REPORT

ON THE

SHIP-BUILDING INDUSTRY OF THE UNITED STATES.

BY

HENRY HALL,
SPECIAL AGENT.

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LETTER OF TRANSMITTAL.

NEW YORK, *November* 30, 1882.

Hon. CHARLES W. SEATON,
Superintendent of Census, Washington, D. C.

SIR: I beg to submit a report on the ship-building industry of the United States.

The work of this investigation began in November, 1880, in the city of Bath, Maine, at which place the greatest number and the largest and finest wooden vessels in this country are built. It was found almost at once that the only means of getting full, reliable, and accurate statistics of the ship-building industry would be by personal visitation of the various ship-building localities of the country. After a thorough study of the state of the industry in Maine, the whole coast southward to Norfolk, Virginia, was visited, every ship-yard, repair yard, boat-shop, and important establishment being entered on the way. All the different establishments scattered along the Hudson river were then visited, and after that the boat-yards of the Erie canal and the ship-yards of the northern lakes all the way from Oswego, New York, to Manitowoc, Wisconsin. The statistics of the industry at Green Bay, Wisconsin, were obtained by correspondence. Letter-writing was, however, seldom resorted to, as one day spent in a ship-yard in personal contact with builder, engineer, and workmen, and in the inspection of such books, draughts, and models as one would be permitted to see, was worth four weeks' correspondence by mail. After a visit to the lakes, several weeks were spent on the Monongahela, Allegheny, Kanawha, Ohio, and Mississippi rivers in gathering the statistics of barge and steamboat building and in learning by actual observation what was going on in the yards. Two months were then spent on the Pacific coast in personal visits to all the different ship-building localities in California and on Puget sound and the Columbia river, Humboldt bay and Coos bay alone excepted, data from the two bays being obtained by correspondence. With regard to the Gulf of Mexico and the south Atlantic coast, the statistics of the industry were obtained through the medium of the local census agents and the local collectors of customs, and were verified by means of data prepared by leading and well-informed shipwrights in Charleston, South Carolina; Key West, Florida; New Orleans, Louisiana; and Galveston, Texas.

Great pains have been taken to verify the facts and statistics presented in this report. A large number of small builders keep no accounts other than rough memoranda on a board, no copy of which is retained after the boat or vessel in hand is completed, or, at any rate, nothing better than equally rough notes jotted down in a pocket memorandum book, which are not complete when entered, and are almost unintelligible in a year's time. Vessel builders trust to their memory and judgment in some things to an extent hardly paralleled in any other trade, and it frequently happened that those who had completed vessels of considerable size in the census year, having no accounts, and not having charged their memories with details, were unable to tell the quantities of materials that had entered into the construction of the vessels or how much money had been paid out for labor in building them. In such cases a careful calculation of the quantities of materials was made, based upon the size of the scantling in the vessels and the style of fastening adopted, and a result was then reached which, when corrected by the recollections of the builder, was practically correct. Results arrived at in this manner were compared with data obtained directly from the books of more careful builders, a large number of whom cheerfully submitted their private accounts for the inspection of the agent of the Census Office; and it is believed that by the continual employment of both of these checks upon the returns of the small builders, and by taking the returns of the larger establishments directly from their books, exaggeration has been avoided and substantial accuracy reached.

On the whole, the ship-builders of the country have assisted in the collection of facts about their industry with great heartiness. A few were sensitive and suspicious, owing to the fact that they had not been making money for a few years; but the great majority gave such practical and sufficient help as to secure the faithful and complete collection of the statistics required. A number of them have taken considerable trouble to supply information for this report. The Census Office is particularly indebted to the following persons:

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William Rogers, of Bath, Maine, for historical and other valued information.

Pattee & Rideout, draughtsmen, of Bath, Maine, for models of old cotton ships and freighting vessels.

Edward O'Brien, of Thomaston, Maine, for information as to the days of labor required for the building of great ships.

Mrs. Donald McKay, of Hamilton, Massachusetts, for data in relation to the famous clipper ships built by her husband during his lifetime.

Hiram Lowell & Son, of Salisbury, Massachusetts, for models of fishing boats and historical information.

William H. Webb, of New York, for historical data in regard to the ship-building of New York city.

Gildersleeve & Sons, of Portland, Connecticut, for historical data.

William Cramp & Sons, of Philadelphia, for draughts, etc., of iron vessels.

The Harlan & Hollingsworth Company, of Wilmington, Delaware, for information in regard to iron vessels.

Robert Ashcroft, of Baltimore, for draughts and models of the clipper vessels of that port.

Emerson Rokes, of Baltimore, for facts about the white-oak supply of the Maryland and Virginia peninsulas.

B. Hufty, deputy collector at Crisfield, Maryland, for models of bug-eyes, and data in regard to them.

T. Quayle & Sons, of Cleveland, Ohio, for data in regard to wooden propellers on the lakes.

Frank E. Kirby, C. E., of Wyandotte, Michigan, and H. D. Coffinberry, of Cleveland, Ohio, for full information about the iron steamships of the lakes.

Joseph P. Rogers, of Cincinnati; James Howard, of Jeffersonville, Indiana; J. L. Shallcross, of Louisville, Kentucky; and Thomas P. Morse, of Saint Louis, for valuable data in regard to modes of building, cost of construction, and achievements of vessels on the Ohio and Mississippi rivers.

Middlemas & Boole, of San Francisco, designers and shipwrights; Matthew Turner, of San Francisco, yacht builder; and J. J. Holland and C. W. Townsend, of Portland, Oregon, for draughts and data relative to Pacific coast vessels.

Commodore Phelps, United States navy, for facts concerning the teredo and the strength of Pacific coast woods.

Constructor George W. Much, of Mare Island navy-yard, for draughts of vessels.

Constructor Samuel M. Pook, of the Washington navy-yard, for strength and weight of American ship-building woods.

Professor C. S. Sargent, of Brookline, Massachusetts, chief special agent of the Census Office on forestry, for data in regard to weights of American ship-building woods and the supply of ship timber.

W. W. Bates, of Chicago, for historical data.

Hon. N. B. Walker, chief of the tonnage division of the Treasury Department, for valuable tables showing the ship-building of the United States from 1797 down to 1882, being the first complete statement ever prepared for publication.

A large number of others have aided in the collection of special information of much value in the preparation of this report.

Respectfully, yours,

HENRY HALL,
Special Agent.

SHIP-BUILDING INDUSTRY OF THE UNITED STATES.

CHAPTER I.—FISHING VESSELS.

Fishing vessels properly come first in any account of the American ship-building industry. In the United States there are owned at the present time more than 51,000 boats and vessels which are regularly engaged in fishing either along the different coasts of the country, or on the banks of Newfoundland, or in the distant latitudes near the north and south poles, where they go for the noblest game the sea contains—the whale, the seal, and the sea lion. This multitude of boats, sloops, schooners, and ships gives constant employment to more than 101,000 hardy and energetic men in the catching and curing of fish and to thousands of people on shore in the various trades concerned in the building, fitting out, repair, and maintenance of vessels, and half a million of our population are afforded a livelihood by the fishing enterprise of the country. The boats put out from hundreds of capes and harbors, in fair weather and foul, and encounter much toil and danger, facing both bravely, and push their ventures under circumstances that would often completely check enterprise in the merchant navy. This rough but fascinating service trains hundreds of excellent new sailors annually, fitting them to go on the larger vessels of the merchant branch of our marine and enabling them to command, if required. It also makes hundreds of new carpenters and builders every year on shore, a large part of them getting their first acquaintance with the forms and the methods of framing and planking vessels in constructing some modest and clumsy boat during the rainy days or in wintry weather, for their own use when the fishing season next arrives, their unpretending efforts in this direction fitting them afterward for the skillful building of larger and more pretentious craft. It is not the least of the good things accomplished by the fishing fleet that it supplies the people with a vast quantity of cheap and delicious food; but that is mentioned only by the way. Fishing vessels are the starting point of our ship-building and merchant service, as they have been, historically, in the case of every nation which has been conspicuous upon the sea; and the experience of the United States is so like all the other important maritime nations of the earth in this respect that the similarity is too remarkable to be passed by without notice.

The first fishermen of whom we have any account were a race of people who settled on a forlorn portion of the Mediterranean coast, in a little territory, 200 miles long, cut off from the interior by rugged and heavily wooded mountains, which ran parallel with and not far from the coast. The land could not support the natives in agriculture, and they lived in part by fishing off shore in row-boats. Fishing villages were scattered along the coast of Phœnicia in large numbers as early as 1500 B. C., and had a large fleet of small boats, built from the strong and light timber of the country. The marketing of the surplus product of the fisheries, and the desire to buy grain and other needed commodities, led to expeditions along the coast to distant localities. This was the beginning of the far-reaching commerce of the Phœnicians, which did not pause until vessels had been sent as far northward as the British isles and as far southward as around the lower cape of Africa; it also made them the vessel builders of their age, and converted several fishing towns into large commercial cities.

The Carthaginians, who were colonists of the Phœnicians, began to build boats and to fish from the first, as their forefathers had done, and afterward to trade, and were the common carriers of the western part of the Mediterranean for several centuries.

Fishing boats were the small beginning from which sprang the sailors and the towering ships of the Barcelonians in Spain, the wonders of their day, in the early part of the Christian era.

The eminence of the Italians as builders of great vessels took its rise from the fisheries of the Adriatic sea. The ravages of the barbarians of the north, who made frequent invasions into Italy after A. D. 400, having driven a large number of people from the mainland to the islands which subsequently became the city of Venice, the settlers built boats for fishing purposes, and soon began to trade with the mainland and with Greece. Thinking only of subsistence, these islanders created by their modest efforts a race of brave sailors and a great fleet of boats, and in due time became the principal ship-builders of the world, their fleets assisting in all the crusades and their vessels being bought or borrowed by every nation of their time which had need to make a demonstration of any magnitude by sea.

The Portuguese also began their maritime career as fishermen. The busy trade of the early nations of Europe swept past their doors continually, but they took no part in it until, after many generations, they began to fish and had built sail-boats and small vessels large enough to go to the North sea and bring their catch safely home. The early commercial treaties of the Portuguese were made to protect their sailors and vessels in the northern fisheries, it being one of their great industries, the country not being so well adapted to agriculture as to other pursuits; and not until after the reign of a king who flourished from A. D. 1279 to 1325, who brought people from Genoa to teach the art of building great ships and planted royal forests of useful timber, did the Portuguese begin to trade, explore, and conquer.

The fisheries of the north of Europe, and the abundant growth of cheap and good timber, made maritime and trading nations of every people in that part of the earth except the French. The latter occupied a fertile and delightful region, which fully employed the population at home. The Dutch became the foremost of the fishing nations. They had an immense fleet of small sailing boats and busses of their own construction and a great seafaring population of daring men, ready for any service. About 1360 they discovered the art of salting and curing fish, which enabled them to make long voyages for the sale of their staple, just as it did afterward in the case of the Americans. With the rise of industry at home this discovery brought them at once into a large and profitable foreign trade, and by 1580 they were the principal carriers of the north of Europe. By 1650, according to the histories, they had 3,000 vessels and 50,000 men fishing off the coasts of Great Britain, 9,000 vessels to market the fish, and 8,000 more which their owners were employing exclusively in general trade, and had taken possession of India, were pushing out to every part of the world, and were the commercial masters of the sea. One of their cities was built upon the immense mass of herring bones accumulated by the industry of several generations, very much as the little modern fishing town of Crisfield, in Maryland, has been built upon the immense bank of oyster shells thrown into deep water by her fishermen, which now affords a strong foundation for a whole town to stand where formerly vessels rode safely at anchor.

England felt the need of ships for defense from the earliest times; and, recognizing the fact that the best way to get them was to make it profitable for the people to build, she encouraged her fishermen by every means in her power. Her general trade was almost wholly carried on by foreigners, but at any rate she might have a fishing fleet. A great many regulations were made; bounties were given, with various special privileges; and, in addition thereto, in the sixteenth century the people were required by law to abstain from meat on two days of each week and sometimes 153 days in the year, in order to make a profitable market for fish and to foster the creation and maintenance of a large native marine. These regulations had the desired effect. Large numbers of boats and vessels were built yearly for fishing purposes, and the native ship-building industry of England received its start and derived a great deal of its early vigor from the construction of small smacks and fishing boats.

America has followed the path of all of her predecessors; and it was the steps she took in this direction which led originally both to the possession of her large fleet of fishing boats and vessels and to her success in the field of general nautical enterprise. The following statement of the details concerning the fishing fleet in the census year of 1880 has been prepared by the fishery branch of the census, in charge of Professor G. Brown Goode, of the Smithsonian Institution, at Washington:

States and Territories.	NUMBER OF PERSONS EMPLOYED.			APPARATUS AND CAPITAL.						
				Vessels.			Boats.		Value of minor apparatus and outfits.	Other capital, including shore property.
	Total.	Fishermen.	Shoresmen.	Number.	Tonnage.	Value.	Number.	Value.		
The United States	131,426	101,684	29,742	6,605	208,297.82	$9,357,282	44,804	$2,465,393	$8,145,261	$17,987,418
New England states	37,043	29,838	7,205	2,066	113,602.59	4,562,131	14,787	739,970	5,038,171	9,597,335
Middle states, exclusive of the Great Lake fisheries.	14,981	12,584	2,397	1,210	23,566.93	1,382,000	8,293	546,647	674,951	1,822,480
Southern Atlantic states	52,418	38,774	13,644	3,014	60,886.15	2,375,450	13,331	640,508	1,145,878	4,789,886
Gulf states	5,131	4,382	749	197	3,009.86	308,051	1,252	50,173	52,823	134,537
Pacific states and territories	16,803	11,613	5,190	56	5,463.42	546,450	5,547	404,695	467,238	1,330,000
Great lakes	5,050	4,493	557	62	1,768.87	183,200	1,594	83,406	766,200	313,175
Alabama	635	545	90	24	317.20	14,585	119	10,215	7,000	6,400
Alaska	6,130	6,000	130	.....	.....	.....	3,000	60,000	7,000	380,000
California	3,094	2,089	1,005	49	5,246.80	535,350	853	91,485	205,840	307,000
Connecticut	3,131	2,585	546	291	9,215.95	514,050	1,173	73,585	375,535	457,850
Delaware	1,979	1,662	317	69	1,226.00	51,600	839	33,227	70,324	113,080
Florida	2,480	2,284	196	124	2,152.97	272,645	1,058	28,508	39,927	65,037
Georgia	899	809	90	1	12.00	450	358	15,425	18,445	44,450
Illinois	300	265	35	3	209.73	8,500	101	2,000	11,900	61,000
Indiana	52	45	7	1	21.90	2,500	15	1,650	20,210	5,000
Louisiana	1,597	1,300	297	49	539.69	20,821	165	4,800	18,000	50,000

States and Territories.	NUMBER OF PERSONS EMPLOYED.			APPARATUS AND CAPITAL.						
				Vessels.			Boats.		Value of minor apparatus and outfits.	Other capital, including shore property.
	Total.	Fishermen.	Shoresmen.	Number.	Tonnage.	Value.	Number.	Value.		
Maine	11,071	8,110	2,961	606	17,632.65	$633,542	5,920	$245,624	$934,593	$1,562,235
Maryland	26,008	15,873	10,135	1,450	43,500.00	1,750,000	2,825	186,448	297,145	4,108,850
Massachusetts	20,117	17,165	2,952	1,054	83,232.17	3,171,189	6,749	351,736	3,528,925	7,282,600
Michigan	1,781	1,600	181	36	914.42	98,500	454	10,345	272,920	60,900
Minnesota	35	30	5	1	33.59	5,000	10	900	3,760	500
Mississippi	186	110	76	.....	.....	.....	58	4,600	1,600	2,600
New Hampshire	414	376	38	23	1,019.05	51,500	211	7,780	60,885	89,800
New Jersey	6,220	5,659	561	590	10,445.90	545,000	4,065	223,963	232,339	490,000
New York	7,206	5,650	1,616	541	11,582.51	777,600	3,441	289,885	390,200	1,171,900
North Carolina	5,274	4,729	545	95	1,457.90	39,000	2,714	123,175	225,436	118,950
Ohio	1,046	925	121	9	359.51	38,400	487	20,830	253,795	151,775
Oregon	6,835	2,795	4,040	.....	.....	.....	1,360	246,600	245,750	639,000
Pennsylvania	552	511	41	11	321.99	10,500	156	13,272	49,538	55,500
Rhode Island	2,310	1,602	708	92	2,502.77	191,850	734	61,245	138,733	204,850
South Carolina	1,005	964	41	22	337.32	15,000	501	9,790	25,985	15,500
Texas	601	491	110	.....	.....	.....	167	15,000	4,400	23,000
Virginia	18,864	16,051	2,813	1,446	15,578.93	571,000	6,618	292,720	560,703	489,636
Washington	744	729	15	7	216.62	11,100	334	6,610	8,048	4,000
Wisconsin	800	730	70	11	220.25	26,700	319	24,975	145,165	26,000

The first step in the development of the fishing business of America, and the attendant ship-building industry, was that which led to the crossing of the Atlantic by European fishing craft and the planting of small establishments on shore by their crews. At the time of the settlement of the north Atlantic coast fish were in great demand abroad and brought high prices. In 1497 Cabot made known in Europe that the ocean in the neighborhood of the northern part of this continent was full of fish of a size then seldom seen in the old country. Here, he said, "were great seals, and those which we commonly call salmons, and also soles above a yard in length; but especially there is a great abundance of that kinde which the savages call baccalos, or codfish." When this information was printed in London the news spread to every part of Europe, and there was great excitement among fishing merchants and the owners of fishing vessels. In 1504 several Normans and Biscayans crossed the ocean in craft dangerously small for that voyage and took cargoes of cod, which they carried back for sale. The great banks of Newfoundland, 200 miles broad and 600 miles long, were soon discovered. By 1517 there were 50 European vessels on the spot taking fish, and by 1540 there were establishments on shore at Newfoundland for salting and drying what they had caught. From that day to this the banks have been annually resorted to by large numbers of vessels, and the coast has been occupied by fishermen. In 1577 the French had 150 sail on the banks, and there were between 300 and 400 in all on the spot. By 1600 the English were sending out 200 vessels annually, and were employing fully 10,000 men as catchers and curers; and as they had now become familiarized with the idea of crossing the Atlantic, the large profit they found in the business made their fishing expeditions to America a regular feature of British enterprise. In 1602, 1603, 1605, and 1606 several explorers who had pushed on past the banks to the mainland of America discovered that cod could be taken close inshore to what is now Maine and Massachusetts in six or seven fathoms of water which were far larger and better than those caught off Newfoundland, where the depth was forty-five or fifty fathoms; and it was also found that six or seven cod would make a quintal in New England, when, by reason of their smaller size, twice that number were required at Newfoundland, while the shares of common fishermen earned only £6 or £7 each at Newfoundland, against £14 in New England. The reports brought back by these explorers were so satisfactory that they greatly increased a desire then felt in England for colonizing the mainland of America with fishing stations. Merchants found it expensive to add twenty men to the company of a vessel and carry them across the ocean and back again, paying and maintaining them all the while, simply to employ them on shore in curing and packing the fish caught by the regular force of the vessel, as it was cheaper to establish villages on shore, where the fish would be cured by the residents and the expense of doubly manning the ships thus be avoided. The desire to found fishing colonies in New England became strong, and the grant made by James I, in 1606, to the Plymouth company was largely with that idea in view. In a brief time the coast from Newfoundland to the capes of Virginia was planted with a succession of little villages of several different nationalities, the people of which were more or less engaged in the catching of fish.

So far as the English fishing merchants were concerned, their object in aiding the establishment of colonies in New England was to save the expense of the double manning of their ships and to secure permanent drying stations on shore, where their people and apparatus would be protected against the hostility of the Indians. But the

planting of the new colonies had an effect not foreseen by them. The people left behind in the New World, finding the land unfit for high cultivation and able to live easily by following the trade they already knew so well, began to build boats and go fishing on their own account. A fisherman is always half a ship-builder by the nature of his calling. A few ship-carpenters besides had been sent over to the villages in Massachusetts by members of the home company, and the art of building sail-boats was almost the first industry after house-carpentry introduced into the colony. The result was unexpected, and the people of the Massachusetts towns soon owned a large number of fishing boats of their own construction. The country was covered with excellent timber, and vessels were cheaply built. One merchant was fishing with 8 boats at Marblehead as early as 1634, and Portsmouth had 6 great shallops, 5 fishing boats, with sails and anchors, and 13 skiffs in the trade as early as 1635. Canoes were owned everywhere. By 1645 they had sent a "ship and other vessels" from Boston to the banks to fish, Lechford stating in his "Plain Dealing; or, News from New England" that at this time the people of the colony "were building of ships, and had a good store of barks, catches, lighters, shallops, and other vessels". The English government was troubled by this multiplication of fishing craft, and in 1670 an order was issued by the lords of trade and plantations to capture and burn the boats and break up and destroy the boat fisheries of New England. This had some effect, but not much, as the fishermen went on building boats and taking fish; and as the years went by those who were prosperous built larger vessels and pushed out to the banks, while others went out for whales and seals, following their game from one latitude to another until they reached the impenetrable regions of the north and south poles. Vessels were sent out to New York and Virginia, to the West Indies and other islands of the Atlantic, and finally to Europe, to market the products taken from the sea, and their masters brought back the commodities of the lands they visited to sell at home. Afterward many of the vessels went regularly into trade, masters and men being recruited from the fishing fleet. A great and valuable foreign commerce was the result of their operations, and this, reacting upon the ship-building industry at home, made it an active and prosperous business within a hundred years of the time of the first permanent settlements.

While a few trading vessels were built at an early period in the history of the colonies, the number was not for fifty years large enough to give regular employment anywhere to a great number of men. The main stay of the industry, that which enabled men to learn and practice steadily the trade of a ship-carpenter, was the fishing business, and all the early builders learned their art in the construction of boats for that branch of the service. It was the fishing business also which, in large part, supplied the captains and crews of the trading ships, when any of that class were built.

The first vessels sent to America to fish were among the largest of their time in the merchant service of England, France, and Portugal; but, large as they were relatively, they were small compared with those which are sent out in this age for voyages across the Atlantic. As illustrating the size of those early vessels, it is stated that of the 1,232 sail which in 1582 comprised the whole marine of England not over 217 were over 80 tons actual burden; that is to say, not over 75 feet in length by about 23 feet in breadth, and about 10 feet deep in the hold. Fifty of the larger class were sent to Newfoundland annually, so that one-fourth of the whole merchant navy of England fit for distant voyages was employed in the American fisheries. In 1603 England had four vessels, each of which exceeded 400 tons burden. The ships of the discoverers of America were surprisingly small. Columbus made his first voyage in vessels the largest of which was between 150 and 200 tons burden. The Santa Maria was a decked vessel, and, in accordance with the models of that age, must have been about 100 feet long, 29 feet wide, and about 12 feet deep in the hold. The other two, the Pinta and the Nina, were "light barques", or "caravels", decked only at the ends, open amidships, but having cabins and quarters at the bow and stern for the crew and officers respectively. The foremast carried one large square sail; the mizzen carried a lateen sail, attached to a yard which was suspended from the mast by the middle at an angle of about 45° with the horizon; the sail was triangular in shape, and was the fore-and-aft canvas of barks and ships in the sixteenth century. The bowsprits on the vessels of Columbus probably carried no canvas; if they did, the sail was a square one, hung from a sprit-sail yard underneath the bowsprit, which raked high, so as to carry the sail up to where it would take the wind.

Gosnold's expedition in 1602 was made in the "small ship" Concord. Pring explored the waters of Maine in 1603 with the bark Speedwell, of 50 tons, and the Discoverer, of 26 tons. John Smith's fleet in 1606 was composed of a pinnace or long boat of 20 tons and two vessels of 40 and 100 tons respectively. The Mayflower, small as it was, was a large vessel for the times.

It is hard to identify the rig of these early vessels by their names. The term "ship" is now used to designate a vessel of three masts, square rigged throughout, and the term "bark" means a large vessel square rigged on the fore and main masts, but carrying only fore-and-aft canvas on the mizzen. Two or three centuries ago, whatever the size or rig of the vessel, it was called a "ship", in the general sense of the word, as often as by its own class name. There is an English official list of the vessels of the Cinque Ports made in 1587, in which the following expressions occur:

Deal hath small barks from the burthen of 3 tons to 5 tons	5
Walmer hath small barks from the burthen of 2 tons to 3 tons	4
Ramsgate hath small barks from the burthen of 5 tons to 19 tons	12
Dover hath ships and small barks from the burthen of 12 tons to 120 tons	26

In the list are also mentioned "Small boats of the burthen of 5 tons"; "one small bark of the burthen of 20 tons;" "small barks and boats from 2 tons to 25 tons apiece;" "small boats from 14 tons to 20 tons;" and "ships and small barks from 6 tons to 8 tons". In an old lawsuit, the record of which is still preserved, a small sloop was described variously as a "ship", a "boat", and a "vessel". In all vessels bearing more than one mast the mizzen-mast appears always to have carried a lateen sail, while those forward of it carried square sails. The difference between a "bark" and a "ship" seems to have been at first one of size only, the ship being the larger. When tonnage grew large, ships probably carried three masts, with two square sails on each of the forward masts and a lateen sail on the mizzen. A bark was a smaller vessel, usually with two masts, but sometimes three, with one or two square sails on the forward spars, as before, and a lateen sail aft. The tons of burden above referred to were the actual tons weight of cargo the vessels were able to carry.

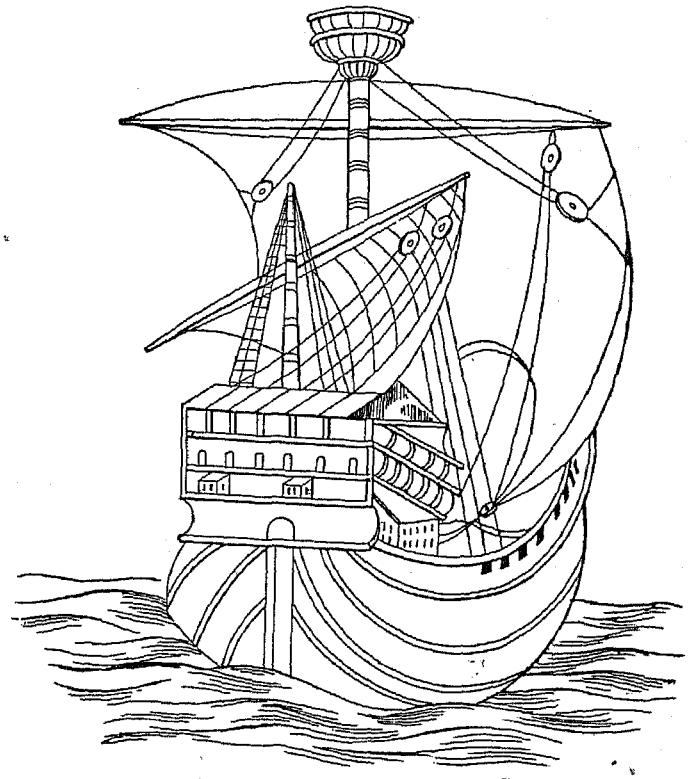


Fig. 1.—Caravel of the Fifteenth Century.

The accompanying (Fig. 1) is the "light bark" or "caravel" of the fifteenth century, as shown by a drawing at Venice.

The boats carried by the vessels of that day were the pinnace, or long boat, and the chaloupe, or shallop, both open boats, mounting several pairs of oars, and fitted with small masts and sails, which could be put up at pleasure. The pinnace was long, sharp, and fast, often carrying 25 men, and was much used by early discoverers in exploring the coast. The shallop, a more or less capacious barge, was handy and safe, and was the more popular style of boat. Shipwrecked mariners often decked the pinnace and set sail in it for distant places. The shallop became the boat in common use for fishing and coasting in the early days of the settlement of America, though many widely different styles of boats grew out of it in the course of time.

It is now proposed to describe, as fully as this report will allow, the different classes of vessels used in America for fishing purposes, the kinds of wood put into them, the manner of building them, and the places where they are and have been built.

NEW ENGLAND FISHERIES.

The first boats used by the settlers in fishing were wooden canoes, made by the Indians. In Maine these canoes were usually made of the bark of birch trees, sewed on ribs of ash wood, and made so light that an Indian would carry on his head for several miles one which would hold eight or ten persons, while in Massachusetts they were usually made from the trunk of a large tree. Wood (1634) says:

> Their Cannows be made either of Pine trees, which, before they were acquainted with English tooles, they burned hollow, scraping them smooth with clam shels and Oyster shels, cutting their outsides with stone hatchets: These boats be not above a foot and a halfe or two feete wide, and twenty foote long. Their other Cannows be made of thinne Birch rines, close ribbed on the inside with broad thinne hoopes, like the hoopes of a tub; these are made very light, a man may carry one of them a mile, being made purposely to carry from River to River and bay to bay to shorten land passages. In these cockling fly-boates, wherein an English man can scarce sit without a fearefull tottering, they will venture to sea, where our English Shallope dare not beare a knot of sayle; scudding over the overgrowne waves as fast as a wind-driven ship, being driven by their paddles; being much like battledoores; if a crosse wave (as is seldome) turne her keele upside downe, they by swimming free her, and scramble into her againe.

The majority of canoes would carry only four or five men; the larger ones, twenty, thirty, and even forty men; and they were round-bottomed and very crank. The bodies of the log canoes were straight, the ends sharp, and the fore foot and heel cut away as in a modern whale-boat. Their narrowness gave them great speed, and three men, with paddles, could drive them faster than a shallop could be propelled with eight oars. An Indian, by going into the woods and giving his time to it, would make a canoe in ten or twelve days.

When the English settled at Plymouth, Salem, Ipswich, Portsmouth, and other places on the New England coast they bought these strong and handy boats in large numbers, both for fishing in smooth waters and for crossing streams and visiting their neighbors, and nearly every family in towns like Salem owned its canoe, as every farmer to-day does his horse. Canoes were the universal oyster boats for the first fifty years on the whole American coast, and were so well adapted to that use that they are still so employed by American oystermen in many localities.

It is not probable that log canoes ventured more than 2 or 3 miles from shore, and then only in calm weather, as they could not be launched through the surf nor taken into very rough water. A larger class of boats was

required for taking cod and for other work in the open sea. The first ones were ships' boats left behind by the vessels which visited the coast; but in 1624 boat-building began regularly at Plymouth, some ship-carpenters having been sent over for the purpose. Two chaloupes, or shallops, were built, one of them afterward making a voyage as far eastward as the Kennebec. They were open boats, like others of their class, having, however, a little deck amidships, to keep the crew dry. In 1625 one of these boats was sawed in two and lengthened 5 or 6 feet by putting in more frames amidships. A deck was laid the whole length of the boat, and she did the colonists good service for at least seven years afterward. A great many shallops were built in subsequent years, as there was need for them at Salem, Ipswich, Gloucester, Medford, Portsmouth, and the other settlements all along the coast. Some were used for trading purposes, but the majority were fishing boats. They usually carried one mast, with one sail hoisted from the deck; but in the larger ones, instead of fitting the shallop with a tall mast and a large sail, the owners usually followed the safer and more convenient plan of adding another mast with its own sail (Fig. 2). Two small sails were more easily handled than one large one, and in a fresh wind the after sail could be lowered and the boat allowed to scud under the foresail alone. The ancient shallop probably carried lug sails, as in the illustration herewith.

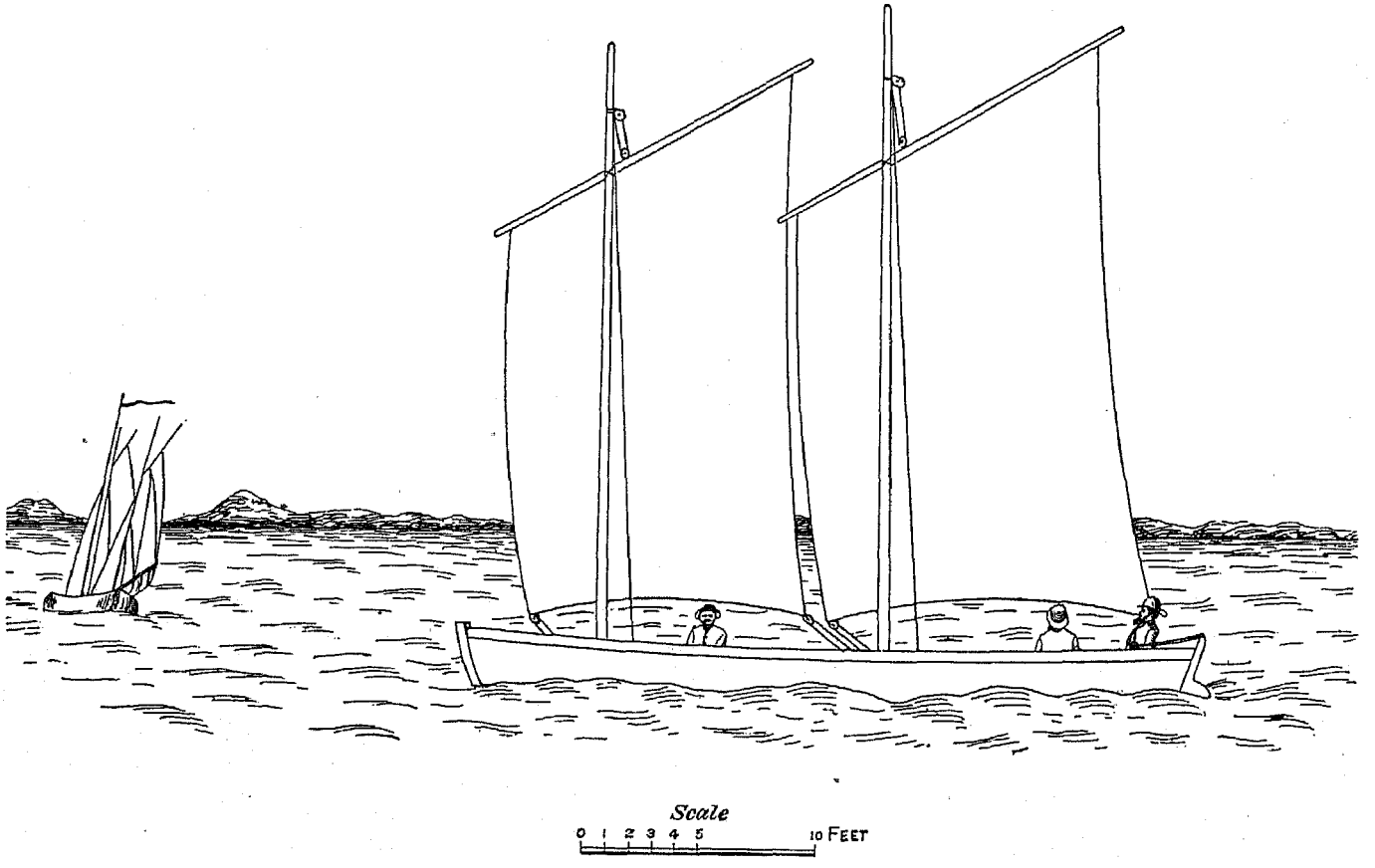


Fig. 2.—FISHING LUGGER.

A great many shallops were built in the winter time by the fishermen and their sons, who thus employed their idle season with useful work. The lumber for the boat was gathered little by little, a good deal being cut in the common woods and some picked up on the beach, so that it cost them next to nothing, and the boat, when built, was found to have cost them little more than the outlay required for nails, paint, iron fittings, blocks, cordage, and canvas. These boats were constructed in door yards, often in barns, and sometimes in the woods 2 or 3 miles from the water, whither they were dragged on sledges of timber. The home company sent over a number of shipwrights among their early dispatches of emigrants; many others came voluntarily among the crews landed from the large fishing vessels from England; and boat-building became an established industry in nearly every village in twenty years after the landing at Plymouth.

The first vessels sent from New England to the banks to fish set sail in 1645, and comprised "a ship and other vessels", their rig not known; but a style of smack which became popular as soon as something larger than the shallop was required was the "catch", or "ketch". The Dutch called them the "pinkie", a name borrowed from the Mediterranean and meaning a hull round at both ends, the outside planking ending on the stem and on the stern-post, in distinction from ships having a broad or "square" stern above the water, which were planked straight across. The "pinkie" hull was popular with the Dutch, and there is reason to believe that the hulls of the vessels in the northern fisheries of Europe were of that class. The first catches carried one mast amidships, with a large square sail. Afterward a small mizzen was added away aft, the mainmast being planted in that case

one-ninth or one-tenth of the vessel's length forward of amidships. The mizzen-mast carried a lateen or a lug sail, which is a lateen with one-half of the forward part cut off. The mainmast bore two square sails, perhaps three. The popularity of the ketch was due to its simplicity of construction, as no ingenuity was required in framing either the bow or the stern and the planking was easily put on. It was a good sea boat, pretty fast and safe on account of its breadth of beam, easily handled, and, when required for the coasting trade, was useful for its great capacity, the bottom being broad and round. The probate records of Suffolk county, Massachusetts, indicate that ketches and shallops constituted the whole fleet of the fishing merchants up to about 1700. The ketches were 9 or 10 feet deep in the hold, drew 7 or 8 feet water, were decked throughout, had cabins aft, and were built of white oak, except the deck and cabin, which were of white pine, and the masts, which were usually of spruce. The broadest part of the hull was two-fifths of the vessel's length from the bow.

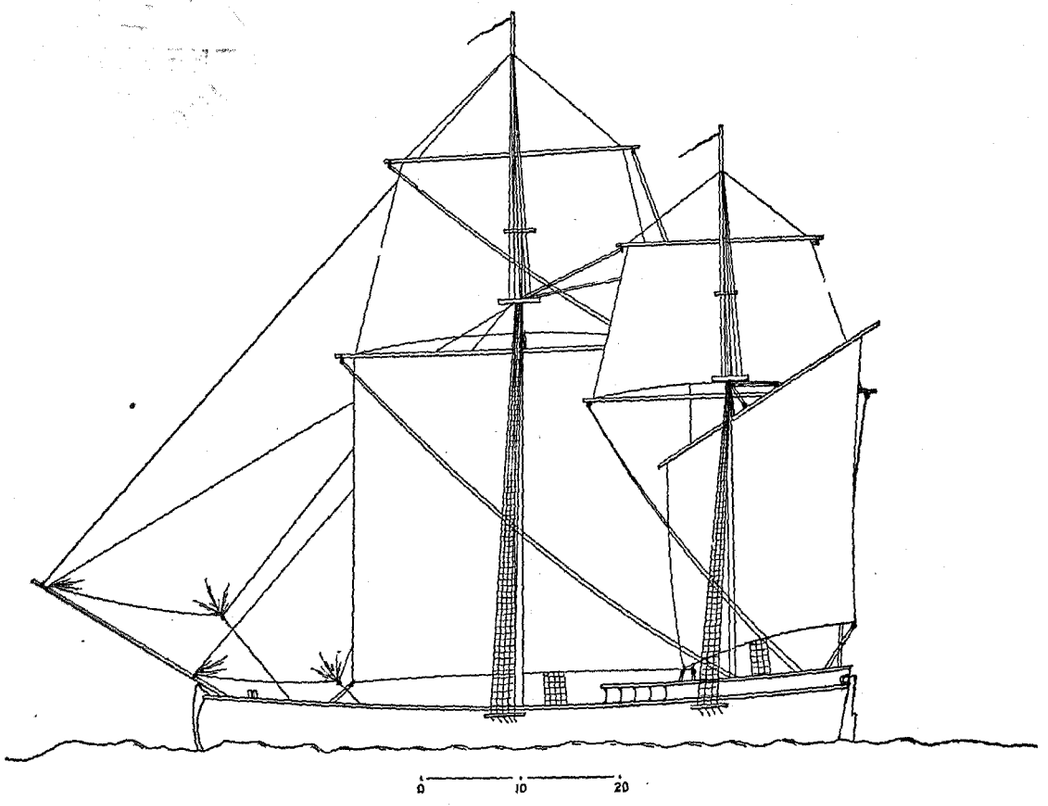
Salem was the principal center for the building of ketches, and it is said that the people of that town clung to the model and rig longer than any other community on the coast, using ketches both in fishing and in general trade. The average size was about 30 tons register, but a few were as large as 80 tons; the majority were below 30 tons, and cost about £3 5*s.* per ton to build.

The accompanying illustration (Fig. 3) represents an English ketch of 1692 with the bulwark pierced for eight light guns and the top sides curved home above the load-line, after the fashion of the times, so as to bring the weights further inboard, and thus maintain the vessel's stability.

Before the independence of the colonies the ketch had ceased to exist, and had become, through slight modifications of hull and rig, the brigantine of to-day—a class of vessel used only in trade.

Out of the old shallop grew two classes of small vessels which have remained in permanent use. In one of them the two small masts were retained, but were planted a step farther forward, the foremast being set not over 4 feet from the bow, and, in 30-foot boats, the mainmast 10 or 11 feet aft of the foremast, bringing it about amidships. A change took place in the sail. A part of the sail and of the yard forward of the mast was cut completely off, and the end of the yard was shaped to slide up and down the mast, the fore edge of the sail, or the luff, being attached to the mast by wooden hoops, which would also slide up and down with ease. The head of the sail was narrowed, and the foot was spread by means of a "sheet", attached to it at the lower after corner, carried aft and hauled taut. The boat remained open and without deck for many years, was round at both ends, being moderately sharp on the bottom, and the prow was often pointed. These changes in the fishing shallop culminated at Essex, Massachusetts, formerly called Chebacco, the story being that the first Chebacco boat, probably not much larger than the yawl of a modern schooner, was built in a garret, and was taken out of the house through a window and dragged to the water's edge by cattle. The shrewdness of the inventors of this new and handy rig brought a great deal of business to Chebacco, and the Chebacco boats, as they were called (or pinks, from the shape of the hull), became famous along the whole of the New England coast. First used in fishing at Sandy bay, these boats soon came into general use, the majority of them being built in the village in which they originated. They ranged from 3 to 5 tons burden at first, and their owners put out in them to the ledges and shoal grounds for cod, hake, and pollack early in the day, always to return at night; but in later years, especially after the independence of the colonies, they were built larger and decked, and were fitted with a cabin, sometimes being of 30 tons register. When they reached a large size the foot of each sail was fitted with a boom. The Chebacco boats were always framed and planked with white oak, cut from the abundant forests of that timber which grew all around the town, and nothing except heart of oak was used, all of the sapwood of every tree being sawed or hewed off and thrown away. Thus the boats were built of wood which would scarcely perish. The deck beams were usually of oak, but the deck plank and cabin were of white pine, and the masts of white pine or spruce. These boats were often built in the woods, or, at any rate, a long way from the water, and as late as the revolutionary war fishing boats of from 10 to 20 tons were thus built and were dragged to the river by cattle. Though built in Chebacco (or Essex), the boats were chiefly owned in Gloucester, and by 1792 this latter town had 133 boats of this class, registering 1,549 tons, in the shore fisheries; but by 1804 the number had increased to 200, with the tonnage nearly doubled. From 1800 to 1840 the boats were built for $18 a ton, a good price for the times, but much smaller than the builders got afterward. From 1861 to 1865 the price was about $65 a ton, but it is now about $40 a ton.

About 1820 the fishermen began to put bowsprits into the Chebacco boats, shearing off the pointed prow, and calling them "jiggers". The planking of the low bulwark of the boat was carried out beyond the sharp stern 3 or 4 feet and nailed to a short triangular stern-board, like that of a dory. This projection had a seat for the use of the crew, and the boom of the mainsail rested on it while the boat rode at anchor. Fishermen built "jiggers" of 40 tons register for mackerel catching, on account of the abundance of that fish at the time, the first great year being 1825, when one jigger, with 8 men, caught 1,300 barrels of fish; but when the mackerel began to disappear, which was about 1845, the large jiggers disappeared with them. Chebacco boats of moderate size remained in use for many years, but are now obsolete in New England. A few pinks, with bowsprits, are still to be seen occasionally at Gloucester, and especially in the waters around Eastport, Maine, and they are also to be seen, usually without decks and always without projecting prow, but in other respects like the Chebacco boats of the earlier times, at Block island, where they are almost the only style of boat employed (Fig. 4). Full in the forward body, a trifle leaner aft, sailing with a drag of from 2 to 4 feet, broad of beam, and carrying a great deal of stone ballast, they



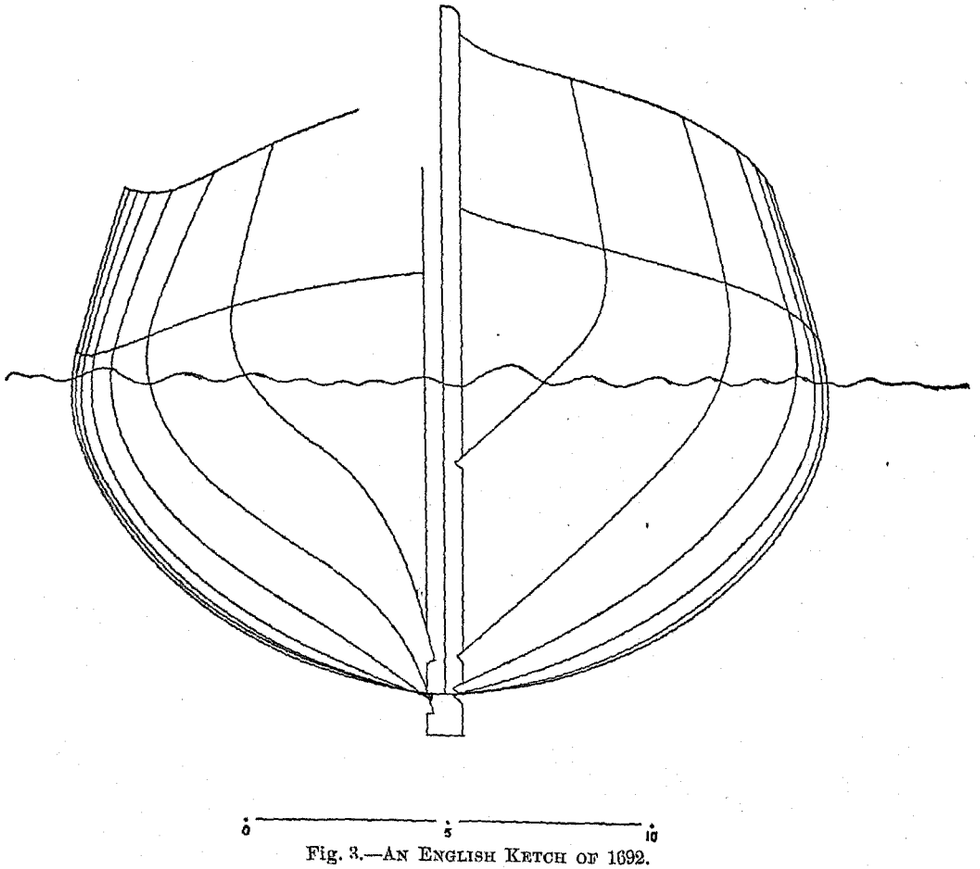


Fig. 3.—An English Ketch of 1692.

Measurements.—Length from rabbet of stem to rabbet of stern-post, 60 feet; extreme breadth, 19 feet; depth of hold, 7¼ feet; depth from plank sheer to top of keel, 8 feet. Displacement to 7 feet from top of keel, 138 net tons; coefficient of D., 53 per cent. Register tonnage by modern rule, about 60 tons. Cargo burden, about 80 tons. Fullest part of the body (or midship section), ⅔ length from bow. Weight of vessel, about 58 tons; draught, when light, above keel, 4 feet 2 inches. Center of gravity of vessel, light, 7 feet above the keel; center of buoyancy, loaded, 4 feet 6 inches above the keel, and 21 inches forward of middle of length. A crank vessel, requiring ballast or cargo to steady her.

are a cheap and excellent fishing boat, safe, comfortable, and almost non-capsizable. At Block island, lying 20 miles out to sea from Newport, Rhode Island, the little community of resident fishermen had 100 fishing boats and 200 men employed as early as 1800, as appears from a petition sent by them to Congress in that year, all under 5 tons each. It is probable that the islanders originally built their own boats from the timber which anciently covered their lands in a dense growth, but of late years they have been obliged to send to the mainland to buy, as the island has become entirely denuded of trees of all kinds. The cod banks being within two leagues of the shore, the men go out to them early in the day, returning at dusk, and, drawing up their boats on the beach, fasten them to poles planted in the sand, to protect them from the fury of the waves. The secluded life of the islanders prevented the newer fashioned boats from creeping in among them for any purpose (as

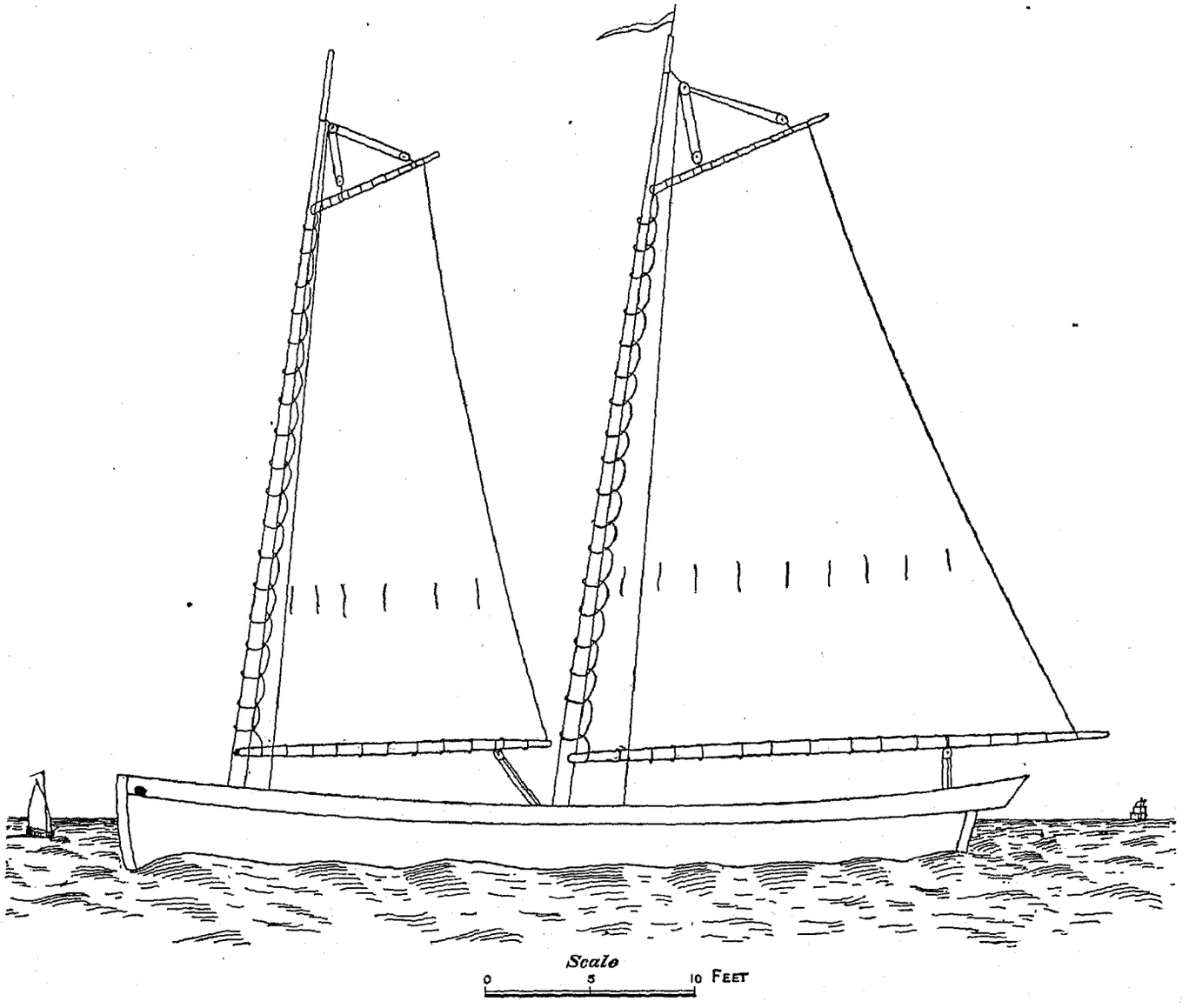


Fig. 4.—Chebacco boat, or Pink.

40 feet on load-line; 14 feet beam; 5½ feet depth of hold, registering about 20 tons. Sharp at both ends, with bulwark rising and projecting at stern.

in the case of most of the fishing islands on the northern coast) until about twenty years ago, when people from the mainland began to spend their summers there to enjoy the cool air and the surf bathing. They are now buying boats which are half sloop-yachts and half fishing boats (Fig. 5).

The other style of vessel which grew out of the old "chaloupe", or shallop, was the modern sloop whose name is a contraction of that of the foregoing (Fig. 6). The sloop is a vessel with one mast, spreading a large fore-and-aft sail, the foot of the sail attached to a boom and the head to a gaff, and with a bowsprit spreading a large jib. This class of vessel appears to have been used in America originally for trading purposes; there was certainly a large fleet of them owned in the towns adjacent to Massachusetts bay, employed in freighting fire-wood, hay, and goods along that part of the coast. The hulls were built with broad decks, square sterns, and pretty full models. After the sloop came into existence it was extensively employed in the fisheries, and is now popular among yachtmen,

the rig being generally regarded as the handsomest in existence for pleasure boats. When properly designed, the sails present the appearance of a large and showy triangle of canvas, reviving in outline and effect the old lateen sail. The sloop was in vogue at an early day in England, and may have come to America from that source. Square topsails were fitted to the larger sloops in England, and a picture of an English war fleet is extant in which there is a sloop with two square upper sails. In 1714 the Hazard, a sloop, was sent expressly from England to America to carry the news of the accession of George I to the throne and orders for the colonial government. This vessel, after crossing the Atlantic in safety, was wrecked on Cohasset rocks on the 12th of November and dashed to pieces. No papers of any consequence were saved, and of all her company only one man came to land alive. The rig of the sloop was a handy one for boats between 10 or 12 tons register and 30 or 40 tons burden, and came into favor rapidly after 1700, both for large fishing vessels on the New England coast and for trading purposes everywhere in America. Many of the "bankers", and all of the early mackerel boats, were sloops, and the first vessels

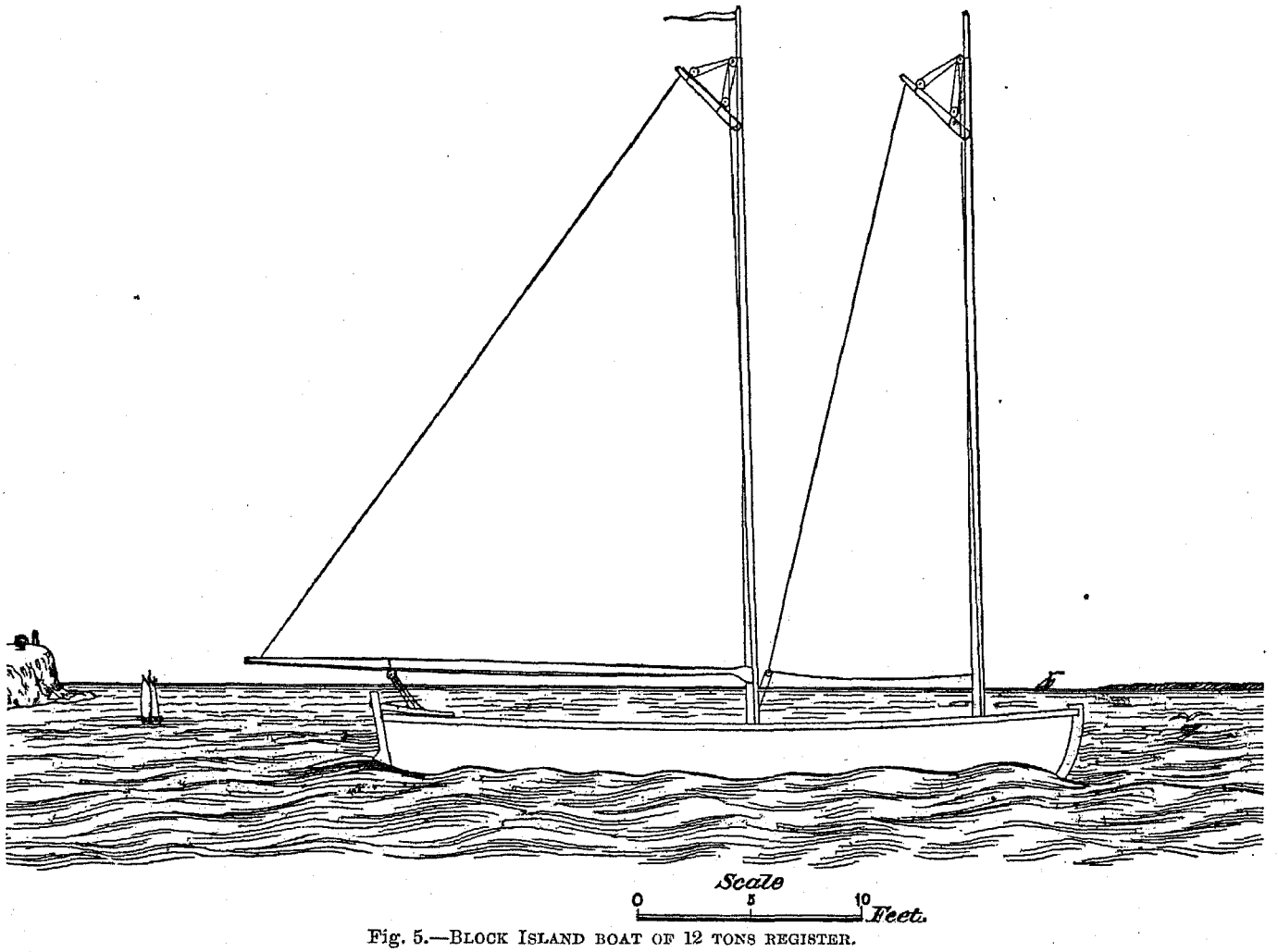


Fig. 5.—BLOCK ISLAND BOAT OF 12 TONS REGISTER.

Keel, 23 feet; length over all, 31 feet; beam, 11½ feet; depth from gunwale to floor, 4 feet 5 inches. Width of main thwart, 10 feet 8 inches; width at forward and after stroke thwarts, 8 feet 7 inches. Masts, 36 and 37 feet, 9 inches in diameter at keel, and 2 inches at head. Gaffs, 4 feet. Boom of mainsail, 23 feet. Foresail has no boom. No shrouds or stays to masts. Two tons of ballast. Keel, 4 by 12 inches. Frames, 2 by 4 inches, spaced 24 inches from center to center. Frames and planking, white oak. Foremast 4 feet from bow; mainmast 10 feet farther aft. These boats are open, but sometimes have a little cabin, which will shelter 6 men.

with which whales were chased out to the Gulf Stream, and thence to distant latitudes, were of this class, the larger ones probably being fitted with a square topsail, to catch the air in light weather. The majority of sloops were not over 10 or 15 tons register, but some were as large as 30 tons. In the little fleet of 10 vessels hurriedly fitted out in Massachusetts, manned by fishermen, the smartest and ablest of sailors then, as now, and sent in 1745 to capture the great fort at Louisburg with its 200 cannon, 3 were Yankee sloops, and of the 34 vessels burned by the British in 1778 at New Bedford at the time of the capture of that town 10 were sloops. Many of the fishing sloops were very fast vessels, and they and their crews were accordingly much in demand during the revolutionary war for privateering, their exploits forming a romantic chapter in the naval history of the United States. The principal places at which sloops were built were Boston, Scituate, Salem, Charlestown, Gloucester, and Newbury, but the boat-yards all along the whole coast began about 1700 to devote considerable attention to this class of vessels, which, as before stated, were employed partly in fishing and partly in trading, entirely superseding in both employments the ancient "catch".

In after years the square topsail was given up and a gaff topsail was bent in its place, being a large triangle of canvas hoisted along the mast above the mainsail, and the jib was divided into two smaller head sails. A great number of sloops were built before the revolutionary war for the open sea fisheries, chiefly at Boston, Charlestown, Scituate, Essex, Salem, Beverly, Marblehead, Gloucester, Ipswich, New Bedford, Portsmouth, and the fishing towns along the coast of Maine. In the cod-fishery Massachusetts alone had 4,000 men and 28,000 tons of shipping before the revolutionary war, the fleet being largely composed of sloops. The great advantages of the sloop were its safety, and particularly its cheapness, arising from the small size of the vessels and from the abundance of native oak and pine near the fishing towns. The fishing vessels built in New England before the revolutionary war cost only one-half what the fir-built vessels of the Baltic did, and the result was that American fishing vessels continually increased in the cod and whale fisheries of the Atlantic, while European vessels continually decreased. Jefferson

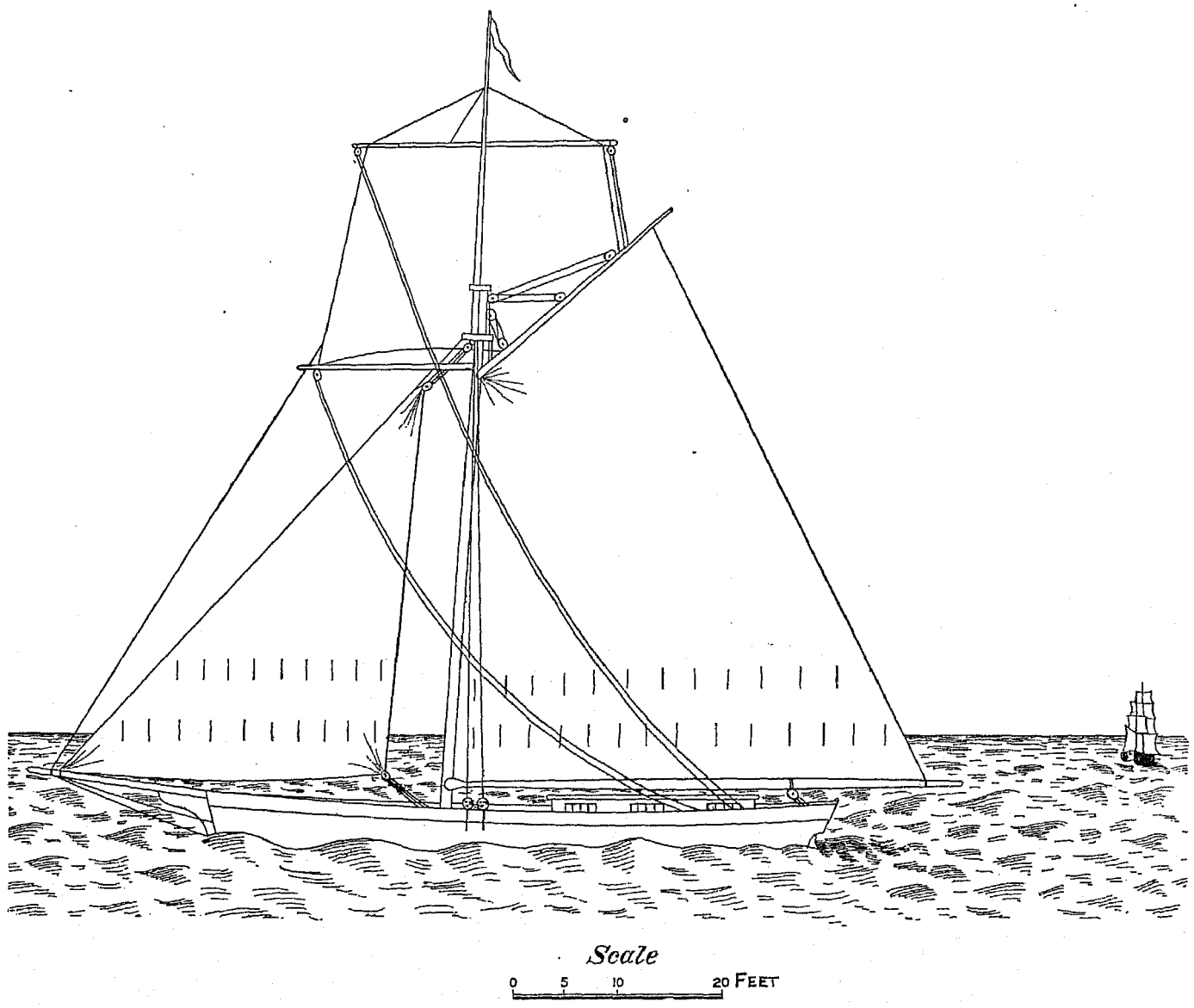


Fig. 6.—TOPSAIL SLOOP, 50 TONS.

reported in 1791 that no other nation except the Americans could make a profit in the Newfoundland fisheries without national aid, and the governmental machinery was invoked to secure the widest possible market for American-caught fish.

Sloops were also largely built at and around New York city for shore fishing, and many are still employed there by the fishermen.

In 1745 Andrew Robinson, of Gloucester, built a vessel with square stern, which was fitted with two masts, bearing a sloop sail on each and a bowsprit with jib. She was sharp on the bottom and fast, and, on being launched, sped over the water so fast from the impetus gained by descending from the ways as to elicit from a bystander the remark, "See how she scoons." "Scoon" was a word used by plain people to express the skipping of a flat stone over the surface of the water when skillfully thrown, and the builder of the vessel, having been

somewhat at a loss for a name for the new rig, seized upon the trifling incident referred to and replied, "A scooner let her be," and two-masted vessels, with jibs and fore-and-aft sails, have since been called by that name. The advantage possessed by the "schooner" (as the name is now spelled) is that the canvas of the vessel is divided into a larger number of sails, which are more easily handled than the large sails of a sloop could be, each containing the same amount of cloth. The schooner quickly superseded the sloop in the banks fisheries and in all others requiring voyages of any duration. Carrying twice as many men as a sloop, and making quick trips, a schooner could catch as many fish as two vessels of the other style, and were large enough to carry their own fish to foreign markets. Since the revolutionary war they have been the only vessels employed by Americans in the banks fisheries.

The American fisheries were annihilated during the revolutionary war, and the vessels were captured, the utensils and apparatus destroyed, the ship-yards closed, and both fishermen and carpenters were driven into other employments. The business revived promptly after the peace of 1783 both on shore and out to sea. By 1788 the New Englanders had an aggregate of 540 vessels, registering 19,200 tons, and 3,290 men in the deep-sea fisheries, and for more than half a century, interrupted only now and then by war or by small profits, the business went on increasing steadily. These statistics are from Jefferson's report to Congress in 1791.

The largest schooners were those sent to the Grand Banks, and for many years after 1800 about 70 sail of vessels were annually sent thither, chiefly from Cape Ann. The original "banker" was strongly and substantially built of oak. Her decks and cabins were of pine; her spars of either pine or spruce; her rigging and cables entirely of hemp. The ship-yard was usually located at the water's edge (although a vessel of 100 tons has been built 1 or 2 miles from the water and dragged on sledges over the snow in winter by 200 cattle to a spot suitable for launching), and the ways were planted so that the hull of the new vessel should just escape the water at high tide. The keel was laid of oak or other hard wood. Beginning at the fullest part of the vessel, the frames of the forward body were put in, going forward, and the stem, with its apron, knight-heads, and hawse timbers bolted together, was then raised to its place. The frames of the after body were then raised, and the stern-post, with the frame which belongs to that part of the vessel bolted to it, was fitted to its place. The keelsons were put in, the vessel was ceiled, planked, and decked, and in due time was launched, often with her principal spars in place. The only tools used in the ship-yard were those wielded by hand—saws, axes, hammers, augers, squares, chisels, and calking irons—the largest being the great saw, for cutting timbers lengthwise, worked by two men, one at each end, the timber being placed across two wooden horses, and one man standing on the top of the log, the other in a pit below the surface of the ground. All the beams, planks, keelsons, etc., were carried into the vessel on the shoulders of the men, but the masts were raised and set by means of an extemporized derrick. In model the vessels would be thought uncouth at this day. The bows were nearly as full as half of an apple, the bottom as round as the side of a barrel. They sat low in the water, and there were no bulwarks amidships other than the covering plank, with a chock, which rose in all about 15 inches above the surface of the deck. Aft there was a quarter-deck extending nearly half the length of the vessel and rising 4 feet above the main deck, reached by a flight of steps. The cabin was large, and, as this was before stoves were invented, was furnished with a large fireplace and chimney, the smoke sometimes going out by way of the chimney and sometimes through the open door of the apartment. The masts were rather short, and there was no topmast, except on the mainmast. The bowsprit was set high, sometimes at an angle of about 30°. The cutwater was a large and strong knee, securely bolted to the stem, and served as a means of securing the bowsprit in place, that spar being lashed to the knee with hemp or iron. There was not much beauty to the old-time "bankers", but they were staunch and durable vessels. Built for strength, well calked, and immediately repaired when showing a leak or weakness anywhere, they often lasted for forty or fifty years. The last of them owned at Gloucester was the Manchester, which, after long service on the banks, was sold to go into the coasting trade, and was a successful vessel in that business for more than twenty years. The bankers used to make about three trips a year, beginning in March and ending in November, and then either went into trade or were laid up for the winter.

The clipper schooner succeeded the banker. A few good years, in which fish were plenty and prices profitable, and the anxiety to make rapid trips and as many as possible in one year, led to great improvements in form. The body of the vessel was made leaner and sharper under the water, the bow longer and finer, the run cleaner, and the angle of entrance forward was sharpened from 85° to 45°. The spars were lengthened, and the schooner put under a heavier press of canvas. The clipper fashion is said to have been set at Essex, and the models of the carpenters of that town were so much admired as to bring a great deal of business to their yards. The Essex men have always shown originality in the shapes of their vessels, and have always led every other town upon the New England coast in the production of tonnage for the fisheries. Of the 475 schooners, sloops, and boats

owned at Gloucester in the census year, 218 had been built at Essex, 133 only having been built by the Gloucester men themselves. The places where the rest of the Gloucester fleet of 1880 was built will appear in the following statement:

Essex, Mass	218	Belfast, Me	2
Gloucester, Mass	133	Damariscotta, Me	2
Salisbury, Mass	9	Brunswick, Me	2
East Boston, Mass	5	Harpswell, Me	1
Newburyport, Mass	5	Yarmouth, Me	1
Danversport, Mass	4	Wells, Me	1
Chelsea, Mass	3	Portsmouth, N. H	1
Salem, Mass	2	Middletown, Conn	3
Quincy, Mass	2	East Haddam, Conn	1
Medford, Mass	1	Essex, Conn	1
Rockport, Mass	1	Chatham, Conn	3
Ipswich, Mass	1	Noank, Conn	1
Annisquam, Mass	1	New London, Conn	1
Duxbury, Mass	1	Bridgeport, Conn	1
Dorchester, Mass	1	East Haven, Conn	1
Wellfleet, Mass	1	New York	3
Bath, Me	36	New Jersey	1
Boothbay, Me	13		
Kennebunk, Me	9	Total	475
Bristol, Me	3		

As soon as Essex and Gloucester had adopted the fast schooner every other fishing town along the whole coast did the same from necessity, and the new boats superseded not only the bankers, but also the pinks, for shore fishing; so that after 1850 a complete revolution was effected in the character of the fishing fleet of the whole Atlantic coast. Except on the Chesapeake, where a distinct class of vessels, peculiarly local, had been evolved, old fashions lingered only in a few scattered and out of the way places. The fast schooners added greatly to the prosperity of all the fishing towns; the American fishing fleet multiplied rapidly, and the capital invested in fast vessels yielded a far larger return than that put into the slower craft that preceded them. The vessels owned in large towns were provided generally by fishing merchants, who would put the profits of one year into a new schooner, to be added to their fleet the next, and who would fit out annually from three to twelve, and even as many as twenty vessels; but the masters of most of the schooners had shares in the craft they sailed, and hundreds of them came in course of time to possess and sail their own vessels. Builders, sailors, and merchants all became prosperous after the new impetus given to the business by the clipper class of schooners; the fishing towns were filled with neat and comfortable residences, owned by them; and their operations gave rise to shops, lofts, and mills, which made employment for thousands of men in the various arts that a large fishing fleet calls into action. Nearly all the fishing towns in New England made their own sails, rigging and cordage, anchors, and outfit, a contract for a new vessel, therefore, meaning work for nearly all the shops in town. The majority of the villages were supplied with small marine railways, on which regularly twice a year all the vessels of the town were hauled up out of the water for calking and painting and such other repairs as circumstances demanded; and thus there was work both winter and summer. This state of affairs continued, especially in New England, until the operation of the new fishery treaty with Canada brought a blight upon the business by admitting Canadian-caught fish to the United States free of duty.

The early schooners, both bankers and clippers, were from 20 to 40 tons register. The size increased with the growing accumulations of capital, and since 1860 the majority have been built of from 60 to 90 tons register, the fair average being about 75 tons, but many from 100 to 140 tons.

It is remarkable that, while the form and the rig of the schooners have been greatly improved, the manner in which they have been framed and built has scarcely changed in the last hundred years. The measurements, scantling, etc., of a 75-ton schooner are as follows:

DIMENSIONS AND SCANTLING.—Length, 76 feet, from the outside of planking at the bow to the after side of the stern-post, measured along the deck; breadth from outside to outside of planking, 22 feet; depth of hold, 7 feet 8 inches, and molded depth from under side of plank-sheer (top of beam), 8 feet 6 inches; keel, 70 feet long; molded with shoe of 6 inches, 18 inches, and sided 10 inches; stem, 12 feet long, sided 15 inches; stern-post, 10 feet long, sided 15 inches; knee to stern-post on keel, 4 feet 3 inches high, about 12 feet long on keel, and sided 10 inches; keelson, 10 inches square. The ceiling of the hold is 2 inches thick, except on the turn of the bilge, where a few streaks are laid 3 inches thick, and except just under the beams (the clamps), where they are also 3 inches. The outside planking is 2½ inches, with 3-inch fender streaks. The beam knees are sided 5 inches and molded 10 inches in the throat. Beams are 9 inches wide, tapering from 7 inches deep in the center to 5 inches at the ends. Carlines are 4 inches by 6; decking, 3 inches thick. Frames, double, are 14 inches wide and 8 deep over the keel, the depth or molding of the frames tapering thence to the plank-sheer, where it is 4 inches. At the plank-sheer only one of the timbers of each frame rises to form the bulwark of the schooner, this timber, or stanchion, being sided 5 inches and molded 3; bulwark, 2 feet high amidships, 2 feet 6 inches forward; sheer of vessel, 22 inches.

SPARS AND SAILS.—Length of foremast, 69 feet; length of mainmast, 70 feet 6 inches; length of mast-heads, 6 1/2 and 6 1/2 feet; length of topmasts, 35 feet; length of poles of topmasts, 6 feet; rake of masts, ⅝ inch to the foot; the masts bury below deck 8 feet 6 inches;

from knight-heads to center foremast, 21 feet; from center foremast to base of mainmast, 27 feet; from center mainmast to center of taffrail, 36 feet; length of bowsprit outboard, 21 feet; center line of bowsprit strikes stern-post above keel 4 feet; length of jib-boom outside cap, 13 feet; length of fore boom, 23 feet; length of main boom, 57 feet; length of fore gaff, 23 feet; length of main gaff, 25 feet.

The spars, with the bill for labor in making them, cost about $300.

Mainsail: Hoist, 46 feet; foot, 55 feet; head, 24 feet; after leech, 60 feet; containing 2,015 square feet of area and 410 yards of canvas.

Main gaff topsail: Hoist, 36 feet; after leech, 31 feet; foot, 24 feet; area, 350 square feet; canvas, 70 yards.

Foresail: Hoist, 46 feet; head and foot, 22 feet; after leech, 51 feet; area, 940 square feet; canvas, 190 yards.

Fore gaff topsail: Hoist, 36 feet; after leech, 34 feet; foot, 23 feet; area, 340 square feet; canvas, 70 yards.

Staysail: Fore leech, 15 feet; after leech, 36 feet; head, 31 feet; foot, 24 feet; area, 550 square feet; canvas, 115 yards.

Jib: Fore leech, 60 feet; after leech, 44 feet; foot, 46 feet; area, 840 square feet; canvas, 175 yards.

Flying-jib: Fore leech, 68 feet; after leech, 40 feet; foot, 32 feet; area, 350 square feet; canvas, 75 yards.

Jib-topsail, or balloon jib: Fore leech, 84 feet; after leech, 42 feet; foot, 50 feet; area, 805 square feet; canvas, 165 yards.

Riding-sail, or lug-sail: Area, 450 square feet; 90 yards of canvas.

Total sail area, 6,640 square feet, or 1,360 running yards of canvas, to which add about 60 yards for linings; cost of the suit, about $570.

[The sails vary in area somewhat on different vessels of the same tonnage, as the masts are planted at slightly different distances apart and the topmasts are shorter or longer, but the variation is seldom more than 50 yards of canvas either way.]

Blocks, etc.: 16 double and 46 single blocks; 24 6-inch and 8 4-inch dead-eyes; 36 21-inch and 16 10-inch mast hoops; 24 24-inch, 30 18-inch and 40 16-inch jib-hanks; 2 topmast balls. Average cost of blocks, etc., for a two-topmast schooner, about $140.

A schooner of this size will carry, in addition to what is mentioned below, two chains from 30 to 45 fathoms long each, if fitted out for mackerel fishing; but if fitted out for cod or halibut fishing she will have from 225 to 425 fathoms of best 8½-inch or 8¾-inch manila cable and three anchors, one of them being carried on deck for use in case one of the others should be lost. The following is the hemp standing rigging, the table giving the circumference and the fitted lengths ready to go on the vessel:

	Lengths, in feet.	Circumference, in inches.		Lengths, in feet.	Circumference, in inches.
Jib stay	88	8¾	Maintop-mast stay	38	2¾
Foremast shrouds, each	54½	6¾	Bowsprit foot-ropes, each	24	2¾
Mainmast shrouds, each	56½	6¾	Main-boom foot-ropes, each	26	2½
Bowsprit shrouds, each	28	5	Counter stay (foretop-mast)	37	2½
Spring stay	25⅝	5	Maintop gallant stay	41	2
Flying-jib stay	108	4½	Foretop gallant stay	133	2
Flying-jib guys, each	35½	4	Flying-jib foot-ropes, each	15	2¼
Foretop-mast back stays, each	86	3	Jib topping-lift	36	3
Maintop-mast back stays, each	88	3	Fore-boom topping-lift pendant	24	3
Foretop-mast shrouds, each	32	2¾	Main topping-lift pendant	57	4½
Foretop-mast stay	129	2½	Main-boom topping-lift pendant	30	4½
Maintop-mast shrouds	32	2¾	Flying-jib topping-lifts pendant	15	3½

The following are the circumferences and lengths of the manila running rigging:

	Lengths, in feet.	Circumference, in inches.		Lengths, in feet.	Circumference, in inches.
Main sheet	132	3	Flying jib sheets, each	60	2¼
Cat stoppers	27	3	Fore staysail halliards	120	2¼
Main topping-lift runner	18	3	Topsail sheet	114	2¼
Fish-hook	12	3	Crotch tackles, each	48	2¼
Fore and main lanyards, each	30	3	Main topping-lift, fall	96	2¼
Fore-peak halliards	318	2¾	Topsail halliards	114	2
Fore-throat halliards	264	2½	Main-peak downhaul	126	1¾
Fore sheet	96	2¾	Fore-boom topping-lift	156	2
Main-peak halliards	324	2¾	Fore-peak downhaul	60	2
Main-throat halliards	270	2½	Topsail back	60	2
Jib halliards	180	2½	Reef tackle	96	2
Jib sheet	60	2½	Main-peak whip	144	2
Jib downhaul	87	2	Fore-peak whip	138	2
Main-staysail halliards	165	2½	Jib-peak whip	138	2
Main-staysail sheet	60	2½	Jib-topsail halliards	258	1¾
Main-boom tackle	108	2½	Jib-topsail downhaul	108	1½
Flying-jib halliards	198	2¼	Jib-topsail sheet	72	2½
Flying-jib downhaul	105	1¾	Topsail clew-line	138	1¾
Jib topping-lift	156	2¼			

Weight of tarred hemp, 1,330 pounds; weight of manila cordage, 890 pounds. Cost, about $440, including rigger's bill of $100 for fitting and setting up.

The practice has been in vogue for the builder to contract to furnish only the hull and the spars of the vessel, the sails being furnished by another contractor. The cordage is bought by the owner from the manufacturer or from

a ship-chandlery store, and is fitted to the vessel by a rigger, whose bill is almost exclusively for labor, and the chains and anchors are bought from either a shop or a store. The fine carpentry work on the cabins is done by a joiner; the iron ballast, often costing $500, is purchased from the mill, and when the sails, rigging, cabins, chains, anchors, and ballast have been purchased the main features of the outfit of a fishing schooner have been provided, the rest of the outfit consisting of a large lot of small articles, costing in all from $400 to $600.

Many of the fishermen sail with no foretop-mast, this being thought to be a snugger and safer rig, the rolling and pitching of a fishing boat being severe upon all the top hamper. In such cases the "top bills" of the vessels are lessened somewhat.

The following statement, taken from the books of a leading sail-maker in a fishing town in New England, shows the yards of canvas in schooners of different sizes, the first cost, the yearly amount spent for repairs of sails, and length of time the suits of sails last:

In what fishery.	Tonnage of schooner.	Yards of canvas in sails.	Cost of suit.	Yearly amount for repairs.	Life of a suit of sails.
					Years.
Halibut, the year round	95	1,350	$600	$100	2
Mackerel and herring, the year round	93	1,338	600	70	2½
Halibut, the year round	88	1,380	570	100	2½
Mackerel and herring, the year round	88	1,380	570	50	2½
Mackerel, the season	80	1,349	650	50	3
Bank fisheries, the season	75	1,360	570	100	3
Mackerel and shore, the season	72	900	470	80	2
Bank fisheries, the season	65	850	570	83	3
George's banks, the season	60	800	500	70	2
Do	56	750	450	60	2½ to 3
George's banks and shore, the year round	48	700	340	50	2½ to 3
Shore, the year round	40	640	300	40	2½
Do	32	550	250	40	2½ to 3
Do	28	500	240	30	2½ to 3
Do	26	460	200	30	2½ to 3

The differences between vessels of nearly the same size are due to the lack of foretop-mast on some of them, and to the use of light canvas in some cases and of heavy canvas in others.

The manner of building a 75-ton schooner in the New England yards is as follows: All the plank, and a good deal of the square lumber, such as is used in keelsons, beams, and stern-posts, are bought from the lumber-yard in the town, or in the most favorable market near by and sent to the town by coasting vessel or by railroad. The frame timber is obtained in two ways: Either it is bought at the nearest saw-mill in the flitch, that is, in heavy plank sawed only on two sides, the bark of the tree remaining on the other two edges, and drawn to the yard on wagons or sleds, according to the season, when the crooked pieces of the frame, stem, etc., are hewn from it with broadaxes; or the cheap pine board patterns of the crooked pieces are given to a contractor, who makes a business of getting out frames in the woods in Delaware, Maryland, or Virginia. In that case the contractor goes to the scene of his operations in the winter time, fells the trees, hews the frames from the trunks on the ground on which they fall, marking each separate piece when finished, and brings the whole frame to the yard in New England by coasting vessel in the spring. The contractor pays about $3, but sometimes from $4 to $6 per thousand board feet for the white oak standing in the woods, and it costs him about $9 a thousand to fell the trees and hew out the frames, besides an additional charge for hauling out of the woods. Freight to the north is about $7 a thousand, and by the time the timber is delivered in the ship-yard the frame has cost the builder about $34 per thousand board feet. The white pine used for decking and houses costs him about $35 a thousand, and the pitch-pine, for beams, keelsons, and other uses, $25 a thousand.

The keel is stretched on a series of blocks made of cheap timber, and such of them as have to be split out are usually hemlock or spruce. The declivity toward the water is usually about five-eighths of an inch to the foot. A keel 73 feet long would be made of two pieces, with the ends united by a horizontal beveled joint, or scarf, about 6 feet long, strongly bolted with round iron. Owing to the fact that single sticks of timber of the right curvature long enough to reach from the keel to the main rail cannot be obtained for the ribs of the vessel the frames have to be made of several pieces. A frame is composed of eleven pieces, the first being the "floor timber", 7 inches wide and 8 inches deep, tapering toward the ends, which is laid across the keel, extending each way as far toward the bilge as the natural crook of the log from which it is cut will allow. Abutting against each end of the "floor timber" is another curved stick, or "futtock", which carries the sweep of the frame farther on upward, and against the end of that another futtock, or "top timber", as in the illustration on page 16, which carries it to the plank-sheer on either side of the vessel, the frame tapering gradually from the keel to the plank-sheer. This collection of pieces makes one-half of the frame. In front, and strongly fastened to them by treenails of oak or locust, are the pieces composing the other half of the frame, which break joints with the pieces first mentioned. There are, first, two

"navel timbers" abutting over the keel; then a "futtock" adjoining each navel timber; then a "stanchion", which rises to the main rail and supports the planking of the bulwark of the vessel. As the frame is thus double, it measures over the keel 14 inches by 8. The pieces are laid together and treenailed on the ground, and the completed frame is then raised to its place by a derrick and held up by shores. The arrangement of the frame is shown in Fig. 7.

In a schooner of 75 tons there are about 27 frames, spaced 24 inches from center to center, the first one being set up about 6 feet from the stem at the water-line. After these frames are set up, and each is fastened to the keel with 1-inch iron bolts about 2 feet long, the stem, with the hawse timbers and knight-heads bolted to it solidly, is raised and bolted to the keel. Then the stern-post is set up, the deadwood is placed at the stem and stern, upon which the extreme forward and after frames, or "cants", are stepped, and then the keelson is laid, bolts 1 inch thick and about 20 inches long are driven through each frame into the keel, and these bolts often go clear through the keel and are clinched on the under side by spreading the ends with a hammer. The forward cants are usually four or five in number, and are of the same size as the frames of the "square body", so called; but the bottom ends are tapered to suit the model of the vessel, and are bolted with $\frac{7}{8}$-inch iron to the deadwood. There are five or six after cants, which are secured in the same way. After the frames are all up, three sets of ribbons, or strips of wood, are run around the vessel lengthwise and nailed to the frames, to hold them steady and in proper position while being planked, one of these ribbons being fastened at the head of the navel timbers, another on the bilge, and the third at the gunwale. The planking and ceiling generally go on at the same time, but in many cases the ceiling is put in first, and is fastened with spikes. The planking is fastened to the frames with

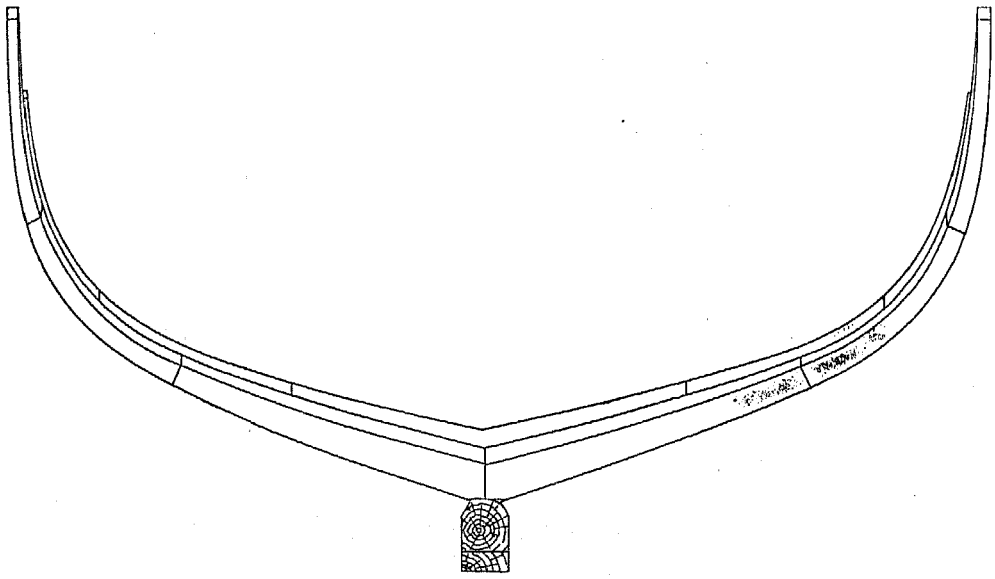


Fig. 7.—MIDSHIP FRAME OF A 75-TON FISHING SCHOONER.

oak or locust treenails, 4 in each frame, one-half of the treenail going through frame and ceiling, and is clinched at each end by driving wooden wedges into the treenail. The ends of the planking are fastened by two 5-inch spikes of galvanized iron and one $\frac{5}{8}$-inch galvanized iron bolt, going through, and clinched inside over an iron ring. Each plank of the "bends" is bolted to every set of timbers, this being called "bend bolting". The beams are put in about 4 feet from center to center, and are bolted to the clamps, or piece of thick ceiling, with $\frac{3}{4}$-inch iron, there being four $\frac{3}{4}$-inch bolts through each lodging knee into the beam and about six through the body of the knee into the side of the vessel. The deck planking is laid nearly straight fore and aft, but aft it follows the sweep of the sides of the vessel somewhat. The decking is 3 inches thick, 5 or 6 inches wide. Two 5-inch spikes are driven through each plank into every beam, the heads countersunk, and the holes plugged with wooden plugs set in white lead. On the top of the main rail, at the bow, is placed a wooden chock 5 inches high, tapering to 3 inches aft, and $5\frac{1}{2}$ inches thick, tapering to 4 inches aft. This chock extends from the bow to the fore-rigging. The taffrail varies from 14 to 18 inches in width on the main rail; the top rail is 9 inches wide. The houses are the last thing built. The whole of the top and outside of the vessel is duly planed, the deck oiled, the hull calked and painted, and the schooner is then launched (Figs. 8 and 9). At present, it is more frequently the case that fishing schooners are launched before the spars are set.

If there are ship-chandlery stores and sail and rigging lofts in the town the new schooner is placed alon[illegible] of a wharf and fitted out at once, but in many towns near cities as large as Rockland, Portland, Gloucester, Boston, and New York the schooner is placed in tow of a tug and sent to the city, where she gets her spars, rigging, anchors, hawsers, boats, and all the paraphernalia of her outfit. It costs from $50 to $100 to tow a schooner to the nearest large city, but, as a rule, outfits can be purchased there relatively so cheap as to w[illegible]

this expense. The use of the steam tug has within the last twenty-five years extinguished the sail and rigging lofts, anchor shops, and chandlery stores of a large number of vessel-building towns along the Atlantic coast by concentrating the outfitting business in the large cities.

From first to last, about thirty distinct trades are concerned in the collection of the material for a fishing schooner and the construction of a vessel. The largest part of the cost is for material. Fishing schooners were built in the census year for from $55 to $65 per register ton. The cost of a 75-ton vessel was about $5,000; the amount paid out in the ship-yard for labor of building was about $1,900.

The outfit of such a vessel for a five-weeks' mackerel trip for a crew of master and 14 men is:

1 seine, costing $850.
40 hogsheads of salt, $70.
1 seine-boat, $225.
400 barrels, $400.
4 barrels of flour.
2 barrels of beef.
100 pounds of pork.
120 pounds of sugar.
25 gallons of molasses.
½ barrel of beans.
25 pounds of dried apples.
25 pounds of cornmeal.
10 gallons of kerosene.
10 pounds of coffee.
50 pounds of lard.
60 pounds of butter.
10 bushels of potatoes.
1 bushel of pease.
10 pounds of rice.
50 pounds of oatmeal.
Other small stores, costing about $40.

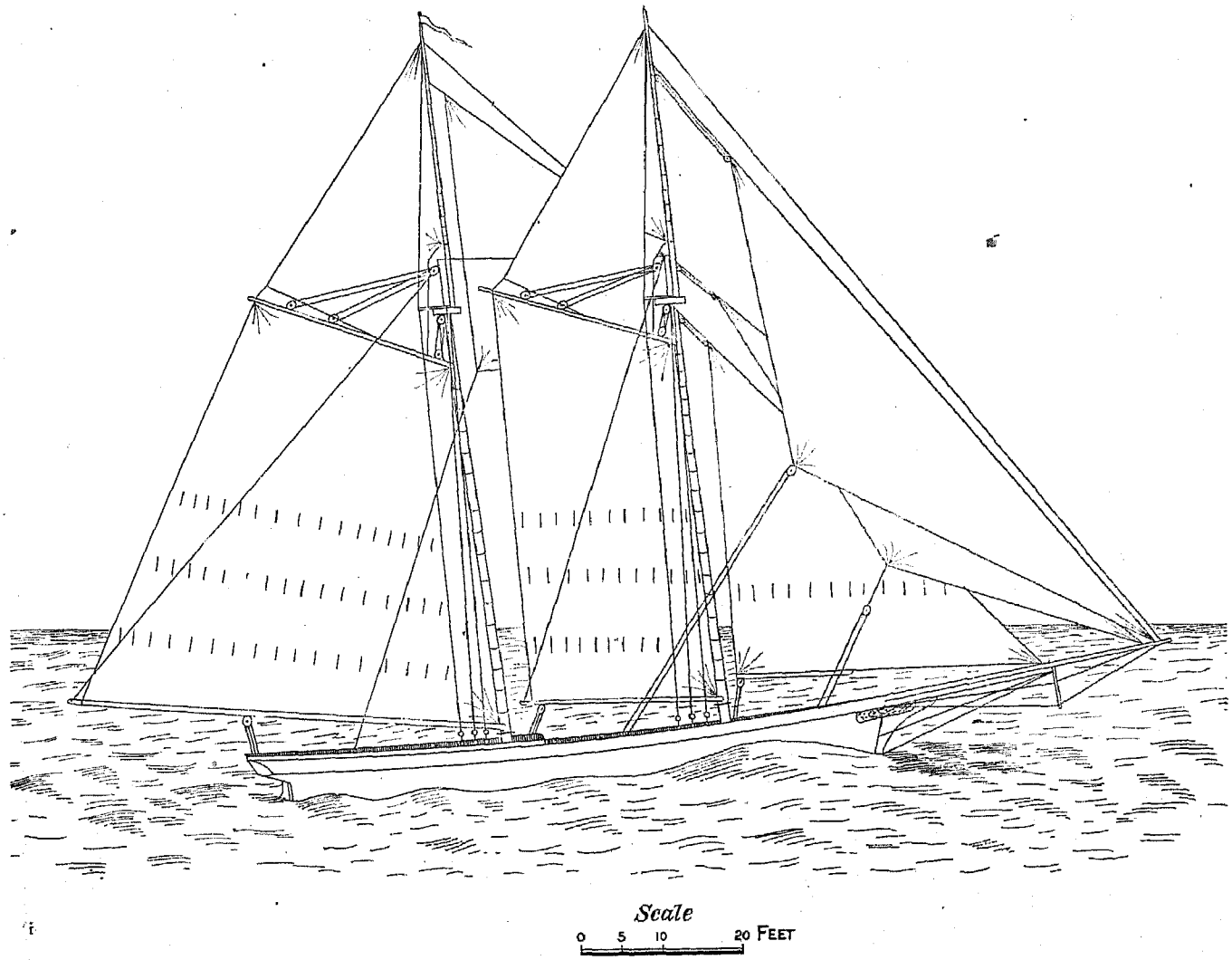


Fig. 8.—NEW ENGLAND CLIPPER FISHING SCHOONER.

75 tons, 76 feet long, 22 feet broad, and 7⅞ feet deep in the hold. Draught, forward, about 4 feet + the keel; aft, about 6 feet + the keel. Coefficient of D., to 6 feet from keel amidships, 0.39; to 5 feet from keel amidships, 0.33. Total displacement to 5 feet draught above keel, 89 net tons. Angle of entrance at bow, 40°.

It ought perhaps to be stated that the shallowness of the clipper schooner and the smallness of its under water midship section are doubtless the causes of a large proportion of the terrible losses of life and capital that yearly afflict the fishing communities of New England, especially Gloucester. Captain J. W. Collins, with others, have been trying for some time to induce the people engaged in the business to build deeper vessels for the winter fisheries.

The fishing smacks built on the Connecticut coast for the Long Island and New York fisheries are clipper schooners carrying light poles for topmasts, but often with no foretop-mast at all (Figs. 10 and 11). They usually carry a jib-boom. The rig is adopted for its convenience, but, as a rule, the vessels do not remain out over night.

However, they are able vessels, and sometimes are out a week without making harbor, especially in the spring and summer time. They are of smaller tonnage than the New England schooners, though deeper, and usually range from 20 to 45 tons register. Usually they have a well amidships, into which the fish are thrown, to be brought to market alive. A fair specimen of this class is the Elisha A. Baker, built in 1848 at New London, which is 65 feet long over all, 17 feet 10 inches broad on the beam, and has an 8-foot hold. Amidships, the well is 18 feet long and 5 feet high, with access into it through a 4-foot hatchway on the deck, covered with a wooden grating, the curb of the well lengthening fore and aft, so as to make an 8 by 4 feet opening. There is a bulkhead across the vessel in the middle of the well, while on top, and under deck, is an ice-house extending the whole length of the well. Forward of that is a little bait pen, and still further forward, reaching to the bow, is a forecastle and bait room 5 or 6 feet high, under which ballast is stowed. The mainmast steps on the after end of the well. The steerage is just aft of the mainmast, and the cabin, 12 feet long, aft of that, with a companion-way at its rear. The stove is in the forward end of the cabin, and ballast is stowed under the floor of the cabin. At the mainmast the deck rises 6 inches for a quarter-deck. The stern-post rakes about 4 feet to the head of the rudder-post, and the stern overhangs 6 feet from the cross-seam. A smack of this class has a broad keel and draws about 7 feet forward and 8 feet aft. It generally carries a yawl at the stern and two dories on deck.

A large number of these little smacks are owned in New York city and vicinity by fishermen who bring their fish to Fulton market for sale. They are now generally built all along Long Island and in Connecticut, and

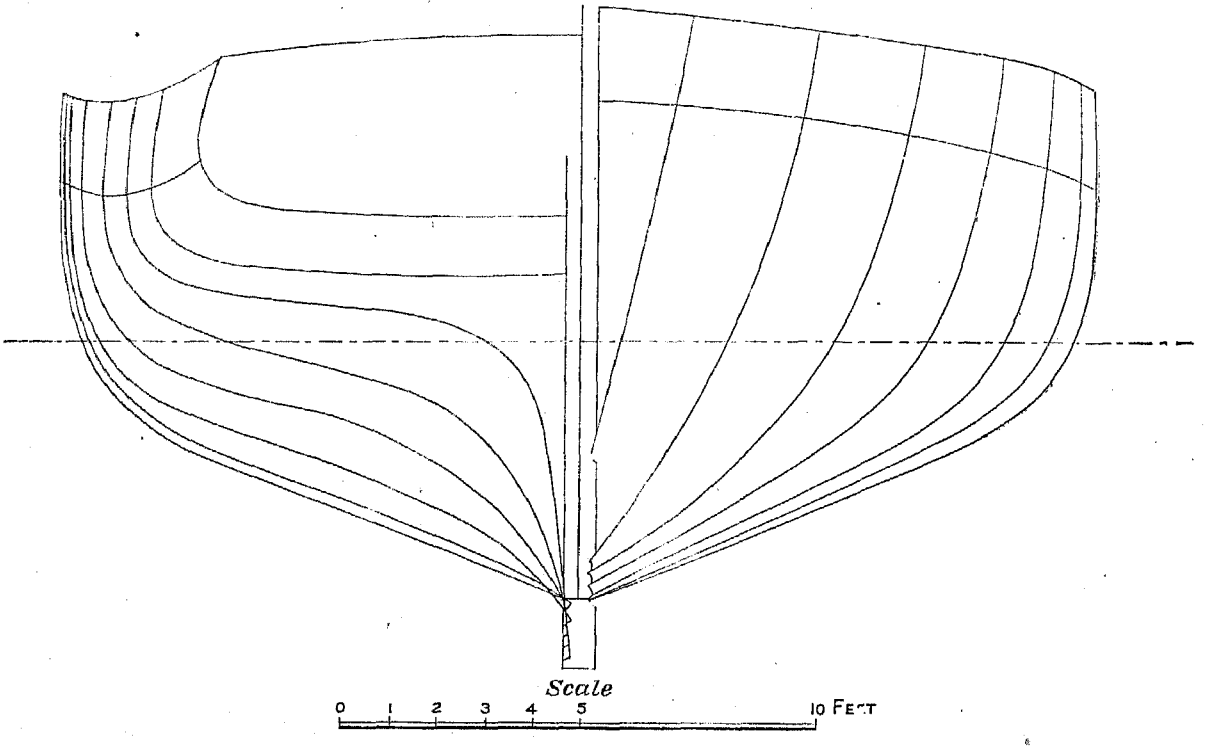


Fig. 9.—Lines of the fishing schooner.

being made of oak, locust, and the best pine, they do good service for from twenty to forty years. Formerly they were built in the ship-yards of New York city, where large numbers of smacks, both sloops and schooners, of great beauty of model have been constructed. Forty years ago the smacks of New York city were built with a tumble home to the top side, as in the illustration, and the bow raked sharply. The sides are now perpendicular amidships above the water, as in New England. The high price of labor in New York city has driven the business of building them out to country towns, as before stated. The smacks add little to the tonnage of the merchant marine of the United States, but their number is so great that they give employment to large numbers of carpenters on shore and of sailors on the deep. Any man who can build one of them right can build a good wooden ship of 2,000 tons register; and as long as they are built in large numbers the United States will not lack a handful, at least, of competent carpenters and builders.

In place of the schooners used on the New England coast for the capture of menhaden to make into fish-guano and oil there has been employed during the last five years a number of small-sized fishing steamers. These fishing steamers are sloop-rigged, but carry tug-boat engines and screw propellers. Seven were built at Boothbay and Kennebunkport, in Maine, and Noank, Connecticut, during the census year, ranging from 80 to 145 tons register. The hulls cost from $5,000 to $7,000, and the boilers and machinery from $6,000 to $10,000 each. The machinery, with propeller, weighs about 30 tons. Steamers have virtually superseded sailing craft in this particular employment.

A brisk business is done in New England in building boats for fishing schooners. Formerly fishing was done entirely with hand-lines over the side of the vessel, and then the schooner only needed a yawl; but the method has changed during late years, and now the crew take along a number of small boats, and when they reach the cod grounds they scatter away in them from the vessel, each boat on "its own hook", and after a load is obtained the boats return to the schooner. This new method has developed the business of boat-building immensely, not only making a demand for what is needed to fit out new schooners, but also supplying the shop steadily with large orders in behalf of vessels already in commission. Fishing on the banks is a stormy and perilous occupation, as a great deal of heavy weather is encountered and the decks of the schooners are often swept clean of nearly everything on board by huge seas. There is a continual loss of boats in that and other ways, and the result is that a schooner seldom sets sail from the home port for a fishing trip without first having to buy from one to five or six boats for the occasion.

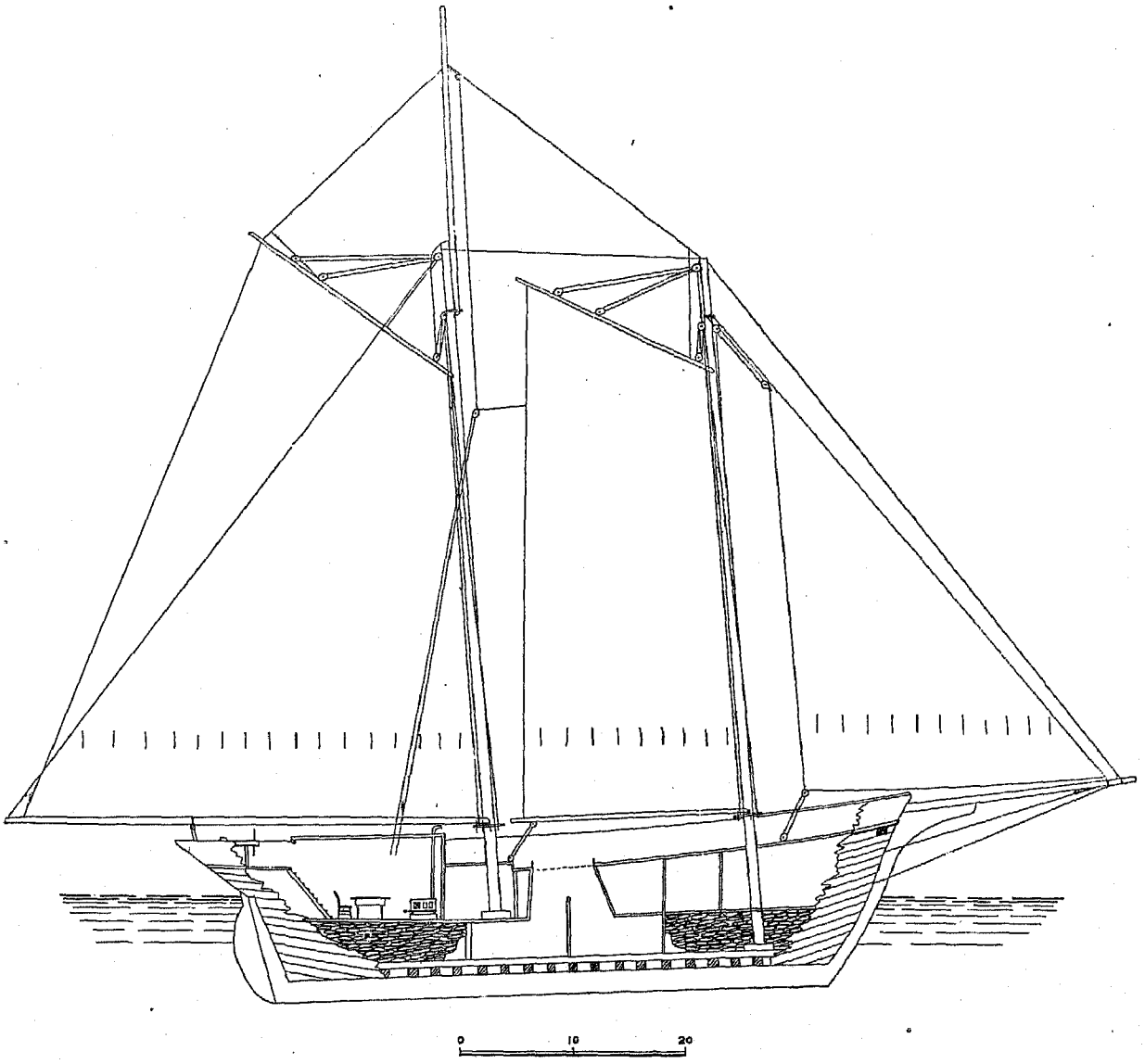


Fig. 10.—NEW YORK FISHING SMACK, 45 TONS REGISTER.

The boat now used is the "dory" (Fig. 12), a Yankee invention of most excellent qualities. It is built in five different sizes, designated by their length on the floor, viz: 12, 13, 14, 15, and 16 foot boats. The different sizes are used in different fisheries, the small sizes being used for hand-line fishing, the others for haddock trawling, and the largest of all for halibut. The boats carried by any one schooner are usually of the same size, for the reason that when the thwarts are removed the dories of a special size will stow away within one another in a "nest". Five or six boats will thus occupy on deck no more space than one boat. Sometimes one larger or one smaller dory is carried, and in that case it has to go at the top or the bottom of the nest. Experience has taught the best shape and sheer for a dory, and this admirable boat has reached almost perfection of form. The boats are swift, easily handled, capacious, and safe, and, if properly handled, are hard to capsize. Occasionally one will be tripped by a wave, but such an occurrence is rare; and there have recently been three instances in which some daring sailors crossed the Atlantic ocean to England in one of them.

The regular builders of dories are found at Cundy's Harbor and Portland, Maine; Seabrook, New Hampshire; and Salisbury, Newburyport, Essex, Beverly, and Gloucester, Massachusetts; but numbers of them are built in a small and scattered way all along the New England coast down as far as New York city by farmers and fishermen. The principal center of this industry is Salisbury, Massachusetts, where there are seven shops, each producing from 200 to 650 dories every year. About 200 are built at Gloucester yearly, 75 in Portland, 75 in Cundy's Harbor, and from 20 to 50 in each of the other places named. The large builders have the advantage of being able to buy a car-load of lumber at a time, by which means they get it cheaper and can sell their boats at a lower price. At Salisbury, in the census year, the stock for a dory did not cost more than $12 on the average, the expense of labor in building being $5 or $6. The boats sold for $18, $20, and $25 each. The business in the shop is organized in a way not seen in any other branches of boat-building, except in the few establishments (not exceeding twenty in the whole country) where ships' boats are built on a large scale. Each man has a special task to perform, as the getting out the boards for the floor, the planks for the sides, the frames, or other pieces, the fitting of the several parts of the boats into place, or the painting and finishing. Each one is paid by the piece, and the result is seen in a degree of rush and hurry in the large shops not noticed in other branches of the art. The boats are built in winter time, and the active work of the men serves to keep them warm in spite of the rather excessive ventilation of the barn-like buildings.

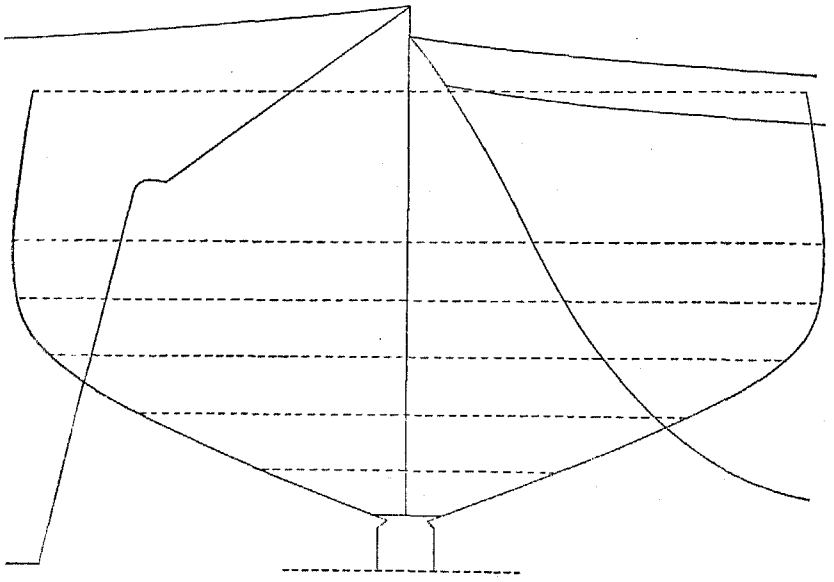


Fig. 11.—Outlines of midship section, bow, and stern of the sloop-smack "Prouta", built in New York in 1842.

The frames of the dories are spaced from 27 to 30 inches apart. They are of white oak, and are cut from natural crooks when the stuff can be obtained; but owing to the difficulty of obtaining the large supply of natural elbows required a patent iron dowel has been invented for uniting two sticks of oak into an elbow, and frames thus united are almost exclusively put into boats in the large shops. In making the dory the first step is to cut out the floor of the right length, width, and outline from two or three $\frac{7}{8}$-inch white-pine boards, grooved and jointed at the edges. The boards are driven tightly together and fastened by laying floor strips of oak across them midway between the places for the frames and nailing them strongly to the boards. As the bottom of the boat is to be given 3 or 4 inches sheer, the next step is to lay the floor on a row of blocks having just the sheer required. It is held in place firmly by poles reaching to the ceiling of the room. The frames having been meanwhile made, are put into position on the floor of the boat and nailed. The stem-post, with its knee, is placed, as is also the narrow V stern-board and its knee. The planking is of white pine about five-eighths of an inch thick, and is cut from planed boards with the aid of a wooden pattern or mold, the edges being beveled so as to lap. There are three streaks on each side of the boat. Builders are guided by personal taste in deciding whether to make the upper of the three planks of the side or the bottom one the widest, the practice varying; but a wide upper streak is held to make a handsome boat. The lower board is the first one put on, and is held to the frames by carpenters' set-screws until fastened. The other boards are then put on in order, being nailed to the frames, the stem-post, and stern-board, and to each other where their edges lap. The boats have about 14 inches sheer, but when built for use near shore and in comparatively smooth water they can be somewhat less crooked on top than that.

Thirteen-foot dories have two thwarts, with parting boards or bulkheads under them, to keep the fish from shifting about, and one pair of oars. A narrow batten, or "rising", is fastened to the frames for the thwarts to rest upon. Fifteen-foot or trawl dories have three thwarts and three parting boards, with two pairs of oars. The space aft of the after parting board is occupied by buoy lines, anchors, etc., and the seats are usually on the first, second, and third timbers. The bow and stern rake considerably. The top length of a 13-foot boat is 15½ feet; of a 15-foot boat, 19⅛ feet. The sides flare from 12 to 15 inches amidships. Dories are very light for their size, the 13-foot size weighing about 180 pounds, the 14-foot 190 pounds, and the 15-foot 250 pounds. They float like an egg-shell on top of the water, drawing from 3 to 5 inches only, and it is possible to load them down to within 6 inches of the gunwale in safety.

A variety of other boats are built along the New England coast for fishing, some to go with vessels, others for alongshore use, primarily intended for rowing, but often having also some sort of a small fore-and-aft sail, with a pole for a mast that can be unshipped and taken down readily. The shore boats are for lobstering and fishing with hand-lines, seining, etc. They are regularly framed keel boats, usually open, and are sometimes clinker built and sometimes sharp at both ends. The seine boats are always sharp at both ends; they are rather full on the floor amidships, are well modeled at the ends, and are given a good sheer. On the coast of Maine some of the shore boats have a little cuddy forward, in which is placed a stove, to keep the men warm in winter, and also to prevent the lobsters

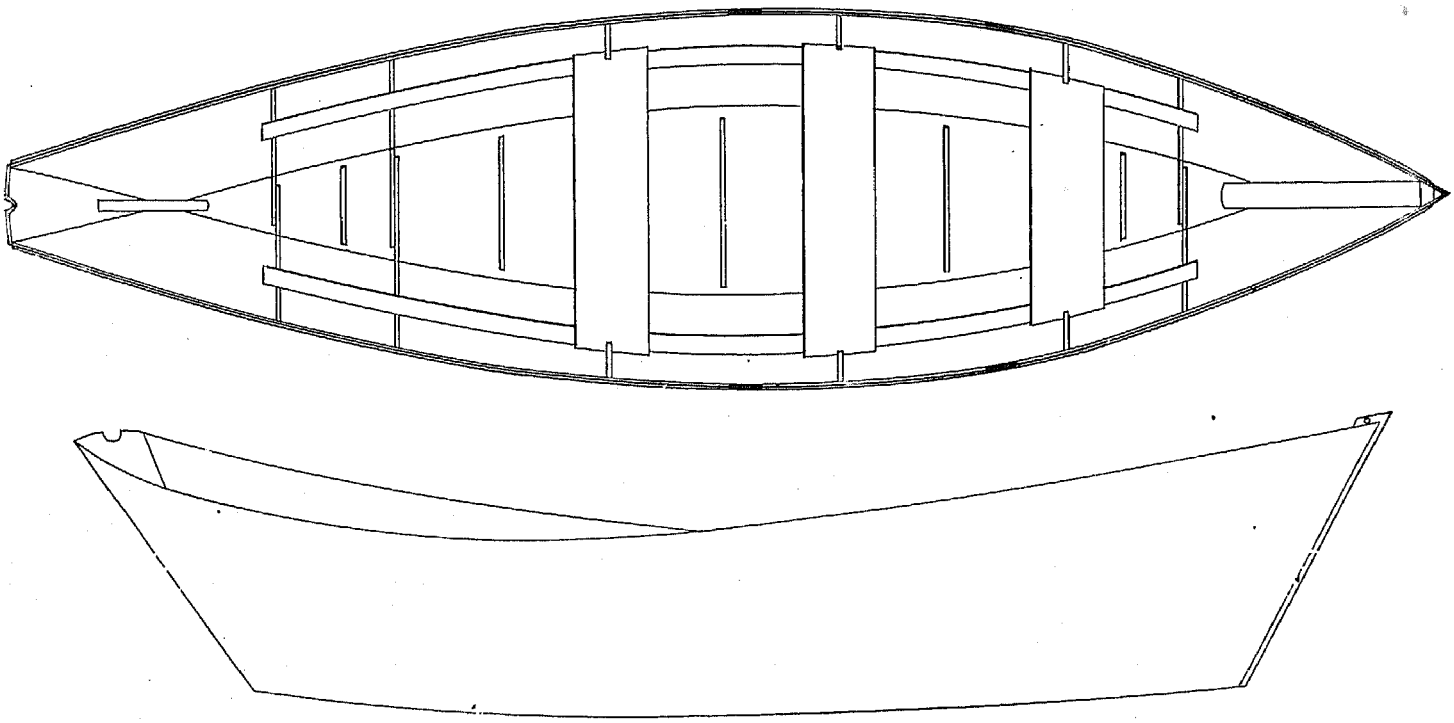


Fig. 12.—15-FOOT FISHING DORY.

19 feet 4 inches long over all; 22 inches deep; 31 inches wide on the floor; 5 feet 3 inches wide across the gunwales; 14 inches flare. Weight of boat, 250 pounds. Will float at 3¾ inches draught of water. At 9 inches draught will carry 1,200 pounds; at 13 inches draught, 2,000 pounds.

from freezing until they can be brought to shore and sent to market. The general model of the open boat is a legacy from early times. It came into existence at a very early period, owing to the exigencies of the peculiar calling in which it is employed, which has compelled the shore fishermen to adopt a boat suited to flat beaches and having the properties of light draught, buoyancy, stability, and stowage capacity for fishing apparatus and fish. The object of building the boats with sharp ends is to enable fishermen to launch and land through the surf with facility and to handle the boat in rough water with safety. The New England fishermen of to-day have been accustomed to this general model from childhood, and they pin their faith to it with the utmost tenacity. It is the model which forms the basis of the admirable boats used in the United States life-saving service. The crews of the life stations have been largely recruited from the sea-coast fishermen, and the bureau at Washington gives them the model they know so well and can handle with such remarkable skill. Whale and seine boats are the largest of this class of boats used in the fisheries. The seine boats of Gloucester are extremely handsome specimens of workmanship, and are now built 36 and 40 feet long; but the usual size is 34 feet long, 7 feet 10 inches wide, and 33 inches deep. They are fuller than a whale-boat, and can carry a net 200 fathoms long and 1,000 meshes deep. Extensive use is made of this class of boats in shore fishing. They consume a great deal of material in building, namely, 600 board feet of cedar, 230 feet of oak, 250 feet of white pine, 70 pounds of iron nails and bolts, 75 pounds of iron fittings, and 35 pounds of paint, and are expensive boats, costing from $200 to $250. The model bears so close a resemblance to that of the whale-boat that the one illustration, given elsewhere, will do for both.

Many keel-boats were formerly built in New Hampshire and elsewhere for Labrador fishing, but the business has declined of late years. In one shop in Seabrook, New Hampshire, that used to build a hundred boats per annum, only five were constructed in the census year.

On the Connecticut shore a large fleet of small flat-bottomed fishing boats are employed, called "sharpies", which have a family resemblance to the dory. These are fully described under the heading of "Oyster boats".

WHALING VESSELS.—The whale fishery was actively pursued in Europe before the settlement of America, the Biscayans and Basques being the first to capture this gigantic fish. Their earliest exploits were on their own coasts; but, becoming expert in handling the whale, they followed their game to the north of Europe by the middle of the fifteenth century, and in 1578 they had 25 large sailing vessels in the business. The Dutch, following the example of the Biscayans, also went into the business, and about 1650 had 200 vessels in this fishery, while the people of Hamburg had 350. The English also sent out whaling vessels, and by the time the coast of New England was settled the commercial value of the whale was thoroughly understood. The early visitors to America had a sharp eye to business opportunities, and finding that the whale was a native of the American coast they made repeated mention of the fact in the several reports of their voyages.

The first whaling in America was limited to securing such specimens of the fish as had died a natural death and had drifted ashore, cape Cod, the Massachusetts coast northward, Nantucket, Rhode Island, and Long Island being the principal localities where this business was carried on. Drift whales, as they were called, were always the property of the public, and the colonial government, the township where the whale came ashore, and the finder of the game divided the oil, etc., equally. The active pursuit of this profitable fish began, however, within twenty years after the landing at Plymouth. The first organized work appears, from the report of Mr. Starbuck, published in 1878, to have taken place on the eastern end of Long Island, at Southampton. Encouraged by the example of the Indians, who occasionally put out from the shore in their log canoes and attacked a whale with spears and arrows, the settlers built boats suitable for the purpose and chased every whale blowing in sight of land that it was possible to get. On Long Island, and afterward at Nantucket, a regular lookout was kept on shore. A mast was set up, and a watch kept from a platform built upon it; boats were kept in readiness to launch; and when a whale was seen to spout an alarm was sounded by shouting or by blowing a horn, and the boats were manned and launched and sent out in eager pursuit of the game. In calm weather these boats would sometimes venture almost out of sight of land—a dangerous proceeding, as it often proved—and many times they could scarcely reach the shore again. On one occasion 30 boats were out from Nantucket for whales when it began to blow and snow, and it was only after long and hard rowing and a desperate struggle with wind and tide that they reached land again in safety.

The boats first used were shallops, built after the fashion of ships' boats, but sharper. The first requisite in a whale-boat was speed, with its consequent ease in rowing, and the object was gained by making the shallop long and narrow, with keen ends and a sharp floor. The bow raked considerably, after the universal fashion of the day in vessels large and small, and the stern was sharp, but had a post or skag, on which the rudder was hung. It is probable that by the year 1700 this boat had reached nearly the form it keeps to-day; and by the time of the revolutionary war, large and a double-ender, it was a style of boat famous for its speed, lightness, and capacity. The accompanying cut (Fig. 13) is of a boat built in 1789 which nearly resembles the whale-boat of to-day.

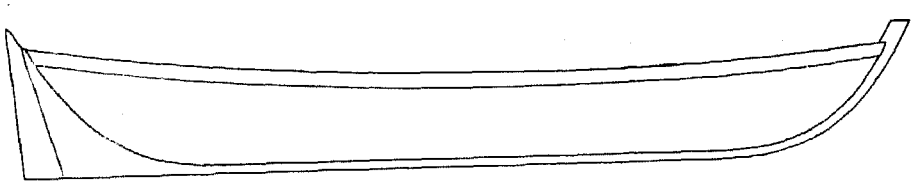


Fig. 13.—WHALE-BOAT OF 1789.

Whale-boats played a part in the war for independence, their size and speed making them useful to the Americans for warlike service, short expeditions, and quick surprises. The British took pains to destroy as many of them as possible in their raids on the Rhode Island, Massachusetts, and Long Island towns, and Sag Harbor, Newport, Warren, Rhode Island, Martha's Vineyard, Nantucket, and New Bedford suffered heavily from the capture and burning of large numbers of whale-boats, as well as of whaling vessels.

Living on an island, the people of Nantucket were obliged by necessity to own shipping for communicating with the main land. As early as 1694 they were buying sloops of from 15 to 25 tons measurement in Scituate, Salem, and Boston, and later at Newport and other towns in Rhode Island, the sloops thus obtained being used in cruising a little off shore for whales as early as 1712. In 1715 Nantucket had six small sloops, which in that year got 600 barrels of oil and 11,000 pounds of bone, worth £1,100. The catching of a sperm whale excited the people of Nantucket greatly, and they began at once to "whale out in the deep" with larger vessels for that species of the fish. Sloops of 30 tons were fitted out for cruises of about six weeks each, carrying two whale-boats, one with which to chase the fish, the other for use in case of accident to the first boat, and with only hogsheads enough in the hold to contain the blubber of one whale. Whenever a prize was caught they sailed for home again, and, unloading the sloop, they left the blubber ashore to be tried and immediately put to sea again. The people of Nantucket soon took the lead in whaling, it being their only means of support, and by training they became more expert and successful than their neighbors on other coasts. Sloops were also sent out from cape Cod, Sag Harbor, Boston,

New Bedford, Rhode Island, Martha's Vineyard, New York, and Williamsburg, Virginia, along from 1750 to 1760, and from 1760 to 1775 whaling vessels grew in size and multiplied rapidly. It is not known definitely when the schooner was first employed in whaling, but that style of vessel was adopted as soon as whalers began to visit the West India islands and remained longer than six weeks at sea, as it was then necessary to have something larger than a sloop of 30 tons. Schooners are mentioned as early as 1760, and they soon superseded sloops for distant voyages. A number of brigs were added to them as early as 1770, and small barks were soon added. Voyages were then from two to ten months in duration. In 1770 Nantucket had 120 sail of from 75 to 110 tons register engaged in whaling. This fleet had grown in 1775 to 150 vessels of from 90 to 180 tons. In all the colonies at the outbreak of the Revolution there were owned 360 whaling vessels, registering 33,000 tons and employing 4,700 men at sea, besides the large number of people on shore who were building them, fitting them out, and repairing them. The vessels in the Greenland fisheries were of about 65 tons register, and it cost to build and fit them out about $3,000 each. The larger schooners, and the brigs and barks that sailed to the south Atlantic, were of 140 tons register on the average, and cost $6,500 each. The Revolution nearly destroyed the whale fishery of America, and in 1788 there were only 80 whaling vessels in the United States. This did not crush the spirit of the whalemen, however, and after the war the first vessel that carried the American flag into Great Britain was the Yankee whaler Bedford, which sailed up the Thames to London. After 1812 the business revived and increased steadily in importance until 1858, when there were over 700 American whaling vessels at sea, of 198,000 tons register, employing 17,000 men. The greater number of the vessels were rigged as barks and ships, and were each of 400 tons register; the others were brigs and schooners, the sloop having ceased to be used as a whaler shortly after the revolutionary war. Owing to the large size of these vessels, they were unable to enter many harbors where whalers had been fitted out in previous years, and the business had become concentrated at New Bedford, New London, and Sag Harbor, where the water of the harbors is deep. There was afterward some whaling from New York.

Whaling boats and vessels have been built chiefly at Nantucket, Newport, New Bedford, New London; Sag Harbor and Greenport, on Long Island; Provincetown, and Boston, and at a number of small villages along that coast which have carried on whaling to a small extent. Within the last 40 years the larger whaling vessels have frequently been built in Maine, and they are now built in Maine almost exclusively, chiefly at Bath.

Whale-boats continue to be built in New London, New Bedford, and Fairhaven, and at Provincetown and other places on cape Cod. The form and all the details of these craft have been closely studied, and the experience of 220 years has led to the production of a class of boats equaled nowhere in the world for their strength, lightness, speed under oar or sail, and seaworthy qualities. The model is substantially the same wherever in America the whale-boat is built. The early boats could not have been longer than from 15 to 20 feet. They were carried on the deck or at the davits of sloops and schooners, and 15 feet was probably the most convenient size. In later days they grew to 25 feet, barks and ships having from four to six of these boats at the davits when on the fishing grounds. They were narrow, and could have been placed inside of one of the boats now used. The whale-boat of to-day (Fig. 14) is either 28 or 30 feet long, 5 feet 8 inches or 6 feet wide across the gunwales, and from 24 to 26 inches deep amidships, with 16 inches sheer. It is sharp at both ends, with hollow lines forward and aft and a rather flat floor amidships; is fitted to be rowed with five or six oars, and is steered with an oar, put out aft over the stern. Formerly it carried a pole mast 12 feet long, with a small sail about three cloths wide; but now that the fish have become shy and are easily frightened by the splashing of the oars this boat is handled chiefly with the aid of the sail. It carries a 24-foot mast, mounted upon a hinge, so as to be conveniently raised and lowered, and has from 35 to 55 yards of canvas. A sprit sail is sometimes used, but as a rule the whale-boat has a regular sloop sail, with the boom reaching out over the stern, and sometimes a jib and a gaff topsail are added. Now that sails are employed so largely, the model of the boat has been altered slightly to correspond, and it has been widened several inches and made a trifle more full forward, so as to bear up under a press of canvas. A great many boats are also fitted with a center-board about 8 feet long and a rudder, which can be easily removed when desired. When under sail a boat is ballasted by five or six men sitting on the weather gunwale. Thus fitted out, a whale-boat can live in any weather, almost beat a ship for speed, and can cross the Atlantic ocean in perfect safety. It costs $90 or $100 to build a whale-boat, the material costing $45 or $50, and from 20 to 25 days of labor of a single man is required for its construction. To rig the boat costs $30 or $32, viz: 5 oars, $8 50; 24-foot mast, with sail, $8; mast hinge, $4; mast fasteners, $3 25; rowlocks, $6 50; jib and topsail, about $3 more. A large and specially fine whale-boat complete has cost as high as $212.

The stem, stern-post, keel, frames, and gunwales are of white oak; the thwarts, 5 or 6 in number, and the seats at each end, are of white pine; the planking is of white cedar, half an inch thick; and the keel is 9 or 10 inches wide amidships when pierced for a center-board, tapering to 4 inches at the ends, and is 2 inches thick. The keel is laid on building blocks on the floor of the boat-shop, and the stem and stern-post, with aprons, are fitted to their places with a scarf on the keel and secured in an upright position temporarily by wooden shores from the ceiling of the shop. Several molds of cheap 1-inch pine boards are then set up at intervals along the keel, the profile of each being a fac-simile of the section of the boat at the point where it stands. The molds are kept in place by narrow ribbons or battens (extending the whole length of the boat), which are nailed to them and to the stem and the stern-post. The outside shape of the boat is thus reached in skeleton form. The frames are not put

in first, as in vessel building, they are put in last. The planking goes on first. Two gunwale streaks of oak are first put on each side of the boat, each one lapping over the streak below it, after which five or six streaks of cedar planking are placed on each side of the boat, completing the shell from keel to gunwales. The edges of these lower streaks abut squarely against one another, and are fastened, after the molds are removed, by running a batten 2 inches wide on the inside of each seam the whole length of the boat and fastening the edge of each plank at each seam to the batten by a row of nails driven clear through and clenched on the inside. The shell is completely built and

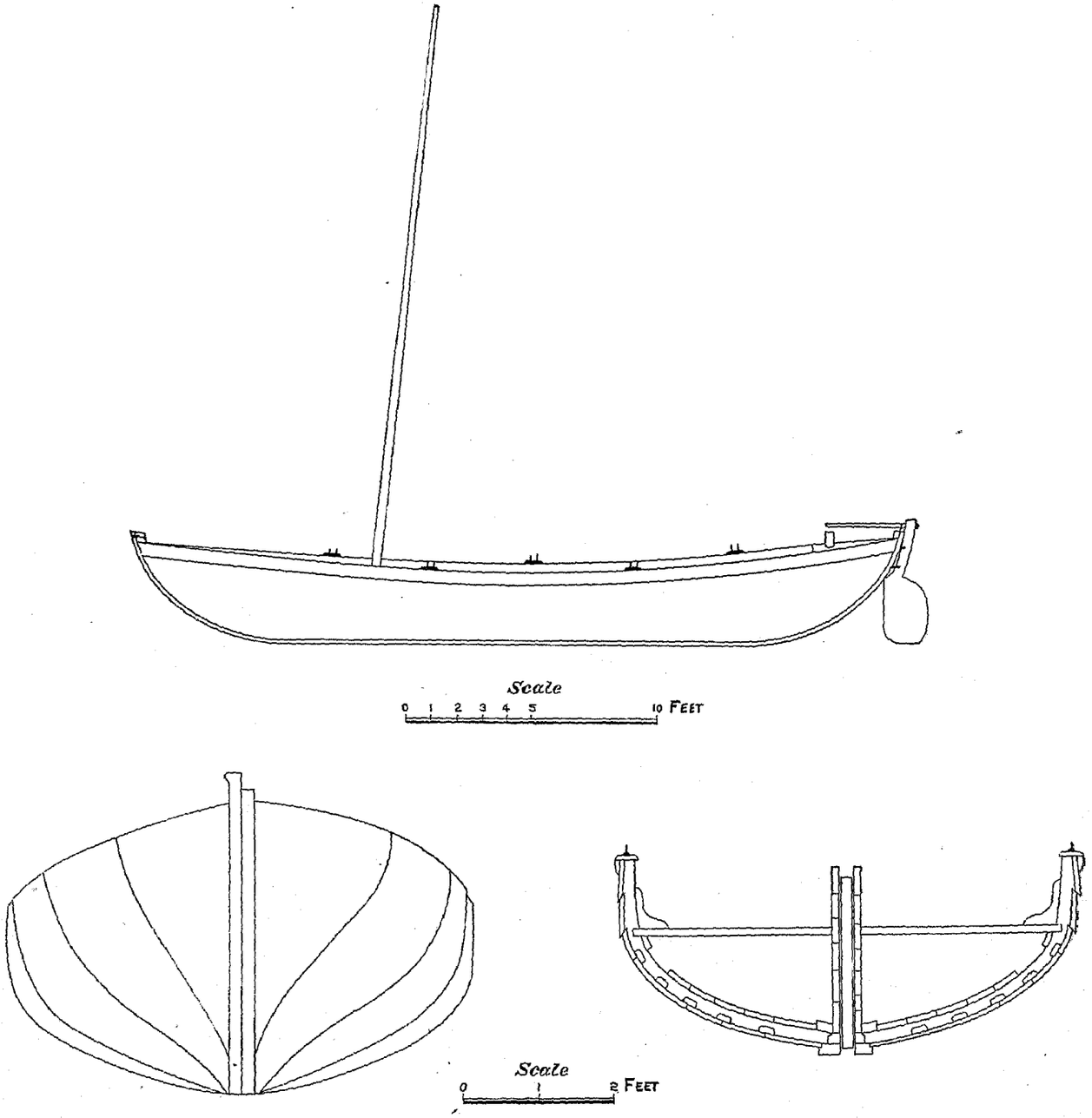


Fig. 14.—WHALE-BOAT.

30 feet long by 6 broad and 26 inches deep; 30 inches molded. Displacement to 19 inches draught of water above the keel, 7,100 pounds. Weight of boat with fittings, about 1,100 pounds. Coefficient of D., 43 per cent; angle of entrance at bow, 33°.

nailed before the transverse frames are put in, and the battens serve the double purpose of calking each seam and of forming a light and admirable system of longitudinal frames. Planks long enough to reach the whole length of a 30-foot boat cannot often be obtained; and if they could, it would make a great waste of material to cut them out from the boards, as each streak has to have a certain amount of curvature to fit conveniently to the curved surface of the boat. Each streak of planking is therefore made of two pieces, lap-jointed, the joints of one streak being carefully arranged so as to come nearly in the middle of the streaks above and below it. The ends of the planks are strongly nailed to the stem and stern-post, and the garboard-streak is well fastened to the keel.

The frames are put in next. They are single frames, extending in one piece from keel to gunwale, and are made of oak, bent to the right curvature on molds after being thoroughly steamed. The outside edge of each frame is notched, so as to fit over the batten and laps of the planking. They are fastened with copper or composition nails, driven through the planking and clinched on the inside over disks or rings of the same metal. The frames are spaced from 9 to 18 inches apart, and a light keelson of oak is laid to cover and secure the heels of the frames. The boat is floored across the bottom and part way up the sides with pine. The thwarts, of pine, are then laid; the ends rest on a batten nailed to the frames, and are also secured with small cedar knees. If there is a center-board, the well for it is made in the same manner as all other center-board wells, large and small. An upright post is set in each end of the slot through the keel and nailed in place, and is then planked up the sides to the top of the posts. The mast step, rail, oar-locks, the bit of decking at the bow, the snubbing post, rudder hangings, and other finishing touches, are then added, and the boat is complete. From 150 to 200 board feet of oak, from 550 to 700 feet of cedar, and about 200 feet of pine, with 18 or 20 pounds of nails and 20 pounds of iron fittings, are required for the building of a whale-boat. The lumber wastes from one-fourth to one-third in cutting up. The boats are painted either a white or lead color.

The business of boat-building requires but little capital, a cheap shed near the water and $100 worth of tools and apparatus being all that is required. At the same time the business is a profitable one, and in every town that built whale-boats during the busy period, when over 3,500 hung at the davits of the whaling fleet in the service and several hundred new ones were called for every year, the builders were a prosperous class of men. William Smith, of New Bedford, and others each built from 100 to 120 boats a year, employing several of the finest mechanics, and not only paid high wages to the men, but received for their own work the very best compensation. The reduction of the whaling fleet to about 170 vessels, carrying not over 900 boats and requiring not over 150 boats yearly, has extinguished a large number of the boat shops which were active 30 years ago, and left those which are still open struggling to get along in a business in which there is sharp competition and little more to be made than a moderate day's wages all around.

In whaling vessels, as in boats, speed has always been desired; but seaworthiness has been the prime requisite, and schooners, brigs, barks, and ships have all been built with the latter quality chiefly in view. Large capacity has never been demanded, and whaling vessels have seldom exceeded from 250 to 400 tons register. Before the last war the whole fleet did not contain more than 20 vessels that approached 500 tons each, and it is believed that there was only one, the ship George Washington, which was as large as 600 tons. Those now employed are each under 500 tons, the size preferred being from 300 to 400 tons (Fig. 15). The problem which has occupied the builders has been how to make a strong, dry, seaworthy, good-going vessel, looks and every quality not specially needed in the whaling business being passed by. Above water the hulls have accordingly had a clumsy shape, owing to the large square stern, the full, round, flaring bow, and the large cut-water and figure-head; but under water they have always been of a well-considered and often extremely good model, sometimes quite sharp, both on the floor and at the ends, and never very full, a little narrower than merchant freighting vessels, deep, with the broadest beam, well forward of amidships, averaging two-fifths the length from the bow. Of late years lighter sterns, handsomer bows, and smaller cut-waters have been introduced; and the whaler has become as neat looking a vessel as any in the merchant navy, while retaining its satisfactory speed and good qualities in a sea way.

The New London, New Bedford, and Sag Harbor builders have always prided themselves upon the staunchness and durability of their vessels, as no material except the best was ever put into them. Whalers were usually constructed of oak throughout, except the beams, decking, and houses; and timber or planking with a flaw of any kind was instantly thrown away. Every bolt, rope, sail, seam, or part of the vessel on which its strength and safety and the lives and success of the crew depended has always been attended to with a degree of care not known in any other branch of the ship-building industry. The calking of the seams of the hulls was done with peculiar thoroughness, and the system of "heaving down" the vessel—that is, pulling her over on one side so as to strain open the seams on the other, which were then thoroughly calked, the hull being afterward coppered—was often practiced at New Bedford. The George Howland and the Roman were vessels thus treated, and it is said they sailed for 18 years without recalking. The length of life of the whalers has been remarkable, forty years being a usual and sixty not an uncommon age for them to attain; but they have been known to do good service for over seventy-five years, the ship Maria, of 202 tons, built in 1782, being one of the vessels of noted longevity.

The following specifications will show the scantling, etc., of a whaling bark of 310 tons, two decks, now in the service, a fair specimen of its class:

Length on deck, 115 feet. Breadth from outside to outside of planking, 27 feet. Depth of hold, 16 feet. The keel is of rock maple, in two lengths, sided 13 inches, molded 29, with a 3-inch shoe in addition. Stem, stern-post, apron, knight-heads, transom, and counter timbers of the best white oak; stanchions the best white oak, and to be made half tops. The floor timbers of the frame, white oak, with some maple; first and second futtocks and half of the forward and after cant frames of white oak, the remainder being of hackmatack; top timbers one-half oak, the others hackmatack. The frames are sided over the keel 22 inches and molded 13, being spaced 6 inches apart; at the gunwale they were molded 6¼ inches, diminishing to that point by nearly a true taper. Keelson, 14 by 14 inches, with a rider keelson 12 by 12 inches and a sister keelson each side of the main 6 by 10 inches, all well bolted through frames and into the keel with 1¼-inch galvanized iron bolts, and through the scarf of the keel with yellow metal bolts. The outside planking was of pitch-pine, except where a twist occurs, when the best oak plank was used. Garboards, 5, 4, and 3 inches thick; bottom plank, 3 inches; wales, 4 inches,

fastened at the butts with metal bolts, and elsewhere with oak and locust treenails, those of locust driven clear through and wedged at both ends. Ceiling of pitch-pine, 3 inches thick on the floor, 5 inches on the bilge; two sets of clamps, 5 inches thick, under the lower deck beams; ceiling of sides to the main deck 3½ inches, with two streaks of 4½-inch clamps under the main-deck beams. Water-way on the end of the lower deck beams 8 by 10 inches, and on the upper deck 8 by 12. Lower deck beams, pitch-pine, 10 by 13 inches, secured at the

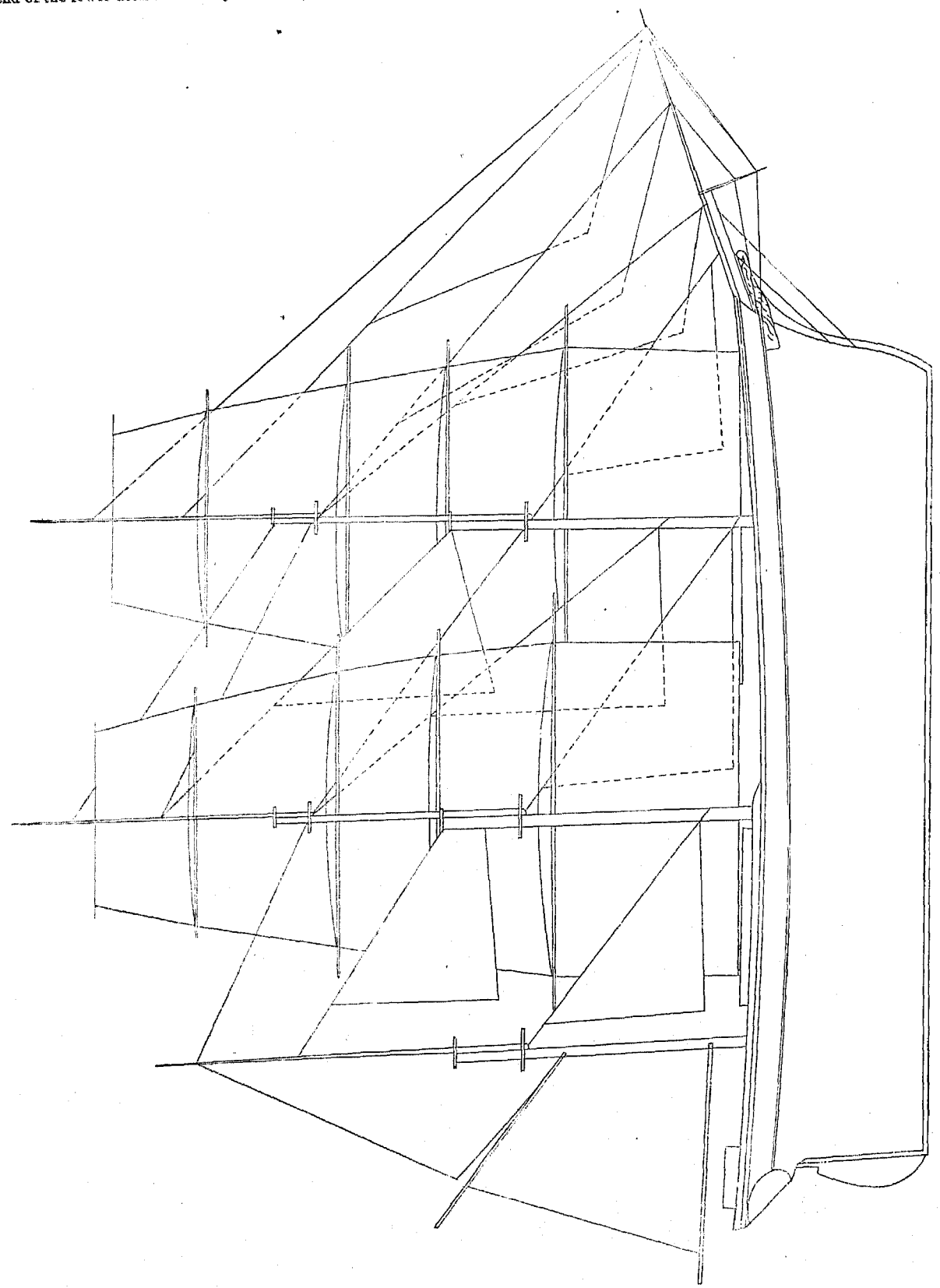


Fig. 15.—Sail plan of a 300-ton whaling bark, New Bedford, 1882.

ends by one hackmatack hanging and two horizontal or lodging knees, sided 7 inches. Lower deck plank 3 inches, same wood as beams. Main-deck beams, 8 by 12 inches at center, 7 inches thick at the ends, secured with three hackmatack knees at each end. The beams abut against a timber at each end, are bolted to the clamps, and are spaced about 56 inches apart. Knees are bolted heavily to beams, clamps, and frames adjoining. Main-deck plank, 3-inch white pine, of the best quality, the seams calked and pitched, with two spikes in each

beam, the heads countersunk and the holes filled with wooden plugs, set in white lead. Plank-sheer and main rail, 4½ inches thick, with "monkey" bulwark on top of rail. The bulwarks to be tight forward, but with gangways amidships, as is usual in whalers, and lower bulwark boards, hung on composition hinges. A small top-gallant forecastle deck at the height of the main rail, for working the anchor, etc. A forecastle house for the crew and cook at the the foremast, with a hurricane deck for the boats. The cabin aft, with skylight. Cut-water and billet-head of modern style; square stern, with spread eagle for ornament. Windlass bitts, 9 feet long, with 24-inch patent windlass gear; ends straight, with iron whelps. The hull to have two coats of good black paint. Two 8-inch stern and five 6-inch quarter lights. The vessel to be thoroughly salted from plank-sheer to light water mark with rock salt between the timbers before leaving the stocks. Two 1¼-inch iron anchor chains, 90 fathoms each, weighing together 8 tons net. Three anchors, 2,000, 1,600, and 250 pounds weight respectively. Rudder hangings, plates for bobstays and cabin stairs, and rail for cabin gangway of composition and brass. Wheel steering apparatus. The sails of the bark include four headsails (jibs and staysails); a lower, top, top-gallant, and royal sail on the fore and the mainmast, respectively; a spanker and gaff topsail on the mizzen-mast; a maintop-mast, a maintop-gallant staysail, and a mizzen-topmast staysail. The shrouds and great stays of 3½-inch wire rope; the running rigging of best manila. The vessel to be delivered to the owner complete, except the sheathing and coppering of the hull below the water-line, the boats, and the apparatus for trying out the blubber of the whale.

In the main, the scantling and fastening of the vessel are much heavier than would be required in the merchant navy to obtain on the books of the American Shipmasters' Association the class of A1, the highest given by the surveyors of the association.

All whalers are coppered to the load-line, the metal covering the keel, rudder, stem, and stern-post, as well as the planking, the object being to protect the bottom of the ship from the attacks of the teredo (a worm which burrows through the wood and completely honeycombs it with cells), and also to prevent it from becoming incrusted with barnacles and shells, which would greatly retard its motion through the water. The gradual corrosion of the metal by salt water causes the barnacles to shell off as fast as they become attached and keeps the bottom of the ship smooth. It was not until the latter end of the last century that copper was introduced as a means of protecting the immersed part of the hulls of vessels, and the expense of pure copper soon led to substituting in its place an alloy called "yellow metal", which was cheaper and answered the purpose as well. Zinc has also been used; but yellow metal has always been the preference of whalers. The metal is rolled in sheets 48 inches long and 14 inches wide and of a great many different thicknesses, about ten in all, although five only are used on whalers, the thicknesses being indicated by the weight per square foot, a whaler taking 18, 20, 22, 24, and 26 ounce metal. The process of putting on is as follows: The bottom of the hull is first made smooth; and if it is an old vessel, the worn copper is stripped off with chisels and adzes, the sails removed, and the surface of the planking is scraped clean, the old metal and nails being sent off for sale. The hull is then either sheathed with a light planking, or is covered with cement or graved with tar and papered or felted. The oldest fashion with whalers was the use of cement. Sheathing was also in vogue, and is still common; but papering or felting is the new idea, and is extensively practiced, as it is claimed that worms will not go through paper. The sheets of metal are meanwhile being prepared by punching either two, three, or four rows of holes along their edges for nailing them on. The heaviest thicknesses are put on at the bow as far back as the foremast at the load-line, but no farther aft at the keel than the forefoot. The metal of the next weight goes on aft of that, the after boundary of this thickness being a line from the mainmast at the load-line to the heel of the foremast at the keel, and grows lighter yet as the men work aft along the hull. The rudder and keel are both covered with heavy metal. The sheets lap one inch. A bark of 310 tons requires about 1,025 sheets of metal, weighing 6,300 pounds, and 770 pounds of composition nails; cost of metal in the census year at New Bedford, 16 cents per pound; cost of suit, including nails, $1,130; average cost of cleaning off the old and putting on the new metal, about 35 cents a sheet, or $358; but this varies with the amount of tarring and felting required by the fancy of the owner, as it is often as high as 45 cents a sheet.

The weight of copper required to sheathe a whaler varies a great deal. A vessel which is likely to be gone more than two years will take heavy metal, while those sent out for light service, or which are being economically equipped, are clad with lighter suits. The following suits were put on different whalers in the census year:

Weight of metal.	BARKS.				SCHOONERS.		
	440 tons.	420 tons.	310 tons.	380 tons.	180 tons.	130 tons.	66 tons.
	No. of sheets.	No. of sheets.	No. of sheets.	No. of sheets.	No. of sheets.	No. of sheets.	No. of sheets.
18 ounce	300	246	275	.....	125	169	.....
20 ounce	300	241	275	.....	146	97	.....
22 ounce	260	289	175	200	120	53	350
24 ounce	298	181	175	200	96	100	200
26 ounce	250	18	125	200	156	82	.....
28 ounce	.....	.....	.....	*a* 450	110	90	.....
Total number of sheets	1,408	975	1,025	1,050	753	591	550
Weight of metal in pounds	8,839	5,946	6,300	8,130	5,221	3,895	3,654
Average weight per sheet in pounds	6 3/10	6 1/10	6 1/7	7 3/4	6 9/10	6 1/2	6 6/7

a 100 each of 28, 30, and 32-ounce.

The following is the weight of the different thicknesses of yellow metal and the number of sheathing nails to the pound:

METAL.		NAILS.	
Weight per square foot.	Weight of sheet.	Length in inches.	Number to the pound.
Ounces.	*Lbs. oz.*		
14	4 1	$\frac{7}{8}$	230
16	4 11	1	190
18	5 4	$1\frac{1}{8}$	186
20	5 13	$1\frac{1}{4}$	160
22	6 7	$1\frac{3}{8}$	112
24	7 0	$1\frac{1}{2}$	105
26	7 9	$1\frac{3}{4}$	74
28	8 2	2	64
30	8 12	$2\frac{1}{2}$	51
32	9 5	3	35

Whalers usually, but not always, go out with two suits of sails. A 200-ton schooner carries about 1,900 yards of canvas, the suit being worth $900, and a bark of 425 tons about 2,900 yards, worth $1,400. A suit is expected to last two years, and every whaler is expected to spend either $500 for the repair of sails or $1,300 for a new suit, $500 for repair of rigging, besides about $1,400 for recoppering, every time she returns from a two years' voyage, to say nothing of the carpenter work, boat work, etc., which must be done. Whalers are engaged in rough and perilous service, and come back storm-beaten and battered, bringing a vast amount of work for the shops in their native town and rich cargoes of oil and whalebone with which to pay the bills.

Within a few years steam has been employed in whaling with great advantage, in imitation of the Canadians, who have transformed nearly their whole sailing fleet into steamers during the last fifteen years. In July, 1879, the propeller Mary and Helen was launched at Bath, Maine, for Captain Lewis, of New Bedford, being the pioneer of its class. This vessel was 138 feet long on deck, $30\frac{1}{4}$ feet beam, and $16\frac{2}{3}$ feet deep in the hold, registering 420 tons, and was rigged with a full suit of sails, having 2,850 yards of canvas, but carried coal bunkers and a small engine, with a screw propeller capable of driving her at the rate of from 6 to 8 miles per hour. The hull was made a trifle fuller to bear the increased weight. The Mary and Helen was built of oak, yellow pine, and hackmatack, cost $65,000 when ready for sea, and was a successful vessel. With her steam-power she could push her way among the ice floes, and was not dependent on a favorable wind while cruising in the fishing grounds. In June, 1880, the steam bark Belvidere was launched from the same yard in Bath for the same owners. She was $140\frac{1}{2}$ feet long on deck, $31\frac{1}{4}$ feet beam, and 17 feet deep in the hold, registering 440 tons, and was furnished with a condensing engine, cylinder 22 inches, with 28 inches stroke, and a boiler $12\frac{1}{2}$ feet long and 7 feet diameter, carrying 60 pounds of steam. The first ship was sold to the government for Arctic exploration, and a second Mary and Helen has been built during the present year to take her place. The new bark is 151 feet by 31 feet by 17 feet, registering 508 tons. She is built of white oak, pitch-pine, and hackmatack, has four sets of heavy pointers in the bow, braced across the vessel with heavy timbers, to strengthen her against the shock of ice floes, and carries the usual small propeller engine, and also two donkey engines in the forward house for handling the anchors and for general hoisting.

OYSTER BOATS.

As oystering is an inshore occupation, it only requires a small class of boats. The universal oyster boat was originally the Indian canoe, which was made from a white-pine log. In the beginning the early Americans simply imitated the example of the Indians in taking shell-fish, and oysters and clams were so abundant on the coast of Massachusetts, Rhode Island, and Connecticut that canoes were extensively employed by the white men in collecting them from the date of the very first settlement. This was especially the case on Narragansett bay and along the northern shore of Long Island sound, and the canoe was a good boat for the purpose, on account of its ability to withstand rough usage.

Roger Williams says that canoes were occasionally made by the Indians from the trunks of oak or chestnut trees, these being probably the larger and stronger ones. He says:

> I have seen a native go into the woods with his hatchet, carrying only a basket of corn with him and stones to strike fire. When he had felled his tree, being a chestnut, he made a little house or shed of the bark of it; he puts fire, and follows the burning of it with fire in the midst in many places. His corn he boils, and hath the brook by him, and sometimes angles for a little fish. But so he continues burning and hewing until he hath within ten or twelve days, lying there at his work alone, finished, and, getting hands, launched his boat, with which afterwards he ventures out to fish in the ocean.

The Indian canoes were round on the bottom, partaking closely of the shape of the tree, and rarely carried sail. The white men improved the model as well as the methods of making, and generally used the trunk of the pine, on account of the superior lightness of the wood and straightness of the tree. With them the boats were made by

hewing out the trunks and shaping the ends with axes, and many of them were used at New Haven to accompany the lighters and sail-boats which brought up the goods from trading vessels arriving at the mouth of the river. Their value is not known, but about 1640 the fine for stealing one was 20 shillings. With the clearing of the timber the use of canoes disappeared on every part of the New England coast, except in Connecticut, where they were favorites with the oystermen for 150 years after the time of the first settlement. Flat-bottomed skiffs came into use along with canoes after a while, but the latter have been built for use at the mouths of the Connecticut and Quinnipiac rivers down to within twenty years of the present time. When pine trees grew scarce builders went to the headwaters of the Connecticut river and made canoes in the winter time, rafting them down stream in the spring, Zebina Allen being noted for the large number that he made and brought down in this way. When that source of supply failed, one of the builders, Mr. John Smith, sought the banks of Cayuga lake, in New York, where large and tall pine trees were abundant, and returned every fall for a number of years with a fleet of from 20 to 30 canoes, which he sold at prices ranging from $30 to $75. Sometimes he made two trips a year, employing a number of men in the business. These canoes were of the shovel-nosed type, so called from

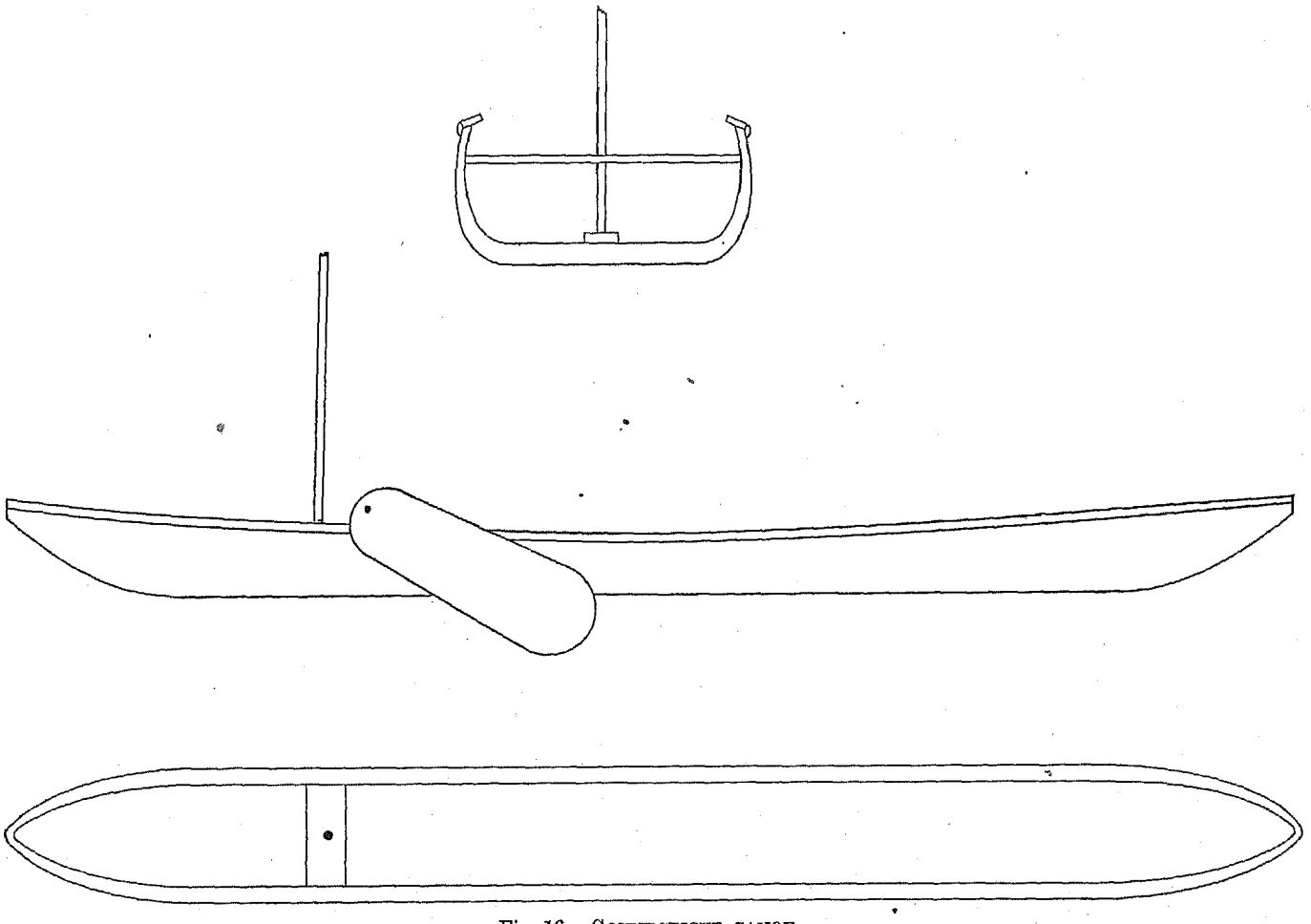


Fig. 16.—CONNECTICUT CANOE.
28 feet long, 3 feet wide, 15 inches deep inside.

the shape of the wooden shovel used in handling grain and flour. They were flat on the floor, having great stability, and were accordingly furnished with one or two light pole masts and sails. The average size was 28 feet in length, 36 or 39 inches beam, and 18 inches in total depth, the wood of the bottom being 3 inches thick, the sides 2½ inches. They were always made from single sticks of white pine, floated at 3 inches draught of water, and were able to carry two men and a ton of oysters in the shell at 9 inches draught. Owing to the flat bottom, and to the fact that three-fifths of all the wood of the canoe was in the thick floor and kept the center of gravity low, they were pretty stiff under a light leg-of-mutton sail. A few dozen of these boats are still seen at Fair Haven, on the Quinnipiac river, some of them being 35 feet long. When under sail they carry a lee board, which is dropped over the side just aft of the mast thwart, and is held by a rope and shifted every time the boat is put about (Fig. 16).

The flat-bottomed skiff followed the canoe. The clumsy shape of the original skiffs is suggested by the name of "New Haven flat-iron boats". They were pointed at the bow, were as broad aft as amidships, and were flat on the floor, with upright sides, having a little outward flare, two or three rowing thwarts, and rowlocks and

rudder. They were easily constructed, were cheap and serviceable, and any boy who had learned to handle a hammer, brad-awl, and saw and to drive a nail straight could make one, no other tools being needed. The boards were brought from the lumber yard and were put together on the floor of the owner's woodshed or barn during the season when open-air occupation was light. A great many of these boats were owned by those living near the river side or the coast at an early day, and were used both for fishing and for carrying goods and passengers. When canoes became expensive the skiff came into favor, and as soon as the growth of the oystering business made it necessary to have boats of large size and broad beam an improved skiff became the popular model in Connecticut. The "flat-iron boat" was cheap and safe and drew very little water, which is all that can be said in its favor, as the broad, square stern neutralized the effect of the pointed bow and made rowing a difficult and tiresome occupation. The boat was short and had little capacity; but the remedy for these defects was found in increasing the length and in giving the bottom a gradual round upward at the stern, so as to permit the displaced water to flow in behind the boat easily, as it does behind a keel vessel with a good run, without retarding the forward motion in the slightest degree, and sometimes the floor forward was given a rise of 3 inches to help the speed. The sharper bow and the round upward of the floor at the stern have given this peculiarly American boat its good qualities and its name. It is now universally called the "sharpie" (Figs. 17 and 18), and is so good a fishing boat and so fast a yacht that it has been adopted in a great many other localities throughout the United States where the waters are tolerably smooth and a safe, comfortable, and capacious boat is required. The sharpie is at present the oyster boat of Connecticut, and is also a favorite for all general pleasure rowing on the rivers and lakes of that state. The regular boat-builders at Groton, New London, Norwich, Essex, and other places on the Connecticut river, and at Fair Haven,

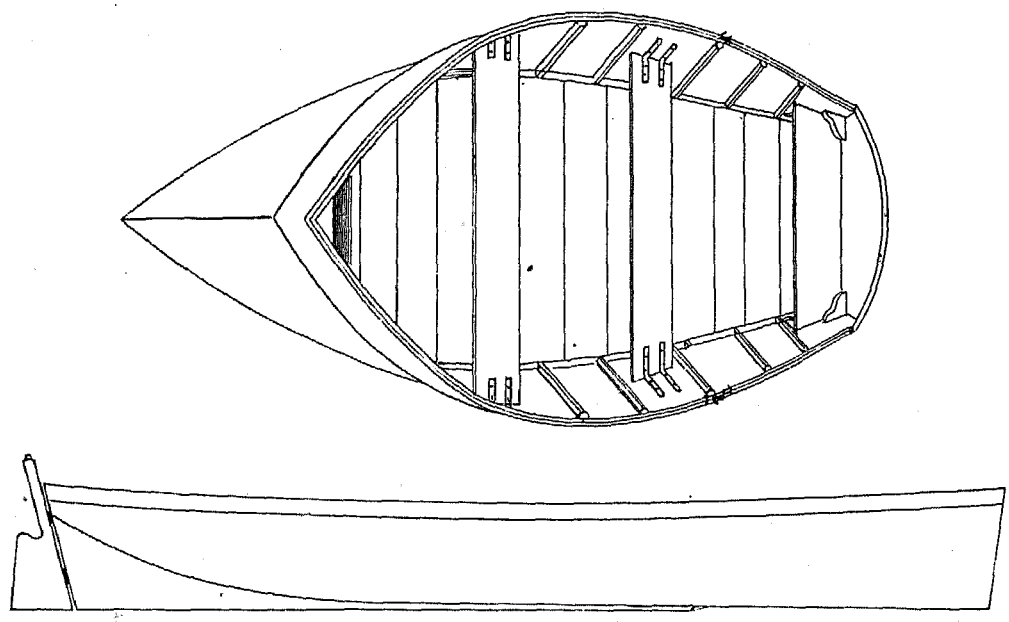


Fig. 17.—Rowing sharpie in Connecticut.

New Haven, Bridgeport, and South Norwalk, make as many as from 10 to 50 of this class of boats a year. A large number are also made by fishermen, one at a time, for their own use, and many are also made every year by young men for pleasure rowing and sailing, some getting out the stuff themselves from the lumber yard of the town, others sending to New York for it. If the immediate construction of a large number of sharpies were demanded by a sudden emergency Connecticut would be found to contain hundreds of young men (mechanics, clerks in stores, students, and others) who could at once build large and excellent boats; in fact, all through the United States the amateur boat-builders are by no means an unimportant element in the population.

The small sharpie for rowing is from 12 to 15 feet long, about 3 feet wide, and 18 inches deep, and has three thwarts. It will carry 3 or 4 men, and costs $20 or $25 to build complete. The bottom is made of 1-inch white pine, the sides of $\frac{5}{8}$-inch pine or cedar, the thwarts of 1-inch pine. The stem, 3 by 4 inches; bilge streak, 1 by 2 inches; frames, 1 by $\frac{3}{4}$ inches; and skag, $\frac{5}{8}$ inch thick, are made of white oak; the knees are of oak or cedar. These boats weigh from 150 to 200 pounds, and about 200 board feet of stuff is cut up in making them. The only tools required by the builder are a hammer, brad-awl, hand-saw, tenon-saw, jack-plane, smoothing-plane, rule, square, bevel, and perhaps a screw-driver, and the addition of a putty-knife and a paint-brush would make the kit complete.

The larger sharpies require no greater outfit of tools on the part of the carpenter, but they do call for more judgment in regard to the keenness of the bow, the rounding up of the stern, and the location of the various parts. Boats from 20 feet in length upward are usually made for sailing. The size used by oystermen would average about 30 feet in length; they vary, however, from 20 to 40 feet. The breadth of the boats is from 0.17 L. to 0.25 L., and the depth amidships about 0.11 L. in small boats and 0.06 or 0.08 L. in large ones, the proportions varying

slightly with the fancy of the owners, some wanting large and capacious craft, others fast craft. In the latter case the beam is made narrower. A sailing sharpie carries a pole mast, and if more than 20 or 25 feet long two pole masts, without shrouds, except in a very large one, when one small wire shroud is rigged on either side of each mast. A center-board is generally fitted into a large boat, as also a narrow strip of decking, or wash-board, along by the gunwales, with a low hatch-coaming on the inner edge. The sails are narrow or pointed at the top, and are

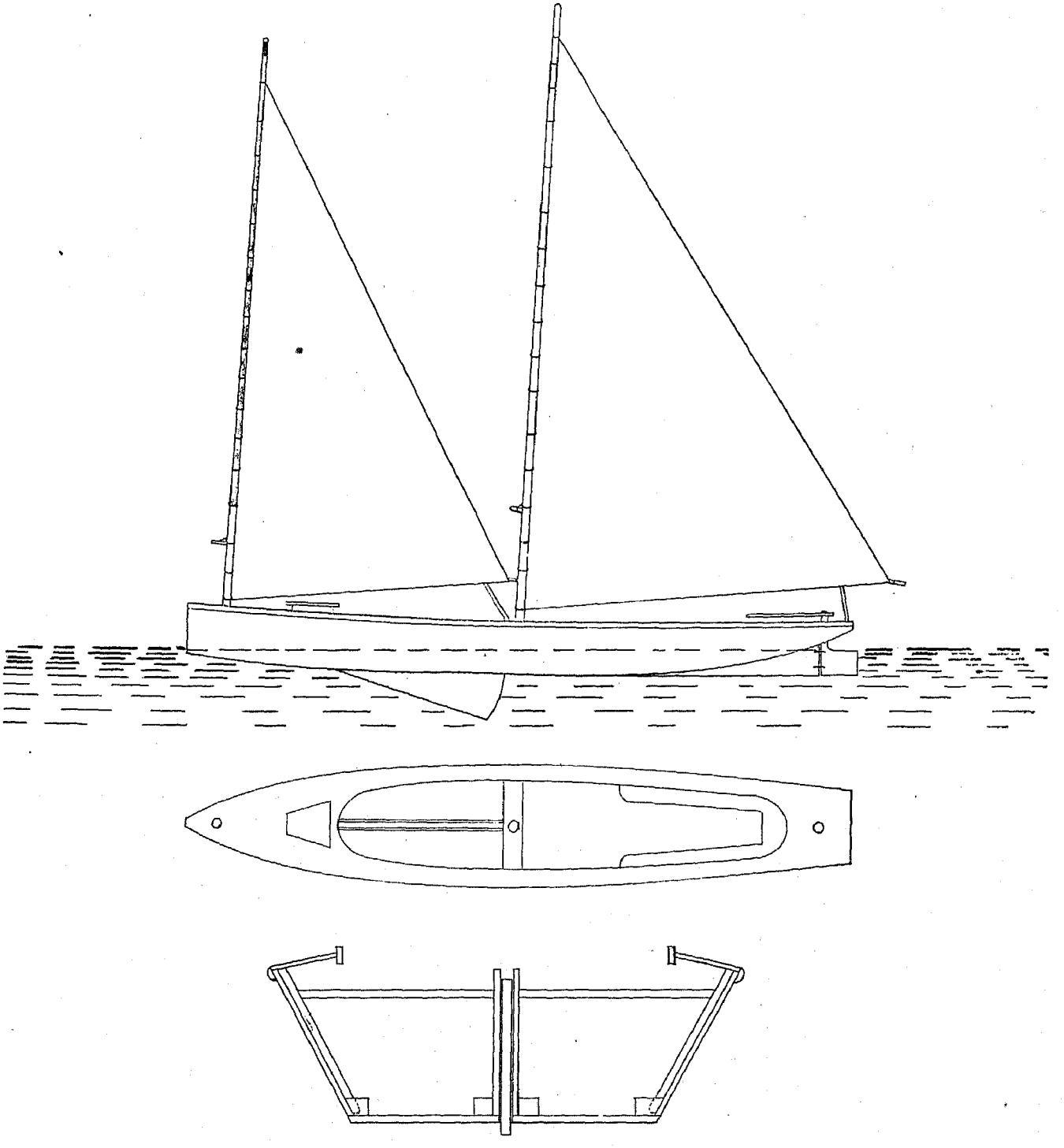


Fig. 18.—SHARPIE 35 FEET LONG, 6 FEET WIDE ON TOP, 4 FEET WIDE ON THE FLOOR, AND 2 FEET DEEP AMIDSHIPS.

spread at the foot by sprits in the smaller boats, but by booms in the larger ones. The sides flare 10 or 12 inches. In small boats the sides are each made of one plank; in deeper ones, of two planks, the sheer being given by the addition of a third and narrow streak forward and aft. They are made throughout of white pine, except the framing pieces, which are of oak or chestnut. The floor is invariably planked across the boat. The capacity and small draught of the sharpie are astonishing, a large one, with the addition of a cabin, and with everything on board, seldom drawing over 3 inches forward and a foot aft. Sharpies are admirably adapted for floating over the bars and

shallows of the rivers and coasts of Long Island sound, and are stiff and seaworthy boats. They have been sent out for long cruises, and one drawing 12 inches has sailed in safety to the West Indies. Their speed under sail is one of their good qualities, and when matched against the deep-draught sail-boats and yachts which continually cruise through Long Island sound in the summer time they rarely fail to beat a rival of the same length. The sharpie is pre-eminently an oyster boat, but its speed has led to its introduction into yacht races and to its being now generally debarred from admission into such contests. Many experiments have been made with the model, and light-draught schooners, intended to run in the shallow rivers of the southern states, have been built of 200 tons register for the lumber and other trades; but for large vessels the model has failed to do what was expected. It is now generally understood that a sharpie should not be built more than 50 feet long, but the best results are obtained from 35-foot boats (Fig. 18).

Large sharpies cost from $200 to $400. A schooner-rigged boat of this class, built for racing on the Shrewsbury river, in New Jersey, fitted with cabin and berths, cost $500, the high price being due to the furniture in the cabin. For sharpies used in oystering the cost seldom exceeds $200. The principal place where the sharpie can be seen is is at Fair Haven, Connecticut, where at nightfall in the oyster season nearly 200 of them can sometimes be seen alongside of the wharves.

On the New Jersey coast there is nothing built except fishing and oyster boats, with occasionally a coal barge, from Staten island to the region of Barnegat and Absecom. At Amboy a great many oyster skiffs are employed by the fishermen of that busy locality, and probably 125 of them can be seen every day at nightfall gathering about the landing places on both sides of the Kill at that point. Two or three boat-shops are steadily engaged in their production. Unlike the Connecticut skiffs, these boats are regularly framed, and have a strip of flat bottom, tapering to a point at each end, with clinker-built sides nailed to frame timbers inside, placed about 20 inches apart, the sides being full and round and the stern perpendicular but V-shaped, as in a yawl. There are three sizes of these oyster skiffs, 18, 19, and 20 feet respectively. This is the length of the bottom. The boats over all are 4 and 4½ feet longer. The beam is about 6 feet, and the depth from 20 to 22 inches. The planking is pine or cedar, strongly fastened with copper rivets through each lap; the frames are roots of the white oak tree, selected as having the proper curvature naturally, squared and fitted to their places; and the bottom is floored over and the thwarts made removable, so that a large pile of oysters in the shell can be heaped up in the boat amidships. Most of the skiffs have a pole with small fore-and-aft sail, the mast being planted a little forward of amidships, but not in the bow. When there is a sail, there is generally a center-board also. About 250 feet of cedar are cut up for the planking and flooring. The boats cost $90 and $100 each, and one man with an assistant can make twenty of them in a year. The building of new boats and the repair of old ones is a pleasant and profitable local industry.

Farther down the New Jersey coast the fishermen use a light-draught sail-boat, which, like the dory and the sharpie, is an American invention, and goes by the name of the cat-rigged boat (Fig. 19). In England it is known as the Una boat, from the name of the first specimen of its class seen in England—a yacht built at New York and sent over in 1852. These boats are more complicated in their construction than any others in the oyster service on the northern coast. As a rule, they are built by regular carpenters; nevertheless, in New Jersey, as in New England, amateur boat-builders are numerous, and probably one-third of all the petty craft that sail in and out of the shallow harbors of this part of New Jersey, cruising with the guests at the beach hotels in the summer months and diligently employed in gathering oysters in the fall and winter, are the product of those who build chiefly for themselves. It is the saying in New Jersey that the first thing a boy learns is how to use a gun and go hunting; the next, how to sail a boat; the next, how to build one. A great number of these excellent cat-rigged craft have been made by mere boys, with the occasional advice of older heads.

The frames are cut from cedar roots. There is an abundance of material remaining in the woods, and the roots, being crooked, tough, and light, are desirable for the purpose named. With ax and spade a young man will in one day provide himself with the material necessary to frame a 24-foot boat. He digs out the stumps, sends them to the saw-mill, and has them cut into from three to eight slices, paying ten cents a cut. The stuff for the planking is bought from the nearest saw-mill, and is usually cedar, but sometimes it is oak. The keel and center-work are of oak; the decking of pine. Cedar planking cost $30 per thousand board feet during the census year—an average price—but during the war the price was $55. About seventy-five days' labor is consumed in building a 24-foot boat. The model of the hull is flat and full, the bow sharp, the beam broad, the run lean, and the stern above water is almost perpendicular, V-shaped, and broad on deck, being about two-thirds the width of the main beam. On deck the vessel is about the shape of a flat-iron. The proportions of the boats are, L. by 0.40 to 0.45, L. by 0.10 or 0.125 L. The narrower beam is adopted where speed is wanted. Each boat carries one mast, which steps right in the bow and stands perpendicular, rather inclining to rake forward, if at all, and spreads one large sloop sail, the boom extending several feet over the stern; it is decked over forward, leaving just enough of the center-board projecting beyond the deck to allow of its being worked. The decking is continued aft along the sides of the boat in a strip from 12 to 18 inches wide, and covers a few feet of the stern, leaving a large elliptical cockpit in the after part of the boat, with seats around the side for the passengers, and protected by a 6 or 8 inch coaming from the wash of an occasional wave. Several hundred pounds of ballast, in the form of stones, bars of iron, water casks, or bags of sand, are placed under the flooring of the cockpit and along by the sides of the center-board, and sometimes, but rarely, a cabin is built forward and partly over the cockpit.

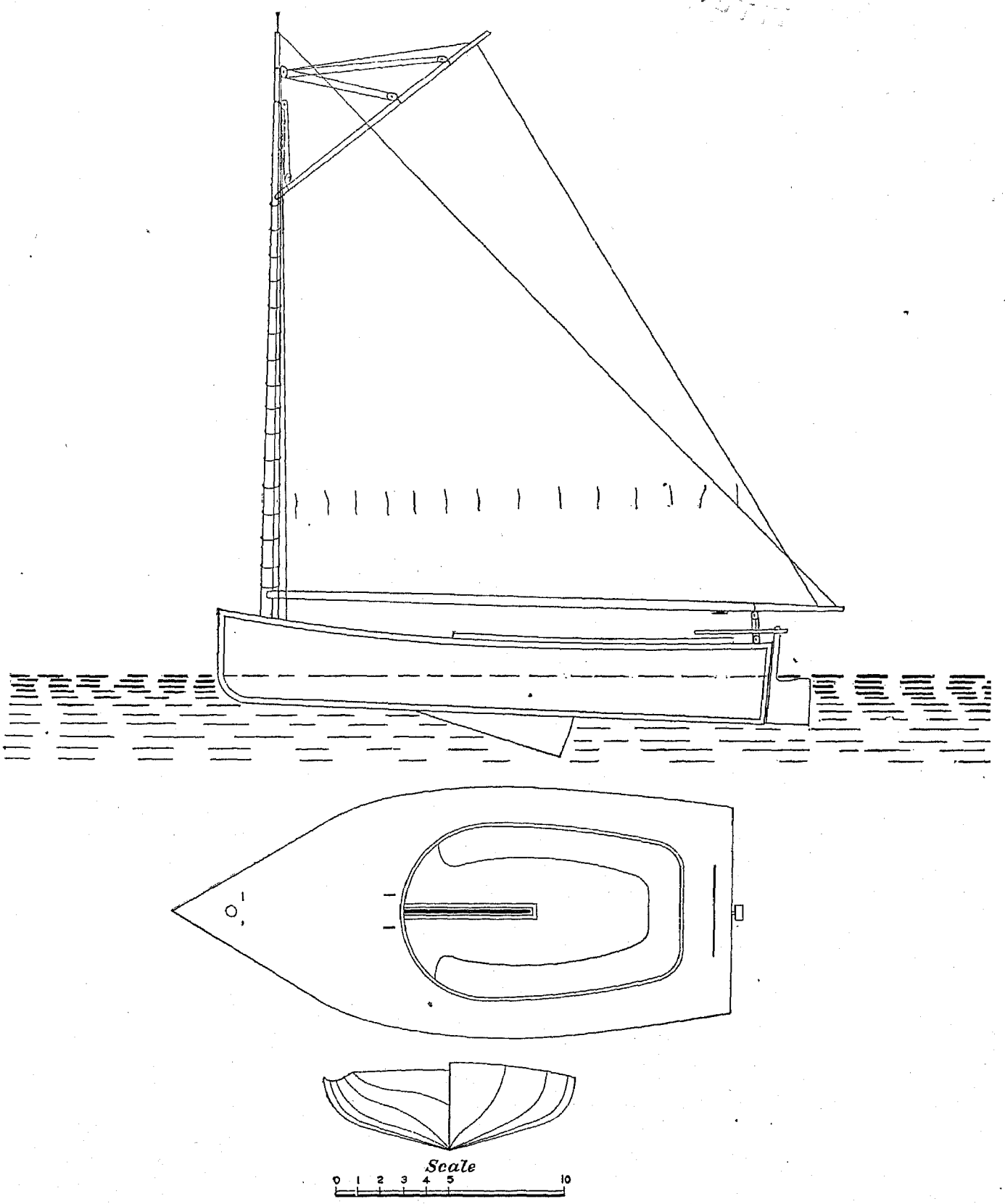


Fig. 19.—CAT-RIGGED BOAT.

24 by 11 by 3 feet. Broadest beam, $\frac{1}{10}$ L. aft of middle. Weight of boat, 1¾ tons. Will carry 3¼ tons on 18 inches average draught of water, and 4¼ tons on 2 feet average draught. Coefficient of D. to 2 feet from keel, 37 per cent.; of load water-line, 65 per cent.; of midship section, 56 per cent. Angle of entrance of load water-line at bow, 55°; of run, 75°; angles of entrance of vertical planes, from 9° to 12°; of run of same, 10° to 13°. Spreads 75 running yards of canvas.

As already stated, the principal incentive for the building of these boats is the profitable oyster-fishing on the New Jersey coast; but of late years another has presented itself in the desire to sail on the part of the hundreds of people who frequent the beach hotels in the summer time for the invigoration which the cool air and salt water bring. No craft that skims the water equals the cat-rigged boat for either employment, as it can go almost straight in the eye of the wind, and for shallow waters and crooked channels is unsurpassed. In light airs it will speed by large yachts spreading clouds of canvas, and can beat up against the tide, by keeping close inshore, as no other sail-boat can do. It is manageable in squalls, is seldom capsized, and can carry heavy loads with very slight additions to its draught of water. In New Jersey it is the fashion when an oyster-boat has proved to be fast under sail to enter it in the yacht races in New York harbor, in order to make a record for its benefit; and then, should the boat win, its value, which is only $250 for oystering, would at once rise to $400 or $600 for yachting, and its owner would promptly find a purchaser at a high price.

The construction of a cat-rigged boat is ship-building on a small scale, and the man who can make one understandingly is fit to contract to build a vessel of large tonnage. The ordinary size is 24 feet over all, 11 feet beam, and 3 feet deep, being a little below 5 tons register, and consequently escapes the payment of custom-house fees. There are several hundred men on the sea front of New Jersey (farmers, carpenters, and fishermen) who have all the skill and knowledge which are needed for making this class of boats, and these constitute a reserve force from which good ship-carpenters could be recruited in time of need.

A good year in oystering is always followed by a busy year in the building of these handy and serviceable boats in New Jersey. During 1881 there were being built 8 at West Creek, 7 at Tuckerton, 4 at Greenbank, and others at various places in that region. In the vicinity of Atlantic City and Cape May, and around in the Delaware river, there were many other places at each of which 1, 2, or more boats were being made by both amateurs and regular builders.

The fishing vessels of Chesapeake bay employ large numbers of people on shore and a great deal of small capital in both new and old work. About 175 oyster boats are produced on the shores of the bay yearly, and there are 20 marine railways, costing from $3,000 to $4,000 each, for hauling the vessels out of the water for painting and repair, each doing from $2,000 to $5,000 worth of work yearly. Many of the boats, and indeed all the framed ones, are made in the yards of professional builders; but it is surprising to notice that, after all, about one-half of the whole number annually produced are to be credited to private builders, fishermen mostly, who make their own boats, either in the woods or in their own back yards. Give a fisherman a boat, and let him spend three or four years sailing it on the bay, gathering oysters and fish, loading his boat until its capacity is tested, going with his catch to market, hauling his boat out on the bank two or three times a year, painting it, calking the cracks, repairing it when injured, seeing it, in fact, in all possible lights, and comparing notes with his neighbors, and when the time comes for him to get a new boat the chances are that he will make the boat himself, knowing by that time all there is to know about how to do it; but if he should have it built for him, it will generally be because he is prosperous, and would prefer to spend his time in some other way than in boat-building.

It is on the Chesapeake that the log canoe has retained its greatest popularity in the United States, the preference for this style of boat dating back to the first settlement of the states of Virginia and Maryland. When John Smith arrived in 1609 with the pioneer colony he found the rivers and the bay swarming with dug-out canoes, which the Indians used for fishing, travel, and warfare. In his "Travels and Adventures" Smith says:

> Their fishing is much in Boats. These they make of one tree, by burning and scratching away the coales with stones and shels till they have made it in forme of a Trough. Some of them are an elne deep and fortie or fiftie foot in length, and some will beare 40 men, but the most ordinary are smaller, and will beare 10, 20, or 30, according to their bignesse. Instead of Oares, they use Paddles and stickes, with which they will row faster than our Barges.

It was easy for the colonists to buy these boats from the Indians by trading, and they purchased them in large numbers for fishing and for traveling by water, as did their countrymen in New England in other years. The upper Chesapeake region was settled by colonists from England about 1635, and the lower part of the bay by people from the James river about 1650. The islands on the Maryland shore became densely populated early in the history of settlement, especially Smith's, Deal's, and Tangier's islands. From the necessity of their position the people were obliged to have the means of crossing the water, and from the earliest times they bought or made for themselves wooden canoes, each hewn from the trunk of one tree. Almost every family owned one, two, and even three boats, and the men were out in them the greater part of the time, taking the daily meal of fish for the family, traveling to and fro, or sailing off to market somewhere with a canoe loaded down with oysters and fish. A great deal of general trading took place in these boats. The inhabitants of the islands went to church in them on Sundays, and in fact the whole population, white and black, were used to owning and handling canoes, and knew how to make them.

Pitch-pine timber has always been abundant on the bay, particularly on the southern part, and it is from this tree that boats have been made. The supply has lasted for 250 years now, and there are still enough large trees to make all the canoes that are needed. Canoes played a part in the revolutionary war, and from that day to this there has never been any other kind of boat used on the Chesapeake for small fishing and oystering.

The durability of a pitch-pine canoe is great, one well made from a sound tree lasting from 30 to 50 years if cared for and painted every year.

The ordinary canoe is 20 feet in length, 4 feet wide across the gunwales, and 18 inches deep inside. It is made from a single log, is straight in the bow, but is pointed at both ends. Formerly 30-foot boats, 5 and 6 feet wide, were also made in one piece. The famous "Methodist canoe", which carried "the parson of the islands" for so many years while visiting the members of his congregation, was one of these boats. The tree from which this canoe was hewn was too large to be useful at a saw-mill, and an Annamessex man finally bought it for $10 and felled it himself, the job occupying nearly three hours. Two logs were cut from the tree and hauled to King's creek, and then towed around to Annamessex, each log making a canoe, the larger one being the boat above referred to. Few of these big trees now exist, and therefore the larger canoes have to be made of more than one stick. When three logs are put into the boat, one is carved to make the keel, floor, stem, and stern, the other two forming the sides to the gunwale. Many are made of 5 and even 7 logs each, and others are carried up on the sides by adding two or three streaks of narrow and heavy plank, which are bolted through into the sides of the canoe. The 35- and 40-foot boats, which have from 6 to 11 feet beam, are generally carved from 5 or 7 logs, with top streaks as above described, the different logs being joined to each other by wooden keys and dowels and by treenails and iron bolts driven in edgewise. None of the smaller boats are decked, but all have an 8- or 12-inch wash-board, with a narrow coaming the whole length of the boat along each gunwale. This top work is supported by light knees spaced from 4 to 6 feet apart; and sometimes short crooked pieces, cut to fit the curvatures of the surface, are nailed along the bilge inside, to strengthen that part of the boat. A 35- or 40-foot boat generally has a short length of decking in the bow, and sometimes a small house. The thickness of the walls of a canoe is as follows: In a 30-foot boat, about 3 inches on the bottom, 2¼ or 2½ inches on the bilge, and 1 inch at the gunwale, gradually thickening toward the ends; in the bow, 3½ or 4 inches on the bottom, 2½ to 3 on the bilge, and 2 at the gunwale. In a canoe of smaller size the thicknesses would be in proportion. In a large 7-log canoe building at Point Lookout, Maryland, in the census year, 40 feet long, 11 feet wide at the main beam, and 3½ feet deep amidships, the wood was 5 inches thick near the keel, 4 inches in the bilge, and 2½ and 2 inches at the gunwale, being a little heavier toward the bow. In a large boat there is often, but not always, a center-board, but there is seldom a center-board in a boat of less than 30 feet in length.

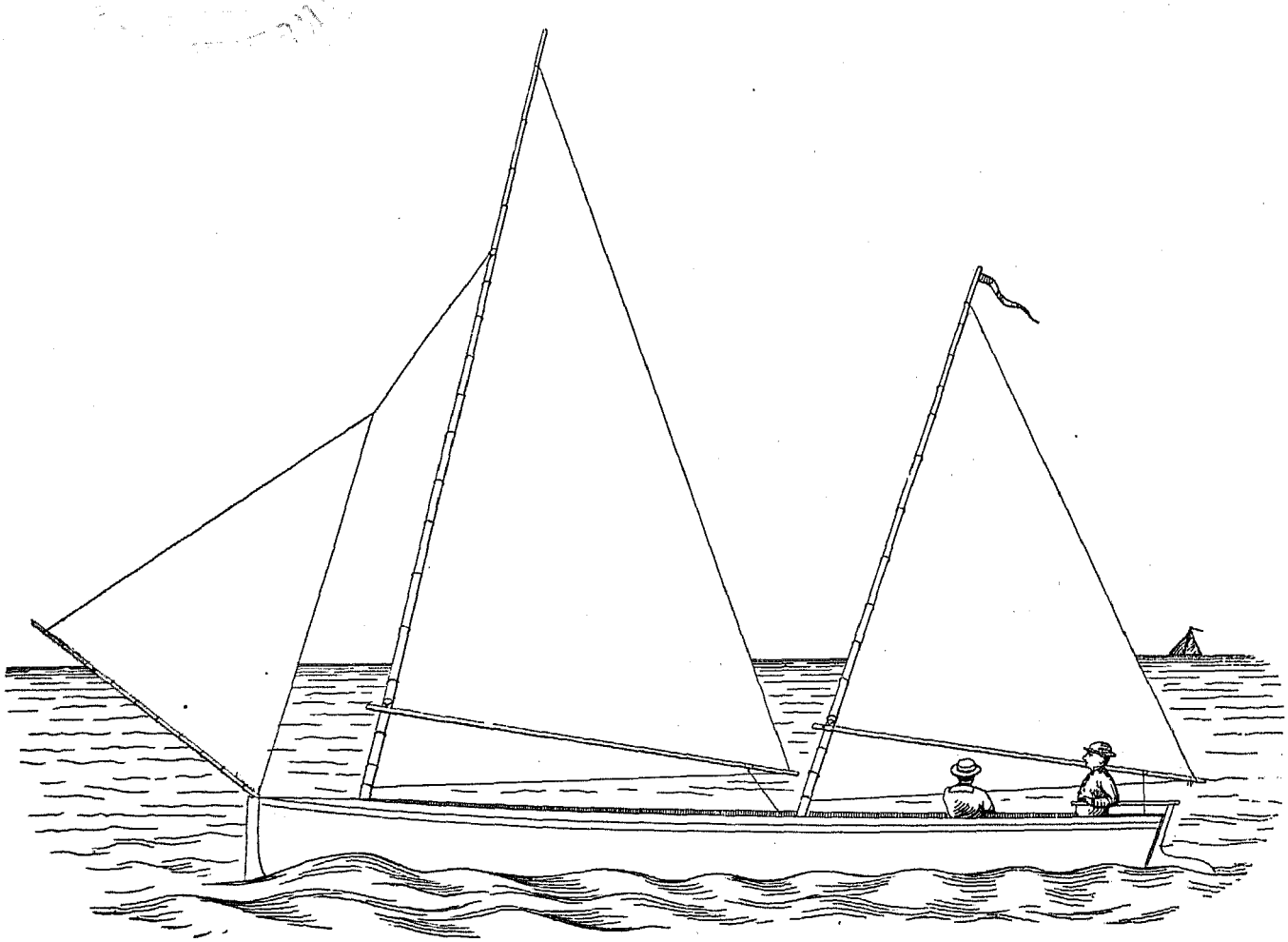
In rig these canoes are the most unique and interesting in the United States. A 20-foot boat carries one pole mast, with triangular sail forward of amidships; all others two masts, with triangular sails, the foremast being the tallest and raking 1¼ inches to the foot, the mizzen, which is two-thirds the length of the other, raking 1¾ inches to the foot. A 20-foot boat has no jib, but in a longer one there is often a 12-foot pole bowsprit, stuck up in the bow at an angle of 40°, with a horizontal line, carrying an odd-looking triangular jib, which is spread by a halliard tied to the mast about three-fourths of the way up from the gunwales (Fig. 20.) When the bow is decked over there is a short horizontal bowsprit with a long and narrow jib. The main and mizzen sails are spread by a sprit, and are furled by taking out the sprit and wrapping the sail around the mast. The rig is a safe and handy one. The center of effort is very low, and a canoe is consequently seldom capsized.

The model gives both speed and capacity. These canoes are very nearly flat on the floor amidships, and a 30-foot boat, weighing 2,000 pounds, will skim over shallows in safety, drawing, with keel, only 12 inches of water. The water-lines are hollow forward and aft, the after body being lean enough to give a drag of 6 or 8 inches. The keel is deepest at the bow, tapering from 5 to 8 inches at the fore-foot to 2 inches at the stern. The broadest beam is usually a trifle forward of amidships; but many place it in the middle of the length, and a few a trifle aft of the middle.

The builders hew out their boats with no other guides than the eye, sometimes aided by a rough draft on a piece of paper, and use no other tools than the ax, adze, square, callipers, two-foot rule, plane, auger, and hammer. A 20-foot boat costs from $50 to $60; but the price increases rapidly with the size, 40-foot boats costing $500 and $600 each.

A great many canoes are now made by farmers and their boys for other purposes than fishing. Near the cities of Baltimore, Annapolis, and Norfolk, and near many bay towns reached by steamboats, there are numerous farms devoted to the raising of melons and vegetables. Boats must be had to carry the produce to market, and rather than buy one the proprietors of these farms will often build; and it often happens that some smart farmer's boy, having thus become initiated into the art of canoe building, will continue the industry as a regular calling. It is usual for the builder of a canoe, professional or amateur, to go into the woods, select his trees, and buy them standing, paying a fixed sum per log, per cord, or per thousand board feet. Logs cost from $3 to $5 each, and the sum of $35 will buy all the trees needed for a 40-foot boat, worth, when finished, from $400 to $500. All the value over $35 is given to the boat by felling the trees, hauling them to a convenient stream, towing them down to the boat-yard, and then expending upon the materials the time and labor of the builder and his men. Sometimes the canoe is carved out of the felled trees in the woods and is hauled down to the water's edge when finished. The outside of the boat is first roughly formed with the ax; the inside is then carved out, the pieces are joined with keys, bolts, spikes, and treenails, and the thwarts, etc., fitted to their places.

A quaint and serviceable oyster boat has been evolved from the canoe by enlarging it, adding a long-pointed prow, and decking it over from end to end, leaving a large hatchway amidships, into which the oysters are thrown, and a smaller one aft for the steersman. There is no bulwark except a simple chock, or water-way, bolted to the top of the gunwales. This boat is the "bug-eye" (Fig. 21), a craft which has now grown so large that it cannot always be



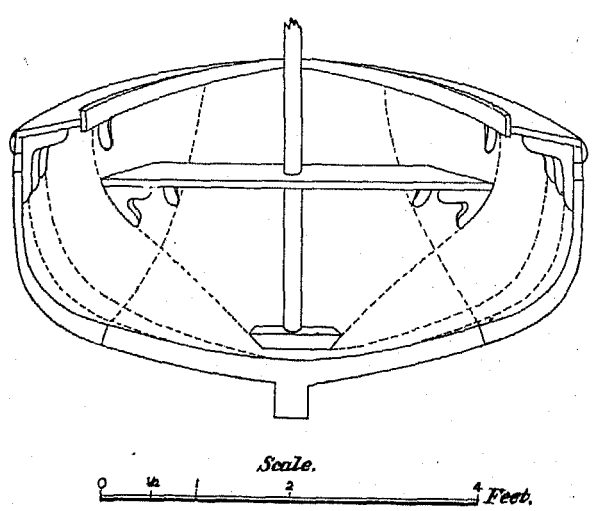


Fig. 20.—CHESAPEAKE BAY CANOE.

20 feet long, 6 wide, and 2½ deep to top of keel amidships. Coefficient of D. to 18 inches from keel, 44 per cent.; of L. × B. × D. to 2 feet, 51 percent. Weight, 2,000 pounds. Boat will float light at 8 inches draught above keel, and on 18 inches draught will carry 2½ tons. Spreads 65 running yards of canvas. Angle of entrance at bow of load water-plane, 45°; of the planes below, 25°.

made of logs. A large number of "bug-eyes" are in use on the Chesapeake which are regularly framed and planked like other sailing vessels. The 5 and 7 log canoes—at any rate, all above 40 feet in length—are all called "bug-eyes", from their size, but the name itself comes from a peculiarity of the framed boat. The hawse timbers and knight-heads are carried up above the plank sheer, and when painted red the hawse holes look like eyes and the long prow like the beak of some strange insect or bird. In all matters of form and rig the large boat follows closely

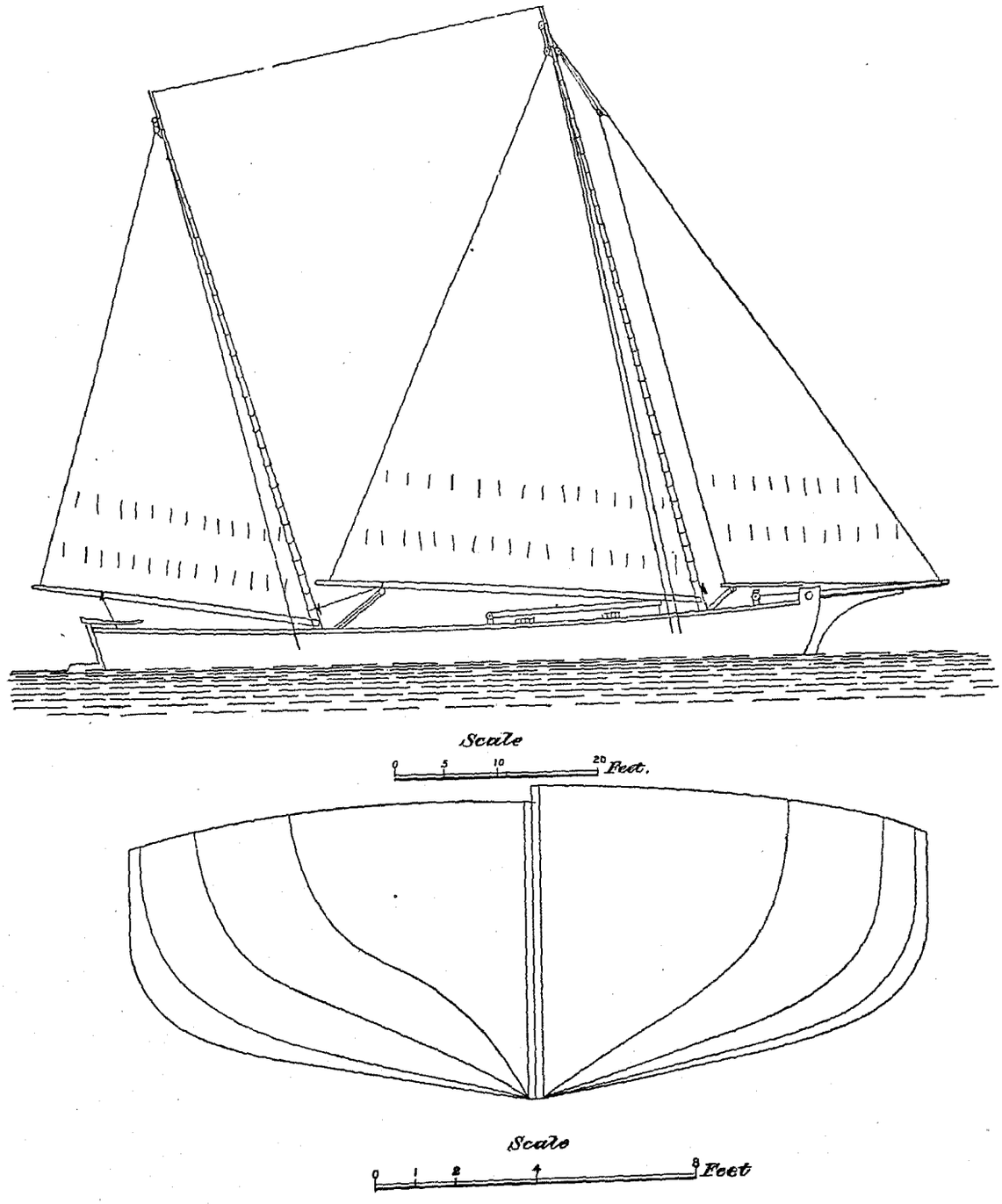


Fig. 21.—BUG-EYE.

72 feet long, 20 feet wide, and 5½ feet depth of hold amidships; molded depth, 6½ feet. Displacement to 4 feet above the keel, 84 tons; 2$\frac{1}{10}$ tons per 1 inch of immersion above that plane; coefficient of D., 45 per cent.; coefficient of load water-line, 0.72 per cent.; of midship section, 0.76 per cent. Angle of entrance at bow, 65°; below, 50°; angles of run, 55° and 25°.

all the peculiarities of the canoe. With its large center-board, however, it can sail closer in the wind. The latter boat does better with the wind on the quarter. A few years ago some adventurous Chinamen came to America in a native junk, and the strange rig excited amusement wherever it was seen; but the Chesapeake bay "bug-eye", though a better boat than the junk, is equally as curious and interesting a craft as that which came from the celestial empire.

The average proportions of "bug-eyes" are L. by 0.27 L., by 0.08 L. The boats vary somewhat, however, as will be seen by the dimensions of the following four:

	Length.	Width.	Depth.	Tonnage (approximate).
	Feet.	*Feet.*	*Feet.*	
Raven	48	13	3⅝	8½
Minnehaha	56	11½	2¾	8
Virginia G. Holland	60	18	5	25
Bug-eye now building at Solomon's island, Maryland	72	20	5½	45

The increased tonnage of the larger bug-eyes is due in part to the houses built upon them. Bug-eyes made from logs carry 200 or 300 bushels of oysters each and cost from $600 to $800, while the framed boats cost from $1,500 to $2,500, according to size. Fishermen much prefer those hewn from logs, if they can be obtained, as the hulls are heavier and have greater stability with a smaller quantity of ballast. Each has to carry 2 or 3 tons of ballast, and sometimes more.

The bug-eyes are increasing in size year by year; and it is a singular fact that just as the old "pinkie" sail vessel, inherited from the Europeans, has disappeared from New England, owing to a preference for other boats, a new, original, and purely American "pinkie" has sprung into existence on the Chesapeake, bidding fair to come into great and extended popularity.

The new vessel now building at Solomon's island is of the largest size yet built. As above stated, it measures 72 by 20 feet, being 5½ feet deep. The keel is 64 feet long. It is 14 inches square at the center-board, tapering to 4 inches at each end. The frames are hewn from flitch oak timber 3½ inches thick, the double frame measuring 7 inches by 6 over the keel, tapering to about 3 inches at the gunwale. The keelson is of white oak, 4 by 6 inches, and white-oak boards 2 inches thick are used for planking and ceiling. The deck-beams are of pitch-pine, 5 by 7 inches, spaced 2 feet apart; the decking of 2-inch pitch-pine. There are no bulwarks to a bug-eye, but the boat in question has a wide 4-inch waterway of pitch-pine spiked on top of the frames at the gunwale, with a log or chock, 4½ inches by 6, bolted on top of it. The center-board is 16 feet long. Twelve feet from the bow stands the foremast, 68 feet long, with a 38-foot boom to the sail. The mizzen-mast is 60 feet long, and there is a 14-foot bowsprit, with jib. This vessel is designed to carry 1,400 bushels of oysters, or about 75 tons of cargo, on a draught of 5 feet of water forward and 5½ feet aft.

Oyster canoes are built on nearly all the peninsulas jutting out from the woodland counties of Maryland and Virginia into Chesapeake bay and on the fishing islands. The principal counties are Dorchester, Worcester, Somerset, and Wicomico, in Maryland, and York, Mathews, and Northumberland, across the bay. At Crisfield, in Somerset county, a little fishing town built on a solid bank of oyster shells about 50 rods wide by 150 rods long, there are more than 1,400 fishing vessels owned, 700 of them being canoes not large enough to register at the custom-house. The Crisfield boats have nearly all come from the rivers of the lower Chesapeake. The canoemen are numerous in the vicinity of York, Gloucester, and Pocoson, Virginia. The Pocoson builders make the finest models.

It is a fact of interest that the colored men of the Chesapeake bay region are becoming large owners of oyster boats.

FISHING BOATS IN THE GULF.

The fishing interests of the lower Atlantic coasts, though not so important as those north of the capes of Virginia, nevertheless employ a large number of small vessels. These consist of small sloops and schooners, built for light draught, and large enough to meet the needs of the local markets. In Florida dug-out canoes are seen on many of the rivers. The majority of the 1,058 fishing boats of the state are to be looked for principally at Key West and Cedar Keys and all along the tier of islands that skirt the lower coast. At Key West there are owned about 100 vessels ranging from 5 to 25 tons, costing from $500 to $4,000 each, employed in the sponge business; about 25 vessels of from 35 to 50 tons for deep-sea fishing, with sharp bottoms and wells to carry the fish alive to market, costing from $4,000 to $8,000 each; and about 300 boats of less than 5 tons register, for sponging and other fishing, costing from $100 to $500 each. In addition to this fleet there are about 25 vessels used in farming; that is to say, in freighting the produce of the coast and river farms to market. At Cedar Keys, Apalachicola, and other points similar but smaller fleets are owned. The smallest boats are either cat-rigged or canoe-rigged, and the Chesapeake cut of sail and jib is often followed; the fishing boats which venture much out into the open sea are, however, as a rule, either sloop or schooner rigged, and the larger ones are all fitted for sailing to Havana with their cargoes. These boats meet with much heavy weather, and, on the other hand, are frequently becalmed, and they need both to be good sea boats and to be able to spread enough sail in light airs to carry them as fast as may be under such circumstances. The schooners carry no foretop-masts, imitating in this respect the fashion preferred among fishing smacks at New York. The sponging and farming vessels are usually flat on the floor amidships, with sharp entrance and run, and have center-boards; all the rest are sharp built throughout, are all fast sailers, and resemble northern boats in most respects.

The ship-building business in Florida and along the Gulf coast is confined almost entirely to this class of vessels. As is common on all fishing coasts, much of the building and repairing is done by non-professional carpenters; but there are also a considerable number of regular and skillful carpenters, who find constant employment in their trade all through the fishing regions. The reason why these men do not build large vessels is not for the lack of the requisite skill and experience nor the absence of good framing timber, for excellent vessels can be made entirely of pitch-pine, with live oak for the principal pieces. Vessels can be cheaply built, too, on that coast, owing to the low cost of native timber, the drawbacks to extended ship-building being the preference of insurance companies for white-oak framing timber and the fact that shipping enterprise has not yet fully awakened among the merchants of the South.

A number of varieties of wood little known in the north are put into the fishing vessels of the Florida coast. The frames are usually made of Madeira wood, a light, tough, lasting timber that grows on the keys, and cannot be found so good or in such abundance any nearer to Florida than the Bahama islands. Horse-flesh dogwood, mastic, live oak, and pitch-pine are also put into vessels. The planking and decking are generally of pitch-pine, worth $25 or $30 per thousand board feet; but spruce is preferred for spars. Florida-built boats last about 30 years; with good care, longer.

The proportions of the average boat in Florida are L. by 0.35 L., by 0.11 L. depth of hold; but the beam varies from 35 to 45 per cent. of the length, according to the fancy of the owner. The following are a few of the size built in the census year, the dimensions being those for custom-house tonnage:

SLOOPS.

Length.	Breadth.	Depth.	Tonnage.
Feet.	*Feet.*	*Feet.*	
39.0	13.6	3.6	13.00
26.2	11.5	3.1	5.13
14.2	11.8	2.6	5.90

SCHOONERS.

31.8	15.40	3.80	10.00
39.6	15.00	4.40	13.10
46.8	19.90	4.00	10.80
30.7	10.75	2.75	5.75
37.6	13.00	4.25	12.77
37.5	14.60	6.00	16.80
32.4	10.70	3.30	6.17
28.5	10.30	3.00	5.80
37.5	15.60	4.80	15.36

Farther down the Gulf, especially in the vicinity of New Orleans and on the lakes and rivers surrounding that city, a popular boat with fishermen is the lugger (Fig. 22), and this is the only locality in the United States in which that ancient style of boat is still employed. The cause of this is doubtless the fact that the oyster, fish, and fruit trades demanded the employment of small boats; and these trades are largely carried on by men of Spanish and Italian descent, who have brought to America their ancient ideas and fashions. In modern ship-yards on the Calcasieu, Pascagoula, and other rivers of that region, on Lake Pontchartrain, and at Shieldsboro', Mississippi, large numbers of these little vessels are built every year, some of them large enough to register; but at New Orleans the preference is for Louisiana-built boats, there being an old law which exempts them from tolls and wharfage dues. The framing timber is sometimes but not often live oak, but red cypress and pitch-pine are preferred for the whole vessel. The cypress is light, tough, and durable, and is worth about $22 per thousand board feet; pitch-pine about $25 a thousand.

In model the luggers are sharp, and are mostly keel-boats with a yawl stern. The yard is hung at about one-third of its length on the mast, and experience teaches exactly the right proportions of the sail to go forward and abaft the mast. The yard is secured to the mast by an iron ring, and is hoisted by a halliard, rove through two double blocks, one at the mast-head and one at the yard.

The following are the custom-house dimensions of some of the large luggers built in the census year:

Length.	Breadth.	Depth of hold.	Tonnage.
Feet.	*Feet.*	*Feet.*	
32.6	10.6	3.1	5.31
37.9	11.4	3.4	7.29
36.1	12.1	3.4	7.42
35.1	10.7	3.2	5.42
39.8	12.4	3.6	8.35
37.7	12.2	3.2	7.20

Four schooners were built in Louisiana in the census year of from 8 to 35 tons register.

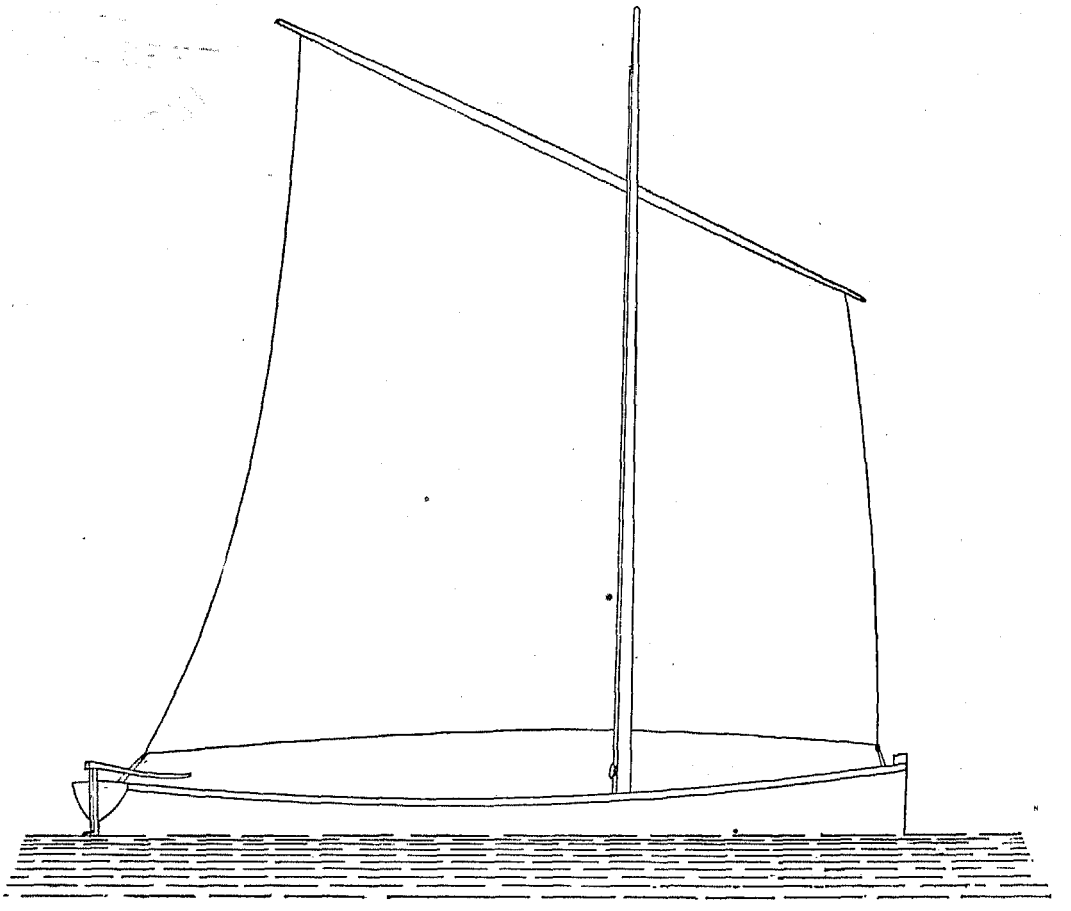


Fig. 22.—LUGGER OF THE LOUISIANA COAST.
35 feet long, 10½ feet beam, 3¼ feet deep inside.

ON THE PACIFIC COAST.

The lateen sail is seen in America only on the Pacific coast, where it has been introduced by people from Mexico and Central America. The small fishing business of San Francisco is carried on almost exclusively by men of foreign birth, who have brought with them a unique and beautiful style of boat rigged with one mast and a lateen sail (Fig. 23). About fifty vessels of this class are employed in San Francisco bay, each of them just below the size which would make it liable to a tonnage tax, namely, less than five tons. They are from 20 to 35 feet long, have a beam one-third their length, and are from 2½ to 4 feet deep. The model is the nearest approach to a Norwegian pilot-boat of anything built in America for practical use. It is peaked at both ends, and is very sharp on the floor, with hollow water-lines forward and aft and a deep, thin keel. The stem and stern are both perpendicular. The boat is decked and has two hatches, the larger one amidships, into which the fish are thrown, being closed with a hatch-cover when necessary. The apparatus and the "confusion" of small things used by the men are stowed under the forward deck. Aft there is a small hatch, or well, in which the steersman sits. The mast is from 12 to 20 feet in length, and is planted a little forward of amidships, raking sharply forward, after a fashion peculiarly and solely its own. A long, slender yard spreads the sail; but when 30 feet in length the yard is made of two poles, spliced or lashed together at the end. A halliard is tied to the yard somewhat forward of the point where the sail will balance, being about two-fifths of its length from the forward end, and is carried through a sheave in the head of the mast. There is sometimes a bowsprit run out horizontally through a hole in the low forward chock, or gunwale, which is secured with staples, and in this case the boat carries a narrow jib. Rowlocks are placed on each side for 4 or 5 oars. With from 800 to 1,500 pounds of stone ballast aboard in the after hold such a boat dances lightly over any wave, and is good, fast, and seaworthy.

On the Sacramento and other salmon rivers of California quite a different style of boat is in use. There are about a hundred scows on the Sacramento river with houses upon them, in which the fishermen live with their families; but the flat-boat is the popular style, being the old-fashioned fishing punt in principle, flat on the floor, rising at the ends, with the bow and stern square across. The gunwale plan is a rectangle with slightly rounding sides. For description of the flat-boat, refer to the chapter on the vessels of the Mississippi and Ohio rivers.

To complete the review of the fishing vessels of the ocean coasts of the United States the canoes (Figs. 24, 25) of the far Northwest may be mentioned. These are the native boats of the Indians of Puget sound and Alaska, and

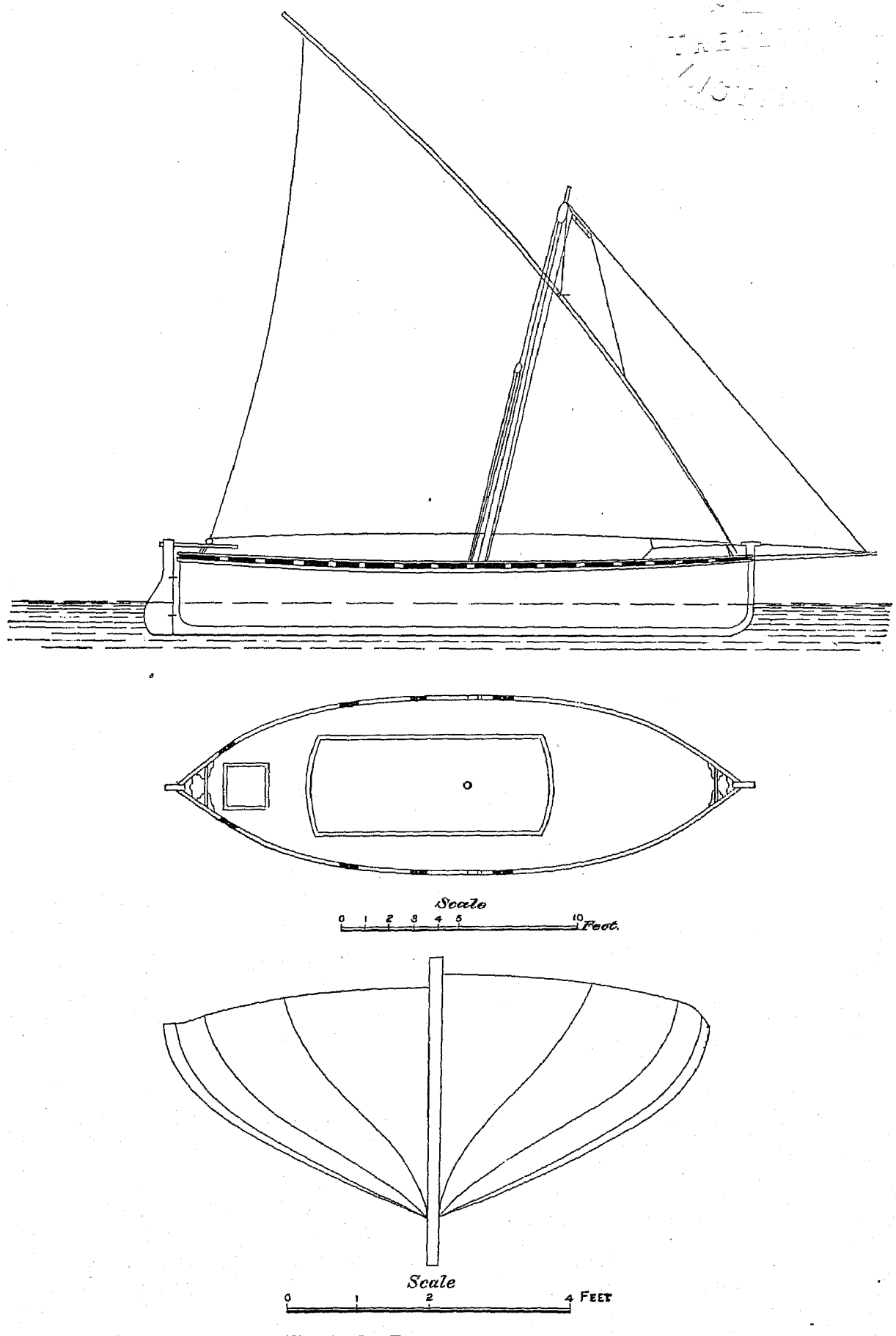


Fig. 23.—San Francisco fishing boat.

24 feet long, 7½ feet wide, and 2¾ feet deep. Weight of boat with outfit and ballast, 2,500 pounds. The boat will float at 14 inches draught above top of keel, and will carry from 1 to 1½ tons of general cargo. Angles at entrance and run, 60°; on the load-line, 30° below; coefficient of D. to ⅔ of depth, 34 per cent.

figure conspicuously in all the boat fisheries of that wild region. The immense war canoe at the Centennial Exhibition, decorated with grotesque images of hideous gods and animals in red, green, blue, and black paint, and now permanently placed in the Smithsonian Institution, in Washington, came from this region, and has the general appearance of all Indian canoes. Its dimensions are: 59 feet in length, 8 feet beam on the gunwale, 4 feet 8 inches in width on the floor, and 3 feet depth amidships. Only war canoes are decorated with painted pictures, however, the fishing boats, as a rule, being simply painted black outside, with green or brown, or no paint at all, inside, while the channel in the peaked prow and the eyes in the prow and stern are painted red. The striking peculiarity in the form of the canoes is the long projecting prow, which bears a quaint resemblance to the outstretched neck and head of a deer. Sometimes the stern is equipped with a similar projection, but usually it is cut off short perpendicularly.

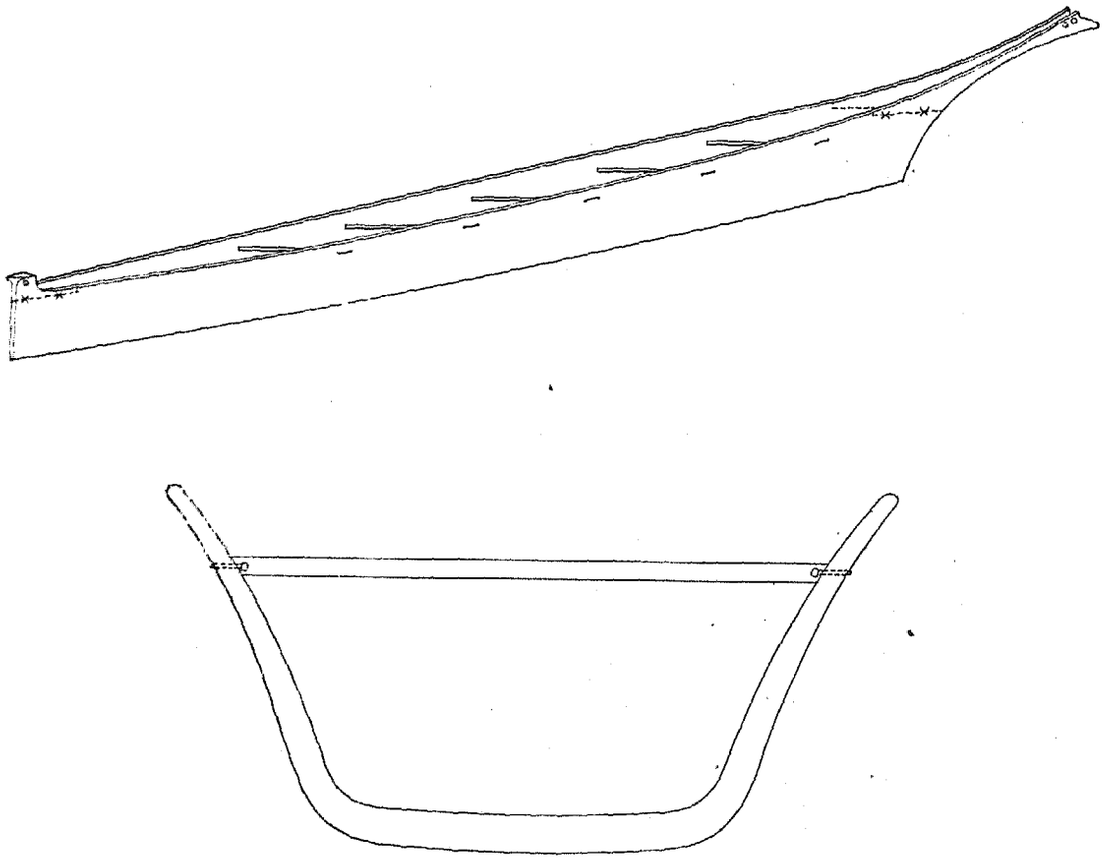


Fig. 24.—PUGET SOUND CANOE.

30 feet long, 4 feet wide on top, 2 feet wide on floor, and 24 inches in total depth, made of a single log of cedar. Boat weighs 800 pounds and floats light on 3 inches draught. Will carry 20 men on 12 inches draught.

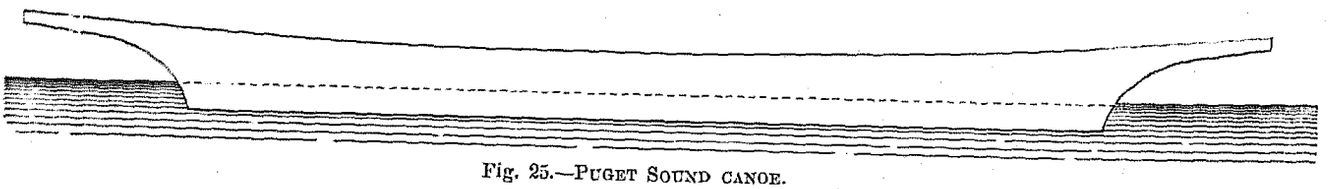


Fig. 25.—PUGET SOUND CANOE.

A form not uncommon for fishing boats.

The Puget sound and Alaskan canoes are hewed from the trunks of the white cedar tree, two varieties of which grow all along the coast from Sitka to California, standing thickly in the fir forests. This tree attains a height of from 100 to 150 feet, and is often 6 and 7 feet, sometimes 8 feet, in diameter near the ground. The wood is white close-grained, elastic, light and durable, the Puget Sound cedar being the lightest and best. It is easily worked, and a boat of any size desired can be carved from a single log. The usual sizes of canoes for shore fishing are from 20 to 30 feet in length, from 3 to 4 feet in width on top and 2 feet on the floor, with a depth of from 20 to 24 inches. The body of the boat to the gunwale is made from one solid log, but the prow and stern pieces are made separately, and are fitted closely to their places and fastened there by means of thongs tied through small holes. There are no thwarts to these canoes, but 4, 5, or 6 round bars of wood, each about 2 inches in diameter, are used in the place of thwarts and are lashed to their places with thongs rove through small round holes, the object being to support the sides of the boat against the dash of waves and the pressure of the water outside. Short broad-bladed paddles

are used for propelling power, the Indians sitting on mats and blankets, half on the bottom of the boat, half on the gunwales, facing toward the bow, and when driven by three or four muscular pairs of arms these light canoes move with surprising speed. One knows not which to admire the most, the skill which has led to the production of so light, swift, and serviceable a boat by savage men, or the almost incredible endurance displayed by the Indians, who paddle them steadily, while en route to distant points, for from 12 to 15 hours at a time, with no pause whatever, refreshment being snatched in mouthfuls by the men while busily plying their oars. Latterly, the white men's fashions have crept into these canoes to some extent. Many of them are fitted with a pair of short oars, which are plied by a man sitting in the bow; others have a short pole mast forward of amidships, with a small sprit sail; but even if oars and sail be used, the occupants of the boat still line the gunwales after their own ancient fashion and work with the paddles continuously until they reach their destination.

ALONG THE NORTHERN LAKES.

There has always been more or less fishing on the northern lakes; but within the last fifty years the business has grown to be an industry, and of late years it has increased to such an extent as noticeably to affect the inland sales of fish caught in the salt sea. The business is carried on in a multitude of small boats, the majority of them not large enough to register at the custom-house, being of less than 5 tons. Fishing on the lakes is an alon g-shore occupation. It is not necessary, as a rule, for the men to be out over night in their boats, as they put out from the mouth of the river, or from the bay where they belong, in the early morning, and calculate to be back again perhaps in time for supper. Carried on in this way, the business does not require boats with decks and houses, and the fishing craft of the lakes, therefore, do not as a general rule have either, nearly all of them being open boats. These boats are built chiefly at Ogdensburg, Clayton, Oswego, Charlotte, and Buffalo, New York; Erie, Pennsylvania; Ashtabula, Cleveland, Lorain, Huron, Rocky River, Vermillion, Sandusky, and Toledo, Ohio; Sanilac, Bay City, Alpena, Marquette, and the islands in Michigan; and on Green bay, and at Sheboygan, Manitowoc, Milwaukee, and Racine, Wisconsin; but the business is greatly scattered, and there are few men who construct more than a dozen boats a year. A great many boats are the work of men half fisherman, half carpenter, who make only one boat, or at most two or three boats in a year. It is a modest industry, and is the means of utilizing the spare time of a great many men whose labor would otherwise find only partial employment.

The patterns of boats used on the lakes all come from the sea-coasts, the builders in the majority of cases being eastern born, or of eastern descent. At Erie, Pennsylvania, keel-boats are being built for fishing purposes 28 feet long, 8 feet wide, and 3 feet deep, with a foot sheer, not decked, except sometimes for a few feet at the bow, but with wash-boards the whole length of the gunwales. These boats have perpendicular stems and V-sterns, are round on the floor, and are fitted with center-boards, the bottoms rounding upward aft, as in sharpies and in many racing yachts. They usually have skags to assist in sailing on the wind and also to support the rudders, but in many cases these are omitted. The framing and the center work are of white oak, and the boats are often planked with oak. Their weight causes them to sit low in the water, but they are strong and seaworthy, and can stand a great deal of hard usage. The chief peculiarity is their rig, their generous beam and the stability of the boats enabling them to spread an extra amount of canvas. A boat is accordingly fitted with two tall masts, on each of which is hung a fore-and-aft lower sail and gaff topsail, made into one. A boom spreads the sail below, and a gaff does the same above, the gaff being split in two, one-half going each side of the canvas. The two halves are joined with screw bolts, and thus hold the canvas tightly in their clasp. This rig makes necessary the use of one halliard only, the same rope being used as the downhaul. There is no jib. It is said that this fashion came originally from New York. The boats cost about $250 each.

Along the Ohio coast the sharpie (Fig. 26) is the favorite of the fishermen. This fashion came from Connecticut along with a large percentage of the population of that state. The mouths of the Huron, Black, and other rivers are full of this class of boats, which are pulled up into the bulrushes on the flats when not in use. They are large, open boats, each carrying an anchor and often a chain. The average size of a sharpie is 36 feet long, 10½ feet wide, and 3 feet deep, being thus a fuller, heavier, and more capacious boat than a Connecticut sharpie of the same length. It takes two men 17 days to build one, and its value, when finished, is about $225. While 36 feet is the average and popular length, the boats vary in size, some being not over 24 feet in length and others as high as 42 feet, and cost from $275 to $300 each. The bilge-log, top timbers, stern, and center-board of an Ohio sharpie are made of oak; the planking and flooring are white pine. About 800 feet of pine and 200 feet of oak are cut up in building a boat. The stem rakes a few inches; the sides flare from 10 to 12 inches.

The greatest beam is forward of amidships. Right in the bow there is a stout breast hook, supporting a bit of "ekeing", or a short deck, which in its turn supports the foremast and allows room for working the sail and anchor. A few feet from the bow there is a stout thwart, with a parting board or bulkhead underneath to prevent the fish from sliding about. The center-board is nearly amidships. A strong thwart just aft of the board supports the mizzen-mast, and a few feet farther aft occurs a low thwart with parting-board. The stern is broad and overhanging, and there is a stern seat for the steersman, with a raised platform for his feet. As a rule, the boat has no wash-

board. There are two masts; no bowsprit. A 32-foot sharpie is fitted with 36- and 34-foot masts; a 36-foot boat with masts 48 and 46 feet long. The masts rake considerably, and carry the same style of sail as the Erie boats.

The capacity of the Ohio sharpie is quite unusual. It carries from 7½ to 12 tons of pound-nets, fish, and apparatus, besides the crew; and, in addition to its ability in this direction, it is also a very fast and manageable boat.

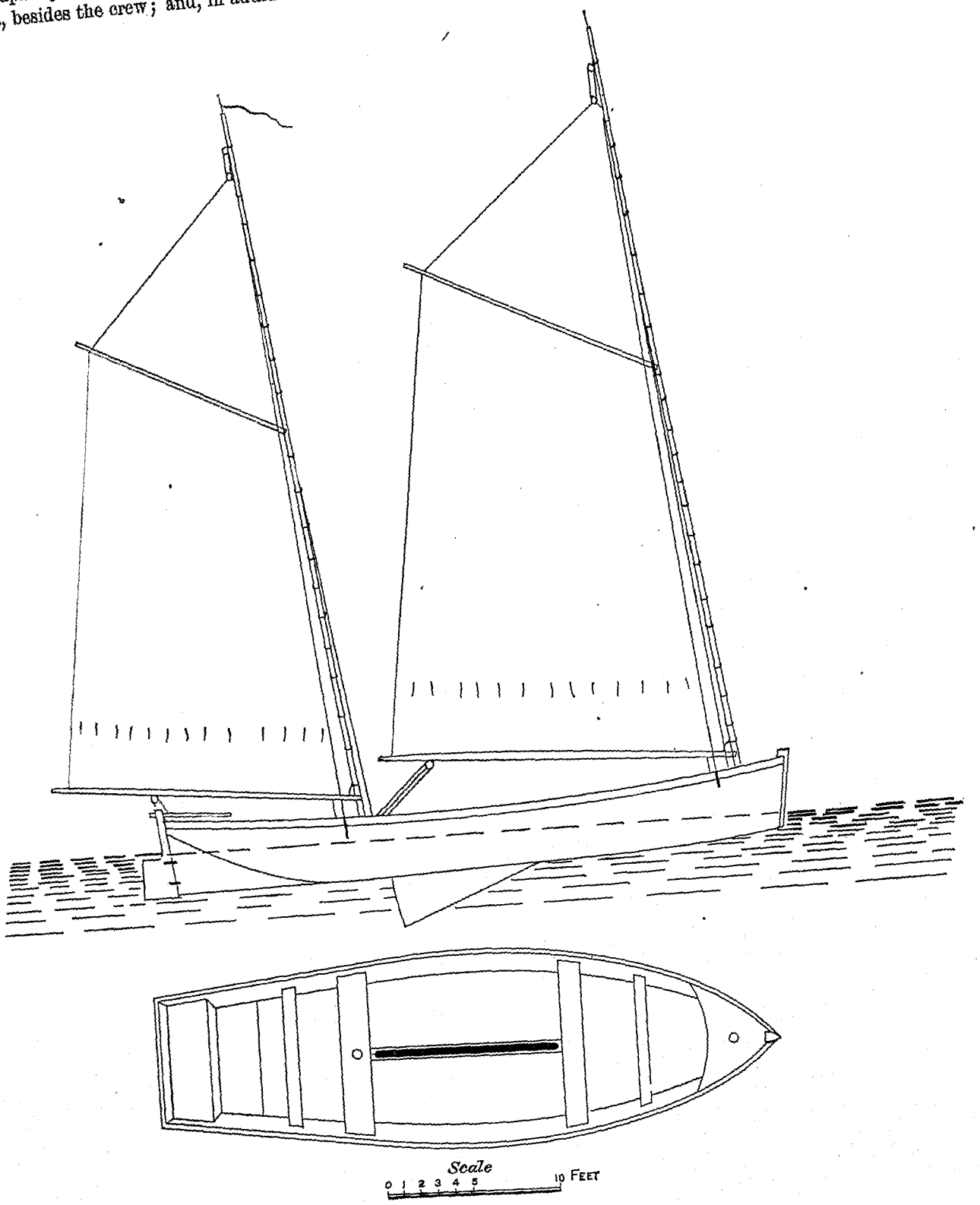


Fig. 26—OHIO SHARPIE.

36 feet long, 10½ feet wide, and 3 feet deep inside. Weight, with sails and rigging, 3,500 pounds. Will carry 8 tons of nets, fish, etc., on 18 inches draught of water.

At Marquette boats are in use that greatly resemble the pink. They are clinker-built, sharp-sterned, and schooner-rigged, and measure from 22 to 28 feet on the keel and from 7 to 9 feet across the gunwales. These boats are from 24 to 32 inches deep, and cost from $200 to $300 each.

Steam has lately come into use at Marquette to a considerable extent, small tugs from 40 to 50 feet long on the keel, 8 to 12 feet beam, and 5 or 6 feet deep, being now employed, and the principal part of the business is carried on there by the owners of these vessels. As the steam tug is not peculiarly a fishing vessel, it will be described elsewhere.

THE BUILDING INDUSTRY.

The preceding pages will show in what a scattered and fragmentary manner the business of building fishing boats and vessels is carried on. The industry is not concentrated in a special class of shops and yards, but is widely diffused among the regular builders of boats and vessels, and some of it is carried on by amateurs. There are few establishments which make a specialty of any branch of fishing-boat building; and as it would be difficult to separate the statistics and details of this line of ship-building from the general work which goes on in behalf of the merchant service, it is deemed best to postpone consideration of the present state of the building industry, so far as fishing vessels are concerned, until the same topic is taken up with reference to wooden merchant vessels.

CHAPTER II.—MERCHANT SAILING VESSELS.

Wooden sailing vessels for the merchant service comprise the bulk of the tonnage built and owned in the United States. A statement prepared by Mr. T. C. Purdy, special agent of the census for the collection of statistics of steam navigation, shows the following facts concerning the tonnage of the United States in the census year of 1880:

Vessels.	Number.	Tonnage.
Sailing vessels	16,830	2,366,258
Steamers	5,139	1,221,207
Canal-boats	8,771	1,253,688
Barges	5,032	1,331,563
Flat-boats	2,702	220,690
Wharf-boats	145	86,300
Hulks	46	7,638

The fishing fleet comprises about 2,600 vessels large enough to be documented by the custom-houses, registering in the aggregate 120,000 tons. The documented yachting fleet includes 180 small vessels, a total of 4,300 tons. All the rest of the sailing fleet are merchant vessels, employed on the coasts or on the northern lakes, or in foreign trade. There are only five or six iron ships in the whole number, all the rest being timber-built. Americans prefer wooden vessels, and at present they build few others for the general freighting service. For fifty years the largest and best wooden sailing ships in the world have been built in the ship-yards of the United States.

Nature having fitted this continent for ship-building by supplying it with an abundance of good timber, vessels have been built upon our shores from the first year of actual settlement, the first ship, oddly enough, having been constructed to carry a little band of settlers away from an inhospitable region which they wished to leave after their first winter. This vessel was built at the mouth of the Kennebec river, in Maine, a region which has since become famous for its ships, and which is now the leading locality, certainly in America, for the construction of sailing ships. In 1607 a company of English colonists came to Stage island, at the mouth of this river, in the vessels Gift of God and Mary and John to plant a settlement near the fishing grounds of New England. Sir George Popham, Sir Ferdinando Gorges, Sir John Gilbert, and other leading men were identified with this enterprise, and the company of emigrants was composed of Captain Raleigh Gilbert, Edward Harlow, Edward Davis, and about a hundred others. The original purpose was to land on Monhegan island, then, as now, noted for fishing; but finally they went to Stage island and began the settlement. The ships then returned to England, leaving 45 people behind. The severity of the winter discouraged the pioneers, and, growing homesick, they built a vessel in which to return. It was a staunch and excellent little vessel, a two-master, named the Virginia, and in after years this bark made several voyages to the English settlements on this continent. She is said to have been of "thirty tons burden", and judging of her dimensions from the rules for tonnage then in vogue, and also from the relative proportions of the vessels of that day, she must have been about 60 feet long, 17 feet broad on the main beam, and 10½ feet deep in the hold.

The Dutch at New York built the next vessel. The emigrants from Holland in 1614 lost one of their ships by fire, and in 1615–'16, to replace it, Adrian Blok built the small yacht Onrest, of 16 tons burden, which was 38 feet long on the keel, 44½ feet long over all, and 11 feet beam. What is now understood as a yacht is a vessel with a long, sharp bow and sharp floor, designed especially for speed, and used solely for pleasure; but the Onrest was no such craft, the yacht of her time being broad and round, with a bluff bow, and was made for light draught, on account of the shallow water of the rivers and harbors of the Netherlands. This model has been preserved in Dutch drawings. The Onrest was employed for several years in exploring the Atlantic coast from the thirty-eighth to the fortieth degree of latitude. Block island was visited during one of her excursions, and took its name from Adrian Blok.

With the exception of fishing boats and shallops there is no record of the building of any other boats until 1631. In that year, on the 4th of July, the little bark Blessing of the Bay was launched into the Mystic river at Medford for the use of the Massachusetts colony. She was built at the instance of Governor Winthrop, and was finished under his eye, the object being to open communication with the Dutch at the mouth of the Hudson and to trade to various parts of the coast. Governor Winthrop wanted a strong vessel, and she was largely made of locust. The Blessing of the Bay ran to Long Island and other settled localities for a short time and then disappeared from view, and it is possible that she was the unfortunate vessel that was sent by Winthrop and others from Boston to Virginia in 1633 with a load of fish and furs and was wrecked on the capes when near her destination.

The abundance of good timber in New England was a strong attraction to some of the British merchants under whose auspices the new colonies were settled. The forests of England were beginning to be impoverished; timber

was dear in the mother land and ships were costly; and the importation of American lumber, particularly of sticks suitable for masts and spars, was encouraged from the earliest years. One of the Massachusetts company, Matthew Craddock, an eminent merchant and ship-owner of London, and president of the company, began an organized effort at ship-building, and it is stated that he "was more forward in advancing out of his substance than any other, being generally the highest in all subscriptions". He never came to the colony in person, but sent over a number of his own men to build vessels and operate for him. Every one of the company who subscribed £50 was to have 200 acres of land allotted to him. Mr. Craddock located his claim on the Mystic river, 3 miles from the infant village of Charlestown, at a place called Medford at the time, and afterward "Neck of Land". Wood says, in 1634, speaking of the Mystic river:

On the East side is Maister Craddock's plantation, where he hath impaled a Parke, where he keepes his Cattle till he can store it with Deere: Here likewise he is at charges of building ships. The last yeare one was upon the Stockes of a hundred Tunne; that being finished, they are to build one of twice her burden. Ships without either Ballast or loading may floate down this River: otherwise the Oyster-banke would hinder them which Crosseth the Channell.

Several vessels of good size were launched from the yard at this spot, and they all went to England to go into the general service of their builder and owner; but as they were not employed on this side of the ocean, there is little record of them.

There was so much large timber of thoroughly good quality, and the wood was so cheap, that vessels could have been built here at a large reduction from the cost in England; an advantage which has never failed to produce striking results when put to proper use. For several years, with the view of taking advantage of the resources of the new territory in this respect, the emigration of shipwrights to America was encouraged, and special privileges were given them, such as exemption from the duty of training and from the taxation of property actually used in ship-building. The inducements offered brought a number of good carpenters to New England, who settled in Boston, Salem, Gloucester, Scituate, and other coast towns and constructed whatever vessels were demanded by the times. But there was no organized effort to develop the industry after the death of Mr. Craddock. Natural advantages go for little without enterprising men to make use of them, and for many years the production of merchant shipping was only of a scattered and modest character. Fishing boats were built in abundance, but trading vessels only now and then, the cost of the latter being about £4 per ton.

After the village of Charlestown, Massachusetts, was planted a small coasting trade sprang up around Boston bay which led to some building. The villages on the bay were without firewood and hay, and sloops and lighters were built to bring these articles from the islands and from the coasts north and south. Many fishing boats were employed in this trade in the winter time; but firewood being a cargo for which they were not well adapted, regular wood boats were preferred, and from a small beginning there soon grew up a large fleet of wood sloops, owned all along the Massachusetts coast, the most of them probably being built at Salem. Six shipwrights had settled in Salem as early as 1629, and three small shallops were built there the same year; and while there were not many vessels demanded, there was nevertheless work enough for a few good men. The industry seems to have thrived in Salem from the start, and the village soon became conspicuous for its ship-yards and for the abundance of vessels produced. Many wood sloops were afterward built on Cape Ann, and Gloucester had 50 in 1706.

The building of merchant vessels is the offspring of a desire to trade. For the first 20 years after the landing of the Pilgrims the colonists thought only of building enough boats to keep the fishermen employed and to carry products along the coast to and from the different towns. The transatlantic trade took place entirely in European ships. About 1640 the colonists began to need large vessels for themselves. They had fish to sell, which the merchants of Barbadoes, Jamaica, Antigua, and other islands wished to buy; and the latter had produce which, on their part, they wished to market in New England. Rev. Hugh Peters, of famous memory, stirred up the people on this subject with great success, and the building of vessels with which to trade with the southern islands followed as a consequence of his efforts. Winthrop writes:

The general fear of want of foreign commodities, now our money was gone and that things were like to go well in England, set us on work to provide shipping of our own, for which end Mr. Peters, being a man of very public spirit and singular activity for all occasions, procured some to join for building a ship at Salem of 300 tons, and the inhabitants of Boston, stirred up by his example, set upon the building of another at Boston of 150 tons.

These two vessels were finished the following year. In 1641 two other vessels were building at Salem, and in 1642 three at Boston, one at Salem, and one at Dorchester. This was the real beginning of ship-building in New England for the general trade. The vessels were successful, and gave the industry a strong impetus. One wide-awake and zealous man woke up the whole coast, and after 1642 a large number of New England towns began to build vessels for distant voyages. That was 240 years ago; and there has been scarcely any change from that day to this in the method of dividing the ownership of vessels among a number of part owners in the general system of framing and planking vessels, or in the terms used to designate the different parts of the structure. The things which have changed in the course of these 240 years are the forms of the hulls, in view of a better knowledge of the scientific principles governing speed and stability in the water, the fashions of sails and rigging, the materials of construction, the cost of vessels, and the devices employed in the ship-yard for saving human labor and for improving its efficiency.

The dawn of the industry in the New World was thought worthy of comment in England, and was referred to in books of travels and in official reports. In *New England's First Fruits*, September, 1642, is the information:

Besides many boats, shallops, hoys, lighters, pinnaces, we are in a way of building ships of an 100, 200, 300, 400 tons. Five of them are already at sea, many more of them in hand at this present.

In Lechford's *News from New England*, London, 1642, it is stated that the people of the provinces were "building of ships and had a good store of barks, catches, lighters, shallops, and other vessels". There is very little in the records to show what the products of the little ship-yards were from year to year. The amount of building up to 1665 was referred to, however, in the report of a committee of the general court of Massachusetts while having that famous legislative dispute with Colonel Richard Nichols, George Cartwright, Sir Robert Carr, and Samuel Maverick:

The number of their ships and vessels, as follows: about eighty from 20 to 40 tons, about forty from 40 to 100 tons, and about a dozen ships above 100 tons.

That more than this number were *built* is certain, for even at that early period the merchants of Barbadoes, Antigua, Jamaica, and the other islands were sending to New England for their vessels, and many were built for them.

About 1670 Sir Joshua Child took alarm at the growth of shipping in America. He declared:

Of all the American plantations, his Majesty has none so apt for building of shipping as New England, nor any comparably so qualified for the breeding of seamen, not only by reason of the natural industry of that people, but principally by reason of their cod and mackerel fisheries; and, in my poor opinion, there is nothing more prejudicial, and in prospect more dangerous, to any mother kingdom, than the increase in shipping in her colonies, plantations, or provinces.

In Connecticut ship-building began soon after the first settlements. The people all provided themselves with fishing boats at the start, and shallops were then built for small coasting and river trade between the different towns. Travel and traffic being by water, on account of the lack of good roads, the shallop, afterward called the sloop, was the universal boat for the purpose, and was generally decked. A few pinnaces, or open long boats (though sometimes decked), were also built, and lighters were made to bring goods from the ships arriving from England up to the river towns. Small as these ships from Europe were, they each drew about 10 feet of water, and could not ascend small rivers. A decree of the general court at New Haven, June 11, 1640, will throw some light on the infant industry of that town. In callings that required skill, among which was that of "ship-carpenters", master-workmen were to be paid not above 2 shillings 6 pence per day in summer, "in w^{ch} men may worke 12 howers, butt lesse then 10 howers dilligently improved cannot be accounted nor may be admitted for a full dayes worke, nor in winter above 2*s.* a day, in w^{ch} at least 8 howers to be dilligently improved in worke." Those not master-workmen were to have 2 shillings per day in summer and 20 pence in winter. The order of the court continues: "For goeing with boats of severall sorts, the man not above 2*s.* a tyde, the whole tyde being dilligently improved, according to the nature of that imploym^{t}. And for boates, according to their quallity and burden. A lighter of 16 tunne wth a boate or cannow wth her not above 3*s.* a tide, and one of 12 tunne, with a boate, not above 2*s.* 6*d.* a tide. A shallop of 4 tunne, not above 1*s.* a tide, and so in respective proportio^{n}. Butt in such raines or stormes that goods cannot be laden without spoyling, nor the boat stirr though the tide serve, no paym^{t} to be made for the boate in such tides, though the man be paid while he attends the service." The rates for master-workmen were lowered 6 pence a day in 1641. In 1648 a ship was built at New Haven by carpenters, who were brought from Boston for the purpose, and for many years Massachusetts gave to the other coasts of the country the best carpenters they had for ship-building. Hutchinson says that the chief object of the people of New Haven, Guilford, and Milford was trade, and the better to be accommodated they built their houses on small lots of land near the water's edge.

They built vessels for foreign voyages, and set up trading houses upon lands which they purchased at Delaware bay for the sake of beaver, but were unsuccessful, and their stocks sunk very fast, and in 5 or 6 years they were much exhausted. Unwilling to give over, they exerted themselves as a last effort in building a ship for the trade to England, in which they put their whole stock of money, plate, and all the proper goods they could procure, to make a more valuable adventure. In her went passengers Mr. Grigson, one of the magistrates, in order to solicit a patent, and 8 or 10 more considerable persons, who, to use Mr. Cotton's expression, all went to heaven by water, the ship never being heard of after sailing. The loss of this ship entirely broke them up as traders, and they turned to husbandry for their support.

The names of the Swallow and the Fellowship are preserved in the Connecticut records of 1649 as two of the vessels of that date. The unfortunate end of the early ventures in general trade did not, however, stop the building of small vessels in Connecticut, and sloops for coasting and river purposes were built at New Haven and on the Connecticut river in considerable numbers. There was a fine body of excellent timber in the province, white oak, chestnut, pine, and spruce, all of it coming down to the banks of the water-courses, and this was continually resorted to as material for small vessels.

Ship-building at the mouth of the Hudson river began early. The yacht of Adrian Blok has been already mentioned. The directors of the Dutch West India Company were anxious to encourage the starting of ship-yards, and granted many privileges for the purpose. March 10, 1649, it was ordered that only the owners of real estate in New Amsterdam below the Harlem river should have the right to build yachts, sloops, and vessels; but in 1650 new freedom and exemptions were granted, and all who were willing to emigrate to the Hudson river were to have the right, gratuitously, to cut and draw from the public forests as much timber as they should need for the

construction of vessels. In 1652 a master ship-carpenter came from Holland expressly to build a ship-house and stocks and go into business; but most of the work done in the early years was at the ship-yard of the company. Private enterprise was long in awakening. The following document has been preserved in the company's records, covering the work done in the years from 1633 to 1638:

RETURN OF THE SHIPS BUILT AND REPAIRED IN NEW NETHERLAND DURING WOUTER VAN TWILLER'S ADMINISTRATION.

Before me, *Cornelis van Tienhoven*, secretary of *New Netherland*, appeared in presence of the undersigned witnesses *Tymen Jansen*, ship-carpenter, about 36 years old, and with true Christian words in stead and under promise of a solemn oath, if necessary, at the request of his Honor, Director General *Kieft*, declared, testified and deposed, that it is perfectly true that he, deponent, during the administration [of Mr. *van Twiller*] has worked as ship's carpenter and has been engaged on all old and new work which Mr. *Twiller* ordered to be made, to wit:

A° 1633 the ship "*Southerek*" repaired and provided with new knees.
Other carpenters have long worked on the ship "*Hope of Groeningen and Omlanden*".
The yacht "*Hope*" captured A° 1632 by said *van Twiller* was entirely rebuilt and planked up higher.
The yacht "*Prins Willem*" has been built.
The yacht "*Amsterdam*" almost finished.
A large open boat.
In the yacht "*Wesel*" an orlop and caboose were made.
In the yacht "*Vreede*" the same.
The boat "*Omwal*" at *Fort Orange*.
The yacht with a mizzen sold to *Barent Dircksen*.
The wood-cutters' boat.
Divers farmboats and skiffs were sold to various parties.
Also many boats and yawls made for the sloops.
Moreover the carpenters constantly repaired and caulked the old craft.

All of which he, deponent, declares to be true and to have testified and deposed at the aforesaid request to the best of his knowledge without regard of persons but only in the interest of truth. Done at *Fort Amsterdam* this 22d of March A° 1639.

WYBRANT PIETERSEN, } as witnesses.
MAURITS JANSEN, }

This is the m + of
TYMEN JANSEN. VW

After the English occupation of New York ship-building was continued on a small scale. Two ships are known to have been built in 1669, one of 120 tons at New York, and one of about 65 tons at Gravesend, Long Island. In 1678 Governor Andros reports:

There may have lately traded to y° collony, in a yeare, from tenn to fifteen shipps or vessells of about together 100 tunns each, English, New England, and our owne built, of which 5 small shipps and a ketch now belonging to New Yorke foure of them built there.

The record of passes issued by the governor of New York during the years 1678–'80, however, mentions 23 ships as hailing from New York which were probably built in the province, as in several cases not included in the above 23 the entry reads "Ship Beaver, of New York, an *English-built* craft". The description of one of the 23 as "a great square-sterned boat with two bulkheads" gives us an idea on what lines ships were then built. Governor Andros must have been mistaken when making the above statement, or else the trade of New York increased rapidly within a year after he made it; for from June to November, 1681, 154 entries of vessels were made at the New York collector's office, and from November, 1680, to March, 1690, 530 clearances were issued, a large percentage being without doubt New York built ships, including vessels navigating the Hudson and East rivers.

In 1700 there hailed from New York 124 ships of 100 tons and under, ketches, brigantines, and sloops, while Boston had 194, among them ships of 300 tons. Lord Cornbury (governor of New York from 1701 to 1709) found that the war then waging between England and France had a pernicious effect upon the shipping interest of New York, as many New York vessels had been lost, and the continuance of the war did not encourage the owners of ship-yards or capitalists to invest money in such property. His report to the lords of trade and plantations in 1708 tells us how far the shipping of New York had been injured: "There has formerly belonged to this port 32 topsail vessels, besides sloops; now we can't reckon above 28 topsail vessels and sloops." It also informs us that many of the vessels owned by merchants in Jamaica, Barbadoes, and others of the Leeward islands, which were nearly all built in America, came from New York, and that not more than six vessels belonging to the islands were built in the West Indies. The ship-building interest at New York did not recover quickly from the blows inflicted by the war. In 1721 the lords of trade, etc., reporting to the king on the state of the American colonies, say that the vessels belonging to the province of New York are small and not considerable in numbers, being employed only in the carrying trade to the southern islands and neighboring colonies. The transatlantic trade seems to have been carried on by English bottoms, of which 64, with a tonnage of 4,330 tons, arrived in New York from 1714 to 1717. During the same period 63 English ships were cleared from New York for British ports, 464 ships, sloops, and other vessels for the British colonies on this continent and the West Indies, and 118 to other than English ports. A certain percentage of these vessels were built at the port, but the ship-yards languished for many years, their product being principally sloops and small vessels.

It is probable that one strong reason for the dullness in ship-building at the mouth of the Hudson was the activity in New England through all this period. The latter section enjoyed the great advantage of a steady demand for the fisheries and the coasting trade, and its ship-yards had something to do nearly all the time. If the men were not hewing out the timbers and putting together the materials for a new sloop, ketch, or bark, they were apt to be busy repairing an old vessel; and as wages are lower and labor more skillful where work is steady, the New England yards could build better and cheaper ships than those in the other provinces. South of New York there was little or no building in colonial times, and, as above shown, there was not much even at New York. Tonnage was chiefly built in New England, and it is to be regretted that there is little of a definite character on record to show what the production in New England amounted to in that period, the only data that I have been able to find being contained in the colonial archives in the state-house at Boston. The inspection and registry of vessels of 30 tons and upward was ordered in 1698, in imitation of the practice of the mother country. From 1698 to 1714 a registry of vessels was kept, and this record, covering 450 pages of a large ledger, has been condensed and tabulated for this report. The act required:

> That when and so often as any ship or Vessel of Thirty Tuns or upward is to be built and set up in any Town or place within this province [of Massachusetts], before any Plank be brought on the Carpenter or Undertaker shall repair unto one of the Justices of the Peace within the same County, who upon request made is hereby impowered to appoint and authorize one or more able Shipwrights to be Overseers and Surveyors of the s[d] Building, and of all the materials and workmanship.

The inspectors were required to survey each plank and timber. Another law for carrying into effect "An act for preventing frauds and regulating abuses in the plantation trade" demanded the registry of the vessels. In their enactments fishing vessels were left out of the account, as they were, as a rule, of less than 15 tons burden. It was therefore substantially the merchant fleet of the time alone which came under the notice of the law. As for the tonnage itself, that was arrived at by a rough estimate of the cargo which could be actually carried, so many tons meaning the actual burden of the vessel. The rule on this subject was established in France in 1681 by order of Colbert. With a view to fixing the relation between capacity of hull and cargo, or burden, the cubic feet of space occupied by a ton of 2,000 pounds was considered as being 42 cubic feet. The average contents of the hull were 45 per cent. of the parallelopipedon inclosing it; and hence the product of the principal dimensions, multiplied by 0.45 and divided by 42, was supposed to represent the actual number of tons weight of goods that would be stowed away in the hull and carried. It was the same as multiplying the length of keel by the breadth and depth, and dividing by 94. The English adopted this plan in substance; but, after all, the rule was so variously applied that the result was indefinite. Besides that, the government officers had one plan, the builders another, and often individual builders had different plans. The owners often had plans of their own, and the same ship which paid duties on 50 tons when importing foreign goods would often be rated at 100 tons when hired as a government transport. This looseness in estimate is seen in the record at the Massachusetts state-house, many vessels appearing several times in the ledger, and often at a different rating each time, the burden varying 10 or 20 tons from the original register, and one extreme case was found where a ship was documented once as of 130 tons and afterward as of 20 tons. The tonnage stated in the register, therefore, can only be regarded as approximate. The dimensions of vessels are not given; such as it is, however, the record remains a valuable one, as showing the production of New England ship-yards from 1696 to 1714, and to some extent for a few previous years. The record, condensed, is as follows, the duplications having been sifted out as far as possible:

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1674.												
Salem			1	15								
1676.												
Beverly					1	34						
1677.												
Lynn	1	15										
1678.												
Charlestown	1	15										
Scituate	1	16										
England					1	70	1	35				
Cork, Ireland												
1681.											1	90
Newbury												
1682.							1	20				
Boston	1	30										
Scituate	1	20										
1683.												
Scituate	1	25										
England											1	70

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1684.												
Salem					1	30						
Scituate	1	30										
England			1	60								
1685.												
Boston	1	12										
Lynn	1	15										
Milford, Connecticut	1	14										
Virginia	1	12										
England			1	70								
1686.												
Ipswich							1	30				
Middletown, Connecticut	1	15										
Killingworth	1	10										
Virginia	1	15										
England			1	25	1	30						
1687.												
Salem	2	32			2	50						
1688.												
Salem					1	16						
Marblehead									1	20		
Newport, Rhode Island	1	12										
England											1	80
1689.												
Boston							1	60				
Salem					1	25						
York							1	60				
England											1	90
1690.												
Newbury							1	20				
Providence, Rhode Island	1	10										
New London, Connecticut	1	15										
Pennsylvania	1	20										
1691.												
Boston					1	30						
Salem					1	12					1	170
Lynn	1	10										
Hampton, New Hampshire							2	60				
New Jersey	1	12										
1692.												
Boston									1	35	3	400
Scituate	1	16					1	40				
Amesbury	1	35										
Piscataqua											1	130
Milton											1	300
New London, Connecticut	2	37										
1693.												
Boston							3	120			1	90
Scituate	1	40					1	60				
Salem			1	60			1	40				
Newbury							1	35				
Braintry							1	30				
Milton							1	60				
Hingham	1	20										
Kittery, Maine	1	25										
Rhode Island							1	50				
New London, Connecticut	1	25										
Virginia	1	40										
1694.												
Boston	2	55									3	230
Charlestown	1	30					1	30				
Cambridge							1	45				
Salem	2	50			1	30	3	140	1	60	1	80
Scituate	5	145					2	110	1	70	1	80

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1694—Continued.												
Newbury	1	30										
Beverly	1	30			1	25	1	40				
Milton							2	90				
Swanzey	1	40										
Stony Brook	1	20										
Hingham	2	40										
Portsmouth, New Hampshire	1	10										
Rhode Island	1	30										
Long Island, New York	1	30										
Connecticut							1	50				
Milford, Connecticut							2	50				
New York	1	40										
1695.												
Boston	2	38					3	145				
Charlestown	2	45					1	50			1	400
Salem	3	70			1	40	1	20				
Scituate	1	25							1	60		
Ipswich	1	30										
Newbury	3	94										
Bristol	1	10										
Hingham	1	20										
Pemaquid, Maine	1	35										
York, Maine											1	60
Kittery							1	40				
Rhode Island							1	60				
Connecticut	2	45										
Milford	1	30										
Glastonbury	1	15										
England											1	70
1696.												
Captured from the French and Spanish					1	70			1	60	10	1,120
Boston	3	80			1	30	1	45	1	40	2	290
Charlestown							1	50			1	150
Cambridge							2	70				
Salem	1	25			2	50						
Scituate	1	35					1	50			3	280
Gloucester	1	15										
Beverly					1	40						
Plymouth							1	60				
Weymouth									1	50		
Bristol									1	50		
Piscataqua, New Hampshire									1	60	1	110
Hampton, New Hampshire							2	60				
Tiverton, Rhode Island	1	25										
Connecticut	1	30										
Killingworth, Connecticut	1	15										
New London	1	20										
New Haven	1	20										
Milford					1	30						
Stratford	1	10										
New Jersey	1	16										
Maryland	1	20										
England											1	150
1697.												
Boston	2	82					1	60			1	200
Charlestown											4	630
Cambridge	1	18										
Salem	2	45			1	40					1	200
Scituate	2	100					2	120			1	90

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1697—Continued.												
Newbury	1	25										
Salisbury							1	30				
Haverhill	1	30										
Plymouth	1	16										
Weymouth							2	110				
Swanzey											1	78
Piscataqua, New Hampshire											2	224
Hampton	1	20										
Rhode Island	1	50										
Providence	1	10										
Connecticut	3	95										
New London	1	25										
Lyme	1	20										
Haddam	1	35										
Guilford	1	25										
Glastonbury	1	50										
Killingworth	1	20										
Milford	1	15										
New Haven	3	86										
Middletown	2	37										
Gardner's Island, New York	1	12										
Southold, Long Island	1	20										
England											1	75
1698.												
Captured from enemy									1	60	3	340
Boston	2	20			3	105			2	125	3	290
Charlestown	2	177										
Salem	2	60			4	130					1	60
Scituate	2	35					3	120			2	200
Newbury	1	30			1	35						
Weymouth							1	40				
Chebacco	1	18										
Plymouth					1	35						
Milton							1	50				
Hampton, New Hampshire	1	30										
Connecticut	2	45										
Bradford	1	12										
Long Island, New York									1	80		
New Jersey	1	12					1	18				
Bermuda	1	25										
1699.												
Captured from enemy									1	60		
Boston	1	25			2	75	4	185	1	60	11	1,160
Charlestown	2	65			1	80					6	680
Medford							1	40				
Salem					9	275			1	80	1	60
Scituate	3	90			1	40	3	135			4	310
Gloucester	1	40										
Chebacco	1	12										
Beverly	1	22										
Lynn					1	30						
Amesbury					1	30						
Newbury	1	30			3	85			1	30		
Weymouth											1	100
Rehoboth							1	30				
Wayland	1	35										
Milton											1	90
Connihasset	1	30										
Taunton											2	200
Hingham	1	45										
Hampton, New Hampshire							1	30				

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1699—Continued.												
Manchester	1	30										
Maine											1	50
Newport	1	30										
Connecticut	2	50									1	90
New London	1	15										
Hartford	1	30										
England					1	30						
1700.												
Boston	3	87			1	50	1	60	1	35	8	790
Charlestown	4	116					1	50	3	140	3	490
Salem					10	310					1	130
Scituate	3	70			2	60	5	215	1	60	2	146
Gloucester	1	20										
Lynn					1	30						
Ipswich	1	30										
Weymouth											2	175
Plymouth					2	56						
Taunton											1	60
Newbury	2	60			1	20	1	40				
Piscataqua, New Hampshire	2	50										
Newport, Rhode Island	1	40										
New London, Connecticut	1	30					1	50				
Lyme	1	20										
New Haven	1	35										
Guilford	1	8										
Cape Sable	1	12										
1701.												
Boston	3	75			2	75	3	120	2	125	4	540
Charlestown											1	125
Salem	3	76			4	140						
Scituate	4	100					1	60	2	130	1	70
Ipswich	1	30										
Gloucester	2	58										
Newbury							1	50				
Bristol	1	30										
Taunton											1	90
Rehoboth							1	55				
Plymouth	2	50										
Weymouth											1	100
Lynn	1	35										
Milton	1	50										
Kittery, Maine	1	35									2	160
Saco							2	90				
New London, Connecticut	1	25										
Lyme									1	70		
Haddam	1	35										
Guilford	1	16										
Hartford	2	50										
New Haven	1	35					1	60				
Norwalk	1	40										
England											1	110
1702.												
Captured from enemy	2	38									7	316
Boston	5	205					4	195	1	65	2	170
Charlestown											1	80
Salem	1	16			3	75	1	45			1	70
Scituate	2	80					6	270			2	190
Gloucester							2	120				
Newbury	2	55							1	40		
Manamoy	1	20										
Weymouth											1	100
Plymouth	1	25										

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1702—Continued.												
Hingham	1	36										
Taunton	1	30					1	60			1	200
Hampton, New Hampshire	1	20										
New Castle, New Hampshire	1	30										
Berwick, Maine	1	50										
York, Maine	1	40										
Connecticut	1	20										
Middletown	1	40										
New Haven	1	26										
Wethersfield	1	30										
England			1	80								
1703.												
Boston	6	130					7	360			6	465
Charlestown											3	320
Medford											1	60
Salem	2	52			2	40					1	150
Scituate	5	146					4	182				
Newbury	2	55										
Amesbury							1	40				
Duxbury	1	35										
Taunton							1	50			2	150
Plymouth	1	30										
Weymouth											1	130
Manchester					1	25						
Piscataqua, New Hampshire	1	40										
Kittery, Maine											1	100
York	2	60										
Hartford	2	56										
1704.												
Captured from enemy (*a*)	1	15									2	200
Boston	7	225					6	305	1	50	10	840
Charlestown											2	220
Salem	1	30	1	80	1	20					2	250
Scituate	1	35					3	145			2	110
Gloucester	1	35					3	185				
Lynn	1	50										
Rowley	1	25										
Newbury	2	65										
Amesbury							1	40				
Duxbury	1	35					1	50				
Taunton									1	55		
Bristol	1	15										
Weymouth											1	100
Piscataqua, New Hampshire											2	180
Newport, Rhode Island							1	60				
Long Island, New York	1	15										
Hartford, Connecticut	1	34										
Newcastle, Pennsylvania	1	50										
1705.												
Captured from enemy	1	20									1	100
Boston	2	60	1	50			8	525			8	880
Charlestown	2	55									4	450
Salem					1	25					4	620
Scituate	2	80					6	380			1	90
Gloucester	3	88					4	240			3	270
Newbury	2	60			1	50	2	95				
Plymouth							1	50				
Weymouth											1	120
Hingham	1	30										

a Shallop.

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1705—Continued.												
Duxbury	1	20									1	75
Taunton	2	55									1	120
Marshfield	1	40										
New Hampshire			1	85							1	80
Exeter							1	48				
Piscataqua							1	40				
Hampton	1	20									1	70
Manchester											2	175
Kittery, Maine											2	450
Bristol, Maine							2	125				
Rhode Island	3	120										
New Haven, Connecticut	1	35										
Middletown	1	50										
Stratford							1	50				
1706.												
Boston	5	165					4	190			6	486
Charlestown	1	35					3	185			2	290
Salem	3	101					4	180			4	770
Scituate	2	70					3	195				
Gloucester	5	185					6	360			1	60
Newbury							2	115			1	100
Haverhill	1	30										
Ipswich	1	30									1	90
Duxbury							2	70				
Plymouth	1	20					1	40				
Hingham							1	40			1	160
Taunton	2	45							1	70	1	90
Bristol	1	35					2	135				
New Hampshire											2	220
Piscataqua							2	100				
New Castle, New Hampshire									1	70		
Manchester	1	34										
Portsmouth											2	155
Kittery, Maine	1	30									5	920
York	1	35					1	60				
Rhode Island	1	30										
Tiverton							1	45				
Connecticut	1	40										
Guilford	1	30										
Milford	1	20										
Glastonbury	1	18										
Lyme	1	15							1	70		
1707.												
Captured from enemy							1	40			1	260
Boston	7	240					6	270	1	60	5	616
Charlestown	1	30					1	60			2	220
Salem	1	15			1	28	1	50				
Scituate	2	60					2	130				
Gloucester	3	90					3	220				
Newbury	3	90					1	30				
Plymouth	1	35										
Duxbury	1	35										
Weymouth	1	40										
Swanzey											1	120
Freetown											1	120
Hingham	1	35										
Taunton	1	40					1	55				
Bristol	1	50										
Hampton, New Hampshire	1	16					1	30				
Kittery, Maine							1	40				
Connecticut	1	35										
New Haven	1	45										
Cow Neck, New York	1	12										

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1708.												
Captured from enemy											1	120
Boston	7	245	1	80			2	140			9	1,020
Charlestown											6	685
Salem							1	60	1	60	2	260
Scituate	1	30									1	50
Gloucester							1	40				
Chebacco	1	36										
Ipswich	1	30					1	50				
Hingham	1	30										
Lynn							1	40				
Newbury	3	100					1	60			3	590
Swanzey							1	50			1	170
Duxbury	2	45										
Bristol	2	70										
Taunton							3	200			1	120
Piscataqua, New Hampshire	1	18										
Hampton									1	70		
Portsmouth											1	140
Exeter											1	100
York, Maine	1	35										
Connecticut	2	85					1	55				
England	1	50									1	100
1709.												
Captured from enemy									1	60	4	490
Boston	8	305					4	185			18	1,968
Charlestown	1	40									2	400
Salem	2	55					1	95	1	65	4	500
Scituate	2	50					1	40			1	70
Gloucester	5	128					1	70				
Lynn							1	50				
Ipswich	1	30										
Newbury	1	40					1	20			2	230
Swanzey							2	110				
Duxbury	2	60										
Hingham	1	16										
Taunton	1	25					1	70				
New Hampshire											1	65
Piscataqua			1	80							5	910
Connecticut	1	30					1	55				
Bradford												
Milford	1	40										
Newfoundland	1	40										
1710.												
Captured from enemy											6	900
Boston	7	175					7	360	1	70	18	2,060
Charlestown	1	30					1	50			2	400
Salem	3	90					2	150				
Scituate	1	30					1	60				
Cape Ann	1	25										
Gloucester	6	180					1	60				
Lynn							1	30			1	200
Newbury	6	195										
Duxbury	2	55										
Plymouth	3	75										
Milton	1	40							1	40		
Hingham											1	120
Taunton											2	160
Piscataqua, New Hampshire												

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1710—Continued.												
Kittery, Maine							2	120			2	360
Rhode Island	1	25										
Newport	1	30										
Connecticut	1	25										
New Haven	1	40										
England											1	110
1711.												
Captured from enemy	3	60									4	350
Boston	7	240					5	285			8	740
Charlestown											2	260
Salem	2	80					1	55			2	170
Scituate	1	30									2	140
Cape Ann	3	90										
Connihasset											1	60
Newbury	4	150							1	40	1	70
Salisbury	1	40										
Lynn	2	75										
Weymouth	1	30										
Plymouth	2	60										
Marshfield											1	70
Bristol	1	50										
Taunton	1	30					1	50			*a* 3	1,080
Exeter, New Hampshire											1	130
New Castle, New Hampshire											1	70
Newport, Rhode Island											1	55
Tiverton	1	14										
Kittery, Maine	1	25	1	80			1	65			3	470
York, Maine	1	55										
New London	1	40									1	120
Wethersfield	1	45										
1712.												
Captured from enemy	3	72	1	80	1	15					3	310
Boston	10	370					2	130			14	1,355
Charlestown							2	120			1	200
Salem	4	170									1	150
Scituate							3	140				
Cape Ann	1	30										
Newbury	4	145					1	45			3	300
Duxbury	2	50					1	45				
Swanzey	1	35					1	50			1	80
Plymouth	3	100										
Hingham	2	35										
Dighton											1	70
Exeter, New Hampshire	1	30										
Kittery, Maine	3	115					1	50			1	120
Newport, Rhode Island	2	85										
New Haven, Connecticut	1	50										
Fairfield	1	25										
1713.												
Captured from enemy	1	15									1	80
Boston	11	330					5	305			18	1,860
Charlestown	2	75	1	80							6	645
Salem	1	30										
Scituate	1	30									1	70
Ipswich	1	30					1	100				
Gloucester	2	68										
Lynn	1	30										
Newbury	9	275					5	205			3	135
Duxbury	1	30										

a Two of these ships are registered as 600 tons and 400 tons respectively. This is no doubt a great exaggeration.

Places where built.	SLOOPS.		PINKS.		KETCHES.		BRIGANTINES.		BARKS.		SHIPS.	
	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.	No.	Tonnage.
1713—Continued.												
Rowley	1	35										
Plymouth	1	30										
Marshfield	1	30										
Bristol											2	150
Hingham	1	50										
York, Maine	1	30										
Kittery, Maine	3	150									1	50
Connecticut	1	20										
Haddam	1	25										
1714.												
Boston	9	325									16	1,575
Charlestown	2	65									3	330
Dorchester	1	50										
Salem											1	90
Newbury	3	120					2	70			4	340
Haverhill	1	50										
Plymouth	1	75										
Dighton											1	80
Kittery, Maine	1	30										
York	1	35										
East Haven, Connecticut	1	20										

Of the 1,332 vessels American built in the above list, seven-eighths were owned in Boston. The following 239 were built for foreign owners, every class of vessel being comprised in the list, the majority being ships:

For owners in the British isles	169
For owners in Barbadoes	21
For owners in Antigua	9
For owners in Nevis	7
For owners in Montserrat	11
For owners in Jamaica	6
For owners in Fayal	2
For owners in Madeira	1
For owners in Teneriffe	1
For owners in Oporto Royal	3
For owners in Saint Christopher	9

The names of these early vessels were expressive. Endeavour, Industry, Tryall, Speedwell, Happy Return, Brother's Adventure, Beginning, Blessing, Hopewell, Goodspeed, Unity, and Friendship were popular titles repeated a hundred times in vessels owned on the same coast. A great many were named after members of the owners' families, and a very few had names like Sea Flower, Dispatch, Dove, Lark, Swallow, Swift, and Dragon. Some of the large vessels were named Bedford Galley, Diamond Galley, Leopard Galley, Dudley Frigate, Granville Frigate, and Boston Merchant, Port Nevis Merchant, Antigua Merchant, etc.

Arrivals and departures of vessels were also kept at Boston during the years above named, and show that large sloops left Boston chiefly for points on the American coast. Pinks and ketches were also engaged in the coasting trade, and a few cleared from time to time for Newfoundland, apparently for fishing on the banks. The craft engaged in trading to the West India islands and to Europe were pinks, ketches, barks, and ships, but occasionally sloops sailed for all these destinations.

Small as were the merchantmen of that day, they carried large crews and usually were armed with a number of cannon, a circumstance which affected their form, as they were so round on the floor that the placing of a number of heavy guns on the upper deck was liable to make them crank. A remedy for this was sought in making the hull narrower on deck than on the load water-plane, the top sides often falling home several feet. This brought the deck-weights in toward the center of the ship, and did much toward making her stiff in a sea way. The record of clearances from Boston shows how well armed some of the merchantmen were. A few cases are quoted:

Pink Swallow, for Charleston, South Carolina, 60 tons, 10 men, 2 guns.

Ship Two Brothers, for Jamaica, 140 tons, 19 men, 14 guns.

Ship Swallow, for Barbadoes, 150 tons, 18 men, 12 guns.

Pink Mary, for Barbadoes, 60 tons, 8 men, 4 guns.

Pink Return, for Madeira, 40 tons, 9 men, 4 guns.

Ship Richard, for London, 100 tons, 14 men, 12 guns.
Pink Olive Branch, for Barbadoes, 45 tons, 7 men, 3 guns.
Ketch Hopewell, for Madeira, 40 tons, 7 men, 3 guns.
Ship Trident, for Barbadoes, 140 tons, 15 men, 14 guns.
Pink Richard and Margaret, for Barbadoes, 40 tons, 10 men, 6 guns.
Ship Samuel and Thomas, for London, 120 tons, 16 men, 6 guns.
Brigantine Supply, for Leeward islands, 15 tons, 5 men, 2 guns.
Brigantine Resolution, for South Carolina, 30 tons, 5 men, 2 guns.
Ship James, for Jamaica, 80 tons, 12 men, 7 guns.
Pink Samuel, for Jamaica, 60 tons, 10 men, 6 guns.
Ship Prudent Sarah, 100 tons, 14 men, 10 guns.
Ship Francis and Dorothy, for Nevis, 200 tons, 20 men, 20 guns.
Ketch Fidelity, for Bilbao, 35 tons, 7 men, 2 guns.

The necessity for carrying such an armament on merchant vessels was removed in after years, when America had become a free and independent nation, as much by the treaties and the influence of the United States as by any other cause.

Various contracts for the construction of vessels are on file in the valuable colonial records which are yet preserved in the United States. One of 1661 at Gloucester, Massachusetts, was for a "new ship", 68 feet long on the keel, 23 feet beam from outside to outside, 9½ feet deep in the hold, with two decks. From the mainmast to the forecastle the upper deck was to be 5 feet high, with a fall of 15 inches at the forecastle and a rise of 6 inches at the mainmast for the quarter-deck. The cabin was to be 6 feet high. The price was £3 5*s*. for every ton of burden, and a part of the payment was to be made with £150 worth of muscovado sugar, reckoned at 2 pence per pound at Barbadoes.

A contract of 1695 at Charlestown, Massachusetts, called for a "new square-sterned ship" of best white or black oak, with pine decks and houses, having two flush decks, a half-deck, round house, forecastle, and head, and of the following dimensions: Keel, 82 feet long; breadth on the frame timbers at the main beam, 25½ feet, with 4-inch plank in addition; depth of hold, 11 feet; rake of stem, 18 feet, 6 feet to be at a foot rise from the keel. Her scantling and details were as follows: Keel, 12 inches square, with a 3-inch shoe; keelson, 12 by 16 inches; stem, either 14 or 16 inches, according as the stuff could be obtained; stern-post, 12 by 24 inches, with a false stern-post of 18 inches to run from the keel to the wing transom; wing transom, 14 by 28 inches; the other transoms, 12 inches; a large knee to unite the stern-post to the keel, with arms 7 and 9 feet long; the floor timbers of the frames to be sided 12 inches at the keel and molded 9½ inches at the floor heads, each timber being 18 feet long; the lower foot-hooks (or futtocks) to fill up between the lower timbers and have a 7-foot scarf, being 12 inches broad over the keel, and running up 2½ feet above the lower or gun-deck; the top timbers, stepping on the lower futtock heads, molded 7½ inches at the heel and 3½ inches at their heads, and sided 7 or 8 inches; between decks, 6 feet high; the outside planking, 3-inch; garboards and channel streaks, 4½ and 4 inches; the lower wales, 7 inches; the ceiling was 3 inches thick, with 2 streaks of 4-inch at the rung-heads, 2 more for middle bands of 4-inch, and a 4- and 5-inch clamp; beams of the gun-deck from 14 to 17 inches broad by 11 inches deep, spaced 4½ feet apart, with carlines, and two knees at each end; water-ways of 4-inch oak, and the rest of the decking 3-inch; the spirketing, 4 by 18 inches; 4-inch clamps to the upper deck; upper deck beams, 9 inches deep and 5 feet apart, with carlines, and with one lodging and one hanging knee; the ceiling between decks, 2½-inch plank; water-ways, 3-inch and 2-inch oak; decking, 2-inch deal; bulwark planking, 2 inches; rails, 4½ inches thick; as many gun-ports as the owners should require; 11-inch wing-transom knees, with arms 6 and 11½ feet long, the other transoms double-kneed with 10-inch knees; beams of the poop-deck, 4½ by 8 inches, with 2-foot spaces between them and 3-inch water-ways; beams of the round-house, 4 by 7 inches, 2 feet apart; 7 breast-hooks, with arms 8 feet long, molded 14 inches; a step for the foremast, 16 feet long, 2½ feet broad, and a similar step for the mainmast; rudder, 18 inches at the head, 20 inches deep, with tiller, drum-head, capstan, and windlass; mainsail and foretop-sail sheet-bits; a pair of small quarter-galleries; bulkheads; a complete set of masts and yards, the vessel finished in all respects down to a cleat, all the materials to be provided by the builder, except iron work, nails, and carvers' and joiners' work; the fastenings to be chiefly with treenails of oak, and the vessel to be built in one year's time. The contract price was £4 5*s*. per ton, the tonnage to be determined as follows: After multiplying her length, breadth, and half-breadth for the depth, the product was to be divided by 95. £100 was to be paid down on signing the contract, the remainder to be paid from time to time, £200 being reserved until delivery of the ship. Sums amounting to £985 were indorsed on the contract, which, with the £200 on delivery, made the cost of the vessel about £1,185. Her carpenters' measurement was 276 tons; her real carrying capacity was very nearly the same. She would register under our present rules about 180 or 190 tons. She was a two-master, with bowsprit, and was either a brigantine, a brig, or a bark, as the names were then understood. These details give a pretty fair idea of the vessels of her size at that time.

Another contract was for a square stern ship in 1700 at Boston having two decks, a half- or poop-deck, round-house, forecastle, and head. She was to be 72 feet long on the keel, the stem raking 17 feet and the stern-post about 2 feet, 24½ feet wide at the main beam, and 11 feet deep in the hold, with a height of 4 feet between decks. Her

scantling were about the same as in the last-named contract. She would have been of about 222 tons, carpenters' measurement, and the contract price was £3 12*s.* per ton. Money was so scarce in America at this time that it was a common practice to pay for ships in goods, and one has been known to be paid for almost entirely in calicoes.

A third may be mentioned, dated in 1701, for "a new vessel, barque, or brigantine" 45 feet long on the keel, 18½ feet wide, 8½ feet deep in the hold, one deck, 4½-foot waist, quarter-deck, cabin, and forecastle. The stem was to rake 12½ feet. There were to be three gun-ports on each side and two in the stern. The contract called for white oak throughout, except for decking and houses, which were to be of white pine. The price was 53*s.* per ton, carpenters' measurement; and £40 was to be paid down at the signing of the contract, as much more at the laying of her deck, and the rest on delivery of the vessel. She was of about 60 tons.

About the year 1700 the ketch and the pink began to be less preferred than in previous years, and by 1715 they were not built for trading purposes to any extent. These vessels were round-sterned, easy to build, and not expensive, but they lacked a feature much needed in a period when trading ships had to fight: there was no room in the stern for the convenient working of cannon pointing right aft, and the round stern was abandoned for a so-called square stern, which at first did not overhang as in modern vessels. Below water the stern was sharp, but above water it was about the shape of the end of a barrel until it reached the deck, when it ran up with straight sides to accommodate the galleries and houses. While this change was going on the positions of the masts

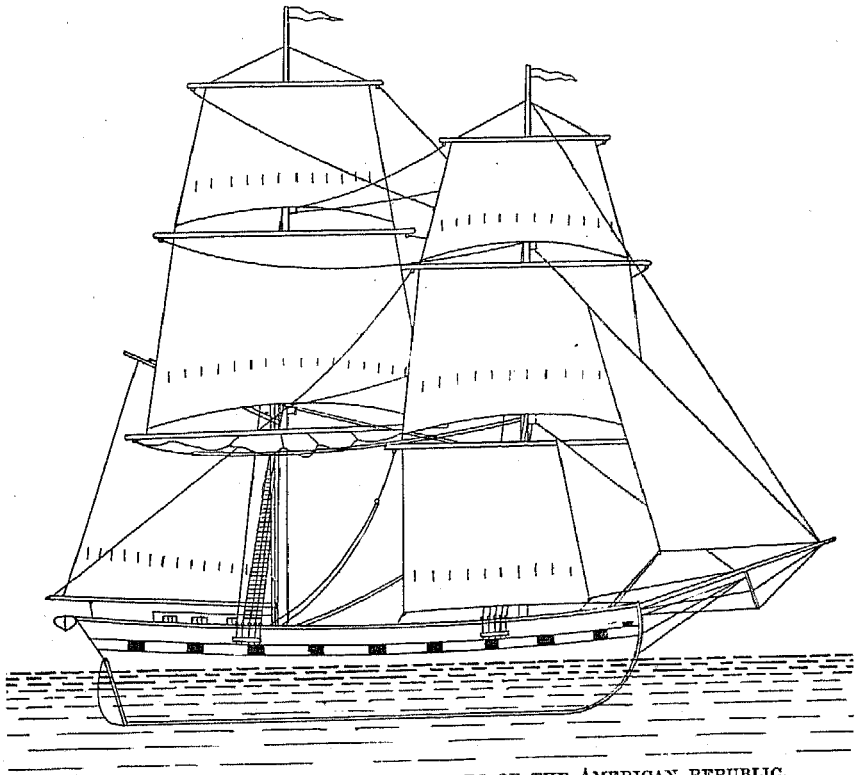


Fig. 27.—A Snow of the early years of the American republic.

of the ketch were changed, both being brought farther forward, and the light bonaventure mast aft was enlarged until it became in reality the mainmast of the vessel. This mast carried a lug or lateen sail below and sometimes a square sail above, the foremast having square sails only and the bowsprit two or three jibs and often a sprit sail. A square sheet of canvas hung below the bowsprit on a yard, and thus changed the ketch became a brig or brigantine, and its former name was dropped. The new name was of European derivation. After 1745 the schooner became a popular rig in America for coasting vessels of any size, and also for foreign voyages of moderate length.

One variety of the brigantine was called the snow (Fig. 27), a style of vessel built from time to time from 1700 to 1800, but it might as well have been called a brig as anything else, as its only marked peculiarity was that the fore-and-aft sail on the mainmast was a regular sloop sail, spread by boom and gaff, its luff or fore edge being attached by hoops to a third small mast, placed close to the mainmast and in contact with it, heeling on the deck and having its head attached to the after part of the maintop. Substantially the vessel was what we would call a full-rigged brig, and the name "snow" was never much used. In the expedition from Massachusetts for the capture of the great fort at Louisburg, in Canada, in 1745, the American fleet was composed of 3 ships, 3 snows, 1 brig, and 3 sloops, with a number of whale-boats.

The hulls of that day were round bowed and broad beamed. It was a popular fashion to curve the stem above the hawse holes backward, like the bow of an ancient Dutch galliot, and to dispense with any cutwater or head; but this fashion went out of vogue after independence, as there was little lifting power in such a bow, to say nothing

of looks. Americans afterward made their bows flaring at the top. The broadest part of the hull was one-tenth the length forward of amidships. The topsides always had more or less of a fall home, while the fore foot was cut away under water and the stern-post raked 1, 2, or 3 feet.

The sloops of 1700 and for fifty years afterward were large boats for their rig. Whaling and the carrying of firewood along the coast had the effect to develop them, and many cruised back and forth in trade across the Atlantic. It is said that before the Revolution a regulation of England allowed lumber to be imported to the mother country only in sloops, which was one reason for their large size, a sloop built on the Kennebec in 1772 registering 140 tons. These vessels carried one and two square topsails and two jibs when bound on long voyages.

Ship-building flourished at Philadelphia, Baltimore, and Charlestown to some extent before the revolutionary war. Vessels were fitted out by their merchants chiefly for foreign trade, and while not remarkable for number the shipping of these ports was well built and well modeled. Philadelphia was always active in the West India trade, and at one time had almost entire possession of the East India trade to this country.

Each period of our national history has had its peculiarly profitable industry, and before the Revolution ship-building was the one which took nearly the first rank with us. By 1760 from 300 to 400 trading vessels were being built annually in the different provinces, to say nothing of a multitude of small boats for fishing along shore. The coast from New York harbor to Eastport, Maine, was one long row of ship-yards, and wherever there was a village planted by the sea there some vessel was seen in course of construction. Workmen were drawn here from England, much to the disturbance of the master carpenters of that kingdom, and the latter asked parliament more than once in that period not to encourage America in the production of shipping, because of the emigration to which it led. The industry was a valuable one for America, as a large part of the tonnage built was for foreign owners, and the constant exportation of ships brought large sums of money annually to a country where coin was scarce and in great demand. The advantages enjoyed by our ship-builders were, in the first place, cheap timber, low wages, and long days, the men toiling in the yards from sunrise to sunset; and, secondly, the possession of great fisheries, a good foreign commerce, a parliamentary law forbidding foreign-built ships to bring foreign goods to any of our provinces except from their own home ports, and a passion for foreign trade on the part of American merchants, that field of enterprise being the most profitable one in which they could employ their capital. The magnitude that ship-building had attained a few years before the Revolution is illustrated by a report to the house of commons in 1792, in which appears the following information: In 1769 the colonies built and launched 389 vessels, 113 square-rigged and 276 sloops and schooners, of an aggregate burden of 20,001 tons. Of these Massachusetts (including Boston and Salem) provided nearly one-half, New Hampshire and Rhode Island the next largest number, while New York had only 5 square-rigged vessels and 14 sloops and schooners, measuring in all 955 tons. Pennsylvania owned 1,344 tons, Virginia 1,249 tons, North and South Carolina 1,396 tons, and Connecticut 1,542 tons, while Georgia had 1 sloop and 1 schooner, whose combined measure was only 50 tons. In 1769 the entrances to all the ports of the present United States amounted to 332,146 tons and the clearances to 339,302 tons, of which 99,121 tons cleared for Great Britain, 42,601 for southern Europe and Africa, 96,382 for the British and foreign West Indies, and 101,198 for the continent of America and the Bahamas. The aggregate value of the whole imports amounted to £2,623,412, and the exports to £2,852,441, of which Great Britain sent £1,604,975, receiving in return £1,531,516.

During the Revolution ship-building was nearly suspended. English cruisers hovered near our coasts and captured and destroyed large numbers of vessels, the whaling and fishing fleet being almost annihilated. Foreign trade suffered the same fate. Raids were made on various coast towns and the shipping in port was burned; it was not safe to send anything except an armed vessel to sea, and few, except privateers intended especially for preying upon English merchantmen, were fitted out at any American port. A great part of the idle fishing and merchant fleet being employed in privateering in that war, for the time being it was a profitable field for them, and while the losses to their owners were large at times, their gains were sometimes immense, little armed sloops frequently capturing large merchantmen. The ships of one Newburyport merchant who built the first privateer of the Revolution took 23,360 tons of shipping and 2,225 men during her career, the prizes, with their cargoes, selling for 3,950,000 specie dollars. Four frigates and three sloops-of-war were built for Congress, familiarizing our people with the idea of producing powerful vessels of large class, and as the war went along large privateers were built by many merchants, especially in New England, Philadelphia, and Baltimore.

When the war ended many ships were too large for the coasting and other employments in which the bulk of our tonnage had been previously employed, and were no more fit for the small shopping business along the coast and to the West Indies than the great Californiamen of to-day would be for yachting; but while retaining a part at least of their armament, these ships were speedily converted into merchantmen, and were sent, from the necessities of the case, to China and distant parts of the world. It was a Baltimore vessel which, in 1785, sailed into the Canton river and first displayed the new flag there, returning with a cargo of teas, chinaware, silks, etc. In September, 1788, Captain Read, of an American ship, returned to Philadelphia from a voyage to China. The ship Atlantic, of Salem, in 1788, was the first to display the flag in Surat, Bombay, and Calcutta. The peaceful victories of American vessels in the following twenty-five years in the trade to these distant lands sprang, in great measure, from the possession of large privateers at the close of the Revolution, and were also due, in part, to the new

conditions under which shipping enterprise had to be conducted after peace was declared. After 1783 American ships were foreign vessels in the eye of British law. Cut off at once from a part of the trade which they had enjoyed before the Revolution, they were compelled to go into the fields of employment which were open to them, and the East India and Asiatic trades being free, our larger merchantmen went into them at once.

Nothing else could have been expected than that American ships should come under the operation of the British navigation act immediately after peace. Nevertheless John Adams and other representatives of Congress were sent to London to endeavor to negotiate such a treaty of commerce as would secure as nearly as possible the advantages which had been enjoyed before the war; but they were unable to negotiate a treaty, and failed even to secure equality as to tonnage taxes. The same repulse was met with at the courts of France and Spain, and the American government was compelled to pass retaliatory laws. The first Congress under the Constitution met in April, 1789. July 20, 1789, two acts became laws which were intended expressly to secure fair play for American shipping abroad. They provided that on each entry from a foreign port an American vessel should pay a tax of 6 cents per ton, a vessel built in America and owned abroad 30 cents per ton, and a foreign vessel 50 cents per ton. Goods imported in American vessels were to pay 10 per cent. less duty, and India and China goods from 9 to 25 per cent. less duty. These laws were effective in securing commercial treaties and enlarging the field of employment for American ships.

The sixteen years that followed, ending with the war of 1812, were perilous times for American ships. English policy excluded us from a profitable trade with the British West Indies, and the same policy led to the searching of our merchant vessels for British subjects, the capture and confiscation of our vessels and cargoes, and the detention of large numbers of them for evasions of English law. England, France, and Holland were at war through a greater part of that time, and this led to other troubles. If the right of neutral nations to trade peacefully with nations with which they were themselves at peace had been fully established, the ships of the new republic would have become the common carriers of the whole world; but to prevent us from gaining that advantage, as well as to injure each other, England and France reciprocally issued a number of famous decrees and orders, each one forbidding trade with her rival, and these orders were vigorously enforced by the detention, seizure, and confiscation of hundreds of American vessels and cargoes and millions of dollars' worth of property—a policy which certainly had the desired effect. In that period ship-building thrived better than did ship-owning. A great many privateers were built, and to replace the large losses of tonnage new vessels had to be produced continually; but there were years when the industry languished, in consequence of the loss of capital and the embargoes and non-importation acts passed by our own government. The news of the peace of 1814 had an instant effect for good. Many privateers were building in Maine, Massachusetts, and elsewhere, and when the news came the ship-carpenters dropped their tools to rejoice over the ending of the disastrous war, but took them up again next day to complete their ships for the new mission of peaceful trade. Ax, hammer, and calking-iron were put to work in scores of yards that had been long lying idle. The maritime world was in excitement, as after so long a paralysis of commerce the ships first in the field were sure to earn the best freights and the cargoes first imported to bring the most profitable returns. Everybody began to think of ships, and in less than a week after receipt of the news of peace ship-building sprang into activity on every part of the coast engaged in the industry.

March 3, 1815, Congress passed a law forbidding any foreign vessel to bring goods to America, except from the country to which it belonged. This act was the legislative weapon by whose unsparing use we were enabled in the course of a few years to obtain from every foreign nation a treaty of reciprocity in trade and to break down, one by one, the vexatious obstructions of foreign law to the free enterprise of American citizens in the carrying trade of the world. The legislative annals of Congress contain the complete record of this struggle and the victory. After 1815 our maritime career was one of great prosperity.

A permanent impression had been made upon the form and rig of American vessels by forty years of war and interference. It was during that period that the shapes and fashions which prevail to-day were substantially attained. The old high poop-decks and quarter galleries disappeared with the lateen and the lug sail on brigs, barks, and ships; the sharp stern was permanently abandoned; the curving home of the stem above the hawse holes went out of vogue, and vessels became longer in proportion to beam. The round bottoms were much in use, but the tendency toward a straight rise of the floor from the keel to a point half way to the outer width of the ship became marked and popular. Hollow water-lines fore and aft were introduced; the fore foot of the hull ceased to be cut away so much and the swell of the sides became less marked; the bows became somewhat sharper and were often made flaring above the water, and the square sprit sail below the bowsprit was given up. American ship-builders had not yet learned to give the vessels much sheer, however, and in the majority of them the sheer-line was almost straight from stem to stern. Nor had they learned to divide the topsail into an upper and a lower sail, and American vessels were distinguished by their short lower masts and the immense hoist of the topsail. The broadest beam was still at two-fifths the length from the bow. Hemp rigging, with broad channels and immense tops to the masts, was still retained; but the general arrangement and cut of the head, stay, square, and spanker sails at present in fashion were reached. The schooner rig had also become thoroughly popularized, especially for small vessels requiring speed, and the fast vessels of the day were the brigs and schooners, which were made long, sharp on the floor, and low in the water,

with considerable rake to the masts. The changes made in those forty years of perilous enterprise were chiefly introduced for the sake of speed and ease in handling the sails and the vessel. A merchantman was always liable to be called on to fight or to run away, and quickness in maneuvering and ability to slip away from an armed cruiser were qualities of the first importance. Builders were called on to study models and rig with reference to the needs of the times, and the result was that after the war of 1812 Americans had the ablest and smartest vessels in the world. Many ideas adopted by our builders were borrowed from the French, among whom naval architecture had been most critically and scientifically studied. The French frigates sent to assist us in the Revolution were closely studied, and when taken out of water at Salem and elsewhere for repair their lines were sometimes copied and frequently imitated in American-built ships. Many men-of-war and merchantmen were built on the models of these frigates, and it is possible that a part of the admiration expressed by the French for American frigates built during the Revolution, especially for the Alliance, which was the pride and favorite of our navy, was due to that fact. Our vessels got rid of much of their old clumsy shape and look, and improved materially in speed and beauty and in all other desirable qualities. In the timber employed for building there was no change, except to employ more chestnut, locust, and some live oak, the latter being brought from the south. White oak was the main dependence for frames, center work, outside planking, water-ways, rails, etc., and was much used for ceiling and for beams. Pitch-pine also came into use after awhile, and was first used for beams, afterward for ceiling, and then for keelsons. White pine comprised the rest of the ship, except the upper spars, which were made of spruce, on account of the need of lightening the top gear as much as possible. Treenails, on account of the expense of iron, were liberally used for fastening. The principal part of the iron of our ships had to be imported, and this included not only the bolts, the bar-iron for the fittings of the spars, and much of the other iron work of the ship, but also the rigging chains and the anchors; afterward, when iron chain cables were introduced, they, too, were at first imported. After the termination of hostilities, when our merchant marine had fairly settled down to peaceful enterprise and heavy freighting, our ships lost some of the jaunty character acquired from 1775 to 1814, but that was only because the builders were free to adopt the models best suited to the trades in which the vessels were to be employed, and not because they had forgotten the lessons taught by the previous years of war.

Within a few years after 1814 the foreign carrying trade of America had nearly all been gathered up by home-built vessels, and this was due to the superiority of the ships themselves, the vigor with which our citizens threw themselves into foreign trade, and the protection afforded them by our laws. There were no railroads then, no steamboats, no mines of gold and silver, no cattle ranches, no great and general development of manufacturing industry. Foreign trade was the field for the most profitable employment of our capital, as nearly all our manufactured goods had to be bought in Europe. Travel upon the sea was entirely carried on in sailing vessels. Immigration, which was only at the rate of about 8,000 a year before 1825, rose to over 20,000 a year in 1830, and to 300,000 a year about 1850. The fisheries were prolific and profitable, producing a vast surplus that had to be marketed abroad; and our fertile fields and wonderful forests yielded a great variety of important products, which were in large demand abroad, while on the other hand the teas, coffees, spices, fruits, silks, and wares of the far East were in larger demand among our people. The persistent efforts of the government at Washington having gained, little by little, fair and equal rights for our ships abroad, all the conditions were favorable to foreign trade, and, so far at least as shipping is concerned, our national history from 1814 to 1861 records little except the varying phases of a peaceful development of a profitable foreign commerce, and of the naval art to which it gave steady and paying employment.

Ships naturally took the shapes which fitted them best for the goods they had to carry. The cotton ships were a special class. They were sent out to carry bales of cotton and hogsheads of tobacco from the southern states to Europe and bring back salt, iron, and general manufactures. Great capacity was the prime consideration. Before the powerful compressing apparatus of to-day was invented a gross ton of cotton occupied about 100 cubic feet of space, the reduction to 60 cubic feet being a late achievement. To carry a good cargo of this bulky commodity, therefore, required a large vessel; and as a large ship is expensive, owners prudently studied how to gain the capacity they wanted without at the same time incurring new cost of operation. Tonnage taxes and port charges were the expenses most dreaded, as being the least within the control of owner or master after the vessel was launched. Advantage was taken of the laws for the measurement of vessels to reduce the official tonnage of the cotton ships considerably, (*a*) and the rule of the law (adopted from the English practice),

a May 6, 1864, Congress established a new system of measurement, in accordance with the modern English practice, and American vessels are now measured under the tonnage law of that date. The register length of a vessel is the length from the fore part of planking on the stem to the after part of the rudder-post (after part of the main stern-post in screw steamers), measured on the upper deck, or, in the case of three-deck vessels, on the second deck from below. The beam is the broadest part from outside to outside of planking. The depth of hold is measured from the under side of the deck plank to the floor of the hold. The tonnage of the vessel is only an expression of her actual internal cubical capacity in tons of 100 cubic feet each. It does not express her carrying power; it is merely a standard of measurement. The cubical capacity of the hull is ascertained by what is called "Simpson's one-third rule". The capacity of the houses on deck, the space under the poop-deck, and all other inclosures, is next ascertained, and the total is the vessel's gross tonnage. The adoption of the new measurement law has left builders absolutely untrammeled as to models. It may be stated, incidentally, that the cargo-carrying power of American sailing ships is about 1½ times their register tonnage. A ship of 2,000 tons register will carry about 3,000 tons of dead-weight cargo.

mathematically expressed, was as follows (L being the length from the fore part of the stem to the after part of the stern-post, measured on deck; B the breadth from outside to outside of planking at the broadest part of the vessel; D the depth of hold from the plank of the deck to the ceiling of the hold, assumed to be $\frac{1}{2}$ B.):

$$\frac{(L - \frac{3}{5} B) \times B \times \frac{1}{2} D}{95}$$

This was the rule for double-decked vessels. In single-decked vessels the actual depth was taken, instead of considering one-half the beam as the depth; the old divisor of 94 was superseded by 95, the latter being more accurate.

This was very nearly the old European rule for obtaining the actual tons weight of cargo the vessel would carry. It was, at best, only a rough approximation, as the ship often carried more than her official tonnage, often less. The reasonable accuracy of this rule depended entirely on closely following the model of the old merchantmen of about 1700. In those ancient vessels the stem raked forward from the keel about three-fifths of the length of the vessel's main beam, and, as the extreme bow thus had no buoyancy of its own, it was a part of the vessel not appropriated for cargo. The available depth of old vessels was about one-half the beam. A ton of goods occupied from 40 to 42 cubic feet of space, and the rule was an effort to arrive at a fair statement of the tons of goods that could be stowed within a vessel, or the part of the displacement which was due to the weight of cargo alone. Builders of cotton ships were able to turn the inaccuracy of the law to their own advantage and lengthened out the bow under water, so that the deduction of three-fifths of the beam made the tonnage length less than the actual length. They also made the hold much wider at the water than on deck, and much deeper than one-half the beam, and also constructed large poop and top-gallant-forecastle decks, covering nearly the whole top of the ship, open, however, amidships, which were good for the stowage of 200 or 300 bales of cotton, which, nevertheless, escaped tonnage taxation. The result was a roomy ship, with the old-fashioned falling home of the top sides, which passed muster at the custom-house as of far less capacity than she really had. The government did not get its just dues, but shipping was benefited. Boston, Kennebunk, and Bath built a great many vessels of this model, and the builders of those places won the reputation in time of producing the largest ships of a given official tonnage in America. In the tables of tonnage built in the United States from 1814 to 1861 some allowance must be made for this fact, as the actual amount of tonnage produced was larger than the tables show. The bark Saone (Figs. 28 and 29), built at Bath, Maine, in 1846, the model of which has been preserved, is a fair specimen of the "kettle-bottoms", as they were called, of that period.

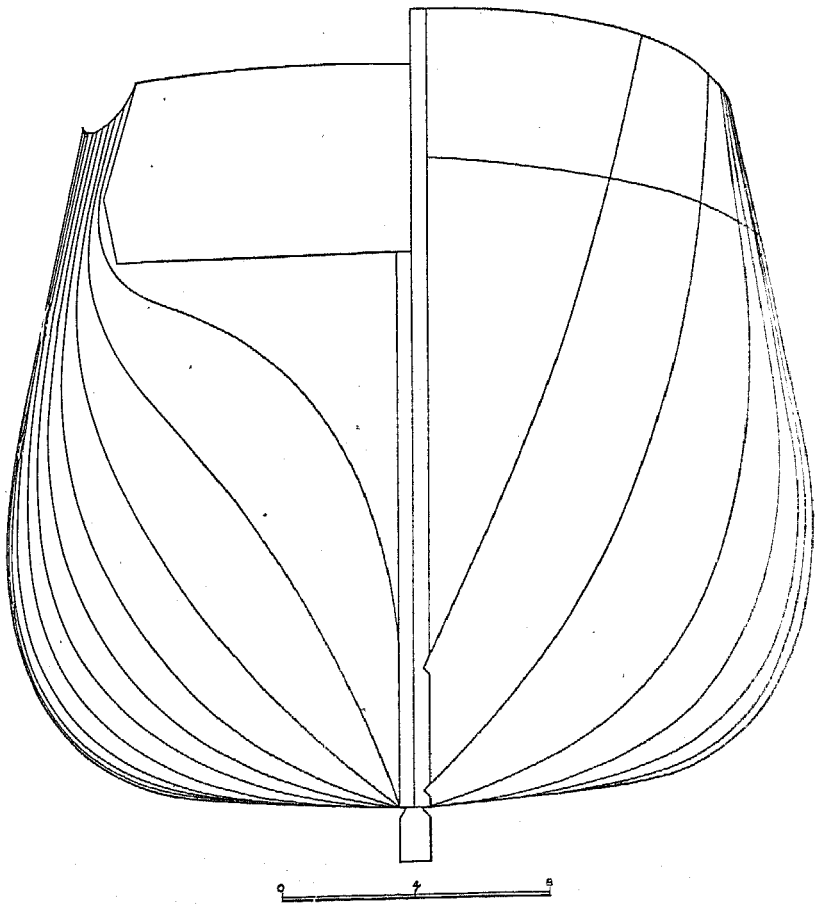


Fig. 28.—Bark Saone, built at Bath, Maine, in 1846, for William A. Rea, of Boston; register, 292 tons.

Length on deck from stem to taffrail, 116⅝ feet; breadth of beam, molded, at upper deck, 21½ feet; depth, molded, 16¾ feet; swell of sides, 20 inches. First square station, 3 feet from rabbet of stem at rail; Nos. 1 to 7, 6 feet apart; 7 to 8, 9½ feet; 8 to 18, 6½ feet. Coefficient of midship section to 11½ feet, or about two-thirds depth from keel, 0.89 per cent.; coefficient of displacement, 0.69 per cent. Angle of entrance at bow on load-line, 155°, angles below diminishing to 60°. Angle of run at load-line, 95°, angles below diminishing to 20°. Bark will carry 460 tons of cargo on 14 feet draught of water, reckoned from top of keel.

As no roomy ship could ever be loaded down to her deepest draught with so light and fleecy a cargo as cotton, it was customary to stow away bales in every available sheltered space to be found on board, from the limber strake to the main rail, and even the mess-table in the cabin was often a bale of cotton. No matter how big the cargo, the ship would not be down in the water to her bearings, and would be top-heavy and crank in consequence; so that it was always necessary to carry from 100 to 300 tons of stone ballast for the sake of stability, and even then the "kettle bottoms" were apt to go away over on their sides whenever the wind was abeam and stay there, to the discomfort of all on board. The sailor loves to see a good space between the deck he treads and the water

upon which he floats; and whatever beauties the owner saw in a "kettle bottom" that carried a big freight and paid him well, Jack saw none. His preference has always been for a ship that would stand up stiff under sail, and some of the cotton fleet would. They were not all of the model of the Saone. A good many had straight sides, with only enough of a curve home to wear a graceful look and to suit the inclination of the shrouds, and

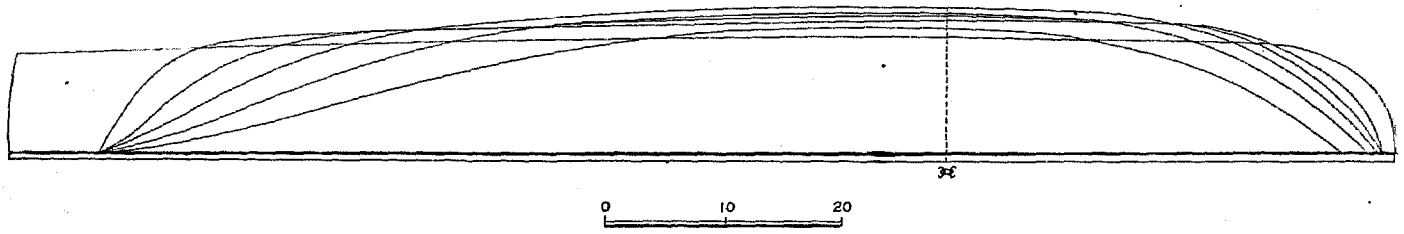


Fig. 29.—HALF-BREADTH PLAN OF BARK SAONE (SHOWING 5 WATER-LINES 3 FEET APART AND LINE OF MAIN RAIL).

often had a longer bow. These were large and fast carriers, and with a large freight on board they sailed well and attained an excellent rate of speed. American cotton ships in time began to do about two-thirds of all the business there was in their line from the ports of the United States, and thronged the wharves of New Orleans, Mobile, Savannah, Charleston, and New York, where the flag of this country is now seldom seen flying from the peak of a transatlantic vessel.

Reference has been made to the evasion of tonnage duties. The success of a ship is necessarily and chiefly due first to a rigid keeping down of all her expenses and to strict economy both in and out of port, and next to her being placed in charge of a good captain and crew, and the adoption of a model which would save taxation was a natural proceeding. It must be said, however, that the burdens of port charges and of taxation in its various forms never weigh hard on shipping unless trade is dull, freights are low, and competition is sharp. No matter how big and costly a ship, no matter what wages are paid or how expensively she is run (and a ship *is* an expensive investment, spending money right and left with a prodigality known in few forms of business), she can carry every burden if trade is good and freights are profitable and spend from 20 to 45 per cent. of her value, as she does, every year, without feeling it. When a ship does make money, it makes it rapidly.

Congress was called upon more than once after 1814 to legislate in behalf of our cotton-carrying fleet. France had considerable tonnage in the trade to New Orleans, and to protect it she enacted a discriminating duty on certain American goods. If brought in a French ship, cotton was to pay $1\frac{1}{2}$ cents per pound less duty, tobacco $1\frac{1}{8}$ cents per pound less, and potash $\frac{55}{100}$ths of a cent less—a discrimination which actually amounted to more than the freight. A French tobacco ship of 300 tons saved about $6,300 on each cargo over what an American vessel had to pay. In 1820 Congress levied a duty of $18 a ton on French vessels in retaliation; a step which secured equality in duties, and soon gave the carrying trade to American ships, by reason of the superiority of the vessels and the management of them.

The bulk of American tonnage during the period from 1814 to 1860 was employed in general freighting and passenger carrying between this continent and the eastern world, and some of it to and from South America. It was into this general trade that the fast privateers of 1812–'14 went after peace, and in which they were steadily engaged until they were worn out, which was in about twenty years' time, when they were succeeded in general freighting by a fuller class of ships, carrying large cargoes and spreading a vast expanse of canvas. It was required that vessels should carry the greatest number of tons of goods on a given draught of water consistent with stability under sail, rolling easily in a sea-way, steering well, and sailing fast, and there was great difficulty in deciding upon a model which would answer all the multifarious demands of trade, as there was such wide variety in cargoes. Sometimes the charter would be for a cargo of railroad iron; sometimes for teas and East India goods; sometimes for grain and flour and naval stores; at other times for a miscellaneous cargo. A good average style of vessel, which would do fairly well under any circumstances, was the best result that could be attained so far as model was concerned, and builders always found it safe to err on the side of capacity to carry a little larger and heavier cargo than was called for. Commerce was growing rapidly. If there was not business enough to guarantee full cargoes when the ship was built, there was apt to be more than enough before the twenty years of her existence should have expired, and no owner ever complained because his vessels carried bigger freights than was expected of them. The tendency was decidedly toward full ships, the old plan being followed of locating the dead flat, or largest section of the ship, at two-fifths the length from the bow. The round floors and the long turn of the bilge, lingering from the preceding century, gradually gave way to flatter floors and a sharper turn of the bilge; the huge swell of the sides was slowly abandoned; figure-heads were left off; the bow was made flaring above water; more sheer was given; the center of buoyancy was moved farther aft; and the handsome freight-carrier used between 1845 and 1860 came into existence in consequence of the successive changes introduced. One sample of this model was the Universe (Fig. 30), built at New York in 1851 to sail between that port and Liverpool, which was one of the first vessels to depart from the old rule of broadest beam at two-fifths the length from the bow,

placing it nearer amidships. Her water-lines were hollow forward and aft. The Universe was not a remarkable ship, but her lines have been preserved and are valuable for reference. Reference also is made to the Great Republic, illustrated elsewhere.

The majority of American ship-yards receiving their principal patronage from the merchant owners of this class of ships, the freighter was naturally carefully studied in all its details, and much attention was paid to the subject of strength. European builders gained the rigidity of hull needed to withstand the constantly varying stress brought on the different parts of the ship's length when floating among the waves by strapping the outside of the frame timbers with iron bands extending from a longitudinal iron band bolted to the top timbers down diagonally across the frames to the ends of the floor timbers. These straps crossed amidships in a sort of lattice-work, and were bolted to each other and to the frame at each crossing. From 50 to 100 tons of iron would be put into this work. Straps were also used on the inside of the frames, as also wooden straps and riders; and the same device was adopted in many American ship-yards, particularly at New York, Boston, and Bath. The general plan adopted, however, was one original with American builders, which served the purpose well and has continued in constant use to the present time. The inner planking of the hull, or, as it is called, the ceiling, was made extremely thick on the turn of the bilge, a strip about 10 feet in width being laid with squared logs from 10 to 12 inches thick the whole length of the hold. From this thick stuff the ceiling diminished in thickness to the deck, the planks covering the upright part of the side of the hold remaining, however, of unusual thickness. The water-ways, clamps, and other longitudinal pieces were all made of large dimensions. All this work was fitted to its place with the greatest care, the edges of adjoining pieces faying against each other very tightly. The keelsons were also carried up very high and bolted strongly through and through, and sister keelsons were added. In large freighting ships the iron and composition bolts driven down through the keelson, frames, and keel were often from 9 to 10 feet in length. With such a tremendous backbone, aided by the thick stuff on the bilge and strong clamps and water-ways, wooden ships attained a rigidity and strength never before known, and did not need the aid of iron straps on the frame timbers, although strapping was sometimes resorted to. This system of heavy scantling became universal in American vessels of every class after 1830. The coasting schooners of to-day are, in consequence, more heavily built than even East Indiamen were before the adoption of this system.

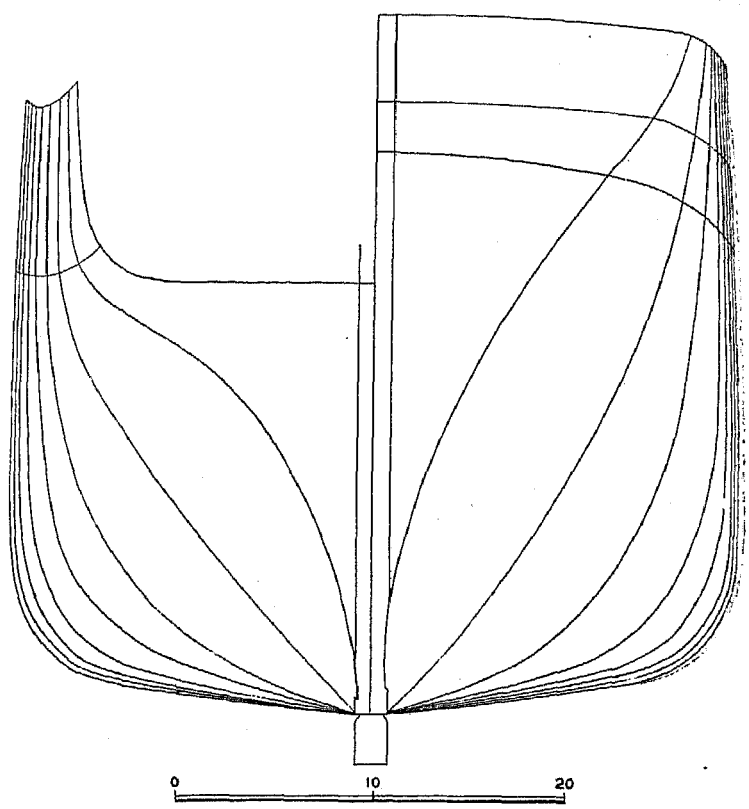


Fig. 30.—FREIGHTING-SHIP UNIVERSE, 1851, AT NEW YORK.

Register tonnage, 1,298 feet. Length between perpendiculars on 15-foot water-line, 175 feet; breadth, 37⅞ feet; depth from plank-sheer to keel, 27 feet. Weight of vessel, about 940 tons net; with anchors, cables, and tank of 2,000 gallons of water aboard, 1,033 tons. Draught, thus loaded, 10 feet 1¾ inches. Capacity between that and 19 feet draught, 1,488 tons net. Coefficient of displacement, 0.67 per cent. Center of buoyancy at 15-feet draught, 8⅛ feet above keel. Foremast reaches load-line 30 feet from forward perpendicular; mainmast 74 feet aft; mizzen-mast 48 feet aft of mainmast.

As the weight of additional timber and material was concentrated in the lower part of the hull, the center of gravity of the ship was kept well down (a point of some value) and stability was greatly promoted. A coasting vessel of good model thus built would often sail from port to port, seeking cargo, with the hold entirely empty, without putting aboard a pound of ballast to steady her. A large number of the wooden sailing vessels of the present day in America have this quality, which is valuable at all times, and especially to coasters, because it saves them a great deal of time and money. It is a trait the iron sailing vessel does not possess. The English merchantmen which frequent our ports now, being nearly all of iron, cannot stir without ballast; and they require ballast when laden with cargo more frequently than do our wooden merchantmen.

Good ships are necessary to maritime eminence, but good sailors are equally required. The great prosperity of our shipping from 1814 to 1861 was due in large measure to the excellent personnel of the crews and officers of the merchantmen. These people were recruited in the main from the fisheries and the coasting trade. The majority were American born, having homes and families ashore, and were persons of good principles, abstaining especially from the use of spirituous liquors. Sailors were paid good wages, and the captains were spurred by the payment of a percentage of the freight and passage money as a premium. A good crew means energy on board ship, quick voyages, the saving of time in getting into and out of port, the rescue of the vessel from wreck and injury under trying circumstances, a lower cost of insurance, smaller bills of expense generally, and fewer losses to

the owners. The energy and daring of the excellent crews of that period were the admiration of the maritime world, and gifts of plate, the freedom of the city, and other testimonials to their merit were not uncommon. The temperance that prevailed on American vessels was the subject of comment in a report to the British parliament in 1838. The committee said:

> The happiest effects have resulted from the experiments tried in the American navy and merchant service to do without spirituous liquors as an habitual article of daily use, there being at present more than 1,000 sail of American vessels traversing all the seas of the world in every climate, without the use of spirits by their officers and crews, and being, in consequence of this change, in so much greater a state of efficiency and safety than other vessels not adopting this regulation that the public insurance companies in America make a return of five per cent. of the premium of insurance on vessels completing their voyages without the use of spirits, while the example of British ships, sailing from Liverpool on the same plan, has been productive of the greatest benefit to ship-owners, underwriters, merchants, officers, and crews.

A special class of ships which grew up after 1814 were the sailing packets, or vessels carrying both passengers and freight, which cleared from port on regular days in each month and ran back and forth between special points only. When the war ended there were only a few small British ships in the packet service between England and America, and scarce any between America and other parts of the world. Soon after the peace, however, a large number of lines came into existence as a natural outgrowth of the rush of emigration from Europe to America and the general expansion of ocean travel and trade. The carrying of passengers was a profitable business, and there was considerable competition among shipping merchants to get the largest share. None but the best and finest vessels could be used in this business, and the old-fashioned freighting ships, with their small cabins and houses, underwent a considerable change to adapt them to the new state of affairs. A great many houses in Portland, Boston, New York, Philadelphia, Baltimore, Norfolk, Charleston, and New Orleans put their money into ships especially built for the passenger service, and ran them in regular lines to all the ports abroad and on our own coast whither trade and travel chiefly tended. In the coasting trade brigs, schooners, and barks were used, but in the packet service to foreign ports barks and ships only were thought of. The latter were vessels of the largest size, handsomely built and sumptuously fitted up, and carried often from 600 to 1,000 persons and 1,000 tons or more of freight. The lines to Liverpool, Havre, and Australia often comprised 15 or 20 vessels, each of the finest specimens of marine architecture afloat. When the clipper era began the packets improved in speed and made trips across the ocean to Europe and to Australia which it took the steamships years to surpass. These lines were owned chiefly in the north by old shipping houses of great experience and large capital.

It was at New York that the packet business between America and Europe chiefly centered. There were lines from other ports; but New York was the pioneer, and always kept the lead, and had the most and finest packets. The New Yorkers were restless under their dependence on the old English ships sailing to Falmouth, which ran only in the winter time, and besides were slow. In the summer time they sailed from Halifax. It was resolved to run an American line from New York, and a start was made a year or two after the war by Isaac Wright & Co. with the four ships Pacific, Amity, James Cropper, and William Thompson, of from 400 to 500 tons each. These packets constituted the Black Ball line, so called from the round black dot in a white field which was adopted as the pennant of the ships. They were put at once into the packet business to Liverpool, sailing the first of every month, and made the run outward in an average of 23 days and the homeward run in 40 days. The ships were well built, fleet, and handsome, were managed with great energy, and were a success from the start. In about six months four vessels were added to the line, sailing on the 16th of every month, and each vessel made three round trips a year. The Black Ball line remained in existence, though changed in ownership, until the decline of American shipping finally terminated its career, and was one of the last to surrender the field to the new monarch of the sea, steam. A London line followed the Black Ball; then a Havre line was started. In 1821 a second line to Liverpool, called the Red Star, was established, sailing on the 24th of every month, the four ships of this pennant being the Manhattan, Hercules, Panthea, and Meteor. Then Fish, Grinnell & Co. and Thaddeus Phelps & Co. originated the Swallow Tail line, to sail on the 8th of every month.

One of the best of the New York packet lines was John Griswold's, which started in 1823 with the Sovereign, Cambria, President, Hudson, Columbia, Hannibal, Corinthian, and Ontario. In 1837 the number of vessels was increased to twelve.

The New York packets were all superior vessels, and were commanded by a remarkably fine class of men, the best families on the ship-building coasts contributing men to officer these ships. The frequency and regularity of their sailing were strong points. Toward the last there was a packet sailing every five days. No foreign vessel got the mails in those days, as they were all given, at least by the American government, to American packets; and so great was the reputation of these vessels that they were regularly patronized not only by Americans going abroad, but by the West India merchants, Canadians, and even by the English officers of the large garrisons in Halifax and the provinces generally. These packets drove nearly all their foreign rivals out of the business. Many efforts were made to compete with them, but never with any success.

In the construction of these vessels the best talent of the day was employed, and they were generally built for the owners by contractors who had already attained some celebrity. The rivalry of the various lines was keen, and it was this eager competition as much as anything else which led to the continual improvement in models, rig, workmanship, and general excellence of American ships, each new vessel being expected to excel some rival or all the predecessors of its own fleet in some desirable quality. Builders found that more was required of them

than at any previous period of their history, and in order to hold their own and maintain the reputation of their yards they were forced to study the scientific principles involved in the form and sparring of ships. After 1815 the designers and builders of packets could not afford to remain in ignorance of the fundamental principles of their art. They did not sufficiently know what made one ship bad and another ship good, and therefore began to study. They sought every source of information. Books were imported from Europe, and many builders went to school to the constructors of the American navy. Delicate tests were made with small models of different forms; fast fishes were cut up and their shapes analyzed; the flow of waves away from the bow of a boat was investigated, and every other conceivable point was looked into. The period from 1815 to 1850 was thus one of study, experiment, and discussion, especially in the large cities; and, in consequence, there grew up a race of acute and daring ship-builders, whose achievements were the wonder of the world, and whose fashions were imitated, both on this and the other side of the ocean, by everybody who built ships.

The qualities desired in a packet ship were strength, speed, stability at sea, ease of handling, easy rolling, beauty of model, and comfort in the passenger accommodations. It must not be supposed that these were all attained at one bound; on the contrary, the best good general model for the packet ship, and the best sizes and dimensions of timbers, were reached only by patient study and slow degrees. A great many bad ships were built before all the questions that interested the building world were decided; but it was the final result of the forty years of study and investigation following the war of 1812 that the sailing ship reached substantial perfection as an ocean carrier, and scarce any advance has been made from that day to this. So well is the art now understood that a ship can be built to perform exactly the service required of it and to meet its owner's expectations fully. What remains to America now to accomplish is, first, to reduce the cost of ships; and, secondly, to handle them in such manner when at sea as to withstand the general competition of other maritime nations.

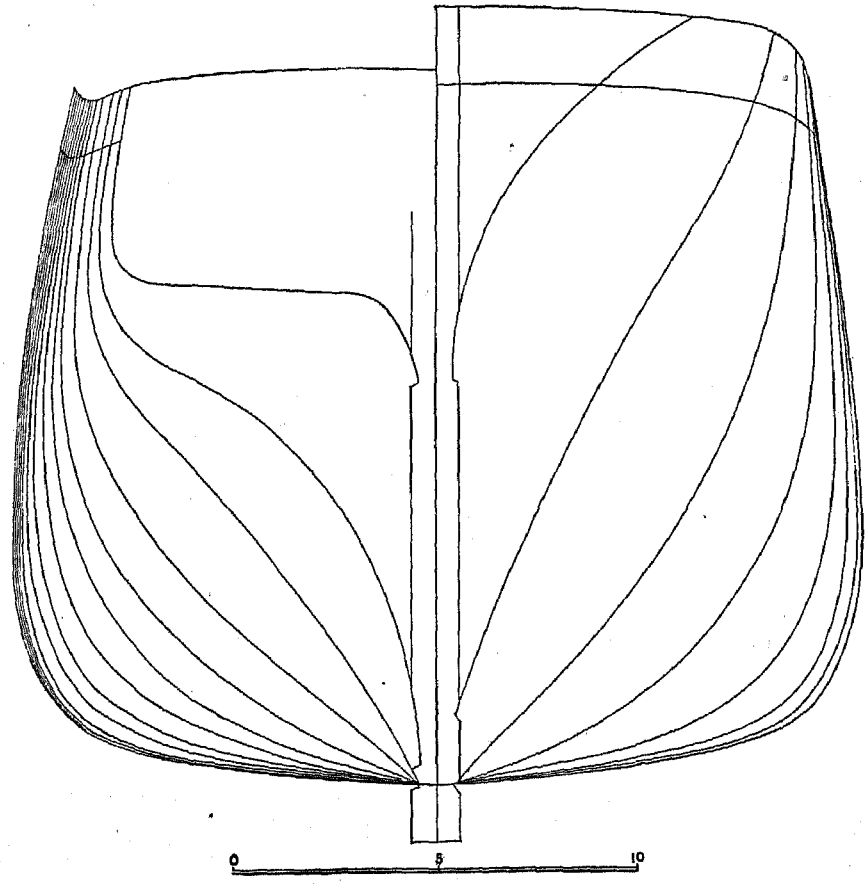


Fig. 31.—Lines of the packet ship Guy Mannering.

Down to 1849 packets were either one- or two-decked vessels, with a poop-deck aft and a top-gallant forecastle forward. Those in the service to Europe were of from 900 to 1,100 tons register. The cargo was stored in the lower hold, some of the light freight going between decks if the cargo was a large one. The between-deck space aft was divided into cabins for the passengers; the middle portion was fitted up with kitchens, pantries, etc. The steerage passengers and crew were forward. On deck were houses for the crew and various officers, with others which served as vestibules to the apartments below. The first three-decker was the Guy Mannering (Fig. 31), of 1,419 tons, which was built in 1849 by William H. Webb, at New York—a noble structure and a good ship. Three-deckers, with poop and top-gallant forecastle decks, were afterward the popular style of packet. The Guy Mannering was 190½ feet long, register measurement, 40⅕ feet beam, and 28⅔ feet deep in the hold. At 20 feet draught above the keel she would carry 2,400 tons of cargo. Her greatest beam was at ⅖ L. from the bow. The lower water-lines at bow and stern were concave, and at the plank-sheer and rail the bow was almost round. Her building lines are given above.

The American packets carried the best officers and the largest crews of any ships afloat. They were fast, dry, handsome, and sumptuously fitted up, and were managed with so much energy, care, and ability that they gained a virtual monopoly of the passenger, mail, and express traffic to Europe. They made the best time of any ships afloat, were insured at the lowest rates and earned the highest freights, and superseded nearly all the English, French, and German ships in that business, and their success and fame were the subject of intense envy abroad. After 1830 there were frequent dispatches of rival packets, transient, but all American, from Boston, New York, and Philadelphia to England and other parts of Europe. All the ships sailed with great speed, and made the run across the Atlantic in excellent time. The James Baines ran from Boston to Liverpool in 12 days 6 hours;

the Red Jacket once ran from New York to Liverpool in 13 days 11½ hours; the Mary Whiteridge made the trip from Baltimore in 13 days 7 hours; but the usual time was 19, 20, and 21 days to Liverpool, and from 30 to 35 days homeward. One of the New York packets, the Great Western, sailed regularly from New York on the 4th of March every year with a copy of the President's message to Congress. As they were the noblest ships of their day, the packets had the most dignified names. President, Vanguard, Yorktown, Ivanhoe, Guy Mannering, London, New York, Sovereign, Courier, Orbit, Napoleon, Manhattan, Hercules, Independence, Albert Gallatin, Abbott Lawrence, and United States were the class of titles given them. The ships of one of the New York lines were called after eminent actors.

English steamers were sent out in 1838 and 1840 to compete with these packet lines. The Cunard line began in 1840, backed by a subsidy of £90,000 a year, afterward increased to £145,000. The Americans responded in 1847 with a line of steamers to Bremen, and in 1850 with the Collins line to Liverpool. Then began the era of steam navigation of the Atlantic; but the steamers at first did not display remarkable speed. Under ordinary circumstances their trips across the Atlantic were made only in good average sailing-packet time. Nor did they have great carrying power, as their capacity was occupied with coal and machinery; but they enjoyed the advantage of being able to pursue their course in storms, and in 20 years they had gained so much in speed and carrying power and were so heavily backed with subsidies that sailing ships could no longer compete with them. The United States aided the revolution from sail to steam just enough to destroy her splendid packet lines to Europe completely without replacing them by steamships carrying her own flag. In 1857 all the subsidies to steamers to Europe were withdrawn by Congress, and, in consequence, the Collins and the Bremen lines were taken off. The sailing packets had meanwhile been entirely superseded, and from that day to this the passenger, mail, and express traffic of the Atlantic has been transacted almost wholly in European-built steamships. Sailing packets had disappeared even before the war of 1861, which gave the final crushing blow to the hopes of early American supremacy of the sea. The coast lines of packets were also superseded during the same period by steam vessels.

One peculiarity of this period was the increase in the size of vessels. Referring again to the table of vessels registered at Boston from 1674 to 1714, it will be noted how small were the merchantmen of early days. The fleet with which our forefathers navigated the oceans of the world was composed of little vessels, which would be none too large for the coasting trade now. The three-masted schooners carrying lumber from the southern states to northern ports at the present time would have been regarded then as immense ships. In 1714 sloops were sailing to Europe, and even from the Hudson river to China, and brigs and ships of from 200 to 400 tons were the large merchantmen for the service across the Atlantic and to the East Indies. The lack of capital on the part of our merchants, and the lack of a dense population in the United States, kept the size of vessels down. There was also some timidity on the part of owners and builders with regard to the ability of long ships to live in heavy weather, as they dreaded making the hulls long enough to reach two waves, fearing lest when bow and stern were lifted on different crests the midship portion, being in the trough of the sea, would lack support and be terribly strained. After 1812, however, large ships were demanded. The frigates of the war had done well enough at sea, and owners took courage. Builders were equal to the emergency, and a few large merchantmen were built and sent out, their performance dispelling all fears on the subject of length. Every new experiment in the maritime world was keenly watched by a multitude of eager men, and it needed only the first half dozen of successful ships to prove that the way was clear for all who chose to embark their capital in large vessels. After that the only considerations that governed owners, so far as size was concerned, were their ability to command the capital to build large and the chances of receiving business enough for a big ship. Two of the large ships were the Splendid and the Superior, built in 1822 by Isaac Webb, at New York, for Charles Henry Hall, which were monsters at the time. They were intended for the China and East India trade, but were too large, and it is related that one or both were at one time laid up and partially dismantled because there was not business enough to employ them. Nevertheless, about 1825 the Washington, of nearly 1,000 tons, was built, the largest merchantman of her day, which excited such wonder in foreign ports that people thronged to the wharves to see her. It was many years later before the size of 1,100 tons was attained. In 1841 a bold experiment was made by Clark & Sewall, of Bath, who built the ship Rappahannock, 179.6 feet long, with 37 feet beam, custom-house measurement, and of 1,133 tons, the largest merchantman in the world. Her great size astonished everybody, and it was a general prediction that she would be a failure. It was not believed that there was foreign commerce enough to occupy such a vessel, and it was declared that even the Rothschilds could not afford to own her, and that she would be sure destruction to the fortunes of whoever undertook to employ her. The launching drew a great crowd of people to Bath. The Rappahannock was a bluff-bowed, full and long-bottomed ship, narrower on deck than below, and full-rigged. Her scantling was no larger than that of a 300-ton schooner of the present day, and the fastening throughout would now be considered light. The managing owner of the ship lived in New York, and he did, indeed, have some trouble in providing her with full cargoes. She ran as a packet to Liverpool in the summer time and as a cotton ship from New Orleans in the winter. A good illustration of the limited extent of the export trade of that period is the fact that freights to Liverpool always dropped one-eighth of a penny per pound when the Rappahannock was reported to be coming up to New Orleans, rates in that day ranging from five-eighths to a penny per pound. The ship was a success, living 21 years, and ending her existence in freighting coal to the Mediterranean; she foundered at sea.

The following lists of vessels built for a few large shipping houses show the growth in size in sailing vessels for the deep sea after 1814:

VESSELS BUILT BY THE HOUGHTONS, OF BATH, MAINE, FOR THEMSELVES.

Year.	Vessel.	Register dimensions. Length.	Breadth.	Depth.	Tonnage.	Year.	Vessel.	Register dimensions. Length.	Breadth.	Depth.	Tonnage.
		Ft. In.	*Ft. In.*	*Ft. In.*				*Ft. In.*	*Ft. In.*	*Ft. In.*	
1819	Brig Bolton	72 4	22 9	8 7½	121	1855	Ship Potomac	193 6	36 5	18 2½	1,198
1822	Warren	94 9	23 5	12 3½	214	1856	Pocahontas	193 7	36 4	24 5	1,196
1823	Sublime	93 6	24 6	12 3	249	1856	Rochester	156 8	31 5	21 4	824
1824	Clarissa Ann	97 3	25 3	12 7½	276	1858	Bolton	180 6	34 3	17 0	987
1828	Caledonia	102 0	25 7½	12 9½	290	1859	Crescent City	184 6	37 5	24 2	1,205
1832	Ship Cordova	106 1½	26 5½	13 2½	332	1859	Europa	177 4	36 9	24 2	1,174
1833	Braganza	111 5½	26 6	13 3	353	1860	Persia	182 4	35 2		1,248
1834	Missouri	117 3	27 5	13 8½	399	1860	Caledonia	179 3	37 3	24 0	1,179
1837	Rochester	131 2	30 1	15 5	563	1863	Virginia	177 0	35 5	23 6	1,094
1838	Hanover	135 0	30 8	15 4	577	1865	Scotia	182 6	36 8	24 5	1,171
1840	Bark Clinton	112 8	26 2	13 1	349	1866	China	184 8	38 1	24 2	1,173
1842	Princeton	105 0	25 0	12 6	296	1868	Arcadia	183 1	38 1	24 0	1,234
1845	Ship Charlotte Reed	128 6	28 4	14 2	471	1868	Prussia	184 2	36 6	23 9	1,212
1847	Milan	146 0	32 5	16 2½	699	1870	Austria	198 9	39 0	23 9	1,300
1848	Bark Henry Warren	113 3	26 0	13 0	347	1871	Columbia	205 9	40 0	24 0	1,471
1849	Ship Houghton	156 6	33 1	16 6½	787	1873	Louisiana	202 4	40 0	24 4	1,436
1850	Clara Ann	122 8½	27 5½	13 8½	421	1874	Geneva	216 4	39 9	24 6	1,535
1851	Pelican State	153 4	33 7	16 9½	849	1875	Bohemia	221 7	40 2	25 5	1,633
1852	Kate Swanton	135 6	28 0	14 0	489	1876	Samaria	217 6	39 1	24 1½	1,509
1852	Northampton	174 9	35 9	23 7	1,130	1877	Armenia	223 3	40 4	25 0	1,698
1853	Shamrock	186 6	36 0	18 0	1,194	1882	Arabia	233 9	43 2	27 6	2,081
1854	Baltic	154 0	33 0	16 6	769						

VESSELS BUILT BY THE SEWALLS, OF BATH, MAINE, FOR THEMSELVES.

[By Clark & Sewall first, and after 1855 by E. & A. Sewall.]

1823	Brig Diana				199	1863	Brig Glendale	121 9	28 8½		454
1824	Orbit	83 6	23 7½	11 6½	199	1864	Ship Intrepid	183 6	35 6		1,078
1825	Lewis	93 4	23 5	12 2½	247	1864	Bark Volant	129 0	29 1		496
1827	Dummer	76 0	22 0	10 1	146	1864	Ship Ocean Signal	193 0	36 9		1,215
1828	Pleiades	93 4	25 0⅜	12 8⅞	284	1865	Freeman Clark	190 1	38 5	24 6	1,336
1829	Schooner Emulous	72 0	21 1	7 6½	99	1865	Bark Frank Marion	143 5	31 4	20 4	678
1831	Ship Emperor	105 6½	25 9		314	1866	Ship Matterhorn	189 7	38 3	24 2	1,327
1832	Girard	110 5½	25 3		343	1866	Wetterhorn	151 8	31 5	20 6	698
1832	Tropic	110 10	26 5½		349	1868	Hermon	193 1	38 2½	24 2	1,316
1833	Ceylon	120 0	27 1½		421	1869	Tabor	195 5	36 8	24 5	1,399
1835	Roger Sherman	126 2	29 6		490	1869	Undaunted	207 3	41 1	27 7	1,764
1836	Diadem	140 7½	32 1		657	1871	Eric the Red	198 7	41 1	25 9½	1,580
1837	Ville de Paris	130 4	30 2		537	1872	Humboldt	177 6	35 5	22 1	1,018
1840	Pennsylvania	143 8	32 2		677	1872	Carrollton	198 2	39 6	24 6	1,450
1841	Genesee	128 2	28 0		459	1873	Sterling	208 4	42 7	25 11	1,731
1841	Rappahannock	179 6	37 0		1,133	1873	El Capitan	205 9	39 9	24 6	1,493
1843	Bark Detroit	102 0	25 3½		292	1873	Schooner Salilla	128 9	31 6	10 7	312
1845	Ship Macedonia	124 0	27 0½		414	1874	Ship Granger	209 9	40 0	24 7	1,526
1846	Rio Grande	135 1	29 6		542	1874	Occidental	210 6	39 8	24 7	1,533
1847	Switzerland	134 1	30 6		570	1874	Oriental	220 1	42 2	24 9	1,688
1847	John C. Calhoun	143 11	32 11		708	1875	Continental	220 0	42 2	25 1	1,712
1848	Brig Marcia	86 8	23 2	8 10½	157	1875	Harvester	210 1	39 2	24 0	1,494
1848	Ship William D. Sewall	141 0	32 5		672	1876	Reaper	211 6	39 2	24 0	1,468
1850	Adriatic	147 0	32 8		715	1876	Thrasher	211 9	39 7	24 0	1,512
1851	Sarah G. Hyde	166 9	34 0		890	1876	Indiana	208 9	40 0	23 9½	1,487
1851	Erie	128 6	28 0		458	1877	Challenge	212 4	39 7	23 9½	1,456
1852	Commerce	180 0	36 1		1,085	1878	Schooner Carrie S. Bailey	137 6	32 1	11 7	396
1853	Lady Franklin	138 0	29 5½		549	1878	Ship Chesebrough	212 4	40 0	24 15	1,507
1854	Samaritan	191 3	37 0⅜		1,219	1879	Solitaire	213 7	40 1	24 1	1,531
1855	Holyhead	182 1	36 0		1,099	1880	Thomas M. Reed	227 4	42 4	27 0	1,987
1855	Kineo	159 6	33 7⅝		829	1880	Schooner Belle Higgins	143 1	32 9	11 9	412
1856	Hellespont	159 3	32 3½		767	1880	Kate Markoe	142 8	34 2	14 8	503
1857	Leander	166 0	34 2½		896	1881	S. M. Thomas	167 0	35 2	15 0	761
1858	Valentia	158 0	33 2		799	1881	Ship Iroquois	237 1	43 6	28 1	2,121
1859	Villa Franca	170 9	34 1		918	1881	Schooner B. L. Lunt	163 2	35 6	15 6	758
1859	Vigilant	143 2	31 7		652	1882	Ship Henry Villard	219 2	39 8	24 1	1,553
1860	Ocean Scud	181 8	34 6		1,008	1882	Schooner Nora Bailey	145 8	33 0	12 8	448
1862	Vancouver	163 8	36 0		969	1882	Ship W. F. Babcock	240 8	43 8	28 0	2,029
1863	Vicksburg	183 1	36 6		1,130						

VESSELS BUILT BY DONALD McKAY IN EAST BOSTON.

[Custom-house dimensions.]

Year.	Vessel.	REGISTER DIMENSIONS.				Year.	Vessel.	REGISTERED DIMENSIONS.			
		Length.	Breadth.	Depth.	Tonnage.			Length.	Breadth.	Depth.	Tonnage.
		Feet.	*Feet.*	*Feet.*				*Feet.*	*Feet.*	*Feet.*	
1845	Ship Washington Irving	150⅝	33	21	751	1854	Ship Santa Claus	184	38⅝	23	1,256
1846	Anglo-Saxon	158	35½	21	895	1854	Commodore Perry	212	44½	20	1,961
1846	New World	187	40½	28	1,404	1854	Japan	212	44½	20	1,964
1847	Ocean Monarch	178½	40	26⅝	1,301	1854	Blanche Moore	220	41⅝	25 7/12	1,787
1847	A. Z	143½	32⅛	22	675	1854	Bark Benin	155⅛	32½	15	602
1847	Anglo-American	149½	32	20½	704	1855	Ship Donald McKay	200½	46	20	2,595
1848	Jenny Lind	141½	28½	22	533	1855	Defender	202½	38 7/12	24½	1,413
1848	L. Z	163½	34 7/12	22½	897	1855	Minnehaha	209	41⅝	28½	1,695
1849	Plymouth Rock	174¼	34⅝	22½	739	1856	Baltic	187½	39¼	24½	1,320
1849	Bark Helicon	128	26½	19½	414	1856	Adriatic	187½	39¼	24½	1,327
1849	Ship Reindeer	156½	33 5/12	22	800	1856	Bark Henry Hill	140½	30½	14½	507
1849	Parliament	173	35½	22½	998	1856	Ship Mastiff	168⅝	36⅛	22½	1,091
1850	Moses Wheeler	165	33⅝	23	872	1856	Amos Lawrence	193⅝	39½	24½	1,306
1850	Daniel Webster	185	37¼	24	1,188	1856	Abbott Lawrence	202½	39½	24½	1,498
1850	Stag Hound	209	39⅝	23½	1,534	1857	Flying Fish	198⅛	38⅝	22	1,340
1850	Cornelius Grinnell	182	36 5/12	23½	1,118	1859	Alhambra	174½	37	23½	1,097
1850	Bark Saltana	121½	28½	14½	452	1859	Schooner Benj. S. Wright	84	24	8	107
1850	Ship Antarctic	177	37	23½	1,115		Side-wheel iron steamer Ashuelot. (*a*)				
1851	Flying Cloud	229	40⅝	21½	1,782	1861	Iron-clad monitor Nausett (*a*)				
1851	North America	200½	39⅝	25⅝	1,404	1865	Propeller (wooden) Trefoil (*a*)				
1851	Staffordshire	230	41	20	1,817		Yucca (*a*)				
1852	Sovereign of the Seas	258	44½	28½	2,421		Sloop-of-war Adams (*a*)				
1852	Westward Ho	214	40⅝	23½	1,650	1866	Steamer Theodore D. Wagner	172	27⅛	21½	607
1852	Bald Eagle	215⅝	41½	23½	1,703	1866	George B. Upton	164½	27⅛	21½	604
1853	Empress of the Seas	240½	44½	27½	2,197	1867	Brig North Star	120	29½	15⅝	410
1853	Star of Empire	222½	40 7/12	28	2,050	1868	Ship Helen Morris	174½	36½	23⅝	1,285
1853	Chariot of Fame	222½	40 7/12	28	2,050	1868	Sovereign of the Seas	202	41	24	1,502
1853	Great Republic	334½	53½	38	4,555	1868	Schooner R. R. Higgins	78½	22 7/12	8	90
1853	Romance of the Seas	240⅝	39½	39½	1,782	1869	Frank Atwood	88	24½	8½	107
1854	Lightning	243	42⅝	25	2,084	1869	Ship Glory of the Seas	240½	44 7/12	30½	2,102
1854	Champion of the Seas	252	45½	29	2,448						
1854	James Baines	266	46 7/12	31	2,515						

a For the United States Government.

After the packet came the clipper ship, a vessel intended primarily for freighting, and built to secure the highest possible speed when laden with cargo. The packets were the fast vessels from 1815 to 1845, but after 1845 there grew up various branches of trade in which speed was as important for commercial purposes as it was for passenger travel. For instance, there was the tea trade from China to the United States, in which speed had always been thought essential. The cargoes consisted of teas, spices, coffee, dried fruits, etc., which were liable to deteriorate in a long voyage of four months to the home port, and to shorten the voyage as much as possible was desirable for obvious reasons. Furthermore, there were no telegraph lines and ocean cables in those days, and the uncertainty of the markets made fast trips home from the East Indies very important. Merchants had repeatedly suffered heavy loss, sometimes ruin, by the decline in cotton and other eastern goods brought home by ships during their absence on the voyage out and back, and good ships were therefore always required in that trade. Both in America and in Europe up to 1845 the East Indiamen were, as a rule, the large and fast freighting ships of their day. After 1815 a friendly rivalry broke out among owners of ships sailing to China, and every year races took place homeward with the first offerings of the new crop of tea which had come down to Chinese ports. The shipping houses gave their captains good vessels, and the captains did their part by driving the ships homeward through all sorts of weather, with all the canvas spread that they could carry. Americans earned a world-wide reputation for speed soon after 1814, and finally put the English so much on their mettle that the latter sent out a new and finer class of merchantmen than they had ever before owned to contest for the palm of superiority. The Alexander Baring, John o' Gaunt, Euphrates, Monarch, Foam, and other ships of that class, were equal to any under the flag of the United States in capacity, spread of canvas, and speed. This, in turn, stimulated the pride of the American houses, who responded between 1840 and 1850 with vessels of good and carefully studied form. These vessels sat low in the water, in strong distinction from the fashion of earlier times. The beam was broad, the bow sharp, and the water-lines fine. The masts were tall and raking, and the yards were so long that the ships spread an enormous cloud of canvas in a favoring wind. With these vessels the Americans kept their position ahead of all competitors.

The first clippers were built at New York city. The pioneer was the Helena, of 650 tons, built in 1841 for the China trade by William H. Webb, on the order of A. & N. Griswold. Though a good carrier, this beautiful vessel was modeled for speed, and, under the management of Captain Benjamin, made a number of rapid trips and earned a great reputation for the house to which she belonged.

Howland & Aspinwall followed with the Rainbow, of 750 tons, built by Smith & Dimon. The Rainbow was a good ship, and once went to Canton and back in 6 months and 14 days, having spent three weeks of the time in discharging and loading cargo, thus shortening the regular voyage by two months. Brigs and schooners had previously been built for speed and large vessels for burden. The Helena and the Rainbow revolutionized matters. They got better prices for freights than slow ships, and in every respect proved desirable. Other sharp ships soon followed.

In 1844 the Montauk, of 540 tons, was built by Mr. Webb for William S. Wetmore. A. A. Low & Co. then employed Brown & Bell to build the rival ship Howqua, of 706 tons, a very fast and fine vessel, which once ran from Shanghai to New York in 87 days. Not to be beaten, the owners of the Rainbow added to their fleet the famous clipper Sea Witch, of 907 tons, a sharper vessel than her predecessors, with raking bow and stern, fine lines, sharp floor, and remarkable beauty of form throughout, which was intended to beat any ship afloat. She was a fast vessel, a good investment, and a credit to Smith & Dimon, her builders, and once made the voyage to California in 97 days.

The era of sharp ships was now fairly inaugurated, and many of this class were built not only at New York, but at Boston, Philadelphia, and Baltimore. Nearly all the early ones did not exceed 1,000 tons register, but competition and expanding trade led to a great increase in size, and every year saw vessels launched spreading more and more canvas, longer, larger, and faster than ever, and expressly intended to beat everything that had gone before them in the merchant shipping of the world. In ten years after the first clipper the size of 2,400 tons was reached, and there were large numbers built of about 2,000 tons. The exploits of the new ships were amazing, and created the greatest excitement in shipping circles; in fact, they effected a remarkable revolution in the sailing tonnage of the world.

Foreign merchants were by no means idle spectators of what was going on in America, and in 1846 England began to awake to the new and dangerous rivalry from America. Alexander Hall & Co., of Aberdeen, made a specialty of clipper ships, and there were launched from their yard many superior and famous vessels; but the Americans, though hard pressed, were able to maintain the lead, and are entitled to the best record ever made by ships sailing under canvas. There were several famous races home from China between American and English clippers. Once, while a bet was being talked of, the British clippers Chrysolite and Stornaway and the American clippers Race Horse, Surprise, and Challenge engaged in a race from Canton to Liverpool and Deal, and arrived at the home ports as follows: At Liverpool, Chrysolite, in 106 days; at Deal, Stornaway, in 109 days; Challenge, in 105 days; Surprise, in 106 days. The British ship Challenge ran from Shanghai to Deal in 113 days; the American clipper Nightingale in 110 days. These races were claimed by both parties; but the Americans kept the reputation of superiority, and many ships were ordered at our ship-yards on foreign account.

In 1848 an event occurred which gave a great stimulus to the demand for clipper ships. Gold was discovered in California; and as that region was practically as far away as Asia, no vessels could be sent there except those that were large and staunch. A few vessels had found their way to San Francisco before that territory had been purchased, and a number soon afterward. Parcels of gold sent East by way of the isthmus of Panama created a rush of emigration and trade wholly unparalleled in the history of the New World for its sudden rise and great magnitude, and a great part of the freighting tonnage of the eastern states was called on at once to engage in voyages to and from the isthmus of Panama on both sides of the continent, and also in trips to San Francisco around cape Horn. An immense number of people had to be transported to the new territory on the Pacific, and with them all the goods, provisions, furniture, clothing, tools, etc., that they required, including their houses, large numbers of which were made ready in the East, loaded on ships, and sent out entire, ready to be set up. No one in San Francisco wished to be troubled with any more mechanical work than was necessary, and everything that could save labor was done in the East, leaving the emigrants free to make the eagerly-desired, quick, and brilliant fortune in the new El Dorado. By 1850, such was the rush, from 150 to 200 vessels were sometimes at anchor in the bay of San Francisco, where five years before it had been rare to see half a dozen. These were nearly all American vessels, as under our laws none but American ships could bring cargoes from the Atlantic coast. A few packet ships were turned into this new and profitable trade, but the majority were freighting vessels of large size. The time spent in making the run between New York or Boston and the Pacific coast was from 120 to 150 days; but in the summer of 1850 two small tea ships arrived from New York in 100 days. This quick passage caused the merchants of the West to realize the advantage of fast ships, and Alfred Peabody, of Salem, Massachusetts, and J. P. Flint, of Boston, who were on the coast, at once resolved to build clipper ships for the trade. Mr. Peabody started for Boston by way of the Isthmus and arranged with Glidden & Williams and one other firm to build at once the John Bertram, an extreme clipper of 1,100 tons, for freighting to California. The keel was laid in September in East Boston, the ship was launched in 60 days, and in 30 days more she was on her way to California

with a cargo at a freight of $40 per measurement ton of 40 cubic feet. In 1879 the John Bertram was still doing well in the merchant service, although then under a foreign flag. This was the first clipper ship built for the California trade; but the clipper Witch of the Wave and four others of the same model, of 1,500 tons each, were built by the owners immediately afterward.

With this beginning the American ship-yards brought out large and fine clippers, exceeding in size and excellence anything ever before seen. Commercial rivalry was strong, not only between the merchants of America, but between them and those of England, and each year ships were ordered to exceed in size and speed everything which had gone before. Merchants realized the benefit of quick returns; owners and builders went wild over the enormous prices paid per ton for freights, and ship-builders could get almost any price for a ship that would meet the requirements of the trade. The goods forwarded were light, and were of such wide variety as not to be brought under any general rule based on dead-weight, and the measurement ton of 40 cubic feet of space was adopted as a basis for freight rates. From $40 to $50 a ton was paid in the first year of the California excitement, although $15 would have been a good profit, and ten years afterward the rate was still as high as $25. Forty dollars a ton would pay a ship to sail for California and then return in ballast for a cargo of goods, as the one freight made a handsome profit on the voyage both ways. Afterward, when rates fell, ships began to sail from California to China for a return cargo of teas and oriental ware, and could thus add to the freight money of from $20 to $30 per ton to California one of from $15 to $25 from China home, making from $35 to $50 per ton of stowage space on the one round trip. Only American ships enjoyed this advantage, for our laws excluded foreign tonnage entirely from all branches of our coasting trade, of which the California business formed a part. Several other influences came into play from 1850 to 1860 to increase the demand for fast ships. Gold had been discovered in Australia, causing a general rush from all parts of the world to that distant continent. Steam began to be employed in crossing the Atlantic, and the yards of Aberdeen and other places in Great Britain began to produce clippers that pushed ours hard in the tea races. Then there was the Crimean war, which broke out in 1854, turning a good deal of the existing tonnage into the transport service, giving a fresh impetus to freights, and making a demand for good ships for general trade. Sailing vessels were paid from $5 to $8 per register ton per month for use as transports during that war; steamers got from $8 to $16 per gross ton per month; timber freights across the Atlantic ran up from $8 to $12 per ton, and even to $14 in some cases; freights from India were from $12 to $20, and ran up to $45 per ton. All these influences combined made the period from 1848 to 1857 one of the greatest excitement and activity in ship-building in the United States. The years 1851, 1852, and 1853 were noted for the fine ships produced, and 1854, 1855, and 1856 have never been equaled in the United States, either for the amount of sailing tonnage built or for the gigantic size and great beauty of the large vessels, and no other age has seen so noble a sailing fleet as that which sprang into existence from the ship-yards of Baltimore, Philadelphia, New York, and Boston in those years of unwonted excitement and prosperity.

The clippers first built had sharp floors and sailed with a drag. Some of them from Baltimore drew 16 feet aft and only 8 feet forward, the midship section, or broadest part of the hull, being at two-fifths the length from the bow, as in the packets and heavy freighting ships. The forward body was full and the after body lean and tapering under water. This was gradually changed in imitation of the fast yachts and pilot boats of New York city, and after 1851 the long, sharp bow was considered the best for speed. The midship section was moved back in a few vessels to the center of length, and the after body was made fuller and more powerful. The ship was then made to sail on an even keel. The bottom was also made fuller. The sharp floor did not give enough cargo capacity; and the sharp bow and stern had so little buoyancy, as compared with the square body or middle portion, that the ends of many clippers sagged and broke down, subjecting them to continual repairs, one of them being compelled to repair to the extent of $15,000 after her first voyage. Besides that, there was a lack of stability in the sharp bottoms. About 1854, therefore, clippers began to be built with full bottoms, retaining the long bow, hollow water-lines, and other peculiarities of the swift model. These were good ships, and the form thus attained has ever since been popular in fast ships. A few draughts (Figs. 32 to 41) will illustrate the changes which took place. The lines of some of these vessels, including some of the most celebrated clipper ships that have ever been built, appear for the first time in this report.

The speed of clippers was remarkable. Six miles an hour was, and still is, a good average rate of speed for long voyages, and nine miles is excellent time, especially for a ship loaded with a full cargo of merchandise. Cargo steamers at this day make no better time. Clippers ran across the Atlantic to Liverpool at an average speed of 9 miles an hour, spurting at the rate of from 10 to 13 miles with the right wind, and on voyages that gave them the advantage of the trade winds they ran for days and weeks in succession at an average speed of from 12 to 15 miles an hour. To sail 300 miles a day was not exceptional. The Red Jacket made 325 miles a day for a week; the Flying Cloud once sailed 427½ miles in 24 hours; the James Baines, an Australian packet, built by McKay at Boston, once sailed 420 miles in 24 hours; and the Sovereign of the Seas, it is said, while on a voyage from the Sandwich islands to New York, lasting only 82 days, made 437 miles in 24 hours, the fastest time ever made by any vessel, sailer or steamer, on the deep sea. The average time of the fast Atlantic steamers now does not exceed 400 miles a day, and there is no record better than that made recently by the Alaska, which on one occasion made 419 miles in a day. The fast ships gave a great stimulus to trade, and were of vast benefit to commerce.

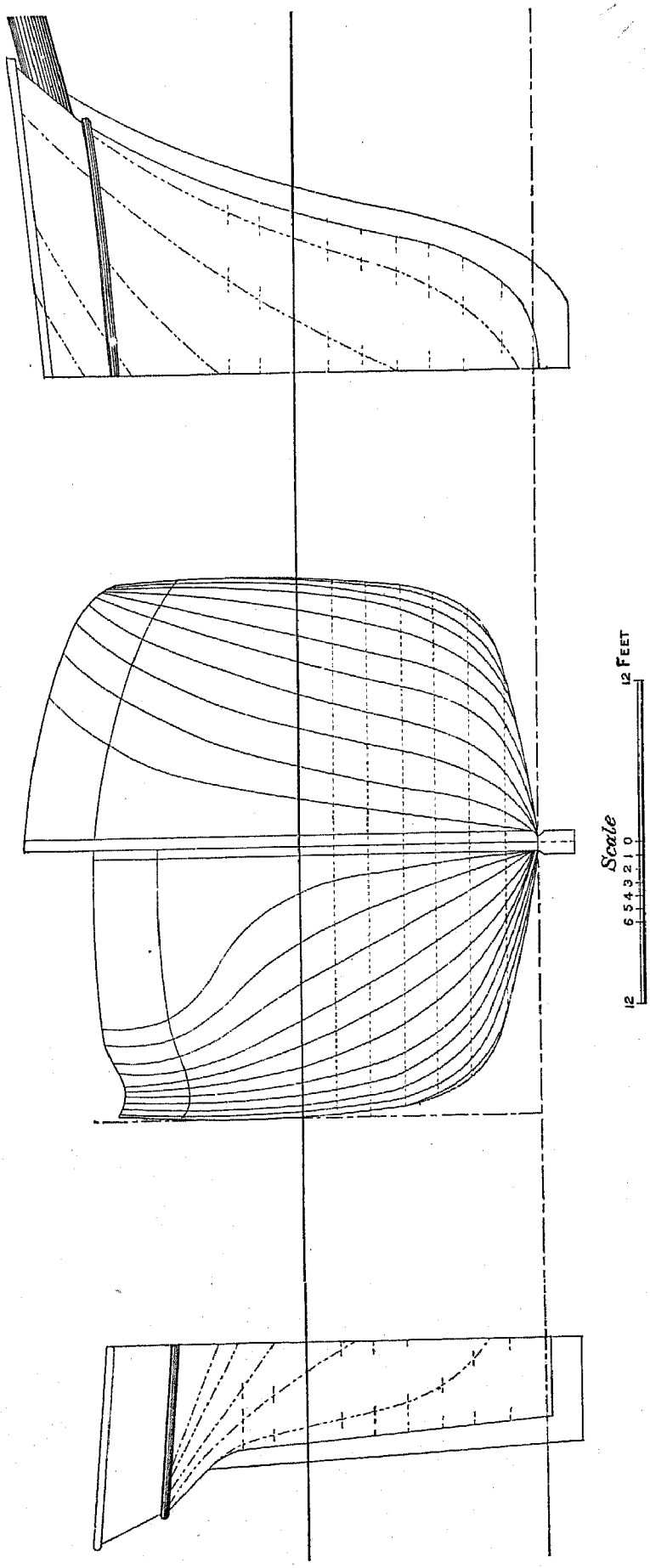


Fig. 32.—Clipper ship Sovereign of the Seas.

Built at East Boston in 1852 by Donald McKay. Register, 2,421 tons; displacement, 2,403 tons; length on load-line, 231½ feet; beam, molded, 43½ feet; depth, molded, 26½ feet; coefficient of D., 0.52; coefficient of load-line, 0.60; coefficient of midship section, 0.84.

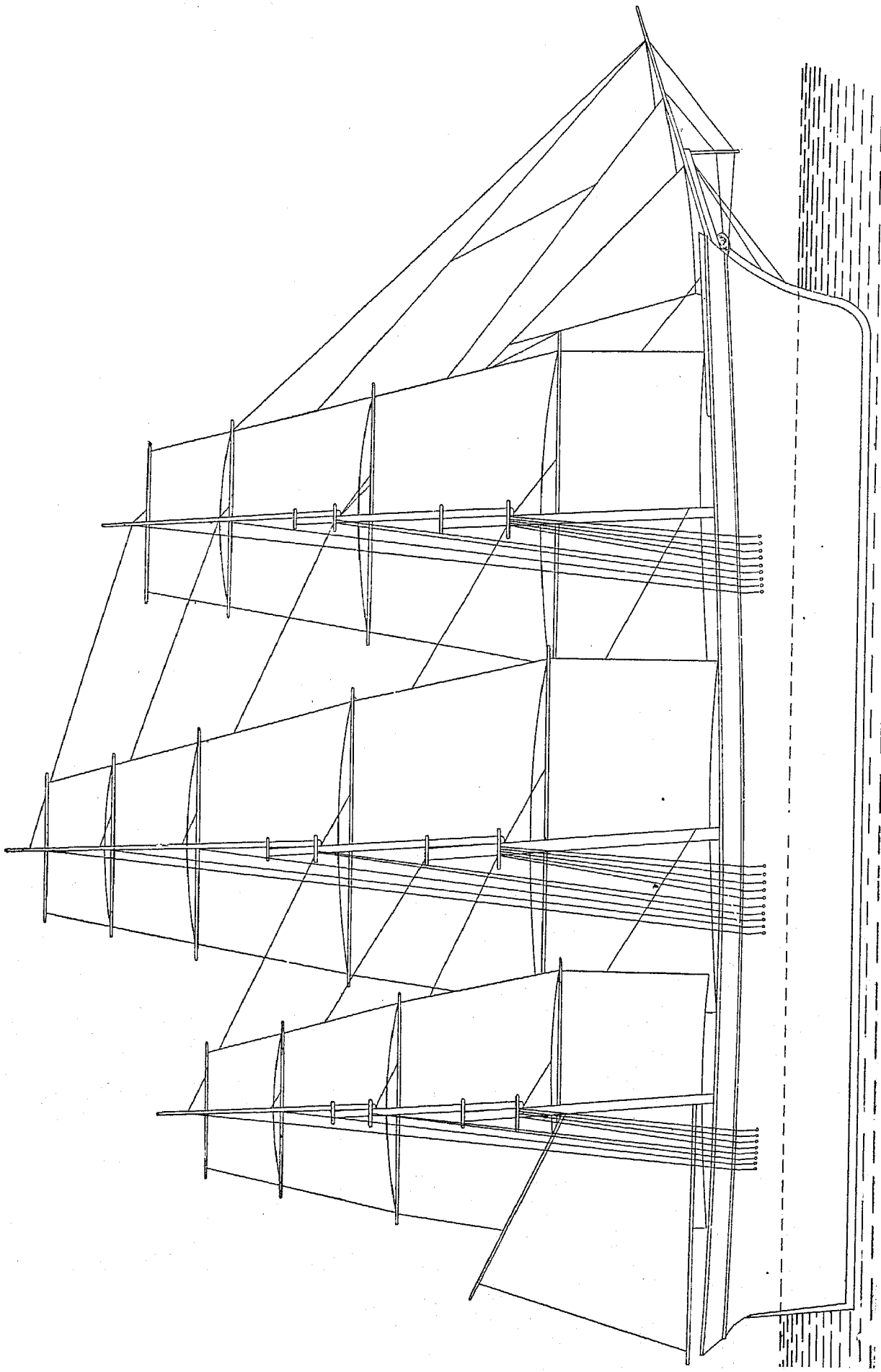


Fig. 33.—Sail plan of the Sovereign of the Seas.
Showing old-fashioned full topsails. Rake of masts, ¾, ¼ and 1½ inches to the foot, respectively.

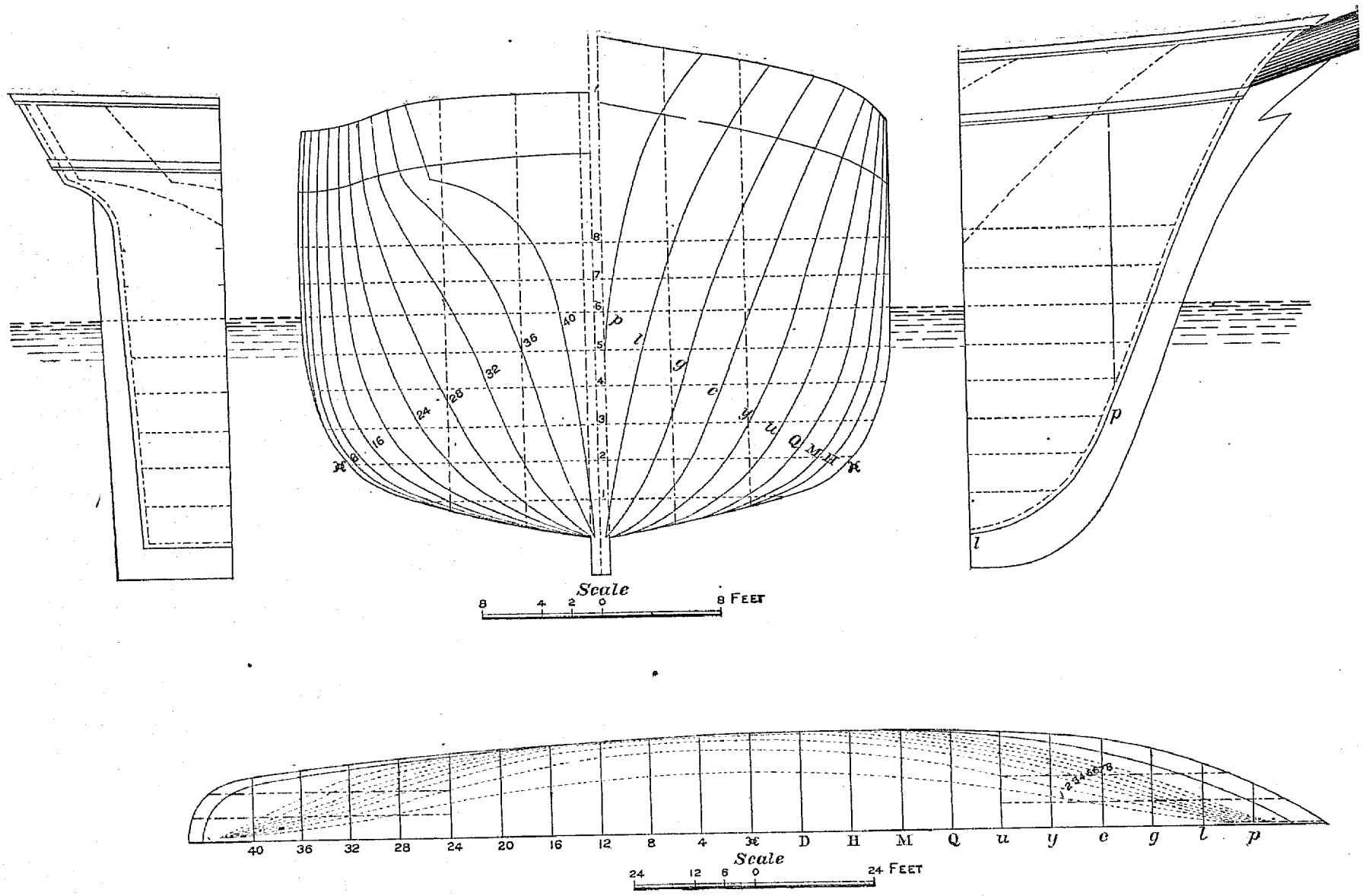


Fig. 34.—CLIPPER SHIP FLYING CLOUD.

Built at East Boston by Donald McKay in 1851. Register, 1,782 tons; displacement at 20 feet, 2,375 gross tons; displacement at 17½ feet, 1,951 gross tons; displacement per inch at 17½ feet, 13.91 gross tons; length on deck, 217½ feet; register length, 229 feet; length on load-line, 209½ feet; beam, molded, 40 feet; beam, extreme, 40¾ feet; depth, molded, 23¼ feet; coefficient of D., 0.5146; coefficient of load-line, 0.682; coefficient of midship section, 0.82.

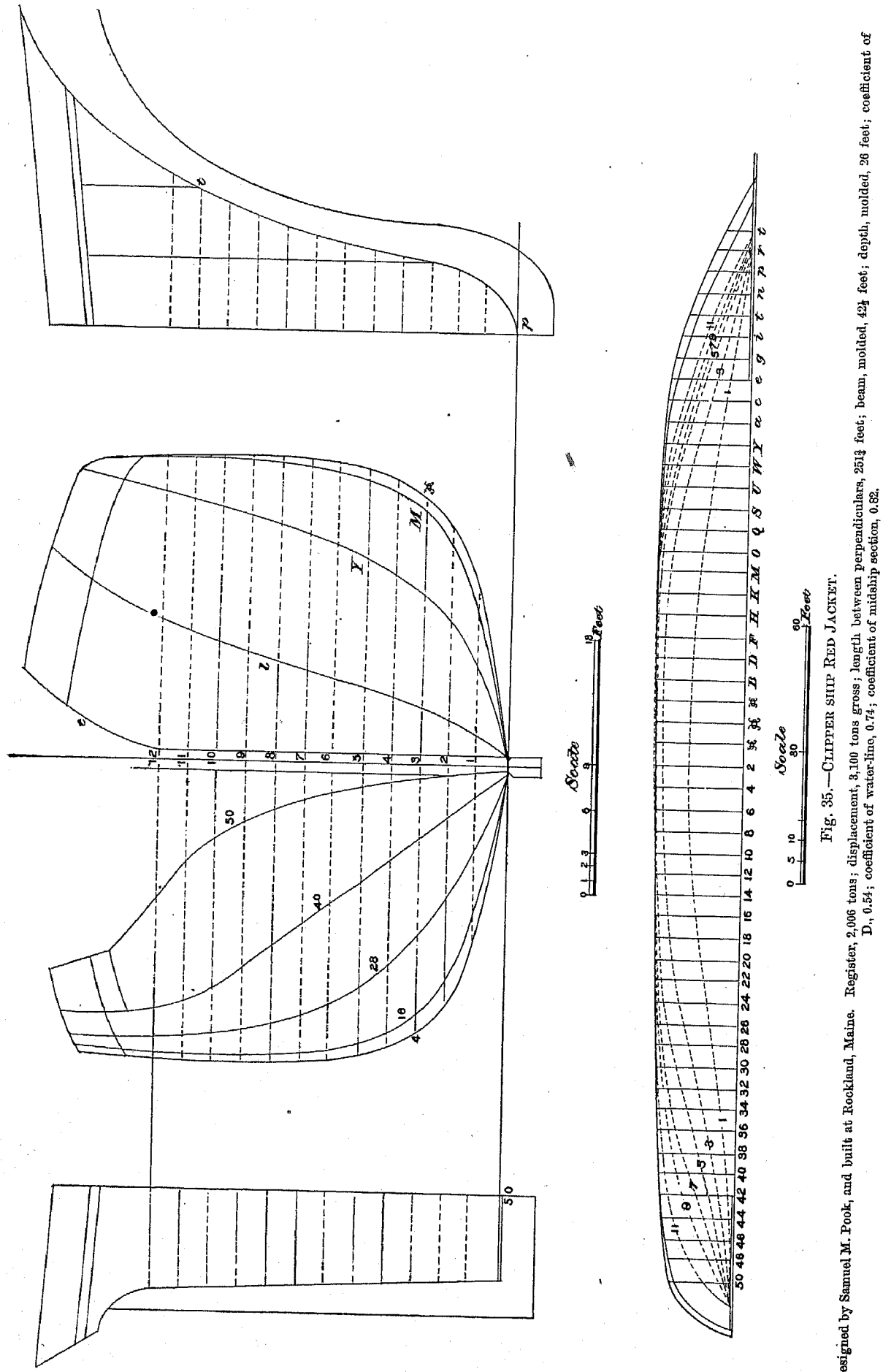


Fig. 35.—Clipper ship Red Jacket.

Designed by Samuel M. Pook, and built at Rockland, Maine. Register, 2,006 tons; displacement, 3,100 tons gross; length between perpendiculars, 251¼ feet; beam, molded, 42½ feet; depth, molded, 26 feet; coefficient of D., 0.54; coefficient of water-line, 0.74; coefficient of midship section, 0.82.

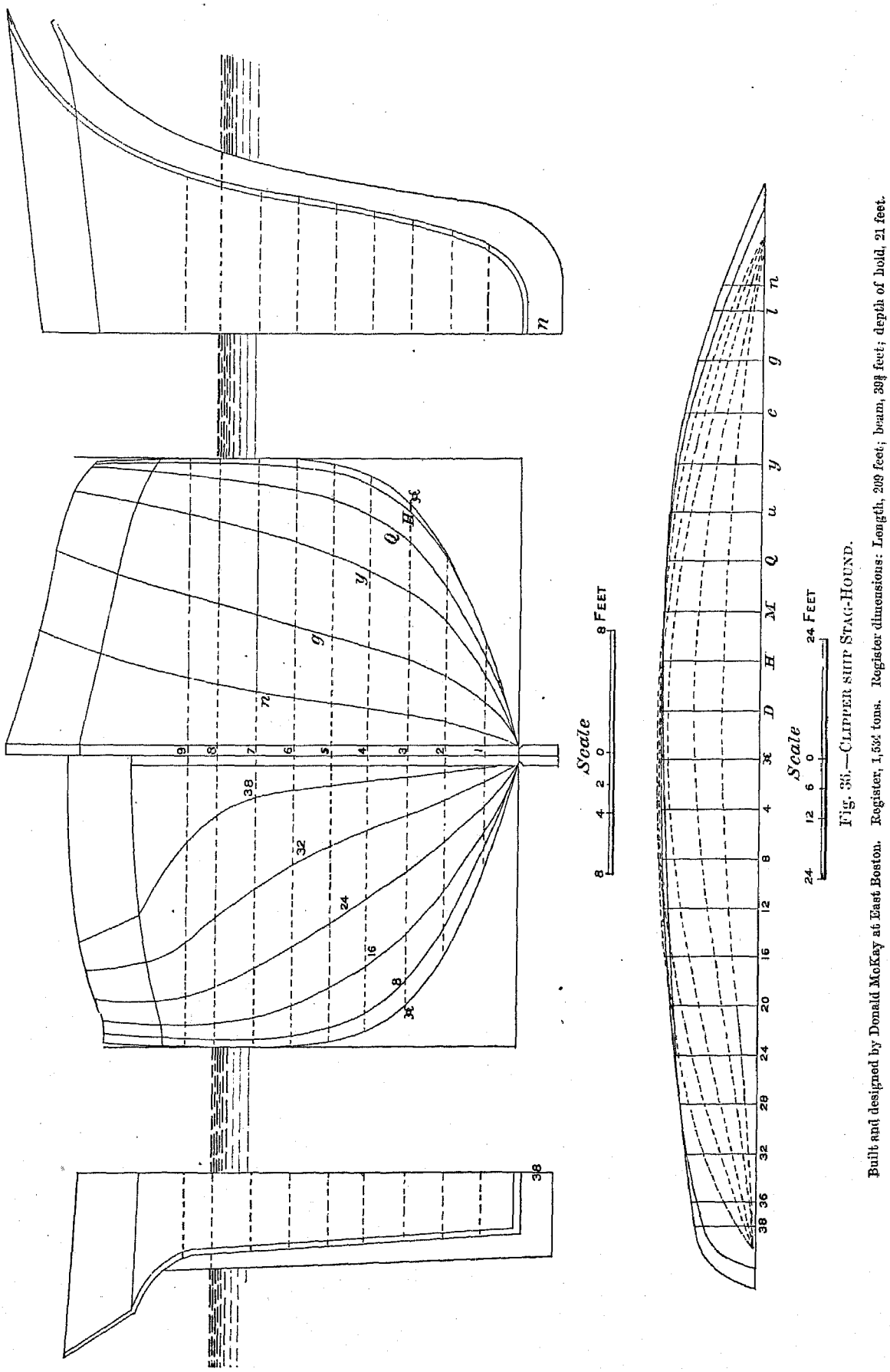


Fig. 35.—Clipper ship Stag-Hound.

Built and designed by Donald McKay at East Boston. Register, 1,534 tons. Register dimensions: Length, 209 feet; beam, 38½ feet; depth of hold, 21 feet.

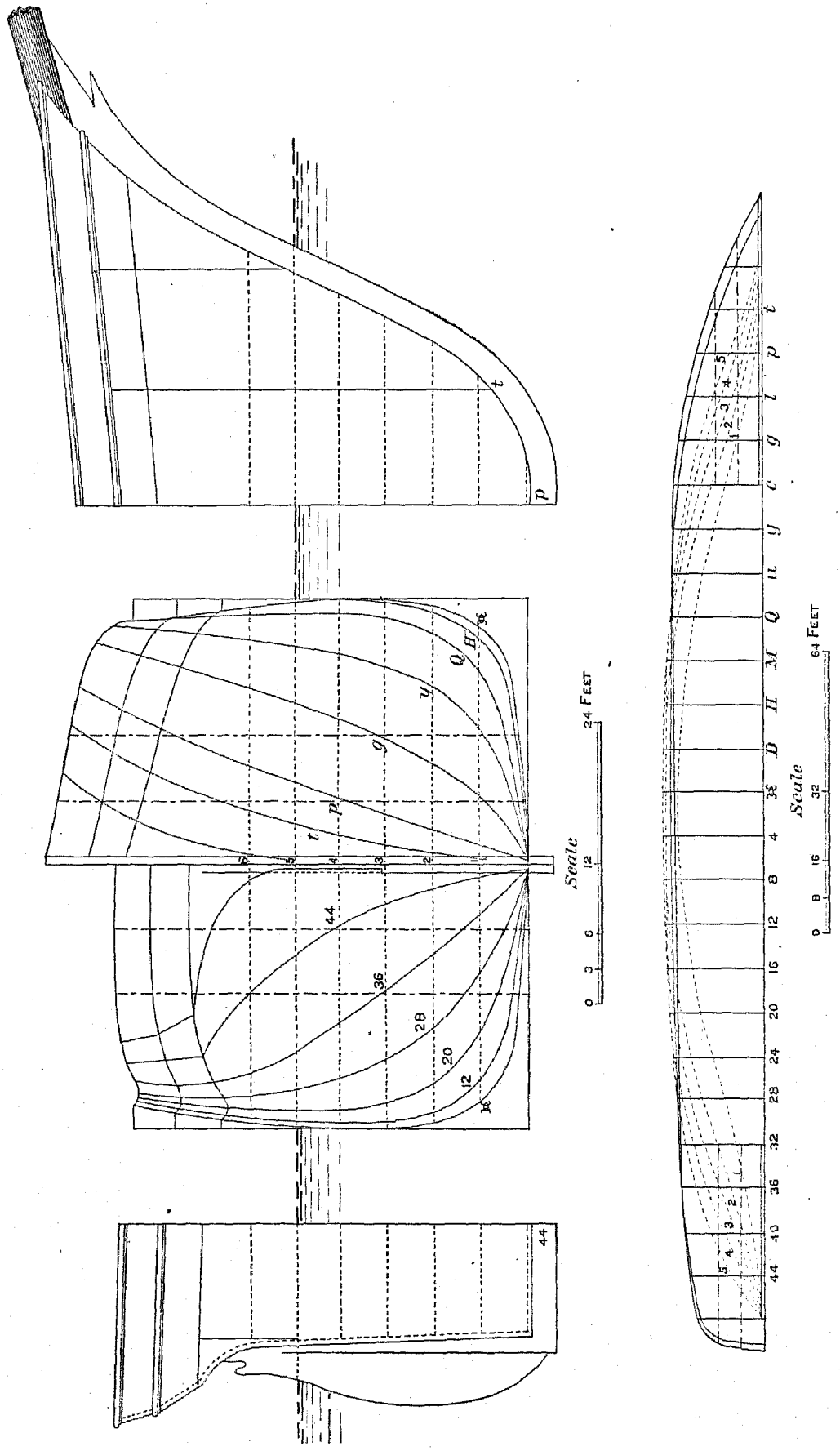


Fig. 37.—Clipper ship James Baines.

Built by Donald McKay at East Boston in 1854. Register, 2,515 tons; displacement to 22½ feet draught, 3,839 tons gross; displacement per inch at load line, 13¾ tons gross; register length, 266 feet; length on load-line, 240 feet; beam, molded, 45 feet; beam, extreme, 46½ feet; depth, molded, 30 feet; coefficient of D., 0.584; coefficient of load-line, 0.750; coefficient of midship section, 0.914.

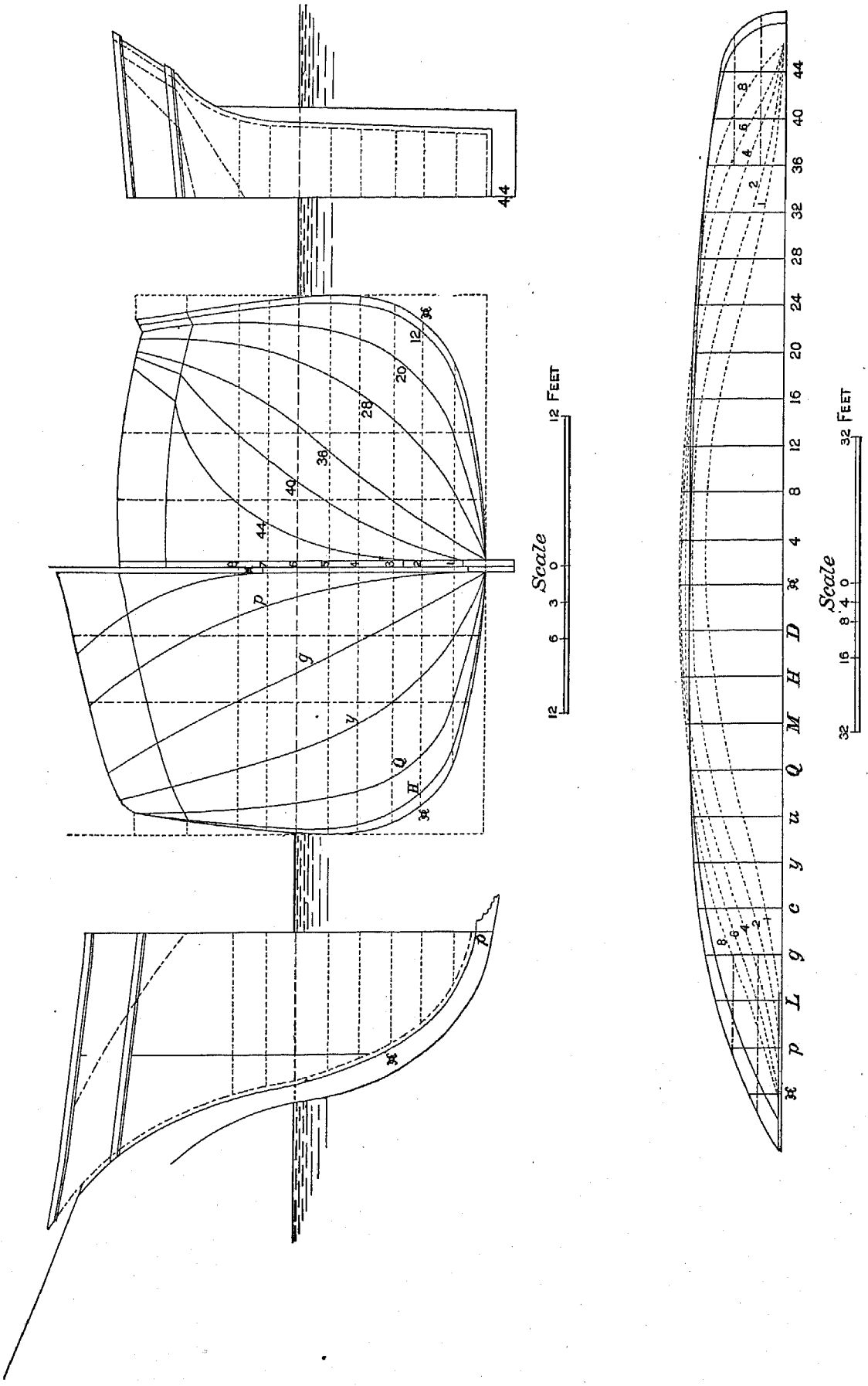


Fig. 38.—Clipper ship Lightning.

Built by Donald McKay at East Boston in 1854. Register, 2,084 tons; displacement at 16½ feet draught, 2,367 tons gross; displacement per inch at load-line, 16¾ tons gross; register length, 243 feet; length on load-line, 226 feet; beam, molded, 42½ feet; depth, molded, 25 feet.

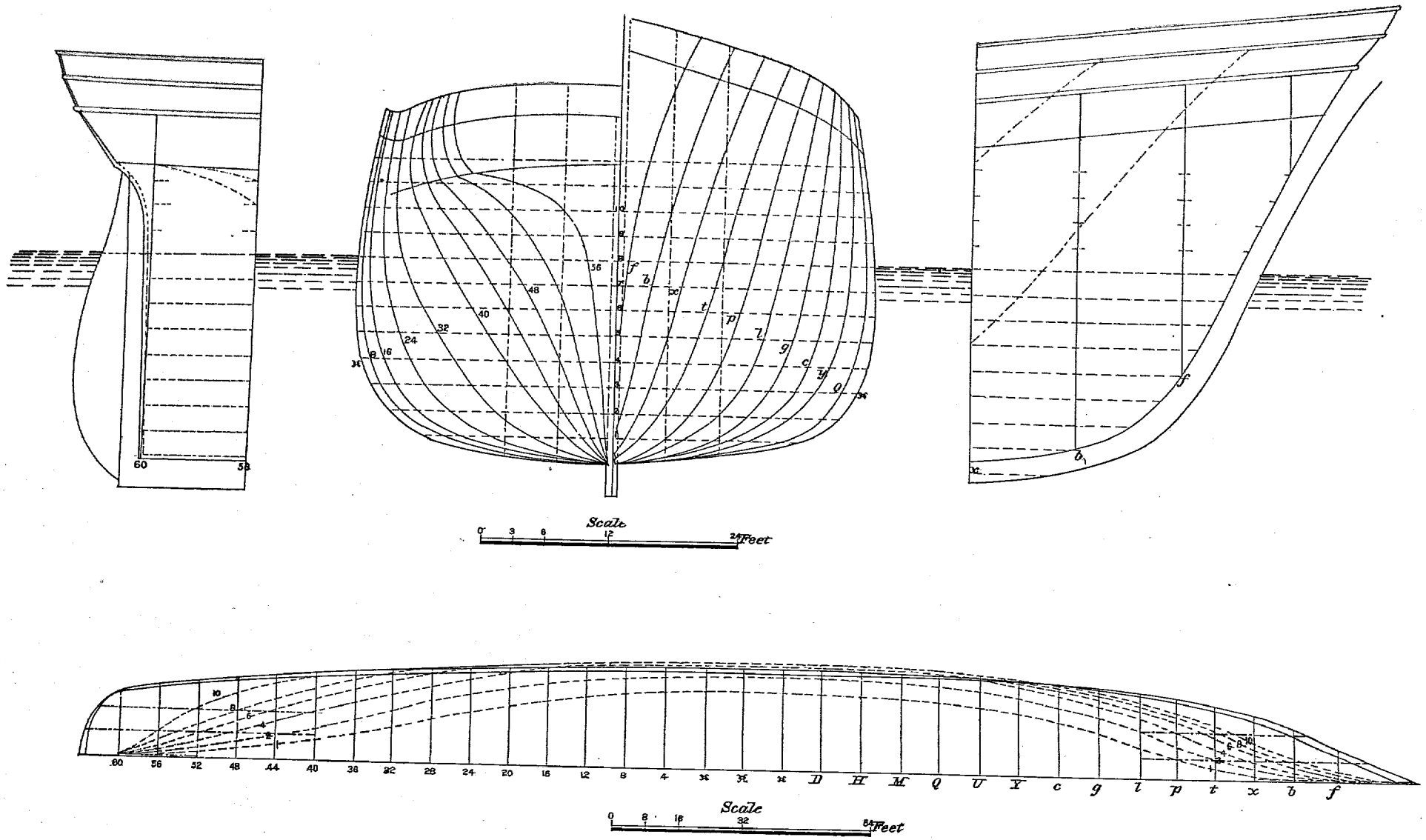


Fig. 39.—CLIPPER SHIP GREAT REPUBLIC.

Built by Donald McKay at East Boston in 1853. Register, 4,555 tons; displacement at 25 feet draught, 5,923 gross tons; displacement at 23 feet draught, 5,273 gross tons; displacement per inch at 23-foot water-line, 26⅞ gross tons; length on deck, 325½ feet; length on load-line, 314 feet; beam, molded, 49½ feet; beam, extreme, 50½ feet; depth, molded, 32 feet.

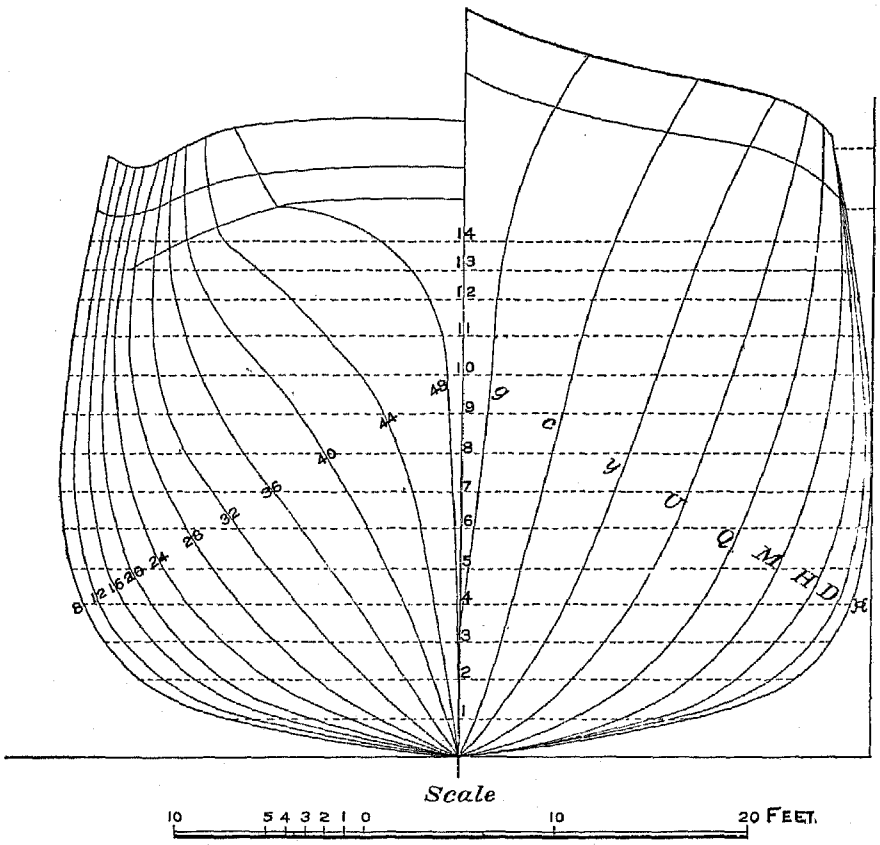


Fig. 40.—CLIPPER SHIP YOUNG AMERICA.

Built by William H. Webb at New York in 1853. 1,962 tons register; length, 236½ feet; beam 42 feet hold, 28¼ feet.

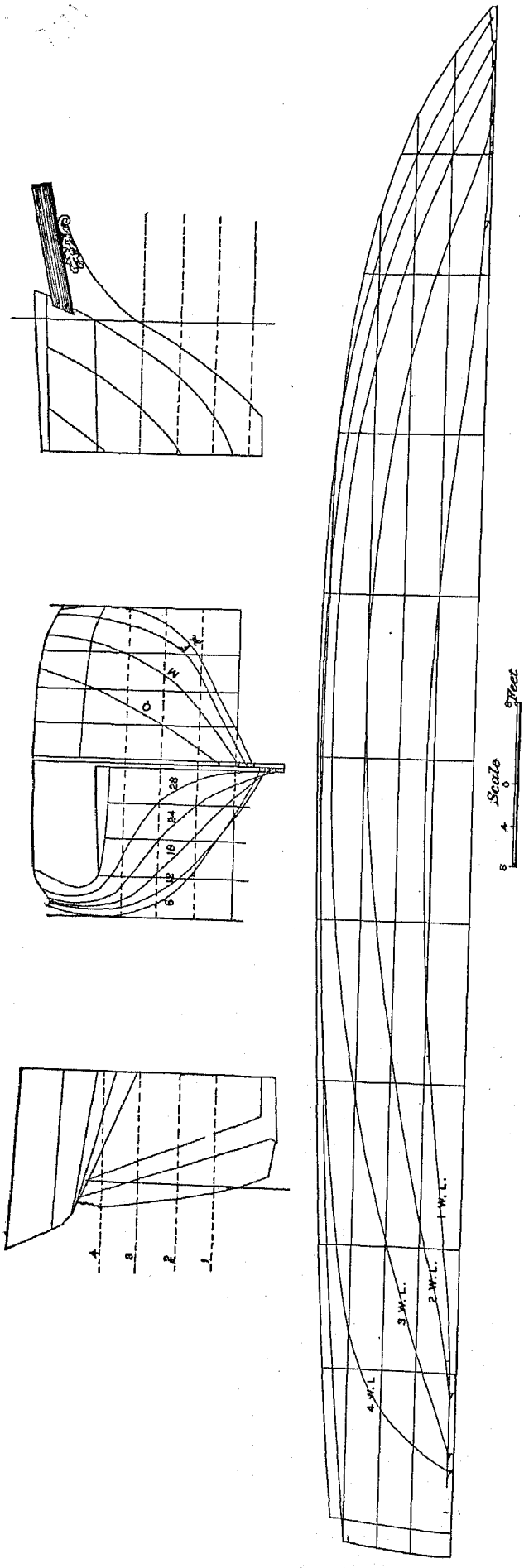


Fig. 41.—Clipper ship Ann McKim.
Built at Baltimore in 1832. Length, 143 feet; beam, 31 feet; depth, 14 feet.

The following are the more important facts relative to the principal clipper ships of the period from 1840 to 1861:

Year when built.	Name of ship.	Place where built.	By whom built.	Registered tonnage.	Dead rise to the foot, in inches.	Length on deck to after side of stern-post.	Depth molded to water-line.	Depth from keel to deck-plank.	Greatest breadth on planking.	Center of buoyancy forward of middle.	Displacement to water-line, net tons.	Cargo at load draught, net tons.	Coefficient of displacement.	Coefficient of midship section.	Coefficient of water-line.	Angle of entrance.	Angle of run.	Remarks.
.....	Mary Whiteridge.	Baltimore, Md ..	.....	.....	.....	*Feet.*	*Feet.*	*Feet.*	*Feet.*	.....	.....	.....	.....	.....	.....	.....	.....	Baltimore to Liverpool in 13 days, 7 hours.
1851	Flying Cloud . . .	Boston, Mass....	Donald McKay..	1,782	.....	229	.....	21½	40⅔	.....	.....	.....	0. 51	0. 82	0. 68	.....	.....	374 miles in one day; from New York to San Francisco in 89 days, 18 hours; in one day she made 433⅓ miles, but reducing this to exactly 24 hours, she made 427⅓ miles.
1851	Gazelle	New York, N. Y.	William H. Webb	1,244	5⅛	184	.....	22 9/12	38½	.....	.....	.....	.....	.....	.....	.....	.....	Sharp below and broad above.
1851	Comet	....do	....do	1,836	2¼	229	.....	24⅝	42	.....	.....	.....	.....	.....	.....	45°	75°	Beautiful model and good ship; she made many rapid voyages. Her first voyage was made from New York to San Francisco in 103 days, thence to Hong Kong in 37 days, and on the return she made 332 knots in 24 hours, and 1,512 knots in 120 consecutive hours; from San Francisco to New York in 86 days, and afterward in 76⅝ days; from New York to Liverpool in 19 days, and from Liverpool to Hong Kong in 84 days.
1851	Invincible	....do	....do	1,769	.....	221½	.....	27¼	41½	.....	.....	.....	.....	.....	.....	.....	.....	
1851	Challenge.....	....do	....do	2,006	3	230½	.....	27⅛	43½	.....	.....	.....	.....	.....	.....	30°	34°	A handsome, fast, and good ship; originally oversparred.
1851	Nightingale.....	Portsmouth, N. H.	Samuel Hanscom	1,066	.....	178	.....	21¾	36	1 5/12	1,240	.....	0. 47	0. 70	0. 74	44°	.....	In 1852, on the way home from China, she ran 336 nautical miles in 24 hours; the distance from Batavia roads to London, 13,726 nautical miles, she made in 70 days; in 1854 she ran from New York to Melbourne in 76 days, 16 hours.
.....	Trade Wind.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	New York to San Francisco in 75 days; homeward in 84 days.
1852	Sovereign of the Seas.	Boston, Mass ...	Donald McKay..	2,421	25	258	.....	28½	44½	.....	.....	.....	0. 52	0. 84	0. 60	.....	.....	From Honolulu to New York she ran 6,245 miles in 22 days; 436 miles in 1 day; for 4 days her average was 398; she made the trip to New York in 82 days.
1852	Flying Dutchman.	New York, N. Y.	William H. Webb	1,200	3½	187⅝	.....	24½	38½	.....	.....	.....	.....	.....	.....	.....	.....	She made 4,620 nautical miles in 16 days.
.....	Andrew Jackson	Boston, Mass....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	...	New York to San Francisco in 80 days, 4 hours.
.....	Euterpe.....	Rockland, Me...	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	From New York to Calcutta in 78 days.
1853	Flying Scud	Damariscotta, Me.	Metcalf & Norris	1,713	.....	221	.....	25½	41	.....	.....	.....	.....	.....	.....	.....	.....	From New York to Melbourne in 80 days; is claimed to have run 460 miles in 24 hours, but this is improbable.
1853	Panama.....	New York, N. Y.	Thomas Collyer.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	A fast but wet ship; rolling heavily; from Shanghai to New York in 85 days.
1843	Rainbow	....do	Smith & Dimon.	750	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
1844	Montauk.....	....do	William H. Webb	540	2¾	127	.....	19½	14½	.....	.....	.....	.....	.....	.....	70°	55°	
1850	Stag-Hound.....	Boston, Mass....	Donald McKay..	1,534	4	209	.....	23½	39½	.....	.....	.....	.....	.....	.....	.....	.....	Sailed from New York to San Francisco in 110 days; her mistake was in lack of stability and capacity.
1853	Young America.	New York, N. Y.	William H. Webb	1,902	2	236½	.....	28¼	42	.....	.....	.....	.....	.....	.....	45°	55°	A very fast and popular ship, which made many rapid voyages. She was always fast. Five trips from San Francisco to New York were made in from 83 to 92 days, and the voyage was once made in 83 days, loaded; five trips were made in from 97 to 101 days. She once ran from New York to Liverpool in 18 days, and back in 23 days; from Liverpool to Melbourne in 81 days; from San Francisco to Liverpool in 102, 103, 105, and 106 days, and one return voyage in 99 days.

Year when built.	Name of ship.	Place where built.	By whom built.	Registered tonnage.	Dead rise to the foot, in inches.	Length on deck to after side of stern-post.	Depth molded to water-line.	Depth from keel to deck-plank.	Greatest breadth on plank-ing.	Center of buoyancy forward of middle.	Displacement to water-line, net tons.	Cargo at load draught, net tons.	Coefficient of displacement.	Coefficient of midship section.	Coefficient of water-line.	Angle of entrance.	Angle of run.	Remarks.
						Feet.	*Feet.*	*Feet.*	*Feet.*									
1854	Lightning	Boston, Mass.	Donald McKay	2,084	228	243	15½	25	42⅜	....	2,590	.....	0. 52	0. 84	0. 71	14°	....	Ran 436 miles in 24 hours, drawing 22 feet of water; from England to Calcutta, with troops, in 87 days, beating other sailing vessels by from 16 to 40 days; from Boston to Liverpool in 13 days, 20 hours; Liverpool to Melbourne, 77 days, back in 64; again in 75 and 65; once in 63.
1854	James Baines	do	do	2,515	.....	266	.....	31	46 7/12	....	.....	.....	....	....	....	.....	.....	From Boston to Liverpool in 12 days, 6 hours; from Liverpool to Melbourne in 62½ days; a return was made in 60 days.
1853	Red Jacket	Rockland, Me.	.....	2,006	.....	260	.....	26¾	44	3 5/12	3,460	.....	0. 54	0. 82	0. 74	42°	....	From New York to Liverpool in 13 days, 11 hours, 25 minutes; New York to Melbourne, 69 days, 11 hours; from New York to Fastnet Light, 10 days.
.....	Northern Light	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	From San Francisco to New York, 72 days; to Boston, 76 days, 8 hours.
.....	Dreadnaught	Boston, Mass.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	Honolulu to New Bedford, 13,470 miles, in 82 days; from Sandy Hook to Liverpool, 13 days, 8 hours.
1869	Glory of the Seas	do	Donald McKay	2,102	.....	240½	.....	30 7/12	44 1/12	....	.....	4,000	....	....	.....	.....	....	With 4,000 tons of cargo ran 161 miles a day for over three weeks; from New York to San Francisco in 94 days.

The enthusiasm of the times found expression in the names of the clippers and in the literature of the day, and no title was too grand for a good ship. The song of the day was:

An open sea and a flowing sail,
A clipper ship and a driving gale;
A golden broom at the gallant mast
That fearless sweeps the ocean vast.

A great many improved appliances were invented for use on the clipper ships, among them the idea of double topsails. Captain R. B. Forbes, of Boston, was the first to divide the enormously large and high old-fashioned topsail and make the lower topsail yard stationary at the cap of the lower mast-head. He made the mast-heads long, to suit the rig. The upper topsail yard kept the place occupied by the original yard, and was raised and lowered in the same manner. This idea was not original with Captain Forbes, for he saw topsail schooners as long ago as 1819 with topsails hoisted on the head of the lower mast and a square sail above on a pole mast; but he was the first to revive the old idea and apply it, in 1841, first to schooners and afterward to ships, to obviate the extreme size to which topsails had grown. Captain Forbes also invented the idea of topmasts fidded abaft the lower mast-head, in order to house them without interfering with the lower yards. This idea did not become popular, but double topsails did after 1850, and are now a common rig throughout the world.

As American clippers gave to their builders a world-wide reputation, this had the practical effect of bringing millions of dollars' worth of business to the United States from foreign countries, especially from the governments of Spain, France, Turkey, Italy, and Russia, and frigates of great size, strength, speed, and cost were built in large numbers for those governments in New York, Philadelphia, Boston, and elsewhere. American ships were in demand in all parts of Europe for the merchant service, and a number of private fortunes were accumulated by builders in filling the profitable foreign orders which were continually coming to this country.

The construction of great ships led to some changes in the manner in which mechanical labor was performed at the ship-yard. In the first place, the labor became differentiated. The old fashion was for the ship-carpenter to be a man of all trades. He would aid in hewing out the frames and setting them up; would line out his streak of planking on the timbers of the ship, dub off the surface of the frames so that the plank might fit truly, put on the plank, bore the holes for the treenails and bolts, fasten the plank, and perhaps even calk the seam; but when business became active this plan would not do, and the work was divided, the separate parts being allotted to different gangs of men, and carpentry, calking, fastening, joining, painting, etc., all became different trades—a system under which time was saved and better work secured. Various devices were introduced to save labor. Previously all the frame timbers were hewed out of the rough log or the flitch plank with broad-axes in the hands of men, and timbers that needed to be cut lengthwise were sawed through by two men by hand; but Donald

McKay set up in his yard in East Boston a steam saw-mill to perform both of these operations. The saw was hung in such manner that it could be tilted first one way and then another while in motion, and thus all the frames could be sawed out to the proper bevel by three men as fast as twelve men could put them together and set them up. All the heavy sawing being done by steam, the work of the yard was immensely facilitated, and a frame could be got out and put together in less than one-third the time it formerly took. Another improvement was effected by setting up a derrick in the yard to lift the heavy timbers and beams to their places in the ship. That work had previously been done entirely by manual labor, and in building a vessel the master carpenter always required a force large enough at any rate to pick up a large keelson piece or a beam and carry it on their shoulders to its home on the vessel. The heavy ceiling and planking had to be carried from the steam-box to the vessel in the same way. There was an immense loss of time in this clumsy and laborious way of doing business, as all hands had to be called off from the work from time to time, often as much as once an hour, to spend twenty minutes or more in carrying about a huge plank or stick of timber. To change this teams of oxen and horses were brought to drag the pieces about and large derricks were set up, worked by other teams, to lift them to their place. Various other devices were adopted from time to time by smart builders. Treenails were formerly made by hand in the shed on rainy days, and were chopped out of sticks of wood with axes; but a treenail lathe machine was invented to do this work. A machine worked by a hand lever was also invented to cut the long, round bars of iron into suitable lengths for bolts. These bolts had previously been cut by hand with a hammer and cold-chisel. The auger was also improved; and the saving of labor by these various improvements was worth thousands of dollars to the builder of a large vessel, and aided greatly to cheapen the cost of a ship. These improvements were adopted chiefly in the cities of Baltimore, Philadelphia, New York, and Boston, the country towns still adhering to the old-fashioned way of doing things. It was long before Bath, Maine, bought even a bevel saw, and the first that went there was the one previously used by Donald McKay, which was sold after he had built his last ship in 1869. To this day the bevel saw, derrick, and bolt-cutter are unknown in the majority of the ship-yards of the Atlantic coast outside of the five cities above named.

Changes also took place in the kinds of timber used for building ships, as about 1835 the supply of oak timber began to grow scant in New England. Two hundred years of occupation and settlement, with the pursuit of ship-building and other industries, having nearly cleared the primitive forests from such parts of the country as were accessible from water-courses, southern timber was now finding its way plentifully to the northern markets, and between 1830 and 1840 was introduced into the ship-yards. The peninsulas of Delaware, Maryland, and Virginia were overgrown with splendid forests of towering white oak, and the getting out of the timber for the frames of vessels in that region soon became a regular industry. A complete set of patterns, or molds as they are called, having been made for the timbers of the vessel, they were turned over to contractors, who went out into the woods in the winter time with a party of men armed with axes. The party encamped in rough board or log huts, and remained until the trees had been felled and the complete frame of the ship hewn from them. Each piece was then marked, and the whole was hauled to the nearest water-course before the snow disappeared in the spring and put aboard a coasting schooner and sent north. This industry of getting out frames on these peninsulas is still a marked feature of ship-building as now pursued on the north Atlantic coast, nearly all the frames of the large New England ships being now obtained from the region named.

Southern pitch-pine timber was also introduced, the sticks of which could be obtained of such great lengths that they strengthened the ship. This timber was first used for beams and decking and the various longitudinal ties, such as water-ways, clamps, keelsons, etc.; but as soon as the insurance companies were induced to approve of pitch-pine its use also became general for the ceiling and planking of ships, its great length making it desirable for both purposes. Pitch-pine remains the favorite wood for all the parts of a vessel of over 100 tons except the stem, keel, stern-post, and frames, for which oak, hard wood, and hackmatack are preferred. For the masts and spars preference is given to white pine and spruce, but a great many lower masts are made of strips of oak or maple and yellow pine, doweled, bolted, and hooped over with iron. Topmasts and bowsprits are frequently made of pitch-pine sticks.

There was a difference in the cost of ships in this period in favor of American owners. In 1825 a 300-ton ship cost from $75 to $80 per ton in the United States, from $90 to $100 per ton in Canada, and from $100 to $110 per ton in England. In 1847 a large ship, first class in every respect, cost from $75 to $80 per ton here, against $87 to $90 in England.

The interest felt at this day in the ships of the clipper period centers principally in those of the largest size, as large ships alone will now do for transoceanic trade.

The Champion of the Seas, of 2,448 tons, was built by McKay for James Baines & Co.'s Liverpool and Australian line of clippers. This firm owned 20 first-class sail in that trade, and had under charter about as many more. The following are the principal details of this ship: Length of keel, 238 feet; length on deck, 252 feet; extreme beam, 45½ feet; depth of hold, 29 feet; dead rise at half-floor, 10 inches; swell of sides, 10 inches; sheer, 4½ feet. The concavity of load-line forward was 2½ inches, the bow above flaring decidedly outward. Figure-head, a sailor, hat in right hand, left hand extended. Keel, white oak and rock maple, sided 16 inches, the upper part molded 20 inches, the lower 12 inches; false keel, 6 inches; four scarfs, 12 feet in length, fastened with ten 1-inch copper bolts. Stem,

white oak, sided 16 inches, molded 20 inches at the head and 26 inches at the foot, in two pieces; main stem bolted to the keel with copper bolts. The gripe of white oak tapered to 4 inches at the front edge. The stern-post was of white oak, sided 16 inches at the keel, 20 inches at the top; molded 24 inches at the keel, 21 inches at the top, and fastened to the keel with 16 bolts of 1¼-inch copper. Deadwoods white oak, sided 16 inches, fastened with 1¼-inch bolts of iron and copper. The entire frame was seasoned white oak. Room and space, 30 inches; timbers sided 12 and 14 inches over the keel and molded 20 inches, so that the double frame was 26 by 20 inches. The second futtocks sided 12 to 13 inches, and each succeeding shift of timbers diminished in siding to 10 inches at the plank-sheer and 9 inches at the rail. Frames molded 13 inches at the bilge, 11½ inches at the lower deck, 9 inches at the middle deck, 7 inches at plank-sheer, and 6 inches at rail, and tapered truly between these points. Floor timbers 24 feet long, and the timbers of each frame fayed closely from keel to plank-sheer. From four to seven iron bolts in each futtock, from 1 to 1⅛ inch in diameter. Every second floor was bolted to the keel with 1⅛-inch copper bolts, driven through and clinched. Cant frames tenoned and bolted to deadwood with 1⅛-inch bolts. Apron white oak, sided 30 inches at the bowsprit, and fastened to the stem with 1¼-inch bolts 18 inches apart. Inner stern-post molded 20 inches at the head, 16 inches at the foot. Stern-post knee, the arms 16 and 7½ feet long, molded 46 inches in the throat. Stern timbers, the two at the side of post 10 by 14 inches, with 1⅛-inch bolts through the post; other stern timbers 10 by 10 inches. Main keelson pitch-pine, in three tiers, 64 inches deep in all, sided 16 inches, the lower piece fastened to every other floor with 1¼-inch copper bolts, the bolts going clean through keel, the second tier with 1⅜-inch iron bolts, going to within 2 inches of the lower edge of the upper piece of the keel; 1⅜-inch iron bolts through the upper piece of the keelson down through the navel timbers. Scarfs of keelson, 8 feet; sister keelson, 14 by 30 inches, bolted with 1¼-inch iron through every futtock. Ceiling on bilge, and thence to deck, 14 inches thick, bolted to every timber, and fastened edgewise with iron bolts every second frame space, all of pitch-pine. Clamps 14½ inches, bolted edgewise to the next strake below. Beams of lower deck pitch-pine, sided 15 inches, molded 14 inches at middle and 10½ inches at ends. Middle deck beams, sided 15 and 16 inches, molded 15 inches at middle and 10½ at ends; upper deck beams, 16 by 10 inches. Lower deck knees white oak; arms 6½ to 7 and 4½ to 5 feet; sided 11 and 12 inches; 24 inches thick in throat; twenty 1⅛-inch bolts through each knee; lodging knees, sided 8 inches, molded 30 inches in the throat, eight bolts through each knee. Middle deck hanging knees oak, sided and molded about 1 inch less than above, and arms a foot or two shorter; lodging knees sided 8 to 9 inches. Upper deck hanging knees, hackmatack; arms 4½ feet, sided 10 to 12 inches; 21 inches in the throat; 1 and 1⅛ inch bolts; lodging knees hackmatack, sided 7 inches. Lower deck water-ways, of pitch-pine, lay flat on ends of beams 14 inches deep, 15 inches wide, 6 feet scarfs, riveted to every timber with 1⅛-inch iron rivets, and bolted to the clamps; a binding strake, 10 by 12 inches, on beam outside of water-way; deck plank, yellow pine, 3½ inches thick, 6 inches wide; thick strakes in the middle of the deck to receive stanchions, two 14 inches wide by 6 thick. Two standing strakes above water-way, each 20 inches wide and 10 inches thick. Main deck clamps, pitch-pine, 14 by 10 inches; water-way, 15 by 14 inches; binding strake, 12 by 10 inches; deck plank, 3½ inches, 6 and 7 inches wide; thick strakes in middle, 5 inches thick; standing strakes above water-way, two 18 inches wide by 10 inches thick; the upper deck clamps 15 inches wide by 10 thick; water-way 14 inches wide, 12 inches deep, fastened with 1⅛-inch iron bolts; binding strake, 8 by 10 inches; deck plank, pitch-pine 3½ inches thick by 6 inches wide. Partners of mainmast and foremast, 15 by 15 inches; of mizzen-mast, 14 inches thick by 15 inches wide. Plank-sheer and main rail, 6 by 15 inches. Planking, all pitch-pine; garboard, 15 inches wide, 9 inches thick; the next strakes, 14 inches wide by 8 thick, and 14 inches by 7; bottom plank to bilge, 7 to 5 inches thick; wales, 24 strakes, 7 inches wide, 6 thick; waist plank, 4½ inches thick. The bulwarks, solid like a man-of-war, 4½ feet high, with monkey rail, strapped diagonally on the outside of frames with bands of iron 5 inches wide, ⅞ of an inch thick, and 38 feet long. Top-gallant forecastle for crew; aft of foremast, a house 50 feet long, 18 wide, 6½ high, with kitchen, second-class cabin, and state-rooms for forward officers. A double staircase from the forward part of the house leads to the deck below. Aft of the mainmast a house 16 feet square, with chief mate's state-room and large staircase leading to the vestibule below, from which the cabins are entered. Aft of the mizzen-mast was a house for smoking-room, to shelter helmsman and approach to staircase to captain's cabin below. All the passenger cabins were below and aft. The after one, 30 feet long, 14 feet wide, and 7½ feet high, had two recess sofas, with costly mirrors, pictures, tables, carpets, gilding, panels, etc. The dining saloon, 40 feet long, was plainly finished, and the pantry, mess-room, bath-room, and other apartments were grouped around the entrance to the dining saloon. The deck forward of the cabins was fitted up for accommodation of the passengers. There were also arrangements below this deck for passengers, for use if needful. Her spars were as follows:

	Diameter.	Length.	Mast-heads or yard-arms.		Diameter.	Length.	Mast-heads or yard-arms.
	Inches.	*Feet.*	*Feet.*		*Inches.*	*Feet.*	*Feet.*
Foremast	40	63	17	Jib-boom	21	a16, 15, 6	
Foretop	20	47	10	Foresail yard	24½	88	5
Foretop-gallant	15	26		Fore-topsail yard	19½	69	5½
Fore-royal	13	17		Foretop-gallant	19½	51	4
Fore-royal pole		8		Fore-royal	9	37	2
Mainmast	42	71	17	Mainsail-yard	24½	95	5
Main-topmast	20	50	10	Main-topsail yard	19½	74	5½
Main-top-gallant	15	27		Maintop-gallant	13½	54	4
Main-royal	13	17		Main-royal	9	42	3
Main-royal pole		12		Cross-jack yard	20	74	4½
Mizzen-mast	36	61	14	Mizzen-topsail yard	15	57½	5
Mizzen-top	16	42	9	Mizzen-top-gallant	9½	42	3½
Mizzen-top-gallant	12	24		Mizzen-royal	7	30	2
Mizzen-royal	10	15		Spanker boom		58½	
Mizzen-royal pole		8		Spanker gaff		42	
Bowsprit	40	a 22		Main spanker gaff		22	

a Outboard.

Mast-heads and yards painted black; lower masts, white; studding-sail booms unpainted, but with black ends; hemp rigging; chains and iron work for bobstays, bowsprit shrouds, martingale stays and guys, topsail sheets and ties, patent trusses, iron futtock rigging, caps, etc.; three backstays on each side to fore and main topmasts; double top-gallant backstays; 12,500 yards of canvas in the sails. This ship was painted black outside and white inside, with blue water-ways.

The Ocean Monarch, of 2,145 tons register, built by William H. Webb, at New York, was 240 feet long over all and 46 feet wide, with 30¼ feet depth of hold, 3 decks, a forecastle for 50 men, two deck-houses, and a large after-cabin. She had 7 hatchways. The keelsons were of five tiers of white-oak logs from 50 to 64 feet long. The side keelsons were 3 logs deep, and were placed at the floor heads. The timbers were of live oak and locust, at least the principal pieces; the rest were white oak and cedar. The frames were spaced 30 inches, and the keel sided 16 inches. The between-deck spaces were 7 and 7½ feet. This ship was double strapped with 4½ by ⅝ inch iron, and could carry 900 passengers and 4,000 tons of cargo. A year after she was built this strong and handsome ship, on account of being improperly loaded, was thrown on her beam-ends in a violent gale, and foundered in consequence.

The Great Republic (Fig. 42), built in 1855 by McKay, was 334½ feet long, with 53½ feet beam and 38 feet depth. For 60 feet from the bow the keel gradually rose from a horizontal line and curved upward into an arch, blending with the stem, and was of rock maple, two tiers, 16 by 32 inches, with five 12-foot scarfs, the end tiers being in six pieces; shoe, 4½ inches. The frame was of seasoned white oak; dead rise, 20 inches. The floor timbers sided 13 and 14 inches, and were molded 22 and spaced 28 inches from center to center; the timbers tapered to the plank-sheer, where they were from 11 to 13 inches in siding and 8 inches in molding. Molding on the bilge 14 inches; at the main deck 12½ inches; and the frames were bolted together and the ends of the timbers wedged. The floors and first futtocks were 25 feet long, and the stem was molded 30 inches at the foot, 26 inches at the head, with the cutwater tapered to an edge. The apron was 51 inches through, with heavy stemson inside, and the bolts in the stem, apron, and stemson were of 1¼-inch copper, and about 6 inches apart. The stern-post was oak, in three upright pieces, molded in all 5½ feet, and was sided 16 inches at the keel and 24 inches at the top. The stern knee was sided 16 inches and molded 36 inches in the throat, with arms 8 and 20 feet in length scarfed to the lower keelson and bolted with copper. The frames on the inside were strapped with iron by braces 4 inches wide, 1 inch thick, and 36 feet long, there being 90 straps on each side of the ship. The keelsons, ceiling, and deck frames were of pitch-pine. The midship keelson was in four tiers, 15 by 60 inches in all, and the sister keelsons in three tiers, the first two of which were each 15 by 15 inches, while the upper one was 12 by 14 inches, and all were wedged, bolted, lock-scarfed, and keyed. There were two 1⅜-inch copper bolts driven through every floor timber and the keel, the first through the timber and keel alone, the other also through the two lower tiers of the keelson, and riveted. Iron bolts were driven through all the navel timbers and keelsons into the keel, and the sister keelsons were bolted diagonally through the navel timbers into the keel and horizontally through the midship keelsons. Whole depth of backbone, 9 feet 10 inches; ceiling (nine strakes), 10 by 12 inches on floor, square fastened through frames and edge-bolted every 5 feet; over the floor heads two bilge keelsons, each 15 inches square and in two depths, square-bolted with 1¼-inch iron through each timber and edge-bolted with 1⅛-inch iron; ceiling of floor, 10 inches. The bilge was double ceiled with 6- and 9-inch stuff, square-fastened and edge-bolted at every second beam, the double ceiling extending to a lap-streak, 6 by 15 inches, on which the lower edge of the hanging knees rested. The lower deck clamps, in two depths, were 6 and 10 inches thick; the beams of the lower and main decks 15 by 16 and 18 inches amidships, tapering to 12-inch molding at the ends, there being 38 beams to the lower and 40 to the main deck; while the upper deck beams, forty-one in number, were 12 by 20 inches in the center, tapering

to 10-inch molding at the ends, twenty-five of them being double and bolted together, and the spar-deck beams varied in size and were close together, there being eighty-nine of them. The lower- and main-deck hanging knees were of oak, sided from 10 to 13 inches and molded from 22 to 24 inches in the throats; bodies, 5 to 6 feet long; arms, 4 to 4½ feet, each fastened with twenty 1¼-inch bolts; and the lodging knees were also of oak. The upper- and spar-deck knees were of hackmatack, and were all light and diagonal. Between the main and upper decks the ceiling had diagonal braces of pitch-pine from the throat of one hanging knee to the foot of the one next aft, bolted through ceiling and timbers. The lower deck clamps were 12 inches wide, in two thicknesses, 6 and 9 inches; the water-ways 16 inches square, the binding strake 12 by 14 inches, and the standing strake 24 inches wide by 10 inches thick. Main-deck clamps, 16 inches wide, 10 inches thick; water-ways, 16 inches square; binding strake, 12 by 10 inches; standing strakes, 18 by 12 inches thick; filling-in strakes to deck above, 8 inches thick, 14 inches wide. Upper-deck clamps, 12 inches thick, 15 inches wide; water-ways, 12 inches deep, 15 inches wide; binding strake, next the water-ways, 10 by 8 inches. Ceiling up to the spar-deck, 3½ inches; planking of lower three decks, 3½ inches, of pitch-pine; of spar-deck, 3 inches. Plank-sheer at upper deck, 16 by 7 inches; one at spar-deck 7 by 20 inches, having upon it a chock 12 by 6 inches, into which turned stanchions are fitted, supporting a main rail, 3½ feet high from the deck, 5 by 12 inches square. Beam-stanchions of hold, 8 by 24 inches, tenoned into the keelson and strapped with iron to the same; also strapped at the head over the beam and to the heel of the stanchions of the deck above. This system was carried clear to the spar-deck. Planking: First garboard, 10 inches thick, 14 inches wide, bolted clear through into the opposite garboard with 1⅛-inch bolts 5 feet apart, and through every third frame into the sister keelson; next strake 9 inches thick, 14 inches wide; the next 8 inches. Bottom plank, 6 inches thick, 14 inches wide, treenailed with 1¼-inch locust through the timbers; butt bolts, 1-inch copper. Bilge planking, 8 inches thick, 12 inches wide, four in number and projecting, square treenailed with 1¼-inch locust, with a copper bolt driven into every fourth timber of the frame. Wales, 6 inches thick, 8 inches wide, double and single fastened. Waist plank, 5 inches thick, 6 and 7 inches wide, treenailed and iron butt bolted; plank above plank-sheer, 4 inches. There were heavy hooks and pointers of white oak, three in the forward hold 30 to 40 feet long and 11 by 12 inches in section, one under each of the decks. The ship had four masts, the after one being called the spanker. The other lower masts were built of pitch-pine, doweled, bolted, and hooped with iron. Her spars were as follows:

	Diameter.	Length.	Length of head or yard-arms.
	Inches.	*Feet.*	*Feet.*
Foremast	44	130	36
Foretop-mast	24	76	12
Foretop-gallant	18	28	
Fore-royal	15	22	
Fore sky-sail mast	11	19	
Fore sky-sail pole		12	
Mainmast	44	131	36
Main-topmast	24	76	12
Main-top-gallant	18	28	
Main-royal	15	22	
Main sky-sail mast	11	19	
Main sky-sail pole		12	
Mizzen-mast	40	122	33
Mizzen-topmast	22	69	10
Mizzen-top-gallant	16	22	
Mizzen royal	10	19	6
Mizzen sky-sail mast	8	15	
Mizzen sky-sail pole		8	
Spanker mast	26	110	14
Spanker topmast	15	40	
Foreyard	26	112	6
Fore lower topsail yard	24	90	5

	Diameter.	Length.	Length of head or yard-arms.
	Inches.	*Feet.*	*Feet.*
Fore upper topsail yard	19	76	4½
Foretop-gallant yard	15	62	4
Fore-royal yard	12	51	3½
Fore sky-sail yard	9	40	3
Mainyard	28	120	6
Main lower topsail yard	24	92	5
Main upper topsail yard	19	76	4½
Main-top-gallant yard	15	62	4
Main-royal yard	12	51	3½
Main sky-sail yard	9	40	3
Cross-jack yard	24	90	5
Lower mizzen topsail yard	19	76	4½
Upper mizzen topsail yard	15	62	4
Top-gallant yard	12	51	3½
Royal yard	9	40	3
Sky-sail yard	6	20	2
Spanker boom	11	40	2
Spanker gaff	8	34	3
Bowsprit	44	*a* 30	
Jib-boom	22	*a* 18	4
Flying jib-boom	5	*a* 14	6

a Outboard.

Fore and main rigging and fore- and main-topmast back-stays, 12½-inch patent hemp rope; fore- and main-topmast rigging, 8-inch hemp; mizzen rigging and topmast back-stays, 11-inch hemp; 8 shrouds on each side, 4 topmast shrouds, 3 topmast back-stays, shifting breast back-stays, double top-gallant and royal back-stays. The lower and topmast stays were double. She had iron futtock rigging, chain bobstays and bowsprit shrouds, martingale stays and guys, topsail sheets and ties, and iron patent trusses and jack-stays. The amount of canvas in her sails was 15,653 yards, and her lower studding-sails were triangular, terminating in a point below. There were four complete decks, and the height between the upper and spar decks was 7 feet, between the others 8 feet. Abaft the foremast was a house, 23 feet long by 16 wide, for a work room, shelter for the watch, and hospital. Aft of the fore hatchway a house, 25 feet long by 16 wide, and 6½ feet high, contained the galley, blacksmith-shop, and

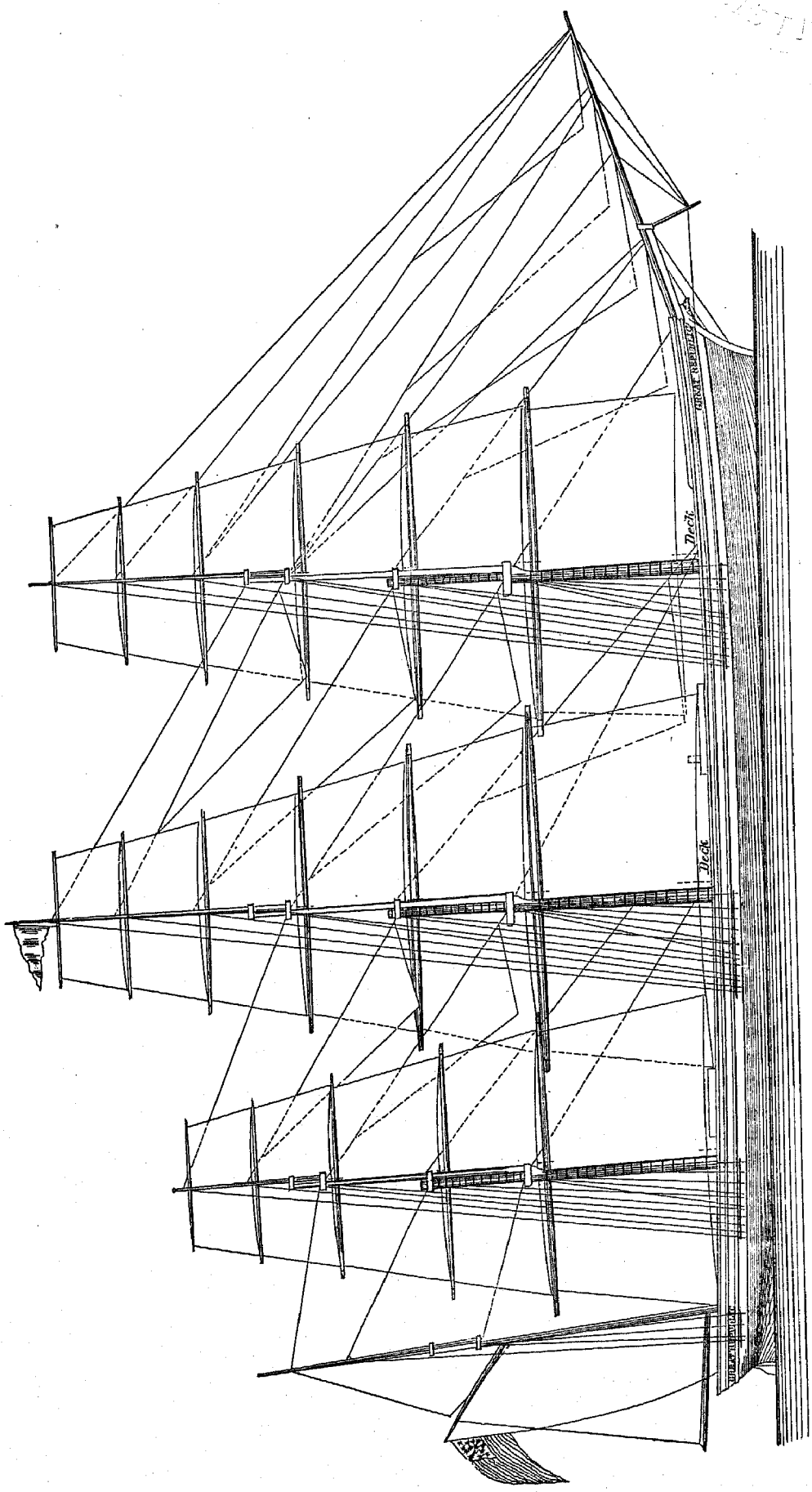


Fig. 42.—SAIL PLAN OF THE FOUR-MASTED SHIP GREAT REPUBLIC,
Showing the fashion now prevalent of dividing the topsail into upper and lower topsails.

engine-room for a donkey engine of 15 horse-power. Abaft the mainmast a house, 40 feet long by 12 wide and 6½ feet high, served as a mess-room for the officers, and had a staircase to the quarters of the petty officers and boys on the deck below, while farther aft a house, 17 feet long by 11½ wide, protected a staircase to the vestibule of the cabins below. Near the taffrail there was a small wheel-house. Under the spar-deck were accommodations for a crew of 100 forward, space for spare spars and rigging, a tonnage space aft of the foremast, a large sail-room aft, a store-room, rooms for 30 boys, state-rooms for the lower officers, and a dining-saloon 30 feet long by 14 feet wide, with four state-rooms on each side; and aft of that a vestibule, with stairs to the deck above and the cabins below, the captain's and chief officers' state-rooms, and an after cabin, 25 feet long by 14 wide, with six state-rooms. The chain lockers in the lower hold were ample. She had four chains of 120 fathoms each, two of 2½-inch iron, with 6,500- and 8,500-pound anchors, and two of 1½-inch iron, with 2,500- and 1,500-pound anchors, and two hemp stream cables and several hawsers. There were three hawse-holes. To build this vessel required 1,500,000 board feet of pitch-pine, 986,000 feet of white oak, 336½ tons of iron, and 56 tons of copper, besides her sheathing. There were about 50,000 days' work upon her hull.

There was little timber in the Great Republic longer than 50 and 60 feet, but the oak was in much shorter lengths. If ships of this size are to be built hereafter, the best timber in the United States for the purpose is the Puget Sound fir, on account of its length and other qualities. The Great Republic never sailed as a four-master except to New York city for a cargo. While loading she caught fire, her upper works being burned off, and she was cut down one deck and refitted as a three-master. She lived the usual life of a ship, but, with her shortened sail area, did not develop remarkable speed.

After 1857 there ceased to be a necessity for great speed and size. Too many ships had been built, and a reaction set in, which lasted for many years. The California excitement was over, the rush to the gold mines had slackened, and the settlers of the new territory had begun to produce for themselves the common necessaries of life, which had previously been sent to them from the East by clipper ships. Owing to the enormously high prices of food, agriculture had made rapid progress in California, and when it became so productive as to answer the requirement of the territory for food ships sailing around cape Horn experienced much difficulty in getting cargoes. By 1857 there were from 100 to 150 large ships in the California trade (more than were needed to transact the business), and rates of freight fell off one-half, and the ships were thrown into the general trade of the world. In the next place, steam vessels had been built to run on all the principal ocean routes. Steamers took all the passenger, mail, and express freight business at once, and in consequence, except in the case of a few scattered lines of packets sailing to Australia, South America, and Asiatic ports, there was no longer any need for sailing vessels to be fitted out with large cabins and roomy passenger accommodations. Three-deck sailing ships were useless for many years, and when those in existence had worn themselves out they were not replaced, the large sailing tonnage being reduced to two-deck ships. The reaction in American shipping circles that began in 1857 was helped by the extraordinary losses of vessel property in the winter of 1856 and the first part of 1857. There were several disastrous storms, the coast was strewn with wrecks, and more than 400 American vessels were lost, worth over $11,000,000. The loss of capital was itself a severe blow. The reaction was helped by the high prices of merchandise that prevailed in the world at large at that time, export trade being checked in various countries. In the general freighting business across the Atlantic there was also a reaction, owing to the falling off in immigration and to the importation of railroad iron to America which followed the financial panic of 1857. The Crimean war had come to an end, liberating a large amount of tonnage which had been in the service of the allied armies for the transportation of troops and munitions of war. To complete the list of depressing causes, the war of 1861 broke out in the United States, and the foreign and coasting trade of the southern states was completely cut off for four years. Cruisers from English ports were sent out to capture and burn American vessels. The rates of insurance rose so high on American vessels and cargoes that no one could afford to pay them, and the owners of American tonnage, finding themselves in a position where, to save themselves from bankruptcy, they were obliged to sell off all their ships, sold a large quantity of shipping to the United States government for war purposes and 800,000 tons to foreigners, our merchant marine declining heavily from 1861 to 1865 in consequence. All in all, that whole period of eight years from 1857 to 1865 was unfavorable to the production of ships of large tonnage; in fact, it almost put an end to American ship-building. The reaction on some coasts was painful. When, to use the expressive phrase of the Maine men, "the bottom dropped out of things" in 1857 there was great havoc among the ship-building firms of the whole country. Many towns in New England which had been building and launching large sailing vessels every year since the great expansion began, 30 years before, ceased entirely to build, and large ships then under way often lay idle a whole year at some wharf awaiting a purchaser in vain. In many of these towns there has not been another large ship built down to the present day. Numbers of builders were completely ruined, and in Maine the ship-yards of Bath and Thomaston were about the only ones that withstood the shock. From 1861 to 1865, in New York, Philadelphia, Baltimore, and Boston, the building of large sailing vessels ceased on account of the war; when the war ended the high prices of labor in those cities prevented the industry from reviving, and those who wanted ships went to the country towns to have them built, both labor and materials being cheaper in those places. No traces of the industry remained at the four great ports named, except the construction of vessels requiring the greatest mechanical

skill and ingenuity, such as yachts and steam vessels, and excepting also the repair of old vessels—a class of work which is naturally required in ports frequented by large fleets of vessels, where repairs have to be made immediately.

Since 1865 there has been a change for the better, and sailing ships have again come into demand in spite of the great increase in the employment of steam in ocean navigation. One cause has been the fact that the eight years of reaction diminished the world's supply of shipping and made new vessels necessary. There was, however, an enormous expansion of the foreign trade of the United States, and that has been the main cause of the improvement. Railroad building had made a demand for iron beyond the power of the United States to meet. Nearly every species of iron and steel has been required, and those articles, with coffee, sugar, manila hemp, jute, tea, and European, South American, and Asiatic goods of every description, have been imported in immense quantity. On the other hand, the productiveness of the farms and forests of the United States has been greatly developed, and the exportation of grain, tobacco, cotton, provisions, kerosene, lumber, etc., has grown to five and six times what it was before 1865. A special feature of the export trade has been that from the Pacific coast. Before the war that coast had no export trade, and ships sailed thither from every part of the world with cargoes and departed in ballast, a few cargoes of lumber, canned salmon, and seal skins being all that were sent away from that 1,500 miles of coast.

After 1865 the wonderful fertility of California wrought a change. A good crop of wheat in the eastern states would average from 20 to 25 bushels to the acre, while on the wheat ranches of the Pacific 25 bushels per acre was a small crop. Forty bushels would be an average, and a production of 50 and 55 bushels to the acre was so common as to cause no particular comment, and wheat raising became as profitable as gold mining. In Oregon the soil was found to be equally productive, and one plowing and planting was often good for two crops. The first year's crop would be 40 bushels and more, and that of the second year, springing up from the seed shaken out naturally in gathering the first year's crop, would sometimes amount to 20 and 25 bushels per acre. As soon as the coast began to have wheat to export San Francisco became one of the most profitable ports in the United States for traffic, and American ships at first had the advantage in the trade. Sailing from the Atlantic states with miscellaneous cargoes of goods, they not only got the freight out, but had a good freight of wheat back to England. The general trade of the world having revived, tonnage was in demand, and wheat freights from San Francisco to Liverpool accordingly rose to a profitable figure. A complete revolution in the carrying trade of the Pacific coast was the result, and ships have ever since sought that coast from all parts of the world in ballast, coming even from England without a cargo to get one of wheat back. The coast now exports 850,000 gross tons of wheat annually, and supplies about 600 ships with outward cargoes. This business all accrues to sailing vessels. A very few steamers have taken cargoes of wheat from San Francisco to England, but, in the main, this was only because they had brought a cargo to the coast and could not afford to go away in ballast. The voyage of 13,600 miles from San Francisco to Liverpool is too long to make it profitable to employ steamers in the business, sailing ships paying better, on account of their large available capacity and smaller expenses, and it is this profitable trade chiefly which has caused the revival of ship-building in American yards since 1865, and is again leading to the production of large sailing merchantmen. The newest ships, those built in Maine within the last two years, are from 2,000 to 2,400 tons register, carrying from 3,000 to 3,600 tons of wheat; and they are again growing larger year by year.

The California vessel of to-day is no longer an extreme clipper, nor is it the bluff freighting ship of 1840, but it is a handsome, medium clipper, with towering masts and spars, full on the floor, with a good bow and fair run, capable of carrying a great cargo at an excellent rate of speed. The midship section is in the center of the length, the ship floats on an even keel, its carrying power is 1½ times the register tonnage, and it draws from 20 to 24 feet of water. A few of those built at Thomaston and Bath, Maine, within the last five years out of the profits of the California wheat trade are of about 2,000 tons register and carry 3,000 gross tons of freight. Four-masters are now talked of, though none have as yet been built; there are a few British four-masters in the California trade.

Another class of sailing vessel which grew into great repute before 1861 was the schooner. It has been noted that the original coaster was the sloop, its broad beam, shallow draught, big fore-and-aft sail and one or two jibs, simplicity of rigging, and ease of management by about three men making it the right vessel for running along the coast and into and out of rivers. Ketches and brigantines were used for voyages as long as from Salem to Chesapeake bay, for instance, and the two-masted schooner followed. During the packet times trade and travel increased so fast that large vessels were required for coasting, the square rig being preferred. Brigs, barks, and ships were much in favor, but after 1840 they went out of use for coasters, their places being taken on the one hand by steamboats, which were built for the passenger and mail service between all the large Atlantic and Gulf ports, and on the other hand by two- and three-masted schooners, built for freighting. The fore-and-aft rig came to be preferred for coasting vessels for several reasons. Fewer sailors were required to handle the vessel, and a schooner could be worked into and out of harbors and rivers more easily than any square-rigged craft. Her trips could also, as a rule, be made in quicker time, as she could sail closer into the wind, and it was hardly necessary for her to sail from Maine to New York by way of the Bermudas, as some square-rigged vessels have done during baffling winds. The schooner rig became universal in the coasting trade about 1860, and there is probably not a bark or a ship left in this trade anywhere except on the Pacific coast, where the voyages are long and the winds blow in trades, and even there there are few purely square-rigged vessels in the trade. On the lakes the schooner is the popular

rig, a few square topsails being sometimes added on the forward mast. Originally registering no more than 40 or 50 tons, the schooner has become in course of time a large vessel, the two-masters ranging from 100 to 250 tons, the three-masters from 300 to 750 tons. The popular size now for a three-masted coasting schooner on the Atlantic is about 550 or 600 tons, and it is probable that more vessels of the schooner rig are built in the United States every year than there are of all other rigs put together. With square sails on the foremast the vessel is called a barkentine, and many of this class are used for transoceanic service, for which they are well adapted. The hulls of American schooners are as strongly built as those of any other vessels of their size; in fact, the scantling is far heavier than it was in full-rigged ships 75 years ago. They are constructed with a view to class A 1 on the books of the American Shipmasters' Association, and no large ship can do better than that. The best materials and workmanship are put into them. For transoceanic trade, and on the Pacific coast, where the waters are deep, the schooners are keel vessels with some dead rise; but on the Atlantic coast, where the harbors are so frequently shallow and obstructed with sand-bars, the schooners are center-board vessels with flat bottoms. In all cases, however, the models are full, the beam large, the bow sharp and long, the run clean, and the sheer considerable forward. Above the water an American schooner has the jaunty air of a yacht. Schooners with sharp bottoms do not pay, and few are built.

In 1880 an advance was made in the building of the William L. White, of Taunton, Massachusetts, at a ship-yard in Bath, Maine. The hull of the vessel was large enough for a Californian. She was 205 feet long on deck, 40 feet beam, and 17 feet deep in the hold, being 309 feet in length over all from the end of the jib-boom to the end of the spanker boom. She registered 996 tons, and was able to carry 1,450 tons of anthracite coal. This vessel was rigged as a four-masted schooner. To have fitted her out with three masts would have required such large lower sails that the strain upon the masts would have been destructive, and she was therefore furnished with four, the after spar being called the spanker mast. This divided her 5,017 yards of canvas into smaller sails and made her a good schooner, sailing well, easily handled, and requiring a crew of only five men before the mast, besides her two mates and captain. This was the first four-masted schooner built for actual ocean service in America, and probably the first ever so employed in the world, although there is on record a case where a small one was built in England in 1800 for packet service to India. This was the Transit, a little vessel 98 feet long on deck, 22 feet beam, drawing 11½ feet of water. She was rigged with four fore-and-aft lower sails, and there were three square upper sails on the foremast and two fore-and-aft topsails on the after three masts. The lower topsail was spread by a gaff above, and the upper topsail was the usual triangular sail. There were three head sails. A few small vessels were built in imitation of the Transit, but it was left to the Americans to adopt a rig for heavy freighting on the Atlantic ocean. The same yard in Maine which produced the William L. White has since built two other four-masters. One launched in the fall of 1882 is of large size, being of 1,137 tons register. She is 192 feet long on deck to the after side of the stern-post, 40 feet beam, and 16 feet depth of hold, having two decks and 5,000 yards of canvas in her sails. The four-masted rig is a common one on the northern lakes.

Before leaving the subject of ships to describe the localities where they are built reference ought to be made to the ingenious invention of bending wooden frame timbers and hanging knees. This subject occupied attention for many years, especially about 1850, in New York, Boston, Philadelphia, and in the United States navy-yards, and it is probable that the invention would have come into extended use except for the decay of the American merchant marine and the introduction of iron hulls. It is well known that the outside planking of a wooden vessel must be well softened by steaming in a long steam box before being fastened to the vessel's side, especially on those parts of the hull where the surface is greatly curved, this process being necessary in order to allow the plank to be bent without breaking. In the construction of yawls and other small boats the frames are not generally cut from crooked timber, but are composed of slender pieces of white oak, steamed and bent to the proper curvature on molds and allowed to harden in shape by cooling. In iron vessels the frames are all gotten out of straight angle iron, cut to the proper length, heated in a furnace, and bent to the curvature required on a large slab made for the purpose, and it was considered one of the triumphs of the invention of the iron ship that the frames could be made in one continuous length. J. Scott Russell says: "A single tree never furnishes an entire frame. If trees could be found to grow to the right curves for complete frames, it would be glorious times for wooden ships." It has always been one of the disadvantages of wooden hulls that the frames can only be made of a large number of separate short pieces lapped together and given such heavy molding thickness as to compensate in part for the large number of joints. There is no doubt that frame timbers in one piece from keel to plank-sheer would impart greater strength to the ship and lessen the weight of wood, and lighter scantling could be employed. About 1850 it was the inspiration of several men at New York and Boston to experiment in this direction. Machines were made for the bending of straight pieces of white oak, steamed, into ship's knees, and afterward three or four were made of large size and at great cost for the production of bent frame timbers. J. W. Griffiths, of New York, and Thomas Blanchard and C. Allen Browne, of Boston, were prominently identified with this matter. In 1853 futtocks, steamed and bent by machinery, were introduced into the steamer Ocean Bird at New York. In July, 1856, a number of 10½-inch white-oak knees, steamed and bent, were tested at the Novelty iron works, in New York, by Lieutenant J. T. Worden and Naval Constructor B. F. Delano, and the same year a full set of bent hanging knees was put into the bark Lexington, built by Edward F. Williams, in

Brooklyn, New York, and another set for both decks into the bark Jane Daggett, built by Webb & Bell at Greenpoint. In consequence of the favor with which the new idea was regarded in naval circles, the steam sloop-of-war Pawnee, which was built in Philadelphia in 1858, was supplied with 60 machine-bent timbers from 20 to 24 feet in length. These were the longest futtocks which had been used up to that time, and were inserted in the difficult curvatures of the bilge amidships. In 1858 the ship Richard S. Ely, at East Boston, was supplied with bent hanging knees. New notions are proverbially and necessarily slow in winning general favor, and the pioneers of this new invention had the usual experience and expended and lost a great deal of time and money in their experiments. But having worked out their ideas on a small scale, the owners of the invention determined upon a bolder policy. In 1864 all the patents became concentrated in the hands of Mr. Browne, and Mr. Griffiths continued his indefatigable championship of the new idea. Bent knees continued to be occasionally used. In 1869–'70 a two-decked ship for the California and East India trade, with bent frames, was built for Glidden & Williams and M. D. Ross at East Boston. This vessel (called the New Era) was finished in May, 1870, and left for Liverpool (via Saint John's, New Brunswick) in June of that year on her first voyage. She was enthusiastically claimed by her owners to be the strongest built ship and the best carrier of her size in the world, and she certainly was a good ship. The details of her construction were as follows: Length at load-line, 183 feet; breadth, $38\frac{2}{12}$ feet; depth, $23\frac{4}{12}$ feet; height between decks, $7\frac{1}{12}$ feet; register, $1{,}146\frac{3}{4}$ tons. Two decks, half poop, trunk cabin; house on main deck; open topgallant forecastle. Keel, gum wood, 12 by 20 inches, in four pieces; stem and apron, white oak; stern-post the same. Every frame timber, floor, sharp rise, knee, breast-hook, rail forward and aft, and chocks thereon, was bent. Frames, white oak, in one length from keel to gunwale and rail, 11 by 13 inches over the keel, tapered to 6 inches molding at the plank-sheer and spaced 21 inches, the joint over the keel strengthened by a floor timber extending from bilge to bilge. Ceiling, pitch-pine, 6 inches, except on bilge, where it was 8 and 9 inches. Keelsons: main, pitch-pine, 15 by 30 inches; sister keelsons, each 12 by 13 inches. Planking, pitch-pine; garboards, 7 and 8 inches, thence to wales 5 inches; wales, 6 inches. Lower deck beams, $7\frac{1}{2}$ by 10 inches, spaced 21 inches, with pitch-pine stringer 6 by 12 inches. Upper deck beams, 7 by 10 inches, spaced 21 inches, with strake 5 by 14 inches, bolted to the under side of beams, and a water-way above 12 by 13 inches. Two hanging knees of white oak, bent, at each end of all beams, sided 5 to 6 inches, with 4-foot arms, bolted to the sides of the beams and to the frame timbers. Besides the bent deck hooks forward and aft there were two pairs of pointers, with large bent hooks in the throat, at each end of the lower hold. Fastening, iron and copper. The ship was well salted. In model she was very full on the floor and otherwise adapted to large capacity. Draught, 20 feet. Anchors, 3,675, 3,500, and 1,000 pounds; standing rigging, wire rope. The New Era proved to be strong, dry, and satisfactory in every respect, and obtained high rates of freight and low rates of insurance, the final test of a good ship. Her actual cargoes were as much as 1,460 tons of coal and 1,555 tons of wheat. Her original rating was A 1* for 12 years, and after survey she was pronounced a model vessel in type of construction. She saw much general service in carrying ice, coal, grain, and mixed cargoes in all latitudes, and her bent frames showed remarkable freedom from decay.

The experiment with the New Era was sufficiently satisfactory to promise a more extended popularity of the principles on which she was built. But the times did not remain favorable to American shipping interests, the continual agitation for "free ships" and the general uncertainty as to the future checking enterprise in this as in many other directions. The machines were costly, and none except a few large contract yards could afford to own them; and finally their most energetic advocate, Mr. Griffiths, died. It is believed that the idea of bent frames has now been practically abandoned.