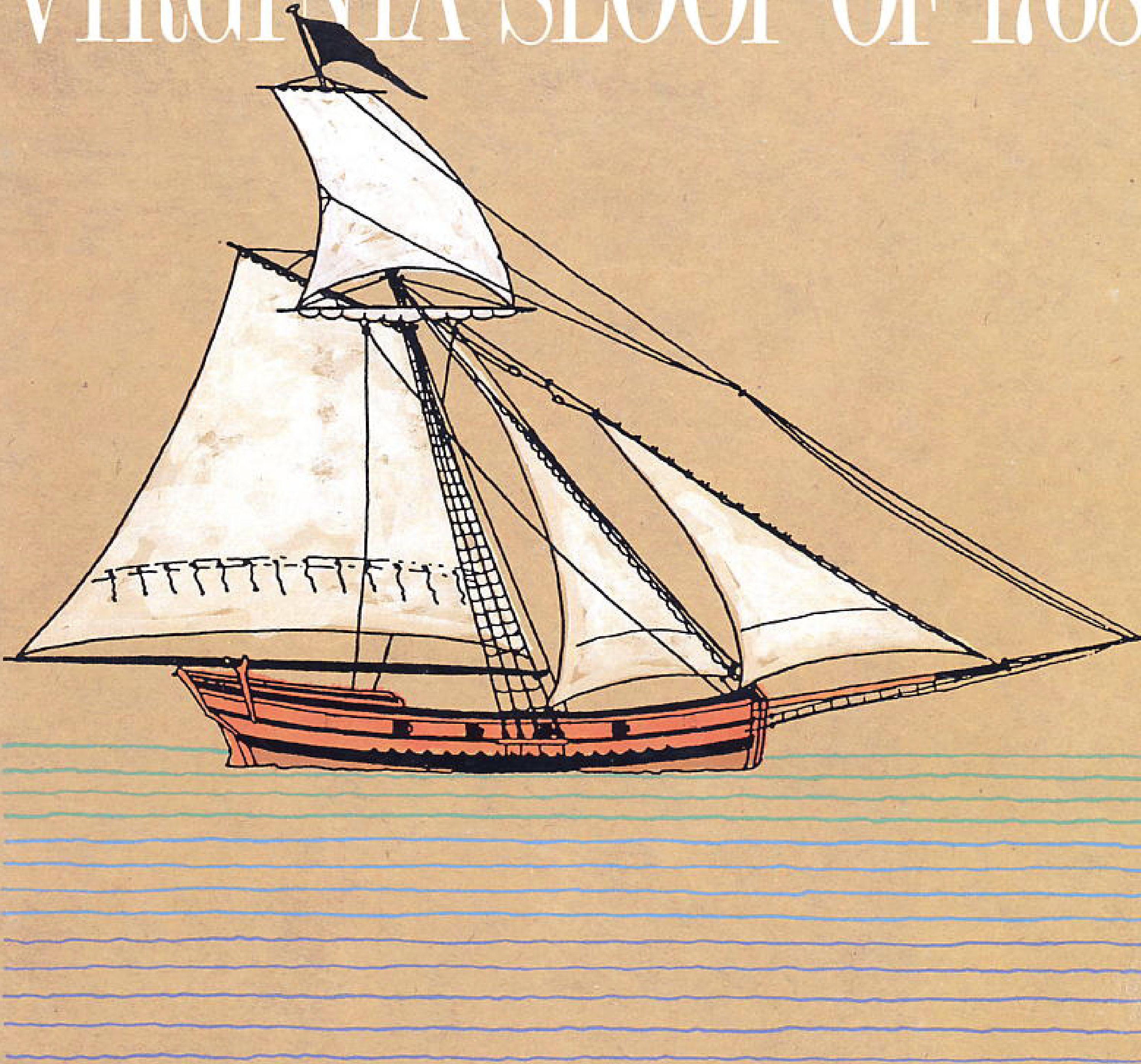
MODELING AN ARMED VIRGINIA SLOOP OF 1768



BY CLAYTON A. FELDMAN

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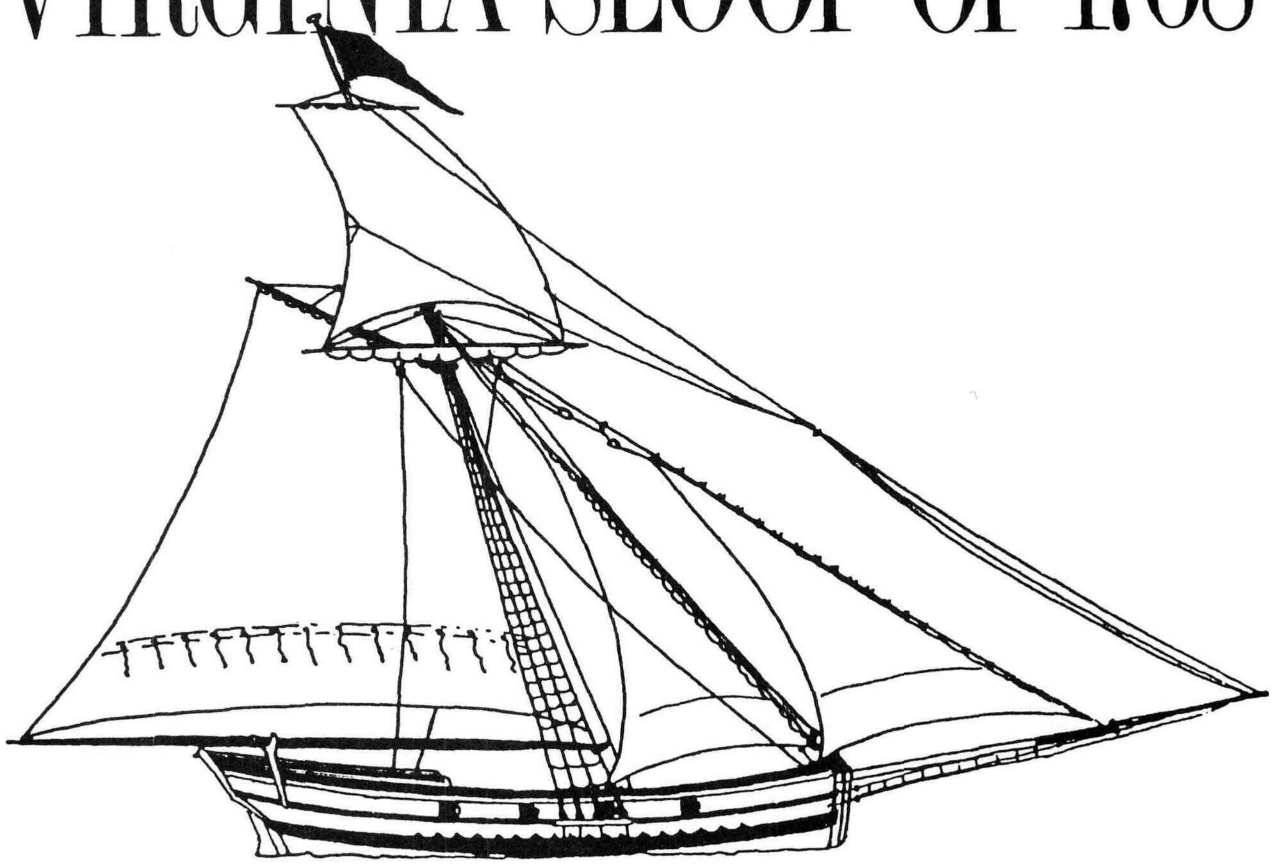

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INTRODUCTION

Several years ago I approached the author with the idea of writing an article for the beginning scratch modeler. He suggested an article on a Virginia sloop. Thus the project started, with the only stipulation being that complete information be included. The finished manuscript, printed in magazine article format, would have taken over three years to publish. Modelers could have built several models before they could have read how to finish this Virginia sloop. The decision was then made to publish a book. And, here it is! Not only does the author take you through the steps of construction, he also has researched and drawn his own set of plans! I know you will enjoy this book and soon have a model of a Virginia sloop to add to your collection.

Jeffrey A. Phillips
Model Ship Builder Editor

"Among the most precious and dependable of our satisfactions (is) the joy of craftsmanship. In that I include all efforts to impose upon the outside world an invention of our own; to embody an idea in what I shall ask your leave to call an artifact. It is not important what form that may take. It is enough that we set out to mold the motley stuff of life into some form of our own choosing; when we do, the performance is itself the wage."

Learned Hand, The Spirit of Liberty, 1957

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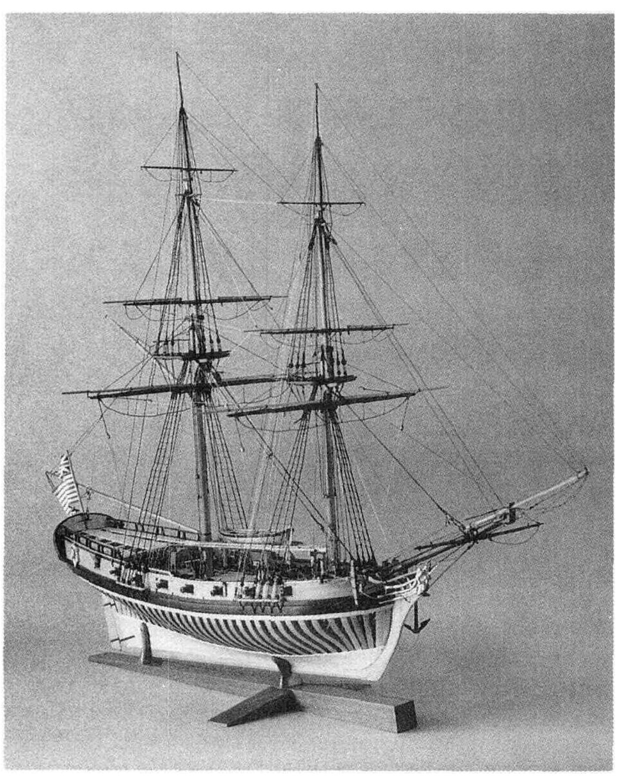
PREFACE

For the advanced modeler, re-creating ships at museum scale, and more or less piece by piece as they were originally built, is probably the pinnacle of the ship modelers art. That process, plank-on-frame ship modeling, is an appealing level towards which to aspire, but not a good place to begin — too complex by far.

For this book I have taken a look backwards into my own education in nautical research and ship modeling. I have put together, in an orderly fashion, all the information I had to acquire to complete my first scratch-built project, the privateer brig FAIR AMERICAN. It's not that the project didn't turn out well — it did — but it took four and a half years of rather intensive labor, both in the workshop and in the library. Only the commitment I had made to record the process for *Model Ship Builder* kept me on track. It would have been easy to fall off and a never get the project done, but the public embarrassment of not finishing would have been greater than the private satisfaction of just doing something else. Anything else!



The author's FAIR AMERICAN model.

My education was not all that long ago, and even now I am not an expert, but rather an intermediate level ship modeler. My intended role in this information transfer is that of a Teaching Assistant; one of those apparently knowledgeable graduate students who helped college undergraduates. It wasn't that they were the ultimate source of the knowledge that they rather unceremoniously passed on, or that their depth and breadth of knowledge was so great, but rather that they had only recently acquired the knowledge themselves, and thus they still remembered what was significant and what could be safely ignored.

This book, then, is the equivalent of my college notes, edited for your use. These notes should be able to guide you through your upper classman years in the College of Nautical Knowledge. I will start with the lecture courses on background, research, library building, and scale and scope of projects. Then I will get into the drafting process and finally progress to the lab courses, during which each student will build a completely rigged model, from the ground up.

The ship I have chosen is an attractive single-masted privateer or smuggler, a Virginia sloop of about 1768. My assumption will be that you spent your first two years of college productively, acquiring good basic craft skills and nautical knowledge, and that you have put together a fairly decent workshop. Furthermore, I will assume that you have built at least a few wooden ship models from kits and that you are drawn to the smaller vessels of 18th century sail.

If I can convince you to read this book and build the model, I think that there is enough generic education in the process to bring you to the point of being able to do the whole thing yourself the next time. You will be able to choose your own contemporary drafts or modern plans and turn them into complete construction plans. By the way, for the experienced scratch-modeler the Virginia sloop would be an ideal sabbatical project, an easy and pleasant interlude between the complex and demanding triple-masted multi-deckers that take so many years of spare time to complete. Well, there have my megalo-and-mono-mania: the Virginia sloop of 1768 by Feldman, the complete project for guide as objective as possible; except in the pre-construction chapters where I'll be dealing with the philosophy of scratch building and the like, all very subjective stuff and all open to discussion if not argument. If this teaching process works, you can thank me later; if it doesn't, blame the professors. I'm only the TA!

THE PHILOSOPHY OF SCRATCH BUILDING

Tangibly related both to the romance of history and the technologic fascination of complex structures, sailing ships have great appeal both in the library and in the workshop. They are a wonderful stimulus to ongoing research and craftsmanship. In a smaller but still remarkably complete fashion, it is possible for the amateur researcher-craftsman to re-create these marvelous constructs with both great fidelity and great aesthetic appeal—the ultimate combination of document and art. The commitment to do so isn't trivial. It requires a lot of time and effort as you know from kit building, but it is extremely satisfying and exciting and well worth it.

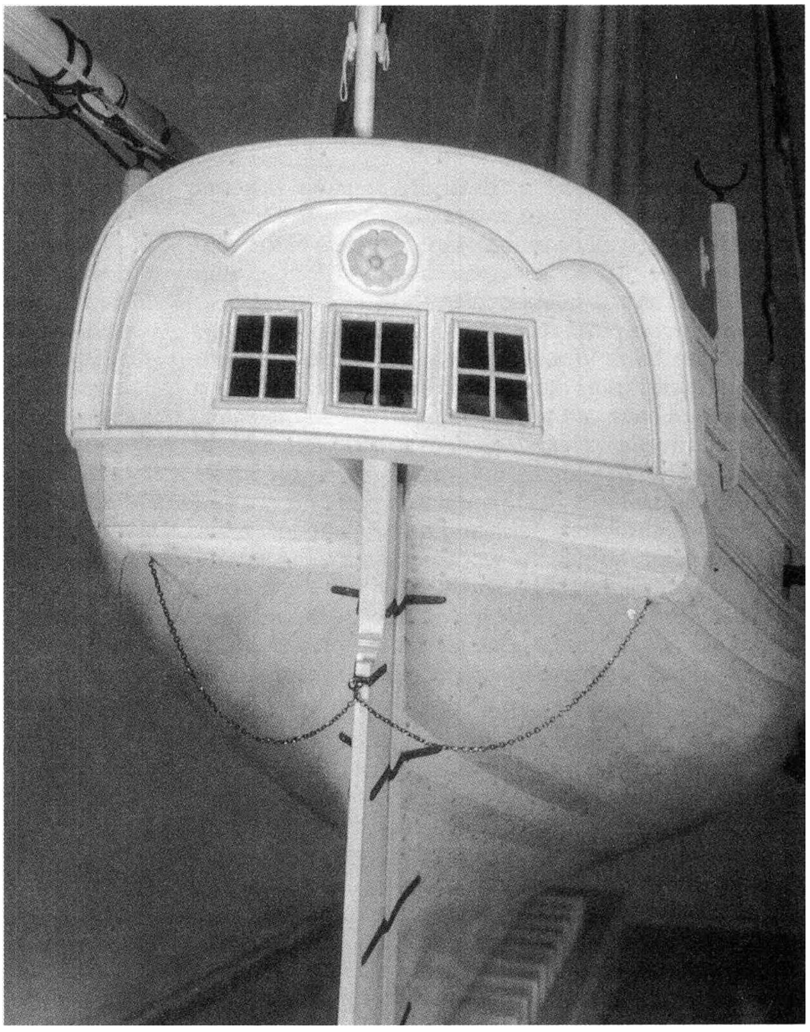
Even beginning with a complete set of plans and very detailed instructions, as I hope to have provided, at least a year-and-a-half's spare time in the workshop will be consumed. Less time will be needed if you use store-bought fittings rather than make them yourself. Still, a great many new techniques not native to kit building will have to be learned. The workshop itself will have to be enlarged, not in space, but rather in equipment. I have been accused of trying to put amateur ship modelers into professional workshops, and perhaps that's true. At least that is a noble goal.

The hand tools of the kit builder (pin vise, jeweler's saw, hobby knife, etc.), while still needed, will join forces with a motorized platoon of a small table saw, a jig saw, a belt/disc sander and a hand grinder. It's not that all the work can't be done with hand tools, it's just that it would take at least twice as long and therefore is not at all practical. The tools need not be purchased all at once up-front, but can be acquired gradually and as particularly needed. Hand tools can always be traded for time. You will determine for yourself in a very short time which power tools will be most used in your own style of model making.

In the practice of learning scratch building, a good deal of frustration will develop and will be overcome as successes surmount less-than-successes. I truly hope that as you progress, the idea of merely pursuing a hobby or pastime will gradually disappear. Blasphemy, you say? Not at all. I can almost guarantee that you will develop a rather pleasant and satisfying feeling that you are involved in a kind of scholarly discipline on the research side and a new, higher level of craftsmanship on the workshop side. In this process, carefully uncovered data is converted into a special kind of three dimensional artful document, one which can be shared with others and with posterity. To do this well, it really is necessary to choose a single era, and probably also to chose a limited number of vessel types, at least if one hopes to ever achieve any significant expertise.

Expertise is defined here as just enough knowledge to know what you don't know and where to look for it. Failing to reach that level of competence dooms one forever to re-inventing the wheel at best and to endless error at worst.

I can't leave the general topic of the philosophy of ship modeling without at least mentioning the inflammatory art-vs-craft argument that so appeals to the ship modeling fraternity. The subject is responsible for many crossed swords. I personally am comfortable with the following definitions: art is the physical expression of feelings or emotions, and it comes symbolically from the spirit if that's not too saccharine for your tastes such as music, poetry, painting, sculpture, literature, theater and so on. Craft, on the other hand, is the physical expression of an idea, a plan, if you will. It comes out of the mind via the hand, such as furniture, woodcarving, architecture, musical instruments and the myriad of artifacts and tools that we need and use in our daily lives. Each has its own language and its own network of participants, and they are almost mutually exclusive. The final products of the effort are displayed and/or sold in different places.



The ship model as art; the stern of Rob Napier's Bermuda Sloop model.
Courtesy of Rob Napier.

for different reasons and for different relative values. The imagination and license required for the one are anathema in the other.

Perhaps rather than craftsmen ship modelers are artisans like the guild members of yore. Artisans tend to get paid for their efforts relative to units of time expended. Artists get paid for more than expended time. If we actually paid those poor devils who tie 900 silk knots per inch into those magnificent Chinese and Persian carpets, they would be among the world's wealthy. I think, therefore, that what we are doing in scratch building ship models is craft and not art, although craft at a level a good deal higher than ordinary. We produce in this endeavor three dimensional historical documents, albeit artful ones. These constructs are indeed beautiful and often inspirational, but their primary purpose is educational and not artistic. The purpose of a ship model is an historical one, linking data from the past to the observer in the future. It is a meaningful responsibility. What it is not is art, at least not in the conventional sense. So, I guess that what I'm finally saying is that if you love ships and the sea and want to be an artist, paint a picture of a ship! Having said that, I am willing to back off just a bit.

At a past Nautical Research Guild meeting, Michael Wall, a prominent ship model gallery owner, made an interesting point. He said that collectors are finally beginning to acquire ship models and that they are collecting the work of particular modelers. Collecting the work of a single producer, he points out, is one of the hallmarks of art collecting. When buyers want the work of one individual rather than what is necessarily the best academic reproduction of the subject, they are buying art, not craft or documentation. Maybe I'll have to rethink my position.

SCALE AND SCOPE

Small ships in large scale is the general theme of the process in which the beginning scratch builder can most easily become involved in scratch building. Even competent, longstanding workshop enthusiasts will be initially uncomfortable at building small copies of large objects. Although one must put in more detail at larger scales, the actual construction of the parts is easier. The building process becomes more like the full size process and the work proceeds with greater comfort.

At 3/8" scale, three-eighths of an inch in the model represents one foot in the full sized ship. This scale is also properly known as 1:32, as each unit of linear measure, whether an inch, a foot or a yard, is 32 times smaller on the model than on the ship. This ratio, by the way, can be developed from any scale given in fractional inches, by multiplying the fraction's denominator by twelve and reducing the resulting new fraction. Thus 1/4" scale is 1:48, 3/16" scale is 1:64, 1/8" scale is 1:96, etc. It must be noted that 3/8" scale is not 3/8 scale. The latter model, of a hundred foot long ship, would be 37 $^1/_2$"long, while the former is a more manageable 37 $^1/_2$".

A nice workshop benefit of 1:32 projects is ease of transferring the dimensions from the original to the model, as one inch on the full size ship is 1/32" on the model, a very easy unit to work with. The drawback to 1:32 is the finished size of the model, the major workshop reason for choosing small vessels to model. Even so small a vessel as the 42 ton Virginia sloop, with its over all length from main boom end to jib boom tip of only 125', produces a model 47" long. For the ease of construction of a first scratch modeling project, however, it's well worth its space.

If one has an absolute problem with either construction or display space, there are two options: one is to build the model with the topmast housed (lowered in place) and the jib boom run in; this reduces the overall dimensions for the case about one third. The other option is to reduce the scale. Both the plans and the construction techniques presented here lend themselves well to smaller scales. The standard museum scale of 1:48 will bring the model down to a more manageable 31 $^1/_2$" overall and still permit much of the ease of construction that the larger scale makes possible.

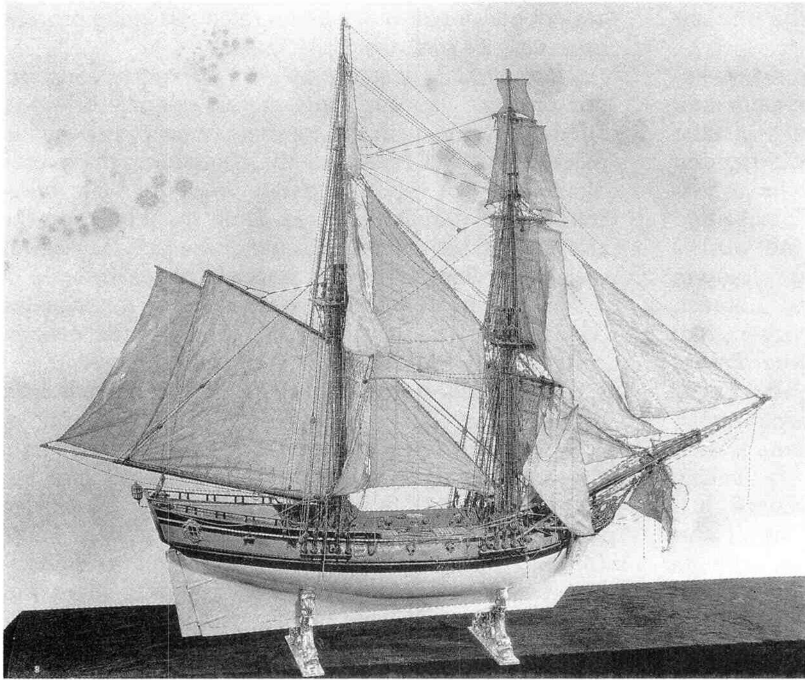
The smallest scale that the new scratch builder probably can successfully work in is 3/16" = 1" or 1:64, half the size of the model described in this book. Any smaller and one needs to be a miniaturist. Besides, it's probably true that special hand-eye skills are needed to successfully model in the miniature scales, 1:128 (3/32" = 1'), 1:192(1/16" = 1') and even smaller. For the gifted few, it is a reasonable alternative. Just remember on behalf of your future viewers that a single Faberge is endlessly fascinating, while a room full of them is tedious.

The patterns in this book are full size at 1:32 scale. They can be easily photocopied and reduced to any smaller scale should that be desired. The profile former that supports the bulkhead formers will have to be enlarged from the plans, but there is no need to enlarge the entire plan set, as most dimensions are given both in full-size dimensions and at 1:32 reduction in the text and the accompanying tables. For the few odd bits not so given, a scale and a home-made single ratio proportional divider will be all that is needed. For those who would like the ease of working from a full-size plans set, one is available and sold separately from this book. If you do go to a smaller scale, be sure and reduce all the dimensions given in the text proportionately. First calculate the ratio of your chosen scale to the given scale of 3/8" = 1' (e.g., for 3/16" = 1' the ratio is .5). Then, with calculator in hand, multiply each given dimension by that decimal. Cross out the existing numbers and write in the new ones right above them, doing one section at a time as you go along.

STYLE

If compromise is the answer, what is the question? Well, in ship modeling the question is a compound one. First, "How does one properly represent the study vessel in miniature?" and then "What style shall I build in?" The answers to the two parts of this question do not necessarily coincide. It is much more complex an issue than it seems at first glance, as simple representational craftsmanship is no more common among ship modelers than is simple representational painting among artists. Ship modeling includes such diverse styles as admiralty modeling and various modifications of plank-on-frame, block or lift models, builders' half-models, miniatures, decorative models and probably quite a few others. The basic problem (and the least controversial part of the process) is to reduce a subject ship in size. Even this is much more of a problem than it seems.

If it were possible to view the Virginia sloop in life and to see the entire ship in even the relatively small, sharp-focusing arc of our field of vision, we would have to stand back at least two hundred feet. At that distance,



The Rogers' Collection FAIR AMERICAN model.
Courtesy *of the United States Naval Academy* Museum.

even through the minimal atmospheric haze of a clear, clean-air colonial day, we certainly would not see much detail. We definitely wouldn't see treenails, which we modelers are all so fond of displaying. We couldn't tell much about the run of the rigging. We couldn't see the panels in the sails (much less the stitching). All the brilliant colors of the paint scheme (if the builders had been so extravagant as to use brilliant colors) would be grayed by the distance.

What's a modeler to do? Compromise, of course. Compromise certainly does not mean reduced standards, but rather the necessity of modifying the laws of optics with just a touch of artistic license. It should be pointed out that there is a school of modeling which attempts not to compromise these laws. It includes dioramists and builders of weathered vessels, all of whom endeavor to reproduce the worn, stained and apparently distant vessels as they would have appeared to the contemporary human eye.

Most modelers, however, have opted for one of the modeling styles that permit re-creation of the prototypic vessel as it might have looked as it just came off the stocks and only then if it had been built perfectly. To make matters even more complicated, modelers tend to reproduce as much of the small detail of the original ship as possible, making it much more visible than would have been possible in real life. When competing with real life, ship modelers certainly seem to have minds of their own!

The second part of the question posed above deals with style. Historically, there were only two or three modeling styles in use in 18th century England: the formal admiralty models built for the Navy Board as visualization aids, block models built as mementos of profit or encounter, and decorative models often built by prisoners of war to pass the time and earn a bit of cash.

Admiralty models were probably built by teams of craftsmen, each with a specialty. They generally were not rigged, had a natural wood finish, were made of boxwood, and had a special, stylized alternating-overlapping futtock construction. Examples can be found in virtually all maritime museums in America and Britain. Block models, as the name implies, were carved from a solid wood block and were generally rigged. The best known example in America is the United States Naval Academy model of the privateer brig FAIR AMERICAN, from the Rogers' Collection. The prisoner of war models were often made of bone, with hair rigging, and were generally not to scale. They were quite beautiful as works of art.

The modern history of ship modeling in America evolved in tandem with the growth and publication of do-it-yourself magazines in the early 20th century. The home mechanic of this era began his metamorphosis into the home craftsman of today with the aid of these magazines. As leisure time expanded, hobby projects began to supplement purely utilitarian ones. Modeling articles were frequently featured in these magazines, and those by Capt. E. Armitage McCann in *Popular Science were* especially popular. Ship modeling companies began to appear about fifty years ago, mostly producing solid hull kits of famous ships.

The greatest impetus to scratch building in America came from the massive data base assembled by Howard I. Chapelle, naval architect, curator, historian and author. His data base was collected largely because of his responsibility for the development of a significant and representative American history collection of ship models for the Smithsonian. This resulted in a magnificent accumulation of drafts and interpretative text sufficient to fill several books, the most important of which from the point of view of this present project is *The Search for Speed Under Sail.* Each of the Chapelle plans is worthy of a model and each draft can be converted into a construction plan by the method described here without great difficulty.

Chapelle helped develop a set of standards of quality and craftsmanship through the contracts he let for the Smithsonian collection. This resulted in a "Smithsonian style"—extremely accurate in dimension, devoid of visible fastenings, subdued in coloring and ruthlessly pruned of any evidence of the hand of the craftsman. Chapelle had very clear ideas of which ships should and which ships should not be modeled, whether the craftsman should do any significant research at all, and how much reconstruction was permissible. He made his views well known in the pages of the *Nautical Research Journal*, some of which are reprinted in the Nautical Research Guild's Ship *Modeler's Shop Notes* and are well worth reading.

Chapelle seemed to have been astonished at the stubborn insistence of the ship modeling fraternity to do things their own way, both in style and in substance. This is a bit ironic as his work is often used as a starting point and reference marker for modelers. The phrases "Now, Chapelle says..." and "but I decided..." are often seen in conjunction in the ship modeling literature, probably causing him to be in an eternal spin in his sea chest. Scratch builders are a stubborn lot, stiff necked and iconoclastic, each with his own clear and individualized approach to modeling. As you will no doubt *realize* as you read further, one doesn't have to be an expert to be both opinionated and stubborn. It all comes from spending too much time alone in the workshop; modelers probably get a bit de-socialized!

The style proposed here for the Virginia sloop model is in itself a compromise. As mentioned earlier, even though plank-on-frame modeling is ultimately more satisfying, it's just too much work for a first try at scratch building. The first timer's greatest risk is burn out; that insidious disease caused by under-estimating the work and time involved in completing an inherently complex project. Accumulated frustration results in an incomplete model, together with a shift to another pastime, as we usually escape to our workshops to avoid frustration.

To keep interest high in this first venture, the hull should go together quickly and easily. Having a visible skeleton upon which to hang detail is a great stimulus to continuing progress and enthusiasm. A bare plank-on-frame hull will itself take a year of spare time to build. We can do much better with the simpler construction technique described here. Using a modification of the plank-on-bulkhead skills already learned in kit modeling, the Virginia sloop will take shape rapidly and in an already familiar construction format. The process is an easy introduction to some of the skills of plank-on-frame building. The skeleton of the hull will be built of bulkhead formers notched into a profile former and will be essentially self-aligning.

Unlike kits with their cost saving, widely spaced formers stamped from thin ply stock necessitating double planking, the plans presented here show 20 bulkhead-style formers. The real ship would have had approximately the same number of double frames. (Whether or not small 18th century vessels actually had the full number of conventional double frames is still under investigation by underwater archaeologists; more later.) The formers are the same thickness as scale double frames and are beveled in the same fashion, but just on the outer surface. Having closely spaced frame equivalents, the hull can be planked with scale thickness timber, just like the P-O-F models. The planking and decking will also be with scale length timber and fastened with (unobtrusive) scale diameter treenails. Sparring and rigging will be by conventional methods, explained in devilishly great detail as the project progresses.

The final consideration in the general area of style is the degree of scratch one wants to adhere to. What does that awkward little term mean? Well, most competitions and galleries divide ship models into three basic groups, depending upon how much of the model was actually built from raw materials, as contrasted with purchased parts. The classes are:

A. Entirely scratch built (still permits a few purchased items, such as line, belaying pins, chain).

B. Largely scratch built (may include purchased blocks, wheels, anchors, deadeyes, cannon, etc.).

C. *Kit* built, (generally heavily modified or bashed).

For the purposes of this project, we are only concerned with classes A and B. All the necessary information for completely scratch building the Virginia sloop of 1768 will be given, but if time and/or temperament requires the purchase of the odd bit here and there, the indiscretion will be forgiven.

A PERSONAL RESEARCH LIBRARY

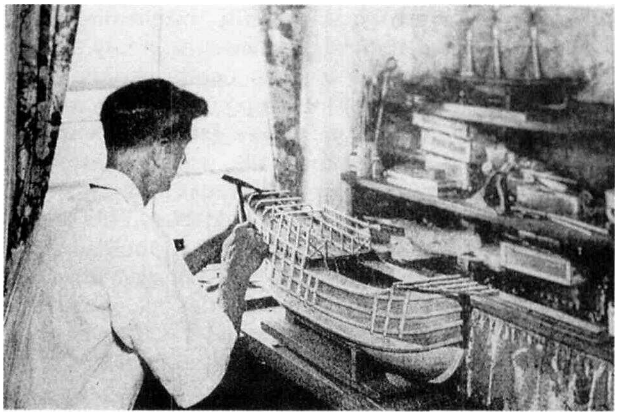
The problem confronting beginning and intermediate ship modelers is quite straight forward: for both, the major pitfall is error compounding error. Increasing awareness of this negative process tends to be followed by frustration, wheel-spinning attempts at ongoing correction and finally exasperation and dropping-out. The problem often results from the limited availability of readily accessible guidance. This in turn leads to poor choice of subjects for modeling and a rather random, undirected library building. Without at least a purpose-built library (and better yet, some form of mentoring), failure to understand the limits of one's personal knowledge rapidly puts the modeler into the unfortunate state described above, precluding accurate and effective work.

What then can be done to prevent such talent-wasting scenarios from developing? If one could control the entry point into ship modeling for the beginner, the job would be relatively easy. One would select a simple, quality kit—a sloop or schooner from a good manufacturer and one book, probably George Campbell's *A Neophyte Ship Modeler's Jackstay,* as the starting package. This would permit the beginner to get the look and feel of the hobby with a bit of guidance and see if it appealed to him. If it did, he would then be encouraged to purchase a bit more advanced kit, together with a small library consisting of (in this author's opinion) one book and two articles. The book is the Merritt Edson edited Ship *Modeler's Shop Notes;* in it are excellent chapters on research and ship selection for modeling as well as innumerable articles on construction, tools and processes.

The two recommended articles are Charles O. McDonald's "Books as a Key to Modeling Success" *(Nautical Research Journal,* Vol.31, No. l, pp 17-36) and Peter Sorlien's article "Before the Chips Fly, A Few Thoughts to Guide the New Ship Modeler" *(Scale Woodcraft,* No. 6, 1986, pp 23-29). The first article is a master book collector's personal guide to library building for ship modeling and nautical research. It philosophically suggests that the library builder is well-served by sticking to one general era and not many different types of vessels and by rather ruthlessly limiting his library to that era and type. The second article is a general introduction and guide to the selection of kits, the understanding of the basic research process and the general philosophy of proper ship modeling.

This second ship modeling project and its associated library expansion would start the process of converting the hobbyist into a sort of scholar craftsman. From here on, or perhaps after a couple of more kit models, it would be all library building and scratch modeling, with the personal library being the primary source for the basic research.

It should be noted that the library suggestions above and those to follow form a basic library only for mid-to-late 18th century small and medium-sized Anglo-American vessels, which is my personal area of interest. Other times and places require different libraries and a bit of research before beginning book purchases. One must *realize* that much of the information for these smaller vessels is interpreted and derived from the primary source material for larger vessels, expanding the library somewhat beyond that which seems ruthlessly related to the small vessels themselves. In any event, here I go with the ruthless TWO BOOK library:



Captain E. Armitage McCann at his workbench.

1. Chapelle, Howard I., *The Search for Speed Under Sail,* W.W. Norton Co. Inc., New York, 1983.
2. Petrejus, E.W., *Building the Brig-of-War Irene.* De Esch, Holland, 1970.

Outrageous, you say? Not at all. At least half of all the interesting smaller American vessels of the era are found well-drawn and described in this particular Chapelle work. They are interesting because they were fast and therefore were used in interesting applications, mostly as privateers and smugglers. Although Chapelle's text is almost totally undocumented, a sin for which he has come under revisionist historian attack recently, he is extremely detailed, generally authoritative, a marvelous draftsman and a most adequate source of information gathering basic research. Serious research, however, can never end with Chapelle.

The Petrejus book is practically a single volume encyclopedia. It contains historical research, magnificent engravings and prints, contemporary construction techniques, rigging and fitting data, spar tables and very detailed modeling techniques all in one. Applied specifically to the modeling of a Dutch revision of an early nineteenth century English brig, it applies quite generally to the aforementioned era and type and is a good source for further library research.

Then, The Complete (almost) Two Foot Library: A fairly complete plans source, historical database, and modern and contemporary practices reference library can be had by the addition of another fifteen books to those previously described. Carefully placed notes about the house prior to birthdays and holidays can greatly assist in the speed of acquisition. The books are:

1. Steel, David, *Elements of Mastmaking, Sailmaking and Rigging,* (1794), Sweetman Reprint, Largo, FL, 1983.
2. Lever, D'arcy, *The Young Sea Officer's Sheet Anchor,* (1819), Sweetman Reprint, NY, NY, 1963.
3. Steel, David, *The Elements and Practice of Naval Architecture,* 1805. Sim Comfort Reprint, London, 1977.
4. Chapman, F.H., *Architectura Navalis Mercatoria, 1768,* Sweetman Reprint, NY, NY, 1967.
5. Gill, Claude S. (editor), *The Old Wooden Walls: Their Construction, Equipment, etc.* This is an abridged edition of FALCONER'S Celebrated Marine Dictionary. W&G Foyle, Ltd., London, 1930.
6. Millar, John F., *Early American Ships,* Thirteen Colonies Press, Williamsburg, VA, 1986.
7. Chapelle, Howard I., *The History of the American Sailing Navy,* W.W. Norton Co. Inc., NY, NY, 1949.
8. Chapelle, Howard I., *The History of American Sailing Ships,* W.W. Norton Co. Inc., NY, NY 1935.
9. MacGregor, David R., *Fast Sailing Ships,* Naval Institute Press, Annapolis, MD, 1988.
10. MacGregor, David R., *Merchant Sailing Ships, 1775-1815,* Argus Books, Ltd., Watford, Herts, England, 1980.
11. Lees, James, *The Masting and Rigging of English Ships of War, 1625-1860,* Naval Institute Press, Annapolis, MD, 1984.
12. Goodwin, Peter, *The English Man of War, 1650-1850,* Naval Institute Press, Annapolis, MD, 1987.
13. Lavery, Brian, *The Arming and Fitting of English Ships of War, 1600-1815,* Naval Institute Press, Annapolis, MD, 1987.
14. Harland, John and Meyers, Mark, Seamanship in *the Age of Sail,* Naval Institute Press, Annapolis, MD 1985.
15. Howard, Dr. Frank, *Sailing Ships of War 1400-1860,* Mayflower Books, NY, NY, 1979.
16. Edson, Merritt, A (ed.), Ship *Modelers Shop Notes,* Nautical Research Guild, Bethesda, MD, 1979.
17. Campbell, George, *Neophyte Ship Modelers Jackstay,* Model Shipways, Bogota, NJ, 1979.

Some of these books are still in print or in reprint editions. The Gill Falconer, or one of the other Falconer reprints, will have to be sought out in a nautical used book store. Lacking rich and generous relatives, one may have to find a library for accessing Steel's *Naval Architecture.* Out-of-print books may be found through specialty book dealers or public libraries.

With these volumes added to your historical research and plans sources, you complete the basic documentation of American naval and private vessels. The two additional books from Chapelle contain extensive historical and naval architectural data and scores of the best drafts of American vessels ever drawn. The Chapman book is the single most valuable collection of contemporary plans, unfortunately few of which could be considered American. They are, however, essentially generic types, divided by nautical design and use, by (European) nation of origin and by size. Chapman also has nice sail plan drawings. An enjoyable American vessels scrapbook, the Millar book, has over two hundred copied and/or reconstructed drawings of colonial and Revolutionary era American vessels available for perusal, together with brief historical summaries of the lives of the vessels. It is often a good place to begin one's search for a choice of modeling projects. The two MacGregor contributions are the scholarly delineation of the English side of our era's smaller vessels as the Chapelle works are for the American side. To these books must be added the basic primary contemporary sources on rigging and spar-making (Steel and Lever), the general mini-encyclopedia of 18th century naval architecture (Falconer), and the not-to-be-done-without (but expensive) Steel's *Naval Architecture,* the only primary source available for actual dimensions and scantlings (the size of the smaller timbers) for the smaller vessels. This latter listing is actually a pair of books, the reference book itself and a magnificent over-size folio of large scale engravings of interesting ships of the era.

The modern standard compendium of masting and rigging is Lee's book, that for construction is Goodwin's and for fittings, Lavery. The Harland-Meyers book provides a great many otherwise missing details by both describing and sketching a great many processes showing how the ship and its equipment were actually used. Frank Howard provides a general overview of the era in *Sailing Ships of War,* which misses being a great book only by lacking an index.

New books for the research library are appearing at a rapid rate, and the would-be library builder must often decide within a fairly short span of time whether or not to buy, as single edition production runs are common. In the past few years alone, we have seen Brian Lavery's two books on the ships of the line, a whole slew of Conway Publishing volumes in the "Anatomy of the Ship" series, the magnificent Jean Boudriot series on a wide variety of French vessels of this era, John Franklin's book on Navy Board models, and a modest number of reprints of 18th and early 19th century reference books Steel, Falconer, Sutherland, Fincham and others, if you want names to look for. Most of these books are available from the book shops associated with ship modeling magazines and from mail order hobby suppliers. Ads for the more rare offerings can be found in the pages of the reference journals mentioned below.

Although these suggestions are mainly for a reference library, one would be remiss in not mentioning at least a few books that deal largely with model construction techniques. Of course much valuable construction information is available in the Edson and Petrejus volumes mentioned above. Ship *Modeler's Shop Notes* is useful for models of all types, with information on built-up lift models as well as plank-on-frame. It also is crammed with time-proven techniques for block and spar making, casting metal fittings, making rope, painting, coppering and just about everything else the modeler needs to know. *Modeling the Brig of War Irene* is similarly useful and broad-based. The hull technique described is the lift method of solid hull building, but the fitting, finishing, spar making, etc. techniques are universal in application and the details are especially useful for smaller-than-ship-of-the-line vessels.

For plank-on-frame modelers there are two additional recommendations, the old favorite *The Built-Up Ship Model* by Charles Davis and the well received work of Harold Hahn, *The Colonial Schooner.* The former is fifty years old, written in a charming style, and full of useful construction and research data hints—the size of gunports, the height of sills, the weight of anchors, etc. It is also full of anachronisms and is itself based on an error of identification, Davis having substituted an English brig of the turn of the century for the American Revolutionary War converted merchant brig LEXINGTON. The hull construction techniques are universal and easy to understand. The drawings are wonderful.

Hahn's work has turned his slightly simplified style of building, admittedly a model maker's convention rather than an exact reproduction of contemporary practice, into the middle-of-the-road standard. Widely used by modeler's, this technique of using several jigs for building the frames and a unique fixture for holding the frames upside down in place during construction, provides for excellent continuity of form and alignment of frames as the hull is built.

MAGAZINES AND PERIODICALS

The more experienced researcher-modeler could perhaps get by with only one periodical, the *Nautical Research Journal,* called by Jeff Phillips, the editor of *Model Ship Builder* the PBS of ship modeling magazines. And it is. The *NRJ* is clearly the standard in semi-academic nautical research and high-level expert ship modeling. Well-edited and formatted, it is a major resource for researchers and modelers of all levels. Generally speaking, the way modeling is done by those fortunate enough to publish in the NRJ is the way modeling should be done by all of us, and the research articles are often the gold standard against which one's own work can be measured.

However, to stay in touch with what's being done both in ship selection for modeling and in the evolution of technique, a much broader base of material and a greater investment in time and subscription expense is needed, especially by the beginning or intermediate ship modeler. *Model Ship Builder* is a good place to start; it has, in addition to its broad-based contents, the virtue of having been in continuous publication for more than 12 years, quite an accomplishment for any hobby or avocational publication. Both MSB and Ships in *Scale* should be read. They are much more egalitarian and hobbyist-oriented than the scholarly *Nautical Research Journal.*

The glossy English cousin of these two magazines, *Model Shipwright,* is much more a photographic showcase of expert modeling and occasionally has a major serial reference work included. This periodical is itself expertly crafted and must be read. It is a bit pricey, so shared subscriptions are not a bad idea. *Seaways,* offers itself as an applied research forum for those interested in American vessels of the ages of sail and steam.

The serious researcher must also have access to the two scholarly journals in the field, the *American Neptune* and its British counterpart, the *Mariner's Mirror.* In each, both the articles and the book reviews conform to the highest academic standards of research and writing. Yet they are quite readable and extremely valuable. Neither is era-specific, but with due diligence, the nautical researcher with a bit of library time at his disposal is sure to find material of interest for his current project.

OTHER RESEARCH SOURCES

Once beyond the scope of one's own library, there are many readily accessible institutional resources for further research. Probably the best place to begin is the local public library, especially those in the larger metropolitan areas. The sections of nautical interest, especially of historically related materials, may be surprisingly large. Even without physical access to a large library, a call to the reference department is often rewarding; they can easily find for you the addresses and phone numbers of historical societies, maritime museums, special interest societies, etc.

Among the institutions that the intermediate researcher needs to be aware of and able to contact are the state and city historical societies already alluded to, national institutions such as the Naval History and Marine Transportation sections of the Smithsonian, the National Archives, and the United States Naval Academy Museum. The British counterparts of these organizations are the National Maritime Museum at

Greenwich and the Public Records Office in London. The libraries and research centers affiliated with the many significant maritime museums in the United States and in Britain must be in the researcher's potential armamentarium. Complete listings are published periodically in the ship modeling magazines.

There are probably any number of directly or peripherally related academic disciplines which would be of value to the nautical researcher, were he only aware of their existence. One that the author stumbled across a few years ago through a book review in the *Mariner's Mirror* is underwater archaeology. After obtaining a copy of the reviewed book, it was possible to follow pertinent leads to a variety of research centers at various universities and to the Institute for Nautical Archaeology at College Station, Texas, which eventually led to a great deal of information about the construction practices of vessels similar to the Virginia Sloop. It turns out that scholars in this field are only too willing to help an aspiring student. Many of their publications are extremely esoteric and in very limited circulation, but the authors are often willing to provide reprints at little or no cost.

MENTORING

The lesson to be learned from all of these recommendations is simply that there is a great deal of both valuable and reasonably accessible nautical research material out there for the taking, if one knows where to look. Knowing where to look is generally the skill that the intermediate researcher lacks, which in turn is why some form of mentoring is so helpful. A mentor may be defined as a specialist in the care and guidance of up-and-coming serious students in any given field. The mentor is himself a professional, not necessarily in the sense of gainful employment in the field, but rather in the sense of his dedication to the field and his commitment to the advancement of his particular discipline.

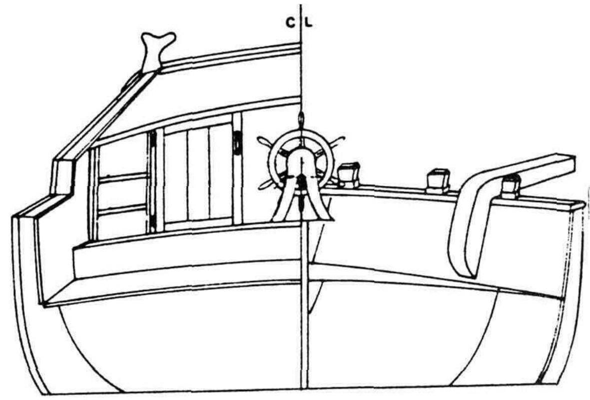
A mentor takes upon himself at least part of the responsibility for the education and training of a more junior individual. The advantage to the trainee is obviously a much more direct route to information, a richer learning experience, and a markedly reduced incidence of egregious error. A bit more subtle, the rewards for the mentor are nonetheless real and result from the satisfaction both of seeing a worthwhile mind develop and the scholarly discipline advance. Mentors, by definition, must be accessible. In our sphere of interest, they might be either professional or academic researchers, advanced modelers, modeling club members, managers in related fields or even intermediate TA amateur modelers.

Burn-out, frustration, and drop-out sharply decline once a mentor is involved. Mentoring should be a relatively short term process in ship modeling and research, perhaps a year or two. This relationship gives the beginner or intermediate the intellectual tools necessary to properly identify, organize and research a particular problem. The process permanently equips him with the general ability to carry on in a productive manner on his own. As mentoring ends, networking the personal connection among a widening circle of professionals and serious amateurs in the field would automatically begin. This higher-level professional communications network can provide most of the additional information awareness that the nautical researcher/modeler will need throughout his career.

How might a mentor be found? The most likely place would be a ship modeling club, scores of which are scattered about the country. Periodic listings of these clubs can also be found in the hobby ship modeling magazines. Either an individual in the club with interests similar to the junior's or the club itself could act as the mentor. The author is aware of one club where each new member is assigned a mentor, has certain tasks to learn, and follows the class project. For those living far from club meeting sites, a little ingenuity could help find a pen pal mentor through, for example, the letters-to-the editor columns of the ship modeling magazines. It is always gratifying to see how readily individuals seriously concerned with ship modeling and research give of their time to properly direct beginners and intermediates. Properly directed researchers are defined here as those who ask for help in how to uncover and develop information and not those who ask for documented completed research. One of the most annoying requests an advanced modeler can *receive* is the one that begins "Please send me all the material you have on. . .". Well, so much for philosophy. Now on to the products of research for a typical small vessel of mid-18th century colonial America.

Clayton A. Feldman

CHAPTER 1



HISTORY, DESIGN AND RIGGING

An evolutionary development in the line of fast sailing vessels linking the Bermuda sloop of c. 1740 and the trim, sharp model Virginia schooners found in Steel's *Naval Architecture* of 1805, the Virginia sloop of 1768 is *a* small, well-designed ship, quite pleasing to the eye, and a most suitable subject for the ship modeler. Fairly typical of the Jamaica-Bermuda-Chesapeake hull form used as privateers, smugglers and fast carriers, the Virginia sloop had a graceful sheer, low freeboard, and a cabin with a rounded roof aft, which, together with a huge fore and aft press of sail, formed a profile virtually defining speed.

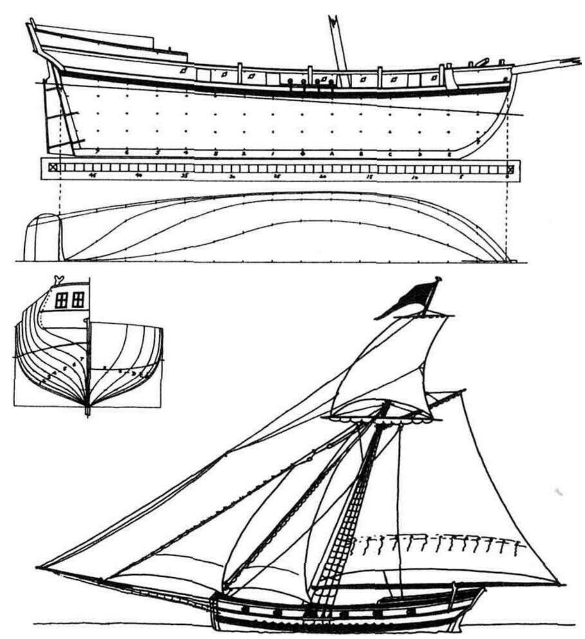
Nautical architect and naval historian Howard I. Chapelle found the plan in European archives, a Dutch copy of a French drawing. The ship had apparently been sold to the French shortly after completion, a not uncommon arrangement. The fragmentary notes and a copy of the plan passed from Chapelle to Joseph A. Goldenberg, author of *Shipbuilding in Colonial America,* and then to John F. Millar, author of *Early American Ships,* whose re-drawing of it caught my eye. Professor Goldenberg told me that Chapelle had told him that the hull form of the Virginia sloop was very good. He also stated that the lines as drawn were nowhere near fair, and that the deck furniture would have to be reconstructed from what was known about colonial, sloops in general if a model were to be built.

Both Millar and Goldenberg thought the plans had been used by Chapelle for a model study at the Smithsonian, but my initial inquiries to that institution drew a blank. The Smithsonian referred me to the National Archives, but that line of investigation drew the dreaded reply: "Plans of the unnamed Virginia sloop of 1768 have not been located among the approximately 50,000 ship plans from the Bureau of Ships." Dead end.

What this all meant was that a general lines plan was available for a very appealing little ship, that the ship was a characteristic type and not a named vessel, and that all one would need to do in order to be able to build a model of it would be to re-draw the plans, reconstruct the deck furniture, develop a masting, rigging and sail plan, and justify it all! Well, maybe not just the right project for the first time scratch builder, but just right for a teaching project for the first time scratch builder, wherein a guided walk-through could provide a complete how-to-do-it course in scratch building, research, plans drawing and construction. For the modeler's first such project, it would have to be a rather easy build—directly from already drawn plans. Hopefully it would also be a stimulus for a subsequent completely original project.

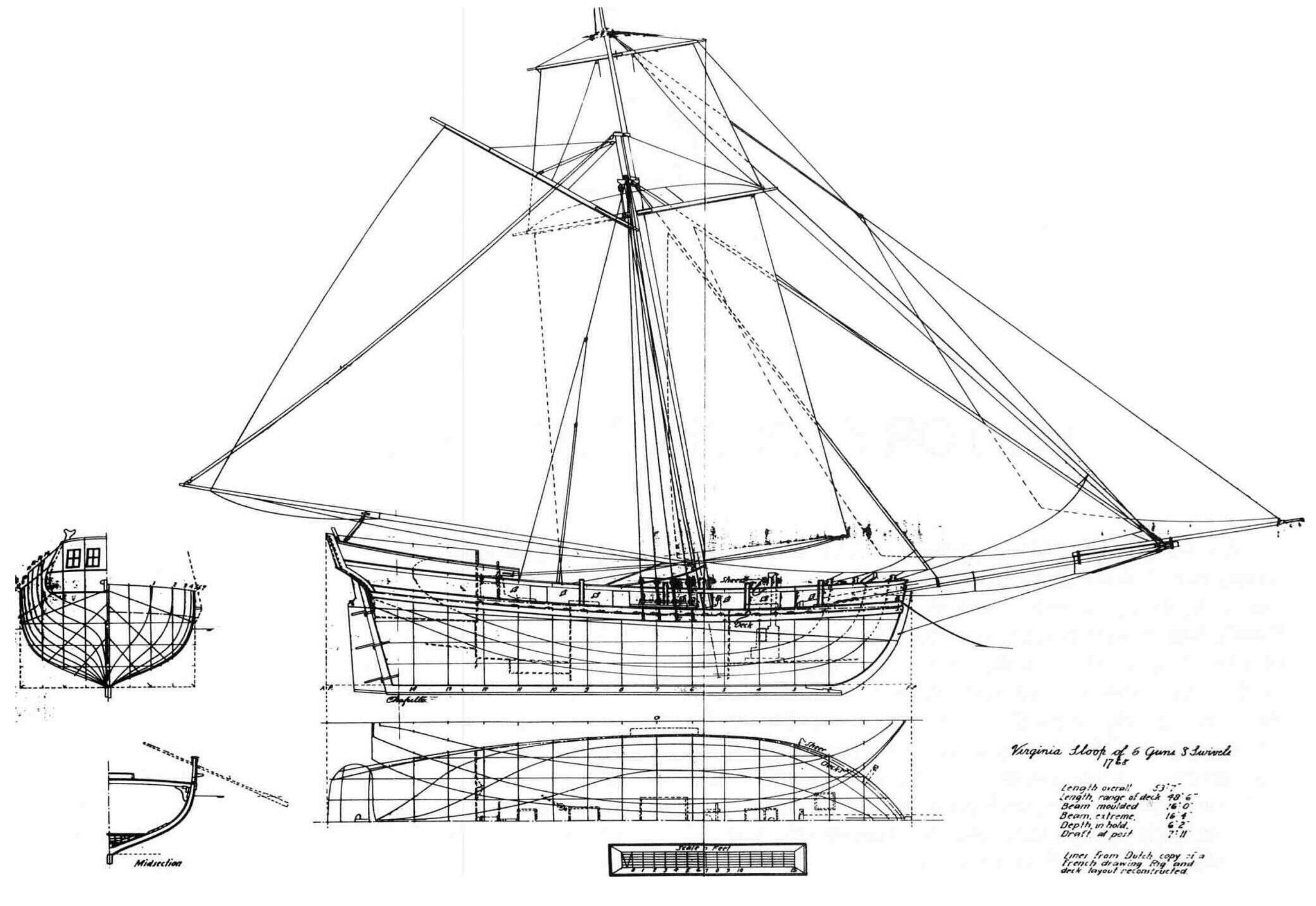
As it turned out, Smithsonian plans were available in their catalog; I just happened to correspond with the wrong person! If you take a look at the Chapelle plan and at mine, you will see more similarities than differences. It's not because I'm such a good store-house of knowledge, it's just because I'm a good student and I had better teachers than Chapelle did. He had no one and I had him plus Napier, Edson, Ronnberg, etc.

If you'd like, you can do the whole project from scratch using the Chapelle plan. The 18th century was



John F. Millar's copy of the Chapelle plan of the Virginia sloop and of the Karzahauine sketch (Soviet National Archives, Moscow) entitled "Armed Virginia Sloop, 1779."

From Early American Ships, courtesy *of John F. Millar.*



The Armed Virginia Sloop of 1768. *Plan courtesy of the Smithsonian Institution (NMAH, Division of Transportation).*

a time of intense naval and maritime competition. In both *peace* and war, the nations and nations-to-be of our sphere of interest, Britain, France and America, looked eagerly towards the development of new vessel types that might further their national or regional economic interests at sea.

Often the private sector was more innovative and daring than the public sector as the quest for quick profits spurred the production and refinement of fast sailing ships. The West Indies, being a maritime trade center for the developing Western World, was the hub of several triangular trades, from America or one of the European nations on one leg and Africa on the other. Jamaica had become rapidly established as a ship building center in the prior century, with a reputation for fast, well-built vessels.

By the end of the century the shift to Bermuda had already begun, coincident with the decline in timber in Jamaica. When the same happened in Bermuda, the hull form seemed to have moved to the Chesapeake. Most of the ships built during this period were fairly large sloops, and according to Chapelle, were often purchased by English merchants for the triangle trade. Goldenberg, in *Shipbuilding in Colonial America*, states that colonial vessels represented cheap tonnage in the home markets, the income from which helped the colonists pay for their (British) imports. In France, they were much in favor as cruisers. A great number of them were built. The vessels were said to have had a reputation for solid construction, weatherliness and the ability to sail well in light and moderate air.

Whether these vessels were a new design development is not entirely clear. The basic form of the small, single-masted vessel that we are interested in may have developed at least in part from the English cutter of the first quarter of the century, a broad, stout vessel with little drag aft, modest deadrise, and a huge rig, both vertically and fore and aft. Later in the century, this design was so successful as a revenue cutter that the British government limited the length of bowsprits on private vessels to stay one up on smugglers. Smuggling abounded over the centuries in both England and in the American colonies, largely because of oppressive taxation. No doubt similar factors were operative in France and the low countries, making these small, fast sailers popular there also. With many wars and rapidly changing alliances, private armed vessels were always lurking just over the swells, quite ready to overtake yesterday's friend for a quick profit.

As you will see, the Jamaica-Bermuda-Virginia sloops were sharper, lighter and sleeker than their cutter cousins, as befitted small vessels intended for rapid, inexpensive construction and short profitable lives.

Chapelle states that the vessels were built of native cedar, which he describes as being similar to what we know as red cedar, strong, light and rot-resistant. Paul McClure, however, states in a note in *Fine Woodworking* (1985) that in this era, cedar was the name given to mahogany, of the species Swietenia Mahagoni, which would mean construction with a much harder, heavier and stronger wood. This leaves a bit of a materials mystery. Materials played a role in the transfer of the baton from Bermuda to the Chesapeake, as the gradual depletion of island timber on the one hand and the heating-up of the political situation on the other led to a great interest in America as a prime site for quickly building fast small vessels for use as privateers and now-you-see-me- now-you-don't cargo carriers. A propitious combination of available materials and available skills caused the Chesapeake to become the second most important ship building center in America by the end of the colonial era. (New England was the first.)

Goldenberg also reports that schooners had begun to replace sloops as the primary rigging type, but that the advantageous sharp hull form remained. The Chesapeake builders used the fewest timbers and the lightest construction, which together with these sharp hull lines produced ships with an international reputation for speed during the Revolution.

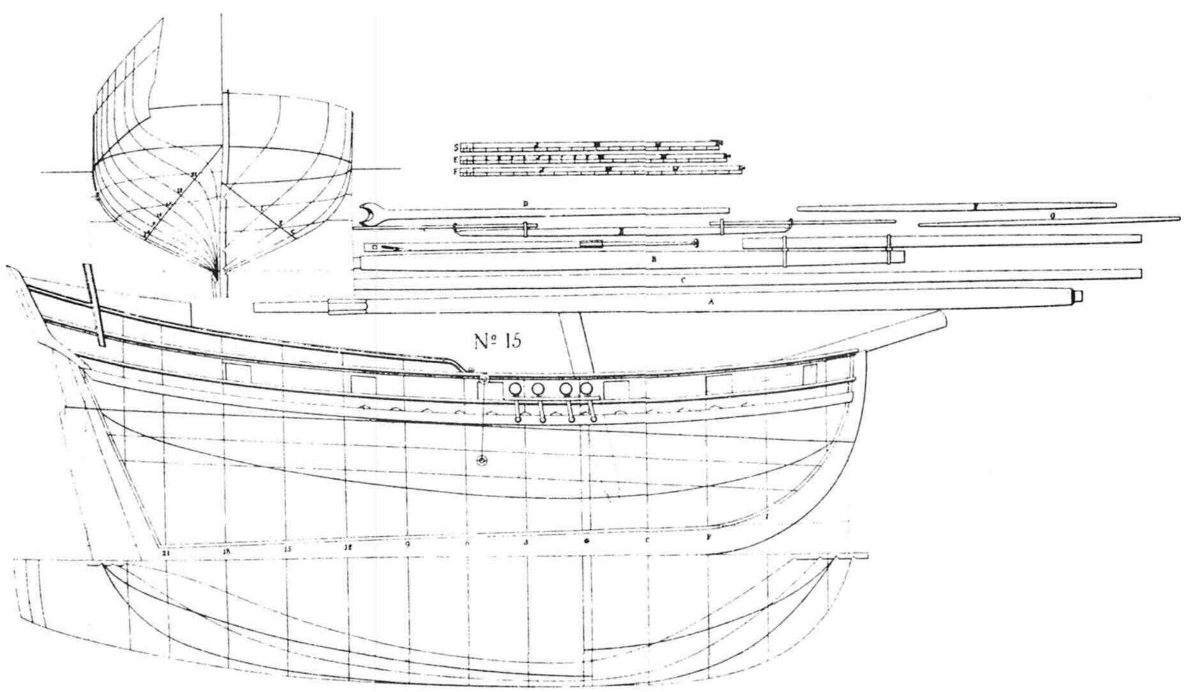
This style of design and building spread north (or simultaneously developed in the north), where large trading and fishing fleets existed. Prime targets for privateers and freebooters, according to Chapelle, these vessels were generally unarmed or lightly armed and had small crews. Their operations were spread out over large areas (the North Atlantic fishing banks, the Atlantic trade routes, and the Indies) and they could not command Naval escorts. Necessity being the mother of invention, they evolved into a fast sailing type, the Marblehead schooner, that rivaled the Bermuda-Chesapeake type in seaworthiness and speed. Chapelle speculates that the same basic English hull form served as the basis both for the Jamaica-Bermuda sloop and the Marblehead schooner. In any event, small, fast sloops and schooners filled the seaways between Europe and America, and had profound influence on the lives and fortunes of individuals and on the political and economic status of nations.

DESIGN AND RIGGING

The description of the hull form by Chapelle for the Bermuda sloop, in *The Search for Speed Under Sail*, can be modified a bit and serve quite nicely to describe the Virginia sloop. It was wide and deep, the depth coming aft from a good deal of drag to the keel. The entrance was short, neutral to slightly convex, and she had a great deal of midships, with relatively little curvature until the long, easy run aft. Just as did the Bermuda sloop, the Virginia sloop had a considerable rake to her sternpost and a well-rounded stem rabbet. The sheer was gracefully curved, although not so much as that of the Bermuda sloop, and each had a heavily cambered roof (rather than a true poop) over the stern cabin.

The Virginia sloop midsection had fairly steep deadrise (the *degree* of upward tilt of the bottom of the hull). The floors were fairly straight, with just a bit of hollow. The turn of the bilge was high and well-rounded, leading to fairly straight sides, but with a bit of tumblehome (inward tilt) aft.

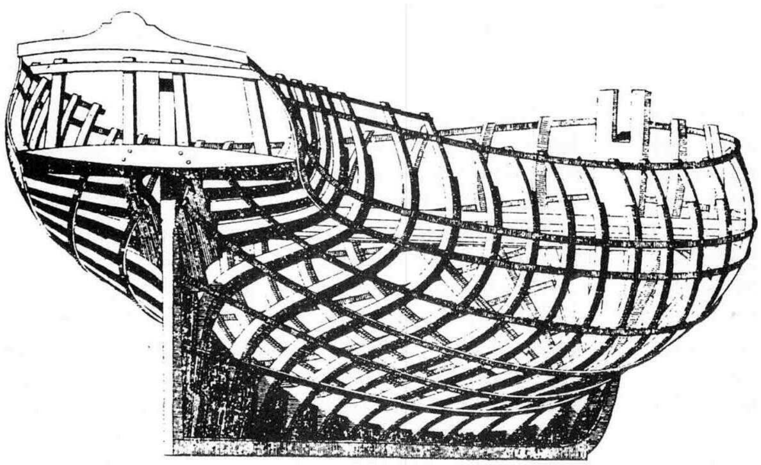
The potential for speed was probably somewhat greater for the Virginia sloop than for the Bermuda sloop, at least relative to waterline length, as the former was sharper and shallower, therefore with a lesser wetted surface. She would have sailed well on the wind, especially with her deeper draft aft, the drag of the keel acting rather like the fin keel of a modern sailboat in preventing excessive drift to leeward. This was a short sloop, as was Chapman's Bermuda sloop, whose length and heavy displacement would cause her to pitch a



A Bermuda Sloop, from F.H. Chapman, Architecture Navalis Mercatoria, 1768.

great deal in a heavy head sea. Even the lighter displacement of this little vessel would not overcome that unfortunate tendency.

How would she be framed and built? There is a variety of contemporary and modern data on this subject, summarized by the author in an article for the *Nautical Research Journal* ("A Study of Mid-Late 18th Century Small Vessel Framing Practices", Vol.33, No.3, 1988). Calling upon the line drawing of the small vessel in Falconer (probably the same as the not-so-small privateer in Plate XXXVI of Chapman), the Spencer Hall Maryland shipyard painting of 1769, the tabular construction data in Steel's *Naval Architecture* and modern underwater archaeological findings, it was possible to demonstrate with what I hope was reasonable academic probability just what Chapelle had described 20 years earlier (albeit with no *reference* documentation). The structural design had been so well established as to be almost standard widely spaced mold frames, made up of futtocks or sections joined and fastened together to form a timber or rib. These were drawn full size on a platform, or scrieve-board, or in a mold loft, from measurements taken off the scale drawing (the draught). At the whim of the builder, these mold frames might be regularly spaced and represent every third or fourth frame, or they might be irregularly placed to produce uneven frame spacing.



A small vessel. From F.H. Chapman (also in Falconer, First Edition, 1769).

To save weight, some builders spaced frames more widely in the ends of the hull than amidships and used cedar top-timbers..... .and between the mold frames, intermediate frames were fitted. These were usually chunks or futtocks, shaped to bear on the ribbans, but not always fastened together to make a rigid frame. The outside planking and the inside skin, or ceiling fastenings, would then secure the otherwise loose intermediate frame futtocks.

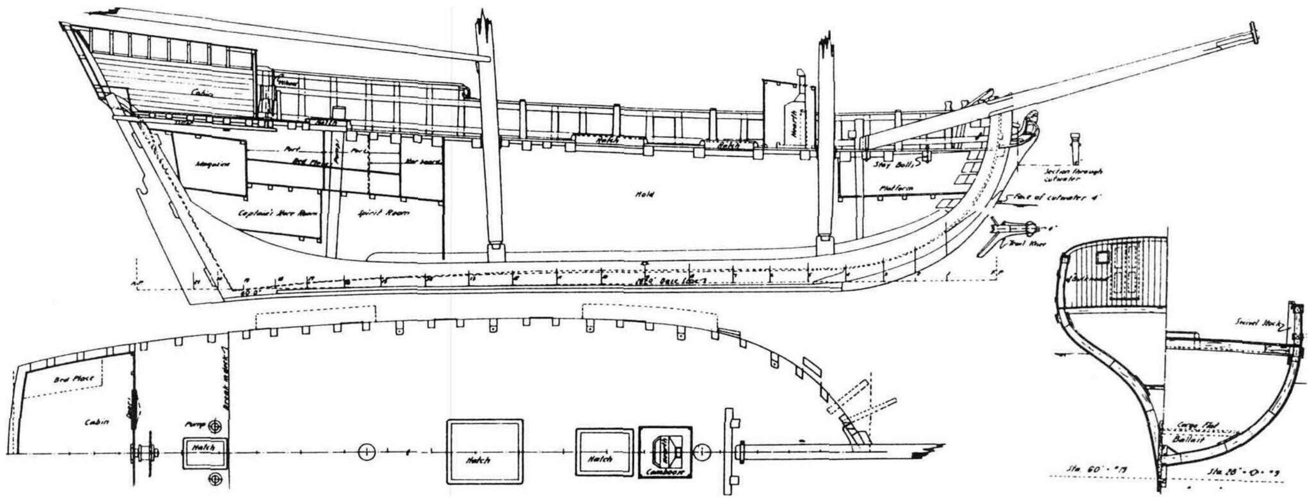
My own summary, after a great deal of additional research, was not a great deal different. In conclusion then, if I were a mid-18th century American small vessel designer, commissioned to create a small armed vessel to serve as a privateer, I would choose a framing style that was strong, light and as economical as possible. I think I would have come up with something not unlike the practice used in framing the BADGER, fairly widely spaced double frames, closing up a bit in the region of the gunports so as to have a complete double frame (no cut futtocks) on either side of the port. This results in the use of 12 mold frames, complete double frames or bends, including the highly beveled frame in the bow. A further three mold frames could be eliminated if the budget demanded, those behind the first, third and fourth gunports, although I'd really like to leave them there for strength. I don't think I'd touch the frame aft of the second port, as it seems to be necessary for the securing of the mast partners.

If more support for the planking and ceiling made itself necessary during construction, I would add filling frame futtocks as needed, not even necessarily as complete frame units. Continuously developing data from the discipline of underwater archaeology, especially the work of Trevor Kenchington on the Terence Bay Wreck in Canada and the work of David Switzer on the Penobscot Expedition privateer DEFENCE, suggests the possibility of a slightly different format. A few mold frames might have been erected, one amidships and as many more fore and aft as needed to define the shape of the hull. The mold frames might be a bit different in configuration than conventional large vessel double frames however, in that the first futtocks might not meet over the centerline, the second futtocks might not reach the upper ends (heads) of the floors, etc.

The remaining frames seemed to have been mostly single frames with a single futtock either forward of the floor (if the frame were forward of midships) or aft of the floor if aft of midships. Far forward and aft, where floors could not exist, disarticulated futtocks were shaped to fit the space and need. All of this post-mold framing work was done inside temporary longitudinal stringers called ribbands which defined the shape of the hull. This could have been different than Chesapeake practice, but as similarities were more common than differences in ship building overall, one must certainly review the latest nautical archaeology literature before making any final decisions for a representational plank-on-frame model.

All the vessels of this genre were characterized by very low freeboard (the distance from the rail to the water), and were wet sailers. Design features to deal with all this shipped water included a marked camber or crown to the deck, large numbers of scuppers to drain water overboard, high coamings around hatches to keep water out of the hold, and perhaps even a break in the deck aft, sort of a false quarterdeck, to keep water out of the aft cabin.

There are actually no contemporary rigging plans for sloops or cutters extant. The best we have is modern interpretations of limited contemporary data—the spar drawings in the Chapman Bermuda sloop plans, the spar dimensions on the sloop plans, the tables of dimensions and calculation charts in Steel, and a variety

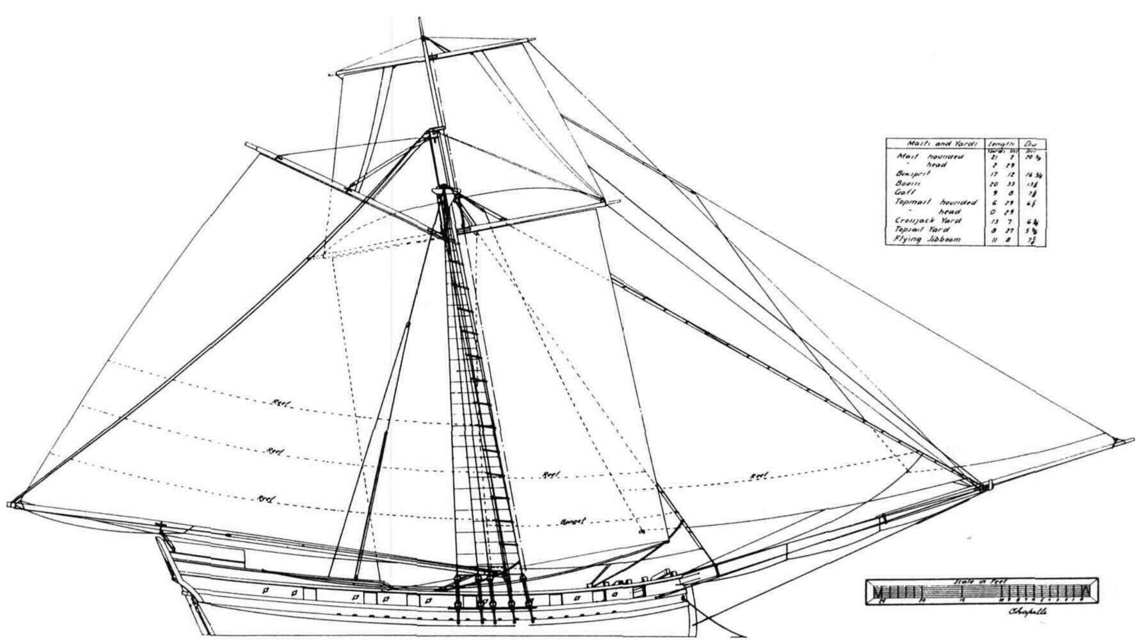


The brig BADGER, inboard works. From a Chapelle drawing. Courtesy of the Smithsonian Institution (NMAH, Division of Transportation).

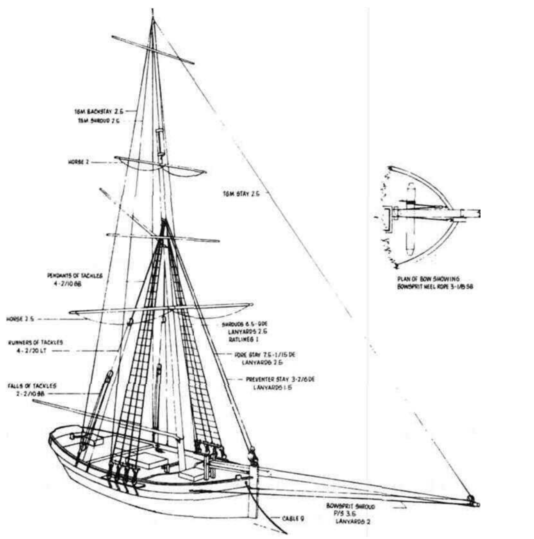
of 18th century drawings, paintings and prints. The best modern cutter rigging reconstruction is Merritt Edson's three panel othographic study of the British Shoreham cutter, also which is worth careful study because of the cutter's great similarity to sloop rig. Chapelle's MEDIATOR sloop rigging reconstruction, the Edson/Chapelle drawings of the Bermuda sloop sparring and rigging plan and Rob Napier's study plan for his appealing plank-on-frame Bermuda sloop model *(Nautical Research Journal*, Vol.30, No.4, 1984) are necessities.

The most helpful contemporary art works are the Serres 1793 painting "A Bermudian Sloop, with a view upon the Spanish Main," which is a wonderful three view study of, the same sloop, and the Bermuda/Chesapeake sloop sketch of the Russian traveler, Karizhavin, from about 1780, as seen redrawn on the Millar plan for the Virginia sloop. Line drawings of a generic sloop and cutter appear in Chapman, and there are similar drawings in Steel. There are also dozens of sketches of sloops drawn by John F. Millar from contemporary originals, for his book *Early American Ships.*

Thus there are many design possibilities for rigging a small sloop of the mid-late 18th century, anywhere from the standardized naval cutter rig, gigantic in all directions with three yards crossing the mast, to a simple, small crew coastal rig, almost entirely fore-and-aft and with not even a topmast. For this sloop, a compromise seems reasonable. The Virginia Sloop of 1768, as presented here, will have the full complement of fore-and-aft sails (the gaff, the foresail, the jib and a

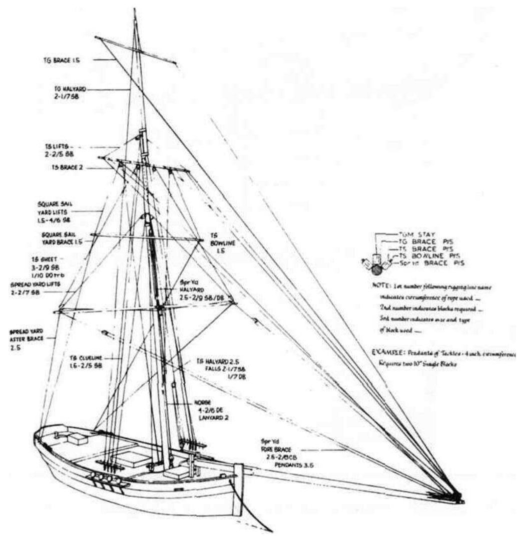


The sloop MEDIATOR, rigging plan. A Chapelle drawing. Courtesy of the Smithsonian Institution (NMAH, Division of Transportation).



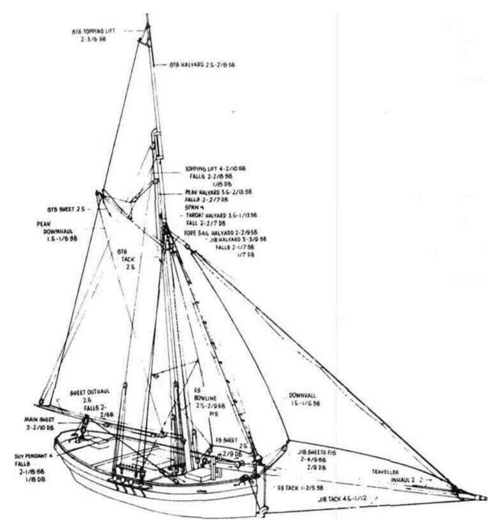
STANDING RIGGING

Panel One, The Shoreham Cutter plan in three panels, by Merritt A. Edson, Jr. Courtesy of Merritt A. Edson, Jr.



RUNNING RIGGING Square Sails

Panel Two.



RUNNING RIGGING fore-and-aft Sails

Panel Three,

a flying jib) for maximum windward performance, and a single, large topsail for speed off the wind.

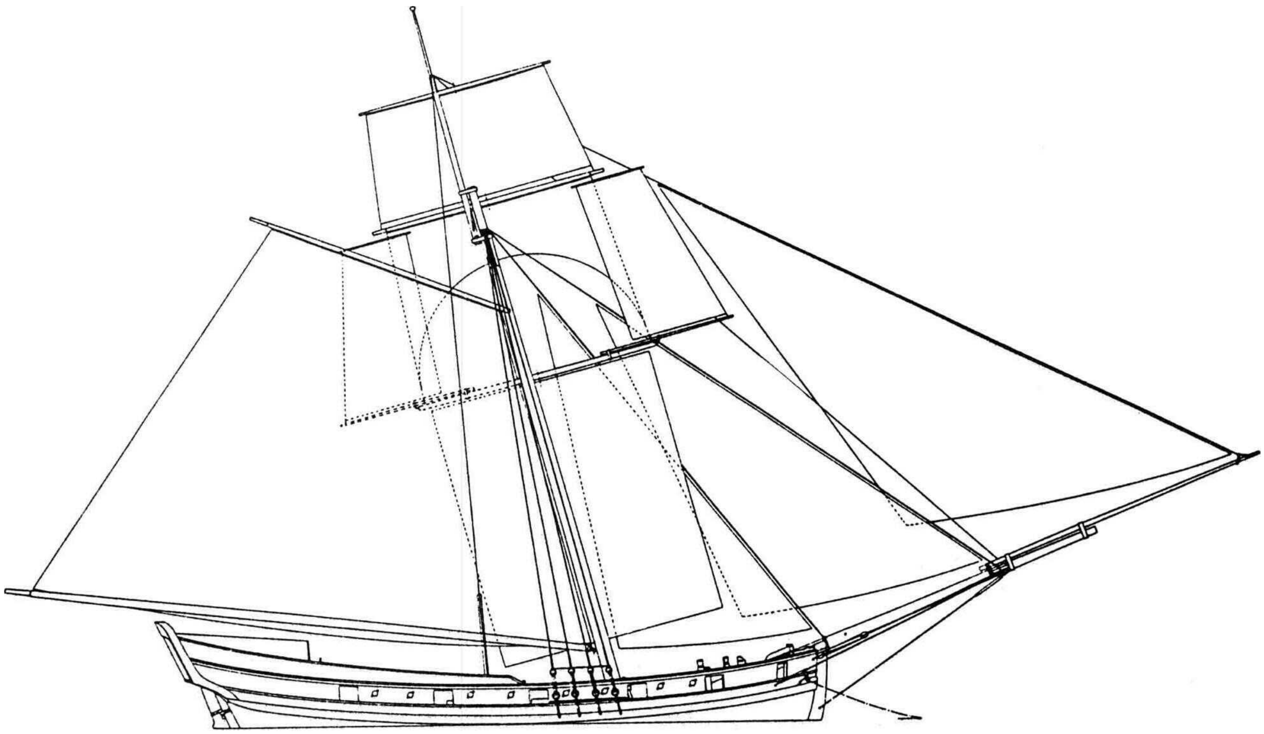
A spreader yard or crossjack not only spreads the foot of the topsail, but also serves as a yard for an optional lower square sail, which could be called the main course, the crossjack sail, or simply the square sail, depending on which source one relies upon. The spreader yard in this Virginia sloop is raised by means of a horse, a stout vertical rope fixed between trestletrees and deck (one of several uses for the term horse). This permits the yard to be rapidly raised or lowered without interfering with the raising or lowering of the gaff. Once up and in place, the yard would be lashed to the mast with a rope guide or parrel.

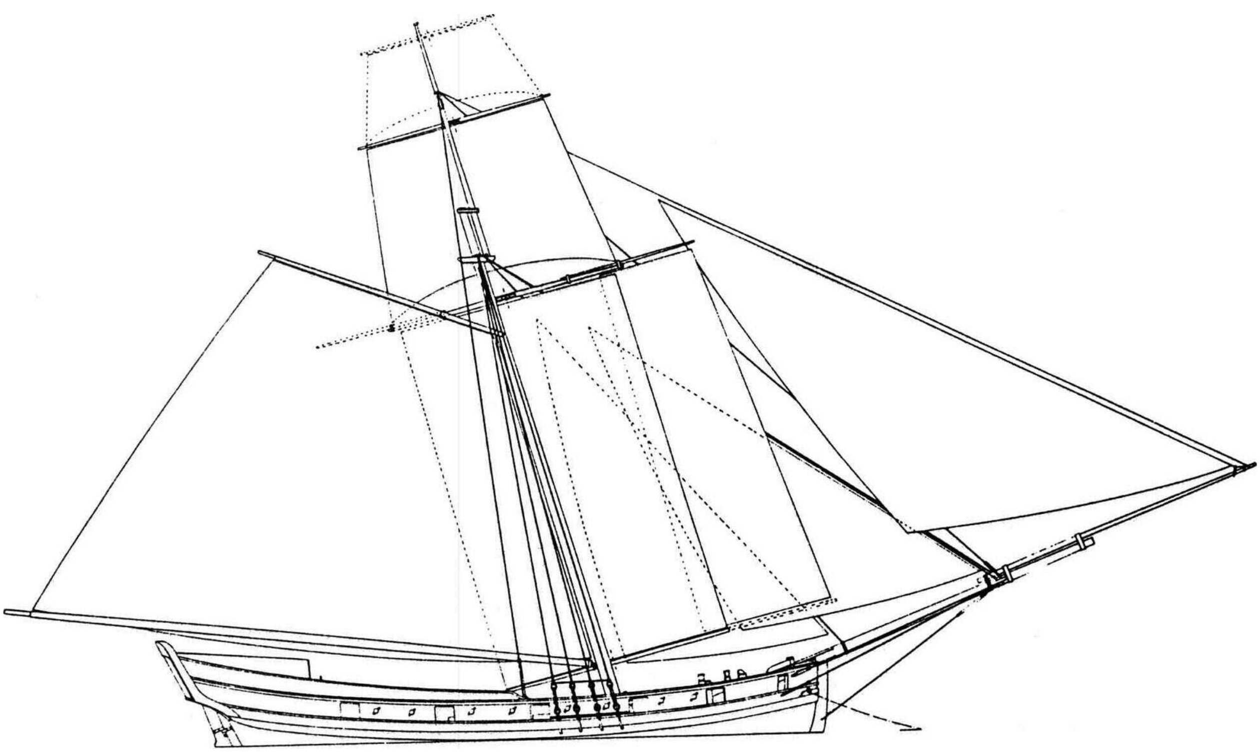
For those interested in small vessel design characteristics that might significantly affect sailing quality, the Virginia sloop is of special interest. For example, a vessel designed to sail fast close-hauled (on the wind), needs some extra lateral plane underwater to prevent excessive leeway (being pushed sideways). Modern sailboats have centerboards or fin keels of one sort or another for this purpose. The Virginia sloop accomplished much the same by having *deeper* draft aft (sailing down by the stern), which would help a great deal. Of course this also pushed the balance point of the underwater lateral plane aft.

One often sees comments puzzling over the reason for the great amount of rake aft of the mast on such sloops, but it's no puzzle to small boat sailors, who know they have to balance their boats so that the lead, the gap between the sails' center of effort and the underwater profile of the hulls' center of lateral plane is relatively small. If it's too great, the close-hauled boat, in danger of knockdown in a stiff wind, won't head-up into the wind to stand up and slow down when the tiller is released, and capsize becomes likely. With a lot of sail forward, one way of getting an appropriately small lead is to tilt the mast aft, which is just what this type of vessel characteristically shows.

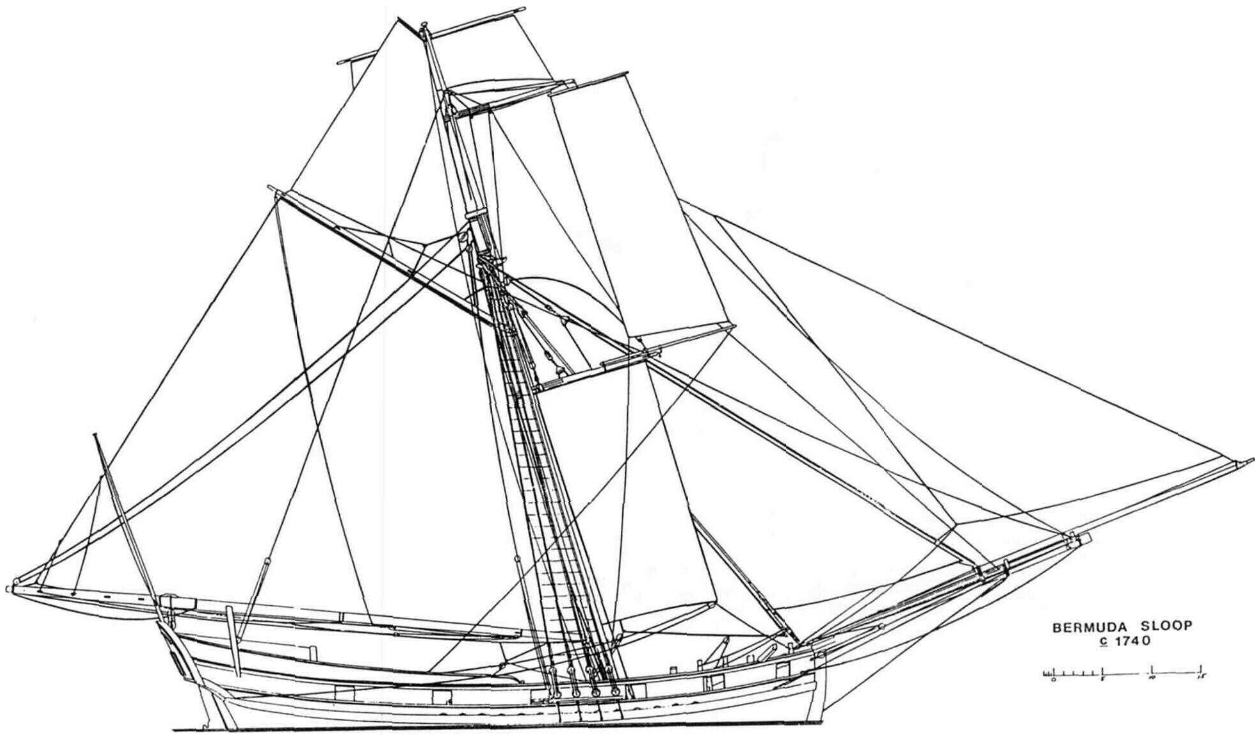
How fast might she have been? Well, the maximum speed of a displacement hull is about 1.3 times the square root of the waterline length. For this hull, this comes to about 9.6 knots, all things being equal, with perfect sails and perfectly smooth hull. All that perfection being unattainable in this era, she probably was a good deal slower. Sails in this era were loose-woven and baggy. The underwater hull, even if not fouled with marine growth, might have been an irregular surface of thin fir sheathing nailed over the planking, with horsehair and tar filling the gap. Coppering had just come into use and was not likely to have been used on these small, inexpensive vessels. It wasn't all that smooth a surface itself. It all balanced out, however, for the hundred foot waterline sixth rate with its 12.5 knot maximum speed potential chasing the little sloop was similarly slowed.

One intuitively understands that these little sloops had one singular advantage over large square rigged naval vessels, and that was windward sailing ability.



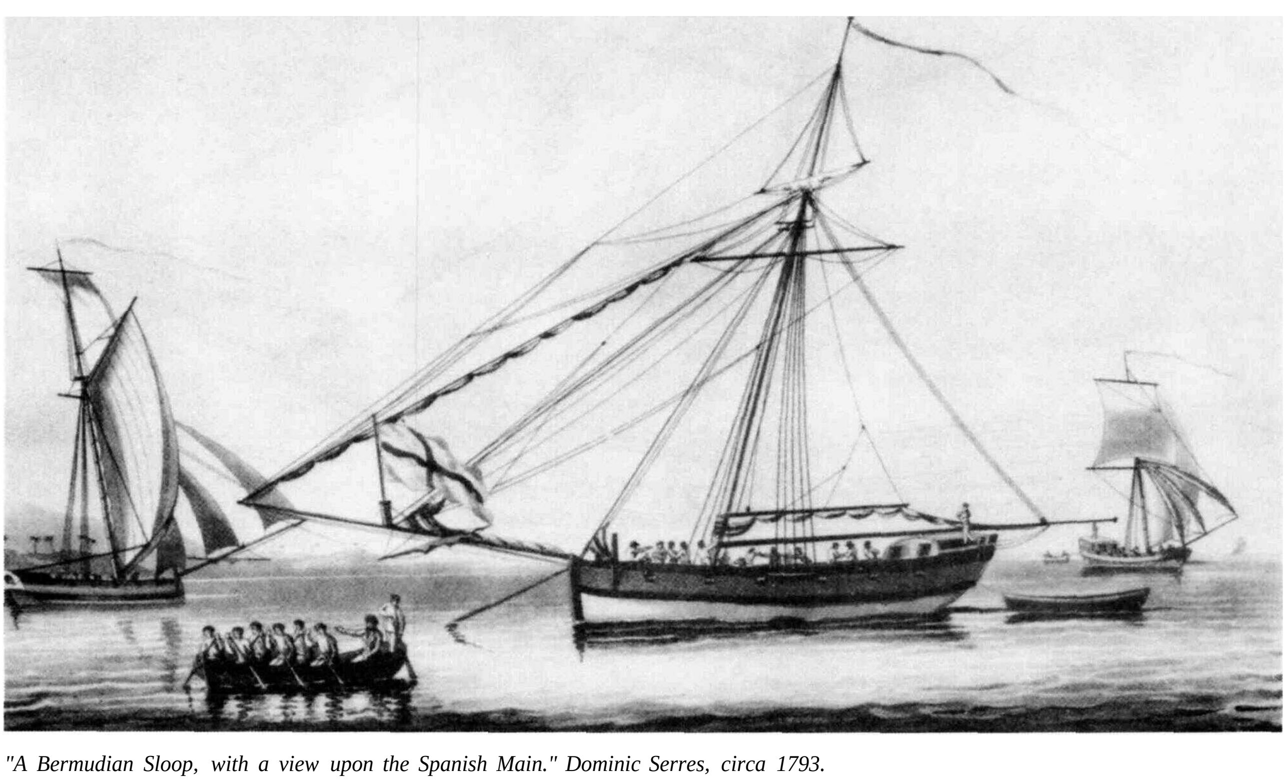


Two reconstructions of a sail plan for Chapman's Bermuda sloop, one by Chapelle and one by Edson.
Courtesy of the Smithsonian Institution (NMAH, Division of Transportation).

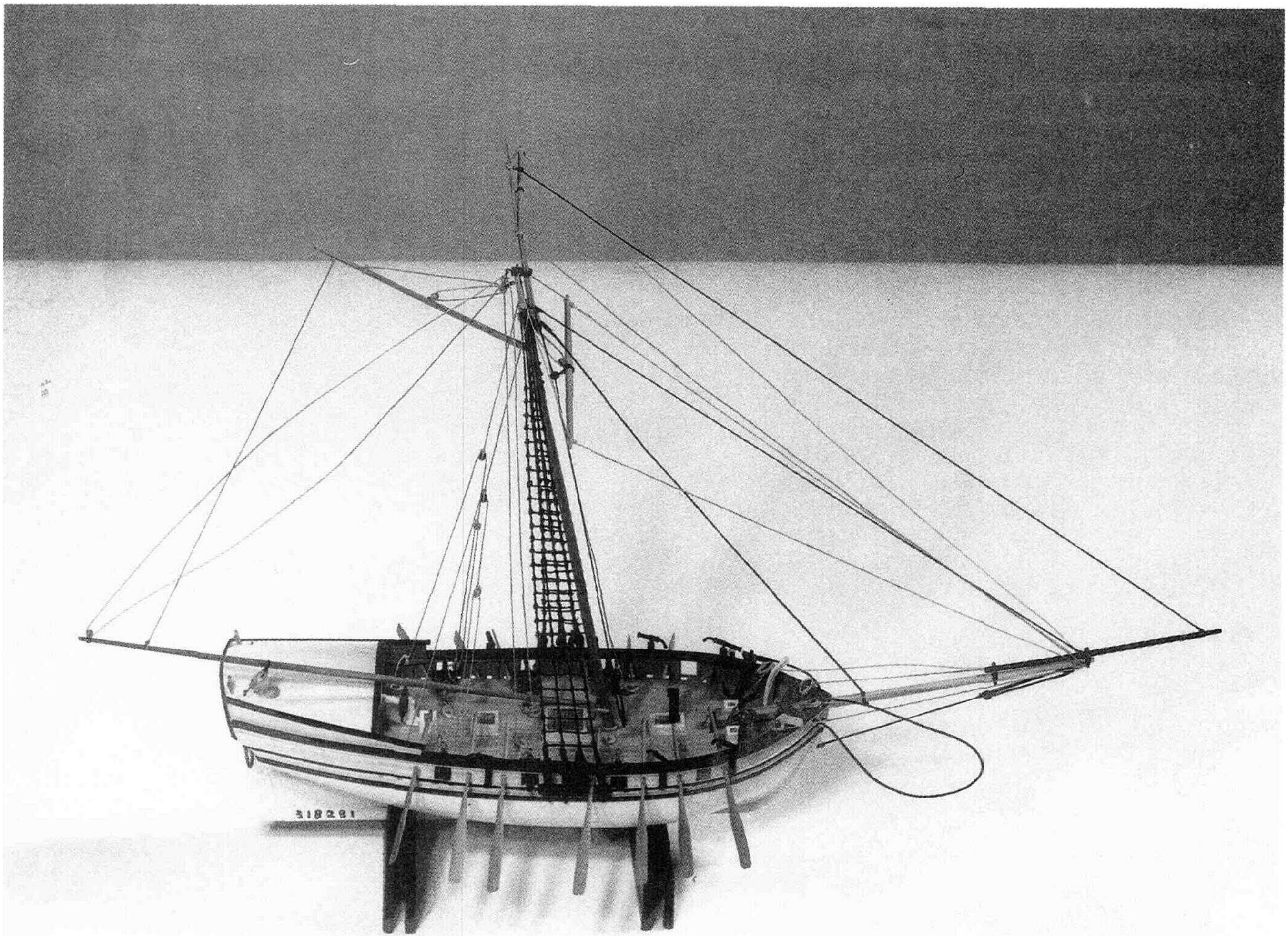


A Bermuda sloop rigging *and sail plan reconstruction.* Courtesy *of Rob Napier.*

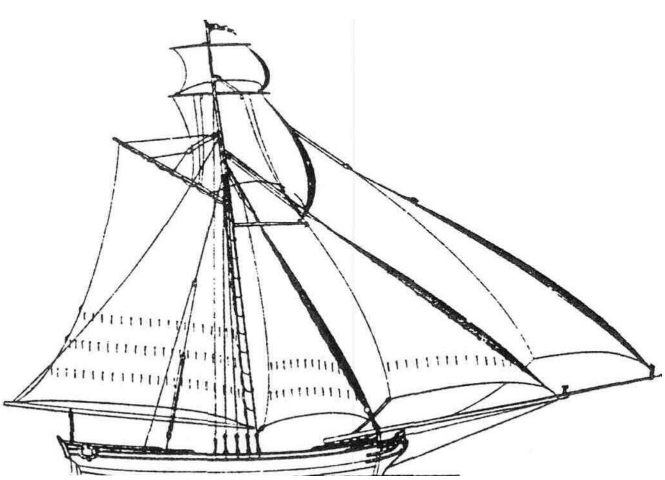
They could sail close hauled, that is, within about 40' of the wind direction, whereas square riggers, even with many fore-and-aft staysails set, could generally only get to a beam reach (wind right over the side). The fastest point of sailing for a square rigger was a broad reach (wind over the stern quarter), whereas the fastest point of sailing for a sloop was a close or beam reach (wind over the bow quarter or directly abeam). Escape,



"A Bermudian Sloop, with a view upon the Spanish Main." Dominic Serres, circa 1793.



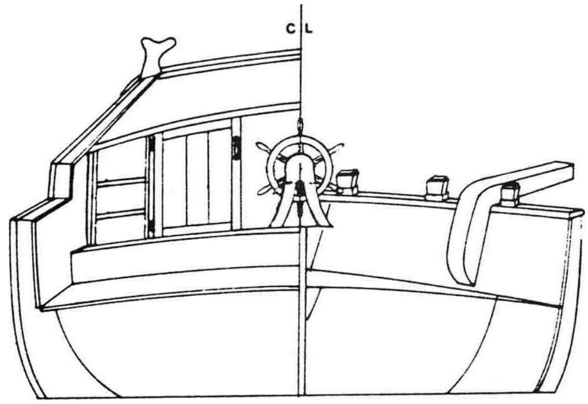
The Smithsonian model of an armed Virginia *sloop of 1768.* *Courtesy of the Smithsonian Institution (NMAH, Division of Transportation).*



Drawing of a sloop (#12) and a cutter (#15) from Chapman.

therefore, lay to windward, barring a shore, a reef, or another sixth rate to windward and weather permitting (rough weather could make little vessels pitch and stagger, thus markedly diminishing their windward advantage). Well, it was a tough life; the risks were great, but so were the rewards.

CHAPTER 2



DRAFTING

Although the thought of drawing up a complete set of plans often strikes terror into the hearts of ship modelers and sometimes causes them to avoid a particular project altogether, taking pen to paper is actually quite interesting and satisfying. It is not at all difficult to learn, especially when compared to the many other even more detailed and involved tasks that ship modeling entails.

Obviously, modelers with only ordinary and infrequently used drafting skills (the author's included) can't draw a plan with the detailed elegance of an Erik Ronnberg composition, the functional completeness of a Rob Napier study or the gallery print quality that Harold Hahn's model plans possess.

What is surprising however is the relative quality of the work that amateurs can do. It certainly is adequate for personal use, and, as you will see, with just a little care it can be good enough to share with others. If you look carefully at the plans presented here, you will notice that the drafting on each sheet is a little better than the previous one, as this infrequently used skill improved with practice. Remember, for non-professional scratch modelers, a new set of plans needs to be drawn only every two or three years!

For this project, which may well be your first scratch built ship model, the complete set of plans is already drawn for you.

Hopefully, in the future you will want to do a project entirely on your own, and what follows, in the promised painful detail, is the way to do it. As with everything else you do, some basic knowledge, a good deal of planning, and a modicum of skill are necessary. You ship modelers can do it!

The obvious question is why do it at all? Does anyone really have to redraw the plans of Howard I. Chapelle or David R. MacGregor, especially an amateur draftsman? The answer is no. Aren't there enough well-drawn plans in the experts' books, in museum and library files and in commercial stocks? The answer is yes. The supply side of the modeling world is crammed full of good and interesting ship model plans in the books of the authors mentioned, in the Smithsonian, the National Maritime Museum and many other institutions, in the collected modern and contemporary literature of the marine world, in the stock of commercial sources, and in magazines and periodicals. Modern plans for plank-on-frame builders, such as those drawn by Harold Hahn and Portia Takakjian, can very easy be converted to the same plank-on-bulkhead format which will be used in this project.

Suffice to say, if one chooses to model a vessel for which an undistorted original draft or a modern re-drafting by an expert is available, you are home free—no midnight hours with ships' curves and India ink, or at least not very many. With a good basic set of plans, only the construction plan will have to be drawn by the modeler. If, however, you happen across some interesting little vessel that you simply must model, and, if you find that not only are the plans not re-drafted, but merely copied, or if you find that your photo-copied enlarged book plate is distorted in one direction or another (absolutely check with your scale), then you must re-draft the plans yourself. If you do not, you will find that the hull of your miniature vessel will have some interesting little dips and curves where none were intended by the designer! Such was the situation with the John Millar copy of the plan of the Virginia Sloop of 1768. As mentioned earlier, the original draft was not obtainable, Chapelle had not included either a copy or his usual re-drafting in any of his books, and the reproduction in *Early American Ships* was both at very small scale and not fair.

How can one determine that it was not fair? Well, first of all, if you look at the plan, you can see a few bumps in the waterline curves in the half-breadth plan (the view from the top). Second, and more important, if you use a scale and dividers to compare the widths of the waterlines at each station, going back and forth between the half-breadth and the body plan (the cross sections), you will find that they do not always match. An unfair plan must be redrawn. On the other hand, the ability to draw up a complete set of plans frees one from the need to rely upon what has already been drawn, opening up wide fields of choice for new work. This chapter will walk you through the process of re-drawing a plan to a new scale and developing a construction plan for the actual modeling process.

Even if you're not going to draw plans at this time, by all means read this section carefully and refer often to the plans, tracing the lines and curves with a stylus as they are discussed in the text. It will help a great deal in understanding eighteenth century small vessel design and construction and it will assist in mastering component terminology, which will make actual model construction just that much easier.

PROVING THE LINES

Proving the lines, or preparing for fairing up of the ship's external surfaces by means of properly drawing the plans, requires three drafting views. They are the sheer plan or side view, the half-breadth or top view, and the body plan or cross-sectional view. Diagonals, seen as downward slanting lines in the body sections and as waterline-like curves in the half-breadth, show that the proposed ship can be smoothly planked. That is because the diagonals are drawn more nearly perpendicular to the surface of the planks than are the waterlines. They are a nice little extra in model plans, often omitted on the reasonably practical theory that waterlines alone sufficiently define the curves for modeling purposes. Buttocks, which are the equivalent of waterlines, but in the vertical-longitudinal plane of the ship, are not ordinarily needed in ship modeling, again for the reason just mentioned.

As you can see, the body line curves are plotted with two points per waterline for each station; the horizontal *reference* point is taken from the half-breadth and the vertical *reference* point from the sheer plan. An outboard profile, not properly part of the lines plan, shows many of the external hull details and, in our case, the location of the main frames. All the extra drafting for the latter could be done on the sheer plan of the lines drawing (as was done on the old English draughts), but an entirely separate view avoids clutter. It is the final drawing needed in this series, but far from the last drawing we will need to do in this project.

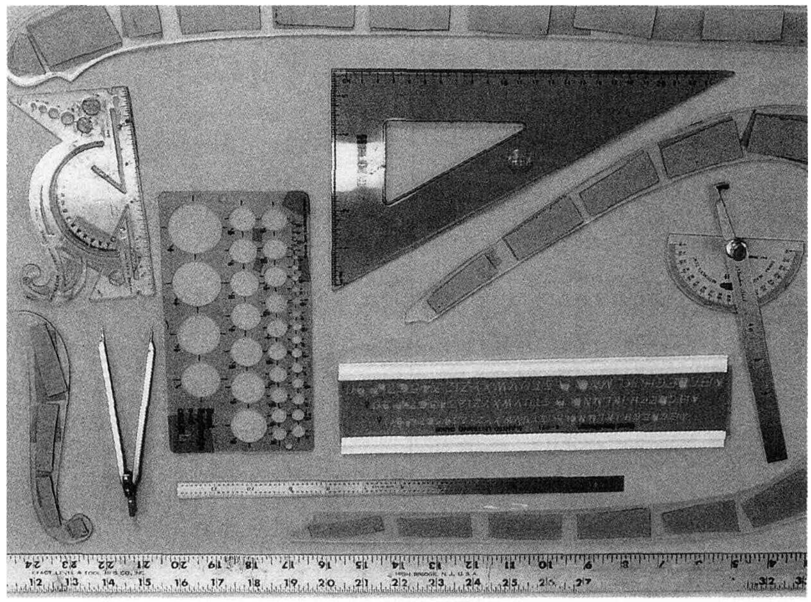
LINES PLANS
SETTING UP THE GRIDS

The basic requirement in drafting and scaling is a dependable *reference* grid upon which to plot the points which will eventually become the lines and curves of the ship under study. The points that define the lines on the original (generally smaller) plan are transferred one by one to the grid and the dots connected to form the new plan. The Virginia sloop was reproduced in Millar's book at a scale of 1/8" =1; so for this 3/8" = 1' scale plan you merely triple everything. The original occupies a space about 7" x 10", and three times that size fits nicely on one of the standard sizes of the commonly used drafting paper 1000H, 24" x 36".

Unless you own a drafting table, it's a good idea to start by taping a large piece of white poster board to your desk top as a proper work surface. Without it, pencil marks on the translucent drafting paper will be much harder to see and there will be no material thickness for your dividers or compass to bite into. Tape the sheet of drafting paper to the poster board work surface, square to the edge, using drafting tape or tape dots (little pre-cut discs of peel-off tape). Don't use regular masking tape; it has too much stickum on it and will pull away part of the drawing upon removal later on.

Ordinary 2H wood pencils, in great profusion and frequently sharpened, will do fine for the preliminary drawing. A drafting pencil, with H hardness lead is even better. Art gum erasers are fine for alterations. An erasing shield, a thin metal plate with various geometric shape cut outs is an absolute necessity; it keeps you from erasing anything other than that which you actually intend to erase.

From this point on, if you follow the text and switch back and forth to the plans, you will be able to follow the process with relative ease. With three 7" x 26" drawing panels penciled in along the right side of the sheet (for the sheer plan, the half-breadths and diagonals, and the outboard profile), there is still



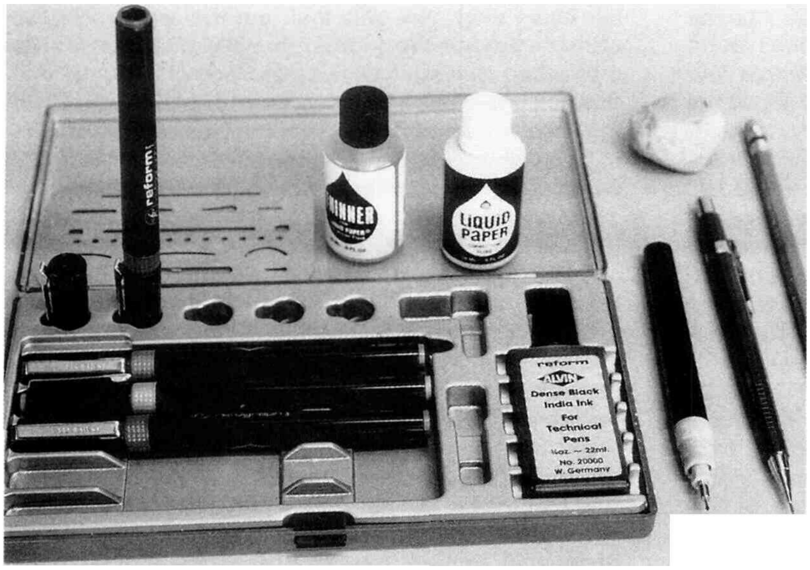
Basic drafting tools: ships' curves, triangle, protractor, lettering guide, ruler and yardstick, dividers, circle guide and combination French curve-protractor.

plenty of room for a 1 1/8" wide decorative border. The upper 7" panel can be extended 6 3/4" to the left for the body plan and the latter split vertically in half with a centerline.

The next step is to draw in the dashed lines for the perpendiculars, the vertical lines that are used to determine the basic length of the hull. Locate the first one with an approximate measurement from the original plan and the second one by measuring from the first. They can be drawn through all three vertical drawing areas.

Draw in the baselines now for the sheer plan and outboard profiles (both will have the same outline), noting that the baseline by convention represents the top and not the bottom of the keel. Many keels, especially on smaller vessels, vary in depth as they travel aft. There needs to be at least one scale foot of depth below the baseline for keel depth on this particular vessel.

Split the middle drawing panel with a horizontal centerline; the waterlines will be drawn on one side of the line and the diagonals on the other. The stations, the vertical lines that indicate the location of the body sections, are next drawn in across all three drawing panels. When it comes time to ink in the drawing, the station lines through the outboard profile will be erased. They are used as reference points for the frame locations prior to that, as the frames will not be located on



Drafting pens and mechanical drafting pencils.

the station lines (to avoid gunports).

Draw in the waterlines. For this model these are seven equally spaced horizontal lines from the baseline up. They are drawn both on the body plan and sheer plan. The first four were taken from the four waterlines seen in the original half-breadth plan. On to the sheer plan and the outboard profile now, where the design or load waterline is now drawn in. It is measured from the baseline at the fore and aft perpendiculars. Note that this waterline slants downward as it goes forward; these sleek little vessels always sailed deeper aft than forward, or down by the stern. With the waterlines completed, the grid or work panel is finished.

DRAWING THE SHEER PLAN AND OUTBOARD PROFILE

Although the sheer plan belongs to the lines plan and the outboard profile to the construction plan or the details drawings, it's easier to do both together. Every side view measurement taken off the original plan is just plotted twice, once in each of the spaces already provided. The simplest way to take the measurements from the original plan, convert them to the larger dimensions of the new scale and transfer them to the new drawing is with a pair of proportional dividers.

Either a commercial instrument or a home-made, one-scale-only accessory will do. A scale can be used, but then a mathematical conversion for each measurement will have to be made, and then the new measurement transferred to the drawing. While time is rarely a limiting factor in ship modeling, there's no point in just throwing it away!

Start by transferring the sheer line from the original drawing to the new drawing. Take the heights from the top of the keel at each station and at the perpendiculars and transfer them to the sheer plan and the outboard profile. Note the slight downward curve of the forward end of the sheer line on this vessel; it is rather an unusual design feature and will not often be seen. When all the points are plotted, connect them with a sprung-into-place wooden batten (held by someone else, of course) or with ships' curves. The fact that the original plans were redrawn meant that all the points did not automatically fall on a smoothly curved line. Eyeballing the proper curve is part of the art of fairing. Any curve drawn at this time may have to be altered later on as we get into the body sections, in a back and forth process, to make all the curves smooth and all the dimensions equal in each related view. Pencil and eraser to the rescue!

The top of the rail is done similarly, but is easier; just measure up the thickness of the rail from the new sheer line and connect the dots. This time the points should pretty well be right on the curve, that is, if you've drawn the sheer line properly! The bottom of the keel can be drawn in now, an easy job, rising 2" in its travels aft. Draw the curves of the bow next, using the intersections of the waterlines and either station F or the fore perpendicular as *reference* points. With the curves of the sheer and the stem drawn, the glimmer of a ship appears hypnotically appealing. The bowsprit goes on next, 80' from perpendicular. The diameter shown in the original plan is incorrect, at least according to the charts found in Steel; it should be 12 $^{1}/_{2}$" in diameter. A protractor with an extension bar is a particularly helpful tool here (and when placing the mast), for getting the angle correct. Pencil in the sternpost now and she's closed-up fore and aft. The lower line of the wales is a natural curve and is located and positioned just as was the sheer. Again, with a helper and a batten, draw in the lower line. With the latter in place as a *reference,* you can measure up the width of the wales to locate the upper border. The black strake (next run of planking above) and the molding are similarly done.

Ships' curves can be used to match each section of each curve to the lower wales line. This is a good time to draw in the stub of the mast. It is 16" in diameter (from the same table in Steel) and inclines 8' aft. The quarterdeck bulwark and rail can be drawn in next, then the stern structures and the cabin.

The final structures to go on both sheer and outboard views are the gunports. They are 21" long and 18" high, just fitting neatly between the lower edge of the sheer strake and the upper edge of the black strake molding. Note that the sides of the ports are perpendicular to the keel baseline; they are formed by the sides of frames in the full-size ship. The shape of gunports is generally not rectangular, but rather they are parallelograms, with the top and bottom more or less parallel to the gundeck and thus the load waterline. That is not the way they appear in our little vessel, which is so tiny and so deep aft that to do so would produce an ugly fenestration, offensive to the eye. It probably didn't make much difference in a vessel this small anyway, as the pitching and rolling would only infrequently bring the ports to the waterline-aligned level, and then only briefly.

Now on to the details that bring the outboard profile to life. First the upper surface of the deck at the sides of the ship needs to be drawn. As this important level is not indicated on the original plan, (it is on many *reference* plans), you have to do a little calculating from standard references again, this time Davis.

This ship is about the smallest size that would be built as a privateer, and probably carried the smallest size cannon found; three pounders. From Davis I found that three pounder shot was 2.792" in diameter and that the gunport sill was 3 $^{1}/_{2}$ shot diameters above the deck. Since it's known where the gunport sill is located, the deck can be located by drawing a dashed line connecting points 2.8" x 3.5 shot diameters, or about 10" below each port. The deck would follow the waterline in a larger ship, but can't here because of the marked slant of the waterline on the Virginia sloop. A natural curve following the curve of the wales (but flattening out a bit in the bow) should be about right. The deck will end aft in the plane of station 4, the break for the quarterdeck.

The forked timber on the aft quarter is the boom crutch. The 6" square vertical timbers along the sides are the swivel gun posts. The oval hole forward (really a round hole seen obliquely) is the hawse hole, the opening in the hull for the anchor cable. The timberheads are the vertical extensions of some of the ships forward frames, and are shaped to facilitate belaying lines. The crooked timber peering over the bow rail in perspective is the cathead, the crane-like device that carries the tackle for hauling up the anchor. The seven oddly shaped smaller holes along the sides of the hull are oar ports; they seem to be about 4" in diameter; the little oblique slits on either side permit the retraction of the oar blades. The round holes would, of course, cause less wear and tear on the shafts of the oars than the usual square ports (ships were sometimes even rowed through the gunports). Draw in the channels, which fit directly between the second and third gunports. The deadeyes were 7" in diameter. Their chainplates extend down to the bottom of the wales; each inclines a bit more from vertically than the last, going from aft forward. The exact amount of chainplate angulation always waits to be determined by the angle the shrouds make as they descend, and thus awaits the drawing of the rigging plan. The outboard profile is completed by drawing in the rudder, together with its pintles (with pins; on the rudder) and gudgeons (with sockets; on the hull).

WATERLINES

Begin by drawing in the width of the keel on the upper of the two remaining horizontal drawing panels. Note that the keel always needs to be drawn in two thicknesses. The difference between the full thickness of the keel forward of the fore perpendicular on the waterline drawing and the partial thickness aft of that line represents the thickness of the planking. For each station, plot the waterline widths both from the original half-breadth plan and the original body sections plan. They will occasionally be the same, but most often different, and often considerably so, equivalent to about six inches on the full size ship.

The art of fairing comes into play as the ships curves are used to average out the differences by eye, knowing that you will probably have to come back and make some alterations when you get around to re-drawing the body sections. Note the extra (fifth) waterline aft. It represents the inward curvature (tumblehome) of the quarterdeck area of the ship.

Drawing the stern structures, the transom with its taffrail above and counter below, is difficult in almost any sailing vessel plan of this era because the transom generally curves athwartships (from side to side) and tilts backwards. Not only that, but the area below the transom proper, the counter, has a vertical curve of its own when viewed from the side. Copying the original drawing is facilitated by using the ends of the taffrail and the lower border of the transom (the vertical curved lines in this view) as additional reference points. With this completed, the waterlines drawings are finished.

THE BODY PLAN

The body plan panel in this drawing sheet is in the left upper section of the plan. Begin by drawing in the width of the keel. Next plot the widths of the midships section waterlines; they are taken from the new half-breadth plan and plotted on their respective horizontal waterlines. The vertical height of the body section is taken from the sheer plan at the proper station line, using dividers spread from the keel baseline to the undersurface of the rail. Ships' curves are now used to connect the points that will form the continuous curve of the body section. Note that the segment of the body section below the first waterline is not a straight line, but rather a slightly concave curve.

The other sections of the afterbody are similarly plotted, with a good deal of eyeballing still needed to match the curves as each section is added. Note that the inward curve of the top of the sides of the ship at the sheer and rail lines (tumblehome) starts at station 3. Go back and modify the waterlines on the half-breadth where necessary, and then back and forth between the two drawings until the sections look right and the half-breadths are smooth and even. Connect the tops of the sections with the aid of a shallow curve. The transom is difficult in this view also, for the same reasons as already mentioned. Extending lines from the sheer plan and taking points from the waterlines plan helps, but a good eye is needed to finish it up. The dotted line represents the junction between the undersurface of the planking and the transom.

The stern lights (windows) are not rectangular, not the same size throughout, and not horizontal! The lateral light flares out a bit at the bottom, and all the lights follow the curve of the deck (camber), which is about the same curve as the transom counter molding curve. The miscellany in this view include the taffrail, transom and counter moldings, the boom crutch (the forked timber above the taffrail), and the load waterline.

As you can see, the LWL is a curved line in this view; that occurs because it is a slanting line in the sheer plan and has to follow the curve of the hull in the body sections plan. When the sections forward of midships have been completed on the left side of the panel, draw the aft sections on the right. Start with section A and do not repeat the midships section. These sections are a bit easier to draw, but they redraw just a bit fuller than on the small original.

DIAGONALS

The body sections finish up with the diagonals, the architectural lines which prove that the hull can be planked. The diagonals are a little different from the waterlines in that they need to be drawn first on the body plan then transferred to the blank area adjacent to the waterlines plan, rather than the reverse. Three diagonals should fill the need. They start at waterlines 4, 3 and 2, at the centerline and end, respectively, at the turn of the bilge, the end of the deadrise (the angle formed by the flattish bottom of the hull from the keel outward as compared to the horizontal), and the point of maximum concavity of the lowest segment of the body section.

The exact location of diagonals is said by the experts to not be important—just their presence. They should be as close to perpendicular to as many of the section outlines they intersect as possible and they should describe areas that are not already described by waterlines. They obviously aren't needed to describe the almost flat sides of a ship. Plot each station for each diagonal on the new panel and connect the dots with ships' curves as guides. This will produce three new smooth curves, distinguished from the waterlines by the fact that they do not exhibit concavities. Makes sense; they prove a hull can be smoothly planked and planking never dips inward as it goes from frame to frame (if you've done everything properly). The only change from a smooth convex curve in diagonals results from the presence of the almost vertical areas low in the hull at the bow and stern in many hulls. These flat areas cause the diagonals to harden, that is, to straighten out a bit and appear almost flat. Not to worry. That's the way it should be. Use a triangle or your scale to extend the intersection of the diagonal with the keel fore and aft, short, straight lines drawn out from the centerline the thickness of the rabbeted keel. The diagonals intersect and end upon these short lines.

THE CONSTRUCTION PLANS

Disposition of Frame. Where did that awkward little term come from, you ask? That wasn't in the list of drawings to do! True, but the outboard profile is an ideal place to draw in the frame locations to avoid still another complete drawing. The latter would have been called the disposition of frame in the classical era. As discussed, Steel would have us put in 18 floors, and thus 18 double frames or bends in a small sloop. His *Naval Architecture* also clearly states that all vessels should have bends forward and aft of each port, and that bends should never be cut. I have also seen that nautical archaeologists have discovered that small vessels, especially New England built vessels, but presumably also Chesapeake Bay ships such as this one, were often built with a totally different framing format than larger vessels.

Conflicting data can be a problem, but reasonably appropriate compromises can be deduced. Aside from the midships bend, which appears in virtually all ships, it seems impossible to disregard the value of frames on either side of each port for strength and for cannon rigging points. We know this was the standard practice for naval vessels. There is very little data that shows whether double frames were actually used to frame ports in small vessels, but it seems like a workman-like solution and will be used here. Thus, in this plan, the first double frame, the midships or primary mould frame, frame #10, goes up first, then the next eight bends go to frame the ports. That makes nine. The dead-flat also takes care of the mounting location of the third swivel post. I put in the next two bends, one aft of station 2 and one centered on station E, to take the mounting bolts of two more swivels; up to 11 now.

In the bow, double frames are located under each timberhead (because a timberhead is the upward extension of one of the top timbers of a bend) and a fourth between the first pair for strength; 15. In the stern, one goes logically at the vertical line down from the roundhouse, one goes aft of station 7, the station that really determines the shape of the after-body of the hull, and one far aft as the fashion frame, the one that the wing transom fastens to. That's 18. Most of the open spaces now seen between bends would have been filled with single filler frames, fitted inside the ribbans, plus a variable number of disarticulated frames far forward and aft, inserted futtock by futtock as construction proceeded. It is not at all practical to show these filler frames in the model, but, since nature abhors a vacuum, it seems appropriate to put in two more bends centered in the large remaining open spaces in the stern to make everything visually coherent. They go in the space between the roundhouse frame and the station 7 frame and between the latter and the fashion frame.

The frames are numbered consecutively from forward aft. Twenty double frames altogether. Not necessarily strict contemporary practice, but a bit more than the usual model maker's convention.

This of course means that there will not be a fixed room-and-space dimension for the Virginia sloop, but since the construction drawings are presented here in their entirety, it won't be a problem for you, at least not for this ship. If you do go on to your own scratch built projects in the future, however, and they involve the smaller American vessels, it will be a problem you will have to consider and resolve.

ODDS AND ENDS

The surface of the deck at the sides is already drawn in. Now draw the surface of the deck at the centerline. The center of the deck is higher than the sides because of the camber or round-up of the deck, the curvature designed to shed water and perhaps limit some of the recoil motion of the gun carriages. According to Steel, the camber for mid-size frigates, which were pretty stable gun platforms, was about 3/16" per foot of beam.

For small sloops such as this one, with low freeboard and lots of shipped water, it was double that. A dotted line drawn 6" above the existing deck line at the midships section indicates the camber; the line flattens out forward as the actual depth of the camber at any station is related to the breadth of that stations athwartship. The bow of the ship is narrow, so the depth of the camber is shallow, barely more than the thickness of the planking. This is actually helpful, as it keeps the deck more or less flat automatically. The concept of the depth of camber is sometimes difficult to understand the curvature is the same; the depth is different. Visualize an orange slice cut in half at the diameter representing midships. Cut off the very top to represent the depth at the bow. You can see that the curve is the same, but the breadth and depth are much less.

It's a good idea to draw in a deck curvature diagram someplace on the plan for *reference.* In such a diagram, as you can see from the one supplied, a semi-circle, whose radius is equal to the calculated camber (a scale 6" in this case) is drawn at the center of a line whose length represents the scale total width of the deck at the midships frame. (They need not be drawn superimposed; it's just a draftsman's convention). The horizontal segment representing the radius of the circle is divided into four equal parts, as is the corresponding arc segment of the circumference, a quarter circle. Straight lines are drawn to connect these points. The length of these resultant lines are plotted vertically along the deck width line, which has also been divided into quarters to receive them. The tops of these short lines are then connected with a smooth arc to form the curve of the deck. This camber pattern is used for all the deck beams in ship construction; remember, the camber is always the same for any given deck; only the length of the segment on each side of the centerline changes for the shorter beams of narrower deck areas.

Chapelle found a break in the deck of the sloop MEDIATOR and included that feature in his reconstruction of the deck of Chapman's Bermuda sloop. Doing so creates a mini-quarterdeck, a one foot high barrier which seems to have been designed to keep deck water from getting into the aft cabin. It seemed such a logical idea that I have included it in this plan. It begins in the vertical line determining the break in the bulwarks aft at station 4 and ends at the roundhouse former. Its assigned camber is seven scale inches, as camber increases on each deck from below/above.

Again concerned with the movement of water from the deck, scuppers, the holes in the sides that acted as storm drains, need to be drawn in. In small vessels these were often of odd shapes, rather like a Cupid's bow pointing upwards, or were semi-circular; they were generally round in large vessels. Ovoid or semi-circular openings thus need to be drawn between each pair of frames, from the first to the last gunports, a total of ten.

The keel would probably have been made of a single timber as it was not very long, thus no scarphs (joints) in the keel are shown. A scarph is needed to join the stem to the keel, however, and it seems that an ordinary horizontal plain scarph would do the job. A similar scarph joins together the two segments of the stem; a single piece here would present too much cross grain at one end or the other and invite splitting. A socket is needed in the keel aft to take the tenon that was usually formed on the lower end of the stern post.

Finally, a scale needs to be drawn for future users of the plan. Any available space will do. Leave one foot of scale to the left of the zero mark for an inches scale, then go as far to the right as your plan permits, with at least ten one foot markers at the start, then whatever interval seems appropriate. In re-measuring the sloop after completion of the drawings, she was found to be very close to the dimensions given in Steel for a 60 ton sloop, just a bit longer and broader, but a fair amount shallower. Both tonnages are probably correct, each representing a different method of calculation for different end purposes, the former for customs purposes and the latter for estimating displacement. The measurements were:

Length overall.................... 59'4"
Length between perpendiculars....... 54'8"
Beam (inside planking)............. 17 '4"
Depth in hold........................ 6'
Draft (average)...................... 7'
Burden in tons (Builder's meas.)42 given; 60 est.

This sheet, number one of four, is now completed by inking in all the lines with drafting pens. Both disposable and relatively inexpensive refillable pen sets are readily available. A #0 does well for the *reference* lines of the grid, and a #2 for the lines of the sloop themselves. One tends to forget that unlike the felt-tip pens in use at home and office every day, India ink runs. Be sure to stick some duct tape, or an equivalent spacer to the down side (or both sides, if you flip them in use) of each drawing instrument you use, a bit away from the edge. The tiny gap thus formed will keep the ink from running under the scale or triangle or whatever and staining the drawing. After the ink is really dry, use art gum to erase what's left of the pencil lines.

For the inevitable occasional smudge, or for the line drawn in the wrong place, thinned typewriter whiteout, painted over the offending area with a small paintbrush will cover it up. White-out is invisible in most photocopy processes (but usually not in other copy formats such as blueprinting). Use only a professional copy service, such as an architectural blueprint service for best results and least distortion. The photocopies of the plans for this project varied less than 1% from the original, and the blueprints matched the photocopies almost exactly.

The space below the body sections is a good place to put in titles, the draftsman's name and the ship's data. The lettering can be done by hand or with a stencil if it's for personal use. If an article is planned for a ship modeling magazine or other publication, a more professional lettering process will be needed. For most of us non-artists, that means dry transfer lettering which are available in many sizes and styles. With dry transfer one simply positions the letter or number properly on the plan, then burnishes the plastic overlay sheet with the equivalent of a flattened, polished dowel to fix the lettering in place. It's very easy and absolutely wonderful for waterline and station indicators. Pencil lines (photo blue) can be used to align the lettering; like white-out, photo blue is photo copy invisible. Dry transfer packs and photo blue pencils can be bought at most artist supply and stationery stores. The occasional dimension line, number or circle elsewhere on the plan can be drawn with the aid of stencils.

INBOARD PROFILE, DECK PLAN AND PROFILE FORMERS

The draftsman must supply the shipbuilder with a good deal more information before the latter can go to work. With the drawings completed thus far, the lofter can begin to draw the frames full size. The builder, however, before he can begin, needs to think about all the structures of the deck (the deck furniture), the placement of the mast and bowsprit, the fitting of the catheads, the location and size of the companionways, hatches and scuttles, and a dozen other things. The designer has to include all this data in the complete set of drawings to guide the builder.

Scratch building ship modelers are both designer and builder, and thus are obligated to do an exceptionally good job for themselves. This second sheet, then, will show an inboard profile with additional views on deck forward and aft, a deck plan, and the first of the lofting drawings, the profile former. The latter is a model maker's convention structure not directly related to full size building. The inboard profile shows the inner sides of the ship (bulwarks) above deck level and the side views of the deck furniture. The view aft will show the quarterdeck break, the steering wheel, the roundhouse bulkhead with its removable doors, and so forth. The view forward will show the catheads, the bowsprit heel and so forth. The deck plan will show these same structures, but looking down from above. The profile former is a longitudinal, midline, vertical plywood plate into which the frame equivalents (which are called bulkhead formers for simplicity and clarity rather than absolute architectural accuracy) will be half-lapped. The formers themselves, the equivalent of lofted (enlarged from plan size to full size) frames in real building, will require yet another sheet of drawings.

SETTING UP SHEET NUMBER 2

Begin by taping another sheet of 24" x 36" 1000H drafting paper over the first plan sheet which should still be taped to the desk. With pencil, draw in the same size border. Across the top of the sheet, pencil in a drawing panel using waterline 2 as a baseline. Draw in the load waterline as a *reference* line. Extend the panel to the left as we did for the body sections on sheet #1, also with a vertical centerline, this time for the fore and aft inboard views. Directly over the half-breadth centerline below, draw in the centerline for the deck plan; we will only draw half the deck, as it's largely (though not entirely) symmetrical.

Much of the profile former will be traced directly from the outboard profile, so just go ahead and trace the load waterline and the baseline (to the sternpost and stem) as reference lines. Waterline 2 will also have to be added to the profile former plan, as this line, drawn both on the profile former and each bulkhead former, is the alignment key when the skeleton of the model is fitted together in the workshop. The next step is to draw in the general outline of each of these special views. For the inboard profile, trace the general outline of the hull above waterline 2, excluding the rudder. Trace the mast, ports, bowsprit and the rail. Draw in the break in the deck, the quarterdeck and the roundhouse bulkhead. Go to the deck plan area, where you can trace waterline 4 as being very close to the deck dimensions to the inside of the planking at the proper level. Extend the break in the deck and the roundhouse bulkhead down from the drawing above.

Move left to the fore and aft view drawing panels and trace the outline of the midships section to the left of the centerline and station A to the right. On the left, draw in the main deck curvature at the midships section, then the outline of stations 4 and 5 with the quarterdeck curvature and the outline of the roundhouse bulkhead. On the right, draw in the shape of the bow at the fore perpendicular, taking the dimensions from the half-breadth on Sheet Number 1 to get a feeling for the perspective of that area. Also draw in station A to get the maximum breadth section for the forebody and station E to locate the cathead and timberheads. Almost the entire drawing of the profile former can be done at this stage. Its outline includes the lines of the sternpost, keel and stem, and then runs two scale inches (1/16") the thickness of the deck planking below the line representing the middle of the deck and quarterdeck. The line then continues one scale inch (1/32") behind the roundhouse bulkhead (to allow for the thickness of its paneling), one scale inch (1/32") under the roundhouse roof (the thickness of its planking) and one scale inch (1/32") under the transom and counter for their planking thickness.

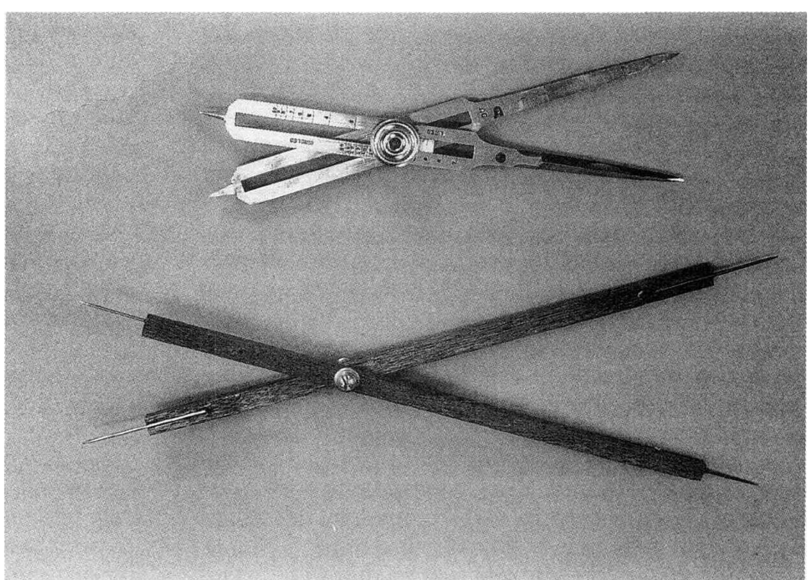
The rabbet as indicated at this point on the plan is actually closer to being the back rabbet line, the resting site of the inner corner of the planking. The rabbet is actually defined by the rabbet line below the back rabbet line internally and the bearding line above. This can all be represented on the plan by drawing half the planking thickness above and half below the existing line.

Extend the stem, sternpost and keel depth 1/4" into the profile former. This will provide strength later when the hardwood keel, stem and sternpost are doweled into the plywood former. Draw in the location of all the frames. Most end at the bearding line, but the last four end higher; take their depth from the body sections plan of Sheet 1. The profile former plan only needs to show the area of contact between the bulkhead formers and the profile former. One could show the full length of the frames by drawing in the bulwarks sections of the bulkhead formers that extends above the profile former, using dotted lines to do so. The bulkhead formers in the area of the aft cabin or roundhouse can be extended now to the upper margin of the profile former. The length of the notches for the bulkhead formers will have to await their individual drawing. The wing transom, the sturdy transverse beam that supports the transom/counter frames, is seen in cross section. It lies one scale inch (1/32") planking thickness again inside the hull at the counter junction, in line with the wales and butting up against the fashion frame, #20.

Now unstick both drawings, remove the original, and tape Sheet Number 2 down again to continue.

DECK FURNITURE

Loosely interpreted, deck furniture includes all the fittings one finds on deck and at the bulwarks, including the bolts and ringbolts. Some reconstruction is needed here as the original plan has no deck drawing. An educated guess as to what the deck of the vessel looked like can be made based upon contemporary data and common sense. The work of Howard I. Chapelle is, as usual, a good starting point. Using his drafts of the Chapman Bermuda sloop and the sloop MEDIATOR (MEDIATOR deck plan, inboard profile), Hewlitt R. Jackson's drawing of the sloop UNION, Harold Hahn's schoner HANNAH plan, and Rob Napier's model of the Bermuda sloop, all with deck reconstruction to a greater or lesser extent, certain deck furniture and



Proportional dividers and shop-made dividers.

associated structures are seen to be required:

1. Scuttle forward: One only. Probably to port.

2. Main hatch: Steel gives 5' x 9' 6" as the size for a small sloop. Two feet of shortening makes it more compatible in size with the other source drawings and allows a bit of room aft for a companionway.

3. Companionway: a 3' x 4' hatch for access to the hold by ladder, covered with a small shed or deck house with a hinged top and doors for weather security.

4. Pumps: Two log pumps are needed. They are located aft of the companionway. They drop down to the sides of the keel, where a special well would have been created to surround them.

5. Roundhouse bulkhead: A scale one inch thick (1/32") plank barrier on the quarterdeck. Contains doors to the cabin, which can either be lifted out of their hinges or hooked to the ladders for fighting room. Site of the steering wheel drum bearing.

6. Steering wheel and its standard: The wheel should be about a scale 3' in diameter (1 1/8"). The drum is a scale 1' in diameter (3/8") and a scale 1' long.

7. Bowsprit clamp: Chesapeake Bay sloops were identifiable not only by their round-roofed cabin aft, but also by the fact that the heel of the bowsprit was fastened to the deck beams not by the conventional bowsprit bitts, but rather by a sturdy iron band. Steel also lists a bowsprit clamp at the sides of the stern. This is an appealing answer to the question, "What holds down the bowsprit at the stem in a sloop, as there is no knee of the head to affix gammoning."

8. Catheads: These are the cranes for the anchors. Steel has them at 3' long for a small sloop, inclining upward 5" for each foot of length. They are approximately at right angles to the sides of the ship.

9. Galley scuttle and galley stack: Small ships may have had a stove in a shack on deck (a camboose), or a stove on a brick hearth below decks, with the stack or chimney going up through the deck. The latter is used here, as low freeboard and decks awash would probably not be too compatible with orderly meal preparation. The galley scuttle is as far forward of the center of the mast as the main hatch is aft of it a scale 2'6" (2 3/16").

10. Binnacle: A small chest, lashed down to the quarterdeck, the binnacle held one or two lanterns, the ship's compass, and perhaps a sand glass for keeping time. This one is about 16" deep and 40" long (1/2" x 1 1/4"), absolutely arbitrary dimensions.

11. Fore bitts: The rail-like structure just forward of the mast. Used to belay certain lines, as will be seen in the rigging process.

As you can see, everything that appears in any one of the three remaining drawing panels appears on each of the others. The easiest way to proceed is to draw all the above-mentioned structures on the plan view (always the one looking down from above), then, by measuring from the perpendiculars, transfer them to the other views (elevations, or views from the front, rear or sides).

One new tool will be required for this part of the work, a circles template. Using a compass to draw even a medium-sized circle is not very accurate; for tiny circles such as ring bolts, it is impossible. It is a good idea to customize your circle template also for drawing the end views of ring bolts and the small curves in the steering wheel handles, both 1/32" wide by 1/16" long (scale size) parallel-sided ovals. The template can be made by drilling two 1/32" diameter holes in an unused area of the circle template and cutting out the sides with a narrow point hobby knife. A similar, larger oval can be made to use as a template for the steering wheel handles. Before starting to draw in these deck structures, draw in the hull planking (scale 2" thick = 1/16"), the bulwark planking (scale 1" thick = 1/32"), the thickness of the frames and thus the internal hull thickness (scale 5" = 5/32") and then the rail with its outboard molding.

The molding is a scale 1 1/2" thick (3/32"), so the rail will be the sum of all of the above, or a scale 9 1/2" wide (19/64"); it is flush with the bulwarks inboard. You will have noticed that at each level higher main deck, quarterdeck, transom the rail inclines just a bit more towards the centerline of the deck because of the tumblehome of the hull. It's a bit difficult to draw. Once that is accomplished, however, draw in the channels, the horizontal hull extensions that hold the shrouds out from the hull. They extend the full distance between gunports three and four. A scale two inch thick (1/16") cap rail holds the deadeye chainplates in place; one by two inch notches (1/32" x 1/16") are provided in the channels for the latter.

Now, with that nice, blank outline of a deck inked in, go ahead and draw in the deck furniture. Note that the aft end of the bowsprit heel is planed flat for about one foot to lie flush upon the foredeck. When transferring the structures from the deck plan to the inboard profile, you will need to know that Steel gives the vertical height of the coaming for the scuttles and hatches as 12". It seems tall at first glance, but when you remember the low freeboard, the break in the deck and the numerous scuppers, it makes sense. The sides of the hatches taper from a scale 4" thick (1/8") at the deck to 3 1/2" thick (1/16") above; the scuttle coaming a scale inch thinner all around.

Between the inboard profile and the deck plan, find a bit of space to draw in the forward elevation of the deck house and another to draw a typical port cannon bolts layout. The deckhouse companionway doors open forward on this ship and are hinged at the sides like barroom swinging doors. The gunports require two ring bolts for the breeching of the cannon (the shock absorbers) in the spirketting, the run of planking just above the waterways.

The latter, by the way, would be a scale 3" thick and a scale 9" broad, according to the charts in Steel for a 60 ton sloop, but as the latter seems to be unarmed, perhaps they should be a bit thicker for a vessel with guns, so that the trucks (wheels) of the gun carriages have their usual cove to run up against. The Virginia sloop will have waterways a scale 4" thick (1/8") and 6" broad (3/16"). There are also two eyebolts flanking each port for the cannon train tackles. The bolts are all of scale 3/4" inch diameter stock (.023"), the eyes being three scale inches in diameter (3/32") and the rings five scale inches (5/32"). The fore and aft views over to the left of the page are much more difficult to draw, as they are partially in perspective we see some of the thicknesses of the hull and the flow of lines fore and aft. A good true perspective by an artist would be much more pleasing to the eye, but for our purposes, accurately locating the quarterdeck structures aft and the catheads forward will be more than adequate. Besides the wheel and its standard the binnacle, ladder and cabin doors need to be drawn. The ladder is not much more than a step stool, 22" wide, with three steps 10" apart, tucked snugly up against and at right angles to the bulkhead. The cabin doors are 32" wide and hinged at the outer side. It's all a little crowded back here, but it's a small ship and it's all necessary. Draw the binnacle below the main drawing to avoid the confusion of several layers of dotted lines. It also makes sense to draw it backwards, that is, draw the aft or working face of the case; the forward side is plain framed woodwork, just like the sides. The holes in the end compartments are for airflow for the lanterns; there would have been glass-paned windows in the partitions between these compartments and the center section for the illumination of the compass.

The odd angles involved make drawing the cathead a bit difficult also, but in fact all we really want to show in this view is the fact that the timber is a grown crook and that it ends short of the deck, being rounded-off below and bolted to the bulwarks.

BULKHEAD FORMERS

The final series of drawings needed to build the hull of this ship are those for the bulkhead formers, the frame equivalents. These are very much like childhood's model airplane formers, as they are vertical solid planes whose shape determines the shape of the hull. They are surprisingly easy to draw, at least once the basic concept of drawing the bevels is mastered.

The formers actually begin on Sheet Number 1, with a modification of the waterlines plan. Using a straightedge, extend the sides of the frames upwards from the disposition of frame plan, conveniently drawn directly below and in line with the waterlines plan, across the latter plan. These two lines per frame determine the forward and aft face of the bulkhead formers, looking down from above. The midships frame, #10, is pretty much square to its faces, up and down, at each waterline. The others have bevels, increasing as one progresses farther forward and aft of amidships.

The bevel is different at each waterline because of the different shape of each waterline. The bevel inclines forward in the forebody and aft in the afterbody. These two drawings determine by themselves the entire shape of the bulkhead formers as well as their bevel. A pad of 8 1/2" x 11" 1000H drafting paper comes in handy for drawing the individual bulkheads. On one sheet, draw a 7" square, with a vertical centerline, and draw in all the waterlines as was done on the body plan. Draw in both the full thickness of the keel, eight scale inches (1/4") at the centerline, up to about waterline 2, and the narrower width of the rabbeted keel above. Ink it all in. This sheet will be the master grid and will inserted under each bulkhead former drawing sheet in turn as you go along.

For each individual frame drawing, ink in the 7" square outline, the centerline, waterline 4 (the latter will be used to align the drawing for folding to trace the drawn half), and waterline 2. In pencil, draw in the width of the keel. Now, with dividers, transfer each waterline width (1 through 4) to one side of the former drawing sheet. (Put a point for the width of waterline 4 on both sides of the midline to help in alignment when folding). These points will determine the shape of the curvature of the bulkhead former, just as they did when in the drawing of the body plan. The only difference is that the body plan stations were planes with no thickness and thus needed only one set of points each: the bulkhead formers, having thickness, need two sets of points each. One set of points determines the curvature of the forward face of the former and the second determines the curvature of the aft face. By convention, we will assume that we are always viewing the formers from the front. The second curve for each; therefore, will be a solid line for the formers forward of midships and a dotted line aft. (The bevel in the afterbody is towards the stern, so the second curvature line is on the backside of the former as we view it; out-of-sight = dotted line in drafting).

As suggested earlier, the midships frame is essentially square, so no second lines will appear as the measurements are taken; unfortunately, it is the only one so blessedly endowed among the 20.

The upper level of the main wale is a key location when planking the hull, so put a mark at that point, taken from the sheer plan, on the bulkhead former outside curve. Also mark the undersurface of the main rail on all those formers aft of the quarterdeck break, so the rail molding can be continued aft smoothly during construction. Take the height of the deck at the sides and at the midline from the outboard profile with dividers and transfer to the bulkhead former drawing. Using a template cut to the curve of the camber diagram, or a ship's curve with the proper curve segment marked with two bits of tape, draw in the curve of the deck. There is a slight fore-and-aft curvature to the deck, so the deck surface of the formers need to have that indicated. Use a dotted line in the forebody (the tilt is aft) and a solid line in the afterbody.

The bulwarks are five scale inches (5/32 ") wide at the undersurface of the rail and can be drawn next. Although these formers have only the outside bevel to be shaped for the most part, the bulwarks need to be planked internally and therefore the tops of the formers for the open deck area need to be beveled internally also. This means, of course, that the full molded dimension of the tops, five scale inches above and a bit more below, needs to be drawn for both faces of each frame. For the frames of the forebody, the stock is already there, just hidden behind the front face; the bevel can be indicated by a dotted line. For the afterbody, the width of the top needs to be added to the inner surface of the tops, indicated by another solid line.

The vertical height of the former at the side is taken from the outboard profile also, again to the under-rail position. There may be a slight fore-and-aft bevel to the tops because of the sheer curve, and this will be in the direction opposite to the bevel of the sides. It can be drawn in or left square using the longer dimension, to be sanded to exact bevel in the building process. Draw in the hull curves as on the body plan, using small ships' curves as a guide. Note that in the afterbody, in frames 17-20, if one draws natural curves in the underbody the curve seems to pass through the vertical line of the profile former. Don't be alarmed, it's not an error inherent in anateur drafting, it really does. This is an important reminder—when the hull is actually built, this area of the profile former will have to be scraped and chiseled away to allow the planking to lie flush with the surface of the keel and stern. This in turn means that the lowest fraction of the bulkhead former height in this region will actually be made up of the substance of the profile former, the part between the keel line and the rabbet line. Finally, allow about half the vertical height of the former body for the notch that egg-crates with the profile former. Ink it all in.

Fold the drawing on its centerline, back to back, using waterline 4 and its extra width marking to help get it just right, then trace the first half onto the second. That's all there is to it! Do the midships frame (bulkhead former #10) first, because it's easiest, then the rest. Compare #10 to the body plan by overlaying, then compare each bulkhead former drawing to the last by holding the drawings up to a light. You actually can stack several this way to get a 3-D view of the developing hull form. Notice the large amount of bevel to the formers in the bow.

In real ship framing of large vessels, the frames of the bow were generally (although not always) tilted in the vertical plane (canted) so that the planking face of the frame was essentially parallel to the planking. This prevented the frames from becoming weak by having been beveled to almost a triangular cross section. The latter, however, was not an uncommon practice in small American vessels. Finally, transfer the bulkhead former notch depth to the profile former drawing on Sheet Number 2. If these are personal use drawings only, they're finished. If the drawings will be shared with others, it's a good idea to trace all the bulkhead former outlines onto a single sheet of drafting paper, as has been done here, for ease of reproduction.

As you have guessed, this whole process can be entered at any point. If one starts with a good set of plans drawn for plank-on-frame construction, only the bulkhead and profile formers will have to be drawn. If one starts with a well-drawn three view draft, such as are found in Chapelle's books, then the plate will have to be enlarged, and the bulkhead formers and profile former drawn. Starting with a simple unfaired drawing, as we did here, the whole ball of wax needs to be done—the lines plan redrawn plus all of the above plans drawn.

THE RIGGING PLAN BASIC SETUP

Much of what has just been said about the construction plan is true also for the rigging plan. The doing of it can be entered at any point in the process and a good pre-existing drawing obviates the need for doing it at all. The following details, however, will increase ones understanding of the vessel, its construction and its function, and will make the building of the model just that much easier. It is also the complete process for doing a ground-up set of masting/rigging/sail plans for a future model.

The fourth and final sheet of drafting paper needs to be fastened down and an educated guess made as to the overall dimensions of the finished model. In many scales, and certainly in the very large scale used here, it will quickly be seen that this elevation will not fit on a standard sheet. For this 3/8" to the foot sloop, a reduction to 1/4" to the foot will permit the elevation to just fit it on the sheet, and even then only with the hull cut off at waterline 2 and placed near the bottom margin line. It's difficult to determine all of this in advance. A certain amount of experimentation will be necessary. The moral of this part of the story is to just outline the hull and spars with a few pencil lines to get the basic setup right before going any further.

Set the proportional dividers to a 3:2 ratio to reduce the lines of the already drawn outboard profile (sheet 1) to 1/4" scale for the rigging plan. Use the perpendiculars, the midships line, and stations C and 4 to transfer points. The profile needs to be pleasing to the eye, but does not have to be as accurate as the lines and construction plans, as no hull measurements will be taken from it. It's just there to hang spars from.

Draw in the centerlines of the first set of spars the mast, bowsprit and main boom. The mast is 76° from horizontal, the bowsprit 80° from vertical, and the gaff about 7' above the deck at the mast (it runs parallel to the roundhouse roof from there). The lengths of all the spars remain to be calculated.

SPAR DIMENSIONS

The Chapelle drawing of the rigging plan of the sloop MEDIATOR rather than his Smithsonian sail and rigging for the Virginia sloop will be our starting point. The latter plan shows a rather unappealing (to me) low rig; no style. We are going taller than the rigging plan of the Virginia sloop. This means that the two spars crossing the masts will be the topsail yard and the spreader yard. The crossjack yard in the Chapelle drawing for MEDIATOR actually calculates out as being the larger spreader yard in the Steel tables, both in length and diameter, so the latter will be the name used here for the spar which spreads the foot of the topsail (that means of course that the spreader yard is really a boom yards suspend sails, booms control the foot of a sail, but that's too much semantics to deal with just now). As seen in *reference* plans, various rigging schemes have used these two yards in various ways, but when the shorter crossjack yard is used, the much smaller swallow-tailed topsail seems generally to have been bent to it.

The charts from Steel that were used to calculate the basic spar dimensions for the Virginia sloop are the chart for the length of spars for sloops, the chart for the largest diameter of the spars (the proportional or given diameter), and the chart for the dimensions at the quarters. Some modifications were done when necessary to permit the general sail dimension ratios taken from MEDIATOR to be used. Some of the spar dimensions are based on the hounded length of the mast alone (meaning the length of the mast from the bottom to the beginning of the head), and that dimension is also included in the developed spar chart for clarity.

The overlap of the jib boom on the bowsprit is 40% of the length of the former, scaled from rigging plans in Chapelle. The overlap of the topmast on the mast is 5" per yard of mast length.

The final dimensions for mast and spars that were used for the Virginia Sloop are given here at full size. The 1:32 scale chart can be found in the chapter on masting and rigging. For drawing the rigging plan itself one has to work out another set of dimensions for the scale of the rigging plan sheet, but there is no point in including that data in these charts. The scale conversion factor is the scale ratio in decimal format (one divided by 32 is .031 for 3/8" scale, one divided by 48 is .021 for 1/4" scale, etc.) times the full size spar dimension.

In drawing the spars themselves, it will be noted that diameters are given for various quarters along the length of the spar. The assumption that this means that the spar is divided into four equal parts and the dimensions apply to the junctions of the quarters is unfortunately incorrect.

There is essentially a different definition of quarters for each type of spar. For the mast/topmast, the portion of the spar below decks is called the heel. The squared-off portion at the top, between hounds and mast cap, is called the head. The length between the mast partners in the deck and the beginning of the head is divided into four quarters for diameter measurements.

For the topmast, the area between the top of the heel and the rigging stop is divided into quarters. The boom, which is shaped more like a baseball bat than anything else, is thickest aft where the sheet attaches; the other dimensions are given in the chart as fore, aft, and middle, rather than as quarters. The heel of the bowsprit is the inboard portion, the quarters beginning as the sprit leaves the bow. The jib boom doesn't have quarters, just a given diameter and a diameter 2/3 of its length forward. For yards, the quarters are set off on each side of the center of the spar; the first quarters on each side of center combine to form the slings.

The dimensions for the topgallant yard or the cross-jack yard are not given in this chart, but should the urge to rig the ship in cutter fashion arise, it's easy enough to calculate from the *reference* charts given or by forming ratios from the MEDIATOR rigging plan. When drawing the spars, remember that the cut-down shoulders at the ends of the spars, the rigging stops, are generally 1/24 the length of the spar. The yard arm is actually the entire outboard quarter. The topmast cap, that generally large block of timber at the top of the head of the mast which acts as the support for the topmast, seems much smaller in the Bermuda-Chesapeake sloop plans than the sizing formula in Steel would suggest. This seems to indicate that the cap (and probably the bowsprit cap also) was at least iron bound and most likely an iron figure-of-eight affair, a format that appeared in British Navy cutters later in the century. It looks much neater in this small a vessel, and will be used here.

SPAR CHART
(Measurements Rounded-Off)

SPAR LENGTHS & DIAMETERS	Full Size	Scale
Length of mast (to head) = 3 x beam = distance between perpendiculars	51.75′	
Mast head = 5″/yard of mast length	7.25′	
Total mast length	59.00′	16.0″
Topmast = 4/7 x mast length	29.57′	11.0″
Bowsprit = .80 x mast length	41.40′	14.0″
Jib boom = .71 x bowsprit length	29.40′	8.6″
Boom = mast length	51.75′	9.7″
Gaff = .46 x boom length	23.80′	6.0″
Topsail yard = 1.3 x topmast length	26.40′	6.2″
Spreader yard = .64 x mast length	33.10′	6.2″

QUARTERS

	QI	QII	QIII	Misc.
Mast	15.7	14.9	13.7	Heel - 13.7; head, upper 12.0 head, lower 10.0
Topmast	7.5	7.1	6.5	Head, lower 5.3 Head, upper 4.1
Bowsprit	13.8	12.8	11.2	Heel 12.0; outer end 7.8
Jib boom	Given diameter (8.6″ for 1/3 length) End 2.9			
Boom	9.5	9.0	8.5	Forward end 6.5 Aft end 7.3; middle 8.9
Gaff	5.9	5.5	4.8	Forward end 3.3
Topsail yard	6.0	5.4	4.3	Arms 2.7
Spreader yard	6.0	5.4	4.3	Arms 2.7

The mast will not need crosstrees, as the purpose of the latter is to support shrouds the next level up and there will be no topmast shrouds extending from the lower mast shrouds in this rigging plan. Trestletrees, however, the fore-and-aft timbers at the level of the heel of the topmast, will be needed to support the topmast.

STANDING RIGGING & SAILS FORESTAYS & SAIL OUTLINES

The sails and rigging are thoroughly intertwined (forgive the pun) so they must be planned and drawn together to a certain extent. With the spars drawn, the gaff sail is an easy addition, requiring only a single line, the after edge or luff to indicate the sail. Drawing in the topsail, which is a modified swallow tail, requires drawing in the general line of the jib stay in order that a the curvature (gore) of the foot of the sail can be determined. The jib stay runs from above as a mouse-restrained loop above the trestletrees through a sheave near the end of the bowsprit, then to a tackle on the starboard side of the stem. The fall of that tackle loops up over the rail.

Above the jib stay is the topmast stay, running from the topmast rigging stop to the end of the jib boom, where it reeves through a sheave then runs to the bow to reeve through a block on the port side of the stem, and finally upwards to tie off on a timberhead. Below the jib stay is the fore stay, which runs from the mainmast hounds to end in a pair of closed hearts, the lower fixed by a rope collar to the first quarter of the bowsprit. The sail on the topmast stay is the flying jib, and that on the forestay is the foresail or forestay sail. The fact that the jib runs up the jib stay should not cause undue surprise. The topmast stay requires a tensioning ring (the inhaul) where it enters the jib boom sheave. The inhaul has two small lines attached to it which run into the bows; more hard to show stuff—some of this data just has to be left in text and added to the model, as the rigging plan just gets too cluttered.

These three sails can now be drawn in, using ratios developed from the source plan or from the 1/8" scale drawings of individual sails given in Steel. Using the MEDIATOR draft again, I compared the length of each sail's leech (forward edge) with the length of its associated stay to get a ratio. I then multiplied that ratio against the actual length of the stay on the new sail plan to get the length of the leech for the latter plan. The same general process is used to calculate the new sail plan's luff and foot measurements. One uses a ratio consisting of the source plan leech length as the denominator and the luff (after edge) as the numerator for the new plan luff lengths, then the ratio between the source plan foot and leech to get the new foot measurements. A little complicated, but workable.

In all these drawings, we will presume the sails to be to leeward and leeward to be the port side of the ship. Thus the mast will overlap the fore sail, the fore sail will overlap the jib, and the jib will overlap the flying jib. This all being done, the remaining standing rigging fairly leaps into place. The standing rigging comprises all the fiber support structures for the fixed centerline spars, the masts and the bowsprit. It consists of the shrouds and the fore and back stays, and certain accessory rigging such as the horse forward of the main mast, the horses on the yards and the horse on the bowsprit. (Four horses in the rigging, what a thought!)

SHROUDS

The location of the main mast shrouds is self-evident. The upper row of deadeyes needs to be drawn in, as well as the lanyards that fasten the rows together. Draw in that shaky staircase known as the ratlines about 14" to 16" apart all the way up the shrouds. The Edson/Shoreham cutter plan shows a single topgallant shroud on each side, which I have chosen to imitate for the Virginia sloop's topmast shroud, rigged from the rigging stop above to tie off via a pair of thimbles on the aftermost lower mast shroud at the level of the deadeyes.

The bowsprit shrouds originate in an eye splice at the far end of that spar and end in deadeyes hooked into an eyebolt in the bow. The bowsprit's fore stay equivalent, the bobstay, is rather the reverse of the shrouds, starting in an eye splice through a hole in the stem and ending forward in a pair of closed hearts fixed to the end of the bowsprit.

BACKSTAYS

Backstays are needed for the mast and the topmast, balancing out the forward pull of the topmast stay, jib stay and fore stay. The format used here is an adaptation of the Edson rigging for the Shoreham cutter, which seems to be the most scholarly and complete rigging plan for either a sloop or cutter of this period. In this plan, the lower mast's tackle pendant system (the block and tackle system used to load cargo) doubles as the backstay. It is a running backstay system, that is, one in which the leeward stay would be loosened considerably to permit the main boom to swing out.

The stay originates in an eye splice around the lower part of the head, but below all the other rigging, as a Burton pendant would. It ends in a compound tackle; the lower block of the tackle hooks into an eyebolt in the forward part of the quarterdeck rail, the fall going to a cleat below the rail. The runner of the pendant block ties off on an eyebolt a bit farther forward, on the main rail.

The topmast backstay begins seized around the top mast above the pre-existing rigging at the rigging stop and runs below with no tackle, to tie off through a thimble lashed to the same eyebolt that the lower mast backstay block hooks into.

RUNNING RIGGING

The running rigging is rather more complex and more difficult to draw completely in advance, mostly because the final belaying points are never entirely clear until the ship (and hence the model) is actually rigged. The square sail yards will each require a halyard/tie system to haul the spar up into position, lifts to raise or lower the yard arms in the vertical plane and braces to move the yard arms forward and aft, that is, in the horizontal plane. The boom will require a topping lift to hold up its outer end. The main boom needs a special sheet; in this instance is not attached to the main sail, but rather is in the form of a tackle near the taffrail lashed about the boom.

Above, the gaff will require a peak halyard to support its outer or aft end and a throat halyard to support the jaws-containing end at the mast. The sails of the bowsprit-jib boom will require halyards, downhauls and sheets. The topsail will need sheets and clew garnets. The sheets control the draft of the sail, the halyards haul it up into place, and the clew garnet helps lift the lower outer corners (clews) of the sail in the furling process.

TOPSAIL

The topsail yard halyard is a tackle system beginning below in a tackle with a long pendant (to clear the rail) hooked into an eyebolt in the aft end of the port channel. The upper block has the end of the halyard tie seized around it. The free end (tie) reeves through a sheave in the top of the topmast to wrap around the topsail yard and become its sling. This pendant, tie and sling are all one *piece.*

The yard lift here is a simple affair, a line seized around the shoulder of the yard arm, which runs through a block seized around the topmast rigging stop. It then runs below to belay upon a wooden cleat seized to a shroud. The braces are also seized around the end of the yard, then run through blocks fixed to the topmast fore stay above the level of the flying jib, to run down with that stay to separate blocks seized around the jib boom end, thence aft into the bows.

SPREADER

The spreader yard, being much larger and heavier than the topsail yard, has for itself a tackle fastened in the space between the hounds above and to a sling around the spar below. From the upper block the tie drops down to seize around the upper block of the halyard tackle. The lower block of that tackle hooks into an eyebolt in the deck, forward of the mast and not easy to show on the rigging plan, with the fall of the tackle belaying on the fore mast bitts.

The lifts originate seized around the shoulder of the yard, reeve through blocks supported by a span (a loop of rope) seized around the mast cap, then below to a tackle hooked into a deck eyebolt near the bulwark opposite the mast, with the fall of the tackle going to a cleat seized to a shroud.

The braces, also seized around the ends of the yard, continue as pendants seized around a block about twelve feet from the yard. The fall of this tackle starts fixed to the strop of a single block itself seized around the end of the bowsprit, reeves through the pendant block, swoops back down to the bowsprit block and then into the bows.

The line that controls the clew of the topsail and into the bows.

The line that controls the clew of the topsail and the aft-of-center horizontal rotation of the spreader yard could be called either the topsail sheet or the spreader yard after brace, a term I picked up from Edson's Shoreham cutter drawing. The rigging is the same as for the regular brace. The eyebolt is in the quarterdeck rail aft, the cleat probably on the boom crutch.

GAFF & BOOM

The peak halyard consists of two tackles. The upper consists of a double block suspended from the mast cap and a single at the mid-portion of the gaff. The runner starts near the end of the gaff, reeves through the double block, down through the single and back up through the double, to run below and seize around the upper block of a second tackle. The lower block of the latter tackle hooks into the deck forward of the mast, to starboard, its fall tying off on the foremast bitts. The throat halyard is very similar; the upper tackle fixes between the hounds and the jaws of the gaff. The lower tackle hooks into the deck to port of the mast, the fall tying off also on the foremast bitts.

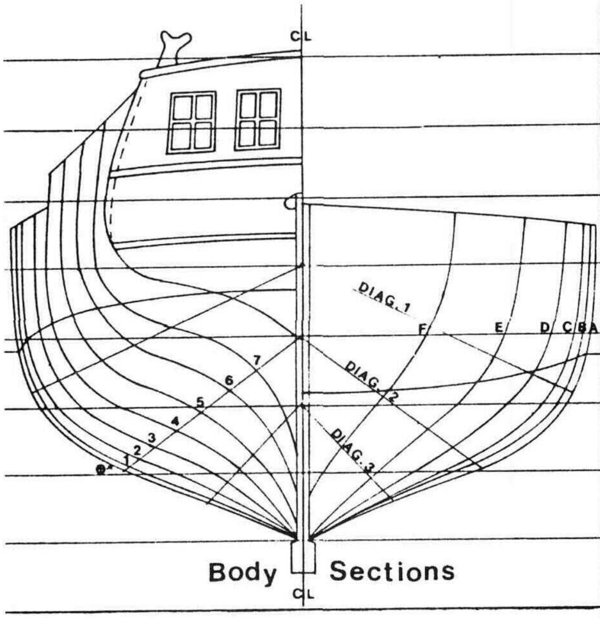
A small block is lashed to the end of the gaff for the flag halyard, the lines tying off below on a cleat on the starboard side of the boom. The forward end of the main boom rests on a wooden saddle nailed to the mast. The topping lift tackle hooks into an eyebolt in the aft part of the starboard channel, the fall of the tackle going to a wooden cleat affixed to the after-most shroud at about shoulder level when standing on the rail; this brings it to just above the bitter end of the shroud.

An ensign staff should also be drawn at the taffrail.

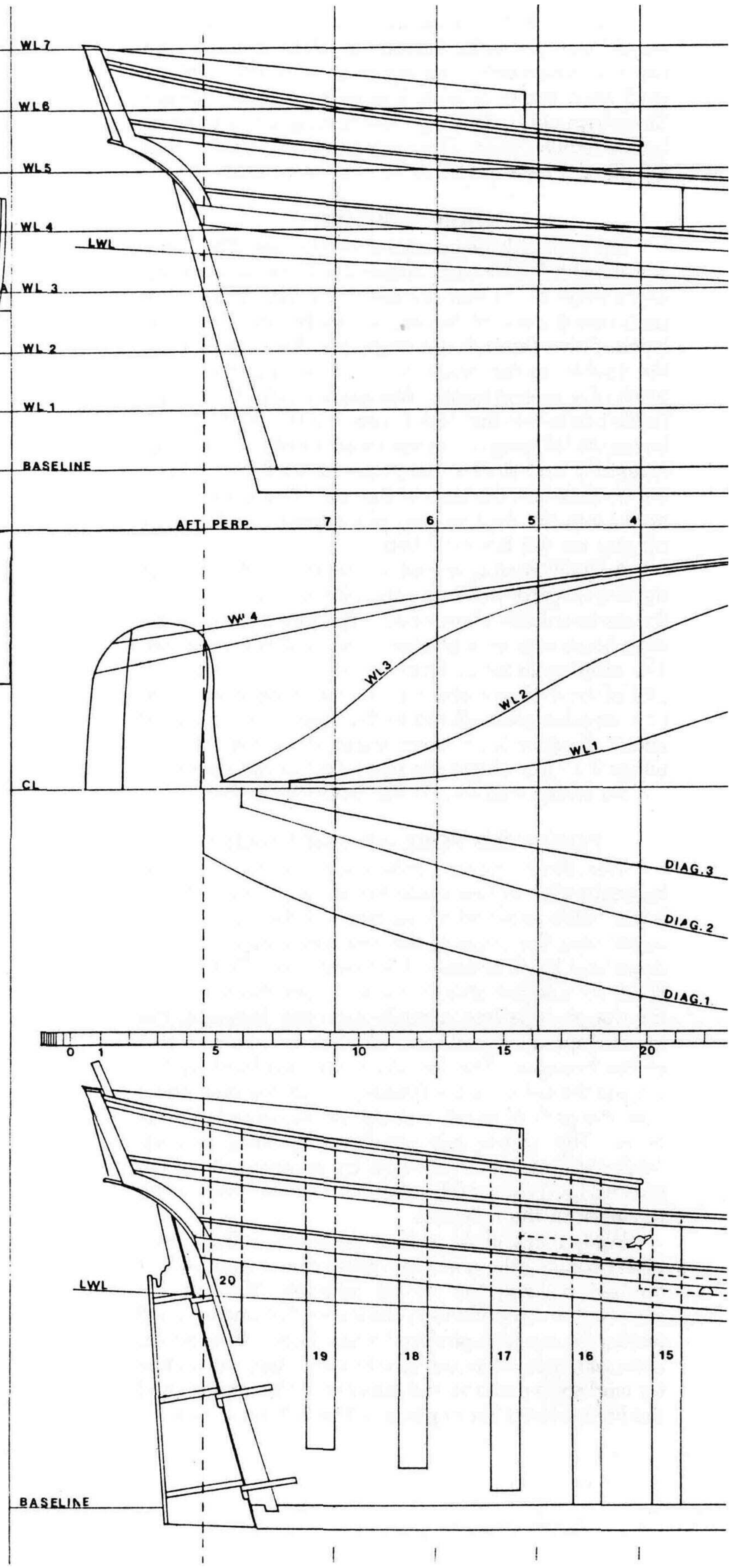
FORWARD FORE-AND-AFT SAILS

The three forward sails each require a simple halyard tackle of two single blocks (a gun tackle), the lower block attached to the peak of the sail and the upper near the origin of the associated stays. A small downhaul block is needed for each sail. That for the flying jib is seized around the jib boom shoulder; that for the jib is lashed around the rope fastening the forward spreader yard brace block down at the far end of the bowsprit. The foresail downhaul block lashes around the collar for the forestay. Each line runs down from the peak of its sail, through the block and into the bows. The sheets are pendant-originating tackles, hooked to eyebolts in the bow for the flying jib and in the rails for the jib and forestay, the hauling ends going to cleats on the bulwarks.

Well, that's it! As a final reminder, refrain from photo copying the plans for others to use until you've finished building the model yourself. You will be surprised at how many revisions to the originals will need to be made as practice revises theory. Blue prints, even with their white-out blotches showing, will do fine for workshop patterns and cut-outs in the interim, and the final, correct set of plans will be a thing of beauty.

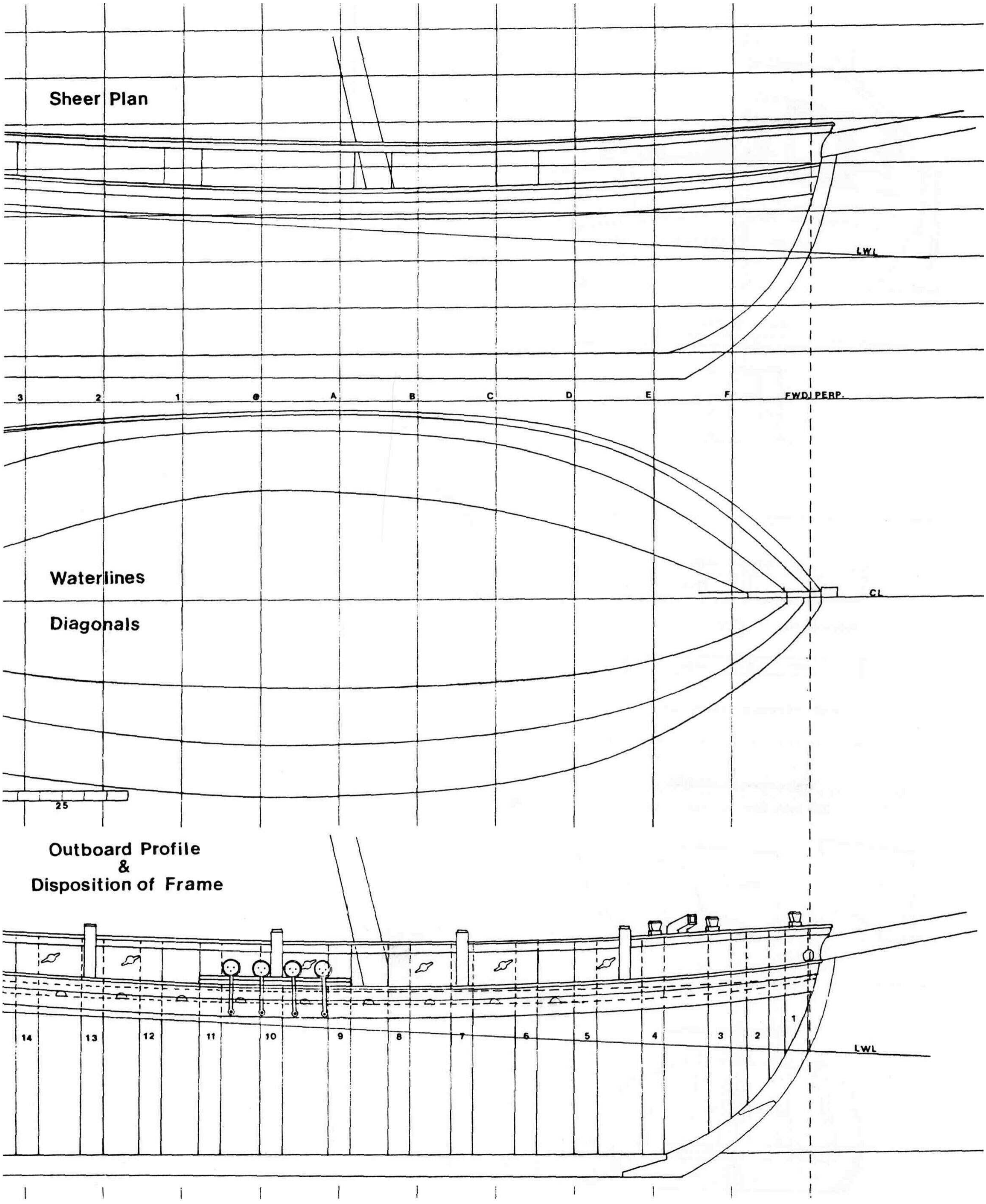


VIRGINIA SLOOP,6
c.1768



An evolutionary development in the line ot fast sailing vessels linking the Bermuda sloop of about 1740 and the trim, sharp model Virginia schooners found in Steel's Naval Architecture of 1805, the Virginia sloop of 1768 is a small, well-designed ship, quite pleasing to the eye, and a most suitable subject tor the ship modeler. Her hull is approximately 54' long. She is 49' on deck, with a 4V keel. Her beam is approximately 16' in the 'original' copy, her draft 8' and her tonnage (B.M.) 42. Fairly typical of the Jamaica-Bermuda-Chesapeake hull form used as privateers, smugglers and fast earners, the Virginia sloop had a graceful shear, low freeboard, and a cabin with a rounded roof aft, which, together with a huge tore and aft press of sail, formed a profile virtually defining speed

Nautical architect and historian Howard I. Chapelle found the plan in European archives, a Dutch copy of a French drawing, the ship apparently having been sold to the French shortly after completion. The fragmentary notes and the plan passed from Chapelle to Joseph A. Goldenberg, author of Shipbuilding in Colonial America, to John F. Millar, author of Early American Ships Millar included his own copy of the plan in the latter book and gave me permission to use it. Chapelle stated that the hull form of the Virginia sloop was good, out the lines were no where near fair, and that the deck furniture would have to be reconstructed from what was Known about colonial sloops in general. What this all meant was that a general lines plan was available for a very appealing little ship, and that all one would need to do to build ft, would be to re-draw the plans, reconstruct the deck furniture, and develop a masting, rigging and sail plan. Well, here it is, in tour sheets!


Sheer Plan
LWL
3
2
1
⊗
A
B
C
D
E
F
FWD PERP.
Waterlines
Diagonals
CL
25
Outboard Profile
&
Disposition of Frame
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13
12
11
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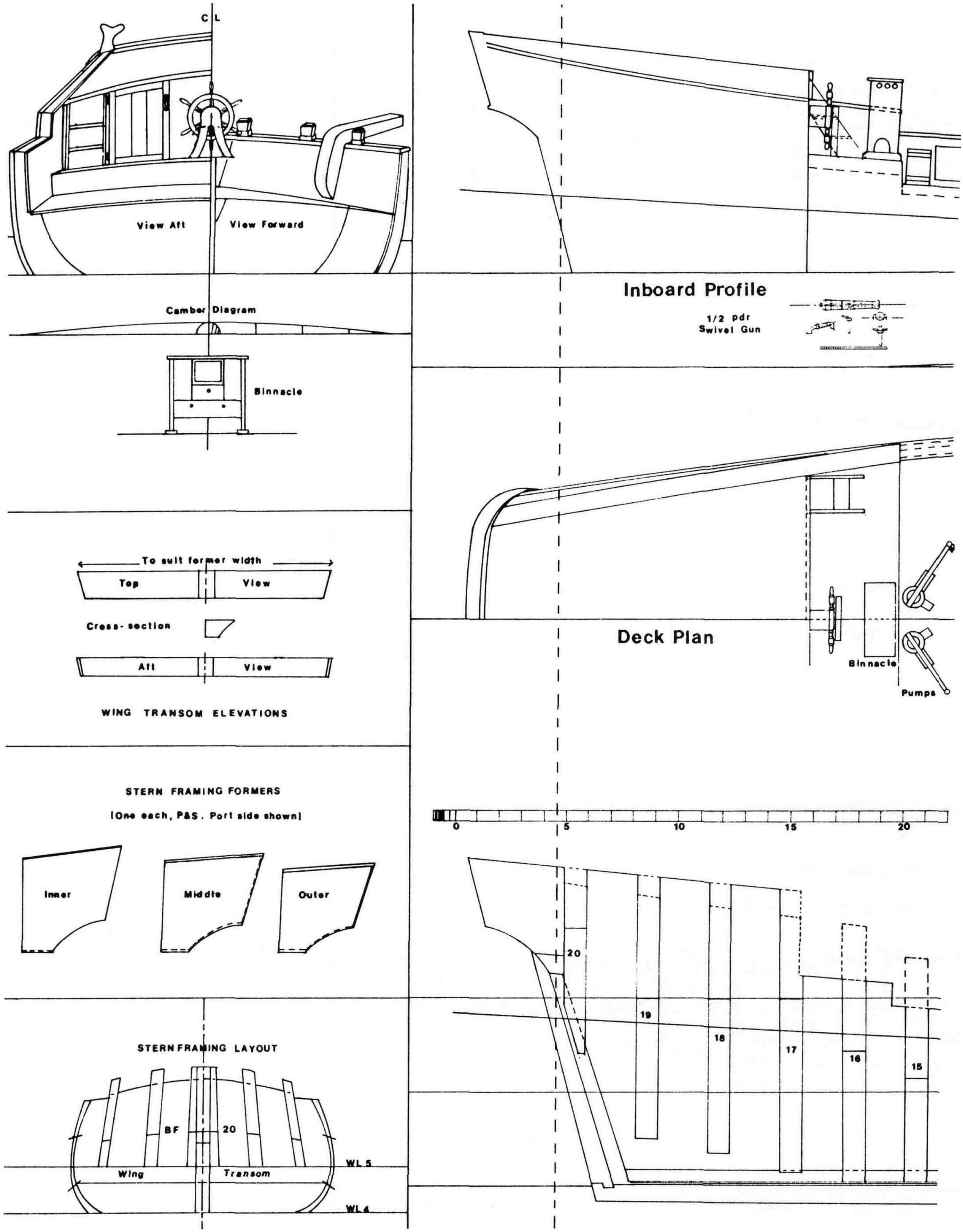
LWL


C L
View Aft
View Forward
Camber Diagram
Binnacle
To suit former width
Top
View
Cross-section
Aft
View
WING TRANSOM ELEVATIONS
STERN FRAMING FORMERS
(One each, P&S. Port side shown)
Inner
Middle
Outer
STERN FRAMING LAYOUT
BF
20
Wing
Transom
WL 5
WL 4
Inboard Profile
1/2 pdr
Swivel Gun
Deck Plan
Binnacle
Pumps
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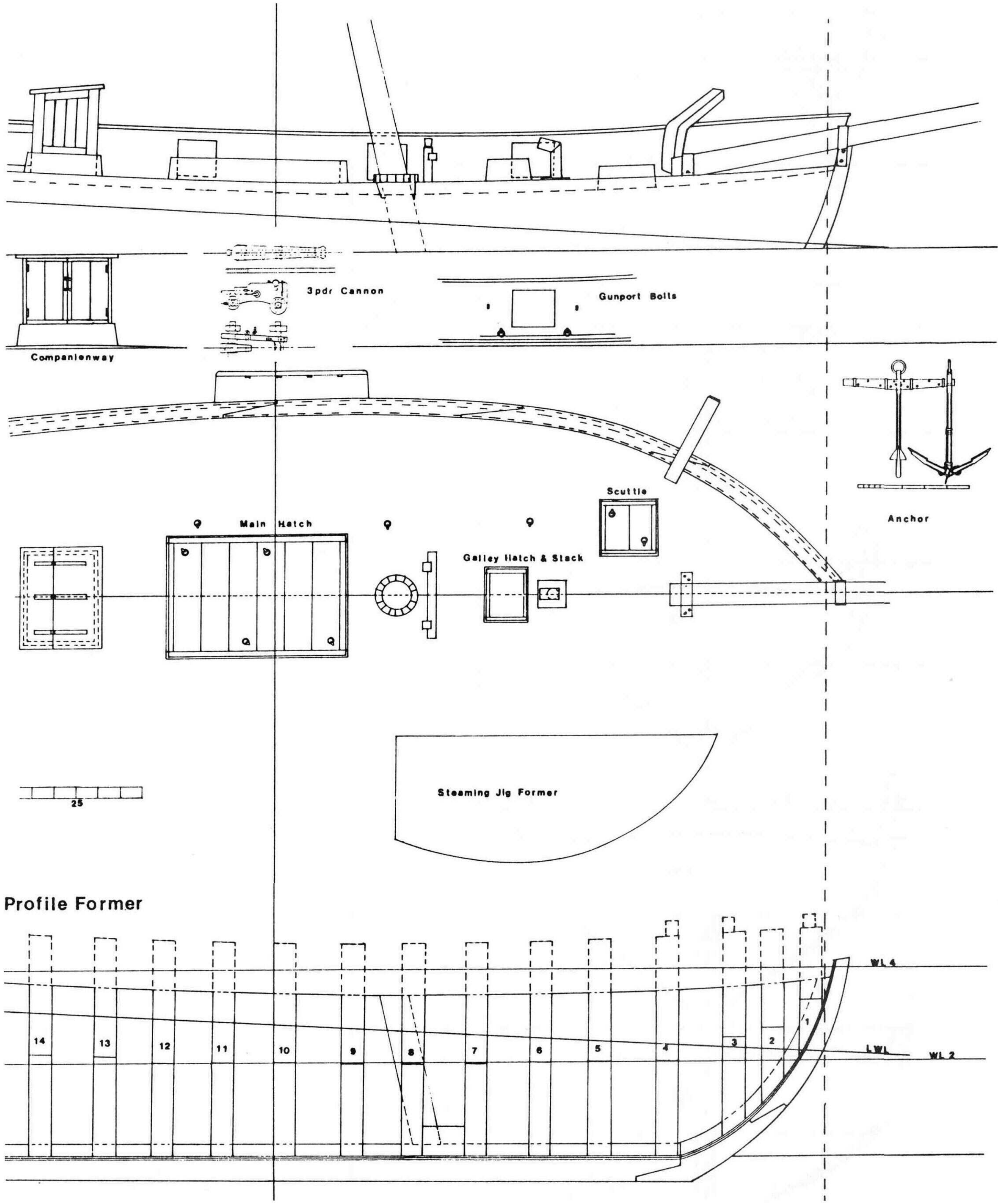
Companionway
3pdr Cannon
Gunport Bolts
Anchor
Scuttle
Main Hatch
Galley Hatch & Stack
25
Steaming Jig Former
Profile Former
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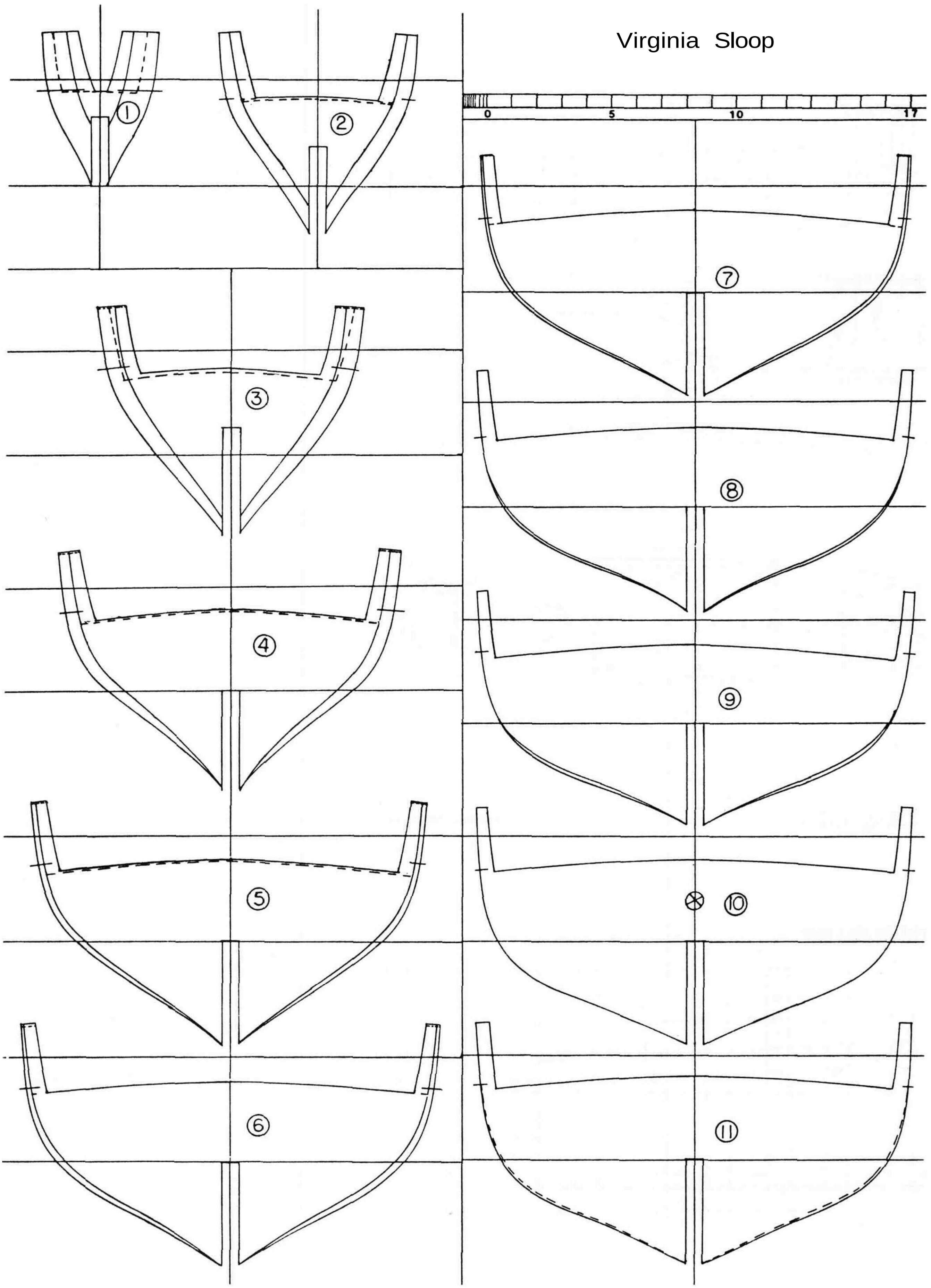
WL 4
LWL
WL 2


Virginia Sloop
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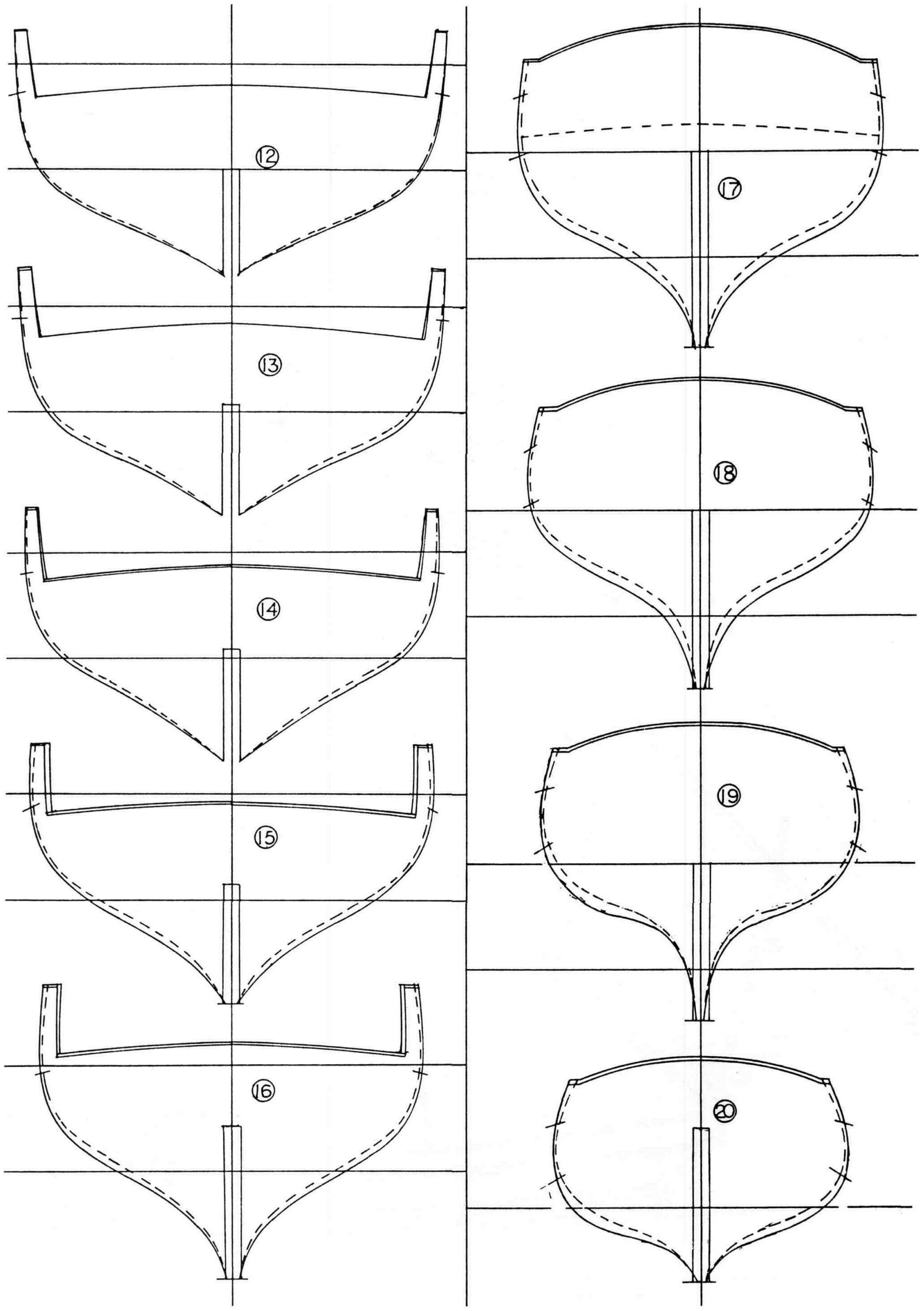
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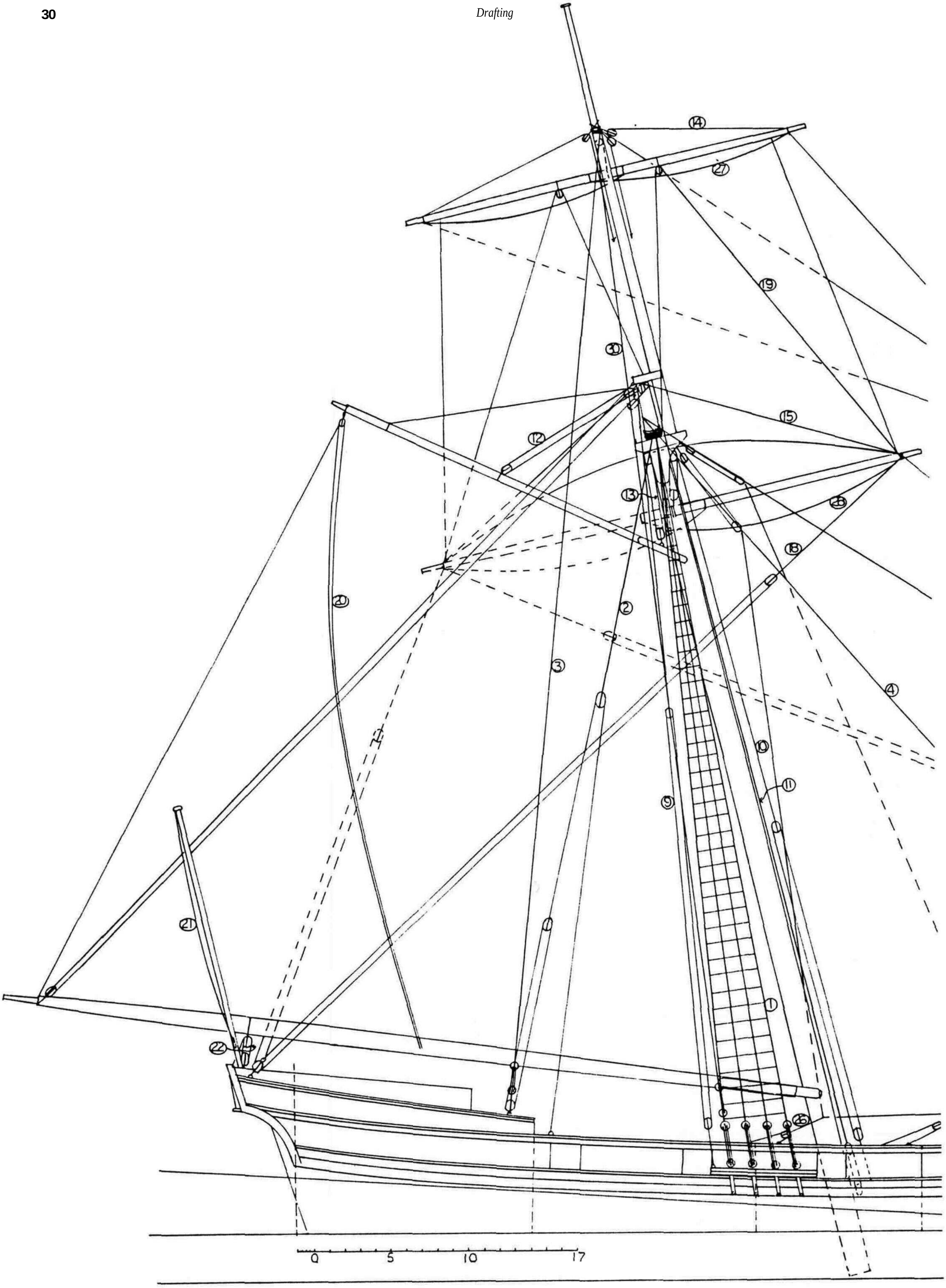
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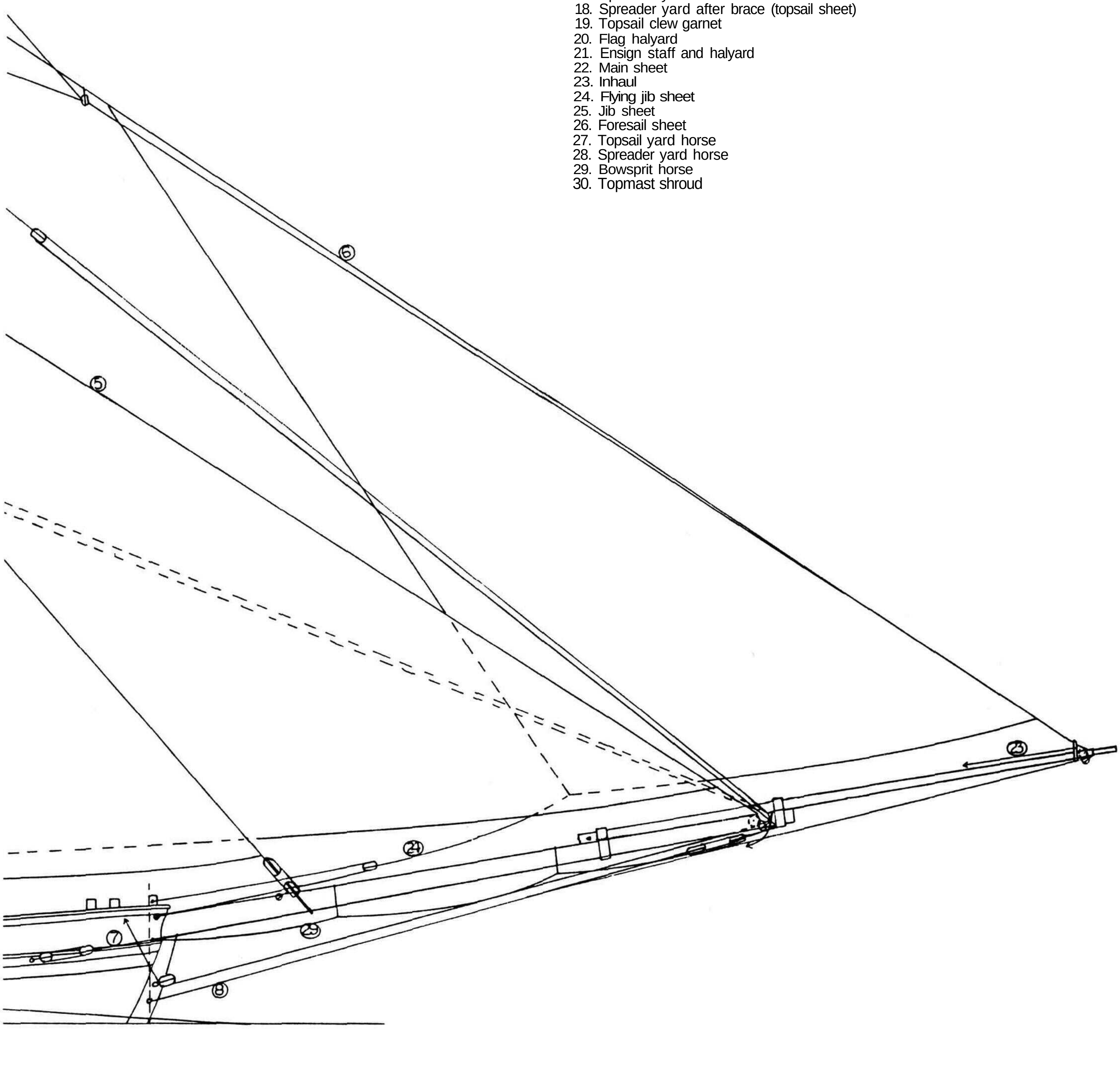
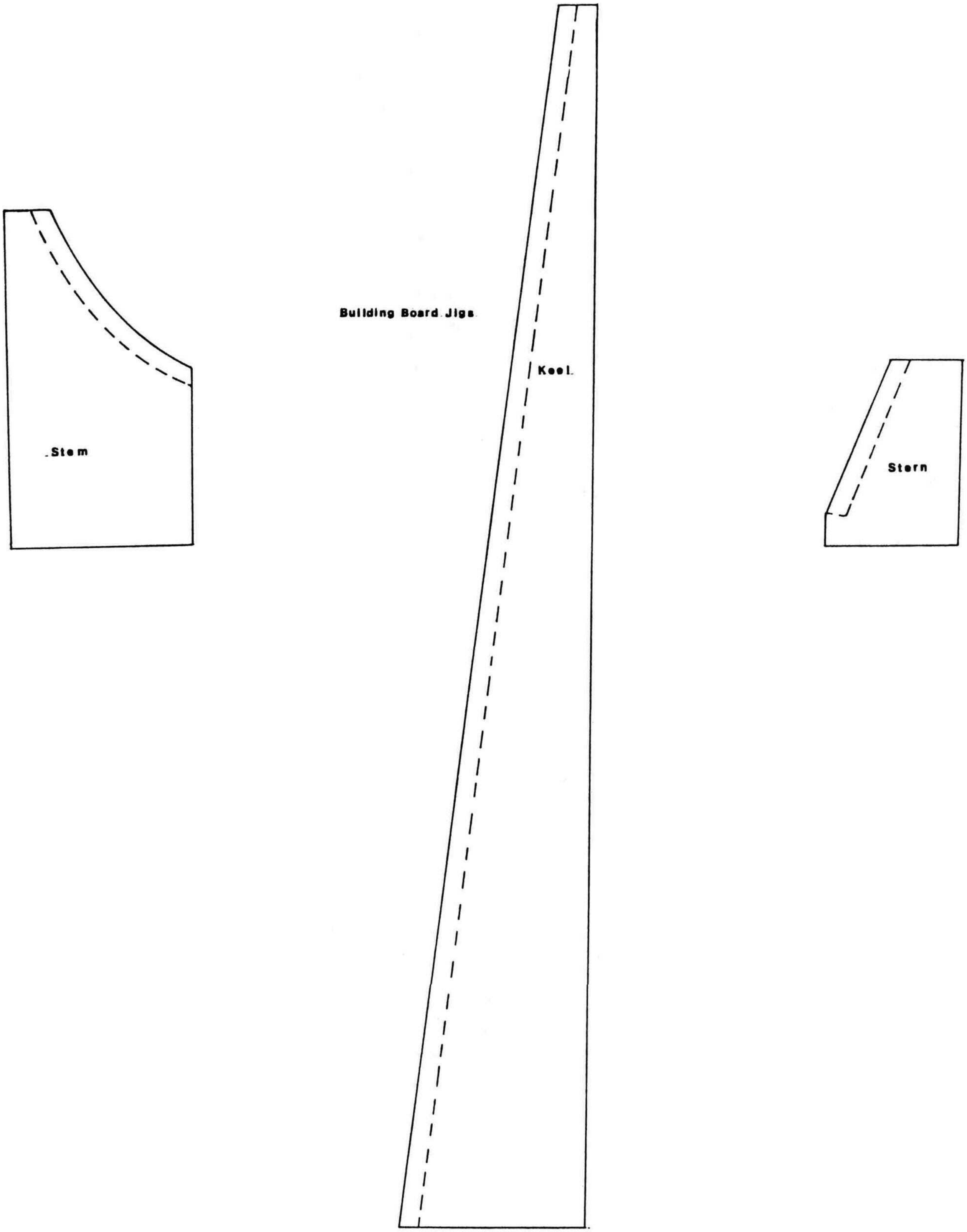
10
17

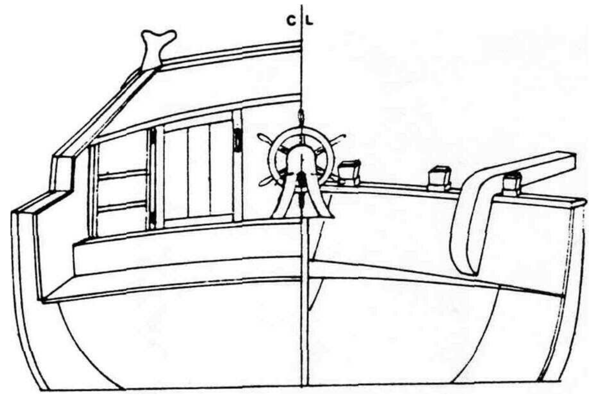
RIGGING CODE

1. Shrouds, ratlines
2. Pendant tackle/ mainmast backstay
3. Topmast backstay
4. Forestay
5. Jibstay
6. Topmast forestay
7. Bowsprit shroud
8. Bobstay
9. Main boom topping lift (S); topsail halyard (P)
10. Spreader yard halyard
11. Horse (for spreader yard)
12. Peak halyard
13. Throat halyard
14. Topsail yard lift
15. Spreader yard lift
16. Topsail yard brace
17. Spreader yard brace
18. Spreader yard after brace (topsail sheet)
19. Topsail clew garnet
20. Flag halyard
21. Ensign staff and halyard
22. Main sheet
23. Inhaul
24. Flying jib sheet
25. Jib sheet
26. Foresail sheet
27. Topsail yard horse
28. Spreader yard horse
29. Bowsprit horse
30. Topmast shroud




Building Board Jigs
Stem
Keel
Stern

CHAPTER 3



BUILDING THE HULL

Happiness is having a set of full-size plans, a pleasure that is not always available if you're working from a book or magazine article. As we stated earlier, it's not necessary to have a set of full-size plans to build the Virginia Sloop because the formers are reproduced full-size and all of the other dimensions are given in charts, tables or the text; only the profile former drawing needs to be enlarged.

If you want a full-size set at a different working scale for this project or one that you will later design yourself, it's not at all hopeless. All that is necessary is to have the plans photo-enlarged at an architectural blueprint service.

A small ship such as the Virginia sloop reproduces across the double page 8 $^{1}/_{2}$" x 11" spread at about 11/64" = 1', a small, difficult and unsuitable scale. The problem seems even worse when you discover that repro shops usually can't work with an exact multiple to increase the size in a single step. If you ask them to enlarge the book pages exactly 2.18 times the size printed (3/8" scale is 2.18 times larger than the putative book scale) they will give you a funny-farm look. Generally they have to get unusual sizes by trial and error.

What you have to do then, is to give them an exact line length to work to. For example, if you want to enlarge the three construction sheets for the Virginia sloop to 3/8" scale, find *a* segment of the plans scale that equals a convenient line length on the final enlargement. If you use trial and error, you will find that sixteen feet on the donor plan scale, no matter what size or scale it is, would be 6" long on an enlargement to 3/8" = 1', (16 x 3/8 = 6). Just tell the service to make the zero to sixteen foot segment of the donor plan (mark it for them) exactly 6 " long on the enlargement and everything will be perfect.

For 1/4" scale plan such as the rigging plan sheet, a 20' segment on the donor scale enlarged to 5" on the repro does it nicely. Again, that enlargement factor holds true no matter what the scale of the original; a five inch length on a full-scale plan which is equivalent to 20 full-size feet defines 1/4" scale (5" divided by 20' = 1/4" per foot). If you want to work to 1/4" scale, you could have all the sheets enlarged to the latter formula.

If you wanted to work to a still smaller scale, say half the size of the model as presented in this book, a scale of 3/16" = 1' is just an enlargement of 16' on the scale to 3", and an accurate 1/8" scale plan would be made by reducing the 20 foot donor segment to 2.5".

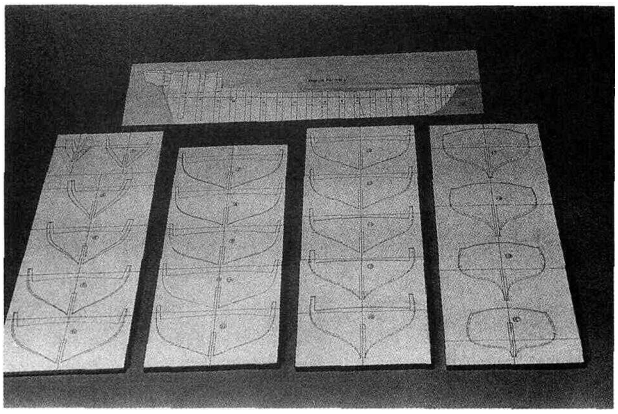
While you're at it, have a set of blueprints made up from the vellum enlargements; they're cheap, good to keep in the workshop, and they don't complain when you spill coffee on them or cut them up for patterns. Photo-copies are much fussier and insist upon being kept clean and safe in the house, and used only for reference. Very little if any difference in dimensions between the original, the photo copy draft and the blueprints for the Virginia sloop can be detected either by measurement or by the crude hold-them-up-to-the-light test. The real danger in distortion is not nearly so much from copying as it is from paper movement when you glue the patterns to the plywood. Rubber cement (lacking water) helps, as does cementing large square segments of pattern-containing blueprint to the plywood panels. Never cut out the bulkhead former patterns to outline before gluing them to the plywood; you will not get them aligned properly, cursing and/or praying not withstanding.

If you have decided to work to a scale other than the 3/8" = 1' used in this book, do take the time to calculate the dimensions for each chapter's work before beginning. Use a felt-tip pen and write the dimensions on removable self-sticking material, like envelope labels cut down to one line width, and cover the original with the recalculations. It will be a lot easier and will help prevent embarrassing errors.

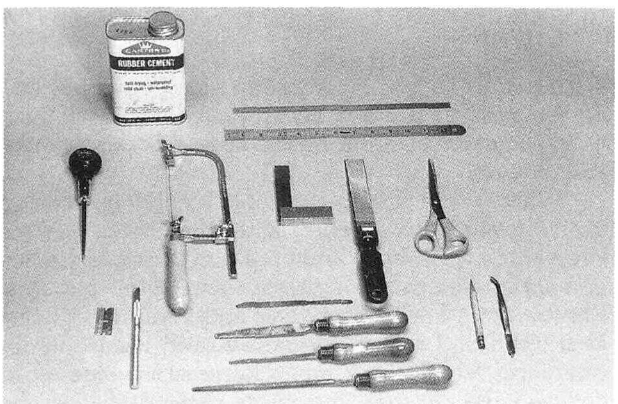
ADHESIVES

Just as there's only one glue for fixing paper patterns to wood stock (rubber cement), there's really only one general purpose wood glue these days, and that's yellow carpenter's or woodworker's glue. Although manufactured similarly to white glue, the yellow glue has one outstanding advantage, and that is that it dries hard and is therefore sandable.

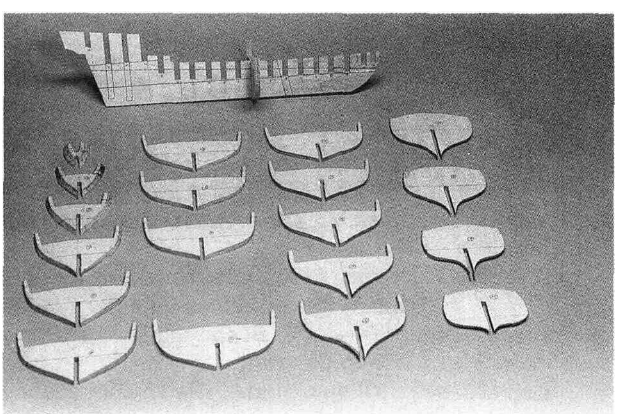
White glue does not and therefore is not, so files clog and sandpaper drags the residue across the work surface. White glue dissolves more easily in hot water than it does yellow glue, so temporary joints can be separated with a knife blade dipped in hot water, this is fine for mistakes, but for deliberately temporarily joined sections, cements such as Duco® or Ambroid® are



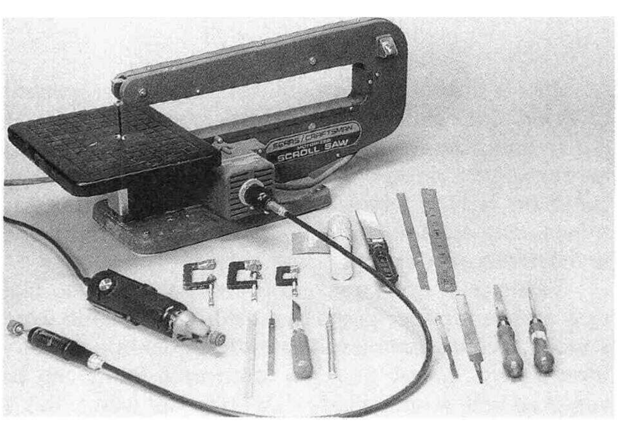
The former plans rubber-cemented to plywood.



The minimum basic hand tools for cutting and shaping formers.



The bulkhead and profile formers cut and shaped.



The basic power tools for cutting and shaping the formers. Note the addition of the jigsaw and hand grinder.

best used, the joint being later dissolved with lacquer thinner or acetone. Yellow glue has limited gap-filling capabilities and should be used with clamps (about a half-hour will do). There are times and places in ship model building where there simply is no way to clamp the materials to be joined, and some pressure must be applied.

This is the ideal situation in which to use the cyanoacrylates, the so-called super glues, which can reach almost full holding power during just the few seconds needed to set up under finger pressure. When using cyanoacrylate's, keep the fumes away from your eyes (they're very irritating) and use some protective workshop hobbyist's silicone skin cream on your hands. It's always embarrassing to have to call for help to have one's thumb and forefinger razor-bladed apart. The cyanoacrylates come in a thin consistency to use on metal and a somewhat thicker sort for wood.

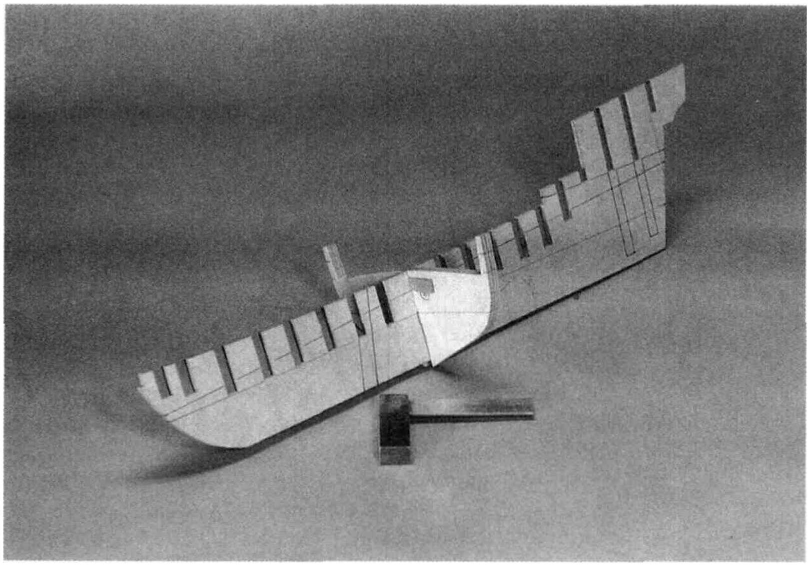
A gap-filling type is available. The thin cyanoacrylate is also useful where parts must be joined to previously finished woodwork. Do a test run on scrap before committing the work to posterity. The thin cyanoacrylate can even be used on previously clamped-together materials, capillary action carrying the glue into the joint. This bonus factor is also the Achilles heel of the cyanoacrylates—it permits the glue to occasionally seep into faults in the wood, leaving brownish streaks that look very much like water stains on old, exposed woodwork. It's great for an aged, weather-beaten effect, but not at all good for a cleaner, more pristine style. Experiment with two or three brands until you get the one that works best with your materials.

Where extra strength is a necessity, especially in joints of small contact area that cannot easily accept hidden dowels or pins, or where joining dissimilar materials is necessary, two-part epoxy is the adhesive of choice. Although the epoxy will also often bind well to finishes, scrape away the finish on contacting surfaces if at all possible. Epoxy is gap-filling and does not need clamping. The 24-hour epoxy is much stronger than the fast drying type, so its general use is recommended; just plan your epoxy gluing for the end of the workshop session for the day.

MATERIALS

Although there is a tendency among scratch builders to use the natural colors of hardwoods to partially substitute for paint, some simplification for this first scratch build has been done so that only commercially readily available milled hardwood stock is used. Most experienced plank-on-frame builders would probably opt for boxwood or pear, but they are expensive and more difficult to come by. Using them generally means that one must do some lumber thicknessing ones self; it requires more equipment and more time.

Cherry is a most acceptable substitute; it is available milled to final dimensions from many hobby shops and from most ship model materials supply houses. It holds an edge well, carves easily, and finishes nicely. It does have a bit more noticeable grain than pear and a good deal more than boxwood, so it has to be selected more carefully. Ebony is the choice of the experts of the above-mentioned school for all the black-painted planking and spars, and it looks lovely and polishes to a wonderful luster. It is hard to get as pear or box, nasty to power sand (turned everything in the workshop grey) and it is difficult to ben, even with steam.



Aligning each** bulkhead former on the profile **former.

For this project, cherry will be used for these parts also, the parts being painted black after assembly. Again, all things being equal, if a premier lighter colored wood were desired for decking, maple would be a strong contender; it oils to a very realistic pine or fir-like appearance, and because it's nice and hard, it's easy to machine and holds edges well. A good deal softer, but still a nice wood and commercially readily available, basswood will be our decking substitute for this project.

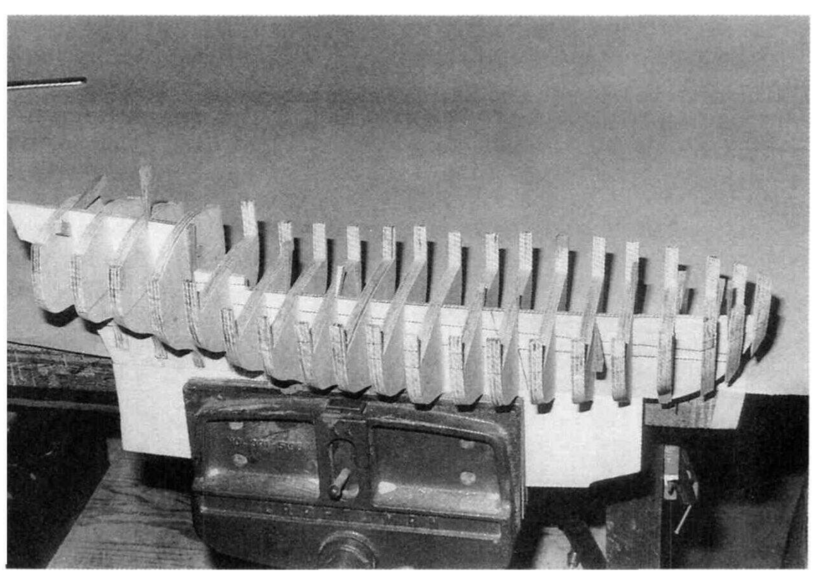
The profile former and the bulkhead formers are of plywood, 1/4" thick for the first former and 3/8" thick for the latter former. Although ordinary fir ply can be used, Baltic birch more than makes up for its greater expense by virtue of its greater stability resulting from more plies and absence of voids. Many lumber stores permit customer selection of a single sheet from among those available, and will cut the sheet to sell a half. Even so, a half sheet of plywood contains enough material for another project or two.

Almost all of the metal work on the Virginia sloop model will be of brass. Brass sheet, strip, rod and tube are readily available at hobby supply stores and mail order houses. Similarly, brass wire of various diameters and brass hobby nails can easily be had. Brass has several advantages, in that it doesn't rust, doesn't need priming or painting to inhibit corrosion or oxidation, solders easily and oxidizes well. Brass also anneals easily, that is, loses its temper by heating, so that it can be bent into almost any shape.

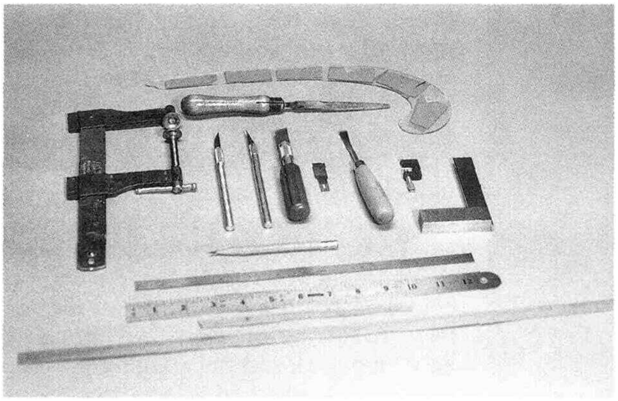
Oxidizing brass, to give it the even metallic black color of wrought iron, is almost an alchemical subdivision of model building, so many methods and opinions are there. Several good formulas for the home chemist are found in *Ship Modeler's Shop Notes,* but most modelers will opt tor commercially available oxidizing solutions such as Blacken-It® or Win-Ox®. The brass fittings for this project were miraculously turned into iron with Blacken-It, generally used full strength. A soak of 5 or 10 minutes did the job. Blacken-It produced a nice deep black surface with just a touch of shine when polished. It has an appealing apparent thickness to it. Win-Ox produces a gun metal type of color and sheen, where that particular characteristic is desirable. For soldered model parts, the best result comes from using both solutions, one after the other.

There is a bit of before and after work to be done: cleaning and degreasing before oxidizing is necessary for a proper take. A little jar of swimming pool acid kept on hand is just the thing for the job. The acid is washed off in tap water before the parts are oxidized. Once done, the oxidized parts also need to be washed free of chemicals to stop the oxidizing process. A little soap and water in the rinsing process helps kill the chemicals. The oxide coat seems to be more securely locked into the surface of the brass when the freshly oxidized parts are heat dried for a half-hour or so under a light bulb at close quarters.

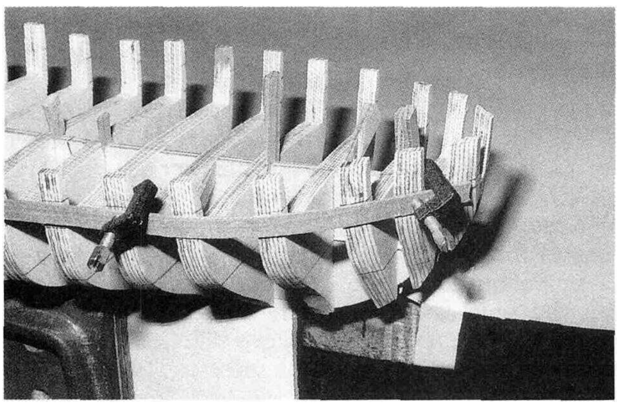
Endless arguments relative to the choice of fiber for ship model rope making appear in modeling literature. Any of the commonly available fibers can be used— linen, cotton, silk, dacron or other polyesters or nylon, but the only fiber universally agreed upon by the cognoscenti is linen, and, as linen is still readily available, it will be the one used in this project. There is little available hard data to refer to, at least in the ship modeling literature, regarding the physical characteristics of these different fibers. It is widely believed that the natural fibers tend to shrink with increases in humidity and stretch when dry. Artificial fibers are said to behave just the opposite. There probably is no harm, however, in mixing fibers in non-contiguous areas; for example, anchor cable of a size hard to find in linen could be made of nylon. Probably all of the line for the standing and running rigging should be of the same fiber so that different rates of contraction and expansion with changes in humidity will not distort the spars. Coloring and treating the line will be discussed in the appropriate sections.



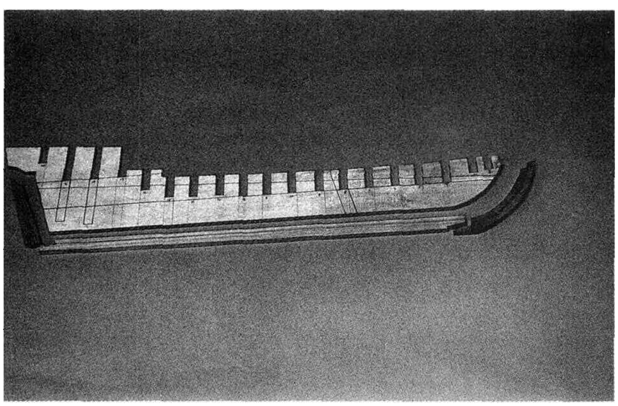
The formers temporarily in place to begin fairing.



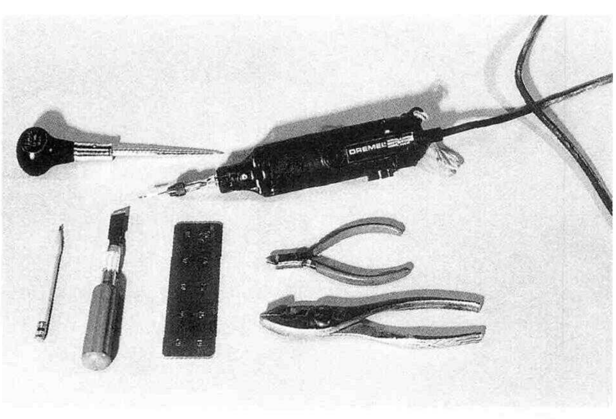
The alignment and fairing tools. Note the addition of a machinist's steel square, a curved, bent chisel and wooden battens.



Battens and small C-clamps are used for fairing.



The parts of the keel, completed and ready for gluing to the profile former.



The treenailing tools. Added are an awl and drill bits, a sharp chisel-bladed hobby knife and a drawplate.

Almost all the scale rope needed will be ordinary laid, that is, right hand twist. That means that when you hold a piece of line, one end in each hand, the spiral points towards your right hand; left hand twist is obviously just the opposite. Copies of contemporary plates are included here for your information, as this bit of data has occasionally been shown absolutely backwards in the modern ship modeling literature. As has been noted, you can not change right hand line to left hand line by switching hands, even with silent (or vocal) incantations.

In the British Navy, large stays (such as forestays and mainstays), were left hand twist rope, as were anchor cables, cutter shrouds and sometimes breeching. Left hand laid rope was thought to have more give. The practice in the Colonies, especially among private builders of small ships, is not really known. Unless otherwise explicitly discussed (and unfortunately, it will be), commercially available right hand twist (left hand twist is not available anyway) linen model rope will be used.

TIME MANAGEMENT

I'm not one to count up the hours spent on a modeling project. Many professionals do so to keep track of their costs and as a method of staying on schedule. Personally, time-keeping to me seems counter-productive—one really has to go with the flow, as the kids say, rather than worry about hours. Even so, it's impossible not to do a quick calculation in one's head and come up with the realization that building this ship model entirely from scratch will be about a thousand hour event: an hour an evening weekdays, two hours a day weekends, for 50 weeks a year—two years of spare time.

Something has to give in the ordinary household, but the experienced ship modeler already into kits is probably not in an ordinary household. There's always at least a few minutes in the evening for the workshop.

The key is to do some piece of work, however small, on the model each day that one is home. Kits have a habit of sitting partially completed on closet shelves for great periods of time. That will not do for scratch building. Developing a habit pattern for the workshop is extremely valuable. It produces an automatic reflex in one's personality, which, like the endorphin-induced runner's high, is not satisfied unless fulfilled.

On weekends, with numerous chores to do around the house, I play the Let's-Reward-Clay-Game. I mow the lawn and reward myself with a half-hour in the workshop. I get 15 minutes in the shop for cleaning the swimming pool, an hour for fixing a fence or putting in some new shrubs, and so forth. As a result I'm buzzing about the house and garden and workshop all the time, happy as a clam with the satisfaction of home-owner's work well-done and workshop pleasure to come. For the workshop is a pleasure. It doesn't require patience or perseverance; those are just automatic side effects of one's interest in the work and they are neither positive nor negative, just neutral givens.

BUILDING THE FRAMEWORK

If you don't have a table or radial arm saw in your workshop at home, have the lumber store people rip the 3/8" ply into 7" wide strips for the bulkhead formers, and have them rip one 7" wide strip from the 1/4" ply for the profile former. Each should have the grain running the length of the strip.

THE PROFILE FORMER

Photo-copy the full-size profile former and the bulkhead former pages, the latter enough times so that you have one copy for each of the formers. Rubber cement the paper plans segments to the ply, using lots of cement so that you can slide the paper into position. Carefully, with a jigsaw or narrow-bladed band saw, (or by hand with a coping or jeweler's saw) cut the formers to their outlines, perhaps just a bit on the generous side to allow for final sizing with a disc and drum sander. A narrow belt sander is great for smoothing the upper curve of the profile former, but files and time will do.

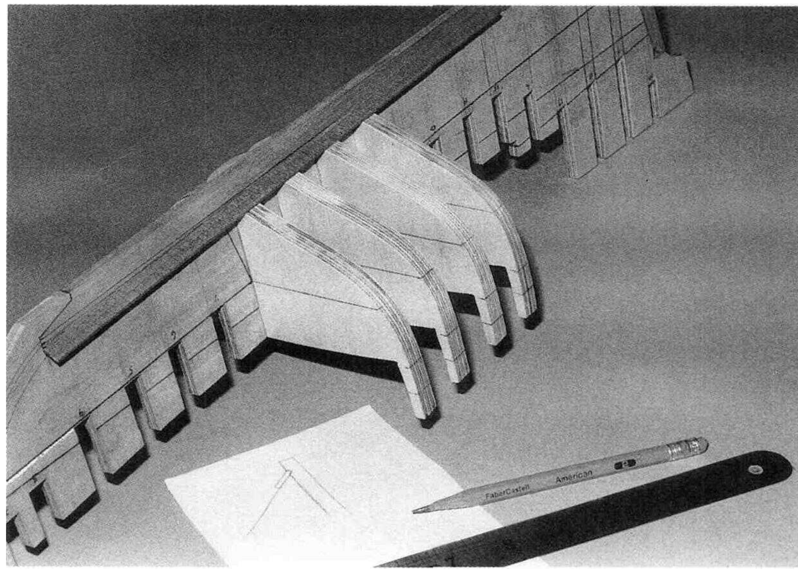
Even using extreme care on the jigsaw, very slight bumps will inevitably appear to spoil this gentle curve.

The belt sander, used mostly from the unpapered side of the former, gently and with lots of eyeballing, does the job. It's also good for doing the rough shaping of the inside bevel of the tops. The drum sander, also used for forming the outside bevels on the concave underbody curves of the bulkhead formers, needs to be the vertical kind as used in a drill press or the accessories end of a radial arm saw. The rounded upper end of a belt sander is helpful for some of the curves, but a bit more difficult to use with accuracy, as there's no table for fine control.

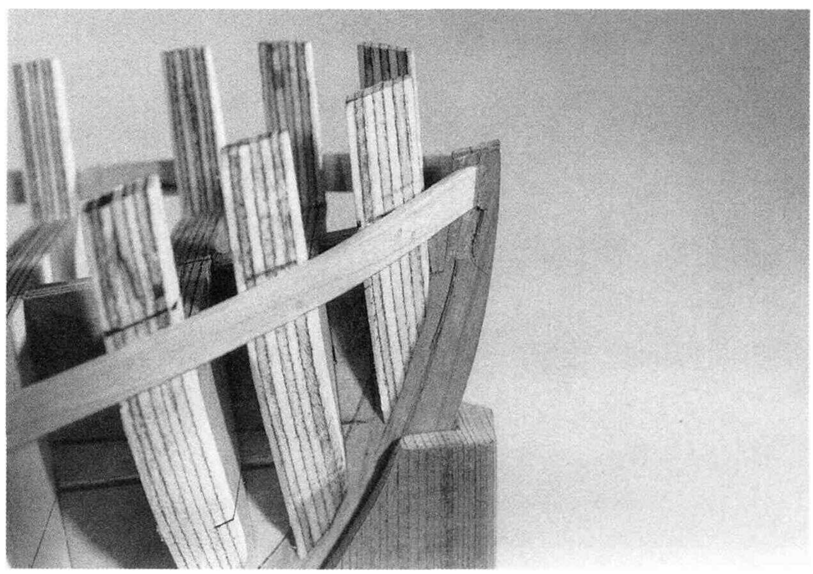
Cut the profile former notches after doing the edge sanding so the notches don't interfere with sighting the straight line of the roundhouse roof and the under deck curve. On the profile former, mark the load waterline, waterline 4, waterline 2 and the location of the mast on the blank side of the wood before removing the pattern, then on the original side after it's off. The area of contact of the last three bulkhead formers on the profile former also needs to be marked on both sides; a tiny hole drilled at each frame's lower corner will mark those points on the blank side of the piece. The area below these formers will later have to be thinned to blend to the same thickness as the rabbeted thickness of the sternpost to enable the planking to lie flush with the surface of the sternpost.

The mast needs to have a socket built to secure its below-decks stump. As can be seen, the plans lines drawn for the mast from the deck to the keel, including the mast step, are more to determine the true length of the mast on the full sized ship than to indicate the length of the mast on the model.

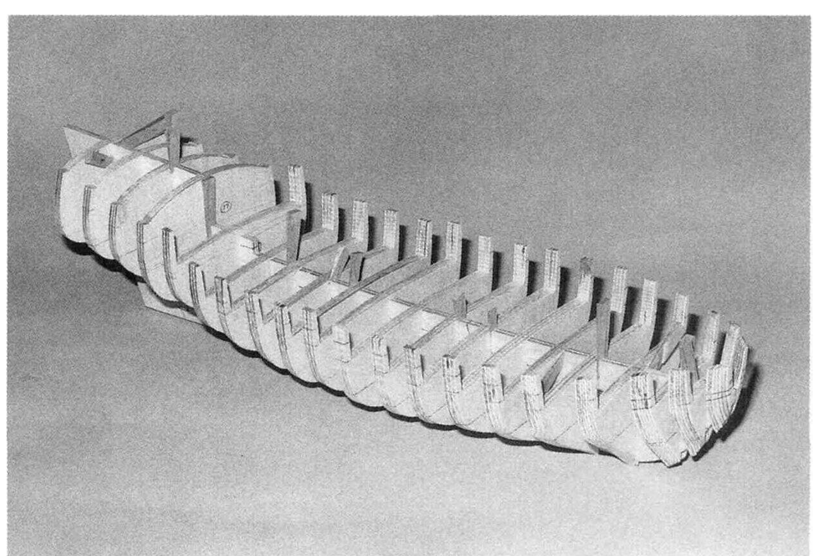
Boring a hole for a full length mast through the profile former and bulkhead



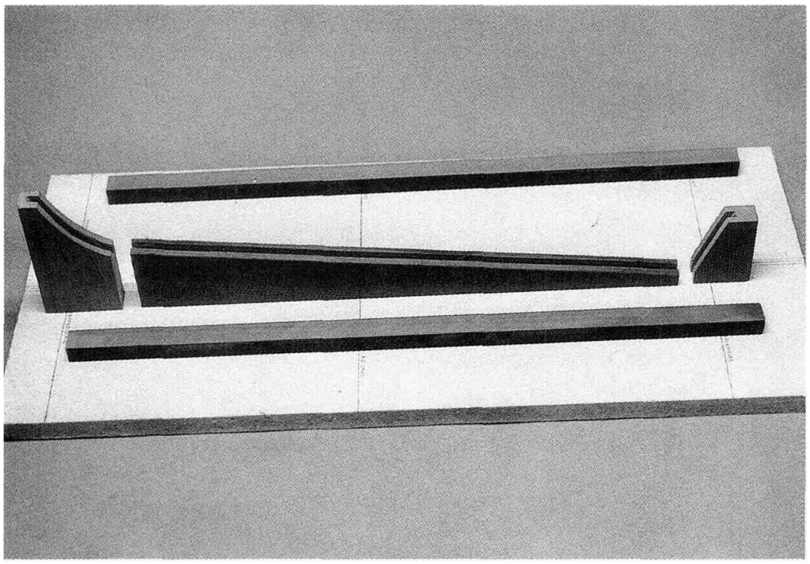
Visualizing *the changing angle of the rabbet with a batten and sketching paper.*



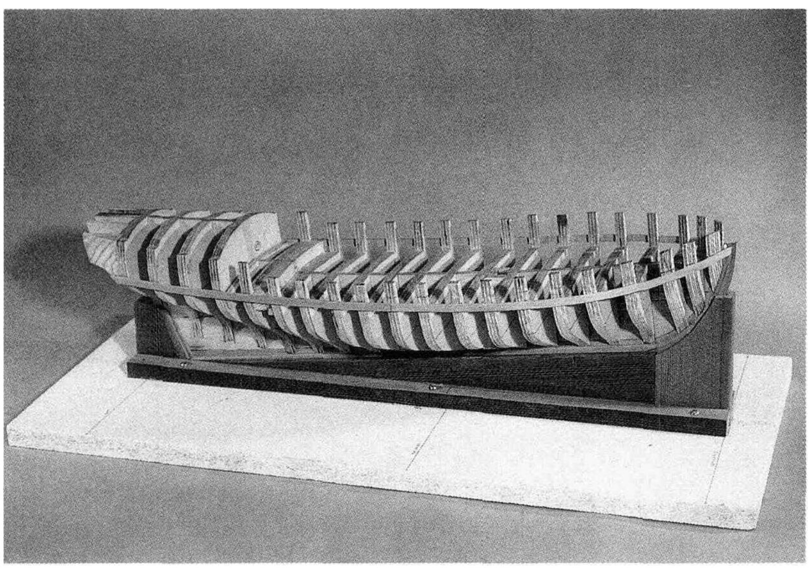
The wider rabbet notches at the stern for the wales and black strake.



The basic skeleton of the ship glued up. Note the wedges glued in place to lock the frames.



The baseboard and the jig components.



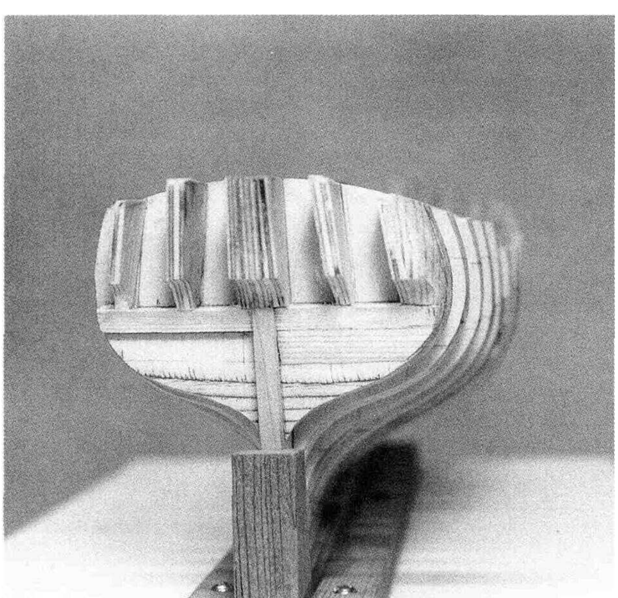
The model in a jig.

former #8 would just about tear the skeleton of the model in half. What is done instead is to taper and cut off the lower mast to fit the triangular area between formers #8 and #9. If the outer ply of wood on each side of this triangle is carefully chiseled away, a 3/16" thickness will remain. The mast is 15/32" in diameter, so a 3/16" slot in its base will still leave a bit over 1/8" in thickness for each leg, which should be fairly strong. A little socket, to prevent sideways shifting of the stump, will be made from plywood scraps later on.

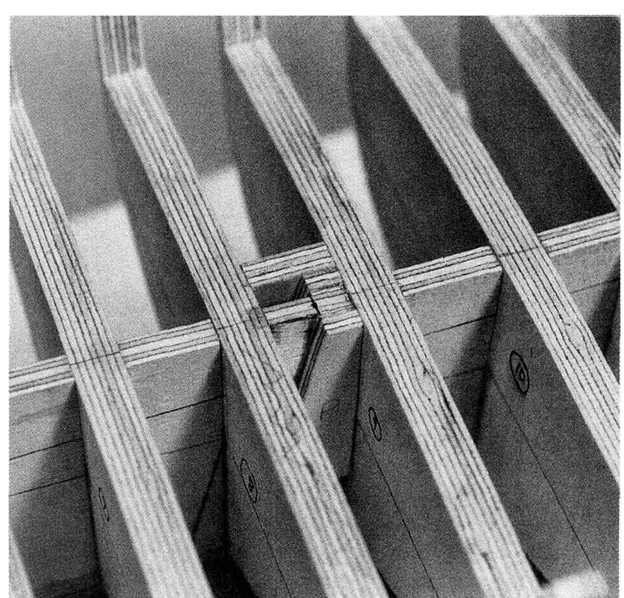
THE BULKHEAD FORMERS

Shaping the bulkhead formers takes a bit of thought, but is not too difficult. Former #10, the midships or dead flat former, needs only outline sanding—no bevels by definition. Do that one first, then move forward and aft as you get the feel of the process. Sand the bevel of the upper part of the formers, the outside or convex curves, on the disk sander, then switch to the drum sander and the top curve of the belt sander to do the concave underbody curves. The general tendency in sanding bevels is to overdo it, so sand just to the bevel lines rather than erase the line with the power sander. Consciously attempt to make each bevel just a little less prominent than you think it should be; you can always take off a little more during the fairing-up process later.

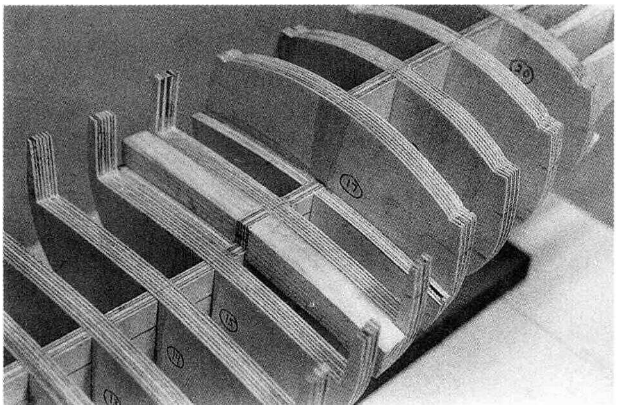
With the basic outline exact, mark waterlines 2 and 4, the vertical centerline and the wales ticks on the formers. As you cut out and size each bulkhead former, fit it in its notch and make sure that its waterline 2 marker and that of the profile former match exactly. With the



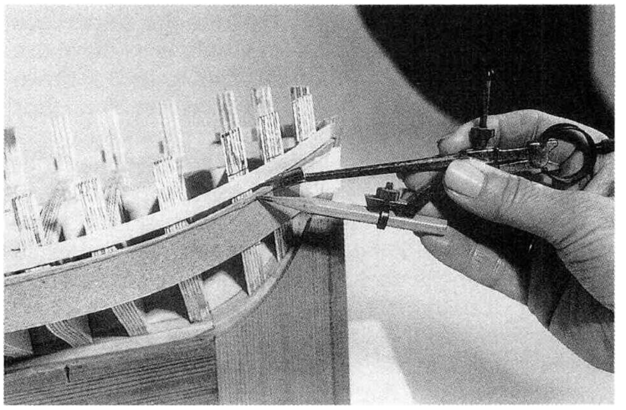
The framing at the stern.



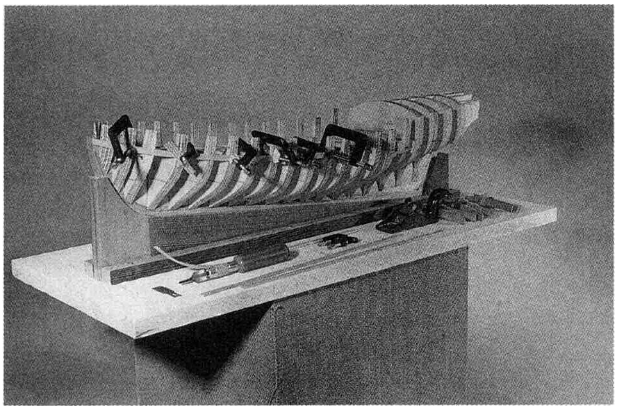
The mast socket.



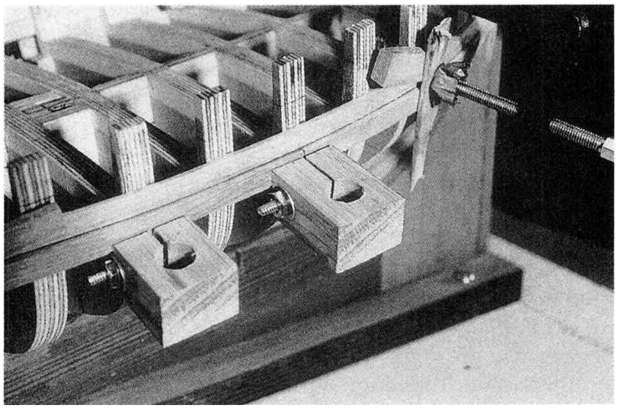
The false deck beams in place.



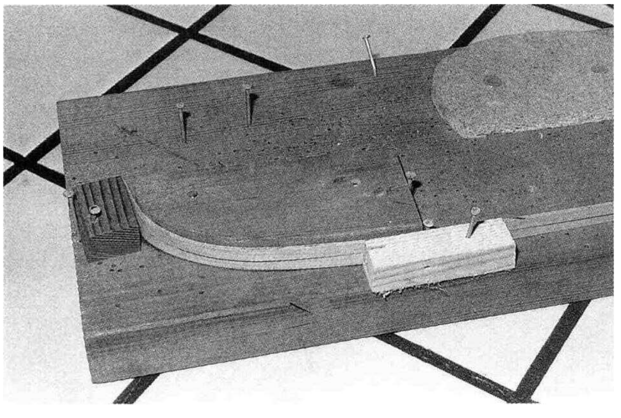
Spiling the upper border of a wales plank.



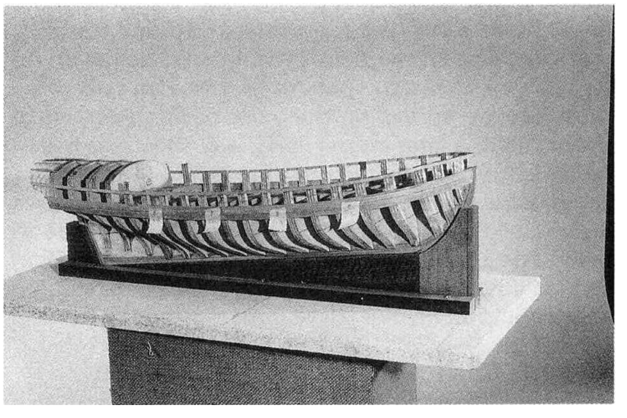
Clamping the black strake in place.



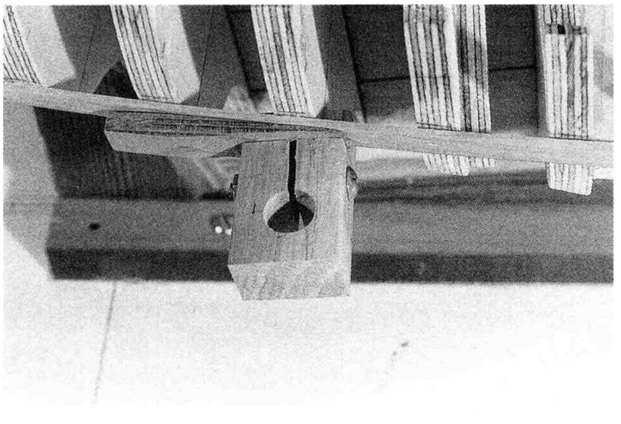
Clamping a wales plank.



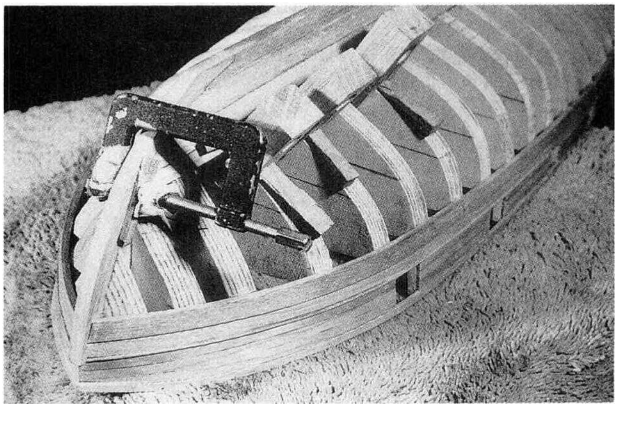
A simple bending jig for steamed planking. Note that there are two layers of planking in the jig at the same time.



The hull *with black strake, wales and sheer strake in place. The tape markers indicate gunport locations.*



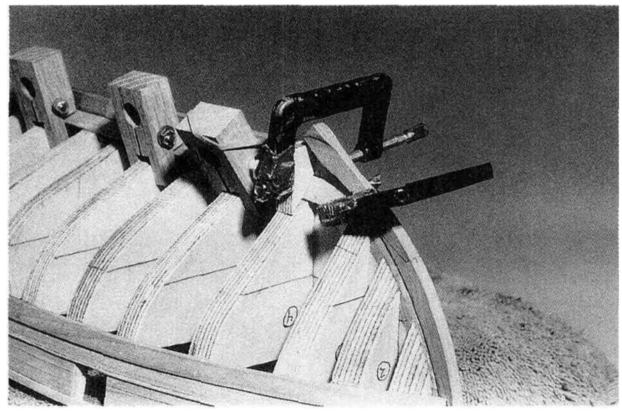
Shop-made bulkhead clamps. The bolt squeezes the legs against the bulkhead former and locks the clamp into position.



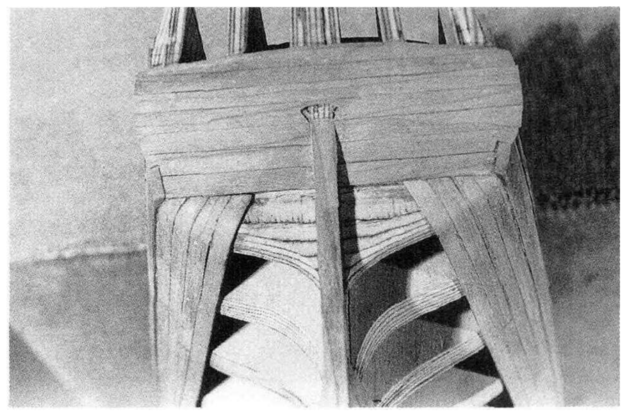
Plankinq from the garboard strakes upward, bulkhead former still in its slot, mark the top of the profile former on each face. Redraw the underdeck curve to match this mark, also on both faces, then use the belt sander, hobby knife and files to take it down to the line. Draw the outline of the aft aspect of the tops on the back side of the former.

Put the former in a vise, mark the diagonal lines indicating the cross section of the tops, and saw down to deck level with a jeweler's saw to rough out the shape of the top; finish it up with files and sandpaper. If anything, leave the vertical dimension of the top timbers a bit long. It's almost impossible to get both the length and the sweep of the sheer curve correct directly from the plans and patterns, but easy to do it as construction proceeds by filing the tops down to the nice curve formed by the planking of the bulwarks inboard and the sheerplank outboard. The bulkhead former should now align perfectly with waterline 2 and its deck curve with the top of the profile former. The centerline of the former should be right on the midline of the profile former. It doesn't have to be snug in its slot, as shims can take care of gaps later, at gluing-in time, but the alignment needs to be perfect, or else planking and decking will develop waves. The slot in the formers, through * 16, extend down below the bottom of the profile former by .2". This creates a housing for the upward extension of the keel and stem timbers, and is thus another key alignment datum that needs careful checking on each former.

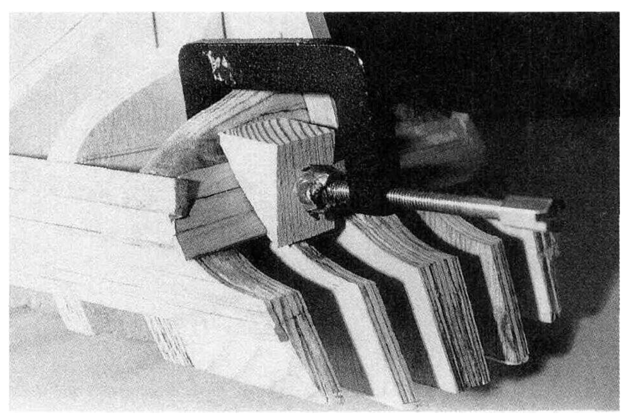
For the formers aft of the deadflat, one has to re-orient ones thinking, as the curves are obviously opposite those of the forebody. It's easier if one considers the face of the bulkhead former with the pattern cemented to it as the aft face, rather than the forward face as we did for formers #10 and forward. That's because it's easier to sand the outside bevels on the side with the paper pattern, rather than redrawing those delicate curves on the back of the piece. That means that the lines drawn solid, e.g. the inner line of the tops, the curve of the underdeck and the lines and curves of the roundhouse, have to be drawn on the back of the piece and beveled in the direction opposite to the outside curves. That sounds more complicated than it actually is, but be sure you absolutely understand it before you start aft of # 10, or you're in for real trouble!



Clamping the garboard strake. Note the specially shaped blocks to permit the use of C-clamps near the bow.



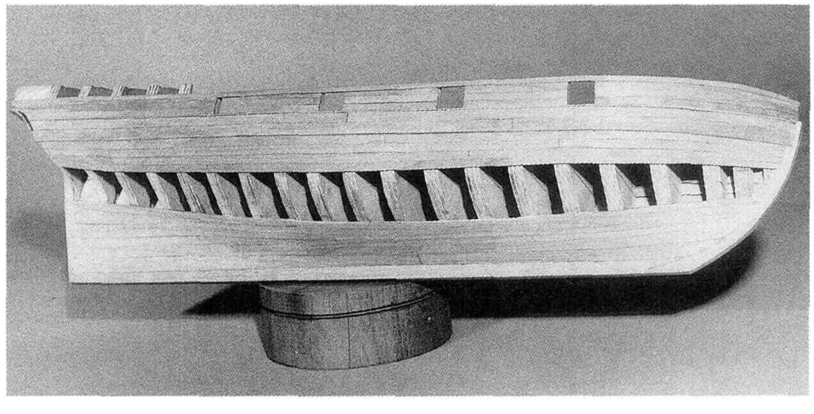
The stem counter planking. Note also the sharply curved planks below the wales.



The special blocks needed to clamp the counter planks.

FITTING & FAIRING THE FRAMES

Even with careful attention to fairing-up when drawing the plans and the formers and with careful attention to cutting out and beveling the formers, there inevitably remains some residual distortion in the smooth flow of lines when the assembly is put together that needs further attention. The first step in alignment is to make sure that each bulkhead former is perpendicular to the top of the keel. Starting with former #10 in its slot, use a small machinist's square against the bottom of the profile former to square it up. Mark the line with a pencil on each side, then turn the square into the horizontal plane to make sure that the bulkhead former is at right angles to the profile former. Fix the bulkhead former in place with tiny softwood wedges, then move on to the formers fore and aft of #10 until all are



The two planking belts.

locked in place. If you still have the remnant of 1/4" plywood left over from cutting out the profile former, snatch it up out of the scrap pile and slip its straight side into the slot formed below the profile former by the bulkhead formers. Lock the scrap, with the ship framework attached, in your bench vise, with the bottom of the profile former just at bench level. With a scale or marking stick, check to see that the tics for the location of waterline 4 are all at the same height, on both sides of each bulkhead former.

When you're satisfied with that, begin the fairing-up process. Using a thin hardwood batten, say 1/32" thick, 1/2" wide and 12" to 18" long, check to see if any frames either stick out or seem recessed from the rest at any point. Search the hull carefully from top to keel, about a third of the hull length per trial, from one end to the other. Be sure to check the inside of the bulwarks and the surface of the deck also. Since both in drawing and in sanding we have tended towards generosity in measurement rather than not, the errors, if any, will tend to be local prominence.

Work one frame at a time, taking it out of its slot to power sand it so that the batten lies flat across its lateral aspect when it's back in its slot. To detect smaller errors in alignment, go back over everything with a thicker batten, which will preview the flow of the actual planking. The planking will be 1/16" thick, so that's a good thickness for this second-time-around batten. More work will probably be needed aft than forward, because of rapid and extensive changes in hull shape aft. With the basic fairing finished, the hull skeleton should look smooth and fair to the eye from any angle, and the batten should lay smoothly along the hull at any point without forcing. If you are absolutely satisfied with the result, take it all apart again.

THE KEEL STRUCTURES

Cement the patterns for the keel, stem and sternpost to a sheet of 1/4" thick cherry and carefully cut them out. For the time being, leave the keel a single width, 11/16" (the plan 5/8" plus a bit for trimming) for its entire length. Power sand the cutouts to final dimensions, then jigsaw and file the scarf joints forward and the tenon aft until all parts fit each other perfectly and mate nicely to the edges of the profile former. Glue together the two sections of the stem with yellow glue.

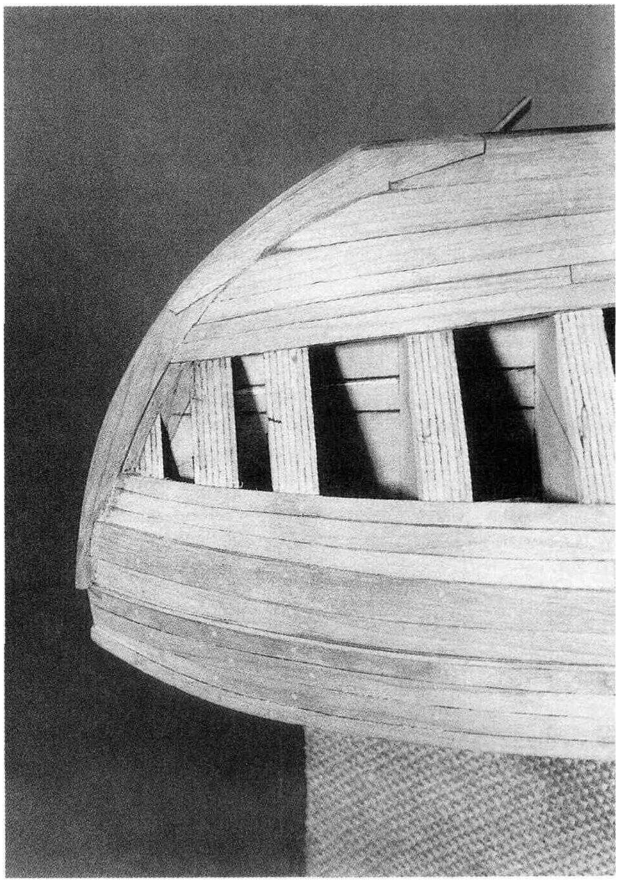
Draw the rabbet on both sides of each piece, making sure to allow the appropriate depth for the slot formed by the downward extensions of the bulkhead formers, and only then power sand the aft taper, 1/16", in the bottom of the keel. To indicate caulking, run the edge of a pencil along the edge of each side of the mating faces of the scarf joint and tenon. When glued together, a dark grey line will remain, which is a good representation of caulking anywhere on the ship. Black paper caulking is just too contrasty for most modeling uses. Arrange to glue the four pieces together rather near the edge of your workbench, so that the key pieces, the profile former and the keel, can be clamped flat. There really is no such thing as a truly flat piece of wood, so clamping now and jigs later will minimize Mother Nature's tendency to be pretty casual about plane surfaces. A thin layer of yellow woodworker's glue applied with a popsicle stick sanded to the shape of a skew chisel will do nicely. Quickly clamp down the profile former. Then, with scrapbox sticks and ply, wedge the three cherry parts tightly against it and clamp them down also, to keep everything flat. Be sure to have a piece of waxed paper under the assembly to minimize subsequent surprises.

Put a couple of #56 birch treenails in each joint. They are made by pulling 1/16" diameter birch dowels through a modeler's drawplate with pliers. Power sand a long taper on one end of the dowel and push it into the flat side of the plate. Start with the smallest hole the dowel will fit through, generally the largest one on the plate (#45), then go down one diameter at a time until you get to the designated end point. There is a fair amount of breakage, but if you hold the drawplate in a vise and take care, it all works out.

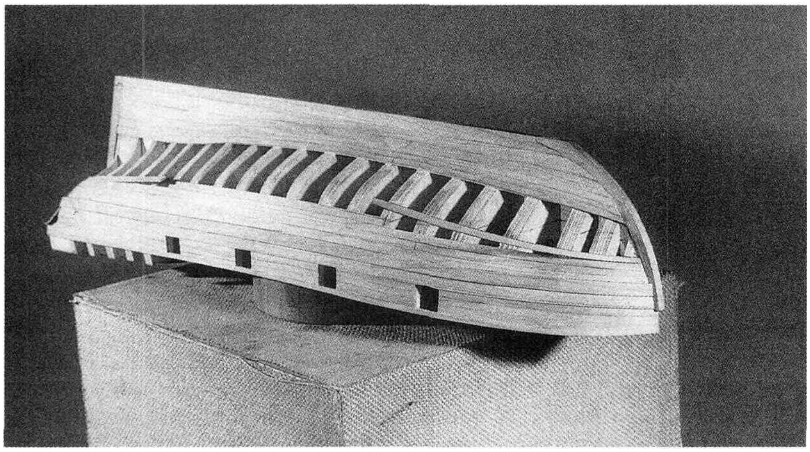
There is some variation in diameter of the dowels, even from the same manufacturer, and I have occasionally had to use a drill measurement plate, which of course is not designed for this purpose, to bring the dowels down to the #45 size. Bamboo is very strong in these small diameters, by the way, but the cellular end grain becomes very visible and non-nautical looking, hence the choice of birch. Birch has the virtue of being close enough in color to both the cherry and basswood (just a bit lighter than one and darker than the other) to give a gentle contrast, nothing too jarring to the senses.

CUTTING THE RABBET

Put the frames back in their slots to mark their bottoms on the keel. This gives a good visual aide to location and extent. The rabbet and bearding lines can now be drawn. These lines should then be scored with a sharp hobby knife to prevent splitting when cutting the rabbet. Use the same curve used in drawing the plans and a straightedge as a guide the knife. Don't



The tapered planks of the bow.



A plank with its forward end glued in place where a clamp can't be used.

try it free hand. It can't be done! Put the frames back in again and fit each one to the rabbet line. Use the power sander cautiously to make what should become small adjustments.

As you may have noticed in the drafting section, the cross-sectional shape of the rabbet varies continuously. In the stem, the ends of the planks come in at an obtuse V angle. It changes from this V shape forward and amidships to vertical panel-in-a-frame aft. The lowest garboard strake has its entire edge in the rabbet, the only strake to be so affected. The sternpost rabbet is a conventional cabinet maker's rabbet, mostly a right angles affair.

This is a good time to thin down the lower part of the profile former to the level of the stern rabbet to take the thickness of the planking (two scale inches; 1/16") aft. As the planking never fits into the rabbet at exactly at right angles, the depth of the rabbet is always a little greater than the planking thickness—about 5/64" works out just about right.

Probably the best way to visualize the varying angles of the rabbet correctly is to put all the frames in place and then lay a 12" length of planking stock (1/16" x x 3/8") along the bottom of the formers. Keep a piece of paper and a pencil handy as you bend the planking around the bottom of the formers, going from the bows aft. With the planking in place, it's easy to visualize the proper angle in your mind's eye and sketch it. It's an easy transition form the sketch to the model.

(Jut the straight line portions of the rabbet with a wide chisel blade in the hobby knife, and the curved sections with the smaller rounded blade. A carver's small flat bent chisel is the easiest tool to use for recessing the aft section of the keel and profile former for the almost vertical run of planking there. Be careful her, as it's easy to slip into the pristine surfaces of the sternpost and keel and ruin them.

Short sections of the rabbet at the stem need to be enlarged to take the thicker planks of the wales and the black strake. The rest of the hull planking is two scale inches thick (1/16"), the black strake is three scale inches thick (3/32"), and the wales are four scale inches (1/8"). That means that the length of the rabbet at the top of the stem that accommodates the black strake (nine scale inches — 9/32") has to be widened by 1/32", and the wales segment, ten scale inches long (5/16"), has to be widened 1/16". This is best done with one of the sharp, narrow chisel blades available for the hobby knife.

GLUING UP THE FRAMEWORK

It's finally time to glue in the bulkhead formers, which I may from time to time just call frames for simplicity. Again starting at frame #10, spread a thin layer of yellow glue on all mating surfaces, and slide the parts together. Use your glue stick and a moist rag to scrape away any glue oozes. Carefully wipe away any glue that gets on the cherry wood parts. It's perfectly acceptable to glue wedges right in with the frames where needed to maintain right angle alignment; use the square to assess need. Protruding bits of wedges can easily be cut away later when the glue has dried.

Do the final (actually semi-final) fairing now, using a 1/16" thick hardwood batten as before. Spend plenty of time getting it right; no matter how carefully each previous step has been done, there will still be occasional bumps that will need to be worked down to have the planking lie smoothly. If worst comes to worst (a state the author is personally familiar with) and hollows need to be filled, a fairly easy way to do it is to glue thin strips of wood, with the grain running horizontally, across the areas of the frame that need to be built up. They can be pinned in place if thin or clamped in place with such devices as one's toolbox and ingenuity may suggest if thicker. Small C-clamps above deck level and tourniquets of masking tape below are helpful.

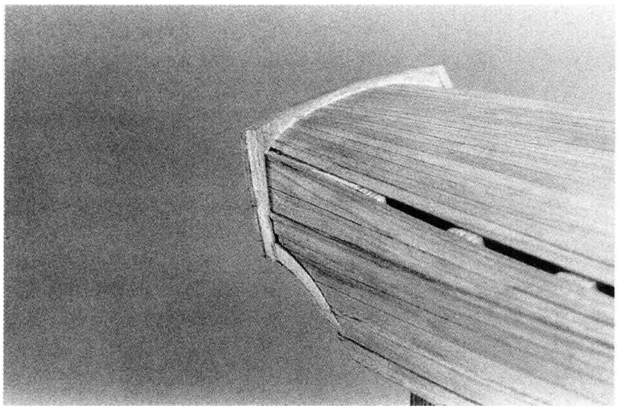
The tool of preference for fairing is a small sanding drum, with coarse sandpaper, in a flexible shaft tool. A hand grinder of the usual sort will not be able to get close enough to the surface of the frames to sand parallel to the surfaces. An inexpensive flexible shaft accessory for the hand grinder is readily available from hobby tool suppliers. The fairing can be done by hand, with files and sandpaper, but the edge grain of plywood is quite difficult to work with hand tools. When you are quite satisfied with the fairness, sand off the rough edges with a sanding stick or emery board and remark the wales and quarterdeck molding tics.

THE BASEBOARD

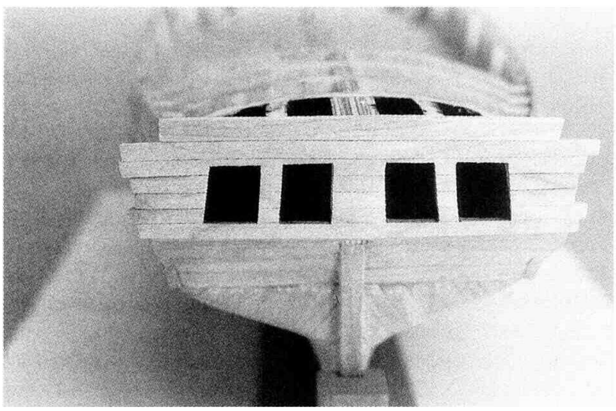
The baseboard is the building board for the model. Grooved jigs hold the stem, keel and stern in a straight line and at right angles to the board. Thus the baseboard acts both as a fixture to maintain alignment of the hull during planking and as a cradle when doing the decking, the deck furniture and the masting and rigging.

The jig, the pattern for which is on Plan Sheet 3, holds the hull so that the design or load waterline is parallel to the baseboard, the waterline being an important reference line in construction as well as the proper line for final mounting. Not to worry that the angle looks more appropriate for a rocket launcher than a ship's cradle — these little speedsters sailed down by the stern, as mentioned earlier.

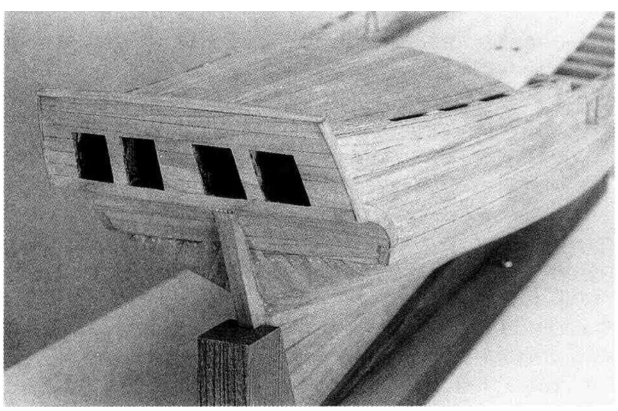
The baseboard itself is a piece of 3/4" thick particle board, perfectly flat, sprayed flat white for ease in seeing the markings. The latter include a longitudinal centerline flanked by jig margins 3/8" on each side, the fore and aft perpendiculars and the midships station (the aft face of bulkhead former #10). Scribe the lines first, then



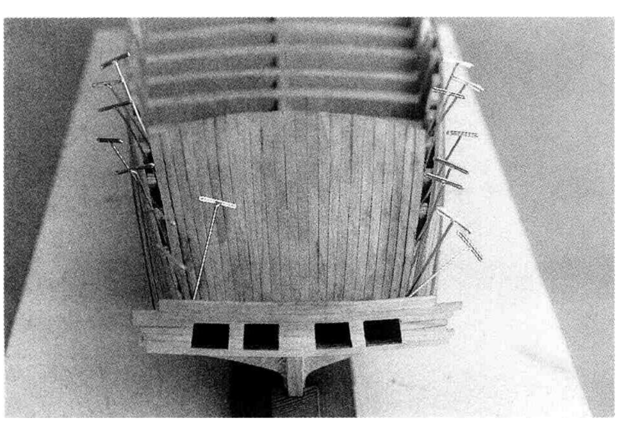
The taffrail and fashion pieces.



The planking of the stern. Three recesses for the lights have been shaped and the interior surfaces painted flat black.



The finished stern (except for the lights) with the taffrail molding and fashion pieces.



Planking the cabin roof.

mark them with pencil. That way they will always be there for redefinition if the pencil marks get rubbed off.

The jig pieces for the stem, stern and keel are shown in reduced size on the plans pages. The dimensions can be scaled-up easily with a ruler; they are not critical. The parts are cut from 3/4" thick softwood — soft so as not to mar the surface of the cherry wood keel structures. Each has a 1/4" deep and wide groove cut in it, most easily done with a 4" hobby type table saw. The middle part of the groove on the section for the stem, the curved part, will have to be cut by hand with a 1/4" wide wood chisel.

The 17" long wedge-shaped section for the keel fits the keel from the junction forward where the curve of the stem meets the straight part of the keel to 1/4" from the edge of the sternpost, where it joins the sternpost jig. Cut two lengths of softwood, 1/2" thick and 3/4" wide, to the total length of all three jig parts, then glue and clamp the pieces together to form the completed jig. Glue and screw the jig to the baseboard, using the aft face of frame #10 to align the baseboard amidships line, then slip the model into its new home.

THE STERN FRAMING

The hull framework is completed by the construction of the stern framing, certainly the most difficult part of the construction process thus far. That's true because back here there are curves everywhere, and in multiple planes. There is the side-to-side curve of the transom and the up-and-down curve of the taffrail. There is the concavity (in the sheer profile) of the counter, that part of the stern below the transom. There are also the curves that define the counter's top and bottom edges in the body plan view.

It takes a lot of thought and a lot of time, with a wee dram of single malt as a reward when you finally get it right. With the patterns drawn here enlarged to full size and already battle tested, there should be no problem.

THE WING TRANSOM

The wing transom is that large bulk of timber that in both the real ship and the model supports the stern frames. The wing transom in the model measures 4 1/4" from side-to-side, or a bit less, depending upon the amount of fairing done on bulkhead former #20. It is shaped according to the drawings on Plan Sheet 2. It is 9/32" thick, 15/32" wide at the top, and 7/32" wide at the bottom. The ends (top view) are power sanded to match the fairing angle of the frame, then the aft face is carved concave with a circular bladed hobby knife the arc matching that of the curved part of the stern formers. Glue and clamp the wing transom in its slot in the profile former and to the back of former #20.

THE STERN FORMERS

Pencil in the locations for the stern formers on the back of frame #20 and the top surface of the wing transom. The two inner-most formers pad out either side of the stern portion of the profile former. They taper from 1/8" thick below to 5/64" above. The middle former on each side is 3/16" thick; its bottom edge is located .5" from the bottom of the inner former; the top edge is .45" from the top of the inner former. The outer formers are 1/8" thick, with a spacing of .55" below and .5" above. The outer formers do not need to be tapered, as their bottoms can be beveled to achieve the proper tilt.

All the dimensions and curvatures of the stern formers are based on their relationship to the exact shape of the profile former stern area, so before cutting wood, cut a piece of thin cardboard to the sheer plan angle of the wing transom-frame #20 junction, slide it over against the profile former, and trace the stern extension of the latter. Cut out this section and compare it to the full-sized plan to see if it's the same. If it is, you can go ahead and use the stern formers as drawn. If not, the stern formers need to be modified to maintain the relationships of all the curves.

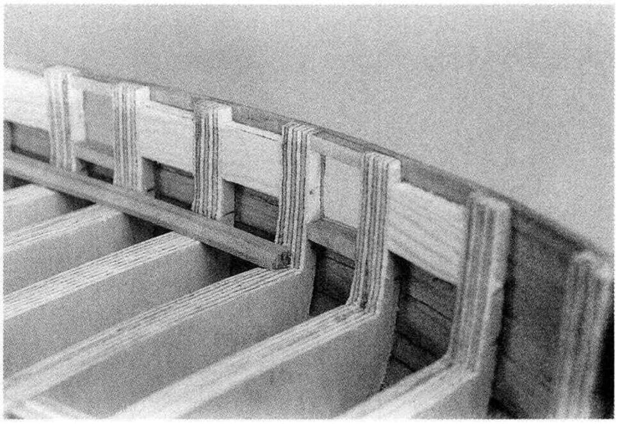
It's best to cut the wood a bit oversize to allow for final fitting. First get the wing transom-frame #20 angle exact, then do the bevel at the bottom of the former to have each piece fall right into its marked out home. Do the vertical sizing next, followed by the top bevel. With the aid of your faithful batten, sand in the aftermost edge and its bevel, remembering that to form the athwartships curve, the middle frames are about 1/32" shorter (front to rear) than the inner frames, and the outer frames are 1/32" shorter than the middle ones. Finally, cut the arc of the concavity, then sand the bevels to form a nice, smooth curve downward and outward from the inner frames. It's helpful here to use double faced tape to tack the formers in position as they are made, to help compare each to the last and next. Glue the stern formers in place.

A full-sized ship has a forest of framing back here to finish off the transom, extend its lateral aspects out beyond the hull, and to accept the ends of the roundhouse planking, the side planking of the hull and the underbody planking. We will simplify a bit (actually a great deal) by using pads of softwood to fill in some of these key areas. Cut a piece of 1/2" thick softwood to the size and shape of the outer stern formers. Fit it carefully to the wing transom and the back of frame #20 as was done with the stern formers themselves. Trace the edge of frame #20 onto the forward edge of the block, then rough out the block with a hobby knife to the resultant shape. Using your flexible batten, slowly taper the block to the fair lines of the hull with the power sander. When the batten lies nice and smoothly along the last several bulkhead formers and the padding block, glue it in place.

Below the wing transom, where the transom frames would be in a real ship, we will put in another pad, this one 1/4" thick and 3/8" wide, shaped to fit the curve of the side of frame #20 looking forward, and tapered from full thickness above to almost zero below when looking at the piece from the side. If done correctly, the pad runs right down the bearding line of the stern rabbet. After it has been glued in place and the glue cured, the ends of the wing transom, the pad below and the side of the stern frame pad can all be finally faired and smoothed with files and a sanding stick.

ODDS AND ENDS

Finish the socket for the lower end of the mast now. 5/64" of width is needed on each side of the profile former, so spacers will have to be made to fill the triangular space behind the recessed area already marked out on each side between frames #8 and #9. Cut the pieces to final shape from 1/4" ply, then split out the outer two plies to get the exact final thickness.

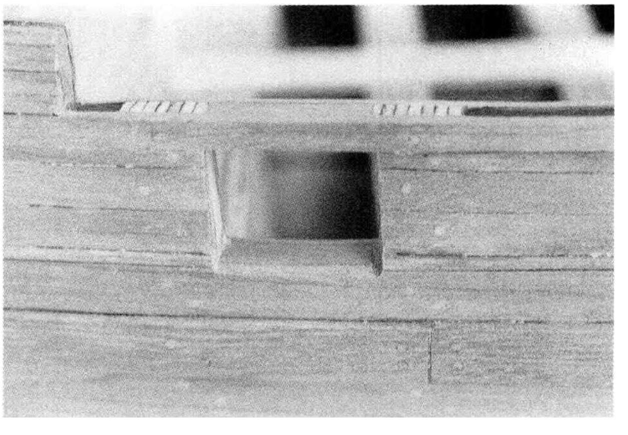


The waterways and the filler blocks for the oar ports.

Cut a rectangular piece of 1/4" ply to cover the spacer and fill the space between the two frames, completing the socket.

Three false deck beams are needed to finish up the hull framework, one to take the ends of the main deck beams, one to form the forward edge of the quarterdeck, and the last to take the ends of the quarterdeck beams. Make them in the reverse of the order given above, each in two pieces, to butt up against the profile former. The first is of 1/4" ply and is glued to the forward face of bulkhead former #17, right at the pencil line for the quarterdeck already marked there. The second one, forming the forward edge of the quarterdeck, is of 7/16" stock and is fitted to the forward face of frame #16. The final false beam is of 1/4" stock (less one ply), and fills the gap between the after face of frame #15 and the thick spacer already glued to the forward face of frame #16; it is level with the deck of #15.

That's it! The framework of the hull is now complete and ready to plank. Almost. That's right—you guessed it: everything should be re-faired one more time, now that the stern structures and deck beams are all in place. The main wale ends up right on the butt end of the wing transom, so the area of frame #20 below that level needs to be rounded off to permit the hull planking to curve (albeit rather abruptly) to the stern rabbet. Use thick and thin, long and short, narrow and wide battens and check it all out. None of what has been done so far, other than the stem, stern and keel, will be seen when the model has been completed, but none of what has yet to be done will be visually appealing unless the



The gunports.

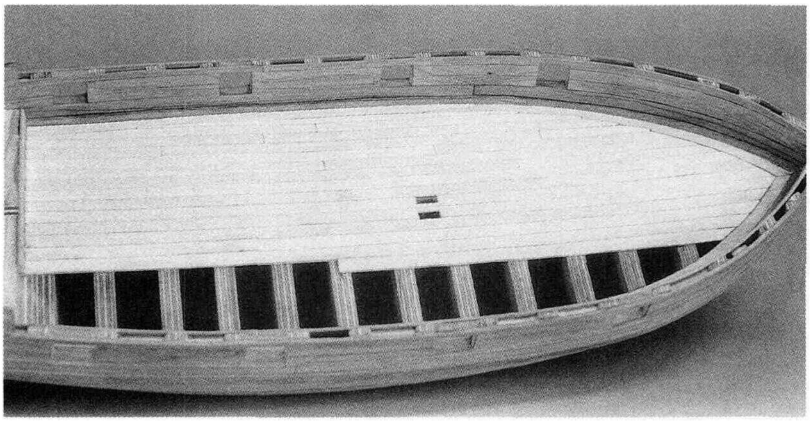
annoyingly endless business of fairing has been properly done.

PLANKING THE HULL

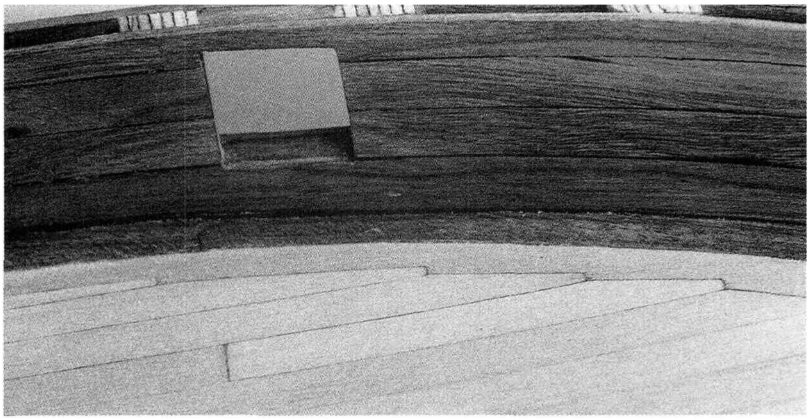
There really isn't much mystery to hull planking, but a little fore-knowledge and planning are helpful. Here's a quick exercise for the modeler new to miniature actual practice planking to illustrate some important points: take a piece of thin cardboard, the width of the black strake (1/4") and 24" long and try to fit it to the hull, from stem to stern, in the black strake band without creasing it. Can't be done, can it? The curve of the bow goes okay, but at about amidships the downward curve of the band sends the strip far below the desired course. Next, take another 24" length of cardboard, this one about an inch wide, and by trial and error, cut it to fit the upper border of the band; takes on some strange and unanticipated curves, doesn't it? Next make the strake by measuring down 1/4" at intervals along the curve, connecting the marks in a smooth curve, and cutting out the resultant cardboard shape. Determining that curve is the essence of spiling.

What you have discovered is that a strip of cardboard does not bend evenly along the smooth curve of a ship's hull the way it would around the walls of a cylinder. Why? Because each segment of the hull is the equivalent of a cylinder of a different diameter for one thing, and the other is that some of the cylinders have been tilted and some even flattened! The hull flattens out at the stern, and even a bit at the bow. There is a definite bulge amidships. Some hulls even flare (greater total on-the-surface length from wales to rabbet) aft, although this little sloop doesn't. If you measure vertically from wales to keel at various intervals, you will find that the distance is greater amidships than near the stem. That means that strakes have to taper forward, and although aft flare isn't a problem, most of the aft planks have to be spiled.

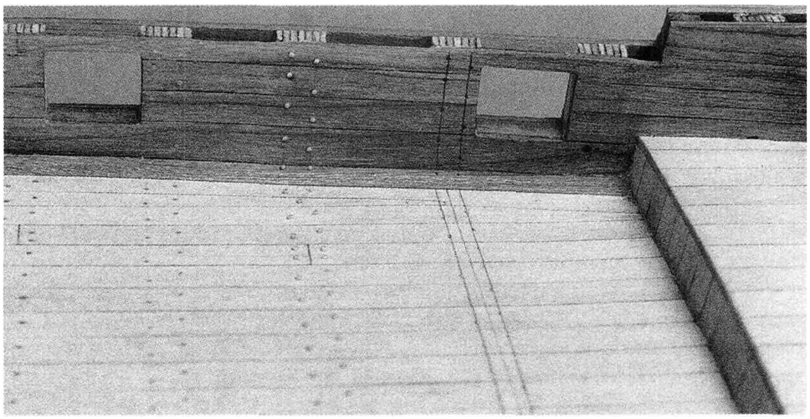
Although some modelers plank models with continuous full-length planks, no real ship was ever planked that way. Planks that long would be very difficult to obtain, and widths of one and a half to two times the plan width (to allow for spiling) would be incredibly wasteful of timber. Likewise it's also easier and more economical for the modeler to plank in scale lengths. If you get out your 1/4" wide cardboard again and divide it into one foot lengths, you will find that you can get the forward half of the black strake in with just simple bending and a bit of upward teasing of its after end. The aft plank will fit with just a little upward bend against its width,



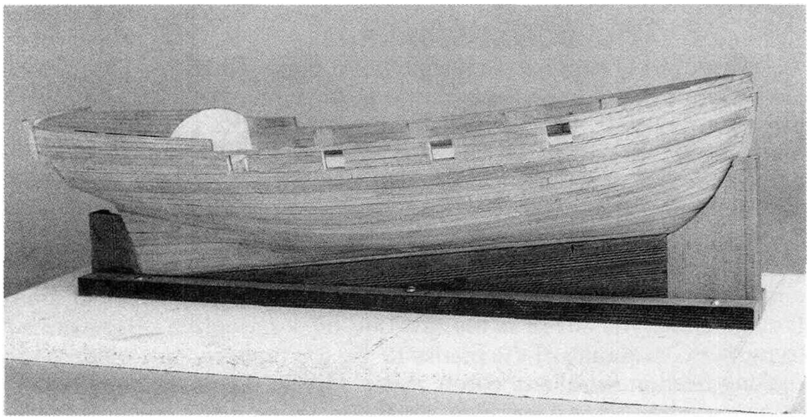
The deck planking. Note the completed waterways and the bulwark planking.



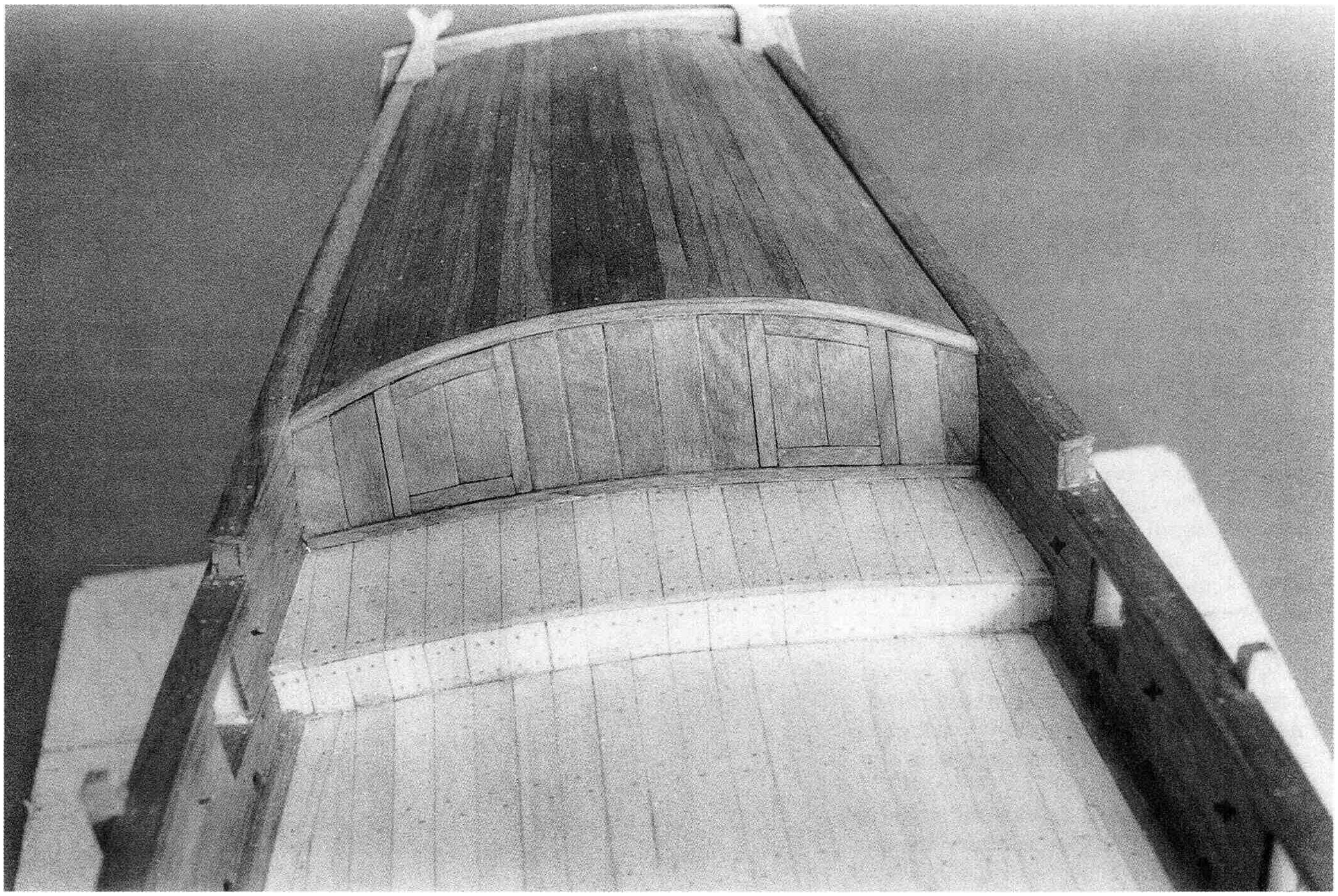
The deck plank nibbing.



Marking the deck planking for the fastener locations.



The completely planked hull.



The quarterdeck and quarterdeck bulkhead planking.

about all that a stout wooden plank can take. No curve cutting is needed and no extra wide plank stock required. Well, it's not always this easy. The hull is fairly straight up and down from the wales up, so little fitting is needed, just some steam bending up front for the wales.

Below the wales, however, all is different and difficult. The planking forward needs to be tapered and the aft planks have to be steamed into oblivion to navigate the sharp curve to the counter. Because of the rapidly changing curvature of the hull, almost all the planks of the underbody need to have their upper edge specially matched to the lower edge of the previous plank (spiling). Being aware of the problems to be encountered is really half of the solution; the other half will be described bit by bit as we go along.

THE BLACK STRAKE

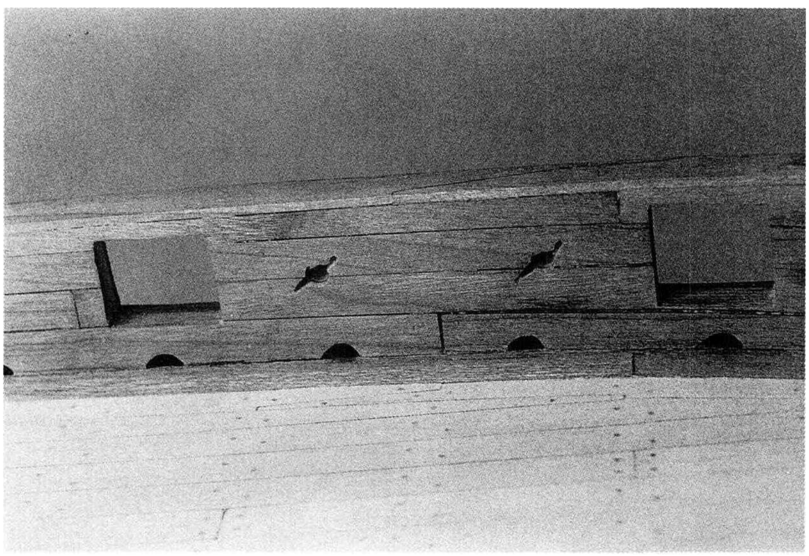
Although the external planking of most ships of this era began with the application of the most prominent planks, the wales, there are several reasons why the black strake, so named for its usual color, is a better choice for our starting point. First, it's thinner and narrower, and thus it will curve and bend more easily. Secondly, it is higher on the hull, where the hull is flatter, thus causing little twisting distortion to be overcome by spiling and no need for either tapering or flaring. Third, the strake is the first one high enough to permit C-clamping of the planks to the top timbers, making fixation for gluing much easier. Finally, there is the hard data of fixed anatomic structures, rather than soft pencil mark tics, to locate both the beginning and end of the strake. It begins at the top of the stem rabbet (less one scale inch — 1/32" —for the molding, to be applied separately) and ends right over the end of the wing transom. Good reasons to start here, don't you think?

If you purchased your wood as milled sheets (4" x 24"), rip saw two 1/4" wide lengths and cut each in half. Stick two of the lengths under the cap of a steaming tea kettle for about ten minutes, then clamp them in a simple jig to hold a curve that is an exaggeration of the bow curve (it's very easy to flatten out excess curvature). The jig can be as simple as a piece of 1" thick softwood bandsawed or even hand coping sawed to the desired curve and nailed to a wooden base. The pattern for the form is on the plans pages. Nail a small block of wood at a distance equal to the thickness of the planking at the bow end of the jig. Have a small block with a nail already in it ready to use as a clamp. Slip one of the steamed planks in the bow clip, bend it around the form, and secure it by nailing the second block out near the end of the jig. A second plank can be slipped in right on top of the first.

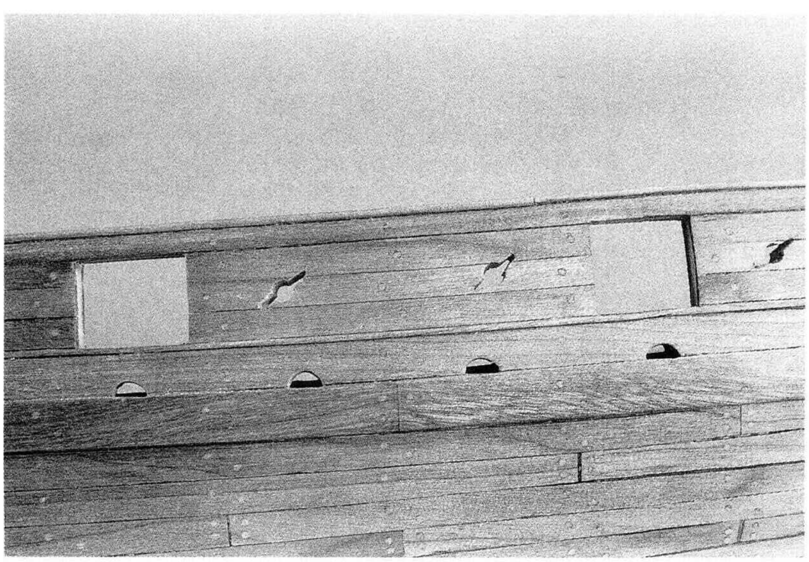
A certain amount of preparation is necessary before the planks can be glued in place. As you may have noticed, the steaming will have swollen the planks a bit, especially in their width, and the bow end will now be wider than the aft end. This flare will have to be taken out with a pass or two with a finely set miniature block plane and a few strokes over a piece of medium grit sandpaper on a flat surface. Fit the curve of the plank to the curve of the bow with finger pressure, then sand or file the end of the plank to the angle of the stem and the bevels on each side of that end to the shape of the rabbet. It should fit in snugly and not need any extra clamping to keep it in place. The corner of the bottom edge of the entire plank can be darkened with a pencil to suggest caulking and then the plank is ready to be glued in place. This is the last opportunity to check the height of the wales tics from side to side. Use a scale—make sure it's absolutely vertical—to measure the wales tics on each side. Make a mark 1/4" above each wales tic to create another visual check point, the top of the black strake band, to use for accuracy when gluing-up. Hold the bow plank up in place and draw a pencil line on its undersurface at the mid-point of each frame. Apply yellow glue sparingly to each frame site on the plank, to each plank band on the frame, and to the stem rabbet. Tuck the plank into the rabbet and start clamping every two or three frames with C-clamps. The plank will overlap frame #11; it will be cut off later. After at least a half hour of clamping time, the clamps can be called into new service to do the other side.

Make sure the planks are both at exactly the same level at each frame; if they aren't, pull off the last one and reposition it after touching up the glue sites. If the planks are not symmetrical from side to side, none of the subsequently applied strakes, nor the gunports, nor the sheer, will be properly located, and the hull will look terrible. It's not that any real ship was entirely symmetrical, or that many (any?) were ever entirely planked with the same length planks on each side of the hull, but rather that in a model, where one can see the whole vessel in one field of vision, asymmetry stands out like a sore thumb. It's also an accepted standard in shipmodeling; one maintains symmetry, alignment and consistency from side to side.

The aft plank in this strake is much easier—no steaming, no rabbet fitting and little curvature. Use a razor saw to vertically cut off the end of the bow strake on the midline of frame #11, then pencil-darken the corners of the butt ends of each plank, mark the aft plank, and glue and clamp it in place. Where there is no top timber to permit the use of C-clamps, special shop made bulkhead clamps must be used. Even with these, the final resting place of the aft plank on the wing transom will need to be fixed by a large rubber band around the whole stern. Note the gentle upward curve of this plank from frame #11 to the stern. Again, make sure it's placed exactly the same on the other side.



The scuppers, oar ports and gunports as seen from within.



The outboard view of the scuppers, oar ports and gunports.

TREENAILING

Perhaps the strongest fasteners for joining certain wooden components of classical era ships, the huge wooden dowels known as treenails (or trunnels) were long, slightly tapered hardwood dowels. They were often of locust, a prime wood for the purpose, and were driven into slightly undersized holes in the parts to be joined. The protruding end was cut off flush with the surface and was sometimes further secured with a wedge driven into a slot. Treenails ranged in size from about 1 1/4" in diameter to about 1 1/2" the most common size. As the treenail swelled upon immersion, the joint became that much more secure.

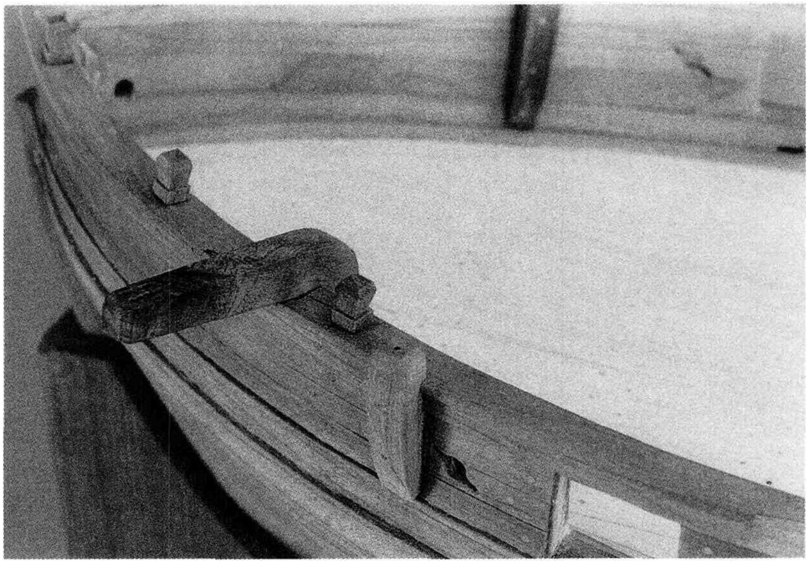
Although the purpose of treenailing was to secure each plank at its joint and not to *create* a particular pattern or design, the general effect of the repetitive fastening in the usual well-defined way at each frame and at each level, did in fact leave at least the suggestion of a vertical geometrical pattern. There may have been more variation in the real ship than we permit in the model, but if the treenails are not reasonably well aligned vertically, the fastenings create the illusion of a wavy line which is very disconcerting to the eye.

The fact that both the American Bureau of Shipping and Lloyds of London defined the standard for fastenings quite similarly in the 19th century, suggests that it was the pattern in use for many generations, and is the one most modelers have accepted as the norm. As almost all the planking used falls into the 8" to 10" width range, single fastening is what will be used, that is, a single treenail in each of the two putative layers of a double frame, on the diagonal—therefore two treenails per plank at each frame. The butt ends of planks were generally bolted, the bolt head being recessed and plugged. The assumption here is that the plugs for 3/4" or 1" diameter bolts would be about the same diameter as the treenails. Mark out the treenail locations for the black strake at each frame in pencil, arbitrarily putting the upper fastening aft. At the stem, the stern and at the butt joint between the planks, mark in the location of a vertical pair of bolts. Use an awl to mark the points for drilling, then drill each hole with a #56 drill (.047" diameter, equivalent to 1 1/2" diameter at scale). Use a bit of tape wrapped around the drill as a depth gauge.

At this rather large diameter, bamboo looks too cellular and distracting. The treenail should be discernible, not prominent. Maritime measles is a disease to be avoided. A good choice to use is cherry or birch, available in 1/16" diameter dowels in the hobby shop. Power sand one end of the dowel to a long taper, to push through the largest hole in the draw plate to offer resistance. Push it through from the flat side of the plate with pliers, then pull it all the way through from the other side. Run each dowel through each hole twice to make sure it's down to size before moving on; it reduces breakage.

About one and a quarter 12" treenail dowels will be needed per strake. Use a sharp knife to chamfer the non-distorted end of the dowel. Touch it to a small pool of slightly diluted yellow glue in waxed paper repose, and push it firmly into the hole, bottoming it with the aid of the pliers. Cut off the treenail at the surface with diagonal cutters. When the glue has dried, cut off the treenails flush with the surface with a sharp disposable chisel blade in the hobby knife. Scrape the plank flat with an old chisel blade, then sand with medium grit (#100), fine (#150), then extra fine (#220) paper, using a small block of wood as a sanding block.

There are 44 treenails in each black strake, by the way. If you want to worry yourself a bit with the threat of potential work, make a quick estimate of the number of planks in the hull and multiply it out!



The swivel posts, catheads and timberheads.

BLACK STRAKE MOLDING

Although the black strake moldings are best put on after the wales are completed to permit proper surfacing of the wales, they are part of the black strake and should be discussed here. Although they probably would have been applied as half-round molding in the real ship, it is easier to make them as separate thin strakes glued to the top of the black strake.

The forward five inches (model size) needs a pattern so that the molding can be jig sawed from 1/32" thick cherry; there is just too great a curve to bend against the width of the wood. The remainder of the molding can be rip sawed from the same stock, 1/8" wide; this narrow stock can be fairly easily bent into shape. Try to put the joints directly above those in the black strakes. Up front, a simple scarf joint will hide the joint between the sawn and the bent sections. Use model maker's T-pins to hold the molding in place while the glue dries. Plane and file the edge of the molding until just a little over 1/32" protrudes, then scrape the edge down to half round. A nice molding scraper with a built-in handle can be had by grinding the half-round shape into the cutting edge of a single edge razor blade, using a cut-off wheel in a hand grinder. Dull the business edge of the blade with a file, so you don't cut yourself. Also file down the corners and edges of the newly made working surface of the scraper so you don't scratch the wood of the planks already in place.

THE WALES

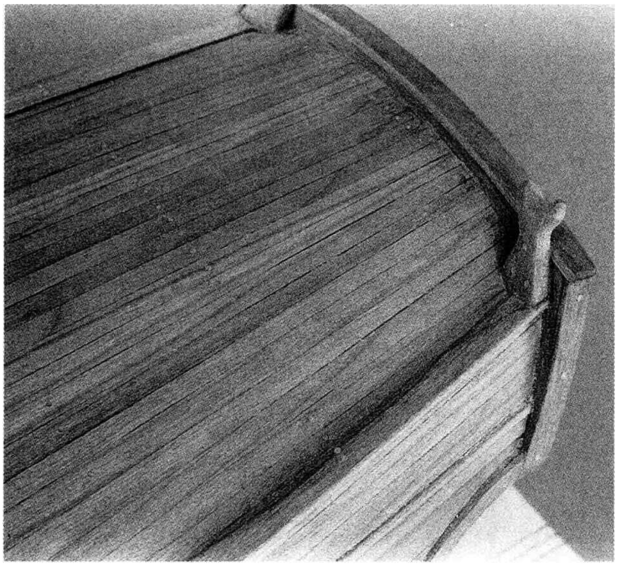
The heaviest timbers in the external hull planking, the main wales measure 4" x 10" scale inches (1/8" x 5/16") and have to be steamed at the bow to make the curve. To avoid having all the butt joints fall on the same frame and cause serious structural weakness, the wales are made in three sections, each twenty scale feet (7 1/2) long. The planks butt on frames *#1* and #14. The aftermost section is just about straight, but the other two have a fair amount of curvature. All three should be spiled, that is, custom fitted to the under-curve of the black strake.

SPILING

Take a piece of cardboard about 3/4" wide and 8" long and tape it up under the bow section of the black strake after cutting the forward end to the angle of the stem rabbet. The strip will touch the strake near the stem and at its aft end. There will be a gap of about 3/16" in the middle.

Take a bow type compass, the kind that has one pointed steel tip and one lead or pencil tip and which is adjusted with a rotating nut for security. Adjust the gap between the two points to just a little larger than the gap between the strip and the strake. Run the steel tip along the underside of the black strake, drawing thus a line parallel to the lower edge of the black strake on the cardboard. That's all there is to it!

Untape the cardboard and be surprised—the curve that you have to cut to fit the convex curve of the underside of the black strake is itself convex, because of the



The boom crutches.

compound curvature of the bows. Cut the cardboard at the pencil line and fit it to the bow to double check and trim to a final fit. The middle section needs to be spiled also, but this pattern will turn out to be a gentle concave guide.

The third section spiling turns out an even gentler concave curve. Thus the general plank shape for most strakes is a convex curve for the bow plank, an essentially uncurved middle plank, and a slightly concave aft plank. From 1/8" thick cherry sheet, rip two 1/2" wide lengths. Cut the lengths into 8" segments. Use the bow segment and middle segment spiling patterns to draw the planks on the wood. Cut them out on the jigsaw, trim to the line on the power sander, and fit them carefully to the matching black strake sections on the model. When it's perfect, draw another line parallel to and ten scale inches (5/16") from the spiled curve, and you have the shape of the bow section main wales plank. Cut and sand this lower border, then you're ready to steam, trim, glue and treenail as we did the black strake. Save all the cardboard spiling patterns, as with little modification they can be used for quite a few runs of planking with no appreciable changes in the curves.

The concave curves are a bit more difficult to bring to a smooth, regular curve than the convex ones. The latter can be done nicely on the disc sander, but the former needs to be done with a large half-round file, the wood plank held in the vise. The finish sanding for these concave curves can be done with the sandpaper held against a large cylindrical object (the hot water heater gives good results). Clamping this heavier stock is also a good deal more difficult, and an open minded approach helps. Hobby size C-clamps with popsicle stick pads and tiny wooden wedges, shop made bulkhead clamps and regular workshop C-clamps with pressure blocks can all be used.

In the world, you can't be too rich or too thin; in the shop, you can't have too many clamps. Follow the same procedure, less the steaming, for the remaining two planks and the wales are almost completed. Let the aft end of the wales terminate one scale inch (1/32") beyond the end of the transom; the wales are flush with the transom planking.

THE SHEER STRAKE AND "SHORT STUFF"

The sheer strake or planksheer is the run of planking at the top of the sides of the hull and is the determinant of whether or not the sheer line is sweet. As such, it's important to the overall appearance of the model (not to mention the ship!) and should be put on next. Shaping the planking in between the ports (the short stuff) and the planking forward of the first port and aft of the last (no special name) can be done afterwards to suit.

The sheer strake is three scale inches (3/32") thick and four scale inches (1/8") wide. It's best done as a single length, contrary to what I've said above, because the visual continuity of the curve is so important and because this small cross-sectional material is so flexible. A false butt joint can be made with a razor saw at the top timber of frame # 10 after installation. The forward end of the planking needs to be steamed to make the bow curve. The sheer curve itself, that is, the curve that you see in the sheer plan or side view, is a natural curve from frame #3 aft, but is rather flat forward of that. It imparts a rather flattish, reverse S shape to the sheer, a not uncommon naval architectural design feature (at least in modern times). Clamp the sheer strake to the first three frames to get that flat section fixed in place, then do the rest when the glue has dried. (If you don't get it just right, split the glue joint with a single edge razor blade and do it again). Treenail the sheerstrake with just one fastening per bulkhead former. In the bow, the junction of the planking from the two sides needs to be reinforced with a stout vertical wooden plug when all the upper body planking is completed. This plug will also take the ends of the bulwark planking.

The remainder of the upper hull planking is pretty easy—little bending, no steaming, and spiling of only the upper strake. There is flare forward, compression aft of amidships and slight flare aft, so that the same planking width cannot be used for each section of each strake, hence the need for spiling. There are several ways that this area can be planked geometrically and there is no hard evidence how it was actually done. Two full strakes of six inch scale (3/16") wide planking above the black strake molding works well as a start. The aftermost plank under the sheer plank will have to be tapered from aft forward to fit.

The planking between the third and fourth and the second and third ports will need to be planed down a bit to fit. A wider plank will be needed forward of the gunport. Eight scale inch (1/4") stock is used here, planed to fit the oddly shaped remaining spaces. Eyeball spiling works just fine in this situation. To plane a plank's edge, one can use a jig like a small saw sharpening vise, but merely holding the plank against the bench top with a pair of forceps (with the teeth filed off) works well.

Stick a piece of masking tape under each gunport site on both sides to remind yourself where the ports are during planking. There should be no joints in the short stuff. You will find that almost every plank in the lower two strakes needs to be firmly depressed at its center (pushing downwards against the top edge) to fill the slight curve formed by the black strake below. This is most easily accomplished by gently pushing a softwood wedge between the plank and the sheer strake. C-clamps will do nicely for the ends. Use just a single treenail in each plank at each bulkhead former, except in the scale 8" wide areas, where two would be appropriate. Spend a lot of time with narrowed emery boards at this time getting the upper body planking smooth and even. Dip a bit of paper towel in mineral spirits and wet down the planking from time to time to highlight any remaining defects. When the solvent evaporates, go back and sand them away.

FROM THE GARBOARDS UP

Turn the hull over and start at the bottom to finish the planking of the major part of the hull before going on to do the sides at the quarterdeck-cabin area aft. A box or platform about a foot high is needed as a work station, as the ordinary bench top is just too low for comfortable work. A piece of carpeting or an old Turkish towel on the box will avoid model scratches and retain dropped parts. Bottoms up!

THE GARBOARDS AND BROAD STRAKES

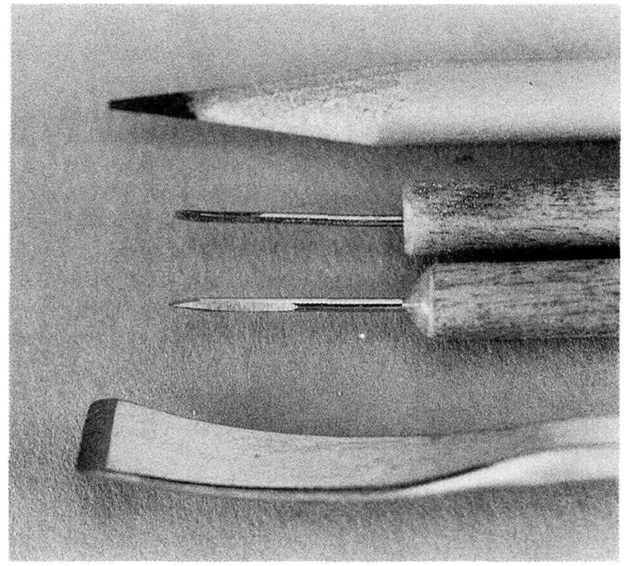
The strake that fits into the entire length of the keel rabbet, and a bit up into the stem rabbet, is called the garboard. It generally is wider than the average hull planking, and in fact, may be the widest run of planking on the ship. Next above it are the broad strakes, one or two strakes of planking also wider than average, but narrower than the garboard. Scale 12" wide planking (3/8") serves for the garboard and two runs of scale 10" wide (5/16") for the broad strakes. All of this planking (and all the remaining planking) is two scale inches thick (1/16") stock.

If you measure the distance from the bottom of the wales to the keel rabbet at the midships frame and aft at frame #20, you will see that the measurements are almost identical. This is unusual; most 18th century hulls were a bit more tubby aft, and the measurement aft was greater. This resulted in the need for flaring of the lower planking aft or the use of stealers, short planks that notched into the edges of a pair of planks and aft fit into the stern rabbet. The flared planks or stealer gave the extra height to the planking needed aft because of the longer vertical measurement mentioned above.

Although this vessel doesn't need stealers for the just mentioned reason, it does need one (or aft flaring of the garboard and broad strakes) for another reason, visual rather than architectural. In a hull such as this, with an easy run—that is a rather sharp transition from the underbody bulge of the hull to a rather vertical stern section—unflared aft planking, viewed from any angle above absolute right angles appears to bend downwards as it curves around the bulge, at least after three or four strakes are in above the broad strakes. This is an optical illusion, but an annoying one. It can be eliminated by flaring the garboard and broad strakes aft. Where they terminate in the stern rabbet, the garboard should flare to 14 scale inches (7/16") and the broad strakes to 12 (3/8"). If for any reason that's not enough, a stealer can be added as planking proceeds.

A pattern needs to be cut for the forward plank in the garboard strake; it curves upward from the joint between the keel and the stem. This plank also tends to curve upward at the bow; it will look better (and there will be more room left over for the tapered forward ends of the hull planks) if it is itself tapered a bit on its top edge, so that from the side, its top edge appears to be parallel to the keel rabbet. This taper will start at about frame #5. The single butt joint in this strake can be located on former #10.

Clamping these planks, with their marked degree of twist, requires a little ingenuity. The custom-made



Shop-made miniature chisels, with a pencil and small bent chisel for size comparisons.

planking clamps described earlier, C-clamps with softwood wedges to make their faces parallel to the keel so they won't slip off, and C-clamps with little purpose-made plywood blocks will do the trick. The blocks have one corner power sanded to the angle of the garboard plank and the keel, so that when clamped to the keel they press in and downward against the plank. Make sure the sternpost rabbet and the recessing of the profile former at the stern permit the aft garboard plank to lie flush before gluing it in place. At least steaming is not required!

Next up are the broad strakes, ten scale inches (5/16") wide amidships, flaring to 12" (3/8") aft. They are made in three planks; the first two butt on frame #8 and the aft two on frame #13. The first and third planks have to be spiled, and thus cut from wider stock. If there appears to be a rise above horizontal in the forward plank, taper it a bit just like the garboard.

The middle plank is straight stock. Use at least two different milled cherry stock pieces to cut adjacent strakes of planking from for a nice random visual effect if you plan to leave the underbody naturally finished.

A STERN PLANKING INTERLUDE

As with so many things done in ship modeling, the path is curved rather than straight. In order to complete the planking of the underwater hull, establish the line at the stern at which the planking terminates. To do that plank the counter, the curved part of the stern as seen in profile. It is the lower border of the counter planking against which the aft ends of the hull planking fits.

The planking is pretty simple. Begin by measuring the distance from the line formed by the lower edge of the wales to the line formed by the projecting lower edge of the transom and divide it into an equal number of planking divisions. Seven scale 8" (1/4") planks did the job on the prototype. The second plank from the bottom had to be notched to fit around the projecting aft ends of the wales. Pencil the edges, then glue and treenail the planks as done elsewhere, being sure to keep the planks in line on each side of the sternpost. A semi-circular notch needs to be cut in the planking just aft of the sternpost to later take the rudder post.

Let the outer end of each plank extend a bit beyond the transom proper to cover the false stern and taffrail which will be added later rather like a tiara. Another special purpose made wedge will be needed here to apply pressure to the planks while the glue dries. It is cut to fit the curve of the counter and has a little notch at its bottom to grab the lower plank and draw it up and in. Its backside is parallel to the frames, so that it can be C-clamped to frame #20. Two are needed to do one side. The first three planks (from the bottom of the wales) can be glued in as one unit with the wedges, the remainder one at a time.

THE PLANKING BETWEEN THE WALES AND THE BROAD STRAKES

Associated strakes of planking, for example those between the wales and the turn of the bilges, are called belts. There are two planking belts to consider now, that just mentioned and that comprised by the strakes from the broad strakes up to the turn of the bilges. With a great deal of planning and not a little luck, they could meet without a gap in the center, but in real life a gap was far from a rare occurrence.

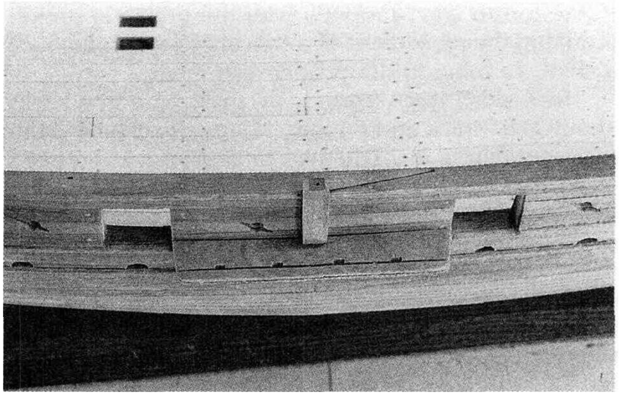
When this happened, *a* plank, tapered on both ends and spiled on both edges, the shutter plank, was cut to fit the gap. These shutter planks were generally part of drop strakes, that is strakes that did not reach both (or either) end of the ship. Needless to say, the ends of the drop strake planks were cut-off square and not pointed. For this model, the vertical distance between the flared broad strakes and the underedge of the wales at frame #20 is 104 scale inches, which allows for 13 scale 8" wide (1/4") planks. This leaves a gap six scale inch wide (3/16"), which will have to be filled with a drop strake shutter.

Gluing in the planks of a drop strake takes a bit of thought, as there are no gaps above or below the plank for mechanical clamping. This is the one place where cyanoacrylate is an absolute necessity. Coat both the edges of the plank to be glued in and the edges of the planking in the gap to be filled with yellow glue first. Then put a drop of gap-filling cyanoacrylate on each exposed frame. Pop the plank in place and hold it there with finger pressure until the cyanoacrylate sets up, usually less than thirty seconds. Then just wipe up the oozed out yellow glue with a wet cloth and you're done. Works great.

Planking patterns have tended to be stylized by model builders, based upon an extension backwards in time of the 19th century Lloyds and American Bureau of Shipping standards, which can be found in Davis' book. The standards called for no butt joints on successive strakes closer together than five feet unless there was a plank without a joint between them and for successive strakes of planking not to have butt ends fastened to the same frame unless there were at least three runs of non-butted-on-that-frame planking between them. Model builders seem to have assumed that this was a pattern standard rather than a construction guide and one often sees the attractive effect of this assumption in the line of plank butts running down the same frame every fourth strake.

The few 18th and 19th century ships that still exist can be seen to have a more random pattern, with the location-of-butt-joints rule still obeyed of course. These ships have been heavily restored, however, so what their original planking pattern (or non-pattern) was cannot be discerned. It is difficult to believe that ship builders would go to the trouble and expense to generate a geometric planking pattern that would have no significant functional or structural effect and would be largely covered by finishing materials. The planking pattern will fit the latter assumption in our little vessel, making it quite compatible with the pragmatic irregularly spaced framing pattern that was chosen as our starting point.

As mentioned earlier, the basic planning to make the planks neatly fill the available space consists of measuring the vertical distance between the bottom of the wales and the top of the broad strake at the widest frame and at the bow and stern and dividing it into an even number of plank widths. You have already done this work for midships and aft, and now you need to do the same for the bows. Measure the vertical distance between wales and broad strake again, this time along the after edge of frame #2. This turned out to be sixty-nine scale inches (2 5/32") on the prototype. For starters you are going to need 13 planks, so divide the distance available up front by 13 and get just under five scale inches (5/32"). This, then, is the width to which the planks will have to be tapered at the bows, at least at frame *#2;* it will actually be a bit narrower up front in the stem rabbet.



The port side channel wales. Note the removable cap strip. Also seen in this photograph is one of the scarf joints in the rail.

It's not a bad idea, by the way, to do the same measurements on a couple of other frames along the length of the plank for greater dimensional accuracy. Remember, if the space starts to narrow more than expected during planking, you can always end another strake short of the stem as a drop strake.

Plank from each *reference* area (wales and broad strakes) towards the turn of the bilges, going from one side to the other as you do each plank, the pattern being the same for both sides. A lot of the planking in the more central parts of the hull can go on without either spiling or steaming, but the bow areas will need spiled planks and the stern areas spiled and steamed planks. The steaming jig used for the wales and black strake planks can be modified for the new, tighter curves of the stern; longer steaming time will also be necessary.

As you will see, the actual cutting of the forward taper in the planks takes a little forethought (forgive the pun). That is simply because the taper begins forward of rather than at amidships—the tendency of planking to hold its shape and form actually pushes the midships width at least one more frame forward. Thus I wouldn't start any plank width tapering before frame #9, and #8 probably comes even a bit closer. Few of the planks will actually begin at frame #8, however, because of the planking rules that were previously mentioned. This means that for many planks with butt joints forward of #8, the taper begins on the next plank aft. One can allow for this in the planning stage by drawing each run of planking from the midships frame forward full size, marking in the existing plank end. The existing plank may have to be tapered to match the bow plank; this can be done carefully with a chisel blade in the hobbyknife.

Having dealt with the fore-and-aft and up-and-down deployment of the planking, you must now deal with the in-and-out. Charles Davis, in his book *The Built-Up Ship Model,* tells us that no ship ever went to sea without shims propping beams or planks into proper alignment. This author, being a traditionalist, would have chosen to continue that wonderful custom by choice, even if chance had not made it a necessity. Especially under the thick timbers of the wales up by the bow, but occasionally elsewhere, the hull planking will refuse to align properly with the previous strake, requiring the placement of a thin shingle of softwood, a shim, to bring it into proper alignment.

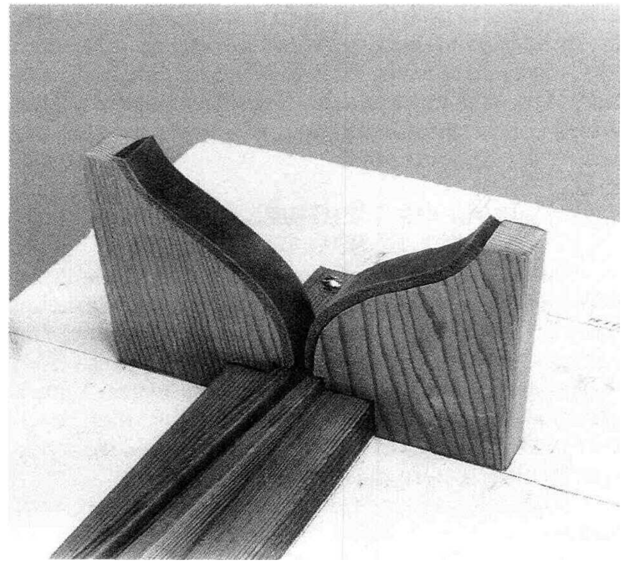
Split shim stock from 1/2" thick pine into sticks about 1/8" thick and 3" long, then power sand them to a very thin taper. The thick end will not often need to be much more than about 1/64" thick and often thinner; it is amazing that so minimal a change can so profoundly affect the lay of the planking. The shims are yellow-glued in place and shaped with a file when the glue dries. Another planking trick for both the bows and the counter, by the way, where clamping is difficult, is to merely glue the end of the plank in place where it fits into the stem or stern rabbet; also glue each of these planks to the next adjacent frame as part of this first stage. One can secure the plank for glue-curing with modeler's T-pins stuck into the stem or stern post and the frame. The rest of the plank is now sticking sideways out into space; when the glue of the first stage has dried, the remainder of the plank and frames can receive their application of glue and the plank can be conventionally clamped.

Even with careful fitting and clamping, the surface of planks will still *creep* up higher than their neighbors from time to time. The elevated portions of the planks will have to be carefully planed down, a small razor sharp wood carver's bent chisel being the best tool for the job. Any small remaining gaps between planks can be filled with sawdust mixed to paste consistency in yellow glue. It turns out that the sawdust from the sanding of the Baltic birch formers is exactly the right color for the job. Apply it with toothpicks, scrape it down wet with small softwood squares, and sand it all flush when dry. You'll be pleased with the result.

THE QUARTERDECK AND CABIN AREA PLANKING

With the hull bottom planked and sanded and the model back in its cradle, the planking of the upper aft section of the hull can be completed. In preparation, the ledge formed by the sheer strake and the roundhouse formers must be cleaned up and a pair of timberheads made to take the ends of the short run of planking that encloses the quarterdeck. These timberheads need to be made of cherry, as their forward faces will be exposed in the finished model.

As you can see from the plans, this forward face is aft of the aft face of frame #15 and in fact, is right in line with the forward edge of the quarterdeck itself. Cut the timberhead from 1/4" thick cherry, fitting it by trial and error to the inside of the existing planking and



The jig modified to permit the addition of the rudder.

to the curvature of the bulwarks on its inner surface. Glue and dowel the timberheads in place, then final sand and file the top to conform to the curve of the roundhouse-quarterdeck rail, using a piece of left-over hull planking to get the shallow curve just right. Each side will need two tapered planks here and a narrow sheer plank. The former taper from about seven and one-half scale inches (15/64") aft to three scale inches (3/32") forward. The sheer plank is two scale inches in depth (1/16") and will have to be cut 3/32" thick to clear the plank of the side by one scale inch.

FINISHING THE STERN PLANKING

Before planking, fit filler pieces of softwood between adjacent stern formers, above and below the window (lights) spaces. The fillers at the bottom thus need be only four scale inches high (1/8"), plus whatever is needed to fit the bevel of the counter planking to which it will be glued; almost any thickness of scrap material will do here.

Above, the fillers need to fill the space between the top of the lights and the taffrail and they need to be about 1/4" thick to take the fastenings in the ends of the cabin roof planking. After gluing in place, they can be filed to both the transom and taffrail curves. The almost enclosed area between the stern formers should now be painted flat black. When we get around to framing and glazing the lights, no evidence of our limited handiwork should be visible within.

The stern planking looks strange if it's applied straight across; it really needs to be custom shaped to the curvature of the upper border of the counter to avoid adversely catching the eye. This is best accomplished by making a cardboard pattern of the stern, then drawing the planks on the pattern to the proper curve using the ship's curves from the drafting table, then cutting out the plank patterns to trace onto the wood stock. Start below, at the counter, with a plank just wide enough to reach to the bottom of the windows (about five and one-half scale inches—11/64"), and work upwards. Measure the remaining space at this point and divide it into as close to the same plank width as the first plank as possible. A combination of cyanoacrylate and yellow glue will be needed in this section also, as clamping surfaces are not available. As below in the counter, let the planking overlap the plank of the sides a bit to serve also as the planking of the taffrail and fashion pieces, which will be fitted around the stern once the cabin roof is planked. Don't forget to cut out the segments of planking overlying the windows as you go along.

PLANKING THE CABIN ROOF

The heading of this section reveals a decision made vis-a-vis the question "Is the aft upper section of the hull a deck (poop) or a cabin roof?" Is it important as far as model construction is concerned? Well, perhaps, because if it's a deck it's planked in pine (or its scale equivalent, basswood), but if it's a cabin roof it's planked with hull planking material—or even with tarred canvas over wood.

There really is no hard data on which to rely. One certainly can find old prints showing crew clambering over the roof or poop to attend to the running rigging, but there also is a rail to use as a narrow platform. In the few references in the literature, it's usually called the roundhouse or cabin roof, so that's the way it is treated here, with cherry planking.

The latter also maintains a nice visual continuity aft. If you measure the cabin roof from side to side at its forward end over former #17 and aft over the arch formed by the stern former packing pieces, you will find the lengths to be about 5 $^{6}/_{32}$" and 3 $^{2}/_{32}$" respectively, a ratio of about 1.75:1. This gives you 27 six scale inch wide planks (3/16"), each of which will have to taper aft to 3.6 scale inches (about 7/32"). The planking is installed conventionally except for the use of only single treenails at each frame. Smaller treenails are used here, about one scale inch, a #69 dowel in a #67 hole. Take plenty of time to file, scrape and sand the roof planks perfectly smooth. Note that aft the roof appears almost flat, an optical illusion caused by the overall shallowness of the crown in the roof.

THE TAFFRAIL AND QUARTERPIECES

With the roof planked, the stern structures that give an enlarged rim to the aft end of the ship, the taffrail above and the quarterpieces at the sides, can be completed. The latter stick out like little ears, joining to the taffrail above and to the curved fashion pieces below; the latter end at the level of the main wale.

These pieces can all be fashioned from a bit of 1/8" thick cherry. Cardboard patterns will need to be made for each. The taffrail piece should be rough cut to fit the curve of the roof, steam bent to fit the curve of the transom, then beveled to fit the slant of the transom—and only then glued in place. The inside edge of the quarter pieces will have to be carefully fitted to the sides of the hull after the appropriate width of molding is carefully chiseled away. When these three pieces are glued in place, the shape of the stern can be carved and filed to the shape shown in the plans and photos. The curved fashion pieces, four scale inches (1/8") wide, are also cut from 1/8" stock, after which their flat inner surface is carved to the curve of the hull. The external surface is then sanded to the thickness of the lower end of the quarter piece above and down to almost nothing below.

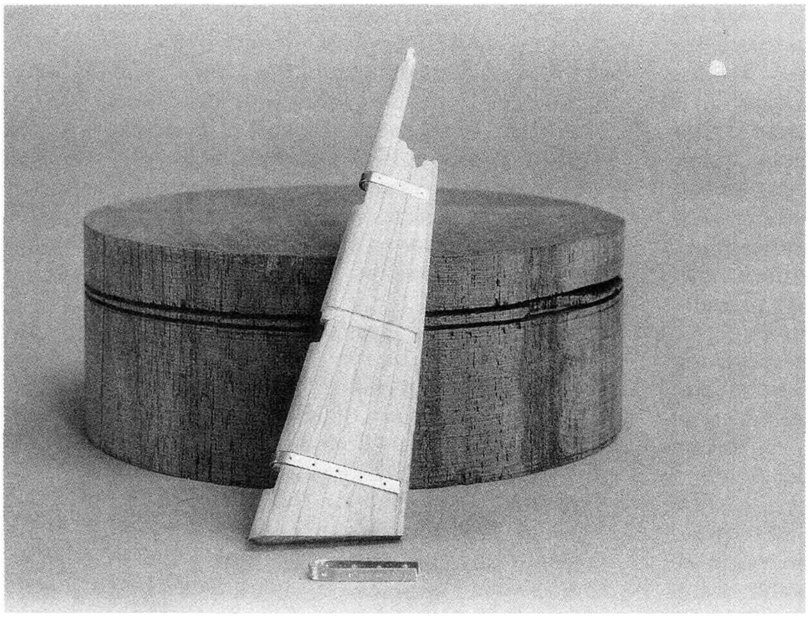
Cover the quarterpieces and fashions pieces with molding just wide enough to project aft about one scale inch (1/32"); that should make it seven scale inches wide (7/32"), 4" to cover the filler pieces, 2" to cover the thickness of the planking, and an additional inch for the molding lip. The molding should be of scale one inch thick stock (1/32"). Special clamping arrangements, or cyanoacrylate plus yellow glue, will be needed because of the curves of the involved surfaces. The transom rail should be of heavier stock, a scale 2" (1/16"), to match the other rails on the ship.

THE BULWARKS

Before you can get on with the relatively easy job of planking the bulwarks, you need to do a bit of preparation, as usual. Softwood fillers need to be shaped to fit the space between frame #15 and the quarterdeck step, the corner formed by frame #17 and the inside of the hull planking, and the gap in the bow forward of frame # 1. All these filler blocks require a good deal of thoughtful shaping. They are needed to secure the ends of bulwark planks.

When they are in place, take a fairly stiff length of planking, about eight or ten inches long, and check both the bulwarks and the deck for fairness. The frame top timbers, to which the bulwark planking will be fastened, must be an even five scale inches (5/32") thick at their top ends for the planking to lie smoothly. They can be trimmed down as needed with the flat bent chisel; the top ends are best trimmed with a small drum sander in a hand grinder.

Another before is the fabrication and installation of the waterways, the heavy band of timber that forms the junction between the planking of the bulwarks and the planking of the deck. Made of scale



The rudder, built-up of several timbers. Note the recessed pintles (pins not soldered in yet).

4" x 6" (1/8" x 3/16") timber, the waterways has its top inner edge chamfered at 45°, beginning at the level of the thickness of the deck plank, two scale inches (1/16"). There are no waterways on the quarterdeck. The waterway from the quarterdeck break forward to frame #6 can be in one piece; it will bend easily into its bed. The section forward of that frame needs to be sawn from 1/8" thick cherry, using a cardboard template. With its curve being in the direction of its greater dimension, it will not even steam into shape with any facility.

The bevel on the straight pieces can be planed using a spar jig to hold the stock, but the curved pieces bevels will have to be hand carved with a hobby knife, then filed and sanded. Of course, if one has access to a shaper table and bits and a pin router attachment for the hand grinder, the bevels can be machined. Note that the inside face of the waterways, the part that fits up against the bulwark former top extensions, has to be beveled a bit from above to below to fit properly; a power sander with the table tilted does this quite nicely. Clamps will not be usable when gluing the waterways, but model makers' T-pins work nicely, two at each frame, one vertically to push the timber against the top timber and one horizontally to hold it flat against the deck.

Softwood filler stock also has to be fitted at the points in the hull where the oar ports will later be bored through. Quarter inch thick pine, a half inch wide, will do nicely. Such fillers need to be fitted flush with the inside of the planking, between frames #4 and #5, #6 and #7, #7 and #8, #9 and #10, #12 and #13, #13 and # 14 and # 15 and # 16. Their upper edge is at the level of the lower edge of the sheer strake. They can be power sanded to the inside shape of the hull and the inside curve of the bulwark planking before they are glued in place, then filed and sanded flush later.

Finally, filler stock, 1/8" thick cherry, needs to be fitted above and below each port to complete the port framing. This is an annoying trial and error job, but not difficult. With all of these prep jobs completed, the actual bulwark planking is easy, especially after all the hull planking practice already done.

Full size planking was probably done with one inch thick timber, but the same 1/16" cherry stock used for the hull planking is also used here; it gives a little extra thickness to allow for shaving boards to make them lie smoothly edge to edge after gluing. Scale eight inch wide planking (1/4") is about right here, except for the planks of the lowest strake, which should be scale ten inches (5/16") wide, both to allow for the spiling necessary to match the curve of the deck and also to reach just to the sill of gunports one, two and three. The bottom aft plank runs from the quarterdeck step, where it is ten scale inches wide, to the middle of frame #7, where it has tapered to eight scale inches.

The planks of the upper strakes are similarly staggered. With the bulwarks planked, filed smooth and sanded, the gunports will need to be brought to final size and shape. The ports at this point will probably be overlapped above and below by bulwark planking and have butt ends of planks extending over the vertical edges. This all needs to be trimmed carefully away, keeping the distance from the waterway constant, so that all the gun carriages will be inter-changeable at any port. The other fixed structural dimensions of the port are the width, fixed of course by the frame spacing, and the vertical height, eighteen scale inches (9/16").

The top of each port should also be the bottom of the sheer strake. Note that the longitudinal structures of the outside of the hull in the wake of the ports, the black strakes and the molding, do not parallel the waterways within. This means that to maintain the height of the ports and the distance of the sill above the waterway some bulwark and hull planking will have to be cut away; it would be just a little embarrassing to have to blow away a bit of bulwark to lower the gun in battle. Below port number three, the molding will have to be cut away; at port number four, both the molding and a bit of black strake will need to be removed. A sharp hobby knife, small files and strips of fingernail emery boards will serve to shape and clean-up the ports to their final state.

PLANKING THE DECKS

Here, in one of the more demanding parts of hull construction, planking the deck, you switch from cherry to basswood. As you recall, this change is to replicate the fir or pine look of real ships' decks. Basswood, being quite soft, is easy to work, but for the same reason, not nearly so satisfying to the craftsman as cherry. It doesn't hold edges as well, it fuzzes up when power sanded, and it doesn't take as good a polish when fine sanded. Nevertheless, it looks good when carefully handled, and edge-rubbing with a soft pencil lead makes a nice caulking equivalent; with an oiled finish, it looks authentic.

By all means, do careful preliminary measurements to determine the number of deck planks per side. The original model needed ten planks just under an eight scale inch (1/4") in width on each side of the midline, plus a 7" (7/32") wide margin plank.

The margin plank has a scarf joint between frames #7 and #8. The plank goes on in straight stock, with a little sideways pressure from that point aft, but the section in the bows needs to be pattern-cut from sheet stock.

The first four deck planks on either side of the midline can go on in single lengths; they would butt up against the main hatch coaming, so they don't have to be put down in scale lengths. Be sure to fit and glue the short vertical lengths of the quarterdeck step planking before fitting each length of the deck plank, as the latter butts up against the former. The slight rise of the deck forward together with the inherent camber of the deck gives rise to the optical illusion of the deck planks widening as they approach the bows. A judicious bit of taper to the deck planks in the bows can help overcome this illusion. As each of the center planks is fitted and glued, be sure to cut out the notches for the mast fixation stub; it will be hard to find once the deck is planked over.

Obviously strakes of decking, just as of hull planking, had to be made up of two or more joined planks, assuming infinitely long planks were not available. The pattern of the butt joints on larger ships, especially British naval vessels, was well established, and was generally either a three step butt or a four step butt. This simply meant that on any given deck beam, either three or four runs of uninterrupted planking would separate any two butt joints. Butt joints in adjacent strakes would be at least 6' apart, and identical lengths of planking would be used so as to form a regular pattern of butt joints across the deck.

Well, in little commercial vessels such as this one, many of the rules went out the window (or out the port). Planking was used as it was available, both in length and width, but the basic rules were still followed as much as possible. A modified three step butt is used here with the joints as follows:

Planks #1 through 4 — no joints.
Plank #5 — butt joint over frame #10.
Plank #6 — butt joint over frame #8.
Plank #7 — butt joint over frame #6 forward and over frame #13 aft (about a scale of 18'8" in length).
Plank #8 — butt joint over frame #11.
Plank #9 — butt joint over frame #10 (note that there are three runs of plank between this butt joint and the one on plank #5).
Plank #10 — needs to be spiled fore and aft to fit the space available. The ends should be cut square across and be about two scale inches wide (1/16").

Planks #7 through #10 will have to have their sharply tapering forward ends nibbed, that is, cut off square, again a scale 2", and notched into the margin plank. This must be done whenever the length of the slanting edge of the plank (the snape) exceeds twice the width of the plank.

It is not clear when the practice of nibbing plank ends, ostensibly to reduce the tendency of sharp ends to quickly rot, began. It was the general practice in the 19th century and some evidence for it is occasionally seen in the 18th. One imagines the sharper hull design of the late 18th century had something to do with it; the decks got more pointy, and, with fewer and fewer wide stock planking lengths available, nibbing would seem to have been a most natural development. In any event, no other solution seemed possible in the planking of this sloop's deck.

Lay a segment of planking in place to see where the width of the plank intersects the margin plank; there will be two such points, one a bit aft at the full width of the plank, and the other forward, where the intersection with the margin plank forms a point. Draw a line to connect the points and cut the plank on the line. Cut off the pointed end where the cut will measure two scale inches (1/16") across. Trace the shaped plank on the margin plank and cut the latter to form a bed for the nibbed end of the plank.

Do the forward end of the plank first, then cut the butt end to fit, for if you fuss with the exact fit forward first, you will tend to end a bit short aft. This tenth deck plank does not follow a straight line aft, obviously, but rather follows the curve of the margin plank. All the shaping for the margin plank curve is done on the outside edge of the deck plank; the inside edge must be straight to mate with the next deck plank.

Fastening decks is not quite so simple as fastening hull planking; the treenailing of the latter into the frames of the ship is well-documented in many sources. Decks were fastened in several ways using treenails, bolts and/or nails. The documentation for small vessels is almost non-existent. Judging from the rust stains found in deck holes in nautical archaeological studies of small vessels of this era, nails (spikes actually) probably were the predominantly used fastener.

Spikes in decks in the 19th century were often sunk below the surface of the deck and the hole plugged or patched with wood. Whether or not this was done in our era is not known, especially as these vessels were quickly and cheaply built. It is also probably true that small vessel shipwrights would have bothered to stick to a formal pattern of nailing for any aesthetic reason either, but random fastenings in this deck would draw the eye unnecessarily, so you'll have to clean it up a bit.

The gudgeons being fitted to the hull (sockets not soldered in place vet).

What has been done in the prototype is to use scale one inch diameter dowels, as was done in the coach roof, which being birch, darken up a bit with finishing. They look much like what a spike with a 3/4" head would have looked like if it were countersunk and the recess filled with caulking material or a patch. The same pattern is used as was done in hull planking. It comes out looking nice. Try to keep the line of fastenings straight in their course across the deck. To do so, first draw a light line in pencil across the deck in the centerline of each frame, then draw parallel lines 3/32" on either side of that. Pencil in the locations for the fastenings on these latter two lines and everything will stay even. Put the fastenings in even where deck furniture will later cover them; it's easier than trying to install a missed one later.

RAILS

The main deck and quarterdeck rails, once installed, give a nice, finished look to the hull; it's actually far from finished, but it is a glimpse of the state yet to come. Trace the four sections of the rail on vellum or tracing paper, then glue the tracing to thin cardboard with rubber cement. Cut out the patterns and trace them (two each) on 1/16" thick cherry, leaving them oversize for later "in situ" fitting.

Start with the after-most segment of each rail; fit it to the quarterdeck bulwark rise and cut and shape the scarf on the forward end. Match the scarf to the second segment before gluing down the first, and in that fashion proceed forward. The first three segments can be clamped down for gluing with C-clamps through the gunports, but the segment at the bows will have to be glued with a combination of yellow glue and cyanoacrylate. Use finger pressure until the latter sets up and acts as the clamp for the yellow glue.

When the glue has dried, use the curved bent chisel, recently resharpened, to plane off the internal overhang of the rail segments; the rail is flush with the bulwark planking inboard. Using a similarly resharpened hobby plane on the outer edge of the rail, bring it carefully down to just a bit proud of the molding extension in the aft hull planking. Use your molding scraper and sandpaper to round it off and bring it to final dimensions. The rail should project outward one scale inch (1/32"). There should be two treenails (#61—a scale 1 1/4") at each frame top location and one near the narrow end of each scarf.

The quarterdeck rails are made similarly; they are each just one piece, however. They probably should not be beveled along their inner edge to fit up against the cabin roof, but should be left square to form a gutter. Such roofs were used to collect rainwater, at least in the tropics.

PLANKING THE QUARTERDECK AFT BULKHEAD

Before planking the bulkhead, the molding that hides the cabin roof edge needs to be made, using a cardboard template to get the proper curve of the roof to transfer to the wood. The molding is made from three scale inches wide (3/32") cherry. Its conventional cove shaping will have to be made with a purpose-made scraper, ground with an *emery* disc into the edge of a single-edged razor blade as was done earlier. Installing the ten scale inch (5/16") wide vertical panels is an easy job; one goes on the centerline and seven more on each side. Make them of scale one inch thick (1/32") cherry, with rounded edges. Fill the bottom of the doorway spaces with scale 1" x 3" molding (1/32" x 3/32"), then cut a piece of similar size molding to cover the entire bottom of the quarterdeck paneling and the just-installed filler molding.

The doors are one piece affairs; they hinge at their sides to hook on the ladders or are removed during battle. They are 32 scale inches wide (1"), with four scale inch (1/8") molding surrounding two vertical scale 12" wide panels (3/8"). All are of 1/32" thick cherry stock. Use patterns to get the curves right for the top and bottom molding. Note that the cabin roof is only chest high for a man standing on the quarterdeck; one would have to hold on and swing down to get below through that 38" high opening. Butt hinges and handles need to be fashioned of brass, but that can be put off until you make similar fittings for the companionway house, doing the whole lot at once.

SCUPPERS, OAR PORTS, HAWSE HOLES AND BOWSPRIT HOLE

This beautiful little hull now needs to be ruthlessly fenestrated (Webster: perforations in a structure). It's actually a good deal more difficult than it seems; there's not much room for error, so careful thought and measuring is needed. All holes should be started with a small diameter drill and progressively enlarged to plan size with larger drill bits and files.

These little vessels were wet sailers and needed an efficient method for ridding themselves of deck water. Whereas larger ships had a half-dozen drainage pipes (scuppers) per side, the Virginia sloop has ten piercing each side; she must have looked like a surfacing submarine when she was actively draining water. Large vessel scuppers generally ran from the junction of the waterways and the deck inboard, then down and out to exit just above the wales. They were lined with lead or tin and had leather flaps outboard to keep water out. Inexpensive small vessels lacked these niceties. Just little half-round holes between each pair of frames did the job. The inboard openings need to be just above the waterways rather than at the junction of the deck and waterways to get anywhere near lining up with the top of the wales outboard; if the outboard openings go through both the waterways and the wales, not only does the arrangement look strange, but it would also weaken the waterways to an unacceptable *degree.*

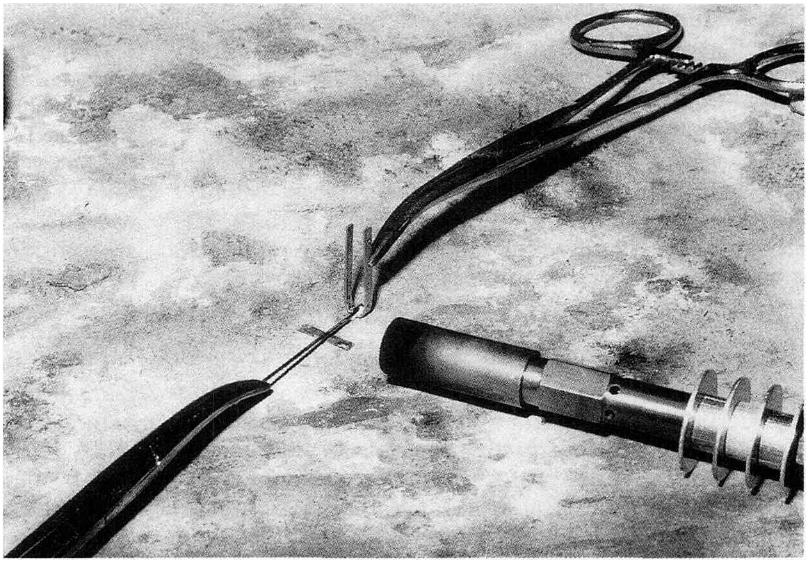
Drill small pilot holes, about a #61 drill, between each pair of frames, starting between #5 and #6. Drill through the bulwarks from the inside, just above the waterway, and from the outside just above the main wales. A bent T-pin through the holes will double-check the alignment. Minor errors can be corrected as the half-moons are cut with the point of a # 11 knife blade and cleaned up with half-round needle files. Major errors need to be plugged and redone. The job is made easier by the fact that you didn't put in filler plugs between the hull and bulwark planking at this level, so there's a bit of a gap in there to work with. This area would either be solid in the real ship or lined with metal, of course, to prevent flooding the interior of the wall of the hull; the gap is essentially invisible in the model.

The oar ports are especially difficult because of their irregular spacing, their visible need to line up inside and out, and their little ears—the narrow V-shaped slots for oar blade retraction. The holes are four scale inches in diameter (1/8") and are located twelve scale inches (3/8") below the rail; their horizontal position can be measured from the plans. Use the vertical lines of the gunports to measure from. The angle of the blade-retraction slots is 20° from the line of the rail; use a cardboard template to draw the line inside and out. Make the extensions three scale inches (3/32") long. Incise the line of the extensions inside and out with a #11 hobby knife, then saw the slot with a # 15 keyhole saw blade, doing the final shaping with a knife-edge needle file. Hawse holes for the anchor cables are bored into the solid timber of the bows 1/2 " aft of the junction of the bow planking with the stem. They are six scale inches in diameter (3/16"), and centered 3/32" above the molding topping the black strake. Again, a small drill to find the angle, followed by a 1/8" bit, followed by a round needle file will do the job. The edges of the hawse holes need to be well-rounded to avoid fraying the anchor cable.

The bowsprit is fourteen scale inches (7/16") in diameter inboard. Its heel will be bolted to frame #4. Get the angle correct by trial and error, using a succession of small diameter drills, using brass rod or dowels as a bowsprit surrogate for each increasing size to make sure the sprit stays seated on #4. A full size workshop tool is used for the final sizing here, a 3/8" diameter round file.

SWIVEL POSTS

Strategically placed to hold the swivel guns, the miniature cannon use as anti-personnel weapons in close combat, the posts are of six scale inch square cherry stock (3/16"). They extend seven scale inches (7/32") above the rail, tapering below to the width of the molding above the black strake. Their tops are chamfered and centrally drilled for the one scale inch diameter (#68 drill) pin for the swivel yoke. Both the rail and the sheer strake need to be notched to accept the posts to permit them to lie flush with the planking of the hull.



Silver-soldering the pintles. Foreceps ***are used as clamps.***

BOOM CRUTCHES

The oddly shaped crooks of timber that support the ends of the boom when the vessel is at anchor, the boom crutches are made of scale four inch thick cherry (1/8"), cut to the shape of a tracing taken from the plan. Cut the blank extra long to allow for the depth of the transom. The heel of the crutch butts up against the quarterdeck rail and lies flush along the taffrail. Dowel and glue them in place.

TIMBERHEADS

The timberheads really should be the upward extensions of one of the futtocks of several of the bow frames, but for the several reasons discussed earlier, this was not a good model construction choice, so now they must be added. There are three timberheads per side, each five scale inches square (5/32") and eight inches high (1/4"). They are doweled above frames #4, #3 and #1, the mounting line on the rail being off-center, 9/32" from the bulwark side.

CATHEADS

The catheads are more difficult to find proper materials for than to make. Those on the author's model are crooks from dwarf Bing cherry trunk-branch cuttings from a dead tree. One does in miniature just what the shipwrights of old had done. Lacking such stock, one could cut the catheads from curve-grained stock around a knot or make the vertical part and the arm separately and glue and dowel them together. They should be seven scale inches thick (7/32"), and each needs a six scale inch diameter (3/16") double sheave drilled and carved in its outboard end. The same technique can be used for all the sheaves in the model, including those in blocks. It's authentic looking and quite easy to do.

Begin by laying out the double sheave both on the top and the bottom of the end of the cathead, two scale inches (1/16") in from the end. There should be a scale one inch (1/32") thick separator between the two sheaves, each of which should be a bit thicker than the separator. Mark the holes with an awl, then drill them with a #68 drill, which is pretty close to real size one inch diameter, half from each side. Score the sides of the sheaves with a # 11 knife blade, using a straightedge, then route out the groove with a miniature chisel, finally shaping the sheave into its rounded form.

Lacking miniature chisels, a satisfactory substitute can be made by epoxying a T-pin into a six inch length of 1/4" dowel, cutting off the T, and grinding the end to chisel shape. The cutting end can be custom ground to any width narrower than the diameter of the T-pin. The steel is soft and must be ground carefully, and the edge needs resharpening more often than a real chisel, but it works surprisingly well.

The catheads mount just forward of the third hull frame and at right angles to the planking of the bulwarks. The rail itself will have to be notched and the notch slanted downwards (towards the bulwark), to take the angle of the cathead arm. Dowel the catheads after they are mounted.

CHANNELS

Lengthwise, the channels fill the space between gunports two and three. They are about fifteen scale inches wide (15/32") and three scale inches (3/32") thick. They taper (the bottom) from inboard out to two scale inches (1/16") in thickness, the outer edge finishing in a double beaded molding. A molding cutter can be custom made to do the edge, as has been done previously, but the end grain is difficult. An easier way to do the channels is to make each of two layers, one of 1/32" stock and one of tapered 1/16" stock. If the edges are slightly rounded with sandpaper before gluing them together, the molding will be automatically formed. The taper can be done on the disc sander, using double-faced tape to hold the blank to a larger piece of wood as a handle.

Lay out the location of the notches for the chainplates and the width of the cap rail on the under surface of the channel (to keep the un-tapered surface down). Drill three #68 holes into the hull-side edge for the dowels that go into the frames, and five such holes about 3/8" deep into the outboard edge, between the chainplate notches and near the ends. Cut off the three scale inch (3/32") wide cap strip from the outboard edge of the channels, sand the mating edges flat, then glue dowels clear through the cap strips that project inward (towards the channel) about 1/4"; they will act later as the fasteners for the cap strip, to be glued in place once the chainplates have been installed. Cut the notches, put the cap strip in place, then glue the channels to the hull. The bottom end of the middle swivel post needs to be cut away to fit the channels to the hull.

MODIFYING THE JIG

Before you can get on to the manufacture and mounting of the rudder, you need to free up the aft end of the hull—the sternpost support of the jig needs to be sawn off just forward of the junction with the keel piece and the remnants chiseled away from the baseboard. Hull-holding cradles are now made from softwood, using the pattern supplied (which is similar to the under-the-wales portion of frame *#16).* These supports are glued and screwed to the baseboard just in line with the forward surface of the quarterdeck bulkhead, or 4 1/2 " forward of the end of the jig (before the end was sawn off!). A non-scratch surface is provided by sticking self-adhering foam weather stripping to the contact surfaces.

RUDDER

An interesting and pleasant introduction to the addition of metal-working skills to your armamentarium, the rudder finishes-up the hull proper. The rudder is made up of three similarly shaped planks of scale eight inch thick (1/4") cherry stock, each just under twelve scale inches wide (3/8") at the bottom and tapering upwards to about five scale inches (5/32 ") wide at the top. A scale two inch thick (1/16") rubbing strip is added after the blank has been glued-up, the hance sawed and the blade tapered. The rubbing strip has a narrow anti-chatter groove first scribed and then filed down the middle of its length before installation.

A jeweler's saw will be needed to form the curlicues at the top of the blade, the hance, and to cut out the recesses along the forward edge for the pintles and gudgeons, the rudder's hinges. The blade tapers to four scale inches thick aft (1/8"). The taper is easily done on the disc sander, after using double-faced tape to affix the blank to a piece of scrap softwood as a handle. The forward face of the rudder and the entire exposed length of the rudder post need to be rounded off. Finish the woodwork by drilling the top of the post (and the undersurface of the hull) for a mounting dowel; a #47 drill seems about right. Glue the dowel into the rudder post, but not into the hull; a length leaving 1/4" above the post is about right.

The hinges are composed of pintles (with pins; on the rudder) and gudgeons (with sockets; on the hull). The straps are made of scale three inch wide iron, actually 3/32" wide standard brass strip. Polish a couple of 12" lengths bright with fine steel wool and you will have plenty of material for all the straps and their preceding errors. Before bending the brass, cut mortises in both the rudder and the hull so that the straps will lie flush with the surface. The corners of the grooves in the rudder post and the stern post will have to be rounded off to take the natural curve of the bent brass, which obviously will not be a proper right angle.

Start the formation of the straps by bending the strips over the frame of the jeweler's saw, which should be just about the right shape. Final bending is done with needle nose pliers, the jaws covered with duct tape to avoid scratching the brass. Proper alignment of the straps on the hull with those on the rudder can be achieved by doing the rudder first, taping its straps in place, inserting a temporary dowel in the rudder post and hull, then taping the rudder in place to mark the exact location of the gudgeon straps on the hull. One can, at the same time, eyeball the correct angle for the straps on the hull.

The gudgeon straps are all twenty-two scale inches long (11/16"); the upper one bends outward and upward at the stern post-hull junction. The ends of the rudder straps butt up against the rubbing strip. When the straps fit properly, they need to be drilled for the bolts which fasten them in place (actually, they'll be a secondary fastening in the model, inserted after the fittings are glued in place). The brass hobby nails commonly available are about 1/4" long and have shanks .024" in diameter (check with dial calipers), the diameter of a #73 drill. Cut a mortise as long as the longest strap in a piece of 1/4" thick scrap stock to use as a jig for drilling. The holes should be approximately six scale inches (3/16") apart. Twist the point of an awl into the brass at each bolt hole site as a starter for the drill, which should be in a hobby drill press for the hand grinder.

To make the actual hinges, a short pin of 1/32" diameter brass rod must be soldered to the inside of the bent portion of the rudder straps; similarly, a length of 1/16" diameter brass tube (it has an inside bore of 1/32") must be soldered to the outside of the bent portion of the hull straps. The pins and tubing sections will each be finished to the width of the straps, 3/32", but should be cut a bit over that and filed to final length after soldering. File a flat on the tubing, for a better fit on the gudgeon straps, before separating off the individual lengths. Cut off 1/4" long sections with a cut-off wheel in the hand grinder.

Any soldered joint in a ship model that is under stress should be silver soldered. It is easy to do, and incredibly strong. Needed are a propane or butane torch designed to produce a small flame, some silver solder (35% silver content is easy to work with) and flux (if you run out of commercial flux, ordinary household borax mixed to a thin paste does fine). In any form of soldering, the fusing of metal is the easy part; holding the pieces in place is the hard part. Holding the pintle straps upside down with a pair of forceps works well. A scrap of the brass strap is placed next to the strap, under the pin, so that the pin is level when it is laid in place. A bit of flux is touched inside the bend, the pin laid in place, and about a 1/16" length of silver solder rod laid next to the pin. Apply the flame to the brass and the solder simultaneously, and the solder will melt and leap into place.

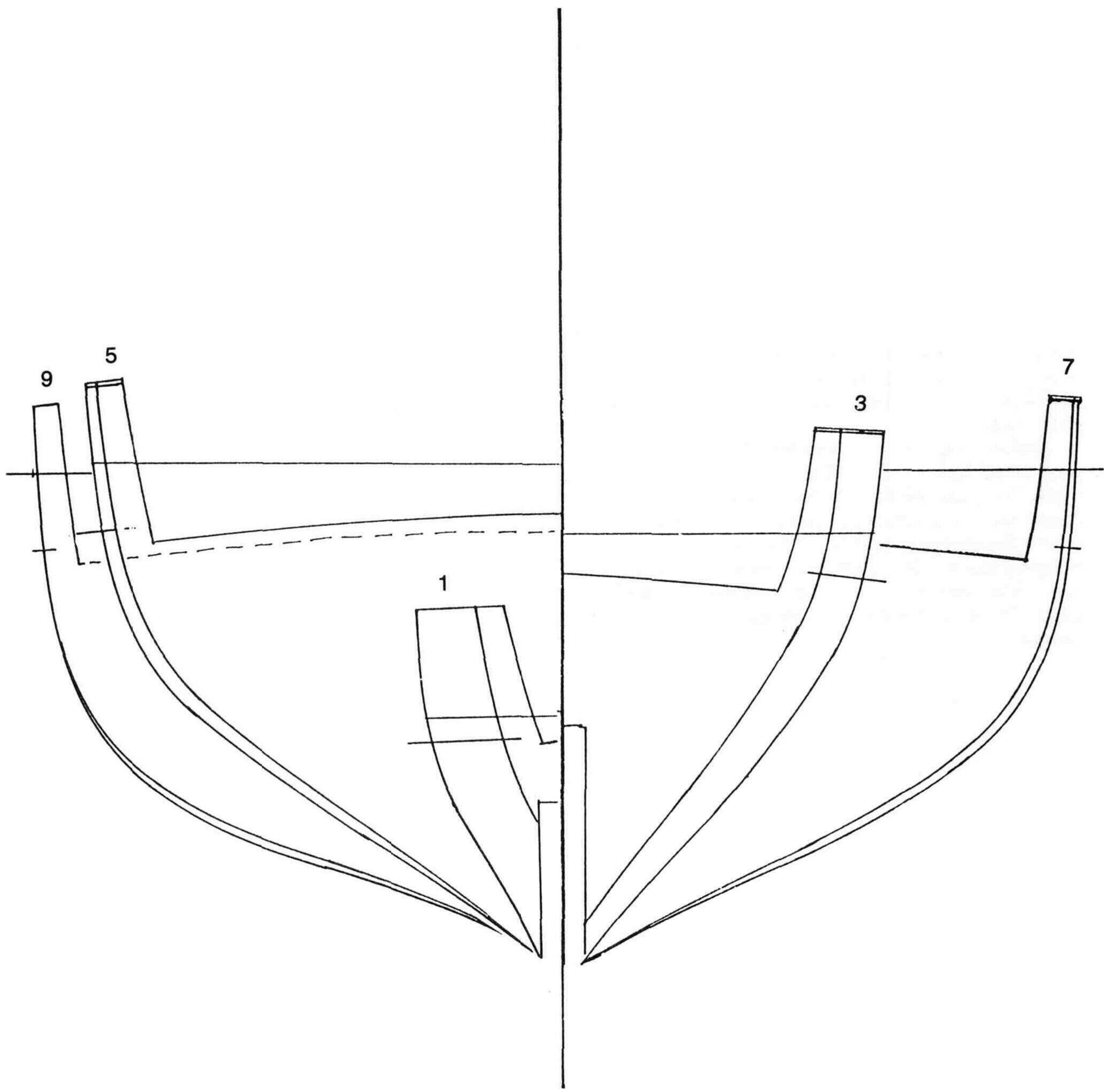
The tubing lengths for the gudgeon can be wired around the strap with a length of fine iron wire (it won't be affected by silver solder), then the whole assembly clamped in a forceps and tilted so that the necessary piece of silver solder rod can lie against the tubing without falling off.

Wash off the flux and oxidation in an acid bath (a little jar of swimming pool acid will do), then wash thoroughly in soap and water. File the pin to length and round the end. File the tubing on the gudgeon flush with the strap. Lightly ream out the tubing to allow the pintle to fit properly. Using an old pair of tweezers, acid wash the completed fittings again, rinse in plain water and then oxidize as previously described. Before cyanoacrylating the fittings to the rudder and hull, it's a good idea to scrape the inside surfaces free of lacquer and oxide.

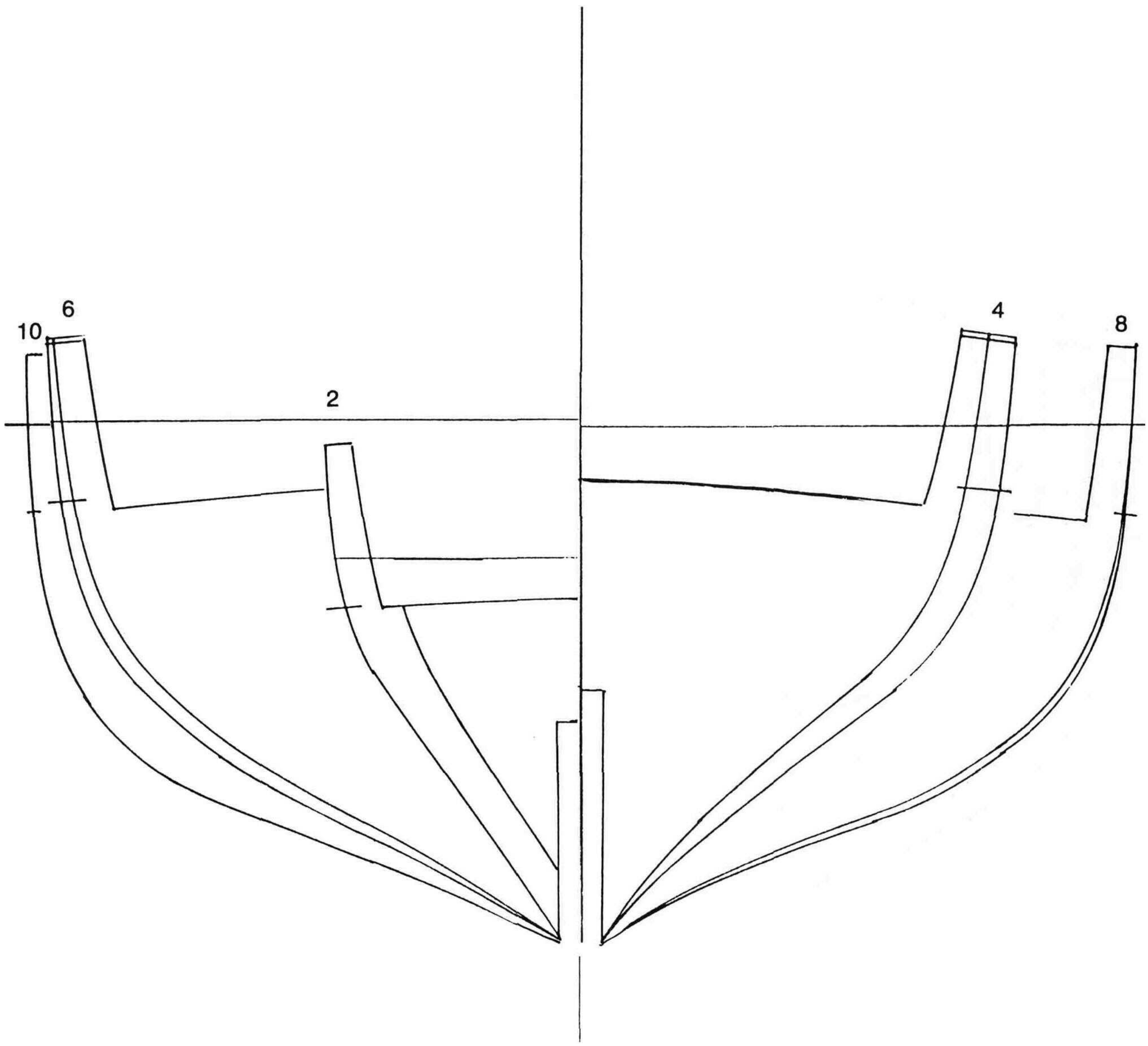
The author has had fittings pop off a hull in the past, leaving an almost bright brass contact surface on the fitting and a most remarkable black layer of oxide rather permanently fixed to hull and rudder. Before fixing the fittings to the hull and rudder, push ahead to the next section, the one on finishing, because it's rather a good idea to get the rudder and undersides of the hull oiled or painted first—one needs a double-jointed assistant to hang the rudder as it is, without worrying about getting to the wood surfaces after installation. With the finishing of the above mentioned areas completed, cyanoacrylate the rudder straps in place, using the gap-filling type of cyanoacrylate to help prevent bleeding, the tendency of thin fluids to find (and permanently stain) micro-gaps. Use your fingers as clamps after greasing your thumb and forefinger surfaces with silicone cream, lest bits of you remain permanently attached to your ship model (similar things probably happened in real life, but here it would be out of scale).

With a #72 drill in a pin vise, drill into the wood of the rudder through the existing bolt holes. The bolts are cut-off, chemically blackened brass nails. If you hold each one at the end of a pair of needle nose pliers and cut them off as close as possible to the jaw with a pair of diagonal cutters, they should come out about 3/32" long, which should be just about right. File the burr off the ends and create a rounded point while the bolt is still held in the pliers. Chemically blacken the bolts as was done for the fittings, then carefully scrape off the coating on the shaft of the bolts for good glue adherence. Glue the rudder bolts in place first, using epoxy, for the reason mentioned above. Cyanoacrylate the gudgeons into their hull recesses and glue in their bolts (ream out the sockets again first—even the thickness of the oxide and the lacquer makes a difference).

Before you hang the rudder, drill out the rudder post dowel hole in the hull to accommodate the post itself. The post will have to be raised the length of its dowel plus the width of the gudgeons to get the pintles above the gudgeon sockets and thus into place. After hanging the rudder, pack the rudder post hole with wood filler; note that the dowel will thus be locked into place. Paint the filled recess flat black and the hull is finished.



Frames 1, 3, 5, 7 and 9.



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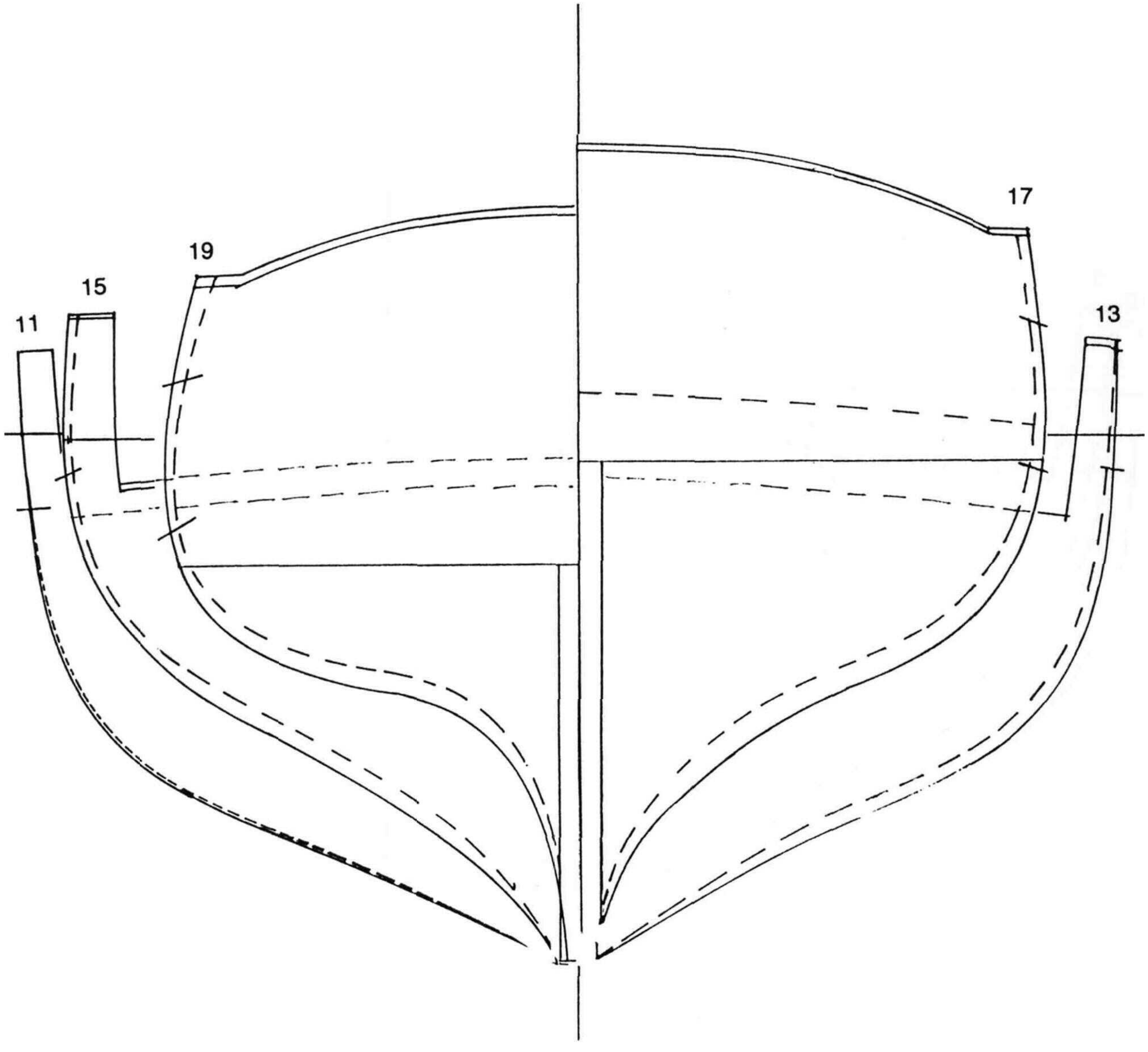
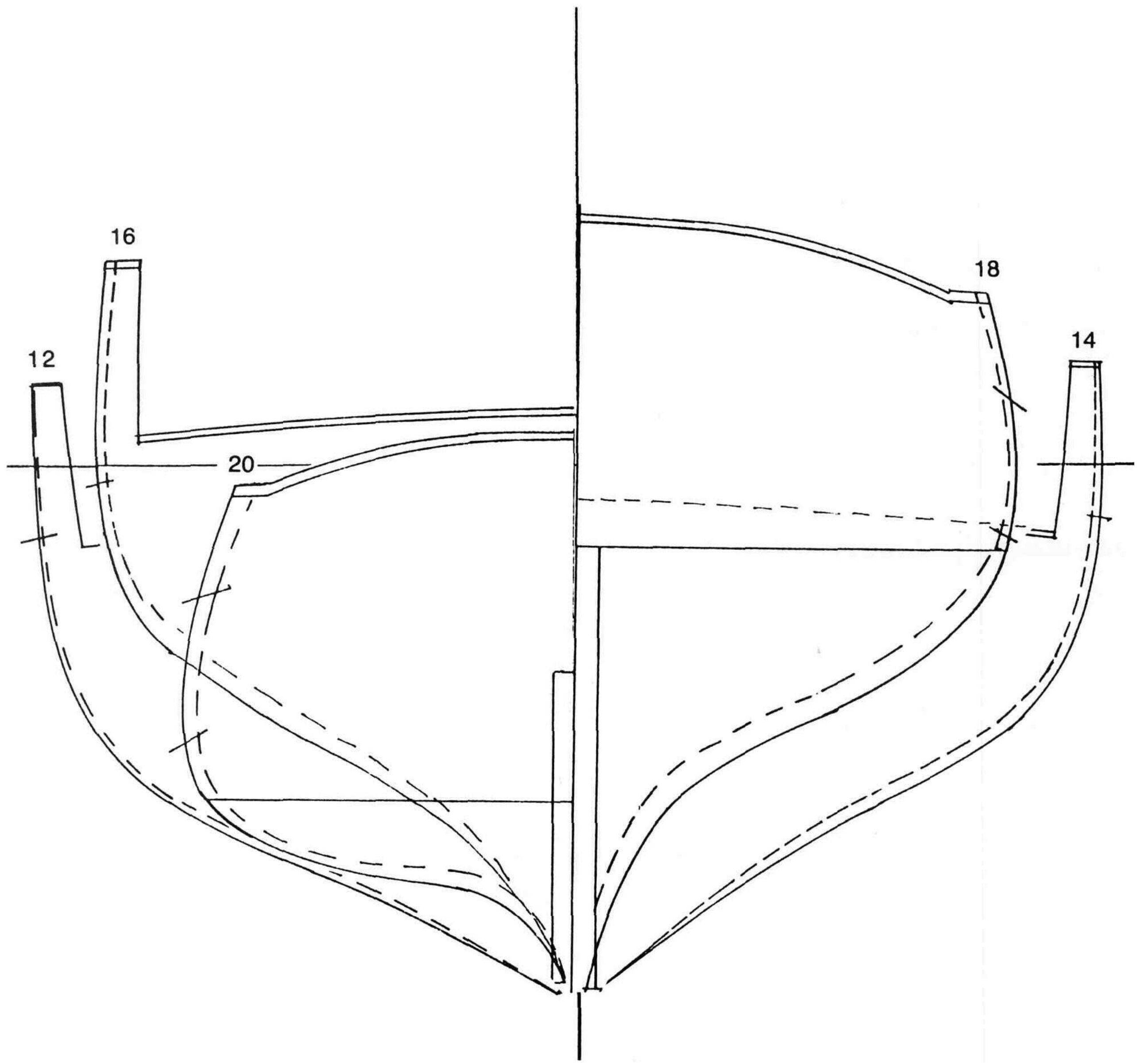
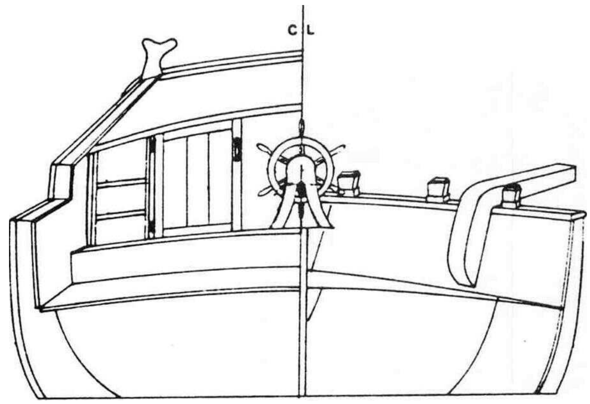


Frames *11, 13, 15, 17 and 19.*



Frames 12, 14, 16, 18 and 20.

CHAPTER 4



FITTING OUT AND FINISHING THE HULL

Decision time is finally here, and it's quite absolute. You must decide upon a style of finishing; once done, there's little ability to reverse. As mentioned earlier, a satisfactory level of finish for a plank-on-frame model is a basically natural hardwood finish, because the color of the woods obviates the need for much paint. Watco® Danish Oil for the hull and deck, with red-painted bulwarks and a touch of gold for the molding suffices. The use of natural finish requires a bit of artistic talent and license, and is one of the knottier controversies in ship modeling, that field wherein we claim to be creating not so much art as three-dimensional documentation.

In this completely planked hull style of building, a bit more color seems appropriate and is, in fact necessary. In the absence of ebony, flat black for the rails and wales is needed to simulate what was done in real practice. Color can appropriately be applied in pseudo-gilding the molding and painting the sheer strake a bright color. The bright strakes of color might be the only real suggestion of decoration on the ship; red, green, yellow, blue, and even the color of lead have been reported.

The original gilding of this era was generally varnish over yellow paint; gold leaf would have been outrageously expensive and there were no gold paints as we know them.

The underbody of the hull presents a greater problem: it can be oiled, creating a very lovely surface which shows off the extensive planking and treenailing handiwork or it can be painted an off-white color, slightly yellowed, to represent 18th century tallow and sulfur anti-fouling. Plain white is pretty, but quite incorrect. Copper was just starting to be experimented with on British naval vessels at this time and would certainly not have been used on an inexpensive sloop built for overseas trade and a short life in smuggling or privateering.

The plank of the sides, between rails and wales, would probably be yellow ochre, the most popular planking color of the 18th century. It was a muddy color with suggestions of yellow, orange and brown. Oil for the cabin and upper hull planking is similar in color and still reveals a good deal of your hard-won planking and treenailing accomplishments.

All of this basic finishing must be done long before you have actually finished. That is because once deck furniture and fittings are in place, any type of finish application becomes difficult, and paint or dust-laden oil tends to build up in corners and crevices. The hull at its current stage represents the most accessible state for comprehensive finishing. All other fittings will be pre-finished, then glued and doweled into place.

Much of this work is more easily done with the model out of its cradle, lying upside down on a soft surface (a square of old carpeting is excellent). The model will have to be raised at least a foot off the bench surface to prevent the modeler from turning into an historical artifact himself, the hunch-back of Notre Dame.

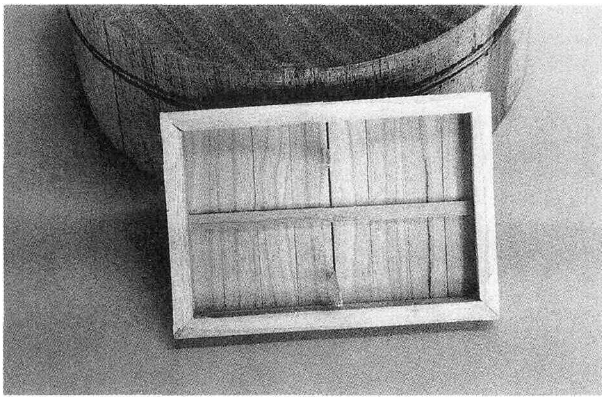
Blow away all loose dust, then wipe the model down with a rag moistened with paint thinner. When quite dry, go over the entire model with a tack cloth (a commercially available cheese cloth rag impregnated with a slightly sticky varnish-like substance) to remove residual dust. Once the model is in this clean state, it should be stored covered; a plastic kitchen garbage can bag does nicely for this purpose.

There are several furniture finishing oils on the market; they are all good. The only caveat offered is this: no linseed oil. While it smells wonderful, it dries slowly if at all and it attracts dust like a magnet draws iron filings. Watco Danish Oil is nice to work with—you merely flood it on with a brush, let it penetrate for a half-hour, re-apply for another fifteen minute soak, then wipe dry with a soft, lint-free cloth. It produces a tough surface with just a touch of luster. It's also easy to touch-up when necessary; the new oil blends right into the old. Its final virtue, should push come to shove, is that it will accept all sorts of paints and lacquers as finish coats after 72 hours of drying.

Turn over the hull at this point and paint the bottom (to the wales) and the stern. A flat, white bristle #8 brush makes short order of this process. Do the rudder at this time also (the part below the waterline), then go back and mount the rudder as per the previous section's instructions.

With the hull still turned over, paint the wales and the accessible parts of the black strake, the transom molding and the fashion pieces. All are black, or dark brown; almost black.

Just the slightest bit of gloss should be seen. On the prototype, an almost flat black hobby paint was used, a solvent-based acrylic called Engine Black, part of the



The main hatch from below, showing mitered corners, planking and bracing and wedges used to separate the planking into distinct covers.

Railroad Colors series manufactured by Floquil®. To the black was added a bit of retarder to slow down drying time and a bit of Crystal Cote® to produce some luster. Within the Floquil lines of Railroad Colors, Marine Paints, Military Colors and the new Historic Ships Colors, one will not be left wanting for color choices. None of the colors of this era were glossy, but neither were they absolutely flat. Many modelers use water based acrylics rather than commercial hobby paints, with excellent results; they are available at artists supply stores. Floquil makes a water based acrylic also, sold under the brand name of Polly S®. A set of round red sable brushes, including sizes 5/0, 3/0, 0 and a #2, were all that was needed for this part, with a #4 flat added for the larger panels of the bulwarks.

This done, turn the hull right side up again and paint the areas that couldn't be reached from below, including the scuppers and the tops of the black strakes in the third and fourth gunports. Masking tape should not be used for separating paint colors for ships of this era. Even though most of us can't paint a straight line worth a darn, one doubts if they could either back then either. In any event, a tape-straight line just looks too artificial. If the paint does slop over unacceptably, just wipe the excess away with some thinner (Dio-Sol®) on a piece of paper toweling (it cleans up fairly well) and repaint.

Paint the molding above the black strake next, using an antique gold paint. The contemporary way, yellow paint with an amber glaze over it to darken the color and add a bit of gloss, looks terrible on a model. Light blue was used to paint the sheer strake and the narrow similar strake under the quarterdeck rail.

This done, paint the bulwarks a dull red (the Floquil Railroad Colors Caboose Red is about right, and then the rails can be painted black. Some modelers choose to over spray their models with a flat or satin lacquer or polyurethane, but such a coating gives much too even a reflection of light, making all the colors look bland, with a tendency to lose their individuality when seen with light reflecting directly from them. Not recommended.

GUNPORT FITTINGS

Before getting on to the woodwork, it's probably a good idea to make and install the gunport eyebolts and ringbolts. Once the pumps, hatches and companionway are in place, drilling the holes in the bulwarks becomes much harder. If one visualizes an eyebolt made of 3/4" diameter iron and forged into a 3" diameter ring, then 23 gauge brass wire formed into a 3/32" circle will be a good modeling equivalent. If you are not able to find brass wire, then 1/64" diameter brass rod (a bit undersize) or 1/32 " brass rod (a bit oversize) will do. Making five or six of these little fittings is fun; doing 46 is a pain. Anneal (heat dull red) the wire, form the loop and then silver solder the junction.

Sixteen of these eyebolts need to be fitted with stout scale five inch diameter (5/32") rings for the cannon breeching at the gunports. Fourteen need to be fitted with scale four inch (1/8") diameter rings, eight for the gun tackles on deck and six for the hatch covers. The remaining 16 eyebolts are for the gun tackles for the cannon at the gunports. The rings are of 22 gauge annealed brass wire; in a pinch, one can anneal 1/32" brass rod and use it instead.

Epoxy all the bolts into #70 holes as per plan, using a small chisel to make a vertical slit across the hole first to recess the eyebolt a bit when it is seated.

HATCH AND SCUTTLE COAMING

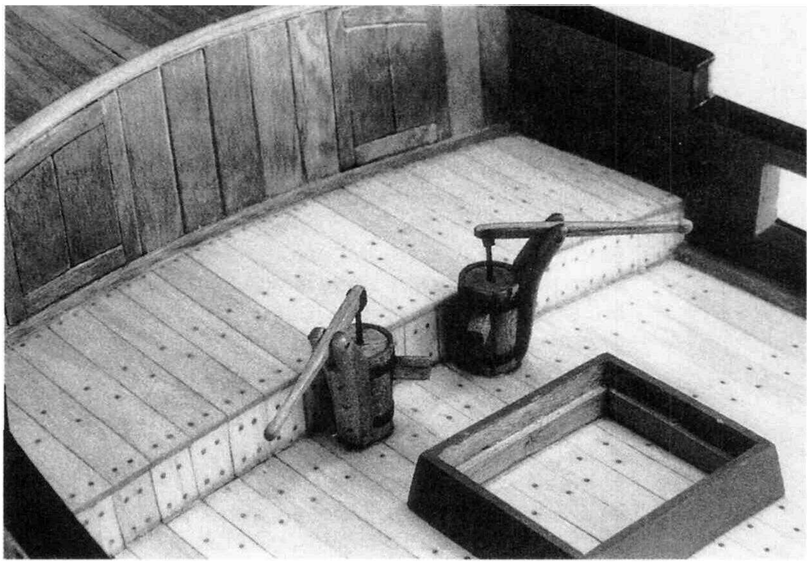
All the hatches and scuttles are built basically the same—mitered frames of stock which has been tapered from below/above and rabbeted on the inside edge for the hatch covers. The main and companionway hatch stock finish down to a scale six inches (3/32") thick, and the scuttle and galley hatch to a scale four inches (1/8") thick. It's actually easier to start with stock about 1/32" thicker to allow for planing and sanding.

For the main hatch, cut a length of stock about twelve inches long, 3/8" high and 7/32" thick; then, with the blade guide on the table saw removed, cut a scale two inch square (1/16") rabbet at one top edge; the latter then becomes the top inner edge. On the upper edge, draw a line two scale inches (1/16") from and parallel to the rabbet, indicating the amount of outside face to be planed away to form the tapering side of the stock. Draw the taper on each end of the stock also, then, with a sharp plane, cut the taper. A piece of aluminum angle stock, by the way, becomes a nice stop for planing thin stock when nailed or screwed over the edge of the work bench.

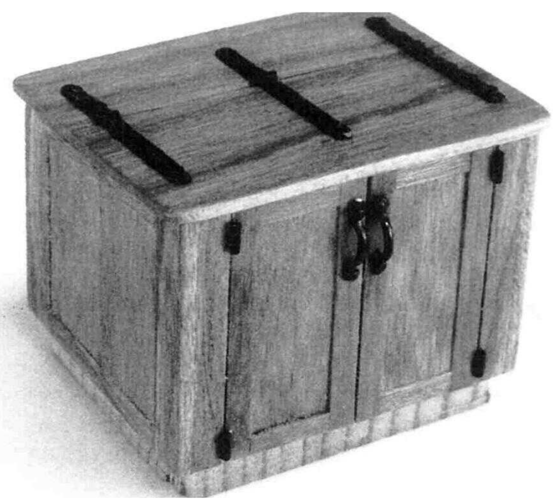
Cut the pieces to full plan length, then miter the edges on the disc sander, glue and dowel. Note that the inside of the frames are vertical, so that the miter is cut with the stock flat on the sander table; the taper is on the outside of the stock and thus does not have to be taken into consideration, no compound miter here, happily. The bottom of the completed coaming will now have to be shaped to the contours of the deck. This can be done (slowly and messily) by rubbing the coaming over a piece of sandpaper on the model's deck. A preferable method is to cut a cardboard template of the deck curvature (remember, the curve is the same at all the frames), trace it on the forward and aft faces of the coaming, and power sand the curve on the top pulley of the belt sander (open the hinged door of the sanding machine for better access to the plane of the sanding belt). The slight inward curvature of the side pieces can be carved with a hobby knife and evened out with files.

HATCH COVERS

The hatch covers are in two sections, each of four athwartship boards 12 scale inches wide (3/8") and two scale inches (1/16") thick. One can find plans and



The after deck, showing the coaming for the companionway and the placement of the pumps.



The companionway cover or house. Note the hinges and handles.

contemporary models showing cambered hatch covers, but just as often they are flat topped, as are these, and the latter are a good deal easier to make. They might well have been bolted together with fore-and-aft planks on their under surface in real practice, so that's what is done on the model. This permits the slight separation of the two covers to increase the scale effect. Use scale 2" x 4"s (1/16" x 1/8") for the braces. One goes longitudinally down the middle and the other two butt up against the coaming.

After the covers are glued up and doweled (to represent bolts — #66 dowels in #68 holes), the two halves can be parted with a razor saw and the edges sanded smooth. Paint the coaming red and oil the hatch covers, then glue the covers in place. The previously made ring bolts need to be installed on the diagonal corners of each hatch cover at this point.

Locate the coaming on the deck according to plan measurements, then draw a pencil line along the inside edge.

Paint the rectangle formed by these lines black (although not much decking will be visible through properly made hatch covers). With a narrow chisel, scrape away a band of oil-finished deck surface all around the black rectangle for proper glue adhesion.

Glue the coaming in place, using epoxy, with some sort of weight on a plank to hold it in place while drying. Drill dowel holes carefully through the sides of the coaming and into or through the decking and glue dowels in place to secure the structure. Glue the covers, complete with ringbolts, in place.

The coaming for the companionway is made of the same stock, except that the rabbet for the companionway cover is six scale inches deep (3/16"). The coamings for the galley stack and the scuttle are made similarly, but from 1/8" thick stock. The latter has a plank hatch, made similarly to the main hatch. The galley hatch could have either a plank cover or a grating; even when the other hatches were covered, the galley hatch would have to be open for ventilation if there were a fire in the stove. The inside of this coaming needs to be oil finished, as it will be visible in the finished model.

The thinner stock coamings do not lend themselves to doweling from above through their rabbets. They can be secured with brass nails, their heads snipped off, set into holes in the underside of the coaming; make a set of short, throw-away nails first to use as position markers, then a full-length set to use for mounting. As the nails will have to be epoxied in place, one may as well epoxy the coamings in place also, doing the whole thing at once. It is not necessary to drill holes in the deck for the brass nails, as the basswood is soft enough to permit the nails to penetrate with finger pressure alone.

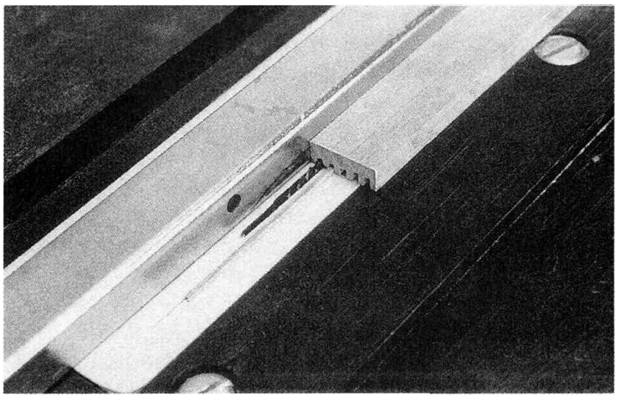
COMPANIONWAY

The companionway is made by planking a solid softwood block, the latter cut to plan height plus the depth of the rabbet. It is planked with scale one and two inch thick stock (1/32" and 1/16") as per plan. The vertical stock on the sides is scale 2" x 6" (1/16" x3/16"), and the boards overlap the corners by 1/16". Scale 2" x 4"s (1/16" x 1/8") are used for the front face corner verticals and the side and rear horizontal framing members. The door frames are 2" x 3"s (1/16" x 3/32").

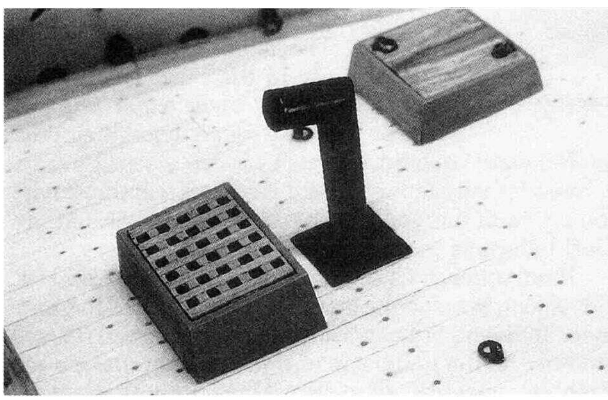
All the panels are cut from 1/32" stock. The top is composed of an aft fixed section, a scale 18" x 50" (9/16" x 1 9/16") and a forward movable section, twenty-four scale inches deep (3/4").

The metal work for the companionway includes four butt hinges for the doors, two handles secured by a total of four bolts, and three strap hinges for the top, secured by a total of 18 bolts. Make twice the number of everything, except the strap hinges and their bolts, and you'll also have the necessary metalwork for the quarterdeck bulkhead doors.

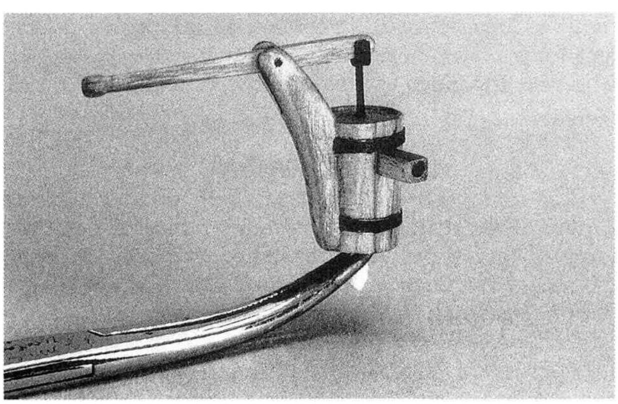
The butt hinges are each made from short lengths of 1/32" diameter brass rod, with the insertion pin made from brass nails with the heads cut off. The two parts are silver soldered together T fashion after the top of the vertical portion (the nail) is filed square.



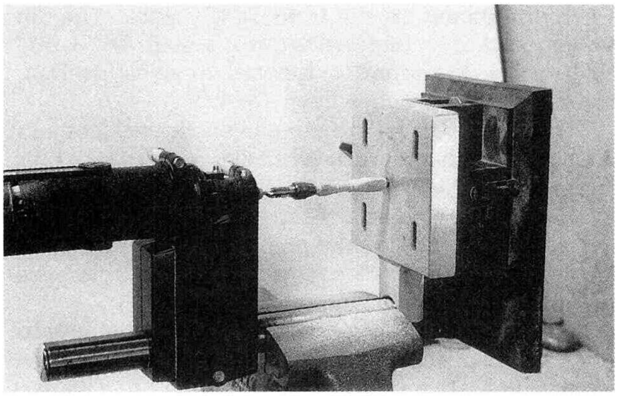
The table saw set up to cut gratings. Note the gap-filling plywood throat insert with its hardwood groove guide (just parallel to the blade).



A completed grating, this one on the galley hatch. Note also the galley stack and the scuttle (with solid hatch cover).



One of the log pumps.



A 60-second lathe. It looks strange because the hobby tool drill press is horizontal and held in a vise.

Soldering is easy if the parts to be soldered are secured in apposition; use a pair of forceps to hold the nail segment against the brass rod. Solder all three nails in place before cutting the rod into segments; the rod has enough weight to hold itself in place. The hinge segments should be five scale inches long (5/32"). The hinges are oxidized, then epoxied into #74 holes near the tops and bottoms of the doors.

The hinges for the fold-back top can be made working if so desired, but a realistic fake can be made by silver soldering a short length of 1/32" diameter brass rod between two lengths of 1/16" wide brass strip, one a scale ten inches long (5/16") and the other a scale eighteen inches long (9/16"). The filed and polished hinges are drilled for brass pins as miniature bolts, oxidized, and epoxied in place.

The handles are made from 3/8" long segments of annealed 1/32" diameter brass rod or wire. About 3/32" at each end is flattened with a pair of vise-grip pliers, then center punched and drilled for brass pins (#72). The ends are filed round, then the handle bent into shape with needle nose pliers. The handles and brass nails are oxidized, then also epoxied into #72 holes drilled near the tops of the doors.

The completed house is best installed after the pumps are installed, then glued in place, with dowels around the rabbet indicating bolts.

GRATING

Making a grating for the galley hatch is easy with the aide of a simple jig. The latter consists merely of a 1/32" thick, 1/16" wide strip of wood glued exactly 1/16" from the saw blade slot. The blade, by the way, must cut an exactly 1/16" wide slot. In use, a piece of 1/8" thick cherry, about twice as long as the hatch opening but just as wide, in this case 20 scale inches (5/8 "), is laid against the guide strip and the rip fence is brought up against it. The saw blade is raised to cut 1/16" deep. After the first cut is made, the saw kerf is fitted on the guide, the fence readjusted to fit against the block again and the next cut made; succeeding rip cuts are made the same way.

Next the rip fence is removed and the miter gauge used to make crosscut slots in a similar fashion, except that now the saw cut is adjusted to 1/32" depth. When finished, there should be fairly evenly spaced 1/16" wide slots separated by 1/16" wood squares.

Remove the grating guide and replace the insert for ripping small dimension stock and cut a few inches of 1/16" wide strip from 1/32" thick stock. Glue lengths of this stock into the 1/32" deep crosscut slots. When the glue is dry, saw to rough over size for the hatch, and power sand to finished dimension.

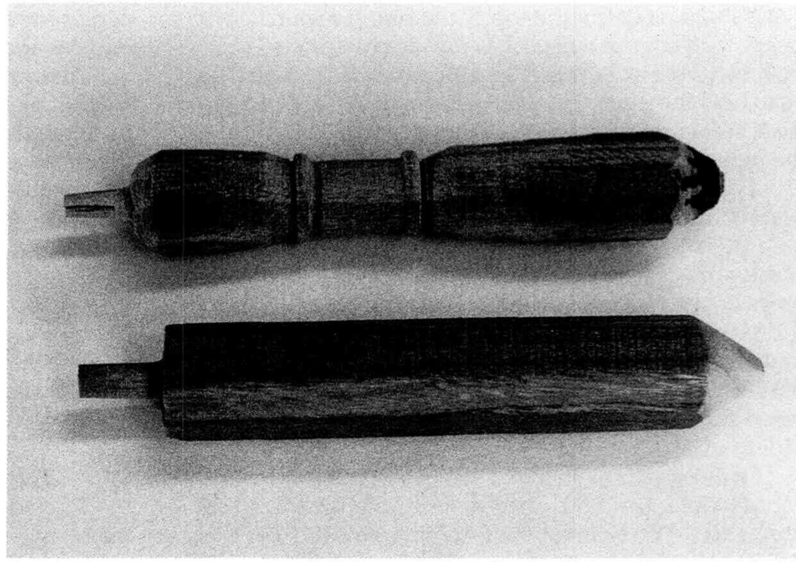
The latter will be less than inside dimension of the hatch opening; the difference is made up by a mitered frame of scale one to two inch stock, as needed, to fit snugly. Finish the grating by power sanding the undersurface of the block until it is 1/16" thick. At that thickness, the rails will be released from the blank and the grating will be a see through construction. Sand and oil the whole grating and glue in place.

STOVE PIPE

The stove pipe, called in later times the Charley Noble, can be made and installed now. If you install a plank hatch cover on the galley hatch, you could get by with making the assembly of 3/16" diameter dowel, painted flat black and flat lacquer over-sprayed.

If the ship were closed-up, the end of the stack would be plugged up with a tampion, as gun muzzles were. If however, you've gone to the trouble of making a grating for the hatch, then you certainly will want to make the stove pipe of brass sheet. It looks wonderfully realistic.

To make a scale six inch (3/16") diameter pipe, anneal a 3/4" wide, 2 1/2" long piece of .005" thick brass sheet. Wrap the brass around a length of 3/16" diameter dowel, rubbing the seam down firmly with a piece of softwood. Remove the dowel and then silver solder the seam. Put the dowel back in to facilitate the cutting and shaping: first, with a cut-off wheel in the hand grinder, cut off a half-inch length of pipe.



These are turning blanks for the 60-second lathe. The raw blank below shows the reduced diameter dowel end needed to fit in the hobby drill chuck. The shallow cone at the far end is soaped and fits in the dimple on the drill press table. The turning above is for the steering wheel drum.

Next, using the power sanding disc, sand a bevel on one end of both the short and the long pieces; the angle should be about 40°, so that the top of the pipe angles upward a bit. Fit carefully to match the openings, file off the burrs, and silver solder the two together. Silver solder is far preferable to lead based solder, by the way, both for strength and for color compatibility after oxidizing.

Cut a scale 16" (1/2") square of .010 sheet brass for the flashing. It's easier to drill the holes for the bolts (#74) near the corners and the hole for the pipe (15/64") at the center before cutting the square from the sheet. Silver solder the flashing to the pipe so that about 1/4" protrudes below the flashing. File the soldered areas smooth, wash the piece in soap and water, dry and acid wash. Oxidize the whole assembly to a nice deep black color and when dry, polish it with a soft cloth or a bit of paper toweling. This is a mixed blessing—it has to be done because the freshly oxidized surface is a bit fuzzy looking but the pressure may remove some of the blackness, leaving a copper-colored metal surface beneath. This tends more to occur with parts that have been soldered than those that are all brass.

If it does happen, re-oxidize with diluted Win-Ox. If bare areas are still present after that, overpaint the denuded areas with flat black paint to which a touch of Crystal Cote has been added. The oxidized brass, even where the oxide surface has flaked off, makes an excellent primer base, with good adhesion for the paint.

Drill a hole for the stub of the stove pipe just ahead of the galley hatch and scrape clear the decking that will lie under the flashing. With an old knife blade, scrape off the oxidizing from under the flashing and from the stub, then epoxy the stove pipe into the deck.

Finally, make four large, square-headed nails from brass pins and drill holes for them into the deck, through the holes in the flashing. They are easily made by chucking a pin in a pin vise with a four section chuck, flattening the head with a few strokes of the file, then using the joints between the jaws of the chuck as index markers for filing the four flats around the edges. Use epoxy to secure them.

THE BITTS

The bitts, just forward of the mast, are used in practice to secure the anchor cable and some of the running rigging. They would pierce the deck to be firmly secured below. These will be shown only from the deck level upwards, and the bases will be doweled into the deck. Make them according to plan of scale four inch square (1/8") stock. The crossbars and uprights each have 1/32 " deep notches cut into them for their mutual joints. The bitts are oil finished. Use a large a dowel diameter for fastening the bitts into the softwood decking; I used 5/64" diameter birch.

THE PUMPS

The pumps are an interesting piece of work. Made in the original from a bored out elm tree (or perhaps split and hollowed out by hand in colonial America where boring machines might have been rare), the log pumps are easily duplicated from a solid or two piece glued up cherry wood blank about 7/16" square and3" long. If you have a hobby lathe, or care to jury rig one, see the 60-second lathe photo on page 68.

The 60-second lathe is created and used as follows: with a 1/8" drill in the hand grinder chuck, just dimple the drill press table. Any blank for the lathe needs to have a 1/8" diameter tenon on one end for the drill chuck and a rounded point on the other for the table dimple. The latter, with a piece of soft soap in it, becomes a dead center bearing for the lathe.

Files and lathe chisels have to be hand held, the hand braced against the vise holding the grinder, turning the blank with its minimal taper is a *breeze*, although it's not too difficult to do entirely by hand. In either event, plane off the corners of the blank to octagonal to begin. A spar tapering jig (see the section on masts and spars) is a handy device to hold the blank for edge planing.

The finished pumps should be 20 scale inches high (5/8"), and about 13/32" diameter at the top and 3/8" diameter at the base. Drill a 5/64" diameter hole in the bottom for the dowel into the deck. With a 1/8" diameter router bit in the hand grinder fixed in the drill press stand, rout out the top of the pump about 1/16" deep, then cut out a disc of 1/32" cherry with a 1/32" diameter hole at its center and glue it in the recess. The jig to hold the pump for routing is simply a piece of 3/4" thick softwood with a 3/8" diameter hole drilled in it; the pump just wedges itself in place with gentle pressure.

The little device shown in the figure makes sanding perfect discs easy; it's just a stick of wood with a #74 hole drilled near one corner. Make any disc or wheel blank a bit oversize, drill a #74 hole at its center for a brass hobby nail, and pin the blank to the stick. Rotate the blank a bit (to make sure its not stuck to the stick) and then push the stick up to the disc sander and turn the blank with your index fingernail. A piece of double faced tape on the sanding table keeps the stick from sliding away from the sanding disc.

Fit the spouts as shown. They are of scale three inch square stock (3/32"), with a #47 hole for the spout bore and a #66 hole for the fastening dowel. Note that the spouts are not mounted directly in line with the pump handles, so as not to pump water onto the quarterdeck when in use.

The brackets for the pump handles are designed for a bit of leverage; the pivot point is twelve scale inches (3/8") from the center of the pump and the same distance above the top of the pump. The blank is 1/4" thick cherry, 3/8" wide. Drill a #72 hole first for the pivot pin. The mating surface of the bracket must be hollowed out a bit with a gouge to fit the round pump surface. The slot for the handle is one third the width of the bracket. The handles themselves are made of scale 2" x 3" stock (1/16" x 3/32") and are a scale 42" long (11/16"). Glue and dowel the shaped and sanded brackets to the pump, then oil finish the pumps and handles.

There is a bit of metal work for the pump: cut tiny recesses between the bracket and the pump body near the top and bottom of the pump to trap the ends of encircling bands of iron. They are made of oxidized .005" brass, 1/16" wide, glued in place with cyanoacrylate. The pump rod is of 1/32" diameter brass, silver soldered to a small bracket of .010" thick brass sheet. The latter is 9/32" long and 1/16" wide. There needs to be drilled a 1/32" diameter hole at its center for the rod, and a #72 hole 1/32" from each end for the bracket pivot pin.

After soldering the rod, bend up the ends of the bracket plate at right angles to take the pin which goes through the end of the pump handle. Oxidize the assembly and pin in place with a length of brass nail, fastened with cyanoacrylate, to represent a small bolt. A similar bolt serves as the pivot pin for the pump handle in its wooden bracket.

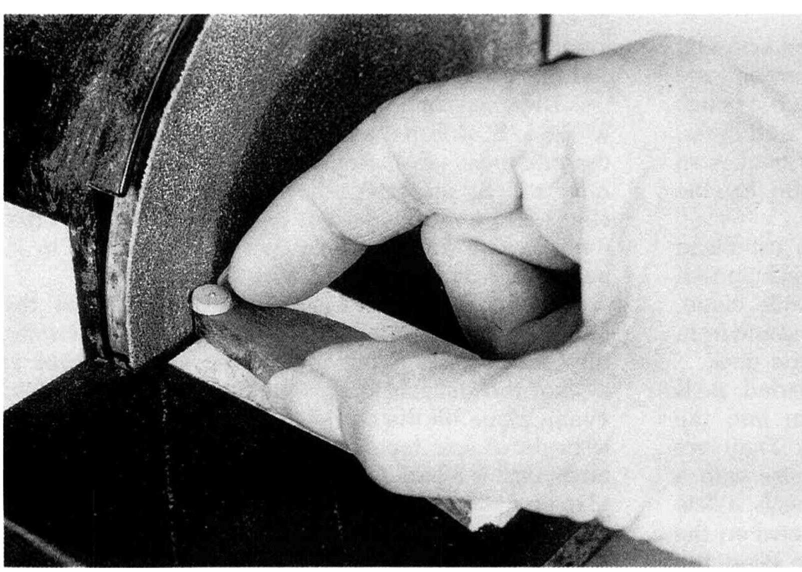
The pumps are then doweled in place, just against the quarterdeck step, the handles at about a 45° angle forward looking down from above, the spouts angling forward about 30°.

This completes the work on the main deck.

THE STEERING WHEEL
THE QUARTERDECK FURNITURE

The steering wheel is a complex structure, and many approaches to its construction can be found in ship modeling literature. Whether one uses a lathe and a faceplate or a jeweler's saw and sandpaper to generate the smoothly rounded surfaces of the rim and hub, a special blank must be made up. If one uses a disc of hardwood, at least 50% of the rim will be in end grain and will surely fracture sometime during the manufacturing process. Begin, therefore, by making up a blank composed of six 60° segments of 1/8" cherry wood, each about 1/2" long, and each with the grain running crosswise. The angled segments can be made by power sanding oversize blanks to the exact shape of the space left by cutting out a 60° triangle from the edge of a piece of cardboard. When glued up as a blank, there will be essentially no end grain; use epoxy, as the sawed out rim blank segments will otherwise be a bit fragile.

Draw a scale 24" (3/4") circle on the blank for the outer rim and draw a concentric 20" ring (5/8") within it. An 8" (1/4") ring around the center point defines the hub. Sand the blank perfectly round to the outer rim margin, using the same technique used in making the discs for the top of the pumps—a brass nail through the center of the blank into a stick of wood to hold it against the sanding disc for thumb-and-finger turning to size.



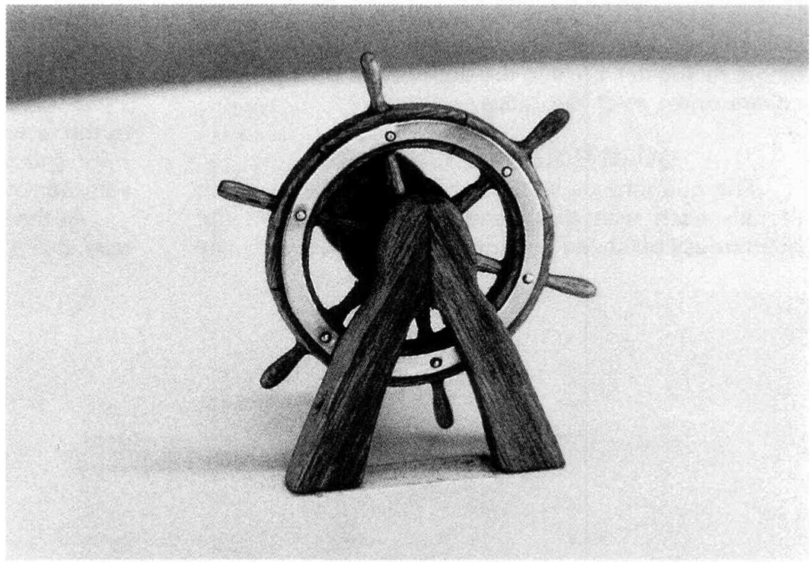
Pinning a rough cut disc to the end of a stick (with double faced tape on its bottom) to use as a guide against the sanding disc. This forms perfectly circular discs.

On the rim of the resultant disc, mark the exact center of each of the six segments, then centerpunch. Carefully align the disc in a drill press vise so that the line between the centerpunch mark and the center of the hub is vertical, then drill on the drill press, with a #59 drill, just deep enough to enter the hub about 1/16". Do the same for each of the six segments, then enlarge the hole to just beyond the depth of the rim with a #53 drill (a smaller size drill enlarged with miniature reamers will also do). Drill a hole through the face of the disc also, in the waste space between hub and rim. Use double faced tape to stick the blank to a hand holding size piece of wood, then use the power disc sander to bring the faces of the blank down a bit to a final finished thickness of 3/32".

With a fine blade in a jeweler's saw, cut out the rim and the hub. Use the same disc forming technique mentioned previously to size the hub. Bring the inside of the rim down to finished width with the aid of a drum sander attachment for the hand grinder.

For finish sanding, wrap a piece of 150 grit sandpaper around a length of 1/2" dowel until just the right diameter is reached to fill the rim blank; sand it perfectly round (carefully to avoid separating the segments) then do the same with #220 grit paper.

The blank for the spokes is a foot long length of cherry dowel, made by pulling a sawed 3/32" square stick through the drawplate down to #53. Cut the dowel into one inch long segments, six for the wheel and two or three for practice. Turning spokes is easy to do (but hard to learn to do). Transfer the spoke measurements (handle, rim segment, spindle and hub segment) to each dowel. Chuck the dowel in the hand grinder, using the drill press held horizontally in a vise for security. Supporting the end of the dowel with your left index finger (assuming you are right handed), use needle files to shape each spoke. A small round file will do nicely to form the narrow end of the handle and spindle and the tenon for the hub. A small flat file will serve to shape the top of the handle. These files can be found in the usual package of miniature needle files sold in the hobby shop. Check the spokes, rim and hub for mutual alignment and then assemble the wheel, pulling out one spoke at a time for gluing.


The completed steering wheel.

Put a bit of epoxy in the sockets in the hub and re-insert the spoke, then apply a bit of cyanoacrylate under the rim to let it seep in and lock the rim segment in place. After all the spokes are secured and the glue is dry, sand the wheel flat on hard, plane surface.

A common practice on 19th century steering wheels was the use of a flat brass ring on each side of the rim to strengthen it. How far back in time that practice extended is not clear from the literature, it is known that brass was expensive in colonial America and one thus wonders if it would have been used this way in inexpensive vessels. This notwithstanding, a re-enforcing ring would have been a good idea; perhaps wrought iron was used. In any event, such rings are recommended here, the choice of brass vs. black being left to the modeler.

To make the rings, make up a one inch square sandwich of .005" thick brass (two layers) between outer layers of 1/32" thick plywood, the whole thing glued together with household cement such as Duco or Ambroid®. Draw diagonal lines from the corners to find the center, drill for a brass pin, then round off on the power sander after cutting to rough oversize on the jigsaw. Saw out and finish the inside of the ring as was done for the wooden rim of the steering wheel. A round grinder bit will substitute nicely for the drum sander. Soak the sandwich in a shallow dish of lacquer thinner to separate the layers and clean up the brass plates carefully with files and steel wool.

Oxidize the plates if wrought iron is your choice, then epoxy them to the wheel rim. Instead of oiling the wheel, paint it with a drop or two of the thin type cyanoacrylate; not only will it lock all the pieces in place, it will secure any hairline cracks and even put a low gloss finish on the wheel. Do the job quickly and get the brush into a bath of lacquer thinner or a petrified brush results. Polish with fine steel wool.

Drill a #72 hole through the plates, rim and spoke rim segment, half from each side, for the plate securing bolts. A length of the shaft of a .025 brass hobby nail, cut just a fraction longer than the maximum thickness of the wheel, the ends filed round, makes a nice scale 7/8" diameter bolt. Secure with cyanoacrylate.

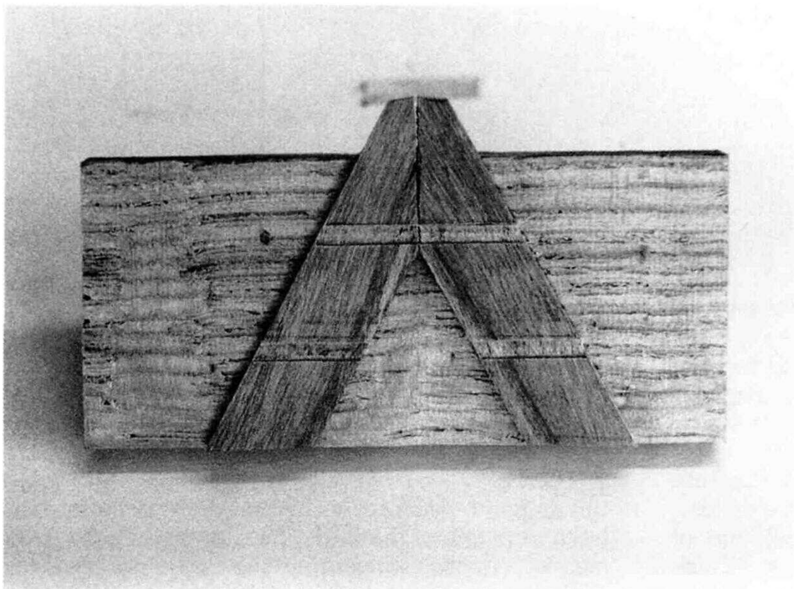
The drum for the helm needs to be turned; it is a scale 12" in diameter (3/8"), with the shaft turned down from the full diameter to leave a lip at each end. The drum for the original was turned on the 60-second lathe, as can be seen in the lathe turning blank photo. The drum is oil finished, then center drilled for a shaft of bamboo dowel (#56).

The standard for the helm is made of two scale 4" x 6"s (1/8" x 3/16") timbers, glued together to form an open-bottomed triangle, then shaped as shown on the plan. Almost vertical holes need to be drilled in the sides of the pieces, down through the base of each foot, for the securing bolts; a small starter recess will have to be cut with the point of a knife before the drill bit will grab at that angle. A hole for the shaft is drilled in the middle panel of the bulkhead former, then the drum and wheel threaded on the bamboo shaft and the whole assembly epoxied in place on the quarterdeck. Finally, an epoxy coated oxidized brass bolt is driven through the holes into the standard and into or through the planking of the deck.

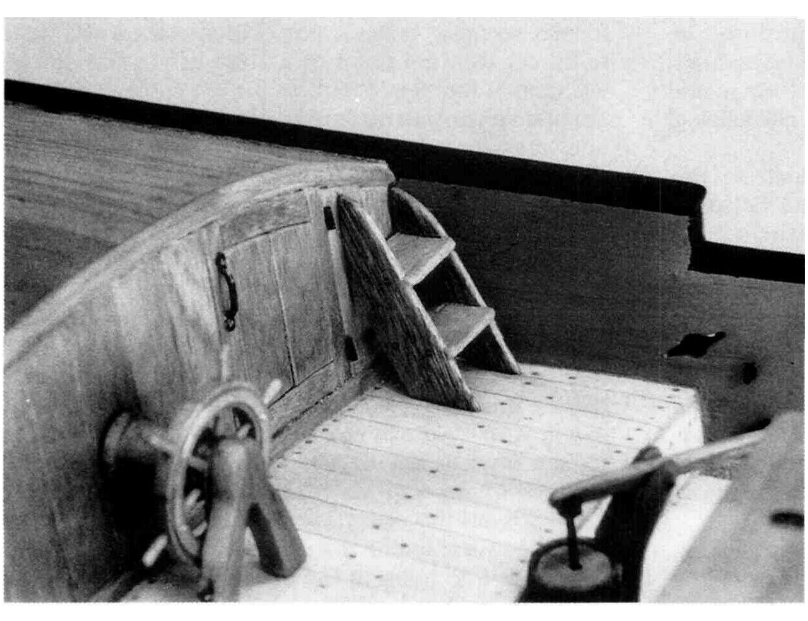
The rigging of the helm is fairly simple. Steel reported the use of white rope for the tiller rope, perhaps referring to bleached, extra flexible line, but I have read one reference to rawhide used here, which may have been a much lighter color than ordinary rope. In any event, working downward from the tiller rope size given for the smallest size of naval vessel, you will come to scale 3/4" rope (.025"&for the Virginia sloop. Five turns around the drum will do; the center turn would have been stapled to the drum. The ends of the line disappear into holes in the deck in line with the sides of the drum, one forward and one aft along the length of the drum. The holes would have been protected from water penetration below decks by means of little leather cone-shaped covers, so make these of wood stained black and slip them over the ends of the line before gluing the line into the deck holes, then glue the covers down over the holes.

QUARTERDECK LADDERS

The quarterdeck ladders are simple affairs: a pair of rails each with two treads, braced between the quarterdeck bulkhead and the next frame forward. The rails are lengths of scale 2" x 10" timber (1/16" x 5/16"), and the treads are 2" x 14" (1/16" x 7/32"), cut to form a cap across the front of the ladder. Cut a cardboard pattern to fit the quarterdeck at the site of the rail closest the centerline, that would be just outside the joint between the bulkhead door and the paneling. Both rails will be made the same, so that the treads can be fitted easily, then the rails will be altered to fit the slope of the cabin roof and the curve of the deck.



The ladder stiles taped to a piece of scrap for parallel cutting of the tread dados on the table saw.



The quarterdeck, with the ladder and wheel in place.

After all four rails are cut, use double faced tape to secure them in book pattern pairs to a block of wood to cut the tread dados. Set your table saw rip fence 5/16" from the blade and the blade depth of cut to 1/32", then run the block across the blade, lower ends to the fence, to cut the first dado. Reset the fence at 5/8" spacing for the second cut. Square up the dados with narrow files.

As the treads will later be glued and doweled to the rails, it is a good idea to drill the dowel holes through the tread dados before assembly. Once the ladders are glued together, it becomes difficult to avoid drilling through the face of a step. Finish the ladders with penetrating oil, then epoxy and dowel in place.

BINNACLE

The binnacle is made in much the same way as the companionway — a block of softwood cut to the inside dimensions of the chest, the legs affixed, and the block planked. The block is 7/8" high, 1 1/8" wide and 7/16" thick. One can just recess the area to be glass-covered and paint it flat black, then glue the glass right over it, but it looks much better to go another step. That would be to cut out the compass-containing compartment on the jig saw, leaving a U-shaped case block. Then cut a recess around the cutout on one face for the glass and paint the cutout flat black.

Cut a piece of microscope coverglass (#1 thickness) or a glass substitute to fit the recess. Thin glass is difficult to cut, even with a fine diamond point scriber to do the marking and a piece of steel or window glass to use as an ultra-flat table. Many will be broken before an intact one is obtained.

Thin plastic or celluloid can be used. The prototype Virginia sloop model used several glass and substitute materials in its construction. The most realistic was not glass but rather a piece of vacuum formed plastic from the package of a dashboard repair kit; the irregular surface of the cheap plastic looks just like antique glass. The leader end of exposed black-and-white film negative is also a good glass substitute and is easy to use; it looks best with the shiny side out. Use cyanoacrylate to hold film or plastic in place. Use epoxy for glass, as cyanoacrylate spreads over glass in a frost-like film.

One could similarly install glass in the side compartments, the ones for the lanterns, but they will be totally invisible (as opposed to the merely partially obscured compass compartment) when the binnacle is installed. It's not too much trouble, however, to make a tiny compass to fit in the binnacle, and this has to be made and installed before the case is planked. Little touches like this bring great delight to viewers of the finished model and are well worth including. They are a clear message to the viewer that more than casual

The binnacle. With a bit of attention, you can see *the* compass inside *the glass panel.*

inspection is the order of the day for the proper understanding of this artistic document, and that time spent will be well-rewarded.

Sand and file a short length of 3/8" diameter dowel to about 9/32" diameter and cut it off to 3/16" in length. Glue the compass card to one face, then solder up a brass sleeve for a tight fit around the dowel; the sleeve should be just a bit longer than the dowel. Cut a disc of film negative to fit inside the sleeve to serve as the glass cover of the compass (nobody is patient enough to use microscope glass here) and hold it all in place with a few dabs of carefully placed cyanoacrylate. For the compass box, drill a hole to take the sleeved dowel, about 11/32" diameter, in a scrap of 1/8" thick cherry, then cut the scrap into a 3/8" square. Sand the box just enough to fit it into the compass compartment of the binnacle, then finish it with oil.

Insert the brass-sleeved dowel in the cherry box, then epoxy the compass in the cut out of the binnacle block.

The compass card, by the way, can be drawn with the aid of circle templates or can be photo copied from a book, using the copy reduction mode on the machine to get exactly the size needed. There's a good one to be found in the binnacle drawing in Wolfram zu Mondfeld's book *Historic Ship Models* (page 147).

The sides of the binnacle are of scale 2" thick plank (1/16") and extend beyond the front and rear of the case one scale inch (1/32") to take planking of the latter thickness. The side planking is a scale 36" high, plus two scale inches for a tenon into the base timbers, a total of 1 1/16" at our scale.

The top is similarly of one inch scale thick timber, hinged by three butt hinges made just as you did for the companionway and bulkhead doors. The knobs for the drawers were made from brass hobby nails, the sharp edges filed off; they are chemically blackened and epoxied in place. The bases are scale 2" x 4"s (1/16" x 1/8"), with mortises for the tenons in the legs. The ends of the bases are drilled for the bolts which hold the case to the quarterdeck, the bolts being fashioned from brass hobby nails as you have done before. Binnacles were often lashed rather than bolted to the deck, but there's not much room on this tiny quarterdeck for eyebolts and tackles as it is; bolts seem more appropriate.

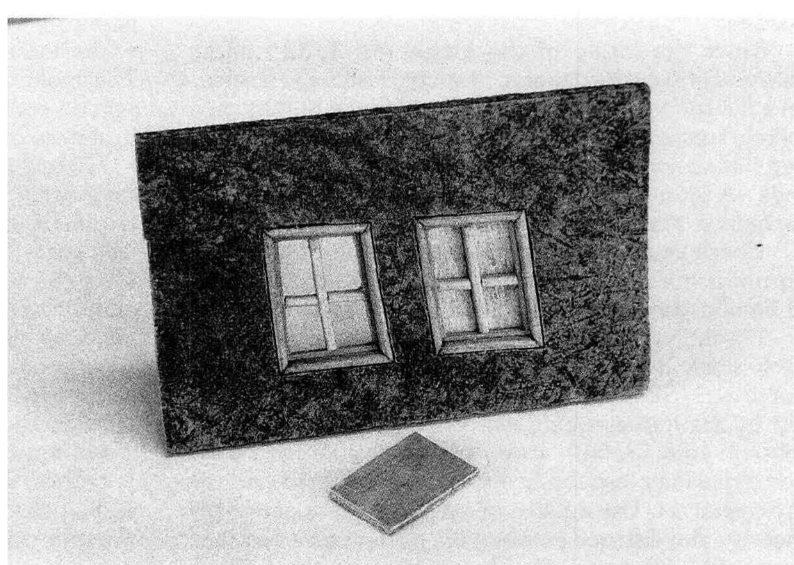
STERN LIGHTS

With all the deck furniture and fittings completed and installed, the final bit of hull construction can be done, the stern windows or lights. They are a bit difficult, but made up in a mold or jig, they are fairly straightforward. Again, it's the glass cutting that will tend to drive one bonkers, so start to look around for substitutes.

Begin by making cardboard patterns of all four windows. The final trimming of the window openings when the stern was built should mean that the patterns for one side should fit the opposite side quite well. Trace the patterns onto a piece of 1/8" thick masonite and cut out the windows to form a female mold. Use knife and file to bring the mold openings to the exact shape of the cardboard pattern. It's probably more accurate to use just a two window mold (used twice); it avoids introducing further dimensional error from pattern to frame. Wax the openings and the faces of the mold to prevent adherence of the frames to the mold during gluing.

Plane off the corners of one edge of a 12" length of 1/16" thick cherry wide enough to hold in *a* vise, then finish rounding off the edge with progressively finer grades of sandpaper.

Ripsaw a 1/8" wide piece from the shaped edge, then perhaps repeat the whole process as insurance against error. Cut a rebate along one face of the strip, 1/32" wide and 3/32" deep from the non-rounded



The masonite model for the lights.

The stern lights installed.

edge. This leaves a 1/32" lip at the rounded edge to fit over the mold during construction and over the stern planking for a perfect fit at installation. Glue up the frames using epoxy, the extra strength of which is needed because of the small mating surface area. The key to success in the actual construction of the frames lies in the careful fitting of the miters as the pieces are offered to the mold; as the angles are not the fixed 45° of regular picture frames, a good deal of eyeballing is needed.

Trace the inside of the frames on 1/32" thick plywood and cut the latter to fit snugly inside the frames on a flat surface. Do not glue them in place — they are merely spacers for the glass. Line the frames then with butt-joined lengths of stock just 1/64" thick and 3/64" wide. A little careful saw adjusting (see photos) and perhaps a slitting saw blade are needed here.

Check your hobby tool supply catalog for the blade; do not use it on stock thicker than 1/8" as the heat of friction can warp the blade fairly easily.

For the vertical and horizontal bars, a bit of 3/64" thick stock is needed (often the actual thickness of nominal 1/32" stock). Shape the edge to half round just as the frame edging was done, then saw off the shaped edge 3/64" wide. Fitting the vertical and horizontal bars, especially the latter, is the hard part of the operation. Use a piece of cardboard as a gauge to measure the distance between the center piece and the frame sides for a snug fit. The angles are very shallow — just off square; the temptation is to cut too great an angle and produce a great deal of 1:32 firewood. Use a single edged razor blade for the cuts. Yellow glue is fine for all the inside-the-frame work.

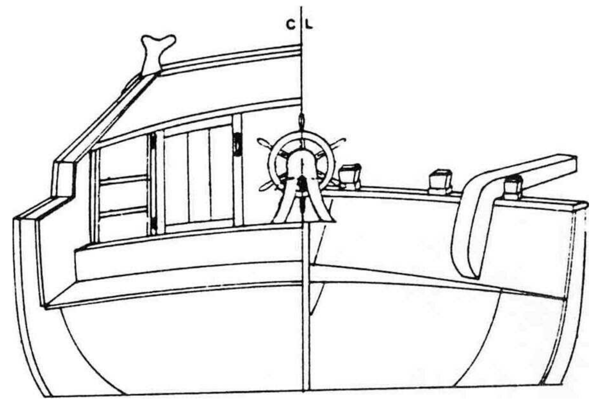
If the windows don't come out of the mold with gentle pressure, don't force them or you will wind up making them again. A stick of wood, one end of which is cut to the approximate shape of the window, can be rested on the back of the frames and used as a pressure aid. If all else fails, release the windows by carefully jigsawing through the top and bottom of the mold at each window, finishing up the cut with the jeweler saw. The mold can always be glued back together for the second round. Paper strips in epoxy make up for the thickness of the saw cut.

Finish the frames with an undercoat, then paint them gold. Glass or glass substitute panes are next cut to the size of the plywood patterns and glued in place with just a few micro-dabs of the appropriate adhesive. Glue the windows into the stern openings just deep enough to leave the frames just a bit proud of the stern planking surface.

It probably seems appropriate at this point to think about masting and rigging, but owing to on-deck space considerations, it's actually much easier to make and install the cannon now.

Once the spider's web of standing and running rigging enshrouds the little sloop, there is no way that the gun carriages can be rigged.

CHAPTER 5



ARMAMENT AND ANCHORS

Awash with arcane measurement details, the collection of dimensional data for cannons and carriages is made quite easy for many models by the fact that most of the calculator work has been done by others. . . at least for essentially every size of cannon ever made in the 18th century except these three pounders!

Not to worry: Michael S. Hohimer's excellent monograph *British Naval Ordinance, 1700-1815,* has all the data needed to do the job, and again your author has done the work for you. If in future you should need to draw up original plans for ship's guns, the Hohimer monograph (a bit hard to find) or the excellent tabular data put together by Merritt Edson and found in Ship *Modeler's Shop Notes* will be just about all that is required. These two sources contain essentially all of the carriage data and a good part of the cannon data, saving many hours of searching and calculation. Both of these references have almost identical primary source-based-drawings of the gun carriages and of the cannon, taken from the John Robertson work *Description of Ships Guns* of 1775. The cannon dimensions are at least partially derived from the British Establishment (Board of Ordnance) of 1764, but even so, there is much less available tabular data for the cannon themselves, especially in this small size.

Other useful sources for research for original projects that one may find valuable include the following:

1. Harold Hahn's *Ships of the American Revolution and Their Models.* This work has excellent diagrams and model photographs and a first rate description of advanced gun making techniques.

Primary and secondary sources used are also given (primary = contemporary; secondary = well-documented modern works).

2. Milt Roth's two part series "Anatomy of a Gun", which appeared in *Model Ship Builder magazine, #32* & #33, (Nov./Dec. 1984 and Jan./Feb. 1985) has a detailed and readable description of guns and carriages together with a great many useful diagrams and sketches. The article also goes into considerable detail regarding the actual manning of the guns in battle and the accessories needed for loading and maintenance.

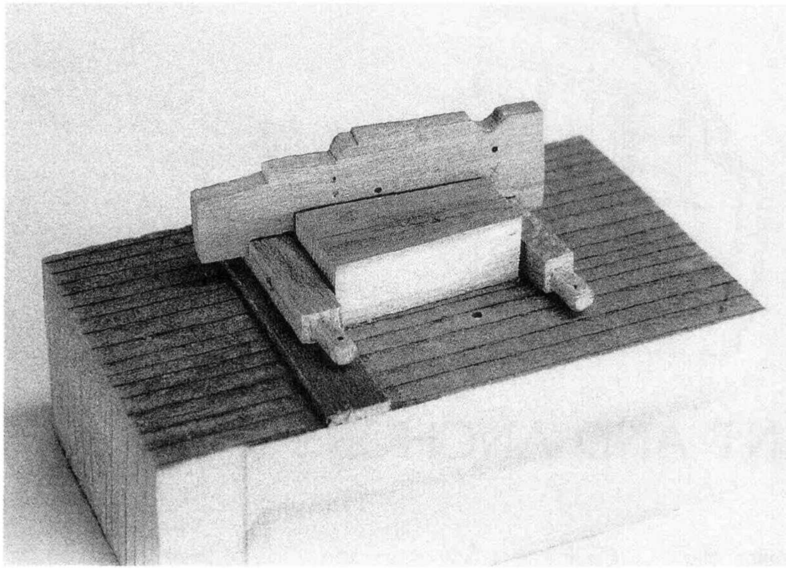
3. A more scholarly article, "The Goleta Cannon" by J.M. Ruhge in the *Nautical Research Journal,* Vol.32, #3, Sept., 1987, describes five Revolutionary War period iron cannon found off the coast of California a few years ago. One of them seems to be a three pounder, the others are fours. The given dimensions of the 3pdr, a 1778 cannon from the famous Carron foundry in Scotland, are:

Bore diameter	3.1″
Ball weight	3 pds
Length (muzzle to end of cascabel knob)	54 1/2″
Bore length (muzzle to touch hole)	44 1/2″
Calibers	15 (older definition; see below)
Weight	608 pds.
Trunnion diameter	3 1/16″

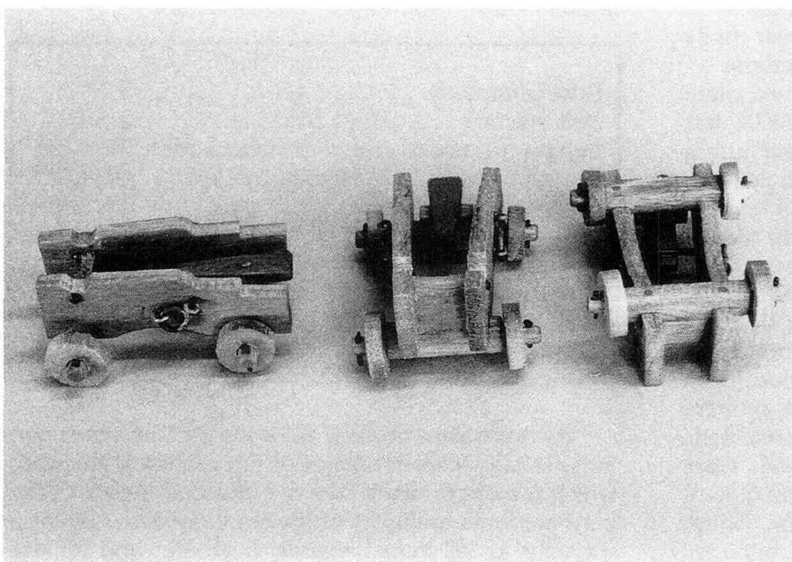
As originally designed, all of the dimensions of gun and carriage were multiples of the caliber of the gun, which dimension itself was the effective length of the bore in whole multiples of the shot diameter. It was a constant for all guns, regardless of size, and for this period was generally about 14 to 16. The bore diameter of the gun was the diameter of the shot plus a little something extra (windage) for insurance. Shot diameter in the 18th century was not quite as constant as it might have been. A ball stuck in the bore during loading might well have caused a disaster. Sometime between then and now the term caliber became misused and meant the same as bore diameter. Almost all carriage and cannon data now available are calculated from multiples of bore diameter caliber and not bore length caliber, and it is in the latter sense the I will use it.

The shot diameter these little three pounder pop guns, assuming they were made of iron and not of brass, was 2.77"; the caliber was 2.91". The total weight of this smallest of carriage guns, 4 '6" long, was still 600 pounds for the iron alone, 725 pounds with the carriages. With six, the little Virginia sloop carried over two tons of gun weight alone. No wonder she sailed low in the water!

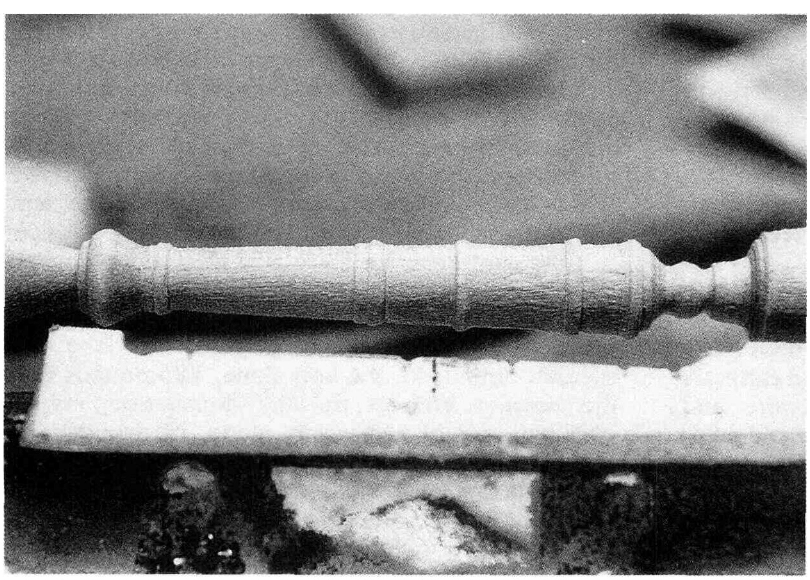
The charts mentioned above list each dimension for the parts of the carriage and some for the cannon together with a multiplier factor for those dimensions. The caliber of the gun times each of these multipliers gives the complete list of dimensions. For example, the



A gun carriage bracket and axletrees aligned with the aid of a jig.



Three views of completed gun carriages.



Turning the cannon pattern on the lathe. Note the brass template of the profile below.

diameter of the fore trucks (wheels) for any 18th century gun carriage of any size was 3.245 times the caliber. For the three pounders that would be 3.24 x 2.91", or 9.43", probably to be rounded off to 9 1/2" in use.

Don't be frightened off — most of the wood work can be done merely by making multiple copies of the scale size (1:32) drawing on Plans Sheet 2. Similarly, a single photo copy of the 1:32 cannon plan will serve to make a shim brass template for turning the pattern for the guns themselves. A large scale drawing of the guns, with most parts labeled, is also provided for clarity here in the book, and it can be photo reduced to 3/8" = 1' on the office copy machine if you don't have a full size set of plans.

Remember that the proper project designer will always make both plan and elevation views of the gun at scale size from the raw data notes and first sketches to try "in situ" on the model as cardboard silhouette. Doing so prevents some awful times later on when a whole group of cannon fail to fit through their gunports. The first pencil drawing for the Virginia sloop guns for this project showed the carriage to be about three scale inches too tall; the drawing was reworked so that the bore of the guns came just about to mid-port with the gun level, just what the 18th century carriage maker would have done.

The names of the parts of the carriage are fairly self-explanatory with a few exceptions: the carriage sides are known as brackets. The wheels are trucks. The cap square is the bent metal strap that holds the pivot rods (trunnions) of the gun onto the carriage. The aim of the gun is depressed with the aid of a wooden wedge with a belaying pin type handle; it is known as a quoin, and fits between the breech end of the gun and a wooden stool. The latter is supported on the rear axletree by a bolster. The transom is a strengthening piece, sometimes with a bumper, at the front of the carriage.

The names of the parts of the cannon proper are almost all strange and unique. The cascabel is the rounded part at the back; the muzzle, of course, is the flared part forward. The pomiglion or button is the knob on the cascabel. The overall length is measured from the button to the muzzle, but the length of gun in contemporary sources often was from the base ring (separating the cascabel from the rest of the gun) to the muzzle. The vent field is the short segment forward of the cascabel containing the touch hole. The next two segments are the first and second reinforces, and the long forward

THREE POUNDER GUN DIMENSIONS

	Actual Size	Size at 1:32
I. Carriages		
Carriage Sides (Brackets)		
Overall length	36.4 "	1 9/64"
Thickness	3.0 "	3/32"
Height (forward)	11.0 "	11/32"
(rear)	6.8 "	3/16"
Distance apart: at the trunnions	8.7 "	9/32"
at the rear axletree	10.75"	11/32"
Distance of the trunnion axis (from fwd.)	5.77"	11/64"
Trunnion seat radius	1.58"	3/64"
Ovolo radius	1.46"	3/64"
Bottom cut out (distance from front)	10.2 "	5/16"
Axletrees		
Length	28.3 "	7/8"
Arms: Length	5.1 "	5/32"
Diameter	3.25"	3/32"
Thickness of forward axletree	4.83"	5/32"
aft axletree	3.57"	7/64"
Distance between axes of axletrees	25.3 "	25/32"
Distance of axis to end of bracket:		
Forward axletree to front of bracket	4.7 "	5/32"
Rear axletree to rear of bracket	6.45"	13/64"
Depth of axletree recess in brackets	2.0 "	1/16"
Trucks (Wheels)		
Diameter (fore)	9.44"	9/32"
(aft)	8.4 "	1/4"
Thickness	2.9 "	3/32"
Stool		
Length	16.9 "	17/32"
Breadth (fore)	3.15"	3/32"
(aft)	5.25"	5/32"
Thickness	2.1 "	1/16"
Notch forward (breadth)	1.0 "	1/32"
(depth)	0.68"	−1/32"
(distance from front)	1.78"	1/16"
Bolster		
Length	8.00"	1/4"
Thickness	2.91"	3/32"
Width	3.68"	1/8"
Transom		
Width	8.7 "	9/32"
Height	8.73"	9/32"
Thickness	2.91"	3/32"
Cap Squares		
Length	8.65"	9/32"
Breadth	2.1 "	1/16"
Thickness	0.36"	0.10"
Radius of bend	3.15"	3/32"
Forward flat area length	3.41"	3/32"
Aft flat area length	2.1 "	1/16"
Joint bolt head: length	1.84"	1/16"
breadth	0.61"	−1/32"
projection	0.60"	−1/32"
Hinge bolt: length	1.21"	+1/32"
breadth	0.63"	−1/32"
Key thickness	0.79"	−1/32"
Eyebolts		
Inner diameter of loop	0.87"	1/32"
Outer diameter of loop	2.10"	1/16"
Breeching Rings		
Inner diameter	2.33"	3/32"
Outer diameter	3.8 "	1/8"

segment containing the muzzle is known as the chase. The strengthening and demarcation rings around the gun are known as rings and astragals; these may have fillets or moldings (ogees). The trunnions are the rod like extensions from the sides of the cannon that serve as its mountings and bearings in the gun carriage.

Cannon of this era were most often hung by the thirds rather than hung by the bore, that is, the trunnions were cast on the lower line of the bore rather than the centerline of the gun. John Muller's *A Treatise of Artillery*, London, 1757, clearly showed why being hung by the bore was a superior design feature, but bureaucracies being what they are, he was largely ignored.

In an attempt to keep the relative beginner properly mystified and confused, dimensions are given two different formats, the carriage dimensions in ordinary inches and fractions and the cannon dimensions in decimal format. Actually, that's a bit of a help: linear dimensions and thicknesses for the carriage correspond to available stock sizes and common scale divisions; radial measurements on the gun correspond to the decimal format found on dial calipers.

The carriage dimensions are rounded off to +/- the nearest 1/64". In practice, almost all of the dimensions worked, that is, the parts went together like a child's toy; where they didn't, the chart was modified to meet the demands of the model.

SWIVELS

Much easier to deal with than heavy metal, swivels were the small, pedestal mounted anti-personnel weapons used at close quarters. Only one shot weight is found listed in all of the available establishments of the era, the half pounder, so the size decision is a narrow one.

With no carriage and merely a yoke to support the gun, data collection and gun drawing is a bounty of simplicity after doing a carriage gun. The figure shown in this chapter and its reduction on Plan Sheet 2 are based on the Hohimer drawing of a swivel found in Boston Bay and not further identified. Note the removable reinforced wooden handle.

The large drawing in the text is to a scale of 1" = 1', so if you want to reduce that drawing for a model sized pattern, you will need three reductions through a photo copy machine (64%, 64%, and 92%). It won't be very sharp, but it will be serviceable.

THREE POUNDER GUN DIMENSIONS

II. Cannon

Linear Dimensions	**Actual Size**	**Size at 1:32**
Overall length	54.8 ″	1.713″
Length of gun (contemporary measurement from base ring to end of muzzle)	48.9 ″	1.528″
First reinforce (from base ring)	14.0 ″	.438″
Second reinforce (from first reinforce)	9.6 ″	.300″
Chase (second reinforce to end of muzzle)	25.3 ″	.791″
Cascabel	5.9 ″	.184″
Muzzle (from muzzle astragal)	5.9 ″	.184″
Vent field (from base ring to vent field astragal)	4.4 ″	.138″
Breech to trunnion center	21.0 ″	.656″
Trunnion projection (from cannon surface)	2.9 ″	.091″
Diameters (Less Astragal and Ring Thickness)		
Breech	8.0 ″	.250″
Trunnion axis	6.6 ″	.206″
Muzzle (minimum diameter aft of swell)	5.1 ″	.160″
Trunnion	2.9 ″	.091″

The 1764 Establishment gave the following data for 1/2 pounders:

Length . . . . 3'0"
Weight. . . . . .125 lbs.
Shot diameter. . . . . 1.52"
Caliber. . . . . .1.68"

From the re-drawn Boston Bay swivel, the following dimensions can be developed:

SWIVEL GUN – 1/2 POUNDER

Linear Dimensions	**Actual Size**	**Size at 1:32**
Overall length	33.6 ″	1.050″
Length of gun (cascabel depth excluded)	30.56″	.955″
First reinforce (from base ring)	9.04″	.283″
Second reinforce (from first reinforce)	6.4 ″	.200″
Chase (second reinforce to end of muzzle)	15.2 ″	.475″
Cascabel	2.96″	.093″
Muzzle (from muzzle astragal)	2.96″	.093″
Vent field (from base ring to vent field astragal)	3.0 ″	.094″
Breech to trunnion center	13.2 ″	.413″
Trunnion projection (from cannon surface)	1.68″	.053″
Diameters (Less Astragal and Ring Thickness)		
Breech	5.28″	.165″
Trunnion axis	4.68″	.146″
Muzzle (minimum diameter aft of swell)	3.6 ″	.113″
Trunnion	1.68″	.053″
Swivel Post		
Overall height	15.84″	.495″
Distance from top to stopper	7.8 ″	.244″

BUILDING THE GUNS

Scratch building cannon requires more care and perseverance than just about any other phase of ship modeling. With about 60 parts per completed and rigged gun, the work seems to go on forever. For the woodworker, more metal working skills must be perfected, especially casting the cannon (barrels, if you will) themselves. For the Class B modelers, this is a wonderful place to buy parts, especially the cannon and the blocks (already stropped and hooked). Eyebolts and even wooden gun carriages can be found in the catalogs also. For the case-hardened scratch builder, well, just read on; making the whole assembly, carriage and cannon, is a wonderfully complete and satisfying experience.

THE CANNON CARRIAGES

Gun building requires assembly line mass production. Quality control is better if the process begins with the manufacture of the parts and then their assembly with the aid of jigs.

For the gun carriages one will need 12 brackets, 6 front axles, 6 rear axles, 6 transoms, stools, bolsters and wedges, 12 large trucks, 12 small trucks, 12 cap squares with hinge bolts, key bolts, keys and chains, 24 bolts, 30 eyebolts and 12 breeching rings! After that, you get on to the serious stuff, the tackles and rigging. There is something to be said for the modeling of unarmed merchant ships!

Begin by making a shim brass template of the gun carriage brackets; .005 brass will do nicely. Copy or cut out the drawing of the carriage on the plan sheet and double face tape it to the brass. Mark the bolt hole locations with an awl, then drill each with a #72 drill. Cut through the paper and brass together with jeweler's saw and small scissors, filing carefully to outline to complete the template. Use the brass template to mark out twelve brackets on 3/32" thick cherry stock and again to bring the brackets to an essentially identical final size. Drill the four bolt holes, also with a #72 drill. Sand and file the brackets to shape. Needle files will be especially helpful in finishing the trunnion seats and the little notch in the upper rear surface of the bracket, just above the ovolo and behind the cap square seat. Match the brackets in pairs as you go along.

For the axletrees, cut a length of 1/8" thick cherry 5/32" wide, then carefully plane it down to 7/64" in thickness. Make a dozen 7/8" lengths, perhaps plus a few spares. Each side of each end of each piece needs to be marked off for the length of the arms; it takes hardly any time at all with the aid of a simple jig. The jig is just two short lengths of the same stock, the 5/32" wide dimension up, tacked (hobby nails through #72 holes) in an L shape to a piece of scrap wood. Hold the axletree vertically in the corner so formed and with the pencil held horizontally, mark each side as you rotate the piece.

Mark the location of the key holes on each arm, using scraps of sheetwood as gauges to get the marks in the same position on each arm, much as was done above. Remember that the key hole is drilled through the narrower dimension face (the 7/64" wide side) on six of the axletrees and through the wider face (the 5/32" wide side) on the other six. The key hole is also #74. Drill a short #70 hole at the center of the rear face of each rear axletree also, these for the train tackles.

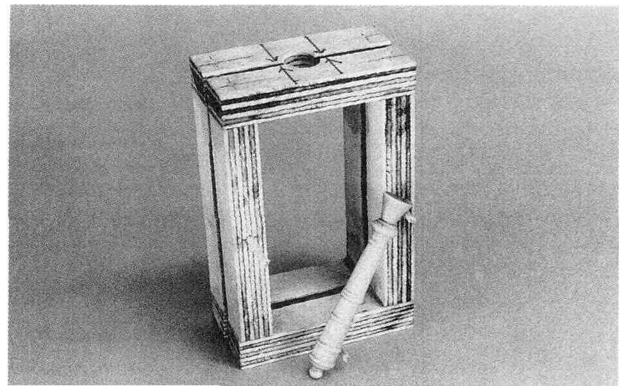
The actual cutting of the arms is an annoying and repetitive piece of work, as 24 arms must be cut and rounded by hand, all of the work being done with a tight grip on the piece. Muscle strain and fatigue awaits! The arms of the forward axletrees are at the lower edge of the tree; they are formed starting with a saw cut on the upper arm width line, using a knife or razor blade to cut away a slice of the arm to leave a square-ended rectangular remnant. The arms of the rear trees are centered, so a small cut is required on each side. Use a hobby knife to cut off the corners of the arms, then bring them to final size with files, knife and a drill gauge plate. The diameter of the finished arm should be just under 3/32" diameter, the latter being the size of the hole in the trucks; #43 in the drill plate is the correct size. Be careful when twisting the axletree arms into the drill plate for the final sizing; they break off pretty easily.

With the brackets and axletrees completed, the basic Structure of the carriages can be assembled, again with the aid of a jig. This jig is a wedge of 1/4" thick stock, 21/32" long. It is 5/16" wide at its rear end and 1/4" wide forward. It is glued to a piece of scrapwood as a base, with a piece of 1/32" thick wood glued behind the wide end, cross wise, to elevate the rear axle to keep the carriage level. In use, the rear axletree is laid on the 1/32" spacer behind the wedge and the front axletree is placed in front of it. The axletree notches in the brackets are angled with a razor blade to fit the axletrees, then the brackets are glued to the axletrees, using T-pins to push the brackets firmly against the jig wedge. Reinforce the joints with bamboo dowels, #69 size, the #68 holes drilled from the bottom of each axletree bracket junction up into the bracket.

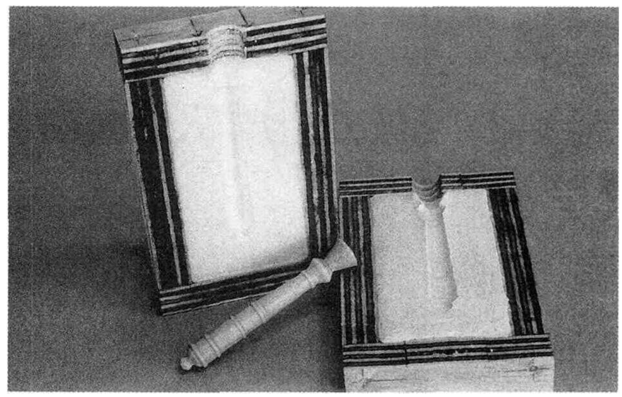
Next the transoms can be cut to fit and glued into place. They are a bit difficult to fit because their tilt requires their bases to be a bit narrower than their tops and because both sides need to have a slight bevel sanded into their edges. Cut the blanks a bit oversize, from 3/32" thick stock, the grain running from side to side. The finished transom should be about 1/4" across the top, 7/32" across the bottom and 9/32" top to bottom. The shallow curve at the top can be cut with a hobby knife and smoothed with *needle* files.

This is a good time to make the stools and bolsters. Glue the latter in place now and let the glue dry, then drill out the stool bolt holes with a #68 drill in a pin vise, straight across the carriage. Cut a short length of 1/32" diameter brass rod to fit through the holes as a temporary support bolt, then fit the notched stools to the bolt. Glue the stool to the bolster, then put a dowel right through the stool and bolster into the rear axletree.

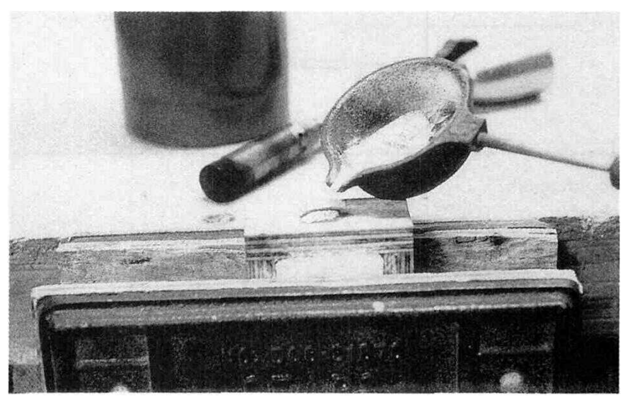
Rather than make all the trucks at once, make up just one set first, as this will be the only remaining adjustment of the vertical height of the gun carriage. Cement a copy of the cannon proper to a piece of cardboard and tape it in place in the wheeled carriage. Try this gun at each of the ports to make sure the height is correct, and if so, mass produce the rest of the trucks. The trucks are made of 3/32" thick stock in the same fashion as were all the disc shaped structures in the previous sections. The axle holes can be done with the



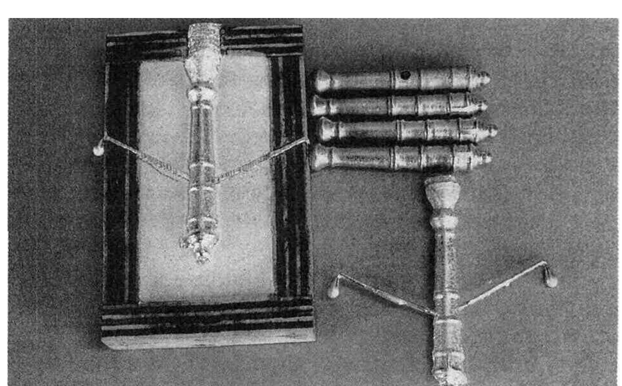
The wooden flask frames after sawing into the upper and lower sections.



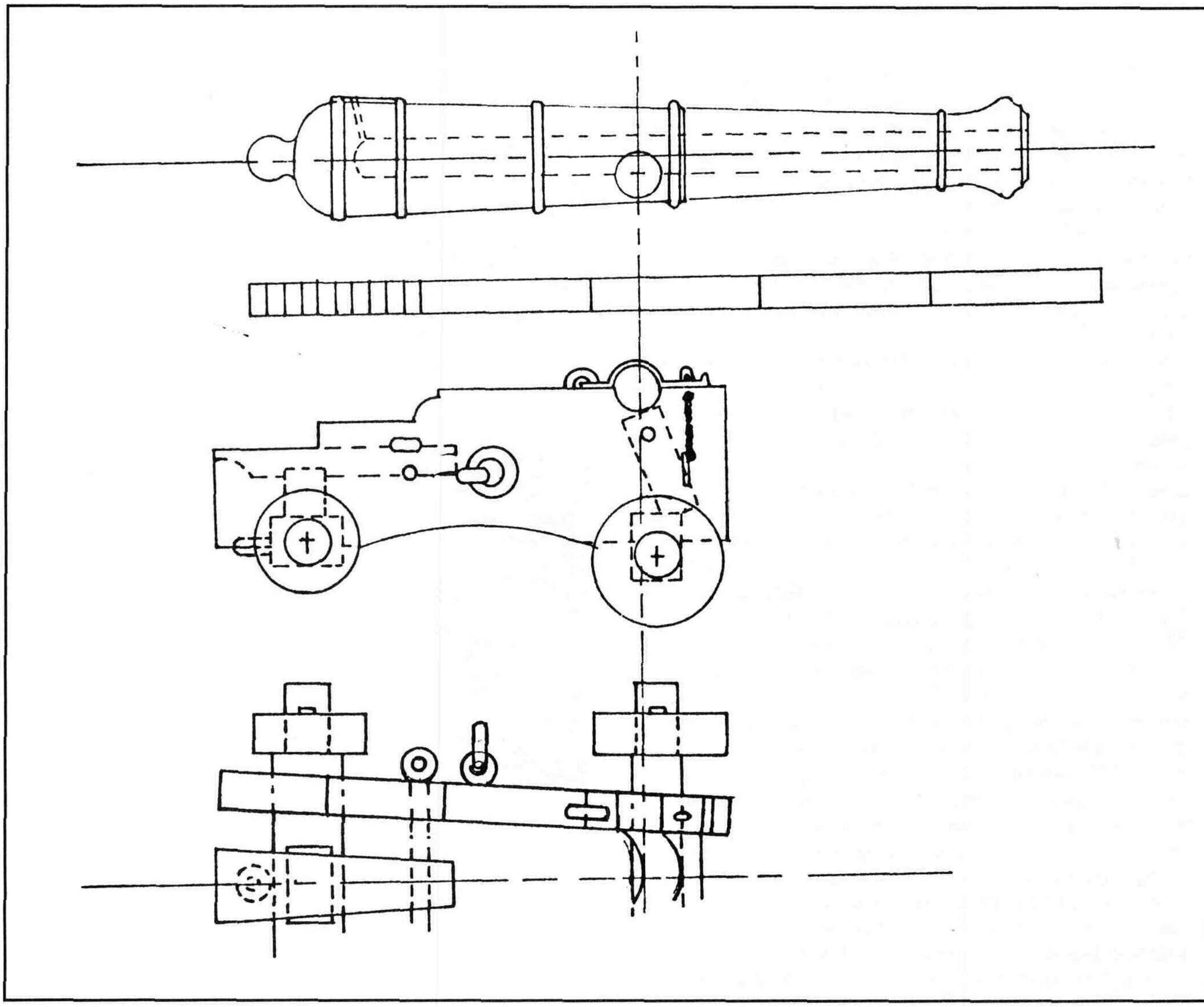
The completed cannon mold. Note how the deadhead at the top of the pattern becomes the pouring funnel in the plaster mold.



Pouring the molten pewter.



The completed cannon castings. The long, thin arms are the sprue or air relief channel vestiges. Cleaned, filed, trimmed and drilled cannon are seen at the right.



Cannon diagram.

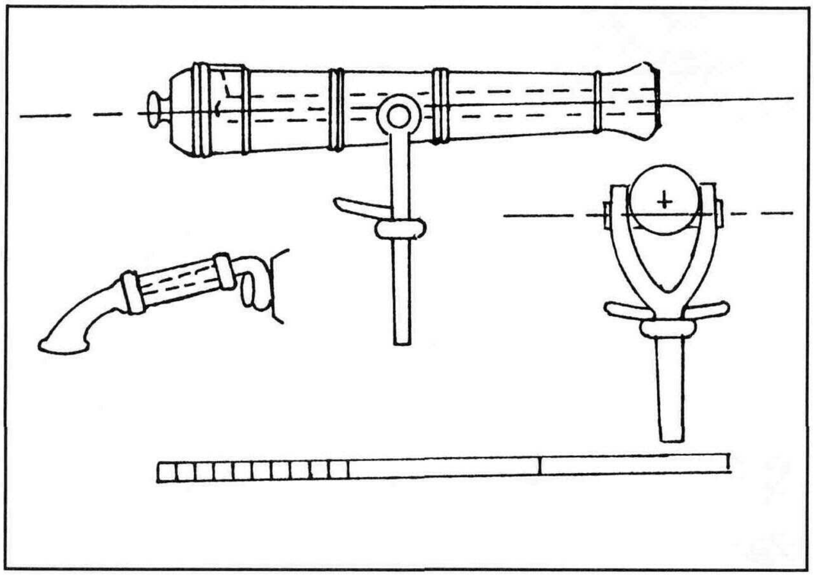
fewest split blanks by holding the truck flat against a piece of softwood in the jaws of a hemostat (across the grain to inhibit splitting) and drilling the hole with a sharp 5/64" diameter drill in a pin vise; a reamer is used to bring the hole to final axle size. Oil finish all the wooden parts.

There are quite a number of metal parts needed for the gun carriages, as was described earlier. Begin by making two dozen retaining pins for the trucks. They are made by hammering flat the heads of brass hobby nails, then filing the resultant irregular shape to resemble the top of a tapered pin. The shaft should be about 1/8" long. They have a standard oxidized finish. Six long bolts are needed to support the stool beds. They are of 1/32" diameter brass rod, cut just long enough to enter the previously drilled holes in the brackets on each side and not fall out; the extra space in the walls of the brackets is needed for fake bolt heads — the heads of brass hobby nails with about 1/32" of shaft left on. The latter are epoxied in place, but will fit and hold better if they have the part of the shaft just below the head flattened with a flat punch (anneal first) — perhaps a hammer tap on large screwdriver — to make the shaft about the same diameter as the hole drilled for the rod.

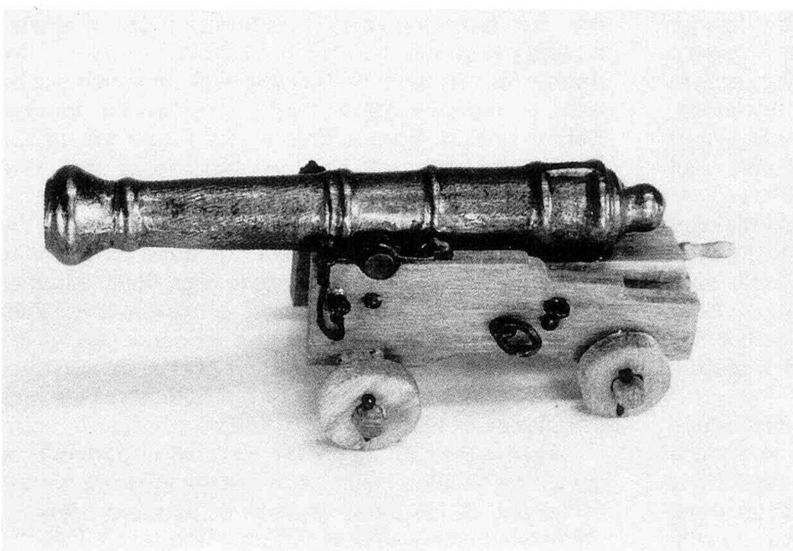
Twelve transom bolts need to be made, also from brass nails cut down to about 5/32" in length. They are oxidized and epoxied into the transom holes in the brackets after extending the latter a bit into the transoms themselves, again with a #74 drill. Be sure to drill at a slightly downward inclining angle to avoid piercing the top of the transom by mistake.

The 30 eyebolts, a two and one-half scale inches in diameter (5/64"), are made by twisting annealed half-inch lengths of 24 gauge brass wire (or annealed rod of a similar size) around a sewing pin held in a vise. The sewing pin is a bit whippy in use, but a T-pin will be too large a diameter. The eyebolts look best if the twisted area just below the eye is flattened with a pair of hobby pliers to disguise the twist. Twelve of the eyebolts need to be converted into ring bolts by the addition of scale 4" diameter (1/8") rings of .031" diameter brass wire or annealed rod. They are formed with needle nose or ring pliers, put through the eye of the bolt, silver soldered shut and oxidized just as you did for the ring bolts in the bulwarks earlier. All of the bolts are then epoxied into their holes in the gun carriages, the latter having been enlarged with a #68 drill to receive them.

The cap squares are made of stock 1/16" wide brass strip, which measures .016" in thickness, a scale



The swivel gun diagram.



A finished gun carriage.

1/2", which is just about perfect. With needle nose pliers, put a bend in the end of a strip 1/8" from the end, bend a half round about 3/32" in diameter, and finish with another 1/8" long flat area. Use a hobby hammer with a brass head to finish the shape of the cap by tapping it over a length of 3/32" diameter brass rod. Drill #66 holes 1/16" from each end, file the free end's rough edges, cut off the piece from the parent stock, and file the remaining rough edges, holding the cap square with surgical forceps to do so.

The hinge bolts, the open eye bolts at the rear of the cap square, and the joint bolts, the pierced vertical bolts at the front, are made next. Both are of 1/32" diameter (.031") brass wire or annealed brass rod. The hinge bolts are bent over very narrow needle nose pliers, with the arch compressed a bit from side-to-side to make it even smaller. They can be made with one long leg (3/16") for a secure purchase, and one short leg (3/32"). The joint bolts are a nuisance to make because one must essentially drill a hole through the rod from side-to-side, a most difficult chore. Probably the easiest way to do this is to slightly flatten the end (the last quarter inch or so) of the wire or rod with a tap from the flat end of a ball pein hammer.

The drill hole site can then be pricked with a T-pin awl, about 3/64" from the end, as a center punch, then drilled with a #75 bit. The drilling is best done with 3/8" of the rod or wire cut off from the parent stock and held in surgical forceps as a drill press vise. Even so, a salvage ratio of only about one in two attempts can be expected. File the head of the bolt round while it's still in the forceps, then cut off the length to 7/32" and file a rounded point on the other end.

The final bit of metal work for the gun carriages consists of making 24 tiny eyebolts. Twelve are to be used as retaining pins for the cap squares (through the joint bolt holes) and 12 to use in the brackets, just under the front of the cap squares, to use to hold the chain or lanyard for the key.

Almost all drawings of larger cannon show small diameter chain used for this purpose, but unless you are able to find (and work with!) chain of scale 1/2" diameter (1/64"), a rope lanyard would probably be a reasonable substitute. Make the eyebolts of .020 brass wire (about 25 gauge), with the leg about 3/64" long and the eye just as small as it can be done, about 3/64" diameter.

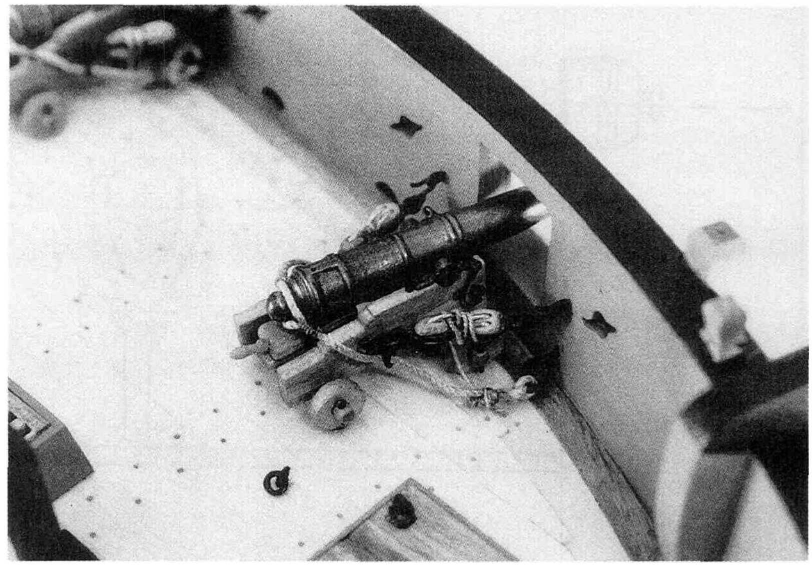
These eyebolts will have no stress on them at all and are small and hard to work with, so failing to solder the joint will not present any future problems.

THE CANNON

If you have chosen to build what was previously described as a Class B model, that is, one supplemented with purchased parts, here's another good place to go to the catalogs and see if you can find britannia metal, brass or other noncorroding cannon castings of the proper size. On the other hand, if a miniature metal-working lathe graces your workshop, you will no doubt opt for turning the cannon from brass rod. The most interesting technique for making cannon, and one not at all unlike the way they were originally made, is casting, the process directions for which follow.

Although out of print, the wonderful pictorial aide to American Revolutionary War era vessels, tactics and gear, *Ships and Seamen of the American Revolution* by Jack Coggins, will guide you through the methodology of cannon casting at the time of the Virginia sloop's construction and will prepare you for doing it yourself. The general process was to prepare a "one off" pattern of clay over a rough mock-up of rope and plaited straw on a central spindle. A metal-edged modeling board or template, cut to the half-shape of the gun barrel, was used to bring the clay pattern to its final form. A mold of the pattern was then made of clay, with appropriate binders mixed in, reinforced with rope and metal hoops. A pouring hopper for molten metal overflow, the deadhead was formed at the muzzle end of the mold. When the mold had fully set, the pattern was carefully broken out and the mold baked until dry. The mold was then positioned in a casting pit near the gate of the furnace and held in place with packed earth.

The molten cast iron was channeled to the deadhead in clay-lined gutters. The cast cannon were allowed to cool for two or three days before removal from the pit and the breaking-up of the mold. The deadhead was cut off, the bore drilled or cleaned-up, depending upon era and location, and the trunnions turned. The casting was fairly rough, and often some turning of the cannon itself was done while it was being bored. The length of gun in the trunnion area could not, of course, be turned; it was finished by hand through filing and chiseling. The final process was the drilling of the touchhole or vent.



A carriage gun mounted on the deck and rigged.

It is most interesting how closely the modeling process duplicates the original manufacture of cannon: you first make a template, then a pattern and then a mold. From the mold you cast the cannon from molten metal (pewter rather than iron, however), then you clean-up the castings with files or turning and bore the piece to finish. Authentic! The only real difference in this technique is that the trunnions will not be cast with the barrels, but rather formed of brass rod inserted into drilled holes in the castings. It's just too difficult to clean up the casting ridges and faults with the trunnion cast in place. One major benefit you have over the full-size cannon casting brethren is that this mold will be in two pieces or flasks and therefore re-useable.

The template is begun by using double-faced tape to stick a half width drawing of the cannon to a piece of .010 thick brass sheet. A fine blade in a jeweler's saw will do to cut out the pattern on the line of the external surface of the cannon. That line is then cleaned up with needle files, with the latter also used to file the astragals and moldings.

The pattern is turned from a 3" length of 3/8" diameter hardwood dowel, using the template as a guide. The 60-second lathe technique can be used, but a bought or borrowed small wood lathe is a real blessing here for accuracy's sake. The only lathe tool needed is a small parting tool; all the fine shaping is done with miniature needle files. A cone is turned on the muzzle end of the gun to receive and guide the poured metal, not unlike the deadhead mentioned above. With the turning completed, and it only takes a few minutes, the cascabel end is cut off (on the workbench) with a razor saw and the flat end filed round. The pattern is finished by waterproofing it with a coat or two of varnish or any other suitable sealer. If left unsealed, it will swell with the moisture of the poured plaster and distort the mold.

The mold is made of scrap 3/8" thick plywood left over from the manufacture of the hull skeleton. Two side pieces 1" wide and 2 ½" long are over-lapped by 2" long top and bottom pieces of the same width. This picture frame-like open box is glued together with waterproof adhesive (epoxy will do fine), a single clamp from top to bottom holding it all in perfect alignment until dry. Reinforce the corners with two 1/16" diameter dowels per corner, leaving enough space between the dowels for the width of the table saw cut which will be used to separate the box into two identical frames. Before sawing, bore a hole in the future top of the frames the same diameter as the top of the cone (deadhead) at the end of the cannon turning (pattern). Also drill 5/64" diameter holes into the edges of the other three sides of the box, not quite all the way through, to use for bamboo pins to align the two frames when pouring the second layer of plaster and when pouring the molten pewter. Use a round burr in the hand grinder to form an undercut pocket on the inner face of each of these three sides of both frames to lock the plaster in place.

Grease the cannon pattern well, with Vaseline® or something similar, making sure that the lubricant doesn't fill up any of the detail grooves or markings. Mix up about two heaping tablespoonfuls of Plaster-Of-Paris,® making a thick but pourable syrup of it. Place the lower frame on a flat surface — a piece of masonite works well — with a sheet of waxed paper beneath it. Pour the plaster, then level the top with the edge of a steel ruler. Push the cannon pattern gently into the plaster, getting the top of the cone as close to the bored hole in the top (now a half-round hole) as possible, and let the plaster set up.

When the plaster is really dry, perhaps after a couple of days in the workshop and a couple of hours in the oven (at the lowest possible setting), gently pry out the pattern. Regrease the pattern, then carefully grease the entire mold, less the cavity for the cannon itself. If you don't take out the pattern, it becomes difficult to grease the mold properly in the area of the cavity, and bits of the top flask casting will tend to break off and stick to it. Push the index pins through the top flask frame and set the top on the bottom frame; push the pins all the way home with pliers or a few gentle hammer taps.

Pour the plaster and let it dry as before. Remove the pins, separate the flasks, and remove the pattern. Cut any spill over plaster out of the pouring hole and trim up any spills on the frames. Any tiny voids can be filled with very thin plaster mix, applied with a paintbrush. The rectangular raised area at the breech through which the touchhole is drilled, the vent field, can be carefully carved into one half of the plaster mold at this time; it is 1/16" wide and as deep as the depth of the ring moldings.

With the molds thoroughly dry, the casting can be done. Just remember that any moisture left in the plaster can turn to steam in contact with the molten metal and crack the mold. Pin the flasks together with the bamboo dowels, only this time cut them flush with the frame. Place the mold in a wood vise to gently press the flasks together and hold the mold upright for pouring at the same time. For the pour itself, no elaborate equipment is needed — a propane torch, a one or two ounce cast iron ladle and an old teaspoon will do it. Any low temperature melting alloy can be used, but the best is probably pewter, as it contains no lead to oxidize into powder, melts at only 450° and chemically oxidizes nicely into gun metal (if not cast iron) black. About a quarter-pound will do all the cannon, swivels and anchors. Pewter can be obtained at do-it-yourself jewelry and lapidary shops and, in one pound bags of pellets, from modelers' mail order supply houses.

Put a little less than a teaspoonful of pewter pellets in the ladle for each individual pour. Heat the bottom of the ladle with the propane torch flame turned up as hot as you can get it. It will only take about three minutes for the ladle to get hot enough to melt the pewter. When it flows freely, the surface will appear dull and gritty, the impurities or dross rising to the surface. Mix gently with a carbon rod (a pencil lead will do) to get all the dross to the surface. The dross needs to be scraped off with a teaspoon and disposed of. When the molten metal is clean and bright, it can be carefully poured into the mold, right to the top of the deadhead. The air passages will fill with molten metal and a little pewter tear drop will form at outer opening.

Let the pour cool for about ten minutes before prying the mold apart with a putty knife. Clip off the sprues, the thin rods of pewter that filled the air relief channels, and saw off the deadheads. Return this metal to the ladle for later pours.

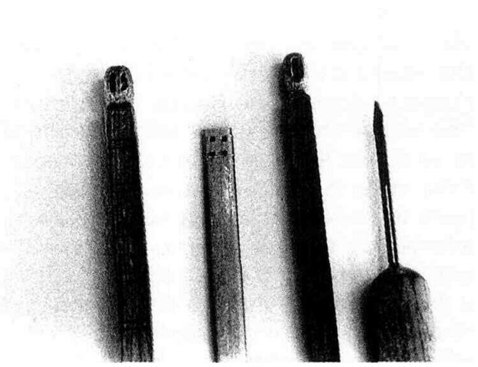
Make an extra cannon or two just in case the bore or trunnion drilling goes awry; the extras can always be melted down when you cast the swivels or anchors. The first order of business in preparing the castings for the carriages is the drilling of the trunnion holes. This is best done before the castings are cleaned up, using the flashings — the flask joint imperfections in the pewter — to help lock the casting in a bed of balsa wood. Press the cannon into a piece of 1/4" or 3/8" thick soft balsa in a vise, being careful not to damage the casting, and a good rotation — inhibiting base for grinding and drilling will be formed. Mark the location of the trunnions on both sides of the casting in pencil. A mark that is 1/16" aft of the molding and 1/16" below the casting flask joint is correct. Make a center-punch dimple with an awl.

Put a small grinding burr in the hand grinder and grind a pocket at the dimple sites. Finish the trunnion holes with first a 1/16" drill, then a 5/64" and finally a 3/32" bit, each held in a pin vise. Drill half the hole depth from each side; use a miniature needle file to make the holes perfectly horizontal before using the final drill size.

Power sand the muzzle end of the cannon to the design length, then mark and centerpunch the exact center. Make a sandwich of two pieces of balsa with the casting as the lunch meat, with the muzzle sticking out, to hold the cannon upright in the drill press vise. Drill the bore with the same three sizes of drills as above, starting with just a dimple with the smaller size. If it appears to be off center, use the grinding burr to enlarge and recenter it, then complete the bore with the larger drills. About 1/2" depth is all that is needed. Drill the touch hole just in front of the base astragal, that is, about 1/3 the length of the touch plate. A #76 drill will be correct.

With miniature needle files and great care, file off the flashing and joint marks from the casting and polish the casting with extra fine steel wool. Working pewter takes a little getting used to for the confirmed wood-worker; it works easily, but feels a bit strange — almost too uniform. If the cannon doesn't come out pretty close to perfect, melt it down and start over. Minor imperfections can be touched-up by carefully soldering over the defect with a low temperature soft solder such as Tix® , then filing down the patch. The trunnions are 7/16" long sections of 3/32" diameter brass rod, glued in place after oxidizing.

As usual, some experimentation with dilutions and immersion times will be necessary for best results of oxidizing the cannon. The best solution (sorry!) in my pewter work was to dip the parts in 50% Win-Ox for a minute or so first, then, after drying, in a full-strength Anchor Tool's® Pewter Oxidizing Solution.

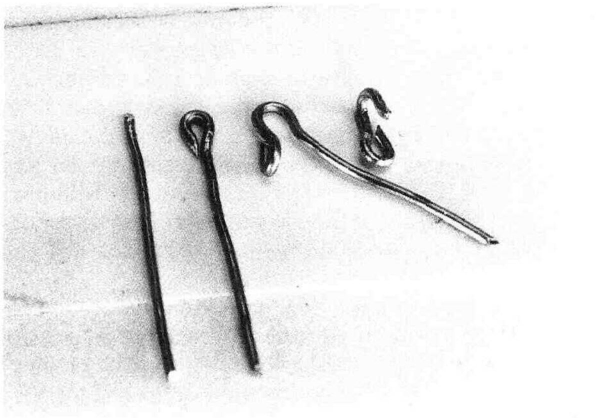


Double and single block making: hole drilling template (the single block template is at the other end) and micro-chisel.

Let it dry under a light bulb, then polish it to its final gun metal gleam with a soft cloth. The usual regimen of cleaning and rinsing is necessary for pewter as it was for brass. Use a minute's immersion in fresh Blacken-It® to match the brass trunnions to the castings.

Carefully position the trunnions in their holes in the cannon, then touch each cannon-trunnion junction, both top and bottom, with gap-filling cyanoacrylate. This will lock the trunnions in place and form a tiny fillet at the junction, just as would have been formed in a one piece casting. Place each gun in its carriage, then cyanoacrylate the cap squares over the trunnions, gluing to the wood of the carriages, but leaving the trunnions free.

Drill right through the holes in the cap squares with a #66 drill deep enough to seat the hinge bolts and joint bolts, then drill another behind the cap squares for the long leg of the hinge bolts. Put these bolts in place with tweezers, then lock them in place with a touch of cyanoacrylate. Tie together pairs of the tiny eyebolts



The steps in hook making.

made *earlier* with scale 1/4" diameter line (.008 — .010"), having dyed the line black previously. The line length between the eyebolts should be about twelve scale inches (3/8 "). Use only a single half-hitch around the eyes, as any other fastening will bulk-up way out of scale. Cut a short free end (bitter end) and secure the knot and the bitter end with a touch of cyanoacrylate. Drill a #76 hole through each gun carriage bracket for the line-securing eyebolt, just in line with the joint bolt above and the transom bolt below. Use the same drill to open up the hole in the joint bolt.

Insert the eyebolts in their respective holes, secure with cyanoacrylate, and drape the line into a natural curve.

As made, the cannon should be tilting slightly upward at the muzzle end when viewed from the side. The device used to depress the muzzle in aiming was the quoin, the wedge-shaped block with a handle aft. The gunners would use a long iron bar under the breech and against the steps in the carriage as fulcrum, then push the quoin in under the breech until the desired angle was achieved. Sometimes quoins were dovetailed into their stools to prevent their sliding out of place. You can see that your accurately made scale cannon really have only a few degrees of elevation or depression possible. Aiming cannon, especially in the pitching and rolling 18th century small vessel, was not an exact science anyway; the limitations mentioned above probably didn't make a whole lot of difference.

The quoin has about the same planar dimensions as the stool, just being about two scale inches (1/16") shorter. It is made of 3/32" thick stock. The quoin tapers in the vertical plane also, being the full 3/32" thick at the rear, but only 1/32" thick forward. A five scale inch long handle (5/32") is fitted to the rear face; it is made by turning 1/16" diameter cherry stock with files and a parting tool in the chuck of the hand grinder. Epoxy the quoins in place, using adhesive both top and bottom to lock the quoin and the breech in place.

The guns can now be mounted. The Virginia sloop is described as a six gun vessel, but it has eight ports. This probably means that the most forward and aft ports were used for the last pair of guns as battle conditions indicated, the forward ports when the cannon were used as bow chasers and the aft ports for broadsides. In the latter condition, the pump handles would be unshipped; since you choose to show them in place, you will mount the cannon in the first three pair of ports. The cannon are mounted by means of cut-off brass nails epoxied into holes drilled in the bottom of diagonally opposite carriage wheels.

The nails are then used to locate the carriages at the ports and mark the deck for drilling. They are then epoxy coated and the wheels pressed to the deck.

RIGGING THE GUNS

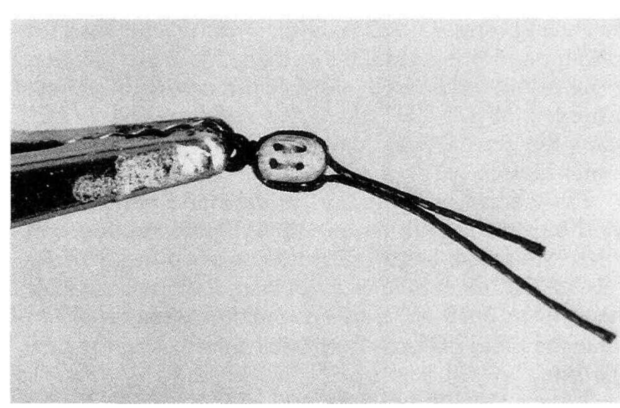
Not even semantically straightforward (the train tackles do not do the gun training and the gun tackles are generally not gun tackles but rather luff tackles), the rigging of the guns requires a bit of research and planning. All of the block dimensions devolve from the dimensions of the ropes used in the tackles. The block and breeching rope sizes themselves were no doubt derived from trial-and-error observation over the centuries. A good source for this data is the *Artillerist Companion of 1809,* by Louis de Tousard, as reproduced in Ship *Modeler's Shop Notes.*

The breeching, the shock absorber of the cannon, is simple — 3.20" in circumference and 2 3/4 fathoms long for a 3 pounder.

The tackles used to train the guns, that is, skew it from side to side, are not called train tackles, but rather gun tackles. To make matters even more confusing, they really are luff tackles, because they are comprised of a single and a double block; a gun tackle classically is comprised of two single blocks. You will follow custom rather than technical accuracy however, and call them gun tackles. Tousard gives the tackle rope dimensions as 1.60 inches in circumference and six fathoms in length. To make matters in this gun-rigging business even more annoying, these tackles require a good deal of modeling time, and in a vessel this small, were probably used more as simple lashings than tackles, as there is just no place for the guns to go inboard to require hauling them back out again! The train tackle is the luff tackle (single and double) at the rear axle of the carriage which hooks into the eyebolt on deck and is used to haul larger vessel guns inboard for loading and to prevent the gun from running itself out when the ship rolled. Again, in a vessel as small as the Virginia sloop, the guns will not come far enough inboard to permit such loading.

They were loaded by having crew lean over the side to do the work. Furthermore, the small distance between the train eyebolt in the gun carriage and the deck eyebolt, even with the gun run all the way out, really isn't great enough for any kind of tackle; a simple lashing was probably used.

Blocks for any use are dimensioned relative to the diameter of the rope they served. The formula can be



Stropping a double block.

found in Steel's *Mastmaking, Sailmaking and Rigging,* in the Lees text or in Ship *Modeler's Shop Notes.* The 1.60" circumference rope converts to about half inch diameter (.51"). The blockmaking rules, for future reference, together with the derived dimensions for the gun tackle blocks for the 3 pounders are as follows:

Sheave thickness: 1.1 x rope diameter. .0.56"
Sheave diameter: 5 x sheave thickness. .2.81"
Sheave hole: thickness of sheave + 1/16". 0.57"
Pin diameter: same as sheave thickness.0.56"
Width of block: 6 x thickness of sheave.3.36"
Length of block: 8 x sheave hole diameter. 4.56"
Thickness of block: 1/2 length. . . . . . . .2.28"
Double block middle partition: 1/6 less
than sheave hole diameter. . . . . . . .0.48"

You will need 12 singles and 12 doubles made to the above dimensions. This is another good place for the Class B modeler to head again for the catalogs, as some nice blocks are available commercially, especially those cast in britannia metal. All purists please march off to the workshop again for further instructions. Note that all 12 of each size are laid out on a single stick or blank, drilled, partially finished, cut off and completed. Please be aware that blocks can fly; they reach orbital terminal velocity just as they are sawed off from the parent stick and often are never found again, having disappeared into the anti-matter universe. A piece of double-faced tape at the end of the sawing board and a finger over the block will help.

Make the blanks a bit oversize to allow for the usual loss of thickness and breadth in the manufacturing and finishing process. Cherry does nicely for the material. Cut two six inch blanks, one 3/32" x 1/8" for the singles and one 1/8" square for the doubles. Mark off blocks five scale inches long (5/32") on two adjacent faces of each blank, leaving a 1/32" space for the separating saw cut between each pair.

The process of block making described here is not unlike the contemporary process for making small blocks, carving them out of solid stock rather than building them up in layers. The sheaves, however, are not working (no one will ever know), but rather are carved into the blank between pairs of drilled holes which serve both as the inside of the shell of the block and the groove in the sheave. The completed blocks look authentic, at least they do if the holes are properly aligned and spaced, another job for a template.

Grind or file one end of a three or four inch length of 1/8" wide brass strip to a width of 3/32". Carefully lay out the thickness face of a single block on the narrow end and a double block on the full width end. The centerpunch marks for the drill should be 3/64" from the ends of the template for both sizes.

They are, of course, down the centerline for the singles and on the lines dividing the doubles into thirds. Drill with a #74 to #76 bit. The size isn't critical, it just needs to be big enough to admit the tip of a sewing pin to mark the blanks.

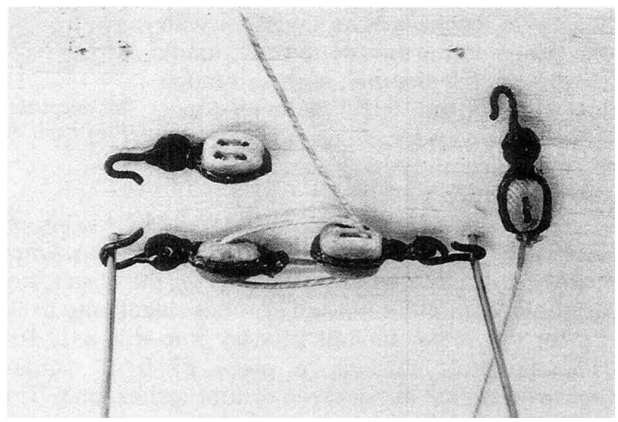
Score the breadth faces of the blanks with the tip of an awl along the vertical centerline to locate the stropping groove.

Drill the holes for the block at the end of each blank, using a #76 drill and a jig to hold the stick at right angles to the drill press table. A piece of left over plywood with a 1/8" square fence glued to one of its long side edges will serve nicely. Score the sides of the sheave slot, the straight line between the sides of the holes, with a #11 hobby knife blade, then recess the area about 1/64" deep.

Finish the sheave by rounding the recess into the holes. A purpose made chisel, formed by epoxying a T-pin into a length of dowel and grinding the cut off end of the pin to chisel shape and the appropriate width, is the tool of choice. Ream the holes lightly to assure easy penetration of the miniature rope.

Shape the block with knife, files and fine sandpaper, then cut it from the blank with a jeweler's saw. Hold the block with surgical forceps (with the teeth ground off) and shape the sawed-off end. Finish the stropping groove with miniature files and sandpaper. Lightly power sand the end of the blank square, and move on to the next block.

As made, the blocks should accommodate



Making up the gun *tackles.*

commercially available .016 or .018 diameter linen line; the former is more technically correct, the latter looks better. As sheave holes always seem to deliberately trap the correct size of line, do try out the line you intend to use on the first block completed and make whatever hole size adjustments seem necessary. The prime rigging trick is to make a needle of the end of any line that needs to be reeved, that is, run through any aperture. This is done by painting the last quarter inch or so of the line with cyanoacrylate and then, when dry, cutting the end to a point in two planes.

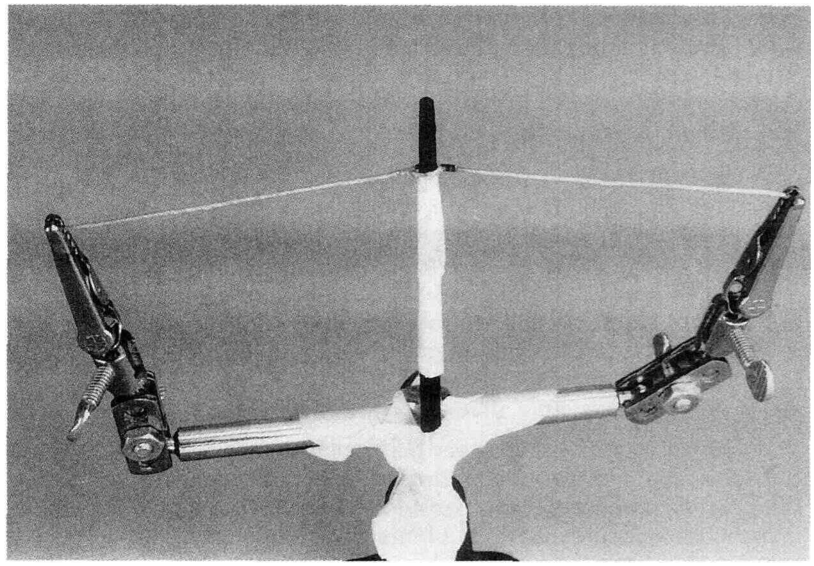
Each block will need two hooks. These hooks are fairly easily made of 26 gauge brass wire (or 1/64" diameter) annealed. It is however, difficult to keep the hooks within the putative scale five inch length of the originals, even with filed down needle nose pliers. The eyes of the hooks actually have to be made a bit over-size to take the thimble and rope, the combined assembly bulking up beyond scale size even when scale components are used; doesn't make sense, but it does happen!

Experiment a bit until you can get the total length to not more than 3/16"; 5/32" is, of course, perfect.

Begin by power sanding or filing a short bevel on the end of a one inch length of the wire, then, with *needle* nose pliers, bend an eye in the wire with the bevel inward. Doing so will create a closed joint between the end of the wire and its mating surface. The eye should be about 1/16" inside diameter.

Bend the wire backwards a few degrees from the plane of the eye, then form the hook in the opposite direction, making it just as small as you can. Bend the end of this loop (about the level of the top of the eye) sharply outward, then form a short lip on the end of the hook by cutting off this outward bend with diagonal cutters and filing smooth. Twenty-four hooks need to be made for this section; they can all be oxidized together.

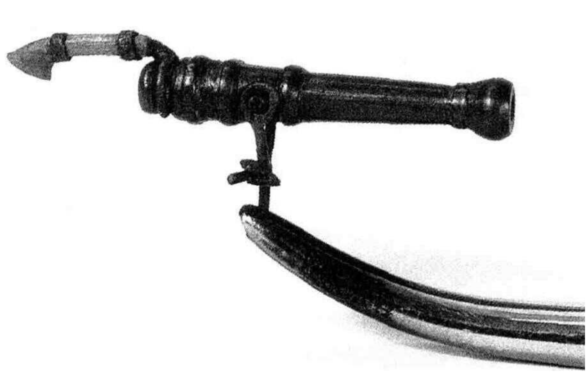
Making thimbles this small, with an inside scale diameter of under an inch, is a special problem. If you are able to find small outside diameter brass or copper tubing, say 1/32" or 3/64", the tubing can be filed to a half-round gutter cross section, annealed, and the round thimble formed with the filed down needle nosed pliers. Tubing that is 1/16" diameter is too large, as the bending of the gutter, backwards as it were — with the groove to the outside, actually tends to open up the channel, making it much too wide for the .018" diameter rope. Metal lathe owners will want to turn the thimbles from 1/16" diameter brass tubing.



Making a cut splice for the breeching. A paint brush handle is taped to centerpiece of a third hand device.

A satisfactory thimble can be made by sawing off 1/16" segments of 1/16" diameter brass tubing. Once cyanoacrylated into the stropping line, the absence of a groove cannot be noticed. A convenient way to jig up for this rather tedious process is to drill a 1/16" diameter hole through a piece of 3/4" square hardwood, itself about three or four inches long. The tubing is pushed through the hole just proud of the surface and the end filed flat and flush. A 3/64" diameter grinder burr in a pin vise (a drill bit could be used) is twirled against the end of the tubing, rounding the hard inside edge of the cut off to a shape not unlike that seen in a real thimble. The tubing is then advanced so that a full 1/16" protrudes, using a piece of planking stock as a depth gauge. The stick is held in the vise and a jeweler's saw used to cut off the thimble. Keep a finger over the end of the tubing to avoid loss. A 1/32" deep, 1/16" diameter hole is drilled in another small piece of hardwood. The cut off segment is pushed into the hole, rough side up, and is filed flat and level with the surface of the wood. The thimble is then held in a pair of forceps, flat side up, so the grinding burr can be used to round off the inner edge. Twenty-four take forever.

The thimbles are oxidized a bit differently than other brass parts because the rim needs to stay bright so that the cyanoacrylate will not peel off the oxide film when gluing up the stropping. Merely touching the hole with a small paint brush laden with undiluted Blacken-It will do the job.



A completed swivel gun.

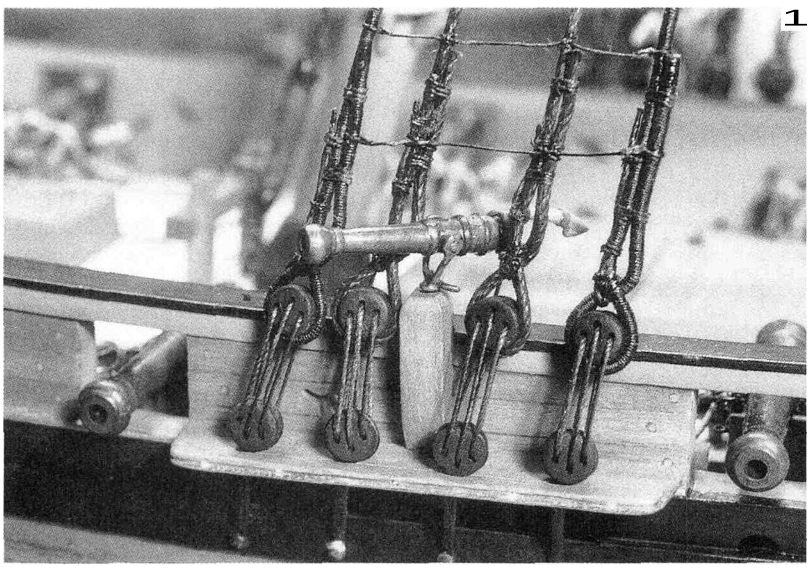
Stropping the blocks will require about four feet of linen line, the diameter of which should be about 12% greater than the size chosen for the tackles (calculated from the tables in Steel). If .018" line is used for the tackle fall, then the stropping should be .020" in diameter. The line can be dyed black by trapping it between a permanent black felt tip marking pen and a wax paper covered hard surface. Two or three tries may be needed to do a complete job. Cut the black line into two inch lengths with a sharp razor blade. The process of gluing the line around the thimbles can be made easier by using a waxed pin to stick the thimble to a piece of softwood, freeing both hands for the glue application and pinching necessary to secure the line.

With the thimble glued in place, secure it in one of the clips of a third hand device. Using black-dyed .008" diameter linen line, tie a half-hitch up around the stropping, as close to the thimble as possible. Lock it in place with cyanoacrylate, then cut off the ends closely with a sharp razor blade. The single half-hitch is not the actual practice procedure (see the plates from Lever), but the proper round seizing and riding turns lengthen the assembly unacceptably, and the length of the blocks with their fittings will be a close fit from carriage to bulwark as it is.

Streak some cyanoacrylate along the inside of the two legs coming from the bound thimble and along the top and side stropping grooves of one of the double blocks. Quickly push the block up as close to the thimble as possible, trapping the line around the arse end of the block with your fingers. When the glue is dry, cyanoacrylate one leg over the end of the block, cut it off at the middle, and fit and glue the other leg in a butt joint. All the double blocks are so done; the only difference for the singles is that the stropping must be over lapped at the arse end because the tackle fall will be seized around it. (The contemporary practice was probably to seize the fall to a becket, a non-thimble bearing loop at the end of the block, but the seizing around the stropping you will do looks much like the original practice and again avoids lengthening of the entire assembly).

This fake splice is accomplished by gluing down the first leg all the way across the end of the block, then cutting the top surface at a slant. The other leg is first stiffened with cyanoacrylate, then its undersurface is cut to a matching taper and then glued down. The joint bunches up just enough to look like a real splice. The blocks are completed by the fitting of the hooks. Any bare spots on the metal parts can be touched up with Military Black paint, using a 3/0 brush.

Rig pairs of single and double blocks into tackles now, using a six inch length of .018" diameter linen line for the fall. To do so, drill a #76 hole under the splice at the end of each single block, drilling half from each side; clear out the debris with a reamer. Dye about three feet of the linen line a light brown color for the fall stock. This can be easily accomplished by opening up a brown felt tip permanent marker to get the dye containing foam insert. Soak the latter in a baby food jar (or the equivalent) half full of lacquer thinner, then remove the insert and discard it. Test the dye on a scrap of linen until you get the proper tan color of new sisal running rigging. The relative amounts of ink and thinner rather than the duration of immersion determine the final color of the line.



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A mounted swivel gun.

Use cyanoacrylate to make integral needles of each end of the fall. Run the line through the hole under the stropping of the single block, tie off with a half-hitch, and glue. This is not an actual practice fastening again, but it will be entirely covered by the usual wrapping of the free end of the fall around the standing parts and is necessary to keep the tackles short enough.

Run the free end of the fall successively through one hole of the double block, the single block, and back through the double. Use a pair of pins stuck in a soft-wood block to measure the tackle against, keeping each about an inch long overall. The final length will be determined "in situ", that is, right on the model.

Do not mount the tackles just yet, as the breeching needs to be made and installed first, and it's hard enough to tie off even with no tackles in place.

The breeching is scale one inch diameter (.032") line, similarly dyed tan. The length will be less than scale contemporary practice as found in the charts, again because this ship is so small. There would have been little room for the cannon to move backwards in recoil, so the breeching could not have had much slack in it, just enough to perform its shock absorbing function. Six 5" lengths of linen line will be needed for the model, which will produce just enough slack for the breeching to touch the deck in its course to the bulwarks. Seize the ends with three or four turns of .008" line, then clamp each length in the jaws of the third hand and mark the center with a tiny piece of tape. Seizing, by the way, will be done the same way throughout this modeling project: half-hitch the seizing line around the line or splice to be seized, lock it in place with the thin kind of cyanoacrylate, then run three or four additional turns around the line or splice and lock that up with cyanoacrylate; cut off the remaining free ends to finish.

To make the cut splice, cut a half-inch length of the .032" line, flatten the ends with pliers, then cyanoacrylate (the thin kind) the flats to either side of the center of the line. When the cyanoacrylate has set, but before it hardens into plastic, trim the flaring parts of the flat off and trim the remaining bumps into a smooth continuous junction. The proper time to trim is about fifteen minutes after gluing. Seize the junction on each side with the smaller diameter line, using a vertical dowel (a small paint brush handle taped to the vertical post of the third hand works fine) to define and maintain the loop that goes over the button at the end of the cannon cascabel. Presto — a neat (but fake) cut splice.

Various hitches were used to secure the breeching to the bulwark ring bolts, the larger the circumference of the rope, the simpler the hitch. Often the rope was passed through the ring, crossed over the standing part, where it was seized, then the bitter end seized to the standing part a bit farther along. For the Virginia sloop, with its smaller size breeching, a simple half-hitch through the ring was chosen, with the bitter end seized to the standing part. The seizing is easier to do if a drop of cyanoacrylate is used to secure the junction of the two parts of the breeching first.

Once all the breechings have been fitted, the side tackles can be hooked in place. Tackles are shown in literature both with the double block on the carriage and at the bulwark.

Although the former is more commonly seen, the latter makes more sense, especially in the cramped quarters of a small vessel's deck. As you will have noticed, the hauling end of the tackle fall comes from the double block. With the double at the bulwark, the hauling end of the tackle leads from the bulwark, so the gun crewman can move along the length of the gun as well as fore-and-aft, permitting a good deal of maneuverability. With the double on the carriage, the gun crewman must jam right up against the bulwark to haul; not handy. The tackles should fit inside the breeching at the gun carriage brackets.

The tackles, which were hooked in place in a slack condition, can now have their falls tightened up. The free end is secured with a half-hitch around the carriage end of the tackle, the free end of which is bent backwards over the half-hitch loop and wrapped around the segments of rope between the block like a large scale seizing. The bitter end is tucked under one of the spaces formed by the fall entering a sheave in the bulwark block. It is secured with cyanoacrylate, the free end just falling to the deck. When all the tackles have been installed, bring out the 3/0 brush and black paint again and touch up all the denuded rings, bolts, thimbles and hooks.

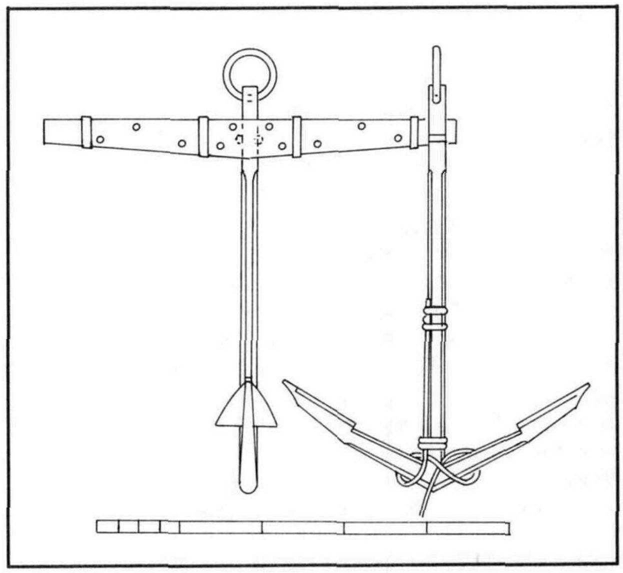
THE SWIVELS

The pedestal gun barrels are made in just the same fashion as the cannon — brass pattern, turned wooden dummy, plaster mold, pewter castings. Six need to be made, bored, fitted with trunions and oxidized. The bore is .052" — a #55 drill. The trunnions should be the same diameter as the bore, but 3/64" brass rod is a little too small and 1/16" is a bit too large. I opted for the 3/64" stuff, using a #56 drill for the holes. One layer of the balsa clamp used to drill the bore, by the way, makes a nice bed for drilling the bore; just hold the cannon in place by laying down a strip of double-faced tape and forcing the barrel down into the already present mould. Narrow strips of duct tape around the gun and the balsa add to the security.

The cannon and trunnions are oxidized in the usual way, then the trunnions are cyanoacrylated in place. The yoke in which the gun barrel is suspended is made from .031" diameter annealed brass wire. A piece 7/8" long, with squared ends, will turn out to be just the right length. Silver solder a 1" length of the same wire or 3/64" diameter rod to the center of the wire segment to form a T. Bend the wire into its U shaped yoke, then slip a small brass washer over the vertical rod to the bottom of the yoke and solder in place; a 1/4" length of the same wire, for the aiming quadrant, needs to be soldered on top of the washer. Form an eye on the end of each upright of the yoke with needle nose pliers, then solder the gap closed. File everything so that it's nice and smooth and even, then oxidize first with fresh Blacken-It and then with 50% Win-Ox. This dual process will fairly evenly oxidize both the solder and the brass.

For the gunstocks, begin with the metal yoke that snaps over the button on the cascabel. It is made of .031" diameter brass wire. Begin by forming a 3/32" diameter loop at the end of a length of wire, then silver solder the gap where it touches the main length of wire; the latter will become the shaft of the yoke. Bend the loop at a 90° angle to the shaft, then cut the latter off, 3/16" long, and taper the end. Directly opposite the shaft, cut the loop with diagonal pliers, spread the ends apart and file the cut ends to a smooth, rounded shape. This cut loop will have to eventually snap over the depression forward of the button. Oxidize the yokes with full strength Blacken-It.

The wooden part of the stock looks just like the stock of an old flintlock pistol. Make a pattern of shim brass to trace on a piece of 1/8" thick cherry. Line up the muzzle ends along the edge, then drill all the holes for the yokes at one time, a #68 drill. Use a jeweler's saw to cut out the blanks, leaving a stick of wood about an inch long attached to the butt for a woodworker's finger hold. Shape the wooden stocks with hobby knives, files and fine sandpaper. Fit the yokes to the stocks, then cyanoacrylate in place. Make the



The anchor diagram.

re-enforcing bands of 1/32" wide strips of bond paper painted metal black. Use cyanoacrylate to glue them in place in the two sites shown on the swivel plan. Finally, fit each stock to a gun barrel, clamping them into the groove with needle nose pliers, then locking them with cyanoacrylate. Touch up any bare spots on the metal with the same paint used on the bands. Fit each swivel to a post on the model.

ANCHORS AND THEIR GEAR RESEARCH DATA

The data available for the manufacture of anchors for small vessels is even more limited than that for small cannon. There are a few guides that can be found. First off, for fairly obvious reasons, the total length of the anchor would not be much greater than the distance from the cathead to the waterline. You have about 6' on the Virginia sloop; allowing for the block and ring, an anchor with a 5' shank was designed.

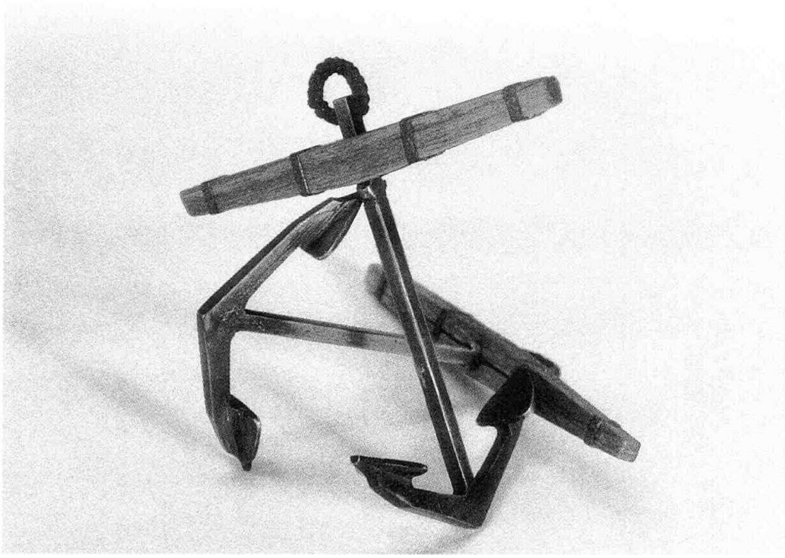
A variety of formula for the weight of anchors is hidden away in the literature, probably the most reliable of which are found in the Harland-Myers Seamanship in *the Age of Sail* and Lavery's *The Arming and Fitting of English Ships of War*, from which an educated guess can be made. The standard unit of anchor weight was the Cwt, or hundred-weight, and the hundred-weight was 112 pounds, at least in England and thus probably in colonial America. By the turn of the century, the cwt was an even one hundred pounds in America and thus there was a short ton at home and a long ton of 2240 pounds abroad. Thus problems arise even at this level, as the tonnage of ships is variously described and variously measured.

The weight determined to be correct for the Virginia sloop anchor (about 234 pounds) was taken from the average of three different formulas derived from the above-mentioned sources:

1. Merchantmen rule: weight of anchor in Cwts = tonnage divided by 20 (42/20 x 112 = 235.2).

2. Dutch rule for small vessels: three kg. of anchor weight per ton of vessel weight (3 x 2.2 x 42 = 277.2).

3. Mainwaring (1625) rule: weight of a ship's largest anchor = 1/500 of her tonnage (1/500 x 42 x 2240 = 188.2).



The Admiralty style anchors for the Virginia sloop.

To get from the calculated weight to the dimension of the iron stock used in the manufacture of the anchor, you use data derived from Davis' *The Built-Up Ship Model.* He states that iron weighs 450 pounds per cubic foot. It is known that the anchor needs to weigh about half that. With a little trial and error you find that three inch square iron will do; that comes to nine square inches in cross section, or .0625 square feet. You need about eight and a half linear feet of iron for the shanks and flukes. Eight and a half times .0625 times the weight of iron gives an anchor weight of approximately 239 pounds — pretty darn close.

The basic form of the wood stocked Admiralty pattern anchor of the 18th century was fairly well standardized. Its general characteristic was the long iron shank, to which fluke-bearing arms were welded. The arms met the shank at the crown.

The anchor was suspended from an iron ring and made functional by a long wooden stock, at right angles to the plane of the arms. The latter design more or less forced the arms into the vertical plane and thus one of the flukes into the seabed for proper holding power.

The other dimensions of the anchor were typically derived from the length of the shank, the stock being about the same length, the combined length of the arms a bit shorter, the ring diameter 1/7 the length, etc. The two timbers that made up the stock were separated at their middles by a gap, to give the hoops which held them together some holding power as they were forced towards the shank.

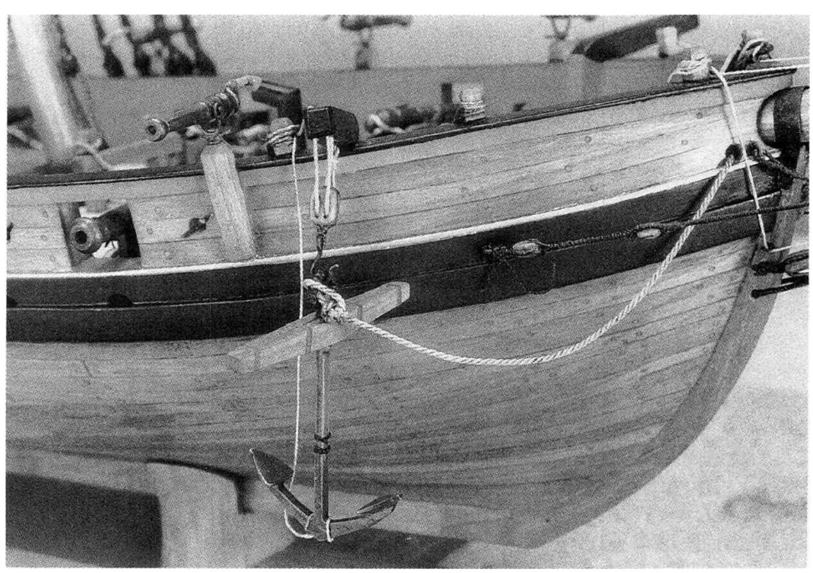
Larger stocks were also fastened together with bolts near the center and treenails farther out. The ring was covered with an anti-chafing binding of rope called puddening. An anchor buoy, described by Lever as a cask-like float on a long line, was fastened to the arms of the anchor with a clove hitch, the free or bitter end being lashed to the shank. Most of the details should be clear from the large scale[1] drawing (if not from the plan detail) and from the engraving from Lever.

MODELNG THE ANCHORS AND THEIR TACKLE

Begin by scaling up (from the plans) or down (from the full-size drawing) to the final scale of 3/8" = 1'. At this scale, the shank pattern is a 1 7/8" length of 3/32" square hardwood. The arms are shaped from 3/32" x 1/8" hardwood, 27/32" long. Epoxy the arms to the shank, taking special care to get the angle just right and to get perfect side-to-side symmetry. Do not cut the chamfers on the pattern — they just don't transfer well in the plaster medium and are best filed off the casting itself. Varnish and grease the pattern as was done with the cannon pattern. Make a mold frame for plaster casting again as you did for the cannon and make three anchor castings, the third as a spare in case of mistakes.

The wooden stocks are made of 3/32" thick cherry, the blanks a bit oversize for finishing at 2" long and 1/4" wide. Saw and plane to shape, then cut the notch on the inner surface of each piece for the anchor shank. The notch should be just under one-half of the anchor stock thickness. This leaves a small gap at the shank when the two halves of the stock are glued together, which is authentic. The compression thus formed when the hoops were forced on, acted as a sort of a spring device to keep everything securely in place. Use yellow glue for the stock, then a touch of cyanoacrylate to lock the shank to the stock. The bolts can be made of short lengths of brass wire epoxied in place or can be indicated by felt pen dots before oiling the stock. My test strip looked like it had the measles with all the dots, so I left them off altogether. The bands are made of black painted paper strips, as you did for the swivel gun stocks.

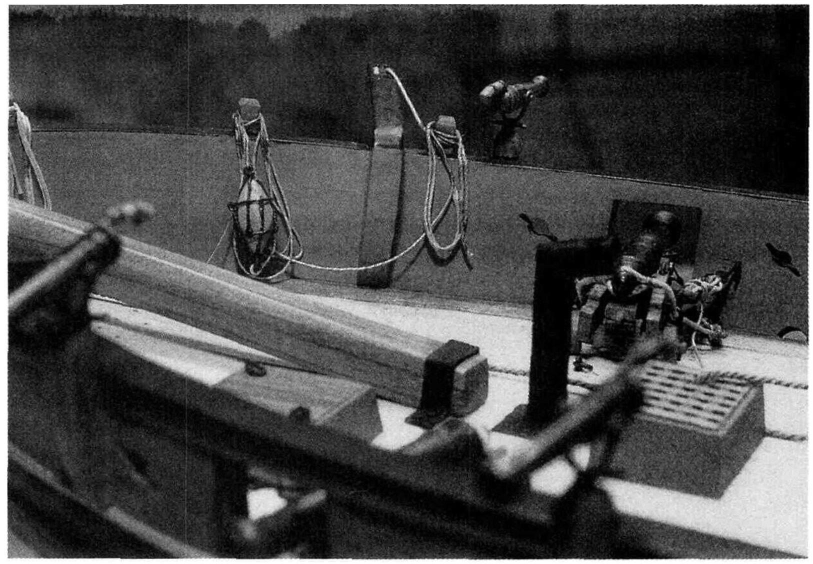
The rings are made of scale 1" diameter brass wire (.031"), formed into a scale 8" diameter loop (1/4") and oxidized. The ends of the ring are fitted into the holes in the anchor shank, then the ring is wrapped with black .020" diameter line to represent puddening.



The starboard anchor, fully rigged.

The anchor rope is made cable-laid, that is, with a left-handed twist, as you did for the fore stay. The merchant ship charts in Steel call for a 5 1/2" circumference rope (1.75" diameter), which comes to .054" diameter at this scale. Three strands of .025" linen in the rope walk will bring out a rope of about .050" diameter, which is about as close as you can get using standard linen line sizes. The rope, being lightly tarred, would probably be a dark brown in color.

The rope is fixed to the ring with an inside clinch, as shown in the Lever plate. In an inside clinch, the rope is passed through the ring, then wound around its own standing part three times. All the winding loops are below the cross-over, hence the designation inside clinch. The windings are seized to each other with light line in conventional practice, rather difficult to do on the model. If you just use a drop of cyanoacrylate at the top and bottom of the windings, they will be nicely secured. Then make up your seizings on a dummy consisting of two short lengths of 3/32" diameter brass rod or tubing, the tubing substituting for the rope. Use three turns around the pair of tubes, then a single turn between the tubes all the way around the three. Saturate the seizing with cyanoacrylate to turn it into plastic, then cut it off the tubing and trim it to fit on the anchor rope. Two seizings per anchor will do; it looks authentic.



The anchor buoy and its rigging.

The anchor buoys, originally made of cork or wood, can here be carved or turned from 1/4" diameter cherry. They should be about a scale 14" long (7/16"), sanded and oiled. The rope retainer for the buoy, with loops above for a pendant and below for the rope to the anchor, can be made as shown in the accompanying Lever plate. Two 1 1/4" lengths of black line of about .016" diameter can be tied around a T-pin held in a third hand device, then secured with a loop of glued .008" line. Each of the four legs is then cut off 9/16" long (make a dummy line first to get the length just right). The end of each leg is flattened with needle nose pliers, then bent back upon itself over a T-pin to form a loop, and the loop cyanoacrylated. The surplus flat line is trimmed away with a razor blade. Two such fittings are made for each buoy.

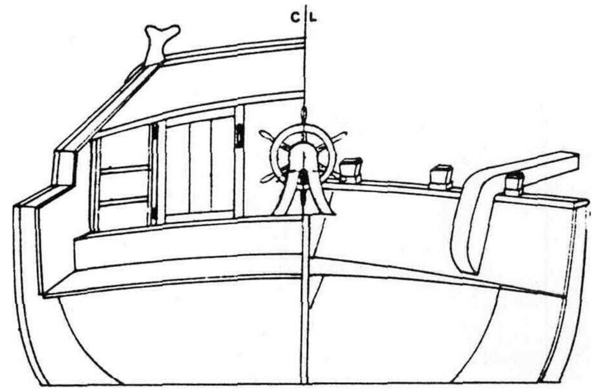
A drop of cyanoacrylate is touched to the top of the buoy and the buoy is then pushed up into the apex of the rope fitting. With both fittings in place on the buoy, two rings of the same size line are run through the loops to complete the retainer, the free ends seized together to finish it up. A 5" length of tan .008" line is seized to one end loop of the retainer as a painter; an 18" length of dark brown .016" line is seized to the bottom loop as the anchor line. The latter is clove hitched around the arms of the anchor, the bitter end being seized to the shank about half way up. A touch of cyanoacrylate will be needed to keep the clove hitch secure.

The blocks that hang from the cathead sheaves to suspend the anchor are hooked double blocks for .019" diameter line. These catblocks are made, stropped and fitted with hooks just the way the hooked blocks for the cannon tackle were. The tackle fall is stained light brown before seizing to an eyebolt, the latter being glued into a hole drilled in the underside of the cathead, just behind the foremost sheave slot. The line is then rove through the block and the cathead twice, to tie off around the third (last) timberhead. It's best to secure the line with a bit of cyanoacrylate, then form a coil of line separately, off the model, and fit it in place.

The anchor can then be hung from the catblock hook. The cable is run through the hawse hole in the bow, around the upright and projection end of the foremast bits, then down into the hull through one of the openings in the foredeck grating. There was great variation in anchor cable disposition in these little vessels where man power replaced capstan power and stowage space was precious. In a large vessel, the cable would have gone below via the main hatch, but I have opted for a less frivolous use of space for the Virginia sloop. Of course, the cable need not be attached at all. It was often removed from the anchor when at sea. The anchor could be hoisted up to the gunnels and tied to a timberhead. In this case, swinging the anchor forward rather than aft to tie it up makes more sense, as so doing avoids the pedestal gun just aft of the last timberhead. One anchor up and one suspended looks nice.

The anchor buoy line seems to be best handled by running it up to the third timberhead and tying it off, then running it below the inboard leg of the cathead to wrap around the second timberhead, where a coil is formed to fit over the timberhead. The buoy itself is suspended from the same timberhead by its painter.

CHAPTER 6



MASTS AND SPARS

A total of only eight mast sections and spars need to be made for the Virginia sloop, a rather remarkably benign process compared even with the limited number needed in a simple brig, much less a ship-rigged vessel. The brig FAIR AMERICAN, for example, has 21 basic mast and spar units, eight studding sail yards and six spars on the gallows, a total of 35.

Such a project turns almost into ones life's work. You are indeed lucky to get such a beautiful and aggressive-looking rig out of so few components. Before you get on with the spars, however, it's time to replace the old faithful building jig with the model's permanent stand.

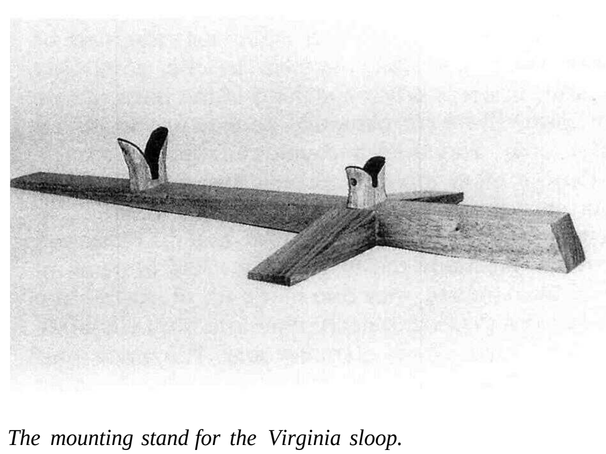
THE STAND

The design of the stand is a subjective preference rather than an absolute design requirement; the choices are varied. The conventional stand most commonly seen consists of brass pedestals on a hardwood plaque type of base. The pedestals can be purchased from any of the model supply houses; a base large enough for this model can occasionally be found in the catalogs, but will most likely have to be shop made. The stand shown here is a stylized suggestion of the contemporary building slip with groundways, slanting aft to facilitate launching. Cruciate in form, the lateral wings add strength and visual balance to the assembly, with sculptured and fitted wooden pedestals holding the model to the base. (This description sounds suspiciously like a paragraph in an art catalog. Is it possible that the stand is art while the model is craft?).

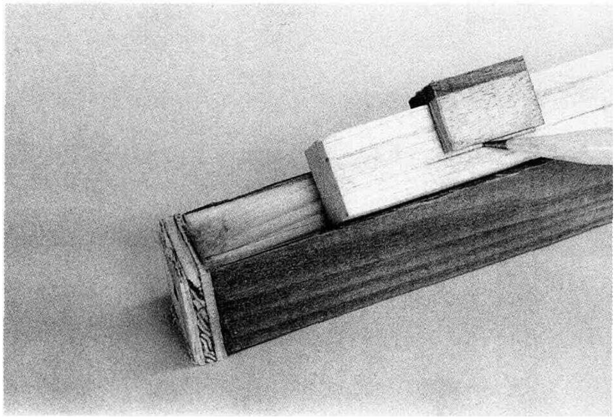
The stand for the original was made from Honduras (real) mahogany, a nicely figured hardwood with a pleasing red-brown color, which works well and finishes beautifully. A single 3 '6" length of 2" x 3" does the job. The long central portion of the stand is 24" long, the wings each 4 3/4" long. The stock is sawn to a square cross section, the dimension being the true finished thickness of the nominal 2" thick stock, or 1 $^{5}/_{8}$" square. The taper is from full thickness forward to 3/8" aft. The wings taper in both directions — across their thickness to follow the fore-and-aft taper of the central *piece*, and from full thickness at the junction with the central piece to 5/16" at the far ends. The pieces are sawed, planed, fitted and sanded, in that order. The centerline of the wings is located 7 1/4" aft of the forward end of the central piece. All non-joining ends are power sanded to approximately a 5° angle.

Holes in the bottom of the stand for the mounting screws which fasten it to the case are best drilled before the assembly of the stand. Starter holes of 1/16" diameter will do. There should be three such holes in the center piece, one at the middle of the line connecting the centerlines of the wings, then one 7 $^{9}/_{16}$" forward of that and one 18 $^{3}/_{4}$ " aft of the forward hole. The wing holes are 2 $^{7}/_{8}$" from the center piece centerline. No hole should be *deeper* than half the thickness of the piece secured. The hull pedestals themselves, the oversize clothespins that actually support the model on the stand, are made of nominal one inch stock, which can be made by sawing a 2 $^{1}/_{2}$" length of the 2" x 3" stock in half vertically. One support will fit on the base at the centerline of the wings, the other on a line 9 $^{7}/_{17}$" aft. The forward support will fit the hull at frame #7, the aft one at frame #16. In designing an original stand, the basic pedestal inside shape can be taken from the hull frame templates for the specified location. For the Virginia sloop stand as described here, the templates are given full size on the plans.

The pedestals and the wings are each attached to the base with a pair of 1/4" diameter dowels. A drill press and dowel centers (the little plugs with needle points on the outer face) will be needed to get the holes properly aligned. Drill all the holes in the center piece after carefully measuring for their location, drilling them all at right angles to the drilled surface (the tapered end of the center piece will have to be blocked-up to get



The mounting stand for the Virginia sloop.



The spar jig and gauge *in use.*

the top surface level for the drilling). Insert the dowel centers in one pair of holes, align the offered piece and press, and presto! you have automatically center-punched the add-on. Drill the remaining holes thus, then glue and dowel, improvising clamping as you go.

Cut two six inch lengths of brown felt, about an inch wide, to fit inside the pedestals, then put the hull in place and mark the location of the screw holes. For the short forward pedestal, the securing screws are best directed into the sides of the keel. At the rear pedestal, the screws should be secured into the plywood of frame #16. Drill for 3/4" long #6 screws. *Grind* down the heads of the screws to 3/16" diameter to keep the countersunk portion of the screw hole a manageable diameter. Remove the screws and the felt, oil the stand, and wax it when dry. Use white or yellow glue to glue the felt in place, using a scrap of 1/4" plywood to force it in place against the pedestals. The hull can be put in place then to keep the felt secured while the glue dries. Trim the felt when the glue is dry, then mount the hull, making any small final adjustments to level it from side to side. Finally fit wood plugs (or wood filler) to the screw holes to complete the stand.

Now find a place to put the model, under a dust cover (a plastic kitchen bag works fine) and out of harms way, laid up in ordinary contemporary parlance, as you get on with the business of spar making.

MAKING THE MASTS AND SPARS

A problem of terminology arises here also, but not a serious one. The term mast applies both to the generic composite structure including lower mast and topmast (plus topgallant and royal on larger ships) as well as to just the lower mast. Thus, when used to assign position to one in a series, as in mainmast, foremast or mizzen mast, the term applies to the composite structure, whereas when speaking of the parts of one such mast, the term generally applies to the lowest section only. Stay alert and you can't go wrong.

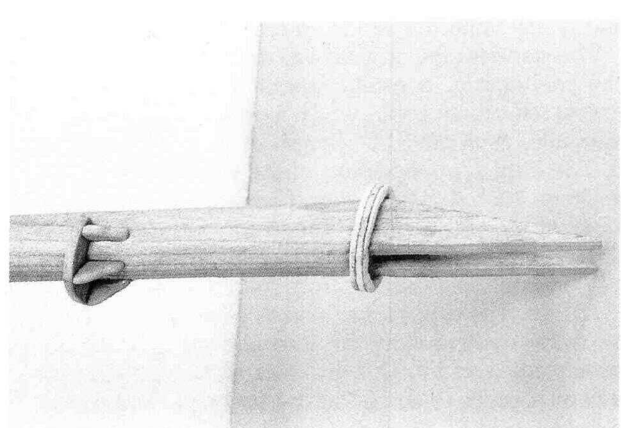
On the other hand, with only one mast to worry about, all this semantics probably doesn't make much difference anyway! Except, of course, that the masts you make are not made masts! A made mast, in contemporary terminology, was one made up of several tree trunks, cut and fitted to each other in a most elaborate fashion to make a large diameter spar. The made mast was held together by rope and later iron bands called weldings. A one piece mast, such as would be found in a small vessel such as this, and made from a single tree, was called a pole mast.

The mast and spars (or just the spars, as the mast is also a spar) are all of cherry and all will be oil finished. One need not split wood (as we have split hairs) to find straight grained pieces as recommended by the ship modelers of yore; choosing small dimension straight stock in the lumber yard, e.g. 3/4" square or 1"x 2", will already have selected for straight grain. Any significant curvature produced by released stresses should have already appeared after the wood was sawn to these relatively small dimensions. Even so, the freshly re-sawn blanks should be left unused for a few days in the workshop just to make sure further distortion doesn't occur.

Any minor residual curvature can be planed away before going any further. The blank for the mast should be rough cut to 9/16" square and at least $1^1/_2$" longer than the 22.13" given on the chart, the latter to allow for the stub that fits in the mast socket. The bowsprit blank needs to be 1/2" square. The topmast and boom blanks are 3/8" square, the jib boom 5/16". The gaff, topsail yard and spreader yard blanks are 1/4" square. The extra thickness (beyond the given diameters in the chart) is needed to allow for loss from the planing and sanding of the spar making process.

Each spar is made from the square stock by first planing the corners down to make an octagonal section from which form the longitudinal tapers are planed. Each edge of the octagon is then equally planed off to a sixteen sided cross section, which is then filed and sanded round. The jig to do the holding for the planing is a simple V-groove in the edge of a two foot length of softwood, perhaps a 1" x 2", with a plywood end plate nailed and glued to one end as a stop. A large V, with 3/8" sides, can be cut in one edge and a smaller one on the opposite edge. In use, the jig is simply secured in a vise and the blank pushed up against the end cap.

A simple right angle measuring gauge to slide along the spar blank and guide the pencil in marking out the octagonal flats can easily be made from thin scrap wood glued together at right angles or from a short length of aluminum or brass angle. The width of the arm used as the marking guide will determine where the pencil line will fall. The pencil can be run along the edge of the guide as the latter is moved down the length of the blank, or a small hole can be drilled for a stick of pencil lead at the appropriate distance from the inside junction if the guide arm is left a bit wider.



The lower mast section, showing the mounting fork, retaining ring and boom saddle.

SPAR LENGTHS AND DIAMETERS
(At Scale 1:32)

	Length	Given Diameter	
Mast (Hounded)	19.41"		
(Head)	2.72"		
(Total)	22.13"	.50"	
Topmast	11.08"	.27"	Heel to rigging stop 8.0"
Bowsprit	15.53"	.43"	
Jib boom	11.03"	.27"	
Boom	19.41"	.30"	
Gaff	8.93"	.19"	
Topsail yard	9.90"	.19"	
Spreader yard	12.41"	.19"	

QUARTERS

	QI	QII	QIII	Misc.
Mast	.49"	.46"	.42"	Head, lower-.35" x .26"; upper-. 27" x .20"
Topmast	.27"	.25"	.23"	Heel- .26"
Bowsprit	.43"	.40"	.35"	Heel - .37"; outer end - .24"
Jib boom	Given diameter (.27") inner third length; end - .18"			
Boom	.29"	.28"	.26"	Fwd - .20"; Aft - .23"; Mid- .28"
Gaff	.19"	.17"	.15"	Fwd- .10"
Topsail yard	.19"	.17"	.13"	Arms - .08"
Spreader yard	.19"	.17"	.13"	Arms - .08"

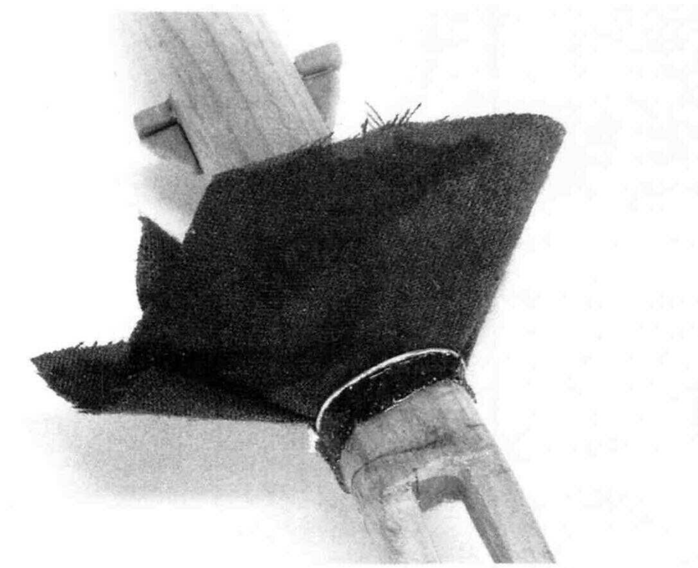
Both an ordinary workshop block plane and a model maker's miniature block plane will be needed for this work, the former for the mast and bowsprit and the latter for the smaller spars. A model maker's spokeshave also comes in handy. Spend extra time at the grinding wheel and polishing stones to get the blades razor sharp.

Although the basic spar making process is as described above, a few particulars are given here which relate to each individual spar:

1. The Lower Mast: The marking gauge for the flats should make a pencil line 3/16" from and parallel to each edge to create an even octagon when planing. Plane the blank to just over 1/2" square, then draw the lines separating the stub from the main body of the mast, 1 1/2" from one end; this is also called the partners after the timbers in the deck which secure the mast at this point. With the mast in the jig, plane off the edges until the octagon-limiting pencil lines are reached.

Next mark off the head, 2 3/4" from the upper end, and divide the length between stub and head into quarters; each should be about 4 3/4" long. Mark the first quarter all the way around the mast, then, starting with the plane half way between the stub line and the first quarter line, plane down the entire upper portion of the mast to the first quarter diameter, just under 1/2". Next draw in the location of the second quarter, and, starting between the first and second quarters, plane down the rest of the mast to the second quarter diameter, or .46". Use the same process for the third quarter. *Leave* the head unfinished for the time being. Plane off the octagon edges to a 16-sided cross section and then sand the spar round and to final dimensions.

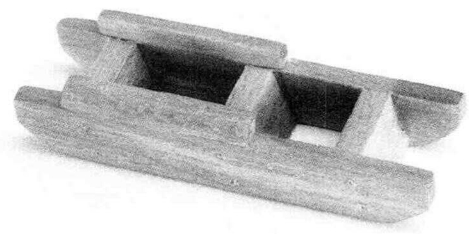
Both the top and the bottom of the mast need further attention, for the masthead and the mounting fork, respectively. The mounting fork is the tapered and slotted structure, a model maker's method rather than a scale reproduction, used to mount the mast in the socket in the hull. As the socket straddles the profile former of the hull, so must this fitting be slotted as well as tapered. It is a good idea to make a template from a piece of left over planking material to check the taper of the stub and the angle of the mast. On the prototype model the straight (aft) edge of the fork was 1 1/2" long. The junction with the lower mast proper was 3/8" long (in the fore-and-aft direction). The lines of the fork were laid out in pencil on all four surfaces of the stub, then the fork was started on the table saw and finished with the jeweler's saw and files. The taper was done on the power sander; the latter was also used to carefully reduce the stub's 1/2" diameter to the required 3/8" length in the one required direction.



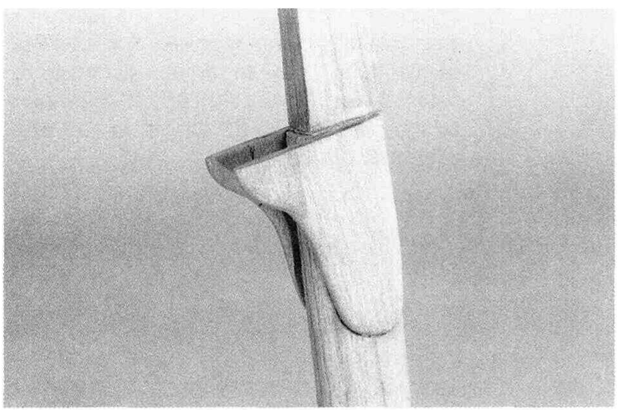
The mast coat wired in place.

Make a cardboard template to check the mast-deck angle and use it frequently to double check the angle as the fork is worked into final dimensions. The mast is essentially self-aligning, but it never hurts to check!

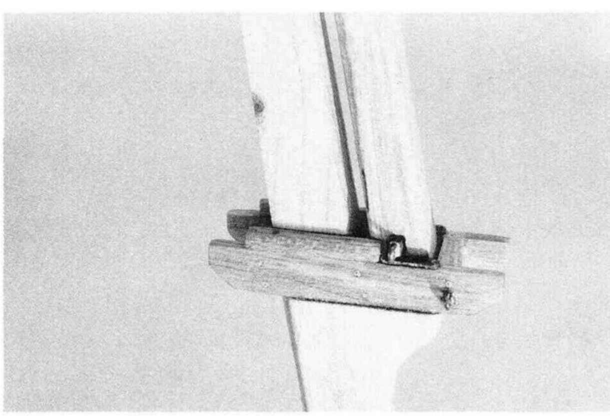
The head is the square cross-sectioned upper segment of the mast. The step formed by the transition from the round mast below to the square head above forms the resting place for the trestletrees to come later. The step should be cut at the same angle as the mast-to-deck angle, so that the trestletrees are parallel to the waterline for ease of use by personnel (although one suspects that the trestletrees were, in practice, rarely parallel to the waterline even with that precaution having been taken). The same cardboard gauge used on deck can be used here to get the angle correct. The squared



The trestletrees.



The hounds and bibbs, *made in one piece.*



The topmast, seated and secured with a fid.

form can be done on the power sander and finished with files and sandpaper. Take special pains to get the faces of the head parallel to the centerline of the ship or the mast tops will be visibly out of line. Note that the head dimensions on the chart on page 93 are smaller than the scale representations of the Steel-derived chart on page 21.

The model dimensions are those, found during the construction of the prototype, needed to form a right angled cross section; the full-size data just produced flats on a rounded cross section; the larger dimension is the fore-and-aft measurement.

At the deck level, wedges secure the mast in its oversize hole in the partners, forming a continuous ring of wood around its base.

This ring is not seen, however, as it is covered with a tarred canvas coat, bound a bit higher to the mast itself and nailed below to the wedges. The coat is the device designed to keep water from getting below via the hole in the partners. Make the wedges as a single ring of 3/32" plywood, 3/4" in diameter, with a 17/32" diameter mast hole. The mast hole needs to be filed in the fore-and-aft direction to lie flat upon the deck. Epoxy it in place.

When the ring glue is dry, the mast coat needs to be made and fixed in place before the other mast structures are installed. Cut a two inch square of ordinary cotton cloth, dye it black with a felt tip pen, and cut a scant 3/8" diameter hole in its center.

Pull the cloth down over the mast to a point about 3/8" above the wedges ring, then, with the open end above—like an inside-out umbrella—secure it in place with a ring of brass wire. Use cyanoacrylate to glue both the cloth to the mast and the wire to the cloth. Pull the cloth down the other way, arrange it neatly, and glue it to the plywood ring.

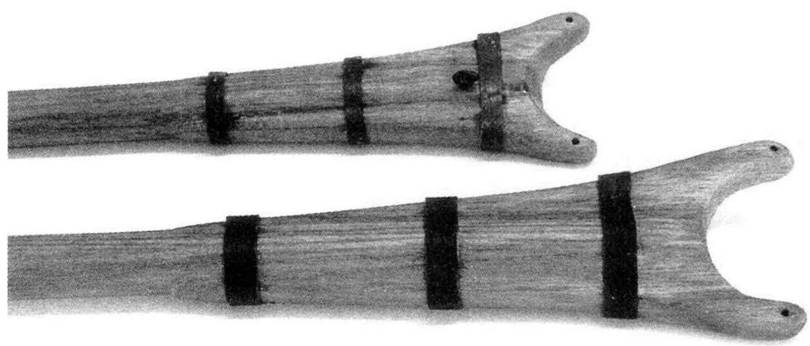
This is the time to make and fit the sail hoops if you are going to use them on the model. Once the trestletrees are installed, it's too late. The hoops can be made of 1/32" thick cherry, 1/16" wide. These strips must be steamed and bent around a round former a bit smaller in diameter than the maximum mast diameter; they will spring out a bit when removed. The ends of each hoop need to overlap about 25% of the circumference. The hoops are stained, the overlap glued down, and two seizings done round to represent the full-size fastenings. About 12 should do.

Once this is completed, you can go on to finish the mast. On the shoulder formed by recessing the head into the mast sits the trestletrees, the structure designed to support the topmast, itself supported below by the hounds and the bibbs. On a sloop, with no fixed shrouds supporting the upper mast (topmast or topgallant), crosstrees are not needed, only fixed chocks separating the crosstrees before and after the masthead and forward of the space for the topmast heel. The trestletrees are made of scale 3" thick (3/32") cherry, 7/32" wide and 1 5/16" long. The chocks, 1/4" wide from side-to-side, need to be cut from basic stock a bit wider than the trestletrees to allow for the slant of their top and bottom; they are not fitted at right angles to the top of the trestletrees.

Glue up the assembly using the masthead as a spacing guide. Put two #68 dowels in each joint to secure the assembly. Check the fit of the topmast heel in its compartment and make any final adjustments. Don't glue the assembly in place just yet.

Bolsters, the quarter-round padded wooden fittings atop the central portion of the trestletrees, need to be made next. Their purpose is to reduce chafing of the shrouds on the trestletrees. Make them of the same thickness stock as the trestletrees, cut square. They are 9/16" long, the length of the mast opening plus the thickness of the two mast chocks. Round off the outside face, then glue and dowel in place.

The trestletrees are supported both by the shoulder cut into the mast and by brackets at each side of the mast called hounds. The hounds are extended by add on segments forward called bibbs; both hounds and bibbs are generally represented as one piece structures, as has been done here. Make the hounds of 3/32" cherry to the shape shown on the rigging plan; the size of the blank is 3/4" square. The thickness will probably have to be filed and power sanded down a bit as the fitting process proceeds. Power sand a flat on each side of the mast continuous with the masthead, but only about 2/3 the length of the hounds. The flat should be just about flush with the masthead surface above. Finish the rounded lower end to 1/6" depth with a gauge, then carefully connect the latter to the sanded flat with files. Fit the hounds frequently during this process; they must lie perfectly fore-and-aft and their upper edge must be at exactly the same level and angle as the masthead shoulder. When the fit is perfect, glue the hounds in place and when dry, fit the trestletrees. A single eyebolt can be fitted near the forward joint of one trestletree for the fid lanyard.



The jaws of the boom and gaff.

Rigging cleats will be needed on each side of the masthead a bit under where the cap will come. Make these of 3/32" thick stock, 1/8" x 3/16" in size, with a slanted upper edge facing aft. The cleats are glued in place, then each is pinned with a single #68 bamboo dowel.

The final mast addition (except for the metal work—which comes later) is the saddle for the boom jaw rest. This is a half-round structure fitted to the after side of the mast, supported by four brackets. The saddle is located two inches above the mast/stub junction, which makes it about 5'4" above the deck at full size. The ring is made of three 5/16" wide segments of 3/32" thick cherry. The important dimensions are those for the center segment, which is 7/16" long and whose ends are cut at 60° angles. With similar angles cut on one end of each of the other two segments (each segment about 3/4" long) a half hexagon can be glued up.

When the glue is dry, use a circle template to draw a 1/2" diameter circle inside to match the mast radius at the desired level. A 3/4" diameter circle defines the outer border of the saddle. If your jigsaw permits it, cut the inner semi-circle with the saw table set at the required 60° to simplify getting the angle right; file to final size. The brackets are 3/32" thick also, 1/4" long, and as wide as the finished saddle. They are glued under the joints in the saddle and near each end after the saddle has been epoxied to the mast.

2. The Topmast: By now you must think that the art of semantics has been incarnated as a nautical monster lying in wait to pounce upon you—and it is! It turns out that if you look carefully at the Steel charts, you will discover that the topmast on a sloop is not a topmast at all, but rather a topgallant. That is because the tall sloop mast is a lower mast/topmast combination, whose length formula makes it relatively taller even than the lofty mainmast of a ship or brig. The uppermost layer of a mast, the segment that heads itself, that is, has no top (the platform, not the end) are either topgallants or royals, depending upon the level. Thus our topmast is really a topgallant, but we will continue to use the former term for simplicity (?). Such masts terminate in poles for hoisting pennants or flags. Depending upon the length of the pole, they are called long poled, stump poled or, as is this one, common poled.

The eleven-plus inch long 5/16" square blank is planed octagonal, leaving the lower 3/8" length square for the heel. The eight sides are then planed to a bit more than the final cross section dimension (.27"). Two sheaves need to be laid out and drilled, both 6" scale inches (3/16") in diameter (the holes thus five scale inches (5/32") apart). The upper sheave, for the topsail yard halyard, is in the midline of the topmast, its upper border 1/8" below the rigging stop. The lower sheave is for the top rope, the sling that hoists the topmast up into place. It runs at a 45° angle from the front of the mast, from the forward square corner of the heel on the port side to the aft square corner on the starboard side. The spar jig is a good drill press vise for this otherwise difficult drilling step. All the holes are made with a #68 bit.

With a spokeshave, trim the octagonal blank to its sixteen-sided shape and rough sand. Sand or file the athwartships dimension of the heel to the same width as the lower head of the lower mast. Use the power belt sander and files to form the pole and button above the rigging stop. The pole is about .18" diameter below and .13" above; the button is .20" in diameter. Drill a #76 hole through the button and recess into the topmast below for the pennant halyard sheave. Fine sand the spar, then cut the three sheaves with micro chisels.

Put the topmast in its compartment in the trestletrees; it should just project a bit below the bottom of the rails. Put a pencil line on the topmast just at the line of the top of the trestletree, on each side. The center of this line will be the location of the centerline of the fid hole. The fid is the preventer key that runs athwartships through the heel of the topmast which keeps the topmast from dropping down through the trestletrees.

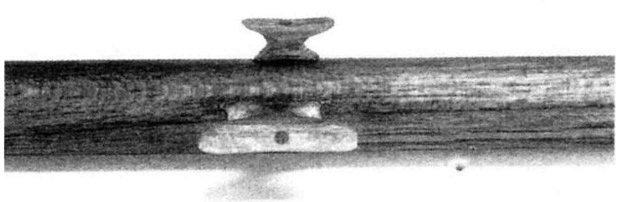
The fid should be about a scale 2" x 3"; the 1/16" x 3/32" rectangular hole can be started with a *#68* drill hole and finished with miniature files and micro chisels.

3. The Bowsprit: With the spar-tapering technique of mid-quarters planing described above now well in hand, the bowsprit is a simple spar to make. Taken from a 1/2" square blank about 15.6" long, the bowsprit is finished to the dimensions given in the chart. The heel, clamped to the deck later with an iron fitting, should be kept square for its 3/8" length. The inboard section of the spar is octagonal, the outboard round. When completed, the bowsprit needs to fit easily through the stem hole from inboard and rest on the stem. The bottom of the heel needs to be power sanded to the angle of the deck where it rests on the deck beam just forward of the scuttle. The sanded area is as long as the heel, 3/8", and takes away about 3/32" of the height of the butt of the heel. The bowsprit also looks better if the butt itself is lightly power sanded so that its plane is perpendicular to the deck.

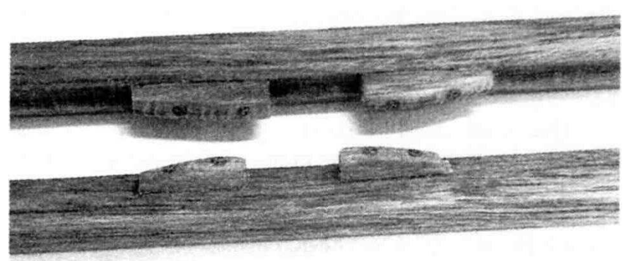
A large sheave, for the jibstay lead, needs to be drilled and carved into the end of the bowsprit. It should be in the midline; it is eight scale inches in diameter (1/4") and centered 7/16" aft of the end. This sheave has to be diddled a bit so that later, when the bowsprit shrouds, stays and horse are in place you will still be able to reeve the jibstay through the sheave hole and be able to retrieve it below. What one has to do is drill the hole at an angle back towards the bow of the ship so that the line actually will go into the foremost hole above, but come out the aftermost hole below, thereby avoiding all the rigging at the end of the bowsprit. The drill size is #60. This is one of the few places on the model where the sheave pin is visible, so drill #67 holes from each side to meet in the middle of the spar for a .030" diameter bamboo dowel.

Rigging cleats, similar to those at the masthead, are needed just aft of the location for the bowsprit cap; they will have to be fitted after the metal work has been installed.

4. The Jib Boom: This extension of the bowsprit is a simple spar to make. It is the given diameter for its entire inner third, then tapers to 2/3 of that diameter (.018") at its end. The heel, 3 1/2 diameters long (about 3/4"), is octagonal; the rest of the spar is round. The forward scale eight inches (1/4") is cut down to form a shoulder rigging stop, coming down to about .12" diameter. A #68 hole across the heel, about four scale inches (1/8") from the butt, is needed for the securing lashing for the spar. A scale six inch diameter sheave is needed the same distance inboard of the shoulder forward; it is made the same way as those in the mast.



The boom cleats. The larger one Is for the sheet, the smaller for the flag halyard.



The slings of the yards, with their rigging cleats.

5. The Main Boom: Shaped like a long, thin baseball bat—the handle towards the mast—the mainsail boom is a sturdy but delicately shaped spar. One starts with a 3/8" square blank, 19 5/8" long, tapering in both directions from the maximum (given) diameter of .30", the latter located one third of the way in from the aft end. The aft end tapers to .23" before the shoulder is cut; the forward minimum diameter is .20". The arm at the end of the spar is sixteen scale inches (1/2") long. The foremost scale five feet (1 7/8") is left square for the fitting of the jaws. Final shaping of this end for the jaws will bring it to a taper with a rectangular cross section. The dimensions of this rectangle are 5/32" x 3/32", the larger dimension being the vertical. No sheaves are needed.

The jaws are cut from 1/8" thick stock to the pattern on the rigging plan insert. The inside of the jaws is cut to the same size and at the same angle as was done on the boom saddle. This is filed to fit after the rough cut jaws are glued to the boom. All the corners and edges of the jaws are filed and sanded round. Holes for the parrel ropes (#72) are drilled near the end of the jaws, in the vertical plane. Later three iron bands and an under surface eyebolt will be added to the jaws.

Two pairs of small stop cleats are needed to secure the main boom sheet. These are placed 3/32" on either side of a line 5 1/2" from the after end of the spar, one pair on each side. They are made from 3/32" square stock and doweled and glued; they are finished after installation. Oil finish the boom. Two belaying cleats are needed on the main boom also, just at the level of the helm (centerline of cleats 11 1/2" from the end of the boom), one for the tackle fall from the main boom sheet and the other for the flag halyard. The former cleat is large—twelve scale inches long (3/8") and the latter half that size. Each is about one third as high as it is long, 1/16" thick at our scale, and secured with a single #68 bamboo dowel and cyanoacrylate.

6. The Gaff: A simple spar made from a quarter-inch square blank 9" long, the gaff has an almost squared octagonal inner end four scale feet (1 1/2") long to take its jaws. The rectangular cross section measures 3/32" wide by 1/8" high. As you can see from the chart, the gaff measures .19" in diameter throughout its inner quarter, then simply tapers to its outer end.

Into that end is cut a rigging stop about eight scale inches (1/8") long. The .10" dimension is the reduced end of the arm. The jaws are of 1/8" cherry, made just as were those for the boom. The gaff also needs two sets of rigging chocks to restrain the peak halyard, as per plan (1 1/2" and 4 1/2" from the after end), three jaw-securing iron bands, and an eyebolt on both the upper and lower surfaces of the spar at the jaws; the former is for the throat halyard, the latter for the mainsail nock cringle.

7 and 8. The Yards: The topsail and spreader yards are identical except for their length. They are made from 1/4" square blanks. The two middle quarters form the slings, an area which is left octagonal in cross section. The remainder of the spars are tapered on each side by the method previously used in the other spars. Scale one foot long (3/8") rigging stops are cut into the arms at each end. A pair of large stop cleats is needed at the slings of each spar, placed a spar's diameter apart at the center of the yard. According to Lees, the stops are one inch per spar yard length long; the width is one quarter the length; the thickness three quarters the width. That makes the cleats for the topsail yard 9/32" x 5/64" x 1/16" in practical model maker's terms, and the cleats for the topsail yard 11/32" x 3/32" x 1/16".

The spar metal work: Several bits and pieces are needed—a fid and fid plates for the topmast, a spar cap for both the topmast and the bowsprit, a spar retaining ring for the jib boom, both a heel clamp and stem clamp for the bowsprit and bands for the gaff and boom jaws.

The fid through the topmast heel is made of 1/16" square brass tubing, lightly hammered rectangular in cross section. It is as long as the trestletrees assembly is wide, about 7/16". A small eyebolt is soft soldered into one end and the other end is soldered shut. The fid is oxidized as usual. Fid plates are anti-wear plates recessed into the trestletrees forward of the bolsters. They can be filed from short lengths of brass strip, oxidized and epoxied in place; filed down brass nails should also be inserted fore and aft. A small eyebolt can also be fitted to one side of the trestletree for the lanyard which is fastened to the fid eyebolt. The topmast should not be mounted until both the mast has been fitted to the hull and the shrouds fitted to the mast.

The mast cap is a hammer welded iron band, or, in this case, a silver soldered, oxidized brass strap. The entire cap is made from a single length (2 1/2") of .015" thick brass, 3/16" wide, trimmed to final length as the bending is completed. It is shaped with needle nose pliers to form a rectangular cap for the masthead and then a round retaining band for the topmast. The bending and folding of the brass will create the proper thickness to separate the mast from the topmast, matching the space in the trestletrees.

On the prototype model the rectangular part was . 27 " long and . 20 " wide, outside dimensions. The ring is .25" inside diameter. The rectangular part fits onto a tenon formed at the masthead. Use the topmast to check both the ring diameter and the cap alignment before eventually epoxying the cap to the tenon, eventually because the cap shouldn't be fixed until after the shrouds have been fitted over the masthead in the rigging process.

The two bowsprit fittings, cap and retaining ring, are made in the same fashion, except of course that each is composed of two rings rather than a rectangular form and a ring. The rings are located so as to have the jib boom overlap the bowsprit by about 4.3". The forward double ring is made of scale 4" wide (1/8") .020" brass, the aft one of five scale inches wide (5/32") brass. The larger ring on each fitting, that for the bowsprit was formed around the handle of an aluminum hobby knife; the diameter of the ring for the fitting near the tip of the spar is .32" in diameter, the more aft located larger ring being .36". The smaller ring for both fittings should be the same, housing the non-tapering segment of the jib boom— .28"; the latter was formed around the shaft of a Phillips head screwdriver.

The final fitting needs to be done using the spars themselves as the test bed. Be careful not to scratch them. Larger vessels than this one (and perhaps even small vessels—the data is not clear) had flat bands welded from ring to ring on each side of the fitting. Optional here. Again, the bands are not glued onto the bowsprit until after the bowsprit has itself been fitted **in** place; a trial fitting of the spar will remind you why.

The securing bands for the jaws of both the boom and the gaff are similarly made. All are made of oxidized .005 "thick sheet brass, those for the boom being 3/32" wide and those for the gaff 1/16". Locate the bands evenly along the length of the jaws, then draw a short line representing the width of each band on the under-surface of the boom. Incise each of these three lines with a #11 knife blade. Bend a short (1/16") tab on the end of a strip of annealed brass, cutting off the corners first for easy insertion into the slot. Bend the strip around the boom or gaff and its jaws, marking where it crosses the slot; cut it off 1/16" beyond, form a similar tab, and push it into the already formed slot. With thumbnail or the end of a squared-off small piece of planking, **push** the soft brass into all the joints and crevices.

As each band is formed, remove it from the spar. Acid wash and oxidize all the bands together. Install each by cyanoacrylating one tab into its slot; when the glue is dry, run the knife blade alongside to free up space for the other tab. Reform the band around the

The iron mast cap.

spar, glue the other tab in place, then put drops of cyanoacrylate at three or four spots around the band to secure it. Finally weld the gap on the undersurface with a drop of epoxy, which can later be dry brush painted black.

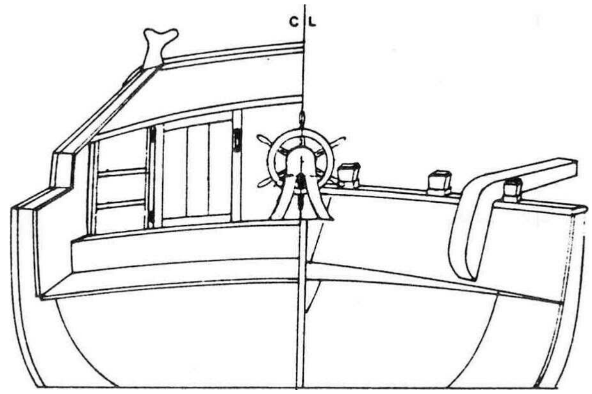
RIGGING CASE

With the spars made and the model mounted on its base and ready to receive them, one immediately realizes that with spars about to stick out every which way, and for great distances at that, a simple bag for a dust cover will no longer do. To keep dust off and to protect the projecting bits of spars and rigging from breakage, some sort of temporary protective case will need to be made. Simple construction from inexpensive materials will do nicely. The rigging case shown here, actually made a few years ago while rigging the FAIR AMERICAN, serves nicely again, a case in point, as it were.

Make the base of 5/8" thick particle board, 24" wide and 48" long. Mark and drill the baseboard to take the mounting screws for the model stand. The holes in the middle line of the transverse cross pieces of the stand are located 24" from the forward end of the baseboard. It looks pretty far back, but the jib boom plus the bowsprit stretch way out. Notch the edges of the baseboard for 1" x 2" uprights. The uprights, of fir or pine, are 42" long. Forming the long upper edges of the case are 1" x 2 "s butted to the uprights before the latter are fastened to the base. The joints are secured with nailed and glued 1/4" thick plywood triangular gussets. The ends of the case frame, between the uprights, are strengthened with 1" x 2"s also, glued and nailed to the uprights, both below on the baseboard (also glued and nailed to the baseboard) and above at the tops. When the glue has dried, 1/4" x 1" battens are glued and tacked across the ends and top of the case to keep the plastic tarp dust cover from direct contact with the model. The tarp can just be rolled back far enough to work on the currently active part of the model; it infrequently needs to be removed altogether. The model can now be temporarily screwed to the case baseboard.

The model in its rigging case for dust protection. The case is made of 1" x 2" stock and pressed board base; it is covered with a plastic tarp.

CHAPTER 7



RIGGING

Rigging is actually fun (if you don't have to make much of the rope yourself). The geometric shapes securing the mast and outlining the sails form a most appealing picture. The web of rope that forms is a promise that the project really will end sooner or later. It's the preparation for doing the actual rigging that is the major nuisance. This is especially true if you are designing a modeling project yourself, for then you have to make a serious effort to predict the positioning of all (or at least most) of the blocks that will be needed beforehand. A pair of blocks hidden up between the trestletrees for yard lifts, for example, will be difficult to install once the standing rigging is up. One must stare at the rigging plan for hours, and on many different occasions, following the leads of all the running rigging again and again to prevent disaster. It's not any different from the way it was done in real practice.

In this project, all the necessary data for preparing the Virginia sloop spars is presented here, but do keep yourself aware of this important planning step as you prepare each of your spars for final assembly. Think all the time of what you would have to do if this or that block had not been installed prior to starting the rigging. It is a sobering experience. Look over the rigging dimensions charts and the block size and number tables, then you can get on with the business of pre-rigging the spars. All the work can be done with the plans and the text, but is easier with a reference work, either Lever or Lees.

Pre-rigging was also done in contemporary practice. For a wonderful description of the actual process on a modern full-size replica quite similar in these details to a Virginia sloop, look up the sixth and last part of Richard L. Miles series "Building the LADY WASHINGTON", in the January/February 1991 issue of *Seaways.* The photographs will make the whole process of rigging much easier for you.

RIGGING DIMENSIONS

The number of line diameters needed to rig the Virginia sloop is not large, especially as compared with larger vessels with their more elaborate, multi-level rigs. At 1:32 scale, you will mostly rig with .008", .012", .016", .028" and .032" diameter linen. Some .044" and .062" line will be needed for the shrouds and a bit of .071" linen for the forestay. These sizes, or sizes close enough to cheat a bit, are available from commercial suppliers. Both commercial and do-it-yourself rope making machines are available for the would be rope maker, but it is a touchy job and takes a good deal of experimentation both to get the machines to work properly and to wind up with the proper diameter and the proper twist.

For example, if you want to make three strand ordinary (right hand twist) rope, you must start with three strands of left hand twist rope of a diameter suitable to give you the desired finished size. Of one thing you can be certain— the diameter of the finished rope will not be three times the diameter of the three strands used! The best description of rope making and the simplest, most fool proof machine are both found in Ship *Modeler's Shop Notes.* It must be admitted that shop made rope has a cleaner, harder twist to it than does commercial rope. That becomes less important if one prefers to finish the ropes, especially those that would have been tarred in contemporary practice, with model maker's tar; in real life, tarred rope tends to lose its definition to a certain extent.

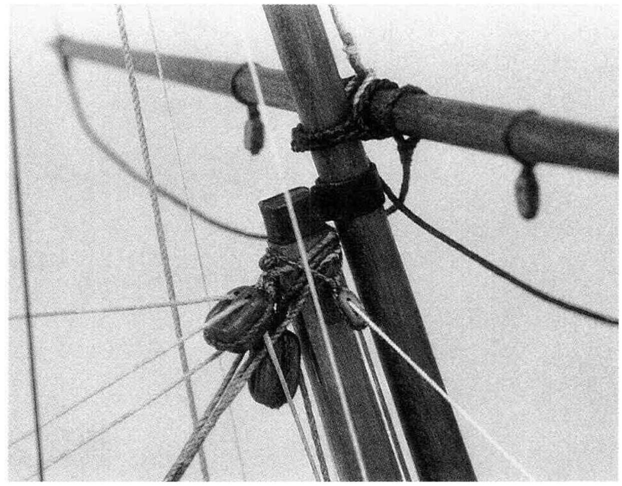
The dimensions given in the accompanying chart are taken whenever possible from the rigging tables in Steel for a merchant sloop of 60 tons. The dimensions are arbitrarily reduced 20% for the smaller (42 tons) vessel. Certain minimal size ropes, such as ratlines, are left unchanged. In most contemporary charts, rigging sizes are given in inches of circumference. For convenience, all chart data here will be in real size and scale size inches of diameter. The data is numbered in the same order as on the rigging plan code (Plan Sheet 4) for convenience in reference. That is not the sequence in which the model will actually be rigged, however, as will be seen as you move along.

The actual chart sizes have not always been used in rigging the model, especially for small lines and lanyards which tend to disappear in their scale sizes. Where I have made a substitution, however, I have indicated it clearly in the text.

The rigging list is followed by the list for blocks, deadeyes and hearts, hopefully all the wooden rigging fittings that will be needed for the Virginia sloop. They are given in the same numerical order, the size given being that of the line used at 1:32 scale. The letter S refers to a single block, D to a double. The number of blocks of each size need to rig the model and their scale dimensions are given in the tables below the charts. They are based on the formula found Steel previously referred to in the chapter five. Not many of us work to three place accuracy, so rounding off from the calculated dimensions to the next largest .01" should work out well.

RIGGING LIST

Rigging	Diameter Full Size	Diameter 1:32 Scale
1. Shrouds	2.00"	.062"
a) ratlines	.38"	.012"
2. Mainmast backstay pendant	1.10"	.032"
a) tackle runner	.50"	.016"
b) tackle fall	.38"	.012"
Mainmast tackle pendant	1.10"	.032"
a) tackle fall	.50"	.016"
3. Topmast backstay	.90"	.028"
a) thimble lanyard	.38"	.012"
4. Forestay	3.30"	.071"
a) deadeye lanyard	.90"	.028"
5. Jibstay	.90"	.028"
a) tackle fall	.50"	.016"
6. Topmast forestay	.90"	.028"
a) tackle fall	.38"	.012"
7. Bowsprit shroud	.90"	.028"
a) tackle fall	.38"	.012"
8. Bobstay	.90"	.028"
a)deadeye lanyard	.50"	.016"
9. Main boom topping lift	1.00"	.031"
a) tackle fall	.50"	.016"
Topsail halyard	1.00"	.031"
a) tackle fall	.50"	.016"
10. Spreader yard halyard	.90"	.028"
a) tackle fall	.50"	.016"
11. Horse (for spreader yard]	.90"	.028"
12. Peak halyard	.90"	.028"
13. Throat halyard	.90"	.028"
14. Topsail yard lift	.38"	.012"
15. Spreader yard lift	.38"	.012"
16. Topsail yard brace	.38"	.012"
17. Spreader yard brace		
a) pendant	.50"	.016"
b) tackle fall	.38"	.012"
18. Spreader yard after brace (topsail sheet)		
a) pendant	.50"	.016"
b) tackle fall	.38"	.012"
19. Topsail clew garnet	.38"	.012"
20. Flag halyard	.25"	.008"
21. Ensign staff and halyard	.25"	.008"
22. Main boom sheet	1.10"	.032"
23. Inhaul	.38"	.012"
24. Flying jib sheet		
a) pendant	.50"	.016"
b) tackle fall	.38"	.012"
25. Jib sheet		
a) pendant	.50"	.016"
b) tackle fall	.38"	.012"
26. Foresail sheet		
a) pendant	.50"	.016"
b) tackle fall	.38"	.012"
27. Topsail yard horse	.90"	.028"
28. Spreader yard horse	.90"	.028"
29. Bowsprit horse	.90"	.028"
30. Topmast shroud	.90"	.028"



Rigging at the mast cap.

BLOCKS, DEADEYES AND HEARTS

Rigging Location	Fitting	Number	Size
1. Shrouds	Deadeyes	16	8″ diam.
2. Mainmast backstay			
a) pendant	Block	1 S	.016″ line
b) tackle	Blocks	2 S	.012″
Mainmast tackle			
a)pendant	Block	1 S	.016″ line
b)tackle	Blocks	2 S	.012″
3. Topmast backstay	Thimbles	4	2″ diam.
4. Forestay	Collar & heart		
5. Jibstay	Blocks	2 S	.028″ line
6. Topmast forestay			
a) topmast shoulder	Block	1 S	.028″ line
b) tackle	Blocks	1 S; 1 D	.016″ line
7. Bowsprit shroud	Blocks	2 S; 2 D	.012″ line
8. Bobstay	Closed hearts	2	12″ long
9. Main boom topping lift	Blocks	2 S	.032″ line
a) tackle	Blocks	1 S; 1 D	.016″ line
Topsail halyard	Blocks	1 S; 1 D	.016″ line
10. Spreader yard halyard			
a) jeers	Blocks	2 D	.028″ line
b) tackle	Blocks	1 S; 1 D	.016″ line
11. Spreader yard horse	None		
12. Peak halyard	Blocks	1 S; 1 D	.028″ line
a) tackle	Blocks	1 S; 1 D	.012″ line
13. Throat halyard	Blocks	2 S	.028″ line
a)tackle below?			
14. Topsail yard lifts	Blocks	2 S	.012″ line
a) tackle below?			
15. Spreader yard lifts	Blocks	2 S	.012″ line
a) tackle below?			
16. Topsail yard brace	Block	1 D	.012″ line
17. Spreader yard braces	Blocks	2 S	.012″ line
18. Spreader yard after braces	Blocks	4 S	.012″ line
19. Topsail clew garnet	Blocks	2 S	.012″ line
20. Flag halyard	Block	1 S	.008″ line
21. Ensign staff halyard	None		
22. Main boom sheet	Blocks	1 S; 1 D	.032″ line
23. Inhaul	None		
24. Flying jib sheet	None unless sails bent		
25. Jib sheet	None unless sails bent		
26. Foresail sheet	None unless sails bent		
27. Topsail yard horse	None		
28. Spreader yard horse	None		
29. Bowsprit horse	None		
30. Topmast shroud	Deadeyes	4	6″ diam.

NUMBER OF BLOCKS NEEDED OF EACH SIZE

Line Size	Singles	Doubles
.008"	1	0
.012"	30	6
.016"	8	4
.028"	6	4
.032"	3	3

BLOCK SIZES AT SCALE 1:32

	.008	.012	.016	.028	.032
Sheave thickness	.010	.015	.020	.030	.035
Sheave diameter	.050	.075	.100	.150	.175
Sheave hole	.012	.017	.022	.032	.037
Pin diameter	.012	.017	.022	.032	.037
Width of block	.060	.090	.120	.180	.210
Length of block	.096	.136	.176	.256	.296
Thickness of block	.048	.068	.088	.128	.148
Double block thickness	.084	.119	.154	.224	.259
Drill size	#80	#77	#72	#67	#65

PRE-RIGGING THE SPARS

Mainmast: Start with the large single block for the main boom topping lift. Make a loop of .034 black line over a 3/8" diameter dowel for sizing, then tie the juncture with a round seizing as shown in the plates from Steel. Lock it up with a touch of cyanoacrylate. The loop goes over the masthead to seat on the cleats already in place. A small eyebolt for the origin of the runner needs to be made and fitted to the aft surface of the masthead, just below the seat for the cap. The peak halyard double block, for .028" line, is fitted with a loop of .032" black line to fit over the mast head and atop the topping lift block loop already there.

The two spreader yard blocks, singles for .012" line, need to be fitted to either side of a 3/8" diameter loop of .020" line. The loop fits over the masthead and atop the other two block assemblies already there. Another small eyebolt is needed aft, between the trestletrees, for the throat halyard tackle upper block. Both the upper and lower blocks are singles, for .028" line. They both are stropped so as to form a small loop or eye with which to lash them to their respective eyebolts. The upper block's strop needs to be miter-overlapped to permit drilling the hole for the runner. An easy way to lash the eyes to the eyebolts is to use a sewing needle for the job. A piece of .008" black line is run through the eye of the needle for a short distance and cyanoacrylated to itself, making the ship modeler's equivalent of a surgical needle. The end of the line is half-hitched around the eye of the block's strop and touched with cyanoacrylate. Three turns through the eyebolt and the eye, then the needle through the lashing and another touch of cyanoacrylate and the job is done.

GAFF

The mate to the peak halyard double block at the masthead is a .028" line single block, which is similarly fitted aft of the second pair of cleats on the gaff. This latter block needs to have its arse end stropping miter-overlapped, so that there is some substance to drill inside of it for the peak halyard runner. This is similar to the way you made up tackles for the cannon, as you may recall. The throat halyard block is installed as described above. The final pre-rigging block on the gaff is the tiny flag halyard block, for .008" line, whose strop is made of .012" line. A single half-hitch, cyanoacrylated, will do for seizing here. This block is fitted to the end of the gaff, of course.

MAIN BOOM

A block for .032" line, a single like the one fixed at the masthead, but with a smaller loop, is fitted to the end of the main boom for the topping lift. The main boom sheet, for the same line size, is formed of a double over a single. The double is stropped with .034" line and fits over the boom between the two pair of cleats already fixed in place. The single, which will later be fitted to a rope horse, needs to have an eye loop formed in its strop for that purpose. The single also needs to have a miter-overlap strop and a hole for the runner drilled inside the overlap.

SPREADER YARD

The spreader yard needs quite a bit of preparation. The biggest part of the job is the jeers, that combination of a sling and a tackle that was used both to suspend the yard from the trestletrees and to raise and lower it. The jeers is served, that is, its entire length is wrapped with the smallest diameter line in your collection, in my case, .008".

I use a modified commercial serving machine. A sheave works better at the end of the machine than anything else; the line supply card or spool can just rotate freely as the line is served. A small brass screw traps the end of the line against a strip of hardwood in the hollow spindle at the handle end to hold it in place. In use, the serving line is half-hitched and cyanoacrylated to the end of the line, then the handle is turned counterclockwise, so that the serving line draws the strands of the line closer together rather than separating them. The serving line is cyanoacrylated in place about every 50 turns. For the jeers, the line used was .024" in diameter.

The jeers blocks are both doubles for .028" line. For the upper block a five inch length of served line is needed. Leave an unserved half-inch of line attached when cutting from the supply source. Flatten the end of the latter with pliers, bend it back on itself to form an eye, and cyanoacrylate it in place. When the glue is dry, trim the joint as much as possible, and cut the attached serving line at about eight or nine inches. Glue the serving line into a needle and serve the eye. Put the topmast temporarily in place. Run the free end of the stropping behind the mast and through the eye, bending it back to mark the spot. Remove the topmast and the block, and fix the line back on itself first with a throat seizing and then with a round seizing. A hole for the tackle fall needs to be drilled under the stropping.

A 3 $^{1}/_{4}$" length of served .024" line needs to be made for the lower block's stropping. The ends of the piece are hardened with cyanoacrylate, beveled, glued together and served. The block is secured in the usual fashion. The block locks onto the spreader yard by simply wrapping around the yard and through its own free loop.

It's hard to believe that sailors actually shuffled out along these relatively small spars to work the sails, but they did, and the rope they shuffled along, slung

The lower block of the spreader yard jeers.

beneath the spar, was called a horse. Make the horses of .032" diameter line, stained black. The horses need to have loops formed in each end, as we have done earlier. The larger loop slips over the spar and butts against the outside of the opposite sling cleat. The smaller loop fits over the shoulder of the yard arm. The horse should sag below the spar about a scale three feet (1 $^1/_8$"); in real life the sag would have to be great enough so that the sailor could have enough depth to brace his lower abdomen against the spar.

Pendants, just as the name suggests, are relatively short lines that suspend a block from a given point. For the spreader yard we need four identical pendants, each of .016" diameter line, 3 3/4" long, and stropping one of the single .012" blocks. Each has a small loop in its upper end for the yard arm shoulder. Two are for the braces and two for the after braces. After slipping these pendants in place, use a bit of paper tape to keep them in place until final rigging time.

While you're at it, strop two more of the .012" blocks for the after brace lower block fittings at the quarterdeck rail. They can be installed later. Each needs a small loop, to be lashed to a small eyebolt, and a splice-overlap arse end for a runner hole.

TOPSAIL YARD

Do the horses first, just as they were done for the spreader yard, and of the same size line. Leave the yard arms loops of the horses hanging loose for a bit until you have made and installed the clew garnet blocks, the .012" singles whose strop loop fits around the spar at the junction of the slings and first quarters on each side. Hold them in place with a spot of cyanoacrylate, then put the horse loops in place and secure with paper tape. The braces will be done later, as they do not have pendants as does the spreader yard, as you can see from the rigging plan.

DEADEYES

Sixteen scale 8" (1/4") diameter deadeyes need to be made and installed at the channels to tie the shrouds to the hull. The deadeyes can be formed by hand with files and sandpaper, but are much more easily turned in the lathe if one is available. Again, a makeshift lathe will do just fine, or in a pinch, a hand grinder in a holder. The basic stock is 5/16" square cherry made eight-sided with a plane in a spar jig. A 4 $^1/_2$" length will do all 16 plus a spare or two.

Chuck the stick in the lathe and use a chisel and files to make it round and bring it down to just over final diameter. Mark the length of the dowel into 1/8" wide segments with 1/16" wide spaces between. Use a parting tool to V-groove the spaces, forming the outer surfaces of adjacent pairs of deadeyes; round and partially separate the deadeyes with miniature files. Mark the center of each deadeye and groove with the parting tool and then the edge of a flat miniature file. Sand all the deadeyes in the lathe, then remove from the lathe and carefully saw apart with a razor saw. Power sand each exposed surface of a deadeye before cutting it from the lathe dowel. File and sand the sawn surface by hand.

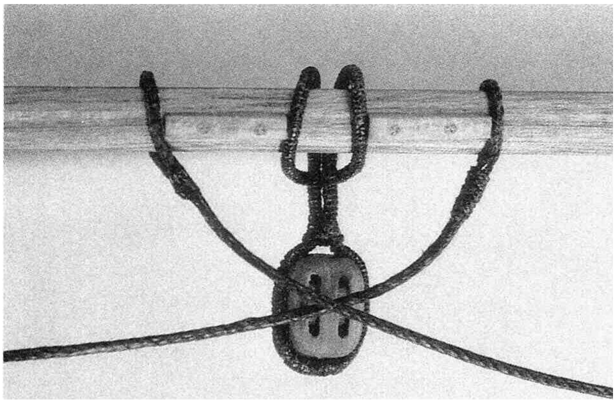
Drilling the lanyard holes requires a jig of some sort for proper alignment. A simple jig can be made by drilling a 1/4" diameter hole about 3/16" deep into a block of wood; this will make a snug fit around a deadeye. A 3/32" diameter hole is drilled through the center of this hole all the way through the block. This latter hole is for a length of brass rod or a nail filed flat to push the deadeye out of the jig after drilling. A flat headed nail is especially handy, as the head can be used to tap the deadeye into the bottom of the larger hole.

A sturdy brass disc, say .010" thick, is cut to fit atop the deadeye and also snugly in the 1/4" hole. The three deadeye lanyard holes need to be marked on the surface and drilled. They form an equilateral triangle whose base is the diameter of the deadeye. Each apex is one quarter the diameter (1/1") from the rim. The holes are drilled with a .032" diameter drill.

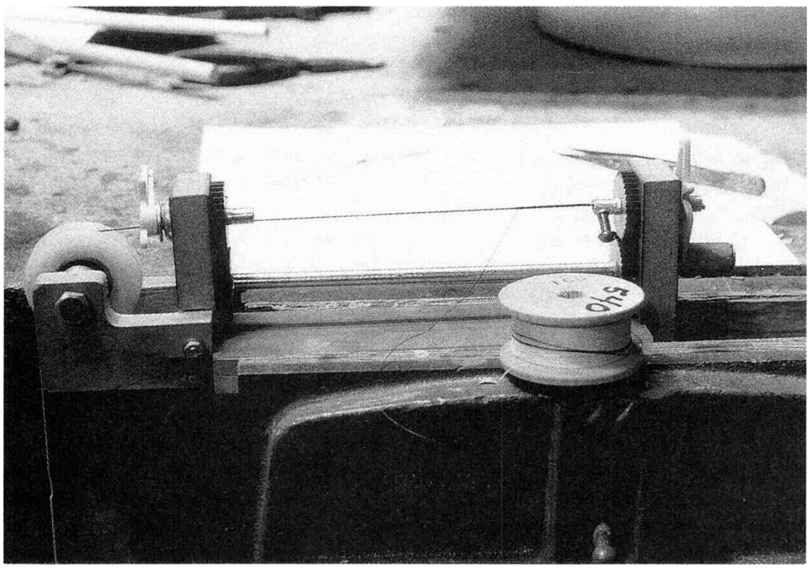
The drilled deadeyes are hand sanded with 150 grit paper, then all the holes (except for the stopper knot) are grooved so that the lanyard will not rub against a sharp edge. That means that the grooves on all the holes will be pointing towards the blank half of the deadeye. Finish sand with 220 grit paper and then tar the deadeyes with the black felt tip pen previously used for line staining. A loop of soft wire wrapped around the groove in the deadeye and secured with a hemostat makes a nice holding device for sanding and staining.

The location of the stopper knot for the lanyard on the inner face of the upper row of deadeyes is rather a complicated business. It turns out that the knot is located in line with the standing part of the shroud. Sounds simple. The standing part is the full length of the shroud—as opposed to the free or bitter end. The location of the standing part varied, however, because the turn around the deadeye was right handed (clockwise) if the shroud was a hawser laid rope and left handed if it was cable laid. You realize from this of course that the end of the shroud was bound forward of the shroud on one side of the ship and aft on the other! It's all just terrible!

Suffice to say, for this ship the shrouds are all hawser laid (right hand twist). Looking at the deadeyes from outboard, the starboard shroud wraps around to the right and the end crosses over at the top to be seized



A block.



A modified commercial serving machine. A bolt is threaded in the headstock fitting to hold the line being served. A pulley is added at the tailstock to let the offered line twist freely, deliver easily and be weighted a bit to keep the line taut.

forward of the shroud. On the port side, the shroud again wraps around to the right and crosses over at the top, but will thus be seized aft of the shroud. All of this incredibly complicated stuff means that the starboard stopper knot is in the forward hole of the two at the base of the deadeye's triangle and the port stopper knots are in the aftermost hole. I suppose I could have just said that last bit and left it at that! An excellent description and sketches of this data can be found in Chapter XIV, "Rigging the Spars", in Petrejus.

CHAINPLATES

The final pre-rigging bit of work on the Virginia sloop is the manufacture of the chainplates. The chainplates are made of scale 1" diameter iron (.031" brass wire or rod). Three inch lengths of the annealed brass are first formed around a T-pin stuck in a piece of softwood to form the bolt loop at the bottom. A bend is made in one leg of the wire to mark the insertion point for a deadeye. Wrap the wire around the deadeye (it will not be removed from this point on) and bend it sharply at the bottom of the deadeye. Cut off this leg of the wire about halfway down the length of the chainplate, to butt against the similarly cut off end coming up from below. The distance from the outside end of the loop to the insertion point of the deadeye should be about 7/8", just long enough to reach the top channel above and terminate at the lower edge of the black strake below. Make a trial chainplate first to get the dimensions right, then make eight good ones for the model.

Pin the chainplate to a piece of softwood with the deadeye extending over the edge, using the T-pins to keep the legs of the chainplate tightly together, then soft solder the legs together. Electronics silver solder (about 5% silver) is good to use here; its small diameter melts easily with a small iron and its silver/tin composition oxidizes well. File the finished plate straight and flat, then oxidize the metal (you have to dunk the whole thing, deadeye and all, so wash it off well afterwards). Bend the plate just below the channel to angle it inward towards the hull, then bend the slight angle at the bottom so that the loop lies flush against the hull. Touch up the assembly with flat black paint.

The chainplates can be installed now. Put the mast in its socket, then tie a string around the masthead to rest on the bolsters (where the shrouds will sit later), the free end of which is long enough to reach the hull below the channels. Put the chainplates in their notches and glue the retaining caps in place. Stretch the string from the masthead to the black strake in line with each deadeye; this will give the exact angle for each chainplate. Holding the chainplate at this angle, mark the location of the hole in the loop on the black strake with any sharp pointed tool.

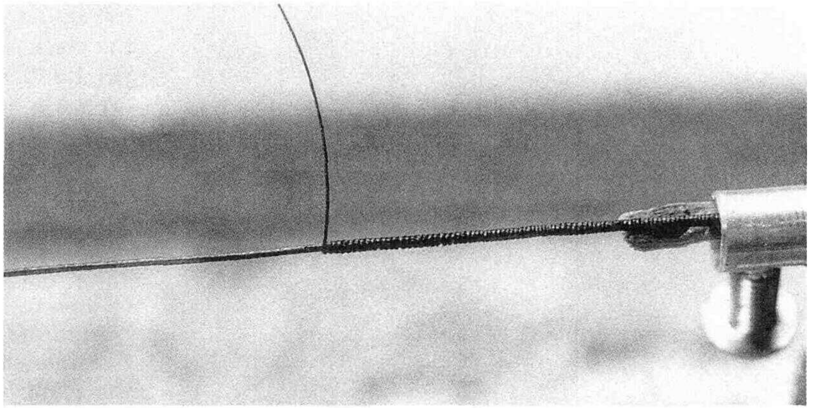
Drill each bolt hole with a #61 drill. Fashion the bolts from #18 brass escutcheon nails. They will have to be turned down in the hand grinder, using files to bring the diameter down to about .039" and the heads to about .080", the size of a 2 1/2" diameter bolt head in full size practice. Larger ships had additional preventer plates also held down by this bolt, the lower ends separately bolted lower on the hull. Epoxy the bolts in place and the pre-rigging is completed.

SPAR INSTALLATION

It's time to mount the hull in the rigging case if that hasn't already been done and to install the mast and bowsprit to prepare for the final rigging process. Even though the jib boom is a retractable spar on the real ship, it is fixed on the model and essential to its complete rigging, so you'll also install that spar at this stage.

Start with the bowsprit, as was usually done in full-size contemporary construction. Slip the bowsprit in place, the heel resting flat on the surface of frame #4. Secure the spar with #48 size bamboo dowels and epoxy, both at the heel and at the stem. The heel clamp is bent from six scale inch wide (3/16") .020 brass, with two #73 holes on the deck tabs on each side for copper nails (.062" diameter heads). The bowsprit clamp is made from the same stock, but because this clamp has to angle backwards a bit as it reaches from spar to stem, it needs to be cut in the shape of an arc. Cutting it from a 1/4" wide piece of brass to its final 3/16" width will be just about right. Form the ring shaped part of the clamp around an appropriately sized dowel or tool, then bend the verticals with needle nose pliers and drill for two through-and-through bolts of the same *size as* above. Epoxy the clamps in place. The stem fitting will need to be clamped while the glue dries; one of the cut down clothespin clamps used in planking (the tips waxed to prevent adherence) will do fine.

A few cleats are needed on the bowsprit for the bobstay and the horse. The former are a single large pair at the end of the sprit, in line with the sheave in the end. These cleats are about 5/32" wide, 7/32" long and 1/6" thick. They are secured with two small dowels each. The stirrups that suspend the horse need two small cleats, half the size of the others, on each side of the stirrup and on each side of the spar. As there are two stirrups, you need eight small cleats, each mounted with a single dowel.



A dose-up of served line. A bit of glue applied just ahead of the serving line keeps the serving in place.

The jib boom overlaps the bowsprit 4.3" on the model. It is situated about 20° to port, its sheave vertical. The two iron double rings that you made in the section on spars hold the jib boom to the bowsprit. The forward one fits just before the bowsprit sheave; the aft one just forward of the securing line hole in the butt of the jib boom. They should fit snugly at their locations on the sprit. Test them frequently as they are formed. A bit of cyanoacrylate will lock them in place.

The lower mast comes next. It is simply glued in place with epoxy, the fork into the pocket. The angle with the deck and the vertical position of the mast should be automatically exact if the prior fitting was done well. Double check the angle with a cardboard template. The vertical midline position of the mast is best checked by eye, sighting along the jib boom and bowsprit.

A silver coin was often placed at the mast step by contemporary shipwrights for luck. This is a nice little touch for intermediates, who can use all the luck you can get. A miniature silver coin can be hammered out of a tiny slice of electronic or regular silver solder. There is 5% silver in the former and 35 to 100% in the latter, the choice depending upon how much luck you think you are going to need.

STANDING RIGGING BOWSPRIT

As I mentioned earlier, rigging in full-size practice generally began with the bowsprit, that is convenient for ship modeling as well, so start there. It's a good idea, by the way, to tar the standing rigging as you go along, and before installation insofar as that is possible. Over properly black dyed linen line, a mixture of Floquil brand paints, 2/3 Dark Stockholm Tar and 1/3 Tar, is just about right. It adds a bit of brownish tint and a touch of gloss to the rigging, authentic looking. Soak it into the line with a paint brush, being careful to avoid splatter; mask everything you can with kitchen paper toweling.

Back to the bowsprit. Do the heel lashing of the jib boom first. Take about a 6" length of black dyed .020" diameter linen and tie a figure-of-eight knot at one end. Harden the free end with cyanoacrylate, then cut that end into a needle point. Thread the line through the hole in the heel until the knot stops it, then wrap the line, also in figure-of-eight fashion, two or three turns around the bowsprit and the jib boom. Finish with a couple of turns around the overlapping line between the spars, then just run the end through the turns and secure with a drop of cyanoacrylate.

The horse should be of .028" black dyed linen line, or the closest size you can get to it; in this area, a bit larger is better than a bit smaller. The stirrups are of .025" line. Because the horses are moused (knots will do) every three scale feet (1 $^{1}/_{8}$")—as an anti-skid measure—the piece of line needed will be a lot longer than you think, about four feet actually. Simple half-hitches will do for the knots. Tie the center of this double line over the end of the bowsprit, against the cleats, and secure below with a throat seizing. Allow the horse to sag about three scale feet below the spar, then bring it smoothly up to have each leg end in a large seized eye that fits around the base of the knighthead. Use throat seizings to secure the stirrup lines around the bowsprit between each pair of small cleats, then form seized eyes around each leg of the horse.

BOBSTAY

The bobstay serves to oppose the upward forces on the bowsprit created by the pull of the mainstay and the jibstay. This important piece of standing rigging begins with a length of served line fitted through a hole in the stem, spliced to itself to form a loop, ending in a pair of deadeyes lashed around the sprit at the cleats near its end. The deadeyes, the same size as those for the mast shrouds, have already been made in the block and deadeye factory. The stay is reported in the Steel tables as being .9" diameter (.028") line. As the line must be served and because the serving will add quite a bit to the diameter, it's best to start with line a good deal smaller, about .020" in diameter. The segment that secures the foremost deadeye to the spar needs to be about 2 1/2" long. Use a throat seizing to lash it to the spar just ahead of the cleats (inboard of the horse), then cyanoacrylate and diagonally splice it to the deadeye as was done for the block rigging for the cannon earlier on. The piece for the stay itself needs to be about 14" long.

Drill a 1/16" diameter hole through the stem, half the thickness from each side, five inches above the baseboard. It's actually a good idea to start with a small diameter drill and enlarge it bit-by-bit (pardon the pun) to get the hole quite level. Cyanoacrylate the end of the shroud until it turns into plastic; cut the end off as a bevel. Run the shroud through the hole, then glue the beveled end to a razor cut flat a bit away from the stem;

serve over the splice. Fit the second deadeye to the far end of the shroud using the same technique as above. Be sure the final length is short enough to leave plenty of space for the inter-deadeye lashing.

The lanyard is dyed .016" line, with a figure-of-eight knot used as a stopper. Start it off at the far deadeye and finish it up tied around the latter's short pendant.

BOWSPRIT SHROUDS

The shrouds, also being completely served, need to have a core smaller than table size; .016" line does nicely. The total length will need to be about 27", including the 2" segment used to form the fake cut splice over the end of the bowsprit. The shrouds are secured via gun tackles on either side of the hull. The eyebolts to which the double blocks of the tackles are lashed are located in the black strakes, just below the second timberheads.

The fall of the tackle starts tied and glued through a hole drilled under the stropping of the single block at the end of the shroud. After reeving through the blocks, it can be taken up into the bow and belayed around the two timberheads, or wrapped around the standing parts of the tackle and tied off. For the latter format, it is best to run the tackle out to the single block end of the standing parts, half-hitch and glue it, and then wrapped it around the lines between the blocks as you did with the cannon side tackles. The free three or four inch remnant is first half-hitched and glued around the lines at the double block end, then a natural sagging loop formed and finally half-hitched and glued around the block's lashing. A half-inch or so is left hanging free, persuaded to hang straight down with a little cyanoacrylate.

MAINMAST

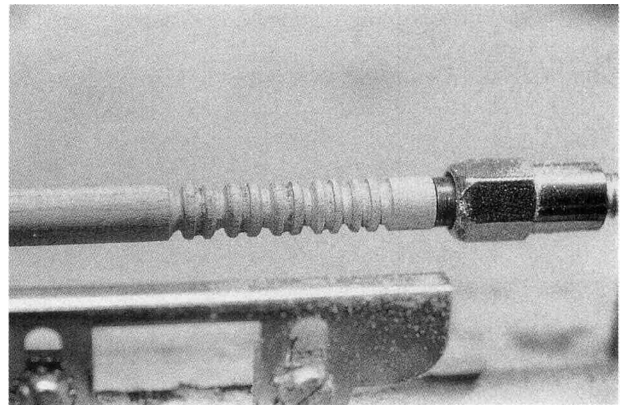
Pendants: A pendant is a rope lashed around and above any fixed structure high up on a mast (such as above the trestletrees), designed to suspend a block for the fall of another tackle. These compound tackles are often the ones used to haul cargo and supplies. On the Virginia sloop, there is one double pendant looped over the mast, the loop going over the trestletrees and hanging down aft; they serve as the cargo tackle pendants at anchor and as running backstays at sea, one being let out as needed to accommodate the boom when on a broad reach or run.

The pendants are made from a single length of .032" diameter black stained line, 15" long. A loop is formed at the center, large enough to slip over the masthead and the trestletrees, the junction formed by a throat seizing. Each end is fitted with a block for .016" line. The completed pendant pair is slipped over the masthead and left dangling, the rigging of its tackles to be completed later. In anticipation of that final rigging, the blocks for .012" line affixed to an eyebolt which you made earlier are now glued into a hole in the quarterdeck rail. This is also a good time to install the pendant with thimble in the same eyebolt. A small eyebolt is similarly fixed to the main rail just forward of the quarterdeck break on each side, as shown on the plans.

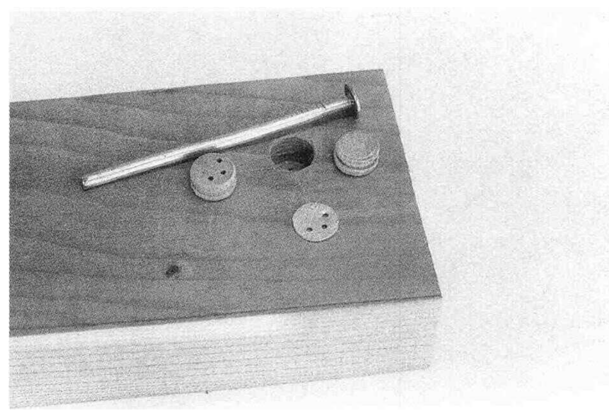
SPREADER YARD HORSE

This horse acts as sort of an accessory mast; it is used to guide the spreader yard as it is hauled up into place or lowered. I am not aware of any contemporary detail drawings of this sort of horse. One does find the occasional reconstruction drawing by modern ship modelers, with the horse done as the mainstay, with an eye and mouse forming the loop that goes over the bolsters just behind the heel of the topmast. I have chosen a slightly simpler form. Considering the fact that the horse need withstand little continuous strain, it is represented here more like a single-legged pendant, completely served to prevent chafing. There is a simple spliced and served loop to fit over the trestletrees and under the shrouds and jeers.

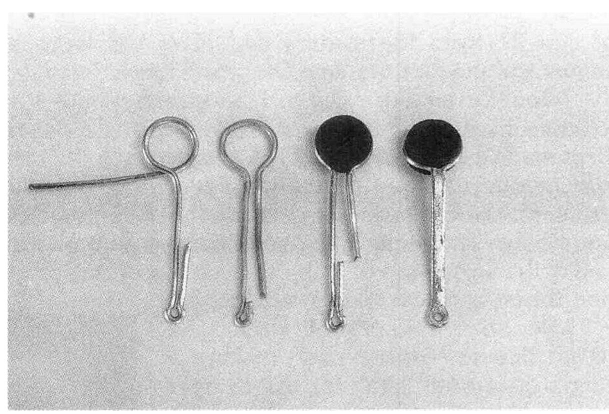
The chart calls for .9" diameter (.028") rope for the horse. I went down to .025" to allow for the thickness of the serving. Leave unserved a 1/4" length



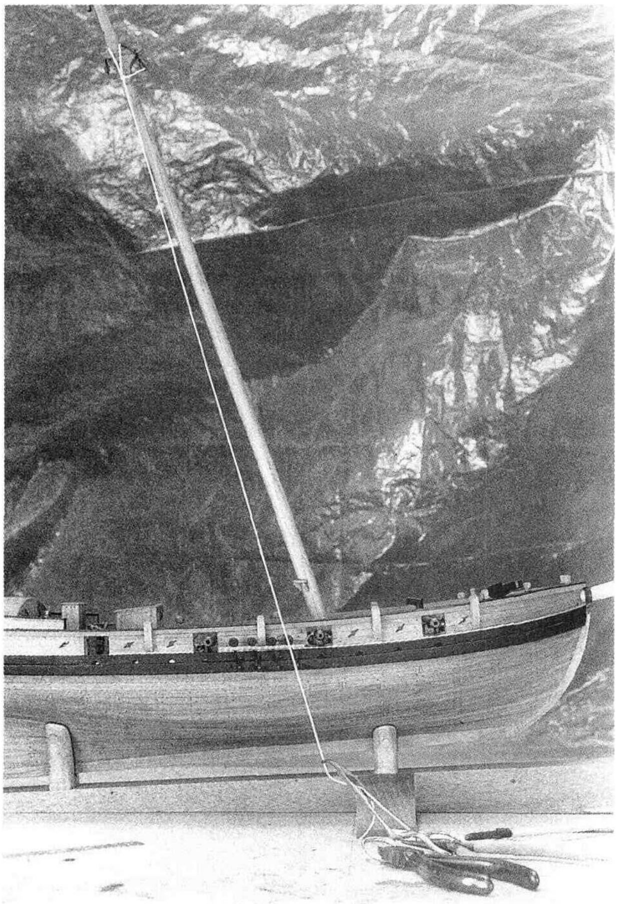
Turning *deadeyes.*



A hole drilling jig for deadeyes. The blunted nail fits through a hole at the bottom of the jig (can't be seen in this view) to push out the drilled deadeye.



The stages in the manufacture of chainplates.



Aligning the chainplates with the aid of a string hung from the masthead.

of line 2" from the starting end. This will leave a convenient site for the fake splice which forms the loop.

Allow for an extra two inch length of served line to make the strop for the lower deadeye. The deadeyes were made earlier; they should be awaiting their disposition in your parts tray. Fit them the same way you did earlier for the gun tackles on the cannon, with thimbles and hooks. The other .028" line deadeye goes on the end of the horse proper, with the same sort of fastening, one throat and two round seizings.

Use an 8" length of black-dyed .016" line for the lanyard, making a simple glued half-hitch for the stopper knot in the upper deadeye. *Reeve* the lanyard through both deadeyes loosely. Epoxy a small eyebolt in the deck just forward of the mast. When the glue is dry, fit the horse loop over the trestletrees and its hook into the eyebolt below. Tighten up the lanyard and tie it off.

SHROUDS

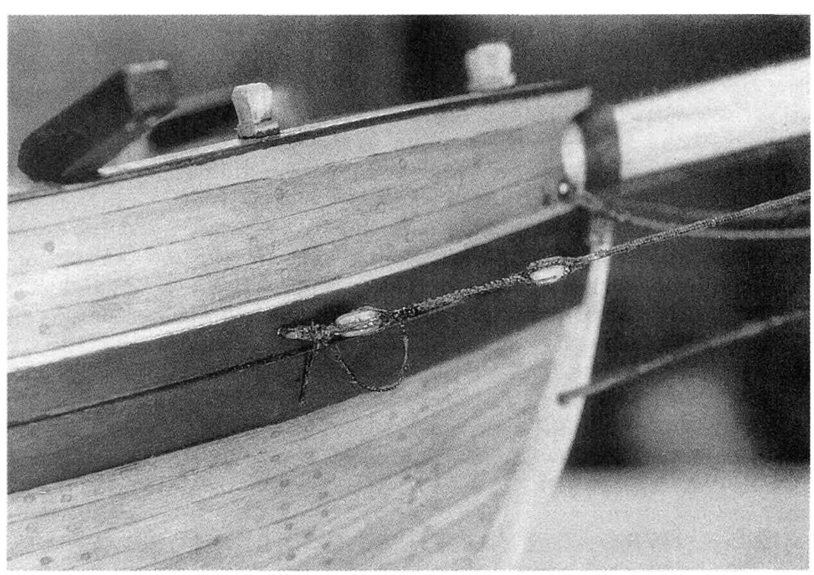
The shrouds are made quite similarly to the pendants, each pair being a single length of line bound together with a loop that drops over the masthead and leads down on one side or the other. The first pair of shrouds is the starboard forward pair, the second the forward port side pair and so forth. Because the fore most and after most shrouds in a gang are served to prevent chafing from yards and the boom respectively, each pair is essentially identical, with one served leg and one bare leg. The serving extends all the way over the masthead and down the bare leg a bit, to resist chafing from contact with the mast and bolsters and other rope structures.

A special problem arises in model work, as you may have guessed, resulting from the over scale bulking-up of served line. The solution here, with the shrouds, is to splice together lengths of two different diameter lines, then serve over the smaller diameter line to a point just past the splice. Splice a 26" length of 0.44" diameter line to an 18" length of 0.62" line, (both commercially available) to do the job. Dye the line black before splicing, of course. Use a long, tapering, cyanoacrylated splice. Saturate the joint with cyanoacrylate after the joint has hardened, let the saturation harden, and smooth the taper with a razor blade and serve. The only danger of using cyanoacrylate saturated lines is breakage. The cyanoacrylate turns the line into plastic; the joint is permanent, but the line becomes rigid and will shatter if acutely bent. The loop is about one inch long, formed with a throat seizing of .016" line. All four shroud pairs are done the same way. After they're tarred, fit them up over the masthead, being sure to get the port starboard sequence right and the unserved legs in the middle.

This is a good time to put the topmast in place; it will help keep all the layers of rigging in place. Friction and the fid will be all the fastening needed.

The next job is to install the deadeyes in the shroud ends. This requires some sort of spacing device to insure that all the deadeye pairs are the same distance apart. The upper deadeyes are usually at about the level of the deck rail. The tool I use for spacing deadeyes is merely a modified spring-type clothespin with a little tombstone-shaped piece of plywood at right angles to its surface to hold the upper deadeye at the proper distance.

The bottom piece needs to be narrowed a bit at its end and to have a notch cut in it to fit around the chainplates. The upper piece needs to have a mortise, 7/32" square, cut in 1/8" from the end; it also needs to be narrowed—to about 3/8". The tombstone is of 1/8" thick plywood and is 1/2" wide and about 7/8"



The bobstay and bowsprit shrouds.

high. It needs to be tall enough to have a square notch cut out of its lower end to fit over the end of the upper piece of the clothespin and still have enough top to let the lower edge of the deadeye be at rail height, 9/16" above the top of the clothespin. The plywood piece needs to be drilled for two #74 holes to take brass hobby nails; the holes are to be as far apart as are the lower two holes in the upper deadeye. The nails are epoxied to the plywood and the plywood is epoxied and pinned to the clothespin. When all the glue is dry, the back the plywood piece and the end of the clothespin will have to be beveled and vertically notched to be able to fit the middle two lower deadeyes, where free access is limited by a swivel post.

In use, the tool is merely clamped to the channel over a deadeye, with another deadeye impaled on its brass nails. Be sure that the third hole in the deadeye is upper-most to avoid serious later distress. Start on the starboard side of the ship. Wrap the first forward shroud, a completely served one, clockwise around the trapped and helpless upper deadeye, and cyanoacrylate it where they cross, the end behind the shroud. A surgical hemostat is an excellent clamp here while the glue is drying. Put in a throat seizing at the crossover, then two round seizings equally spaced further up. The bitter end is forward of the shroud on this side, aft on the other, always to the right as you're facing the model.

The lanyards are of .025" diameter black-dyed linen line. Each is a 10" length with a stopper knot at one end (a cyanoacrylated half-hitch will do) and a cyanoacrylate formed needle on the other end. The lanyard rigging starts with the needle coming through from the inboard side of the upper deadeye's right most hole. It is then reeved down in front, up in back, etc., to finally tie off in a half-hitch through the throat of the shroud. The bitter end is spiraled around the shroud and its bitter end for a few turns, then seized to the shroud alone and cut off. Do the first forward shroud on the starboard side to begin, then the first on the port side; alternating the sides will help keep the tension even and avoid bending the mast. Don't tie off the lanyards just yet—you'll do that and do the horse's lanyard a bit later—after you've gotten the stays up.

"Ratling down" is the annoying process of installing the ratlines, the rope ladder rungs in the shrouds that provide the limber staircase for the seaman's climb aloft. This is best done when you are feeling particularly calm and patient and after the shrouds and stays have all been tied off. This is the process:

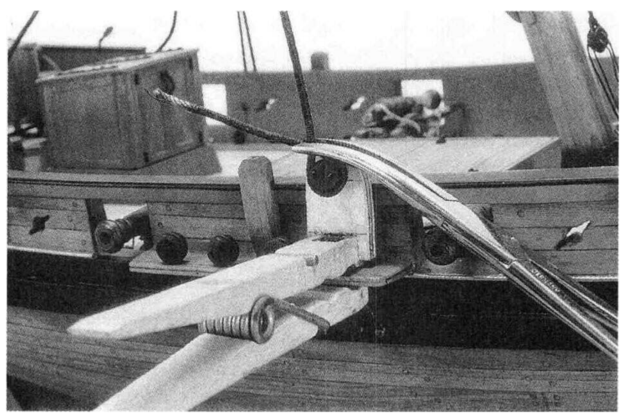
Begin by making a stiff white paper pattern to the shape of the bank of shrouds as shown in the photograph. Cut the bottom off parallel to the run of the rail. Starting just at the level of the tops of the bitter ends of the shrouds, mark off parallel pencil lines a scale 16" apart (1/2"). Then pencil in one more line 1/2" below the first one; this will put the lowest ratline about two scale feet (3/4") above the rail and in the overlapping part of the individual shrouds. Tape the pattern to the backside of the shrouds as a guide, being careful to keep the tape away from the pencil lines and to avoid causing the shrouds to deviate from their natural run.

The ratlines are of black .012" linen. They are generally fixed to the first and last shrouds with a lashing formed through eyes in each end and to the intermediate shrouds with clove hitches. The latter are easy; the former are impossible. While I seem to have the almost endless patience to build a model from tree, fiber and scrap metal—and then to write it down step-by-step—I absolutely can not make and lash a hundred ratline eyes! The thought brings me to my knees in despair. A satisfactory fake can be made by half-hitching the ratline to the foremost shroud, the free end of the line above, then cyanoacrylating the hitch to the shroud, cutting off the free end short, and gluing the end in place, flattening it with tweezers in the process. (I always write long sentences under stress).

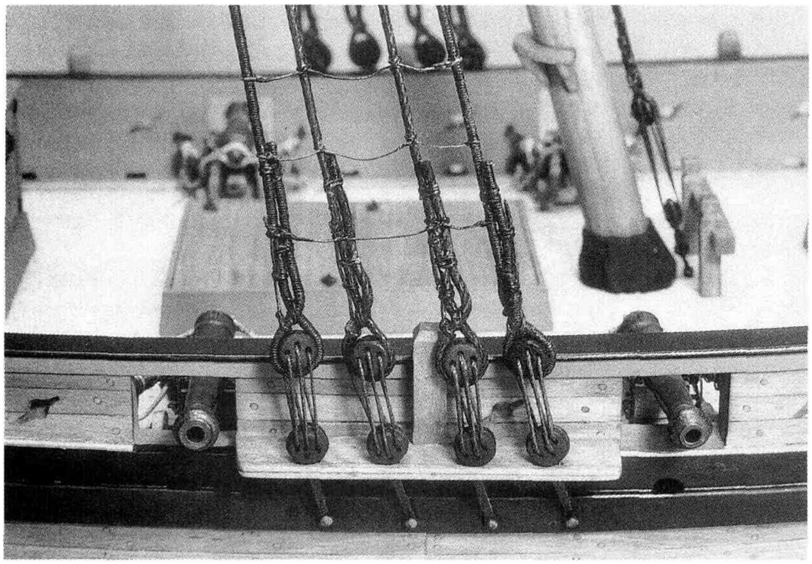
The clove hitches are done as shown—from the right loop the line in front of and around the shroud and over the existing line, then around the shroud again and under the line. Pull up snug with tweezers and/or needle nose pliers, pull down on the ratline between the shrouds to get a nice "sag", then fix in place with a touch of glue. As you get higher up on the shrouds, it's not possible to glue down the short end of the half-hitch; just cut the free end off flush with the knot. At about that same level clove hitches bulk up too much, so a simple half-hitch will have to do. It's a good idea with ratlines to re-institute the workshop anti-bonkers program, that is, to do two or three of the darn things then go off to do a household chore, and so forth.

STAYS

Here you have to make and install the heavy lines that support the mast and topmast in the fore-and-aft direction, opposing both the natural effect of gravity on an aft-leaning spar and the pull aft of the shrouds. The stays—forestay, jibstay and topmast forestay—are fairly long and heavy rope structures and are essentially unsupported except at each end. Although they are set up as taut as is reasonably possible, both on a real ship and a model, they will always assume a catenary curve, the natural curve of a heavy flexible structure suspended between two points. Don't fight it. It's natural, it looks right, and a straight stay almost always means a bent mast. The forestay is going to be the biggest problem; it is .071" in diameter, an almost impossible size to find in any commercial linen line that looks halfway decent. On the other hand, making your own rope is genuine nuisance, so if you can find a piece somewhere—you only need about two feet—grab it. If you can't find any, and I couldn't, you will have to make some. I have an inexpensive commercial rope-making machine which is fussy but satisfactory. Simple machines can be easily made at home, using the plans in Ship *Modeler's Shop*



The deadeye spacing jig in use. A mortise in the upper part of the clothespin fits over the chanel deadeye, while a notch in the lower part slips around the chainplate.



The deadeyes installed and rigged.

Notes, "Building the Brig-of-War Irene" or found from time-to-time in the various ship modeling magazines. One can even turn out a fair piece of rope by clamping three lengths of linen line in a vise and spinning the rope using a power drill on very low speed.

All rope making machines have a similar power head—a central gear with a crank attached engaging three smaller gears spread at equal intervals along its circumference. Because you will be almost always starting with right hand twist line, the crank should be turned counterclockwise to produce a left handed cable, quite correct for large stays (and for anchor cable, by the way). If you try to make right hand rope from right hand rope, the lines used will have to unravel and reform as left hand rope before they can begin to form the larger rope, and that process rarely works out satisfactorily.

For any of these methods, three lengths of .031" diameter line, each four feet long, will do to start. It's messy but easier if you dye each line black before spinning the rope. The finished rope will be about a third shorter in length than the separate lines used in its construction. Newly made rope should be wetted down a bit with a wet cloth and tied off at both ends, then left to dry overnight under tension.

Unfortunately, scratch made rope looks so good that all the other line used on the model suffers in comparison.

FORESTAY

The forestay needs to be served in its chafing area, the part that forms the loop around the mast-topmast combination atop the bights of the shrouds. The served length is about 1/3 the total length, or about 8". Leave the topmost 1" unserved; an eye needs to be formed at this end through which the stay reeves, and unlike smaller diameter line, it's hard to hide the joint in already served line. Another preserving chore is the manufacture of the foundation for the mouse, the little pear shaped enlargement of the stay that serves as a stopper for the loop by trapping the eye I just mentioned.

The mouse in real practice was generally built-up with various fiber materials then secured with a woven mat-like covering. Actually, it's not impossible to do the same on the model, but it looks messy unless you get it just right. A satisfactory substitute is obtained from just serving over a pear shaped wooden bead, glued to the stay and painted black. Carve the bead from a piece of wood about 1/4" square, leaving the stick an inch or two long to hold onto it during the shaping. The mouse needs to be only 1/4" long. Drill the hole down its center first; it needs to be only a little *deeper* than 1/4".

Start with a 1/16" diameter drill; the hole can be enlarged to fit the rope with files after it is shaped. After the basic shaping is done with a hobby knife and files, the bead can be sawn off the stick and a piece of hardwood dowel inserted to hold it for the final shaping. Remember that the taper has to be essentially zero at both openings. Slide the wooden bead on the stay, the long taper pointing towards the deck. It can be glued in place with cyanoacrylate, seven inches from the top of the stay, when the serving process allows. Serve to about 1" below the mouse.

With the serving completed, flatten out the end of the unserved top inch with flat nose pliers, then bend that end around in a small loop to form the eye. Cyanoacrylate it in place. When it's set up, trim off the excess flattened line with a sharp knife, then serve the loop by hand; a large sewing needle is a big help here. Thread the serving line through the eye of the needle, then twist and cyanoacrylate it to itself rather than knotting it.

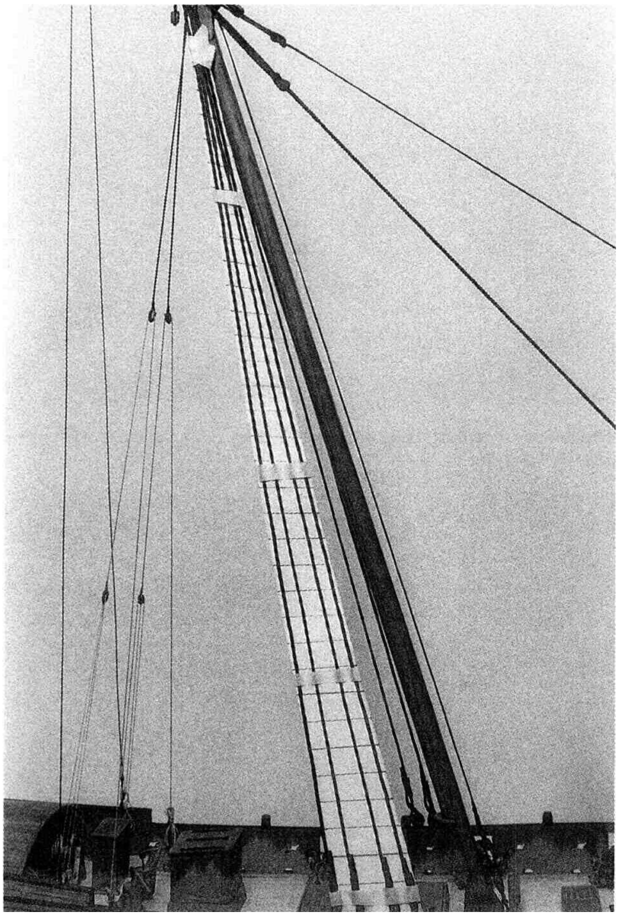
The closed hearts for the lower rigging of the stay are made of 1/8" thick cherry. The dimensions, taken from tables in Lees, are 3/8" long by 1/4" wide. The shape is that of a cone with its top cut off. The central opening is the same shape; it is a bit wider at the broad end of the heart than at the narrow end. The groove is as wide as the diameter of the stay and half as deep. There is no groove across the narrow end.

FORESTAY COLLAR

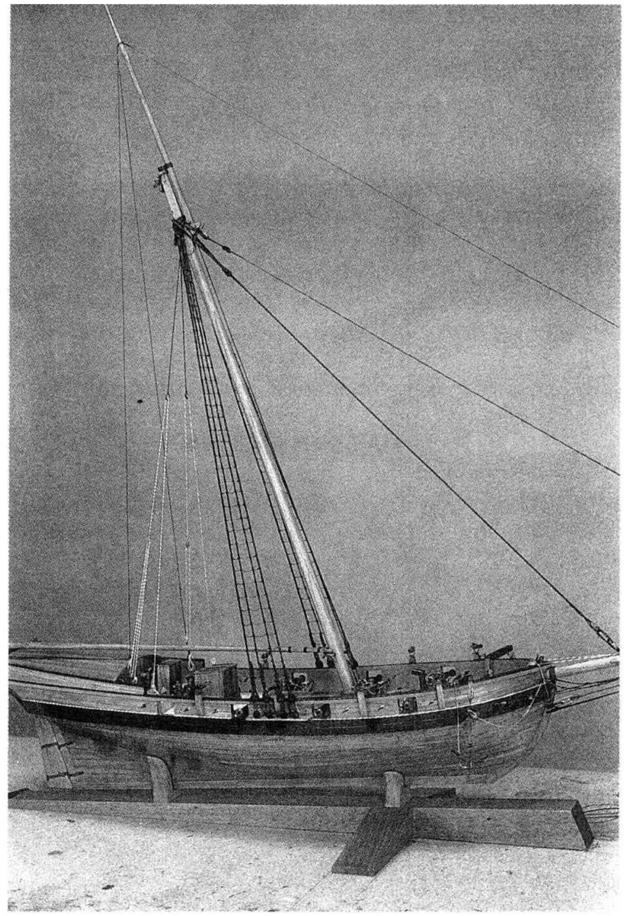
The collar around the bowsprit is made of completely served line. It should be about the same diameter as the stay itself and will look oversize if you start with a piece of line from the stay itself. Hunt through your rigging box and see if you can find a length of .060" diameter linen. Serve all but 3/4" at one end, again to allow for the formation of an eye as you did on the stay proper. The eye needs to be a bit smaller than the one on the stay to keep it in visual scale. The line should be completely served, but you will find that it looks better, for the same reason, if the eye is not served. Seize a heart near the eye, broad side up.

A pair of thumb cleats will have to be made and installed just inboard of the first stirrup of the horse for the collar to bear upon. Wrap the collar around the bowsprit. Reeve the bitter end of the collar through the eye, bend it back on itself and fix it to the collar proper with two round seizings. A sewing needle will be useful for this operation also.

The lanyard here is quite heavy, as you might imagine, .025" diameter line. Wrap a loop around the broad base of the upper heart and splice it to itself. Four loops through the pair of hearts secures the stay. Do not



A paper pattern taped to the shrouds for rattling down.



The major stays—forestay, jibstay, topmast forestay, running backstays and topmast backstays in place.

secure the lanyard yet. Later, when all the stays are in place and adjusted, glue the bitter end to the last leg of the lanyard and further secure it with two round seizings.

JIBSTAY

The jibstay is just a less massive reproduction of the forestay, complete with mouse and upper segment serving. Its upper collar, as you can see from the plan, sits right on top of the forestay collar. The stay then runs through the sheave at the end of the bowsprit, back towards the bow of the ship where it ends stropped around the far block of a simple tackle. The fall of the tackle leads upwards to tie off on the foremost starboard timberhead.

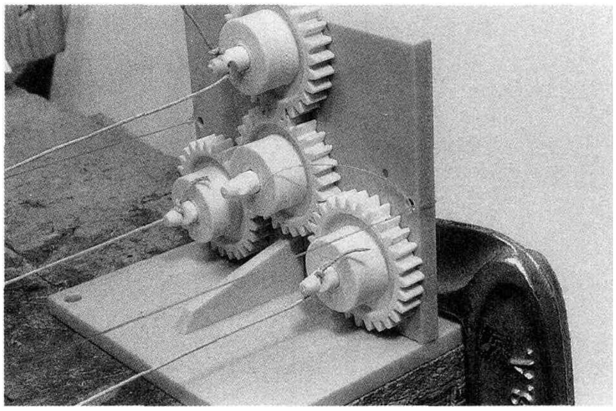
The rigging chart calls for .028" diameter line for both the jibstay and the topmast forestay, but my collection includes only .025" and .031". Everyone knows that decreasing diameters from below upward looks better anyway, so I used the latter for the jibstay and will use the .025" for the topmast stay. A piece of line about 40" long will be needed. Mouse, serve and tar it just as you did for the forestay. The stay terminates as the stropping for one of the single blocks for .028" line you made earlier. The fall of the tackle, of .025" line, begins seized around the arse end of that block. The other block is seized to an eyebolt on the starboard side of the stem just above the bobstay hole. Hauling parts of tackles at right angles to the axis of the falls reeving between the blocks tends to distort the tackle, much more so on a model than at full size. Reversing the lead helps some (seizing the fall around the fixed block's stropping), but I chose to install a fairlead (an eyebolt with a fancy name) just above the tackle eyebolt in the stem. Now the tackle stays nice and straight as my miniature seamen haul away from their perch in the bow.

The fall needs to be made to suggest ordinary weathered, untarred rope—so stain it a light grey-brown in color. Make up a little jar of the stain to use for all the running rigging to avoid the visual distraction of multiple rigging colors. Again, felt tip marking pen dye comes to the rescue: the dye containing foam capsules from one brown pen and one black pen cut up and soaked in a baby food jar half-full of lacquer thinner will be just right. Remember to wax all of this natural color rigging with beeswax to prevent fuzzing.

TOPMAST FORESTAY

More like the topgallant forestay on a large ship, the topmast forestay doesn't use a mouse and eye to secure itself above. The step on the topmast is too narrow; a moused collar would easily slip off. What is needed is a small spliced and seized eye, just big enough to fit down over the flag pole. This bit of rigging takes the longest single length on the entire model, about six feet of .025" linen. From the topmast it runs far forward through the sheave in the end of the jib boom, then back towards the bow to reeve through the block fixed to the port side of the stem, then up to tie off on the first port side timberhead.

This light stay could be tightened up a bit from the bow of the contemporary ship with the aid of a little device called an inhaul. The inhaul is an iron ring, open at its top to a smaller, inverted U-shaped ring of iron. In use, the inhaul slips over the end of the jib boom, the upper ring fitting over the lowest part of the stay. Small diameter, natural color line inhaul leads, of .012" linen in the model, are seized around the rings at each side. They then run into the bows through the throat of the forestay collar (I'm not sure if that is accurate, but it is convenient and neat) then over the rail. The lines belay upon cleats which are about six scale inches long (3/16"). The cleats are located on the inside face of the bases of the first two timberheads. They are more easily made by silver soldering a T of .031" brass wire and filing to shape rather than carving from wood.

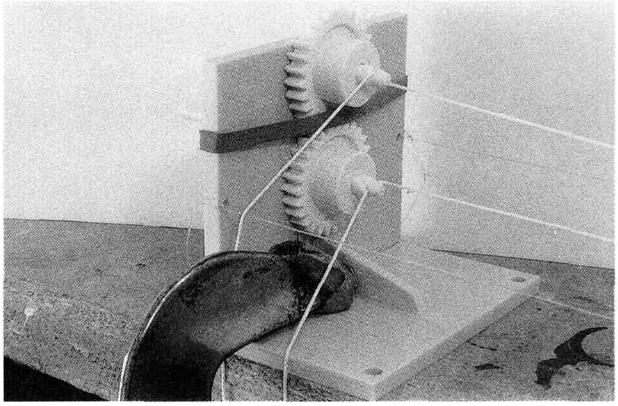


The power head of a rope making machine. The crank is hidden from view behind the upright.

BACKSTAYS

In this category you have two pair of stays—the running backstays of the mast proper and the topmast backstays. As you recall, the former are compound structures, a simple tackle at the quarterdeck rail, the upper block of which is stropped with a long runner that reeves through the pendant block to tie off at the eyebolt already installed in the rail forward of the quarterdeck break. The backstays tackle falls have no designated place to tie off, so I installed eyebolts for them, just forward and inboard of their tackle eyebolts.

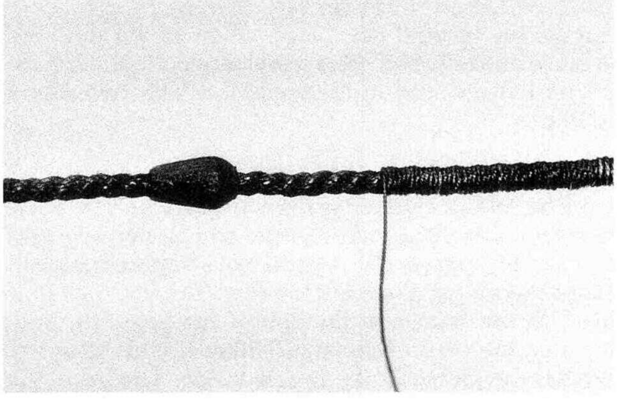
The topmast backstay is a single rope seized around the topmast just above the topmast forestay collar. It terminates seized-off around a thimble which itself is lashed to another thimble on a pendant seized to the same eyebolt as the running backstays tackles.



The tailstock of a commercial rope machine. The gears are not needed for rope making (can be used for serving).

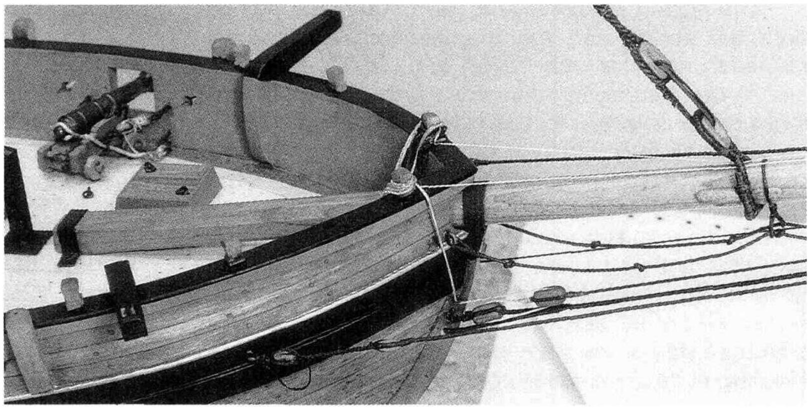
Each running backstay will need a three foot length of tan .016" diameter line and a single block for .012" line. From under the strop of this block comes the tackle fall, of .012" tan line; it needs to be about 28" long. The topmast backstay line should be the same diameter as the topmast forestay, in this case .025". A 4'6" length of black dyed linen is correct here. The thimbles are made the same way you did those for the gun tackle rigging. The pendants are also of .025" line, about two scale feet (3/4") long.

This now is the time to tighten up and tie off all the lanyards and falls of the standing rigging, the shrouds, stays and the horse. I've already described tying off the bitter ends of the shrouds. The bitter end of the fall of the mainstay collar is lashed to the nearest standing part of the fall. The ratling down needs to be done now also. The other lines all belay upon cleats, timberheads or eyebolts and need special attention. The latter consists of fixing the line to the fastening point with a spot of cyanoacrylate, then cutting off close, the end to be hidden by the coil of rope to come; the cut ends of the bow lines need to be short; those at the rails aft need to be a good deal longer, as the coils back here are suspended from their eyebolts rather than looped around them.

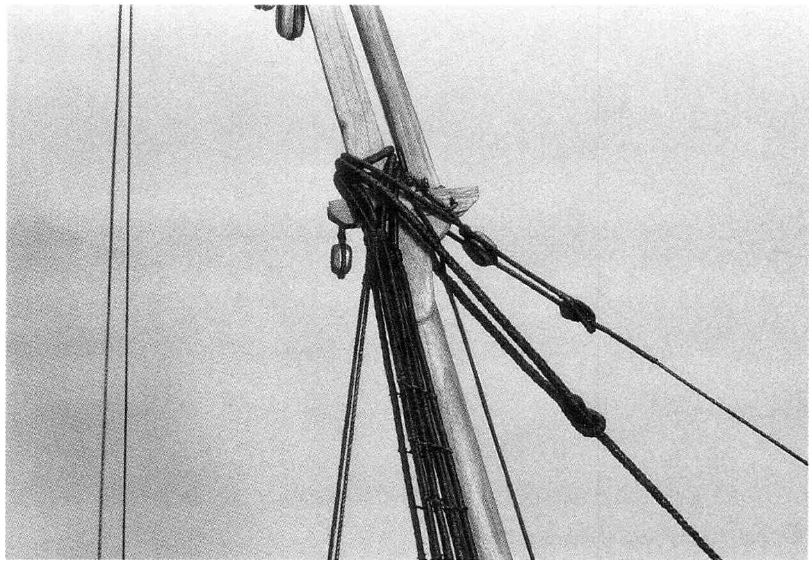


Forming a mouse on the forestay.

Coils are difficult to make so that they lie in a natural, slack fashion. Many methods have been suggested; the one I prefer is to form the loop over pins set in the edge and face of a softwood block. The total distance between the sets of pins is the desired length of the coil. The edge of the block is rounded off, and a



The rigging at the bow, with a view of the forestay hearts and collar.



The forestay and jibstay rigged at the trestletrees.

small piece of waxed paper is laid down before the pins are inserted.

For a narrow coil, use only one pin each at the top and bottom; for wider coils, use two. Glue the bitter end to the line near the top, where it will be hidden by successive layers of line. Wind the line around the pins until it is used up; a touch of glue will secure it to the loop. A tiny bit of glue inside the collar at the top and at the points where the loop makes its right angle turn downward will help preserve its shape. The finished coils for the lines in the bow can then be glued around the timberheads.

The coils for the lines at the rails are suspended from the lines themselves with a variation of a sea gasket—with the free end of the line, tie a half-hitch around the coil 1/3 of the way down from what will be the upper end. Wrap two or three turns of the line around the coil, drawing it into a figure eight. Run the free end under the wrapping from rear to front, over the wrapping, and through the upper loop. Hold everything in place with spots of glue. Wrap the free end around the line which is the standing part of the stay, then half-hitch it to the upper loop of the coil just above the wrapping. Pull the coil down as far as it will go, then glue it to the cut off free end of the standing part of the stay and to the standing part itself.

RUNNING RIGGING

The running rigging installation follows closely the description given in the drafting section. Just a brief guide is needed here therefore.

BOOM

The single block that you stropped for the bottom half of the main boom sheet earlier on now needs a place to shift back and forth as the vessel tacks. That fitting is known as a traveler, and in this ship the traveler is made of 1" scale diameter (.031") iron (oxidized brass) rod. It is a scale four feet long (1 $^1/_2$") and fits into holes drilled into the cabin roof just forward of the taffrail. Make the uprights 13/32" long, then wrap a turn of fine copper wire around each leg, 1/4" from the top. Soft solder the wire to the brass rod to form a pear shaped blob. Cut off the protruding wire ends, then file the solder to a cone shape, the large diameter downward. Use a small square file to file off the bottom of the pear, leaving a small cone shaped deck flange. Oxidize the traveler with Blacken-It and Win-Ox. Thread the stropped block on to the traveler, then glue the device into holes drilled in the cabin top.

At the mast, the boom jaws rest on the saddle already fixed to the mast. The boom is clutched to the mast by a parrel, a wooden beaded rope band running around the forward surface of the mast between the holes in the jaws. The beads, six in number, can be hand carved or turned from a length of 1/8" square cherry.

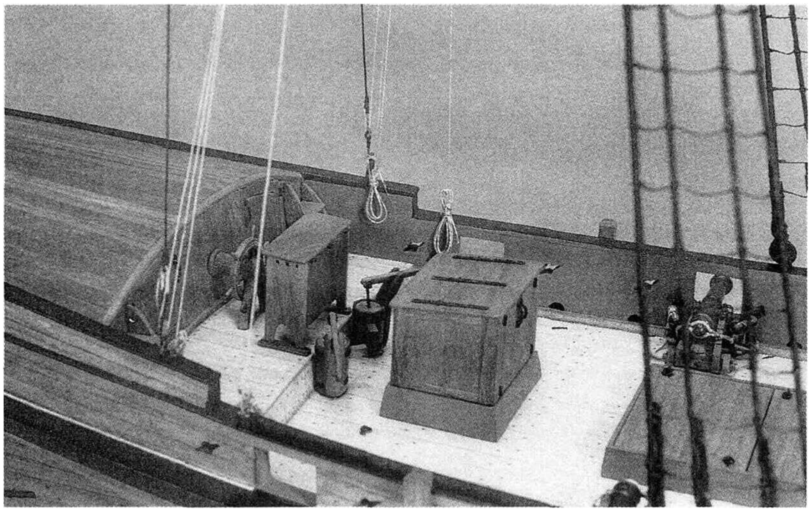
It's easy to do by hand. Drill a short .031" diameter hole, using a pin vise, in the end of the stick. It only needs to be about 3/8" long, so there's not too much of a problem keeping it centered. File down the end half inch or so of the stick to just under 1/16 "diameter, then file down the end to almost the diameter of the hole. Mark off 1/4" in length, then cut a shallow V with a hobby knife all the way around. With a miniature sharp edged file, shape the cone on the new end of the bead, then part the bead from the stick with a razor saw. Put the bead on the end of a T-pin for final shaping and sanding. When all six are done, oil them, then string them on a length of black line of about .020" diameter and tie the boom jaws to the mast.

The topping lift is the heavy line that suspends the outboard end of the heavy boom. It requires a five foot length of .031" line, stained dark brown as might a lightly tarred rope. Seize it around the masthead so that it rests on the cleats already there, under the existing blocks strops. Make the loop or eye large enough to accommodate the tackle's large single block (already in place) in its throat. Run the line down to the large block in place against the shoulder on the end of the boom, then back up through the block I just mentioned. The free end should be seized around one of the store of previously made double blocks for .016" line, the block hanging about 2/3 of the way down to the deck.

The lower block in this gun tackle is a single block for .016" line, on a pendant seized to an eyebolt fixed in the after part of the starboard channel. (The topsail halyard ends in a similarly pendanted block in the port channel, so it's just as well to do both at this time.) The pendant, with the block in place, is 1 $^1/_4$" long. The line is black .025" diameter linen.

The fall of this lower tackle is of .016" diameter tan line. It starts seized around the stropping of the lower (single) block and is, of course, reeved through the upper block twice and the lower block once. It ends tied off on a scale 8" (1/4") wooden cleat fixed to the aftermost starboard shroud, about just above the bitter end of the shroud.

The main sheet is of .032" tan line, the piece being 2 $^1/_2$' long. It is seized around the lower block of the tackle (the one on the traveler) reeves through both block from aft forward, then runs along the boom to tie off on the large cleat on its undersurface in the vertical plane of the quarterdeck break. The sheet can then drop to the quarterdeck, where it needs to be coiled and tied-off somewhere. There's not much space for a flat deck



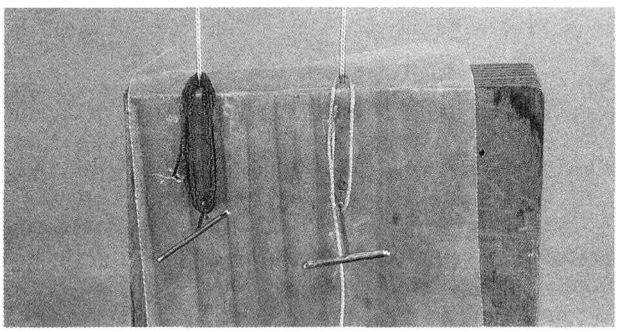
The tackles and falls of the backstays.

coil here. Perhaps one could coil up the line, tie it with light line, and tie the light line to the handle on the starboard quarterdeck bulkhead door.

Optional is the downhaul tackle. You already have the eyebolt in the undersurface of the jaws end of the boom to use. A gun tackle for scale 1/2" line (.016") would be correct here, with the double block hooked to the above mentioned eyebolt and the single block hooked to an eyebolt inserted in the deck just aft of the mast. The tackle would tie off around a wooden cleat fastened to the starboard surface of the mast just below the level of the saddle for the boom jaws.

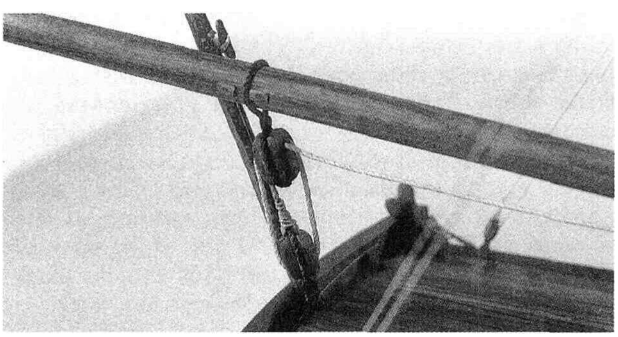
GAFF

The gaff is suspended by two sets of tackles, the throat halyard near the mast and the peak halyard outboard. They more or less have to be worked on simultaneously for the spar to be hauled up into position to enable work on the lower tackles. You are fitting the gaff so that it is hauled up, which is technically incorrect but generally done for aesthetic reasons. In life, when a gaff was not suspending a sail, it was lowered, with its furled sail, to just above the boom.



Using a simple jig to form rope coils.

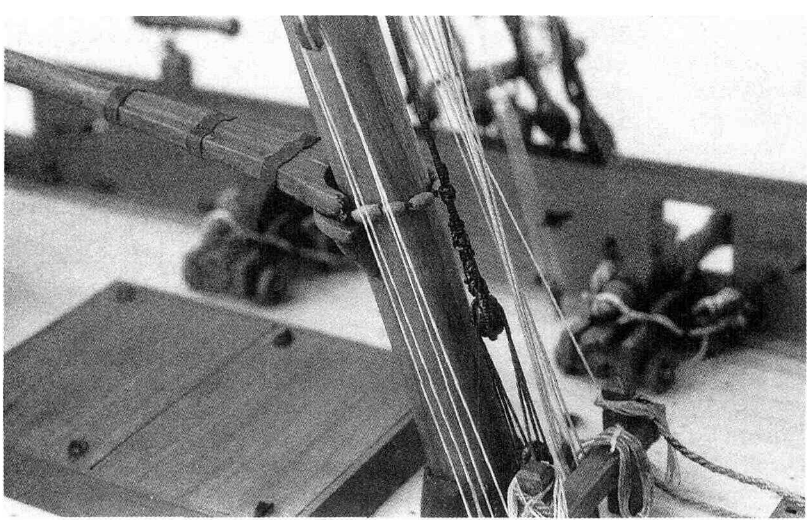
A 28" length of .025" tan line will do for the throat halyard and a 3' length for the peak halyard. Seize the throat tackle's line around the stropping of the single block at the hounds, then run it through the single block at the gaff throat and up through the hounds block; let the fall, which is now a pendant, just hang free. Seize the other line around the gaff at the cleats, then up through the double block at the cap, down through the single at the midpoint of the gaff, back up through the double; again, let the fall hang free. Finally, seize a double block for .012" line at the end of each tackle fall so that the block is about three quarters of the way down the mast.



The main sheet and traveler.

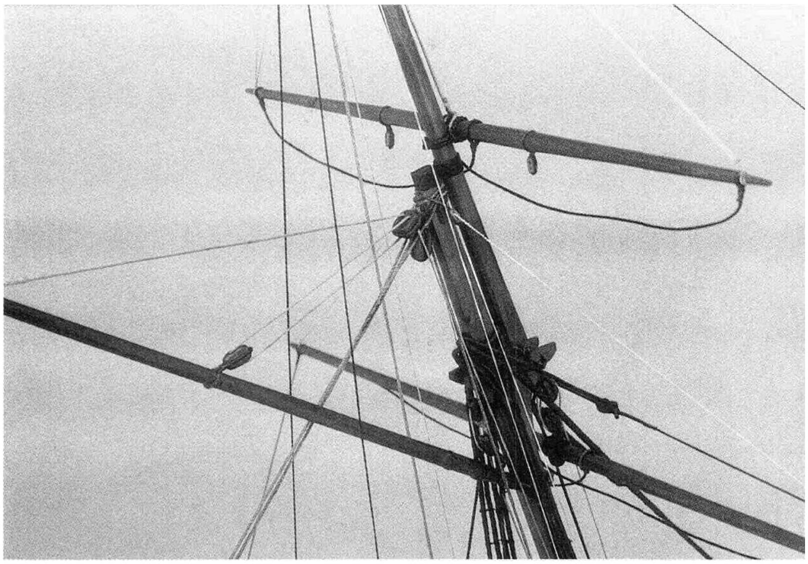
The model's gaff will just not have enough weight to keep these lines taut, so once the lower tackles are completed, hang a small lead weight from the end of the gaff and then paint the lines with Floquil glaze. The latter will add a bit of color depth and just enough stiffness to keep the lines from curving upward.

Before the lower tackles are fitted, the gaff jaws must be secured to the mast, with a wooden beaded parrel, just as you did with the boom. Here however, the beads are 3/32" in diameter and 5/32" long. The line is .025" diameter and the hole through the beads is made with a #69 drill bit.



The main boom parrel.

The lower block in each lower tackle is a single for .012" line. Make an eyebolt for each in the usual fashion, run the stropping line (.025" black line) through the eye, then complete the stropping as usual. Fasten a 2 1/2' length of .012" tan line under the arse end of the stropping, then glue the blocks into .040" holes in the deck. They go just forward of the mast, the one for the peak halyard to starboard and the one for the throat halyard to port. When the glue has



The peal and throat halyards and the topping lift.

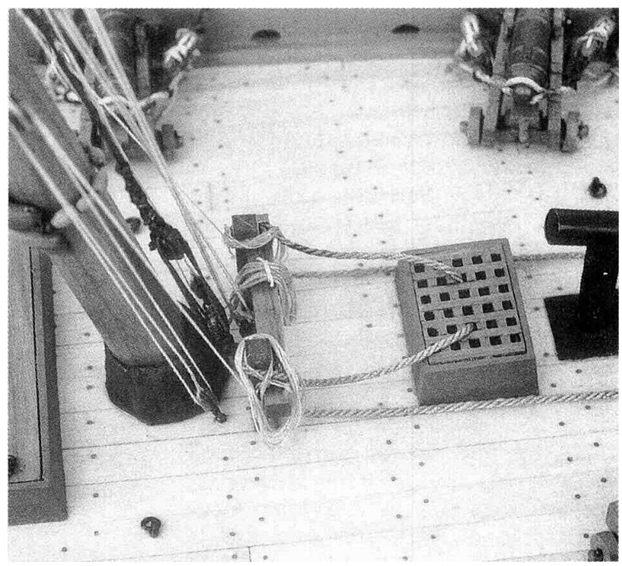
cured, run the line through the double block at the end of the pendants, and tie off the fall around the ends of the mast bitts. Glue the line in place, then cut off short. Use the long remnant to fashion coils which are draped and glued over the cleated off line.

The addition of the flag halyard, a 4 ' length of tan .008" line, helps keep the rigging to the gaff taut. It runs through the block at the aft end of the gaff; both ends tie off around the cleat on the starboard side of the boom above the quarterdeck. A bit of line will be left to form a coil to hang from the cleat.

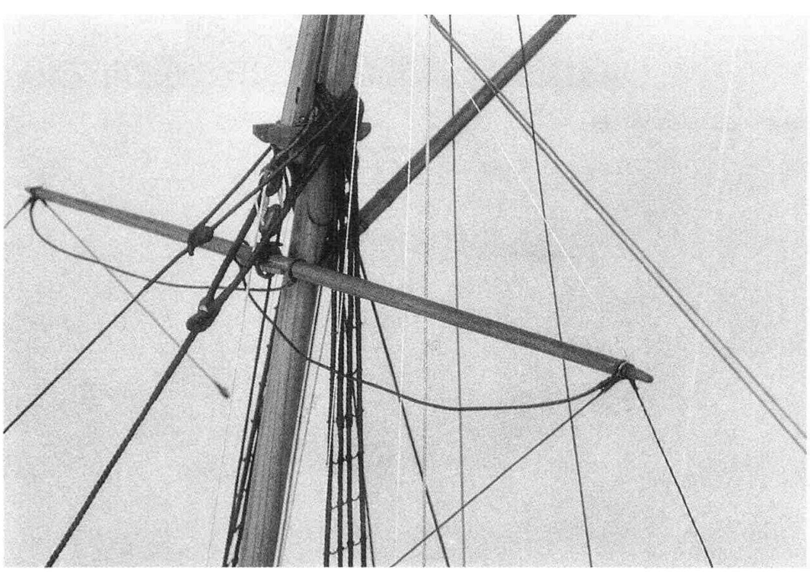
SPREADER YARD

The spreader yard is suspended from the large double block that you already have installed between the forward extensions of the trestletrees. The tackle fall is of .016" diameter tan line, and begins seized around the stropping of this block. It then reeves through the large double block in the slings of the spreader, the doing of which hauls the spar up under the trestletrees and forward of the horse. The fall of this upper tackle system becomes a pendant, suspending a double block for .016" line about two thirds of the way down the mast. The lower block in this tackle system is a single for .016" line, stropped to an eyebolt, the latter of which is glued into a hole in the deck forward and to port of the fitting for the horse. The fall is tied off around the bar of the mast bitts, the coil of which is tied with light line, bent in a U shape and glued to the bar.

The spreader yard would have been lashed to the horse with rope or a special served fitting like the tie for the block, at least when it was going to be hauled or lowered. This rope parrel can be fabricated in situ, using a 6" length of served black rope left over from rigging the horse or the bobstay. Wrap the served line around an accessible part of the horse and form an eye by seizing the legs together. When the glue is dry, spread the legs wide apart. Pull the parrel up to the level of the spreader yard, right behind the slings, and wrap the legs around the yard just inside the cleats. Cyanoacrylate the wrappings in place. If you have the time and the interest, form a pair of fake seizings as you did for the anchor cable lashings and glue them in place.



The spreader yard in place.



The running rigging tackle locations.

TOPSAIL YARD

There is no tackle system suspending the topsail yard, just a tie lashed around the spar at the slings, then run through the sheave at the junction with the pole topgallant/flag pole. The tie is of brown .031" line, 2'6" long. The tie becomes a pendant for a .012" line double block as it leaves the aft side of the sheave and the entire system becomes the halyard with the addition of a tackle below. The lower block of the tackle is on a pendant affixed to an eyebolt at the after edge of the port channel. The fall of the tackle starts seized around the lower block, runs through both blocks obviously and ends tied to a cleat lashed to the aftermost shroud.

The topsail yard also needs a parrel to hold it to the topmast. This parrel is also made of rope, here with a 6" length of .031" black line. Wrap the line around the yard from back to front, around the topmast, and around the spar on the opposite side. Cyanoacrylate the legs together so that the free ends butt up against each other. Be careful not to glue the parrel to the mast. Fake seizings can also be added here.

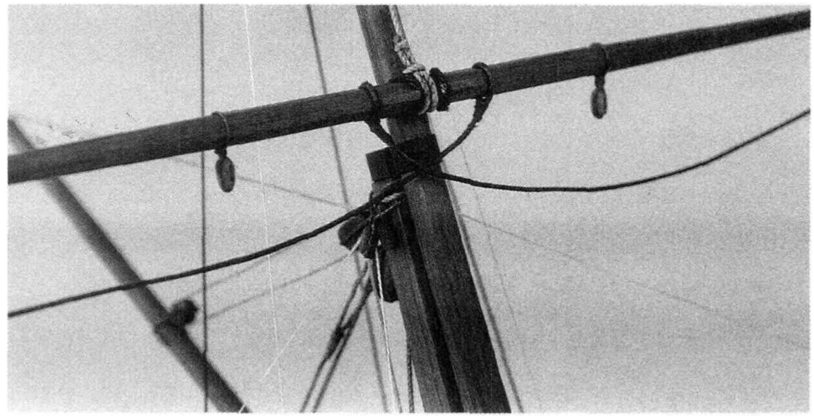
Lower the topsail yard so that it comes just above the level of the mast cap. Drill right through the yard and into the topmast with a .033" drill for a short length of 1/32" diameter annealed brass wire and glue the wire in place. This fixes the topsail yard in the vertical plane so that the yard lifts have something to pull against and the lines stay taut. It still permits enough movement in the horizontal plane to permit it to be manipulated into a proper position, that is, parallel to the baseboard and at right angles to the midships plane.

Each topsail yard lift is a 36" length of .008" tan line which starts seized around the projecting arm at each end of the yard. The chart actually calls for .012" line, but at this high and visible level that size looks too bulky. One may even have to stain the topsail yard lifts and braces a slightly darker color to reduce their prominence. From the yard arms, the line reeves through single blocks stropped together to fit over the pole and rest on the shoulder. From those blocks, the lines go directly to cleats on the third shrouds aft; no tackles. Take special care to keep the yard level from side to side before tying off.

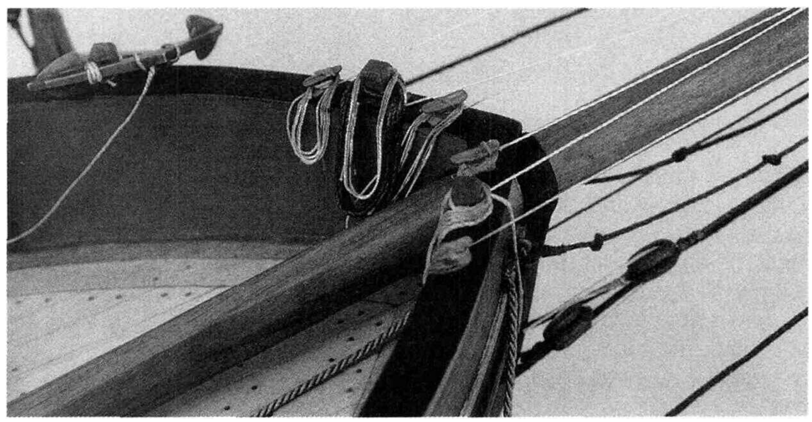
For the braces, a pair of single blocks for .012" line need to be stropped together with a bit of slack between, then seized to the upper part of the topmast forestay, just forward of the topmast. Another pair of the same sized blocks need to be fitted to the arm at the end of the jib boom. Each brace is a 5'6" length of .008" tan line. Each line is seized around the yard arm, run through the block at the topmast, down through the block on the jib boom, then run into the bows to tie off on a scale eight inch long (1/4") cleat. The latter is doweled and glued to the rail just inside the first timberhead. Special care is needed in this step to keep the yard square to the midline of the ship.

THE SPREADER YARD

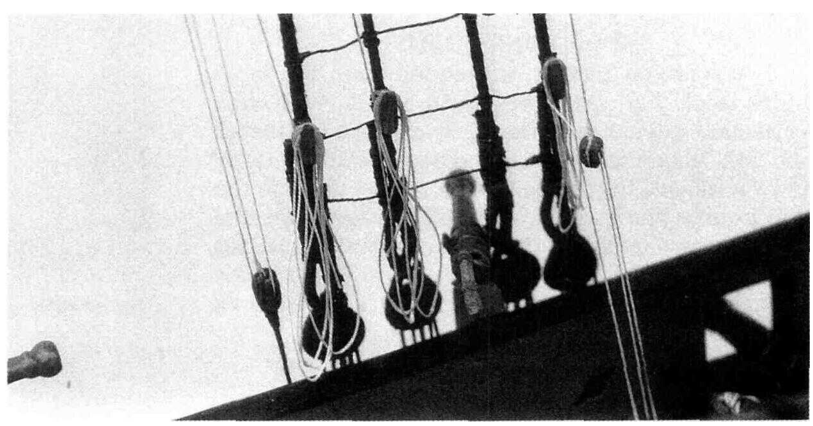
The lifts for the spreader yard are



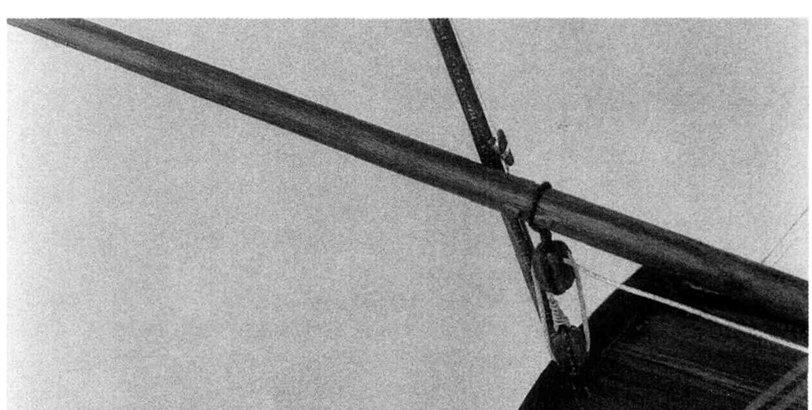
The topsail yard in place.



The final rigging at the bows.



The shroud cleats in use.



*The taffrail flag **pole.***

A view of the completed lifts and braces.

made of .012" lengths of tan line 2'6" long. They originate seized around the yard arms, between the loops at the end of the horse and the brace pendants already prerigged on the spar. The line reeves through the block already stropped in place under the mast cap, then down towards the deck to end as a pendant stropped around a double block for .012" line. The lower block in this tackle, a single, is stropped to an eyebolt, which itself is fastened to the deck near the bulwark, just about in line with the first shroud. The tackle fall is of .008" tan line, 3 ' long. It begins seized around the deck block's stropping, reeves twice through the double, and ends tied off on a cleat seized to the first shroud. Wait to finally tie off the lifts until the braces, fore and aft, are rigged so that all three lines can be balanced off together.

The forward braces are of tan .012" line, 6 ' long. They require a pair of single blocks tied off around the tip of the bowsprit, just inside the iron collar. The brace originates around the strop (or around its seizing to the rope collar), reeves through the block on the spreader yard forward brace pendant, down through the bowsprit block and then into the bows. Scale 8" long (1/4") cleats pinned and glued to the rails just inside the first timberheads are needed for the braces to tie off.

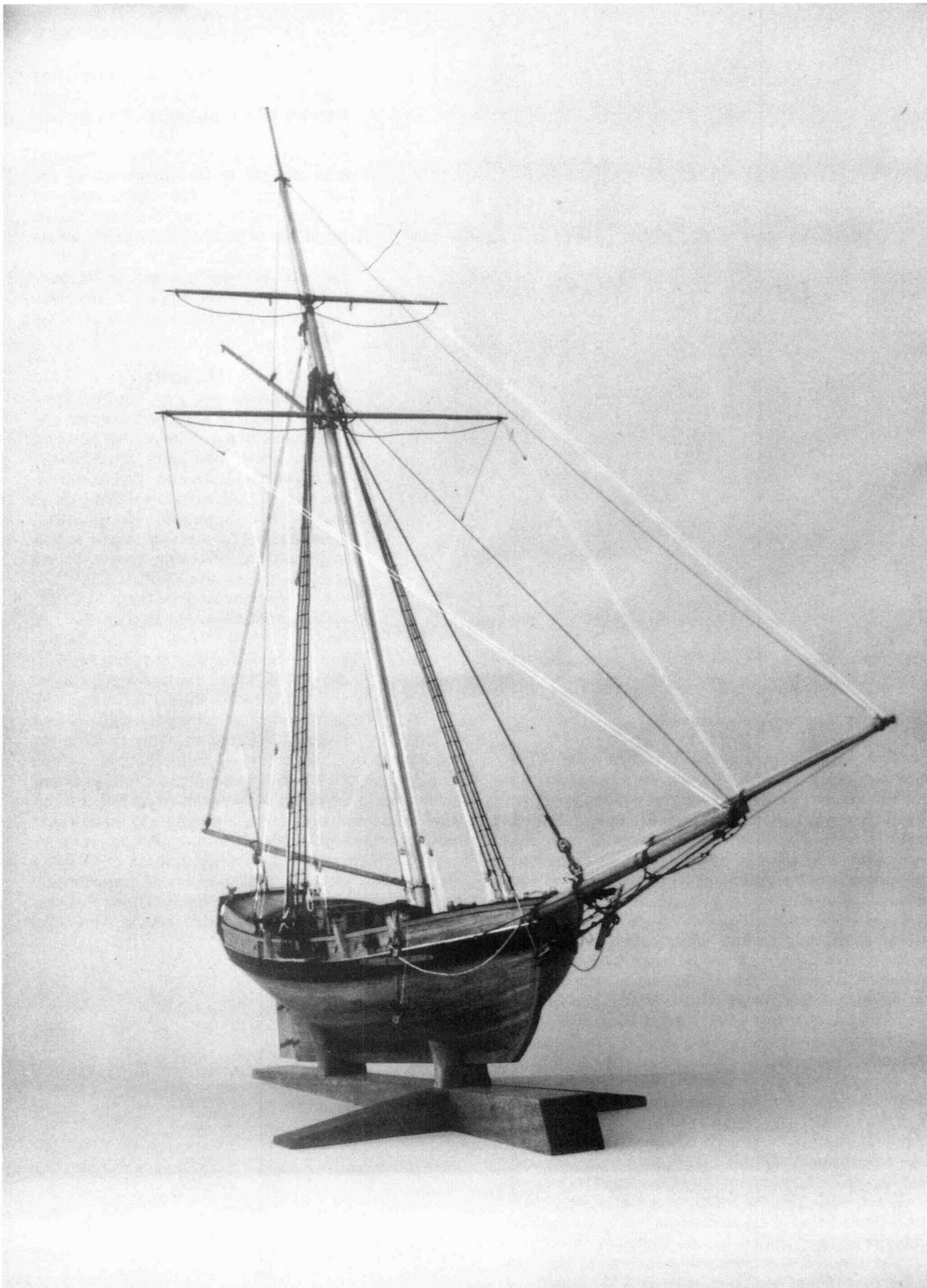
The after braces require similar sized cleats fastened to the boom crutches. They begin as 4'4" lengths of .012" tan line fastened around the stropping of single blocks, the blocks themselves already stropped through eyebolts. The latter are fixed to the quarterdeck rail just forward of the boom crutches. The run of the tackle fall is self-apparent.

You can finish up by adding a flag pole at the taffrail. It is made similarly to the pole mast extension of the topmast, and rigged similarly. The pole is 5 $^{1}/_{4}$" tall, plus about 3/8" for a reduced diameter pin to fit into a hole in the taffrail. Tan .008" line used to rig it and a small cleat is mounted at about chest height above the quarterdeck to tie off the line. The pole needs to be carefully centered athwartships and to be quite vertical in the midline plane. It tilts a few degrees aft, just matching the angle of the stern.

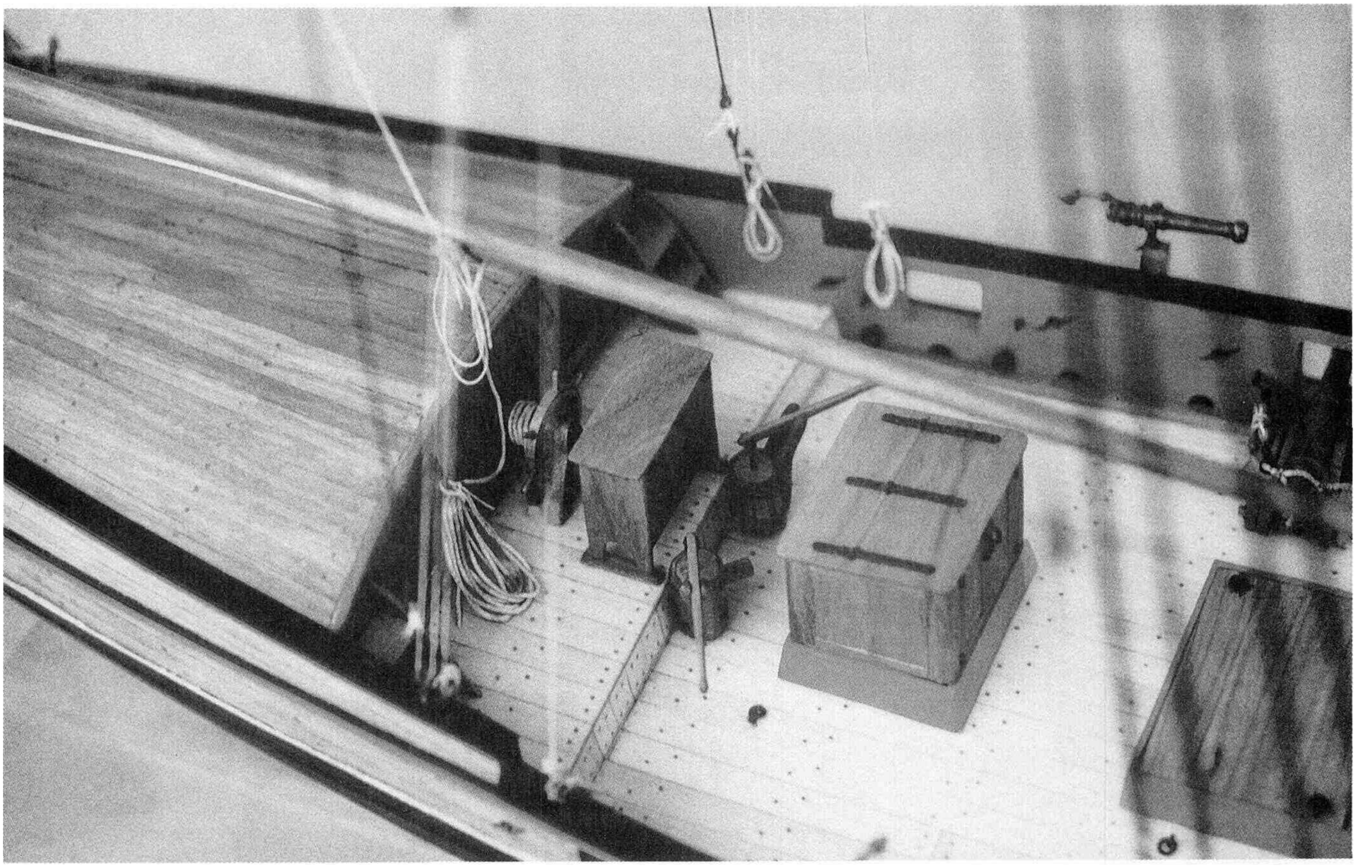
THE END

Well, there you are—finished! Time to touch up the glue spills, repair any paint scratches and retar the standing rigging where glue joints have caused excessive shine. It's also time to start to think about building a case. Many good plans have appeared in modeling literature, but for a model this large you might want to look at my own article on case building for the FAIR AMERICAN, called "Display Cases for Large Models", which appeared in *Model Ship Builder, #57,* Jan/Feb, 1989. It details the construction of a case of rather modern design built of red oak and acrylic sheet.

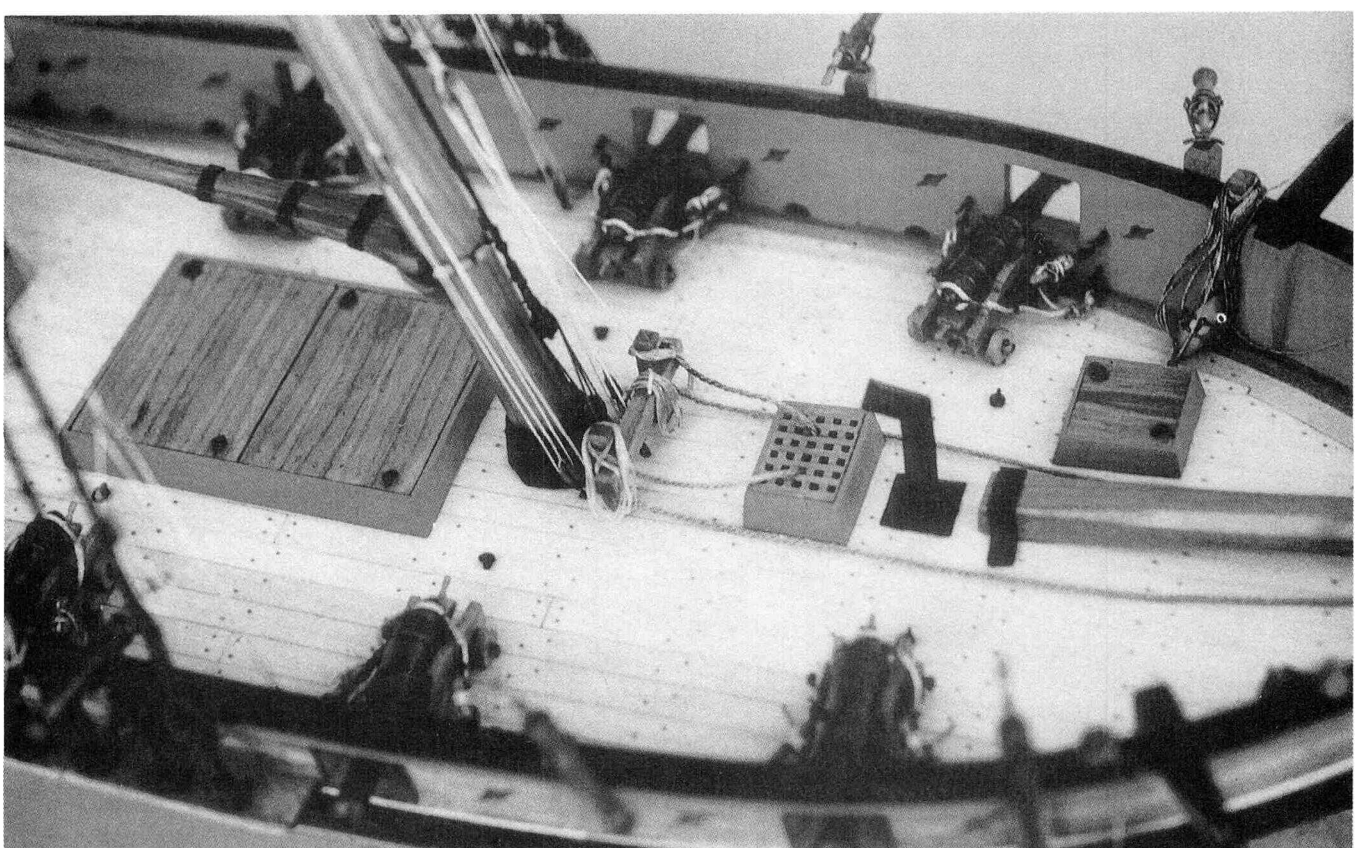
There really should be a diploma printed back here for you to fill out and display, attesting to your progress in self-education and craftsmanship, that marvelous combination of the intellectual and the physical. There are few opportunities in life in which one is able to wrap one's mind entirely around a project—to think it into existence through research and application and to manually bring it into soul satisfying three dimensions through skill, dexterity and persistence. Scratch built ship modeling is one such opportunity. I hope that you will continue to explore and advance this wonderful arena of possibilities.



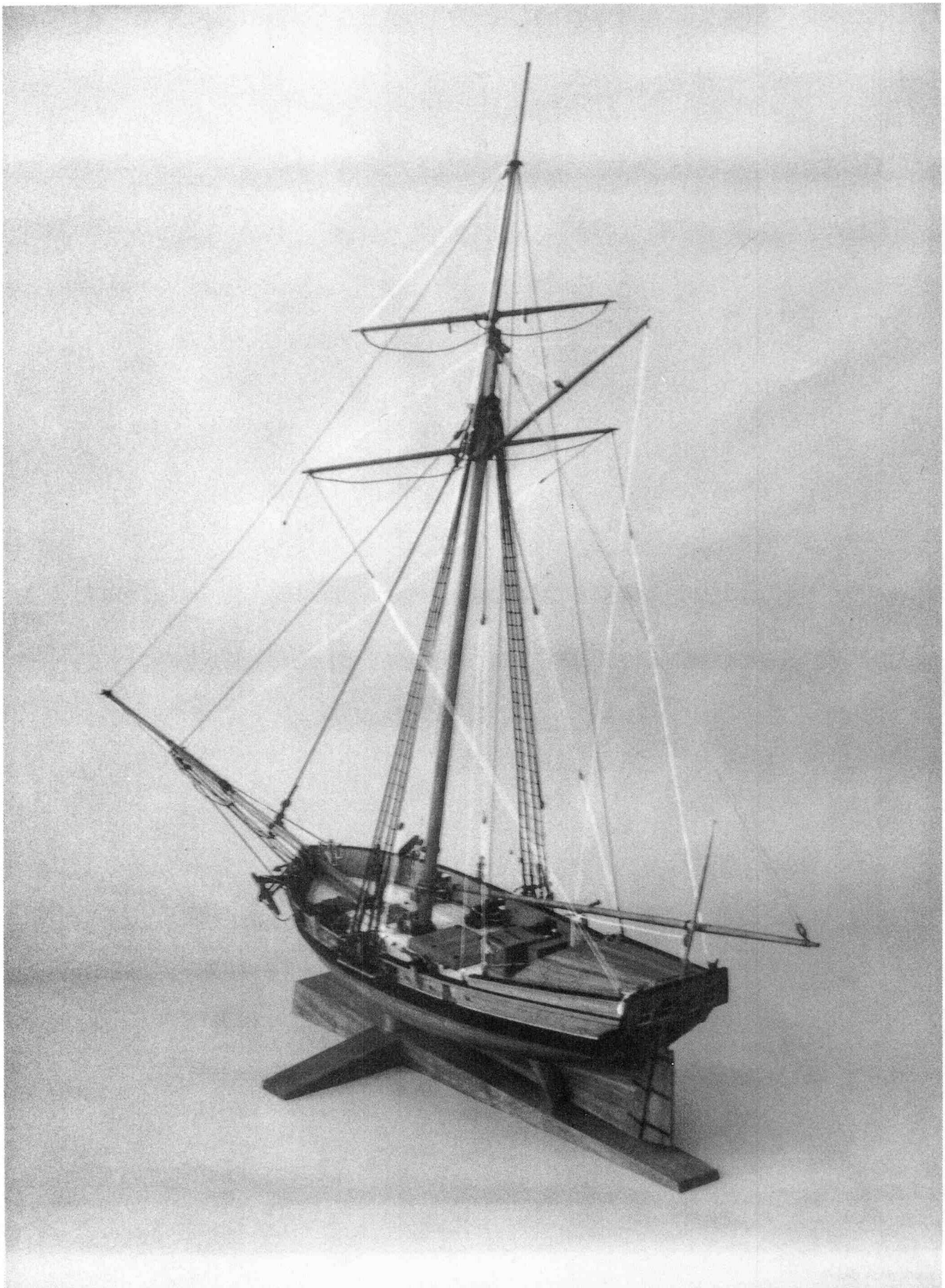
The finished model *of the Virginia sloop.*



Aft details.



Forward deck details.



An armed Virginia sloop of 1768

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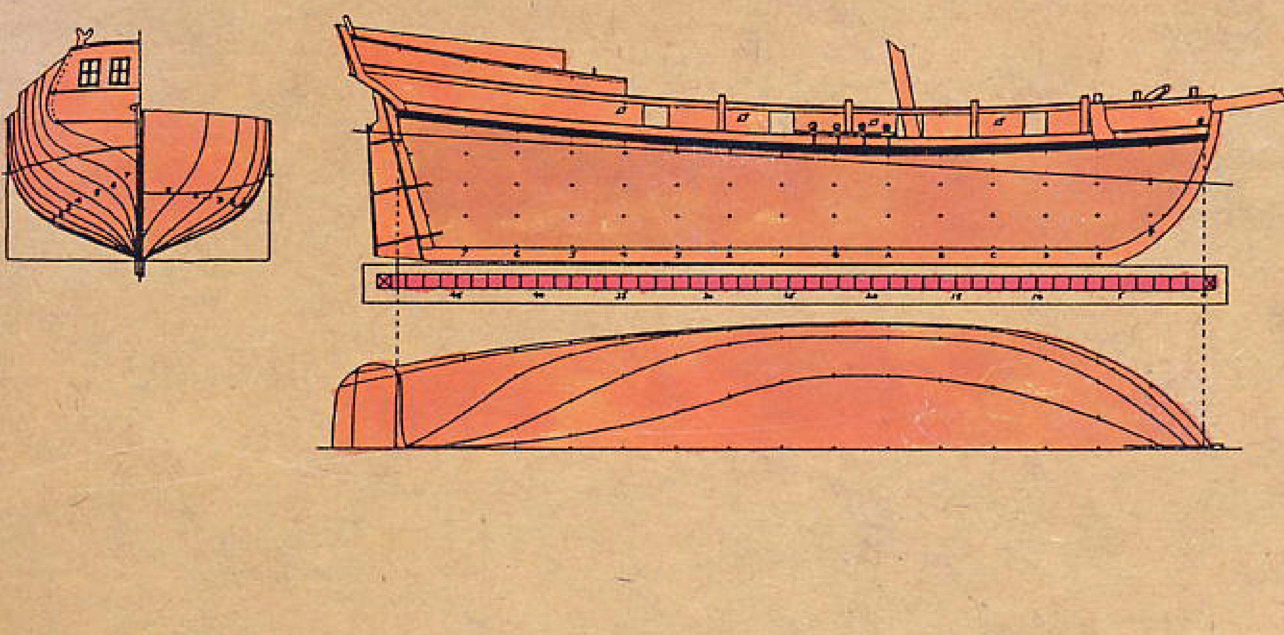
ABOUT THE AUTHOR

Clayton Feldman has been involved in various aspects of nautical design for many years. While doing some medical post-graduate work in London in the sixties, he started crewing on International Fourteens on the Welsh Harp. He soon became more interested in the boats than in the crewing and joined the Amateur Yacht Research Society. Over the years he participated in the society's work on multi-hull and hydrofoil sailing craft by designing several and building three trimarans.

Eventually, he switched to building ship models. His first scratch-built project, dealing with the Revolutionary War privateer brig FAIR AMERICAN, was published in *Model Ship Builder*. A book on the same subject was published by Phoenix Publications, Inc. He has been involved in active research for his projects, and has been published in the *Nautical Research Journal*. Most recently, Feldman became the publisher of his own nautical journal.

Dr. Feldman is a practicing physician specializing in Allergy and Internal Medicine. He has been married for 35 years and has two married children.



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