

*Cape Hatteras
File*

FINAL REPORT ON THE REMAINS OF AN OLD SHIP FOUND
ON BODIE ISLAND, DARE COUNTY, NORTH CAROLINA,

May 3, 1939

by

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UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
COLONIAL NATIONAL HISTORICAL PARK
YORKTOWN, VIRGINIA

OFFICE OF THE SUPERINTENDENT

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Before going into details regarding the ship and the research for its possible identification, the writer wishes to apologize for the length of time devoted to this research; yet he feels justified in having gone into this subject in the most exhaustive manner.

From the time of its discovery on May 3, 1939 until the arrival of the personnel from The Mariners' Museum and the writer, as representative of the National Park Service, on May 8, the derelict had been heavily featured in the press throughout the country as having relation to the Roanoke Island Lost Colony of 1587. Hence, upon our arrival, we were constantly asked to give opinions on its possible value to the community and especially on what we thought of it being removed to the restored Fort Raleigh, indicating the local people had already formed a definite opinion of the boat's relation to the early history of the Island. Besides, its location on Bodie Island

placed it within the boundary of Cape Hatteras National Seashore and identification in this early period would make it significant in an area under National Park Service jurisdiction.

Both Mr. Joseph T. Holabach, Superintendent and Curator of The Mariners' Museum, and the writer were, from the first, of the opinion that the age of the boat did not extend to the early period which had been accredited it by the press, but due to the scanty remains it was impossible to ascertain what the ship looked like originally. The only means of reaching a conclusion was to make a thorough study of the ship's construction and of the material of which it was built, and compare the results of such study with methods of construction and material used in ships built in the sixteenth century. In our research we have endeavored not to overlook any possibility of identification. Various materials of the ship were forwarded to several laboratories of national repute, (see Appendix I for analyses submitted). Books, plates, prints, and paintings searched have been many. With all these items The Mariners' Museum is well supplied, and a list of the books examined there, other than those cited in the footnotes, appears at the end of this report as Appendix II. Therefore this report is considered as nearly comprehensive as the material now at hand permits, though it is to be noted that the absolute identify of the relic has not been positively stated.

On our arrival at Roanoke Island, we were transferred to a Coast Guard truck especially equipped for travel over sand dunes, which is in itself worthy of mention with its huge tires, special, heavily constructed body, and several gear shifts. Before we arrived at our destination we realized the value of those huge tires and creeping gear shifts, (see photograph No. 1). The story of the wreck was related to us by Mr. A. W. Drinkwater, who has for thirty-nine years been an employee of the Weather Bureau and the Coast Guard, and who, in the entire period of his service has been stationed along the Cape Hatteras and Bodie Island seashore. Mr. Drinkwater first noticed the wreck in 1903, after a storm, and again in 1936; but it was not until after its third appearance, on May 3, 1939, that he succeeded in getting sufficient help to have it completely uncovered. Photographs Nos. 2 and 3 show the remains as revealed the first day.

Mr. Harry White, Project Superintendent in charge of CCC Camp #436, B.F. 2, Biological Survey, lacking an approved project for this work, asked for volunteers to excavate the ship over the week-end of May 6 and 7. One hundred men responded, and the excavation was done under the leadership of Mr. Ben Dixon MacNeil. Of the actual excavation there is no record. Doubtless the method used would not have met with approval from any trained archeologist. Few of the artifacts found were left for our inspection. When we

got there most of them had been carted away by other experts (?).

Those that remained will be taken up later.

Photographs Nos. 4 and 5 show the beginning of the excavation. The latter shows how in the early stages the remains suffered from carelessness by the removal of part of the side planking. The part of the vessel which first showed itself proved later to be the stern; the bow was covered by approximately four feet of sand. Photograph No. 6 shows the bow appearing during excavation; part of the mast can be seen in the foreground. Taken looking from the stern facing the bow, photograph No. 7 shows the crew at work. One of the difficulties during the excavation was to keep the water out of the hull. Constant bailing was necessary when the tide was low; at high tide it was impossible to keep the water out. This to a large extent handicapped us in the examination of many small details around the keel and keelson which play a large part in determining the method and period of construction which are necessary for identification. An attempt was made to get proper pumps and equipment for bailing at high tide, but this could not be done in the short time we remained at the site. Photograph No. 8 shows the bow after excavation. Slight stratification can be seen in the sand bank above the frame of the vessel. Photograph No. 9 shows the full length of the wreck, looking from the bow towards the stern, and photograph No. 10 shows the same, looking in the opposite direc-

tion. These are all the pictures which actually deal with the excavation and they constitute the only record of this phase of the work. For this record appreciation is due Mr. MacNeil, who with foresight had the photographing done, and who turned the negatives over to the writer.

Of the wreck itself there remains very little -- only the bottom part. The port, or left, side extends approximately two feet higher than the starboard, or right, side. The vessel is very solidly built; all the timbers and frames are closely spaced. The frames are 6 inches thick, but vary in width. The larger share are 6 inches wide, as shown on photograph No. 11, although many of them run nearly 10 inches as shown on photograph No. 12. Though the vessel is solidly built, and of white oak throughout its entire hull, its timber is not of choice material. It has the appearance of a vessel constructed in a hurry with whatever was left in the yard, or, rather, what could be gotten. Many of the frames are cut and shaped out of limbs, as can be seen by photographs Nos. 12 and 13, and many are crooked and hardly of a dimension to permit squaring off. One feature of its construction is the novel method of bracing the frames. This can be seen on the three photographs Nos. 12, 13 and 14 at the points marked "X" in ink. Whether this was purposely done or only as an excuse for using crooked timber has not been determined. The spacing between

the frames is very irregular, although the majority are placed at intervals of 3 inches, or close to that distance. The destruction of the vessel can be attributed to fire; of this there is ample evidence throughout the remains.

Another interesting feature is the well timbered bow, shown on photograph No. 15. Such heavy, immense framing would hardly be used in a merchant vessel. It belongs, rather, to a man-of-war. The keelson, which is the long timber running the whole length of the ship's interior, measured 10 inches wide by 9 or 10 inches deep. The only place where we could get a measurement of the keel was at bow and stern. It was impossible to get any amidships, due to the sand and water constantly washing in.

Every part of the vessel of any importance was measured and photographed, and from these records the three plates attached to this report were drawn.

PLATE 1

Fig. 1 shows a longitudinal section of the ship, its dimensions, spacing of masts, etc. The ribs or frame timbers on the drawing are placed rather conventionally. Each frame timber consists of two pieces 6 by 6 inches and the spacing between each set of timbers has been set at 3 inches, even though there is in the original ship some variation both in width of timber and spacing. Where the fashion timbers began in both bow and stern they are on the drawing crowded closer together at the bottom in order to form

the fantail necessary for the curving of the ends of the ship. Notice was taken of the solid bow in comparison to the rather weak stern. The third point of interest is the spacing of the masts, one nearly amidship and the other far forward. These items were the principal focal points in the attempted identification.

Fig. 2 is another longitudinal section showing the external planking and fastening. At the stern can be seen the gudgeon, which also plays an important part in the identification.

Fig. 4 shows the gudgeon in detail.

Fig. 5 is a cross section of the sternpost, taken at the location of the gudgeon (see Fig. 2).

Fig. 5 is of the pump which was placed closely behind the main mast.

Fig. 6 is a cross section of the stempost, taken at the location marked on Fig. 2.

PLATE 2

Plate 2 is a cross section of the ship taken about two-thirds forward of the main mast on the port, or left side. This section shows the deadrise as it exists at present. What it actually was we do not know. The weight of sand inside the hull for many years has probably to some extent forced the original to a more generous curve.

On this section the writer has placed the names of various timbers so that those unfamiliar with nautical and ships' terms will be

able to follow the course of description and comparison.

PLATE 3

On this plate the masts are detailed, the mortises for the mast in the keelson, the outside planking, and the method used in fastening the planks to the frames.

Artifacts found were several pieces of china, some shingle ballast (shingle ballast was the common name for small stones, or coarse gravel, usually of glacial formation), a piece of cast-iron, which could possibly have been part of an andiron, one mast hoop, part of the pump shoe, bronze spikes, and treenails, (see photographs Nos. 16, 17 and 18). All of these artifacts have been analyzed by chemists and other authorities capable of giving accurate statements concerning them, (see Appendix I).

After forwarding the artifacts for analyzation and completing the preliminary drawings, the research began. Because of the publicity which had placed the date of the vessel at approximately the late sixteenth century, the research commenced at that early period. Books of several countries and many prints were examined and compared. The outstanding feature of the sixteenth century vessels is the stern. On these early ships the stern was always square, or what is called a transom stern, which commenced

from the keel and went to the top of the quarter deck rail; the sternpost was fastened to the transom; the gudgeons were made in the shape of a bolt and holed through the sternpost, stern planks, and timbers, and then locked in place inside of the vessel. Photograph No. 19 is of the wreck as seen from stern to bow. The long, tapered stern soon discredited the suggestion that it was a sixteenth century vessel. Photograph No. 20, taken from the center of the ship's interior looking towards the stern, also shows the very definitely tapered stern. Photograph No. 21 shows the gudgeon (note arrow). This gudgeon is made in the shape of a "U", and fastened by two bolts driven through the sternpost. See, also, Plate 1, Fig. 4. Sixteenth century vessels were constructed entirely with iron bolts and spikes, besides treenails for fastening planking. No consulted source records the use of bronze spikes. From the above comparison we feel justified in not recognizing the remains as that of a sixteenth century vessel.

Research on boats of the seventeenth century revealed pretty much the same facts, except toward the middle of the century the pointed stern came into use. At that time it was carried for only a short distance above the waterline and from there to the top of the rail a transom stern was constructed. The pointed stern of this period was not long and narrow as shown in photographs Nos. 19 and 20, but rather a bulbous, full one similar to the bow. All

fastenings of this period called for iron and treenails; the only copper nails mentioned are those used for nailing lead sheathing to the bottom of the vessel.

England had long been experimenting with sheathing for the bottom of vessels, especially those engaged in trade in the West Indies. At first wood sheathing was used, but it had no lasting quality and lead was substituted. Only a very few vessels were sheathed with lead up to 1670.¹ From that year until 1691, twenty ships were sheathed; obviously not a universal custom. Many ships whose lead sheathing had deteriorated were re-sheathed with wood. The remains of the ship on Bodie Island bear no evidence of having been sheathed.

Records are not very extensive on the early colonial vessels built in America. The first vessel known to be constructed was the Virginia, built in 1607 by some settlers who tried to start a fishing settlement on Stage Island in the Kennebec River, Maine. After having wintered there, the settlers returned home in the newly constructed vessel. She was about 50 or 60 feet long and carried two masts and could not have been much over 25 to 30 tons. This same vessel made many trips to America in later years.²

¹ Fincham, John, A History of Naval Architecture, (London, Whittaker & Co., 1851), p. 94.

²Chapelle, Howard I., The History of American Sailing Ships, (New York, W. W. Norton & Co., 1935), p. 6.

Descriptions of colonial built ships of the seventeenth century are all similar, as the examples below will illustrate.

"[June, 1636]...I do purpose to build our barke about 25 or 30 tonnes; therefore you may Please to send Cables & Canvas for sailes & ropes for Rigginge of her, accordinge for a vessel of that burden, & pitch & tarr, spukes (spikes) and nailles & Chaine bolts, Rudder Workes & some bouldes drawn out for knees, & other business which wilbe needfull, which I know the carpenters at Home Can direct you best what wilbe needful for a barke of that burden; heare is none to be gotten."³

"On Dec. 21, 1677, William Carr, shipwright of Salisbury, Mass., signed an agreement to build for Robert Dutch, mariner, of Ipswich, a pink-stern ketch,— 'a good & substantial Ketch to bee in length by ye keele thirty fower foot in breadth twelve foot by ye beame & six foot deep in ye hold to bee every way shipshapen. The said ketch to bee built with two inch white oake planke to ye upper wale & with inch & halfe white oaks plank upward & to bee seiled fore & aft with ye like conditioned two inch plank: To lay her deck with good two inch pine plank: the fore Castle to bee raised twelue Inches & ye cabin abaft to bee raised two foot with scuttles & hatches sutable & to doe & compleat all builders worke to a cleat: to fitt her with all ye masts & yards & calke & lanche ye said ketch by ye last day of August next ensuing ye date hereof: Carr was to be paid at the rate of £3.5s per ton and Dutch was to provide the ironwork...."⁴

Most authorities place the beginning of the American shipbuilding industry between 1641 and 1650, and say that between the years 1640 and 1700 no more than sixty vessels were constructed.⁵

³Rowe, William H., Shipbuilding Days in Casco Bay, 1727-1890, (Yarmouth, Maine, 1929), p. 7.

⁴Robinson, John, and Dow, George Francis, The Sailing Ships of New England, 1607-1907, (Salem, Marine Research Society, 1922), pp. 23-24.

⁵Chapelle, op. cit., p. 7

The records agree that the bulk of the vessels constructed were small. The greatest number of them were listed as sloops (one mast with fore and aft sail, with a square top sail, square course sail, and square lower sail), the tonnage varied from about 25 to 70 tons.⁶ What descriptions the writer has found of early Colonial vessels do not conform to the wreck. Neither do the descriptions of the English naval vessels, or English vessels built as merchant ships, of which there are records of actual construction; nor do suggested plans by marine architects of the period. The usual material used in construction throughout the seventeenth century was much the same as in the sixteenth; one finds no mention of bronze or brass spikes, nor do any of the drafts show the long, tapered stern.

In the earlier part of the eighteenth century, construction was just about the same. William Sutherland published in 1740 an excellent volume with drafts and specifications and included English naval ships of the period. In his writings he gives dimensions of particular features in framing the stern of a vessel of 250 tons, which would be the size of a small frigate or a snow. The stempost should be in breadth, fore and aft, 11 inches; thwartships (width) 11 inches; sternpost (length) 17 feet 0 inches; fore and

⁶ Ibid., pp. 11-12.

aft at the head (depth at the top), 1 foot 0 $\frac{3}{4}$ inches; thwartships, 1 foot 0 $\frac{1}{2}$ inches; at the keel, fore and aft (depth) 0 feet 6 $\frac{1}{4}$ inches; stern ribs (fashion timber) 7- $\frac{6}{10}$ inches; and the space between each rib 9- $\frac{3}{20}$ inches.⁷ Regarding gudgeons, he states, "Gudgeons to be drove through, and be well lock'd within side."⁸ Hence, we find as late as 1740 the English still shaping the gudgeon as a bolt instead of in the "U" shape that we found on the wreck. The sternpost on the Bodie Island ship is better proportioned in order to follow the long, tapered stern than the one suggested by Sutherland.

His specifications for types of wood call for oak both in timbers and planking, also the treenails be made of the same. He mentions iron, but not copper, bronze, or brass bolts or spikes. A volume published by Mungo Murray in 1754 agrees in most particulars.⁹ They both speak of timber brought in from Norway, Prussia, North Carolina, and the New England states. For the construction of ships, especially mast material, Sutherland mentions the two types of nails commonly used by the English: "The shape of nails

⁷ Sutherland, William, Britain's Glory: or, Ship-Building Unvail'd, Second Edition, (London, Printed for William Mount and Thomas Page, 1740), pp. 36-37.

⁸ Ibid., p. 87.

⁹ A Treatise on Shipbuilding and Navigation, (London, Printed by D. Henry and R. Cave, 1754), et passim.

are two-fold, viz. sharp pointed, and flat pointed; the sharp pointed is much easier drawn back again than the flat pointed, for which reason all nails in ship-work are flat pointed, except the ribbon nails, believing that they will hold much better in the moving and tumbling of a ship;...¹⁰ The only iron spikes found on the Bodie Island wreck were for fastening the ceiling, but they were so corroded it was impossible to identify their shape. He also mentions that both wood and lead were used to cover or sheath the bottom of ships for protection against worms; usually a coating of tallow and tar was placed on the ship's planking before the sheathing was put on.

Formerly all ships from large frigates and up were double fastened, that is, two treenails or bolts in each timber, or, four to a frame,¹¹ (see Plate 3, Fig. 4). The smaller vessels were usually double and single fastened, alternately placed; again many of the real small vessels were single fastened throughout, and some of the very large, double fastened throughout; others were double fastened at the bottom to a few feet above the waterline and single fastened from there on to the rail. The boat on Bodie Island, or what remains of it, is entirely double fastened, with three treenails and one brass (bronze) spike in each frame.

¹⁰Sutherland, *op. cit.*, p. 129.

¹¹Fincham, John, *An Outline of Ship Building*, Third Edition, (London, Published by Whittaker & Co., 1852), pp. 40-41.

In 1764 the English commenced experimenting in coppering the bottom of their naval vessels as a protection against worms, and in 1783 the navy was instructed to have the bottom of all vessels coppered.¹² In the same year it was ordered to have all fastenings below waterline, formerly fastened with iron, fastened with copper bolts. After the use of copper sheathing on English ships, the iron bolts, formerly used throughout on all ships, had to be discarded. Oxidation took place very rapidly and the iron was soon destroyed when subject to the action of salt water and copper.¹³ Concerning this, many writers on early naval and marine history agree. We can, then, place the use of copper from about 1785. It is from this time we begin to find the mention of composition nails, commonly called dumpnails, which were a mixture of copper, tin, and zinc. Most authorities agree that dumpnails did not come into general use in shipbuilding until the turn of the nineteenth century.

Towards the latter part of the eighteenth century vessels constructed in America began to be well-known in Europe for their sailing qualities. Several that had been captured during the Revolutionary War were put into dry dock and their lines carefully copied. Usually the American vessels were proportionately

¹² Derrick, Charles, Memoirs of the Rise and Progress of the Royal Navy, (London, 1806), p. 187.

¹³ Finchem, John, An Outline of Ship Building, op. cit., pp. 42-43.

longer and to this their sailing qualities were accredited. It is from this period the tapered stern becomes familiar in ship construction. In the year 1793 the English Navy began changing the build of its war ships, by making them much longer.¹⁴ Undoubtedly this change was influenced by the study of American ships.

Coasting vessels of the American colonies had also begun to be noticed by the eighteenth century for their different types and shapes. Each class was constructed for the type of trade the vessel was to engage in and the harbors where the ship was to ply. Some had a very shallow draft for shoal waters, others were deep hulled.¹⁵

In checking various types of vessels constructed by the American shipwrights, there are three which have a close resemblance to the remains found on Bodie Island. The first two vessels have much conformity in a comparison, while there are also some items which are more or less questionable.

Boat #1 - See photograph No. 22 - a New England fishing vessel.

This type of boat originated about 1750; its period

¹⁴ Derrick, Charles, op. cit., p. 201.

¹⁵ Griffiths, John W., Treatise on Marine and Naval Architecture, or Theory and Practice Blended in Ship Building, Fourth Edition, (New York, D. Appleton and Company, 1854), p. 347.

lasted to about 1840. Probably during a period of 90 years slight changes in the hull construction took place. The model shown on the photograph dates about 1820; and represents a vessel of about 75 or 80 tons. Dimensions of this type of vessel were: about 65 feet long, with an 18 foot beam, and a draft of 8 feet. The favorable comparison in this vessel is its full, round bow and tapering stern. The shape of both bow and stern where they meet the keel are similar to the wreck. The spacing and placing of the masts is nearly identical; the placing of the lower gudgeon holding the rudder is also similar. No description of the construction of this vessel is given.¹⁶ There is no mention of details of interior framing and general construction; neither is there any mention of the planking, its material or dimensions; nor the method of fastening planking to the timbers. The only visible feature about this type of vessel which appears to conflict with the Bodie Island boat is the fantail of the stern; it appears to taper rather quickly at the garboard and the three following strakes, giving the impression that considerable deadwood must have been placed at the junction of the keel and sternpost; whereas in

¹⁶Mitsun, Carl W., "Catalogue of the Watercraft Collection in the United States National Museum", Smithsonian Institute Bulletin 127, (1923), pp. 131-132.

the wreck there is no deadwood at all, only the large sternpost knee fastened directly to the keelson.

Boat #2 - See photograph No. 23 - a typical row galley of the Revolutionary War period. Although several of this boat's features resemble the wreck, it does not as closely compare to it as Boat #1. The stempost is rounded considerably, but it shows an exceptionally heavy bow, by having plenty of deadwood placed there, (see "A" marked on photograph No. 23). The line of the stern and the placing of the rudder are closely related, but show also a considerable amount of deadwood (see "B" marked on photograph No. 23), which the old hull does not have; the pump ("C"), placed directly behind the main mast, is similar, (see also Plate 1, Fig. 1); and the spacing of the masts is similar, except for the mast step ("D"). The general dimensions of the vessel are favorably comparable. So few of these vessels are built exactly alike, even though they are supposed to be of the same class, that the question of sister ships is often hard to accept. The one point worthy of notice, as before mentioned, is the heavy bow. These row galleys are built to stand heavy contact and ramming; close contact was the order of the day, and the

sooner a vessel could be grappled and boarded, the better, especially if the attacked vessel had superior armament.

Boat #5 - American Gunboat. This third vessel has so much similarity that the writer is tempted to say, "This is it". The first construction of gunboats in the United States commenced in 1805.¹⁷ The first order called for ten boats; in 1805, 25 more were ordered; in 1806, 50; and in 1807, 188. However, the entire number completed was 176.

According to a letter dated December 21, 1805, from Secretary of War Robert Smith to Captain John Rodgers, he was directed to superintend the building of a gunboat at the Washington Navy Yard; another letter written on the same day to Captain James Barron directed him to superintend the construction of one at Gosport, Portsmouth, or Norfolk.¹⁸ These two boats were copied after a Neapolitan gunboat, which had previously been borrowed and used in the Mediterranean and was chosen as a model for the American boats. Boats numbered from 2 to 10 were

¹⁷ Frost, John, The Book of the Navy, (New York, D. Appleton & Co., Philadelphia, George S. Appleton, 1845). p. 121.

¹⁸ Extracts from Letter Books and other Manuscript records of the Navy Department, used by courtesy of The Mariners' Museum.

long, narrow vessels, 71 feet long, 16 feet in beam, sloop rigged, and carrying two large guns, 24-pounders or 32-pounders.¹⁹

Photograph No. 24 shows the draft of one of the first boats, No. 5. Compare the outline of the boat at the stern and bow, also the gudgeon for holding the rudder. They are identical. Many of the boats carried two masts. Among the letters of the Navy Department there are many giving the dimensions of the vessels constructed. They varied in length from 73 feet to 47 feet and in width from 19 feet 3 1/2 inches to 16 feet 6 inches.

In April and May, 1805, when gunboats numbered from 15 to 22 were ordered, a letter giving specific directions for the strength of the vessels (dated May 26, 1805) speaks of the additional strength to be given the vessels amidships in order that they might better carry the weight of the heavy guns. Indications of this strength are seen by examining photographs Nos. 12 and 13. Frame timbers are placed close together and many of them are 12 inches wide, beside the braces (X) placed at inner

¹⁹ Eamons, George F., United States Navy from 1775 to 1855, (Washington, Printed by Gideon & Co., 1855), p. 22. The same description can be found in Our Navy and the Barbary Corsairs by Gardner W. Allen, (Houghton, Mifflin Company, New York, 1905), p. 181.

walls.

A Letter to the House of Representatives, dated June 18, 1808, from Paul Hamilton, then Secretary of the Navy, setting forth material for gunboat construction, states: "This arises from various supplies, procured and intended at first for the repair of frigates and other vessels, which having been found most of them better adapted to the building and equipment of gunboats, were used for those purposes...."²⁰ We may from this statement understand why such a miscellaneous collection of framing timber was used as is shown in nearly every photograph of the wreck's interior, particularly in photographs Nos. 12 and 13. Any timber not suitable for repairing the larger ships was used in gunboat construction.

In fastening the planks the method commonly called square or double fastening was used, which means two bolts,

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American State Papers (Vol. XIV) of Naval Affairs (Vol. I), p. 198, Item No. 76.

[American State Papers. Documents, Legislative and Executive, of the Congress of the United States, from the First Session of the First to the Second Session of the Eighteenth Congress, inclusive: Commencing March 5, 1789, and Ending March 5, 1825. Selected and Edited, under authority of Congress, by Walter Lowrie, Secretary of the Senate, and Walter S. Franklin, Clerk of the House of Representatives, (Washington, Published by Gales and Seaton, 1834).]

spikes, or treenails in each timber, or four to a frame.²¹
In the Bodie Island boat are two treenails in one timber, and one treenail and one brass spike in the other, making a total of four to the frame, as advocated. Until the end of the eighteenth century there is very little mention of brass or bronze spikes being used in ships' construction, and those referred to were the composition nail called dumpnails. An analysis of the spike taken from the wreck shows it to be made of gun metal, then called brass, but which is really a bronze containing 89 to 90 percent. of copper and 10 to 11 percent. of tin. See chemist's analysis attached to this report under Appendix I. Instead of the common method of making nails from a rod, these nails are cast. The Paul Revere Company of Boston, Massachusetts, in 1808 was manufacturing sheet copper, bolts, nails, etc., for fastening ships.²² The Revere Company is one of the oldest brass manufacturers in the country, and cast brass cannon during the Revolutionary War, the War of 1812, and the Civil War.




²¹ Griffiths, John W., op. cit., p. 368.

²² Bishop, J. Leander, A History of American Manufactures from 1608 to 1860, (Philadelphia, Edward Young & Co., 1868), II, 126.

In casting cannon there is much waste material created in trimming the head after casting, trimming the trunnions, handles, boring out the guns, besides that material left in the furnace after the main casting is completed. There certainly is much material suitable for the casting of nails. In the American State Papers on Naval Affairs there is mention of an order for 2,100 pounds of copper nails 5 inches long to be used on three schooners of 175 tons each.²³ Most of the spikes taken from the Bodie Island boat are $\frac{3}{8}$ ths inches by $\frac{3}{8}$ ths inches by 5 inches, while a few of them measured $\frac{3}{8}$ ths inches by $\frac{3}{8}$ ths inches by 4 $\frac{1}{2}$ inches.

The treenails were all made of white oak according to the analysis of the various types of wood made by the United States Department of Agriculture, Forest Service, (see Appendix I). The exclusive use of locust treenails for ship fastenings did not develop until the end of the War of 1812. Previous to then both white oak and locust were used. Photograph No. 18 shows the treenails used on the wreck; it also shows the novel method of caulking the ends of the nails. It is a square, pointed peg driven in

²³ American State Papers (Vol. XIV) of Naval Affairs (Vol. I),
op. cit., p. 695, Item No. 194.

hard and fast. This is an old English method of caulking. British vessels sunk by Cornwallis in the York River in 1781 had this same type of caulking. The large treenails were caulked four ways, as  ; the middling three ways, as  ; and the small twice, as  .²⁴ One plank on this vessel had been repaired and new treenails driven in. These nails were made of pine and caulked by the old wedge method, as is shown by group No. 1 in photograph No. 18.

The general architectural features of the hull also point favorably to its being a vessel built for war. One feature is the heavy, solidly constructed bow, suitable for ramming - not that it had sufficient power to damage a larger vessel, but it could easily ram and destroy the landing boats and barges from the larger ship. One of the main purposes for the construction of large gunboats was to prevent the enemy from entering and devastating the country along harbors and bays.

Another feature of the vessel is the shallow draft and wide beam. Plate 2 shows a cross section of the vessel; the boat would have had close to a 19 foot beam.

The first ten gunboats copied from those borrowed from

²⁴Fincham, John, An Outline of Ship Building, op. cit., pp. 42-43.

the Neapolitan government proved inefficient.²⁵ Their narrow beam did not give sufficient stability for the firing of heavy cannon. This resulted in a change to wider beams, giving more stability, the bow of a boat being made quite full. This bulkiness was necessary, due to the heavy forward gun. The concussion resulting from fire from heavy guns would have forced the narrow bow too deep into the water. The full bow prevented this and also helped to lift the bow with its heavy load when a heavy sea was running, thus preventing the boat from being constantly awash. Several types of rigging were used on these boats. The old Mediterranean lateen rig was the most common, (see photograph No. 24) both for the one and two masted; some used along the coast for protection against pirates were rigged as brigs. The propulsion of these boats, however, was not dependent on any sailing quality; it depended mostly on sweeps or oars. In a letter dated September 24, 1804, to Mr. Beekman, who was in charge of constructing gunboats Nos. 6 and 7 at New York, he was informed that the boats were to be rigged with two

²⁵ Cooper, J. Fenimore, History of the Navy of the United States of America, (New York, Oakley & Mason, 1866), II, 11.

masts, lateen fashion, with 50 oars made of ash and from 25 to 27 feet long.²⁶ The boat on Bodie Island had two masts, but upon a close examination the masts and sailing rig seem to have been secondary. Plate 3, Fig. 1 and 3, show the masts and keelson with the mast mortise, or step, and study of it reveals one of the weakest points of construction in the vessel. The idea of cutting a mortise 4 inches by 18 inches by 7 inches deep in the keelson for placing the masts is not generally practised; usually a step, or, rather, a heavy timber, is placed over the keelson and the mortise is then cut in this timber. But here it is cut from the keelson itself, with no timber to strengthen it. The step of the fore mast is still further cut, its mortise being 4 inches by 23 inches by 7 inches deep. Why such a long mortise (23 inches) when only a 15 inch diameter mast was used can be explained only two ways - either a mistake was made in cutting the mortise or the boat at one time was rigged as a brigg. If the latter, the diameter of the main mast - 15 inches - was sufficient, as only a spenker sheet would have been used, with perhaps a topsail, the

²⁶ Extracts from Letter Books and other Manuscript records of the Navy Department, used by courtesy of The Mariners' Museum.

fore mast would carry from three to four square sails. This would need a mast of at least 19 inches in diameter.²⁷ The fact that both the fore and aft masts are of the same dimensions may be explained by the enormous number of masts needed for the 176 gunboats, some single masted and others double. Could the government have gone in for a wholesale production of masts for gunboats? Masts were frequently lost in a storm or damaged in action, and destroying them was one of the first attempts of an enemy to cripple the opponent — dismasting him rendered him helpless.

In checking various volumes on early ship wrecks along the coast of Cape Hatteras, there are three very interesting episodes dealing with gunboats, two of them significant. Gunboat No. 1 was driven ashore along the Coast of Carolina. It is recorded as "off the Coast"²⁸ and "driven nearly a mile into the wood"²⁹ during a hurricane in South Carolina.

Gunboat No. 7 was lost at sea on its way to the Mediter-

²⁷ Steel, David, The Elements and Practice of Naval Architecture or, A Treatise on Shipbuilding, (London, Printed for Steel and Co., 1812),

²⁸ American State Papers (Vol. XIV) of Naval Affairs (Vol. I), op. cit., p. 154, Item No. 56.

²⁹ ———, The Naval Chronicle for 1807 [July to December], (London, Printed and Published by and for Joyce Gold), XVIII, 279.

ranean.

The one gunboat which is of particular interest to us is No. 140, which exploded accidentally near Ocracoke Inlet on September 25, 1814. This vessel no doubt burned to the water's edge after the explosion. The vessel found on Bodie Island had also been burned. These is another item of interest about gunboat No. 140 which may tie in with the wreck, namely, the fore mast. This gunboat was at the Washington Navy Yard at the time Washington was captured by General Rose and Admiral Cockburn. In this connection the citation following is of interest: "On my return to the yard on the twenty-sixth, I had the mortification to observe, that the provisions which had been laded on board the old gun boat, No. 140, (and with which she had grounded in endeavoring to get out of the branch, on the twenty-fourth) had become a prey to numerous unauthorized persons...."³⁰ She is spoken of in

³⁰ Letter, dated at the Navy Yard, Washington, October 18, 1814, written by Thomas Tingey to Honorable William Jones, and included in American State Papers (Vol. XII) of Military Affairs (Vol. 1), p. 578, Item No. 137.

[American State Papers. Documents, Legislative and Executive of the Congress of the United States, from the First Session of the First to the Second Session of the Fifteenth Congress, inclusive: Commencing March 3, 1789, and Ending March 3, 1819. Selected and edited, under authority of Congress, by Walter Lowrie, Secretary of the Senate, and Matthew St. Clair Clarke, Clerk of the House of Representatives, (Washington, Published by Gales and Seaton, 1832).]

several other letters as an old gunboat and of being of no further use in protecting the town. (She was built in 1808 and was only six years old when Washington was destroyed). She may have been transferred farther south along the coast. Perhaps she had been built of green lumber. There are many mentions throughout the State Papers on Naval Affairs of such a circumstance. If so, she may not have been able to carry her large sails, perhaps only a make-shift rig, or perhaps a lateen rig had been placed aboard her due to the destruction of the Navy Yard and its sources of material. Though the writer realizes he is treading on dangerous ground in trying to assign the wreck a definite identification, there are several features in these two boats which are closely enough related to tempt one.

In summarizing the report, the writer takes the liberty of making a few statements based on the findings in the report. Though much time was spent in research on the sixteenth, seventeenth, and early part of the eighteenth centuries, not many of the details disclosed have been incorporated into the report because the differences in the Bodie Island ship and those of the earlier periods are quite obvious; in fact, not one recorded vessel had the slightest similarity.

It is only after the middle of the eighteenth century that similarity appears. The two boats mentioned previously, namely, the fishing boat of New England and the row galley of the Revolutionary War period, can be discounted for one salient reason -- it is doubtful that money would be spent for bronze fastenings on a fishing boat since by so doing the cost of the building would be so increased, and during the Revolutionary War copper or gun metal was not overabundant in the colonies and what there was was sorely needed for bronze ordnance.

The suggestion that the wreck was one of the early gunboats is not without merit, and is certainly worthy of grave consideration, as the similarity is so great, and while he is very much inclined to do so, the writer does not feel sufficiently in possession of facts at present to definitely draw the conclusion that the Bodie Island wreck is an American gunboat.

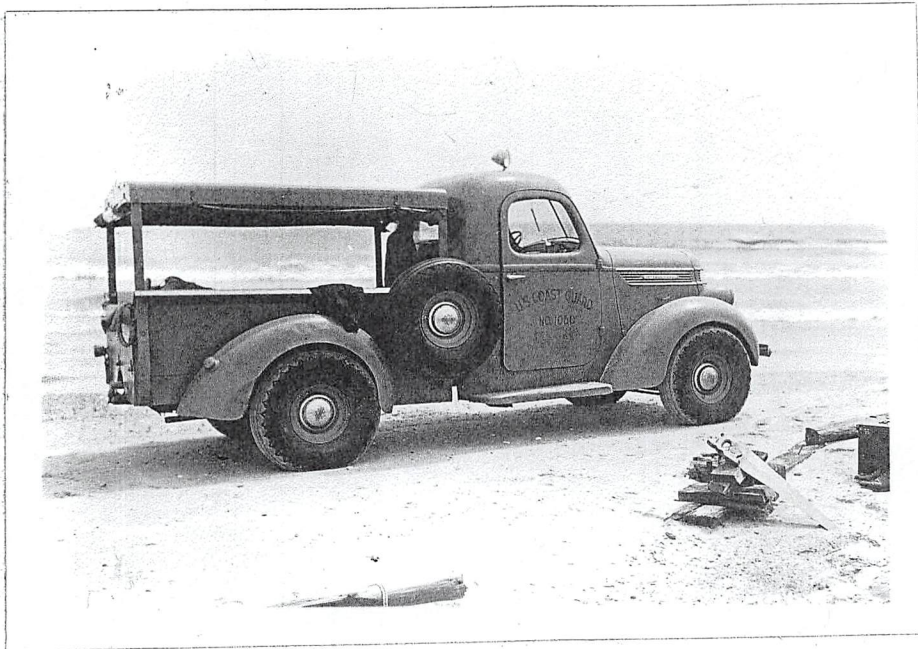


Thor Borresen,
Junior Park Research Technician.

TB.OD
June 13, 1939

(Typed July 13, 1939)

cc: The Mariners' Museum
Dr. C. C. Crittenden
Washington-Supervisor of Historic Sites
The Regional Director (2)
Historical Division
Mr. Borresen
Central File

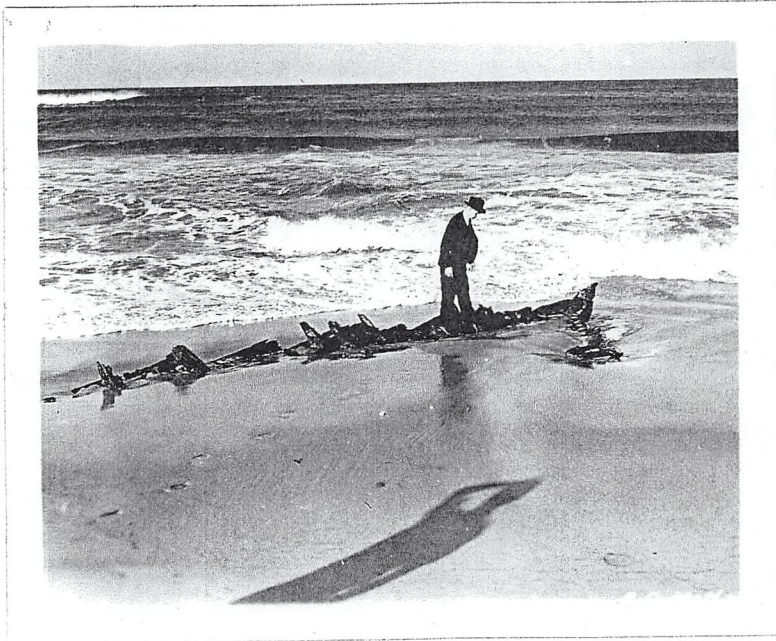


Photograph No. 1

(GNHP #7763)



Photograph No. 2



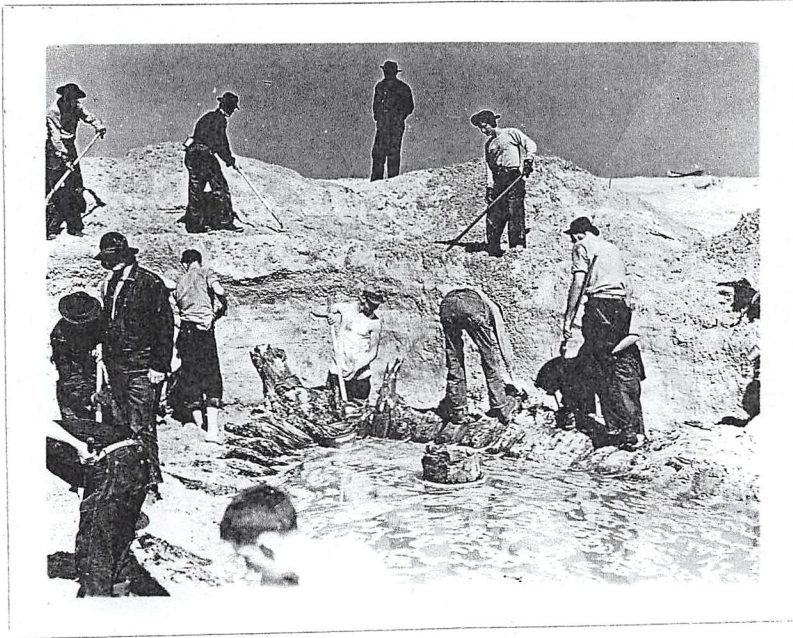
Photograph No. 3



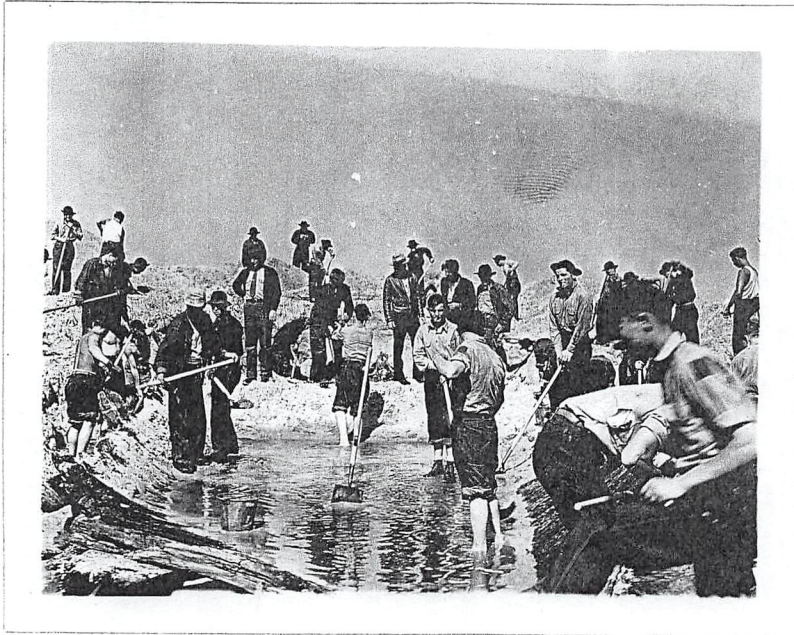
Photograph No. 4



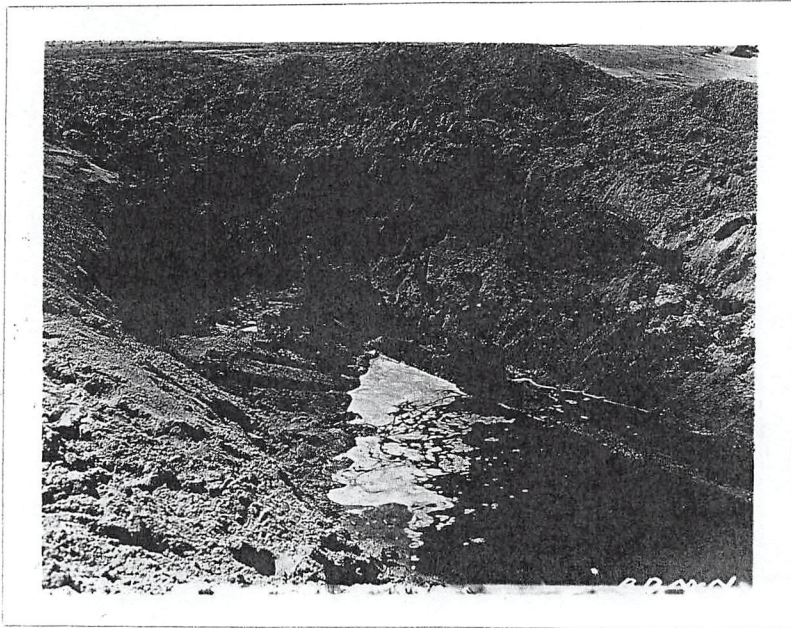
Photograph No. 5



Photograph No. 6



Photograph No. 7



Photograph No. 8

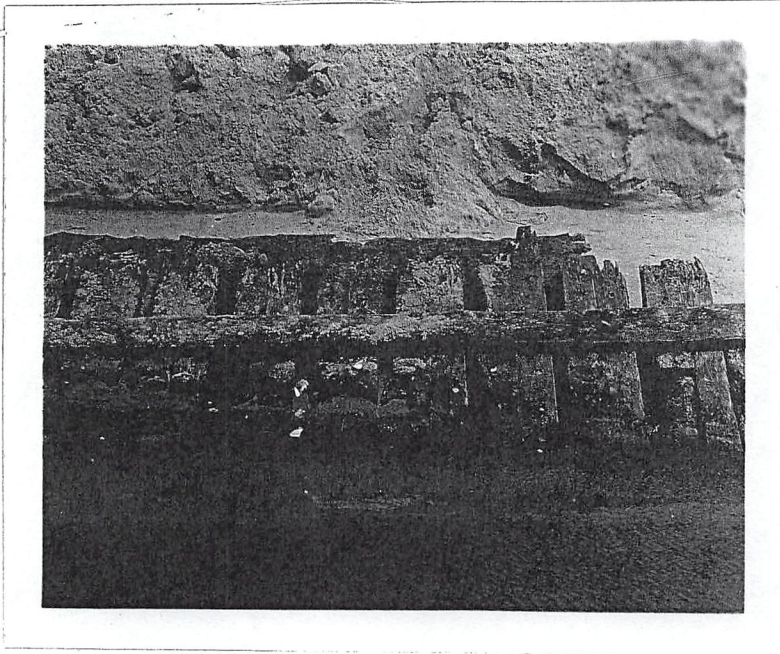


Photograph No. 9

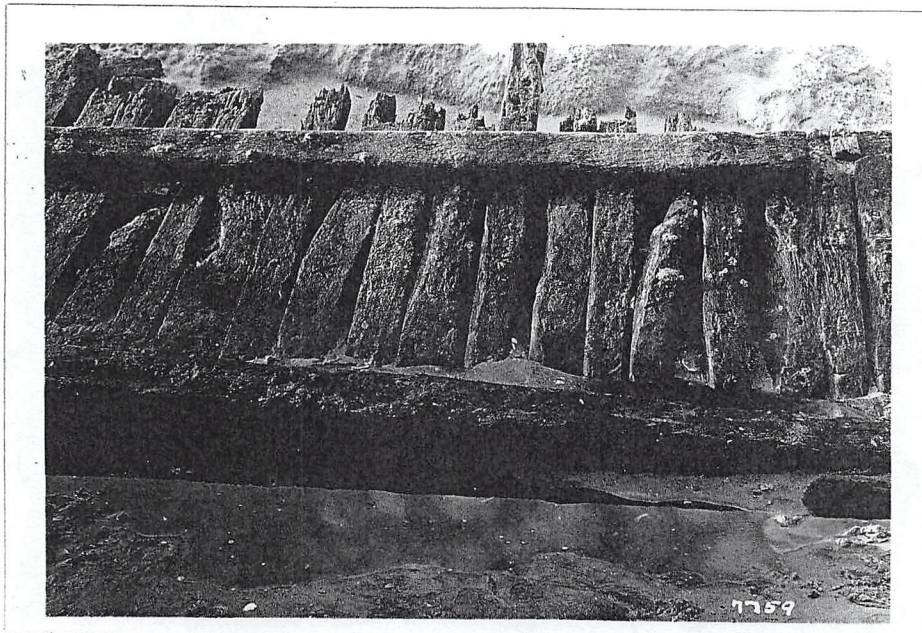
(CHMP #7757)



Photograph No. 10

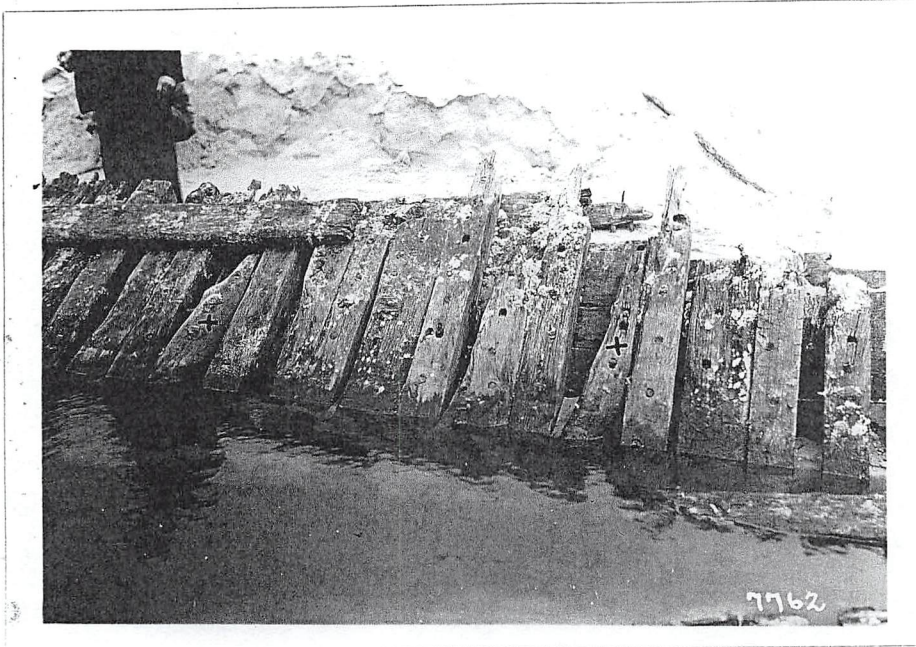


Photograph No. 11



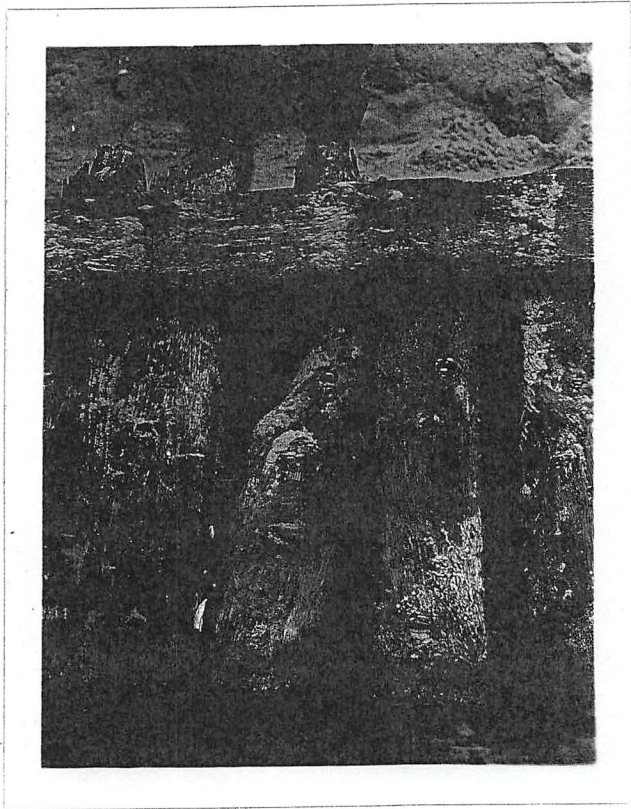
Photograph No. 12

(GNHP #7759)



Photograph No. 13

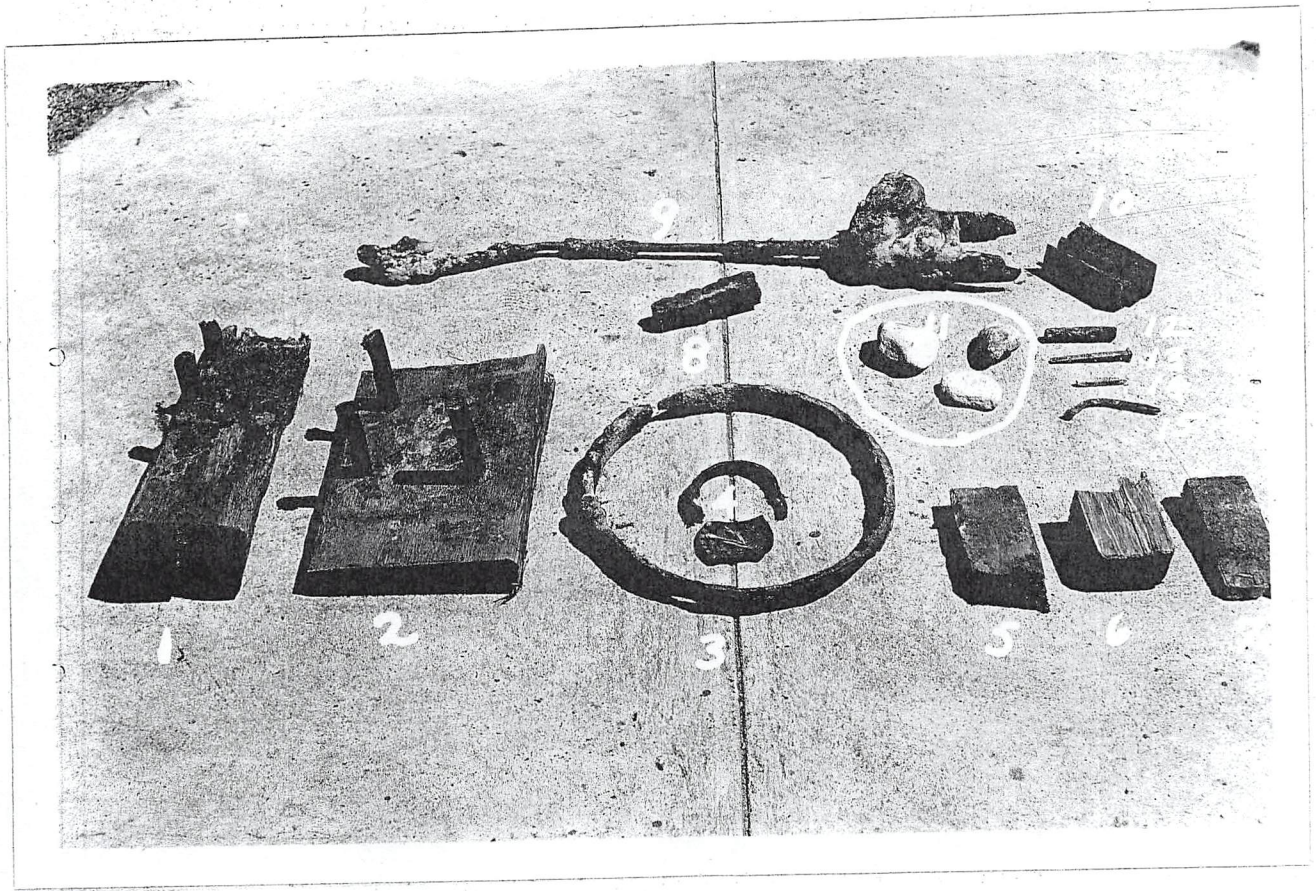
(ONHP #7762)



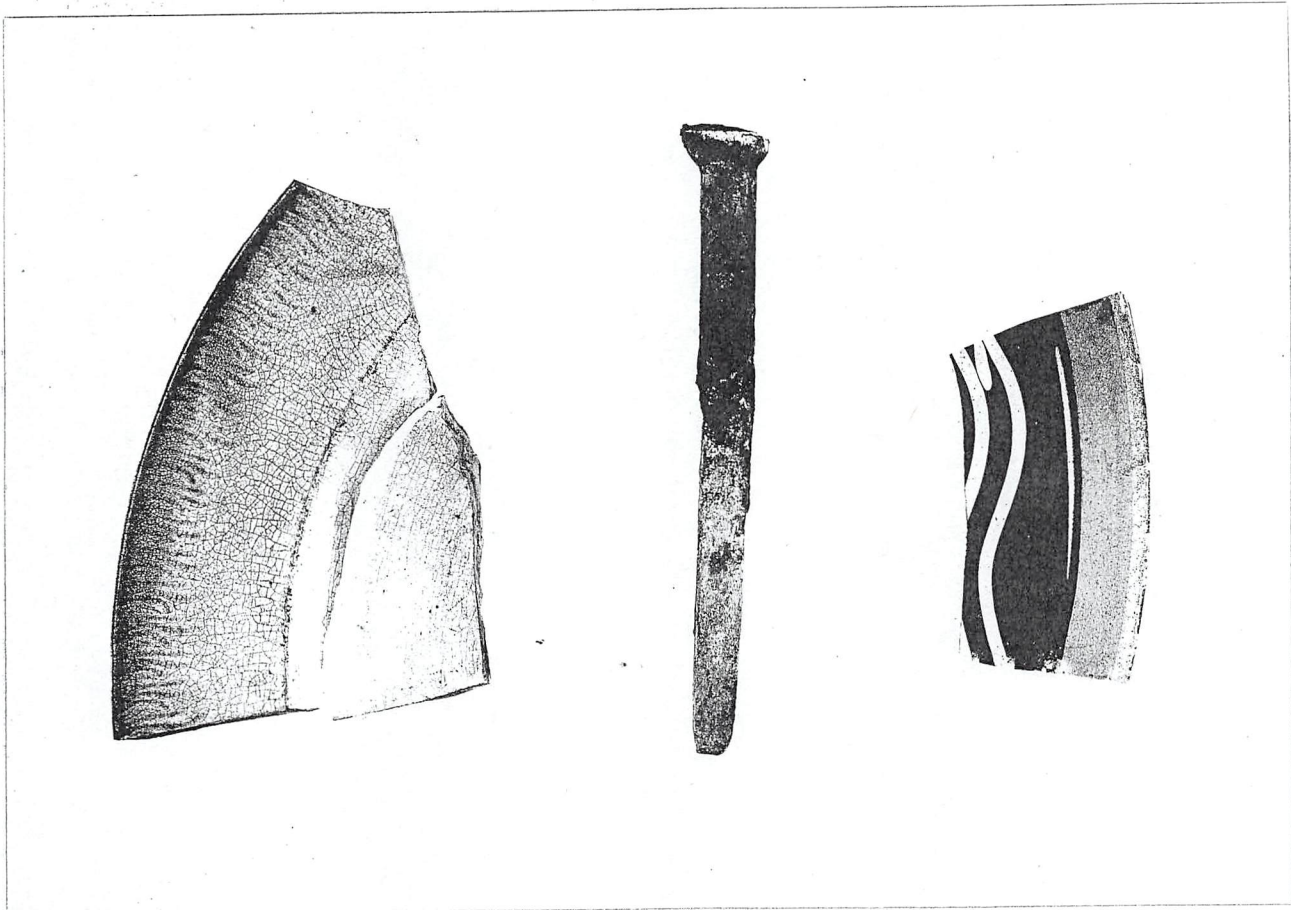
Photograph No. 14



Photograph No. 15

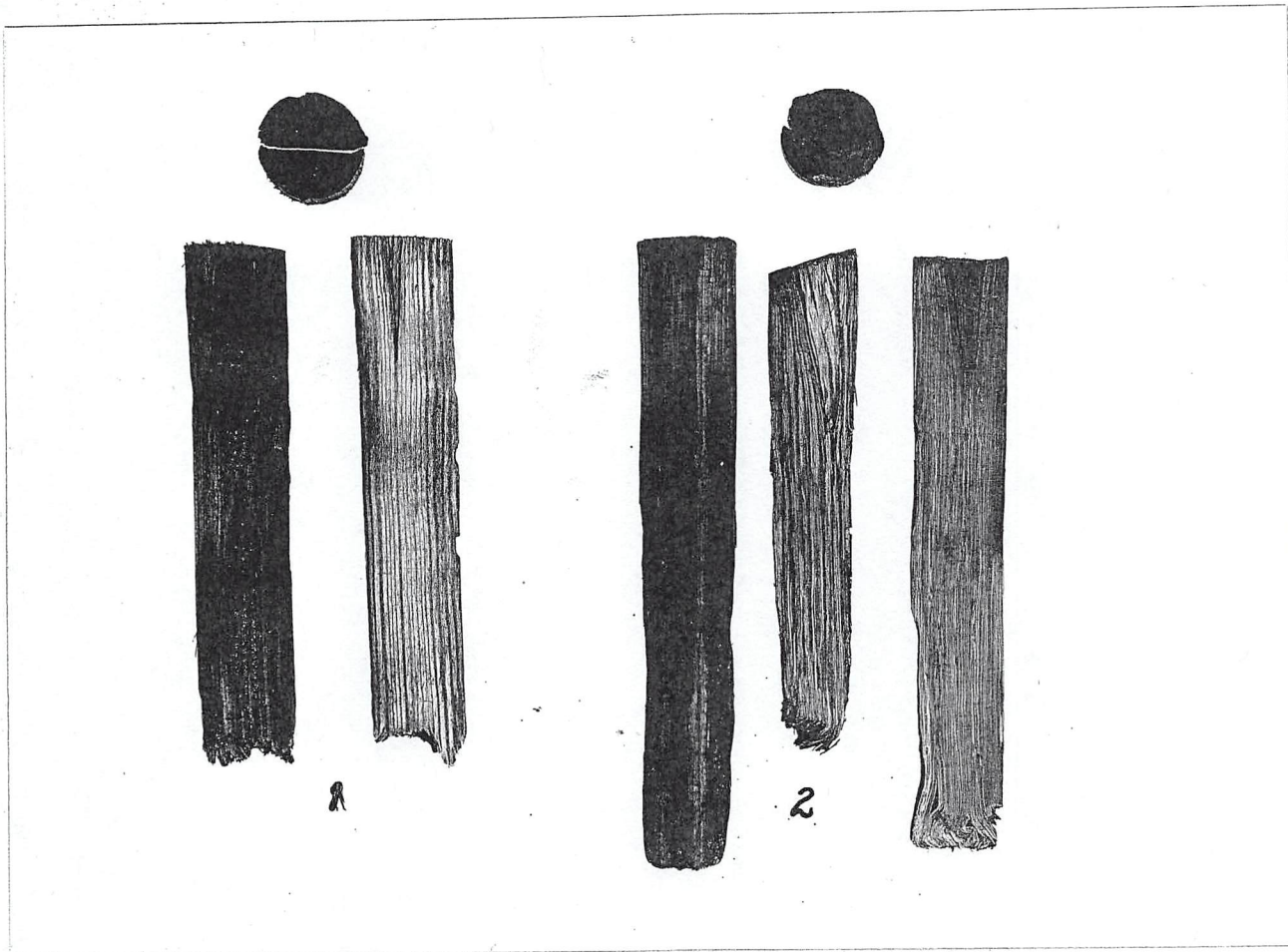


Photograph No. 16



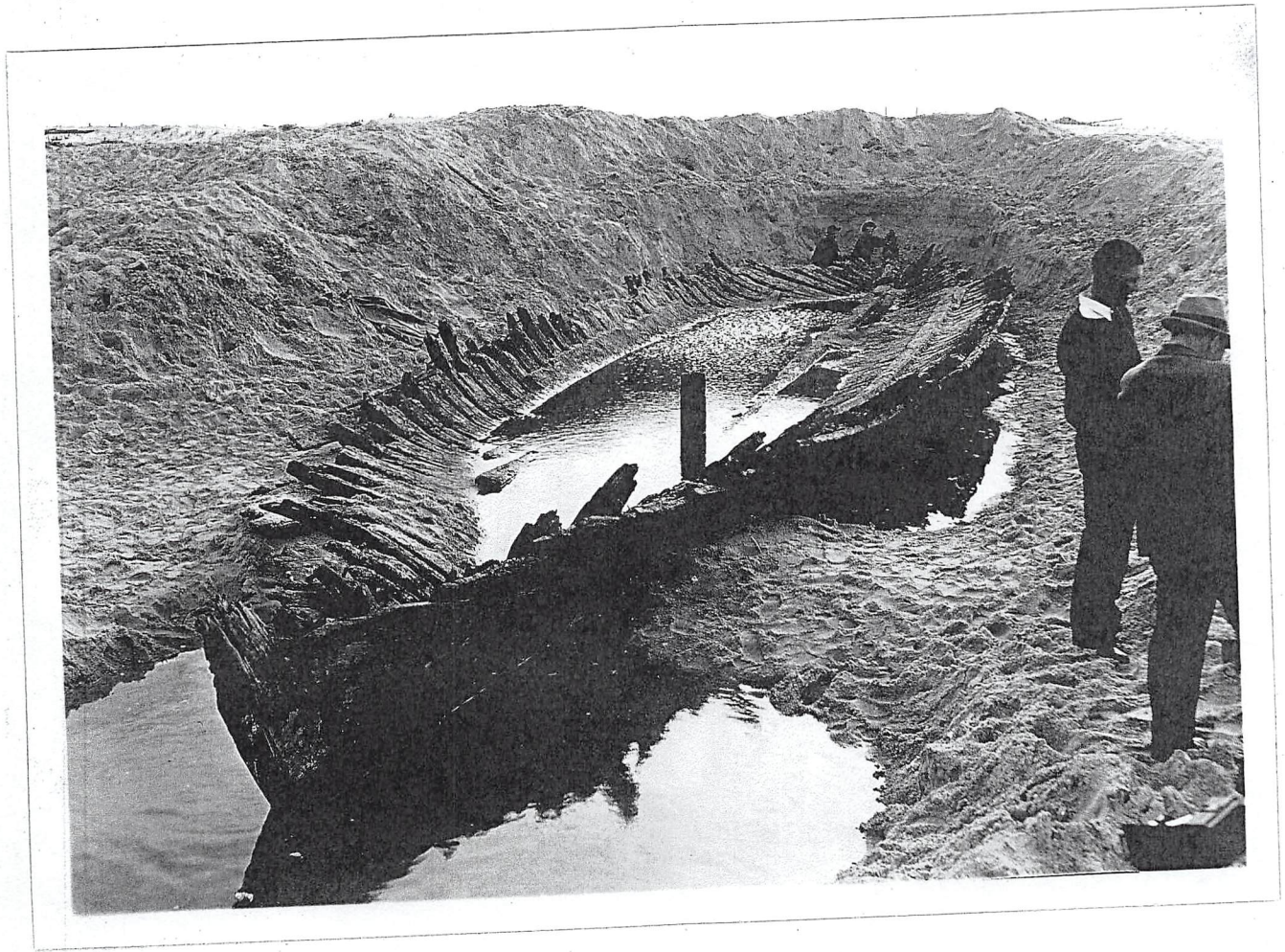
Photograph No. 17

(CHP #7754)



Photograph No. 1B

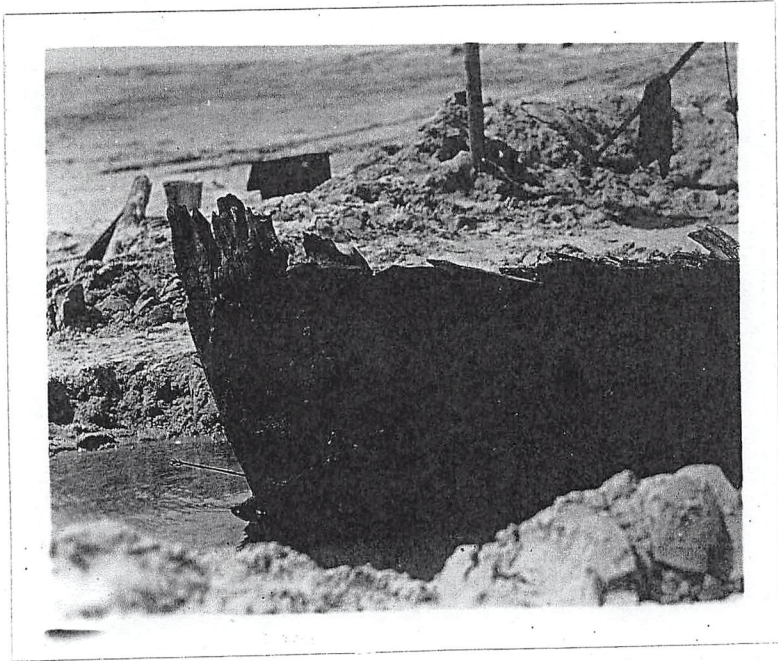
(GHEP #7755)



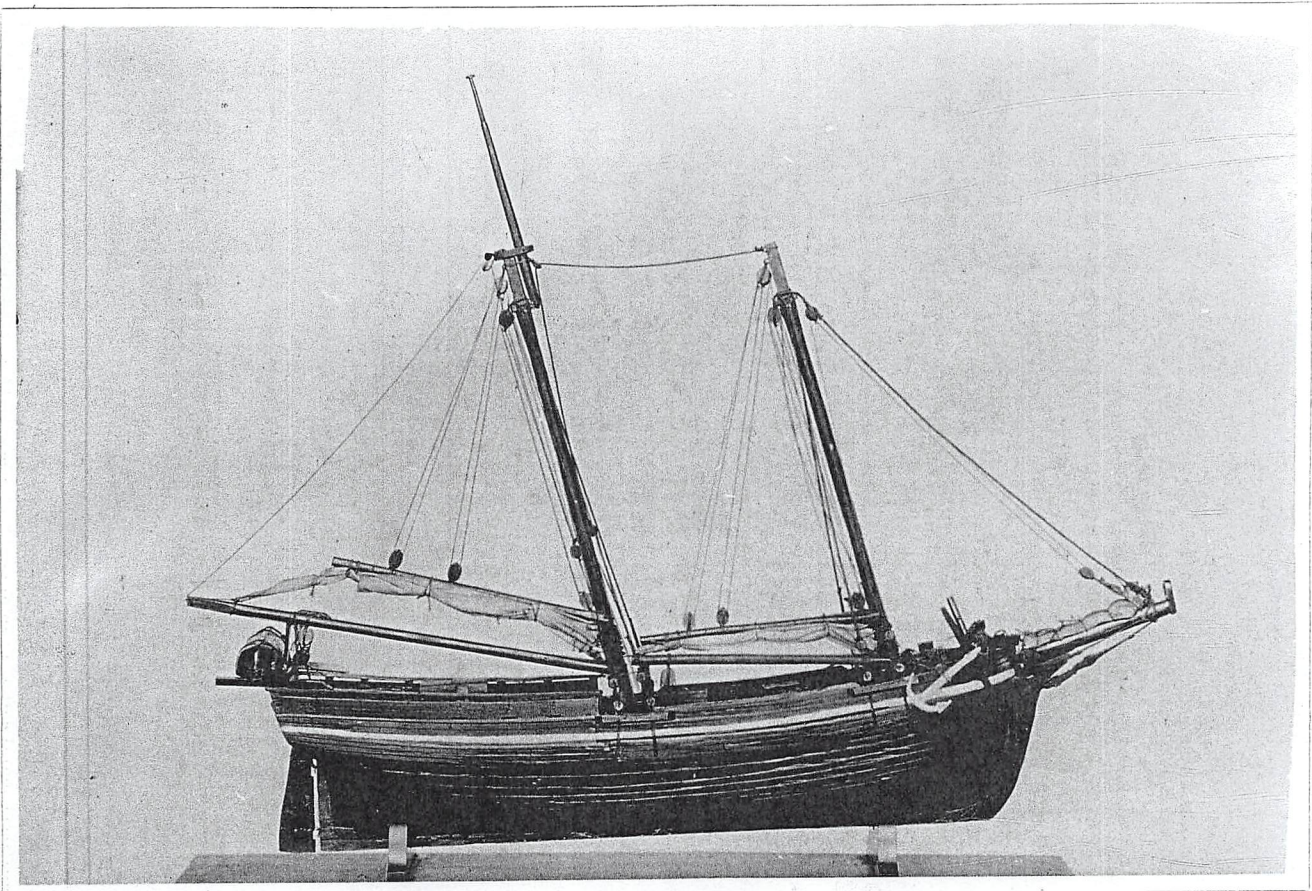
Photograph No. 19



Photograph No. 20



Photograph No. 21



Photograph No. 22
(Boat #1)

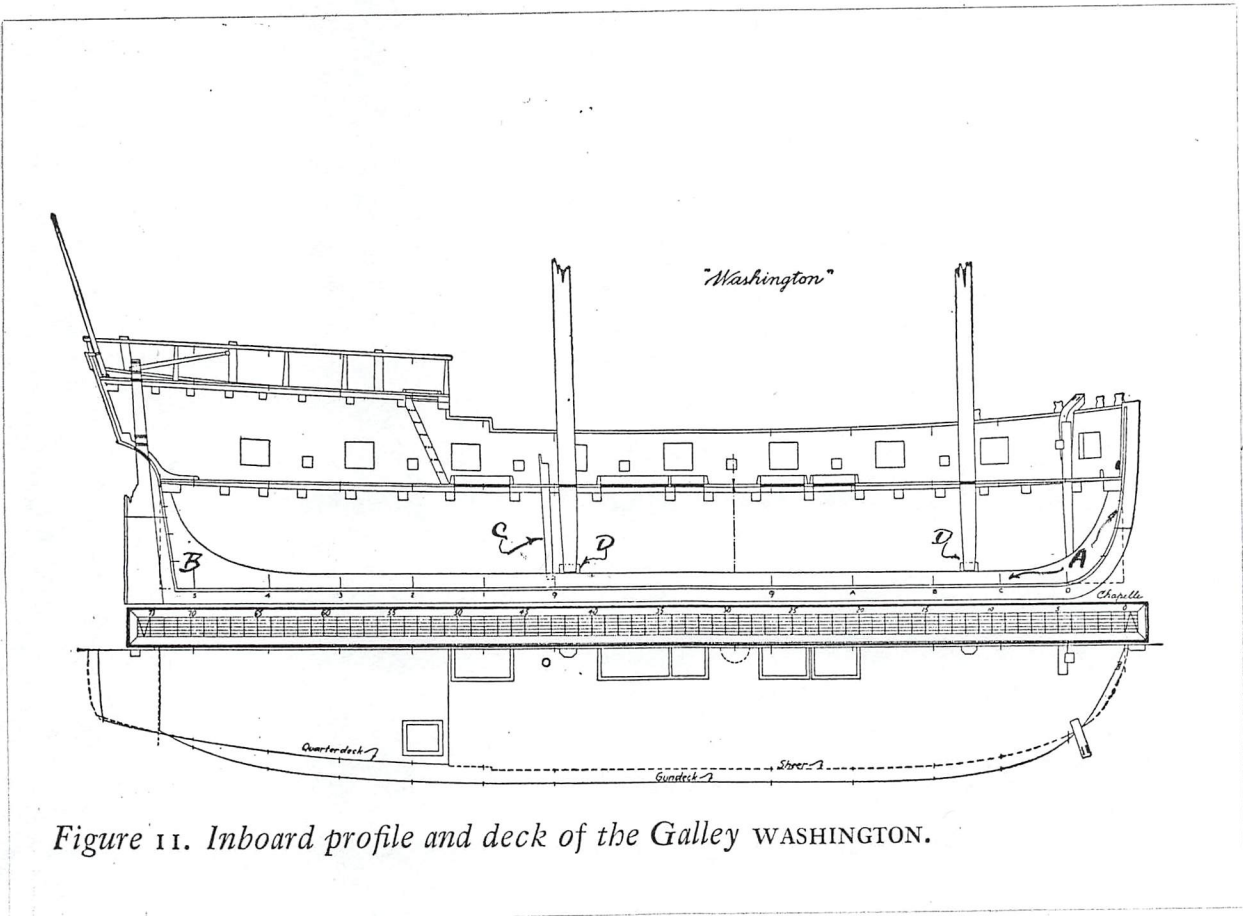


Figure 11. Inboard profile and deck of the Galley WASHINGTON.

Photograph No. 13
(Boat #1)

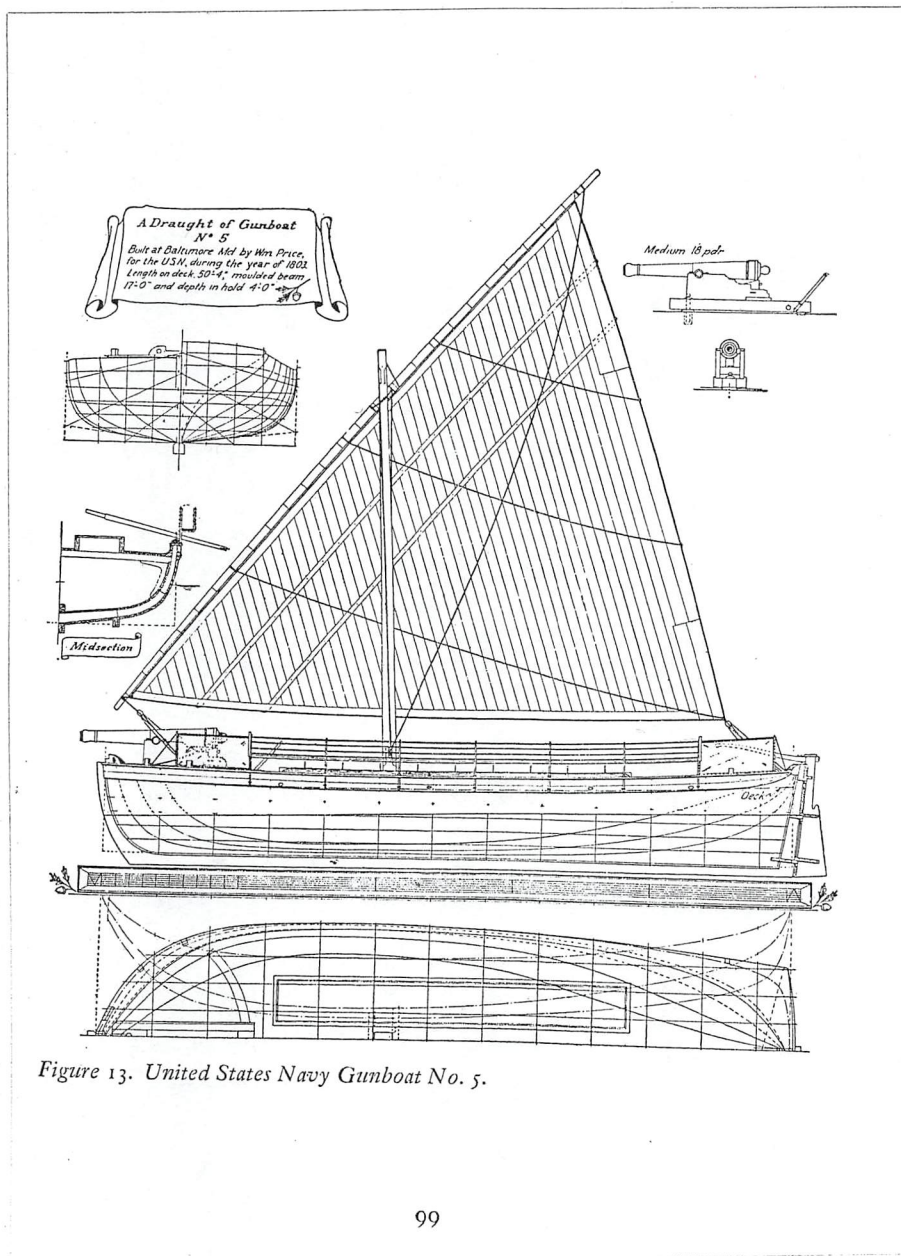


Figure 13. United States Navy Gunboat No. 5.

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Photograph No. 24
(Boat #5)

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APPENDIX I

APPENDIX I

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May 12, 1939

Mr. C. P. Winston, Director
Forest Products Laboratory
Madison, Wisconsin

Dear Sir:

We are very much interested in obtaining information as to type and age of the wreck of an old sailing vessel unearthed on the beach near Manteo, N.C., within the past ten days.

We have made a personal inspection of this wreckage and while we feel that we are reasonably certain of the type and its approximate age, within a period of one hundred years, yet we feel that an analysis of the wood would help us a great deal in arriving at a nearer age, if we could determine whether the oak timbers and planking and the mast stumps are of American timber or of European timbers.

We are sending you herewith a photograph of one of the mast stumps with the iron band attached and showing where same was cut to fit in the keel of the vessel, which mast stump is of pine. Also several photographs showing the framing of the vessel together with one showing the entire hull as excavated. Another photograph shows the stern of the vessel nearest to the man ready to put his hand on one of the frames, the bow of the vessel being further in shore.

We are anxious to know if you could help us in this undertaking, informing us as to whether you could tell whether the oak timbers, etc. are made of American oak or European oak and from this give us some idea as to its age. Also if you could tell us whether the pine masts are of American pine or of European pine.

Enclosed find photographs of certain articles of wood, metal, leather, rock ballast, etc., recovered from this wreck, all of which we feel competent to obtain information from except the wood. You will note from this photograph that the articles

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are numbered and that the samples we could send you are: 1. A section of the ship's frame 6 x 6 x 6 with treenails attached. 2. The section of the ship's outer planking with treenails attached. 5 and 7. Oak mast wedges used for securing the mast. 10. This is in three pieces and was used as a bleeder plug in the hull of the vessel. 6. Sections cut from the bottom of the mast stump and are of pine.

These samples are of no particular use to us except for the purpose of identification and we could send you the whole article instead of just a piece cut off same if you so desired.

We would also appreciate it if you could advise us approximately as to what the cost of analysing these wood samples might be.

I believe the Newport News Shipbuilding and Dry Dock Company has consulted your Laboratories on several occasions and they advise us to contact you. We are also advised by a visitor to our Museum, Mr. Charles V. Bacon, Chemical Engineer, 117 Liberty Street, N.Y. to send this inquiry to you direct.

Yours very truly,

(S) J.T.HOLZBACH

J. T. Holsbach
Superintendent

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APPENDIX I

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
FOREST PRODUCTS LABORATORY

Madison, Wisconsin

May 15, 1939

Mr. J. T. Holzbach, Superintendent
The Mariners' Museum
Newport News, Virginia

Dear Sir:

Your letter of May 12 is received.

We shall be glad to attempt to identify samples of wood from the sailing vessel wreck referred to in as far as possible to do so. No charge will be made for the examination. Pieces measuring one-half inch in cross section and one inch in length will be large enough, but if readily available we would rather have pieces containing five or six cubic inches of wood.

We might say, however, that if the hull of the vessel was made of oak timbers they probably are of the white oak group and that it is not possible to distinguish American species of the white oak group from European species of the white oak group. If the mast, which you say is pine, originated in Europe, it very likely is Scots pine, since that is the principal species of pine growing in Europe. Scots pine can readily be distinguished from all native species of pine except red pine. Therefore, even if we can identify the wood as either Scots pine or native red pine that will not help in determining the origin, but if the mast belongs to the white pine group it undoubtedly is of American origin. The treenails if made of black locust would indicate that they are of American origin, but if made of oak it would not be possible to say whether they are native or European species.

We shall be glad to help you but as you will see we may not be able to make a positive decision possible.

Very truly, yours,
(S) ARTHUR KOEHLER, In Charge
Division of Silvicultural Relations.

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APPENDIX I

May 18, 1939
Re.: RPL2

Mr. C. P. Winston, Director
Forest Products Laboratory
Madison, Wisconsin

Atten. of: Mr. Arthur Koehler, In Charge
Division of Silvicultural Relations

Dear Sir:

We thank you for your prompt reply to our letter of the 12th instant relative to helping us in trying to determine whether the samples of wood recovered by us from a wrecked vessel are of American or European woods.

We fully appreciate that it will be almost impossible to make a definite decision as to these particular samples, however, we would like to have your opinion in this connection and in order to give you more information along this line we are sending you by express prepaid, with the samples taken from this wrecked ship, samples of wood taken from an old British vessel sunk at the siege of Yorktown in 1781 and recovered by us in the fall of 1934 and the spring of 1935. These samples have been under cover since the spring of 1935 and should be fairly dried out.

From the wreck recently uncovered off Manteo, N.C., we are sending you the following samples: 1. A piece of outside planking, oak, 16" x 10 1/2" x 2 1/4", with three treenails attached. 2. Section of ship's frame, 18" x 6" x 5", oak, with three portions of treenails attached. 3. A piece of the bottom section of one of the masts, pine, mortised to fit in the keel, 2 1/2" x 4" x 5 1/4".

The treenails in samples number one and two can easily be knocked out so that you may make an analysis of the treenails.

We are also sending you certain samples taken from British ships of the period of 1781 and are as follows: 4. A piece of a beam knee, oak, 3 x 4 x 6 1/2. 5. A piece of outside planking 2 3/4 x 3 x 7 1/4. 6. Four treenails (one split showing wedge peg).

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All of the samples sent you are of no further use to us so that it will not be necessary for you to return these samples to us.

We have sent to the Smithsonian Institute at Washington, D. C. samples of the rock ballast recovered and also three pieces of china to see if they can help us. The old metal sections have been sent to our Laboratory at the Newport News Shipbuilding and Dry Dock Company's plant.

We thank you for your interest in this matter and your kind offer to help us in this connection.

Very truly yours,

(S) J. I. HOLZBACH

J. I. Holzbach
Superintendent

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APPENDIX I

NEWPORT NEWS SHIPBUILDING & DRY DOCK COMPANY
Newport News, Virginia

CHEMICAL REPORT

May 24, 1939

Lab. Record No	Material From - Old Ship at Manteo, N.C.	Graphite	Combined C	Mn	Si	P	S	Ni	Cr
13601	Cast Iron Bar 1 1/2" sq.	2.59	.55	.87	1.65	.975	.030	---	---
13602	Mast band		.02	None	0.06	.550	.046	None	None
13603	Wrought Iron Nail		.14	None	0.03	.184	.010	None	None

Note: From the above analysis we are unable to determine the ship's history.

R. L. Angell

Signed A. C. Thompson

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APPENDIX I

NEWPORT NEWS SHIPBUILDING AND DRY DOCK COMPANY
Newport News, Virginia
CHEMICAL REPORT

Dept. _____

Date June 1, 1959

Lab. Record No	Material From Old Ship at Manteo, N. C.	Company	Bismuth Bi	Tin Sn	Lead Pb	Copper Cu	Zinc Zn	Manganese Mn	Antimony Sb	Phos	Nicke Ni
M-1235	Long Bronze Nail		0.25	7.98	0.15	87.02	4.12	Trace	0.45	None	None
M-1236	Short Bronze Nail		0.36	6.40	0.18	86.91	5.58	Trace	0.56	None	None

Remarks: Note-The bismuth and antimony content in this material may help in determining when the type of material was made and we are awaiting a reply from the Bridgeport Brass Co. on this point.

R. L. Angell

signed Jesse C. Jones

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APPENDIX I

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM
WASHINGTON, D.C.

June 3, 1939.

W. F. Foshag, Curator of Mineralogy & Petrology.

LIST OF SPECIMENS

No. 1 Schist

No. 2 Basic intrusive igneous rock related to gabbro.

Nos. 3,4. Fine-grained granite

No. 5. Coarse-grained granite.

The rock types are not distinctive enough to tell the exact locality, and represent ballast which could be picked up at many places.

/s/ W. F. FOSHAG.

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APPENDIX I

UNITED STATES DEPARTMENT OF AGRICULTURE
Forest Service
Forest Products Laboratory-----

June 6, 1939

Refer to RPLZ

Mr. J. T. Holzbach, Supt.
The Mariners' Museum
Newport News, Virginia

Dear Sir:

Reference is made to your letter of May 18 and our acknowledgment of May 27, we have examined the pieces of wood referred to in your letter and have made the following determinations:

Sample No. 1 which you designate as a piece of outside planking, sample No. 2 which you designate as a piece of the ship's frame, and the ten treenails and eight treenail wedges, all from the wreck near Manteo, N. C., are unidentified as belonging to the white oak group. Unfortunately we not only cannot distinguish the wood of the native species of white oak but we cannot distinguish the wood of our species of the white oak group from the white oak growing in Europe. Therefore, it is not possible to say whether the white oak from the wreck is American or European wood. I notice, however, that two of the treenails have considerable irregularity in the grain which undoubtedly would have been noticed in shaping the treenails. With the abundance of white oak timber available in this country in the early days of shipbuilding, I doubt very much that such defective treenails would have been used in this country, but in Europe where white oak timber always has been comparatively scarce and where workmen were more frugal in utilizing wood, such defective pieces would more likely have been used. I admit, however, that that is a very weak argument as to the origin of the wreck.

Sample No. 3 which you designate as a piece from one of the masts has the cellular structure of our native red pine (Pinus resinosa), also known as "Norway pine" and of the European Scots pine (Pinus sylvestris). These two species of pine also cannot be distinguished from each other by means of the wood alone although

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they can be distinguished from all other native and European species of pine.

Red pine formerly was used not only in this country for ship's masts but was also exported to Europe. The following statement concerning red pin is made in a British publication entitled "The Trees of Great Britain and Ireland" by Elwes and Henry: "The timber of this tree was at one time imported (into England) to a considerable extent, and according to Laslett (a timber inspector to the British Navy) was then known as red pine, and when straight and clean enough for masts was considered superior to Riga and Dantzic pines for that purpose.....It is valuable for piles, masts and spars." Therefore, even the mast specimen does not tell us definitely whether the ship originated in this country or Canada using native red pine for masts or it might have been built in England or on the European continent using European Scots pine or imported American red pine for masts.

We regret that this identification is not going to be of much value to you in solving the problem as to the origin of the wreck. We hope that some of the other material obtained from the wreck will have greater significance.

Very truly yours,

(S) ARTHUR KOEHLER

Arthur Koehler, Chief,
Division of Silvicultural Relations

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APPENDIX I

June 6, 1939

Bridgeport Brass Company
Bridgeport, Connecticut

Gentlemen:

In order to establish the approximate origin and age of a two masted wooden ship approximately sixty feet in length of unusual construction which was uncovered during a severe storm about May 1st of this year in the vicinity of Manteo, North Carolina. I am enclosing the analysis of a cast bronze spike (the spike itself is being forwarded by parcel post) which I trust you will examine in any way you desire and give us any suggestions that may lead to the date when this type of spike was used in shipbuilding.

The Mariners' Museum of Newport News has become interested in the relic and is attempting a research to determine its history and construction. Samples of oak from its stern and stern post have been sent to U. S. Dept. of Agriculture's Forrest Laboratory at Madison, Wis., in an effort to establish if it is American or foreign oak, and the Laboratory of the Newport News Shipbuilding and Dry Dock Company has made an analysis of cast iron, wrought iron and bronze items in an attempt to establish the type and age of the metals used in its construction.

You will note that the enclosed analysis of the cast bronze spike suggest gun metal (Navy Comp. G) except for the bismuth and antimony content, these elements may help in identifying when this type of alloy was made. Again, it is quite possible it is the result of a remelt or scrap addition.

I was prompted in making this request after reviewing the very interesting pamphlet entitled, "Seven Centuries of Brass Making" published by the Bridgeport Brass Company in 1920. And any information or suggestion that you can offer to help establish the history of this vessel will be gratefully appreciated.

Yours very truly,
(S) R. L. ANGELL
Metallurgist

APPENDIX I

June 13, 1939.

Analysis of china fragments (photograph No. 17)

No written report was procured on the china fragments, but specimens of both kinds found were submitted to Mr. Worth Bailey, Curator at Mount Vernon. His statement after examination was that neither piece could be earlier than 1780 and both wares enjoyed their greatest height of popularity during the first quarter of the nineteenth century.

Thor Borresen,
Junior Park Research Technician.

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APPENDIX II

APPENDIX II

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FIG. 1.

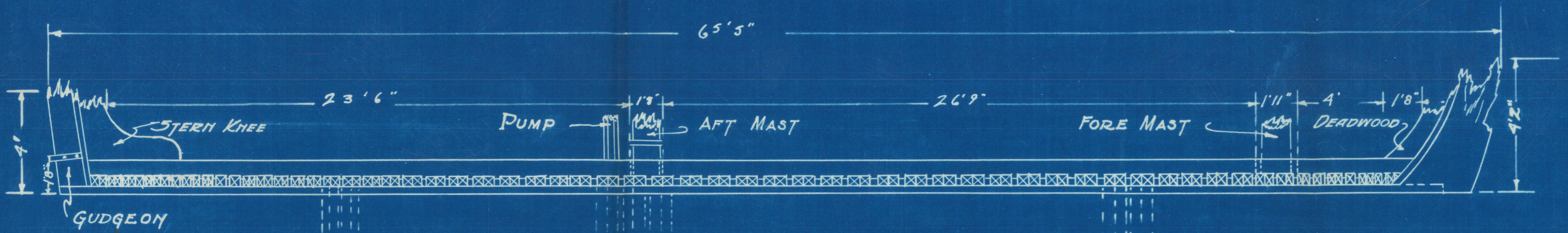
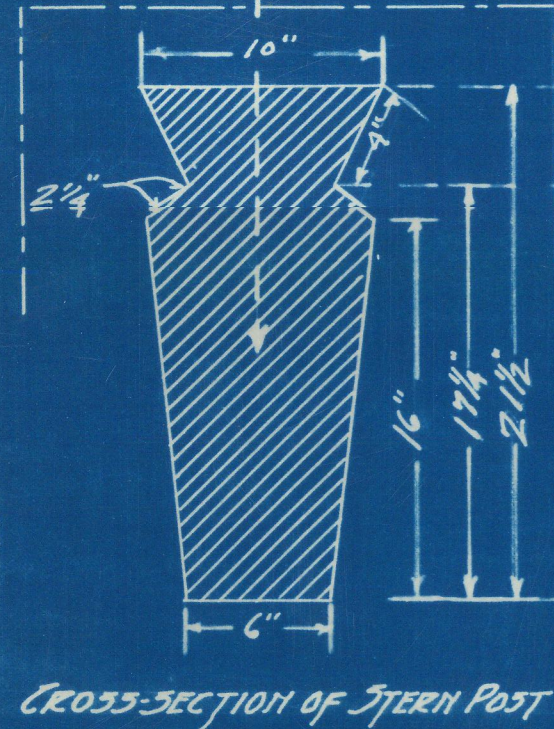


FIG. 2.

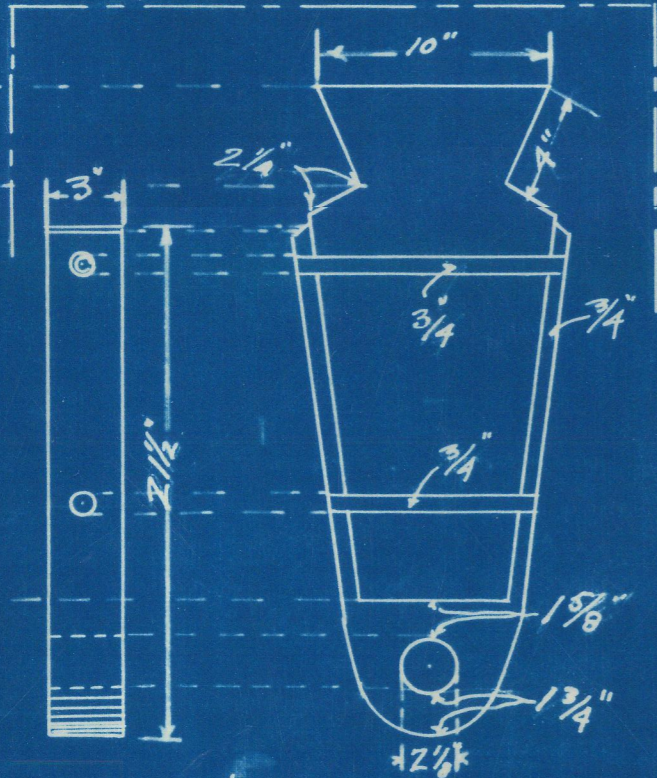


FIG. 3.



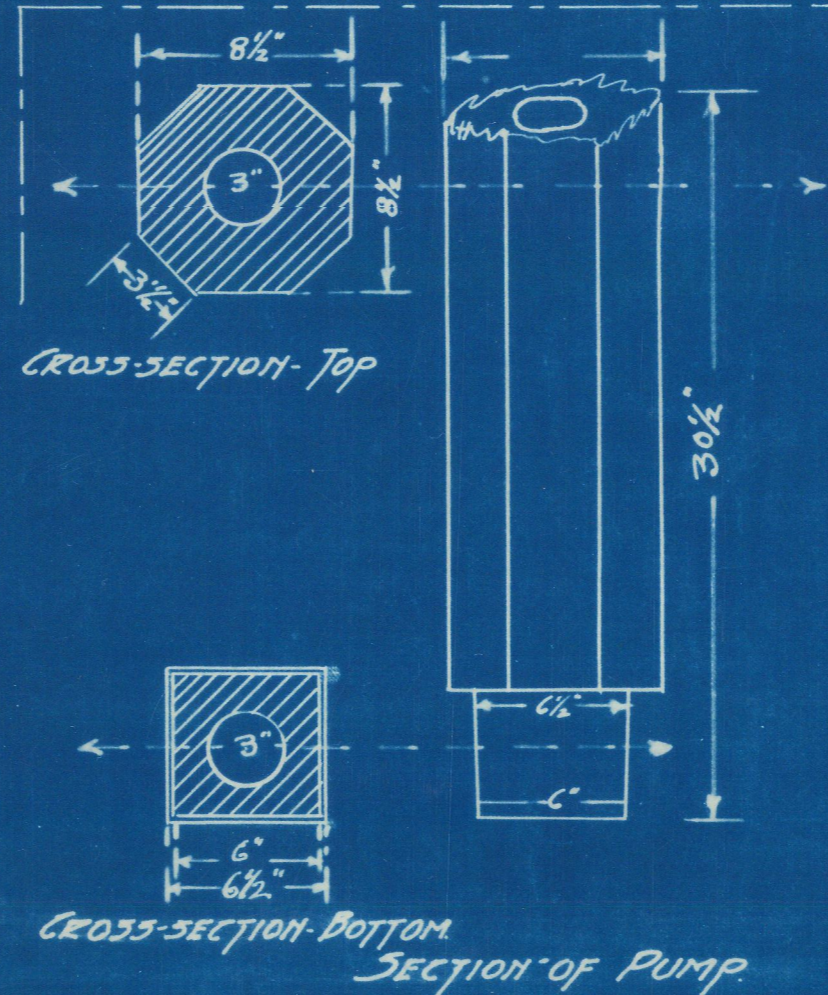
CROSS-SECTION OF STERN POST

FIG. 4.



PLAN & SECTION OF GUDGEON TO WHICH RUDDER IS FASTENED

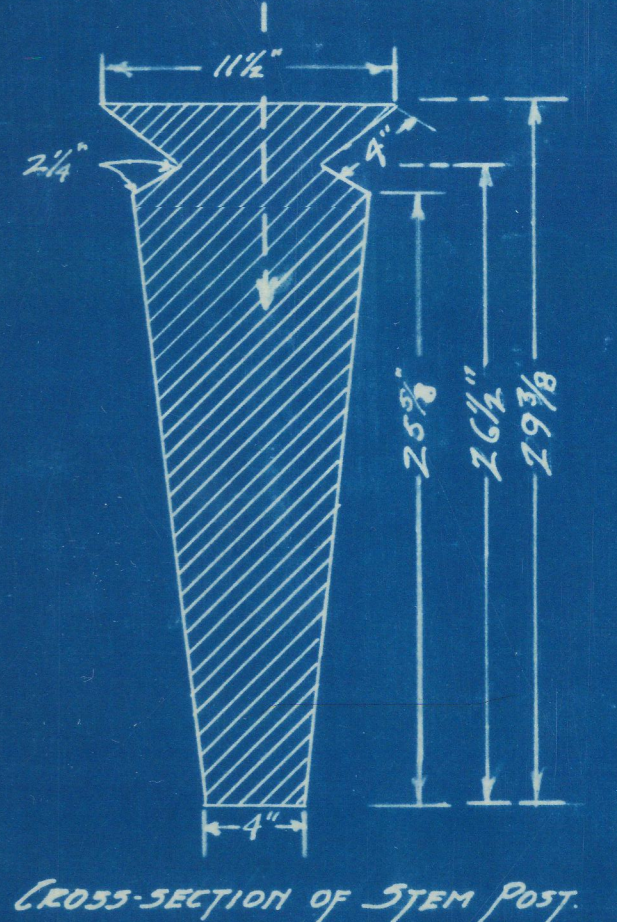
FIG. 5.



CROSS-SECTION-TOP

CROSS-SECTION-BOTTOM SECTION OF PUMP

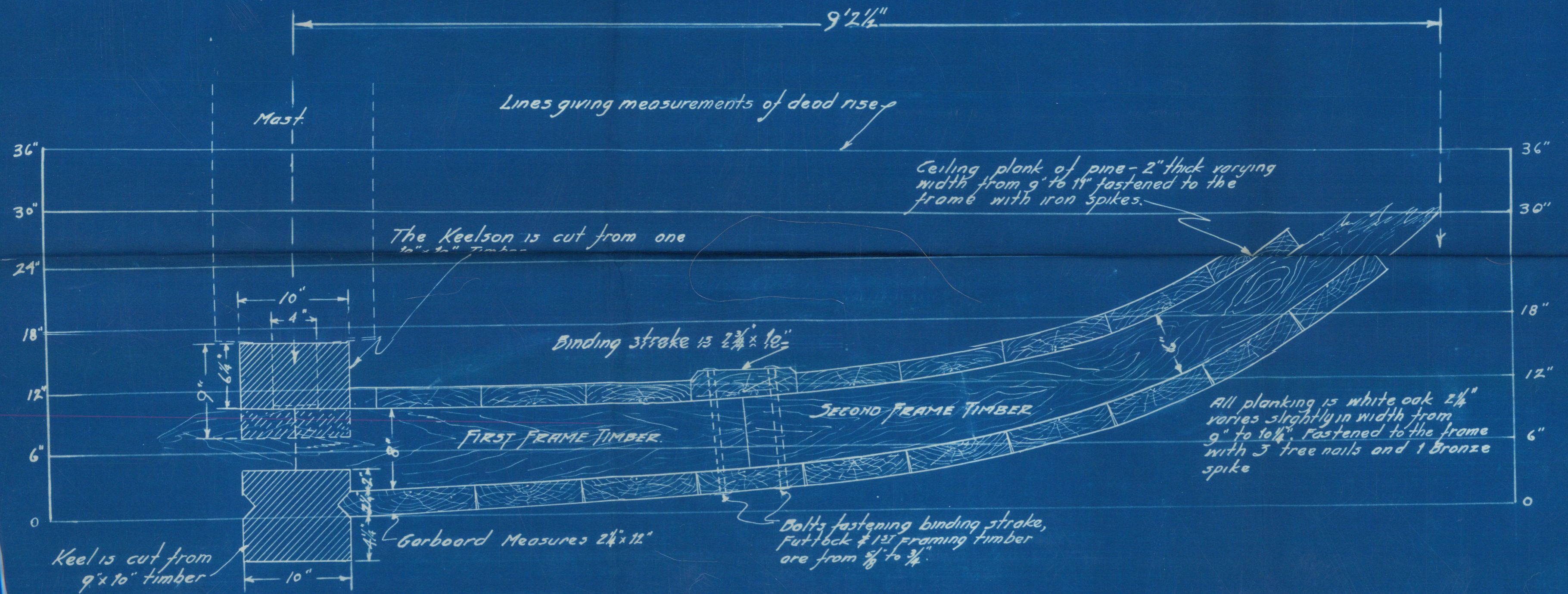
FIG. 6.



CROSS-SECTION OF STEM POST

OLD HULL - FOUND ON BODIE ISLAND, DARE CO. N.C. MAY-1939

CROSS-SECTION OF OLD HULL
FOUND ON BODIE ISLAND DARE CO,
NORTH CAROLINA - MAY 1939.



ELEVATION SHOWING DEAD RISE

FIG. 1 - AFT MAST

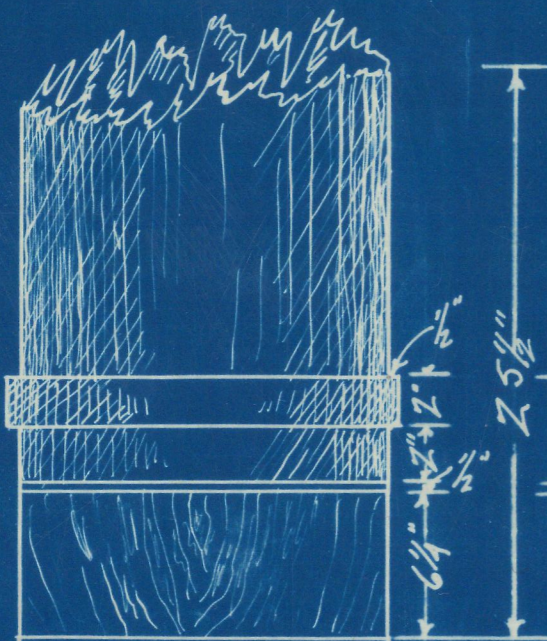


FIG. 2

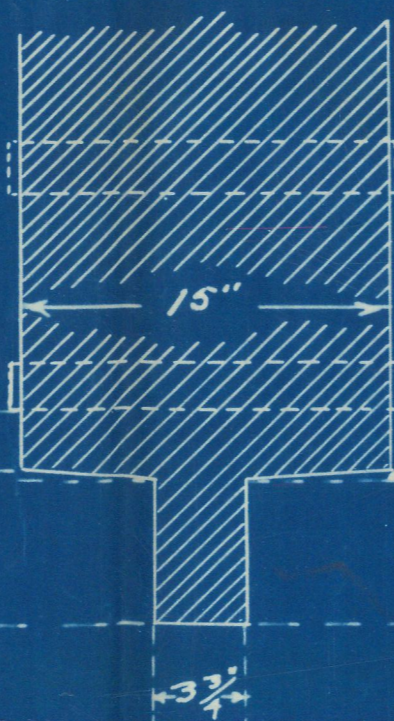
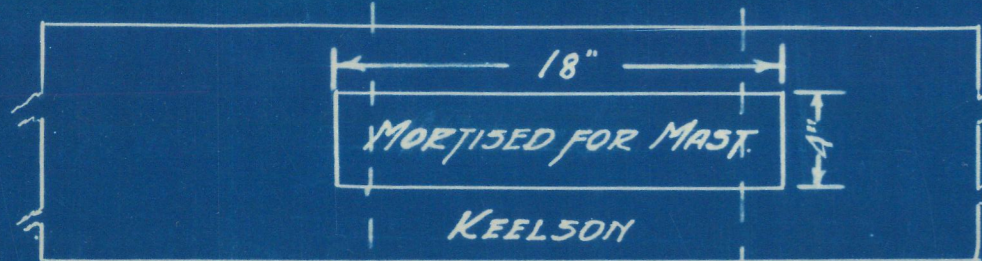
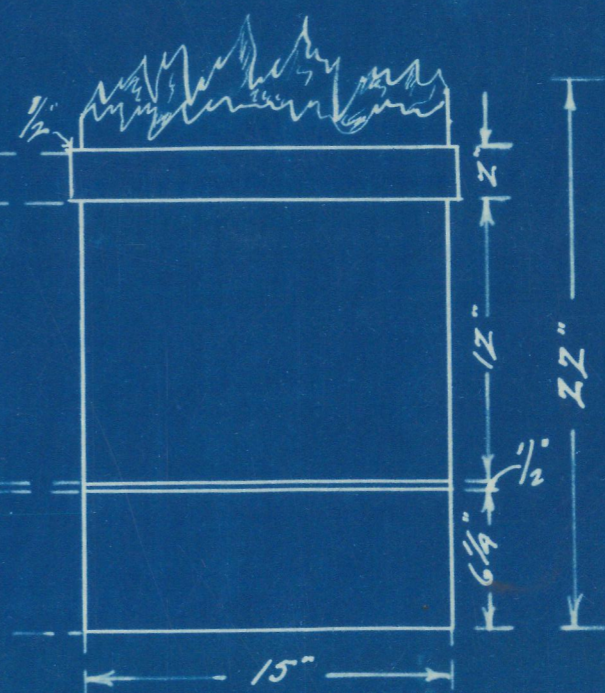
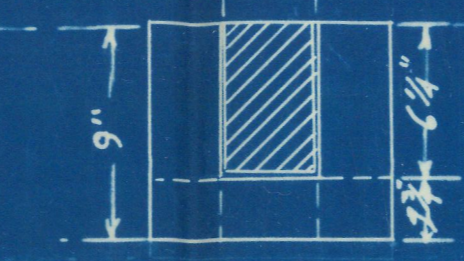


FIG. 3 - FORE MAST



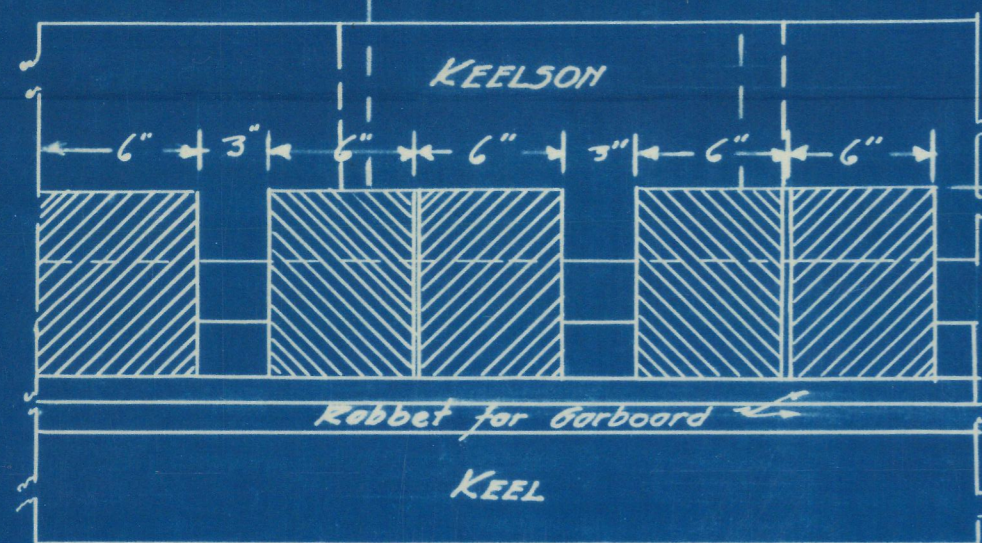
PLAN OF KEELSON & MAST STEP



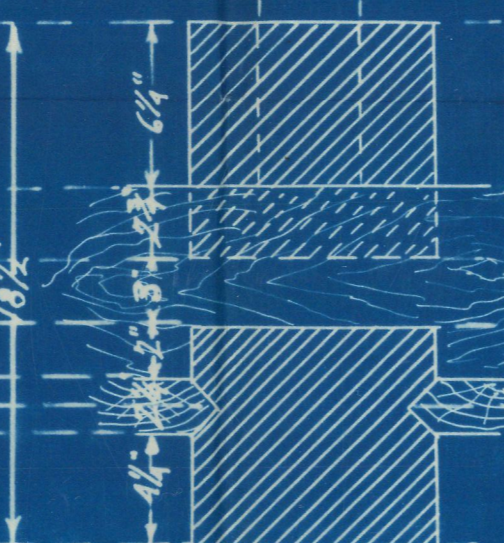
CROSS-SECTION & ELEVATION OF MAST & MAST STEP



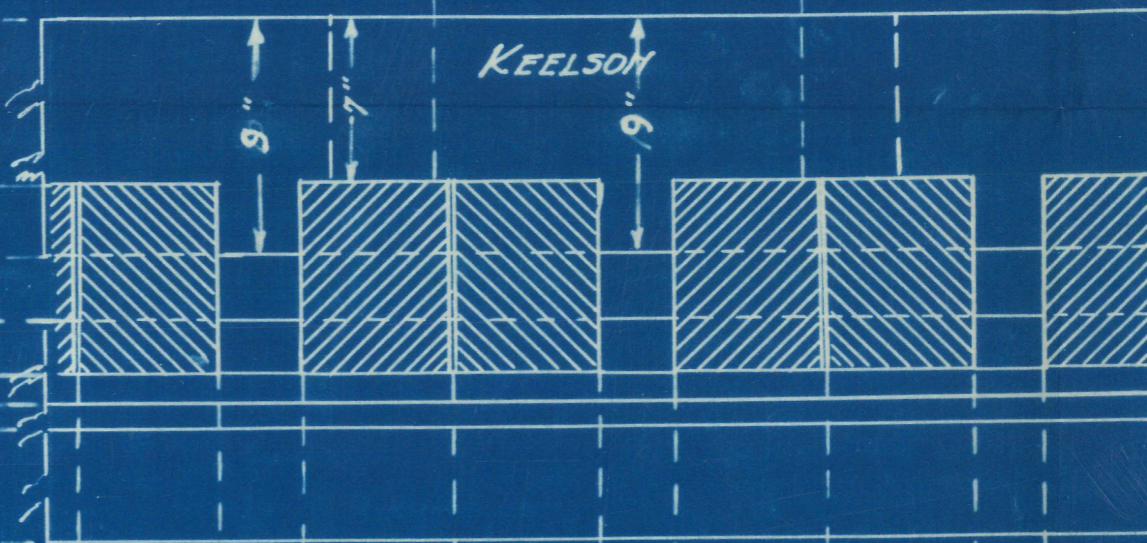
KEELSON



ELEVATION SHOWING KEEL, FRAME, TIMBER, KEELSON & MAST STEP

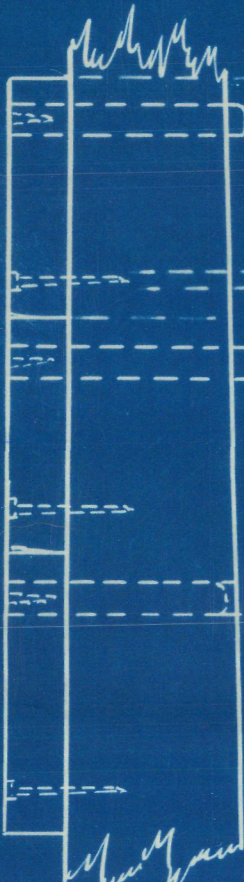


CROSS-SECTION & ELEVATION OF KEELSON, FRAME, TIMBER, GARBOARD & KEEL



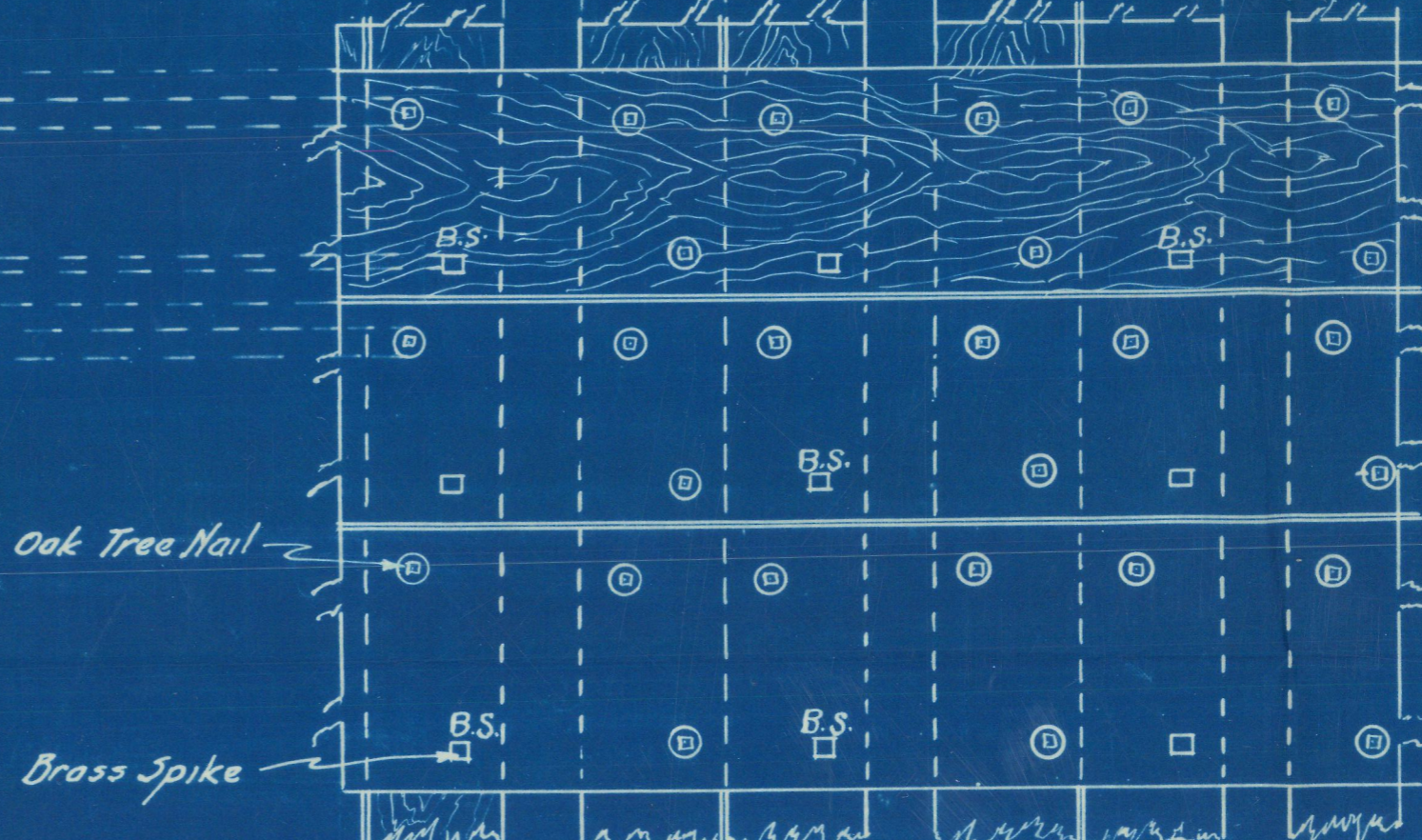
KEELSON

FIG. 5.



ELEVATION OF PLANKING & TIMBERS SHOWING METHOD OF FASTENING.

FIG. 4.



PLAN OF OUTSIDE PLANKING & METHOD OF FASTENING PLANK TO TIMBERS

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