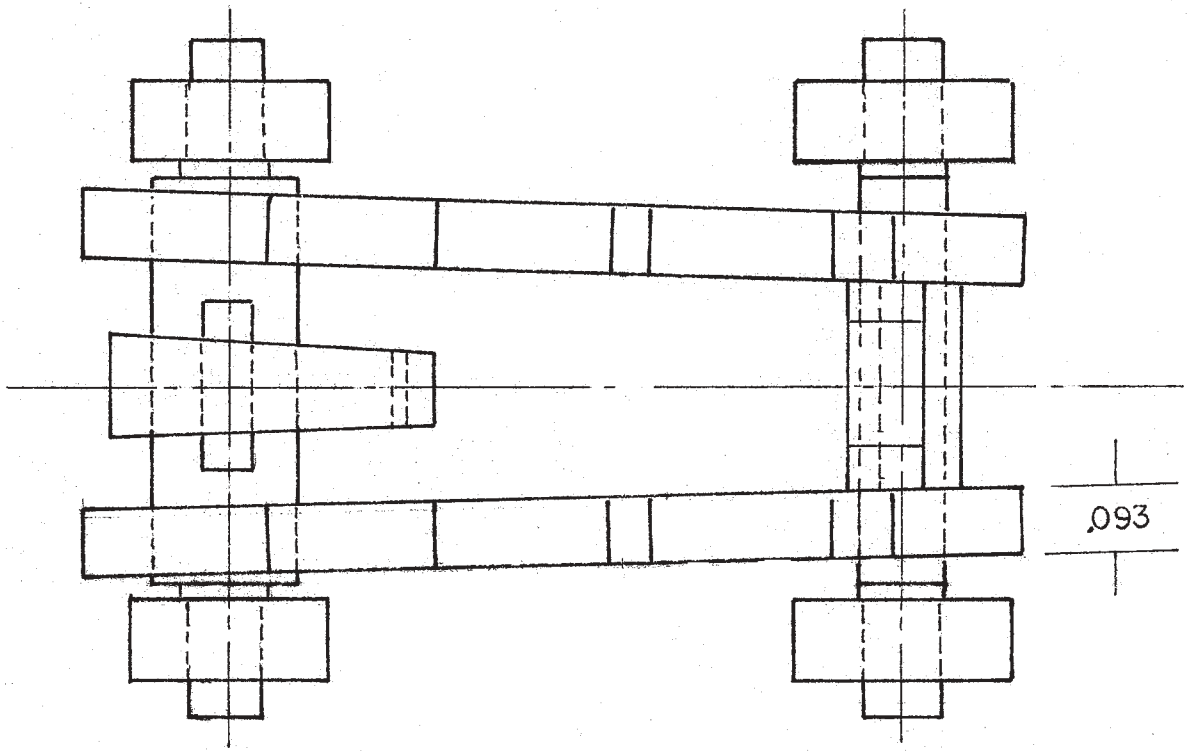
NORWALK, OHIO 44857







6 pd 8'

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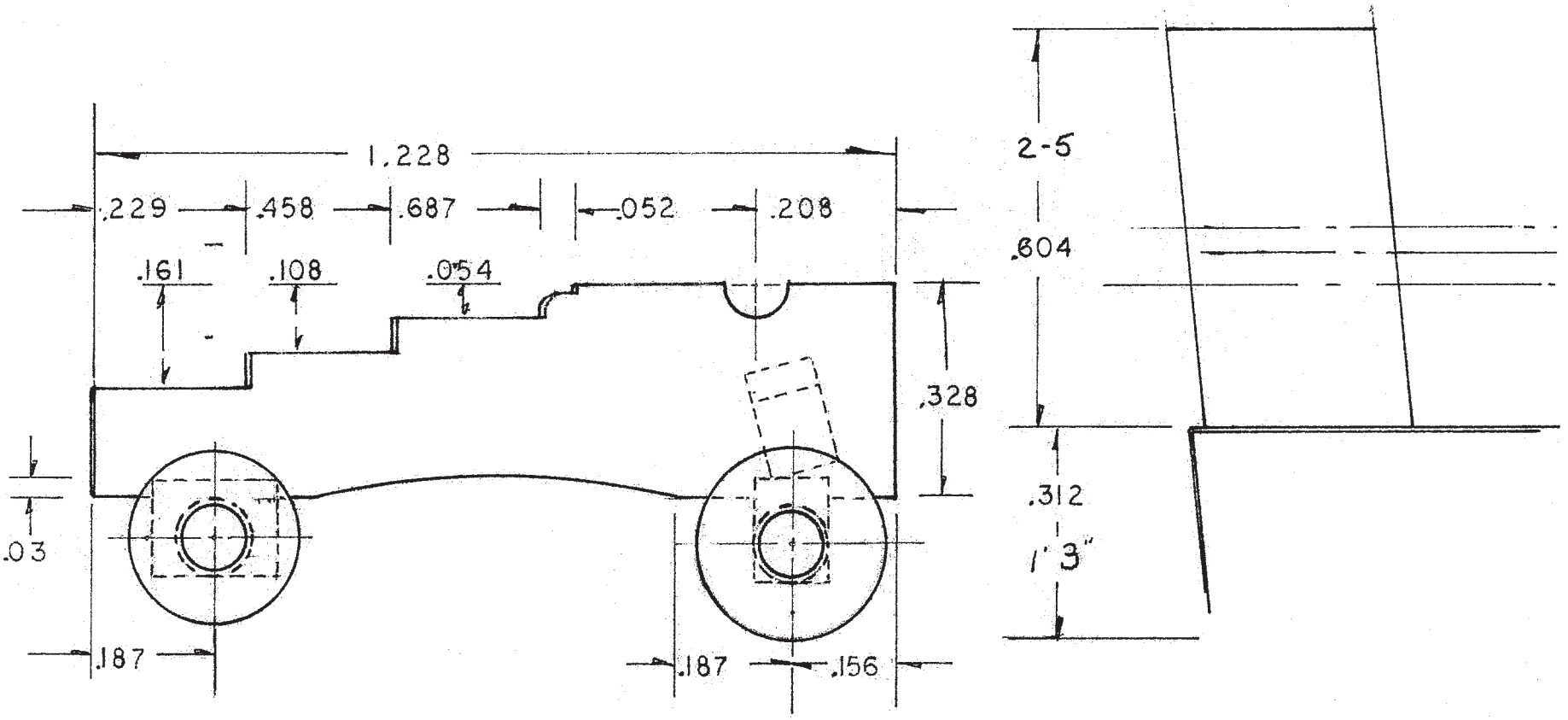
NORWALK, OHIO 44857



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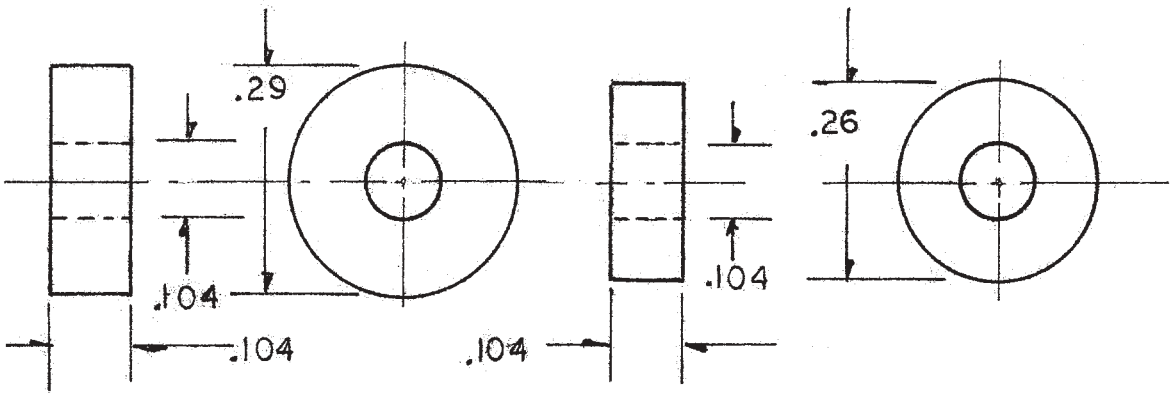

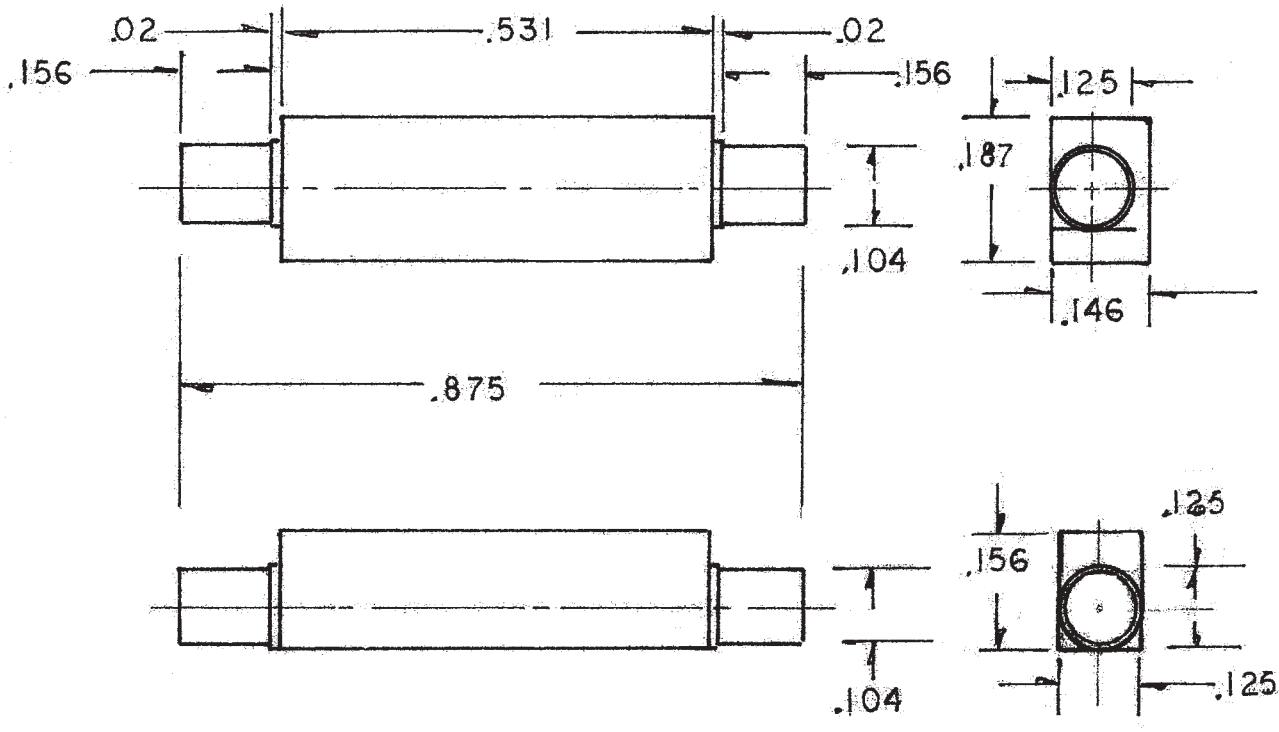

6 pd 8'

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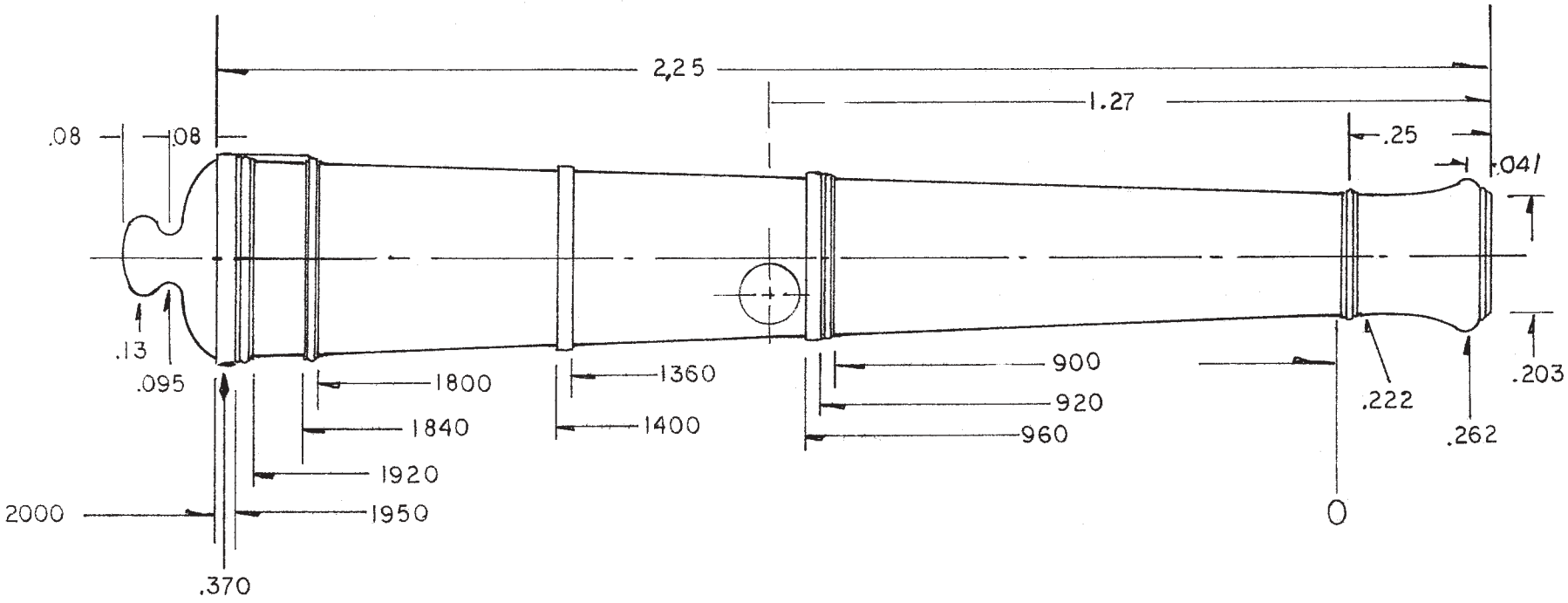
12 PD CANNON

$4\frac{3}{4}$ BORE 098 # 40 DRILL



12 pdr

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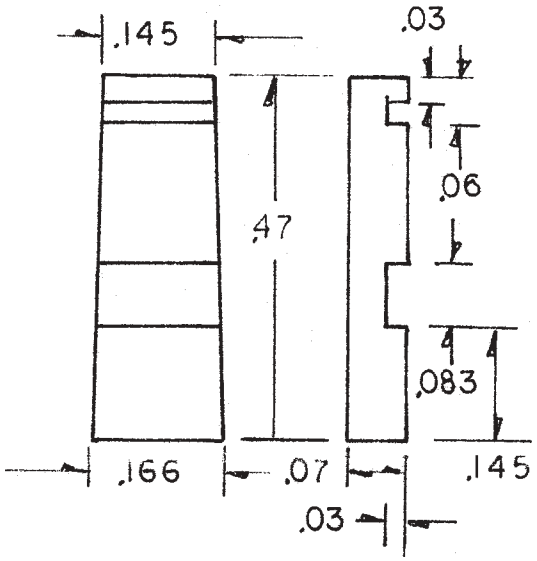

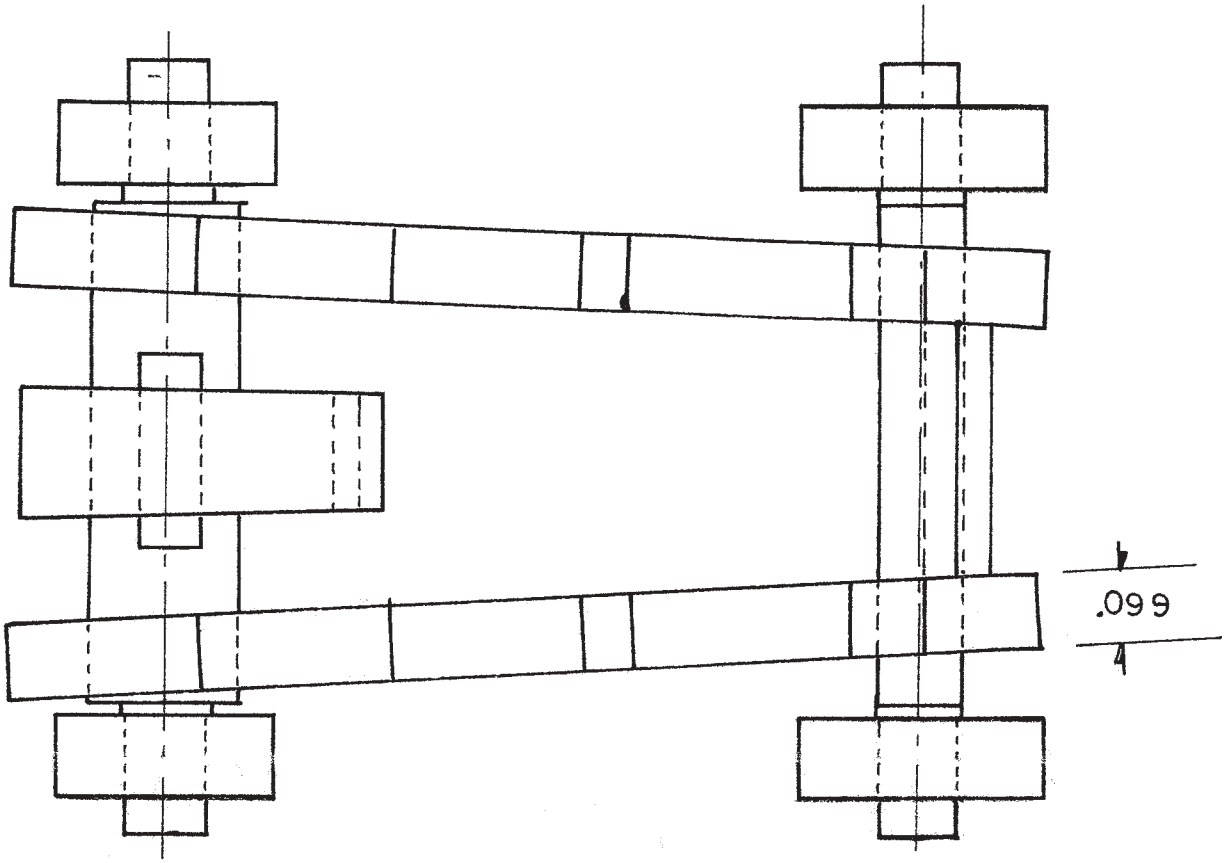

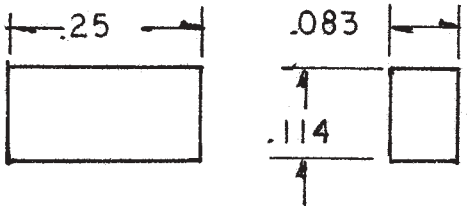

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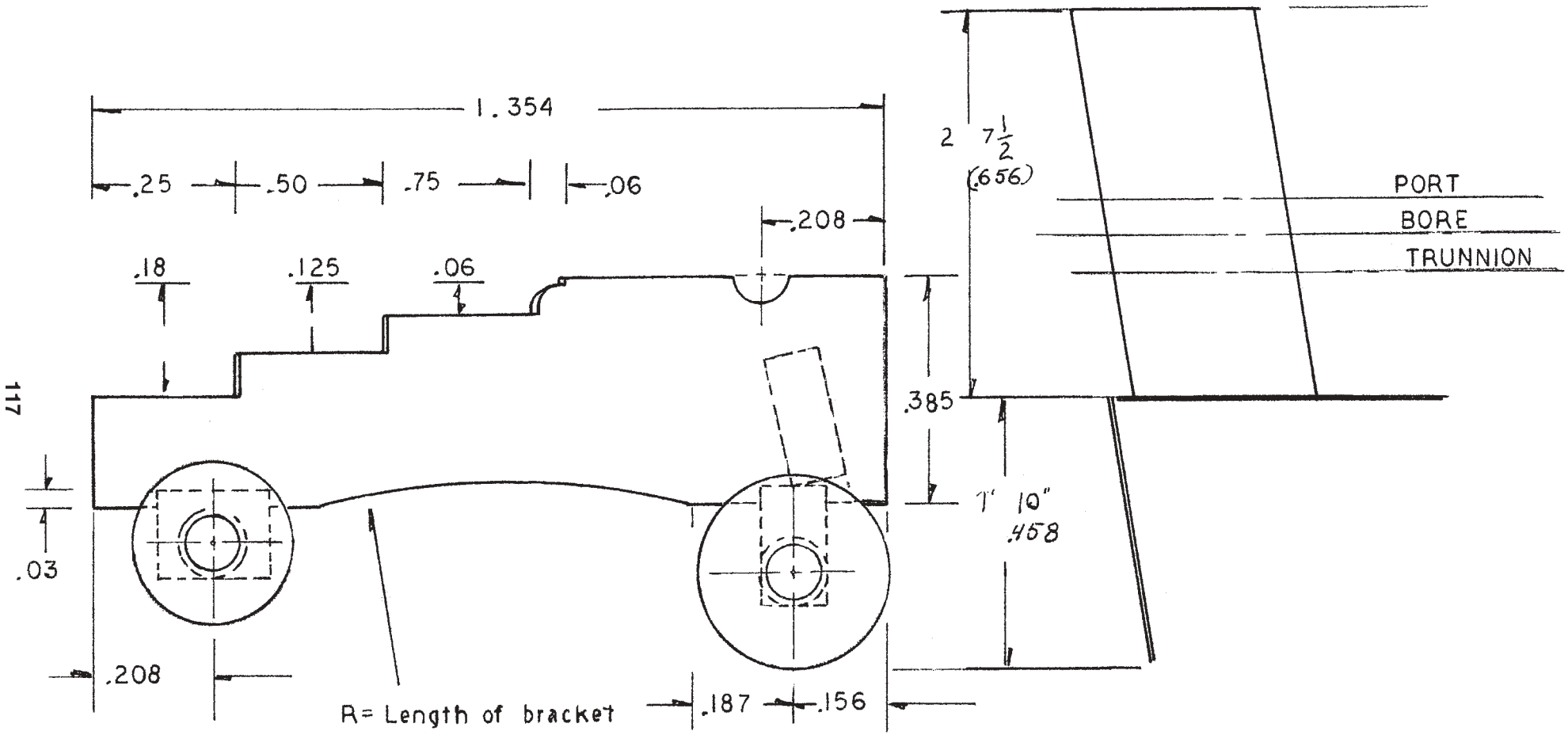

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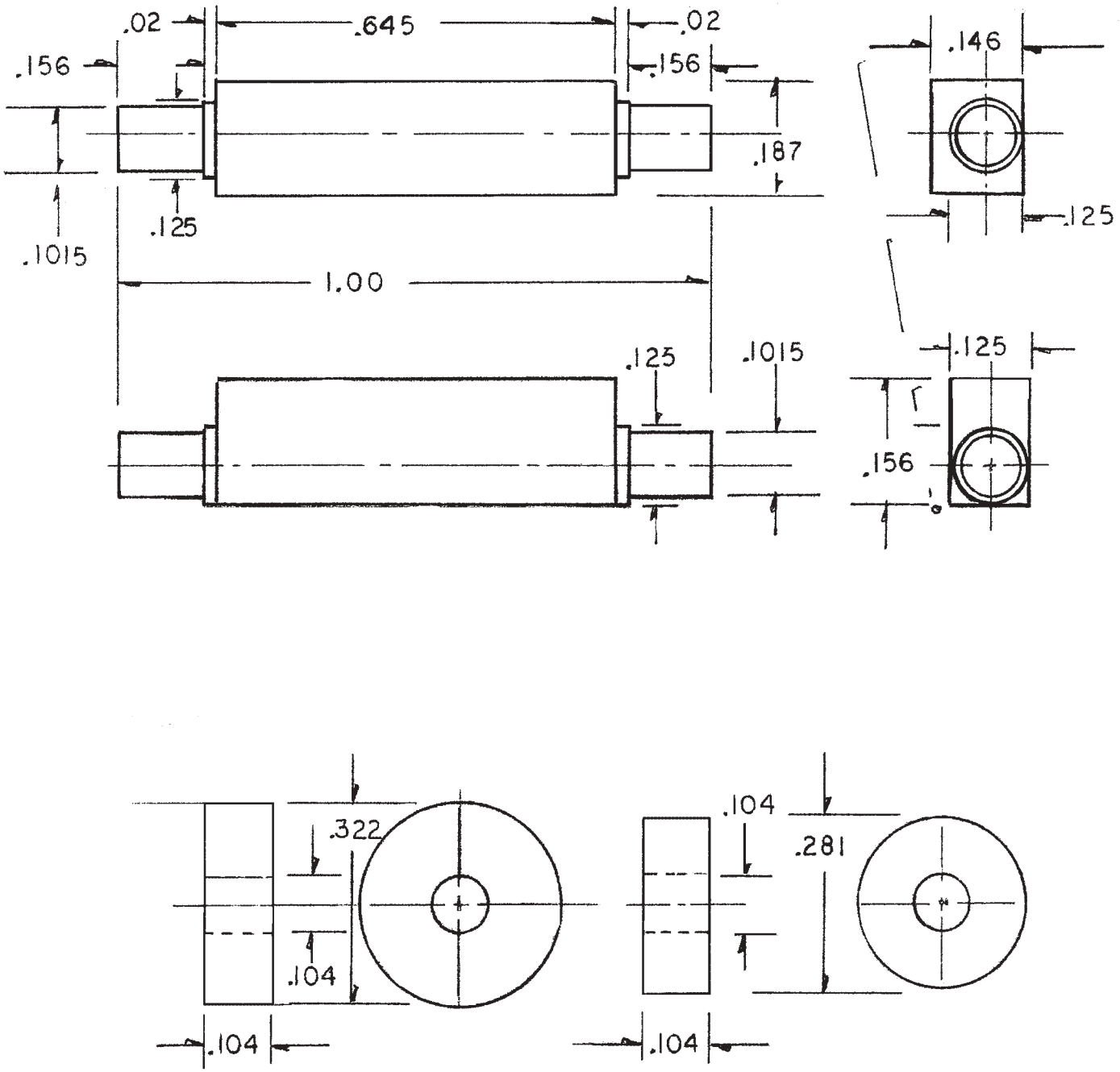

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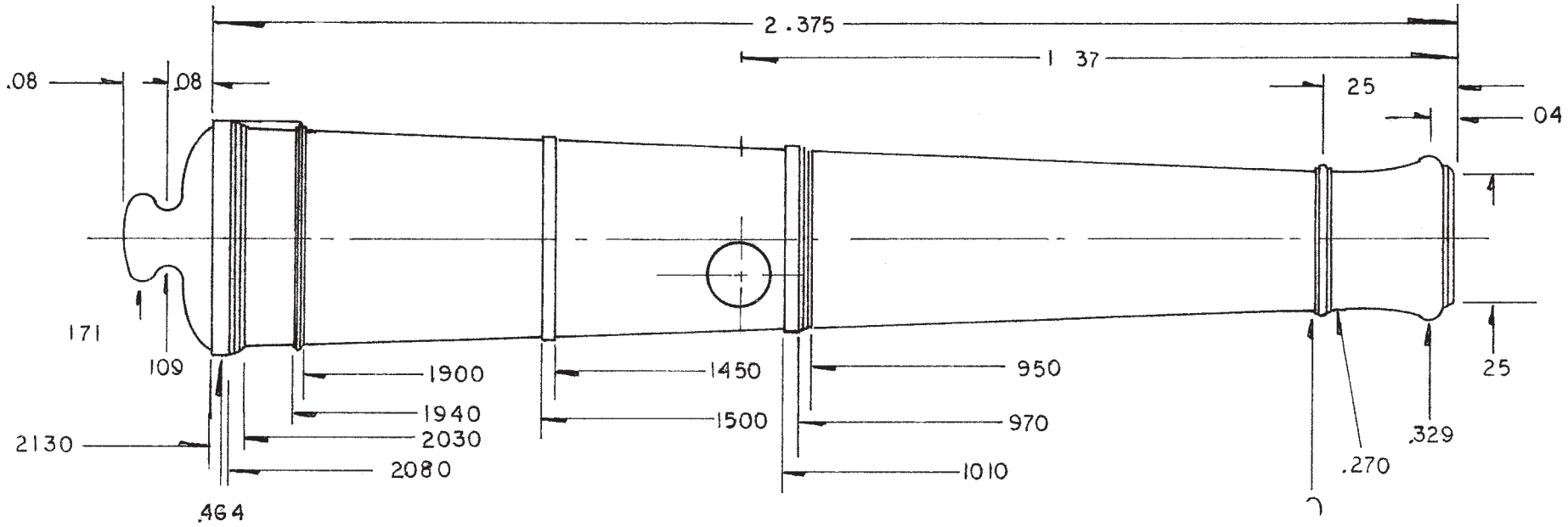
24PD CANNON 5 5/8 BORE .1216 #31 DRILL



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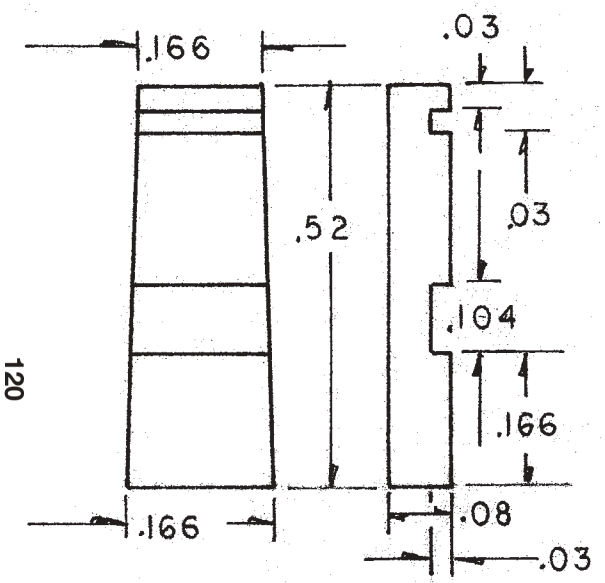

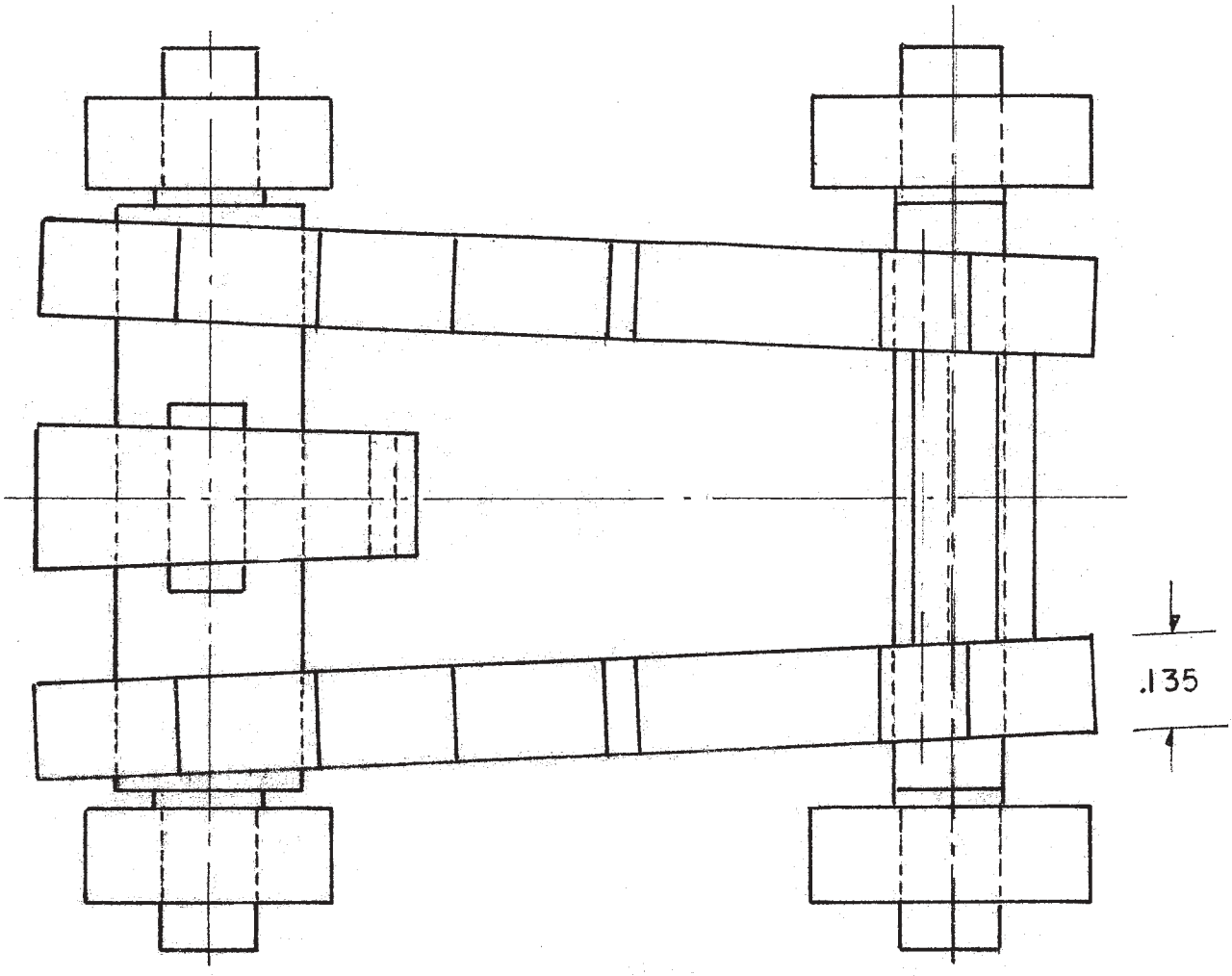

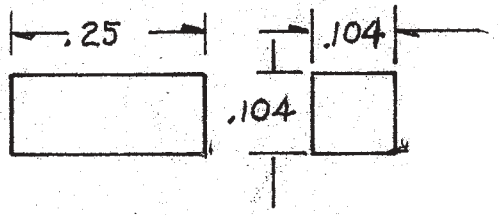

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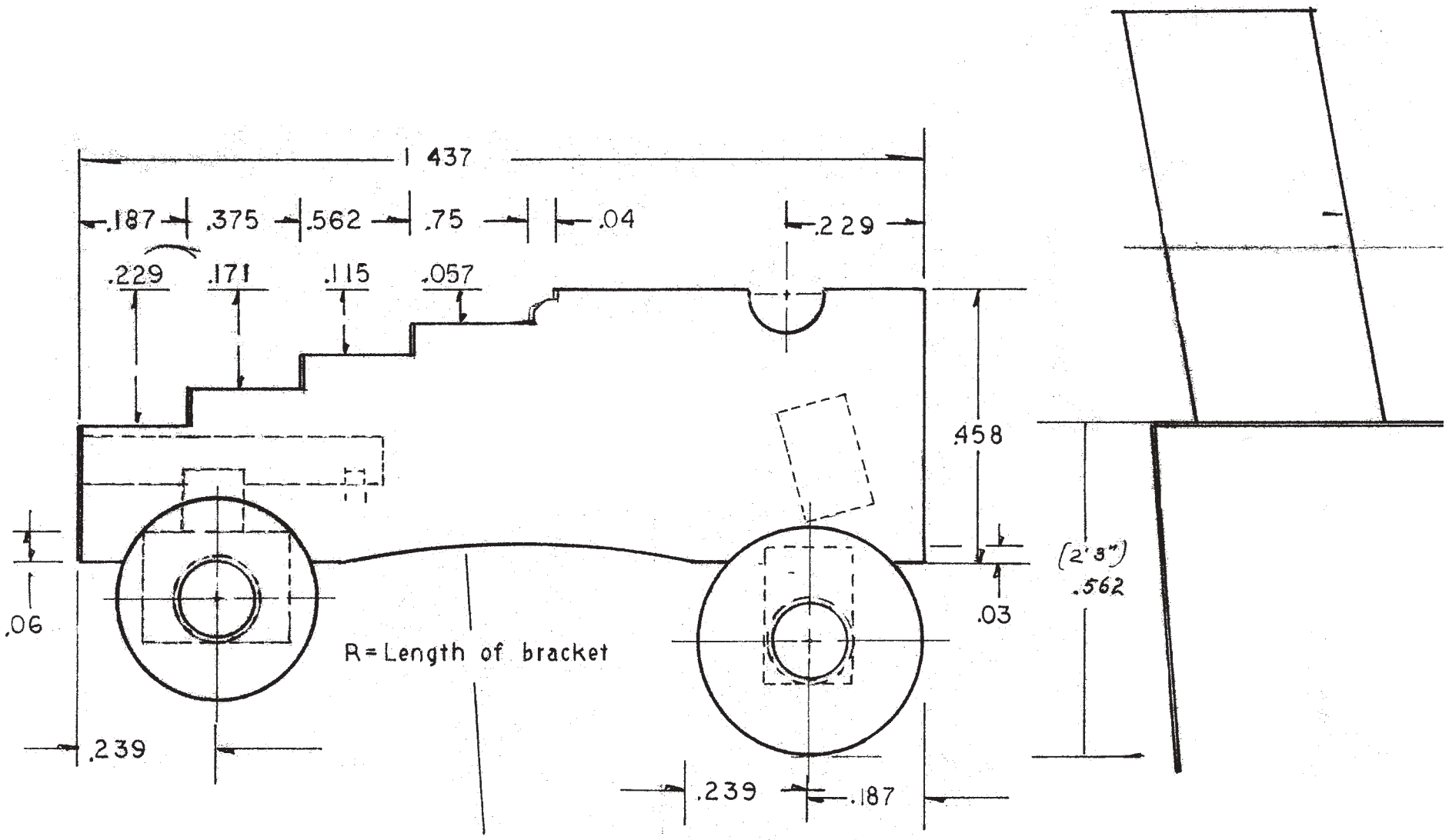

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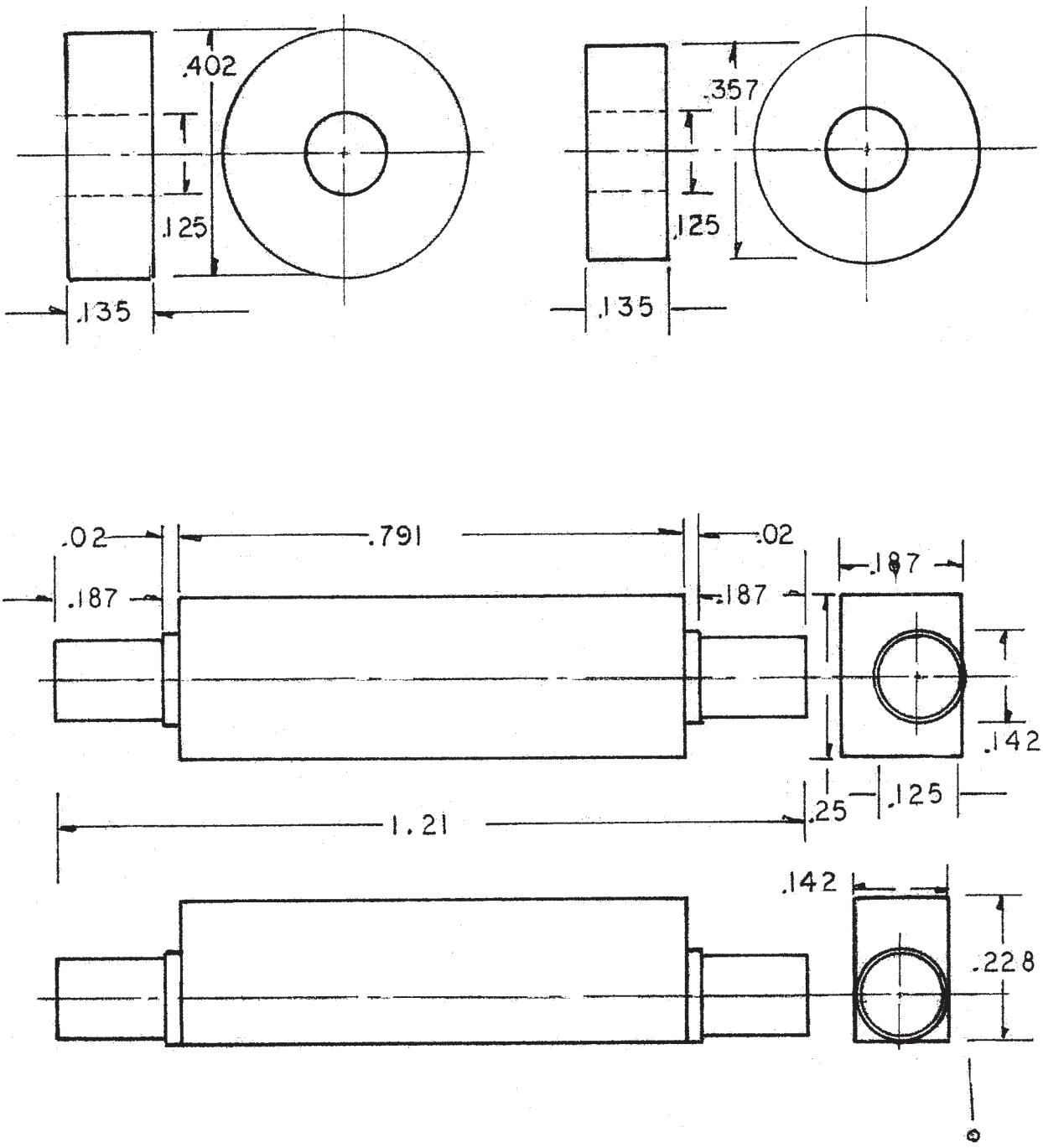

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