TO BUILD A WHALEBOAT

HISTORICAL NOTES AND A MODELMAKER'S GUIDE

by Erik A.R. Ronnberg, Jr.

MODEL SHIPWAYS

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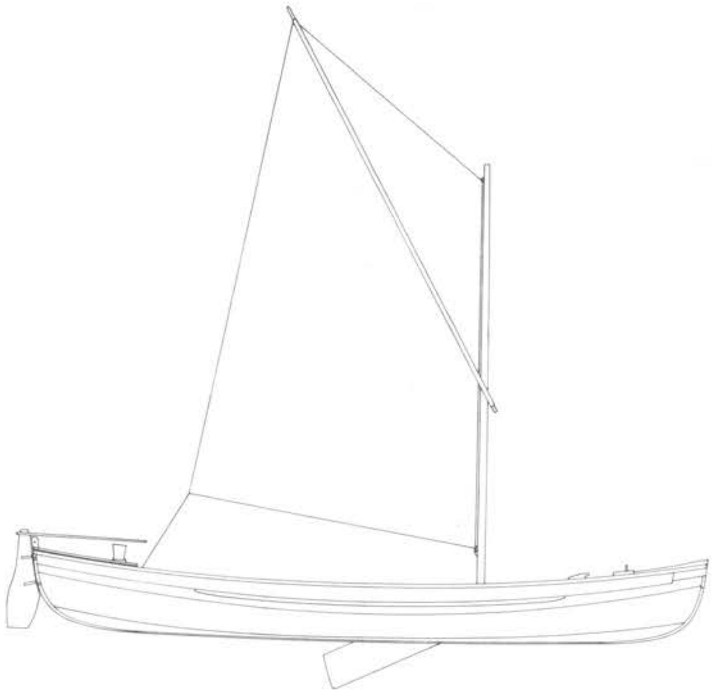

MODEL SHIPWAYS COMPANY, INC.
BOGOTA, NEW JERSEY
1985

To the memory of

the builders

of New Bedford whaleboats

First edition
Bogota, N.J. 07603
Designed by Erik A.R. Ronnberg, Jr.
Composition by the Cricket Press, Inc.
Printed by New England Book Components, Inc.
ISBN 0-915994-05-6

TABLE OF CONTENTS


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Foreword

The number of whaleboats consumed by the American whaling industry during the course of 300 years was nothing less than prodigious. Just how many cannot be said with certainty, but a few rough estimates are possible. Assume, for example, that three to four new boats were needed for each whaling voyage, then apply that average to the 15,000 voyages made from American ports between 1720 and 1920. The result amounts to an astonishing total of 45,000 to 60,000 boats.

Even these figures may be low! The outfitting accounts of the bark *Mermaid*, as cited in this book, record the purchase of 36 whaleboats for the seven voyages that occurred between 1855 and 1880. This average of five boats per voyage was reported earlier by the New Bedford whaling merchant, James Arnold, who claimed in 1841 that five new whaleboats, at $60 apiece, were needed by each of the 650 vessels that then made up the American fleet "on each voyage which they perform." If this figure is valid for the entire period of the fishery, then the total production of boats would rise to 75,000.

Whatever the exact figure, the range of magnitude suggests that few, if any, salt-water craft ever approached the American whaleboat in number. The closest rival might be the Gloucester fishing dory, that smaller flat-bottomed boat produced by the thousands for fishermen from Massachusetts to Newfoundland. Like the whaleboat, the dory was cheap and expendable, but it was also more likely to survive from one voyage to the next. A whaleboat, on the other hand, was generally ready for replacement after two to four years of hard usage, both up on the cranes and down "in the suds."

Of the tens of thousands of whaleboats, only a dozen survive today in whaling and maritime museums. All are examples of the fully-developed boat, having been built in the 1890s or the early decades of our own century. As such, they offer only limited evidence for the size and shape of their predecessors. Nor does the photographic record help much more in tracing the evolution of the craft, for only in the 1890s did the camera

Opposite page—The half-scale model of whaling bark Lagoda *and her whaleboats are flanked by an actual whaleboat of late 19th century or early 20th century origins.*
Old Dartmouth Historical Society
Nicholas Whitman, Photographer

appear with regularity on the wharves of the few remaining whaling ports: New Bedford, San Francisco, Provincetown. As a result, the boats with which we have direct acquaintance, either through photographs or actual examples, are the products of the last three decades of the fishery. Yet on this limited evidence, drawn from a period which encompassed less than six percent of all American whaling voyages, rest both our general impressions and our specific knowledge of the whaleboat as a unique craft with a long history.

Our insights into earlier stages of the whaleboat's development have largely depended on the pictorial evidence of whalemen artists, such as Benjamin Russell, or the verbal descriptions found in first-hand narratives. Taken individually or as a whole, these glimpses offer only a fragmentary picture of the craft as it evolved over the course of three centuries in the boatbuilding shops of southern New England.

In the pages that follow, Erik A.R. Ronnberg, Jr. ingeniously turns to some hitherto overlooked evidence in the form of the whaleboats built for the half-scale model of the bark *Lagoda* in the New Bedford Whaling Museum. For reasons convincingly explained, he approaches these boats as the most satisfactory evidence we may hope to have for the design, lay-out, fittings and methods of constructing these craft during the greatest age of American whaling.

By presenting a precise reconstruction of a mid-19th century boat, Erik Ronnberg also provides a starting point for inquiries that might enable us to chart the full course of whaleboat development from colonial origins to ultimate form. For the present, however, we have before us a masterful introduction to the whaleboat at a key point in its long evolution. Through words and drawings, it represents a major contribution, and earns its author our respect and gratitude.

Richard C. Kugler
New Bedford Whaling Museum

Preface

This book and its accompanying plans were prepared to meet three basic needs: 1, that of the New Bedford Whaling Museum for a study of *Lagoda*'s whaleboats and related documents in its archives; 2, that of Model Shipways Company for a construction set to build a whaleboat model; 3, that of advanced modelmakers seeking information on whaleboats of the mid-19th century. In combining their resources to sponsor this project, I feel that the Whaling Museum and Model Shipways have jointly provided much greater opportunities to examine this subject than if they had sponsored two separate projects.

Although this study has grown out of a great museum collection, it could not have happened without the generous assistance of that museum's staff. Richard C. Kugler, Director of the New Bedford Whaling Museum, not only welcomed this project, but proposed joint sponsorship for a work of much broader scope than I had planned for Model Shipways alone.

The Whaling Museum's library and archives are now so extensive that only a small selection of whaleboat material was possible, leaving much more for future study. Virginia M. Adams, Librarian, and Judith M. Downey, Manuscripts Librarian, were most helpful in locating receipts and account books, as well as sketches and writings from logbooks and journals.

Ready access to all whaleboat material in the Museum's collections was possible with the help of Elton W. Hall, former Curator of Collections. I am also grateful to the maintenance staff and numerous volunteers who assisted me in moving or locating objects for examination.

Photographs of paintings, drawings, and documents in the Museum's collections were furnished by Nicholas Whitman, Curator of Photography. Mr. Whitman also spent considerable time with a number of old and difficult prints and negatives of whaleboats; his prints from negatives by Albert Cook Church are vastly better than Church's own printing efforts, allowing much of their detail to be seen in print for the first time.

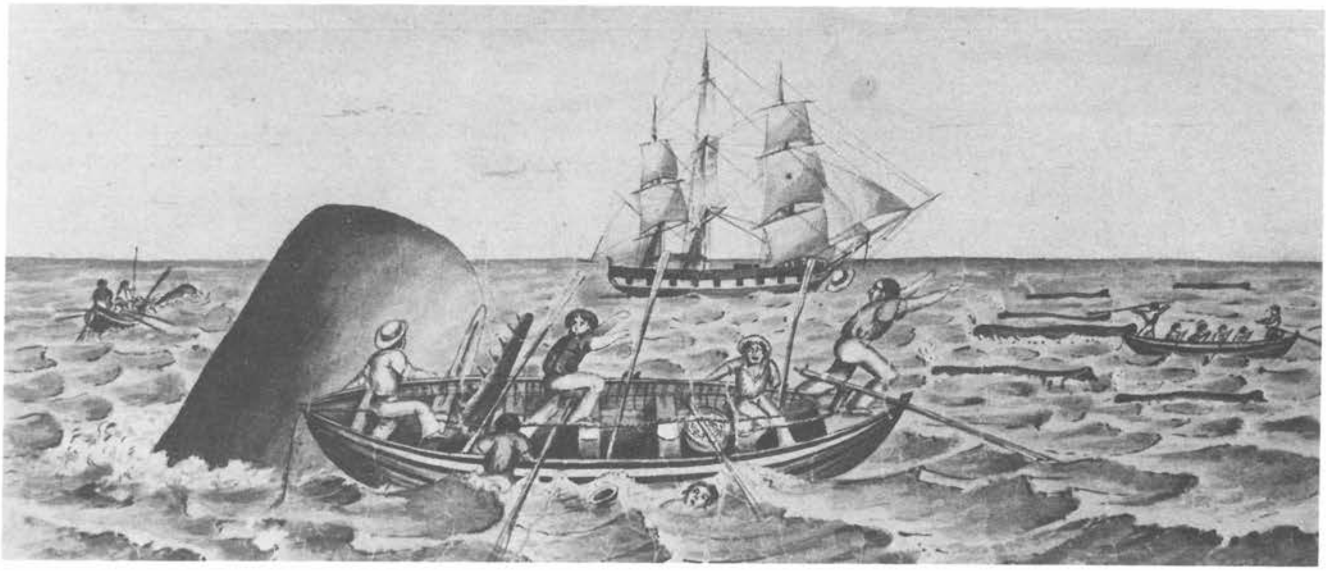
When I first came to work at the Whaling Museum in 1969, Philip F. Purrington, now Senior Curator, gave much valuable advice and knowlege about the boats and gear in the collection, not to mention some healthy skepticism over matters of whaleboat history which were long held dear but never proven. The late Charles F. Batchelder, then a trustee, was keenly interested in whaleboats and had assembled a large body of source material on them in the hope of writing a book. His death prevented the latter, but he had gone far with a card file on many aspects of whaleboat design, construction, and use. This file was of immense value to my research.

Through the Whaling Museum, I came to know two people who knew much about whaleboats and shared that knowledge unhestitatingly. Boatbuilder Leo Telesmanick, who learned his trade at the Beetle shop in New Bedford, recounted many of the procedures of whaleboat construction which he learned as an apprentice and later applied to the building of other types of boats. The late Isaac F. (Ike) Manchester, a sailmaker of the old school, made a new sail for one of the Museum's whaleboats in 1972, and in the process taught me much about his art. The vivid impressions of these maritime trades which these two gentlemen conveyed to me are beyond my abilities to describe.

Among my modelmaking colleagues, two have been particularly helpful in the process of refining the plans and text. Alan D. Frazer, whose efforts at building models of small craft have come as close to "total" replication in scale as anything I have seen, examined the drawings and instructions in their minutest details, making corrections and suggestions for which many modelmakers can be grateful. Charles O. McDonald also read proof and offered valuable suggestions for clarifying the historical material and some tangled building sequences. The efforts of these two have substantially improved this work.

Others have assisted briefly in this project or on earlier matters closely related to it. With apologies for any omissions, my thanks to Willits D. Ansel, Ruth S. Baker, Philip C. Bolger, Michael Costagliola, David Mathieson, and the late Walter E. Channing.

For their patience with my tinkerings and their willingness to let this project be expanded and shared, I am indebted to Sam Milone and John Shedd of Model Shipways Company. Given the uncertainties which plague any reconstruction of a historic boat type for modelmaking, I think it would be impossible to find two people with more understanding and willingness to wait for slower but better results.



CHAPTER 1

Whaleboats at Mid-19th Century

Figure 1-1. Typical whaleboats from the early 19th century are shown in detail in a series of watercolors by an unidentified artist (possibly a whaleman). None of them show whaleboats equipped with sails or centerboards.
Old Dartmouth Historical Society

The two decades spanning 1850-1870 marked a period of transition in hull form, construction, and rig for the New Bedford whaleboat, following a half-century or more of slow change. Whaleboats of the first half of the century were typically of clinker construction, 26 feet—increasing to 28 feet—in length, and by 1850 rigged with small spritsails without benefit of centerboards and rudders. If known European whaleboat types from this period and earlier set any precedent, then their American counterparts were probably very symmetrical in their ends, lacking the fuller bows and finer sterns of later examples. These early hulls were undoubtedly already so adapted to whaling that their characteristics distinguished them from other double-ended workboats and made them unsuitable for most other types of work. Depictions of boats from this period—in the form of paintings, lithographs, and logbook sketches—make it clear that rowing was the usual if not exclusive form of propulsion. Those sources that do show whaleboats under sail indicate that the sprit rig was most favored and the boats were guided with a steering oar with no rudder in evidence. This, compounded by the lack of a centerboard, would have severely handicapped the boats' abilities to sail to windward; indeed, this rig and steering configuration would be efficient only in the pursuit of whales downwind. Throughout the period of most dramatic growth in the American whale fishery, whales were to be chased by boats which were far less refined in form and construction than those boats used in the years of decline. Even at the final peak of the industry, 1856, the last year returns exceeded $10 million, older types probably outnumbered boats built on improved models and it is not until after 1865 that we can be certain that lapstrake boats were out of use.

Figure 1-2. The New Bedford whaleboat in its final development was 29-30 feet in length, depending on the type of whaling intended, 6-6½ feet in beam, and planked in a combination lapstrake and batten-seam style. Photograph by Albert Cook Church.
Old Dartmouth Historical Society

The "improved" whaleboat is well known to historians, museum visitors, and modelmakers. Its hull was termed "smooth planked" by whalemen, although it actually retained three lapped seams. Its construction cannot be regarded as a true carvel type because the planks were still edge-joined to each other, this time with battens, hence the term "batten seam construction." The framing was slightly modified to accommodate this change, but still retained the characteristics of lapstrake hull framing. The construction was light, flexible, and derived as much of its strength from the edge-joining of the planking as from the fastening of the shell to the frame.

The construction sequence—the shell of planking preceded the framing—was also characteristic of the lapstrake boatbuilding tradition. This was a curious and, so far as I can tell, distinctively American modification of the European tradition of clinker boatbuilding, a tradition described somewhat awkwardly (but very usefully) by Basil Greenhill in *Archaeology of the Boat* and much more adroitly by Eric McKee in *Working Boats of Britain*.[1] In its final development, the New Bedford whaleboat retained three lapped seams: one between the garboard and second strakes; a second at the joint of the sixth and sheer strakes; and a third at the joint of the sheer and gunwale strakes. The other seams between the second, third, fourth, fifth, and sixth strakes—four seams in all—were joined with battens. In those types which were direct descendents of these boats, such as the Azorean whaleboat and the Gloucester seine boat, the number of lapped seams was further diminished and finally eliminated. The batten seam was adopted in the construction of Noman's Land boats (a type of small fishing boat once common in the Buzzard's Bay region[2]); this way of working was mainly because the shops which built some of these boats also built whaleboats. Noman's land boats not built by this method were of conventional lapstrake construction, which was undoubtedly the original mode of building.

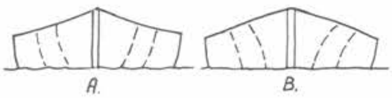
If early whaleboats were symmetrical in their ends, the late ones were much fuller at the bows and finer aft (though the entrance was still sharp and hollow). At the midship section, deadrise was very pronounced and formed a distinct V-bottom with an easy turn of the bilges and some flam* topsides. These characteristics can be found in all the late 19th and early 20th century boats surveyed by Willits D. Ansel with only minor departures.[3] Lengths of the later boats exceeded 28 feet, with surviving examples from the Arctic fisheries measuring from 29 to 30 feet, while Azorean boats were seldom less than 31 feet and have become much longer in recent years. Whaleboats in their final development were thus larger and less symmetrical in longitudinal form.

The sail plans of later boats were also much larger, more varied in rig, and generally indicate greater frequency of use than in earlier boats. The spritsail was almost completely discarded in favor of the lug, gaff, and sliding gunter rigs, while the use of jibs became common. To make serious use of these sails in working to windward, centerboards were necessary while rudders replaced the steering oar except when approaching whales. On many whaling grounds from 1870 and later, it became customary to pursue whales under sail whenever possible, which indicates that the boats had improved their overall sailing abilities.[4] These developments in turn dictated minor but noticeable changes in the boats' inboard arrangements and in the disposition of boat gear and whale craft.

The adoption of the centerboard and concurrent development of the mast hinge and partners to aid in the stepping of the mast effectively divided the inboard space at the widest part of the boat, including one of the spaces reserved for the second, or forward, line tub. This tub had to be made smaller to fit in the

[1]Basil Greenhill, *Archaeology of the Boat: A New Introductory Study* (Middletown, Connecticut: Wesleyan University Press, 1976), pp. 60-88; Eric McKee, *Working Boats of Britain: Their Shape and Purpose* (London: Conway Maritime Press in association with the National Maritime Museum, 1983).

[2]Maynard Bray, *Mystic Seaport Museum Watercraft* (Mystic, Connecticut: Mystic Seaport Museum, Incorporated, 1979), p. 67, plans 15-17.



**Flam* refers to a hull's convex or bulging overhang (A), as opposed to flare, which refers to a concave or hollow overhang, usually at the bow (B).

[3]Willits D. Ansel, *The Whaleboat: A Study of Design, Construction and Use from 1850 to 1970* (Mystic, Connecticut: Mystic Seaport Museum, Incorporated, 1978).

[4]James Templeman Brown, "The Whale Fishery: Whalemen, Vessels, Apparatus, and Methods of the Fishery," in G. Brown Goode, *The Fisheries and Fishery Industries of the United States*, 7 vols. (Washington: Government Printing Office, 1887), Section V, Volume II, pp. 242, 260.

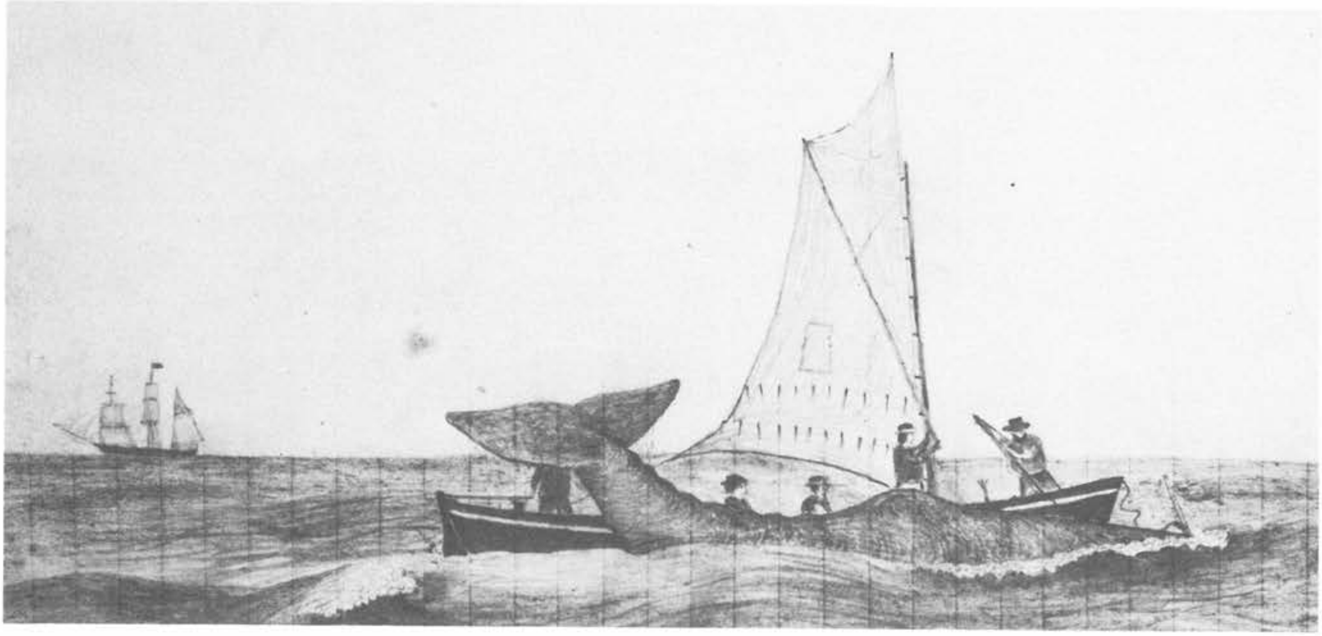


Figure 1-3. Going on a sperm whale under sail. Sketch from a logbook kept on board bark Napoleon *of New Bedford, whaling cruise of 1868-1872 in the Pacific Ocean. The spritsail is either cut so a portion of it is set with a jack yard above the masthead, or a topsail bent to a jack yard has been set above it. As the boatsteerer plants a second iron, the bow oarsman gets ready to pull the heel of the sprit pole out of the snotter in order to douse the sail. The sprit rig was not as efficient as others, but it had the advantage of being very quick to rig down and stow in the stern of the boat during those frantic moments after a whale was harpooned.*
Old Dartmouth Historical Society

same space, while the after line tub was commensurately enlarged. Larger sail plans meant heavier spars and rigging which, when lowered, took up more room and required a chock on the cuddy to support the mast and prevent its accidental shifting. Increasing the size of the boat meant greater problems in stiffening an already limber structure, and the double thwart knees used to support the mast (second) thwart were also applied to the stroke oar (fifth) thwart. Boats built for Arctic whaling were further reinforced with horizontal "clamp strakes" running under the thwarts in conjunction with the risers; also log rails were introduced atop the gunwales, which added about two inches to the freeboard.[5] In addition to myriad modifications to whalecraft, many small boat fittings were changed and improved, such as the iron tub oar lock, which replaced a single iron rowlock and wooden tub oar crotch, and the steering oar brace, which was sometimes of iron and sometimes of wood without any consistent pattern of development.

In offering descriptions of the whaleboat at the temporal extremes of its development in America, it is hoped that the contrasts in form and construction will give an idea of the changes this type underwent over two decades at mid century. The problems are not *what* changed, but *when* and *why*. New Bedford whaleship owners and agents did not greet these changes with much enthusiasm or sympathy for their convenience to masters and crew. There had to be the inducement of greater returns, i.e., more whales, on their investments to justify the costs of improved whaleboats. Ease of handling was not appreciated solely for its own sake; if an improved whaleboat did not catch more whales, its improvements had no practical value. This viewpoint must be considered while assessing the overall efficiency of the American whaling fleet.

[5]Measurements taken from a whaleboat in the collection of New Bedford Whaling Museum, Massachusetts. See Ansel, *The Whaleboat*, pp. 44, 126.

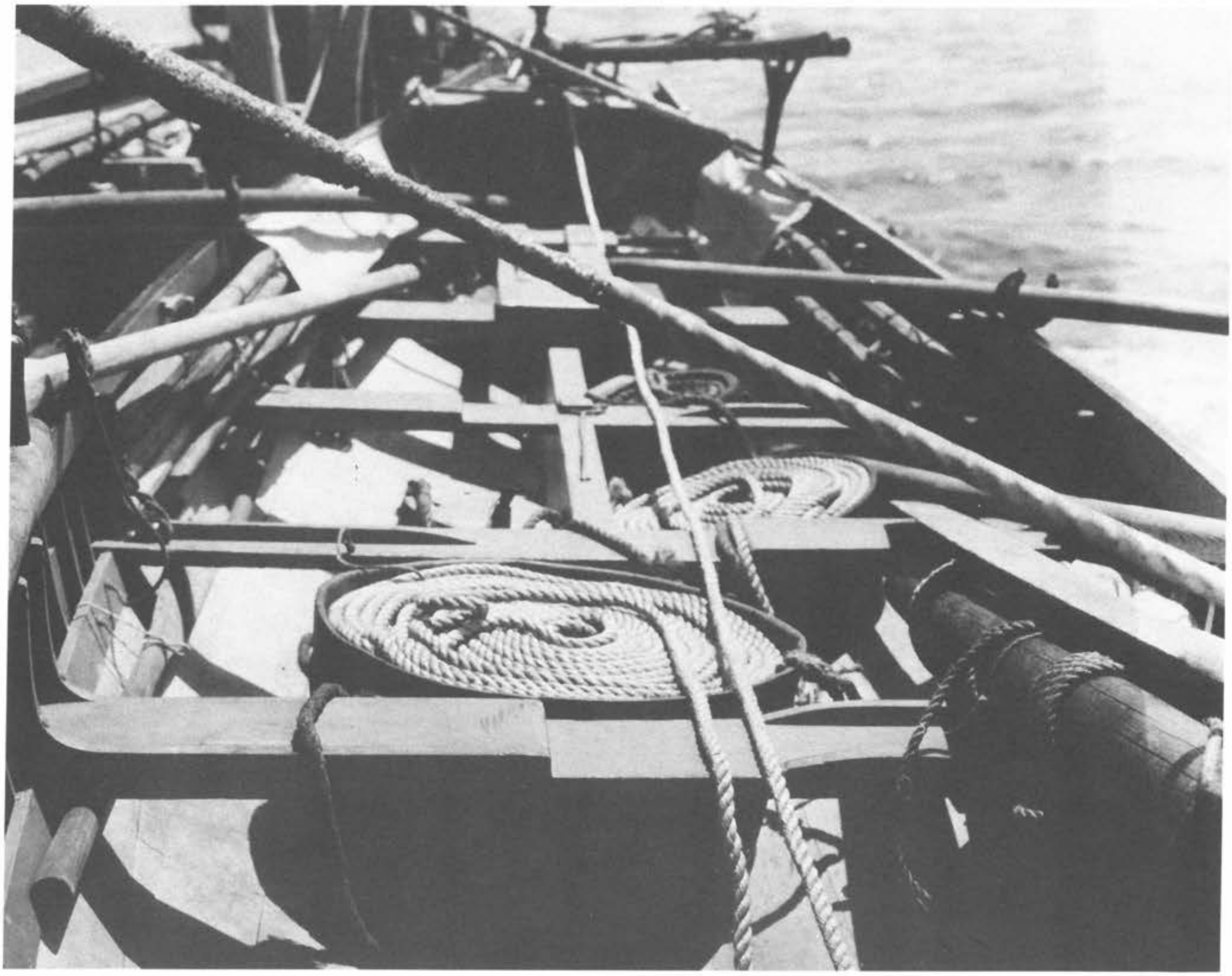
For all the romantic conjurings of writers, the tinkerings of inventors of harpoons, and the minutiae of government studies of whaling, the American whale fishery remained one of the most static of maritime technologies, whose changes, however publicized and romanticized, were minor in their impact on the industry as a whole.[6] The whaleships always remained wooden sailing vessels which carried man-powered boats to kill the whales, which were then processed by hand tools and the simplest mechanical aids. The technology reduces to three basic categories:

1. Transport of boats, crews, and cargo.
2. Capture of whales by the whaleboats.
3. Processing of the catch by cutting-in, trying-out, and (where applicable) preparation of baleen.

In order to improve the efficiency of the whaling operation, the efficiency of each of its parts had to be equal to the others, *and the efficiency of all three had to be improved simultaneously.* It was useless to make any one or two aspects significantly more efficient than the remainder, as the pace of the operation would be governed by the slowest and least efficient part. What good

[6]Richard C. Kugler, "The Penetration of the Pacific by American Whalemen in the 19th Century," in *The Opening of the Pacific—Image and Reality, Maritime Monographs and Report, No. 2,* ed. Basil Greenhill (London: National Maritime Museum, 1971), pp. 20, 21.

Figure 1-4. Bark Sunbeam's *starboard whaleboat, voyage of 1904-1905. With the oars shipped to relieve the inboard congestion, it is possible to see the arrangement of line tubs and other boat gear, and how effectively the centerboard and mast hinge bisected the working room. Note the difference in the sizes of the line tubs and how much smaller the waist tub must be if it is to fit its alloted space beside the centerboard case. Photograph by Clifford W. Ashley.* Old Dartmouth Historical Society



was the extra expenditure on improved try-works and oil rendering techniques if the boats and crew could not capture the additional numbers of whales needed to cover this extra expense? How useful were improved whaleboats and harpoons if the extra whales they killed were subject to the risks of loss due to bad weather while waiting their turn for cutting-in? Certainly New Bedford whaling merchants were not oblivious to the advantages of steam propulsion and iron shipbuilding. These could not be exploited for whaling until the advent of a harpoon gun that could kill whales rapidly enough to justify the technology of processing on the large scale introduced by the modern "killer ship—factory ship" concept. The breakthroughs that led to a scaled-up mechanized industry came through the efforts of European—and particularly Norwegian—whaling concerns. By then, the American industry was all but dead, with neither the incentive nor the capital to start over.

Figure 1-5. As the techniques of catching whales and processing them at sea were refined in the early 19th century, the efficiency of the cutting gear and try-works closely matched that of man-powered, and later sail-driven, whaleboats and manually-operated whalecraft. The whaleship's size (usual tonnage of 300-450, old measurement) was the result of her owner's experience and expectations, based on voyages of one to four years' duration. This watercolor is a companion to Figure 1-1.
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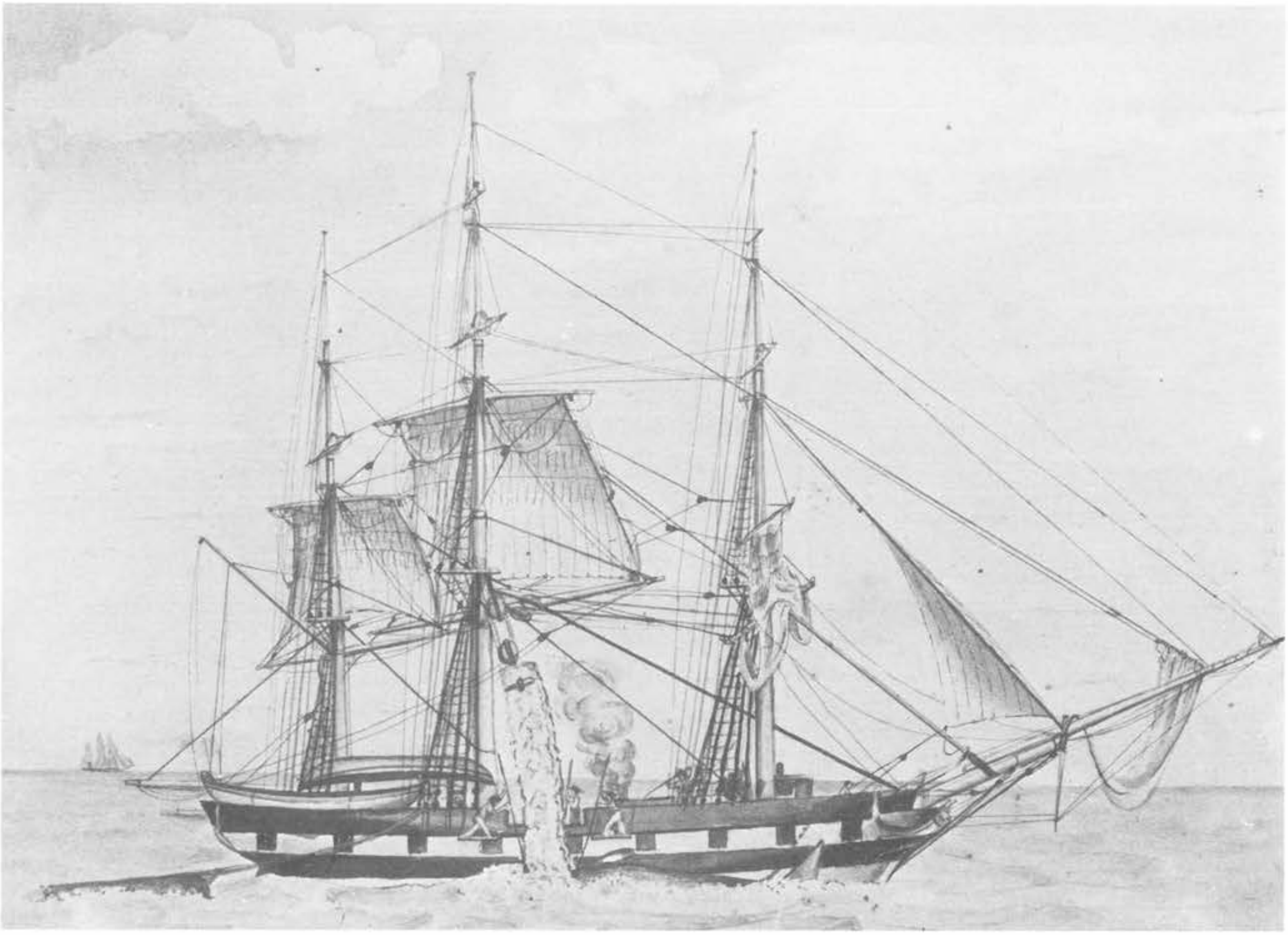
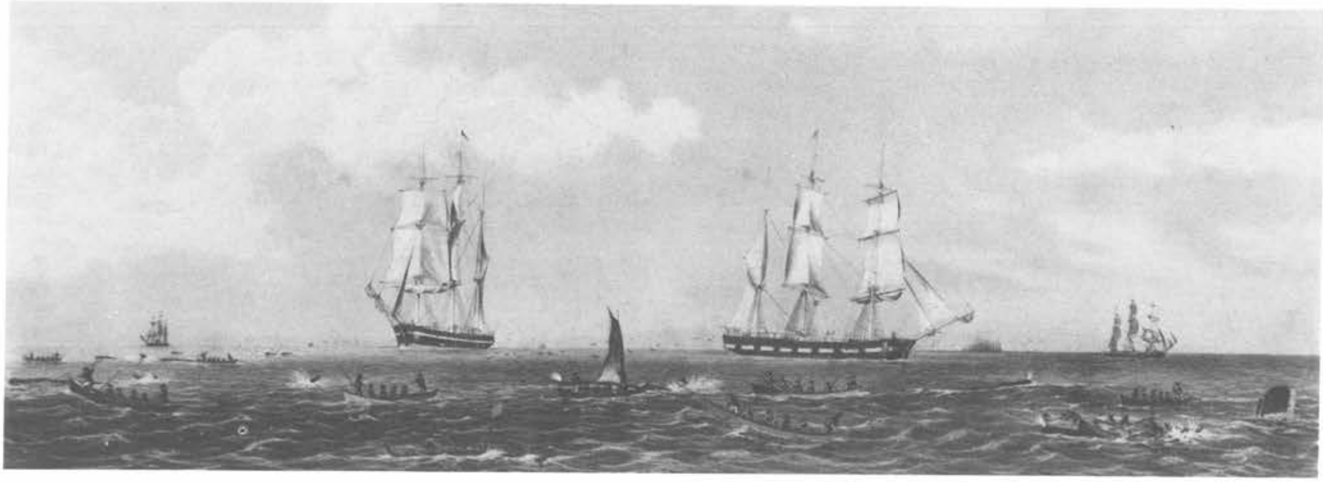


If American whaling ships taken individually had insignificant impact on the whale populations, collectively they were devastating. As the whale fishery flourished in the second quarter of the 19th century, the numbers of vessels rose in answer to the demands for more oil and the promise of profits in a seller's market. In a paper describing the entry of American whaling



interests into the Pacific, Richard C. Kugler describes these pioneer whalemen as "...largely American in nationality, and held together by ties of family, religion, Nantucket origins, and of one motive: to extract whale oil as cheaply as possible from the world's oceans and sell it as dearly as possible in the world's markets." The ethnic origins of whalemen may have changed in the course of the century; the motive did not. By 1846, over 500 ships out of a total of 736 in the American whaling fleet were active in the Pacific, spurred on to ever more remote whaling grounds as the nearer grounds became exhausted. Vessel activity peaked in 1846 with a gradual decline in numbers until 1861, when the Civil War began the decimation of the whaling fleet.[7] The years 1847-1861 thus marked a period of gradually diminishing returns in which the discovery of new whale stocks could not fully compensate for the depletion of older whaling grounds. The American whaling fleet, for all its apparent inefficiencies, was more than enough to drive existing whale populations to near extinction and was thus too rapacious for purposes of taking whales on a "sustained yield" basis.

Figure 1-6. The depletion of the whaling grounds by the 19th century whaling fleets was not due to the efficiency of ships and gear (far more effective technology was available, tried, and rejected), but to the large numbers of whalers and their collective effect on the whale population. The busy scene in this lithograph by Benjamin Russell, 1870, may not be as crowded as we might think. It certainly points out the need for distinguishing marks and colors for each ship's boats so her lookouts can follow their movements and direct them to their quarry with coded signals.
Old Dartmouth Historical Society

[7]Ibid., p. 20.

In this period of initial decline, the whaling merchants may well have viewed minor improvements in ships and gear as a way of covering their diminished returns, but they could hardly have been in the mood to embrace any radically new technology without proof of its effectiveness. Most changes were gradual and conservative, including those made to whaleboats. Also to be considered is the possibility that the diminished whale populations may have been more wary of whaleboats and more stealth was necessary in approaching an ever-warier prey.[8] If so, the claims that smooth-bottom boats made less noise than clinker hulls and that sailing onto the quarry—which had a tendency to swim upwind from danger—was less likely to create disturbance than rowing, are to be considered seriously. Another factor was the increasing remoteness of the richer whaling grounds, which meant longer voyages and the need for greater self sufficiency over extended periods. Maintenance and repair of whaleboats,

[8]Charles M. Scammon, *The Marine Mammals of the North-western Coast of North America: Described and Illustrated Together with an account of The American Whale Fishery* (San Francisco: John H. Carmany and Company, 1874; reprinted, Dover Publications, Inc., 1968), pp. 68, 69.

always a worry to whalemen, became a serious problem, further exacerbated by the increasing departure of skilled mechanics from whaleship crews for more rewarding careers ashore in a growing industrial complex.[9] The extra cost of a batten-seam boat may have been justified when it was found more easily repaired than a clinker hull, using less skilled labor.

[9]Paul Elmo Hohman, *The American Whaleman: A Study of Life and Labor in the Whaling Industry* (New York: Longmans, Green and Co., 1928), pp. 60-63.

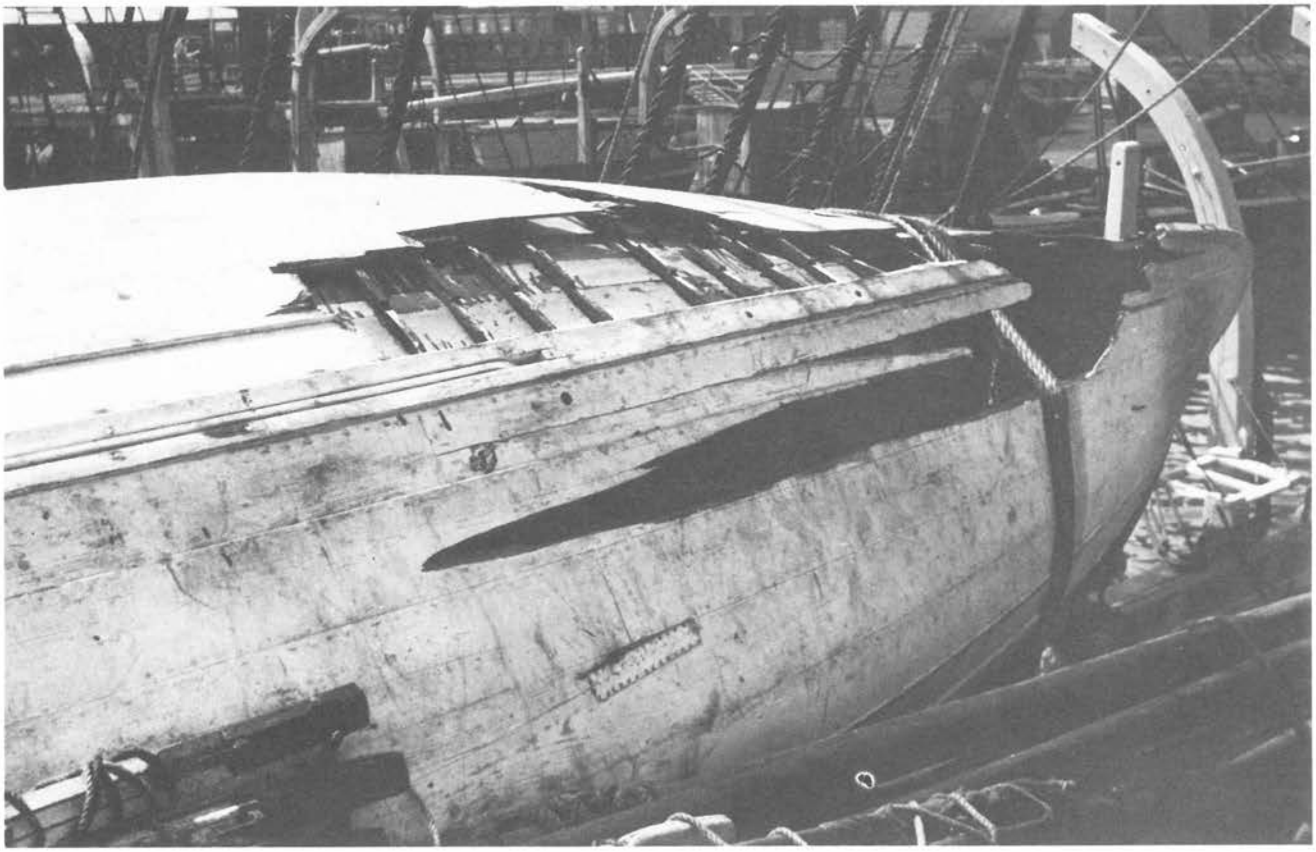


Figure 1-7. While this stove boat is testimony to the brute strength of an enraged whale, its exposed timbers reveal the intricacies of its construction. At the garboards, the frames have tapered notches to receive the planking. Further up, the notches are squared to receive the seam battens. Batten-seam construction was derived from a method of repairing cracked and broken strakes by nailing a batten to the inboard side of the break. This construction proved easier to repair at sea and the smooth hull it produced made the boat quieter when approaching a jittery whale. Lapped garboards were retained as they provided a hand hold for the crew of a flipped boat. The gunwale- and sheer strakes retained their lap-construction probably because it was more economical and there were no marked benefits from other planking methods. Photograph by Albert Cook Church.
Old Dartmouth Historical Society

How did the whaling merchant embrace the improved whaleboat? Documents from this period and eyewitness accounts offer the best clues. The often-cited and possibly overstated claims of James Beetle give some dates for the appearance of important innovations as well as dates marking their general acceptance. Beetle claims to have invented batten-seam construction in 1833, to have fitted a whaleboat with a centerboard in 1841, and to have invented the mast hinge in 1837 and first fitted it to a whaleboat circa 1840. If the authorship of the inventions is arguable, the dates are certainly plausible and give a good indication of the time lag between their first appearance and eventual adoption. Beetle also gives 1830 as the date of introduction of split bent thwart knees, whose adoption was immediate, owing to the scarcity of natural crook knees, while a boat's frame consisted of 46 to 48 timbers up to 1860, a far smaller number than later used.[10]

While the above innovations appeared in the 1830s and 40s, there is good reason to believe that their acceptance was gradual

even into the 1850s, when Beetle states that batten-seam boats were "generally used." Detailed bills of outfits for bark *Mermaid* have survived from her whaling cruises from 1855 through 1880, including the boatbuilders' bills, which itemize her boats as follows:

1855 4 lap boats @ $60 each
1 centerboard boat @ $70
"2 whaleboats" @ $55 each

1860 3 lap boats @ $50 each
1 smooth bottom boat @ $55
1 smooth bottom centerboard boat @ $65
repairing and painting 1 smooth bottom centerboard boat

1865 3 lap boats @ $85 each
2 smooth bottom boats @ $90 each
1 smooth bottom centerboard boat @ $100
3 rudders @ $3 each (first mention of boat rudders)

1869 2 large centerboard boats @ $120
3 common centerboard boats @ $110

1873 5 centerboard boats totaling $483.50 (may include trade or discount)
1 Delano whaleboat @ $100.90

1876 5 centerboard boats @ $100 each

1880 2 29-foot whaleboats @ $100 each
2 28-foot whaleboats @ $95 each[11]

From these bills, it is evident that the transition from lap boats to batten-seam boats was not completed (for some vessels) until late in the 1860s, and that the acceptance of centerboards closely paralleled this trend. It is curious that rudders are first mentioned as late as 1865, but this does not rule out their earlier use. *Mermaid*'s blacksmith bills from 1855 and 1860 list steering braces and rowlocks, indicating that these were iron forgings. Mast hinges are not listed, but might have been bronze castings

[10]James Beetle, statement to A. Howard Clark at New Bedford, Massachusetts, ca. 1879-1880; correspondence with J. Templeman Brown, New Bedford, n.d. and March 19, 1880, *The American Neptune* III (October, 1943), pp. 350-352.

Figure 1-8. The stern of a 30-foot whaleboat built for the Arctic fishery, ca. 1895, looking under the cuddy. The upper three seam battens are visible at left-center; above them are the laps of the sheer- and gunwale strakes. Note the notches in the frames and damage to the one at far left. Between it and the next frame aft can be seen a backing block on the gunwale strake where two planks have been scarfed and fastened. Photograph by the author

[11]Bills of whaleboats and boat gear, bark *Mermaid* to Alphonse Smith, paid at New Bedford, September 4, 1855; *Mermaid* to William H. Smith, paid at New Bedford, October 6, 1855; October 19, 1860; September 12, 1865, July 13, 1869, June 21, 1876; *Mermaid* to Joshua Delano, August 28, 1873; *Mermaid* to George W. Farnham, paid at New Bedford, June 4, 1880. Outfitting book, bark *Mermaid,* Andrew Hicks, owner, Westport, Massachusetts, 1873. In *Mermaid* folio, Andrew Hicks papers, Old Dartmouth Historical Society, New Bedford, Massachusetts.

[12]Bill of rowlocks, etc., brig *Kate Cory* to Gifford & Topham, brass founders, New Bedford, October 21—December 2, 1858, *Kate Cory* folio, Alexander H. Cory papers, Old Dartmouth Historical Society, New Bedford, Massachusetts.

[13]Reginald B. Hegarty, comp., *Returns of Whaling Vessels Sailing from American Ports: A Continuation of Alexander Starbuck's "History of the American Whale Fishery," 1876-1928*, ed. Philip F. Purrington (New Bedford: Old Dartmouth Historical Society and Whaling Museum, 1959), p. 26.

[14]Ansel, *The Whaleboat*, pp. 122-139.

and thus furnished by another vendor (mast hinges are listed among the 1858 bills for brig *Kate Cory*[12]). Whether *Mermaid*'s slow adoption of improved whaleboats coincides with the general trend in the whaling fleet is impossible to say until more documents shed light on the boats used by other whaleships in this period. Even if other adoption dates are at variance, it should not be by much and the same gradual changeover is likely to be found. In this respect, James Beetle's statements are undoubtedly correct and representative.

A minor trend toward the size of whaleboats is also discernible from the *Mermaid* boat bills, in which "large" and "common" boats are distinguished in 1869. The 1880 bill, giving lengths of 28 and 29 feet, suggests that these are also the lengths of the boats in previous bills. It should be noted that *Mermaid* did not enter the North Pacific fishery until her 1891 cruise, so these boats were probably all intended for sperm whaling.[13] Assuming that the largest whaleboats in 1850 were 28 feet long, there was little change until the 1860s saw 29-foot boats introduced, probably for the Arctic grounds. Beetle's statement in 1880 that "The 29-ft. boat is specially adapted to sperm whaling since it is more convenient in management." is in agreement with *Mermaid*'s boat bills. Arctic boats were as long as 30 feet, rarely more, and were generally the largest boats used by American whalemen. A surviving example in the New Bedford Whaling Museum is 29′11½″ long.

Beyond matters of size, construction, and fittings, there is the very troublesome question of hull form of earlier whaleboats. Of all the boats measured by Ansel, most are probably from the last decade of the 19th century or the early decades of the 20th and none can be dated with certainty before 1870.[14] No whaleboats from an earlier period are known to have survived, although they may exist as buried or submerged wrecks yet to be

Figure 1-9. This watercolor, a companion to Figures 1-1 and 1-5, illustrates the problems of assessing hull forms in freehand drawings. Judging from the details of the boat being "chawed," a lapstrake hull was intended, but this boat has nine strakes per side instead of the usual eight. A picture like this is valuable in establishing the presence of many small details, such as the lion's tongue, the steering oar handle, and many inboard details visible in its companion paintings, but their precise forms and proportions are not reliable.
Old Dartmouth Historical Society

discovered. No builders' half models, drafts, offset tables, or molds for pre-1870 boats have come to light either. An absence of *measurable* source material has left us with very general and imprecise descriptions of early whaleboat hull form. Artists' depictions of whaleboats, while pleasing to the eye, have not proved reliable; models of whaleboats from this period are scarce and similarly inaccurate. A few written descriptions of whaleboat form give some useful ideas of midship sections and how they changed, but these generalities are hard to quantify.

In describing whaleboat hull form, James Beetle stated that "The bottom of whaleboats were round—suited for rowing rather than sailing—a change commenced in 1836 when I built the first boat with plumb sides and straight-timbered at the bottom. This style is now universal. No round bottom boats are now built for whaling." Beetle also gave the maximum beam of boats before 1854 as five feet, four inches wide, increasing to six feet and more after that date.[15] These descriptions and figures are certainly reasonable, but they leave the midship section open to many interpretations, while saying nothing at all about the way the ends were modeled.

[15]Beetle, *American Neptune*, pp. 350, 351.

A plan of a "South Sea Whaleboat, 1800-1835" drawn by Howard I. Chapelle may be one attempt to interpret Beetle's description, for the hull dimensions are exactly those given in Beetle's testimony. If Chapelle did use Beetle's figures as his source, he did not see—or chose to ignore—the description of the round bottom and instead gave his whaleboat straight floors with marked deadrise and very little flam above the waterline. If Chapelle's whaleboat came from other sources, they are not documented and are thus of unproven value to scholars. The Arctic boat illustrated by Chapelle is even more of a puzzle, as it differs so strikingly from the boats commonly associated with this fishery. If it was "taken off" an actual boat, then it represents a hitherto undocumented and unusual whaleboat variant.[16]

[16]Howard I. Chapelle, *American Small Sailing Craft; Their Design, Development, and Construction* (New York: W.W. Norton & Company, Inc., 1951), pp. 41-43.

If conventional sources of documentation have produced no answers to the question of whaleboat hull form at mid 19th century, there remains one object that has been unexpectedly helpful in providing clues to what these boats might have looked like. This is the half-scale (6″ = 1′) model of whaling bark *Lagoda*, built for the Old Dartmouth Historical Society in 1916 and today the centerpiece of the whaling exhibits in the New Bedford Whaling Museum. This model was designed by New Bedford architect Edgar B. Hammond who, lacking plans and details of the actual *Lagoda*, reconstructed her to the best of his ability, assisted by whalemen who knew the vessel and using surviving details from other whaling ships.[17] The hull form is not entirely convincing and certainly differs from photographs of *Lagoda* which have since come to light; however, the model's details, executed by blacksmiths, sparmakers, riggers, and sailmakers,

[17]Benjamin Baker, comp., "Inception and Growth of the Jonathan Bourne Whaling Museum," Benjamin Baker Collection: Jonathan Bourne's Office, vol. III (typescript), pp. 306-338, Old Dartmouth Historical Society, New Bedford, Massachusetts.

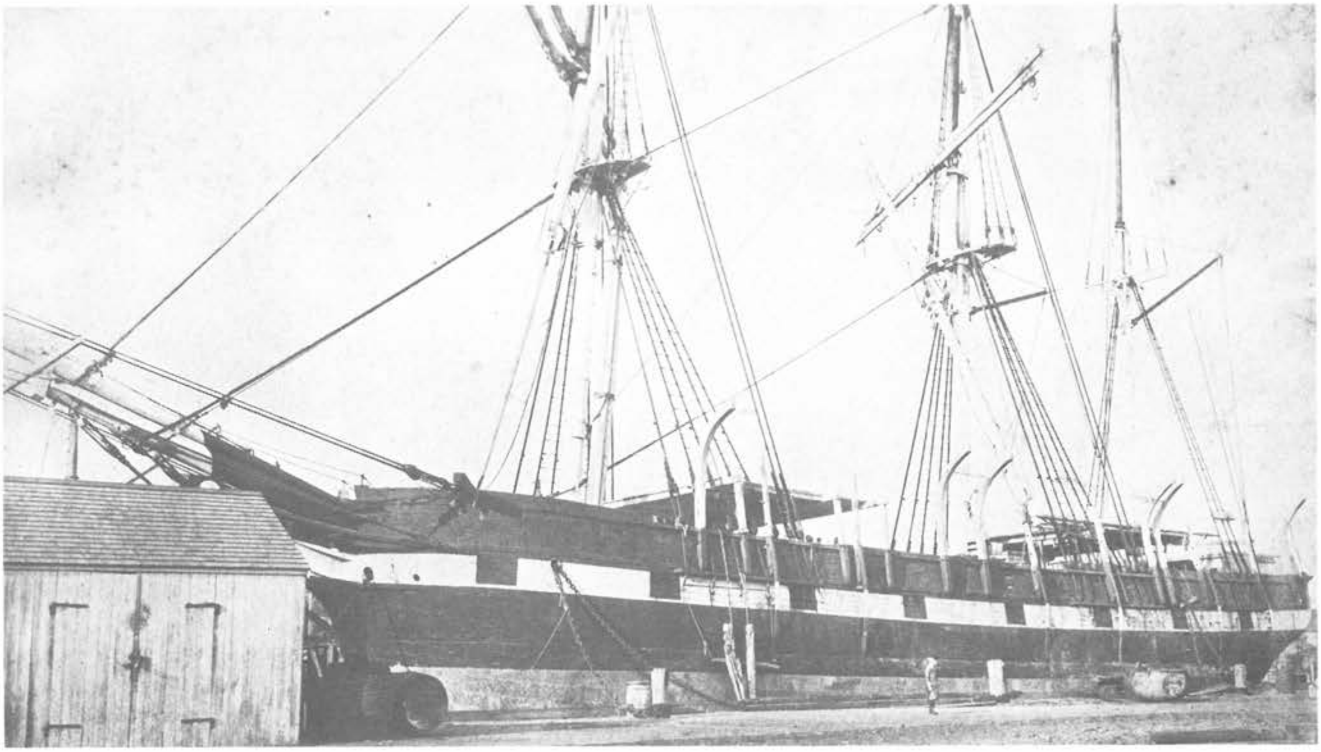


Figure 1-10. This photograph of Bark Lagoda, *taken prior to her last departure from New Bedford in 1888, is the best of only three known views of this vessel, none of which were available when the half-scale model was built for the New Bedford Whaling Museum in 1916.* Lagoda, *built as a merchant ship at Scituate, Massachusetts in 1826, was purchased into the whaling fleet by Jonathan Bourne in 1841. She was rerigged as a bark in 1860, and in 1888 was transferred to the San Francisco whaling fleet. In 1890, she was condemned at Yokohama and sold.* Lagoda *was the most profitable of Bourne's whaling ships, a fact which was decisive in designating her for reconstruction as a half-scale model for the Whaling Museum. No plans, offsets, or half model of this ship have ever been found.* Old Dartmouth Historical Society

were made very accurately to scale and today comprise the most complete and undisturbed collection of whaleship fittings to be found in any maritime museum.

What has just been said about the accuracy of *Lagoda*'s rigging and fittings may also be true of the seven whaleboats she carries, for they were built by a veteran boatbuilder with long experience in whaleboat construction. Joshua H. Delano was born in Fairhaven, Massachusetts in 1851, and followed his father in the boatbuilding business. The scant vital records of Fairhaven (most were destroyed by fire) suggest that he lived and worked all his life in his native town just across the Acushnet River from New Bedford. Delano's family was one of successful merchants, shipmasters, and shipbuilders who lived comfortably and enjoyed the high esteem of a community which had a healthy respect for maritime enterprise. Thus when Delano embarked on a career as a boatbuilder, it was with the approbation of a respected family, and was certainly not the story of an impoverished farm lad who had straggled into town in search of a better life.

In contrast to James Beetle, Delano did not seek publicity and did not figure prominently in any of the historical literature on whaleboats. This was also true of most other boatbuilders in the New Bedford area, with the result that they are completely forgotten and ignored by historians unless rescued from oblivion by the chance survival of receipts for their products found in the records of shipowners and agents. Delano was luckier than most by living long enough (he died in 1923) to enjoy the attention of local historians. That he was chosen to build the boats for the

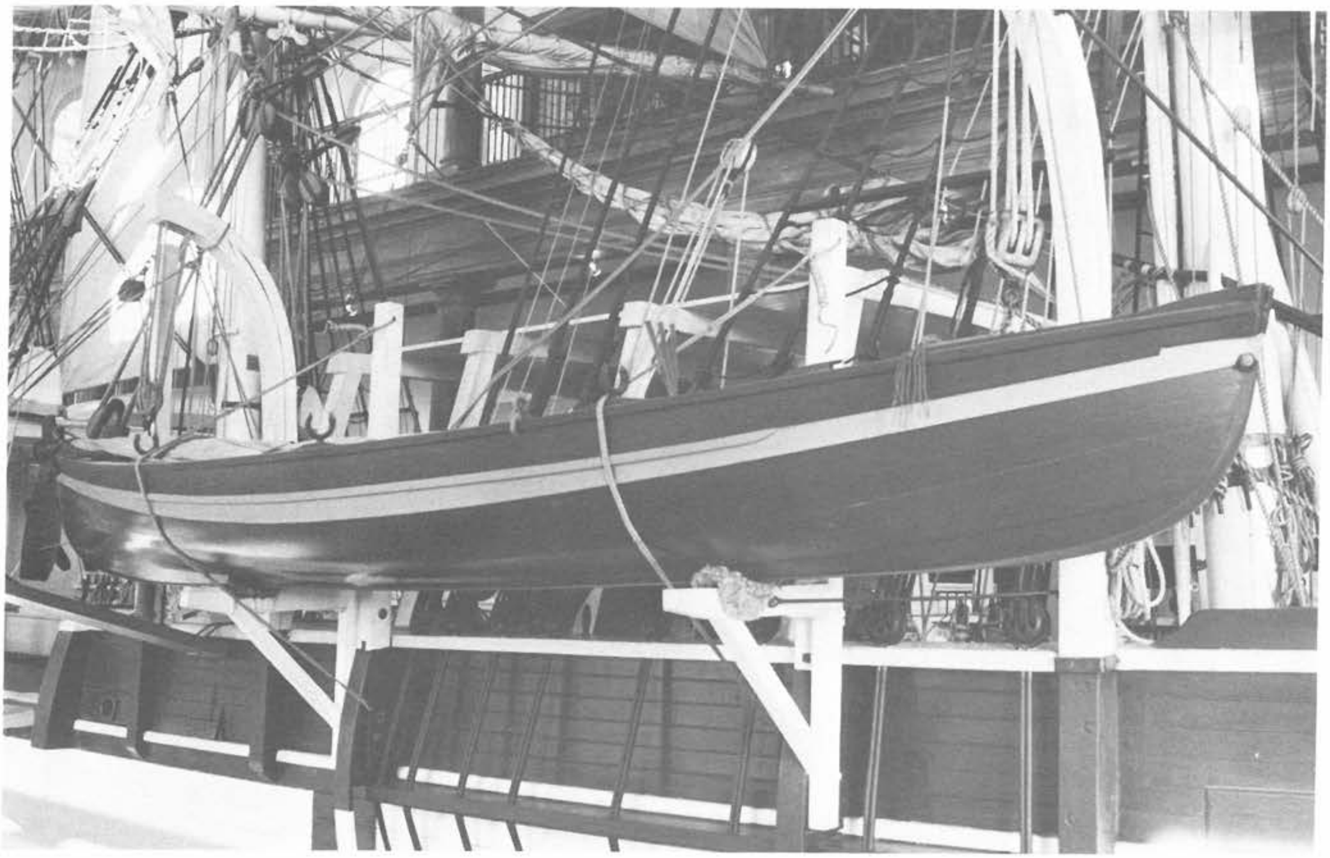
Lagoda model, and not the Beetle shop, is a matter of record, but why this was decided is not certain. Perhaps Delano underbid Beetle for the job; perhaps Beetle was not interested in building "models" of whaleboats. It is even possible that Delano boats had a better reputation for workmanship (Beetle's boats came in for stern criticism on a number of occasions[18]); the record on these problems is silent.

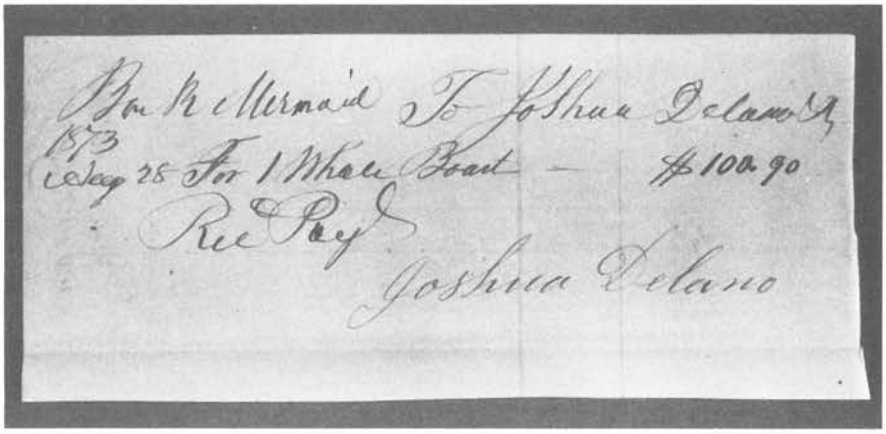
For whatever reasons, *Lagoda*'s builders got their whaleboats from Joshua H. Delano, at a cost of $950, delivered well in advance of the model's completion in November, 1916. They also obtained the construction molds, patterns, and bending traps for timbers and plank which were arranged in a half-scale replica of a boat shop by Clifford W. Ashley in the balcony of *Lagoda*'s exhibition room in the early 1920s.[19] This miniature shop remained on exhibit until the winter of 1977, when damage to the Whaling Museum from a city gas explosion required that it be dismantled and placed in storage. Although this mishap removed a very important exhibit, it presented the opportunity for a close study of the molds and forming tools used to build these boats, and thus the gaining of a better understanding of methods and stages of construction not shown in an arrangement which was "frozen" at one moment in the lengthy process of building a whaleboat. Examination of the construction molds allowed tracing their forms, comparing them with corresponding sections of the boats built from them, and plotting the differ-

[18]George B. Leavitt, journal, steam whaling bark *Narwhal,* 1902 whaling cruise, Baker Library, Harvard University, Cambridge, Massachusetts. An entry, April 21, 1902, excerpted by John R. Bockstoce, states: "In hoisting up one of BEADLES new boats (empty) hoisting straps pulled out. There are no rollers in the boat and for a new boat they are not finished."

[19]Zephaniah W. Pease, *A Visit to the Museum of the Old Dartmouth Historical Society* (New Bedford: The Old Dartmouth Historical Society, 1932), pp. 5, 10.

Figure 1-11. The starboard bow boat of the half-scale model of Lagoda. *The spun-yarns hanging from the bow at the thigh board are the lance tails. It is uncertain if they should be hanging outboard this way.*
Photograph by the author.

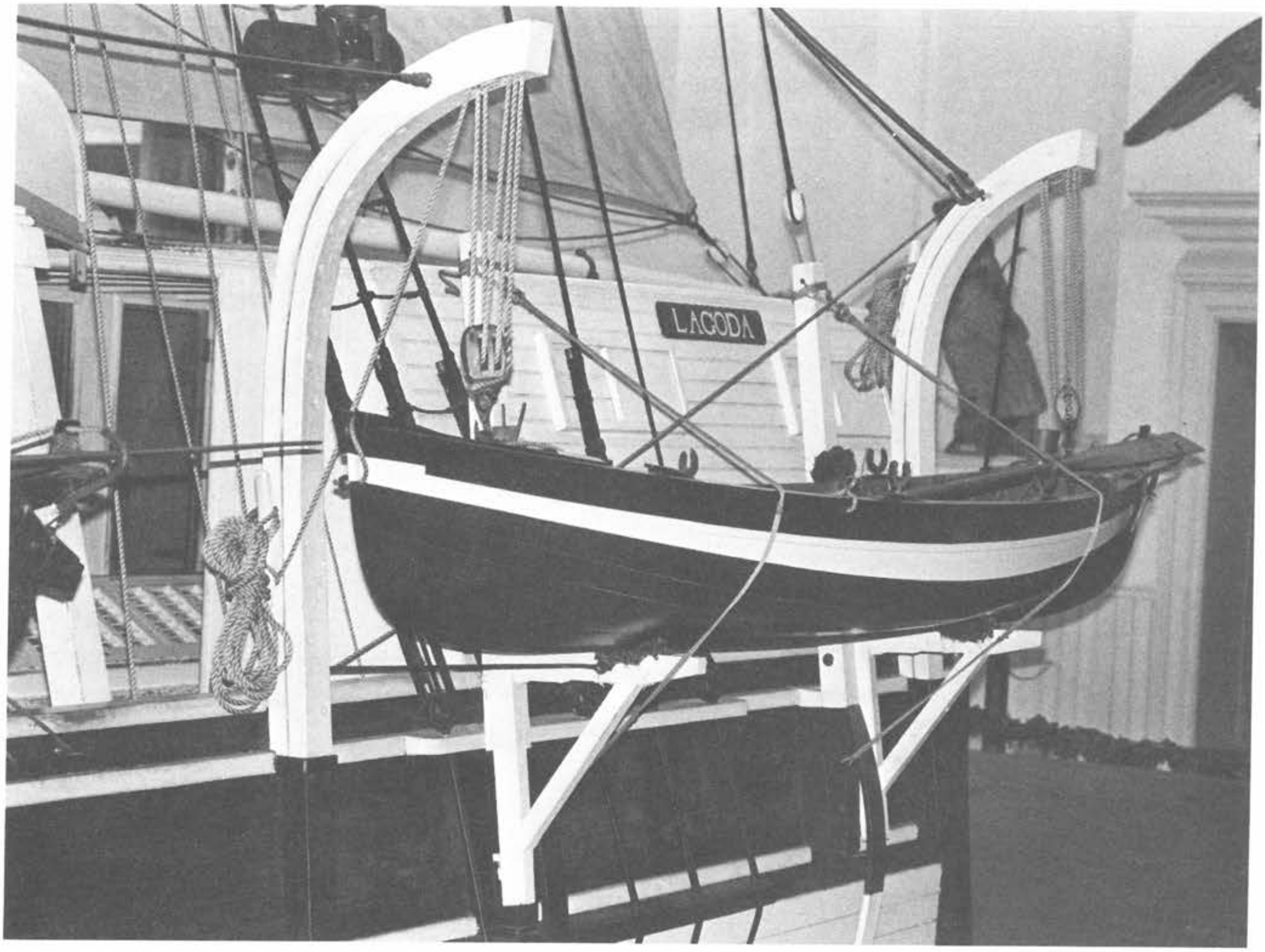




Bark Mermaid To Joshua Delano Dr
1873
Aug 28 For 1 Whale Boat — $100.90
Rec Pay
Joshua Delano

Figure 1-12. Very little of Joshua H. Delano's boatbuilding activities has survived; in fact, if Whaling Museum did not have his model whaleboats and the patterns and tools used to build them, and if Mystic Seaport Museum did not have the Noman's Land boat Orca, which he also built, our knowledge of Delano boats would be virtually nonexistent. This situation has not been helped by the loss of most of the vital records of Fairhaven residents by fires which destroyed its town offices on at least two occasions in the 19th century. The Delano families complicated matters further, for there are at least three Joshua Delanos to deal with in the late 19th century. Two of them, Joshua and Joshua H., father and son respectively, were boatbuilders; Joshua R. Delano was 10 years older than Joshua H., but belonged to another family. Both Joshua H. and Joshua R. died within a month of each other in 1923! Records of the Delano boatbuilding business survive only as fragments retrieved from shipowners' office records, such as this one.
Old Dartmouth Historical Society

ences and similarities in a series of lines plans. The hull forms derived from these surveys, together with the details of construction and fittings in the finished boats, are the basis for the reconstruction of a mid-19th century whaleboat which is the central topic of this book.



Chapter 2

Surveying the Half-scale Delano Whaleboats

Figure 2-1. The Lagoda *model's larboard boat on the cranes.*
Photograph by the author

Unlike the model of *Lagoda* itself, whose design was carefully prepared in plan form, the design of her whaleboats survives only in the form of the boats themselves and the construction molds. Joshua Delano left no half model or records on paper which shed any light on his whaleboat designs; the seven model whaleboats are the only boats of this type which can be attributed to him, so comparisons with his other whaleboats are not possible. While questions arise over the details of these boats, their accuracy and origins, I have attempted to scale my drawings from these boats with a minimum of modification. Only in cases where the historical evidence is overwhelming have I made changes to features which I believe are concessions by the boatbuilder to the problems of building these boats to reduced scale. These changes will be discussed as they arise.

I have confined the remarks in this chapter to those features of whaleboat construction and gear which are of particular historical significance. A broader discussion of this subject has been avoided as the form and function of each whaleboat part will be touched on in the plans and chapter on model construction.

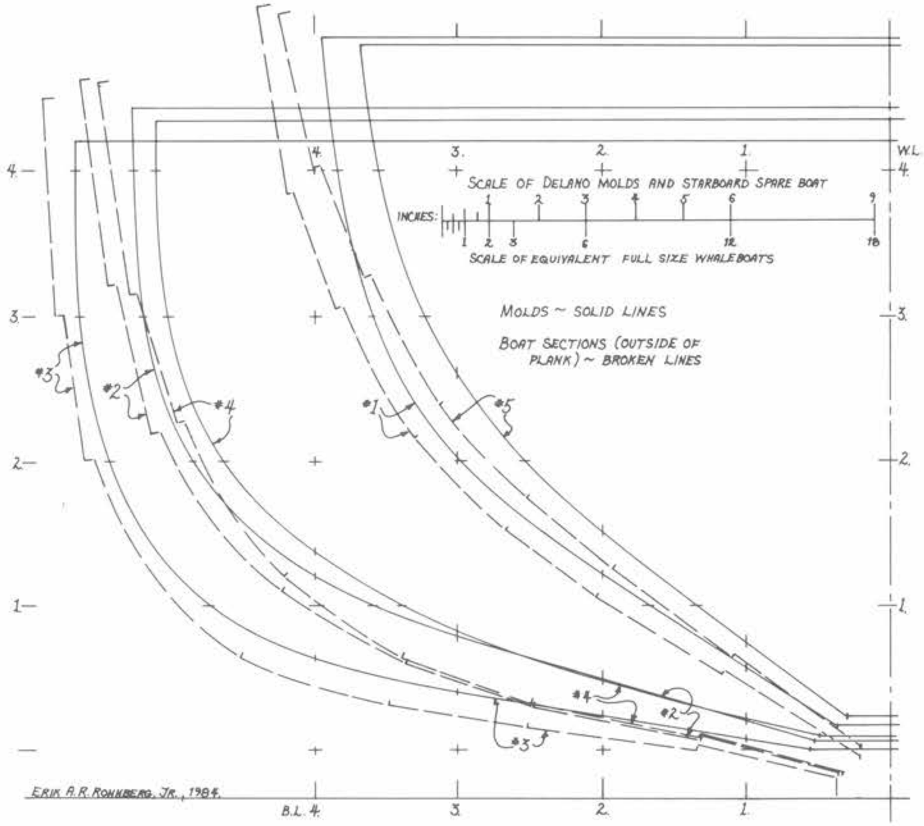


Figure 2-2. Sections of the Lagoda *model's starboard spare boat compared with its corresponding construction molds.*
Drawing by the author

Hull Form—Five of the *Lagoda* model's whaleboats were hung from the davits, while two spare boats were placed on the boat skids upside down, on chocks which supported them at four points on the gunwales. Although the five "ready" boats were additionally supported at two points on their keels by cranes, it seemed that the spare boats were better supported and less likely to have suffered from stresses and deformation which might have altered their hull form, however slightly. On this basis, the starboard spare boat was selected for measurements of a finished hull, which could then be compared with a faired set of lines derived from tracings of the construction molds (Figure 2-2). This spare boat was also used to determine the hull profile; i.e., the rocker of the keel and the curvatures of the stem- and stern posts. The sheer at the stations of the molds was also taken off, as were the measurements and locations of the centerboard slot and the bow chocks. In addition to these critical measurements, it was decided to take girth measurements and half-breadth measurements at the five mold stations, as well as to measure carefully the individual plank widths, in the interest of assuring the accurate delineation of the hull planking. These latter measurements proved to be a very important check against the hitherto-accepted accuracy of the molds.

In delineating the mold sections, these forms were carefully superimposed, taking into account the rocker of the keel. The tops of the molds did not coincide with the sheer line from the spare boat but lay one to two inches below it; mold #5 showed a tendency to rise above the other molds and distort the sweep of the sheer. Molds #2 and #4 were consistently troublesome to reconcile to a faired lines drawing, causing the bottom in way of them to look "pinched" and the sheer at the quarters to look hogged.

When planking girth measurements were superimposed on the mold sections—allowing compensation for the added dimensions of the seam battens and the planking—the planking girths exceeded the mold girths, forcing the level of the sheer markedly above that measured from the spare boat. The sheer half-breadths clearly showed that the planking must have risen off the molds as much as an inch at these points and that the mold sections would have to be revised in form, then refaired, to produce a set of molds on which a shell of hull planking and seam battens would lie closely.

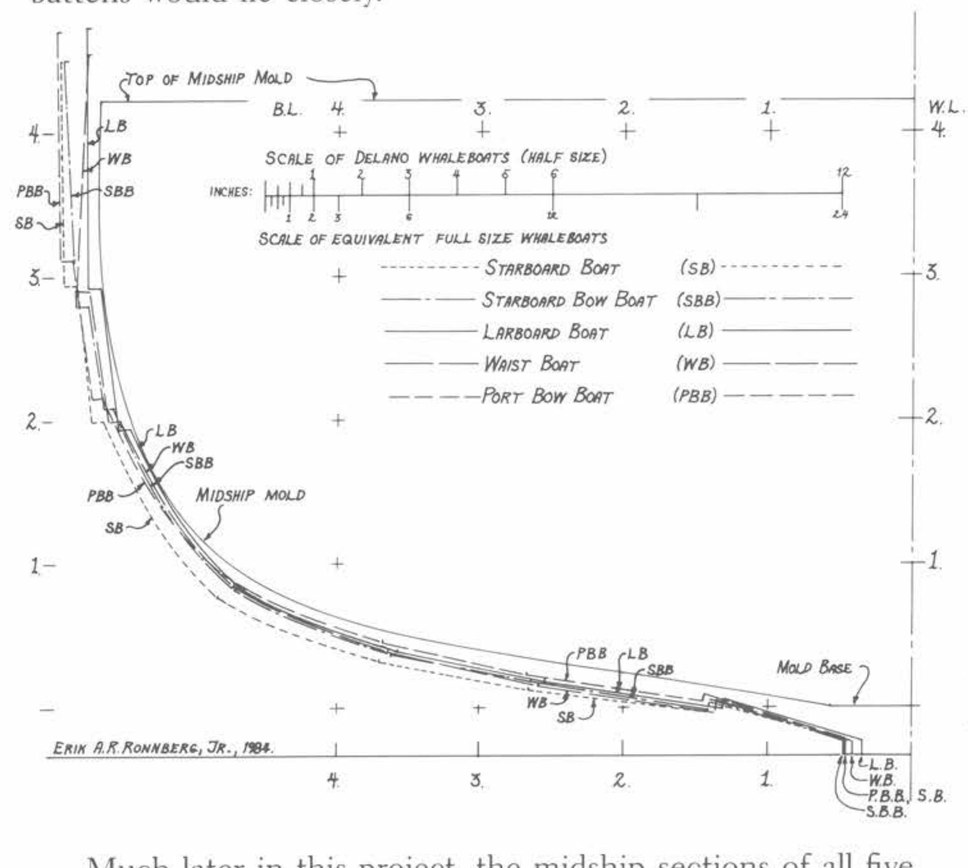


Figure 2-3. Midship sections of the Lagoda *model's five whaleboats on the cranes compared with each other and with the corresponding construction mold.*
Drawing by the author

Much later in this project, the midship sections of all five boats on the davits were carefully measured, using adjustable metal probes mounted on a portable frame. Figure 2-3 compares the sections derived from these take-offs with the midships mold on which the boats were built. The differences suggest that the planking of the upper parts was more dependent on the builder's eye than the mold, and there may have been some experimentation before any degree of consistency was achieved. The section of the waist boat is particularly noteworthy, as its gunwale strake actually has tumblehome, which is quite apparent on visual examination of the boat itself.

Beyond variations in midship form, there were obvious variations in the widths and tapers of several strakes, particularly toward the bow and stern. Considering this together with the gunwale strakes of the waist boat, it seems likely that the first boat(s) built had problems which were resolved by partial modifications and these latter were taken into account in the building of the others. I would guess that the waist boat was the first boat built.

Even the number of frames per boat could differ. Although most have 48 timbers (24 whole frames), several have only 46. The spacing of individual timbers could also vary considerably, so much so that no pattern could be established, not even one that might suggest that timbers near the hull ends were spaced farther apart than the midship timbers. In the end, it was decided to assume that uniform spacing was probably intended, with somewhat more spacing between the end timbers which were "canted."

Before condemning the accuracy and workmanship of these boats, it must be borne in mind that these loose "tolerances" are not at variance with the whaleboat building tradition. Ansel's findings in published sources bear this out, and both he and I, in a conversation with former whaleboat builder Leo Telesmanick, were told that it was not unusual for the planking to rise off the molds as construction of the shell progressed[1]. This apparently did not matter, so long as the planks on both sides behaved in the same way. A number of variables caused this situation, including: the tendencies of individual pieces of stressed wood to bend in different ways (these boats were not built of clear selected lumber, although care was taken in assigning certain grades to specific planks); the customer's desire for some variation in hull form might be attended to with little or no alteration of the molds; also there were tendencies for the steam-bent frames to straighten before the restraints of gunwales, thwarts, and other stiffening elements were added. In the case of these boats, Delano may simply have found that the molds were close enough to produce the hull forms he desired and proceeded to work around, or ignore, their limitations and errors.

These boats were apparently built very quickly by today's standards. Work on the *Lagoda* model began in mid-April, 1916, at which time Delano was probably subcontracted to build

[1]Leo Telesmanick and Willits D. Ansel, interview held during a visit to New Bedford Whaling Museum, late winter, 1973.

them. A photo taken on July 15 shows at least one finished boat on the floor of the exhibition hall next to *Lagoda*'s hull, whose bulwarks were still in frame. By September 27, there were several boats stored in the hall balcony, and all boats were on the model before November 11, so it seems safe to assume that all seven boats were finished in this seven-month time span, if not in considerably less than that.[2] When we add the time required to make patterns, special bending traps for frames, stem- and stern posts, and the cupped strakes which lie at the turn of the bilges, not to mention any other boatbuilding projects Delano may have had on hand for other accounts, it seems unlikely that he would have fussed over trivial (to him) problems of mold discrepancies, since he had more urgent things to occupy his shop time.

[2]Benjamin Baker, "Whaling Museum," pp. 312-335.

Whatever our modern judgment may be, there is nothing in the appearance or workmanship in these model whaleboats that contradicts what we see in surviving whaleboats or what we read in reliable literature about them. In reconciling the mold sections to the girth and beam dimensions, it was possible to leave the lower parts in their original form while allowing the sections to spread above the turn of the bilge. Some excessive deadrise in the bottom of mold 4 was ignored in order to eliminate the "pinched" area in the run; otherwise the lower parts of the molds faired easily. Once the molds were in some state of agreement with girth measurements, a lines plan was drawn and faired to them; i.e., to the inside of the lapped seams and seam battens, which seemed like the most natural way to fair this kind of hull as long as one is working to the "inside of the plank," which in this case also includes the battens.

In easing the molds at the gunwales to correspond with the measured breadths of the boats, sufficient overhang, or flam, was produced to allow the gunwale strake to flare out slightly along its whole length. Had this not been done, this plank would have developed a distinct tumblehome in the midship sections, which would have been not only uncharacteristic of any known New Bedford whaleboat, but would have posed all sorts of problems in the later stages of hull construction. Apparently, Delano let the inherent flexing properties of the steam-bent frames and the shape of the gunwale strakes take care of this problem for him.

Before going further in this discussion of hull form, it might be worthwhile to consider our approach and attitudes in interpreting these models, as they are central to rewarding us with, or denying us, a valid reconstruction of a whaleboat where no other information exists. Viewed negatively, the "tolerances" to which these hulls have been built are so loose and departures from fixed shapes are so random that anyone accustomed to precision handwork might well wonder if there is any validity to a reconstruction based on this information, if it, indeed, is not misinformation. More positively, one might consider that these boats were the product of an experienced boatbuilder, then 65 years old but with seven more active years ahead of him, who was asked to build models of whaleboats as they looked in the heyday of the whale fishery, based on his own experiences and recollections of the type.

We do not know if Delano still had whaleboat molds or offsets from that period, much less if he scaled them down to half-size. We can only assume that he went about the process of laying-out and shaping the molds in ways he used with full-size whaleboats. It may well be that the latter were also built over molds that weren't always fair, but were shimmed and reshaped as experience dictated. Given the need for only seven model whaleboats, he may also have decided that reshaping the molds was unnecessary for such a small production run and simply relied on eyes and experience to get the desired hull shapes.

It is also possible that molds for full-size boats were similarly unfair and too narrow, and that these problems were dealt with in the same way. If a builder used only one set of molds, but had to modify the hull forms to suit individual demands, molds with such apparent deficiencies may well have been necessary and considerable judgment may have been needed in using them. In the effort to figure out how the molds were used, and what happened to the hulls in the process, some valuable clues to 19th century whaleboat building methods might be found. On the premise that this exercise in fairing the molds and reconciling them to the completed boats was valid, the investigation of these whaleboat models continued.

As a test of the accuracy of the faired lines plan—and for other details as well—a model was built to scale ¾″ = 1′ over molds scaled carefully from the master drawing. Results showed that the planking could be made to lie close to the molds with little if any tendency to rise from them. No problems were encountered in forming the hollows at the bow and stern; the planking showed no tendencies to straighten, a situation which was probably helped by the twists induced in the garboard and lower strakes as they approached the hull ends. After planking, the model shell—which was held together at the seams and laps only by glue—was removed from the molds for inspection. It showed remarkable rigidity and fitted exactly as before when returned to the molds for framing.

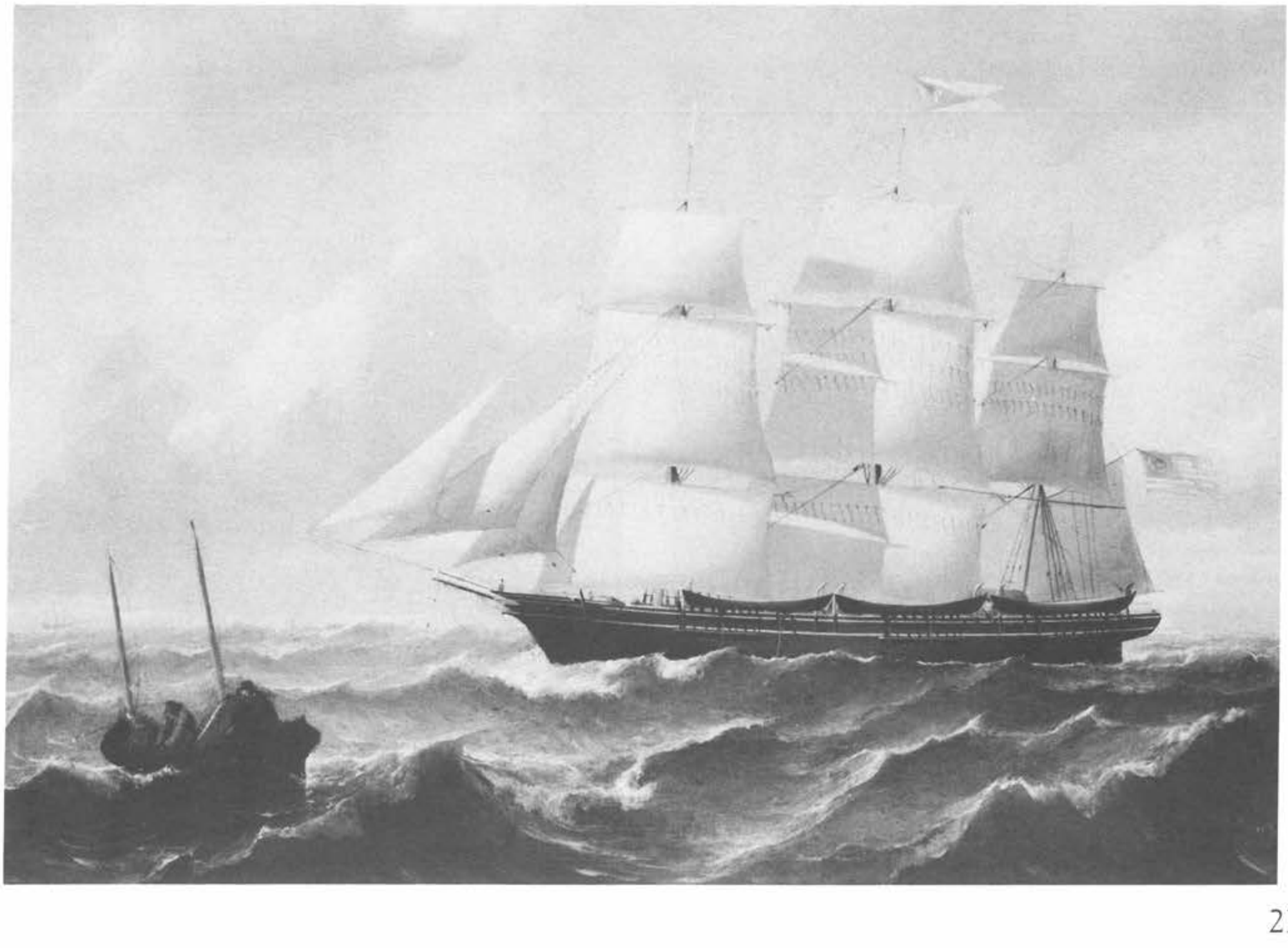
One aspect of hull form that mattered considerably was the shape of the midship section and how it compared with James Beetle's description of earlier whaleboat bottoms. While some deadrise is apparent, this section has a decided U-shape which approaches the "round bottom" claimed by Beetle.[3] There is nothing like the steep deadrise and strongly veed bottom so

[3]Beetle, *American Neptune*, p. 351

characteristic of later whaleboats. If the Delano boat does not have a true round bottom, it certainly represents a conservative departure from it, and this might well have been encountered in the boats that marked the transition period from the first half of the 19th century to its final three decades and the first two of the 20th. The dimensions of these boats also fit nicely with that period; length: 28 feet; breadth: 6 feet ¾ inches; molded depth: 2 feet 3 inches. Moreover, it is unlikely that Delano could have benefited from Beetle's statements, as they were published only in part and Beetle's written testimony had been filed away at the Smithsonian Institution more than 30 years previously. Their agreement is either coincidence or the concurring opinions of two knowledgeable boatbuilders.

Less important but still noticeable features of these hulls are the end profiles, which are unusually straight and plumb in their upper parts when compared with later boats. Paintings which depict whaleships with their boats from the 1850s and earlier show a variety of bow and stern profiles which were possible. In some boats, the foot of the stem and stern are cut away to give long overhangs and a decided "spoon bow" profile; in others, the ends rise very abruptly with nearly plumb upper parts. Also, the abilities of the artists to depict these forms with accuracy is a matter of some question. It is very likely that these profiles varied from builder to builder, and many whaling

Figure 2-4. This painting by William Bradford is believed to represent ship Twilight, *possibly outward bound on her first whaling voyage in 1854 under the house flag of William Phillips and Son. In many Bradford paintings from this period, the handsome whalers of the "clipper" style are shown carrying black whaleboats on their cranes. The strong sheers and short overhangs of these boats closely resemble the Delano whaleboat profile. Of all the New Bedford artists of the 19th century, Bradford showed the most discipline and attention to form and proportion in his canvases of sailing ships. Surviving half-models of some of the vessels in his paintings agree closely in these respects.*
Old Dartmouth Historical Society



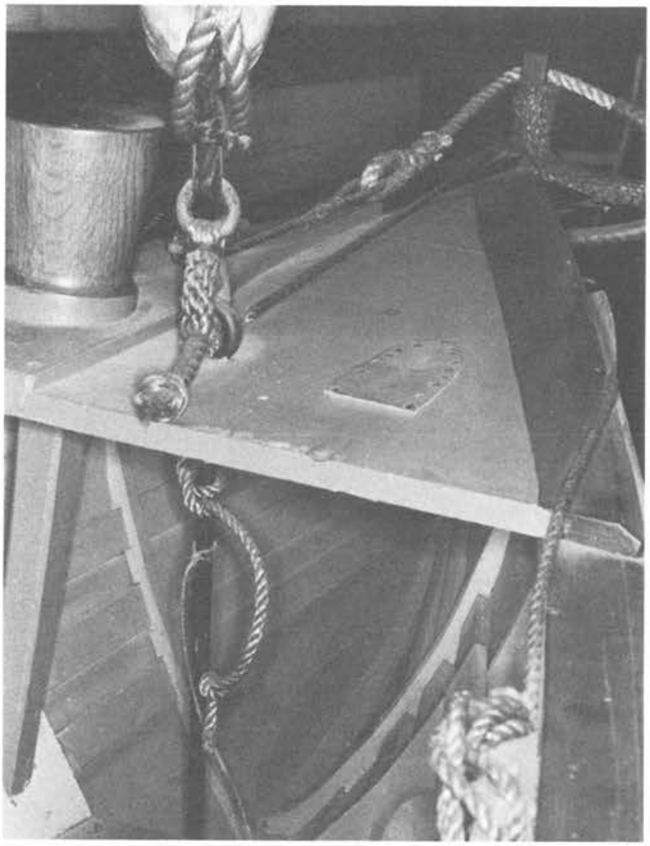
masters surely had their own views about the shapes of whaleboats that builders had to reckon with. Another factor is that with shorter boats whose ends were cut away to any great extent, the shape of the bottom could be adversely affected by making the water line length too short to develop ends that were as long and fine as desired. And there is always the likelihood that Delano knew more about whaleboats than modern historians do. For this reason, the profiles are accepted as they are. Any modifications to them for purpose of building a model or full-size boat are at the risk and discretion of the builder.

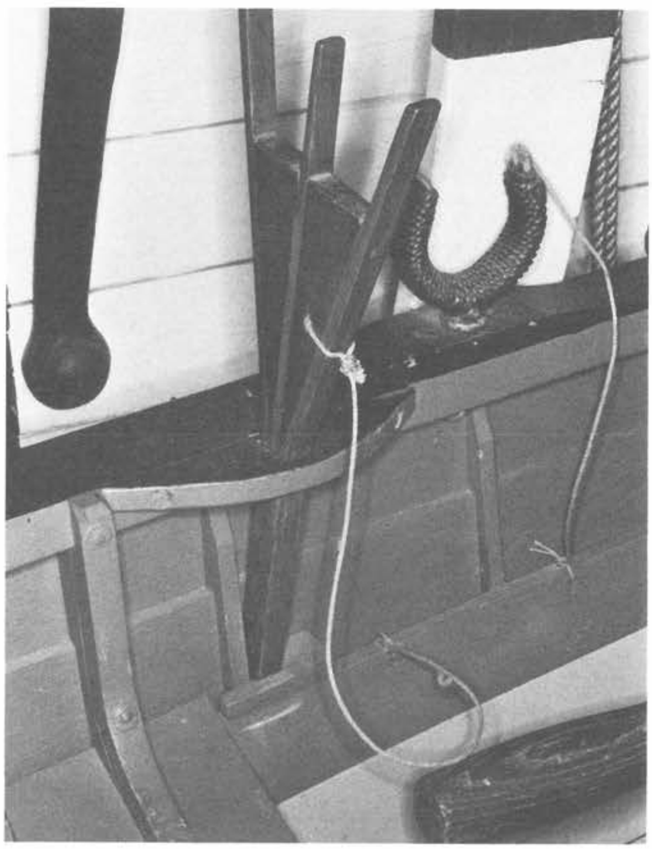
Construction—In building these models, Delano made few departures from what we know of whaleboat construction. Perhaps the most noticeable is that strakes #5 and 6 were combined in a single wide plank, thus reducing the number of batten-seams from four to three (Figure 2-5). A practical reason may lie behind the variation, as these two strakes would have had to be steamed and set in a bending trap to produce cupped sections, the better to produce a smooth rounded surface along the chine. In half-scale, each plank would be rather narrow and thus difficult to work into the required shape; however, a double-width plank could be formed much more easily and was likely to keep its "set" once it was joined with clinch nails to the lap-seam above and the batten-seam below it.

Construction materials in these boats were very carefully scaled down: plank thickness is ¼", keel is 1" thick and 3" wide

Figure 2-5 (left). The Lagoda *model's port bow boat, looking aft under the cuddy. There are only three batten seams per side on these boats instead of the usual four, the builder having decided to fit strakes #5 and #6 as a single wide strake. Note the well-made pigtail on the davit block hook. The trip line for the rudder leads forward from the stern post, through a hole in the cuddy just abaft the lifting strap eye, and is hitched to the shank of the strap. The rudder's tricing line is belayed to the quarter cleat at right.*

Figure 2-6 (right). The scantlings of all hull construction materials were carefully scaled down in these boats, giving them a very delicate appearance. The wood was very well seasoned, as no planks have checked or frames split. The fastenings are very delicate and neatly driven, most of the boat nails being very difficult to detect.
Photographs by the author.





at its mid-point, frames are sided a delicate 3/8", molded 1/2". Other details of construction were precisely worked out in their proportions and scale dimensions. These are recorded on the plans as they were measured from the boats without any attempt or need to reconcile them to later whaleboat construction and measurements. The number and spacing of the frames was at first thought to be in error, but the 46-48 timbers found in these boats are exactly the numbers given by James Beetle for whaleboats of the period in question. The spacing of the timbers was not uniform, varying from 5 1/2" to 8" on centers; the average is 6 3/8" on centers. The more closely spaced timbers were generally grouped amidships, but sometimes this close spacing extended to all the after frames, with the frames at the first thwart and forward spaced 7-8" on centers. Undoubtedly, Delano fitted the timbers by eye, with little more than reference marks on the keel to suggest the spacing. With the molds still in place during this process, there were five vertical planes for reference and rough measurements. The results were certainly sufficient for a strong hull and the unevenness of spacing is not readily noticeable.

The fastening of the hull is impressive for the delicacy and neatness of the clinch nailing. The nails were proportionate to scale—or very nearly so—and driven with such care as not to split or mar any frames or planking. Planks were nailed to the frames in regular fashion: at each frame there was one nail through each lap and two through each batten—one on either side of the seam. Planks were also fastened to each other along the laps and battens, but this was often difficult to detect as nail heads were set and carefully puttied and painted over. In most discernible cases, they seem to be about 3" apart on centers, which is only about half the number of nails used on later whaleboats. Where the laps or battens are exposed to view inboard (beyond the ends of the ceiling), it is very hard to find much evidence of the clinch nails as workmanship is very neat and hidden by paint (Figures 2-5 and 2-6). In the very peaks of the bow and stern, there is little evidence of nails as these areas were too confined, and it was difficult to position a backing iron for proper clinching.

Inboard construction differed hardly at all from what we are accustomed to seeing in later whaleboats. On the basis of literary and pictorial descriptions of early 19th century boats, this is to be expected as the mechanical requirements of pursuing a whale established very soon the best arrangement and scantlings for inboard joinerwork. Certain details in fact suggest that Delano took care to incorporate minor changes that were characteristic of mid-19th century boats, the thwart knees being an interesting example. We know from Beetle's statements that bent split knees were adopted very quickly in the 1830s in answer to the short supply of natural-grown knees; also two

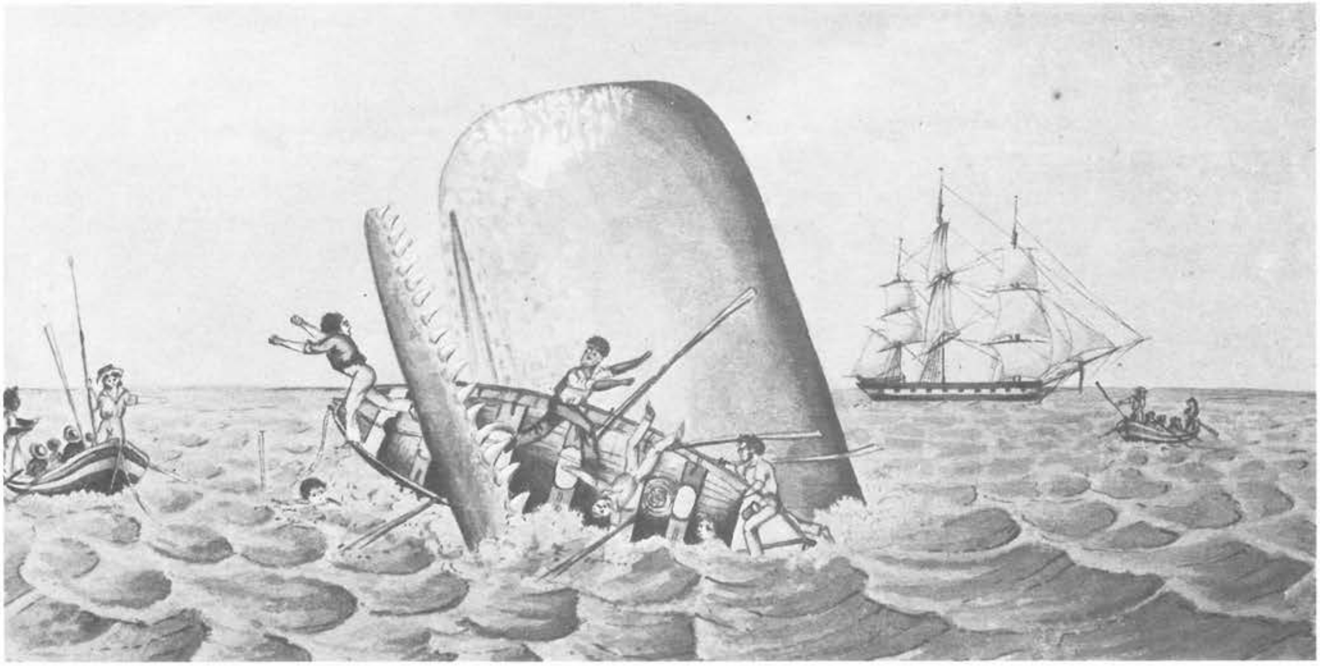


Figure 2-7. *The distressed boat in this view shows very nicely the thwart arrangement of early 19th century whaleboats. Each thwart is braced with but one pair of thwart knees, including the second thwart, which in later years required two knees per side to withstand the strains exerted on it by the mast and its rig. The white circular designs on the center of the thwarts are of uncertain function. They may be painted designs; their use as pads for the oarsmen seems doubtful, as they are centered on the thwarts while other views in this series definitely show that the men sat off-center when rowing. This picture is a companion to Figures 1-1 and 1-5.*
Old Dartmouth Historical Society

knees per thwart, ten in all, were fitted on top of the thwarts, a practice corroborated by logbook sketches believed to date from this period (Figure 2-7). With the introduction of the mast hinge, and perhaps even earlier on boats whose masts were stepped through a hole in the mast thwart, two extra knees were fitted for additional support, thus bringing the total of thwart knees to the twelve we find in the Delano boats. The larger and heavier boats of the late 19th century received an additional pair of knees at the stroke oar (fifth) thwart, as the space between this thwart and the cuddy had grown considerably, placing additional loads on this thwart as a support member. The Delano boats do not have this extra pair of knees and it seems very doubtful that an active boatbuilder would omit them unless there was good reason—probably this was a transitional feature in a boat that had not yet reached a size that required the extra knees.

Between the fifth thwart and the cuddy, at the inwales, are a pair of cleats which extend from inside the thwart riser up to the inwale and are securely fastened at numerous points (Figure 2-8). Ansel suspects that these are stiffeners and I have no doubts that they are exactly that.[4] Because the heads of the frames were not fastened to the inwales, the ½″ thickness of planking that joined the two members was weak and susceptible to splitting. These stiffeners tied the inwales securely to the lower hull structure, just as the thwart knees did in other parts of the hull. The distance between the stiffeners and the fifth thwart knees is almost the same as the spacing between the other thwart knees, thus providing support for the inwales and gunwales at regular intervals. These stiffeners were compared with those of later boats and all were found not to extend below the level of the thwart risers; they are *not* extensions of any frame timbers.

[4]Ansel, *The Whaleboat*, p. 56.

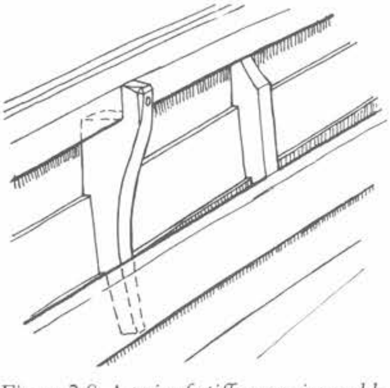


Figure 2-8. *A pair of stiffeners gives added support to the gunwale and inwale midway between the stroke oar (fifth) thwart and the cuddy.*
Drawing by the author

The centerboard scaled to five feet in length; its trunk, six inches longer, about the same size as in later boats. Thwart dimensions were the same as later, and the mast hinge and step were similar to those of later boats, but lighter in scantlings and lacking the tabernacle-like framework associated with larger whaleboat rigs. The bow chocks were exactly like those of later boats which did not have the Beetle-style chocks. The thigh board and bow box were also similar to later examples. The preventer cleats, which were mounted atop the thigh board, or just forward of it in later boats, were found some distance abaft the thigh board on the Delano boats (Figure 2-9). They appear to be too low to be very effective in catching a whale line that had accidentally jumped the bow chocks (or slipped by the mate out of the chocks when going alongside a whale); on the other hand, such cleats are not to be found in old sketches of whaleboats which are at pains to show far less significant features. These cleats may be of a transitional form. There is nothing about the cuddy, lion's tongue, and loggerhead which differs from later versions.[5]

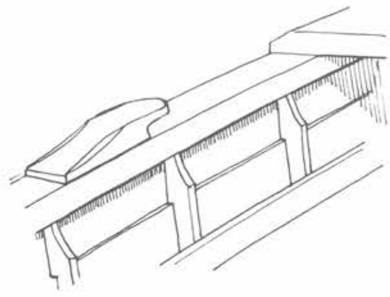
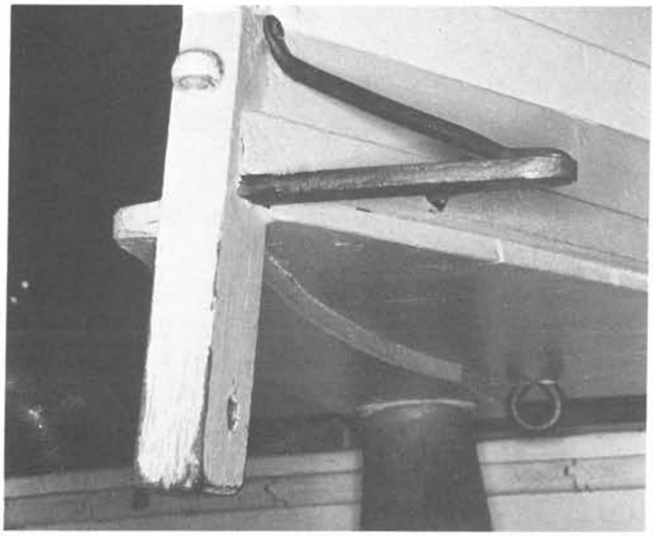


Figure 2-9. Preventer cleats kept a tow line which had jumped the bow chocks from sweeping aft over the crew and towing a boat sideways to its destruction. It would also be very useful when coming alongside a struck whale for lancing, as the boat would be permitted to swing alongside the whale instead of riding up onto the creature's back. On late 19th century boats, these cleats are much farther forward.
Drawing by the author

[5]cf. Ibid., pp. 47-58.



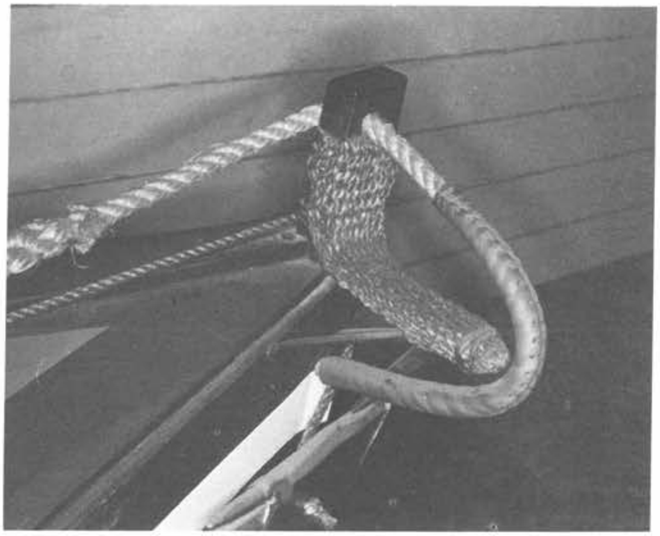


Figure 2-10 (left). The steering oar brace on the Lagoda *model's port spare boat (stowed upside down on the boat skids).*

Figure 2-11 (right). The steering oar brace of the port bow boat, fitted with a chafe mat and with the steering oar strop rigged.
Photograph by the author

Fittings and Boat Gear—Some of Delano's boat hardware is quite interesting and different from later material. The iron steering oar brace with its two supporting struts is something entirely apart from the wooden braces we are accustomed to seeing (Figures 2-10 and 2-11). It is quite common to find steering oar braces listed in blacksmiths' bills from this period, so here is a clue to what some of them may have looked like. None of *Lagoda*'s boats have a tub oar lock (all the rowlocks are commercial castings); indeed, this item seems to have been forgotten. For the plans, I have reconstructed an iron forging similar to later tub oar locks and have also provided the more likely alternative for the period in question: a regular rowlock and a wooden tub oar crotch that switched places on the same socket, depending on which was needed.[6] The lifting straps for the davit tackles are of the usual sort with a forged eye at the head—not a shack-

[6]The wooden tub oar crotch was reconstructed from drawings in Goode, *Fisheries and Fishery Industries*, Section V, Plate 193 and in Scammon, *Marine Mammals*, Plate XXIV.

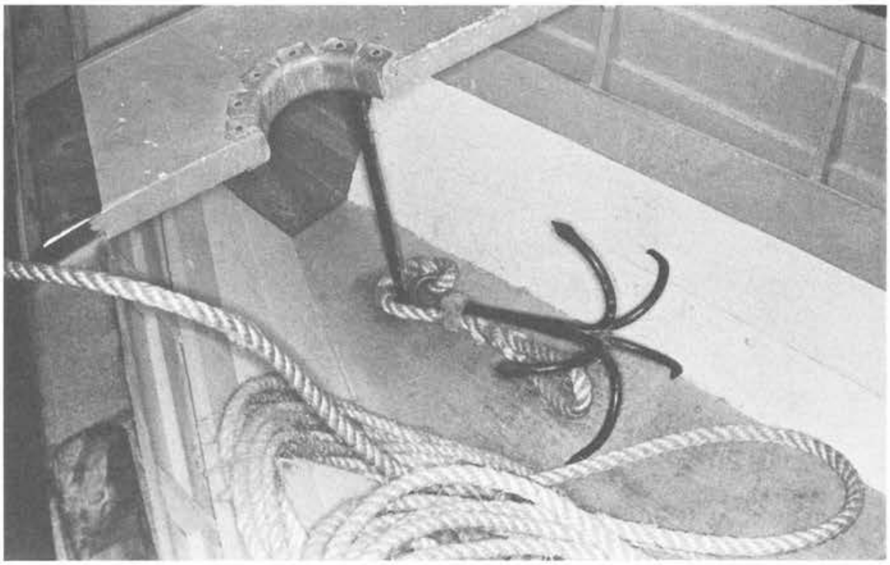


Figure 2-12. The bow of the Lagoda *model's port bow boat, showing the thigh board and leather lining of the clumsy cleat. The five-prong grapnel is unusual, as surviving examples in New Bedford Whaling Museum have only four prongs.*
Photograph by the author

le. The boats are fitted with brass rollers in their bow chocks. Lead linings in bow chocks of some whaleboats have been documented, but this practice was probably in decline after mid-century. Each boat is fitted with a five-prong grapnel (Figure 2-12), nowhere described in the literature, four-prong grapnels of much heavier scantlings being the standard item mentioned. I have found nothing to explain this variation and have drawn a standard four-prong grapnel in the plans as a more likely alternative.

The oars and paddles I do not consider altogether reliable scale replicas of their full-size counterparts, the former being obviously stock oars for small boats as furnished by some chandlery of the day; the looms and handles are machine-turned with handle grips more suited to a full-size hand. The paddles are apparently hand made, but the blades are squared off, not rounded, tapered, or representative of any of the other special shapes we associate with whaleboat paddles. The list of expenses for the building of the *Lagoda* includes "whaleboat gear" as an item apart from the boats themselves, so it is likely that Delano had nothing to do with selection or manufacture of the oars and paddles. The oars in the model plans are scaled from oars in one of the whaleboats at New Bedford Whaling Museum. The lengths of these were compared with oar lengths given in a chandler's bill for bark *Mermaid*, 1855, and were found to be essentially the same: Steering oar—22', pulling oars—seven 18', fourteen 17', fourteen 16', and four 15'.[7] As five boats were to be fitted out (two spare boats were also carried, but not equipped until needed), it is apparent that the three longest pulling oar sizes were the standard ones. The 15' length may have been reserved for use in boats with green hands or oarsmen of small stature; this size is not shown in the plans. The paddles are taken from Plate XXIV in Scammon, which is identical to one in New Bedford Whaling Museum, illustrated in Ashley, and subsequently examined first-hand.[8]

[7]Bill of oars and hardware, bark *Mermaid* to Weston Howland, paid at New Bedford, end of July, 1855, *Mermaid* folio, Andrew Hicks papers, Old Dartmouth Historical Society, New Bedford.

[8]Clifford W. Ashley, *The Yankee Whaler*, 2nd ed. (Boston: Houghton Mifflin Company, 1938). See Plates.

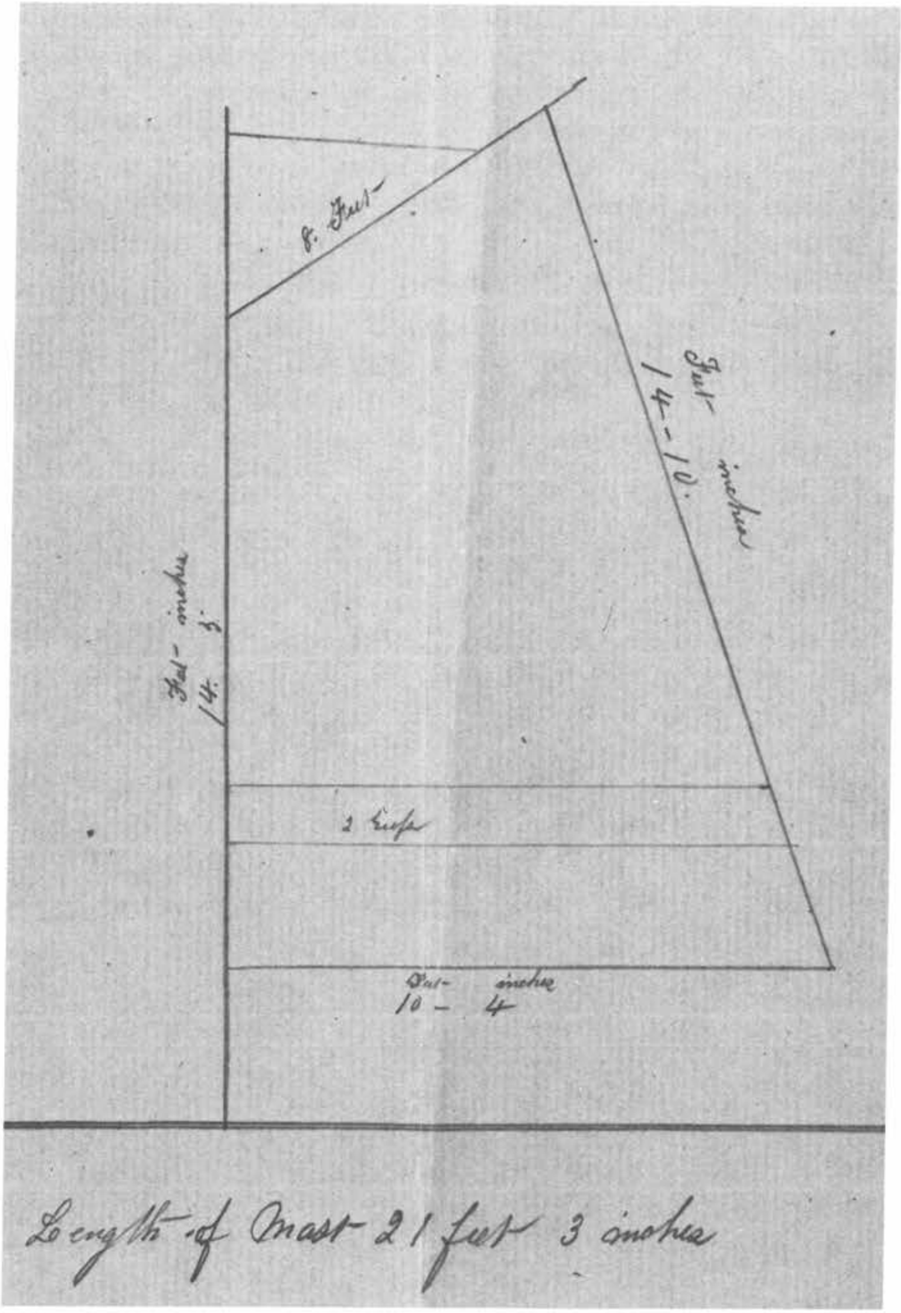


Figure 2-13. Sketch of a whaleboat sail from the logbook of bark Henry Taber, *voyage of 1866. On the next page was the following:*

To make a Boat Sail

Get the Measure of the Boat from Mast-hole to length required on the foot and then have the Head according to Satisfaction.

To Rope a Sail or Table the Same

Table the Larboard Side & then Rope in the Starboard Side. The cloths must be Sewed together first with edges on the Larboard Side.

This plan may not be altogether reliable and probably was not drawn by a sailmaker, but by the captain or mate with some definite ideas about improving his boat's mainsail. The foot of the sail should be peaked instead of horizontal.

Old Dartmouth Historical Society

The boats' rig—a sprit mainsail with no jib—is certainly typical of early whaleboat rigs; its area too, while small by comparison with later ones, agrees with the impression of size we get from contemporary drawings. No sailmaker's plans of whaleboat spritsails have survived to my knowledge, but a plan in the logbook of ship *Henry Taber,* 1866-68 voyage (Figure 2-13), gives a scale drawing for a gaff mainsail of very similar proportions "For 28 foot boat."[9] This is not a sailmaker's draft, but it is carefully constructed with tabling lengths in feet and inches, probably by the captain or mate who desired such a sail for his next boat. The mast length of 21 feet 3 inches—as opposed to 18 feet 6 inches to scale for the Delano boats—is necessarily longer for proper support of the gaff. The dimensions of *Lagoda*'s whale-

[9]Logbook, ship *Henry Taber,* 1866 whaling cruise, Old Dartmouth Historical Society, New Bedford. See photo.

boat sails were probably determined by the sailmakers, Briggs & Beckman of New Bedford, and these in turn decided the lengths and proportions of spars and rigging. While Edgar F. Howland was credited as *Lagoda*'s sparmaker, the whaleboat spars are rather rough specimens and may have been farmed out to an unknown vendor, possibly the maker of the whaleboat paddles. The riggers, Howland & Sampson, may have been responsible for the shrouds (there is no stay).[10]

[10]Benjamin Baker, "Whaling Museum," p. 312.

The rudder was made of one piece with no additional reinforcing at its head. Under such a small sail area and inefficient rig, it was not likely to be strained to the breaking point. It does not differ markedly from later whaleboat rudders, but it hangs more nearly upright due to the shape of the stern post.

Coopered items not classified among wooden boat gear included the line tubs, lantern keg, some types of drogues, water keg, a small bucket, and a piggin. The lantern keg is a watertight container for emergency items such as a boat crew might need if separated from the ship overnight or longer. Contents included a tin lantern and spermaceti candles, matches, tobacco, and biscuits.[11] The tin lantern shown in the plans is scaled from an actual lantern in Whaling Museum collections which was probably typical for most of the 19th century. Other items, such as the water keg, bucket, and piggin are much like full-size gear examined and need no further description.

[11]Ashley, *Yankee Whaler*, pp. 134, 135.

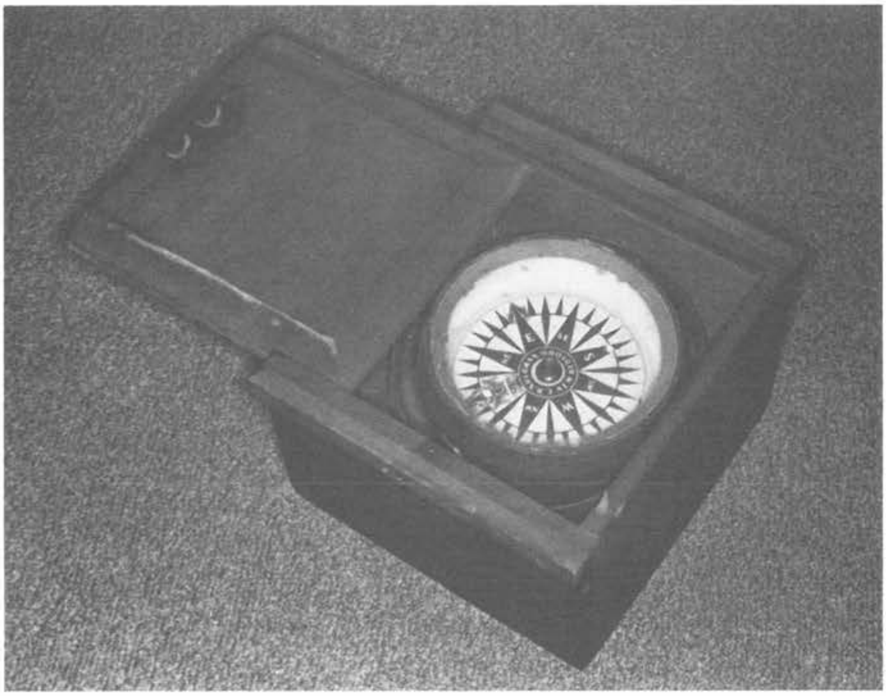


Figure 2-14. A whaleboat compass (full-size) from the collection of the New Bedford Whaling Museum.
Old Dartmouth Historical Society

Each of the model whaleboats was provided with a compass, all of which, for fear of theft or vandalism, have been removed and placed in storage. They are probably "fishermen's compasses" as used in small workboats of the New Bedford area, and not made to order for the model. A very fine whaleboat compass in New Bedford Whaling Museum's collection is the basis for the compass reproduced in the plans (Figure 2-14). It is a "dry card" type, with a turned wooden bowl and paper compass rose backed with cardboard and mounted on a magnet with a brass pivot. The top was glazed and sealed with a fillet of red lead putty. The inside of the compass bowl was painted white; the outside, green. The bowl was hung on two brass gimbals, the inner one acting as a collar to support the bowl; the outer gimbal ring was hung in the compass box with two pins. The box was joined with lapped and nailed joints, fitted with a sliding cover, and hung in glides under either the cuddy or the stroke oar thwart.

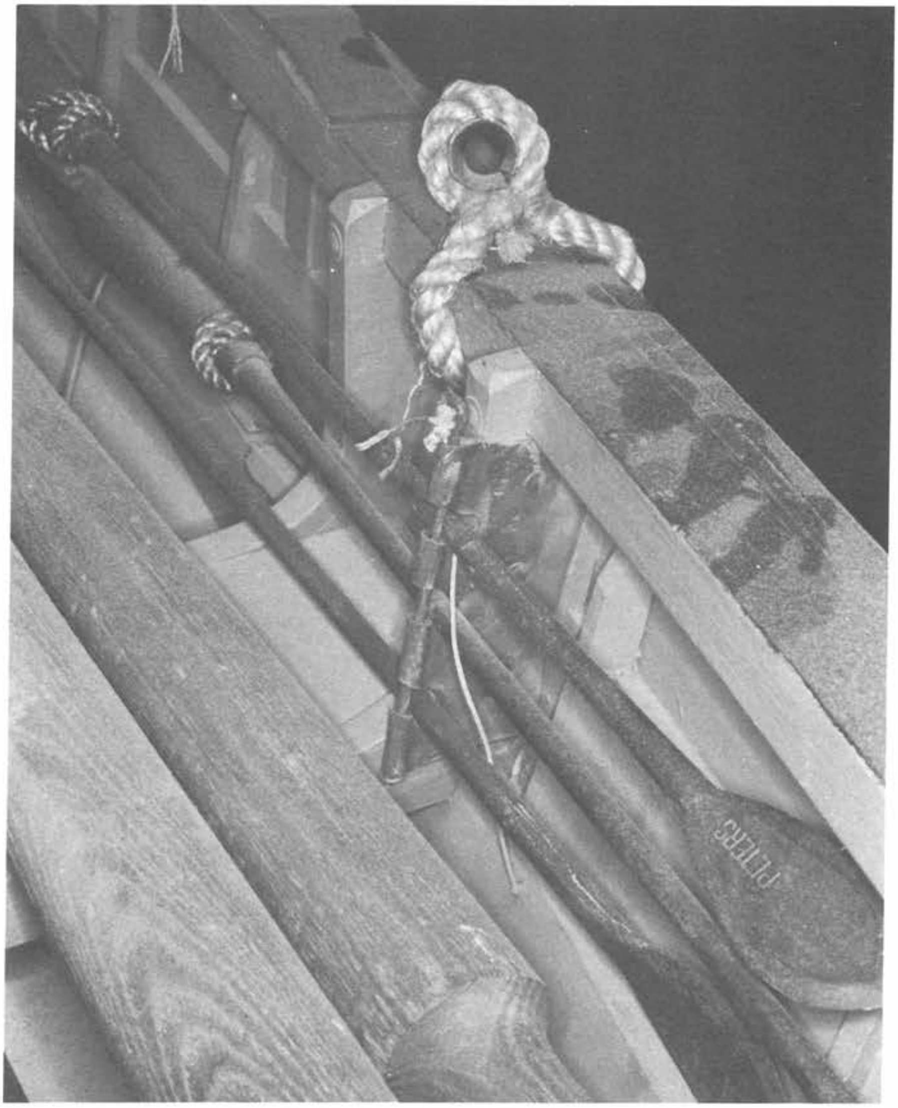


Figure 2-15. The Lagoda *model's waist boat, port side, with its lances stowed in the rack at the mast thwart. The stamp on the lance head is that of Ambrose and Charles Peters, who ran the last blacksmith shop in New Bedford to specialize in whalecraft.*
Photograph by the author

WHALECRAFT—Properly used, the term "whalecraft" refers only to the apparatus used to fasten to a whale, kill it, and process it (cutting-in and trying-out); whaleboat gear not directly involved in these tasks is not so classified. Thus, harpoons, lances, boat spades, whaling and darting guns fall under this definition. Of all materials of the American whale fishery, such equipment was subjected to more tinkering and "invention" than all others combined. Some changes were useful; others were just the experiments of crackpots and romantics. A few were too advanced in their concepts to be incorporated in such an archaic technology. Their history is best described by Thomas G. Lytle; the subject is too vast for more than cursory treatment here.[12]

[12]Thomas G. Lytle, *Harpoons and Other Whalecraft* (New Bedford, Old Dartmouth Historical Society, 1984).

As originally outfitted, *Lagoda*'s whaleboats had all standard items of hand-planted harpoons and lances, plus whale line in two line tubs, a boat spade, and waifs. Pilferage, or the possibilities thereof, have caused the removal of some gear to museum storage, although the quarter boats, which are less accessible to mischief, are still fully equipped. The half-scale ironwork of the harpoons and lances is accurate, save for the shanks, which are a bit heavy. All pieces were properly mounted on their poles with correct ropework and seizings. The harpoon poles were planed smooth instead of being hickory sapling poles with the bark still on them (for a better hand grip). In all cases, it was thought better to scale the drawings of whalecraft directly from actual examples, as there is plenty of mid-19th century craft in the Whaling Museum's collection. Lytle's *Harpoons and Other Whalecraft* was an extremely important guide to the selection and measurement of material that could be regarded as "typical," both in style and dimensions.

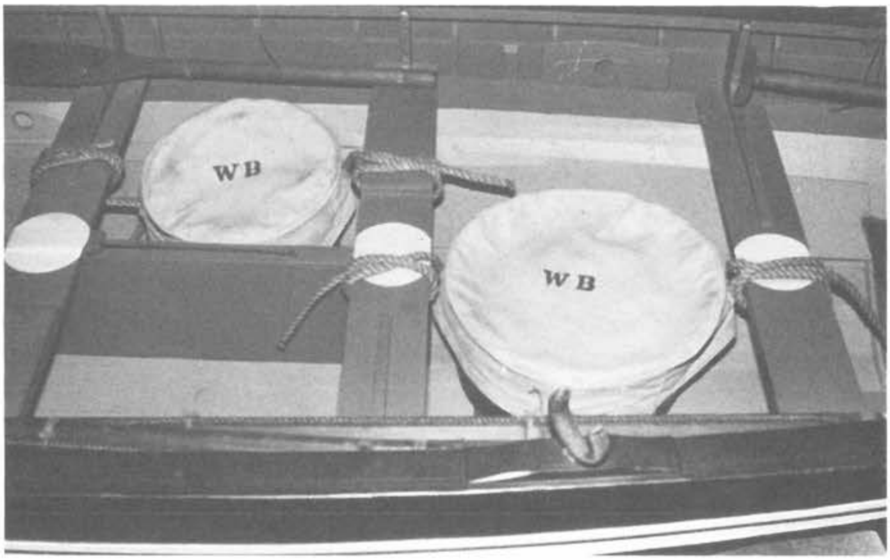


Figure 2-16. The waist boat of the Lagoda *model, showing the line tubs with their canvas covers and stenciled initials. Line tubs were fitted with rope bridles which were hitched to the thwarts to prevent their loss if the boat was overturned.*
Photograph by the author

The line tubs were of dissimilar size, reflecting the impact of the centerboard trunk on inboard arrangement. The after line tub was about as large as space between the tub oar- and stroke oar thwarts would permit; the size of the forward line tub was limited by the space between centerboard and thwart risers in which it would comfortably fit. Both tubs on all boats were fitted with canvas covers which were identified by stencils: SB—starboard boat, LB—larboard (port quarter) boat, WB—waist boat (Figure 2-16), PBB—port bow boat, SBB—starboard bow boat. If *Lagoda* had been a "four boat ship," i.e., no boat on the starboard bow, then the port bow boat would have been identified simply as the "bow boat." What is interesting about this nomenclature is that only the port quarter boat bore the traditional term "larboard," the old name pertaining to the port side; the port bow boat was not referred to as the "larboard bow boat." Well before the mid-19th century, most whalemen fully realized that "larboard" was an archaic term, and many logbooks will show that "port" was routinely used in working ship.

The boat spade has been the subject of much discussion by whaling historians, some accepting the oral tradition that it was originally used by skilled whalemen to sever the fluke tendons of a struggling whale, thus crippling it.[13] The old style thick spades were certainly suited for this task and I feel that there is truth in the stories of their original use. In contrast, the later thin spades were suited only to cutting holes in the carcass for towing. I have drawn both types in the plans as thick spades may still have been in use in the 1850s.

[13]Scammon, *Marine Mammals*, p. 69; Brown, in Goode, *Fisheries and Fishery Industries*, Section V, Vol. II, pp. 264, 265.

The harpoon crotch on the starboard side was of a long-established form (Figure 2-6). In *Lagoda*'s boats, the filler pieces were the same size, but in many others, one piece would sit higher than the other, putting the harpoon poles at two different levels. Because the half-scale harpoon crotches seemed to be too large in relation to the rest of the boats, a full-size example of the asymmetrical type was measured for the plans. Small fittings which these boats have in common with later whaleboats are brass racks with lock pins to hold harpoons and lances secure by their shanks at the forward knees of the mast thwart (Figure 2-15). I have never seen these mentioned in published or archival sources, although these racks are found in most whaleboats now in museum collections. While they are shown in the plans, I am uncertain of the origins of these fittings and wonder if they are not anachronisms for this period. Before their introduction, there were probably short lengths of strong cord in the same locations to answer the same need.

The drogue provided for the bitter end of the whale line was a wooden square of two planks thickness with rope bridles stoppered at holes in each corner (Figure 2-17). A more sophisticated type, shown in the plans, is like a large bucket with very thick staves and heavy hoops. The staves were through-bored at three points for the bridles, which were also secured with stopper knots. Each boat was provided with two waifs, each consisting of a pole with a flag at one end and a sharp point with two barbs at the other. Flag materials were almost anything: blue denim and calico of various patterns are among those found on waifs in the Whaling Museum collection. In earlier years, at the height of competition on the whaling grounds, colors and materials for waifs may have been more carefully selected and used in special patterns to avoid any confusion over ownership of a waifed car-

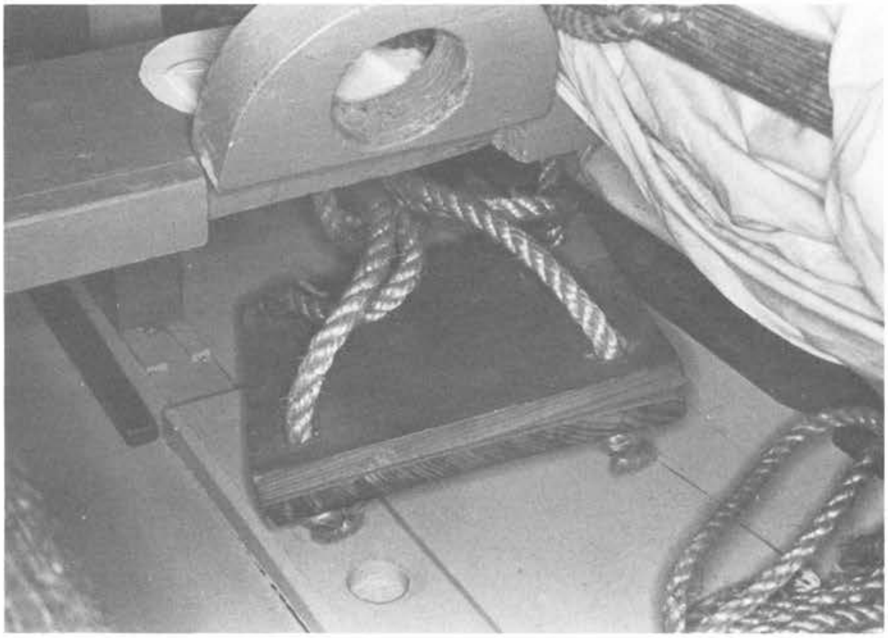


Figure 2-17. A drogue of the simplest type, from the waist boat of the Lagoda *model.*
Photograph by the author

cass. A vessel's house flag might have provided the pattern for her boats' waifs, but this has not been confirmed.

Waifs had another use as signals raised in the boat itself to advise the ship of its movements or a state of distress. This was part of a method of communication between a ship and her boats, using flags and the setting or lowering of sails. A code of signals would be devised by each vessel and kept secret as a means of advising lowered boats on the presence and movements of whales. Secrecy was regarded as essential when rival ships were working in close proximity on the whaling grounds. A number of these signal codes have been preserved in the collections of the New Bedford Whaling Museum, and some graphic interpretations of them have proven to be most interesting.

By 1850, harpoon guns which could fire nonexplosive harpoons and explosive bomb lances were in widespread use; however, darting guns—which could simultaneously plant a harpoon and fire a bomb lance into the whale—were not introduced until 1865.[14] While the earlier shoulder weapon seems appropriate for this whaleboat, the darting gun comes very late in the time frame which concerns us and is therefore omitted. The harpoon gun shown is the C.C. Brand No. 1 gun with a skeleton iron stock and ⅞″ bore, suitable for the projectiles shown with it. *Lagoda*'s boats were not provided with whaling guns.

[14]Lytle, *Harpoons*, p. 60, ff.

Chock pins are truly among the minutiae of whalecraft, but deserve some mention as actual examples are so seldom seen (Figure 2-18). While an example in whalebone is occasionally viewed in exhibits of scrimshaw, all "working" chock pins that I have seen are whittlings of oak or bamboo, about $^{3}/_{16}$″ diameter, and anywhere from five to eight inches in length.[15] The heads are square or rectangular in profile and ½″ square or flat in section, depending on the shape of the splint from which it was

[15]Ashley, *Yankee Whaler*, p. 127.

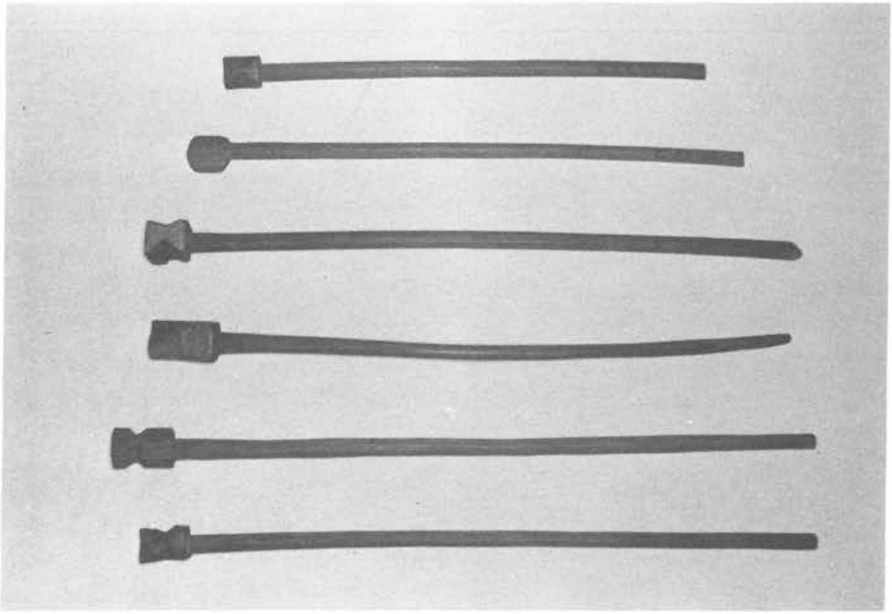


Figure 2-18. Chock pins (full size) made of oak and bamboo. From the collection of the late Charles F. Batchelder, now in New Bedford Whaling Museum. Photograph by the author

carved. Many heads were modified by ornamental notches or beveled corners, or simply finished as very neatly carved cubes. Designed to hold the whaleline in the bow chocks as it payed out, the pin had to be tough enough to withstand the friction from the line, but would break before a kink in the line could damage the chocks. The bottom of the bow box at its forward end was drilled with ten or more holes to hold an ample supply of these pins.

Looking as if it were sprouting from a hole in the starboard side of the thigh board (Figure 1-11) was a bundle of rope yarns carefully teased out of a short length of manila rope which had been secured from the underside by a stopper knot. These were called "lance tails" by Walter Channing in his plan of a Beetle whaleboat; their name hints that the business ends of the lances were tied down to the thigh board until needed during the lancing process.[16] A sharp lance was a dangerous weapon if left to jump about unchecked in a lively boat, so lance tails were undoubtedly an important safety measure. I have found nothing about them in the literature. The large number of loose ends suggests that the lances were freed by a firm pull, breaking the yarn; indeed, many situations left no time for any other action.

[16]Walter E. Channing, plans: "The Beetle Whaleboat of New Bedford," 2 sheets, 1934. Now in the library of the Old Dartmouth Historical Society, New Bedford.

PAINTING OF WHALEBOATS—If we were to go by the photographic record and descriptions of whaleboats from the late 19th century, our ideas of whaleboat colors would be quite monotonous if not monochromatic: white hulls, black gunwale strakes, buff inner works, and gray ceiling—and precious little variation on that theme. However, paintings and drawings of whaleboats from earlier in the century show something very different, with boats painted nearly every color of the spectrum: red, yellow, green, blue, plus black, and a very few white boats. One of the reasons for this variety was economic. Permanent white pigments such as zinc white and titanium oxide were too expensive

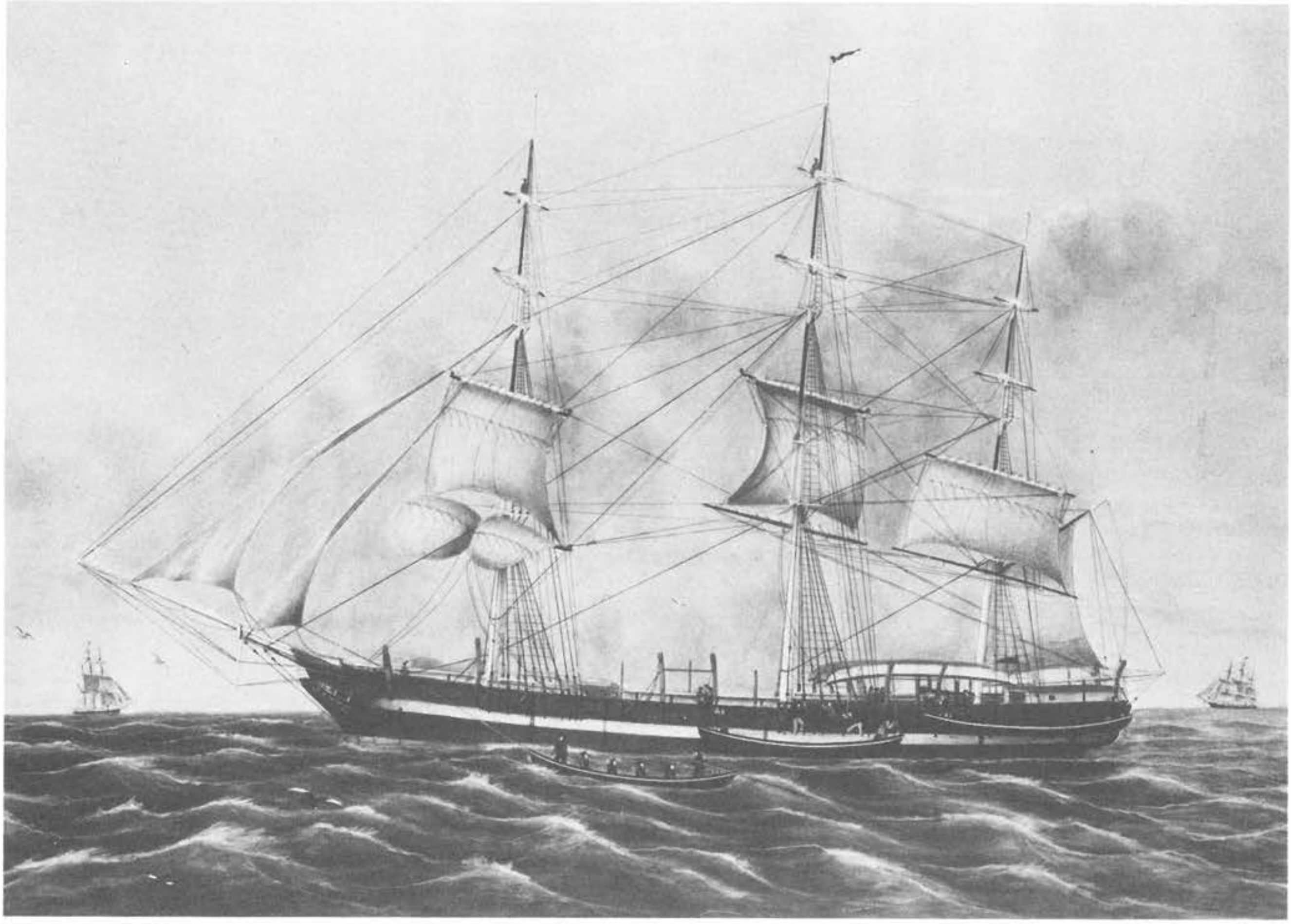


Figure 2-19. Ship Obed Mitchell *in an undated watercolor by Benjamin Russell. The whaleboats are dark green with black gunwale strakes and white sheer strakes. This color scheme is very common in pictures of whaleships dating from the 1840s and 1850s.*
Old Dartmouth Historical Society

for large applications and the only cheap white pigment—white lead—turned grey with prolonged exposure. White lead was a good extender (and binder) of colored pigments, so it was mixed with them to produce the buffs, yellow ochres, and light greens we see on the inner works of both whaleboats and the whaleships themselves. The most common outboard color for whaleboats of the early and mid-19th century was green, and it was generally quite dark (Figure 2-19). A copper-base green pigment called verdigris was mixed with white lead, lamp black, oil, and spirits (all pigments were compounded this way at that time) in whatever proportions were needed. If the color was judged too dull, a little yellow pigment and perhaps some Prussian blue would be added to brighten it.[17]

An important reason beyond economic considerations for varied colors in whaleboats was to give them distinctive patterns which would make them distinguishable from other boats competing for the same whales on a busy ground, a necessity if the lookout was to keep track of his ship's boats and give them correct signals to instruct them as to their movements and where the whales were headed. Each vessel had its own secret system of signals which could convey very detailed information to the whaleboats, so it was vital the the lookouts could spot their own boats when signaling directions.[18] Boat colors, therefore, were

[17]Hezekiah Reynolds, *Directions for House and Ship Painting* (New Haven, Connecticut: Eli Hudson, 1812; reprint ed., Worcester, Mass., American Antiquarian Society, 1978). Contains useful descriptions of methods to mix paint from ground pigments and oil, also mixing directions for popular 19th century colors.

[18]Brown, in Goode, *Fisheries and Fishery Industries,* Section V, Vol. II, pp. 257, 258. The methods described in the footnotes may differ from those of the earlier period in question.

made distinctive by painting the gunwale strakes and sheer strakes in bright contrasting colors. Black was the most common color for the gunwale strakes, but the sheer strakes could be any color. Usually all boats from one ship would be painted alike, but sometimes each boat would have the gunwale strakes or the sheer strakes painted a different color as a variation on the basic color scheme (Figure 2-20). If a ship's boats had green hulls with black gunwale strakes, the sheer strakes could be varied by painting them white, blue, green, and black to produce four variants; a fifth color could be used for a five-boat ship. In the 1830s and 40s it was quite popular to paint the bows a distinctive bright color which could be further varied with a geometric design (Figure 2-20 again). Whaleboats with sails could carry this one step further by having a distinctive geometric shape sewn on the sail or even having one or more cloths dyed a distinctive color (Figure 2-21). These practices seem to have been in decline before the 1850s and were all but gone by 1865.

Scammon's observations of the California whaling fleet in the mid- to late 1850s offer a vivid picture of what may have been the last extensive use of bright colors and vivid markings on both the hulls and sails of whaleboats:

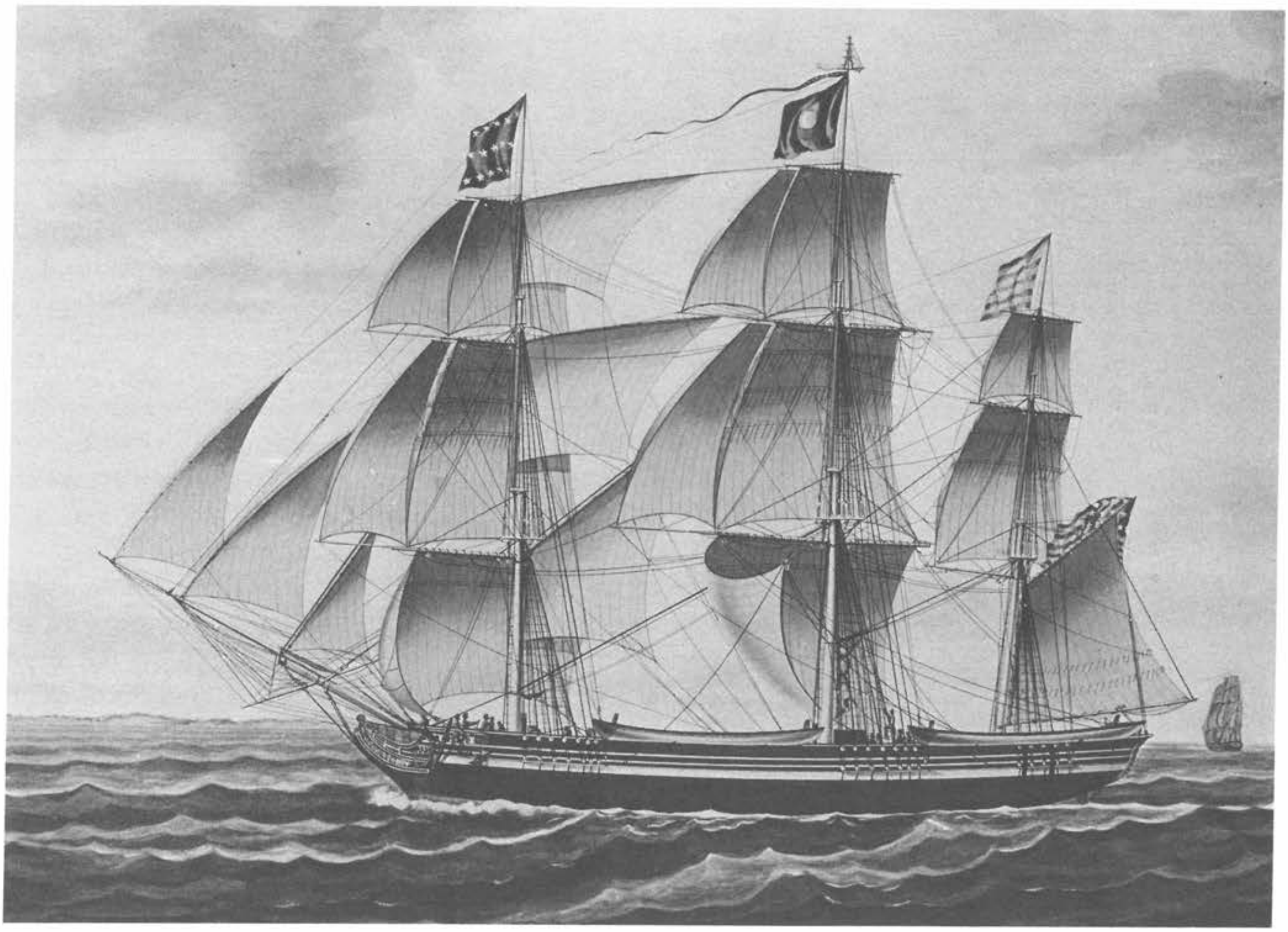


Figure 2-20. Ship George *in a watercolor by Montardier of Havre, ca. 1835. The whaleboats are white with black gunwale strakes and bright slashes of red on their bows with black markings. The sheer strake of the waist boat is blue, which suggests that the sheer strakes of the larboard boat may have been painted another color to give all three boats distinguishing marks.*
Old Dartmouth Historical Society

At such times, a feature was observed in this fishery which is not often witnessed, namely: the peculiar marks or devices pictured upon the sails of the boats belonging to different vessels. Some had a large cross covering the mainsail, while others would have the whole sail of blue, with a white jib or gaff-topsail. On another boat's canvas would be figured one, two, or three balls; or stars, or crescents; or a large letter or number designated the ship to which they belonged. The diversity of colors, and the different tastes displayed in painting the boats, added another pleasing feature: some were pure white, others black, still others of a lead color; or fancifully striped with tri-colors, or with the bow red, blue, or green, while the rest of the craft would be of a contrasting shade. Sometimes a huge eye on either side of the stem, or a large circle, would be the designating mark; all these combined making up an extended group of dashing water-craft, especially pertaining to the California coast and fishery.[19]

[19]Scammon, *Marine Mammals*, pp. 270, 271.

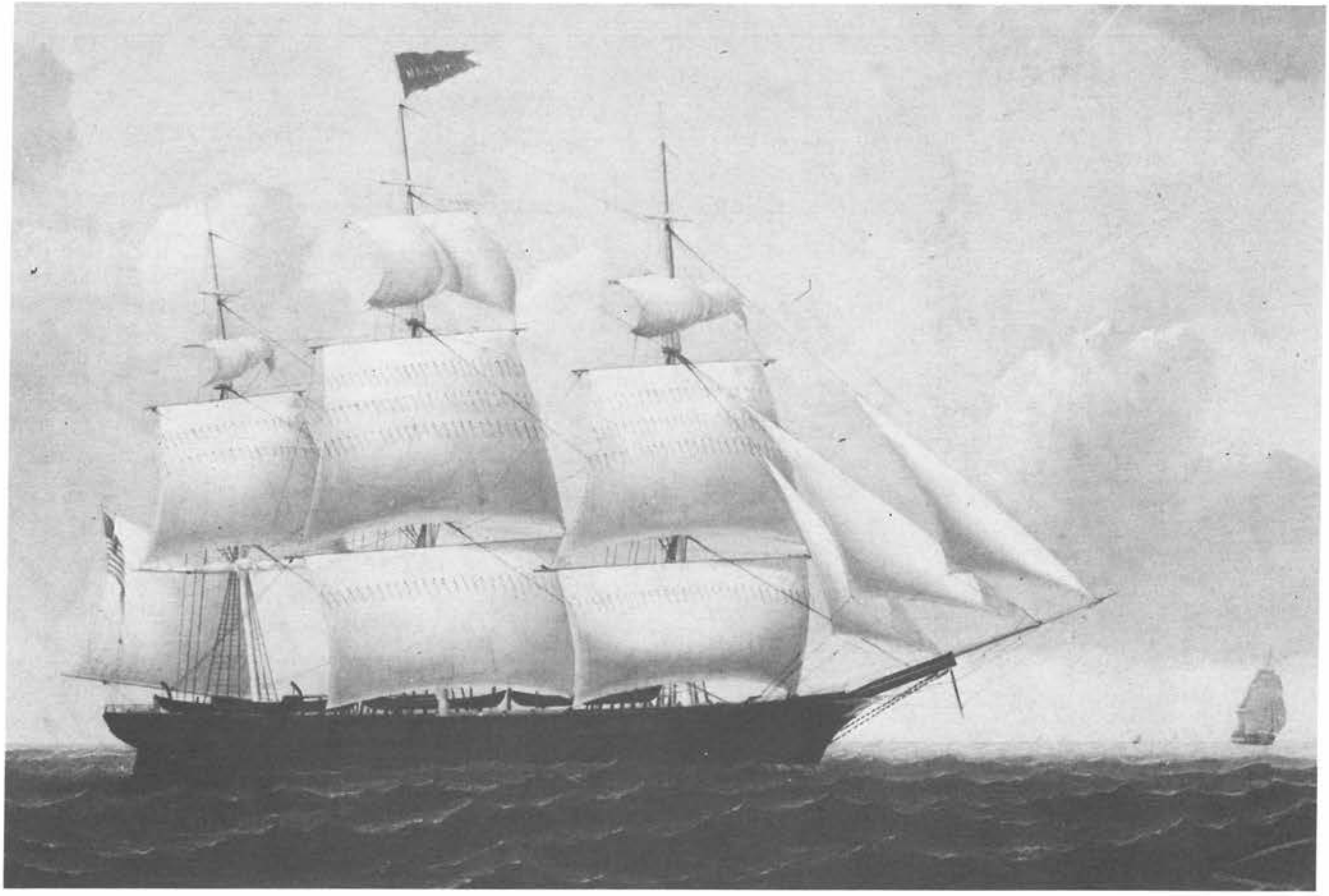
Figure 2-21. A segment from the Russell-Purrington panorama, depicting sperm whaling in the Pacific, ca. 1845. Note the distinguishing color patterns and markings on both the hulls and sails of the boats.
Old Dartmouth Historical Society

These colors and patterns are mirrored in the Russell-Purrington Panorama, painted a decade earlier, and showing whaleboats engaged on other whaling grounds with similar color schemes and sail markings.[20]

[20]Samuel Eliot Morison, *Introduction to "Whaler out of New Bedford"* (New Bedford, Old Dartmouth Historical Society, 1962).

Other popular whaleboat colors from the 1850s and 60s were black hulls from keel to gunwale (Figure 2-22) and dark blue hulls, usually with black gunwale strakes and white sheer strakes. There are paintings depicting red and yellow boats, but these are uncommon and date to earlier periods.

As originally fitted out, the *Lagoda* model's whaleboats were painted white with buff gunwale strakes and inner works, and grey ceiling. At a later date, the gunwales and gunwale strakes of the boats on the davits were painted black. By 1970, it was realized that if the model had been intended to represent the vessel at the height of the whaling industry (1850-1860), these colors were not representative of the period. In an experiment to see how a more typical color scheme might look, one of the boats was painted dark green with black gunwale strakes, light green inner works, and grey ceiling, based on contemporary logbook paintings. The results encouraged the Museum staff to paint the other four ready boats in similar fashion, varying the colors of the sheer strakes as described previously. If these colors have been jarring to the more conventional ideas about whaleboats, they are certainly more in keeping with the time frame



represented by the *Lagoda*'s rigging and outfits.

Figure 2-22. Ship Northern Light *in an oil painting by William Bradford, ca. 1851. The whaleboats are an unmarked black outboard.*
Old Dartmouth Historical Society

Lagoda's spare boats were painted white with buff gunwale strakes and inner works, and grey ceiling. These were the traditional colors given to new boats and were little more than primer coats for the colors they would receive from the ship's crew. Delano delivered all the boats in this state, possibly on the assumption that they would be given their final colors by the model's painters, but this did not happen.[21] While the model was fitted out under the supervision of whalemen who had sailed in the real *Lagoda*, none of these remembered the vessel from her pre-1860 career, and so probably did not consider earlier color schemes for both the ship and the boats.

[21]Benjamin Baker, "Whaling Museum," pp. 332, 333, 335.

Naming of Whaleboats—Although it was a perfectly logical thing for whalemen to do, the custom of naming whaleboats has been poorly documented and seldom mentioned in the historical literature. A few sketches from logbooks and journals showing named whaleboats have been published, those from a voyage in the bark *Orray Taft* being among the best known.[22] Passages from some logbooks in the library of the New Bedford Whaling Museum give some examples of whaleboat names and the shipboard politics of name selection:

[22]*The Bulletin from Johnny Cake Hill*, Autumn, 1965 (New Bedford: Old Dartmouth Historical Society), pp. 13, 14. The original journal is now in the collection of the Kendall Whaling Museum, Sharon, Massachusetts. These views have been reproduced in Margaret S. Creighton, *Dog Watch and Liberty Days* (Salem, Massachusetts, Peabody Museum, 1982), pp. 25, 33.

Journal of James M. Holmes, schooner *Shylock* May 30, 1850:
. . . have today been engaged in carving on boards names of our Boats. I fancied "Jennett," the waist boat was "Jennat" [Janet?], *the starboard boat "Kate," look very well.*

Journal of W.G. Sisson, bark *Java*, December 11, 1855:
Mr. Baker and I couldn't agree whether we should put Susan or Charlots name on the Starboard boat, the one we go in.

Master's journal (C.H. Turner), bark *Napoleon*, January 21, 1859:
. . . got my boat repaired and put her out [on the cranes). *Mr. Barrett is painting her name & I think it will be a lucky one. It is the CLEMENTINE & I think it is a lucky one . . .*[23]

[23]I am grateful to Richard C. Kugler for making these excerpts available.

The *Orray Taft* journals show the names painted on the boats' quarters, just forward of the cuddy in one case, and between the fourth and fifth thwarts in the other. There are no clues from the logbook passages quoted as to where the names were placed. Although the custom must have survived into the era of photography, nothing from the 1860s and 1870s has come to my attention.

CONCLUSIONS—For all the quandaries and tenuous arguments which we have had to consider, the half-scale whaleboats by Joshua Delano are probably the closest thing we have to a reasonable likeness of a whaleboat from the period 1850-1870. Their dimensions and hull form match closely the most reliable verbal descriptions of the boats of this transition period, while the pictorial record offers no evidence to contradict their general appearance. Much the same can be said for their construction, inboard arrangement, and equipment, almost all of which finds precedent in artifacts and written sources. Of the unexpected finds, most offer useful hints to alternative practices which disappeared in later whaleboats. For modelmakers and historians interested in the whaling vessels of this period, this design seems a far closer approximation than those based on whaleboats from later in the 19th century. Unless an actual boat from this period is discovered, we have in these models the most reliable and detailed source for the reconstruction of a mid-19th century whaleboat.

Chapter 3

Building the Model

This book and its plans are directed at the construction of a whaleboat model to scale $^3/_4'' = 1'$, also expressed as 1:16, or $^1/_{16}$th actual size. One can think of these ratios as $^3/_4'' = 12''$, or $^{12}/_{16}'' = 12''$, which is convenient because $^1/_{16}''$ on an ordinary ruler is equal to one inch in actual size. This point was not lost on 19th century shipwrights and boatbuilders because it meant they could use a regular carpenter's rule to read inches in this scale and not have to use special scale rules divided for reading scale inches. The same is true for the modelmaker, who will find that a 12″ rule of reasonable quality, divided into 32nds of an inch, will give very accurate readings to ½″, and even less, for most of the tasks of measuring materials and gauging accuracy. In any event, avoid using the triangular architects' scale rules, whose combinations of dissimilar scales are more confusing than helpful. A steel machinist's rule of 12″ length is preferable to other kinds, and the 6″ version is even better for working with very small parts. Steel machinist's rules with a satin chrome finish (nonglare), like those made by the L.S. Starrett Co., are best of all.

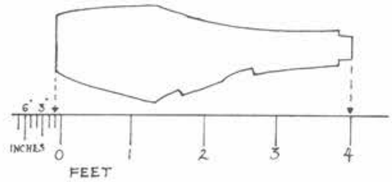


Figure 3-1. When measuring an object from a scale rule, whole feet are indicated on one side of the zero mark; inches to the other. Place one end of the object at the nearest whole foot; the other over the inch scale. The sum of the two readings gives the dimension in feet and inches. Thus, this rudder measures four feet, one inch.
All drawings by the author.

A pair of spring bow dividers, which open and close by turning a thumb wheel, are essential for transferring dimensions from the plans to the construction materials. They are also needed for layout work, such as plotting the spaces of the frames along the top of the keel and insides of the planking. If one of the needle points can be changed for a pencil-point, the dividers can be used for marking lines parallel to an edge, such as marking the joining surfaces of lapped strakes. The needle point is extended ⅛″ or more beyond the lead point; then, holding the side of the needle against the edge to be followed, with the lead point set so it touches the index mark, the dividers are drawn along the edge of the piece as the lead point makes a fine line parallel to it. The usefulness of dividers (compasses) in scribing (drawing) circles and arcs should also not be forgotten but the modelmaker may find the circle templates of transparent plastic, as used by draftsmen, are at times useful. Sometimes it's handy to scribe a circle around a pivot point; at other times, tracing a template is easier.

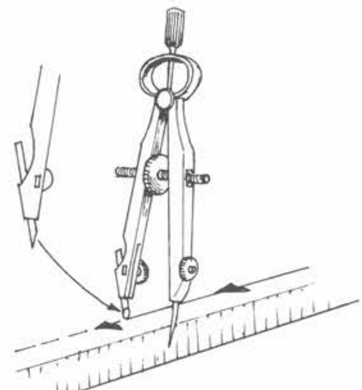


Figure 3-2. Using a spring-bow compass as a marking gauge. The needle point is guided along an object's edge, while the lead point draws a line parallel to it. This method is very useful in marking lapped areas of strakes and other guide marks which follow plank edges.

Being able to read the plans and understand a variety of shapes in different projections is a necessary part of modelmaking. Because the plans are reproduced to the exact size of the finished model, many dimensions and shapes can be worked out by placing the materials for a part over a view of it in the plans. Careful shaping of the part and checking it by repeated comparisons with the drawings can produce very accurate results. The important concept behind the projections of a scale drawing is that you are looking directly down on the boat and its parts, or directly at its side, or at its ends without the benefit, or complications, of perspective. This sometimes makes it difficult to visualize how one part is superimposed on another, but comparing similar dimensions and locations (relative to the center line or a marked reference point) in other views, particularly drawings of sections, should clarify these visual obstacles.

For readers who are about to build this model from the Model Shipways construction set, the first thing to do is to spread out the plans and study the most familiar views in them, such as the construction views in sheet 2. These consist mostly of sections and cutaway drawings—as if the hull had been sliced up or split open in different directions and layers of planking had been stripped away to show the frames and other hidden construction. Thus, you are looking into the boat from the side in the two upper views, and from the top in the two lower views. Because of this 90° difference, corresponding parts will look very different, but some of their dimensions will not be changed, such as the frames, which remain the same width. Keeping track of the dimensions which do *not* change from one view to another will help you identify corresponding parts; keeping track of dimensions that *do* change will give you clues to their shapes and how they are fitted to the boat. The sections at the right-hand side of the drawing are also essential, for they give such necessary information as the thickness of the hull planks, details of the frames, and how pieces like the thwart knees, which are just straight lines in the other views, take shape when you see the boat from one of its ends.

The next step is to take all kit parts out and lay them out neatly on a clean table. Some parts will immediately look like what you see in the drawings, so try to match them to what you see in their different views; it will help you to visualize the forms of other parts whose views you may not understand. Many pieces of stripwood are provided in a variety of widths and thicknesses. Try to find those parts on the plans which will be made from them; also study the sequence of photographs in these instructions which will show how these pieces are formed and fitted to the hull. The inventory of kit parts will aid you in identifying parts by dimensions and matching them to labels on the drawings.

TOOLS. The provision of die-cut hull planking and other small parts from veneer will greatly reduce the need for cutting tools. Thus the focus is on assembly and finishing techniques, and these do not require tools that are complex or expensive. Your greatest needs will be met by a miscellany of paper clips, clothespins, rubber bands, and lill pins, all calculated to hold parts together while the glue sets. Edge-joining of the planks is made much easier by clamping them with "Bulldog" paper clips; enough are included in the kit to join two planks at a common seam at a time. Many modelmakers will want to clamp corresponding seams on both sides in a single operation, as this insures symmetry of construction—and results. Additional clips can be ordered from Model Shipways or bought at a local office supply store. Clothespins are another useful item, and they can be modified by carving their jaws into whatever shapes will fit and hold in a given situation. Rubber bands will be handy for a few joining operations, but should be used with care. Lill pins as hold-downs will be required in a variety of laminating and assembly jobs.

Cutting tools will be used only for minor wood-shaping tasks. Die-cut planking reduces the need for sawing to the point where an Xacto or Zona razor saw can do most of the work; i.e., cutting wood strips to length and trimming the plank ends to fit the stem and stern rabbets. Any carving work is apt to be delicate, such as beveling the planks along the lapped seams or cutting the rabbet into the stem- and stern posts. An Xacto #1 knife handle with #10, #11 and #17 blades is recommended. It may be necessary to smooth the edges of the hull planking during the joining process, and some wood strips for the frames may look better with a lightly planed finish on their inboard surfaces. This can be done with a small woodworker's plane, such as the Stanley #101P or the Xacto modelmaker's plane.

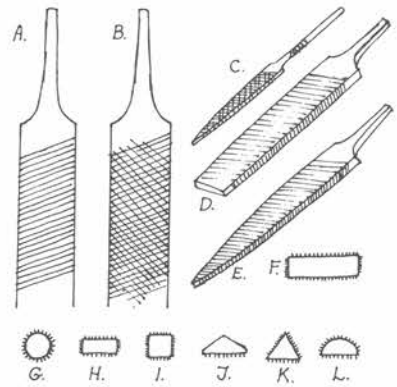


Figure 3-3. Files useful to modelmaking. A, single-cut; B, double-cut; C, Swiss style needle file; D, flat hand file; E, warding file; F, cross-section of D or E. Needle file sections. G, round; H, flat or warding; I, square; J, Barrett; K, three-square; L, half-round.

Files and sandpaper cannot be avoided for small shaping and smoothing tasks, but they must not be overused, that is, used for work where a plane or carving knife would give better results. One or two hand files, 10″ long, medium cut are useful. One can be flat; the other half-round. If the flat file is mill-cut (single-cut), it can be used for smoothing; if the half-round file is double-cut (the teeth form diamond patterns), it will be useful for coarser shaping work. Needle files, about 6″ long, are extremely useful for shaping and finishing small piece work, also opening holes and shaping notches or grooves. They come in sets of six or twelve assorted shapes (a set of six is enough); a medium cut (Swiss 2-cut) is recommended.

Emery boards offer many of the advantages of files and sandpaper combined in an inexpensive, throw-away form. They can be trimmed to any useful shape, while their flexibility permits use where files cannot reach. They will be particularly useful for beveling of plank edges and the rabbets.

Sandpaper is needed only in the finer grades. Aluminum oxide (open coat) paper in grades 150 and 220 will take care of removing saw-cut and file marks; wet-or-dry paper in grits 220 (or 280), 320, and 400 are advised for final smoothing before sealing and painting, and sanding between coats of varnish, primer, or paint. Sandpaper is easily overused, and in work like this it quickly leads to rounded-off edges, accidental breakage by bearing down too heavily, sanding completely through thin planking, or making it so thin it no longer can hold its desired shape or provide necessary structural support. There are two ways to hold a piece of sandpaper in model work: 1. by wrapping or gluing it to a block of wood; 2. by folding a quarter-sheet twice and holding it lightly so the fingertips can sense the contours of the object being sanded. The best sanding blocks are small pieces of hardwood carefully shaped to follow specific contours or to get into sharp corners. The sandpaper is glued to them and some sort of handle (another block of wood) is fitted to the back; in this way, the sanding block is always under control. Small pieces of sandpaper can also be glued to pieces of acetate to give a flexible sanding surface that is very useful in smoothing the hull planking. In using any sandpaper, it cannot be overstressed how easily it can be misused and the results spoiled. Check for smoothness by running your fingertips over the sanded surface or by holding the work piece up slantwise to a light source to show surface defects. If you are rounding off corners which were supposed to be sharp, you are contributing defects of your own making.

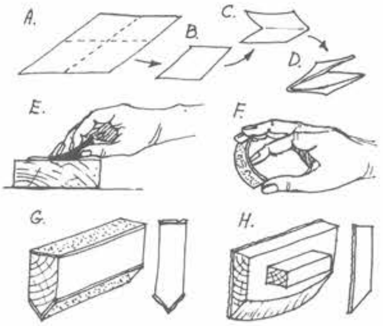


Figure 3-4. Preparation and use of sandpaper. A-D, folding a quarter-sheet of open-coat, garnet, or wet-or-dry sandpaper; E, hand-sanding with a folded sheet of sandpaper; F, holding a folded sheet of sandpaper to sand a concave edge in veneer; G, a small sanding block with a flat surface for general use and a v-edge for sanding in a rabbet; H, a flat sanding block with a curved beveled edge for sanding in narrow corners.

Many holes must be bored for fastenings and a variety of fittings, so a pin vise and an assortment of small drills are needed. The most useful drill sizes will be $^1/_{16}$", #60, 65, 70, 72, and 75. Xacto has assortments of small drills in this range, and you may find other sizes useful as well. Generally speaking, you can bore most holes very easily by hand, but if you are planning to fasten the model extensively, using the miniature copper boat nails, then a miniature electric drill may come in handy. Any such power tool *must* be precise (the drill must not wobble off-center in the chuck) and free of vibration. High speed tools are also undesirable unless they have, or can be fitted with, a rheostat or "speed control" unit; otherwise they behave like gyroscopes and cannot respond to delicate manipulation. Any drill speed over 6000 rpm is excessive. A flexible shaft machine with a small handpiece (which has a small chuck and interchangeable collets) and foot rheostat is best, but expensive. Some larger holes may have to be drilled, such as in the peak cleats and mast hinge block. These can be started as $^1/_{16}$" holes and opened up with a round needle file if larger drills are not available. It is probably wisest to purchase a ⅛" drill for part of this purpose and use files for larger holes. This will reduce the risk of splitting a small piece like the mast hinge block if boring with a larger drill is attempted. An alternative to this is to drill the hole before cutting the piece from stock. The larger the mass of wood you are boring, the less risk there is of splitting and breakage.

If you fasten your model with the copper boat nails to any extent, you will need a pair of needle-nose pliers (with serrated jaws), a small hammer, and wire cutters. The nails will be driven into prebored holes (called pilot holes) by pressing them in gently with the pliers, bit by bit. The copper is soft and will not respond to driving by hammer or by forced pressing. The hammer is used only to tap the head flush with the wood surface and to head over the other end rivet-fashion, or to bend it over like a clinch nail. When the nail is driven, the shank must be cut to the proper length for heading or clinching. For heading (riveting) a flush-cutter is needed, and this can be as simple and inexpensive as a pair of toenail clippers. For clinching, a flush-cut nail shank is not necessary, and any ordinary wire cutters will do, even the cheapest ones. The introduction of miniature boat nails in the Model Shipways kit has been designed to offer the modelmaker the opportunity to simulate full-size boatbuilding practice, and this will be discussed later.

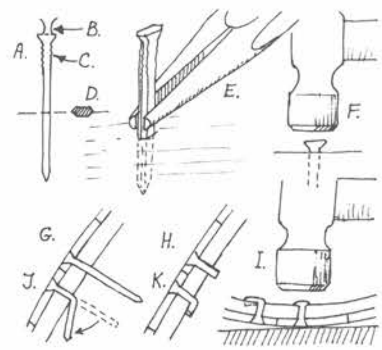


Figure 3-5. Photo-etched copper nails (Model Shipways catalog #446). A, nail attached to the sheet from which it was etched by tab B; C, upper part of shank is scored for holding power; D, cross-section; E, driving a nail by pressing it in with pliers; F, driving in the nail head with a small hammer; G, a nail driven through the outer planking and frame of a hull; H, the same nail trimmed for peening; I, peening a nail with a small hammer and with the head backed on a metal block or anvil; J, a nail bent over for clinching; K, the shank cut and pressed against the frame; I (left), a simulated clinch with the end partially buried in the frame.

Aside from the nails, there are other small metalworking jobs which will require pliers and cutters, but these can usually be done with the types already mentioned. Round-nose pliers are handy for forming wire loops for eyebolts and staples, also for making any kind of bend that requires a radius, but even in these cases, these shapes are easy enough to make using regular pliers to manipulate the wire around another piece of wire or hard metal rod. The point is that few tools and a little ingenuity can go as far as, or farther than, a lot of tools and no sense of their purposes.

Making harpoons and other small implements from the copper sheet and wire is much easier if you can do some simple soft soldering, using either a small torch (propane or butane) or a soldering iron. Use a pure tin solder, such as rosin-core wire available in electronics supply shops, or paste solder in tubes such as "Solderall" (available from jewelers' supply houses). The parts must always be fluxed and heated before applying the solder (unless you are using paste solder); cross-action tweezers (Xacto or equivalent) are advised to avoid burnt fingers. Have a large bowl of water at the table to quench the soldered parts after initial cooling. Avoid breathing solder fumes. If working with a soldering iron, be sure it is tinned before applying solder with it and *always* disconnect it immediately after use or when leaving the bench.

Glue. In the thirty or more years they have been on the market, the water-soluble resin glues like Elmer's have proven to be very stable and predictable in their behavior. Modern variants, such as the yellow carpenters' glues add extra strength and versatility of application and drying times. For the needs of this project, they are ideal, and unless a "working model" is planned for sailing in the local pond, there is little need to resort to the more tenacious and unforgiving waterproof glues. For the modelmaker whose patience or eyesight forbids the use of nails for permanent fastenings, this model can be fitted and joined throughout with only glue and last for many years, perhaps far longer than the builder's lifetime.

Glue application methods can vary from squeezing the stuff out of the plastic bottle onto the joining surfaces to application in thin beads by a glue gun which looks like a hypodermic needle, to application with a sharp-pointed stick or dowel. The best applicator sticks are made of bamboo and can be tapered to sharp points for the most delicate joinerwork, or shaped like tiny forks to hold a larger drop of glue. Thinning the glue is generally not recommended unless it has thickened from evaporation. Watery-thin glue is unreliable for joining wood, but has its uses in keeping rigging knots and seizings from coming apart. Occasionally, it is helpful to dilute it slightly to prevent its drying too soon during the assembly of long joining surfaces, such as plank seams. Spar varnish (or polyurethane varnish) can be used as a glue for plank seams, allowing extra drying time. If the model is then given a varnish finish, the problem of conspicuous "glue stains" will be eliminated.

For bonding metal parts without soldering, the epoxy glues are strong and safer (to your health) than some of the other modern adhesives which contain volatile solvents or give off irritating gases in the curing process. Even the epoxy resins can be quite toxic, so don't get them on your hands and wash up and dispose of excess glue mixtures immediately after use. In using any glue, read the warning labels and follow directions closely, particularly warnings to use them in a well-ventilated area. If you find yourself feeling ill or developing allergy symptoms after prolonged use, stop using the suspected materials and see a physician. Don't let your hobby make you sick (or worse)!

Paint and Brushes. While much more will be said about priming and finishing in the course of construction, it is wise to consider now what kind of finish is desired and how it is to be applied. The basic question is whether the model will be painted or given a natural wood finish. This in turn depends on whether or not the model is to be fastened or simply glued together. In building the pilot model, I had originally planned to paint it inboard and outboard, using a color scheme typical of the 1850s. Once the fastening was underway, and the pattern of copper nails began to look interesting—and instructive—I changed my mind and opted for varnished wood (painting the gunwale strake was another afterthought). I am normally of the opinion that models of working vessels should be painted—and even weathered—to make them look as much like their prototypes as possible. With many necessary delays for purposes of photographing the model in progress, I got well behind in priming the hull, so little more than clear sealer was on the wood when construction was nearly complete, and some parts were quite inaccessible to permit a decent paint job. New Bedford Whaling Museum, being the eventual owner of this model, and seeing the need for a whaleboat whose fastenings were not hidden under paint, then stepped in and made the final decision. Except for the gunwale strake, the model would be varnished. I gave it two coats of Krylon Kamar spray varnish, including the painted strake. I am not unhappy about the decision or the results.

Assuming the model was not fastened with the copper nails and only glue was holding it together, I might well have gone on to paint it without any regrets. Without the nail pattern, this boat is probably more interesting and attractive if completely painted. If this alternative is chosen, the next question is what kind of paint to use. I would have used water-base acrylic paints in tubes, such as Liquitex or Winsor & Newton. I recommend these brands with confidence, having used them to my satisfaction. They are more expensive than other brands, but their pigment content is higher, and it is ground very fine to allow smooth, lump-free application of thin coats. Because these paints are water-base, they will raise wood grain, so I recommend one or two thin coats of flat varnish or other clear wood sealer which can be sanded lightly to give a fine "tooth" for the finish coats. There are other kinds of acrylic paints for modelmaking, such as Floquil Company's Polly-S brand, which I have not tried, but have been told work well. This line carries its own sealer and primer for wood; your hobby dealer can help you.

Other kinds of paint suitable for this project are the xylol-base paints for model railroads, such as Floquil and Flopaque, or the various household enamels available at hardware stores and paint marts. Those who enjoy more traditional finishes can mix colors ground in oil with flat varnish and apply them in much the same way as the now-defunct japan colors once used by sign-painters. This technique demands pigment-rich artists' colors in tubes, and Winsor & Newton brand is the best. These colors blend well with the satin finish or flat polyurethane varnishes available anywhere. Less readily available, but very satisfactory, are the Humbrol model enamels, an English product much-mentioned in the modelmaking literature from that country.

The types and brands of paint a modelmaker likes will depend on preference for premixed colors or basic pigments mixed to suit personal taste. I now find myself in the latter group, which is why I buy colors in tubes, mix them to suit my ideas of historical colors and tints, and keep color chips and records of mixing ratios. It's a more painstaking process, but I always get what I want, and if I did buy premixed colors, I'd mix them again, anyway. Painting a model can get to be like painting a picture in three dimensions, and one can get very involved in the techniques and theories of color mixing, developing "families" of colors based on some shade of gray or olive, as well as making the values (relative lightness or darkness) of colors different or similar so they either stand out from each other or blend together according to the modelmaker's needs. Whole books have been written about this; they can be found in libraries whose collections are strong in art and architecture.

CONSTRUCTION MATERIALS. The Model Shipways construction set provides parts in wood and metal to build the construction mold, the hull, and its fittings and whaling gear. Parts for the molds are die-cut from 1/8" plywood (aircraft birch or basswood, depending on availability); the cap strips are basswood milled to dimensions specified in Sheet 1-A of the plans. These materials should be identified and grouped apart from the other kit parts. Not included is the construction board, which must provide a solid, warp-free base for the molds. The best material for this is 3/4" birch plywood, which can be lumber-core, random-core, or particle-core so long as it's flat and free of surface blemishes which could prevent the mold-horses from being glued evenly to it. A piece of scrap material, no smaller than 6" × 24" can be easily begged or bought from a lumber yard, hardware store, or cabinetmaker's shop. A more expensive alternative is hardwood shelving sold in individual pieces at many hardware stores, usually a "mahogany" of some kind.

Wood for hull construction is provided as die-cut parts from basswood sheets and as strips of basswood and hardwood (holly or maple, depending on availability). The basswood sheets with the die-cuttings for hull planking will have a tendency to split at the ends so the individual planks come apart. These should be taped together at the ends to prevent losing the order of the planks, which could make their identification difficult. When the hull is ready to plank, the die-cut planks must be carefully marked as to their identity, the location of the midship mold, and on which side of the hull they are fastened. There are other die-cut hull parts, such as the rudder, centerboard, and lion's tongue, which should be identified but left in the wood matrix (the wood sheet that surrounds them) until needed. The wood strips for the seam battens, stem- and stern posts, keel, frames, wales, and other hull parts should be picked out, gathered together with the other hull parts, and set aside as a group.

This leaves a miscellany of die-cuttings, wood strips, dowels, and metal parts for the fittings and gear which go on or into the boat following hull construction. Again, they must be identified and grouped, then stored out of harm's way until needed. All die-cut wooden parts for hull and fittings are depicted on Sheet 1-B, which should be hung or posted somewhere so it can be used as an identification chart. The kit parts list should also be consulted.

Scratch-builders will find the patterns on Sheets 1-A and 1-B helpful but not essential to their needs, depending on individual proficiency and ideas about construction procedures. These people will certainly have their own ideas about the woods they will want to use, usually hardwoods like cherry or maple for hull planking, with woods of contrasting color for other parts. A few seasoned veterans will prefer more common woods like pine or whitewood, which take paint well and produce a model that looks like a whaleboat in its working state. It's a matter of personal opinion and taste.

Metal parts include photo-etched nails, the brass straps for the mast hinge, turnings and photo-etchings for rowlocks, a turned bow roller, castings for the compass bowl and whaling gun, and sundries of wire and copper shim. As already indicated, lill pins and "Bulldog" paper clips are provided as construction aids although they do not comprise part of the model itself.

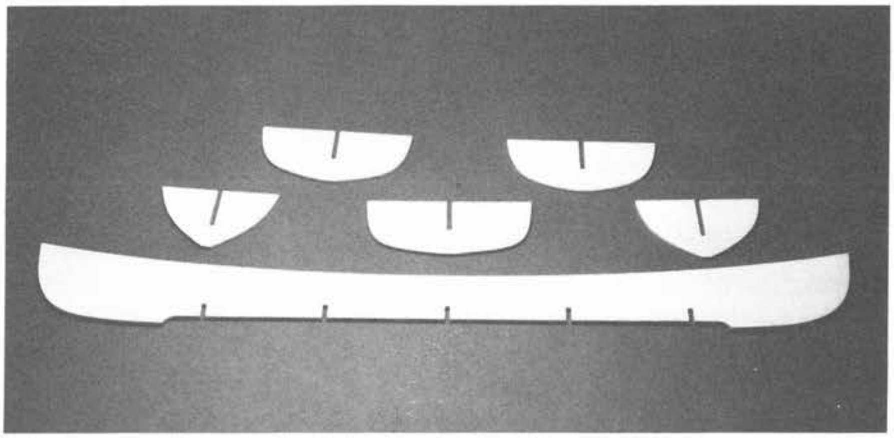


Figure 3-6. The profile mold and section molds removed from the 1/8" birch plywood matrix.
All photographs in this chapter by the author unless otherwise credited.

Setting up the Molds. With Sheet 1-A spread out before you on a table, remove the die-cut mold parts from the 1/8" plywood matrix, and match them to their corresponding pieces on the drawing. With a soft (2H) pencil, or one of the new "razor tip" pens, label each part, i.e., profile mold, molds, 1,2, etc, bow, midship horses, cross-braces, until all pieces are identified. It is important not to mix up molds #1 and #5, or #2 and #4, or the bow and stern horses. Each of these pairs looks very similar, the horses particularly so. Each piece must be carefully matched to its pattern on Sheets 1 and 1-A, *and marked on both sides immediately* to prevent further confusion. The profile mold should also be marked *bow* and *stern*, as its ends are likewise dissimilar, and the mold is therefore not reversible. Next superimpose the profile mold on the upper drawing marked "Top View";

if its edges do not follow the mold outline closely, they should be sanded or filed carefully, keeping the edges square and not rounded at the corners.

The die-cutting process causes the edges of one side to be compressed and rounded, while the edges of the other side are often rough and splintery. The compressed edges can be wiped with a wet rag or sponge to re-expand the wood fibers, then both sides can be carefully sanded, the edges smoothed, and splinters removed. Die-cutting often stresses the wood so it tends to warp or bow, and many thin plywoods have a tendency to warp, even without being die-cut. They can often be straightened by wetting the concave side and gently bending the wood in the opposite direction. Do not use force, and wait for the wood to dry before judging the results. Repeat this process until the warpage is removed and the mold will lie on a flat surface with all of its parts in contact with that surface.

The section molds should also correspond closely to their plan profiles and be free of warpage and rough edges. In addition, molds #1,2,4, and 5 should have their edges beveled as shown in the "Top View" of Sheet 1-A. This softens the edge on which the hull planking lies and also allows the plank to lie precisely on the plane of the mold section. The midship mold requires only careful edge-sanding; no beveling is required.

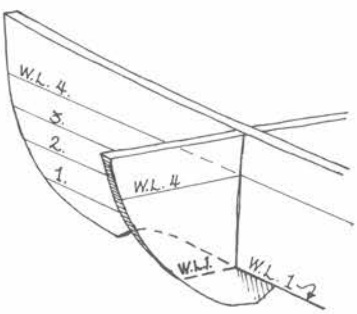


Figure 3-7. The profile mold and a section mold showing waterline layout and the alignment of waterline 4 where the molds intersect.

When the molds are smooth and free of edge splinters, they should be scribed with the reference lines shown in the plan. The most important one is Waterline 4, which aligns the mold parts at their correct levels (Figure 3-7). This should be measured and transferred very accurately with a hard pencil or razor tip pen and straight-edge. There is a straight cutaway at the bottom of the profile mold, and its edge lies exactly at Waterline 1; Waterline 4 measures exactly 1⅛" above it. Make fine pencil marks near sections 1 and 5, then connect them with a straight line. This need be done only on one side of the mold. Waterlines 2 and 3 should also be marked, and this can be done the same way. They are useful only at the bow and stern, so only the ends of the profile mold have to be scribed.

During the planking process, the seam battens will converge at the stem- and stern posts inside the planks. Unless the ends of the profile mold are reduced in thickness, there will not be room for them and the planking will not lie to the stem- and stern posts as it should. To avoid this problem, the ends of the mold should be beveled as shown in the Side View of Sheet 1-A. This bevel tapers gently, so it can be shaped easily with a file. (Carving poses the danger of removing too much wood unless you are *very* careful.) When both sides of the mold ends are beveled, the mold edge should be no more than $\frac{1}{16}$" wide from the top of the bevel down to W.L.2. The bevel tapers out to full mold thickness between W.L.2 and W.L.1. See the Top View in Sheet 1-A. This bevel can also be clearly seen in Figures 3-8, 3-17, and 3-18 and was in fact cut into the mold at a much later point in the building of the pilot model illustrated in this book. If you bevel the molds at this early stage, it will be much easier.

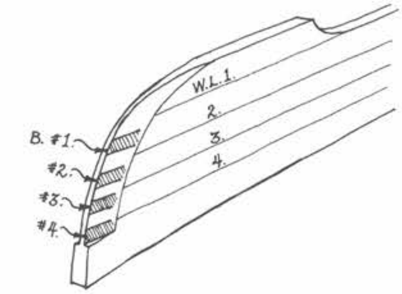


Figure 3-8. An end of the profile mold, showing the bevels for the seam battens. The shaded areas indicate the approximate positions of the battens as they approach the stem or stern.

The section molds are also scribed on one side at W.L.4, and this should be done by carefully superimposing each mold on the section views of the plan and marking the waterline on the edges, both sides. Pick up the mold and carry the edge marks carefully to one side, then connect them with a carefully scribed pencil line. At the center, measure the distance from the waterline to the flat surface which receives the keel; this should be the same as on the plan at that mold.

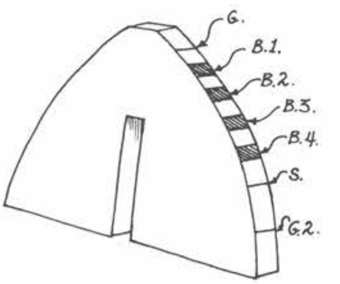


Figure 3-9. A section mold with lines marking the garboard, sheer strake, and gunwale strake laps (G, S, and G2); the shaded areas mark the locations of the seam battens.

To assist the planking process, it is advised that you mark the approximate locations of plank laps and seam battens on the edges of the molds. This can be easily done before the mold parts are assembled. Take each section mold and lay its corresponding drawing on Sheet 1 ("Molds—Planked Over," lower right corner). Once a side is correctly superimposed, mark its edge wherever the seam battens or laps touch. Flip the mold over and mark the other side. When all molds are marked this way, shade the areas of the laps and battens as in Figure 3-9. The same should be done for the profile mold ends on at least one side. These marks can be made the same way by superimposing the mold on the inboard construction profile at the top of Sheet 2. The results should look like Figure 3-8. When the time comes to plank the hull, these marks and shaded areas will be helpful in gauging the accuracy of your work; however, they are only approximate guides and you should allow yourself some leeway in following them.

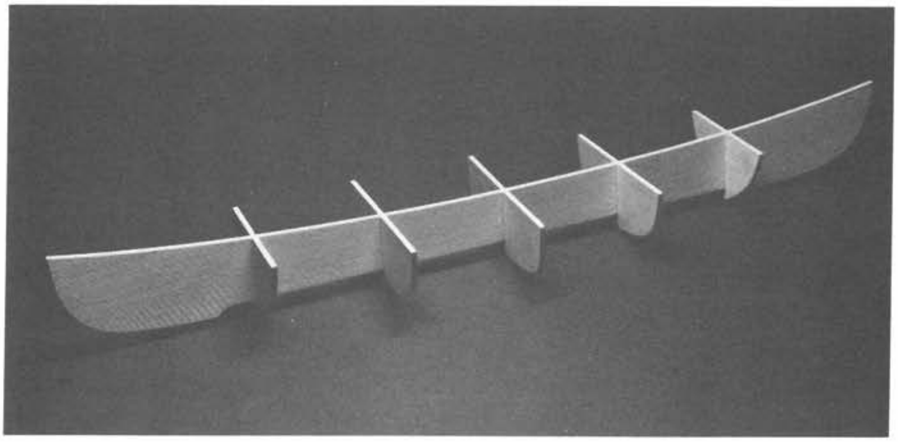


Figure 3-10. The profile and section molds assembled (prior to gluing).

The section molds should now be fitted to the profile mold (Figure 3-10), but not glued. See how the W.L.4 scribe lines match and if there is mismatching of the molds at their top surfaces (where the cap strips are to be fitted). The tops of the section molds, particularly 1,2,4, and 5, must be beveled to follow the sheer of the profile mold, so the top surface of each will align

*In referring to "top" and "bottom," the hull in a *right-side-up* position is always meant. For example, "bottom" will refer to the area surrounding the keel, and "top" will refer to parts adjacent to the sheer, even when the hull is upside-down on the molds. The horses supporting the mold, on the other hand, are described in their present state; i.e., their tops are adjacent to the mold and their bottoms are fixed to the construction board.

with the profile mold top* (note that these bevels slope to the sides *opposite* those which were beveled for the hull planking; see Sheet 1-A). If this happens, your layout work has been accurate; if not, an error of $\pm 1/32''$ is not serious, but anything more than that requires careful rechecking. As a last resort, measure the distances between the "flats" for the keel and W.L.1 (straight surface of profile mold cutaway) and transfer these to the section molds. Fit the section molds to the profile mold so the cutaway edge and these marks are aligned. This will assure that the keel and bottom planking will follow the correct contours.

With alignment work done to your satisfaction, take the mold apart and glue and pin the ⅛" × ½" cap strip to the top of the profile mold. If the molds are birch ply, pilot holes must be drilled before driving the lill pins. A #75 or 76 drill is recommended; bore the hole about ⅔ the depth of the pin shank. Note that the ends of this cap strip are slotted to receive the stem- and stern posts, and you may wish to cut these notches before fitting this piece. Be sure the cap strip sits squarely on the profile mold and does not lean to one side, thus throwing the section molds out of alignment (Figure 3-11). Let this assembly set up thoroughly before fitting the section molds.

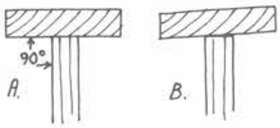


Figure 3-11. The cap strip must fit squarely stop the profile mold (A). If it does not (B), the section molds will not fit properly.

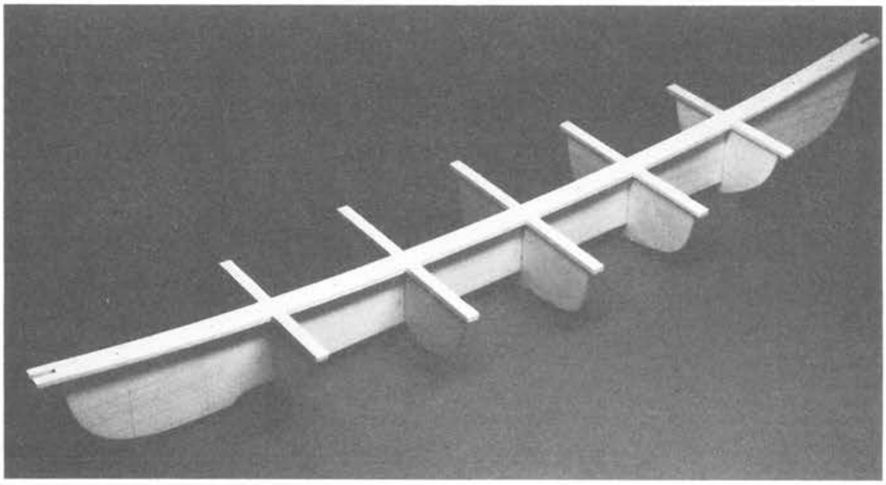


Figure 3-12. The hull mold (profile and section molds) assembled and glued.

When the section molds are fitted again, their top surfaces should drop down onto the cap strip without affecting previous alignment. Check this before gluing them; sometimes all that's necessary is sanding off the corners of the slots which got hung up on the glue fillet between profile mold and cap strip. The section molds are best glued by applying glue to the insides of the slots before sliding them onto the profile mild. Once in place, care should be taken that the molds are square (perpendicular to the section mold); this can be easily gauged by superimposing the mold assembly on the "Top View" of Sheet 1-A and looking directly down on it. A small machinist's square is also handy, but not essential, for this purpose. The ⅛" × ¼" cap strips can be fitted to the tops of the section molds after they have firmly set.

These should be glued and pinned like the profile mold cap, adjusted so their top surfaces follow the sheer, and left to set thoroughly. At this stage, the mold assembly should look like Figure 3-12.

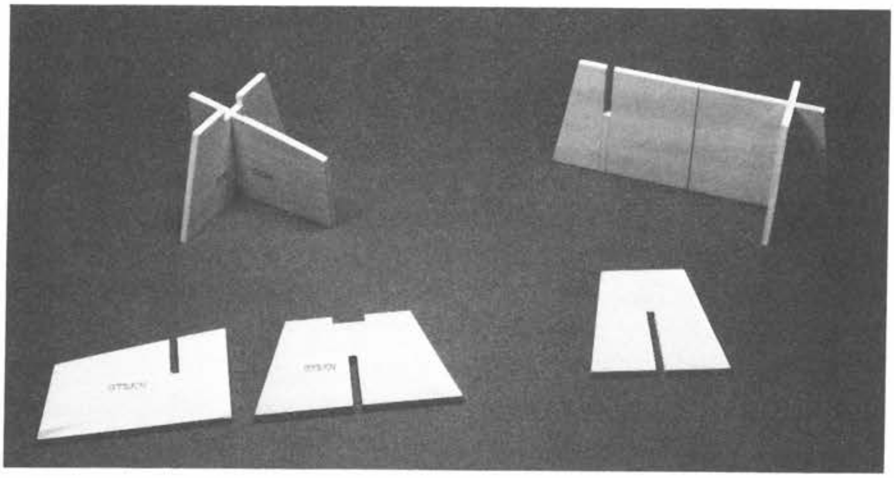


Figure 3-13. The horses for mounting the hull mold.

The three horses which support the molds on the construction board should be cleaned up and assembled (Figure 3-13). Fine joinerwork and finish are not necessary, but the results should not be sloppy either. It is advisable to mark the centerline on the cross-piece of the midship horse to insure accurate positioning. While the glue is drying, the construction board should be sandpapered smooth and marked with the centerline and midship section (Section 3). Glue the midship horse to the board first, aligning it on the centerline and Section 3 as carefully as you can. Let the glue set before you proceed further.

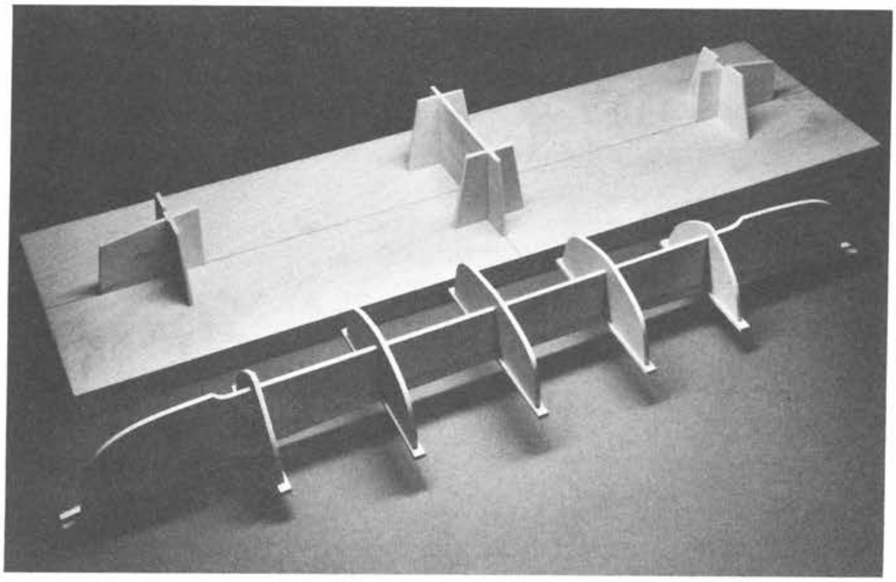


Figure 3-14. The horses fitted to the construction board, ready to receive the hull mold.

The bow and stern horses are positioned on the centerline by taking measurements from the plans, but they should not be glued yet (Figure 3-14). The assembled mold is then placed upside down on the horses, with the midship mold centered over the midship horse. The ends of the profile mold will be aligned over the center line of the construction board. Drill and pin #3 mold to the midship horse so it cannot shift. The bow and stern horses should then be shifted fore or aft until their ends align with the ends of the profile mold. Study this situation carefully in the Side View in Sheet 1-A; if alignment is not precise, the shapes of the stem- and stern posts will be affected, usually for the worse. When molds and horses are aligned, mark the positions of the molds on the construction board, remove the hull mold, and glue the end horses to the board exactly where the marks indicate.

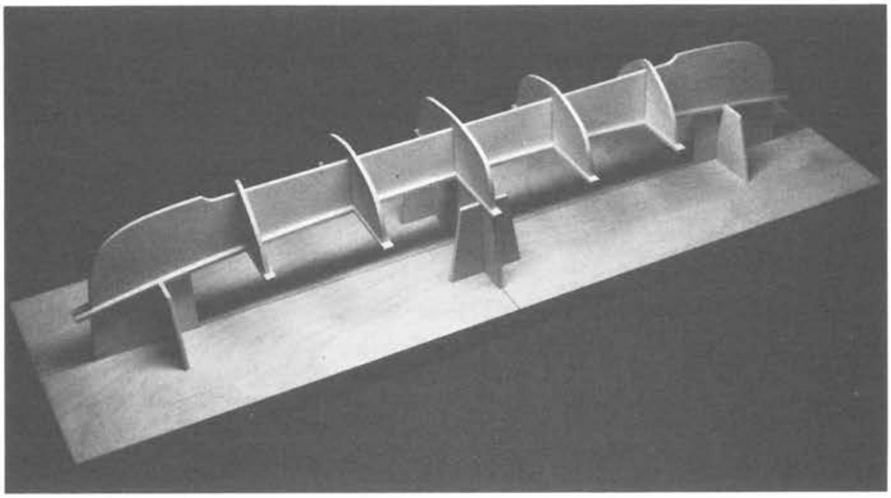


Figure 3-15. The hull mold mounted on the horses and construction board.

When the horses are securely glued, the hull mold can be joined and spot-glued to them (Figure 3-15). It is important not to glue the mold too securely to the horses, as it must be removed together with the hull planking when the hull is ready to frame. First, the tops of the horses should be filed down until the mold makes contact with all three. It is *not* necessary to have perfectly uniform contact with the entire top surfaces of the bow and stern molds, just enough to prevent the mold from "rocking." The midship mold can be spot-glued directly to its horses; see suggested glue application in the Section Views of Sheet 1-A (shaded areas). The ends of the mold should not be glued directly to the bow and stern horses, but spot-glued via glue tabs, which when broken away will free the mold. These can be seen in the End View in Sheet 1-A and in the photographs (Figures 3-17 and 3-18). When spot-glued surfaces have set, the mold will be ready for hull construction.

Stem Post, Stern Post, and Keel. In building a real whaleboat, the stem- and stern posts—collectively termed "stems"—were steamed and bent to shape from single pieces of unseasoned oak. For model construction, it is easier to laminate these pieces, using easily bent hardwood like holly or maple. Once bent to shape and glued, they have great strength and resistance to straightening, two big advantages over one-piece construction. These members can also be laminated in stages which you will find has great benefits in forming the stem and stern rabbets. The construction set provides $\frac{1}{32}$" × $\frac{1}{8}$" hardwood strips which should be soaked in water (hot water or steaming is not necessary) and carefully flexed between the fingers until they start to bend in a curve approaching that of the mold ends. Three layers should then be placed over the mold along the stem or stern profile and clamped in place, using the clips and wedges described in Sheet 1-A and illustrated in Figure 3-17. When this is done at both stem and stern, let the unglued layers dry in place; when removed for gluing, they will retain this shape and be much more docile when reclamped on the molds. Be careful not to allow glue to get between the laminations and the molds or you will have problems removing them later! If this problem seems likely, rub a little beeswax or paraffin on the mold edges before setting the glued layers back on them. Read the construction notes on Sheet 1-A carefully regarding clamping sequence, which should start at the keel scarf and progress upward.

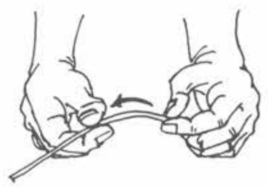
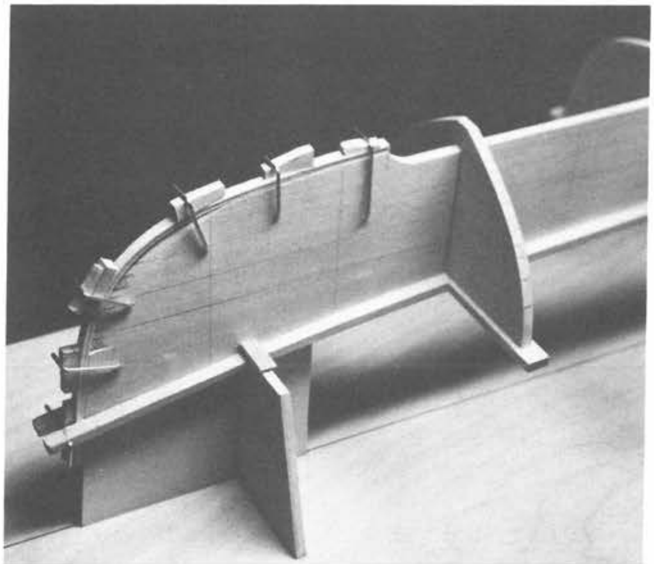


Figure 3-16. The hardwood strips can be partially preformed by soaking them in water and drawing them through your fingers with a twisting motion.



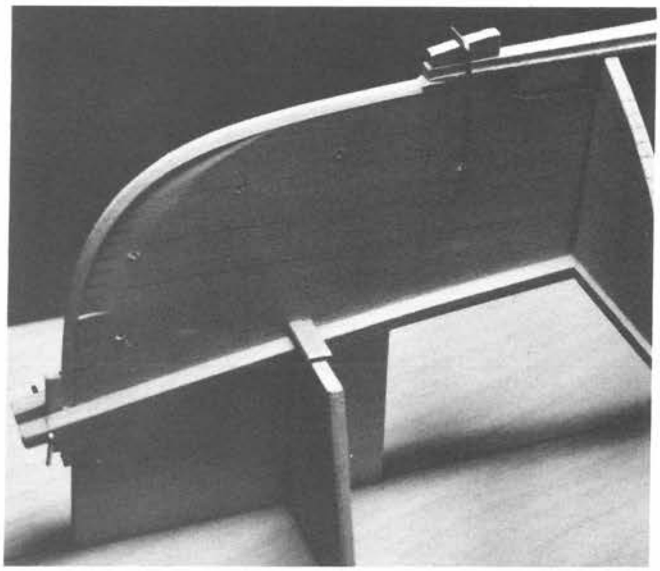


Figure 3-17 (left). The first three layers of the stem post clamped to the profile mold with wire clips and wedges.

Figure 3-18 (right). The clips and wedges are removed from the stem post, which is beveled for the rabbet. The two layers of the keel are assembled and joined to the stem- and stern posts.

The first three laminations should be thoroughly set before removing the clips and wedges, so wait a day or two if you are using white resin or carpenter's glue. Upon removal, file the lower ends to form the scarfing surfaces with the keel, then bevel the sides as shown in the plans and Figures 3-18 and 3-19. This bevel should not lap the scarf joint and it should not extend through the cap-strip of the mold, particularly at the stern post. The angle of the bevel can be checked by springing a strip of wood over the molds and against the stem. When finished, reclamp the laminations in the molds; they need only be wedged down at the keel and at the cap-strip.

The two layers of the keel should now be made from provided basswood strips. The upper layer is $\frac{3}{64}$" thick by $\frac{1}{2}$" wide. Cut it a little longer than shown in the plan, then mark the sections and the width at each section as measured from the views at the

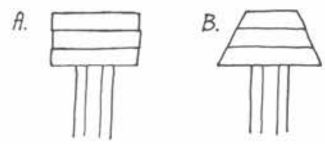


Figure 3-19. A, the first three layers of the stem post after gluing; B, beveled for the rabbet.

bottom of Sheet 1-A. The easiest way to taper the ends to shape is with a small plane, holding the strip firmly at the edge of block of wood (approximately 12-20" long, any width and thickness) with the part to be planed extending beyond the side of the block. This will hold the wood strip steady and prevent its twisting and possible snapping. Be sure the plane blade is sharp and set to make only a shallow cut. The shaped piece can now be fitted to the mold, first trimming the ends to cover the scarf joints in the stem- and stern post laminations, then tapering them to join neatly to the slope of the scarfs. The taper will feather out just short of the far ends of each scarf, as seen in the Side View in the plans. This part of the keel should touch the flats of all the section molds and develop a subtle "rocker" when sighting along its edge from one end. If this does not happen, some of the flats may have to be filed down *slightly,* but care must be taken not to lose the rocker in the keel. Also be sure that the scarf in the stem- and stern post laminations has been filed down to the correct level; if too high, the keel will not sit properly on Molds 1 and 5.

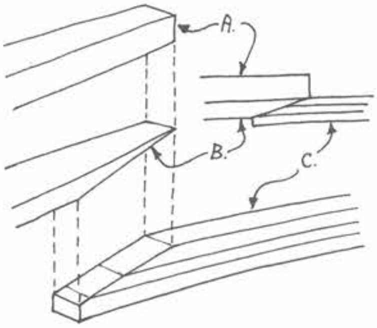
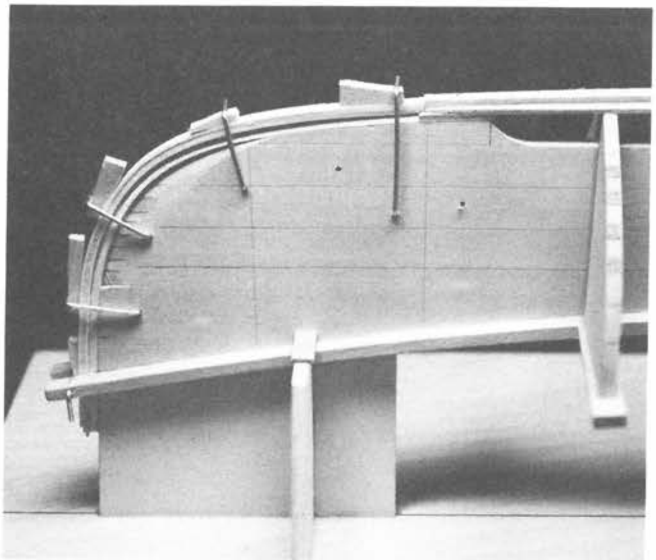


Figure 3-20. The upper layer of the keel (B) is scarfed to the stem post (C). The lower keel layer (A) is then joined to B.

The lower layer of the keel should now be shaped from a basswood strip $^5/_{16}$" wide by $^1/_{16}$" or $^5/_{64}$" thickness, depending on the thickness of the hull planking. True scale thickness of the planking is $^1/_{32}$"; therefore the lower keel layer must be $^1/_{16}$" thick if it is to project below the garboard at scale dimension. In the construction set, plank thickness was increased to $^3/_{64}$" to make these fragile parts easier to handle and less prone to breakage; but this would hide more of the side of the keel than it should, so a thicker lower piece for the keel is necessary. In making this departure, it was felt that the small sacrifice in scale dimension would not be noticeable and would make the amateur modeler's task significantly easier.

The centerboard slot should also be marked and cut out of the lower keel layer, to avoid the inconvenience of slotting the whole keel at a later date when such work becomes much trickier. Leave the upper layer uncut; the keel is stronger this way and you have a ready-made pattern and guide to follow at the time the centerboard case is to be fitted. The lower keel layer can now be fitted and glued to its upper part. Clamp it over the scarf joints with clips and wedges; then pin it to the section molds, driving the pins until their heads press against the keel bottom (drill pilot holes first, please). What you have done so far should look like Figure 3-18.

The final three layers of the stem- and stern posts can now be added. Follow the earlier procedures by prewetting and forming the strips, then clamping them unglued over the first layers. After setting, they can be removed, glued, and reclamped, taking care that the lower ends butt the keel ends tightly at the scarf joint (Figures 3-21 and 3-23). The effect of beveling the first



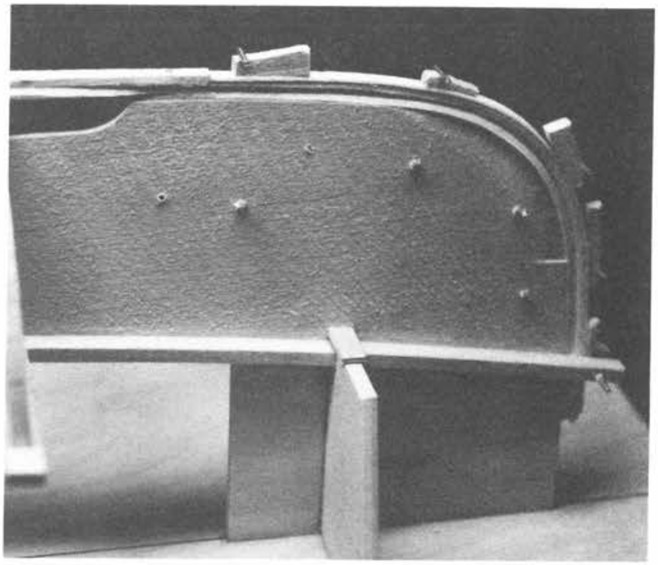


Figure 3-21 (left). The second three layers of the stem post are glued atop the first three and wedged.

Figure 3-22 (right). The other side of the stem post, showing the blending of the rabbet from the keel to the stem.

layers to form the stem and stern rabbets should now be quite apparent. It should also be plain that part of the strategy of the two-layered keel was to create an extension of that rabbet the whole length of the hull; however, the two are not matched at the scarf joint, so they must be blended by careful carving and maybe some filing, if you have a warding file in your needle file collection (a flat file which tapers). Begin by beveling the rabbet along the whole length of the keel. You can see this bevel in the section drawings on Sheet 1, marked "Molds—Planked Over." The bevel angle steepens as it approaches the ends, but you can gauge it quite accurately by laying a $\frac{1}{2}$" wide strip of wood against the rabbet while its other edge touches the mold (Figures 3-24 and 3-26A). An Xacto knife with a narrow chisel blade (#17) works well; cut with the beveled edge against the wood, as this reduces any tendency of the cutting edge to dig too deeply. Make shallow long cuts and repeat until the test piece sits neatly in the rabbet. As you approach the scarf joints, continue the bevel until you reach the bevel in the laminations, then carve gradually down until the keel rabbet joins the stem and stern rabbets in a gradual twisting sweep (Figures 3-22 and 3-24). File away any roughness with the small warding file. If you don't have one, glue 220-grit sandpaper to a small block of wood with sharp, square edges and sand gently along the whole length of the rabbet. Emery boards are also extremely useful for delicate sanding jobs. They can be cut to a variety of shapes to permit sanding in hard-to-get-at places on your model.

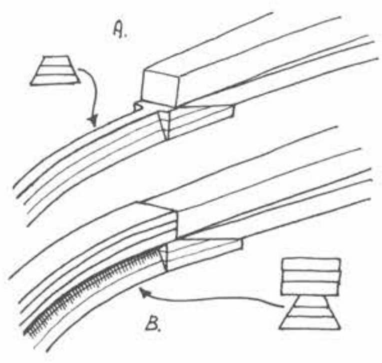


Figure 3-23. A, the first three layers of the stem post, beveled and ready to receive the next three layers (B).

At this point, it is still necessary to anchor the stem- and stern post securely to the mold, but clips and wedges will interfere with the planking process. For this reason, you should drill and pin the posts to the mold, driving the pins to their heads as with the keel. Three pins in each post will suffice: one through the scarf and two equidistant between the scarf and the cap-strip. The wedges and pins in the cap-strip will not be in the way

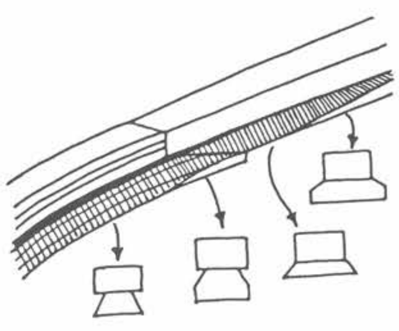


Figure 3-24. The blending of the keel rabbet with the stem rabbet. Note the sections at the different locations.

and should remain in place. Be sure the posts are right on the center line of the mold; otherwise the seam battens will have too much room at the ends on one side and not enough on the other.

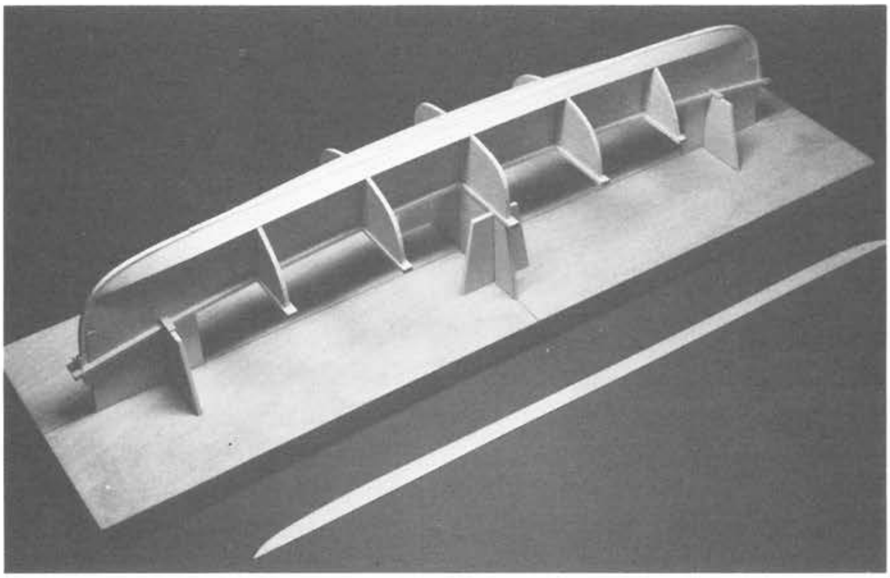


Figure 3-25. The garboards fitted and joined. Their pattern lies alongside the construction board.

Planking the Garboard. Using Sheet 1-B for reference, remove the garboards (port and starboard) from the die-cut basswood sheet, lay them atop their corresponding patterns, being sure the bow and stern ends are *not reversed.* Carefully mark the location of the midship mold, also the letters p (for port) and s (for starboard), and an arrow pointing forward. Use a soft pencil so the marks can be easily erased and sanded away. The die-cut edges may tend to look a little fuzzy and splintered, so sand them carefully with a small sanding block, but do not round the edges. You will probably find after this is done that the plank edges match the plan patterns much better and won't look oversize due to fuzzy edges hiding the pattern lines. Only the outboard side of the garboard will be visible, so if that surface is rough or has planer marks (a minutely rippled surface), sand it lightly and very carefully with 220-grit paper followed by 320-grit. Make short sanding strokes; if too long strokes are made, the plank could buckle and snap, usually in three pieces. Leave the inboard side in its rough-sawn state, which is a better gluing surface for the frames and seams.

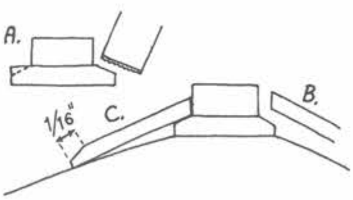
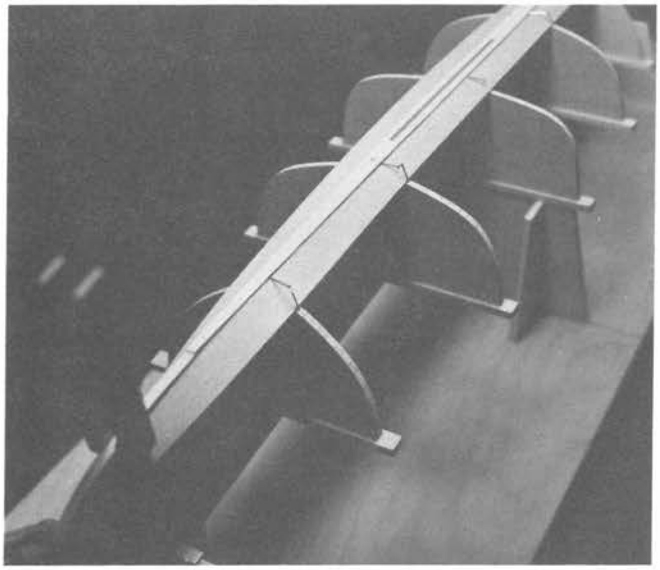


Figure 3-26. A, sanding the bevel into the keel rabbet; B, the lower edge of the garboard beveled to join the keel; C, the garboard fitted to the keel and section mold. Note the bevel to receive the second strake.

In fitting the garboard to the keel, it's not the shape of the pattern on Sheet 1-B that counts, but whatever is needed in additional trimming to get that lower edge to nestle snugly into the rabbet. This should not amount to much, but plane and sand those parts which prevent a close fit at adjoining areas. Begin by fitting the garboard to the keel rabbet amidships with the lower edge of the plank in the rabbet and the upper edge resting on the mold. Be certain that you beveled the rabbet properly so it is not preventing a close joint. Follow the rabbet seam forward and aft, pressing the plank into the seam and onto the molds; the latter is very important as the plank will fit very differently when it is pressed against the molds than when it isn't. Use lill pins to hold one end of the plank to the molds while you work on the other end. Mark those parts of the garboard edge which prevent other parts from fitting to the rabbet, then remove the plank and plane these parts down, *very* carefully. A good rule is to plane off only half the amount you have guessed should be removed, then fit the plank again. Repeat until the rabbet seam along the keel is tight and even. Pin the plank to the keel and molds (Figure 3-27), then proceed to fitting the ends to the stem and stern rabbets.



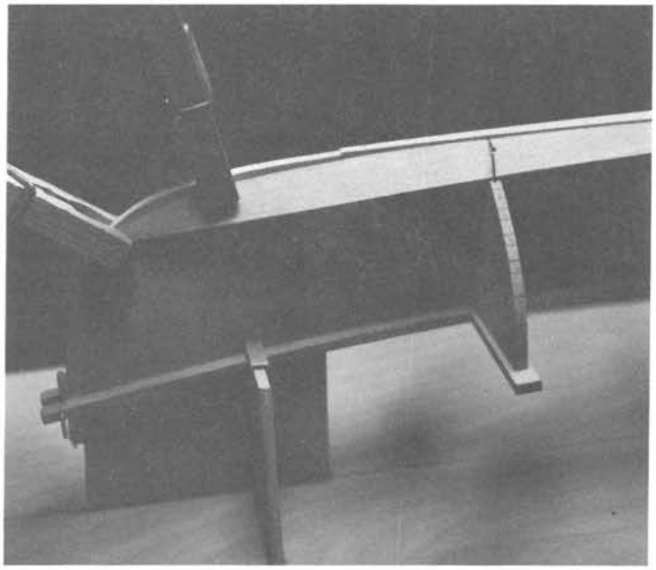


Figure 3-27 (left). The use of lill pins to hold the garboard to the keel and molds.

Figure 3-28 (right). The use of clothespins to clamp the garboard ends to the stem- and stern posts.

At the garboard ends, the plank twists nearly 90° as it follows the rabbet up the stem- and stern posts. This twist can be coaxed by wetting the plank and holding it to the rabbet with clothespins (Figure 3-28). You will probably find that the plank-end is a bit too long and has to be cut down to fit in the rabbet properly. If you find one end far too short and the other far too long, reverse the planks; you have probably fitted them backward. If the planks are not too much over-length, it may be possible to trim them to fit the rabbets without removing them from the molds. This means very careful trimming with an Xacto knife and #11 blade, being careful not to cut away too much of the plank edge or dig into the keel by accident. If this method poses too much hardship, then mark carefully what you want to cut from the ends, remove them from the molds, and trim them with saw, file, and sandpaper. Plank ends can be trimmed very cleanly and precisely with a sharp pair of flush-cutters; however, do not use any other kinds of wire or metal cutters for this purpose. Again, be careful; cautious trimming and repeated fitting is better than risking all your efforts in a single attempt.

Because the upper edge of the garboard is lapped, it must be beveled before the second strake can be joined to it. I attended to this *after* I had glued the garboard in place, believing that the rigidity of this situation might make the cutting of the bevels easier. It certainly was for me, but my colleagues have wisely reminded me that others may find this difficult, perhaps disastrous. If you have the slightest doubts about this, bevel the garboards *before* they are glued to the keel. Read ahead and study Figures 3-26 through 3-31 for details of beveling methods. Beveling the garboards off the model can best be done with files, a small plane, emery boards, or a small sanding block (all four are not necessary). Hold the plank at the edge of a block of wood $^3/_4''$ thick by 18" or more long and shape the bevel slowly, checking frequently for accuracy. Some final shaping and smoothing of the bevel may not be practical until the garboard is permanently in place and the second strake can be positioned along the seam, allowing the joining surfaces to be compared and matched. Remember that it is the *outboard side* of the upper garboard edge that is to be beveled. A convenient reminder (and handy visual aid) is to strike a line $^1/_{16}''$ back from the edge with compasses, as shown in Figure 3-2. These are just tiny slivers of wood which have to be cut or sanded away, but their effect on the assembly process—and the model's appearance—is significant.

Once fitted (and beveled), the planks should be glued; a two-step operation using a glue injecter (similar to a hypodermic needle, but with a curved plastic nozzle) such as the Monoject 412. A thin ribbon of glue is applied along the keel rabbet and the garboard is fitted and pinned as previously; before the glue has set, the plank ends are gently pried up and glue is injected into the rabbets at the stem and stern. The plank ends are then pressed into the rabbet and held in place with pins or clothespins. This general procedure works very well for gluing all the hull planks: first the middle two-thirds of the seam, then the ends.

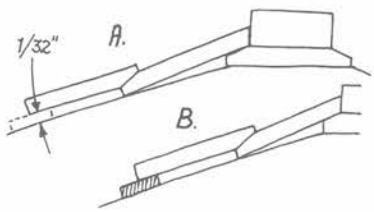


Figure 3-29. Fitting the second strake. A, a space of $^1/_{32}''$ should be maintained between the upper edge and the mold; B, the seam batten (shaded) in place.

THE GARBOARD LAP AND SECOND STRAKE. Fitting the second strake poses two problems: its lower edge is a conventional clinker lap while its upper edge receives the first of the seam battens. The seam is a complicating factor, because we do not want the upper plank edge to lie against the molds, like the upper garboard edge, but to lie $^1/_{32}''$ away from it—just enough to slip the seam batten between strake and mold. This may sound tricky, but remembering to make this allowance is the most difficult part.

First the garboard lap. This can be seen clearly in the construction sections on Sheets 1 and 2. It will be noticed that both of the joining edges are beveled and the outboard edge of the lap, on strake #2, is not very prominent, about $^1/_{64}''$ or so. This lap is uniform in depth until about an inch from the stem- and stern posts, when the bevels of both plank edges are increased gradually in depth—but not width—so the "step" is reduced and the planks are flush at the rabbet. This effect is illustrated with shaded lines on the Hull Planking Profile in Sheet 1. See also the drawings in Figure 3-30.

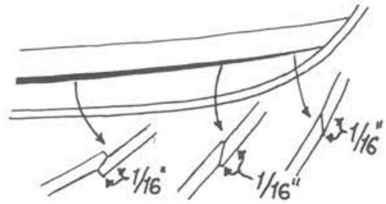


Figure 3-30. The garboard lap tapers as it approaches the stem or stern. Note the changes to the bevels, whose widths are a constant $\frac{1}{16}$".

If you did not bevel the garboards before gluing them in place, it must be done now. I accomplished this with an Xacto knife and #17 blade used like a small chisel, the beveled side of the blade held against the work to provide better control. A #11 blade is also useful to this operation, particularly for cutting the deep end bevels. You must cut *with* the grain, *never against it,* or you may dig out a long splinter that will be difficult to repair. Use compasses to strike a reference line $\frac{1}{16}$" in from the edge. The beveling can also be done with an emery board or a small sanding block, or perhaps with a combination of carving and sanding. If you sand the bevels, *do not round their surfaces,* or the lap joints will have unsightly gaps. The bevel should be about $\frac{1}{16}$" wide and half the thickness of the plank at its edge. This applies to both planks, but you may want to plane a little more out of the lower inside edge of the second strake if you are using the $\frac{3}{64}$" die-cut planking in the construction set. This is due to the extra thickness which is compounded by lapping, which will cause an excessively deep "step." Do the bevel work slowly and check for uniformity of depth along the seam (Figure 3-26).

The second strakes must have their lower edges beveled prior to fitting them to the garboards. These bevels will be on the *inboard sides* of the planks, and will match the bevels of the garboards. The beveling technique is the same as before, although you may wish to remove a little more than half the edge thickness here if you are using the $\frac{3}{64}$" die-cut planking in the construction set. Figure 3-31 illustrates how to compensate for extra plank thickness at a lap seam. Try to keep the visible edge of the lap as close to a uniform $\frac{1}{64}$" as possible; if the inboard edge does not fit well, you have the consolation that it is hidden from sight by the ceiling. Again, it is necessary to increase the angle of the bevel at the ends as you did with the garboard, but be careful to avoid getting a feather edge; this is both unsightly and very difficult to keep from "curling" away from the seam during the gluing.

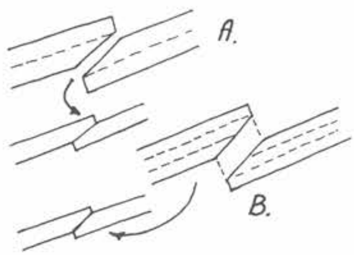


Figure 3-31. A, a half bevel for lapping planks which are $\frac{1}{32}$" thick; B, a two-thirds bevel for lapping planks which are $\frac{3}{64}$" thick.

When both joining edges are beveled, clamp them together —without gluing—using the "Bulldog" clips along the lap (Figure 3-32). Start amidships and work out to the ends until the rabbet seams are reached. Again, the plank ends will probably need trimming to fit in the rabbet, so mark the cut line, remove the plank, and trim it down until it nearly fits. During this process, note whether the upper edge of the second strake is lying off the molds as described earlier. The gap between plank edge and mold can be adjusted by increasing or decreasing the garboard lap at the ends. If you want more of a gap for the seam battens,

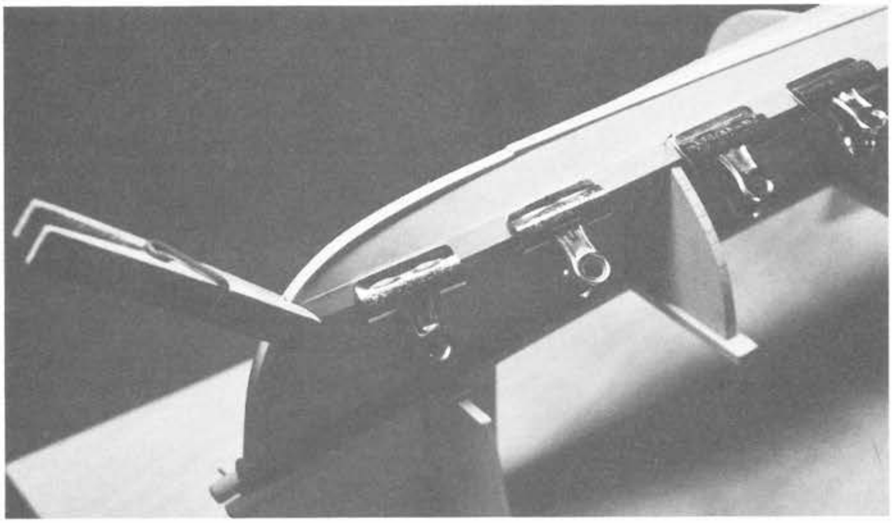


Figure 3-32. Clamping the second strake along the garboard lap.

nudge the ends of the second strake upward, away from the garboard, diminishing the overlap in the process. This will spring the middle of the plank out from the mold. If the gap is too much, draw the second strake closer to the garboard, increasing the lap at the ends (Figure 3-33). This can be a very subtle process, and a small adjustment will produce very noticeable results. It cannot be overdone, or the sweeps of the planks—and ultimately the sweep of the sheer—will be exaggerated. The plank ends can now be trimmed to fit snugly in the rabbets.

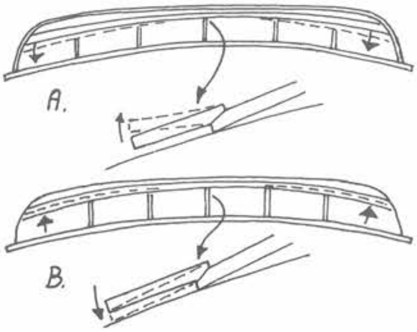


Figure 3-33. The middle part of the second strake will lie differently on the mold, depending on how its ends are sprung. A, if the plank ends are "raised," the upper edge will rise off the mold; B, if the ends are "dropped," the edge will be depressed.

Some modelmakers may find it easier if they pin a piece of batten material to the molds where the upper edge of the strake will land during the fitting process. The pins must be clear of the plank area; otherwise, the plank is nudged up and down as before until it is in contact with the batten without pressing down on it.

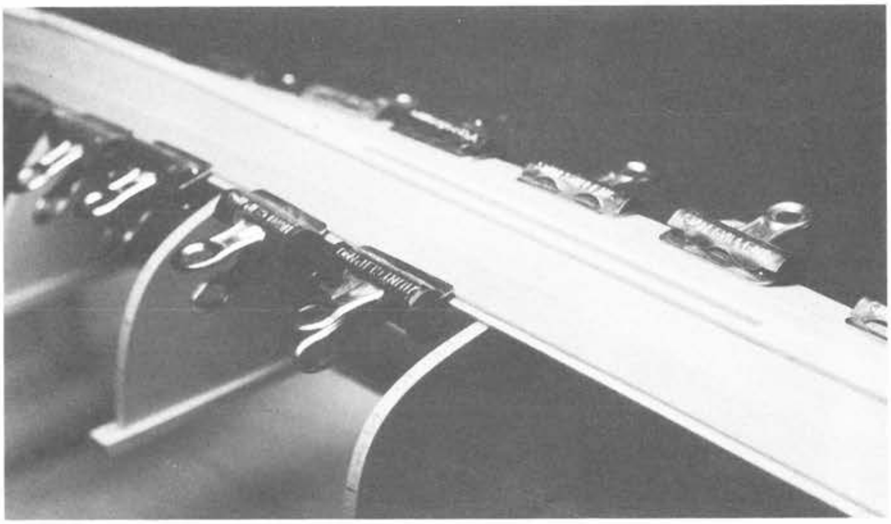


Figure 3-34. The bottom batten seam (#1) is glued and clamped to the second strake. Note the slot for the centerboard, which has been cut in the bottom keel layer only.

The second strakes can now be glued to the garboards. The sequence is the same as the garboard seam: glue the middle part first; clamp it in place; then glue the ends of the seams and clamp them. When the glue is dry and the clips removed, the first seam batten can be fitted by cutting it approximately to length and sliding it under the upper edge of the second strake (Figure 3-34). The batten ends should be trimmed so they butt against the insides of the stem- and stern posts; each batten is half-lapped by the second strake while providing a "rabbet" to receive the bottom edge of the third strake. After fitting, remove the batten and run a bead of glue along the side lapped by the second strake. Starting at the middle, slip the batten under the strake edge, apply one clip, then continue this process out to the ends, applying a clip at every mold. When the batten is in place, go back and adjust the overlap wherever it looks uneven, then apply two clips between each mold (Figures 3-34 and 3-36).

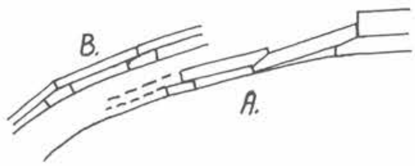


Figure 3-35. A, The batten seams may have to be beveled slightly before joining succeeding planks; otherwise, plank joints will be uneven; B, these bevels are more pronounced at the turn of the bilge.

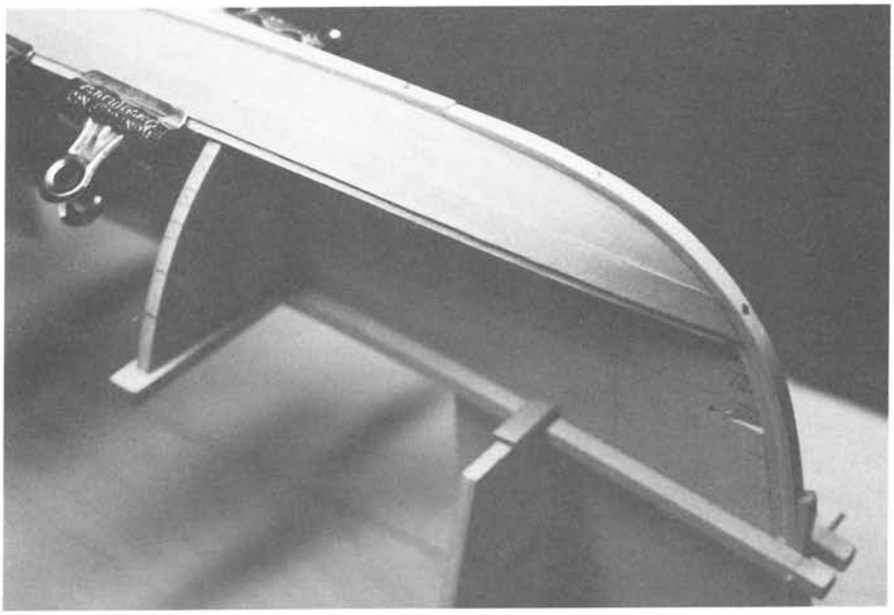
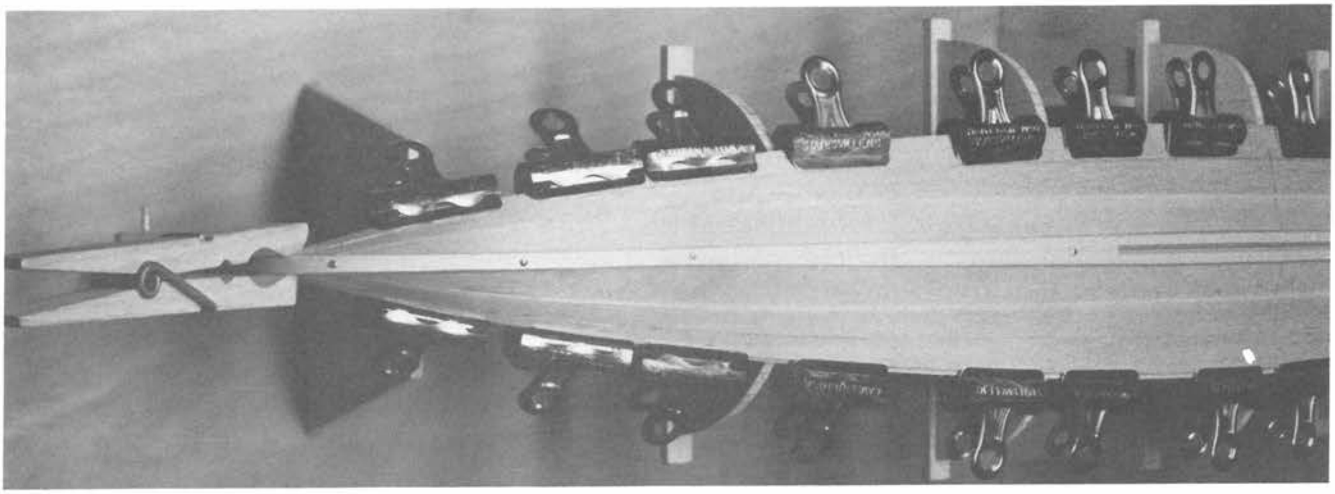


Figure 3-36. The bottom seam batten as it approaches the stem.

Three clips will be needed between the end molds and the hull ends. With a toothpick or wood strip sharpened to a *chisel* point, scrape away any glue which has been squeezed out of the seam onto the step between strake and batten. After setting and removal of clips, the battens should follow the strake edges evenly while making contact with all five molds, but not pressing on them to the extent that the planking tends to straighten between molds.

Figure 3-37. The third strake and one of the second seam battens being glued and clamped.



THE THIRD AND FOURTH STRAKES. These strakes are relatively easy to fit, although the same care must be taken to allow room for the new battens. Note that these strakes are flat in cross section (see sections in Sheet 1), which means that as they follow the rounded contours of the hull, they will form ridges where they join at the seams at slight angles to each other. For this reason, the upper half of each batten may have to be beveled slightly to get the next strake to lie properly on it (Figure 3-35). This calls for a very light touch with the chisel, or better, sanding the bevel down with 220-grit paper glued to just one side of a tiny sanding block (or use emery boards).

ACCURACY. While every effort has been made to make the planking job as easy as possible for the modelmaker, there are bound to be minor fitting problems as well as measuring techniques which are open to individual preferences. If your plank seams and battens are close to your marks on the mold edges—and anything less than $\frac{1}{32}''$ can be regarded as "close"—you can be satisfied that your work is well within tolerances that would be accepted in full-size whaleboats. In fact, if you consider that variations of $\pm 1''$ were probably common in some aspects of whaleboat building, then $\pm\frac{1}{16}''$ would be acceptable error in a $\frac{3}{4}''$ scale model. The biggest problem will be the case of the planks being too wide by a matter of a few hundredths of an inch, which, compounded over three or four planks, will lead to significant error. If this is the case, you can fit one or two planks without correction, then plane the third back until its top seam conforms to the marks.

Do not neglect the reference marks for the seams which you have marked on the ends of the profile molds. In making the dies for the pre-cut planks, the ends were left slightly over-dimensioned, lengthwise *and* widthwise, in the belief that too much wood here is easier to remove than trying to add to a plank that is under-dimensioned. Also, errors compounded at the hull ends can affect the sheer and leave the model with either an excessively "rockered" or "hogged" profile. Both must be avoided.

Lastly, the sweeps of the planks should be fair; i.e., unbroken by wandering or zig-zagging seam lines and reflecting the strong upsweep at the ends. These shapes should be "eye easy" and free of straight segments. Pin Sheet 1 to a wall at eye-level and stand back from it at arm's distance. Holding the construction board and molds upside-down (so the hull is right-side-up) before you, line it up with the Hull Planking Profile and compare the run of the seams in your model with what appears in the plans. A precise comparison is not possible with this method, but you should see a similarity between your model and the run of the planks in the drawing. Holding the construction board with the top of the mold facing you, compare your model's planking with the Bottom View of the hull planking on Sheet 1. If you repeat this from time to time, you will begin to develop an "eye" for hull form and you will be a better judge of your planking work.

Another simple type of visual judgment which is too-often overlooked is "sighting" down a hull; i.e., studying the curves of the seams when viewing the hull from one end. This visually "compresses" long subtle curves and exaggerates any flaws or discontinuities, which immediately become noticeable. You should be particularly watchful of "flats" in planks between the molds with the sweeps compressed into sharper turns as they cross the molds. This means that the planks are under too much tension, usually as a result of forcing the battens into their places under the plank edges.

THE FIFTH AND SIXTH STRAKES. These planks are fitted like strakes #3 and 4, but they must also be "cupped" (formed so they have a curve in cross-section) to give the hull a rounded contour at the chine. The bending process is easy and involves only the middle segments of the planks—between molds #1 and 5—a length of 12". The "mold" is a length of cove molding, $^5/_8$" × ½" radius in cross-section. A plank is simply soaked in water and clamped to the hollow of the molding with clothespins (Figure 3-39), leaving it to dry overnight. Be sure that the outboard side of the plank faces the mold. Once removed, it should be fitted and glued in place as quickly as possible. The tendency to "flatten" is not

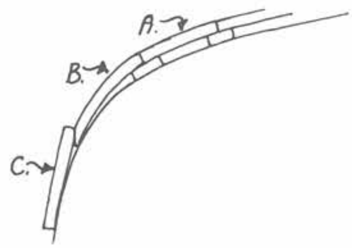


Figure 3-38. The joining of strakes #5 (A), #6 (B), and the sheer strake (C). Note how B touches the mold where it is lapped by C.

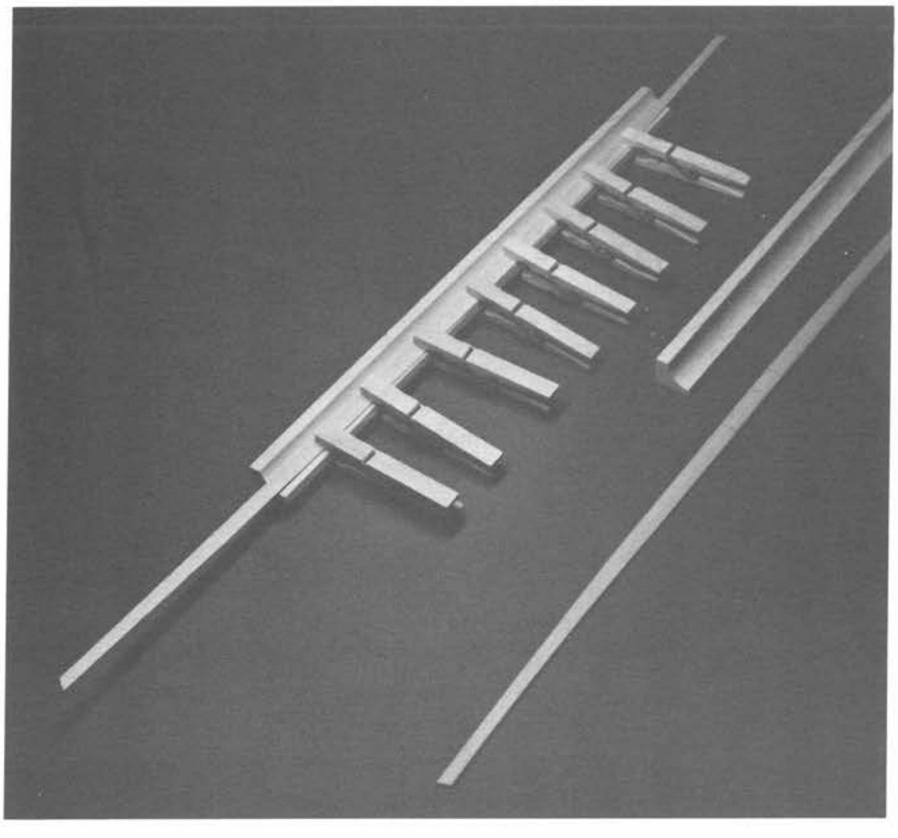


Figure 3-39. Forming strakes #5 and #6 in a mold (a 12" length of cove molding) to give them cupped sections.

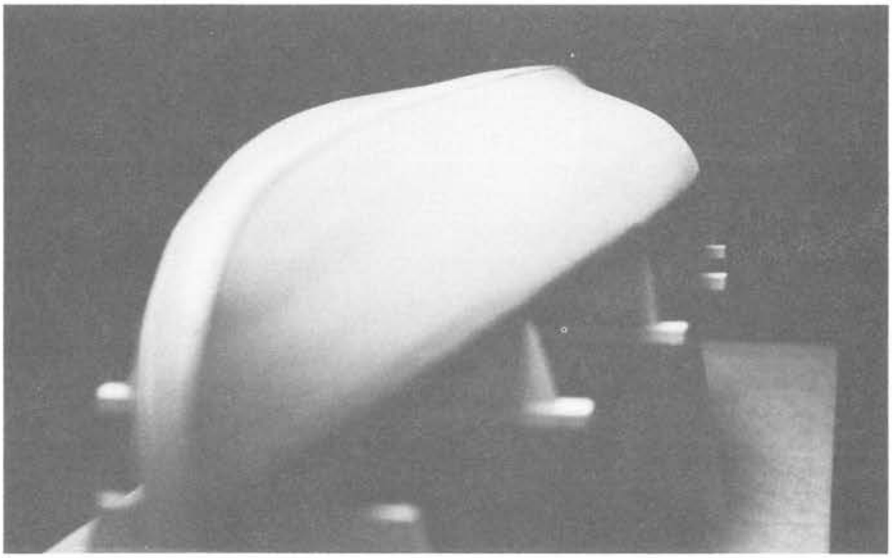


Figure 3-40. Strakes #5 and #6 in place, showing how their cupped areas are important in establishing the hull form amidships (area of sharp focus).

great in basswood, but by gluing the formed plank to the battens and its adjoining planks, this warpage will be reinforced by the rigidity of the glue seams (Figures 3-39 and 3-40).

The upper edge of Strake #6 is lapped by the sheer strake; therefore, it will lie snugly to the mold edges without any gaps for battens. The top outside edge must be beveled for the sheer strake lap before it has been glued to the batten seam below, as you did with the garboard (Figure 3-38).

Before the sheer strake is fitted, this is a good time to sand the hull so any unevenness in the seams can be removed along with glue smears. Care should be taken around the garboard lap so it is not rounded or worn down. It is not necessary to sand out all the flat surfaces of the planks which were not molded like strakes #5 and 6. These "flats" are quite apparent in surviving whaleboats and should be regarded as correct appearance.

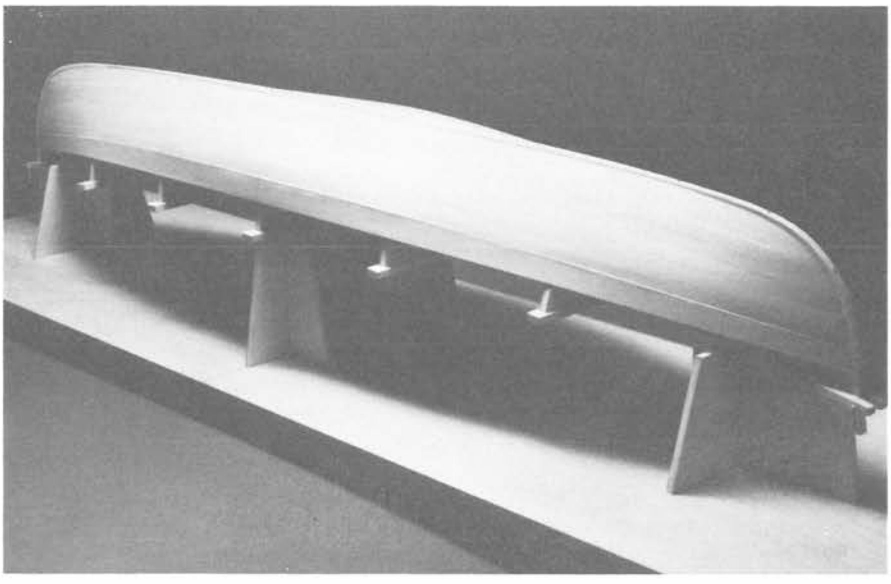


Figure 3-41. The sheer strake fitted and glued.

The Sheer Strake. This plank is flat in cross-section, so does not require special forming. There is a prominent "step" where it laps Strake #6, so the joining edges require slight beveling. Bevel the upper edge (outboard side) for the lap of the gunwale strake, but *don't* bevel the last inch at the bow. The reason for this will be explained shortly. Follow the section drawings in Sheet 1. This is the last strake which can be edge-clamped with the "Bulldog" clips (the gunwale strake is too wide) and care must be taken in fitting, gluing, and clamping, because the mold is now mostly hidden and you will find it difficult to see what is happening inside. Be most careful that the upper edge of this strake lies snugly to the molds; otherwise, the gunwale strake will be forced away from the molds, adding unwanted beam (width) to the hull. Use the same gluing and clamping sequence as for the lower strakes.

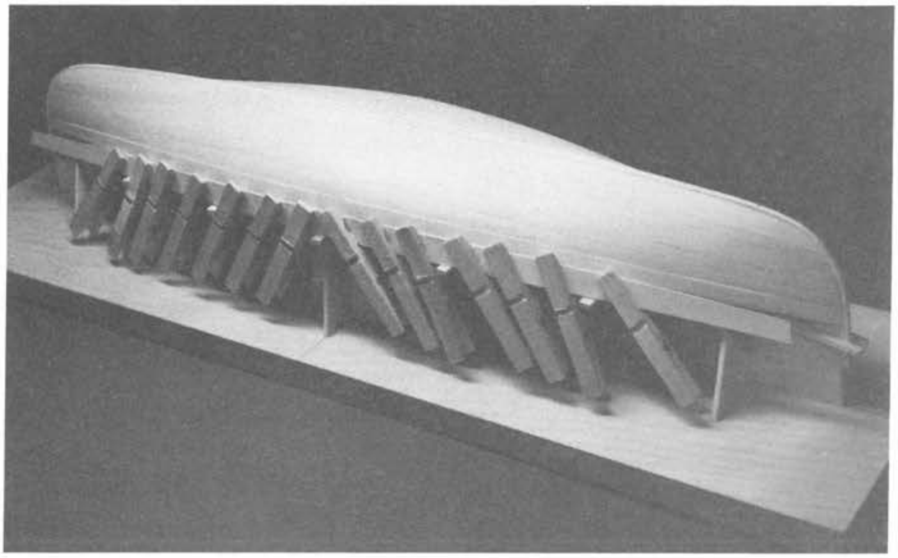
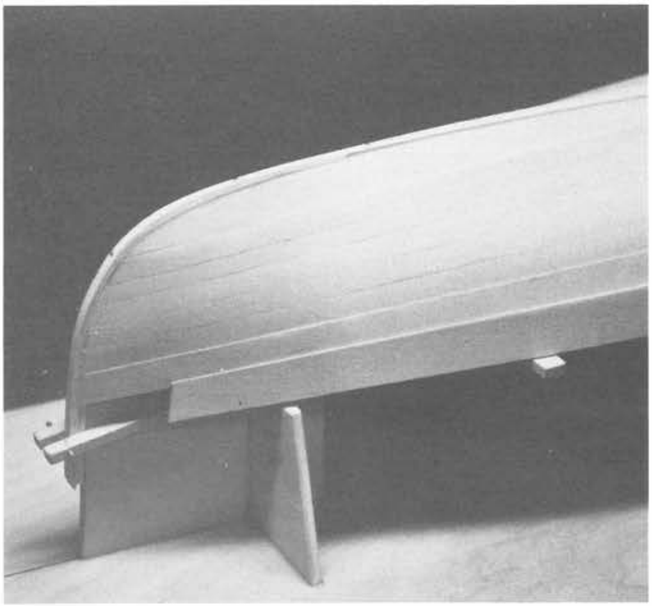


Figure 3-42. Clamping and gluing the gunwale strake. This plank is too deep for the Bulldog clips, so clothespins are used instead. Note that the forward end of this strake does not meet the stem post.

THE GUNWALE STRAKE. The final strake should fall nearly vertically amidships (see sections, Sheet 1), but should not have tumblehome (top leaning inboard). There is again a pronounced "step" where it laps the sheer strake, so joining edges should have only slight bevels. The top edge of this strake should lie snug to the molds and should also touch all parts of the cap strips, including that of the profile mold at the stern. If the top edge can't quite touch, even by as much as $\frac{1}{16}''$, this is not any cause for concern; just be sure that the discrepancy is uniform at every mold. If the gunwale strake is too wide to fit between the lap and the cap strips, this means that plank width errors have been on the plus side and the plank shell has "crept" up without adequate correction. This again is not a serious matter if the strake will fit after $\frac{1}{16}''$ or less of its top edge has been planed off. Don't cut it down any more than necessary and try not to deviate from the sheer established by the cap strips of the molds.

It will be seen that the forward end of the gunwale strake falls short of the stem post by approximately one inch. This space will be filled by two thick pieces of wood called the cheek pieces. Also note that while the top edge of the sheer strake has



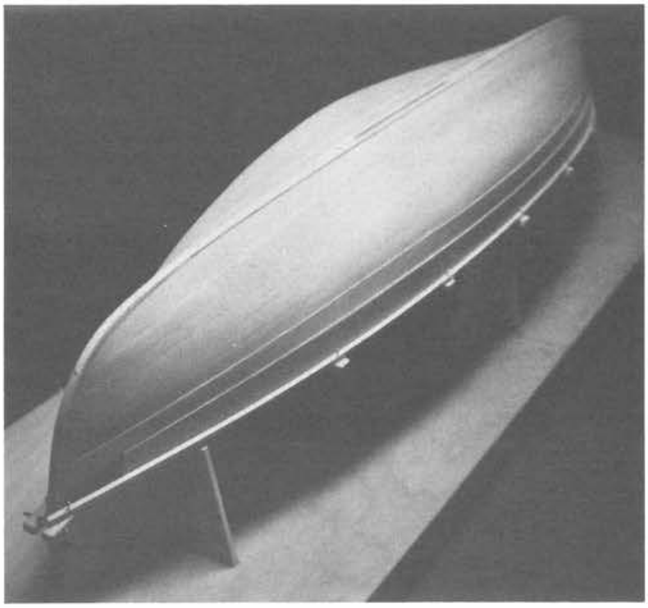


Figure 3-43 (left). The bow with the gunwale strake fitted and glued. The gap between the strake-end and the stem post is for the cheek piece.

Figure 3-44 (right). To keep the planking shell from spreading, a batten is pinned against the top of the gunwale strake at each section mold cap strip.

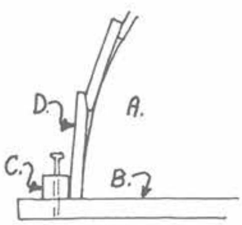


Figure 3-45. Detail of the retaining batten (C), which is pinned to the cap strip (B) of each section mold (A) to keep the planking shell (D) from spreading.

been beveled where it is lapped by the gunwale strake, it is *not* beveled where the cheek piece lands on it, so leave this surface alone. The bevel extends to the forward end of the gunwale strake, where it ends in a sharp notch.

The gunwale strake is lapped, glued, and clamped like the sheer strake, but clothespins must be used as clamps due to the width of this plank (Figure 3-42). When the joint is set and the clamps removed, a ribband of $1/8'' \times 1/8''$ basswood strip should be pinned to the mold cap strips from stem to stern (Figures 3-44 and 3-45). This will protect the fragile top edge of the gunwale strake and prevent the hull from "spreading" while it is being framed.

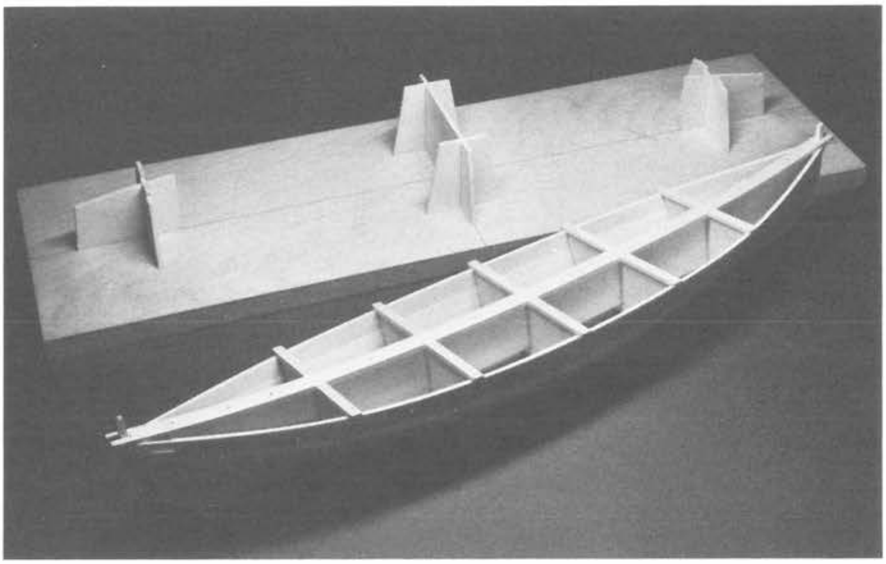


Figure 3-46. The planking shell (still on the mold) removed from the construction board.

Removing the Hull from the Horses. When all planks are successfully edge-joined, the hull and mold—as a unit—should be removed from the horses. The ends should be pried up first, the easiest way being to slip a spatula blade between the cap of the profile mold and the bow or stern horse. Draw it toward the end with a twisting or prying motion and keep forcing it until the glue tabs holding the profile mold to the horse are broken loose. Repeat this at the opposite end until it also breaks loose; by now, the spot-glued joints at the midship horse are weakened if not already broken, so the mold should come free with a little wiggling. If the midship mold still resists, use more forceful persuasion by hitting the cross member of the midship horse with a light hammer or wooden mallet. Or force a spatula blade between the midship horse and the cap strip of the midship mold.

Once freed from the construction base, the hull and mold assembly should look like Figures 3-46 and 3-48. This is an excellent time to sit back and admire the results of some honest, painstaking work. Up to now, the construction process has had to be adapted to the constraints of small scale construction which bear little resemblance to actual boatbuilding methods. As work progresses from this stage, however, construction techniques will bear a much stronger resemblance to full-size practice.

As you admire your handiwork, spread out Sheet 2 and study the views of the inboard construction; then take your model and hold it next to these views so you can see the similarities between what you've done and what is drawn. This is particularly helpful if you have had trouble understanding these views. If you can relate your work to its corresponding parts in the plans, you can better visualize the other parts and how they are supposed to look when your model is in later stages of construction.

Framing the Hull. Our whaleboat model has 24 frames, each made up of two timbers which, except at the centerboard trunk, lap at the centerline—48 timbers in all. In actual construction, each timber was a single piece of oak which was tapered, steamed and pre-bent in a special bending trap, notched to fit the laps and battens, then pressed into place and fastened. While this is possible to do in a model, and I certainly encourage scratch-builders to try it, not everyone will have access to wood suitable for miniature replication of these frames, and there are problems in coaxing these timbers to their proper forms—and keeping them that way. For this reason, laminated timbers are recommended and I shall describe how I made them for the pilot model illustrated in the photographs.

Each timber is laminated from two strips of hardwood (maple or holly), each strip measuring 1/32″ × 1/16″, formed *in situ* on the model to make a timber siding 1/16″ (width) and molding 1/16″ (thickness). The sided dimension (width) is a bit over-scale (1″ in full size, instead of 3/4″), but this will not be noticed by most, and many novices will appreciate the extra $^1/_{64}''$ which will make these small pieces easier to handle. If fastening the hull with the copper nails is contemplated, the wider timbers will be easier to drill and will better resist splitting when the nails are driven and headed over. Holly is ideal wood for bent timbers, because it has a fine, close grain yet bends very freely and resists splitting. It is available infrequently on the veneer market, but almost never in lumber form unless you have access to a large hardwood wholesale outlet or live in an area where holly trees are cultivated as ornamental trees or grow wild. In the latter case, you could cut your own wood and season it, or salvage prunings from ornamental trees, but be warned that holly trees are protected as endangered plant species in some states, so inquire before you start cutting.

A very good substitute for holly timbers is maple, which is somewhat coarser in grain, but bends well after soaking and holds glue very well. Maple will usually be supplied for frames in the construction set.

Another departure from full-size practice has been the omission of notching the frames for the laps and seam battens. In building the pilot model, it did not prove necessary as the planks showed no tendency to collapse inward between the seams. There was also ample gluing surface at the laps and battens, so I see no reason to worry over deformed planks or weakened framing in this case, even if you choose to omit the nails and rely on all-glued hull construction.

Framing procedure begins by marking the keel where pairs of timbers overlap. These can be measured from the framing views in Sheet 2, using the molds as reference points. To facilitate matters, mark in pencil the thicknesses of the molds on these views, and measure the locations of the timber laps from the side of the nearest mold. A pair of dividers with a pencil lead on one point is the best tool for this job. Remove the pivot needle and its threaded clamp from the other arm (if removable) so these parts do not scar your handiwork with their sharp points and edges. With the outside edge of the pivot arm positioned at the mold you have marked in the plan, adjust the lead point until it strikes a frame lap. Without disturbing this setting, transfer the dividers to the model, placing the pivot arm so it touches the side of the corresponding mold, and strike a mark on the keel. If you want, follow up the inside of the hull, marking the laps and battens, and being careful that the pivot arm follows the side of the mold without slipping or the dividers losing their orientation to the centerline (Figure 3-47). Repeat this until all the frame positions between the molds have been marked. You may not be able to mark the frames which are very close to the molds, but these can be marked after the molds are removed.

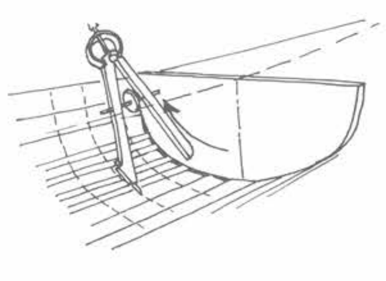
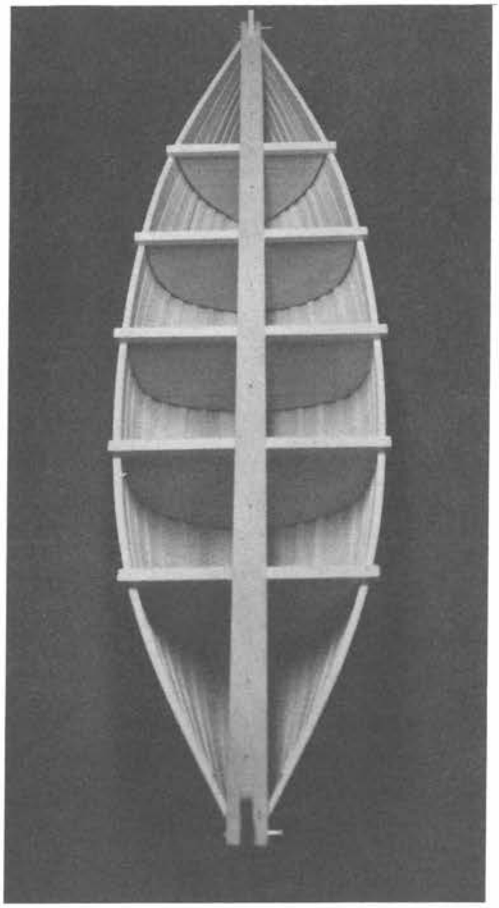
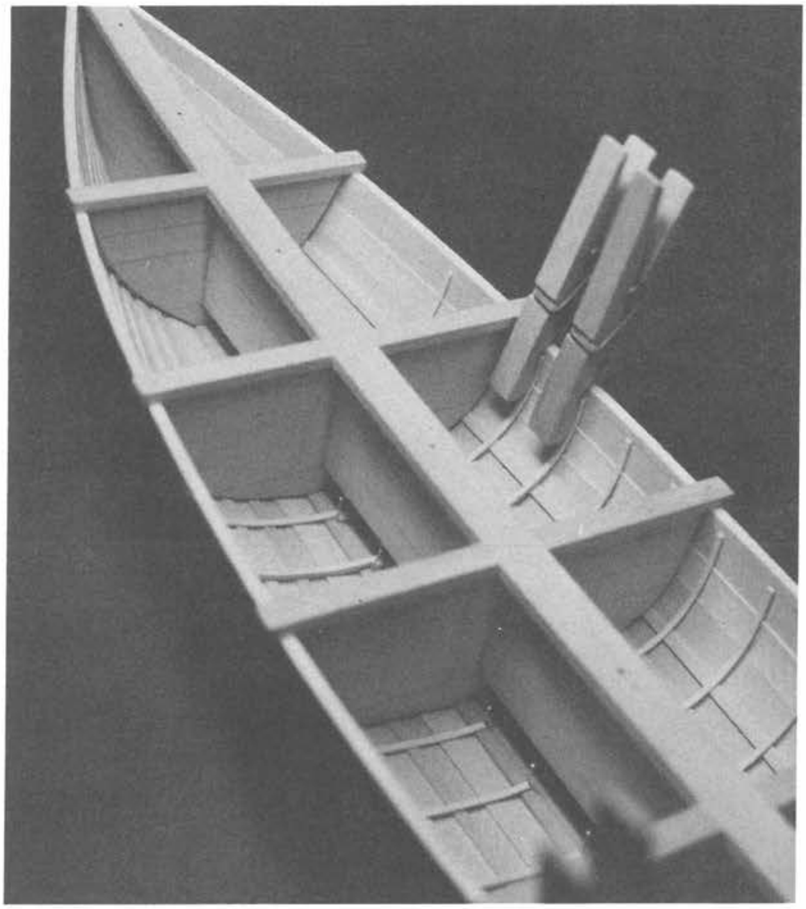


Figure 3-47. Marking the frames inside the planking shell, using a compass (without the pivot needle). The pivot arm follows the side of the section mold.

It is important to remember that your frame marks indicate the lapping surface at the keel, so timbers on the port side will be fitted on the *forward* side of this line; starboard timbers will be fitted on the *aft* side (see Sheet 2). In working closely to these marks, we are being far more exacting than the whaleboat builders, who were accustomed to making one mark at the keel, perhaps another at the gunwale strake, and putting in the frame using their trained eyesight to see that the mid-portions of the timbers were positioned squarely. In many cases, only a mark at the keel may have been considered necessary—witness the irregularly spaced, and possibly out-of-square, frames in *Lagoda*'s whaleboats. In way of the centerboard case, port and starboard timbers of each frame are aligned.





The timbers are fitted one layer at a time, giving the first lamination time to set and glue to dry before fitting the second. The toe, or bottom end of the timber must be held firmly in position while the upper part is gently pressed against the inside of the hull (Figure 3-50). A lill pin driven into the keel makes an adequate stop, while the upper end of the timber is clamped to the gunwale strake (actually the gunwale strake lap) with a clothespin (Figure 3-49). As mentioned earlier, the wood strips should be presoaked, and it is advisable to premold them by drawing them between thumb and forefinger, working them gently into a curve. A ribbon of glue should be applied to the

Figure 3-48 (left). The inside of the planking shell, showing the sweep of the plank seams and battens.

Figure 3-49 (right). Fitting the frames, which are held in place by lill pins at the keel and clothespins at their heads.

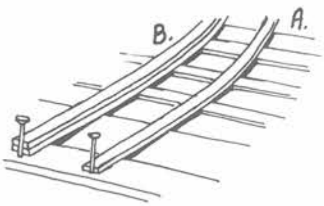


Figure 3-50. Fitting the frame laminations at the keel. A, the first layer is fitted, glued, and allowed to dry before fitting the second (B).

joining side of the strip, which is then set in place, the toe against the lill pin, working progressively upward until uniform contact is made at all seams. Clamp the top and go on to the next timber. It is advisable to fit the first layers of each set of paired timbers, then go on to the next frame. Repeat this process with the second layers of the timbers. Alignment of the second layers with the first is important to a neat appearance, particularly where the upper parts of the timbers are visible.

The tops of the timbers lie just below, and barely touching, the inwale (see Sheet 2). If they are too long by so much as $^1/_{64}$", they will prevent proper fitting of the inwale. It is possible simply to estimate the length of the timber, erring a bit on the long side, and glue the pieces in place, then carefully cut away the excess length with great care and a very sharp knife (a new Xacto #10 blade will do). This is risky at best. Far better to fit the first layers of the timbers very carefully, mark their upper ends precisely, and trim them to this exact length before gluing. Mark their upper limits on the gunwale strake with dividers, making a pencil line parallel to, and $^3/_{32}$" below, the top edge. The second layers do not require such careful measuring, so long as they are within $^1/_{16}$" of the lengths of the first layers. As you can see from the section views in Sheet 2, the upper ends of the timbers are cut to form a short taper, so any disparity in the ends of the timber laminations will be cut away. A useful tool for this job is the Xacto #5 knife handle fitted with a router blade; the one formed in a $^1/_2$" diameter loop is the best. Holding the router is very similar to holding a regular carving knife. Brace your thumb against the outboard side of the gunwale strake, about in line with the frame you are cutting. Make small cuts in a gentle scooping motion. The end of the timber comes almost—but not quite—to a feather edge (Figure 3-51).

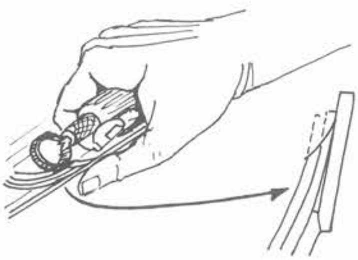


Figure 3-51. Cutting the heads of the frames with an Xacto #5 knife handle and router blade.

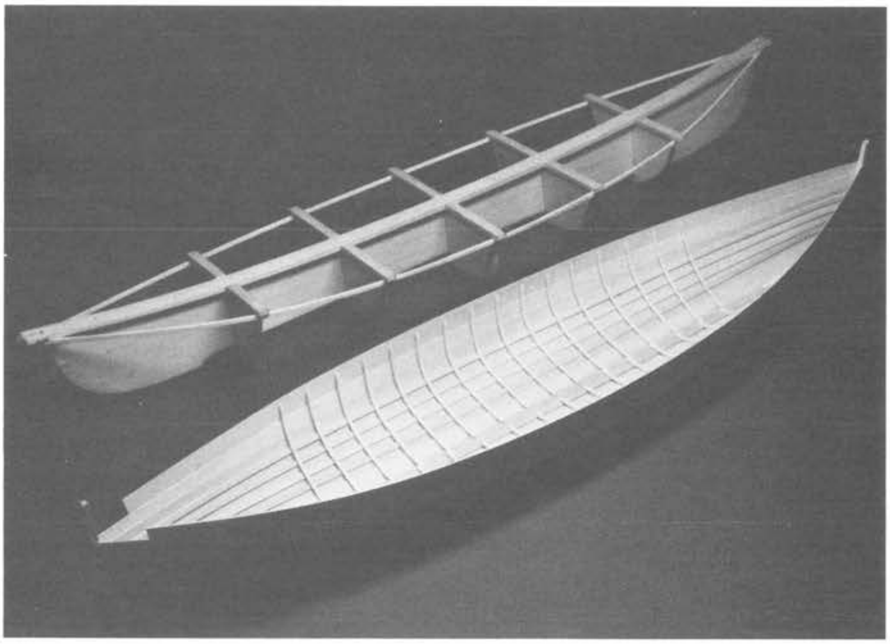


Figure 3-52. The shell removed from the mold, ready to receive the frames for the ends.

You should be able to fit most if not all frames between Molds #1 and 5, and perhaps a frame or two beyond them. Fitting frames with the molds in place is limited by the cutaway which allows you to lap the timbers atop the keel; however, the profile mold cannot have any cutaways at the stem and stern, so it must be removed to complete framing at the hull ends. The mold must now be taken out of the planking shell, so pull out all the lill pins securing shell to mold and remove the wedges and pins at the ends of the profile mold cap strip. If you haven't been sloppy with the glue, the mold can be removed with very little force and you will have what is pictured in Figure 3-52. The pin holes in the keel and stems can be closed by applying small drops of water with a brush.

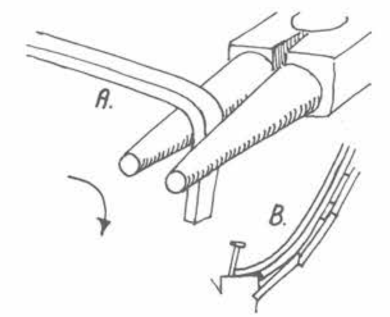


Figure 3-53. A strong bend can be induced in the hardwood strips by first soaking them, then bending them with a round-nose plier (A). B, fitting the frames at the extreme ends of the hull.

If you were unable to fit any of the midship frames due to interference from the molds, add them now; then proceed with the end timbers. The last three frames at each end are "canted," i.e., they lie at angles to the centerline, but more squarely against the planking (see Sheet 2). Their heels also have marked bends which give them a better toeing at the keel (or on the stem- and stern posts as the case may be). These bends should also be coaxed into the lower ends of your model's timbers, and a good way to do that is to form these sharp curves with needle-nose pliers and some gentle twisting (Figure 3-53A). The wood should be quite wet during this operation. Use lill pins as before to hold the toes of the timbers in place. You may find that the first layer wants to end alongside the stem- or stern post; otherwise it will leave a sizable gap as it bends in to land on the post (Figure 3-53B). If so, let it be, and form the toeing only in the upper layer. This will give the garboard more support.

When all the frames are fitted, you can finish trimming and tapering their upper ends. You will have noticed by now that with the mold removed, the hull is very light, fragile to look at, but surprisingly strong and resistant to flexing and deformation. This is very much due to the laminated frames which will keep their shape and resist the tendency to "spread," as single-piece timbers try very hard to do when released from the mold (voice of bitter experience speaking). There will, however, be a tendency for the hull to collapse at the ends, and this must later be checked and reversed by installing spreaders.

You must now decide whether to fasten the hull with nails or forego them for all-glued construction. If this project has taxed your abilities and patience so far, forget the nails and go on to the next phase of construction. This strategy may also appeal to those who plan to paint their models and thus obliterate any sign of fastening. However, if you are planning a natural wood finish, or a minimum of paint application (on just a strake or two), then the nails will show to advantage and you would be wise to add them. There are many modelmakers who feel that

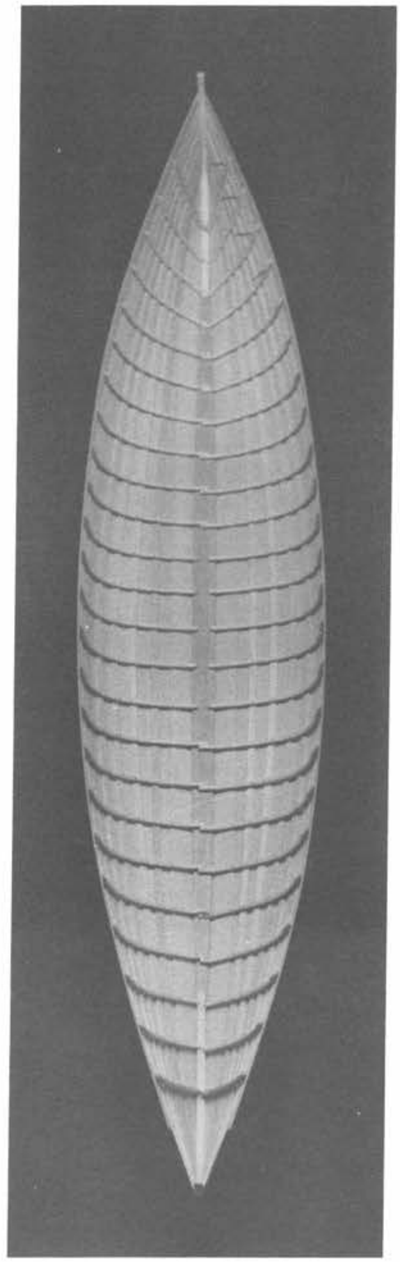


Figure 3-54. The shell, completely framed.

fastenings are essential to any model if it is to have some permanence, so this job will come naturally to them.

HULL FASTENINGS. Model Shipways has developed miniature photo-etched copper boat nails for use in this project as well as other modelmaking applications. The copper is a fairly soft grade, which makes peening (with and without rooves or rivet burrs) and clinching (a hook-like bend) possible without undue damage to the surrounding wood. This softness also makes them difficult to drive with a hammer, and impossible to drive without boring pilot holes. The size of the pilot hole depends on the hardness of the wood. The nails are etched from copper sheet .022" thick and the outlines of their shanks approximate this dimension, sometimes a little more. You may find that these nails drive very easily in soft basswood if the pilot hole is bored with a #76 drill (.020"), but harder wood like maple may require a #75 (.021") or #74 (.0225") drill. You must do your own experimenting to determine what works best for you.

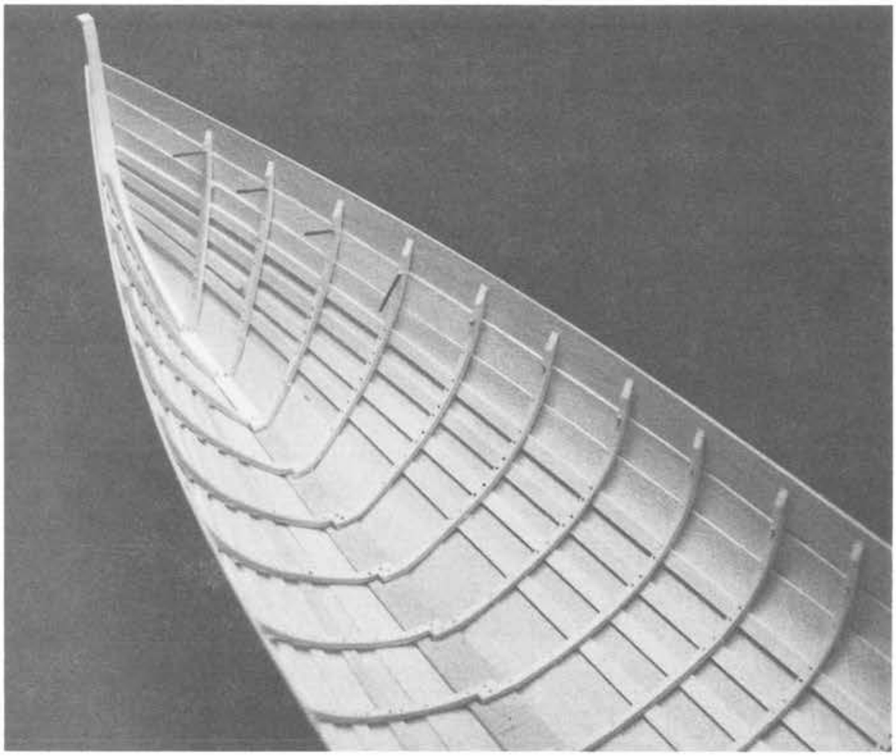


Figure 3-55. Fastening the frames to the shell with copper nails. The top row of nails is in the process of being clinched. See Figure 3-5.

The nails are much more easily driven with pliers than by hammering. Hold the nail in the plier tips ¾ of the shank length away from the head; insert the nail in the pilot hole and press it in firmly in $1/8$" increments. Once the point of the nail is through the frame, you can draw it down by pulling it in from the other side. Tap the head flush with the wood surface with a small (jewelry) hammer. If you are through-nailing, as with the whaleboat frame fastenings, you will want to head over the other end, either by peening or clinching. To peen the nail end, cut off the protruding shank about $1/64$" (approximately the thickness of the nail) above the inside surface. With the head backed against a piece of metal, such as a bench plate, an anvil, or large hammer head, strike the protruding nail end with a small hammer so it "mushrooms," forming a flange as it flattens (see Figure 3-5). This will prevent the nail from "drawing," thus producing a permanent mechanical fastening. The joined pieces must literally be torn apart if the nail is to be pulled.

Clinching is the process of bending the nail shank over gradually as it emerges from the inside surface. This progressive bending forms a "hook end" which loops over and is driven back into the wood again, anchoring the nail very securely. The nails for this model are a bit too heavy to replicate clinching exactly, but a convincing likeness can be had by cutting the shank off about $1/16''$ away from the inboard surface, then bending over this remaining length until it is partially embedded in the wood (in some cases it will be better to bend the shank first, then cut it). Be careful not to embed the end too deeply or it may cause the narrow frames to split (Figures 3-5 and 3-55).

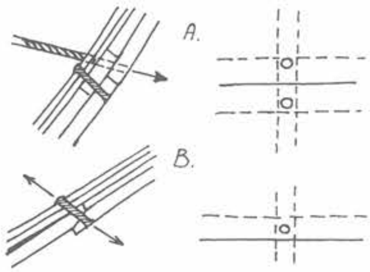


Figure 3-56. Boring for the hull fastenings. A, drilling at a seam batten. Note the direction of the hole axis. B, drilling through a lapped seam. The shaded parts are fastenings. The sketches at right show the nail heads from the outboard side.

These nails can also be used as rivets, using photo-etched rooves ("washers") also available from Model Shipways. If a wide head is wanted at both ends of the nail, press a nail into a roove until it fetches up on the head. Drive it as you would a regular nail, then fit a second roove. Cut the nail shank about .020" above the roove (i.e., the thickness of the nail itself), using flush-cutters or ordinary nail clippers. The shank is then peened over at both ends; this gives a neater appearance at the nail head. Rivets will be important to the appearance of construction to be discussed later.

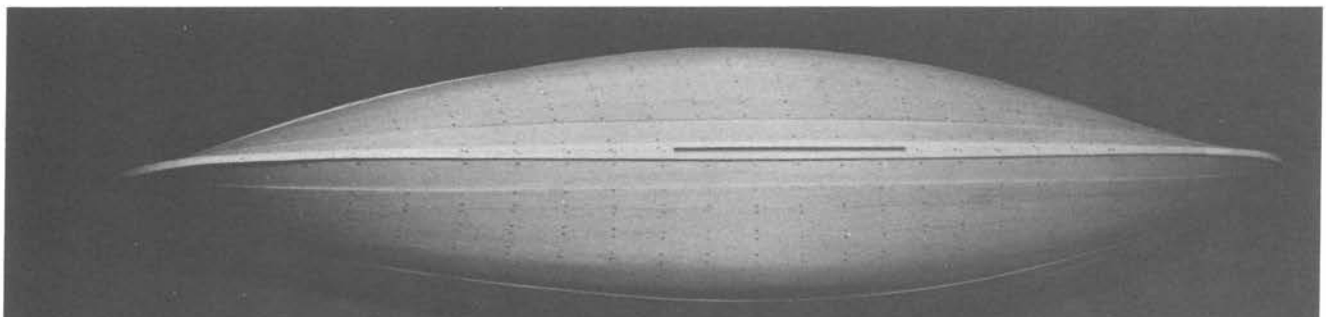


Figure 3-57. The hull bottom, showing the nailing pattern.

In fastening the hull, we will be concerned only with the nails which held planking to frames. The clinch nails which were driven along the seams battens—every 3-4"—must be ignored; they are too small to be represented by the currently available sizes of model fastenings. It is important to note that there are two nails per battened plank at each frame: one each at the lower and upper seams. They also pass through the seam battens, so the nails at each side of such a seam will be fairly close together. Only one nail will fasten a lapped seam at each frame. This general pattern can be seen in Figure 3-56, while the overall appearance on the outboard side should be like that in Figure 3-57.

There are no secrets or short-cuts to this dull business of driving approximately 2,000 nails into the hull. A power drill (with speed control) will help in boring the pilot holes; a flexible shaft machine is ideal, but expensive; even one of the battery-powered miniature drills may work very well. When drilling, start from the inside of the frame and bore outward. There may be some difficulty in getting used to boring at the right angles; invariably, the drill must be guided at an angle which aims it away from the adjacent seam. Drilling through a lapped seam also requires care (Figure 3-56).

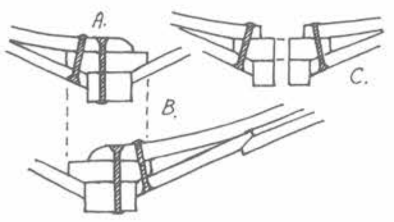


Figure 3-58. Fastenings at the rabbet seam. A and B show the heels of both timbers of a common frame. Note how the nails in the keel are off-center and staggered. C shows how timbers are fastened in way of the centerboard trunk.

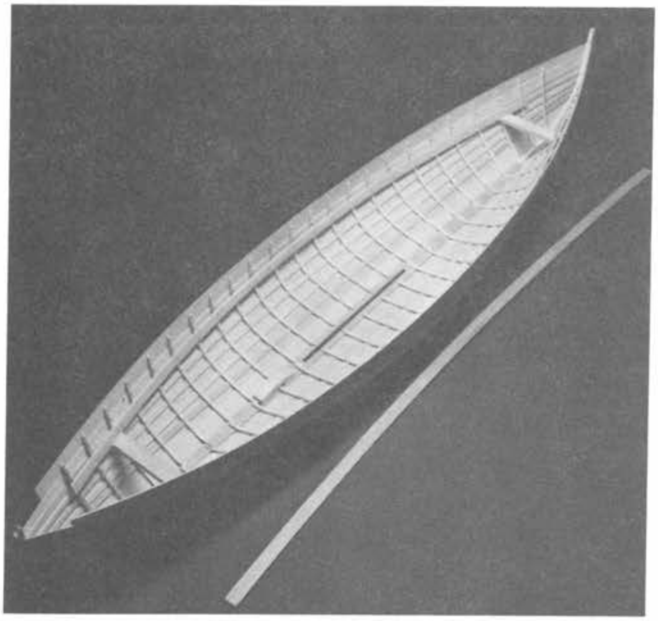
As you approach the hull ends, boring close to the keel and stems becomes more difficult in the progressively narrower confines. At this point, it will be easier to drill from the outboard side. Holding the hull up to a strong light, mark the frames where they can be seen through the back-lit planking. Use these marks to position the pilot holes. The toe of each timber is bored for one nail at approximately the centerline of the keel (these holes may be staggered slightly for better effect). Also, you will want to drill for the garboard fastenings, and this should be done so the hole goes through the keel near its edge while emerging through the garboard a safe distance from the rabbet seam (approx. $\frac{1}{32}$"). The plank ends are bored directly athwartships, so the hole going through the port plank emerges at exactly the same position on the starboard plank.

Because the inboard sides of the sheer- and gunwale strakes will be visible, the ends of the nails can simulate clinching as described earlier (see also Figure 3-55). These will be visible at the gunwale strake lap and at the tapered heads of the timbers.

Whether you decide to fasten your model or not, at this stage it should look like Figure 3-54, and the resemblance to the inboard construction views of Sheet 2 will be very striking.

THE THWART RISERS AND ADJACENT CEILING. The first strake to be fitted inboard is the thwart riser, the heavy plank which supports the thwarts while contributing a great deal to the stiffness of the hull. This will be formed from a basswood strip $\frac{1}{16}$" × $\frac{3}{16}$" and long enough to fasten to all frames but the aftermost one (see Sheet 2). Between Stations 1½ and 4½, the top of the riser is a uniform $\frac{5}{8}$" below the gunwale. Forward and aft of these points it gradually drops so it is $\frac{11}{16}$" below the top of the gunwale strake. Mark these dimensions at the end frames, the frames nearest Stations 1½ and 4½, and at every fourth timber between these stations.

The thwart risers should be smoothly sanded and cut to



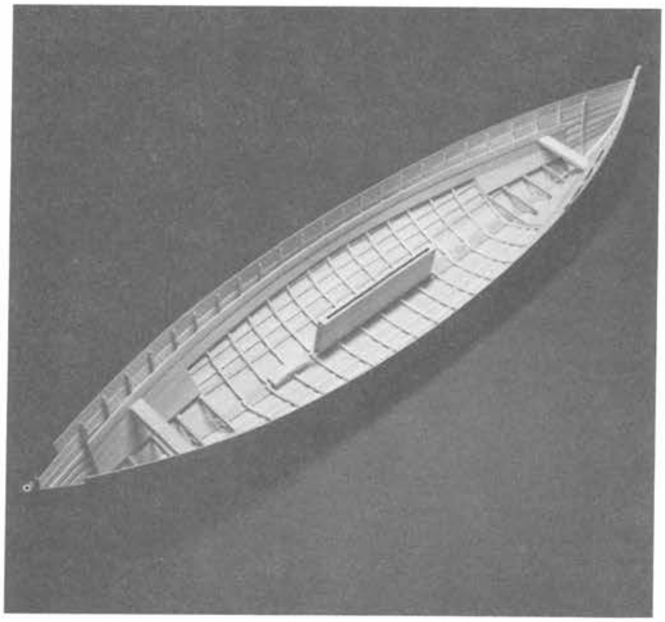


Figure 3-59 (left). The thwart risers are installed and spreaders fitted at the ends to induce the proper amount of flam in the bow and stern. The curved member alongside is the uppermost strake of the ceiling, the only ceiling plank so shaped.

Figure 3-60 (right). The top and end planks of the ceiling installed and the centerboard case and mast step fitted.

length, then fitted in place. Make a light pencil mark at the top of the riser wherever it crosses a frame, then put a drop of glue on the joining surface at each of these points. Clamp the riser to the frames, starting amidships and working carefully to the ends. Check the level of the riser against your reference marks and sight down it from the ends to be sure it follows a smooth curve without contrary bends or twists. When both risers are securely glued, drill and fasten them with the copper nails, whether you have previously fastened the model or not. These pieces are subject to the severest stresses on the model, so glue alone is not completely trustworthy. Two nails should be driven at every timber, but one at every timber is acceptable if the model is to be painted over. These nails should be driven from the inside out and their ends peened over for greatest security; driving them with glue and cutting the ends flush is an acceptable alternative. Figure 3-59 shows these members in place. Note that two "spreaders" have been wedged into the bow and stern just below them to prevent the ends from collapsing inward and making the hull excessively "sharp-ended." The spreaders must be used with care and gradual application. Work them gently into place and drive them a bit farther from day to day until the ends have spread and measurements across the top of the gunwale strake agree with corresponding measurements on the plans.

The first course of the ceiling under the thwart riser is the die-cut plank furnished with the construction set; its pattern appears on Sheet 1-B for the convenience of scratch-builders. It should be coaxed into place, trimmed if necessary, and glued, using clothespins as clamps. You may nail it in place if you wish; however, you may find that the nails for the ceiling—which must be through-driven and are therefore visible on the outboard side—may run afoul of the nails of the outboard planking. At best, the handsome pattern of the outboard fastenings will be spoiled; at worst, nails will converge or be torn out in the process of drilling new pilot holes into them. which usually scars the planks as well. This lesson was soon learned in the process of fastening the ceiling of the pilot model, as can be seen in later photographs. For reasons of appearance (historical and esthetic) and possible damage, don't nail the ceiling planking; simply glue and clamp it in place.

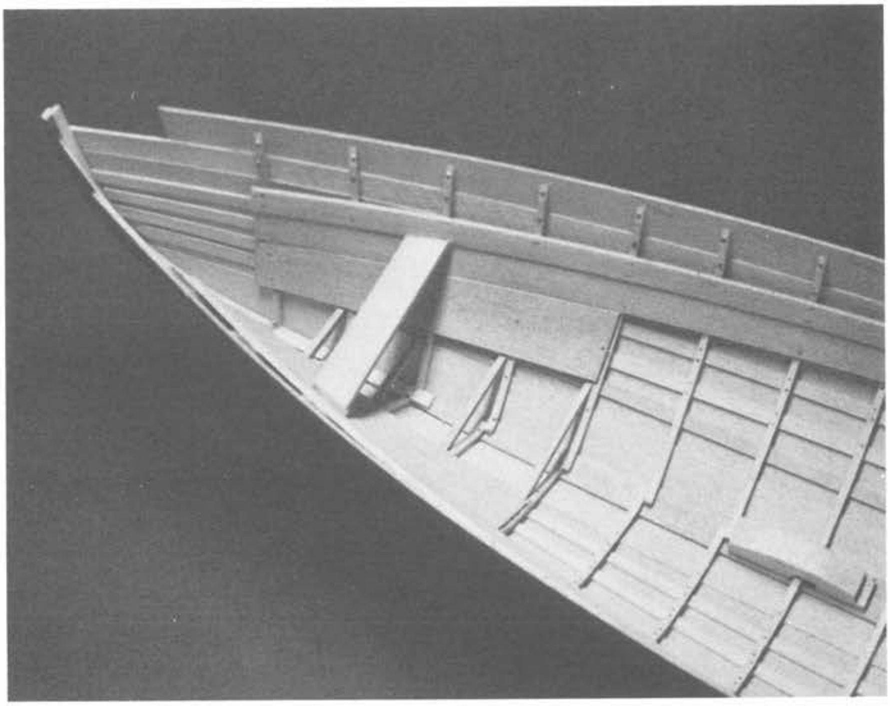


Figure 3-61. Detail of the ceiling at the bow and the beams for the bow sheets.

Both ends of the ceiling are finished with short wide pieces which cover the frames in way of the bow- and stern sheets. These should be cut and fitted from a sheet of $\frac{1}{32}''$ veneer; die-cut pieces are not provided, but the shapes are simple to work out by cut-and-try methods. Prior to fitting these pieces, you should fit the beams for the bow- and stern sheets. Their positions are determined by measuring from their top surfaces to the top of the keel or the stem- or stern post (see Sheet 2). Fit and glue the end pieces first; then determine the heights of the middle pieces by laying a strip of wood across the end pieces and fitting the middle pieces so they just touch the strip. Check heights on both sides of the hull, not just at the centerline. These cross-pieces determine the shape of the bottoms of the end ceiling planks (see Figures 3-60 and 3-61).

When these parts are finished, return the spreaders to their former positions, although they may now need trimming due to the addition of the ceiling.

THE CENTERBOARD TRUNK AND MAST STEP. The centerboard case must be installed before the ceiling can be finished. The upper layer of the keel can now be bored and cut for the centerboard slot, which should be carefully filed flush with the slot in the lower keel layer. The case consists of two end pieces, or "ledges" of $3/32'' \times 3/16''$ stripwood which are lapped at the ends of the slot as shown in Sheet 2. The lower ends should be cut to fit the slot, then removed for bench assembly. The sides of the case are single pieces of $1/16''$ veneer which should be cut to length and $1/16''$ or so too high (they can be trimmed to proper height later). Their bottom edges should be shaped to match the rocker of the keel; note the toeing, small extensions at both ends which enable the case to be nailed in position until the boat is turned on its side so the boatbuilders could fasten it properly with drift bolts from the underside of the keel.

You may find that you cannot get the case siding to sit on the keel beside the slot because the ends of the frame timbers are in the way. These must be carefully cut away until the siding sits snugly on the keel, a job which is not difficult if your knife is sharp. Try not to disturb the nails in these timbers if you can help it.

Assemble the centerboard case and test-fit it; the ledges should fit snugly at the ends of the slot. The top of the case can now be trimmed, and this should be done so it will touch—and support—the undersides of the midship and tub-oar thwarts. Either make these thwarts from materials supplied or simply fit a piece of scrap wood across the thwart risers at the correct places. Cut or file down the top of the case until it is at thwart level. Bore a #56 hole through the case at the pivot point. The case can now be glued to the keel. Be sure it does not lean to one side.

The mast step is a solid block made from stripwood $1/4''$ square by the length measured from Sheet 2. Use these drawings to cut its profile and the rabbet on the aft side which supports the short length of ceiling between it and the centerboard trunk. It will have to be notched at its middle where it straddles a frame. Finish this piece carefully, but do not yet bore it for the mast hole, particularly if you plan to step and rig your model's mast and sail (wait until the mast is made). Figures 3-60 to 3-62 show this piece and the completed centerboard prior to finishing the ceiling. For some modelmakers, boring the mast step after its installation will prove to be difficult and possibly lead to irreparable damage, particularly if the drill wanders or splits the mast step, forcing its replacement. If you are not experienced in drilling operations of this critical nature, omit the mast step at this time, and proceed with the ceiling as described in the following section. This means that you will plank over the area where the step is located. When you are ready to step the mast, make a dummy mast step, bore it out, and glue it down on top of the ceiling after aligning it with the mast.

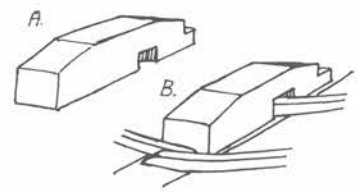


Figure 3-62. The mast step as shaped (A) and fitted to the keel (B).

COMPLETION OF THE CEILING. $1/32''$ × $5/16''$ strips will be used to fit the remainder of the ceiling, which consists of straight planks laid almost parallel to the centerline. Start on either side of the centerboard trunk and work out. Do not taper the ends of these planks unless there is no other way to get their edges to fit reasonably closely. Don't be too forceful, either; these seams were not perfect and esthetics had nothing to do with the way they were cut and joined. As stated earlier, fastening these planks may cause problems, so glue and clamp them. If clothespins can't reach, pin the planks temporarily to the frames with lill pins. When the glue has dried, pull the pins out and apply a tiny drop of water to swell each pinhole shut. The feather-edged planks near the top may require some bending and planing, but try to keep their lower edges as straight as possible.

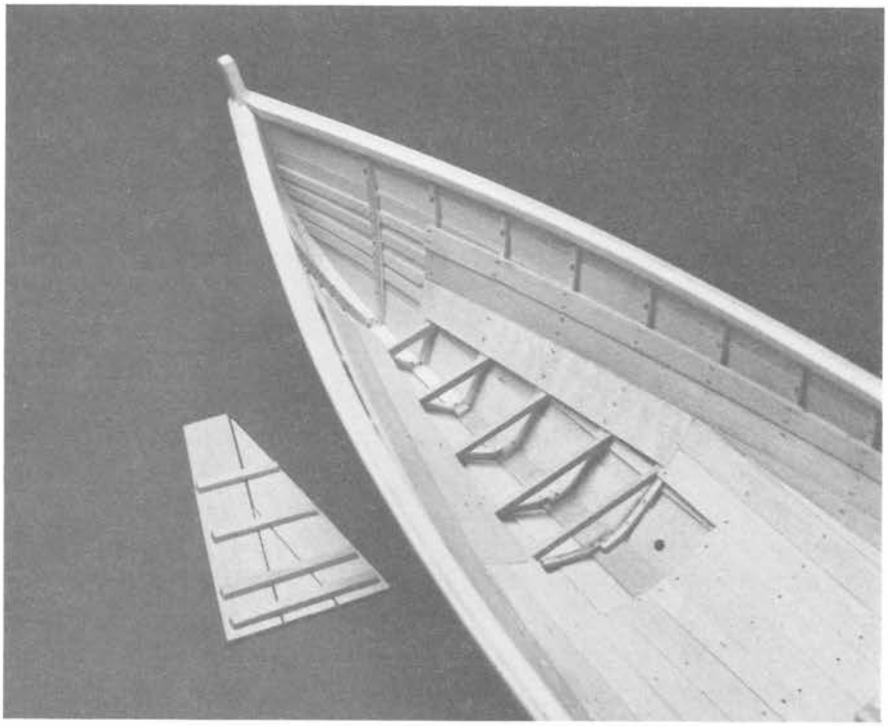
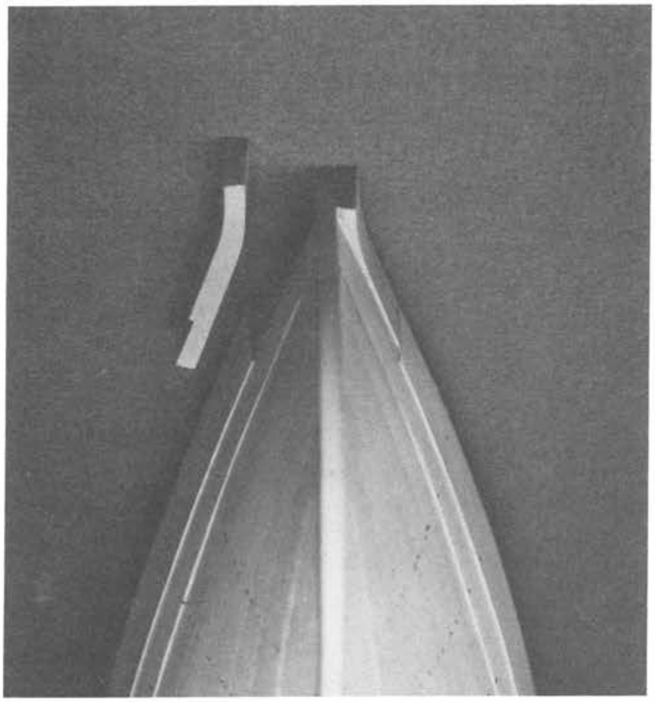


Figure 3-63. The finished ceiling at the stern. Note the bailing well just forward of the beams which will support the stern sheets (the triangular structure alongside).

Before closing up the bottom, you may want to read ahead to the section, "Mounting the Model" and decide how you want to fit your model to a baseboard with mounting pins. If you want this option, then I suggest that you locate and drill the mounting pin holes on the keel and glue some $1/8''$ thick pieces of basswood (also drilled) to the top of the keel to strengthen it and give the mounting pins a more substantial bearing.

The last pieces of the ceiling to go in are at the center line. Make these from $1/32''$ scrap. Note the presence of the bailing well just forward of the stern sheets, an open space giving access to the bottom plank and the drain hole which was stoppered by the boat plug. If your model is to be painted, leave this area natural wood or stained. The bailing well was not fitted with a cover, although it was painted (ceiling color) in some boats. Since this is one of the few places where the bottom construction is exposed to view, it might look more interesting if it were not covered with paint.



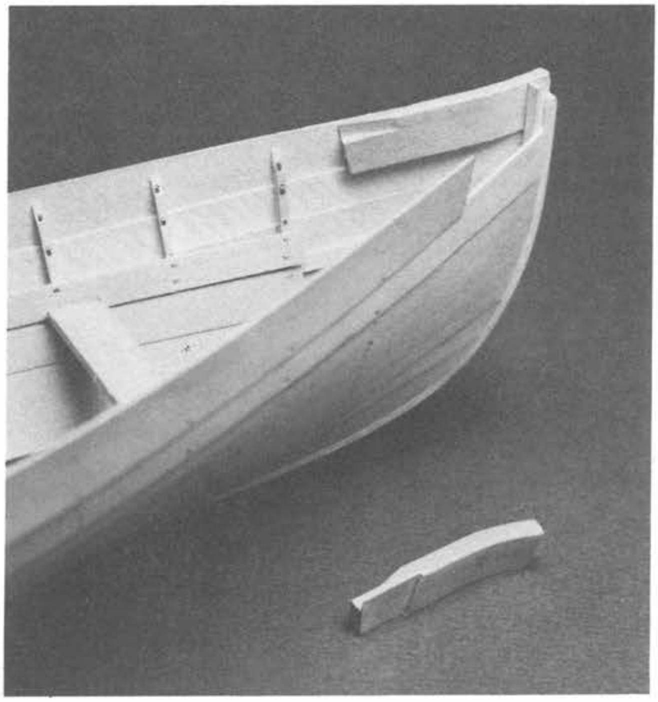


Figure 3-64 (left). Bottom view of the bow with the cheek pieces being fitted.

Figure 3-65 (right). The port cheek piece is installed. Note the scarf joint on its after end to receive the inwale. The starboard cheek piece (alongside) shows the large rabbet on its after end to receive the gunwale strake.

THE CHEEK PIECES. These very important parts are carved from two pieces $1/4'' \times 3/8'' \times 1\frac{1}{2}''$. The overall measurements can be taken from the plan view of inboard construction (port side) on Sheet 2. Your layout work must consider the inside surfaces at the stem post (to which they are joined), which are vertical and parallel to the centerline. All other surfaces of the inboard and outboard sides are sloped and lie at some angle to the centerline. Figure 3-66 shows a suggested sequence for shaping these pieces. Their final forms and installation are illustrated in Figures 3-64 and 3-65.

Once the cheek pieces have been given their basic shapes, they must be fitted to the forward edge of the gunwale strake and the sides of the stem post. Position one of the pieces against the stem post so its forward end is aligned with the leading edge of the stem post. With a sharp pencil, mark the overlap of the gunwale strake on the outboard side. Cut a rabbet into the outboard after side of each piece until the gunwale strake lies in it, flush with its outboard surface (Figure 3-65). The scarf joint for the inwale must also be rabbeted into the after end of each cheek piece, on the inboard sides. The forward ends of the inwales must also be shaped in this process; they are strips measuring $3/32'' \times 1/8''$ (placed horizontally) with tapered scarf-ends $3/8''$ long. This joint can be roughly carved, then fitted into the cheek pieces, filing the inwale ends to join them closely.

Before gluing and fastening the cheek pieces to the bow, the stem post must be measured and cut flush with their top

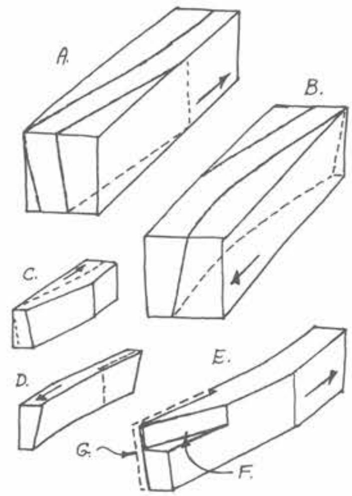
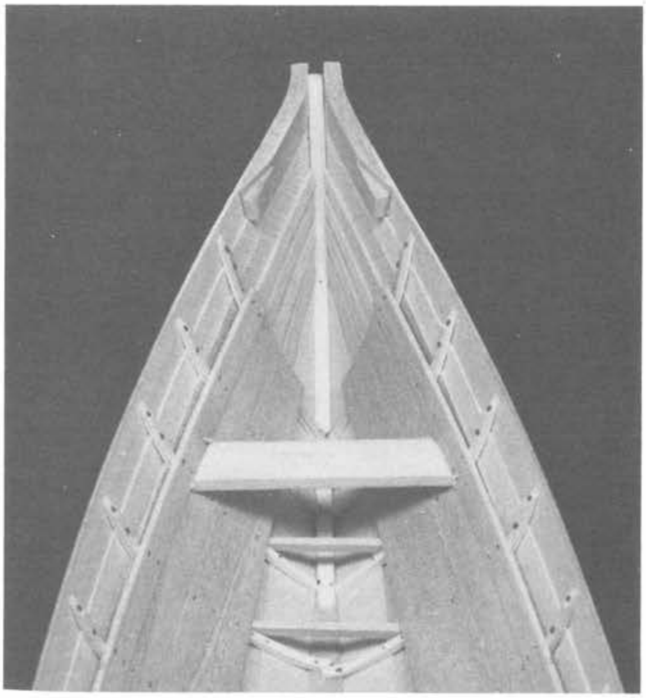


Figure 3-66. Steps in carving the cheek pieces (the arrows point forward). A, inboard wood to be carved away; B, outboard wood to be carved away. C shows the result of step A; D shows the result of step B. E shows the scarfing for the inwale (F) and the rabbet for the gunwale strake (G).



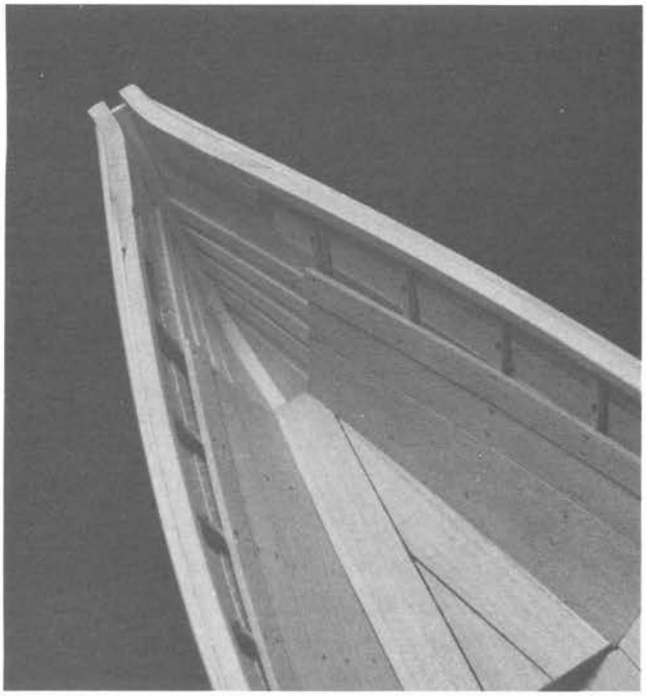


Figure 3-67 (left). The cheek pieces installed, ready to receive the wales.

Figure 3-68 (right). The gunwales and inwales fitted to the gunwale strake and cheek pieces. Note the temporary fitting of the bow sheets.

edges. The stem post head is then filed out to receive the bow roller (Sheets 2 and 3, details); Figure 3-65 shows the port cheek knee glued in place with the notch for the bow roller visible in the stem head. At this point, the brass roller should be installed, due to the design of this fitting as produced by Model Shipways (the roller pin is turned in place, rather than the roller being bored for a pin which is later driven through it). In actual boatbuilding practice, an iron pin was driven hard through the pivot hole of the bronze roller and the assembly was installed as a single piece. Bore the pivot hole in the installed cheek piece and fit the roller to see if it is positioned properly. Remove the roller and hold the other cheek piece in place securely (spot-glue if necessary) while running the drill through the bored pivot hole from the outside and into the second cheek piece. This should assure proper alignment of the pivot holes. Remove the second piece from the stem and replace the roller. When the second cheek piece is reinstalled and glued, the roller will be locked into the stem head. Figure 3-67 shows the cheek pieces installed prior to fitting the inwales. The bow roller is not visible in the model as it was of different design and installed later; however, the installation just described is closer to actual practice.

Inwales and Gunwales. As substitutes for true rails (which would cap the top strake in one piece), the gunwales (outboard) and inwales (inboard) are important reinforcements for the upper part of the hull. Before adding them, be certain that the "spreaders" at bow and stern have done their jobs and kept the hull ends as full as designed. By holding the hull upside-down and positioning it over the Plan View of inboard construction in Sheet 2, you can easily find how closely your model follows this outline. If the ends are too full, or too "pointed," gently move the clamps forward or back until there is closer agreement. A perfect match is not necessary—full-size practice also had its vagaries in this respect—but you should try to get the beam at the thigh board and the forward end of the cuddy as close to plan dimensions as you can. It is important to do this now, because the addition of the gunwales and inwales will make the plan profile much stiffer and very resistant to any subsequent persuasion from the spreaders.

The inwales are first to go onto the model. Fit them first (no glue yet) to the cheek pieces, then work aft, holding them in place with clothespins. If the wood does not dry-bend freely, soak or steam it and work a bend into it by drawing it between your fingers. They do not have to butt against the stern post in a precise fit, and this will not be seen anyway. The inside ends will have to be beveled where both sides converge (Figure 3-63). The fitted inwales can now be glued and clamped.

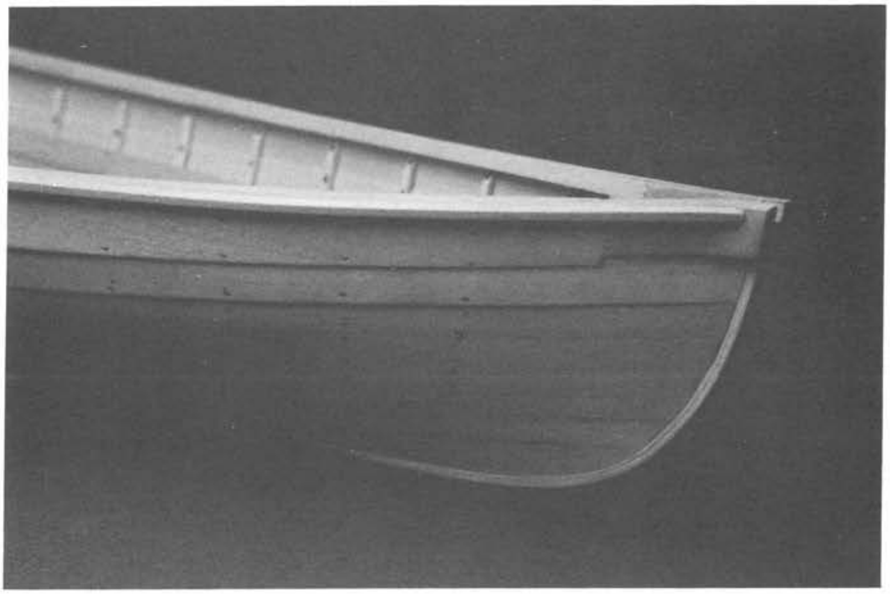


Figure 3-69. An outboard view of the bow, showing the joining of the gunwale to the starboard cheek piece.

The gunwales are next fitted (no glue) and clamped, but here the ends must be joined quite carefully; the situation at the bow is quite different from that at the stern. Fit the gunwale ends to the stern post first, making a bevel on the insides that will lie snug to the side of the post. Proceed forward with fitting and clamping until you come to the forward ends of the cheek pieces. Here, the insides of the gunwale ends must be tapered gradually to match the flare of the cheek piece ends (Figure 3-69). At the same time, the gunwale ends must not flare out on their outboard sides (see the bottom view of the inboard construction drawings on Sheet 2). The ends of the gunwales should be rounded to lie flush with the aft edge of the stern post and to break the feather-edges where they blend with the cheek knees (see Hull Planking Profile, Sheet 1). A barrette-type needle file or emery board will shape the gunwale ends very well.

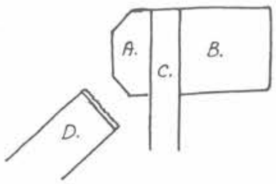


Figure 3-70. A section of the top of the gunwale strake (C), showing the gunwale (A) and inwale (B). The face of the gunwale can be beveled, after fitting, with a narrow sanding block (D).

If you are fastening your model, the inwales and gunwales can be nailed to the strakes in a single operation following the gluing. They may be through-nailed and peened at every frame. The gunwale is beveled along its two exposed edges, and this is the best time to do this. The upper edge can be sanded off with 220-grit sandpaper to make a beveled surface about $1/32''$ wide. The lower edge is finished the same way, but it may be easier to mount the sandpaper on a small block, taking care that the corner of the block closest to the planking is "safe"; i.e., has no sandpaper glued to it which could scar the finish of the plank (Figure 3-70). An emery board might also work well for this purpose.

Bow and Stern Sheets. These are standing platforms or "soles" (decking without camber, or crown) of very rough construction. The rough-sawn boards provided good footing for the mate and boatsteerer and were not painted. The planks were laid in a "herring bone" pattern (Sheet 2 and Figures 3-63 and 3-68) and were generally fastened together over cleats (cross-pieces) to permit installation and removal as a unit. Once in place, they were generally nailed down to prevent accidental shifting or loss. For your model, you may wish to have them removable, as they provide the only access to viewing the inboard hull construction after the ceiling has been fitted.

The construction of these sheets is not difficult. Start with the longest plank and shape its outboard edge until it fits closely against the ceiling. Next fit the plank on the opposite side so it too fits the ceiling; then trim the end so it fits alongside the first plank with a small ($1/64''$) open seam between the two. The third plank is just a sliver which fills the space between the side planks, again with a small open seam to set it off. These assemblies are then "squared off" at their forward and aft ends to give a (reasonably) neat appearance. Being untreated in any way, the sheets would have quickly darkened with exposure to the weather; if you paint your model, these parts look best if stained a light walnut color.

Before fitting the thwarts or other inboard structures, this is the best time to prime and paint (or varnish) the hull interior. See that all surfaces are smooth, rubbing down any rough spots with 400-grit wet-or-dry paper, followed by wiping with a soft cloth. If you have either a vacuum cleaner or blower (such as is used for dusting cameras), use it to get as much dust and grit as possible out of the crevices in the frames and inside the ceiling. The priming coat (clear sealer or pigmented primer) should be brushed on carefully, using a sable hair brush of reasonable quality (the best quality brushes are too costly and the cheapest ones shed their bristles, usually on the most conspicuous surfaces). Two priming coats, followed by careful sanding, are usually sufficient. The finish coats of paint should be applied according to manufacturers' directions. If you are applying a clear finish (varnish or lacquer), you may find a spray finish is easier than brushing techniques. The Krylon aerosol spray varnishes are very simple to apply and give excellent results. Other finishes can be applied with an air brush. Application methods are constantly being changed (often very much for the better), but it is wise to seek the advice of hobbyists who have used specific painting equipment and paint brands before trying something which is unfamiliar to you. When adding subsequent detail to the interior, scrape the finish from the joining surfaces for a stronger glue bond.

Thwarts, Thigh Board, and Cuddy. These pieces have important functions as cross-braces which stiffen the hull and prevent it from going out of shape. The thwarts are first to go in, beginning with the midships thwart, whose ends should touch the insides of the hull planking. Do not cut the thwarts to the lengths shown in the plans, as these are only approximate. Instead, the thwart should be long enough so it spreads the hull to a beam of $4\frac{1}{2}''$ (or $\frac{1}{32}''$ more) at the gunwales. If the hull has spread to more than this dimension, fit the thwart and wrap a rubber band around the hull to contract the topsides to the right breadth. When the midship thwart and beam are reconciled, do not glue the thwart to the risers yet, but go on to fit the other thwarts and check the beam at their locations. Use more rubber bands if necessary.

The thwart risers should be notched slightly, enough to allow the thwarts to make even contact along the riser tops. Begin by marking the locations of the thwarts and nicking the risers at those marks with a knife. With an emery board or small sanding block, level the riser tops between the nicks. Photographs of whaleboats occasionally show thwarts notched deeply into the risers, and this was done to the Delano boats to some extent; however, this may have been a "cure" for thwart risers fitted too high on one or both sides. If your model has similar problems, feel free to take similar measures.

When all the thwarts are fitted, glue them to the risers simultaneously; in this way, the hull can be easily "sprung" open to get the thwart ends past the protruding inwales. Once the thwarts are glued, the hull becomes extremely rigid and you will be quite surprised at its strength and resistance to further changes in form.

Because the mast thwart's construction is complicated by the mast hinge, mast step, and the mast itself (these three must be carefully juxtaposed if the mast is to stand correctly), you may wish to delay its installation until all related parts have been made. You can then assemble and position them with fewer compromises in workmanship or risks of damage or uncorrectable mistakes. One possible construction sequence might be as follows:

1. Fit the mast thwart to the risers, but do not glue or fasten it in place.

2. Notch the mast thwart at its forward edge to receive the mast hinge yoke, which should be made at this time.

3. Assemble the mast hinge hardware and fasten it to the mast hinge yoke, following Figure 3-93 and its accompanying text.

4. Fit and glue the filler piece as shown in Figure 3-74 (the thwart is still not secured to the hull).

5. Fit and nail the mast hinge assembly to the thwart, following Figure 3-94 and its accompanying text.

6. Install the mast thwart in the hull and fit it with thwart knees as in Figure 3-78 and text. Fitting of the forward knees will be slightly different, due to the presence of the mast hinge.

7. Make a dummy mast step to fit over the ceiling and bore it out carefully for the mast heel.

8. Shape the mast, as in Figure 3-108, and taper its heel to fit the mast step hole.

9. Slide the mast into the hinge and position it and the step until it stands correctly.

10. Mark the position of the mast step and glue it to the ceiling.

Due to the size of the larger of the two line tubs, it is very important that the space between the fourth and fifth thwarts be made large enough to allow it to fit. $1^{13}/_{16}''$ to $1^{7}/_{8}''$ is neither too much nor too little. It is not serious if the space between these two thwarts is a bit more than the spacing of the other thwarts.

The thigh board is cut to dimensions from $^{1}/_{8}'' \times ^{1}/_{2}''$ material provided. The notch called the clumsy cleat should be filed out and holes bored for the kicking strap, lifting strap, and lance tails. Fit the board atop the gunwale at the position measured from Sheet 2. It will be necessary to file down the inwale and a bit of the gunwale strake so the board lies close to the top of the gunwale. Because the bow may not taper exactly as shown in the plans, and the "spreader" may not have fully compensated for this, the thigh board ends may require extra trimming so they lie exactly parallel to the sides of the hull. Once this is done, the ends and forward corners may be beveled as shown in Sheet 2. The thigh board should be fastened (three nails at each end) to the inwales for additional strength. Do this whether you have fastened the rest of your model or not (Figure 3-72).

The planking of the cuddy board is fitted very much like the thigh board. Mark the forward end on the inwales, then cut them down so the cuddy planks will lie close to the gunwales. Fit, glue, and fasten the forward plank after you are satisfied that the stern has "spread" as closely to the plan profile as you can coax it. Once the forward cuddy board is in place, the rest is part of a simple sequence. Like the thigh board, the forward cuddy board should be nailed for extra strength; three nails per side are recommended. Repeat this with the remaining planks only if you are fastening the rest of the model.

The lion's tongue, which you should find among the die-cut basswood parts, can now be fitted and glued over the cuddy. A 1/32″ (#68) hole should be drilled for the rudder trip line at its after end (do this before gluing). The ends of the lion's tongue are flush with the aft side of the stern post and the forward edge of the cuddy. If this piece is a little short, the forward edge should be flush with the cuddy edge and the aft end can come inboard a bit; if too long, trim the forward end until it is flush with the cuddy edge (Figure 3-73).

With these final factors to hull form and rigidity behind us, we must now return to the thwarts and make preparations for fitting the thwart knees. First, the layout work, which consists of striking paired pencil lines with spring bow dividers to indicate the outlines of the knees where they will eventually be installed. The locations of the thwart knee pads must also be marked (Figure 3-71). Between the thwart knees and the sides of the hull are blocks of wood—fillers—which provide a solid landing for the knees where they span the thwarts and the inwales. Make these filler blocks from scrap pieces of 1/16″ basswood. You can cut and trim them to shape before gluing them in place, but I glued the rough-shaped blocks in place first, then carved out the hollow joining surfaces for the knees afterward with a knife. The Xacto routers should work well with this method. The results can be seen in Figures 3-71 and 3-74.

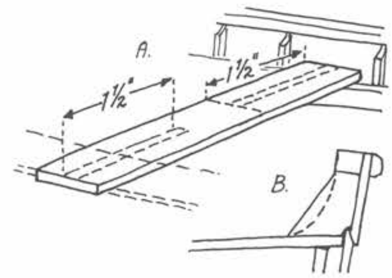


Figure 3-71. A, marking a thwart for the thwart knees and pads; B, fitting a thwart knee filler block. The concave surface is carved out with a router blade after installation (broken line).

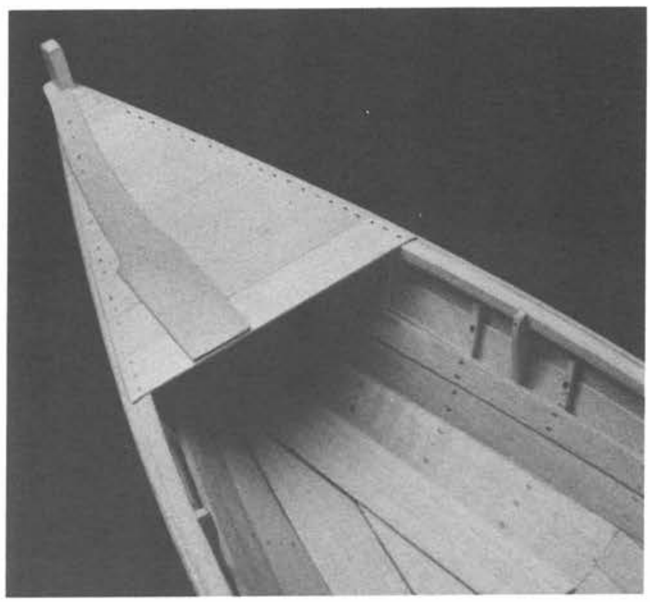


Figure 3-72 (left). The bow with the thigh board fitted.

Figure 3-73 (right). The cuddy and lion's tongue.

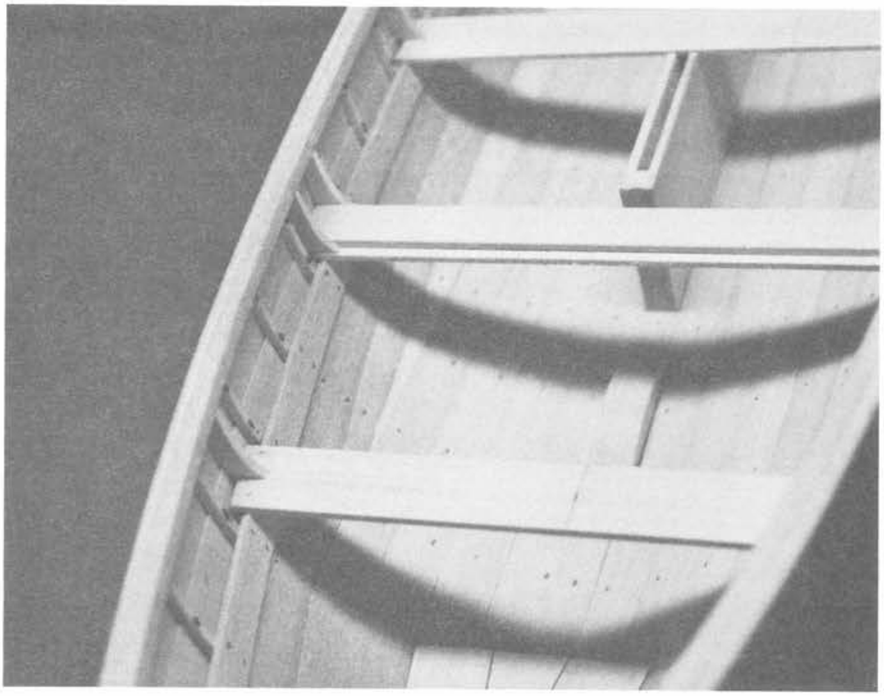


Figure 3-74. Fitting the thwarts. The second is the mast thwart, whose pad runs its full length. Note the filler blocks which are ready to receive the thwart knees.

Between the stroke oar thwart and the cuddy, you will see a small piece of wood at both sides of the hull spanning the space between the inwales and the thwart risers. This is a stiffener which reinforces the tenuous connection of cross-grained wood between the wales and the hull framing. Because the timbers are not connected to the wales, the space between them is very weak and susceptible to breaking. This is the reason for making the thwart knees such strong connecting pieces between the wales and the rest of the topside construction. Because there is no such reinforcement aft of the stroke oar thwart, stiffeners of this sort had to be used. These pieces are short—they do not extend below the thwart risers—so they are easy to make and fit at this time (Figure 3-75).

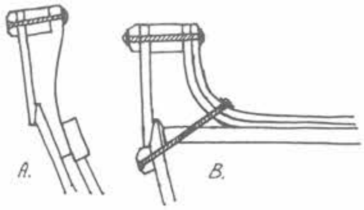


Figure 3-75. Riveting the stiffener (A) and a thwart knee (B). The copper nail ends are peened over copper rooves (Model Shipways catalog #448).

Figure 3-76. An overall inboard view of the model prior to fitting the thwart knees and subsequent inboard detail.

THE RUBBING PIECES. These chafe guards are fitted under the gunwale strake laps and are made from $1/16'' \times 1/8''$ strips. Their

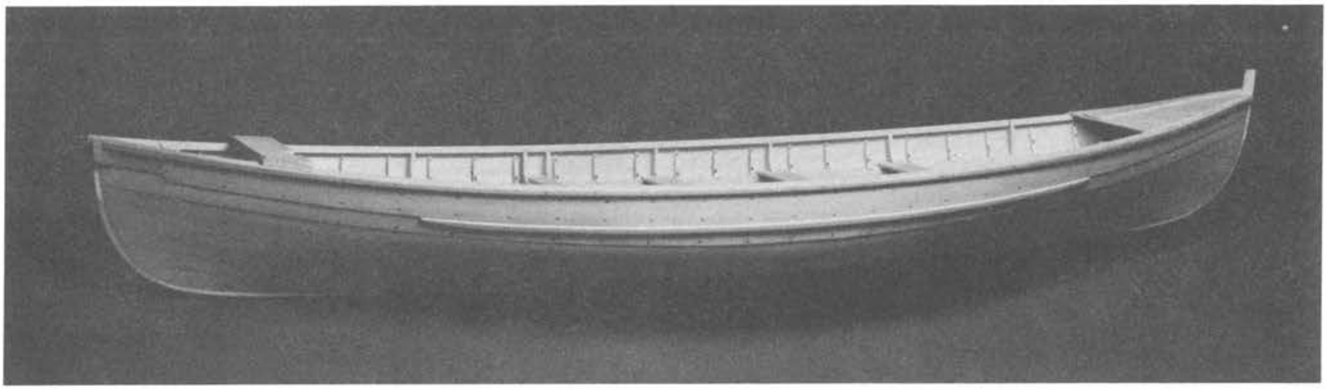


Figure 3-77. An overall outboard view of the model, showing the rubbing piece at the gunwale strake lap.

lengths and tapers can be taken from Sheet 1, Hull Planking Profile; their sections from the sectional views in Sheets 1 and 2. It is useful for modelmaking purposes to have these members in place *before* the thwart knees are fitted, particularly if the knees are to be fastened with the copper nails and rooves. With careful drilling, you should be able to run the lower outboard fastenings through the rubbing pieces, thus riveting both components with the same fastenings. The rubbing pieces can be clamped to the hull with clothespins during the gluing process.

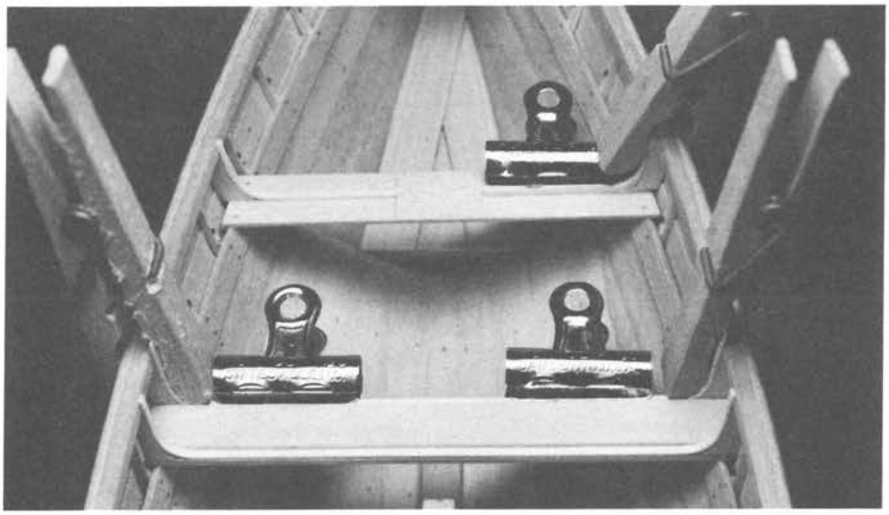


Figure 3-78. Fitting the thwart knees. Those on the mast thwart run from side to side in one piece. Like the frames and stems, these pieces are laminated (two layers). Because the forward edge of the mast thwart must be notched to receive the mast hinge block, the forward knees can be made as two units, thus eliminating the subsequent work of cutting them away at the center.

The Thwart Knees. Like the hull timbers, these are also two-piece laminations. Figures 3-75 and 3-78 show their installation, using clothespins as clamps at the filler pieces, while Bulldog clips hold them in place on the thwarts. The same bending procedures as before apply here: wet the strips before bending and let them dry in place before gluing. The knees at the mast thwart are a little different, and I found it easiest to span the thwart with a single strip, rather than run in knees from both sides and try to butt them at the center line. Another difference here is the "pad" which spans the whole thwart with knees on its forward and after sides. If this is in place before adding the knees, it will act as a guide for the latter operation. The forward edge of the mast thwart is also notched to receive the mast step. This should be done regardless of which sequence you follow in completing the thwart and the mast hinge. The forward thwart knees can still be installed in one piece; just cut out the segment in way of the mast hinge after gluing (a fine-toothed razor saw can do this job neatly).

After the knees are glued in place, the thwart pads should be fitted as shown in Sheet 3. Be careful to get the pads on the correct sides of the thwarts! It will be noticed in the plans that the thwart knees taper in thickness as they approach the center line. This of course must be done prior to adding the pads, but it is not a noticeable feature and can be disregarded with little sacrifice to authenticity.

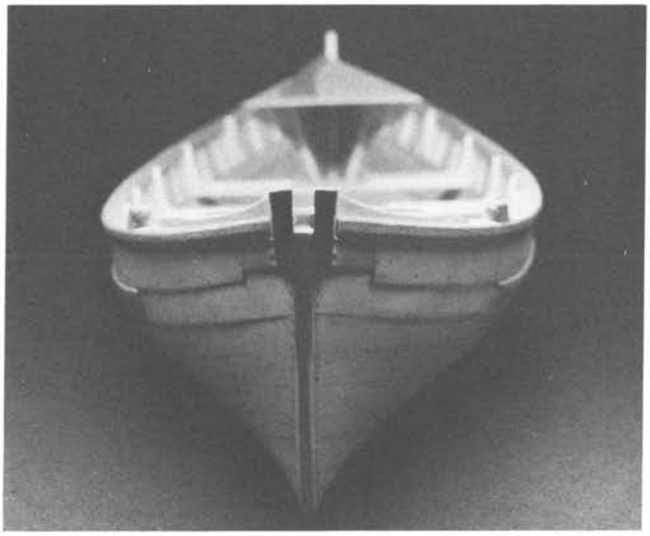
In fastening the knees, bore the pilot holes from the inboard side out. The highest fastenings go through the gunwale, inwale, and thwart knee; the second go through the knee, hull planking, and through, or just below, the rubbing piece. The nails are driven from the outboard side, the heads to lie flush with the outboard side. The rooves are slipped onto the nail shanks, which are then cut and headed over. This will be a noticeable feature on your model, so its inclusion is recommended whether the model is to be fastened and finished natural, or not fastened and painted.

Figure 3-79. The bow, showing the addition of the preventer cleats, bow chocks, and the box. Note the addition of rivets to the forward ends of the cheek pieces where they join the stem post.

Bow Joinerwork. The recessed space between the stem post and the thigh board—called the box—should now be closed in. Its construction is not very substantial, rather rickety in fact in old whaleboats which I have examined. The first piece to fit is the aftermost plank which lies thwartships; this rests on the insides of the gunwale strake laps. It should be so located that the shallow bulkhead which closes the aft side will lap it, while its upper edge is fastened square to the thighboard edge without having to bevel the latter. See the second Longitudinal Section in Sheet 2. Glue this plank in place, then fit and glue the next one. Next fit the single longitudinal plank which underlies and supports the whole structure (its dimensions can be taken from the longitudinal views and the view of Section 1 in Sheet 2). It butts against the inside of the stem post, to which it is supposedly fastened, but I found that by gluing its forward end to the bottom edges of the cheek pieces, a much stronger construction results. The shallow bulkhead may now be fitted and glued; first the two middle planks, then the molding at the bottom, followed by the remaining planks. When dry, bore the holes for the chock pins, using a #70 drill.

The bow chocks are carved from $\frac{1}{8}'' \times \frac{1}{4}''$ basswood, shaping the pieces to follow closely the insides of the cheek pieces and the inwales. Sheets 2 and 3 will show where the chock pin holes are bored (#70 drill). If you are going to rivet the cheek pieces, using the copper nails and rooves (like the thwart knee rivets, this is recommended for all models), these can be plotted from the Hull Planking Profile in Sheet 1.

Abaft the thigh board lie the preventer cleats, which can be made from scrap wood of suitable dimension. Care should be taken to bevel the corners as shown in the plans (Figure 3-79).



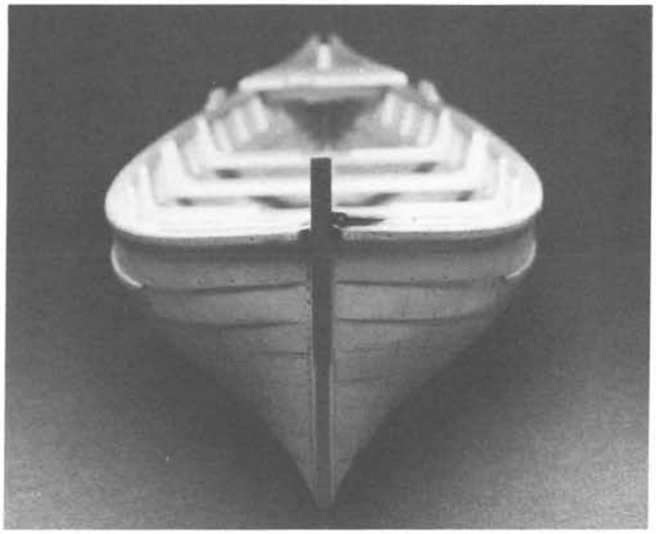


Figure 3-80 (left). End view of the bow, showing the slight flare of the cheek piece-bow chock assembly. Note also the bevels on the stem post.

Figure 3-81 (right). End view of the stern and the joining of the gunwales and lion's tongue to the stern post.

STEM- AND STERN POST BEVELS. This task has been delayed to this point in the strong belief that it can be done better when the hull has been stiffened and easier to hand-hold without fear of breakage. The bevels are shown in detail on Sheet 2; this probably represents a better bevel than fitted on most boats (it was like this on the stem- and stern posts in the Whaling Museum's whaleboat shop exhibit, but the bevels which Delano put into *Lagoda*'s whaleboat stems were by no means as neat). These bevels can be carved either by knife (Xacto with #11 blade) or by chisel, so suit your preference. Generally, such bevels are continuations of the hull contours, so if their angles, and the resultant width of the outboard face of the stem- or stern post, differ a little from the plans, this is nothing to get upset about. However, do not get carried away and bevel the posts to knife edges.

At this point, your model when viewed from the ends will (or should) look very much like Figures 3-80 and 3-81, very pleasing studies in form and symmetry. Having come this far, you have met the most difficult challenges of this project, and what remains is relatively simple—but important to the model's overall appearance.

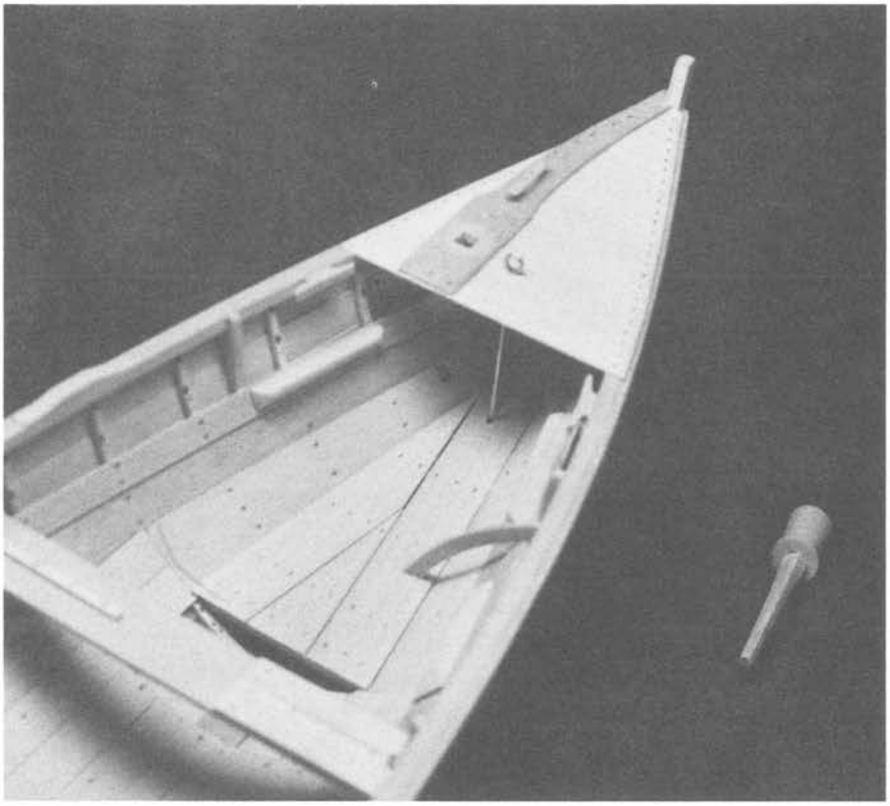


Figure 3-82. Inboard joinerwork at the stern and on the cuddy. The loggerhead (alongside) is ready for installation. Note the hole in the ceiling to receive the loggerhead post.

Details at the Cuddy and Stern Sheets. From scrap you will want to make the standing cleats (on the thwart risers), the foot brace, and three small cleats for the cuddy and inwales. Follow dimensions in Sheet 2.

The loggerhead is a prominent and interesting detail which requires—and will reward—careful fabrication. The head itself is carved from a piece of $\frac{3}{8}$" diameter birch dowel, beginning at the notch. Under a long knife blade (a sharp pen knife will do) roll the dowel back and forth until you have cut to a depth of $\frac{1}{32}$" or so (visual guess). Above this cut, make long shallow cuts to produce the gentle taper of the upper part. The shoulder should be modeled with short steep cuts at 45° angles. In doing this carving, you should be "shaving" off chips in very fine curls. Don't hurry. Only one loggerhead is needed, so do it right. When the taper is carved, it can be gently sanded, across the grain at the shoulder, with the grain along the taper. When smooth, saw off the bottom at an angle close to that in the plans and finish the cut with a file or sanding block. The bottom of the logger-

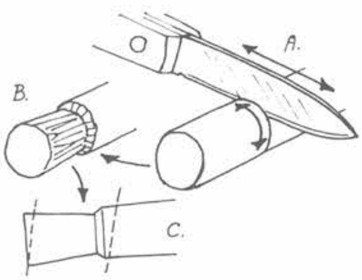


Figure 3-83. Shaping the loggerhead from a birch dowel. The broken lines in C indicate the angle at which the top and bottom are trimmed; the precise angle should be measured from the plans.

head can now be drilled ($^3/_{16}$" drill) for the post, which is tapered from $^3/_{16}$" square basswood strip, then eight-sided (see left margin detail, Sheet 2).

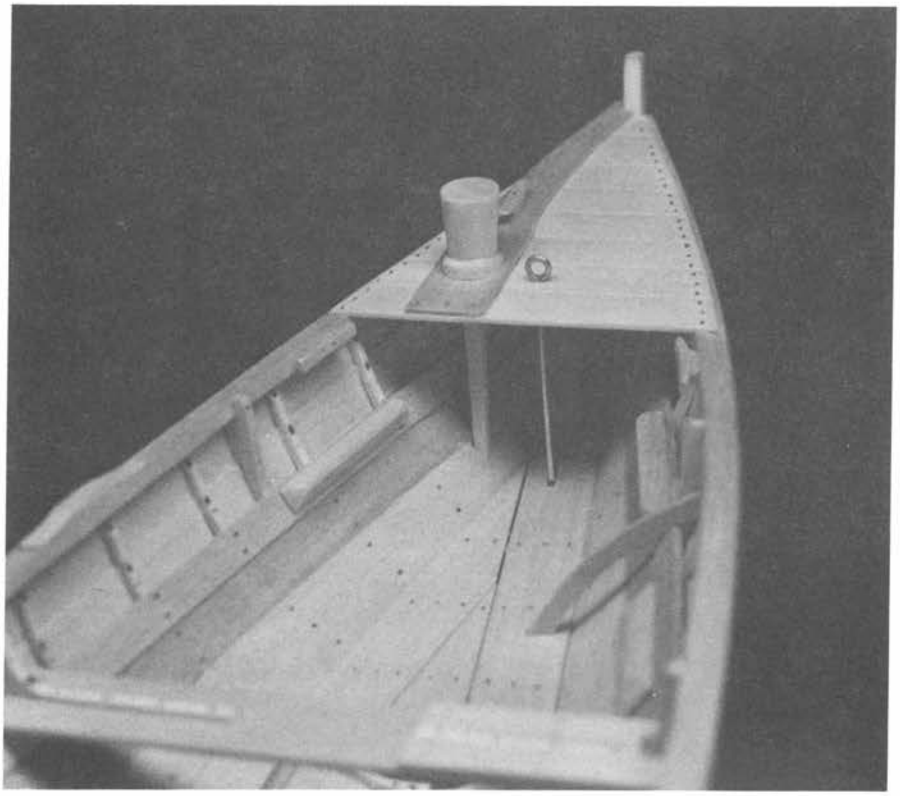


Figure 3-84. A view of the cuddy with the loggerhead installed. Because the lifting straps must pass through the bow and stern sheets, the tapered ends of the longest planks must be slotted to permit the sheets to be removed.

The cuddy and ceiling are bored for the loggerhead first by drilling a $^1/_8$" hole through the lion's tongue, directly down and into the ceiling. Be careful that the drill does not drift and bore out the ceiling where it's not supposed to. Also take care that you don't drill out through the bottom of the hull! The hole in the cuddy can be opened up with a $^3/_{16}$" drill, after which both holes can be "squared" with a needle file. The loggerhead post should stand vertically when fitted, while the loggerhead itself should fit snug atop the lion's tongue (Figures 3-82 through 3-84).

The Lifting Straps. These are shaped from $^3/_{64}$" (.047" ± .005") brass rod or wire. The upper ends are formed into eyes (see end views, Sheet 2) and soldered. The lower ends are tapered so a copper roove can be slipped on and the ends peened over. The trickiest job is to drill for them accurately, starting at the top of the cuddy or thigh board, and boring down through the keel, if you can find a twist drill that is long enough for the job (a commercial $^3/_{64}$" or #56 drill may be too short). If this is not possible, you must then bore the keel (actually the stem- and stern posts) from the bottom and "steer" the drill as accurately as you can so the hole is aligned with the holes in the cuddy and thigh board. If, having done this, you aren't sure of the accuracy, take the wire or rod for the straps, straighten it as well as you can, chuck one end in a pin vise, cut the other end so it has a bit of a burr, then twist this through the upper holes and down through the bottom holes. The burr will ream the latter into alignment. Between this rough-and-ready treatment, and the taper of the lower strap ends, you should be able to get the lifting straps placed accurately.

You will by now have noticed that the lifting straps pass through the bow- and stern sheets en route to the bottom, and these must be drilled and slotted to permit installation and removal. Remove the sheets during the drilling work so you can see what you're doing to the hull bottom. Before you install the lifting straps, return the sheets to their places; then from the bottom, bore up through them with the same drill as before. Now remove the sheets, open the holes a bit with a round needle file, and with a small knife blade make two parallel cuts out to the ends, following the grain of the wood (Figure 3-85). These slots will permit the removal and replacement of the sheets at any time after the installation of the lifting straps.

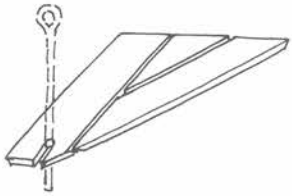


Figure 3-85. Slotting the ends of the bow and stern sheets in way of the lifting strap to permit their removal.

Fitting the Centerboard. The construction set provides a die-cut piece for the centerboard, so only a light sanding and clean-up of the edges will be necessary. The pivot hole should be bored out to $1/16''$ diameter, or slightly more, to avoid a tight fit around the pivot pin. Give the board a light coat of sealer or varnish, depending on your plans for finishing the hull. Centerboards usually went unpainted in whaleboats, though the bottom edges might have been blessed with whatever color was being applied in that vicinity. When dry, the board can be hung by driving a

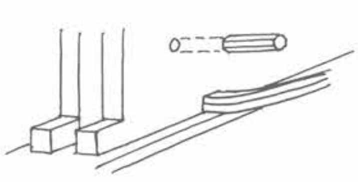


Figure 3-86. The forward end of the centerboard trunk at the keel. The octagonal peg is the centerboard pivot pin, which was driven hard into the pivot holes.

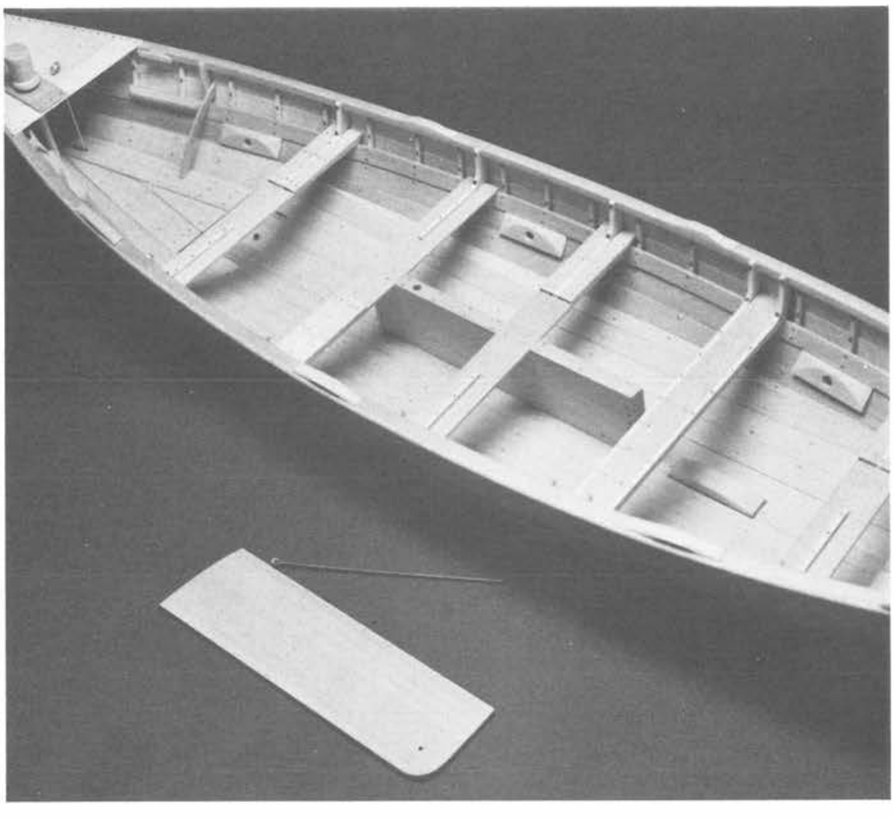


Figure 3-87. Looking inboard, amidships, with the centerboard case finished and the centerboard alongside for hanging. The centerboard lifting strap is not finished until the board is in place. Note the peak cleats below the thwart stringer.

wood pivot pin through it and the case. The pin was usually a piece of oak, whittled to an octagonal section, and driven hard through the case, relying on crushing of the grain and water-swelling for tightness. For a model, bamboo works very well. Like most modelmakers, I had first envisioned this detail in terms of a miniature nut and bolt, but this emphatically is not right! Before driving the pivot pin for keeps, swing the board to make sure it fits inside the case without forcing its confines; then attend to work in the following paragraph. If there is jamming, some sanding and refinishing may be in order.

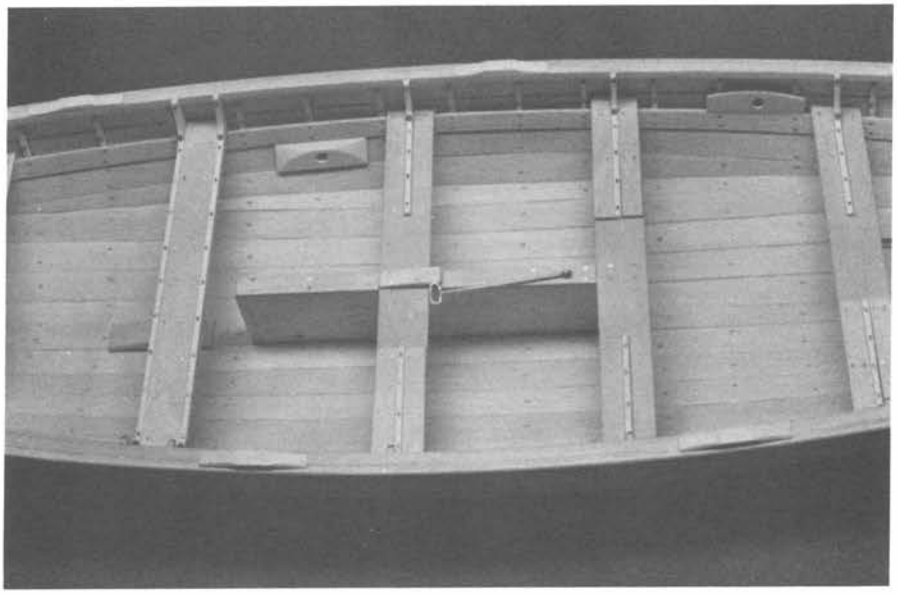


Figure 3-88. With the centerboard hung in its case, the lifting strap handle can be shaped to fit under the cleat on the midship thwart.

Before fitting the lifting strap, the centerboard case should be capped ($1/32''$ or $3/64''$ veneer scrap) and bored for the strap. The top of the centerboard is drilled for the lifting eye, first by pressing it up against the case cap, and marking the edge with a pencil inserted in the lifting strap hole. Now remove the board, center the mark, and bore the pilot hole. The strap is formed from brass or copper wire (.023″ diameter) as furnished; this material may be a bit soft (annealed) but can be tempered by clamping one end of a 6″ piece in a vise, holding the other end with pliers, and stretching it $1/2''$ or so. Form the eye and strap to the dimensions given in Sheet 3, upper left corner, but do not connect them yet. The lifting eye should be set into the upper edge of the centerboard with a firm press-fit. If the pilot hole is too loose, set the eye in glue. The eye should protrude above the centerboard trunk cap just so much that the lifting strap will not bend when it is folded down on top of the trunk. When you are satisfied with this fit, close the lifting strap around the eye and test it to see if the board can be lowered smoothly. If it jams, the eye in the lower end of the strap is probably too large and will have to be closed a bit more. The lifting strap is locked in the raised position by slipping it under a low cleat at the aft side of the midship thwart. This can be patterned from the view of the centerboard trunk, Sheet 2, and the inboard layout view, Sheet

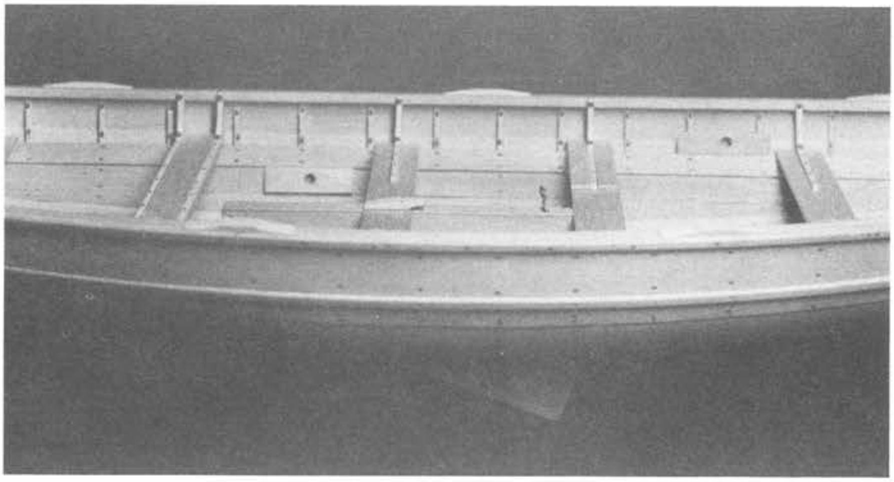


Figure 3-89. In this view, the centerboard is lowered (but not completely), with part of the lifting strap protruding above the top of the case. Note the peak cleat for the tub oar atop the thwart riser at right.

3. Figures 3-87, 3-88, and 3-89 show this assembly process in different stages.

ROWLOCK PADS AND PEAK CLEATS. The rowlock pads are cut from $1/16''$ veneer or stripwood scrap. They are beveled in much the same way as the preventer cleats at the bow; keep the corners of the bevels sharp. The rowlock sockets were metal castings on actual whaleboats, consisting of a tube joined to a top plate set flush with the pad. For modelmaking purposes, the tops of the plates can be simulated with pieces of sheet brass or plate-finish Bristol paper, painted black.

Four of the peak cleats are cut from $1/8'' \times 1/4''$ stripwood. The sides facing the ceiling should be cut so the cleats fit closely while their inboard sides are tilted up to face the inwale of the opposite side. It may have been the builder's intention that these cleats would face the rowlocks so as to be at the best angle to receive the oars when peaked, but that is not always the case. It seems likely that the outboard sides were faced at a certain angle such as seen in Section 3 in Sheet 2, but no attempt was made to adapt each cleat to the slope of its specific position.

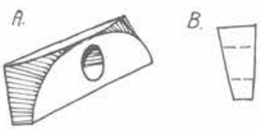


Figure 3-90. Shaping the peak cleats. A, shaded portion indicates the bevel. B is a cross-section at the mid-point of the cleat.

The tub oar peak cleat was set against the frame above the thwart riser in order to give its oar sufficient clearance over the stern line tub. This piece is made from $1/16''$ scrap veneer. Figures 3-88, 3-89, and 3-90 give views of the rowlock pads and peak cleats as fitted on the pilot model.

THE RUDDER, PINTLES, AND GUDGEONS. The rudder is provided as a die-cutting; the tiller can be made from $1/16''$ basswood scrap. The rudder blade is beveled along its lower forward and aft edges, as illustrated in Sheet 3. The tiller is riveted at both ends of the slot for the rudderhead, using copper nails and rooves as supplied. This is a conspicuous feature, particularly if the rudder is shipped and the tiller fitted to it. Bore the rudder for the trip- and tricing lines, then give both parts a coat of sealer or varnish, as preferred.

The rudder hinge, consisting of pintles (at the rudder) and gudgeons (at the stern post), is supplied in the construction set as two pairs of brass stampings (Figure 3-91 and 3-92). It may be necessary to file out the rudder in way of the pintle straps in order to get the strap ends to lie in line with the leading edge. Once done, the rudder can be bored through for the strap holes (#67 drill) and the straps can be riveted, using 20-gauge soft brass wire provided. Doing this is like peening the ends of a copper nail, only you have both ends to head over. Cut the wire ends so they protrude a little less than $\frac{1}{32}$″ above the strap on both sides. With the rudder placed on a flat rigid metal surface, peen one end of the wire so it starts to mushroom, then flip the rudder over and do the same to the other end. Repeat this process several times until the wire ends are headed firmly against the strap. If the wire tends to bend during the peening, cut it down a bit (or cut a new piece of wire) and start over again. The pintles, meaning the pins inserted in the straps, can be soldered in place beforehand or driven in afterwards and seized in place with epoxy or cyanoacrylate glue.

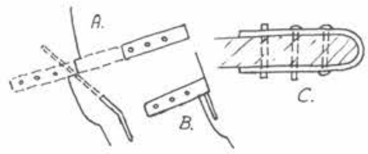


Figure 3-91. Fitting the pintles to the rudder. A, the pintle pin is driven obliquely into the rudder edge and the strap (Model Shipways catalog #931) fitted over it; B, the completed assembly; C, a sectional view of the strap, showing stages of riveting.

The gudgeon straps are simpler to fit, but more awkward to rivet in place, as the hull must be held rather carefully to back the rivets on the anvil. It should be noted that the gudgeon straps do not cross the stern rabbet, so they must be trimmed to leave only one pair of holes for riveting. Note that both pintle and gudgeon straps are *not* recessed into their respective woodwork. The rudder can now be hung for a test fit; given the generous loop of the gudgeon strap, this should not be difficult.

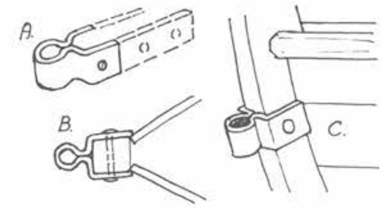


Figure 3-92. Fitting the gudgeons to the stern post. A, the gudgeon strap (Model Shipways catalog #930) is trimmed to fit; B, sectional view shows it riveted to the stern post; C, the completed assembly.

The Mast Hinge. This fitting consists of a wooden yoke to which is fastened a bronze U-shaped hinge strap. The assembly is joined to a pair of straight bronze hinge straps fastened to the mast thwart. The straps are provided as photo-etched brass sheet whose articulating ends must be formed into loops. It is suggested that you form the double loops at the straight straps first, fit them with pieces of brass wire for pins, and solder the pins in place using the U-strap as a spacing guide. The single loops in the ends of the U-strap should then be formed (but not closed yet), slipped around the pins in the straight straps, and crimped shut (Figure 3-93). This assembly should next be positioned at the forward edge of the mast thwart as shown in the detail view in Sheet 3. Be sure that it's centered on the thwart, then pin the straight straps to the thwart temporarily, using lill pins.

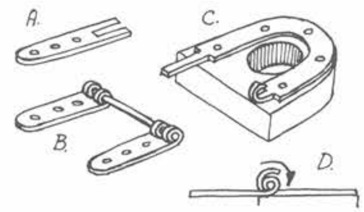


Figure 3-93. Mast hinge assembly. A, one of two thwart straps prior to forming the ends; B, the thwart straps and pin assembled; C, the hinge strap mounted on the wooden hinge yoke and one of its ends partially formed; D, the thwart and hinge straps joined and ready for crimping together.

From the remains of the $\frac{1}{8}$″ plywood matrix of the die-cut molds, cut and bore out the wooden yoke for the mast hinge. It is a good idea to drill out the mast hole first to avoid the risk of tearing out a large sliver of the piece if it were first cut to size, then drilled. Use a round file to get the hole to final dimension and test its size by fitting the dowel for the mast in it. With that done, you can cut the yoke to its outline dimensions and finish it with file and sandpaper.

The yoke should then be positioned under the U-strap at the forward edge of the mast thwart. Be sure it's held firmly in the groove in the thwart edge; now mark the locations of the hinge fastenings by driving a needle through the holes in the hinge into the yoke. Take the yoke away and bore the pilot holes for the copper nails. The brass hinge assembly should now be removed as a unit from the mast thwart, then nailed and peened to the yoke. Finally, the whole hinge assembly can be nailed to the mast thwart with copper nails. Because the situation of the mast thwart prohibits the peening of the nail ends from its underside, the best thing to do is to drive the nails through, cut the ends, leaving $1/8''$ or so extending below the thwart, and bend them over so they cannot work loose (Figure 3-94). If you are assembling these parts before installing the mast thwart, the nails can be conveniently and neatly clinched on an anvil or metal bench block.

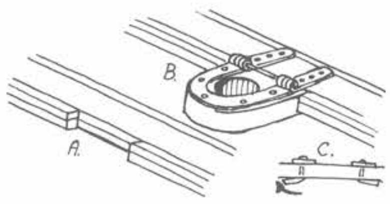


Figure 3-94. Fitting the mast hinge assembly to the mast thwart. A, the forward side of the mast thwart, showing the slot to receive the hinge yoke; B, the hinge assembly joined to the thwart; C, the nails are secured underneath the thwart by spreading them and pressing them against the underside.

THE WHALING GUN BOX (OPTIONAL). If you plan to fit your model with a whaling gun in addition to conventional harpoons and lances, a storage box might be fitted on the starboard side of the ceiling at the bow sheets. Since no information on these boxes is extant from this period, it has been necessary to rely on examples from the late 19th century Arctic fishery, which may not be altogether authentic. For this reason, you may wish to construct the box so it can be removed or replaced if future historical investigations find that mid-19th century whaling gun boxes were different, or were located in another part of the boat.

The box is outlined on the arrangement plan in Sheet 3, and can be made from the scrap material from the hull planking matrix. The top should be just below the top of the ceiling, while the inboard side is plumb. The ends will fit closely against the ceiling. The top is hinged, and leather hinges may have been possible at this early date. An alternative hinge would be a canvas strip running the length of the top, tacked to the box and its lid, and painted.

An alternative to a whaling gun box of this kind is simply to make a rectangular box large enough to hold the whaling gun and a box of bomb lances, fit it with a hinged cover, and stow it in the bottom between the harpooner's and mast thwarts.

MOUNTING THE MODEL. It is a good idea to mount your model on a baseboard, or ready it for hanging from the davits of a section of a whaleship's bulwarks, before you commence the final painting and finishing of the hull. If you are finishing the model in natural wood, with only a minimum of paint work, a baseboard whose color and grain contrast with the hull is your best choice.

The pilot model was mounted on a piece of black walnut, $\frac{3}{4}'' \times 5'' \times 21''$. The edges were beveled 10° from the vertical by making dressing cuts on a circular saw. If you wish to finish the edges with beaded moldings or ogees, this can be done with a router and a wide selection of router bits. I chose a very simple design for my model's baseboard as I did not want it to interfere with the model visually. The severe angular features and planes of the board set off the sweeping curves of the hull in a way that no fancy moldings could. I finished the baseboard with a coat of Formby's tung oil finish, followed by three coats of matte polyurethane varnish, sanding with 220-grit and 320-grit wet-or-dry paper between coats. The final coat was sanded, rubbed down with #000 steel wool, and waxed.

The mounting pedestals can be even more of a visual distraction, and I strongly discourage the use of heavy brass turnings normally provided for this purpose. They are far too heavy and clumsy-looking for this delicate model. I finally decided on brass tubing and rod for hull supports, using $\frac{3}{32}''$ rod and $\frac{1}{8}''$ tubing (the former telescoping within the latter) for the keel and $\frac{1}{16}''$ tubing for the bilges. A $\frac{3}{32}''$ hole was bored $1\frac{1}{2}''$ *abaft* the outside joint between the keel and stem post; a second was bored $1\frac{3}{4}''$ *forward* of the joint between keel and stern post. If you choose different locations for these holes, be certain that they do not interfere with the frames, centerboard trunk, mast step, or bailing well. The hull was centered on the baseboard, and the locations of the holes were transferred from the keel to the board; at these points, $\frac{3}{32}''$ holes were also bored. For me, the model seemed to be at a pleasing height with the bottom of the keel $1\frac{1}{4}''$ above the board, so two pieces of $\frac{1}{8}''$ tubing were cut and dressed to this length. The $\frac{3}{32}''$ rod was then fitted into the holes in the baseboard and marked to protrude $\frac{1}{4}''$ above the $\frac{1}{8}''$ tubing which would slip over it. The rod was removed, cut, and the upper ends of both pieces rounded with files and sandpaper; the finished pieces were once more driven into the board and this time set with glue. The $\frac{1}{8}''$ tubing could then be slipped over the rods to form the "shoulders" which support the keel (Figure 3-95).

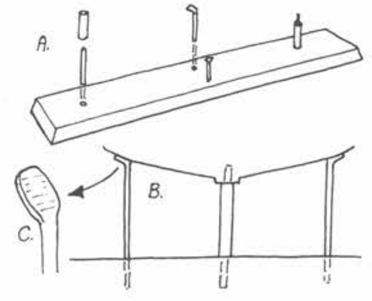


Figure 3-95. Mounting pedestals. A, the keel supports are fabricated from brass rod and tubing; the bilge supports from fine tubing with flattened upper ends; B, end view, showing how the hull is supported by the pedestals; C, the bilge support's upper end is formed by flattening and filing.

Midway between the keel supports, and spaced $2\frac{1}{2}''$ apart, are the bilge supports which are formed from $\frac{1}{16}''$ brass tubing. One end of each support is flattened and bent to form a bracket about $\frac{3}{16}''$ long. The baseboard is bored for these supports which are fitted—by trial and error—so they support the hull on both sides and hold it level. The bilge supports are strictly secondary in their support function, so they should not lift the boat off the shoulders of the keel supports. Having fitted and leveled the model on these supports, I painted them flat black to minimize their visual presence.

This method of mounting is hardly original with me. The Frontispiece shows a very similar mounting for one of the whaleboats in the New Bedford Whaling Museum, and this in turn is based on the supports for the Oseberg and Gokstad Viking ships in the Viking Ship Hall in Oslo, Norway.

The popular alternative mounting—one which is particularly appropriate for painted models—is the bulwarks section with davits, bearers, cranes, and incidental ship's hardware. Sheet 4 has been drawn up to answer specific questions about proportions and details, and I hope that those who do not plan to make this feature will in any case find the information therein of historical interest. Materials for bulwarks, davits, etc. are not part of the construction set, but are available individually from Model Shipways. Ideally, the length of the bulwarks section should be 24", but a 22" length is acceptable to adapt to "standard" stripwood lengths marketed by the hobby industry. Most of the bulwarks can be made from straight lengths of stripwood, but it will be necessary to taper the bulwark stanchions and curve their outboard sides if the section is going to represent the ship's side down to the waterline. If so, shape the stanchions from $\frac{1}{2}''$ square strips.

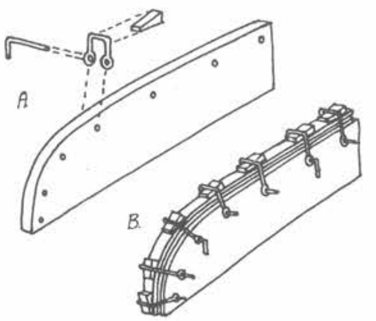


Figure 3-96. A bending trap for whaleboat davits. A, the basic form with examples of the wire clip, lock pin, and wedge used at intervals to hold the davit laminations to the desired shape; B, the trap with a davit in clamp.

The curved davits are the most difficult things to form and should have finished dimensions of $\frac{1}{2}'' \times \frac{1}{2}''$ in cross-section over their whole lengths. I would laminate three strips of basswood over a form cut from $\frac{3}{4}''$ plywood, using the edge of the plywood as the bending surface (Figure 3-96). The basswood strips should be $\frac{1}{2}''$ wide, two pieces $\frac{3}{16}''$ thick and one $\frac{1}{8}''$ thick. Bend and glue them without regard to the saw-cuts of the prototype (these can be scribed in later); once shaped, they should be finished so the glue seams are not visible. The trunnels can be made from round toothpicks or $\frac{1}{16}''$ birch dowels which are driven with glue; wedges will not be necessary.

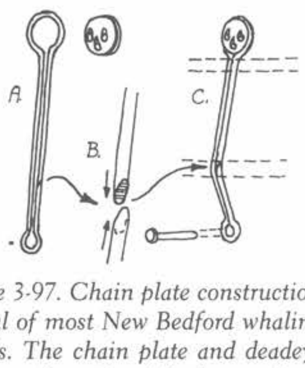


Figure 3-97. Chain plate construction typical of most New Bedford whaling vessels. The chain plate and deadeye strap are of one piece (A) whose ends are joined (soldered) at a place where the channels will hide the joint (B and C).

While the remaining woodwork in the bulwarks section is straightforward joinery, some of the hardware may pose problems in this scale. The chainplates must be formed from $\frac{3}{64}''$ diameter brass wire, and this will require annealing (heating red-hot with a torch) to make the metal soft enough to form around deadeyes and the anchor bolts. A peculiarity of whaleship chainplates is that they were formed from a single length of iron rod whose ends were forge-welded together to form a closed link. For your model, it is advised that the ends be lapped (a scarf joint) and soldered where the joint will be hidden by the lower channels. This will probably have to be done after the deadeyes are in place, in which case there is the problem of heat from the solder joint burning the deadeye if it's wood, or melting it if it's metal. If you do the work quickly, using a low-temperature tin solder, or Tix solder, and if you put some Xacto heat sinks on the chainplate between the deadeye and the solder joint, you should not have problems. The chainplates can be bolted to the hull with brass escutcheon pins, available from any hardware store.

The pintles and gudgeons for the cranes are also a problem. They can be filed to shape from 1/8" square brass rod, if you can get it. Another approach is to form them from brass strip 1/8" wide, doubling the strips over (but not squeezing them flat) to form socket holes for the pintles, which should be soldered into the pintle straps. Using this method, the riveted bolt-ends of these straps are best simulated with miniature washers and escutcheon pins.

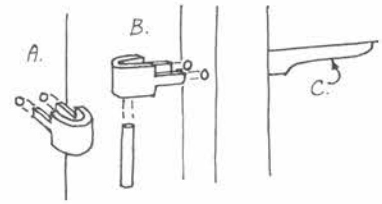


Figure 3-98. Hinges for the whaleboat cranes. The gudgeon (A) can be formed from brass or copper sheet and driven into the bearer post. The pintle is similarly made (B), but a pin is soldered to it. The portion of the pintle strap which extends under the crane arm (C) can be faked with wood or metal.

The davit blocks are not available as pre-shaped fittings in the size required, so the block shells will have to be pieced up from veneers. If you are unable to turn the sheaves on a lathe, workable substitutes can be cut, filed, and drilled from either birch dowel or hardwood veneer. Belaying pins will also have to be turned, or hand-carved and filed from 1/8" diameter dowel stock.

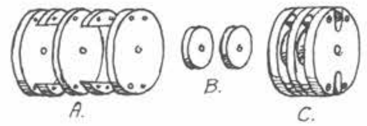


Figure 3-99. The lower block for the davit fall. A, the shell assembly; B, the sheaves; C, the assembled block prior to stropping.

On large whalers, where boats could be carried on the cranes at either of two different levels, the cranes were often not fitted with keel chocks, so the boats could be moved out on them, then tipped inboard for a more secure lashing down during storms. In such cases, the cranes were padded with rope chafe mats or pads of baggywrinkle. The woven mats can be simulated with cloth tapes obtained from a fabrics store; likewise, small pieces of plush fabric, suitably painted a rope color, will serve well as baggywrinkle.

This discussion of a ship's bulwarks can do little more than touch on a few of the features unique to whalers and offer hints for solutions to the more difficult problems. Any questions of a general nature must be answered by consulting ship modeling manuals which deal with the broader aspects of hull construction. Without doubt, the most useful working drawings of a whaleship's hull frame and bulwarks are the plans of ship *Charles W. Morgan* prepared by the shipyard staff at Mystic Seaport Museum. These plans are Serial Number 100-107, and Serial Number 170; other plans are in preparation as part of the ongoing research and restoration work on this ship. All other plans of the *Morgan* are seriously outdated by this material and should be used with caution or not at all.

Finishing the Hull. At this point, all joinerwork in the hull is complete and you can apply the final finish, painted or natural wood, to suit your taste. As mentioned earlier, I finished the pilot model very simply, giving all surfaces a coat of clear sealer, usually soon after each major piece, area, or group of parts was installed. When it came time to varnish the completed hull, I was not satisfied with the appearance of bright basswood every-where, so I decided to paint the gunwale strake black. For me, this was sufficient to take the curse off an almost uniform light wood color, while observing what was practically the only "general rule" about painting whaleboats—that the gunwale strake be black (even this rule was broken!). I also painted the lifting straps and their eyes black, as well as the rowlock socket plates mentioned previously. This done, the entire hull was carefully dusted (I use a vacuum cleaner with a soft brush attachment) and given a spray coat of Krylon matte varnish, inboard and outboard. Krylon also makes a gloss varnish called Kamar which may be preferred by some. The black gunwale strake also received this treatment, much to the betterment of its appearance. The Krylon varnishes are formulated for application over oil- and acrylic-base paints.

For those who are painting their hulls, some general advice on color schemes is in order. Boats newly delivered at wharfside were generally primed white outboard with the gunwale strake and inner works painted a buff color, the exact shade being the choice (and often a trademark) of the builder. In addition to the buff, the ceiling and centerboard trunk were often painted a light gray, sometimes a "powder blue" (very light blue tinged with gray), as preferred by the Beetle shop. New boats were usually delivered pretty bare of metal fittings: just the lifting straps, the gudgeons, and the rowlock socket plates were in place. Mast hinges were often purchased separately, although the mast steps were installed by the builders. The new boat would look like this when first taken on board, and it would be fitted out and painted by the crew en route to the whaling grounds.

During the 1850s, black and dark green seem to have been among the most common colors in whaleboat color schemes; white boats were a minority. A model painted to reflect prevailing tastes of the period can thus be rather dark and dull unless the modelmaker is judicious in his choice of a setting for it. A black boat will look horrible against a dark walnut or mahogany baseboard; likewise, if mounted on a section of a ship's bulwarks which are also an unrelieved black. If you choose such a color, your model should be set off by a light baseboard, such as oak, pine, or maple; if the inboard parts of the boat are painted a yellow ochre with light gray ceiling, the results can be both pleasing and authentic.

Green-hulled boats are a more attractive option, as the green needn't be too dark, and with black gunwales and gunwale strake, and a light blue or white sheer strake, the boat will look downright handsome. Pea green is a good color for the inner works, again with light gray ceiling. A model so painted will also look well against a light baseboard, but in this case, a little staining to give the wood a slightly reddish tint will enhance the contrast; or use cherry with a clear finish.

The popularity of mounting whaleboat models on sections representing a ship's bulwarks and davits certainly offers a lively setting and opportunity for additional color, but this must be tempered by the fact that the boat is the focus of attention and should not have to compete with the mounting. One way to do this is to create a visual contrast in which the boat is the stronger element. If your model is painted black, then by what we see in historic paintings of such boats, they usually are hung on vessels whose topsides are black or black with a white band and painted ports. To keep the boat from merging with the bulwarks and losing its strong visual profile, hang it with the cranes in the upper positions so boat and bulwarks do not overlap. Many whalers had their davits and bearers a light yellow ochre above the rail level, rather than white; in fact, this yellow was the most common color for the bulwarks (inboard), the skids, and the hurricane house.

If you do opt for a white whaleboat, it can be hung from the davits with the cranes in the lower position so the hull overlaps the black topsides, creating a strong contrast. Green boats undoubtedly offer the greatest opportunities for achieving interesting contrasts with bulwarks. During this period, it was common to paint a new whaleship white for her maiden cruise, while many others were painted light gray or tan with the ironwork (davit braces, chainplates, hawse pipe lips, scuppers, etc.) picked out in dull red. Occasionally, these light tones were broken by a broad white band below the planksheer, with its borders accented by narrow red or black stripes. By keeping the colors and tones of the bulwarks on the dull side, while making the boat colors brighter and more contrasty (but not garish!), you can provide a realistic setting for your model without drawing attention away from it. The painting of whaleships and whaleboats, when examined through contemporary paintings and eyewitness accounts, is a far cry from the "black, white, and gray" color schemes of the twilight period which has dominated the brushes of every artist and modelmaker of this century. The 19th century artists who depicted whaleships were not so swayed, and they had highly critical customers—the master and owners of the vessels—to please.

Perhaps the most difficult thing to do—and the easiest way to spoil the visual effect of your model—is to finish it natural, then mount it on a bulwarks section which is also finished that way. I don't recommend it. The purpose of the bulwarks is to provide a more realistic, more believable setting for your model, but that realism is achieved only by painting model and bulwarks the way they might have looked. A whaleboat in natural finish mounted on a finely finished baseboard makes an elegant expression of fine craftsmanship which does not confuse or deceive the viewer. A ship's bulwarks, while picturesque, are not very beautiful and are only made less so—and visually confusing to boot—by being rendered in natural woods of different kinds and colors. I have yet to see such a treatment which does not drown out the poor whaleboat while extolling the maker's efforts as a mere feat of exhibitionism.

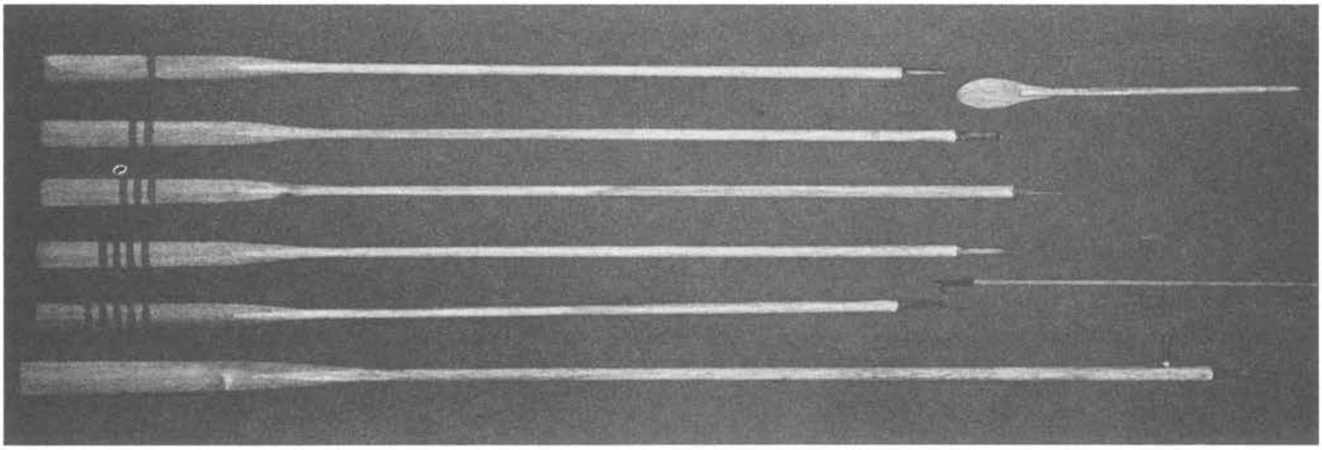


Figure 3-100. The model's five pulling oars, steering oar, and one of six paddles.

Oars and Paddles. The five pulling oars are assembled from $^3/_{16}$" diameter birch dowels and die-cut oar blades from the $^1/_8$" basswood matrix. All five oar blades are alike in dimensions, but the lengths of their looms differ by the dimensions scaled from Sheet 3. The dowels should be tapered to match the loom profiles, then the ends can be cut to wedge forms to fit the deep notches in the blades. Before gluing the blades to the looms, it may be convenient to cut the looms to their finished lengths and carve in the oar grips. Start this by rolling the dowel under a knife blade at the "shoulder" of the grip. Chip away the wood around this groove until a small notch has been formed. Round this groove out with a round needle file until the groove is as deep as the shoulder of the grip. Carefully carve down the grip until it blends smoothly with the shoulder and matches the drawing on Sheet 3.

After the blades have been glued to the looms, they must be blended at the joint and the blades tapered. Note in the section views (Sheet 3) that the blades vary considerably in their cross-sections, going from round at the neck of the loom to diamond-shaped, to a flattened ellipse with squared-off edges. Start with the part marked by the diamond-section and work back from it until the blade blends smoothly with the loom; then work out to the blade-end, gradually developing the gently-rounded flats.

Many modelmakers, whether they build this model from the construction set or from scratch, will want to make the oars from one piece, following historical practice. The procedure may seem more arduous, but is not, and it results in oars with no potentially unsightly glue seams in their blades. Straight-grained wood is necessary for this work. Basswood will suffice, but harder woods like maple, birch, cherry, or even a dark hardwood like walnut, will be more pleasant to work with, and look at. The wood should be wedged and split from a plank, whenever possible, prior to rip-sawing. The strips can be ripped out on a band saw, then planed; this eliminates the dusty and dangerous ritual of sizing stock with a circular saw. This method requires some practice in making allowances for the roughness of a band saw cut.

The planks are shaped by filing and planing (Figure 3-101), which is not too different from the shaping of pieced-up oars. Shape the blades first, as they offer a convenient way to hold the oars while the looms are being tapered and rounded. The looms are formed by the usual squaring, eight-siding, and rounding procedures, followed by careful sanding.

When the oars are shaped and smoothed, they may be stained to give them a more natural, "weathered" appearance; walnut stain works nicely. Because the looms of the two-piece oars are of a harder wood than the blades, they may not take oil-base stain as readily, resulting in a displeasing contrast between the two parts. This can be corrected by applying thinned stain to the blades and one or more heavy coats to the looms. If you are finishing your model with acrylics, then seal the wood with a clear sealer or flat varnish, followed by applications of acrylic paint with a stiff brush that will produce streaks resembling wood grain. Repeated thin applications, changing the color a bit with each coat, can produce very realistic results. If your model is to be finished natural, this method can still be used, only mix small amounts of pigment with varnish or acrylic matte medium and apply thin, transparent coats which will not be too dark or hide the wood grain. When the stained oars are dry, the blades can be marked to identify their place in the boat. Sheet 3 provides ideas for marking patterns.

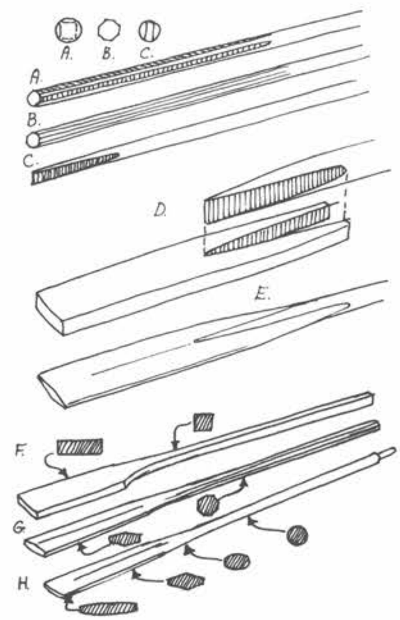


Figure 3-101. Fabrication of oars. The looms are tapered from birch dowel, first by squaring and tapering the dowel (A), then eight-siding it (B), and finally smoothing the taper and flatting the end to receive the blade (C). The blade is next joined and glued (D), then smoothed and finished (E). Oars can be shaped from single pieces of hardwood by first sawing them to their outlines (F), beveling the blades and eight-siding the looms (G), and finally rounding and smoothing (H).

The paddles are authentically assembled from two components: $1/8''$ dowels and die-cut blades from the $1/32''$ (or $3/64''$) matrix. The looms are tapered slightly at both ends, but no grips are necessary. The looms are slotted at one end to fit around the blades as seen in Sheet 3. After gluing, the paddles can be smoothed and finished to suit your finishing methods. In many whaleboats, paddles were painted (gray seems to be the most common color), but this may be decided by the modelmaker on the basis of how noticeable these pieces should be. Painting them will make them less noticeable; staining or varnish will draw attention to them.

The steering oar is like the pulling oars, only the blade is larger and the loom is shaped from a $7/32''$ dowel. Follow the same procedures for assembly, shaping, and finish. The steering oar handle is shaped from $1/16''$ dowel and fitted to the loom as measured from the plans. Generally, there is no mark or insignia on this oar, although a few were marked with the initials WB for waist boat. SB for starboard boat, etc.

The Steering Oar Brace. This metal contrivance consists of a brass bracket made from 1/8″ wide strip with a double wire bracket soldered to its underside (Figure 3-102). The pin-end of the brace is driven into a hole in the stern post and peened over a roove on the opposite side. The wire brackets have eyes formed at their ends and these are fastened to the gunwale and stern post with copper nails. The assembly is painted a dull black. The steering oar brace, and the head of the stern post, are lined with a chafe mat to prevent galling of the steering oar loom. With care, and a lot of guidance from the *Ashley Book of Knots*, it is possible to execute this fancy ropework in miniature. It's far easier, however, to snip a bit of shoe lacing, seize it in place, and paint it a dark rope color.

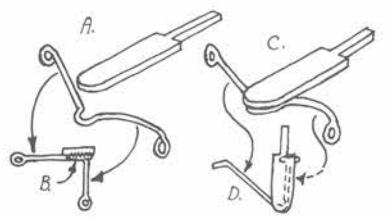


Figure 3-102. Fabrication of the steering oar brace. A, the bracket is soldered to the wire struts (B); C, the completed assembly in perspective; D, a top view.

The Rowlocks and Tub Oar Crotch. Five rowlocks are assembled by bending and soldering the photo-etched rowlock horns to their pivot pins (Figure 3-103). Follow the drawings in Sheet 3 for scale dimensions and form. Whaleboat rowlocks were padded to reduce noise, and the easiest way to do this is to cover the horns with a serving of fine thread. Other types of padding included spunyarn mats and leather liners; these are difficult to replicate in miniature.

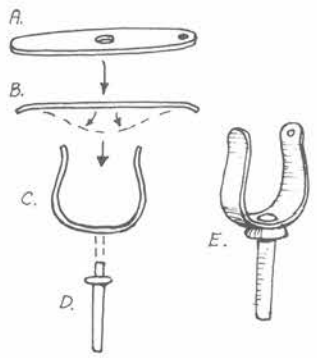


Figure 3-103. Rowlock fabrication. A photo-etched plate (A) is formed to make the rowlock horns (B and C), which are soldered or riveted to the pin (D). E, completed assembly. The hole at the end of one horn is for a lanyard.

The tub oar crotch replaces the rowlock at the tub oar thwart when it is necessary to peak its oar (Figure 3-104). This is to provide clearance for the stern tub. Both the peak cleat and the tub oar crotch raise their parts of the oar by a similar height, so the angle of the peaked oar is similar to that of the other oars (Figure 3-144). The wooden crotch can be made from scrap from the 1/8″ die-cuttings. Its bottom end is bored and the head of a 1/2″ belaying pin is inserted and set with glue; the shank of the pin becomes the pivot pin of the crotch.

The rowlocks have holes at the tip of one horn for the safety lanyards, whose other ends are tied through holes in the thwart riser. The tub oar crotch is secured by a safety lanyard by boring a small hole in one bottom corner to which the lanyard is tied.

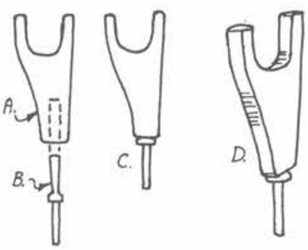


Figure 3-104. The tub oar crotch. The carved wooden crotch (A) is bored and a belaying pin (B, Model Shipways catalog #411) is fitted. Views C and D show the assembly in side view and perspective.

The tub oar lock, a more modern version of the wooden tub oar crotch, will be seen in Sheet 3. This can be scratch-built by anyone who wishes to have a model representative of the late 1860s and early 1870s. To my knowledge, no evidence of earlier use of this all-metal fitting has appeared, but that situation could change.

The Compass and Compass Box. Whaleboat compasses from this period most likely had wooden bowls with dry cards; i.e., the compass needle fixed to a heavy paper disc with a compass rose printed on it. The inside of the bowl was whitewashed, the pivot needle and card fitted, then the bowl was glazed and puttied. A very fine whaleboat compass at the New Bedford Whaling Museum has red lead glazing putty, and the outside of the bowl is painted a deep green. The bowl was hung on gimbals: two brass rings, the inner holding the compass bowl, the outer fitted with two-way pivots, one pair of which is simply a pair of short nails driven into the compass box sides. This can be a wonderful turning exercise for someone who has a small lathe and enjoys a challenge of this sort. Others may be content to use the white metal casting furnished by Model Shipways and let it go at that. The casting represents a glazed bowl, so after painting the recessed top white, mark a compass rose with a few light pencil or pen-and-ink strokes, then apply a drop of acrylic gloss varnish (or regular varnish, for that matter) and let dry. The rest of the compass bowl and its gimbals can be painted as I have described.

The compass box in the plans has dovetailed corners, but these are of the simple hand-cut variety, not the intricate toothy meshings of later machine dovetail joints. If even the simplified version disinterests you, the box can be simply and authentically assembled with lapped corners; if painted (dark green or brown), it will not matter. The box was hung on glides under either the cuddy or the stroke oar thwart. Sometimes there were glides in both places, so the box could be mounted where it would be easiest to see or stowed in the safest place.

Fitting the glides for the compass provides the only real need for trickery in this phase of construction. Of course, they could be fitted to the underside of the stroke oar thwart before it is glued to the risers, but the glides under the cuddy would be troublesome at any stage of construction. Fortunately, a very simple gimmick can do away with the difficulties. After the glides have been fabricated (by gluing two strips of wood together, or by milling), they are spot-glued to a pallet (scrap basswood sheet) and allowed to set. The joining surfaces of the glides are given coats of glue and pressed in place either under the thwart or under the cuddy. When dry, the pallet is broken away by gently pressing down on its end and the glides are ready to receive the compass box (Figure 3-105). Remember that spot-gluing requires very tiny amounts of glue in only one or two places.

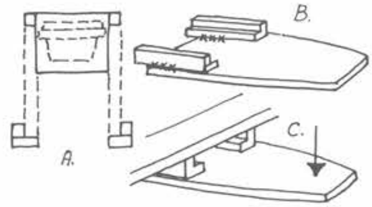
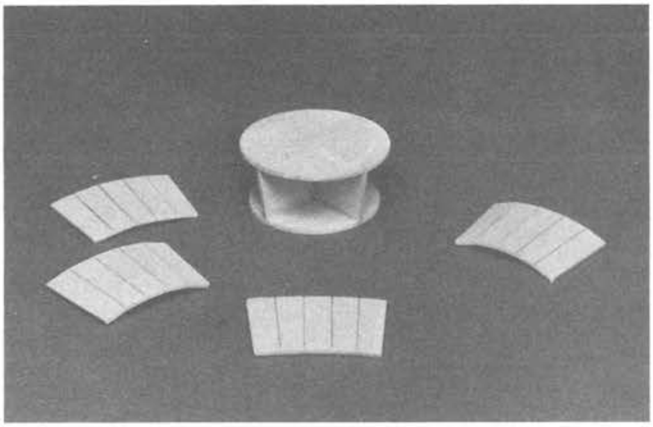


Figure 3-105. Installing the glides for the compass box. A, the spacing of the glides is determined by the width of the compass box; B, the glides are spot-glued (x-marks) to a wooden pallet made from scrap; C, after the glides are glued in place, and the glue has set, the pallet is broken away by pushing it down at the end (arrow).

Cooperage. This term includes all staved and hooped items: line tubs, buckets, lantern and water kegs, and drogue. The construction set furnishes die-cut parts in $1/16''$ basswood sheet and Kraft board for their fabrication. All items are assembled on the same principle, i.e., application of a group of staves to a mold sandwiched between discs comprising the top (usually a false top, or plug) and bottom (Figure 3-106). The cross-pieces of the molds are first assembled and glued; then the tops and bottoms are



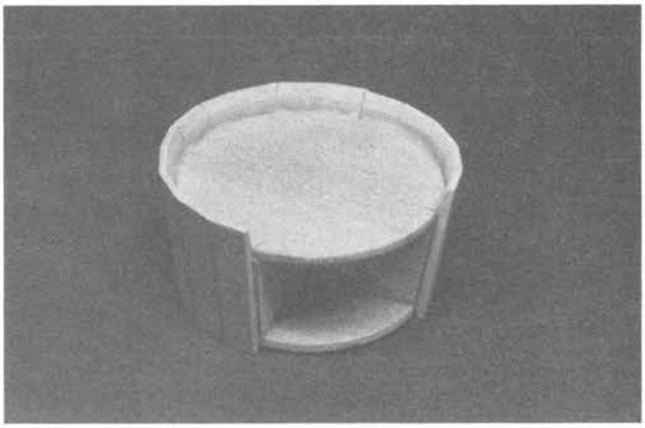


Figure 3-106 (left). Basic construction of coopered items (a line tub, in this case). The bottom and the top (sometimes the top is a plug, to be removed later) are joined to two crossing molds. The staving is glued to this construction in quarters which should first be wetted and preformed.

Figure 3-107 (right). The line tub with three quarters of the staving in place. Note how the sides of the staving pieces coincide with the edges of the molds for gluing purposes.

glued to them. All mold parts (the cross-pieces) are die-cut from Kraft board; all staving, bottom discs, and top discs which are permanent parts are cut from basswood veneer. The top plugs of the drogue, bucket, and piggin are of Kraft board, and must be removed with the molds after their staving is assembled. The top plugs of the line tubs are also of Kraft board, but they should be left in place and a few layers of "fake" coiling glued over them for effect.

The staving pieces each cover a quarter of the side of the item in question. Coverage is only approximate; when three quarters have been fitted, you may find it necessary to cut away all or part of one stave in order to get the last quarter to fit. This is perfectly acceptable as the actual cooperage on board a whaleship was not composed of perfectly alike and symmetrical staving. It may be useful to trim down each quarter so its edges will rest on the edges of the molds (Figure 3-107).

To fit each quarter of staving to a mold, the outside *only* should be brushed down with water. This causes the outside grain to swell and the piece will curl into a shape conforming to the molds. You may need to help it by flexing the staves at their seams. Once all the staves are on, the seams will show as rather unsightly gaps; these can be filled with glue or wood filler, but first the sides should be smoothed down so none of the staves show any flat surfaces. Next smooth the tops and insides of the rims, rounding these edges carefully. The bottom edges should be filed and sanded so each piece will sit neatly on a flat surface.

The three pieces with open tops—the bucket, piggin, and drogue—must be staved so their molds can be pulled out following assembly. This means that the staving quarters can be glued only to their own edges and to the bottom disc. The cross-pieces and top plug can be securely glued to each other, but only lightly spot-glued to the bottom. Rubbing a little beeswax or paraffin on the side edges of the cross-pieces and the edges of the top discs will prevent glue from getting too firmly stuck to them.

Staving the smallest items, such as buckets and the drogue, are more difficult than the larger pieces because the quarters will not bend as freely or want to remain in place. You may have to cut the staves apart, bevel the edges, and glue them in place individually. This is particularly true of the drogue, whose 1/8″ thick sides do not bend well, and whose stave seams are excessively wide if the staves are not individually fitted to each other.

One of the staving quarters of the piggin must be further modified by removing a stave and substituting a handle as shown in Sheet 3. The bucket staving quarters all have ears for the rope handles, but two of these must be cut off (see also Sheet 3).

As noted in Sheet 1-B, the molds for the lantern keg have been revised to make it smaller and easier to stow under the cuddy. Cut these down to the broken lines (the discs for the top and bottom are the correct sizes). The staving quarters are those also used for the larger size keg, but they can be adapted by cutting away one of the staves in each quarter.

When all pieces are staved and smoothly finished, they may be hooped, using either metal (.005″ sheet copper is recommended) or strips of Bristol paper. The copper hoops can be glued on with contact cement, but the lapping ends should be drilled and fastened with copper nails. Paper hoops can be very satisfactory if carefully painted; a good grade of Bristol paper is very durable and will not disintegrate with age.

Finish the water and lantern kegs while adding the small details to their tops. The drogue should be bored out for the bridles using a #60 drill. The ears of the bucket should be bored for rope handles and the sides of the line tubs drilled for the beckets. Before adding ropework, all pieces of cooperage should be sealed and finished. For natural finished models, a light stain is recommended; for painted models, the line tubs and kegs can be dark natural wood (walnut), gray, or green with black hoops. The drogue, bucket, and piggin will be dark natural wood with black hoops in any case.

The Mast and Sprit Pole. From dowels or square strips, these spars can be easily shaped by tapering four sides, followed by eight-siding and rounding the flats (Figure 3-108). The sprit pole has shoulders at both ends, the pole-end for the head of the sail being a bit longer. There is no shoulder cut into the mast head for the shrouds, but two shoulder cleats are fitted to support the shroud-eyes at the splices. Just above the shoulders, and fitted at a right angle, is a wooden pin whose ends prevent the shroud eye from accidentally slipping off the mast when lowered. A wooden cleat is fitted for seizing the tack of the spritsail and a metal staple for the throat cringle. It is advisable not to fit the tack cleat until the mast hoops are made and fitted.

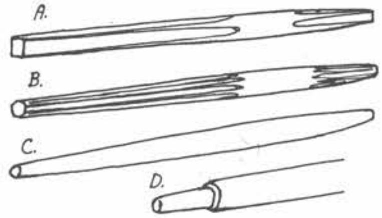


Figure 3-108. Procedure for tapering the mast and sprit pole. A, the ends are tapered and squared; B, the ends are eight-sided, and C, rounded and smoothed. The ends of the sprit pole must also have shoulders (D).

The foot of the mast has a rather quick taper for seating in the hole of the mast step (as yet not bored). Once the taper is worked out, the mast should be slipped into the hinge and its heel set atop the mast step. When you have decided that it rakes aft (2-3°) and stands vertically athwartships, mark the mast step exactly where the heel rests on it. Remove the mast, and bore a shallow ($\frac{3}{32}$" deep) hole of sufficient diameter so the heel will sit snugly in it.

Whether you make sails for your model or not, mast hoops are usually a permanent feature of the mast and so should be present. Only four are needed. The hoops for the pilot model were made by hammering soft 20-gauge copper wire to a flat strip of about $\frac{1}{32}$" thickness (or a little less). The strip was then wrapped around a dowel of somewhat smaller diameter than that desired for the inside of the hoops (the hammering will temper the wire so it is a bit springy and will not form tightly around the dowel). Pieces are cut with the ends overlapping about $\frac{1}{3}$ of the circumference. After aligning the lapping ends, solder them. The laps should be tapered by filing so they blend with the other part of the hoop, the whole of which can be sanded lightly to provide a "tooth" for paint. I painted the model's hoops with three coats of acrylic paint, the first coat being a light tan, followed by a dark brown mixed with matte medium, and finally a coat of matte medium only. The second coat was applied with a stiff-bristle brush to give a streaked effect which looks like wood grain.

Before sliding on the hoops, stain the mast a bit (to take the curse off the bright birch dowel); a light walnut color makes a pleasing effect. If your model is painted and weathered, then both spars should be quite dark, the result of weather action on linseed oil and/or tallow. After the hoops are on, add the wooden cleat for the spritsail tack and blend it with the rest of the spar with stain.

THE SAIL. The single spritsail (no jib) is outlined to half model scale on Sheet 4. Your decision on material for your model's sail (if you *want* your model to have a sail) will depend on whether you want it furled or set, realistically treated or given a more meticulously sewn "formal" presentation, and on your personal feelings on how a model's sail should look. There are several options.

To begin with, if your model is receiving a "realistic" finish, i.e., painted and perhaps weathered with no pretensions to a fancy finish, consider using Silkspan or one of the Japanese rice papers (available in art supply stores) if the sail is going to be furled. Furling a spritsail on a whaleboat involved dousing the peak to form a triangular, or leg o' mutton profile, then wrapping the sail around the mast, followed by wrapping the mainsheet over the sail in a spiral running the length of the luff. This effectively hides any fine details, and if the paper is painted a dirty tan color, it can look very much like the real thing. Middle weight Silkspan furls well and achieves good scale appearance of furled lightweight sail duck. It is a good idea to glue a bolt rope on all sides so the sail can be seized to the mast and hoops securely. The seams (selvedges and tablings) are optional—draw them in with a 3H pencil. After the sail is bent to the mast, place the sprit next to the latter, then drop the peak and wrap the sail around mast and sprit. Follow this by wrapping the main sheet (previously seized to the clew) around the sail in a spiral and secure the end with a few hitches. The sail can now be painted with a mixture of acrylic burnt or raw umber and acrylic matte medium, being careful not to get the sail too dark. This technique produces interesting highlights and shadows, which can be enhanced with little touches of "tar" color (black and burnt umber) here and there, but do not overdo this. The resulting sail will be very stiff and unresponsive to further modifications, but when finished carefully, will look very cloth-like on your model.

Cloth sails are much more work and very demanding of deft needlework, whether sewn by hand or machine. The cloth provided in the construction set is acceptable for a model to this scale, but the best material by far is unbleached Egyptian cotton sail cloth of fine weight, such as is (or was) used for yacht spinnakers. This is the stuff that sailmakers (not yard-goods salesmen) call "balloon cloth" ("balloon" is an old name for spinnakers and large light-weather jibs) and it is now virtually out of production, but some remnants may still be lurking on the shelves of old sail lofts. If you can find such treasure, you are lucky indeed. But if you do, don't ruin it by bleaching it to make it white; the tan "ecru" color is absolutely authentic and the material has more than twice the life span (and strength) of cotton that has been bleached, sized, dyed, or whatever else they do to the poor stuff these days.

Having selected the sailcloth, you must next decide how you want to show the seams and stitching. Many very good-looking sails have been made with the selvedges ruled in as double pencil lines, as this gives the suggestion of a seam without the bulk of folds, which then must be stitched, often resulting in an even bulkier appearance. Folded and stitched seams must be no more than 1/8" wide for correctly scaled dimensions, and there is *no* margin for error when running machine stitches along the seam edges.

If you opt for pencil-ruled seams, your layout procedure will be to scribe the sail outline (twice the plan dimensions) on the material, and on both sides to scribe double pencil lines (spaced 1/8"), starting at the leech (the aft side of the sail). The first pair of seam lines is about 1/2" from the leech, the remaining seams spaced 1" apart, all seams lying parallel to the leech (see Sheet

4). With the seams ruled, you can now measure and rule off the folds for the tablings. This procedure will be described following a discussion of sewn seams.

If you choose to make the seams by folding and stitching them (technically, these are bight seams), then you must make them prior to drawing the sail outline on the cloth. I recommend making a cardboard pattern of the sail in full size for the model (twice the plan size), to be used for reference and visualizing the final dimensions. Figure 3-110 shows why. Every $1/8''$ wide seam shortens the cloth by $1/4''$ (if you work accurately), so after nine seams, the piece of cloth is $2\frac{1}{4}''$ shorter than when you started, so any premarked sail outline would be deceptive. With the cardboard outline to lay over the seams, you can tell when you have made enough to cover the sail.

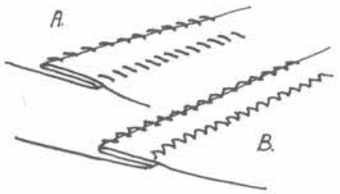


Figure 3-109. A bight seam in a sail, showing the difference between a hand-stitched seam (A) and machine stitching with a small zig-zag pattern (B).

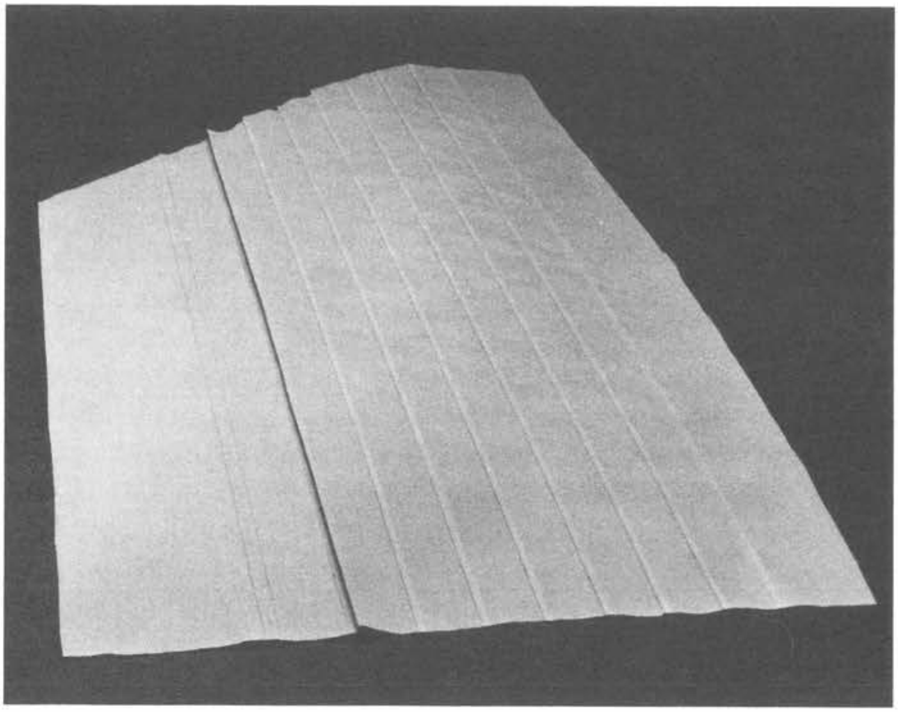


Figure 3-110. The whaleboat model's sail being folded for bight seams. Note the double ruled lines at left.

Begin folding the seams at the one nearest the leech. First you must rule two lines $1/4''$ apart; these are guide lines. The aftermost line is first folded—simply double the cloth over and crease it along the line (Figure 3-111). Lay the cloth out flat again, then make the second fold by placing the creased edge along the second line and pressing it down with your fingers (Figure 3-112). Into the second fold, run a thin ribbon of glue with a syringe-type applicator or glue gun, then press down until this part of the seam lies flat. You may find that pressing the seam under a plastic ruler or straightedge does a better job; just wash off any glue that's oozed up through the cloth onto the plastic. Turn the sail over and repeat the gluing process with the other side of the fold. If you decide that you can cope with the tedium of this process, mark and rule off the remaining guide lines with a space of 1" between each pair.

Having folded the seams, you must now sew them, and a sewing machine is the quickest way to do this. Use a fine cotton or cotton/polyester thread whose color matches the cloth. A fine needle is also essential. It's a good idea to make practice runs on extra material that's been folded like your sail, as it takes some time to get used to guiding a machine stitch on *both* sides of a 1/8" wide seam. I found that a tight zig-zag pattern breaks up the monotony of a straight row of stitches and looks more like the spiral stitch used by sailmakers. The setting is a very small one, and do not be tempted to straddle the full width of the seam with a single zig-zag stitch! After practice, I found I could get the stitch to straddle a crease, making the "spiral stitch" illusion even more effective (Figure 3-113).

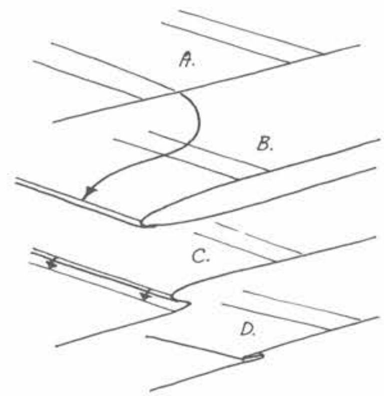


Figure 3-111. Folding procedure for making bight seams. A, double-ruled lines, 1/4" apart, are at 1" intervals; B, a fold is made along one line; C, the second fold is made by bringing the first fold to the second line; D, the two folds are pressed flat (under finger pressure) and held in place with a thin ribbon of glue inside the folds.

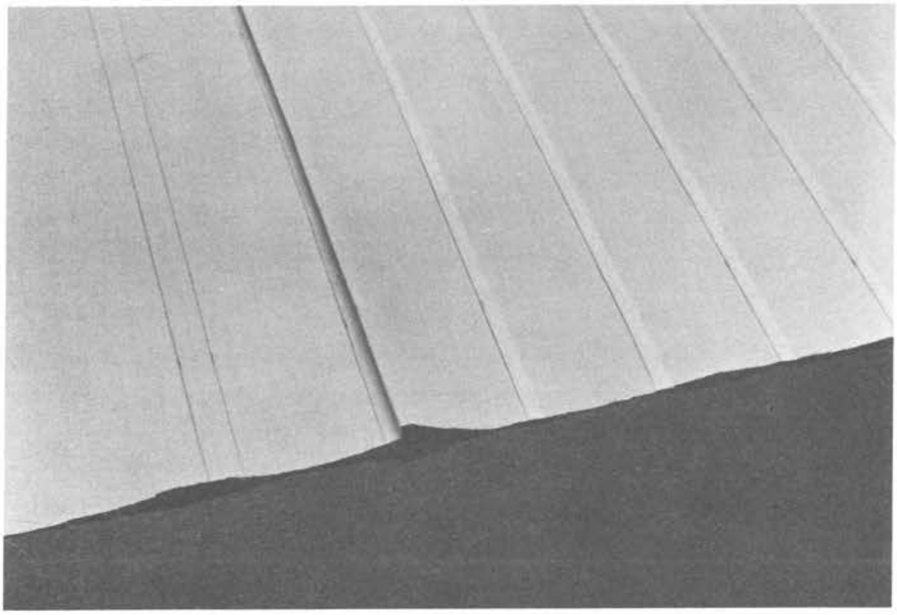


Figure 3-112. Detail of the bight seam folds. The previously-folded seams have been glued.

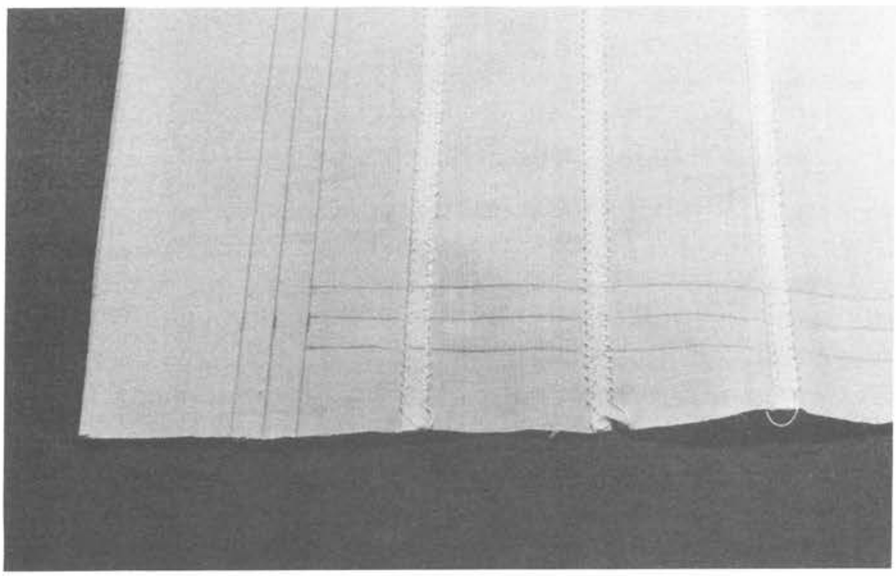


Figure 3-113. The seams are machine-sewn with a very tight zig-zag stitch pattern.

When all the bight seams are sewn, the outline of the sail can be marked, taking care that the leech is 1/2" from, and parallel to, the aftermost seam. If you made the cardboard pattern, as

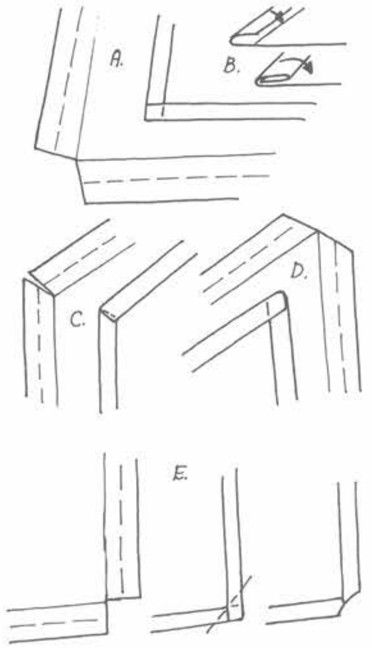


Figure 3-114. The tablings (hems). Folding procedure (B) is used and all folds are on the port side of the sail. Note how the folds overlap at the tack (A), the throat (C), the peak (D), and the clew (E). The clew corner is cut away to receive the grommet and thimble for the cringle to which the sheet is spliced.

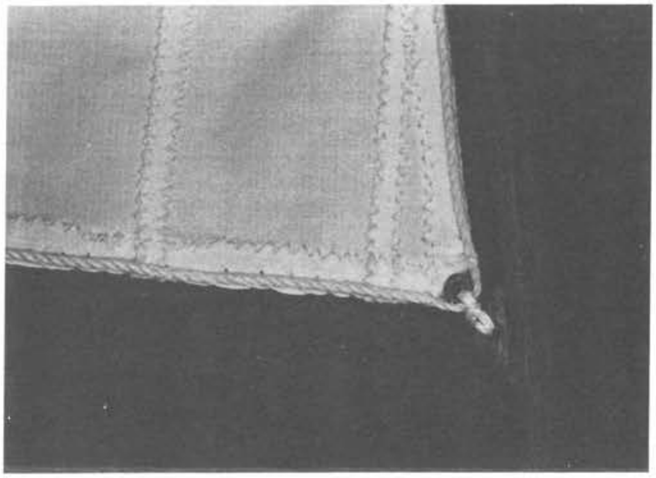
suggested earlier, you can use it to trace the sail's outline on the cloth. When the sail outline has been ruled, the folds of the tablings (the hems) can be marked outside the margins. These are two parallel lines, spaced $^3/_{16}$" apart on all four sides of the sail (Figures 3-113 and 3-114). At this point, a sail with pencil-ruled seams is finished the same way as a sail with sewn bight seams. The only noticeable difference is that when sewing the tablings of the latter, care must be taken to keep the sewing machine stitch from "drifting" as the presser foot travels over the folds.

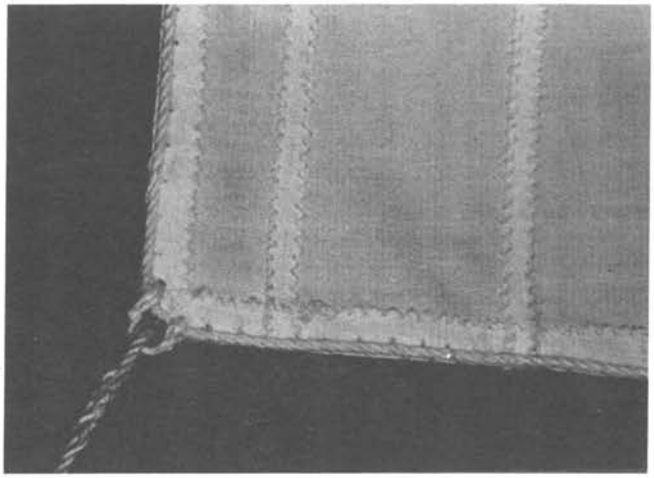
The tabling is cut carefully along the outside line, and the first fold is made on the port side of the sail (see Sheet 4). While you can make this fold by creasing the cloth in your fingers, it is usually a good idea to put this fold under uniform pressure by laying a wood batten or flat plastic ruler over it and pressing down firmly along the length of the tabling. When a straight sharp crease has been formed, a thin bead of glue can be applied along the inside, followed by a second pressing. When you have folded a seam on one side and understand how the process works, cut the tabling corners (Figure 3-114) before continuing with the folds.

When the first fold has been made on all four sides, proceed with the second fold, which is also on the port side (Figure 3-114). This will be a little easier than the first fold, as the glue in the seam has made the edge of the material stiffer and easier to crease. This fold should likewise be glued along its inside, then pressed flat with a batten as described earlier. The tablings will lap at the corners; the lapping pattern can be seen in the sail plan on Sheet 4.

The tabling is sewn with a single line of stitches along the inside seam. Again, a slight zig-zag setting will improve appearance, and if you can get the stitch to straddle the seam, so much the better. See Figure 3-109 and 3-115 through 3-118.

The bolt rope is sewn on the starboard side of the sail, in contradiction to a widely adopted sailmaker's rule which requires bolt ropes to be sewn on the port side of a fore-and-aft sail. Hand stitching is the only way to do this job, but driving a needle through three layers of tightly-woven cloth, which has been glued, is not much fun. I have eased this problem with my sails by running a row of blank stitches (no thread in the bobbin) along the tablings, using a heavier needle. This leaves a row of evenly spaced holes which make hand-sewing much easier, and the stitches much more even. There is no zig-zag pattern and the stitches should be spaced at least $^1/_8$"-$^5/_{32}$" apart. When stitching the bolt rope, be sure the needle goes through some of the yarns of the thread, and does not simply go into the lay and around them. The bolt rope goes all around the perimeter of the





sail, with the ends spliced together along the luff, usually below the throat cringle. This detail can be faked with some careful seizings if you are not up to the task of making a miniature short splice (or more correctly, a sailmaker's splice, which you can find in *The Ashley Book of Knots*).

Figure 3-115 (left). The model's sail, showing the tack, its cringle, and bolt rope.

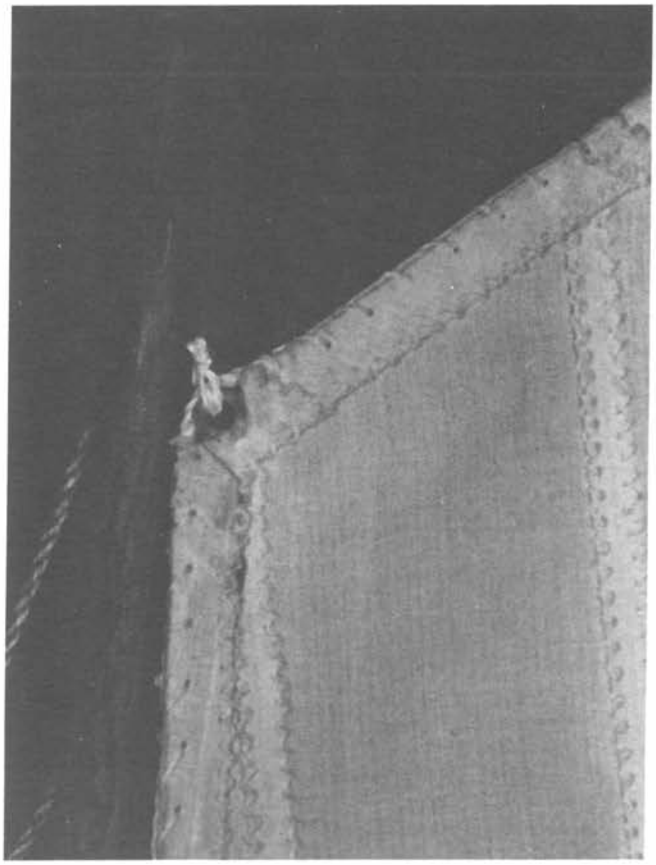
Figure 3-116 (right). The clew, its cringle, and the bolt rope. Note the grommet and thimble for the main sheet.

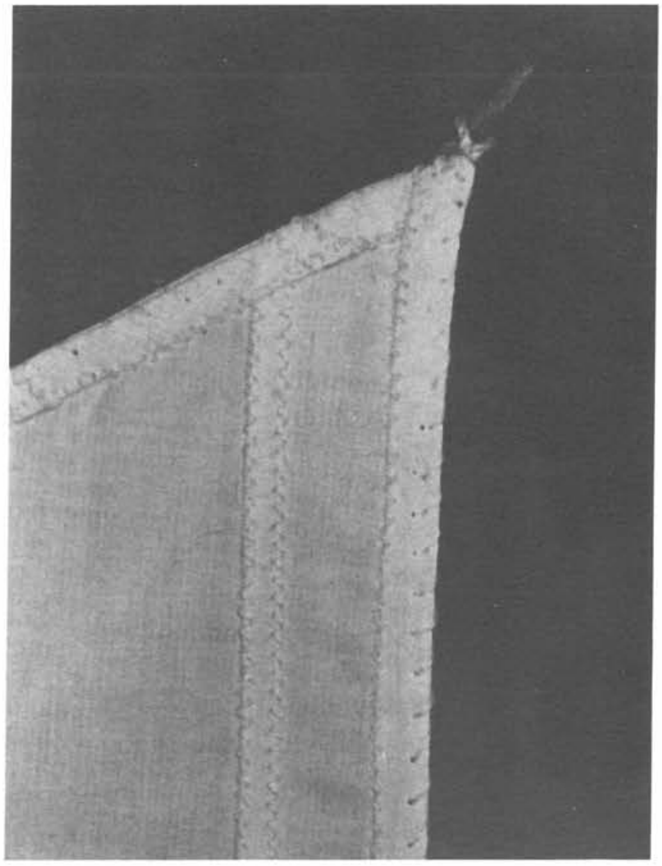
The corner reinforcements, or patches, are small pieces which can be glued in place and stitched in afterwards. On sails with pencil-ruled seams, the patches can be simulated in the same way. They lie only on the port side of the sail.

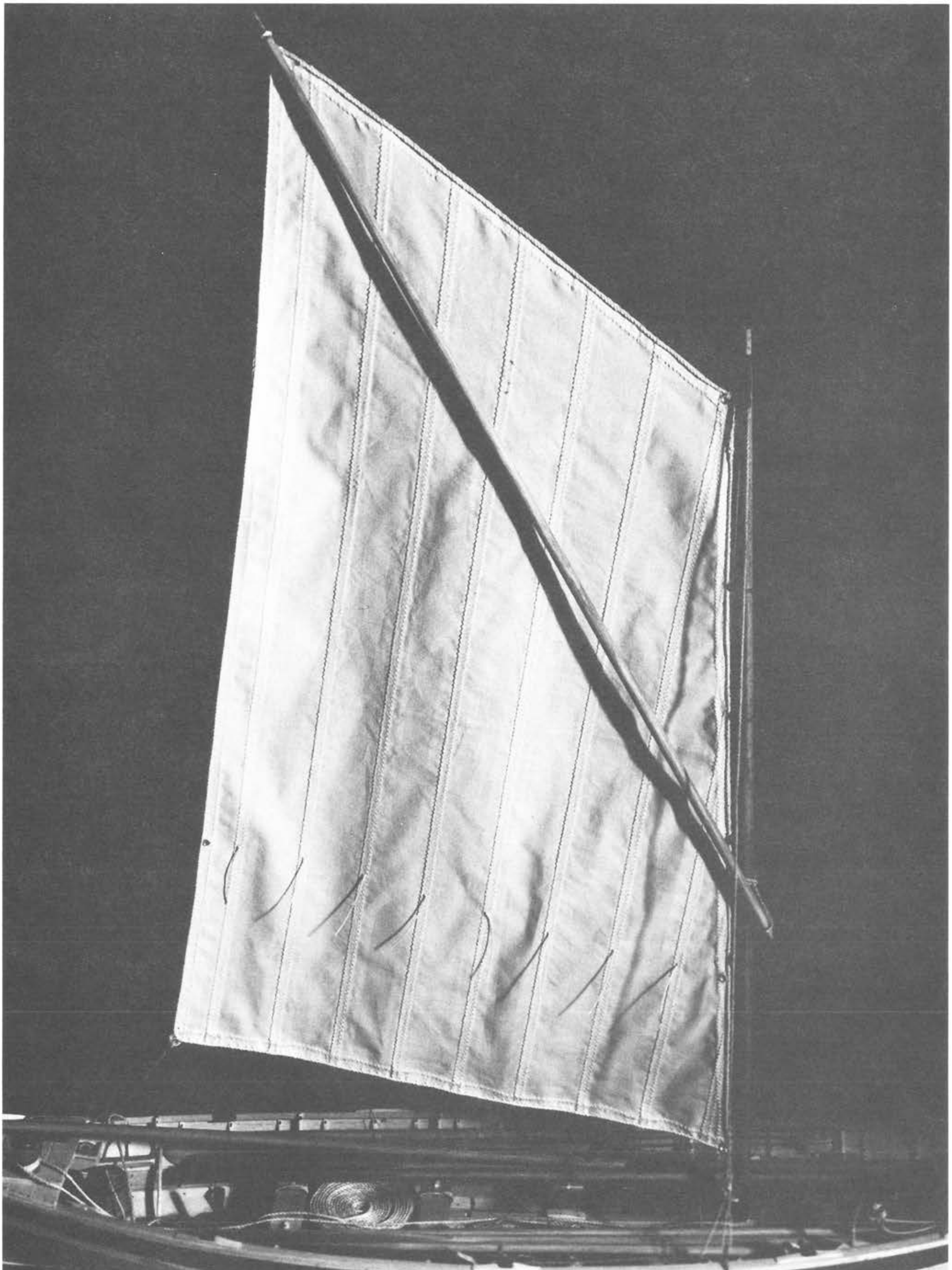
Cringles, or eyes for seizings, reef lines, the sprit pole, and the main sheet, can be studied on the sail plan (Sheet 4). The head cringle is simply an eye seized into the bolt rope during the

Figure 3-117 (left). The throat and its cringle, port side. Note the thimble and seizing to a staple in the mast head.

Figure 3-118 (right). The peak, showing the loop formed from the bolt rope to hold the end of the sprit pole.







process of roping the tablings. The throat and tack cringles are metal grommets (probably sewn grommets in the mid-19th century) which might best be represented by small holes carefully made in the tabling with a heavy needle. The reef cringles are similar. The clew cringle is a metal thimble held to the bolt rope with a rope grommet, but this can also be simulated by a loop in the bolt rope (see *The Ashley Book of Knots,* #2847, p. 467).

Figure 3-119 (opposite page). The finished sail with spars and rigging in place. Note the heel of the sprit pole, which is held to the mast with the rope snotter.

The reef points are short lengths of thread passing through holes in the selvedges and held in place with knots (overhand) on both sides. Trim them to correct length after getting them on the sail. Tie in the four seizings to the luff tabling for the mast hoops and splice or seize the main sheet (a 12"-15" length of Model Shipways #871 linen line) to the clew cringle. The sail can now be bent to the mast by seizing it to the mast hoops and the throat and tack cringles to the masthead staple and the wooden cleat for the tack (Figure 3-119).

If the sail is to be set, you will have to rig the snotter, a rope sling which supports the bottom of the sprit pole at the mast. There is an eye splice at each end (its length is $1\frac{9}{16}$"); these can be seized in if splicing seems like too much effort. The snotter is rigged as shown in Sheet 4 and the lower end of the sprit pole seated in the eye splice at the free end. The set of the sail is adjusted by sliding the noose of the snotter up and down the mast until there is moderate tension, but not enough to bend the sprit pole or stretch the peak of the sail.

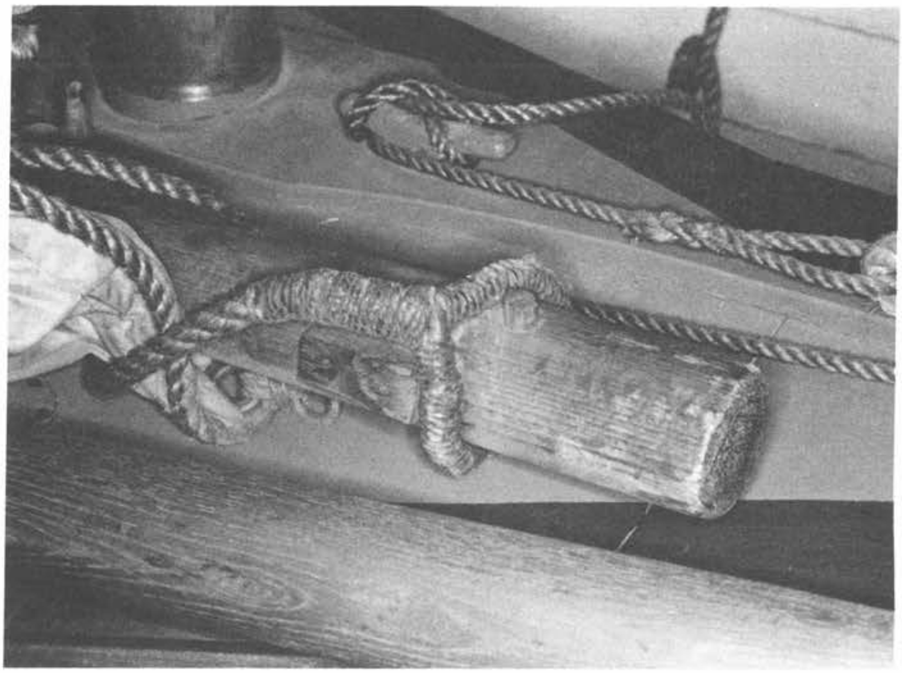


Figure 3-120. The head of the mast of Lagoda's *waist boat, showing the served eye of the shrouds, the shoulder cleat (the shroud has been shifted, but the cleats should support it at the splices), and the wooden peg to prevent the shrouds from slipping off.*

The Shrouds. The single pair of shrouds is made up of two lengths of cordage, seized or spliced together to form the eye which is seated over the masthead (Figure 3-120). Follow the rigging plan on Sheet 4 for lengths and details. The bottom of each

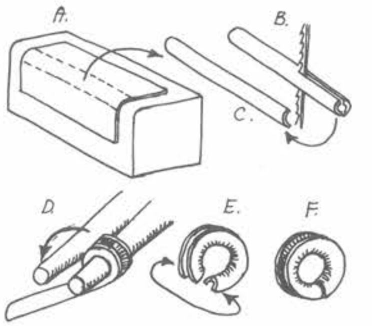


Figure 3-121. Fabrication of thimbles. Bending and trimming soft copper or aluminum (A) or splitting $\frac{1}{16}$" aluminum tubing (B) will produce basic stock (C), which is formed by round-nose pliers (D), trimmed and closed (E) to make a finished thimble (F).

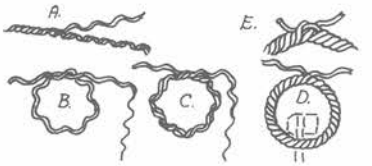


Figure 3-122. Making a grommet. Linen cordage (approximately .025" diameter) is unlaid to obtain a single strand (A). The ends of the strand are crossed and relaid around each other in a ring approx. $\frac{3}{8}$" in diameter (B). One of the strand ends is taken around a third time (C), and when the two strands again meet (D), their ends are tucked in, as in making a splice (E).

shroud is again spliced or seized to form an eye for setting up the shroud lanyard. This eye should be fitted with a thimble, and you will have to form one by hand from copper or aluminum. Counting the two thimbles in the shrouds, and the two thimbles in the grommets at the gunwale, four thimbles in all are needed. Figure 3-121 gives suggestions for forming them.

The shroud lanyards are spliced (or seized, if you prefer) into the shrouds, just above the eyes. They are rove and set up as diagrammed on Sheet 4. This is the same as #3299 (page 535) in *The Ashley Book of Knots,* which has other interesting methods as well (this is the simplest, and the one used on *Lagoda*'s whaleboats).

Based on the shrouds of *Lagoda*'s boats, and those of other whaleboats at New Bedford Whaling Museum, these lines should not look as though they have been heavily tarred; i.e., do not use black cordage. Whaleboat shrouds were probably a very lightly tarred hemp or manila, and this can be closely simulated by giving these lines a coat of acrylic burnt umber thinned with water. The served eye at the masthead can be a bit darker due to the darker color of serving marline.

Passing around the gunwales and inwales, port and starboard, are rope grommets in which are seized the thimbles for setting up the shrouds. With care, a good piece of linen line can be unlaid and one of its strands retwisted into a very respectable miniature grommet through the hole in the gunwale strake (Figure 3-122). See *The Ashley Book of Knots,* p. 470 for a detailed study of grommets and tying them. An acceptable substitute can be had by making three round turns over the thimble and through the gunwale strake and tying the ends to resemble a cross seizing.

With spars, sails, and rigging completed, the mast can be stepped and the sail sheeted whenever you wish. It may be advisable, once the rig has been tried and found satisfactory, to unship it and store it in a clean place until the rest of the boat gear has been made up, put in the boat, and secured.

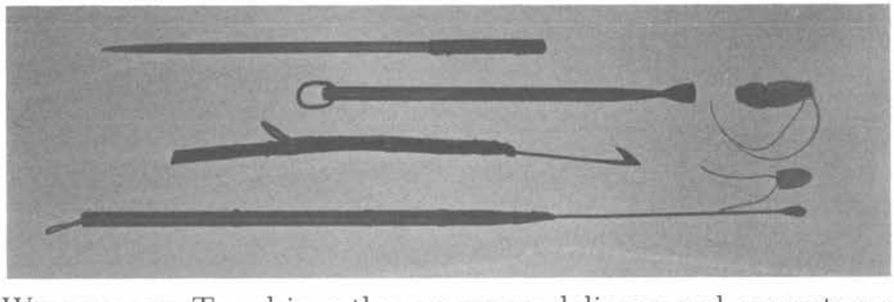


Figure 3-123. Examples of the whaleboat model's whaling gear, including (top to bottom) one of two waifs, the boat spade, and sheath, a harpoon (single-flued iron), and a lance with sheath.

WHALECRAFT. To achieve the necessary delicacy and correctness of proportion in the various pieces of ironwork, it will be necessary for the modelmaker to fabricate harpoons, lances, and other gear from copper wire and sheet, using solder or some of the modern synthetic adhesives. I have found solder to be superior to the latter methods; indeed, there is no obstacle to fabricating any of the required pieces with anything but a simple soldering iron or torch and a high-quality tin solder such as is used in electronics assembly. Tin-lead solder is a source of concern to many modelmakers who plan to put their models in glass cases (lead is very susceptible to oxidation by air pollutants when in a confined atmosphere), but there are several types of pure tin solder, including an excellent one in paste form called "Solderall" which is used widely in electronics and jewelry making.

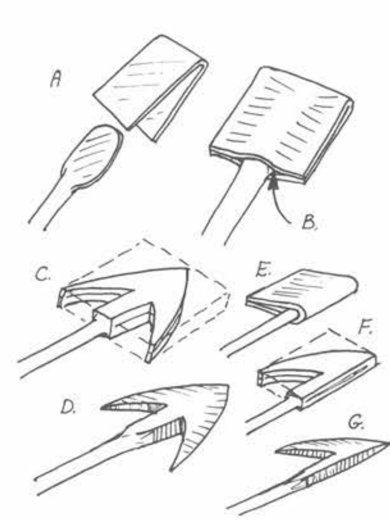


Figure 3-124. Fabrication of harpoon heads. A, a piece of folded sheet copper is slipped over the flattened end of a copper wire shank; fluxed, and soldered at point B. Epoxy can be used as a solder substitute. C, D, the shaping and finishing of a double-flued harpoon head; E-G, the forming of a single-flued harpoon head.

Wire for the shanks of harpoons and lances should be about .025", which is the diameter of 22-gauge copper wire. Most copper wire is available in a partially annealed (half-hard) state, which can be tempered by stretching it. Clamp one end in a vise, grasp the other with a pair of pliers and pull firmly, but not too much (the wire can break); you will get straight and reasonably stiff shanks for harpoons and lances.

Making harpoon and lance heads begins by beating the ends of the shanks flat. This is best done with a hammer and anvil; however, the latter can be replaced with a flat piece of steel, or even a large bolt whose head had been ground flat and smooth and then mounted in a vise (or epoxied to a block of hardwood). A piece of sheet copper or brass (30-gauge or .010" thick) is folded nearly double and slipped over the flattened end. After trimming to overall dimensions and hammering it to fit snugly over the wire, the joint is fluxed, heated, and the solder run in (this practice will be modified according to the type of solder you use). After cooling, the flues of the harpoons are shaped (by sawing or filing) and the edges formed and sharpened by filing. Figure 3-124 illustrates important steps in this process; Figure 3-125 shows equivalent steps for making the lance heads. Note that the heads of the one- and two-flued harpoons have heavy square bossings which join them to the shanks. This feature should be incorporated into your model's fittings by having the pieces of folded sheet metal extended far enough back on the shanks so the bossings can be filed out of them. The toggle irons will call for somewhat different fabrication methods; Figure 3-126 shows some simplified ways of making these pieces.

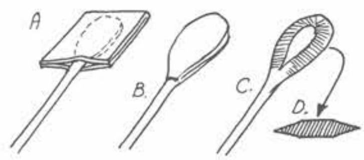


Figure 3-125. Fabricating lance heads is the same as in Figure 124, but a bit more delicate. A-C show the construction sequence; D is a cross-section of the finished lance head.

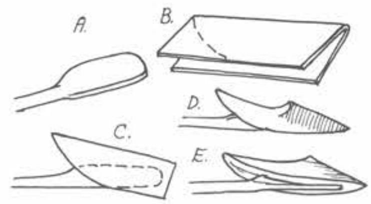


Figure 3-126. The simulation of a toggle-head harpoon can be similar to Figure 124, if a swiveling head is not required. The process is repeated in steps A, B, and C. D and E are views of the finished harpoon head.

The sockets of harpoons and lances are covered with serving of spunyarn set in tar (to prevent the rope mountings from sliding back and loosening). Because this detail of metalwork is conveniently hidden, you have the option of setting the heel of the iron in a hole bored in the pole-end, then faking the socket by wrapping Bristol paper and covering it with a serving of thread. A more conventional metal socket can be made from 30-gauge sheet brass or copper and soldered to the shank as shown in Figure 3-127.

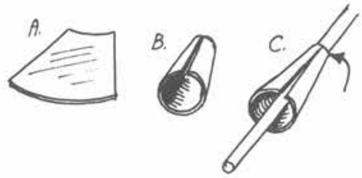


Figure 3-127. The sockets for harpoons, lances, and the boat spade can be made from sheet copper and soldered prior to mounting them on their poles. An alternative is to make the sockets from paper and glue them to the poles after the hardware has been fitted.

Harpoons were traditionally mounted on hickory sapling poles; the bark was left on to provide a better handgrip. To mount a harpoon on a straight dowel is decidedly incorrect, so an expedition to gather miniature harpoon poles is in order. For many of us, a garden, arboretum, or even a plant nursery should provide suitable material. Ornamental shrubs of the genus *Spiraea* have second- and third-year woody growth that closely resembles hickory branches in miniature. Most of these twigs have a soft center or pith, which is very useful for those who forego proper sockets and embed the harpoon shanks in the pole ends. The wood in these twigs will often be almost white, so stain them a bit after mounting the iron.

The lance poles were cut from straight stock which was as free of knots and uneven grain as possible. Although round in section, they were finished by hand-planing, and these plane marks should be evident on your model's lance poles. If you are using dowels, plane them carefully, making long thin shavings, giving the poles the appearance of being faced by many long, narrow bevels. This measure applies also to the boat spade and waif poles.

The rope mountings of the harpoons and lances are shown in the views on Sheet 3. The harpoon mountings are made from #874 linen, the lance mountings from #870. They are bent to the shanks with a round-turn and an eye splice (or seizing, if preferred). The warp-ends (to which the whale line is hitched) are eye-spliced. The mountings are seized to the poles as shown on the plans; however, note that the warp-end of the lance mounting passes through a hole in the butt-end of the pole with much of the eye-splice buried. This may be difficult to replicate without making the hole too large, so you may want to start mounting the lances at this end and finish at the shank. The mountings were lightly tarred, so no black thread, please.

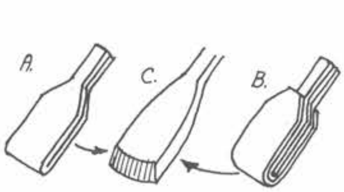


Figure 3-128. Forming the boat spade iron. A "thin" spade (A) is shaped from a piece of doubled-over sheet copper (soldered at the seam); a "thick" spade is made of four sheets doubled over a single sheet for a total of five layers, then soldered (B). The result in either case should resemble C.

The boat spade offers the choice of thick- or thin-blade type; the thick blade style seems preferable if your model represents a boat from the 1850s and early 60s. The thin blade can be shaped from .010″ sheet brass, which should be bent over double and soldered. Five layers of this stock can be laminated to form a thick blade (Figure 3-128) or a piece of thicker material can be used. The socket can also be faked with Bristol paper, but here, the joint with the metal blade must be skillfully made as there is no serving to cover the deception. The boat spade handle has no rope mounting like harpoons, but has a grommet passing through a hole in the pole-end for retrieval. This should be made up from #874 linen.

Optional, but a definite possibility, is the harpoon gun, a casting of which is provided in the construction set. In a whaleboat, most ordnance was likely to be stowed in boxes of some

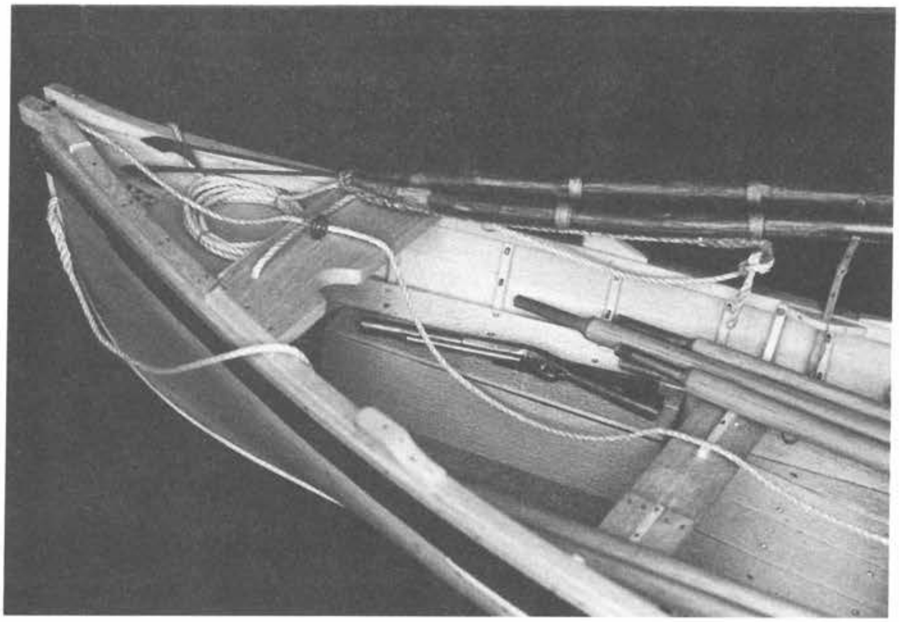
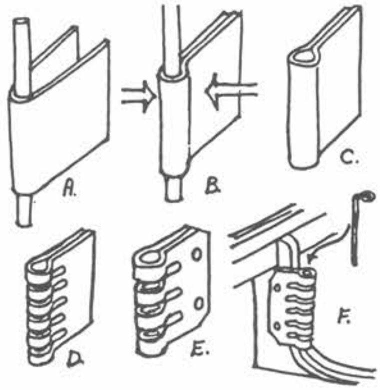


Figure 3-129. A view of the bow with a whaling gun box fitted to the ceiling, starboard side, just below the thwart riser. The whaling gun has been placed on it, but would normally be kept inside.



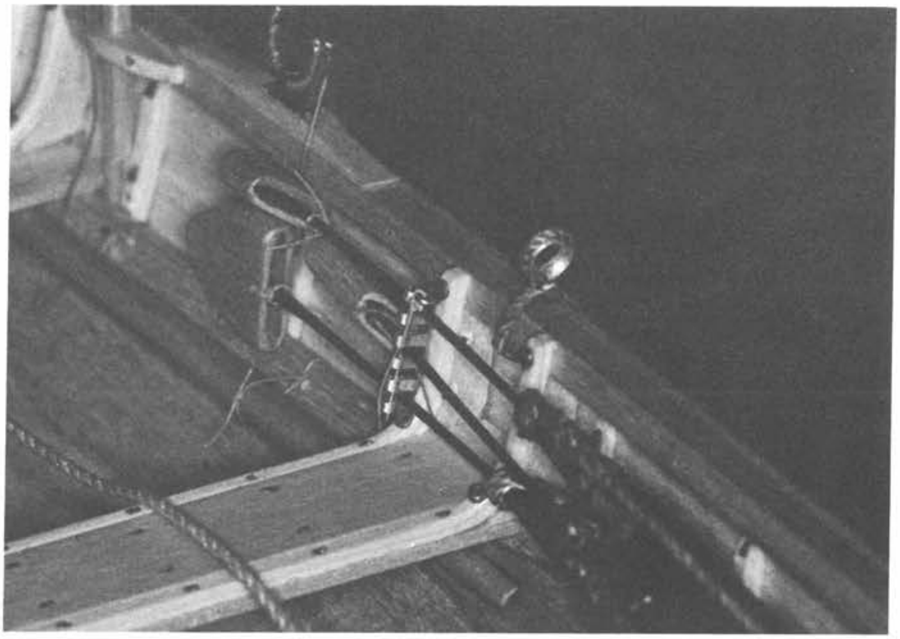


Figure 3-130 (left). Inboard view, starboard side, showing three harpoons in the rack (there is space for two more). The harpoon heads are fitted with sheaths (above). The racks are formed from .010″ copper or brass sheet. Begin by doubling a piece ½″ × 1″ around a short length of #28 gauge wire (A) and crimping the fold in a vise or pliers (B). Slots are sawn or filed (D) and the rack is trimmed and drilled (E). The racks are fastened to the filler pieces of the thwart knees with copper nails (F). Note that the lance rack has only three slots (E).

sort, and a likely configuration for a built-in box has been described earlier. Into this receptacle would have gone the gun, bomb lances, and shorter harpoon projectiles, leaving little to be seen except at the moment the harpooner prepares to strike the whale. These are small, fussy objects which are best made with machine tools and jewelry-making equipment. Their intricacies will reward the exacting craftsman who enjoys metalwork, but they need not bother the consciences of those who do not.

The sharp edges of harpoons, lances, and boat spades were fitted with sheaths to prevent injury to their users, but more importantly, to prevent the dulling of very sharp edges so important to their use. Sheaths are illustrated on Sheet 3; there were many variations, particularly in exterior form and finish. Many were canvas covered and painted; no doubt some were decorated

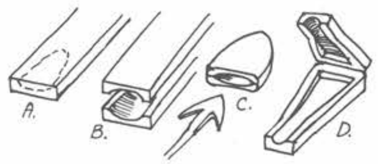


Figure 3-131. Fabrication of sheaths for whalecraft. Steps A-C show the fabrication of a sheath for a double-flued harpoon head; see plans, Sheet 3 for details of other types of lance and harpoon sheaths. The boat spade sheath (D) opens like a clam shell and has a leather hinge (not visible).

with initials and distinguishing patterns. Note that the boat spade sheath has a "clam shell" hinge; this type was generally not canvas-covered, but simply painted wood. These sheaths are easy to make from $^1/_{16}''$ scrap basswood sheet (Figure 3-131). I did not fit sheaths on all the irons of the pilot model, as the harpoon and lance heads are more interesting to look at.

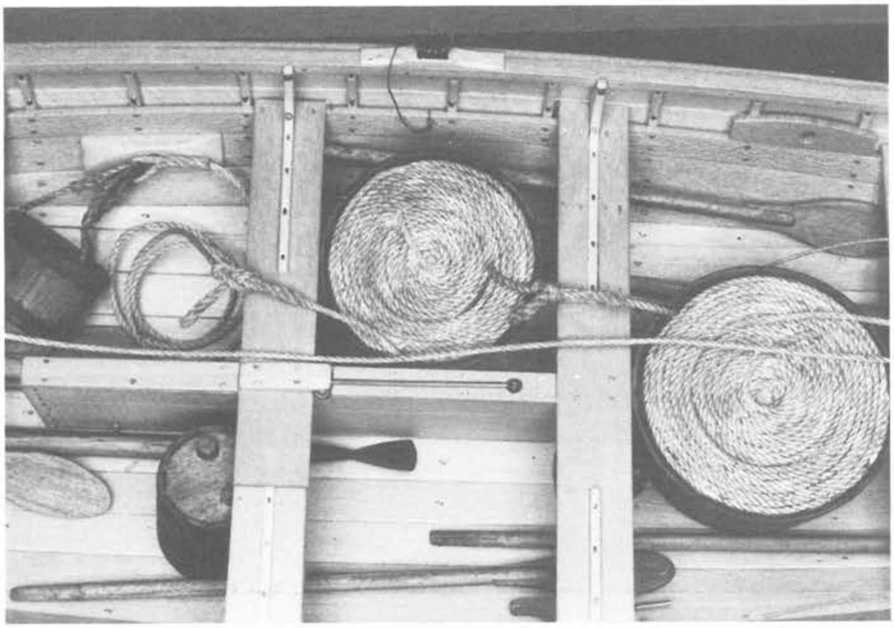


Figure 3-132. The line tubs and drogue. All are connected to each other via double becket hitches.

At this point, or later if you find it more convenient, the line tubs can be fitted with whale line. The latter should be paid out, taken around the loggerhead (follow the direction of the turns on Sheet 3), led forward under the kicking strap, through the bow chocks, back to a small coil in the box, and finally bent to one of two harpoons at the iron crotch (Figures 3-129, 3-132, and 3-135). The whale line, or "tow line" as whalemen called it, was a loose-laid rope of selected long-fiber manila which was carefully made for this purpose and was *not* tarred, but moistened with water or oil during the spinning process. Such rope was called water-laid or oil-laid and had great strength, pliability, and resistance to kinking.

By mid-19th century, whale line was made in the standard circumference of $2^1/_4''$, or $^3/_4''$ diameter, and was sold in coils of 90-110 fathoms. Due to its limpness and ease of handling, whale line did not require the tedious and destructive measures necessary to get other types of manila to behave when any length of it was coiled.[1] Because it was untarred, it could not be exposed constantly to strong sun and was carefully covered to keep rainwater off (most line tubs were fitted with canvas covers). For these reasons, whale line would have a bright straw color, but not the sickly greenish tinge we see in modern "treated" manila. A thin application of acrylic burnt umber and water, and perhaps a bit of raw sienna, should give a satisfactory appearance.

[1]Interesting discussions with sometimes contradictory statements on whale line and its fabrication are to be found in Ashley, *Book of Knots*, pp. 23, 24, 516; *Yankee Whaler*, p. 94 and Lytle, *Harpoons and Other Whalecraft*, pp. 18, 19. Samuel Eliot Morison, *The Ropemakers of Plymouth* (Boston: Houghton Mifflin Company, 1950), pp. 13, 29, 30, 48, describes briefly the considerable involvement of the Plymouth Cordage Company in the whaling cordage market and notes that by the 1850s, that firm was capable of furnishing 100-fathom (or more) lengths of rope. This contradicts other sources which claim that only 75-fathom lengths of whale line were available to this fishery. Bark *Mermaid* (cited earlier) obtained whale line in 100-110-fathom coils for her 1855 outfit.

Although some modelmakers have taken the trouble to coil line in the line tubs from the bottom up, this is wasteful of precious linen cordage, not to mention expensive. For this reason, the "plugs" should remain in the line tubs and you can coil down two or three "flakes" (layers) over them, until the tubs are coiled to the rims. Whale line is always coiled in flakes, and *all* of them begin at the periphery and spiral inward in a clockwise direction (Figure 3-133). When the center is reached, the line is led out to the periphery and another flake is begun. The starting end of the coil does not sit in the bottom of the tub, but is led up the side and allowed to hang over the rim. It has an eye splice to receive the line from the next tub or the drogue warp. The other end (actually the leading end as it runs out of the boat) is finished with a crown knot and back splice.[2] It will be hitched to the eye splice in the harpoon warp (or the eye splice in a coil of line preceding it) with a double becket hitch (Figure 3-134). This hitch should *always* be used when bending whale line to an iron or another whale line, and when bending the drogue warp to the tow line's end. These details are well worth the extra pains taken to make or simulate them convincingly.

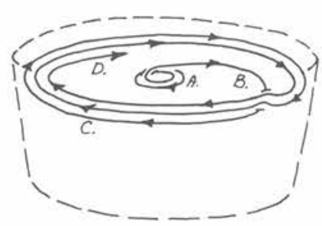


Figure 3-133. Coiling whale line in the line tub. Each layer, or "flake," starts at the periphery and spirals—clockwise—in to the center. Having reached the center, it is led out to the periphery again and the process repeated. Steps A-D show the sequence from the center of a lower coil to the first 2½ turns of a new one.

[2]Ashley, *Book of Knots*, pp. 116, 462.

Figure 3-134. A double becket hitch.

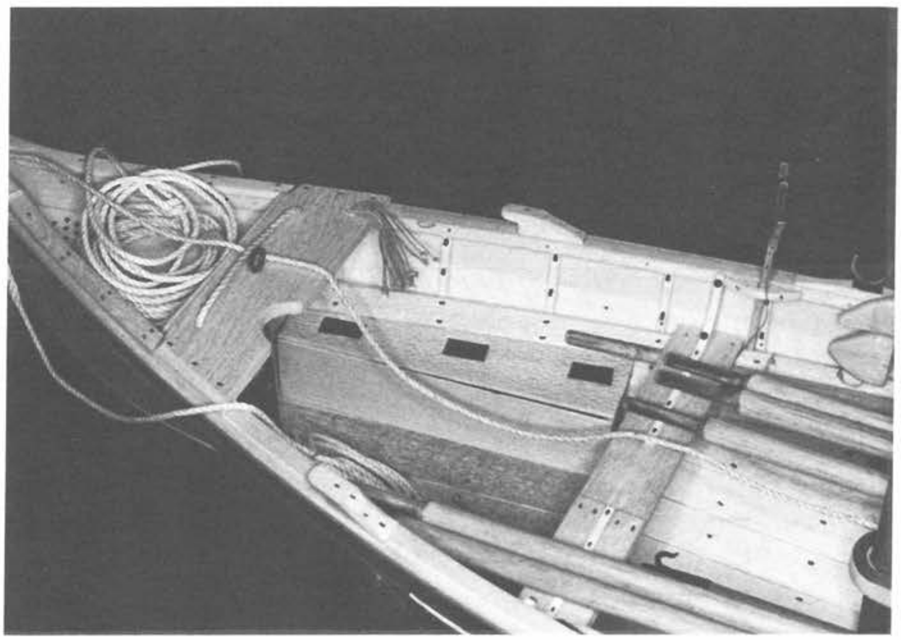


Figure 3-135. The box line and the short warp are stowed together (as separate coils) in the box. Note the lance tails in the clumsy cleat.

With the whale line in the tubs, taken around the loggerhead, and led forward through the bow chocks, a length of it must be coiled and placed in the box before hitching it to the harpoon. This is called the "box line" or "stray line" (sometimes called the "box warp" in later years) and it varies in length from 10 to 20 fathoms, according to the whaling literature of this period (in later years it was less, which may indicate changes in harpooning techniques). For a ten-fathom coil, you must allow 45″ of cordage for your model, which means very careful coiling and neat stowing in the box (Figure 3-135). From the box, the line leads aft to one of two harpoons resting in the iron crotch (so called because whalemen referred to harpoons as "irons") and is bent to the harpoon warp with a double becket hitch.

The "second iron"—also darted when the whale is first struck, but thrown overboard if there is no second chance to plant an iron—is connected to the whale line by a four-fathom length of tow line called the "short warp." The short warp is bent to its harpoon with the usual double becket hitch, but its other end is made up into a small loop with a bowline, the loop linking the second harpoon with the tow line of the first. Historical references do not say exactly where the short warp joins the tow line, but my guess is at about the mid-point of the box line. It also seems likely that the short warp would be coiled and stowed in the box along with the box line, probably underneath it; if so, care must be taken that the two lines don't become entangled. The second harpoon was darted as soon as possible after the first, a means of keeping fast to the whale if the first iron drew. The bowline in the short warp allowed it to slide freely along the tow rope so as not to compound tension on the first iron. If the first iron did draw, then the short warp would fetch up on its pole and the fortunes of the hunt would devolve on the second iron. If the whale started to run before the second iron could be darted, it and the short warp were tossed overboard (still connected to the tow line) to prevent accidental injury to the boat crew by a "loose iron" rolling about.

Chock pins, the wooden retaining pins which keep the tow line in the bow chocks, can be simulated by taking some of the copper boat nails, cutting them to the length shown in Sheet 3, and painting them to look like wood. One should then be inserted in the bow chocks while the others are placed in the holes at the forward end of the box.

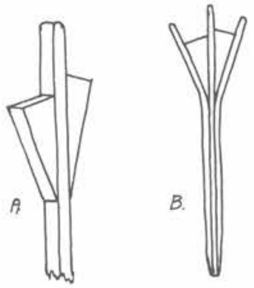


Figure 3-136. Making a harpoon crotch. A, two wedges of wood are glued to the sides of a hardwood strip; B, two hardwood strips are glued and clamped to both sides of assembly A.

Harpoon Crotch (Iron Crotch). This important accessory is made by laminating three scrap pieces of $\frac{1}{32}'' \times \frac{1}{16}''$ hardwood strip left over from making the frames. Following the procedure depicted in Figure 3-136, glue two wedges of $\frac{1}{16}''$ basswood scrap to each side of the central layer. When set, the two outer layers should be soaked until pliant, then glued and clamped in place with a clothespin. While the crotch is drying, make the chock which supports it at the inwale from $\frac{1}{16}''$ basswood scrap and glue it in place (Sheets 2 and 3). The shank of the crotch is drawn overly long on Sheet 3 and must be trimmed to length so its top is at the indicated height above the gunwale. This height is not a hard and fast rule, but it will be necessary for each modelmaker to adapt the lower end of the shank to fit in the space between the thwart riser and hull planking as individual situations dictate. A safety line should also be rigged from the harpoon crotch to the thwart riser as with the rowlocks.

The Grapnel. While used in some fisheries as a beach or ice anchor, the grapnel's primary use was for retrieving or unfouling submerged whale line connected to or wrapped around a whale's carcass, particularly when fetching up the flukes for towing the dead whale back to the ship. Surviving examples at New Bedford Whaling Museum have four prongs, but the grapnels in *Lagoda*'s boats have five and Ashley mentions six-prong grapnels, so variations are possible. Sheet 3 shows a four-prong example which I believe may have been most common.

As the plan shows, this can be a rather delicately-proportioned piece of forge work. I suggest that it be simplified somewhat by using 20-gauge copper wire, formed and soldered as shown in Figure 3-137. The delicate eye for the grapnel line and the tapered prongs can be worked down with files and metal cloth after assembly and soldering of the parts. The finished piece can be painted dull black or the color of weathered untreated iron.

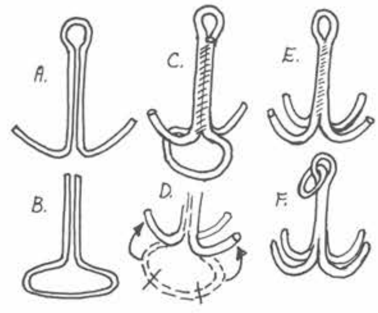


Figure 3-137. Fabrication of the grapnel from wire. A, one piece of wire forms the eye, two of the prongs, and part of the shank; B, a wire armature comprises the rest of the shank and what will be reshaped into the other two prongs; C, the two parts are joined and soldered; D, the loop of the armature is cut open and reformed; E, F, the assembly is finished and a ring is added.

Descriptions of grapnels at my disposal do not specify size or length of its line, but it seems safe to assume that whale line was used and a length of 25 fathoms would be useful for most purposes; therefore, a length of 9′ would be suitable for the model. With one end spliced to the grapnel eye, the rest of the line is carefully coiled and stopped with fine thread. Grapnel and line are then stowed in the bow, forward of the lifting strap and under the box.

The Kicking Strap and Painter. The kicking strap was a rope bridle which spanned the thigh board, its ends being rove through holes in the board and stoppered with knots. The whale line was passed through the bridle as a means of preventing it from sweeping aft if it accidentally jumped the bow chocks and missed being caught by one of the preventer cleats. This innovation appeared in the latter half of the 19th century, possibly during the late 1860s, which is late for the type of boat under consideration. The *Lagoda* model's whaleboats are not fitted with kicking straps, so this may be regarded as an option for your model, depending on the period you wish your model to represent. If you elect to fit your model with it, use #874 linen. Figures 3-129 and 3-135 show the kicking strap fitted on the pilot model. The length of the bight is a matter of conjecture. It should probably have enough scope so the whale line could be slipped from the bow chocks and led to a preventer cleat on either side without chafing the strap (this would be necessary at times when coming alongside a whale to lance it). This results in a rather long and ungainly bight which is difficult to arrange or stow neatly. On the pilot model, I drew one end through its hole in the thigh board to make the bight shorter and neater looking. This may have been done in actual practice to avoid snarls with the whale line.

The painter, or "boat warp," as whalemen called it, was a towing line fitted to an eye in the stem post below the level of the sheer strake lap (see Sheets 1 and 2). I have no records of its length, but presume that ten fathoms (roughly twice the boat's length) would be a minimum. Your model, therefore, should have a boat warp which is 45″ long. Use #874 linen line, eye-splicing it or seizing it to the stem (Figure 3-129). Bring it aft along the port side, coil it neatly, and seize the coil to the thwart riser, between the thigh board and the first thwart. Figure 2-12 shows how the coiled painter (and a coil of spare line) was stowed in *Lagoda*'s port bow boat.

Waifs and Boat Hook. To mark a whale's carcass as belonging to a particular ship, a flag with distinctive markings or pattern was planted in it. This was necessary in the event a captured whale had to be set adrift in bad weather or if the whaleboat had to leave it in order to pursue other whales or assist other boats. The pole of the waif was straight-grained pine, planed but not perfectly finished (like the lance poles), tapered at the bottom with two barbs carved into the point. The flag could be almost any material, such as denim or calico as described earlier, but it is likely that a store-bought printed fabric was used in preference to flags with custom-made patterns. These were expendable items and thus made as cheaply as possible.

Because the flag was generally rolled up on the pole and stopped with twine, you may decide to simplify its construction. I simply glued a square of cloth to the waif pole, painted it a dull blue denim color with acrylic paint, and rolled it up after drying. When stowed in the bottom of the boat (port side, along the mast step and centerboard case), the waifs are barely noticeable.

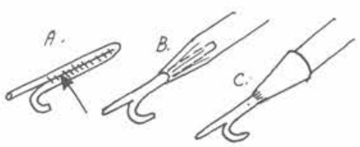


Figure 3-138. The boat hook is formed from wire and soldered (A), shaped and set in its handle (B), and a socket of metal or paper fitted (C).

The boat hook is of very simple design and construction; as in the case of the harpoons and lances, the hardware can be reduced to bent wire and solder, with a sheet copper or paper socket as desired (Figure 3-138). After painting and staining to conform with the other boat gear, it should be stowed in the bottom next to the waifs.

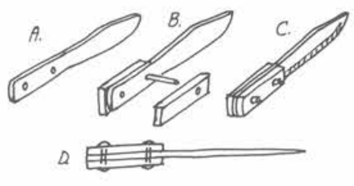


Figure 3-139. Fabrication of the boat knives (two required). A metal blank (A) is shaped and bored, then fitted with its handle slabs (B), which are riveted in place (C, D).

Knives and Boat Hatchet. For some reason, every whaleboat modeler seems to take pleasure in making these three items, often with a degree of detail and finish not found in the rest of the model! The knives are probably best made like the real ones—from a piece of sheet metal having the profile of both blade and handle. Two holes are bored through the handle portion, these being transferred in steps to two pieces of wood which form the handle slabs (Figure 3-139). The slabs are then riveted to the blade with copper wire, after which they are filed and sanded down to their finished dimensions. After the handles are finished, the blades can be "sharpened" with a fine file and painted to suit.

The boat hatchet can also be made in a way similar to the original, by forming the head from a piece of doubled-over sheet metal. Instead of a forge-weld, solder is floated into the fold until it is nearly filled (Figure 3-140). The solder is then bored out at the socket and a wooden handle is carved and fitted. After "sharpening," the hatchet can be finished like the knives.

I varied the hatchet construction by making the handle from heavy copper wire which I hammered to an oval section, then soldered to the head to give a one-piece construction. After careful shaping and painting, the hatchet looked very much as if a wooden handle had been fitted.

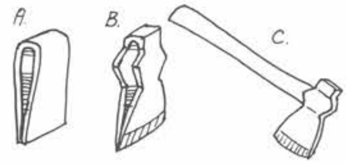


Figure 3-140. Fabrication of the boat hatchet. The head is folded, shaped, and filled with solder or epoxy (A, B). The filler is bored out at the socket and a handle is fitted (C).

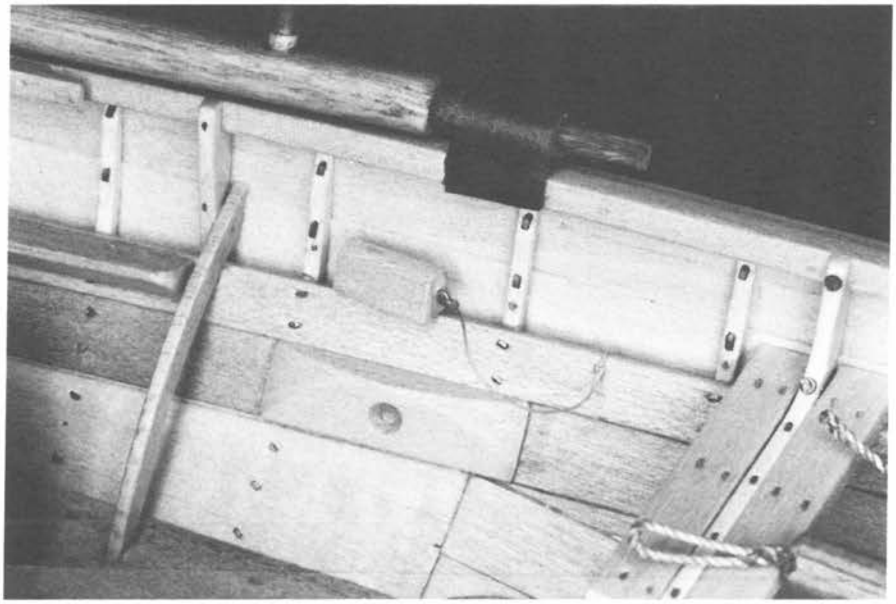


Figure 3-141. The leather steering oar rest with the steering oar handle slipped in it. The wooden plug which maintains the shape of the leather cowl is sitting on the thwart riser. Note its lanyard.

Knife Sheaths and Steering Oar Rest. Like their full-size counterparts, these are best made from real leather. I obtained some thin brown leather from a shoemaker (any crafts shop with leathercrafting supplies will have this) and scraped it even thinner (about 1/32" with a sharp #10 Xacto knife. Care must be taken, or you can cut right through the material. To make the scraped side look a little neater, I sanded it lightly with 220-grit wet-or-dry paper.

To make the steering oar rest, first make the wooden plug, then wrap a small piece of leather over it, trim it to size, and glue it to the edges of the gunwale and inwale. Be sure the plug can be removed if you plan to have the steering oar handle in the rest at any time. Fastenings can be made from the copper nails if you wish to add this detail.

The knife sheaths must be molded to take the knife blades, and this is done by soaking them and pressing them over a raised form with a simple die made from 1/8" basswood scrap (Figure

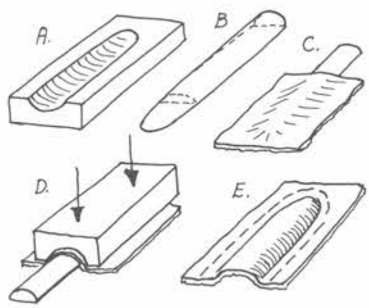


Figure 3-142. Shaping the leather boat knife sheaths (two required). Molds A and B are made from wood scrap. A piece of thin moistened leather is placed over mold B and mold A is pressed down over it (C, D). When the leather has set dry, it can be cut to shape (broken line) and glued in place (E).

3-142). Allow the leather to dry for a day before taking it out of press. The sheaths can be trimmed to final shape and glued to the places indicated on the cuddy and the inside of the box.

MISCELLANEOUS CANVAS WORK. Strictly speaking, your model is not completely outfitted without two canvas nippers and covers for the line tubs. The nippers are shown on Sheet 3 and are probably easiest made by gluing three small squares of sailcloth together and making two diagonal lines of stitches at right angles like those in the plan. The line tub covers are more of a problem to make (Figure 3-143) and probably unwanted on a model due to the interesting detail they hide! They were probably used during rainy weather to keep fresh water away from the whale line and removed in fair weather to allow the seawater-soaked line to dry. *Lagoda*'s line tub covers were painted white with the boats' initials stenciled in black (see note on Sheet 3). I did not make line tub covers for the pilot model and do not recommend that they be made unless the modelmaker has a special situation in mind which he wants his model to depict.

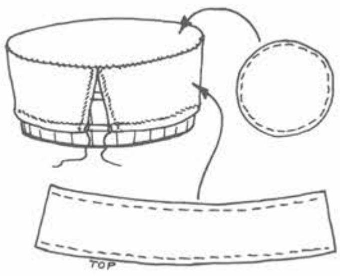


Figure 3-143. Each line tub cover consists of a top and side panel, the latter being open-ended and fitted with a draw string.

COMPLETION OF THE MODEL. The pilot model I have built illustrates a "formal" presentation of a whaleboat, with the sail set, oars and paddles stowed, and the whale line rigged for darting. The arrangement of boat gear and craft does not conform to any precise moment in the sequence of events during the pursuit of a whale; rather, the boat gear is arranged so most of it can be seen to best effect. If the sail were furled and stowed atop the thwarts, it and the oars would hide virtually everything underneath.

A more realistic depiction of a whaleboat at work can be achieved if the model is painted (and perhaps weathered) and either hung from the davits of a section of a ship's bulwarks or mounted much like a formal display, but with gear and craft arranged as it should be at some important stage of the hunt. The latter will be difficult to make convincing unless the model is "manned" by carefully made figures of the boat crews. Such treatment can make the model bulky, awkward, and very delicate, particularly if it is being "rowed," and thus bristling with pulling oars, the steering oar, and the mast and sail hanging outboard over the cuddy. The study of a whaleboat in action involves careful scrutiny of a multitude of motions and processes and always the worry of what has to be placed where it will be out of the way of something else.

For an example, a whaleboat going on a whale under oars must have the mast and sail out of the way of the whale line, which otherwise would run out directly over it with the risk of snagging and far worse consequences. The expedient was to jam the heel of the mast and sprit pole under the port side of the stroke oar thwart, letting the rig hang out beyond the stern (sometimes with sail and rigging dipping into the water). At the same time, the whale line must be arranged to run freely out without fouling the oars and crew, which usually meant passing it over the oars rather than under them. This is especially true in situations when oars would be peaked—with the looms still resting in the rowlocks while the handles were inserted in the peak cleats.

Until they were needed, the paddles were lashed to the thwart risers under their respective thwarts. There is documentation for going on a whale under oars alone, under paddles alone, under sail alone, under sail and oars, under paddles and oars, but I am not aware of any situations where paddles were used while the oars were still peaked. For obvious reasons, oars and paddles could not be used simultaneously.

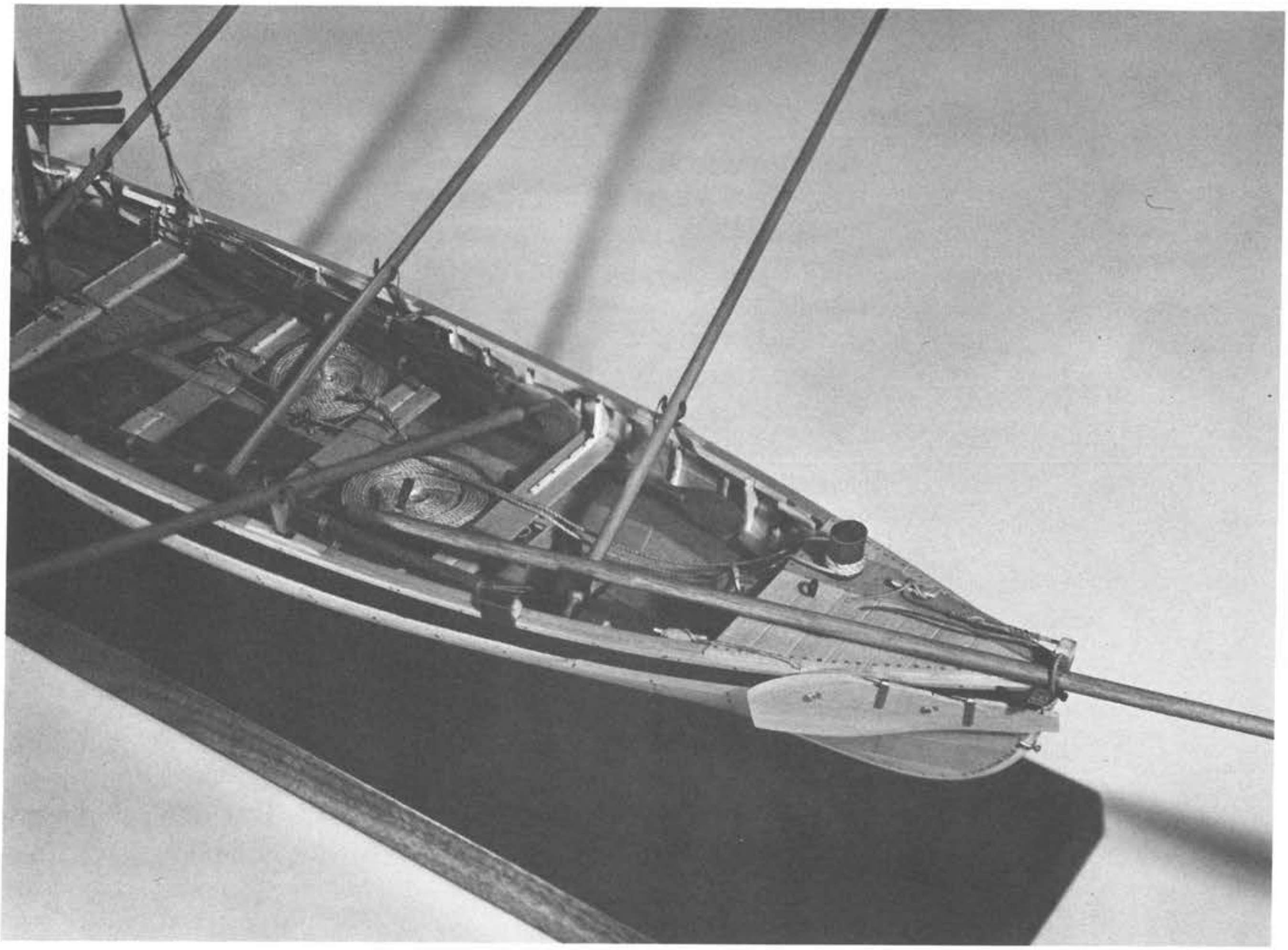


Figure 3-144. The port quarter of the completed model, with the rudder triced up, the steering oar shipped, and the pulling oars peaked. Note how the tub oar crotch and the raised peak cleat enable the tub oar to clear the line tub. in this view, the compass box has been hung in its alternative location, under the stroke oar thwart.

While the steering oar was generally used when the whaleboat was rowed and the rudder used under sail, the former was most likely used in any close-quarters situations with a whale, when an immediate change of course was necessary or if the boat had to be swung quickly away from danger. When the steering oar is rigged, the rudder must be triced up as in Figure 3-145. In the first decade of the use of sails in whaleboats, the steering

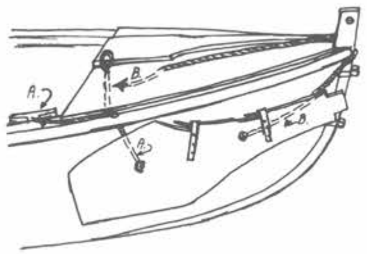


Figure 3-145. The rudder triced up with the tricing line (A) belayed to the port quarter cleat and the trip line (B) hitched to the lifting strap.

oar may have been the only means of steering a whaleboat, as evidenced by contemporaneous illustrations and the absence of rudders in detailed receipts for whaleboats of the early and mid-1850s which have come to my attention.

In addition to observations of whaleboats in action in the standard accounts of 19th century whaling, Chapter II ("Performance and Use") in Ansel gives some very useful observations on the problems of rowing a whaleboat while simultaneously working with sails and tow line in some modern reconstructions of whaleboats. Combined with the standard literature, some useful insights on what can be done, how, and when, can be drawn by the modelmaker for recreating specific situations.

Disposition of whalecraft on a boat was a serious matter, not just for ready access to the right iron at the right moment, but for safety to the boat crew. Study carefully the discussions of these items in Chapter 2 and the preceding pages in this chapter.

These brief descriptions of arrangement of boat gear can do little more than touch on the more obvious problems of depicting a boat in action, and unless you have a diorama setting in mind, it is difficult to make specific configurations easy to understand. More satisfying to many is the hanging of a model from the davits of a section of a ship's bulwarks, with bearers and cranes and selected details of the ship's deck and bulwarks. This subject has been discussed previously, and most of Sheet 4 is devoted to its details; however, in the final fitting-out of this display, attention to a few more details is necessary.

Due to their weight, the line tubs were not kept in the boats when on the cranes, but instead transferred to the ship where they could be stowed atop the hurricane house (this is the usual case for the starboard and larboard boats) and elsewhere. It is likely that the line tubs for the waist and bow boats were stowed on deck near their respective boats. In photographs of whalers in later years, we sometimes see small hinged platforms hung inboard between a davit and a crane above the main rail on which the line tubs were kept. I am skeptical that such fittings were present on whalers of our whaleboat's period and do not recommend that they be fitted. This could be an interesting detail on a model depicting a late 19th century (or early 20th century) whaler, but the early photographic record does not seem to show such features. If you are following the bulwarks features as drawn on Sheet 4, your best course of action will be to stow the line tubs (with or without canvas covers) on deck.

The whaleboat described herein differs in many ways from its late 19th century descendents which are far better documented and in many respects are representative of a whale fishery which had changed markedly in its outlook and goals from the

palmier days of the sperm whale fishery. Comparing this boat with one used in the Arctic bowhead fishery is rather like comparing the clipper ships of the 1850s with the steel ships of the nitrate trade of some 50 years later. The whalers' goals had changed, due to drastic changes in the demands and economics of maritime trade, not to mention local factors of environment and human needs. Too many modelmakers have chanced upon whaleboat details in photographs of Arctic whaling, and in their zeal to proclaim their discoveries, have added these details to boats of other times and types of whaling without pausing to ask if doing so is documented or warranted by the historical record. In all too many cases, the wrong details are put on otherwise fine models, whose historical value is not only destroyed, but the model itself becomes a snare and delusion for other modelmakers who admire it and imitate its details.

Figure 3-146. The author's completed model of a Delano whaleboat, period 1850-1870, now in the collection of New Bedford Whaling Museum.

The same is true for a whaleboat model's setting. If it is mounted on a ship's bulwarks, be sure the bulwarks and davits are correct to period; if the model is part of a boat shop diorama, don't have the hull planked over a Herreshoff type mold or fill the workbench with iron-sole planes, wrought-steel auger bit braces with fancy chucks, or saws with modern handles. There are plenty of books about 19th century tools which can help you select wooden planes and bit braces of the correct styles, not to mention saws, clamps, draw knives, and other items of proper style and construction for the desired period. In other words, put as much care into research as into modelmaking technique.

As the first two chapters of this book have stated, our knowledge of mid-19th century whaleboats is very imperfect, but enough information has survived to indicate that these boats cannot be reconstructed by simply referring to later examples. There are still many missing pieces to the puzzle, and they can only be found through research and patient examination of surviving fragments from this period. There is no little irony in the fact that whaleboats from the peak years of the American whale fishery are as obscure as the ships themselves are popular as modelmaking subjects. For years, modelmakers have been content to model whalers of the 1850s fitted with boats of the 1890s and later. It is my fondest wish that this book will help to correct this inconsistency.

Chapter 4

Historic Whaleboat Building Practices

Although it is not the intent of this book to describe full size boatbuilding methods, there is much about whaleboat building techniques that is of interest to historians and modelmakers, and it is to these two groups that this chapter is addressed. A very small minority of modelmakers will want to work in such fine detail that this material is essential; however, a larger group, who like to build dioramas, will find the sequences very important in depicting a boat shop with a whaleboat under construction inside. This is not to say that those sequences can be followed closely in scale without great difficulty, but it should be possible to build a whaleboat model using the methods described in Chapter 3, stopping at the desired stage, and making the necessary alterations to simulate very closely what one would see in full-size practice. This chapter should thus be viewed as grist for advanced modelmaking projects or as a brief introduction to whaleboat building methods for non-boatbuilders.[1]

For many diorama builders, it might be desired to show the planked-up shell in the early or middle stages of framing. To do this, the model must be planked over the inverted molds, as described, then removed and fastened right-side-up to a keel block on the shop floor. The hull would be braced with short strips placed between the laps and the floor, and the ends would be fitted with the thigh board, a cuddy plank, and some small end molds to prevent the ends from collapsing and becoming too sharp. The gunwales and inwales would be fitted and the desired number of frames shown, either in place or being fitted. One of the boatbuilders would be inside the boat fitting the preformed timbers by straightening them as needed and marking for the laps and battens. His helpers would be at the bench cutting the notches and working the taper into the upper parts of the timbers. One might be nailing a timber to the shell while another is inboard, holding the frame in place. No doubt there was a young apprentice or two running about, fetching stock or drawing water for the steam box kettle (which was set in a brick oven). Thus, in gaining some idea of the general construction sequence, the modelmaker can pick those operations which could be going on at a given moment and recreate that moment in a whaleboat shop without transgressions of logic or historical accuracy.

[1] I am grateful to Leo Telesmanick, boatbuilder, of South Dartmouth, Massachusetts for describing whaleboat construction methods in the Beetle boat shop during the early 1930s, when he worked there. Although whaleboats were no longer being built for whaling, the type survived another decade as a surf boat popular among merchant vessels engaged in the islands trades of the Caribbean and western Pacific. Mr. Telesmanick also worked on the fully equipped whaleboat built by Beetle for the Mariners Museum, Newport News, Virginia. By 1940, whaleboat construction had ceased, but many of the building methods survived in the production of a small, cat-rigged sailboat class called the Beetle Cat. For many years, Mr. Telesmanick supervised the production of these boats, carrying on many building techniques which had their origins in whaleboat construction. This chapter is based on numerous interviews with him at New Bedford Whaling Museum and at South Dartmouth, November, 1984 through February, 1985.

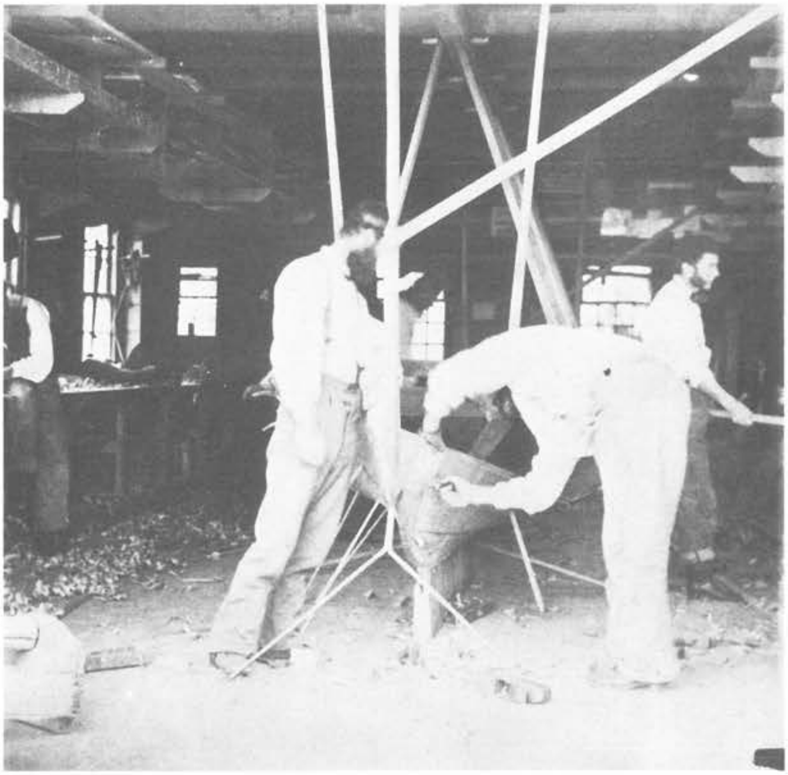


Figure 4-1 (left). The boat shop of George Hart, New Bedford, circa 1860. The third strake of the port side is being clinch-nailed, whereas it appears that the fifth strake of the starboard side is being fitted, the gentleman at left center putting his weight against the plank end. Compare the iron horse for anchoring the stem with that in Figure 4-4. Note also the stringers from the shop ceiling which hold the stems and molds steady. A wooden block plane lies on the floor at right foreground; next to the keel block lies a wooden seam clamp.
Old Dartmouth Historical Society

Figure 4-2 (right). This view of Hart's boat shop may be from the same period with the boat in Figure 4-1 nearly completed. The men in the doorway are holding (left to right) a wooden parallel clamp, a mallet, a wooden fore plane, and a hand saw, all of which are quite distinctive in style for the period. Note that while the cheek pieces have been fitted to the bow, the stem post has not yet been cut down to receive the bow roller. Whoever got this job had some careful chisel work to do.
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Nonsequential Operations. These are tasks which are usually done well in advance of the stages which require the materials involved, using time between the completion of one boat and the beginning of another, or occupying time during pauses in the main sequence of construction. These include:

1. Sizing of stock for steamed and dry-sprung items, such as stems, frames, thwart knees, wales, seam battens, and risers.
2. Steaming and bending of stems (stem- and stern posts, collectively), frames, and thwart knees.
3. Cutting parts from patterns, such as the keel, strakes, rudder, lion's tongue, thigh board, mast hinge block, and small pieces of inboard joinerwork.

Sequential Operations. These follow a set pattern of events with limited opportunities for variation, if any:

1. The centerboard slot is partially cut in the keel (Figure 4-3).
2. The sides of the keel are rabbeted and the ends are shaped for the stem scarf joints.
3. The keel block is set up at a specified place on the shop floor and the keel is bolted to it. [Note: If the length of the keel block exceeds keel length, the stems must be fastened to the keel before it is bolted to the block.]
4. The end scarfs, rabbets, and bevels are cut in both stems.
5. The stems are joined to the keel and fastened with either two

iron rivets or one rivet and two nails. To prevent the stems from splitting, they are clinch-nailed (vertically) just beyond their scarf joints (Figure 4-5). They are braced from the floor by horses made of iron rod and fitted with clips which are secured to the stems with thumb screws (Figure 4-4). The stem heads are braced by battens secured to an overhead stringer (Figure 4-1 and 4-4).

6. The molds are positioned on the keel, fastened down, and braced with battens from overhead (Figure 4-4).

7. Precut garboard planks are fitted to the rabbet. Due to the length of the boat, each strake must be made up of two pieces which are scarfed and fastened together with butt blocks. Scarfs of corresponding port and starboard planks generally mirror each other, but the scarfs of adjacent strakes are carefully staggered to avoid areas of weakness. The garboards are taken to the side bench for scarfing and beveling for the lap, then refitted to the rabbet and fastened with boat nails.

8. The second strakes are fitted, then removed to the bench for scarfing and beveling. After refitting and clinch-nailing them to the garboard, with boat nails at the rabbets, the seam battens are slipped between their upper edges and the molds

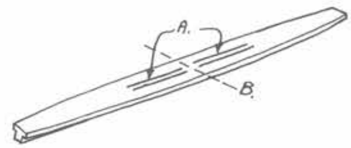

Figure 4-3. Cutting the keel for the centerboard slot. The saw cuts (A) are not continuous, but leave uncut wood in way of the midship mold (B) to prevent the slot from widening or closing due to stresses from the adjacent shell and framing. When the hull is turned over to spike the centerboard case, the saw-cuts will be finished and the plug removed.

Figure 4-4. The Beetle whaleboat shop, circa 1910. The keel, stems, and molds are set up and ready for planking. The Beetles apparently chose to notch their molds for the garboard lap. Note the blending of the rabbet from keel to stem and that the stem has already been beveled. From a negative by Albert Cook Church.
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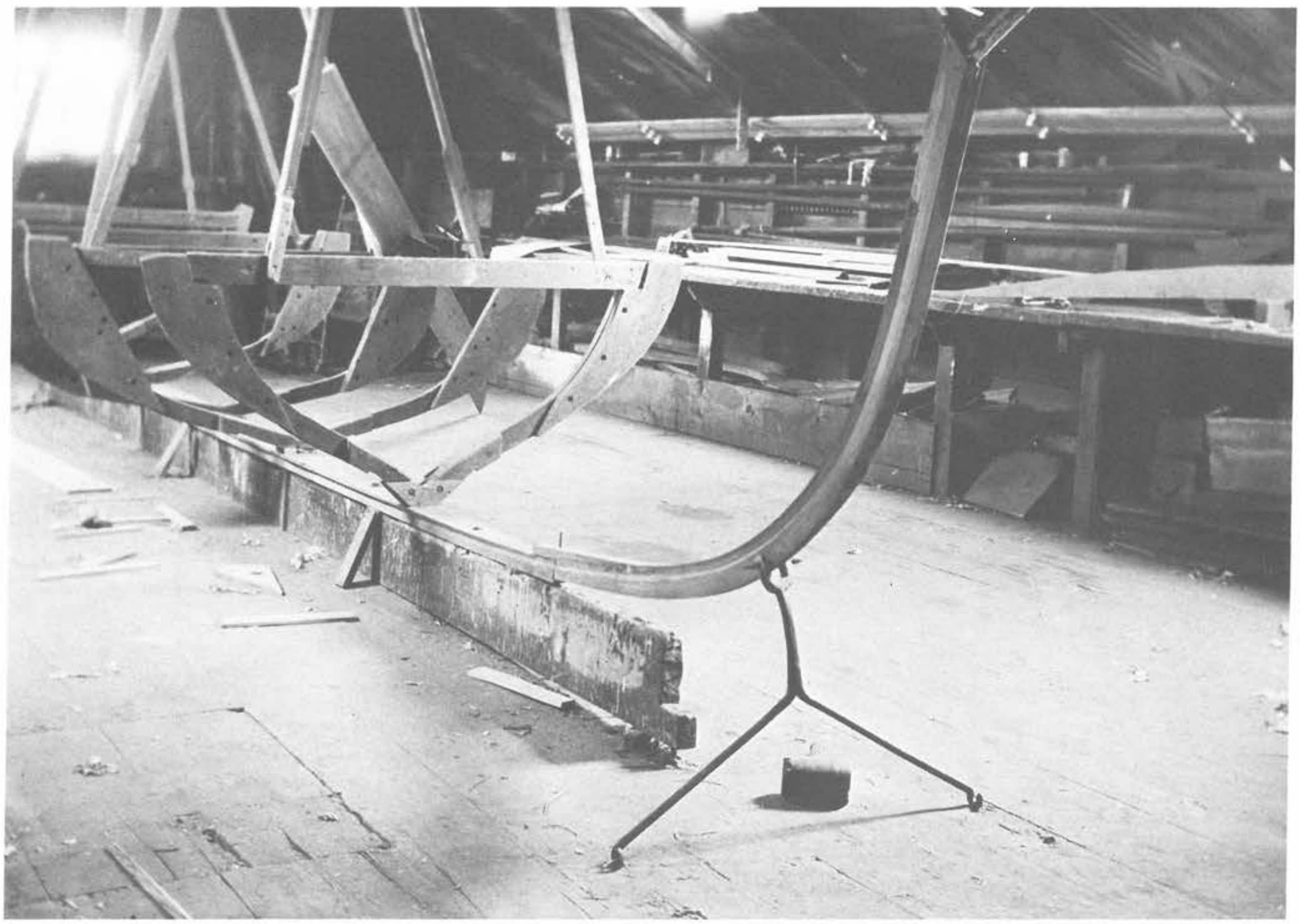

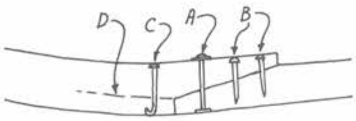

Figure 4-5. Fastening a stem to the keel. A, a rivet (spike and roove); B, boat nails; C, clinch nail. The clinch nail is driven just beyond the scarf joint to prevent the stem from splitting (D).

and clinch-nailed. Care is taken that scarf joints in the battens do not coincide with scarfs in the planks.

9. The third and fourth strakes are fitted, scarfed, nailed, and battened in sequence.
10. The fifth and sixth strakes are steamed and cupped, then joined and battened like the previous ones. There are no battens at the top seam of strake #6, which is beveled (before refitting) and lapped.
11. The sheer strake is fitted, scarfed, and beveled, then joined to strake #6 (lapped seam) and the rabbets (Figure 4-6).
12. The gunwale strake is fitted, scarfed, and beveled (lower edge only), then joined to the sheer strake at the stern rabbet.

13. The shell is shored at the laps to permit builders to work inside it. A few shores can be seen (out of this sequence) in Figures 4-1 and 4-6.

14. The cheek pieces and bow roller are fitted to the bow.

15. The inwales are steamed to shape, either over a special bending trap (Figure 4-19) or held in place by stops on the shop floor. If not of sufficient length in one piece, two pieces will be scarfed together and fastened to the inboard side of the gunwale strake. The gunwales are dry-bent and nailed on the outboard side.

16. The thigh board and the first plank of the cuddy are fitted and installed to help "spread" the hull ends, which have a tendency to collapse, producing a bow and stern too sharp to be practical for a whaleboat.

17. The frame timbers are fitted for marking. In many cases, this requires partial straightening to adapt the preformed shapes to the inboard contours. This is done by cutting a concave taper in the head of the timber, then jamming it into the seam between the gunwale strake and the underside of the inwale, and bending the lower end down until it meets the keel (Figure 4-7). After marking the locations of laps and battens, the timber is removed to the bench, where it is notched. It is then refitted and fastened to the planking with conventional boat nails. The use of clinch nails for fastening frames is very infrequent; most examples have been found at the frame heads, and may represent repairs in some cases.

18. Spreader molds (small versions of hull molds) are fitted at the extreme ends to prevent collapsing.

19. The thwart risers are fitted and double-fastened (two nails at each timber).

20. The centerboard case is made and fitted to the keel. It is temporarily nailed down at the ends (which is the reason for the lug-like projections) after being set in a bedding of wicking or canvas strips and white lead.

21. The mast step is cut and fitted to the keel.

22. The ceiling is fitted (Figure 4-8).

23. The bow and stern sheets, together with their supporting beams, are made and fitted.

24. The thwarts are installed, followed by the thwart knees, filler blocks, and pads, in that order.

25. The box is installed in the bow and the cuddy is finished.

26. The boat is turned over and the centerboard case is spiked to the keel.

Figure 4-6 (opposite page). This photograph of the Beetle shop was taken perhaps a day or two after Figure 4-4, and shows the shell planked up to the sheer strake (#7), with only the gunwale strake to be added. Chalk marks on the planking indicate that the locations of the frames had been determined by this time. The "flat spot" on the upper planks amidships suggest that the molds, even after many years of use and adjustment, weren't quite fair and were relied upon more as guides than at fixed sections. This defect will disappear in the course of framing. From a negative by Albert Cook Church.
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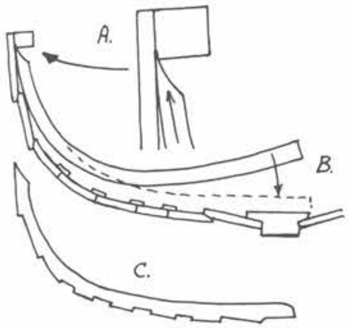

Figure 4-7. A timber is fitted to the shell from top to bottom. The sharp end of the timber head is jammed into the inwale seam (A) and the lower part is pressed against the inside of the shell (B), marking the locations of laps and battens. After notching for these (C), the timber is repositioned and fastened.

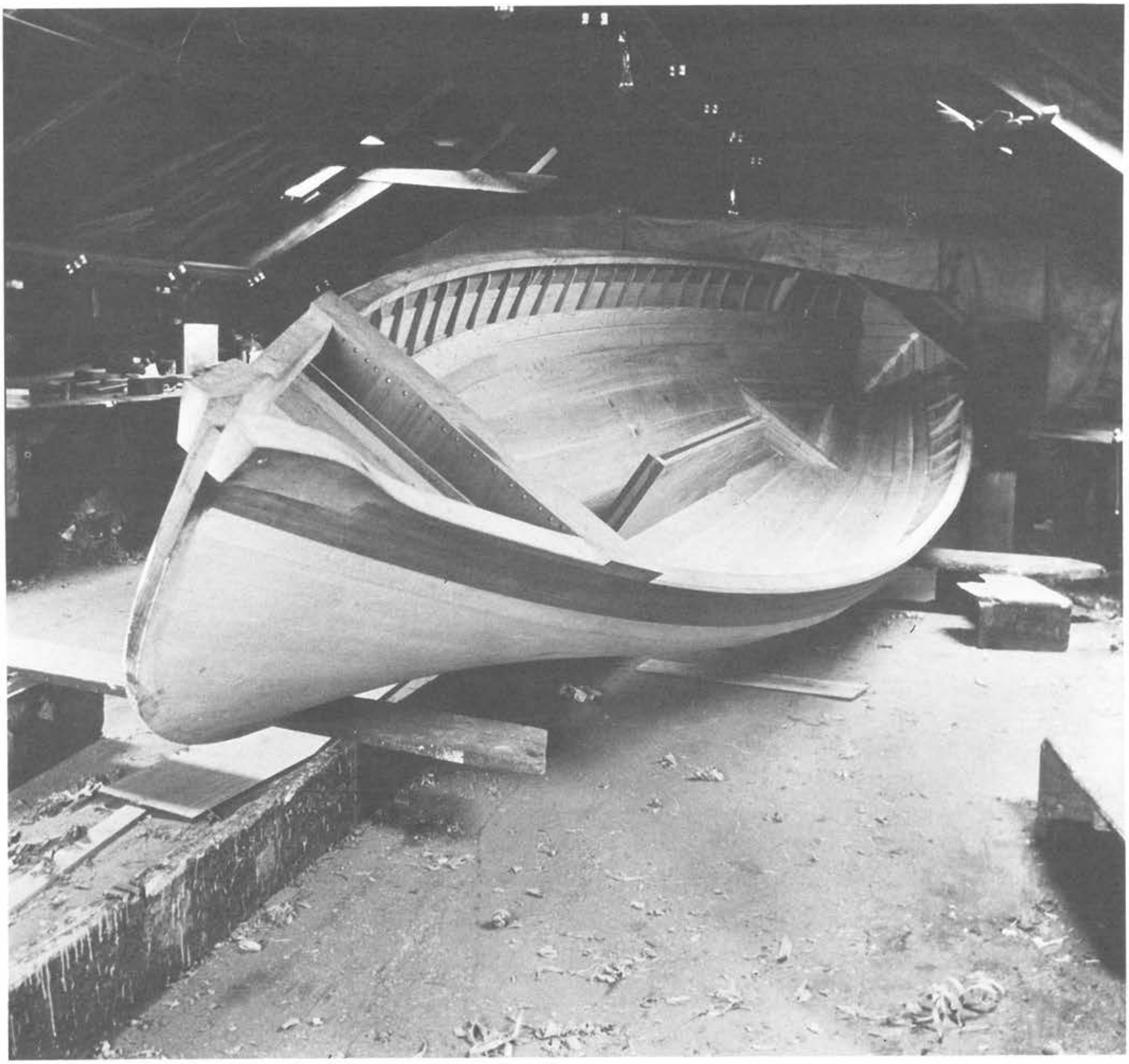

Figure 4-8. The Beetle shop with the boat from Figures 4-4 and 4-6 framed and ceiled. Note the widths and shapes of the ceiling planks. The thwarts will probably be fitted before turning the boat over to spike the centerboard case (from the keel up). Note the construction of the bow chocks and the absence of cheek pieces, a hallmark of Beetle whaleboats. From a negative by Albert Cook Church.
Old Dartmouth Historical Society

27. The centerboard and its hardware are installed.
28. The bottom is smoothed. The garboard seams are caulked and wicking is rolled into the batten seams. All seams are primed; when dry, they are sanded and puttied. Nail heads are puttied over and the entire bottom is painted.
29. The boat is turned right-side up, and remaining inboard details are finished.
30. The inboard parts of the boat are primed and painted.

The time of installation of the lifting straps is not known, but may have varied considerably, possibly pending instructions from the customer. Contrary to popular belief, the spacing of a whaleship's davits could vary, and this might have to be taken into consideration when positioning the straps.

There could be much in the way of small wooden and iron fittings which were not installed at the boat shop, but were left to the ship's crew to take care of during the outward passage. A spare boat could be quite bare of detail when placed on the skids, and would not be fitted out before one of the regular boats was too badly "stove" for further use. Fittings from the latter would then be removed to complete the outfit of the spare boat.

Figure 4-9. The Beetle shop from a later period (possibly around 1920). The boat has been given its prime coats of white, buff, and "powder blue" (for the ceiling), and is ready for delivery. This photograph appears to have been taken on the ground floor of the shop. In the preceding photos, the boat was built on the second floor, which was preferred by the Beetles until quite late in the shop's history.

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MATERIALS. While builders in later years were forced to use materials gathered from afar, locally available woods were preferred for whaleboats. Swamp white oak was the favorite for steam-bending because it could be formed into fair curves without kinking or "favoring" dense spots. Native white cedar was also preferred to other varieties, as it had a more "leathery" working consistency, which was appreciated by the builders and allowed the hull to work more easily in a seaway without pulling the fastenings. Together, these two woods accounted for most of a whaleboat's substance. Spruce might be used for thwart risers, or other parts not subjected to constant soaking; pine was used for thwarts, the thigh board, and the centerboard case; long leaf yellow pine was preferred for the centerboard on account of its density.

While wood was purchased in lots of random quality, the selection of material for specific parts was done carefully. The clearest cedar would go into the bottom strakes; lesser quality material, into the ceiling and inboard joinerwork. The planks with the most knots were saved for the gunwale- and sheer strakes, as the denser wood in these pieces was better able to resist the chafe and shocks sustained when hoisting or lowering the boats; moreover, any cracks which developed in these planks would stop on reaching a knot. The clearer pieces of oak were selected for stems and timbers; the remainder was used for knees and small items of joinerwork or fittings. The clearest pine would be used for thwarts, thigh board, and cuddy; the poorest for the bow and stern sheets and small pieces.

Figure 4-10. Cross-section of a whaleboat's planking, showing growth rings with their heartwood sides facing outboard. A, a plank as cut from the log; B, the tendency of cedar to "cup" during the drying process; C, utilization of this characteristic in planking and ceiling the shell.

Beyond selection for quality, it was also important to position each piece of the planking and frame so the "heartwood side" faced outboard (Figure 4-10). This assured that the densest part of the wood was facing the elements and that any tendencies for the strakes to "cup" would be directed in a way which would benefit the contours of the hull. When piecing up the centerboard, the heartwood sides would be alternated so the cupping tendency would not be compounded, resulting in a jammed centerboard.

In what has been described (quite in earnest) as a variation of "basket construction," the assembly methods and selection and matching of materials was as important to getting the desired hull form as the molds—perhaps even more so, as five molds for a 28-foot hull are few and far between. The bending qualities of the cedar and oak were critical to the way the planks took form in the spaces between the molds and to the curvatures of the stems and frames. Stock for corresponding strakes of each side had to be as similar as possible to assure symmetry of hull form. In many instances, the planks might rise off the molds by an inch or more, and the aberrations of one side had to be mirrored by those of the other side. In this respect, the hull molds were followed more as guides than as immutable standards.

The following is a basic list of preferred woods for building a whaleboat:

Keel—swamp white oak, 2″ × 6″ butt cuts (from base of trunk)
Stems—swamp white oak, 1⅝″ × 3″, steam-bent butt cuts
Planking—native white cedar, ½″ thick
Battens—native white cedar, ½″ × 1⅞″
Frames—swamp white oak, sided ¾″; molded 1¾″ at keel, 1¼″ at head, steam-bent butt cuts
Inwale—yellow bark oak or swamp white oak, 1¾″ × 2″, steam-bent
Gunwale—white oak, ⅞″ × 1¾″, dry-bent

Thwart risers—spruce or pine, ⅝″ × 4″
Ceiling—white cedar (second grade or scrap), ½″ thick
Bow and stern sheets—pine or cedar, ¾″ thick
Thwarts—pine, 1″ × 8″
Thwart knees—swamp white oak, 1″ × 1¼″, split and steam-bent
Box—white cedar, ½″ thick (scrap)
Thigh board—pine, 2″ × 10″
Cuddy boards—pine, ¾″ × 6″
Loggerhead—swamp white oak, dried and seasoned, 6¾″ diameter
Lion's tongue—swamp white oak, ½″ thick
Centerboard case—pine, 1″ × 17″
Centerboard—long leaf yellow pine, ⅞″ thick
Cheek pieces—white oak (not used in Beetle whaleboats, due to different construction)
Bow chocks—white oak
Rudder—white oak, 1″ thick
Miscellaneous cleats and chocks—oak
Peak cleats—pine, 2″ thick

The dimensions given in this list mainly follow practice in the Beetle shop, which may differ slightly from those of the Delano whaleboats; however, variations among different builders and periods are to be expected.

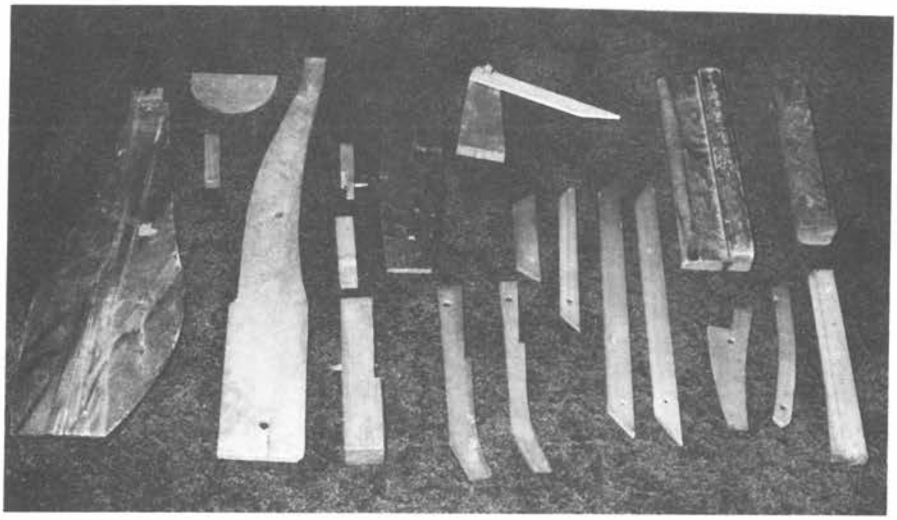


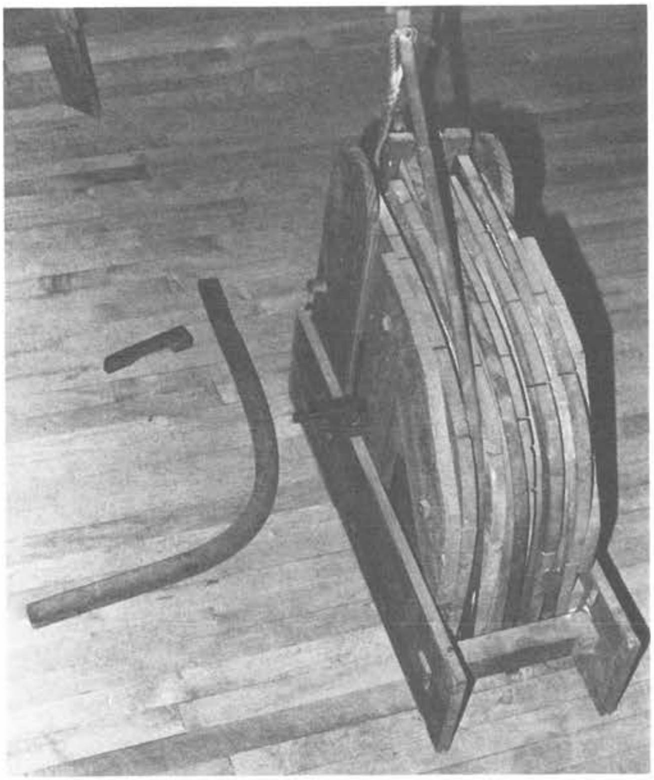
Figure 4-11. Patterns and marking gauges made and used by Joshua H. Delano when he built the whaleboats for the Lagoda *model. The patterns for the rudder, mast hinge block, lion's tongue, and quarter "stiffeners" are readily identifiable. The straight pieces with sharp ends are probably patterns for the beams which supported the bow and stern sheets. Other pieces are depth and marking gauges and a beveling gauge.* Photograph by the author

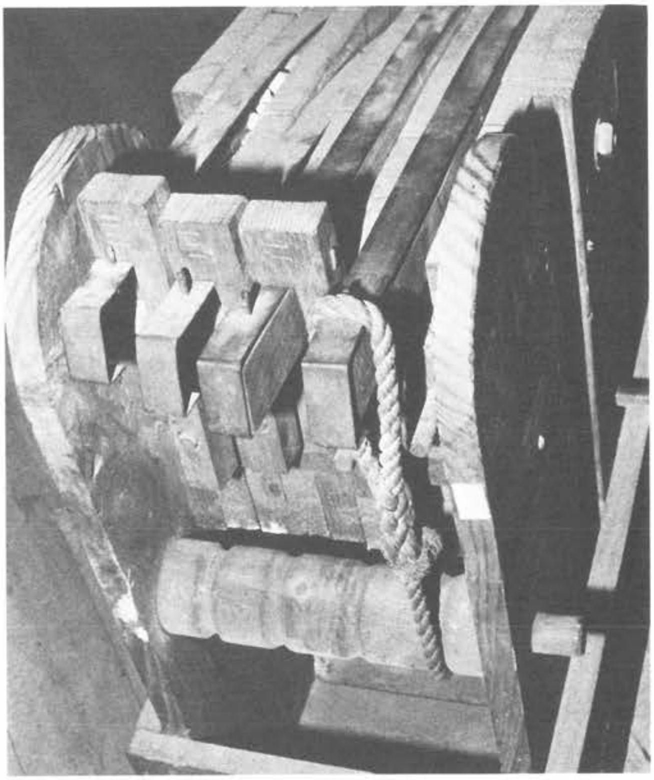
Patterns and Sawn Parts. Patterns were used as guides for cutting stock to make the keel, strakes, some pieces of the ceiling, the centerboard and centerboard case, the rudder, lion's tongue, mast step and hinge block, even the small filler blocks between the thwart knees and the shell. Many of Delano's patterns for the smaller parts have survived (Figure 4-11), including some unexpected examples. There were patterns also for the stiffeners, beams for the bow and stern sheets, and a variety of small shapes not readily identifiable. Others were gauges or patterns for marking segments of larger pieces; a few looked like bench blocks, which, although they are not patterns, were used as guides for specific shaping operations. This is probably the most problematic aspect of reconstructing the whaleboat building process as practiced in 19th century New Bedford. Even if the use of known patterns is finally figured out, there appear to be many others whose precise shapes and uses can only be guessed.

Figure 4-12. Delano's bending trap for the Lagoda *whaleboats' stems. The iron crank on the side was used to draw the steamed oak down into its groove. The iron straps helped to distribute the bending load. At left is a formed stem and one of the wooden clips which holds its upper end to the mold.*
Photograph by the author

Figure 4-13 (right). Detail view of the same trap, showing how the stem-ends are secured with wooden locks during the setting process. Note the roller which keeps the rope bridle in line with the groove in the trap.
Photograph by the author

STEAMING AND BENDING. Stems, frames, thwart knees, and inwales were bent to shape by steaming and forming pieces of oak over traps. Cedar planks at the turn of the bilges also had to be steamed prior to forming the "cupped" sections in their midship parts. The longest of these pieces seldom exceeded 16-18 feet, which determined the length of the shop's steam box, a wooden chest 12″-15″ square in cross-section. Steam was piped to the box from a boiler, which, for most 19th century shops was a closed iron kettle set in a brick oven; in the Beetle shop in later years, a copper boiler was recessed into the top of an iron pot-bellied stove. Once they had been steamed for the prescribed amount of time (depending on wood type and thickness), individual pieces were quickly removed from the box and formed over the bending traps, then left to set overnight, or even longer.





Because frames had to be straightened to varying degrees in the process of fitting them, they were used as soon after bending as possible. Stems could be left in the traps as long as desired; the more time to dry, the less tendency to straighten. Due to the dimensions of stem stock, it was necessary to fit the traps with simple hand-cranked "winders" to winch the pieces snugly to the forms (Figure 4-12 and 4-13). Iron strapping was generally used to distribute the bending load to prevent breakage. Joshua Delano made several extra stems, frames, and thwart knees for *Lagoda*'s boats; some of these were found to be still in the traps while others had been removed for display in Whaling Museum's former whaleboat shop exhibits. Those members still in the traps had retained their shape, while loose pieces had straightened noticeably. This problem had to be reckoned with when setting up and bracing the stems, as any tendency to straighten during construction could cause problems in fitting the plank ends, both at their seams and to the rabbet. For this reason, horses of forged iron rod were hooked to eyebolts in the shop floor while clevises in their upper ends were clamped to the stems with wing nuts (Figures 4-4 and 4-6). Thwart knees were formed over simple traps fixed to a bench or a wooden horse in some out-of-the-way corner of the shop (Figure 4-14). They could be left in the traps until needed.

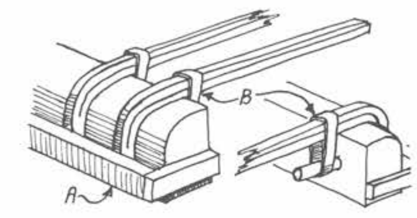
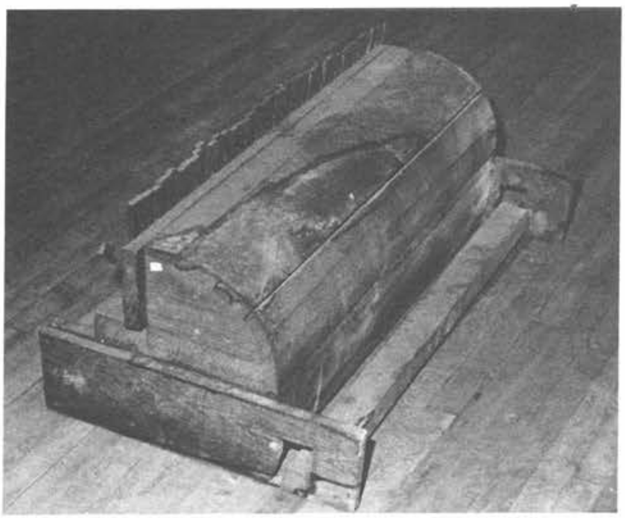


Figure 4-14. A bending trap for thwart knees. The upper end of the knee is held to the trap with a brace (A). After forming the knee over the trap, the thwart-end is held in place with an iron clip (B).



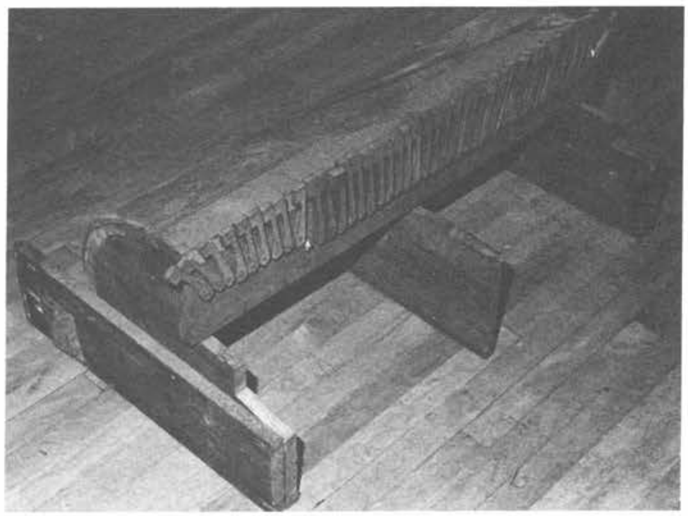


Figure 4-15 (left). Delano's bending trap for the frame timbers. These pieces were sufficiently light to permit bending them by hand; hence no winding apparatus was fitted.
Photograph by the author

Figure 4-16 (right). The other side of the frame bending trap. Forty-six timbers could be formed at a time, enough for one boat (the end timbers were probably sawn to shape).
Photograph by the author

Frames were of lighter scantlings than stems, which meant that their bending traps were not so heavily built and didn't need winders; however, many more timbers had to be formed. Delano's frame trap provided enough timbers for one boat, allowing a few spare pieces to replace those broken in bending. This trap (Figures 4-15 and 4-16) is very simple in design, with a heavy beam to anchor the timbers at one end and wooden catches to hold each piece at its other end. Unlike the stem trap, which provides side support for each stem, the Delano frame trap leaves the timbers unsupported at their sides, which could, and did, allow turning where the bends were strongest. Several of the leftover frames were obviously unusable for this reason. In the Beetle shop, the frame trap resembled more closely its counterpart for the stems, with divider strips forming deep recesses for each timber to prevent it from twisting at the bend.

The bending traps for cedar planking differed in principle, as they molded the planks across the grain (Figure 4-17). The

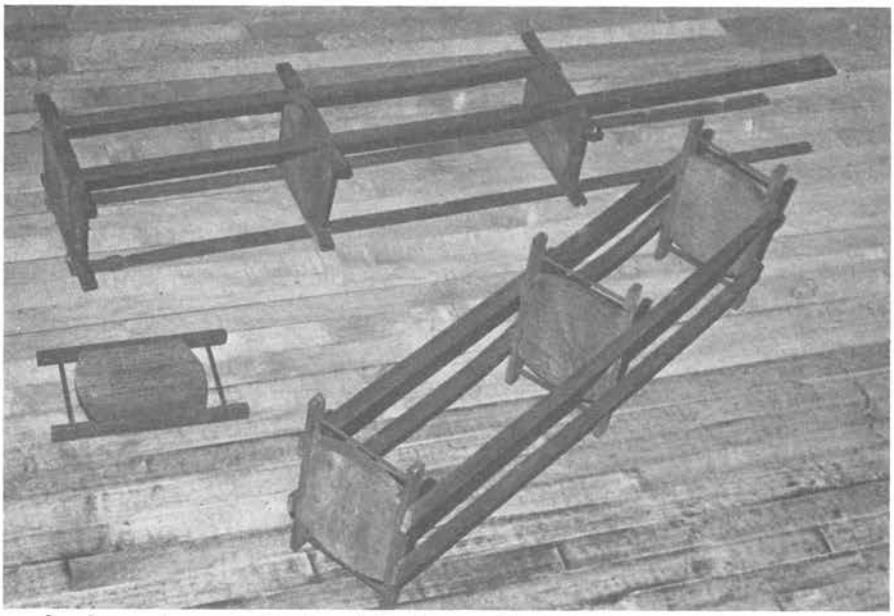


Figure 4-17. *The forming trap for the fifth and sixth strakes. To produce the "cupped" sections, these planks were fitted between the iron rods and curved surfaces of the trap sections, then wedged to conform to the curvature.*
Photograph by the author

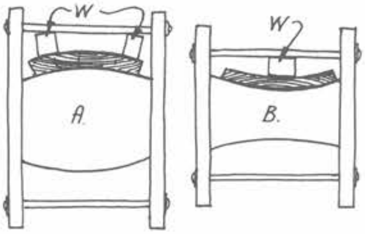


Figure 4-18. *Bending traps for cupping hull planks. A, the Delano trap forms the strake over a convex mold, using two wedges (W); B, the Beetle-style trap forms the strake over a concave mold, using only one wedge.*

cedar boards were first cut to shape from patterns, then steamed. When ready, they were slipped between the molds and wedge bars, and wedged firmly against the former (Figure 4-18). The resulting "cupped" planks would hold this shape despite the compounding of this curve in the process of fitting each strake to the hull. The molds in the Delano trap require two wedges to press the plank against a convex mold; the Beetle traps required one wedge to press a plank against a concave mold.

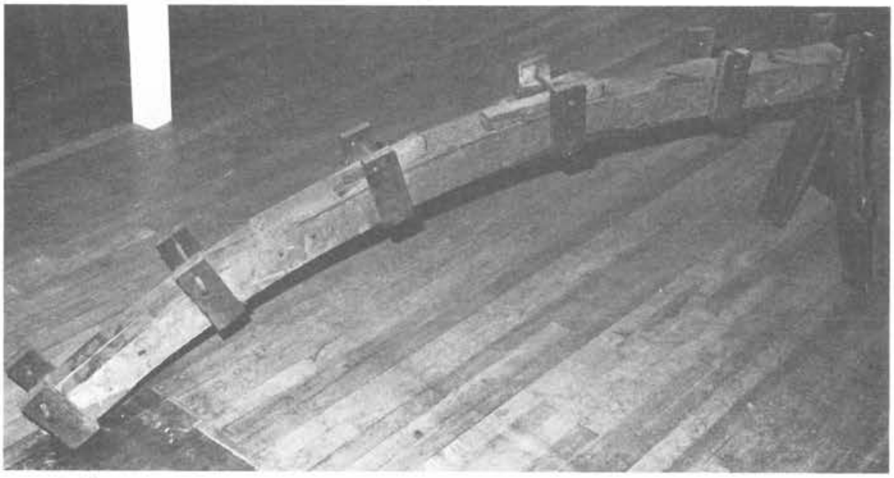


Figure 4-19. *Delano's bending trap for inwales. Because of their substantial dimensions, the inwales had to be steamed to shape to prevent the ends from collapsing and becoming too "sharp." The steamed wales would be placed on the top surface while iron pins were fitted through the side blocks and wedges driven.*
Photograph by the author

The trap for bending the inwale seems improbable and unnecessary, but was in fact essential to getting the ends to "spread" so they would not be too sharp and lack the necessary buoyancy, particularly at the bow. The modelmaker who has reached this stage in Chapter 3 will readily understand this problem! Delano preferred to have a special trap for his whaleboats, but the Beetles were not so fussy and pegged the steamed inwales to the shop floor. Figure 4-19 shows the Delano trap; it is the heaviest and clumsiest of the bending paraphernalia, about eight feet in overall length. The inwales are steamed, placed over the trap, and secured with pins and wedges at regular intervals.

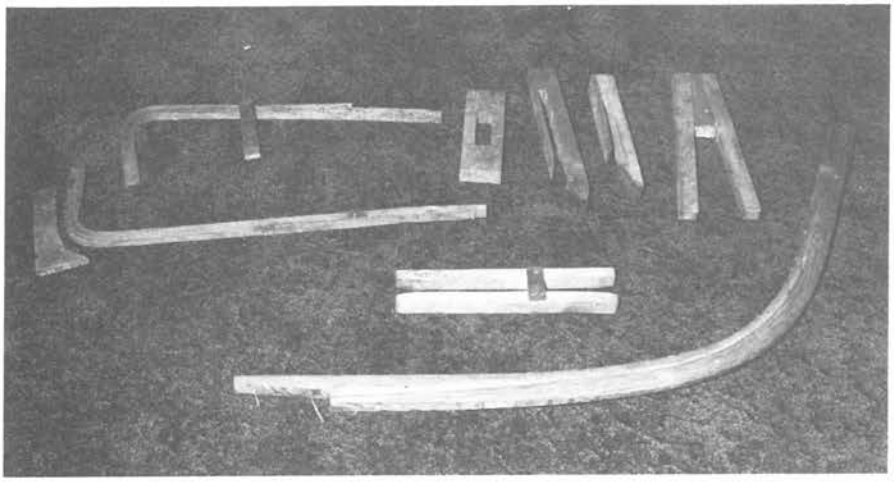


Figure 4-20. Miscellaneous forming tools used by Delano for some of the formed parts. Note the pattern for the filler block next to the thwart knee at left. A finished stem is at right foreground. While care was taken in setting up the miniature whaleboat shop in the New Bedford Whaling Museum, no notes or records by Delano have survived; hence the exact uses of many pieces have been forgotten and now can only be guessed.
Photograph by the author

FASTENINGS. All whaleboat fastenings were soft or galvanized iron, boat nails and clinch nails comprising the vast majority, with limited applications of spikes and rivets. Practically all edge-fastening was done with clinch nails of $1\frac{3}{16}''$-$1\frac{1}{4}''$ length; 1″ clout nails or copper tacks were used at the ends where lapped seams diminished to lie flush with the stems (Figures 4-21 and 4-22). The method of driving and heading over these nails has been described by Ansel.[2] These nails had flattened shanks with chisel points which allowed them to penetrate wood easily and hook quickly when driven against the backing iron, usually a case-hardened iron block. In driving, clinch and boat nails should "split" cedar grain and "cut" oak grain (Figure 4-23) for greatest holding strength and least tendency to induce splitting the wood.

[2]Ansel, *The Whaleboat*, p. 89.

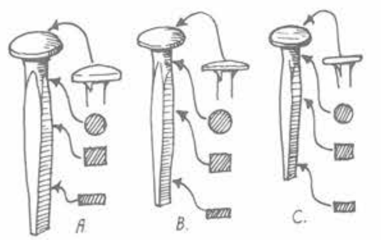


Figure 4-21. Sectional views of a boat nail (A), a clinch nail (B), and a clout nail (C). All of these nails have chisel-shaped points.

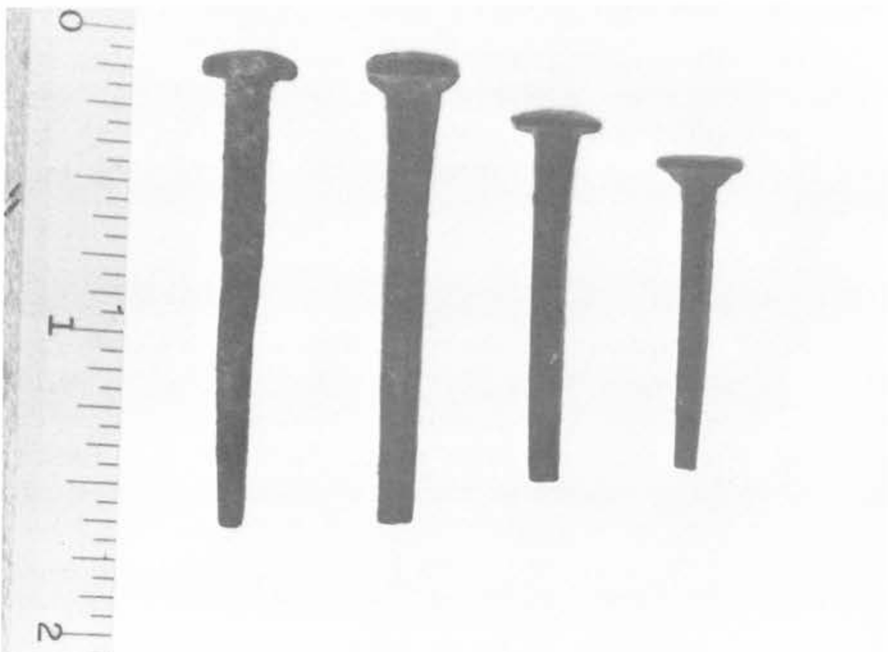


Figure 4-22. Nails used in whaleboat construction. From left to right: a boat nail pulled from a whaleboat in New Bedford Whaling Museum; a similar, unused boat nail; a clinch nail; a clout nail, used for nailing laps as they approach the rabbet seams. The latter three are from Leo Telesmanick.
Photograph by the author

Clinch nails were spaced 3″-4″ apart along the laps and batten seams. Lap seams would require only one row of nails; batten seams needed two—one on each side of the seam. Because they were set flush on the inside, it was not necessary to worry if a

Figure 4-23. When driving boat nails and clinch nails, the chisel point is used to penetrate the wood without inducing splitting. Thus, the nail should split the grain in cedar (A), but cut the grain in oak (B). These conditions are met when nailing cedar planks to oak frames.

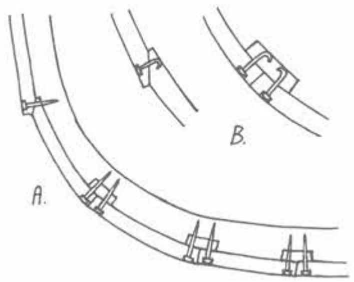


Figure 4-24. Fastening planks. A, boat nails; B, clinch nails.

clinch nail coincided with a frame. Planks would be fastened to the frames by nailing through a lap or batten.

Planking was fastened to oak frames with boat nails, which were not clinched as a rule (those nails going through the thinnest part of the frame, at the head, may have been an exception). Boat nails were used for all fastenings at the rabbet. Inboard, most fastenings were boat nails, their length as a rule being twice the thickness of the part being fastened; thus, the ½″ thick ceiling was fastened to the frames with 1″ clout nails, 2″ nails would hold the pads to the thwarts, etc.

In fastening the frames to the shell, care would be taken to drive the boat nails through lap seams or battens. In historic practice, frame notches for laps and battens were left slightly shallow, resulting in a slight gap between the frame and plank. This gap, through deft and practiced hammering technique, was closed while driving the head of the nail just below the surface of the strake. Properly done, the plank came in firm contact with the frame, there was no "hammer dent" around the nail head on the outboard side, and the nail head was sunk deeply enough so it could be puttied over and thus be invisible after painting. Figure 4-24 shows the usual practice for fastening planks to frames. Hammers with heads somewhat larger than those of standard capenters' hammers were preferred.

Riveting was done with iron spikes whose ends were headed over iron rooves, as in the case with the thwart knees, cheek piece, and the rivets holding the stems to the keel. ¼″ (shank diameter) spikes were generally used.

The centerboard was spiked to the keel (from its under side), using 6″ × ¼″ diameter flat-head nails at approximate 8″ spacing. The centerboard planks were secured together with drift pins (6″ spikes with their heads cut off) at about the same spacing.

Delivery of Whaleboats. While some whaleboat shops were conveniently situated near the waterfront (such as Beetle's and Delano's), many were some distance inland, particularly earlier in the 19th century, when building whaleboats was a "cottage industry" which supplemented meager farm incomes. One of the last of these was the Leonard boat shop in Acushnet (the next town north of New Bedford). The problem of getting these boats out of the barn and down to the wharves led to a picturesque solution: the whaleboat wagon. Figures 4-25, 4-26, and 4-27 show a boat from the Leonard shop being loaded for delivery; Figures 4-28 and 4-29 show whaleboats from other shops arriving on the wagons of New Bedford teamsters. Mounting a model on such a wagon, whether as part of a diorama, or as the display mounting itself, could be an interesting variation from

Figure 4-25. The Leonard boat shop, Acushnet, Massachusetts, circa 1900. The finished boat is being eased out of the shop for transport to New Bedford on a wagon. The outbuilding to the right of the shop entrance houses the oven and kettle for the steam box.
Old Dartmouth Historical Society

Figure 4-26. Loading a whaleboat onto a special wagon at the Leonard boat shop. After getting the stern positioned on the rear part of the carriage, the portable square frame would be moved and the bow raised to get the front part assembled.
Old Dartmouth Historical Society

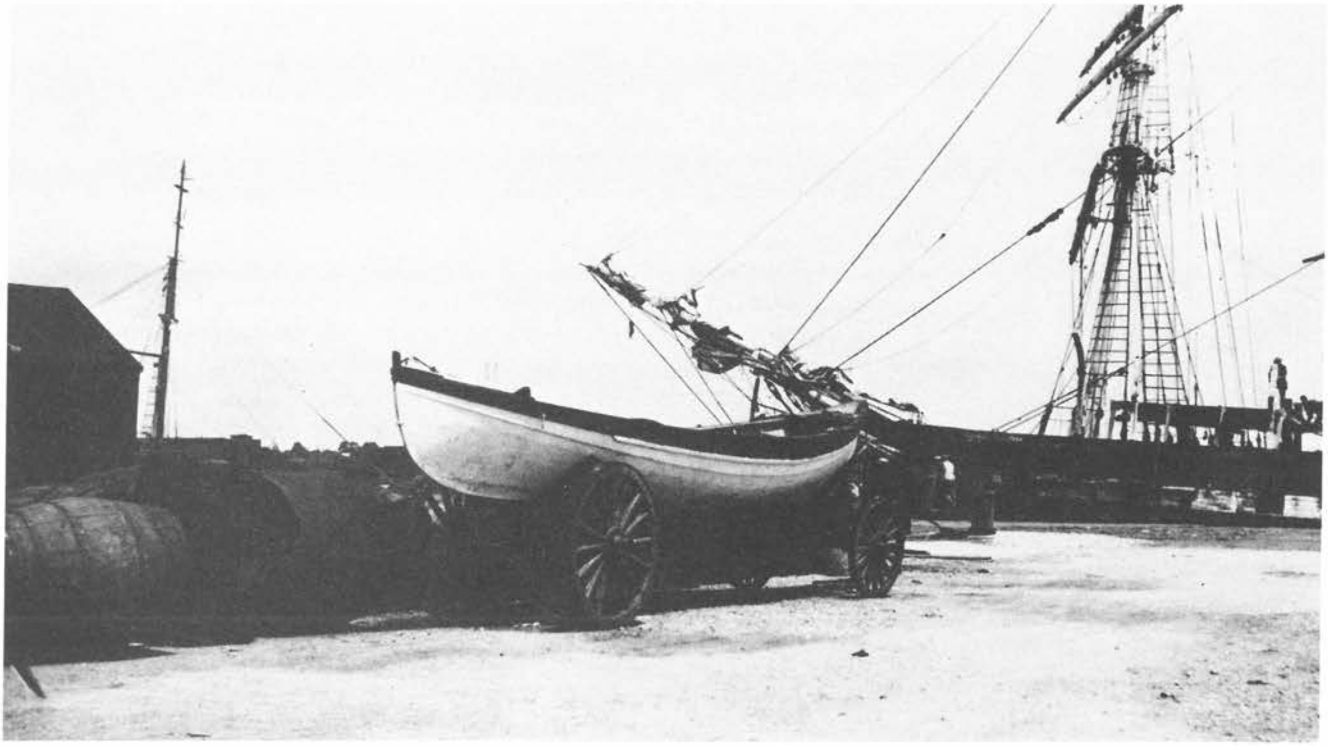
Figure 4-27. With the whaleboat securely on the carriage and builder Eben Leonard at the reins, the drive to New Bedford begins. In an hour or two, the boat will be on the wharf.
Old Dartmouth Historical Society

more conventional settings. This is a convenient excuse to avoid making whalecraft and other boat gear which was fitted at sea. In fact, to add such gear to a model so mounted would be inaccurate!

Figure 4-28. Boat shops located in New Bedford could hire a local teamster to deliver their boats if it was not convenient to put them overboard at the shop and deliver them by water. Boats were frequently stored in open fields or empty lots in many parts of the city, necessitating their transport by wagon. From a negative by Albert Cook Church.
Old Dartmouth Historical Society

However you wish to "deliver" your whaleboat model, it is hoped that this project has been an interesting and informative exercise of your modelmaking skills.

Figure 4-29. The whaleboat in this undated photograph by Clifford W. Ashley probably belongs to bark, ex-ship Charles W. Morgan, *at wharfside in the background.* Morgan's *painted ports indicate the picture was taken after her movie-making years of the early 1920s, but before she was moved to South Dartmouth in 1924. Both ship and whaleboat are probably being readied for the latter event, the first leg of a long and checkered voyage into the realm of historic preservation.*
Old Dartmouth Historical Society



Photography Notes

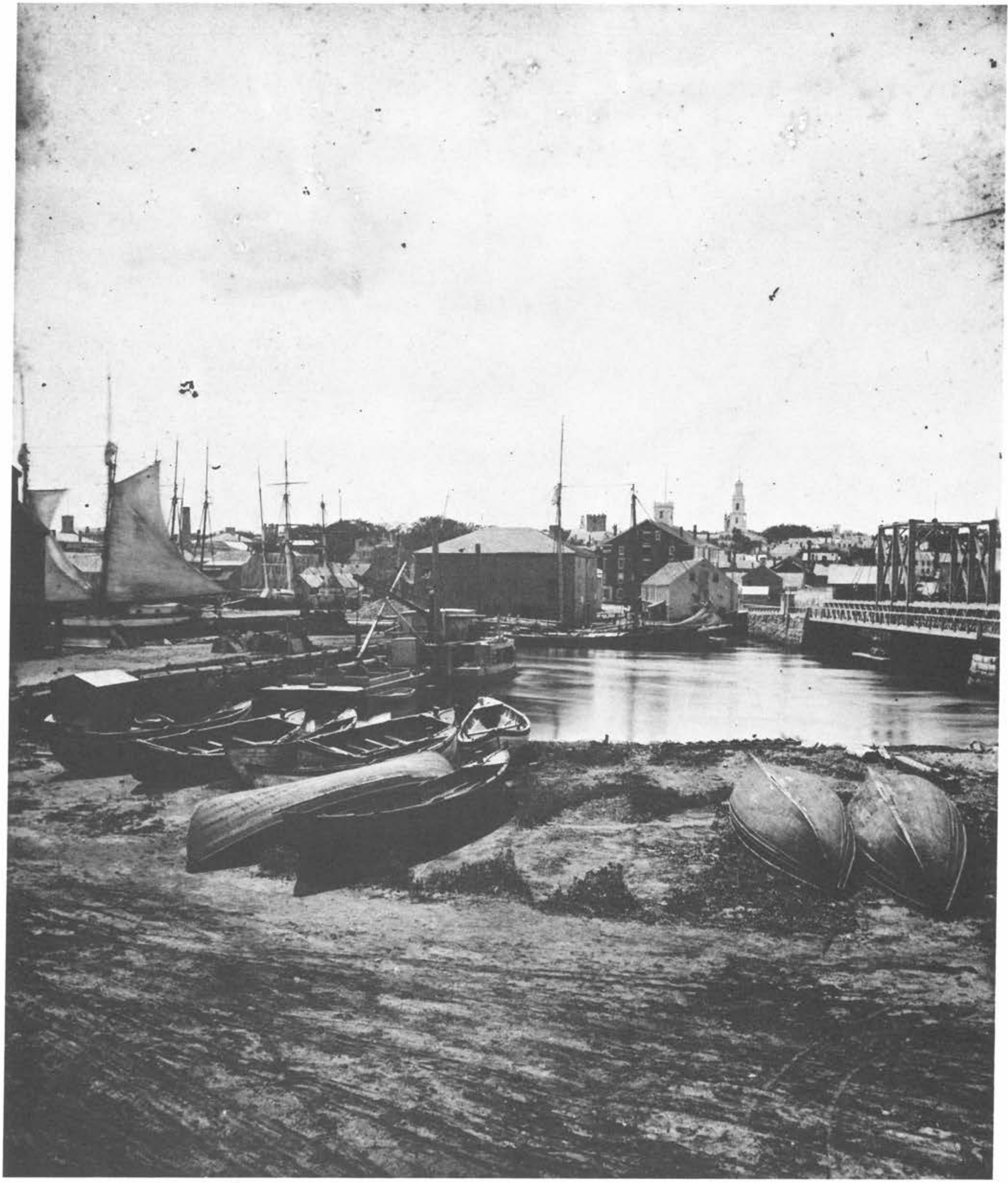
The model illustrated in Chapter 3 was built during the summer and fall of 1984, during which time it was photographed at important stages of construction. All of the photographs are of that model and its construction mold; none of the views have been retouched.

Most in-progress views were taken with a Rolleiflex SL66 and 80mm f/2.8 Zeiss Planar lens. The camera was mounted on a rolling camera stand which permitted rapid setting-up and composition. The built-in bellows and lens-tilt movement permitted close focusing and fine control of the desired plane of focus through the subject. The lighting source was a swiveling bench-top fluorescent lamp, this type of illumination being preferred for softer highlights and shadows. Tri-X 120 roll film was exposed at ISO 200; most exposures were made between ½ and ⅛ second at f/8 to f/11. The film was developed in Kodak HC-110, dilution B, at recommended processing times.

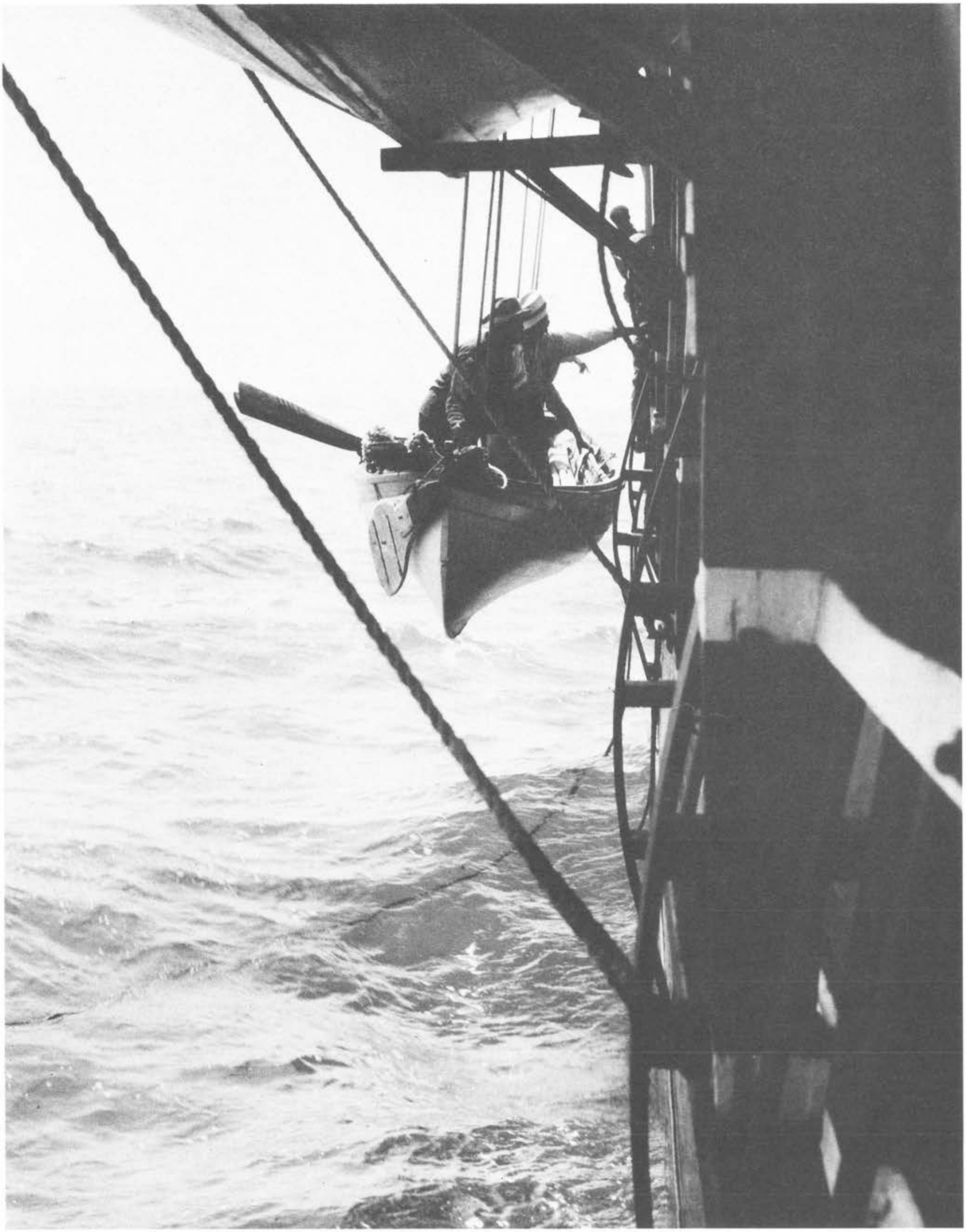
Close-up views of the model as finished (or in late stages of construction) were taken with an Olympus OM-4, using the following lenses: 50mm f/3.5 Zuiko macro, 135mm f/4.5 Zuiko macro (with telescoping auto-tube), and 85mm f/2 Zuiko. Olympus macro-flash units were used with the first two lenses: T-10 ring flash (with and without a cross-polarizing filter), T-8 ring flash with 200 mm reflector bowl, T-28 twin bar flash (for less extreme close-ups). An Olympus T-32 normal flash unit was used with the 85mm lens. Flash exposures were made in both auto and manual modes, with and without exposure compensation. Tri-X 35mm film was exposed at ISO 200 and developed in HC-110, dilution B.

Formal overall views of the finished model were taken with an MPP Micro Technical flat-bed view camera, 135 mm f/5.6 Schneider Symmar lens, and 180mm f/5.6 Nikkor W lens. Moderate use of swing- and tilt lens movements was made to control focus. Film was 4x5 Tri-X sheets exposed at ISO 320 and processed in HC-110, dilution B. The model was illuminated with two 500 watt photoflood lamps; exposures were made at ¼ to 1 second at f/16, depending on bellows factor and the positions of the lights.

Photographs by the author in other chapters (mostly taken at New Bedford Whaling Museum) were taken with the OM-4, using previously mentioned lenses and flash units, plus the following: 24mm f/2 Zuiko, 35mm f/2.8 Zuiko shift (perspective control lens), and 50mm f/1.2 Zuiko. Tri-X film was used and processed as described previously.



Fish Island, New Bedford, ca. 1910. At the time this photograph was taken, the New Bedford waterfront had long been in decline and the whale fishery's demise was at hand. In earlier times, used whaleboats like these would have been condemned after a voyage and sold for junk, but these will probably be saved for short voyages in the Atlantic, then cannibalized to prolong the life of another old boat. From a negative by Albert Cook Church.
Old Dartmouth Historical Society



Lowering the bow boat, bark Sunbeam, *voyage of 1904-1905. From a negative by Clifford W. Ashley.*
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