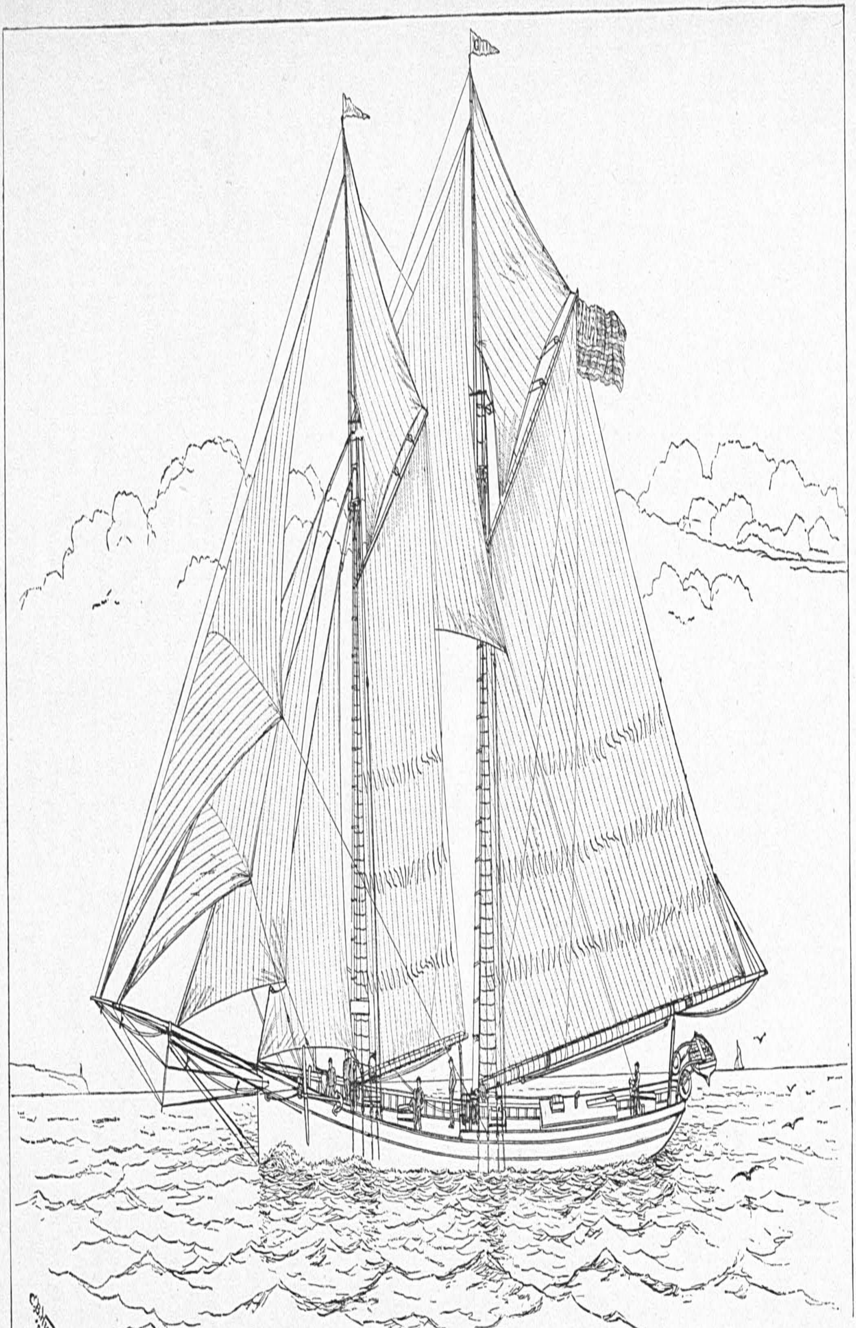


THE GRAMPUS UNDER SAIL.

Drawn by C. B. Hudson.

5.—REPORT ON THE CONSTRUCTION AND EQUIPMENT OF THE SCHOONER GRAMPUS.

By J. W. Collins.

A.—INTRODUCTORY NOTES.

The purposes for which the *Grampus* was constructed are various, and have an important bearing upon the work of the Commission. For some time previous to her construction it was felt that it was necessary to have a suitable sailing vessel provided with a well in which marine fishes could be kept alive and transported from the fishing grounds to the hatching stations on the coast, where the eggs might be obtained for the purpose of artificial propagation.

It could also serve a useful purpose by bringing in alive various marine species not, perhaps, in a gravid condition, which can be put into large aquaria, and thus afford to biologists the opportunity to study the habits of our ocean fauna under conditions that can not possibly be otherwise afforded.

It is also believed that a welled vessel, which is seaworthy and swift, will be able to visit European waters and bring therefrom alive to the United States certain marine species which do not occur in American waters, and which are held in high repute for food. The introduction and propagation of such fish as the sole, turbot, plaice, brill, etc., in our waters will doubtless be of great advantage to the United States, not only in giving to our people additional species of delicate food-fishes, but also in introducing for their capture the method of fishing with a beam-trawl, which is not at present in vogue here, and may, perhaps, profitably employ many vessels and men.

With the object of testing the practicability of using a beam-trawl in American waters in a commercial way, the *Grampus* was provided with a trawl such as is used in the fisheries of the North Sea, and certain modifications were made in her construction to fit her for operating it. While we have not the species of flat fishes which constitute the principal objects of the beam-trawl fishery in Europe, there are, nevertheless, several varieties in our waters that are nearly as good, and it is probable that in many localities on the sandy and muddy bottoms frequented by these off our coast the beam-trawl may be very effectively employed.

One of the most important works contemplated by the Commission is a comprehensive study of the movements of migratory fishes in the spring and autumn when they are approaching and leaving the feeding grounds frequented by them in summer. Hitherto less has been done in that special line of research than is desirable, owing chiefly to the fact that the Commission has not had at its disposal the requisite means for conducting so complete an investigation as seems to be necessary. In order to continuously follow the movements of the migratory species it is necessary to have a sailing vessel which is able to keep the sea in all weathers. Besides, having sails alone as a motive power, it is not dependent upon a supply of coal, and may, if necessary, remain at sea for weeks or months in succession.

An additional requisite for this work is to have a vessel which is adapted to and fit for carrying on fishing operations, and upon which various appliances and methods for the capture of fish can be used, in order that the presence of fish in any locality may be determined even when they do not come to the surface.

The *Grampus* is also fitted with appliances with which the various forms of minute life that constitute the food of most species of the migratory fishes can be obtained.

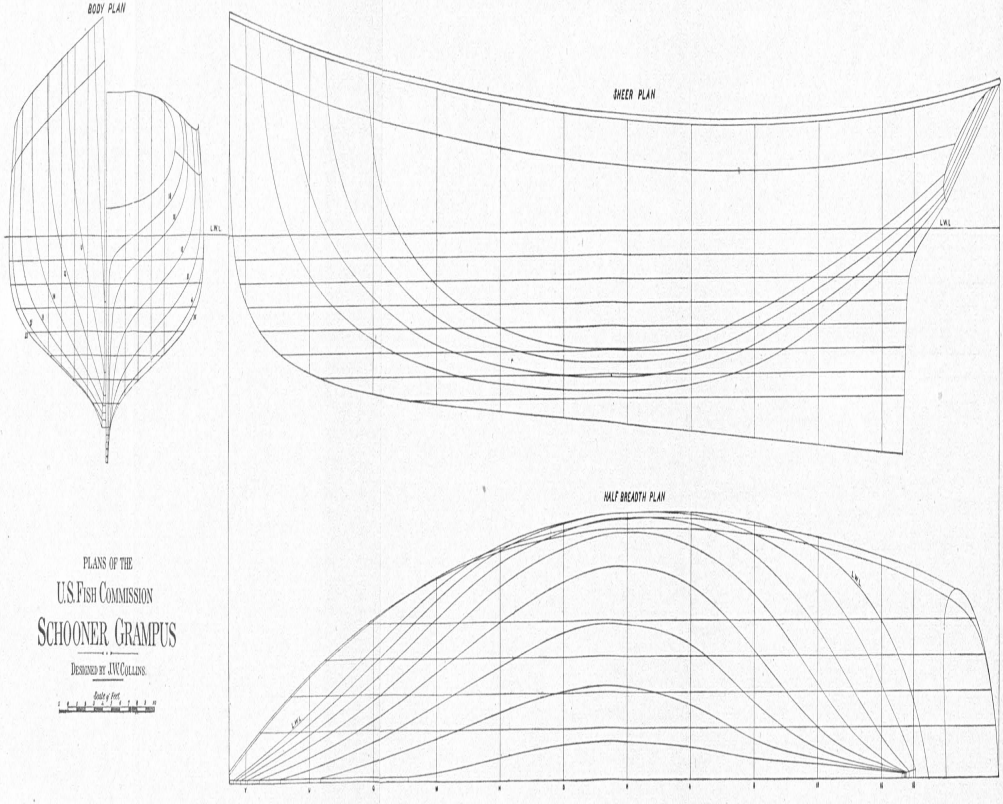
She is specially adapted to making researches at sea for the discovery and practical investigation of fishing grounds, as well as for collecting the fauna of the localities visited, and thus determining the value of certain regions for commercial fishing.

Perhaps the most important thing, however, in connection with the building of the *Grampus* was the opportunity afforded to attempt the introduction of new ideas in the construction of fishing vessels, both as relates to form and rig.

For many years previous to 1885, the tendency had been to build vessels employed in the ocean fisheries from New England wide, shallow and sharp, the object being to obtain speed and also considerable sail-carrying power, since it was believed the latter was necessary to produce a swift-sailing schooner. This form not only failed to produce the best results in the matter of speed, but it was highly dangerous, for when exposed to a gale a vessel constructed on such principles is liable to be capsized by heavy seas, and since her center of gravity is not sufficiently low to enable her to right again, the consequence has been that in such cases schooners have generally filled and sunk with all on board.

On many occasions the loss of life and property from this cause has been enormous, and the average for a period of years has been great. In the ten years from 1874 to 1883, inclusive, Gloucester alone lost eighty-two schooners that foundered at sea, of which seven were abandoned in a sinking condition. But on those never heard from eight hundred and ninety-five men were lost.

While an increase in the depth of these vessels was the most impor-



SHEER PLAN, HALF-BREADTH PLAN, AND BODY PLAN OF THE GRAMPUS.

tant object to be attained, there were, nevertheless, many other objectionable features besides shallowness in the typical clipper fishing schooner. Almost without exception, a vessel of that type was built very wide aft, with a heavy, clumsy stern and flat counters, the run being hollowed out excessively so as to produce in the after section a series of very abrupt horizontal curves, which are anything but desirable when speed is an object. It was also a universal custom to make the masts of a length that would insure their heads being nearly of the same height above the water-line, and to carry a large jib extending from the bowsprit end to the foremast. It is evident that both of these features are objectionable. When the masts are nearly of an equal length it follows, as a matter of course, that it is impracticable to give as much peak to the foresail as is desirable, providing the sail has all the hoist that the mast will permit. Thus, one of two things is the result; either the sails are unsymmetrical, from being too square on the head, or else the foremast is several feet longer than is actually necessary, and that much additional weight of spar is superfluous; besides increasing the cost it adds materially to the weight aloft and is a serious handicap upon the speed and stability of a vessel in strong winds and rough seas. A still greater objection can be urged against the practice of carrying a large jib. In the first place, when it becomes necessary to shorten sail, and the mainsail has to be reefed, it is almost invariably the case that the bonnet is taken out of the jib. In that event the center of effort of both the mainsail and jib is carried forward several feet, perhaps an average of seven to ten feet. The center of effort of the sails being carried so much in front of the normal position, the effect on the vessel is to prevent her from holding well to the wind, when sailing close-hauled, and to make it difficult for her to come in stays when under reefed sails. A more serious matter, however, is the fact that when the jib with the bonnet out can be no longer carried, and it is necessary to furl it, the sail can be handled only by men going on the bowsprit, and if the vessel is by the wind this duty must be performed at a great risk. Instances have not been uncommon when men were washed from the bowsprits of fishing schooners and drowned. It is, therefore, evident that both for safety of life and to improve the working qualities of a schooner, it is better to have a "double-head rig," since, having a fore staysail setting on a stay that comes to the knight heads or near it, the jib can be furled on the approach of rough weather, and there is no necessity for men to go upon the bowsprit in a gale, while it is thus possible to keep the center of effort of the sails in its proper position.

As early as the spring of 1882, the writer urged the desirability of improving both the model and rig of our fishing vessels, in a series of letters that were published in the Gloucester, Massachusetts, newspapers. These communications attracted considerable notice, and received the support of a number of intelligent men who were or had

been interested in the matter of building or running fishing vessels. Among these was James Davis, esq., judge of the police court at Gloucester, and formerly a builder of fishing vessels at that port.

However, although a slight change was made in some vessels to the extent of building them a few inches deeper, no decided innovation was made in the construction of fishing schooners until 1884. During the summer of that year, Mr. D. J. Lawler, at the suggestion of the writer, built the schooner *Roulette*, which was nearly 2 feet deeper than the ordinary fishing vessels of her length. She proved to be remarkably swift, as well as sea-worthy, though she still had the objectionable features of a heavy stern and rather flat counters.

In the spring of 1885, after my return from the cruise to the Gulf of Mexico in the steamer *Albatross*, Professor Baird instructed me to prepare the plans and specifications for a sailing schooner for the U. S. Fish Commission, for which Congress had made an appropriation of $14,000.

It had previously been determined that a schooner-rigged sailing vessel of about 80 tons net register would be best adapted to the requirements of the Commission.

The whole matter of designing her in all the details of model, rig, interior arrangement, and equipment, with the exception of the steam machinery and iron water-tanks, was placed in my hands.

The matter of determining what form of steam apparatus would be best adapted to the work of the new schooner was referred to Lieut.-Commander Z. L. Tanner, U. S. Navy, commanding the steamer *Albatross*. He decided that a steam windlass, with engines of 35 horse-power, would be the most suitable. Passed Assistant Engineer I. S. K. Reeves, U. S. Navy, consulting engineer of the Commission, had charge of obtaining and putting on board the steam boiler, steam pump, iron water-tanks, and such piping as was necessary for the operation of the steam apparatus, and to connect the water tanks.*

Owing to the fact that I had to make a trip on the *Albatross* during the summer of 1885, and also that other important work demanded my attention, the preparation of the plans and specifications for the *Grampus* was considerably delayed, and they were not finished until fall.

Acknowledgments are due to Mr. D. J. Lawler, of Chelsea, Massachusetts, for mechanical assistance he rendered in the preparation of the model and plans, and for the specially creditable manner in which he "laid down" the vessel and prepared her molds.†

* The steam windlass, engines, and boiler were found on trial to be entirely too heavy and disproportionate to the size of the vessel, and in consequence they had to be removed. A wooden windlass was substituted; this relieved the schooner of a very considerable accumulation of weight forward and made her easier in a sea-way.

† The fact may properly be mentioned here that the model and lines of the *Grampus* were placed on exhibition at the rooms of the American Fish Bureau, at Gloucester, Massachusetts, in the autumn of 1885. They attracted much attention, so much indeed that they served as the basis for designing some new fishing vessels. One in

B.—CONSTRUCTION OF THE GRAMPUS.

1. SPECIAL FEATURES OF THE GRAMPUS.

The U. S. Fish Commission schooner *Grampus* is a wooden, two-masted, schooner-rigged, keel vessel. In general she resembles the typical fishing schooner of New England, from which she differs, however, in the following particulars:

First. She is about 2 feet deeper than the average schooner of the same length as usually built.

Second. Instead of having a raking stem and a long projecting head her stem is nearly straight and almost perpendicular above water, and below load-line curves away at an easy slope to join the keel.

Third. The stern is not so wide, and has much more rake.

Fourth. Instead of the run being excessively hollowed out, leaving the quarters and counters very flat, with abruptly curved horizontal lines, the after section of the *Grampus* approximates more closely to a V-shape in cross-section, and has much easier lines than the typical clipper schooner previously in use.*

Fifth. In having wire standing rigging fore and aft.

Sixth. In having the mainmast considerably longer than the foremast.

Seventh. In having a fore staysail and small jib instead of a large jib like that ordinarily carried by fishing vessels.

Eighth. In having the chain plates outside, and let into the wales so as to be nearly flush with the plank.

There are other minor points of difference, and some special arrangements, the latter having been adopted for the purpose of making the vessel adapted to the work she had to do, and which it is not necessary to specify in speaking of the points of difference between her and the clipper fishing schooner. The most noticeable of these peculiarities is the well, which is of the type ordinarily termed "box-well."

2. PARTIES WHO BUILT AND EQUIPPED THE VESSEL.

The hull (including the spars) was built at Noank, Connecticut, by Robert Palmer & Sons; the sails, rigging, blocks, and ground tackle were furnished by E. L. Rowe & Son, of Gloucester, Massachusetts;

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particular, the schooner *A. D. Story*, of Gloucester, was begun some weeks after the contract had been made for the *Grampus*, was completed, made a voyage to Newfoundland and back, and was about ready to start on a trip to Iceland for halibut when the *Grampus* was launched.

* The object in designing this form of hull was to obtain the maximum of seaworthiness, a considerable amount of carrying capacity, and as much speed as could be secured with a large midship section. In other words, to produce a safe, economical, all-around fishing vessel.

the boats were built by Higgins & Gifford, of the same port; the steam windlass was constructed by the American Ship Windlass Company, of Providence, Rhode Island; the boiler was obtained from M. V. B. Darling, of Providence, Rhode Island, and the remainder of the equipment was purchased chiefly from Bliss Brothers and H. M. Greenough, of Boston, Massachusetts.

3. DATE OF LAUNCHING, ETC.

She was launched on Tuesday, March 23, 1886, and went into commission on June 5, 1886.

4. DIMENSIONS.

Her general dimensions are as follows: Length over all, 90 feet; length on load water-line, 81 feet 6 inches; beam, extreme at deck, 22 feet 3 inches; beam at water-line, 22 feet 9 inches; depth from top of keel to top of main-deck beam, 11 feet 1 inch; height of quarter-deck, 9 inches; height of bulwarks, deck to top of rail, 26 inches; height of cabin-house, 27½ inches; length of cabin-house, 15 feet; width of cabin-house, forward end, 14 feet 7 inches; after end, 12 feet 6 inches; registered tonnage (net) 83.30 tons.

SPARS.*

Name.	Feet.	Inches.	Greatest diameter in inches.
Mainmast, deck to hounds	55	1	19
Mainmast head	7	6	
Maintop-mast, above cap	28	6	9
Foremast, deck to hounds	52	11	19
Foremast head	8		
Foretop-mast, above cap	26		9
Bowsprit, outside stem	19		†21
Jib-boom, outside of cap	17	3	9¼
Jib-boom, cap to flying-jib stay hole	11	6	
Jib-boom, cap to balloon-jib stay hole	15	6	
Main-boom	58		‡13
Main-gaff	28	6	§7½
Fore-boom	23	10	7
Fore-gaff	24		6½
Swinging boat-booms, each	20		5

* The masts and bowsprit are made of white pine and all other spars were originally of spruce. In 1888 the main-boom was made of Oregon pine.

† The bowsprit is square between knight-heads, where its diameter is greatest. Outside of the stem it is rounded and tapers to a diameter of 15 inches at end.

‡ Main-boom made in 1888 was 59 feet long, 11¼ inches in diameter.

§ Main-gaff made in 1887 was 30 feet long.

Report U. S. F. C. 1887.—(To face page 7.) Collins. Grampus.

INTERIOR ARRANGEMENT.

STARBOARD SIDE

Fig. 1.

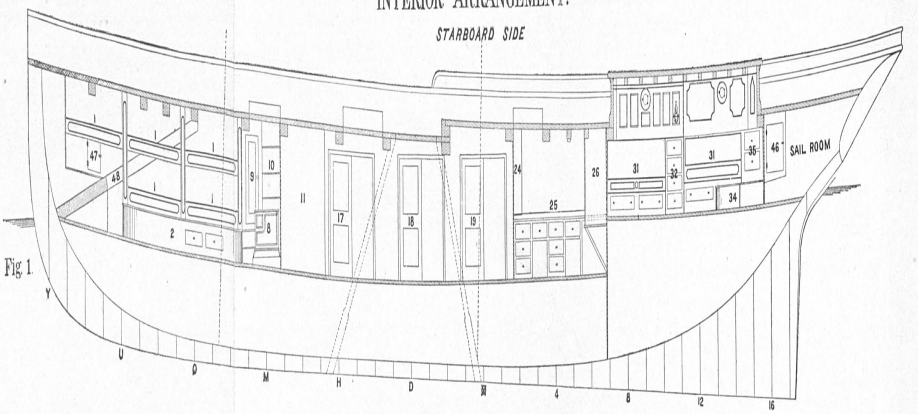
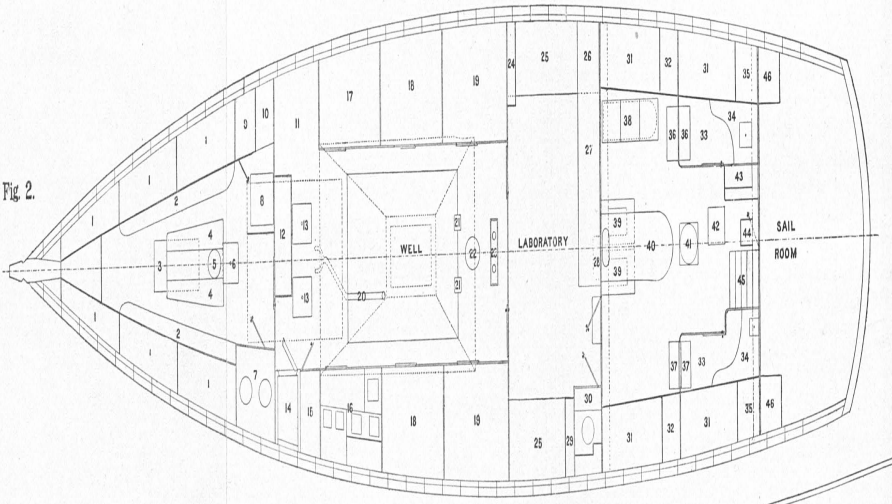


Fig. 2.



PORT SIDE

Fig. 3.

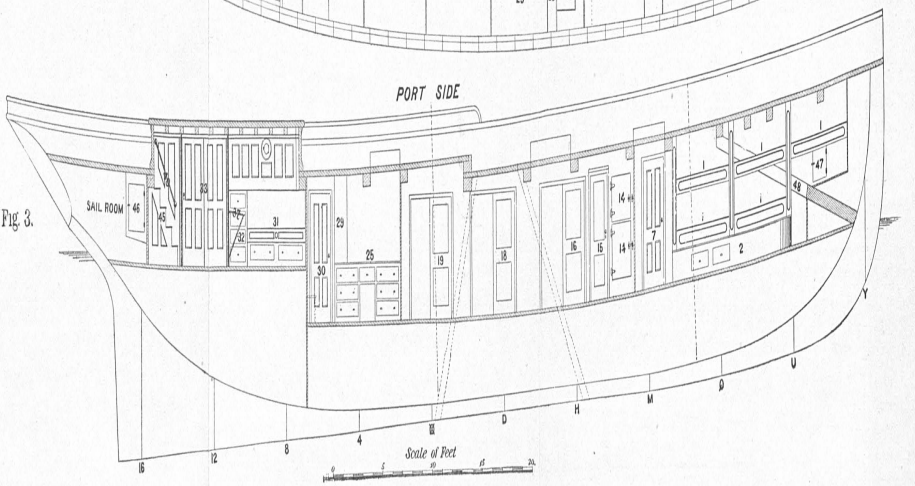


Fig. 1. Longitudinal sectional elevation, starboard side.

Fig. 2. Plan of interior, under deck.

Fig. 3. Longitudinal sectional elevation, port side.

Designed by J. W. Collins.

5. INDEX TO DETAILED PLANS OF GRAMPUS.*

(See plates III, IV, and XIV.)

1. Berths in the forecastle.
2. Locker seat.
3. Scuttle in forecastle floor.
4. Table.
5. Foremast.
6. Scuttle in floor aft of foremast.
7. Water-closet and lavatory.
8. Galley stove.
9. Dish closet.
10. Locker for cooking utensils.
11. Starboard side of fore-hold used for temporary stowage of small stores.
12. Chain lockers.
13. Scuttle or man-hole in water tank.
14. Refrigerator.
15. Grub-locker.
16. Store-room for provisions, and cook's pantry.
17. Coal pen.
18. Store-rooms for fishing apparatus, etc.
19. Bait and ice pens, frequently used for storage of fishery appliances.
20. Forward bilge pump.
21. Stanchions to main fife-rail.
22. Mainmast.
23. After bilge pumps.
24. Medicine closet.
25. Shelves.
26. Chest of drawers for spare bedding.
27. Sliding drawers, etc., for storage of collections.
28. Scuttle in floor leading to pipes connecting forward and after tanks.
29. Library closet.
30. Water-closet.
31. Berths.
32. Chests of drawers.
33. Floor of state-rooms.
34. Locker seats in state-rooms.
35. Drawers in state-rooms.
36. Writing-desks.
37. Adjustable or "drop" writing-tables.
38. Bath-tub.
39. Scuttle or man-hole in water tank.
40. Cabin mess-table.
41. Stove.
42. Scuttle in cabin floor leading to store-room.
43. China-lockers.
44. Binnacle.
45. Cabin steps or stairs.
46. Lockers in sail-room.
47. Locker underneath fore-peak berth.
48. Breast-hook.
49. Hand-rail to cabin stairs.
50. Forecastle step-ladder.
51. Step-ladder leading out of main-hatch.
52. Original pawl-bitt.
53. New pawl-bitt.
54. Windlass.
55. Fife-rail around foremast.
56. Main fife-rail.
57. Stanchions to forward fife-rail.
58. Forecastle companion.
59. Bowsprit.
60. Main-hatch with booby-hatch in position.
61. Entrance to well.
62. After-hatch with booby-hatch in position.
63. Cabin sky-light.
64. Cross section of sky-light.
65. Step-ladder leading from laboratory out of after hatch.
66. Laboratory lamp.
67. Sail-room.
68. Rudder-head.
69. Position of deck funnel for galley stove.
70. Andrew's ventilators.
71. Deck-lights.
72. Cabin stove-pipe.
73. Cabin companion.
74. Man-hole to sail-room.
75. Cavil stanchions.
76. Cook's table.
77. Jib-topsail or balloon jib.
78. Flying jib.
79. Jib.
80. Fore staysail.
81. Foresail.
82. Fore gaff-topsail.
83. Main staysail.
84. Mainsail (the dotted line shows form and dimensions of riding sail).
85. Main gaff-topsail (the full line shows size of club gaff-topsail, and the dotted line indicates the size of jib-header).

*The figures and letters shown on the keel of the plans indicate only the number of the frame against which they are placed, and the figures given in this list of explanations has no reference to those.

DETAILS OF CONSTRUCTION.

HULL.

Keel.—The keel of the *Grampus* is made of white oak; the main section running well forward and scarfing under the forward deadwood. It has only one scarf. It sides 15 inches in center and tapers to 9 inches at the deadwoods. The keel is molded 15 inches outside of garboard, and is curved to fit the shape of the hull. Bolted to the keel and forming part of it, is a shoe of white oak, molded 6 inches through the greater part of its length, tapering to 3 inches at its ends. The scarf of the keel and the shoe are bolted with 1-inch yellow-metal.

Stem.—The stem is made of white oak. It sides 12 inches at head, 9 inches at water-line, and also at heel where it joins dead-wood. It is bolted with 1-inch yellow-metal below water-line, and with galvanized iron above.

Stern-post.—The stern-post is of white oak, its lower end being a knee resting on after end of the keel, and firmly bolted to the latter with 1-inch yellow-metal bolts.

The stern-post, at the head above the rabbet, sides 16 inches; at the outer rabbet it is 12 inches, tapering to 9 inches at the heel. The after edge of the stern-post tapers from 12 inches at the port, where it is hollowed out to receive a 10-inch rudder-head, so that the hollow at the lower end will receive a 5-inch rudder-heel. It has a backing of white pine in the port, and the port is lined with heavy sheet lead.

Forward deadwood.—The apron piece of deadwood is white oak; it sides 12 inches at gunwale sheer and 9 inches at water-line, to conform to the dimensions of the stem, to which it is bolted with 1-inch bolts, yellow-metal being used below water-line and galvanized iron above.

The forward deadwood which comes over the scarf of the keel and stem is white oak, and sides 9 inches; the filling and lacing pieces of deadwood are hard pine, and are bolted with 1-inch galvanized iron.

After deadwood.—The lower piece of the after deadwood is oak, bolted with 1-inch yellow-metal. The upper or lacing pieces of deadwood are hard pine; siding 8 inches and bolted with 1-inch and 1⅛-inch galvanized iron, except where the bolts go into the stern-post, in which case yellow-metal is used.

Frames.—The frames are of white oak, grown to the mold, and spaced 22 inches from center to center. They are double to the gunwale, and arranged in the usual manner for the floors to break joints with the futtocks and so on, the frames being bolted together with ⅝-inch galvanized iron. The floor timbers side 8 inches, with the upper ends snapped to 6 inches; the futtocks side 6 inches and the top timbers or stanchions 5 inches. One of the latter is bolted to each frame, and has a quarter-round worked on its inner corners above deck. The frames mold 7½ inches at side of keel, 6 inches at second futtock head, and 5 inches at gunwale. In the throats of the flattest frames the floor timbers are 9 inches deep, but forward and aft the depth increases with the change in the shape.

In the well every other frame is omitted, and here the floors are worked with a quarter-round on their inside edges.

The floor timbers are bolted throughout with 1-inch yellow-metal bolts, which are driven through and clenched over composition rings on the bottom of the keel.

The stern frames are supported by "riders" of oak, which extend 4 or 5 feet up on the frames, and with the lower ends running down on the ceiling. These riders are strongly bolted to the ceiling and counter frames, as well as to the stern timbers.

Keelsons.—There is no keelson in the well, but there is one forward and one aft of it. These are made of hard pine, siding 10 inches, and are bolted to second-floor timbers with 1-inch yellow-metal; these bolts go through the keel, and were clenched over composition rings before the shoe was put on.

Breast-hook.—The breast-hook is of oak, backed by a hackmatack knee in its throat. It is strongly bolted with 1-inch and ⅞-inch galvanized iron; the bolts are clenched over rings. It extends diagonally from below water-line to the deck.

Deck-frame.—The beams are of white oak; they side from 7 to 9 inches and mold 7 inches in center and 6 inches at the ends. The ends of the beams are bolted to the clamps with ⅞-inch iron bolts. The ledges and carlines are of hard pine; they side 3½ inches to 6 inches. The knees are of hackmatack; they side 5 inches. The mast-beds and partners are of hard pine, 10 inches thick, let down between beams 6 inches, and let in on edge of beams 1½ inches. The edges which show above the deck-plank have one quarter-round worked on them all around, forming a raised panel on the deck. The windlass-bed, originally put into the spaces between the beams forward of the foremast, was of hard pine scantling, filled in flush with the beams and securely bolted to them. To this, on the underneath side, was secured the engine for operating the windlass.*

Pawl-bitt.—The original pawl-bitts are of white oak, each 8 inches by 8 inches, and 3 feet 6½ inches high, separated so as to receive the heel of the bowsprit above the deck, and filled in above the bowsprit with white oak bolted through the bitts, coming to within about 10 inches of the top, above which the edges are rounded. An additional pawl-bitt 5 inches by 12 inches, backed on forward side by an oak piece 8 inches by 10 inches square on top, tapering to 6 inches by 4 inches at deck, was put in after the removal of the steam windlass. The bitt itself is about 19 inches abaft the other, while the backing piece is only 13 inches from it. There is an oak brace between the two 7 inches wide by 3 inches thick, rounded on upper side and placed 26 inches above deck.

* When the steam windlass was removed and the engine taken out, it was necessary, before putting in a wooden windlass, to remove this windlass-bed, and also to put in an additional beam to support the pawl-bitt for the wooden windlass, the position of which was about 19 inches abaft where the iron steam windlass was placed.

Fish-well.—The well of the *Grampus* is pyramidal in form, with the apex at the deck. It is 16 feet long in the clear at the bottom, and about 8 feet wide. At the top it is 4 feet long by 2½ feet wide. It is what is termed a "box well," and has a bulkhead athwartships coming nearly to the surface of the water. The forward and after bulkheads extend from the bottom of the vessel flush with the top of the deck. The bulkheads are made of the best selected yellow oak, 7 inches thick. The lower plank in each bulkhead is canted and molded to fit the shape of the bottom on its lower edge, coming out flush with the outside planking, or made with "primings-out." It is rabbeted to receive the ends of the outside planks. The upper edge of the plank is level, and to this is bolted the succeeding plank. The ends of all the lower planks are flush with the outside planking up to the point where they join the "well-log" on each side. The bottom planks or floors have each two 1-inch yellow-metal bolts driven through them and the keel, and clenched over composition rings underneath the keel. The other well-planks are bolted edgewise with ¾-inch galvanized iron bolts, driven at distances of 14 inches from center to center, alternately, near the opposite edges of the plank. The planks on the sides of the well are so arranged that their edges come opposite the middle of the planks across the ends, so as to equalize the fastening in the corner posts. The planking of the well inside of the vessel is tongued and grooved on its edge, provided with a ½-inch tongue of white pine in a groove 1 inch from inside of plank. Besides this, before the bolts were driven, a layer of calking cotton was placed in all of the seams between the well-plank. At the lower edge of the well, on each side, is what may be termed the *well-log.* This is of the best white oak; it sides 9 inches and is 21 inches deep. It comes out flush with the outer planking, being recessed to receive the frames which enter the well. The spaces over these frames are filled in, outside, with short pieces of plank, in the same manner as when the floor of an ordinary well is built with "primings-out." This well-log is fastened to the frames by ¾-inch yellow-metal bolts, which are headed outside of the timbers.

The floor frames in the well are fastened with 1-inch yellow-metal bolts going through them and the keel and clenched underneath the latter.

In each corner of the well is a white-oak post 7 inches square on two sides to fit into the corner, with one side half round. To this are fastened the ends of the well-planks, with ¾-inch galvanized iron screw-bolts set up on the outside with nuts.

A corner post or quarter round of hard pine is let in at the ends of the well-plank to flush the ends and sides of the well on the outside.

There are two hundred and four 2½-inch holes in the outside planking covering the bottom of the well, to permit the water to circulate freely. After these holes were bored they were all burned with a red-hot iron.*

* In December, 1887, the well was coppered inside to a foot above the water-line, and "sleeves" were worked into the holes from the outside, thus making them somewhat smaller.

CONSTRUCTION PLANS.

Fig. 1.

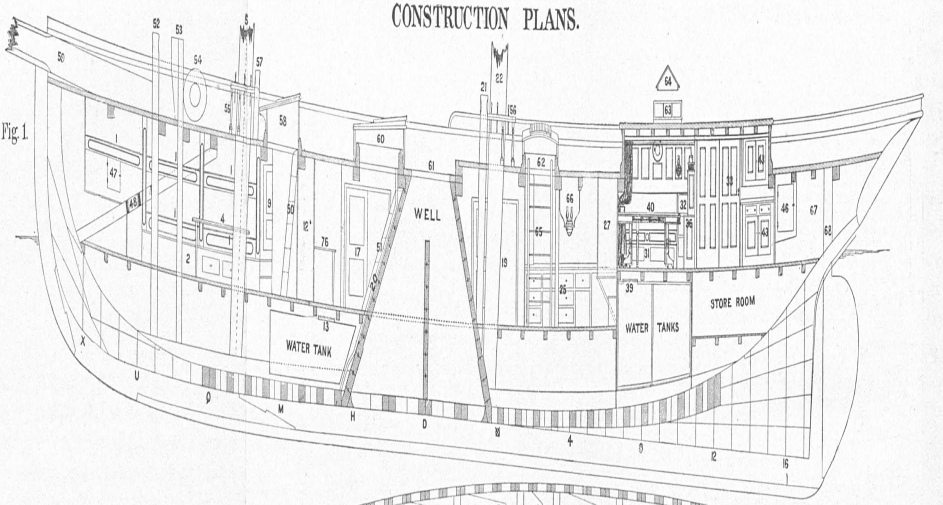


Fig. 2.

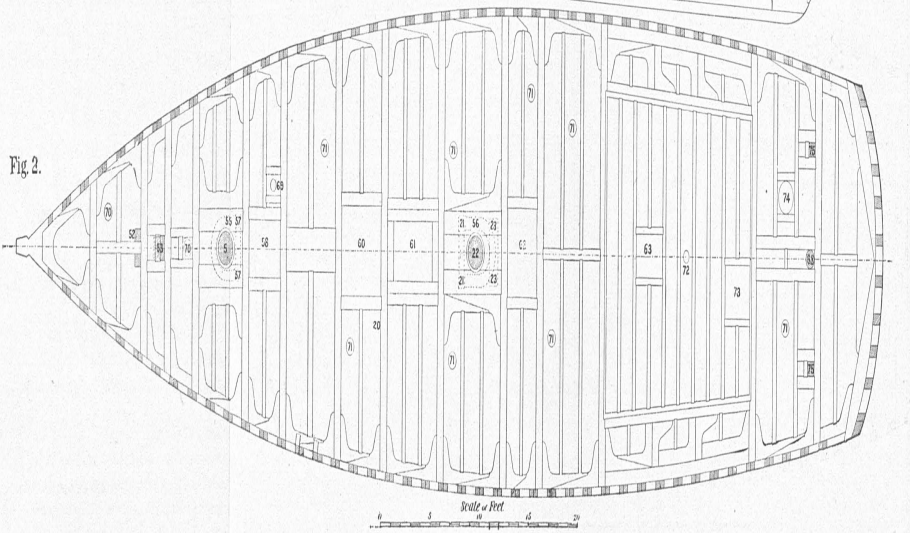


FIG. 1. Longitudinal sectional elevation, showing framing.

FIG. 2. Plan showing deck frame, etc.

Designed by J. W. Collins.

Ceiling.—The ceiling is of hard pine, and most of it was put on before the vessel was planked. There are two thick streaks alongside of the well-log, each of which is 6 inches thick by 9 inches wide, tapering to equal 3 inches in thickness at forward and after ends. These thick streaks are fastened with ⅞-inch galvanized iron bolts, one bolt in each edge driven through the frames and clenched on galvanized iron rings. There are also, besides these, five thick streaks on each side which are 4 inches thick by 12 inches wide, tapering at the ends to 2½ inches thick, and fastened with galvanized iron bolts, half of which are driven from the face of the plank and the other half from the outside of frame, all clenched over galvanized iron rings.* There are two streaks of 3½ by 9 inch plank tapering to 2 inches at the ends, and three streaks of 3-inch plank, the latter fastened with galvanized-iron bolts and spikes.

The clamps are, like the rest of the ceiling, hard pine, 3½ inches thick and 12 inches wide. They are joined with lock scarf, and fastened like the other ceiling. There is a bead worked on the lower edge.†

Deck plank.—The deck plank are white pine 3 inches square, laid straight, fastened with 4½-inch galvanized iron spikes let into the plank and covered by bungs set in white lead.

The plankshear is white oak, 3 inches thick, by 10½ wide, fastened to the wales with ⅞-inch galvanized iron bolts and with a ½-inch galvanized iron bolt driven into the back of each stanchion.

Outside planking.—The outside planking is of white oak. The garboards are each 8 inches wide and 4 inches thick, tapering from each end of well to equal 2 inches in thickness at the wood ends to conform to the thickness of the rabbet at forefoot, and at the heel of sternpost. In addition to the ordinary fastening, the garboards are edge-bolted to the keel with ⅝-inch yellow-metal bolts.‡

The bottom plank are 2½ inches thick, and fastened with 6-inch composition spikes in addition to the locust treenails which go through all the plank and are 1⅛ inches in diameter. All the bottom plank are

* Besides the fastening specialized in this description, note should be made of the fact that the treenails which are driven in the outside planking come through to inside of ceiling, and are wedged on each end.

† A peculiarity of the ceiling is that the thick streaks sweep up from the bilge at each end of the vessel, crossing the direction of the outside plank diagonally. This method of putting on the ceiling adds very much to the strength of the vessel at the ends.

‡ This peculiarity of construction adds little to the expense; it increases very materially the strength of a vessel, and the chances of being saved in case she had the misfortune to get on shore. It ties the garboards to the keel in such a manner that the keel, keelson and garboards combine together to form one continuous backbone. Ordinarily, when a vessel is stranded, the greatest strain comes upon the garboard or the keel, and if not built in this way, either the keel is twisted out of position or the garboard is strained so as to work the oakum out of the seams, the result in each case being that she fills with water, and the chances of her safety are decreased. I earnestly recommend this peculiarity of construction to be adopted in building fishing vessels.

"square fastened," having four treenails in a frame, while the other plank have two treenails and one spike to each frame.

The wales are 3 inches thick and 6 inches wide, and there are four streaks of the same thickness below the wales. The wales are fastened with 6-inch galvanized spikes, and with treenails, like the rest of the plank, but below the fifth wale the plank are fastened, in addition to treenails, with 6-inch composition spikes, which are let in, and the heads are covered with bungs set in white lead. All butts below the sixth wale are fastened with ¾-inch copper butt-bolts, driven and clenched on composition rings on the inside of the ceiling.

Main-rails.—The main-rails are of white oak, 3 inches thick and 9 inches wide, fayed with lock scarf, and worked with a double bead on each edge; they are bolted to the stanchions with ¾-inch copper bolts let into the rail, and the heads covered with bungs set in white lead.

Monkey rail.—The monkey-rail, or quarter-rail, which rests upon the main-rail in the after section of the vessel, is 9 inches high. The rail proper is of white oak, 2¼ inches thick and 6 inches wide, worked with a double bead on each edge.

The "filling-in piece" of the monkey rail is hard pine, 4 inches thick on the lower edge, tapering to 3 inches thick on the upper edge, with the exception of that portion which goes around the stern forming a part of the taffrail, which is made of white oak, increasing in thickness to the midship line to receive the mortise for the main-boom crutch.

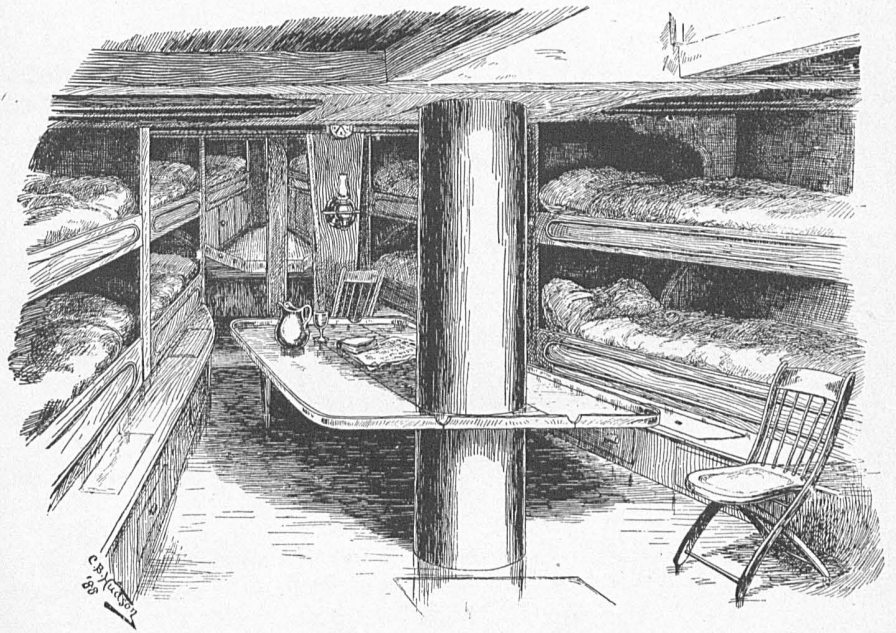
The fastening is ¾-inch copper bolts, going through into the heads of the top timbers or stanchions. The bolts are let into the rail and covered with bungs set in white lead. In the main and quarter rails are holes fitted with appropriate galvanized-iron castings to receive awning stanchions.

Bulwarks.—The bulwarks are of 1-inch white pine, beaded 3 inches apart, and extending from the main rail down to the covering board on the quarter, and on the main-deck to the waist-plank, which is 9 inches high. There is a water-port in the bulwarks on each side of the quarter-deck, just forward of the house; this is 21 inches long by 9 inches wide.

Bow-chocks.—The bow-chocks, which extend from the fore rigging to the knight-heads on top of the main-rail, are of oak, 5 inches high at the forward end and 2½ inches at the after end, molded 4 inches at bottom and 3½ inches at top; bolted to main-rail with ⅝ and ¾-inch bolts, the fastening covered with bungs set in white lead.

Cat-heads.—The cat-heads are white oak, worked knee shape, and grown to mold; they extend outboard 20 inches, are fitted with a sheave hole in the outer ends, are provided with an iron brace on the after side extending to the main-rail, and eyebolts on the forward side for the jib-boom guys to set up to. They are bolted to a top timber on each side of the bow, 11 feet forward of the fore rigging.

Bow-grating.—The main-rail forward, about 6 feet abaft the knight-



FORECASTLE, LOOKING FORWARD.

Drawn by C. B. Hudson.

heads, is carried around in a semi-circle on the after side, from one rail to the other, over the heel of the bowsprit, and between this and the extreme bow is fitted in an adjustable triangular-shaped white oak grating covering the forward part of the heel of the bowsprit.

Rudder.—The rudder is made of oak and pine; the front and back of it being of oak. It is hung with three sets of best quality composition braces.

Fife-rails.—There is a fife-rail around each mast, in form something like those ordinarily put on fishing schooners. The fife-rail around the foremast has the bitts, which are 6 inches square, on the after side of the mast, and the rail, which sets upon stanchions, curves around the forward side of the mast; a straight piece of rail extends from one stanchion to the other abaft the mast. There are bolts going through the stanchions and rail, and these are set up by a nut underneath the beams and mast bed.

The bitts of the main fife-rail are 9 inches square and extend down through the deck until they reach the after side of the well. The heel of each bitt is chamferred to fit the angle of the well, to which it is bolted with ¾-inch galvanized iron bolts; it is also securely fastened to the deck-frame. These bitts stand forward of the mast on each side of it, and are made and fastened in the manner specified in order that they will sustain a heavy strain, since it is expected that the towing line of the beam trawl will be fastened to them. A rail extends from one bitt to the other in front of the mast, and another curves around abaft the mast, and is supported by several stanchions, which are fastened in the same manner as indicated in the description of the forward fife-rail. The rail, stanchions, and bitts are made of white oak.

Coamings.—The hatch-coamings are of the best quality of white oak, 5 inches thick, and worked with proper moldings all around. The upper edges of the coamings are rabbeted so as to receive skylights or booby-hatches. The coamings are bolted to the beams with ¾-inch galvanized iron, clenched underneath the beams over galvanized iron rings.

Booby-hatches.—There is a booby-hatch made to fit over the main-hatch; it rests upon the deck with an entrance on its after end. It is built of white pine 2-inch plank, side and ends, and covered with lighter material. It is held in place by stout galvanized iron hasps on the inside, which hook into staples on the hatch-coamings, and also by rope lashings through ringbolts in the ends of the booby-hatch and on the deck.

There is a booby-hatch over the after-hatch, built in a similar manner, with the opening on the starboard side, and constructed to fit down over a rabbet in the hatch coaming. It is held in place by hasps inside and metal plates screwed to the outside.

Cabin-house or trunk.—The house or cabin-trunk is 15 feet long, 14 feet 7 inches wide on forward end, 12 feet 6 inches wide at after end, and 27½ inches high. The coamings are hard pine, 5 inches thick and

6 inches high above deck, worked with a molding. The sides and ends are made with 3-inch white pine plank fastened to posts at the corners, and with a quarter-round post at each corner on the outside to flush the plank. It is fastened to the beams with $\frac{5}{8}$ to $\frac{3}{4}$ inch bolts. Those of the after end and starboard side are of yellow metal or copper, the rest being galvanized iron. The top of the trunk is covered with 3 by 3-inch clear white pine plank, fastened with composition spikes $4\frac{1}{2}$ inches long; the latter are covered with bungs set in white lead. The beams are of hard pine spaced 18 inches, from center to center; the ends are bolted to sides of house with $\frac{5}{8}$-inch yellow-metal bolts. There is a mahogany skylight on top of trunk 3 feet long by 2 feet wide. The companion or cabin entrance is on the after end, at the port side; it is fitted with swinging doors and sliding top.

Forecastle companion.—The forecastle companion is located immediately abaft the foremast. It is built of white pine on a coaming of white oak, provided with a slide-cover like the booby-hatches, and with an adjustable door sliding in vertical grooves; it opens on the after end.

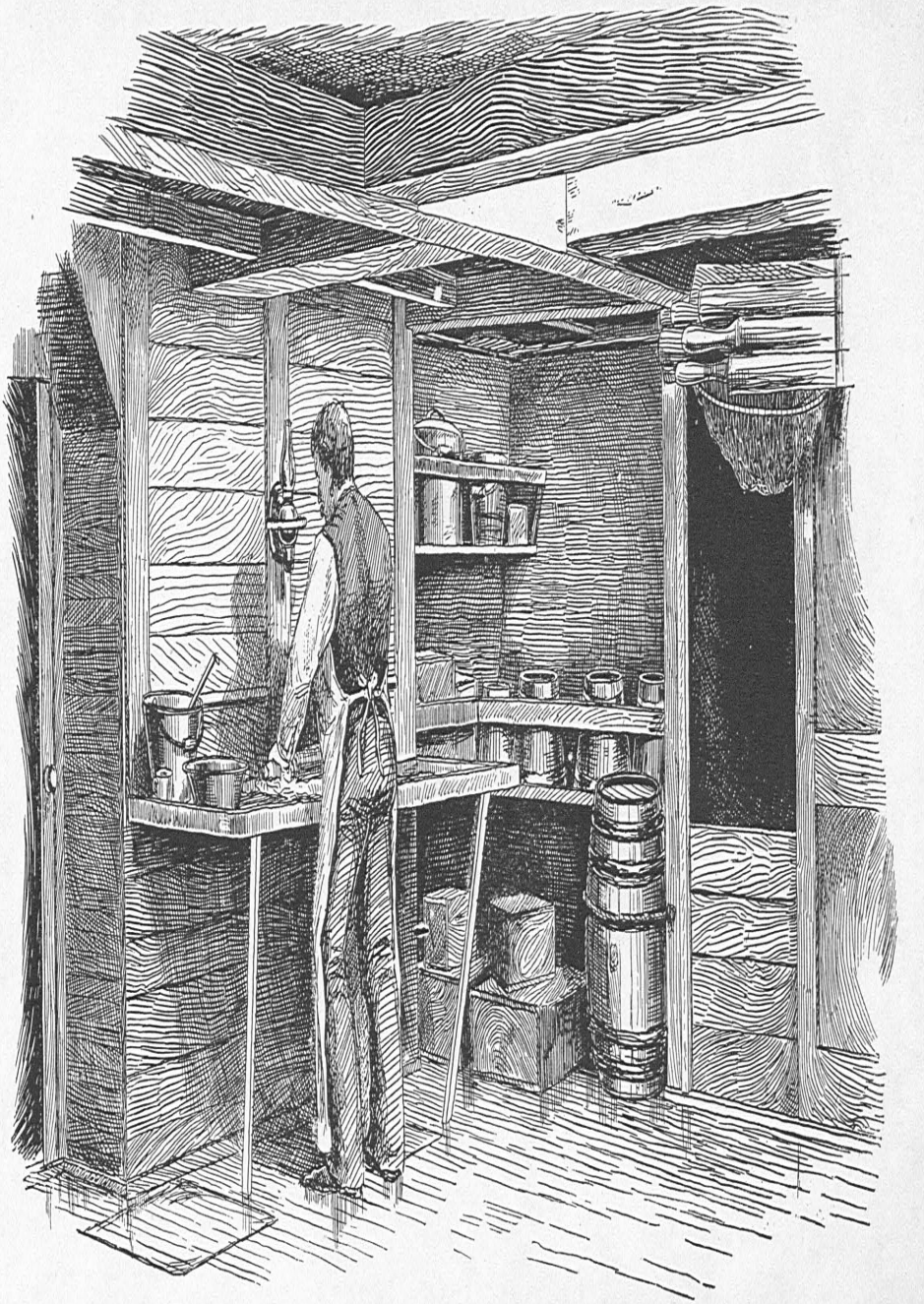
Wheel-box.—The wheel-box is built of ash and black walnut, paneled on the sides and ends. The top or cover is adjustable, made quarter-round on the sides, and fitted with hasps for holding it in place. The box is oblong in form, 3 feet 4 inches long by 2 feet wide; 2 feet 8 inches high on forward end, 2 feet 2 inches high on after end. There is a slot cut in the forward end to allow the telltale, indicating the position of the rudder, to work in.

Cavil-chocks.—There is a cavil-chock on each side abaft the house, on frames 17 and 18. It is made of oak, securely bolted to the stanchions at each end, and has a panel worked on its inside, with a 3 by 5-inch hole in it for receiving mooring hawsers, etc.

A similar cavil is placed on each side on frames A and B at the forward end of quarter-deck. A small cavil, $3\frac{1}{2}$ inches wide by 2 inches thick, is fastened on each side to stanchions of frames G and H on main deck, 7 and 8 and 13 and 14 on quarter-deck.

Stanchion cavils.—There are two oak stanchions, with cross-cavils, abaft the cabin-trunk, one on each side, for belaying the main sheet to; these go through the deck, and their lower ends are bolted to the frames.

Pin-rails, cleats, etc.—There is a pin-rail of oak fastened to the main-rail on each side abreast of the main rigging, and holes are bored for pins in the main-rail on each side abreast of the fore rigging. There is a snatch cleat, provided with sheaves, on each bitt of the fore and main life-rails; also on the stanchion abreast of starboard fore rigging; three cleats on each side forward for the head sheets, and a stout oak cleat for the fore sheet on the forward side of the cross-bar to the main life-rail, which is a little above the deck. On each side of the stern, about 8 inches above deck, is a cleat to which the crutch-tackles are fastened. Besides these, there are the davit-tackle cleats on the quarter-rail near the davits; the necessary cleats, with sheaves, to the



FOREHOLD, LOOKING TO STARBOARD.

Drawn by C. B. Hudson.

gaffs for the gaff-topsail sheets, and cleats on the main-boom for belaying reef-tackle, boom-tackle, and topping lift-fall to.

Crutches.—There is a white oak crutch, to receive the end of the fore-boom, which steps into the forward side of the main fife-rail; it is 4 feet 9 inches long and 9 inches wide at the upper end, tapering to lower end as required. There is a white oak crutch for the main-boom to rest in which steps into the taffrail; it is 4 feet 5 inches long, exclusive of that part which enters the taffrail, which is 6 inches long. The crutch is 15 inches wide at the upper end tapering to 11 inches, where it rests upon the taffrail, and below which it is formed to fit into the socket that receives it. Both of these crutches are concaved at the upper ends, or worked out with a half-round of the proper size to receive the boom they are intended for; they have a bolt going through them at the upper and lower ends to prevent splitting.

Hatches.—The hatches (properly speaking) or hatch coverings, are made in two parts for each hatch; they are made of 2½-inch pine and oak fastened to 2½ by 2½-inch carlines of oak. Galvanized iron ring-bolts are fastened into the corners.*

Deck-lights and ventilators.—There are eight circular deck-lights, 9 inches in diameter by 1½ inches thick, let into the deck and set tightly in white lead, held in place by composition rings screwed to deck. There are two gun-metal Andrews's ventilator deck-lights forward, for ventilating the fore-castle; one of these is located forward of the windlass on the starboard side, and the other abaft the windlass amidships.

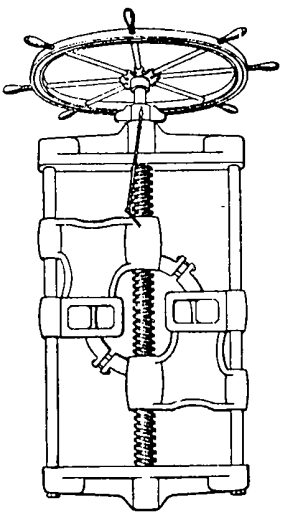


FIG. 1.—Steering wheel.

Sail-room man-hole.—Abaft the house, on the starboard side, is the man-hole leading into the sail-room. The cover, and the rim into which it fits, are of brass, and the cover is provided with a special locking arrangement, which secures it firmly in place. There is, in addition, an open scroll-work brass cover for the man-hole, which can be put on in dry weather for ventilating the sail-room.

Well-grating.—The top of the well opening, or "curb," is provided with an oak grating which fits on flush with the deck, and is held in place by a galvanized iron bar, 2 inches wide, properly secured at the ends by means of staples.

Steering wheel.—The steering wheel is the Richardson challenge steerer. It is of the right and left screw pattern in common use on small vessels.

* Under ordinary circumstances the hatches are not used, the booby-hatches supplying their places, but they are always kept ready for an emergency, so that in case one of the booby-hatches should be stove they can be instantly put on to prevent water from getting into the hold. Sometimes, in a gale, the main-hatches are put on and secured by the hatch bar underneath the booby-hatch.

Sheet-buffers.—The lower fore- and main-sheet blocks are provided with patent rubber buffers to ease the jerk of the sheets.

Calking.—The vessel was calked on the outside with three threads of the best oakum in each seam. The house was calked with cotton, and the deck and ceiling were calked with two and three threads of oakum. All the seams were pitched or white-leaded. In addition, the outside seams were puttied flush with the plank.

Cementing and salting.—The spaces between the frames (except in the fish-well) are filled flush with Portland cement as high as the underneath sides of the floors of the hold, and after this was done all the spaces between the timbers were filled with salt to the deck.

Ballast.—The ballast is pig-iron, stowed alongside of and abaft of the well, as far aft as the forward bulkhead of the cabin; leaving, however, sufficient space next the floor for operating the cocks on the pipes which connect the water-tanks. She carries about 40 tons of ballast, including the cement between the frames previously referred to.

Pumps.—There are two patent iron pumps abaft the mainmast, and one copper pump forward of the well. The latter is provided with an adjustable upper box that can be removed when not in use, and with a screw top which fits in flush with the deck. From the lower end of the copper cylinder, forming the chamber of the pump, a 3-inch lead pipe (cased with wood above the floor of the hold) extends down to the keelson where it is divided into two parts, one of which goes on each side of the keelson, so that both bilges can be pumped dry.

Beam-trawl roller.—Aft of the fore rigging, on the port side, is an iron roller for the beam-trawl warp to run over, fitted in between two stanchions. The main-rail is cut over this roller, and arranged on hinges so that it may be turned back when the roller is in use. A section of bulwarks is also made so that it can be removed.

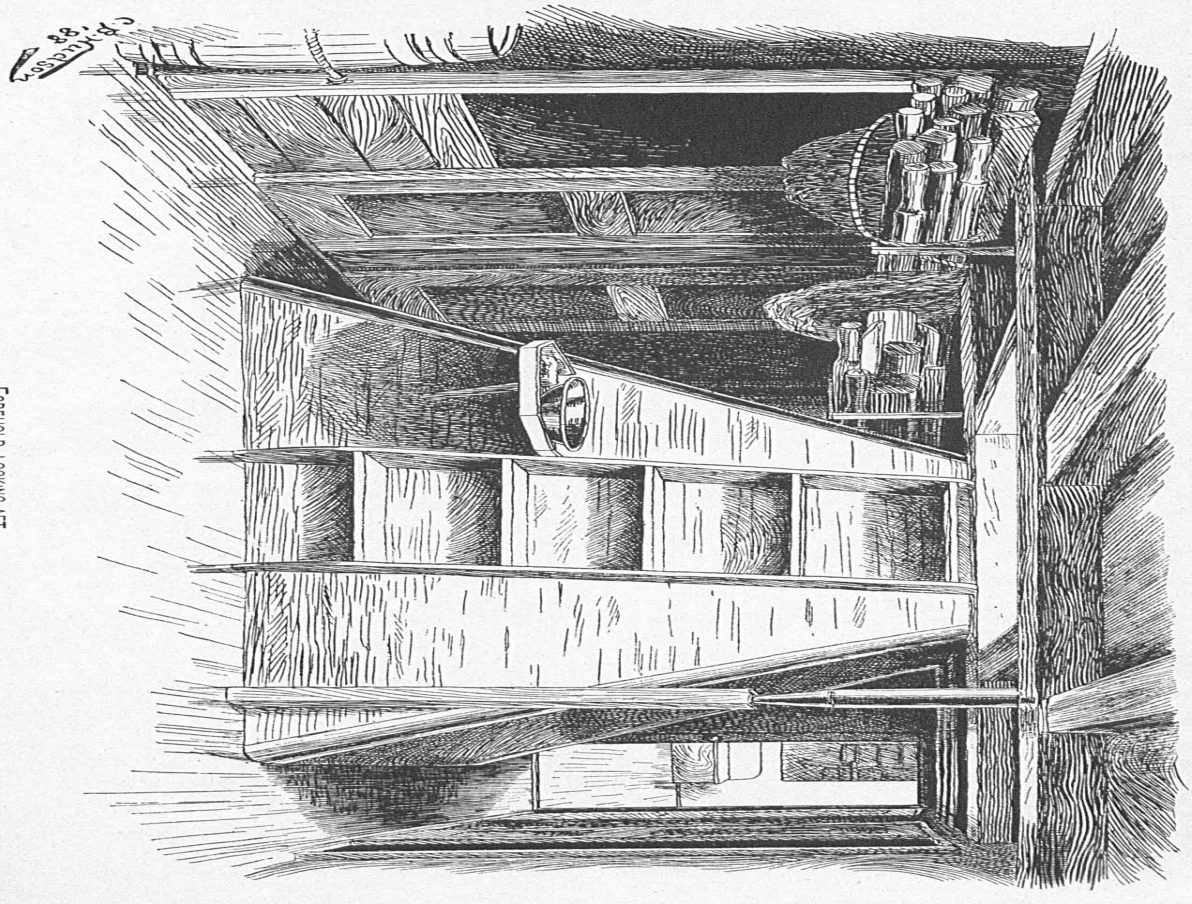
Iron warping-chocks.—On each side of the taffrail is let in and fastened a galvanized iron warping-chock of the ordinary pattern, and a similar chock is fastened to the top of each bow-chock near the knightheads.

Davits.—The davits are made of galvanized wrought iron, 3 inches in diameter, bent to a proper curve, fitted with suitable braces, and each provided with a block at outer end to receive davit-tackle fall.

Hawse-pipes.—The hawse-pipes are made of galvanized cast-iron, cast to a special mold to fit the vessel.

Chain pipes.—The chain-pipes, of galvanized iron, are placed abaft the forecastle companion, about 5 inches diagonally from the after corners; the chain hawsers lead through these into the boxes below. They are 5 inches diameter inside.*

* As the vessel was originally constructed, there were pipes leading from beneath the windlass to the space underneath the forecastle floor, where the chains were at first stowed, while the steam windlass was on board. When the steam windlass was removed and a wooden windlass put on, a box was built to receive the chains abaft the forecastle bulk-head, and the location of the chain pipes was changed.



FOREHOLD, LOOKING AFT.

Drawn by C. B. Hudson.

Anchor plates.—On each side of the bow, near the water line, and directly beneath the cat-head, is a thick metal plate, about 3 feet square, to prevent the bill of the anchor from injuring the plank when the former is being catted in rough water.*

Iron guards.—On each side of the bow-chocks, forward of the fore rigging, there are galvanized iron guards for the anchor bills to rest upon. There is also a galvanized iron guard of half-round iron, 1¼ inches wide, on the after edge of the taffrail, to prevent the rail from being chafed by lines or boat painters.

Chain-plates.—There are three chain-plates on each side, abreast of each mast, for the shrouds, made of galvanized Norway iron, 3 inches wide by $\frac{9}{16}$ inch thick, chamferred slightly at the edges. These are let into the wales nearly flush, and are bolted through wales and ceiling with 1 and 1⅛-inch galvanized iron bolts; these are keyed over rings on the inside of the ceiling. There is also a similar chain-plate, not quite so wide, on each side of each mast abaft the others, for the topmast backstay.

Ring-bolts and eye-bolts.—On each side of the stern, inside near the deck, there is a 1-inch galvanized iron ring-bolt for crutch tackles, and on top of the taffrail, on each side, is a ring-bolt of ⅝-inch galvanized iron for the boat-gripe lashings. On stanchions D, F, O, 5, and 12 there are ring-bolts of ⅝-inch galvanized iron, the diameter of the ring being 4 inches; those on stanchions O and P, forward of the fore rigging, are for lashing the bill of the anchor to on each side, and for other necessary purposes.

There are also two similar ring-bolts on port side of the main deck, near the main-hatch, and four on starboard side to lash boats to, and smaller ones forward and aft of main-hatch to lash the booby-hatch to. On each side, outside of the stern, is a stout galvanized iron eye-bolt for the boat-gripe to hook into. There is a ring of ¾-inch iron in after end of the bolt which holds each of the after lower dead-eyes for the fore and main rigging. On each side, in the forward side of the grub beam, there is a ⅞-inch galvanized iron bolt for hooking in a tackle to keep the foreboom steady when jibing in a gale, etc. On each side, forward of the main-hatch, there is a 1¼-inch galvanized iron eye-bolt which goes through deck and beam, and keys over ring underneath the beam. This is for the purpose of hooking to it a heavy snatch block through which the beam trawl warp or other similar line may run. Aft of the cat-head, on each side, is a ¾-inch galvanized iron bolt worked onto a plate, which is fastened to the outside edge of the main-rail, for the foreboom tackle to hook into. There is a similar eye-bolt of ⅞-inch iron on each side forward of the cat-head for the inner dead-eye of the martin-

* When the vessel was new the plates used were made of galvanized wrought-iron, but at the time she was coppered in the winter of 1887, the iron plates were taken off and plates of yellow-metal substituted.

gale back-rope to shackle to, and another of 1-inch iron on each side on the wale below the cat-head, for the bowsprit shrouds to fasten to. Besides these, there is a $\frac{5}{8}$-inch eye-bolt driven from outside, into stanchion P, 19 inches below rail, to lash outer bill of anchor to; also on each side, near the forward end of the bow chock, a $\frac{1}{2}$-inch eye-bolt for the inner end of the life-line (which goes from the bowsprit end to the bow) to fasten to. There are two $\frac{7}{8}$-inch eye-bolts on the forward side of each cat-head for the jib-boom guys to set up to; these go through and head up on after side of cat-head. Aft of the fore and main rigging, on the port side, is a $\frac{5}{8}$-inch eye-bolt for the lower block of the peak-whips to hook into. Aft of the fore and main rigging, on each side, is a $\frac{7}{8}$-inch U-shaped bolt for the boom-tackle to hook into; those forward go through the main-rail and key underneath, the others drive into the quarter-rail. On the starboard side, aft of main rigging and boom-tackle bolt, is a $\frac{5}{8}$-inch eye-bolt in rail. On top of the bow chock, on each side, are two $\frac{3}{4}$-inch eye-bolts for the jib and flying jib sheets to hook into; these are located, respectively, 5 feet and 10 inches from the cat-head.

On each side, abreast of frames K and L, respectively, and 21 inches inboard from the stanchions, there are two 1-inch eye-bolts driven into the deck (going into beam and carline), for the lower fore staysail-sheet blocks to fasten to.

On the main-rail, inside and abreast of the lower forward dead-eye of fore-rigging, on each side, is a $\frac{5}{8}$-inch eye-bolt, into which the fore staysail lift or tackles can be hooked. There is a similar eye-bolt on each side, on the fore and main fife-rails.

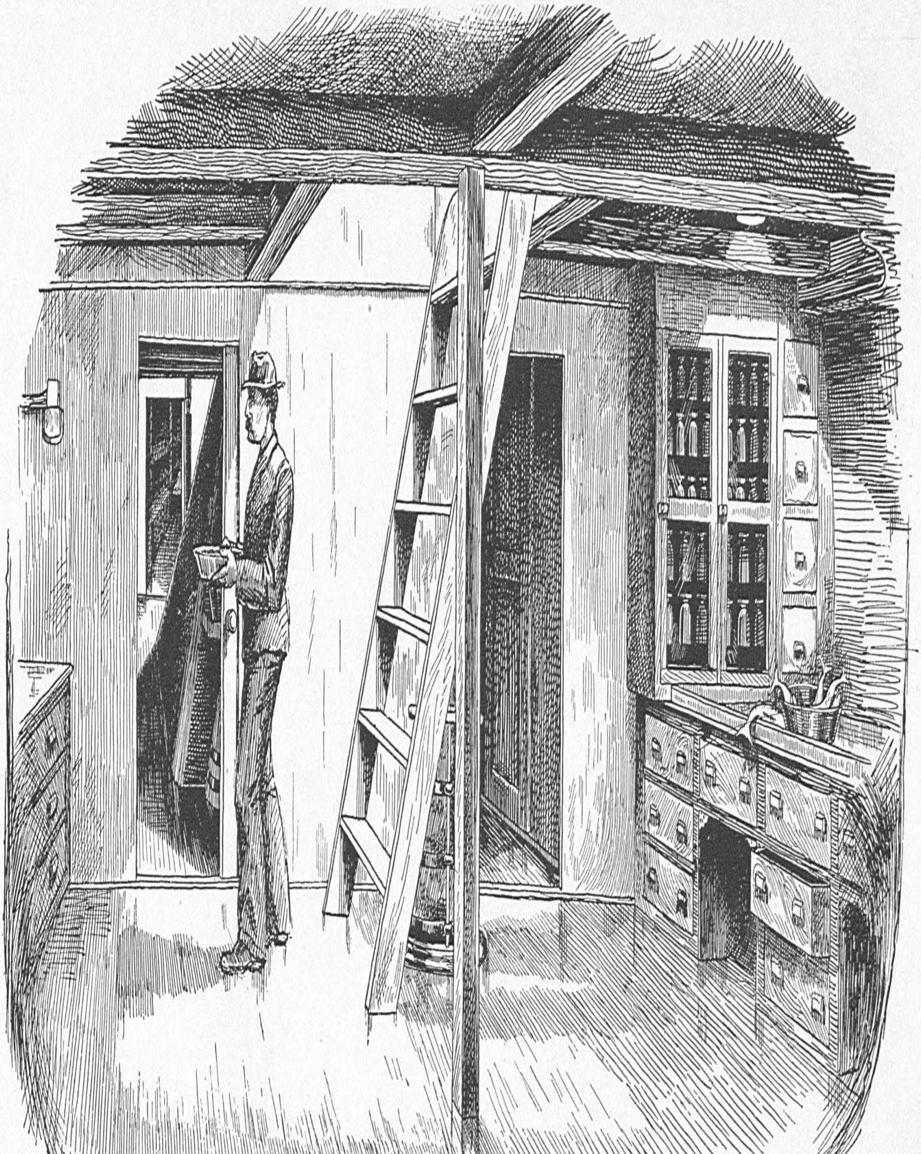
Bobstay and jib-stay plates.—The bobstay and jib-stay plates are galvanized Norway iron, 3 inches wide by $\frac{3}{4}$ inches thick, let into the plank and stem, and extending back onto the plank, riveted through with 1-inch galvanized iron bolts. Galvanized iron rods each 3 feet long and $1\frac{1}{4}$ to $1\frac{1}{2}$ inches diameter are held to the plates with bolts, and extend forward to receive the ends of bobstay and jib-stay, the end of the former being held by a bolt and the latter setting up on end over a roller-thimble in the end of the rod.

Gammon-strap.—The gammon-strap is of galvanized Norway iron, $3\frac{3}{4}$ inches wide and $\frac{3}{4}$-inch thick; fitted at the top to receive the iron thimble over which the forestay sets up.

Saddle-band.—The saddle-bands on the masts are of galvanized iron, $2\frac{1}{2}$ to 3 inches wide and from $\frac{1}{2}$ to $\frac{3}{4}$ inches thick.

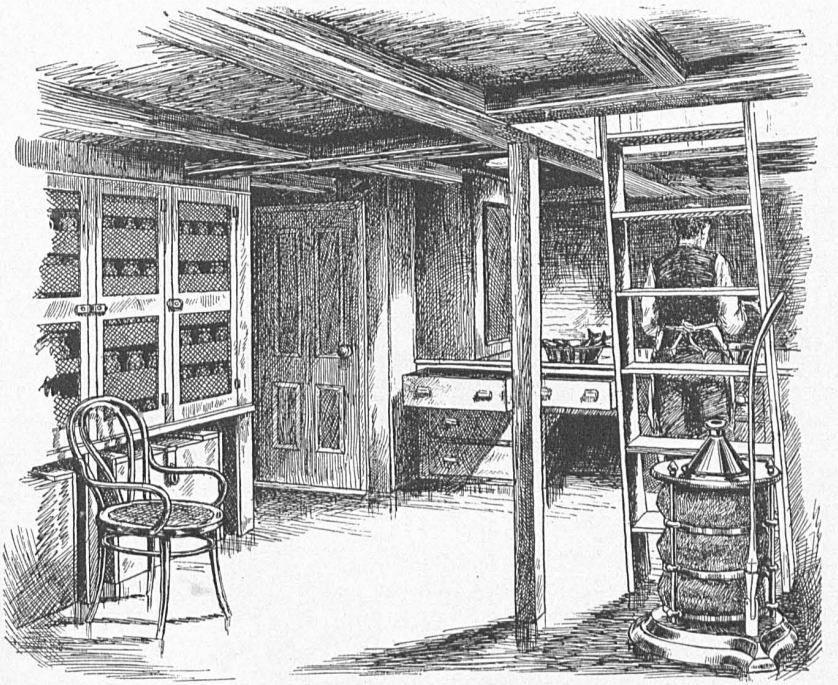
Jib-boom guy outrigger.—The jib-boom guy outrigger, which extends and supports the jib-boom guys, is made of galvanized iron of a special pattern, in one piece, 7 feet 4 inches long, $1\frac{1}{2}$ inches average diameter. It is fastened by screw-bolts to a band crossing the end of the bowsprit.

Martingale.—The martingale is made of oak, 5 feet long, 4 inches in diameter, and is provided with the necessary galvanized iron hooks, bands, eyes, etc.



LABORATORY, LOOKING FORWARD.

Drawn by C. B. Hudson,



LABORATORY, LOOKING TOWARD AFTER-PORT SIDE.

Drawn by C. B. Hudson.

UNDER DECK ARRANGEMENT.

(See Plates III to XI.)

The under deck space is divided generally into the forecastle, hold, laboratory, cabin, and sail-room.

Forecastle and galley.—The forecastle (Plate V), which is also used as a galley for cooking, and as a sleeping apartment of the seamen, the cook and cabin-boy, and the quarters where they eat, is under deck forward, and is about 22 feet long; it conforms in width to the shape of the vessel. It is finished with ash and black walnut, and has three lengths of berths on each side. There is a dish closet on the starboard side next to the after berths, and a locker or closet for cooking utensils abaft the dish closet. The galley stove sits on a platform, about 3 inches high, on the starboard side next the after bulkhead. On the port side aft is a water-closet and lavatory. On each side of the forecastle is a locker seat, 18 inches high and 9 inches wide, fitted underneath at the after end with two drawers for clothing. The forward end of the lockers are provided with adjustable scuttles so that the interior may be utilized for the storage of such material as it is necessary to put into them. The space underneath the fore-peak berths is finished with closets for the storage of lanterns, etc. The table, which is 5 feet 9 inches long, is made with leaves so that when not in use it will fold around the foremast, leaving the floor space clear of obstruction. There is a scuttle in the floor forward and one abaft of the foremast, to give entrance to the space underneath the floor. The floor is double, being made of 1-inch ash boards over 1-inch hard pine boards; these are fastened with galvanized iron screws 2¼ inches long. The sleepers, upon which the floor is laid, are 4-inch by 3-inch scantling and are supported by stanchions, cleats, etc., as needed.

Hold.—The floors of the hold and laboratory are made of 2-inch hard pine, laid on sleepers which are 4-inch by 5-inch, supported by stanchions, cleats, etc., to prevent them from springing or sagging. The hold is divided, as shown in the plan. On the port side, next the forecastle bulk-head, is a refrigerator, in which meat or other stores can be kept cool in warm weather. This is provided with a door at top and bottom, and with the necessary gratings, hooks, etc. The bottom and sides of the refrigerator are covered with galvanized iron, soldered together and well fastened, and from the after corner a lead drain-pipe, fitted with a trap for draining water, leads into a reservoir below, which can be pumped out through another tube into which an adjustable brass hand-pump is screwed. Abaft the refrigerator, on the same side, is a cupboard or grub locker, for keeping food, dishes, etc. Next the grub-locker, on the same side, is a store-room or cook's pantry, in which the stores in daily use are kept (with the exception of meats), and which is so arranged that the cook may do much of his work therein. Between

the store-room and the laboratory bulkhead on the port side are two pens, which are ordinarily used for the storage of fishing apparatus, and can also be used for the storage of ice, or for icing fish, bait, etc. There are two similar pens opposite on the starboard side, and in each case these pens are provided with piping, which carries the drainage from them into a reservoir beneath, which can be pumped out by a hand-pump in the same manner as that connected with the refrigerator. This prevents the drainage from getting into the bilge and making the bilge-water offensive. Forward of the two pens, on the starboard side, is a coal and wood pen, in which a supply of fuel is carried. The pens are provided with sliding doors, which run in grooves at top and bottom. Inside of these doors are vertical grooves in the stanchions on each side of the entrance, in which boards can be slid to close the aperture gradually when using a pen for icing fish, etc. Of course, after the fish are iced, the main door is closed also.

Abaft the forecastle bulkhead are the chain-lockers, previously referred to, in which the chain cables are stowed (see Plate VI). These are separated by a bulkhead in the middle; they are 20½ inches fore and aft, 5 feet 4 inches long athwartship (outside measurement), and extend from floor to deck, a height of about 6 feet. They are built of 1¾-inch spruce plank, and fitted with sliding planks on after side which can be removed, so that the chains inside may be reached whenever it is necessary.

Attached to the after side of the chain-box, 2 feet 6 inches above the floor, is a plain pine table for cook's use, 4 feet 7 inches long and 2 feet 1 inch wide. It is hung on hinges and provided with swinging legs, so that it can be let down when not in use. The after corners are rounded.

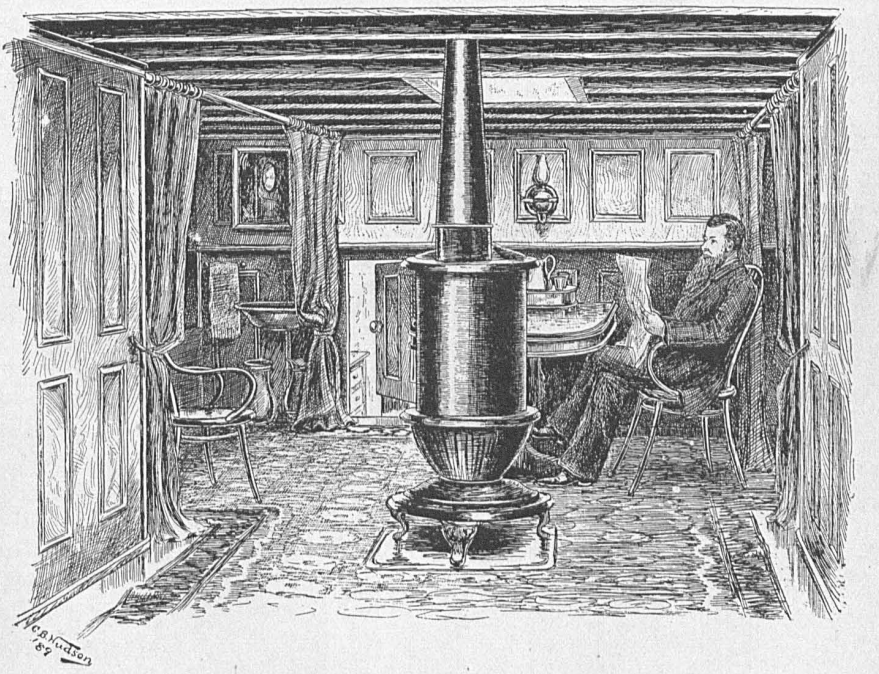
On the starboard side, forward of the coal pen, are a series of shelves, some with holes and all provided with racks or rails, to hold firkins, galley coppers, etc.

The well occupies the middle of the hold, and on each side of this is a passage-way connecting the forecastle with the laboratory and cabin; it is 17 inches wide at the floor and 34 inches wide at top (see Plate VII).

There are adjustable ash steps leading from the fore hold to the deck, through the main-hatch, on the forward side of the well.

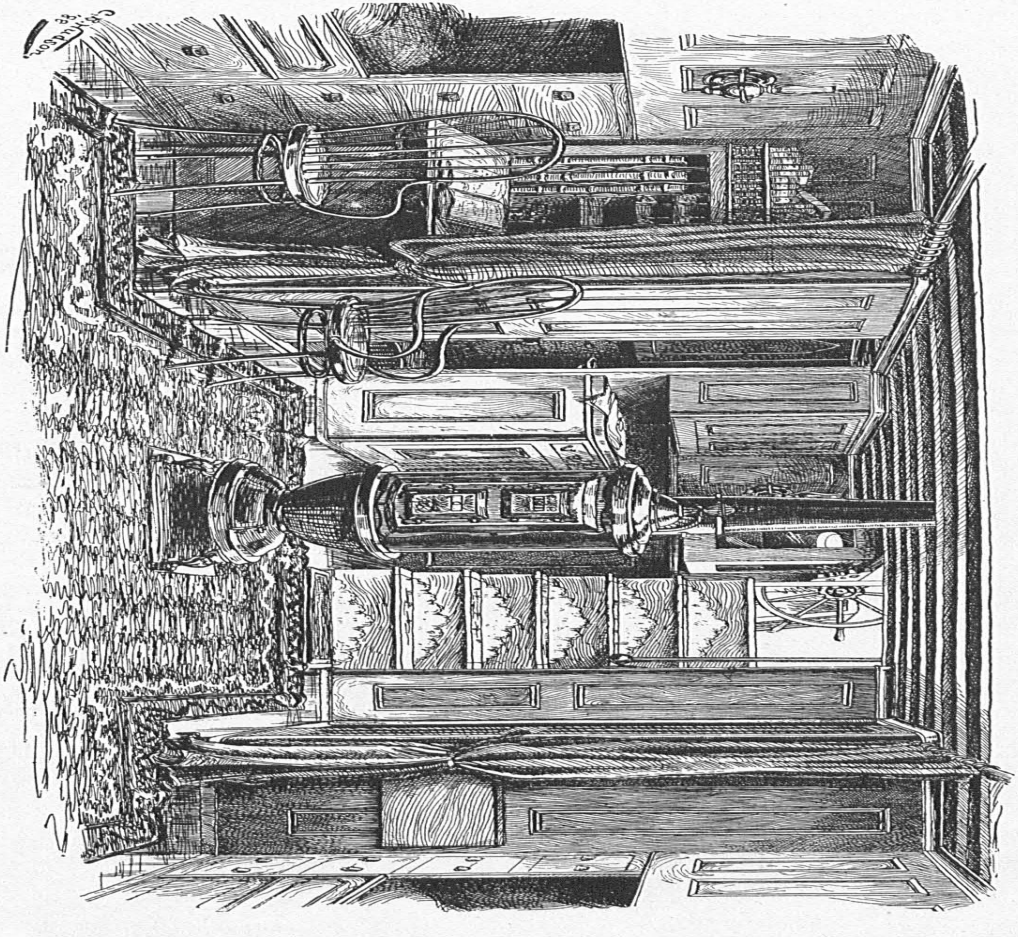
A harness cask is stowed on each side abaft the well, and provision is made by staples, etc., for hanging harpoons, boat-masts, sprits, etc., over head alongside the well. The pumps are cased in with white pine.

Laboratory.—The laboratory (see Plates VIII and IX) is abaft the hold, between that and the cabin, separated from each by a bulkhead, access being had to the hold by a door on each side, and to the cabin by a door on the port side. The laboratory extends the full width of the vessel, and is 9 feet 6¾ inches fore and aft from bulkhead to bulkhead. A flight of wooden steps leads to the deck through the after booby-hatch. On each side is a shelf, 2 feet 8½ inches high, with an average width of 3 feet 10 inches covered with sheet lead to make it water-tight, and fitted with a low adjustable black walnut railing in front. Underneath these



CABIN, LOOKING FORWARD.

Drawn by C. B. Hudson.



CABIN, LOOKING AFT.

Drawn by C. B. Hudson.

shelves are built a series of sliding drawers—eight on starboard side and seven on port side—in which are kept various kinds of fishing gear, apparatus for loading guns, flags, charts, etc. On top of the starboard shelf, at the after end, is a set of drawers—four in all—2 feet 2 inches deep and 3 feet 10 inches long, in which are kept spare bedding, and on the forward end a closet with two glazed doors, and series of drawers, for containing medicines. The closet extends to the deck; it is 10 inches deep and 2 feet 10 inches wide. The drawers are each 7½ by 11 inches front. On the after end of the port shelf is a closet 15½ inches deep and width of shelf, to hold the vessel's library, and just abaft that, near the entrance to the cabin, is a water-closet. Across the after end of the laboratory is arranged a series of sliding drawers—nineteen in all—each 21 inches by 20½ inches by 6 inches, outside measurement, to hold bottles, jars, etc., in which the collections are placed. These drawers are held in a case 8 feet 1 inch long, 3 feet 11 inches high, and 2 feet 2 inches deep. It is provided with four wire-screen doors that lock at side, top, and bottom, and it is 2 feet 1½ inches above the floor. The lower drawers are thus high enough to receive beneath them large alcoholic tanks. The finish of the laboratory is generally in ash and black walnut, but it is sheathed over the ceiling with hard pine, and white pine is also used to some extent. The hard wood is finished bright and varnished; the rest, including deck and beams, is painted white.

The fog alarm, when not in use, is stowed back of the laboratory steps, next the forward bulkhead. The rifles, axes, etc., are supported in cleats on forward bulkhead and between beams and carlines overhead. The laboratory is lighted at night by a large brass double-burner lamp, which hangs over the starboard shelf.

Cabin.—The cabin (see Plates X and IX) is finished in cherry and bird's-eye maple, with the exception of the interior of the state-rooms, which is finished in ash, black walnut, and white pine, the pine being painted in parti-colors. The floor is similar to that in the forecastle. The ceiling is white pine, painted white. There are two state-rooms, one on each side in the after end of the cabin, and heavy draperies or curtains, which slide upon poles, make it possible to shut off the forward berths on each side from the rest of the cabin.

In the starboard state-room is a writing-desk made of bird's-eye maple and cherry, and a similar desk is placed just abaft the after end of the berth next forward of it. In the port state-room, and next to the berth forward of it, are "drop" tables for writing. There are drawers underneath each of the berths and abaft them for clothing.

There are but four berths in the cabin, but these are fitted with a device originated by the writer, so that they can be extended when necessary, to make ample room for two persons in each berth. When not in use they can be easily closed. The forward berths are also provided with an adjustable arrangement, for use in rough weather, to prevent the occupants from falling out.

There is an extension table of black walnut, 3 feet wide and 8½ feet

long, to its limit. There is a box binnacle on the starboard side of the cabin, 26 inches high and 14 by 15 inches square (outside); the binnacle lamp is hung to starboard of the box so as to throw the light upon the compass. On the starboard side, aft, is a sideboard and china-closet, and between the sideboard and companion-stairs is a door giving entrance to the sail-room. Just forward of the foot of the cabin stairs, nearly amidships, is a scuttle leading into a small store-room beneath the floor. In the forward part of the cabin floor, each side of the midship line beneath the table, is a scuttle leading to corresponding scuttles in the top of the water tank.

On the starboard side, in front of the forward berth, are two scuttles which form a cover to the bath-tub that is located beneath the floor, and which is provided with proper piping for filling it from the deck.

The cabin is heated by a stove.

Sail-room.—The sail-room occupies the extreme after end of the vessel, next to the cabin. It has a locker built of white pine on each side, and a small floor placed at the proper height; otherwise it is unfinished. In this are stowed the spare sails, cordage, blocks, awnings, paints, etc.

Water-tanks.—Forward of the well, on each side, is an iron water-tank, extending several feet underneath the after end of the forecastle floor and having a capacity of about 270 gallons; the two tanks hold some 540 to 570 gallons of water. Beneath the cabin floor is a wooden tank (built to conform with the shape of the vessel, and divided into two main sections by a tight bulkhead running fore and aft) which holds about 1,500 gallons of water. This is connected by piping with the tanks forward, so that water can be draughted from the after tank to the iron tanks. It also has adjustable cross bulkheads, that are perforated with holes, to prevent the water from swashing.

8. WINDLASS AND ENGINES.

(See Plates XII and XIII.)

The windlass originally put upon the *Grampus* was fitted to be operated by steam or hand, being of the pump-brake pattern, built by the American Ship Windlass Company, of Providence, Rhode Island. It had two loosely mounted wild cats fitted for 1-inch or 1⅛-inch chains, and they were adapted to lock to rigidly secured driving-heads keyed on the shaft and each controlled by a friction-band and lever. The windlass was provided with adjustable gypsy ends to be used for warping and for heaving in the beam-trawl. It was also fitted with adjustable whelps for the port wild-cat, so they could be put on whenever it was intended to use the steel wire hawser. The windlass-bitts were bolted to an iron bed-plate.

It was driven by a pair of right-angle engines of 35 horse-power, which were bolted underneath the deck upon which the windlass stood. The steam-power was communicated through a worm-shaft operating upon a worm-wheel on the windlass.

Fig 1

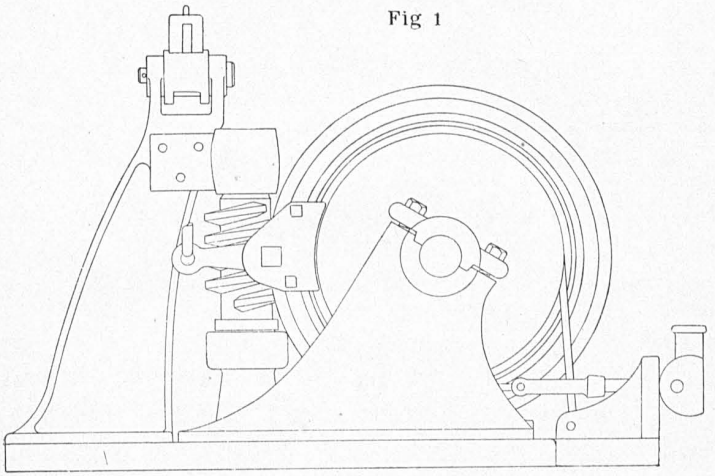


Fig. 2.

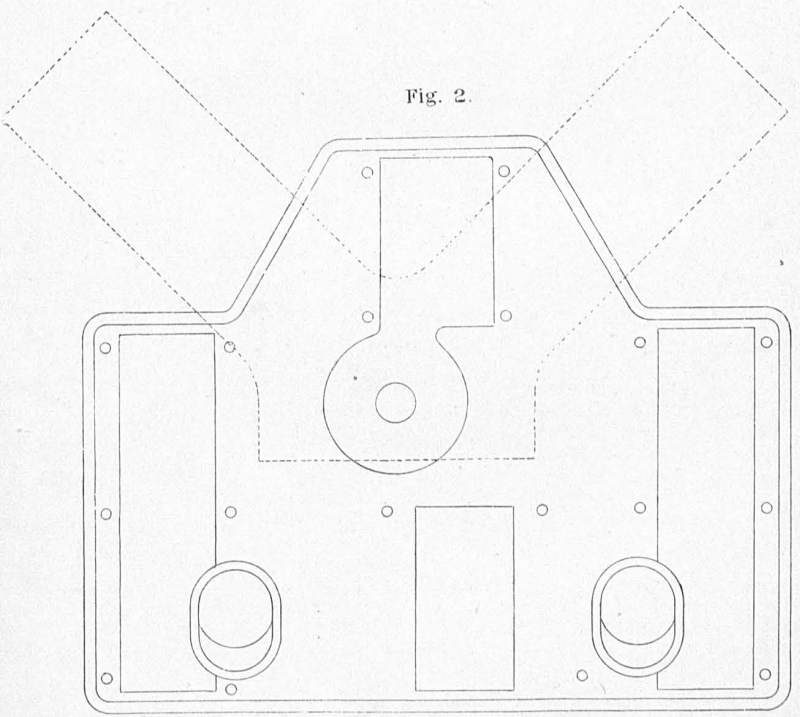


FIG. 1. Cross-section of steam windlass.
FIG. 2. Bed-plate of steam windlass; the dotted lines represent the outlines of the engines.

Fig. 1.

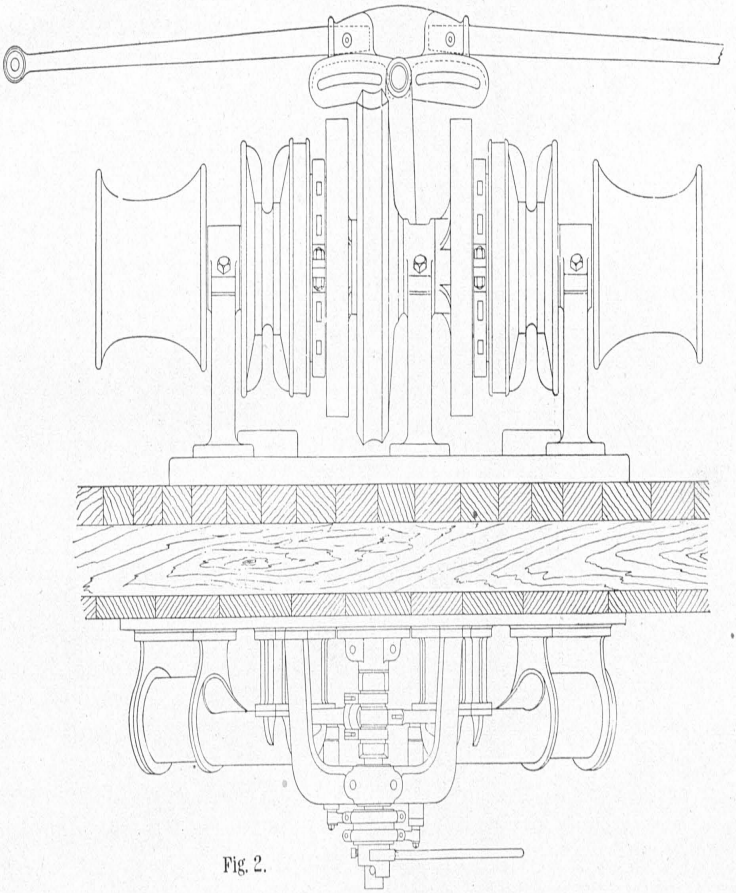


Fig. 2.

Scale of Feet.

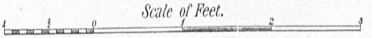


FIG. 1. Plan of steam windlass, looking forward.

FIG. 2. Plan of engines for windlass.

The hand-power or pump brake arrangement for working the windlass when steam was not used was so arranged that it could be geared to obtain different degrees of purchase power.

The weight of the windlass and engines (exclusive of the 24-inch gypsy ends) was 5,800 pounds. The gypsy ends had a combined weight of 1,000 pounds, making a total weight, including these, of 6,800 pounds.

As has been stated elsewhere, the steam windlass was removed after the vessel made one trip and replaced by a common wooden pump-brake windlass, of the type used on fishing-vessels of the same size. This windlass is 19 inches diameter in the middle, 14 inches on starboard barrel, and 22 inches on port barrel, over whelp. It is arranged for chain on the starboard side, and is fitted with a hard-wood jacket or smooth whelp on the port side for the steel hawser, which is generally used, though it is also adapted to a chain-cable.*

9. STEAM BOILER, FORCE PUMP, CONDENSER, ETC.†

A 20 horse-power Brayton patent coil boiler was used for operating the steam windlass. This was 6 feet high and 5 feet in diameter; provided with an adjustable pipe or smoke-stack, 1 foot in diameter and 6 feet long, made in two lengths so that it could be shortened or removed altogether, as occasion required. There was a brass deck-plate for this pipe to pass through, and this was provided with a water-tight brass cover that was put on when the pipe was taken off.

The boiler was located between the well and the forecastle; it was connected with a Knowles combined vacuum and force-pump (located to starboard against the ceiling) and with a keel-condenser. The latter was made of heavy 2½-inch seamless brass tubing, and was 28 feet long outside of vessel—14 feet on each side of keel, through which it passed. The 2½-inch pipe began at boiler-room deck (floor of fore-hold) inside of the vessel, and continued of that size until it passed through the keel and returned to enter the vessel on the port side, where its size was reduced to 1½ inches diameter for suction-pipe of vacuum pump, and continued of that size above boiler-room floor.

There was a brass sea-valve of 1½ inches diameter, fitted with strainer over its end.

The requisite piping for connecting the boiler with the steam-engine passed through the forecastle bulkhead to starboard of the stove, thence under locker seat to engine.

10. CHAIN STOPPER.

One of the Emery and Cheney patent elastic chain stoppers is located close to the hawse-pipe on the starboard side.

* The windlass originally put on the *Grampus* was transferred to the U. S. Fish Commission steamer *Fish Hawk*.

† These were all removed when the steam windlass and engines were taken off the vessel.

11. RIGGING.

The standing rigging, with the exception of foot-ropes, life-lines, and a few pennants, is galvanized iron wire; the running rigging is manilla.

The following are the sizes of rope:

	Inches.
Wire rigging:	
Jib-stay and bobstay	4½
Forestay and fore and main shrouds	3¼
Spring-stay (or triatic-stay) and preventer-stay	3
Bowsprit shrouds	2¾
Flying-jib and jumper-stays	2½
Back-ropes	2¼
Inner jib-boom guys, outer jumper-stay, fore and main-topmast back-stays, foreboom, and fore-staysail topping-lift pennants	2
Balloon-jib stay and outer jib-boom guys	1¾
Main-topmast stay, "counter-stay" (from head of fore-topmast to main-mast-head) fore and main-topmast shrouds	1½
Upper topmast stays and belly lashing for jib-boom	1
Hemp ropes:	
Jib foot-ropes and life-lines	2¾
Main-boom foot-ropes and jib-boom foot-ropes	2½
Ratlines, size universally used	
Manilla rope:	
Main-boom topping-lift pennant (four strands)	4½
Main-boom tackle pennant (four strands)	4
Fore-boom tackle pennant (four strands)	3½
Main-boom topping-lift runner	3
Boat-gripes	3
Tarred manilla lanyards (four strands) for fore and main rigging	3
Tarred manilla lanyards (four strands) for head rigging and fore-topmast back-stays	2
Main sheet, fore- and main-peak halyards	3
Fore- and main-throat halyards, fore sheet and cat stoppers	2¾
Jib halyards, fore-staysail halyards, fore-staysail sheet, jib sheet, after main-staysail halyards, main-staysail sheet, main-boom tackle fall, balloon jib sheet, davit tackle falls, and reef earings	2½
Forward main-staysail halyards, flying-jib halyards, flying-jib sheet, fore-boom tackle fall, gaff-topsail halyards, gaff-topsail sheets, crutch tackles, main-boom topping-lift fall, fore-staysail topping-lift fall and main topmast back-stay fall	2¼
Fore-staysail and jib down-hauls, fore-boom topping-lift fall, fore and main-peak down-hauls, gaff-topsail tacks, reef tackle, main-peak and fore-peak whips, and foot lacings for sails	2
Balloon-jib halyards, flying-jib down-haul, fore and main gaff-topsail clew-lines, and jib stops	1¾
Head lacings for sails and sail gaskets	1½

The pennant halyards are special size, cotton line, made for that purpose.

12. BLOCKS, TRUCKS, LEADERS, PINS, ETC.

The blocks are, generally, made of ash with lignum-vitae sheaves, provided with iron or patent bushings, as specified in the list, and steel pins. The straps are generally galvanized iron, and are inside of the shell of the block. A few of the blocks are made of lignum-vitae, as indicated, and in some cases iron sheaves are used.

No.	List of blocks, etc.	Size.	Bushing.
	MAINSAIL.	*Inches.*	
1	Three-fold main peak	12	Patent.
2	Single-fold main peak	12	Do.
1	Three-fold main throat	12	Do.
1	Two-fold main throat	12	Do.
1	Three-fold main-sheet	12	Do.
1	Two-fold main-sheet (lignum-vitæ)	7	Do.
1	Single-fold runner main-boom topping-lift	8	Iron.
1	Single-fold upper main-boom topping-lift	7	Do.
2	Single-fold main peak-whips	5	Do.
1	Single-fold main peak down-haul	7	Do.
2	Two-fold main crutch tackles	7	Do.
2	Single-fold main crutch tackles	9	Patent.
1	Two-fold main-boom tackle	9	Do.
1	Single fold main-boom tackle	6	Do.
1	Two-fold main reef tackle	6	Do.
1	Single-fold main reef tackle		
	FORESAIL.		
1	Three-fold fore peak	12	Patent.
2	Single-fold fore peak	12	Do.
2	Two-fold fore throat	11	Do.
1	Two-fold fore-sheet	11	Do.
1	Single-fold fore-sheet (lignum-vitæ)	8	Do.
2	Single-fold fore boom topping-lift	7	Iron.
2	Single-fold fore peak whips	7	Do.
1	Two-fold fore-boom tackle	7	Do.
1	Single-fold fore-boom tackle		
	FORE STAYSAIL.		
1	Single-fold fore staysail halyards	9	Patent.
1	Two-fold fore staysail halyards	9	Do.
1	Single-fold fore staysail down-haul	7	Do.
6	Single-fold lignum-vitæ (round) staysail sheet	8	Iron.
2	Single-fold topping-lift blocks	8	Patent.
	JIB.		
2	Single-fold jib halyards	9	Patent.
1	Single-fold jib down-haul	6	Do.
2	Single-fold lignum-vitæ (round) sheet	7	
	FLYING JIB.		
2	Single-fold flying-jib halyards	7	Patent.
1	Single-fold flying-jib down-haul	5	Do.
2	Single-fold flying-jib sheet (round)	6	
	JIB TOPSAIL.		
2	Single-fold jib-topsail halyards	6	Patent.
1	Single-fold jib-topsail down-haul	5	
	FORE AND MAIN GAFF-TOPSAIL.		
2	Single-fold gaff-topsail sheets	7	
4	Single-fold gaff-topsail halyards	6	Iron.
6	Single-fold gaff-topsail clew-lines	4	Do.
2	Cleats on gaffs with sheaves	.....	
	MAIN STAYSAIL.		
2	Single-fold staysail halyards	7	
1	Staysail tack club	.....	
	MISCELLANEOUS.		
30	Locust belaying-pins	.....	
6	Iron belaying-pins	.....	
30	Purrel or peril trucks for gaffs	.....	
12	Dead eyes for shrouds	6	
4	Heart eyes for jib stays and guys	4½	
2	Gilded trucks (balls)	.....	
11	Riding-sail hoops with hooks	.....	
8	Dory tackle blocks, rope straps (single)	6	Patent.
2	Two-fold davit tackle blocks	8	Do.
2	Single-fold main-topmast back-stays	7	Iron.
2	Two-fold main-topmast back-stays	7	Do.
4	Two-holed fair leaders for gaff-topsail gear	.....	

Lightning rods.—Lightning rods extend from the top mast heads to the water on the starboard side, passing through fair-leaders on the topmast back-stays. The rods are flexible copper wire rope, with copper tips extending above the trucks about 6 inches. The lower ends are coiled up and tied to the back-stays, 7 or 8 feet above deck, except in stormy weather, when they are unloosed and thrown into the water.

13. SAILS, SAIL-COVERS, AND AWNINGS.

(See Plate XIV.)

The original suit of sails, sail-covers, and awnings, were made of medium-hard Woodbury duck of the ordinary width, and of the following thickness: Foresail, fore staysail, and riding-sail, No. 0; mainsail and jib, No. 1; flying jib and sail covers, No. 6; fore and main gaff topsails, No. 8; main topmast staysail, No. 10; balloon jib, 8-ounce duck.

The sail-covers and awnings are made of cotton duck.

The awnings are made in two sections to extend from foremast to taffrail; they meet at the mainmast.

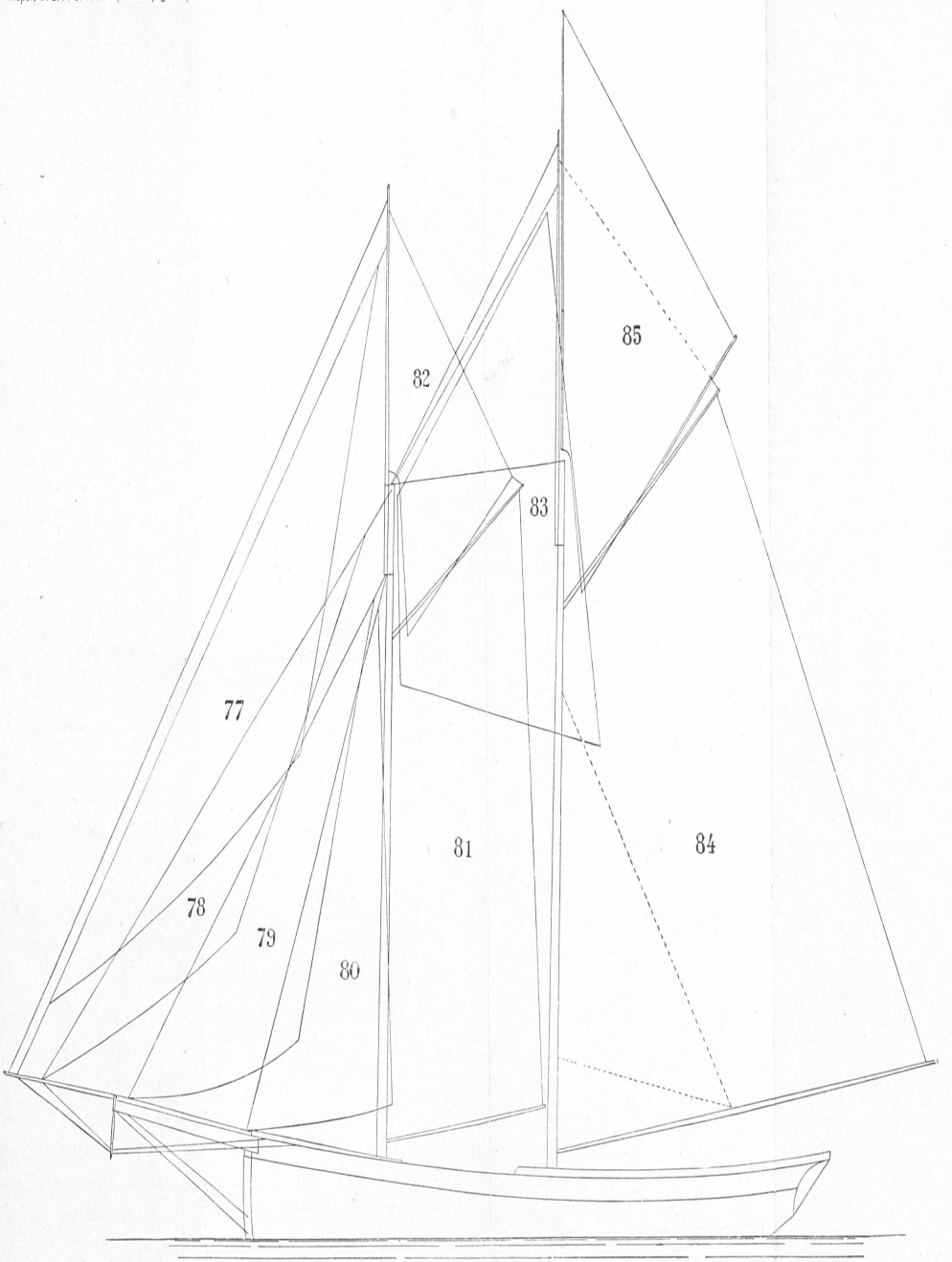
A second suit of sails was made of hard Woodbury duck, 14 inches wide, and of the same thicknesses as those given above, with the exception of the foresail and fore staysail, which were made of No. 1 canvas. No riding-sail was made in this suit. All the sails, sail-covers, and awnings, as well as a portion of the running rigging, have been treated with Nelson's preservative for preventing rot and mildew.

14. ANCHORS AND CABLES.

The anchors are of the special pattern used on fishing vessels, having large palms and long shanks, the latter designed to receive wooden stocks. The kedge, however, is provided with an iron stock. Two of the anchors weigh 700 pounds; a third anchor 500 pounds, approximately, and the kedge weighs 200 pounds. The chain cable is 1-inch, barred; in two strings of 60 fathoms each. The hawser is the Bullivant elastic steel-wire cable, 1 inch in diameter. There are 400 fathoms of this, of which only 175 fathoms have yet been used.

15. COLLINS' IMPROVED MARINE DRAG.

This drag (or drogue) is made of galvanized iron and canvas. The frame consists of a stout hoop of round galvanized iron, jointed so that it can be folded and stowed away in small compass when not in use. It is fitted with lugs, into which are fastened the cross bars that keep it distended when rigged, and to four other lugs are attached chains, that together form a bridle from the four quarters of the hoop and join, at a common center, to a large swivel which is fitted with a big thimble into which a hawser can be bent.



SAIL PLAN

Designed by J. W. Collins.

To the hoop is attached, by sister hooks, a deep canvas bag, shaped like a skull-cap, which will fill with water when thrown overboard and hold the vessel steady, nearly head to the sea and wind, and with only a moderate leeway. The drag, when in use, is secured to the end of a hawser, and it can be suspended at any required depth by means of a buoy. A line is attached to the bottom of the bag so that it can be tripped and easily hauled in when its use is no longer necessary. The advantages of this drag are that it is always ready for use, being easily adjusted in a few moments when needed; that it can be unrigged and stowed away when not in use.

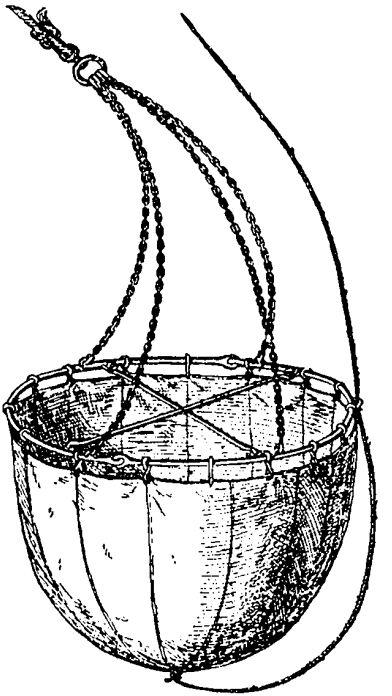


FIG. 2.—Collins' improved marine drag.

Dimensions: Circumference of hoop, 18 feet; length of cross-bars, 5 feet 10½ inches; size of iron, 1¼ inches; length of bridle-chains (each), 5 feet; circumference of bag, 19 feet; depth of bag, 4 feet; canvas (No. 1), white cotton duck.

This drag was designed to insure the greater safety of vessels in heavy gales, and also to prevent them from drifting so rapidly to leeward as they usually do when it is not employed. It is secured to a hawser or chain and paid out from the bow of the schooner, the distance varying from 25 to 75 fathoms. A bag containing oakum saturated with oil can be used, in connection with the drag, to smoothen the sea, and thus, to a still greater extent, insure the safety of the vessel.

16. FOG-HORNS.

Collins' patent fog-alarm.—(See fig. 3.) This consists of an upright cylindrical bellows of stout grain-leather, supported by and working upon three brass rods which are fastened at the lower ends to a galvanized iron pedestal, and the upper ends of which are secured, by means of screw-caps, to an iron top, to which also is attached the upper part of the bellows. This cap piece is surmounted by a cone-shaped top, having a hole in its apex into which is screwed a large reed horn fitted with a revolving top or cowl by means of which the sound can be thrown in any desired direction. There are three of these horns, so that in case one is injured it can be instantly replaced by another.

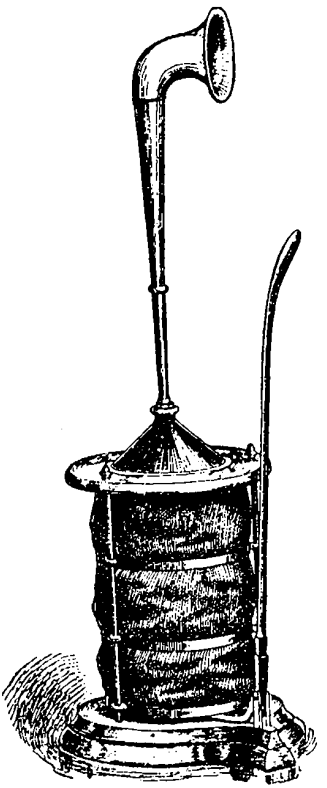


FIG. 3.—Collins' patent fog-horn.

The bellows is collapsed or distended by means of an iron lever working on a hinge attached to the base. By moving this lever the air in the bellows is driven through the horn at the top with great force. A very heavy sound is obtained, while the horn can be blown to its fullest capacity with very slight exertion on the part of the operator.

This implement was originally designed for use on fishing vessels, especially such as are employed in the trawl-line fishery; it is adapted

for use on all classes of vessels. Dimensions, diameter of base, 2 feet; thickness, 4 inches;* diameter of top, 19 inches; diameter of bellows, 15 inches; height, 20 inches; height of cone, 6½ inches; diameter of cone (at base), 9 inches; thickness of brass rods, five-eighths of an inch; length of lever, 4 feet.

Tin fog-horn.—There is a common, reed, tin fog-horn to be blown by the mouth. This is about 3 feet 6 inches long.

C.—BOATS AND LIVE CARS.

There are five boats, namely: one purse-seine boat, one stern-boat or dinghy, and three dories. Besides these, there are three boat shaped live cars.

17. SEINE-BOAT.

The seine-boat is like the ordinary type used in the purse-seine mackerel fishery. It is sharp forward and aft, and is carvel built. The frames, gunwales, etc., are of white oak, and the planking is white swamp cedar, fastened with the best quality of galvanized iron. The boat is fitted with special galvanized malleable iron appliances, as specified in the detailed description. She is provided with a schooner rig of spars and sails, and carries, when sailing, a jib tacked down to the stem-head, a loose-footed gaff foresail, and a sprit and boom mainsail, the latter being much smaller than the foresail. The foresail is bent to hoops, and has two reefs in it. The mainsail and jib are not provided with reefs. The sails are made of cotton drilling, and, like the sails of the vessel, have been treated with Nelson's anti-mildew preparation. They have a total area of 50 square yards. All the spars are of spruce. There are special casings under the thwarts into which the spars are stepped so that the latter can be put in or taken out without interference with fish or nets that may be in the boat. The latter is fitted with an oak rudder that can be used when sailing, and which is hung by gudgeons to straps that are attached to the stern-post, and so formed as not to entangle the seine when the latter is being used, at which time the rudder is unhung. The boat is also provided with a white oak, brass bound, water-breaker, holding 5 gallons.

The following is a detailed description of the boat: Length, over all, 33 feet; breadth of beam to outside of planking, 7 feet 2 inches; depth from top of keel to top of gunwale, amidships, 2 feet 6 inches.

Keel.—The keel is made of oak in two parts, commonly called "partners" or sister keels. The lower or outer portion is 2¼ by 2¾ inches. The inner "partner" is 4¾ by 1 inch. This is nailed to the lower part with galvanized iron sheathing nails.

Stem and stern-post.—Of "pasture" white oak; bent to the proper form, the upper end of each nearly perpendicular, and from thence curv-

*The thickness of iron averages about three-sixteenths of an inch; the thickness given above relates to the vertical dimension of base.

ing to meet or intersect the keel, to which both stem and stern-post are joined by a splice, with a clamp over the splice, and bolted together with galvanized iron bolts ¼-inch diameter.

Aprons.—It has a white oak apron 2¼ by 3 inches, bent to fit inside of the stem and properly fastened; also a similar apron, 1½ by 3 inches, bent and fitted inside of stern-post.

Ledges.—There are ledges between each timber, from the fifth timber from the bow to the fifth timber from the stern; these are oak, ⅞-inch thick and averaging 7 inches high, and are fitted to the plank and on top of keel; the top of each ledge to receive the platform.

Frames.—The timbers are made of white oak butts, steamed and bent to the proper curve, 1½ by 1⅜ inches, and are notched over lap of top streak. They are spaced 12 inches from center to center; are nailed on each edge of every streak, the nails going through plank, battens, and timbers; and the foot of the timbers are fastened through back to rabbet or upper portion of the keel into the lower or outer keel.

Plank.—The plank are of white swamp-cedar $\frac{9}{16}$ inch thick, and have had at least two years atmospheric seasoning.

Battens are of elm; they lap ⅞ inch on each edge of plank—either side of seams—and are $\frac{9}{16}$ inch thick.

Ribbands.—The lower chafe ribband is three-fourths round, 1¾ inches wide by ⅞ inch thick, and made to fit under the upper streak of plank. The top ribband is 3 inches wide by 1 inch thick amidships, tapering to 2 inches in width at either end; it is nailed at the ends, but amidships it is bolted through the gunwale and forelocked on the inside, and the lower edge is riveted through plank and timber heads.

Risers are of spruce, 4 inches wide by ⅞ inch thick.

Ceiling is $\frac{9}{16}$-inch thick; in narrow strips, and closely fitted from gunwale to riser (or rising) and from riser to platform.

Platforms.—The platforms are of white pine ⅞ inch thick, laid on top of the ledges. There is a forward platform extending from forward thwart to stem, and dropped 5 inches below the thwart. The after platform commences at the bulk-head, at the fore part of the stern deck, and extends to and covers the after thwart; there is a bulk-head from this after platform downward to the lower or main platform.

Thwarts are of spruce, 1⅜ by 8 inches, except the midship thwart in which the pursing davit is fixed, which is of oak.

Knees are of juniper 1½ inches thick, with the horns finished 1¾ inches; these are bolted through ribband, gunwale, and the head or horn of the knee; also one bolt through each knee, the chafing ribband, plank, timber, and ceiling. All these bolts are forelocked over rings.

Breast-hook is of galvanized malleable iron, with one bolt through its throat, thence through apron and stem, and riveted on the outside. It has three bolts through each arm.

Stern-hook is of galvanized malleable iron, and fastened in the same manner as the other.

Stem-cap is of malleable galvanized iron, of suitable size and shape to cover stem-head, rounded off to prevent its marking the vessel, and has flanges on either side to take the wear of towing link.

Stern-deck.—There is a stern-deck of $\frac{3}{8}$-inch white pine (except the after-piece, which is of oak, to support the after ring-bolt) fitted to top of gunwales, and extending from stern-post to the bulkhead of the upper after platform.

Thwart stanchions.—There is an eight-square ash stanchion, $1\frac{1}{2}$ inches diameter, under each of the four thwarts known as the second, third, fourth, and fifth thwarts.

Pump.—A wooden pump of the ordinary pattern used on seine-boats; this is fitted with a spout to carry the water over the boat's side, and has a galvanized iron spear and box, the latter properly leathered and fitted for use.

Thwart knees.—The first, second, and sixth thwarts each has a single knee at either end, and the third, fourth, and fifth thwarts have two knees at either end of each thwart.

Gunwale supporters.—There is a gunwale supporter, of galvanized malleable iron, on each side of the boat; this is bolted through the gunwale and upper ribband, and also has one bolt through the lower or chafing ribband.

Butt clamps.—There is a clamp on each butt of the planking. This clamp laps far enough over the ends of each plank, so that two rows of nails may be driven into either end of the clamp.

Calking.—All butts, wood ends, and garboard seams are calked with cotton.

Plank fastening.—The planking is nailed through the edge of each streak to the battens, and has three nails in the space between two timbers, these nails being 4 inches apart.

Hooks and garboard jumpers.—There are two natural-growth juniper hooks, bolted through keel and nailed through plank streaks. There are also six garboard jumpers in each end of the boat, extending from the keel upward over three streaks of plank on each side, these jumpers being fastened to keel and plank.

Hoisting ringbolts.—There is a hoisting ringbolt of galvanized wrought-iron forward and aft. The bolt at the stern goes through the after-deck; the lower end of the bolt is flattened and pierced with two holes to receive bolts that secure it to the stern-post.

Rowlock sockets.—There are eight sockets for the rowlocks, each secured with four screws. These sockets are of galvanized iron.

Fastening of ledges.—The ledges are nailed diagonally through the bottom into the keel, and through the planking and battens into the ledges, the upper ends having rivets turned down so as to form a clench.

Painting, etc.—The boat is painted with three full coats of paint inside and out. The bottom, outside, below water line, is painted with

pure French verdigris. The inside of the planking, underneath the ceiling, is payed with bright varnish, with enough dry paint mixed with it to make a heavy body. The color of the boat is as follows: The bottom, below water-line, green; the bends, white, with vermilion stripe; the top streak, gunwale, and inside top work, as far down as the lower edge of risings, straw color; the platform, green, and the ceiling amber color.

Oars.—The oars are straight-grained white ash, of the following dimensions: One steering oar, length, 16 feet; two rowing oars, length, 14 feet; four rowing oars, length, 13 feet; two rowing oars, length, 12 feet.

Fittings.—The boat is provided with the following articles of equipment. All these implements are of the best galvanized malleable or wrought iron:

10 row-locks, of seine-boat pattern.
2 patent steering row-locks.
1 pursing-davit, 22 inches long.
8 oar-holders.
1 tow-link, with hooks.
1 side-link, with eye.
1 towing-pin.
4 malleable iron pursing-blocks, with 5-inch wooden sheaves, and brass patent-roller bushings.
1 davit-guard.
2 pursing-cleats.
4 eye-plates for oar-holders.
2 eye-plates for leading-blocks.

18. DINGHY.

The *Dinghy* is an open, carvel-built, square stern, keel boat. It is built of seasoned white and grey oak and white swamp-cedar, fitted to pull four oars, fastened with copper; all fastenings are riveted over copper burrs on the inside. She is sloop-rigged, carrying a loose-footed sprit mainsail and jib, the latter tacking down to the stem-head.

The following are the detailed dimensions: Length over all, 17 feet; breadth, 5 feet; depth, 2 feet 1 inch.

Keel, of oak, 2½ inches deep by 1⅞ inches wide.

Stem, oak, sided 3 inches, molded ⅞ inch back to 1⅞ inches.

Stern-post, sided on bottom end 6 inches, tapered to 1¾ inches on top, bearded up on outside 1¼ inches to 1⅞ inches.

Stern, oak, 1⅜ inches thick.

Floors, oak, 1½ inches by 1¼ inches, tapering at upper end to 1⅛ inches.

Frames, white oak, steamed and bent to proper form, 1⅛ to 1⅜ inches at bottom and bilge, tapering at top to 1⅛ inches, and spaced 12 inches from center to center.

Gunwales, oak, 1⅝ inches by 1¾ inches.

Planking, topstreak of clear grey oak, ⅝ inch thick; remainder of plank white swamp cedar, well seasoned, ¾ inch thick.

Ribband for thwarts, of oak, 1½ inches by ¾ inch.

Stern-sheets and *thwarts*, of ash, 1⅛ inches thick.

Thwarts, 8 inches wide. *Stern-sheets* vary in width from 9 inches to about 1 foot. There is a turned ash stanchion under the center of each thwart, to support it. Each thwart has two juniper knees on either end, to hold it in place.

Gratings.—There is a grating forward, flush with the bow-thwart, and one aft, under foot. They are made of ash and black walnut.

Backboard.—The backboard is made of black walnut, and has on it the vessel's name in gilt letters.

Footlings and ceiling.—There is a foot-board extending fore and aft, excepting in the bailing well. On either side of this the boat is ceiled up to the floor heads. The foot-board and ceiling has a fastening in each timber.

Stretchers.—There are four stretchers of oak, 1¼ inches square, to brace the feet against while rowing. The ends of these rest on cleats on the side of the boat.

Rowlocks.—There are four thin wooden cleats, two on each side, to receive the metal socket into which the rowlocks go. The rowlocks and sockets are made of polished gun-metal.

Ring-bolts and hoisting irons.—The ring-bolts and hoisting irons are of galvanized wrought iron, and riveted through the stem and stern-post.

Stem-band and Rudder-braces.—The stem-band and rudder-braces are made of brass.

Rudder.—The rudder is of oak, fitted with brass gudgeons and brass yoke.

Mast-clasp.—The mast-clasp is made of galvanized wrought iron, with eye on hinge, so that it can be unhinged from the thwart when it is necessary to take the spar down.

Boat-hook.—The boat-hook is of polished gun-metal, fastened to an ash pole 6 feet long.

Oars.—Of ash; ends of blades coppered to prevent splitting.

Spars.—Mast, of spruce, 16 feet long, with sheave at upper end for jib halyards. *Sprit*, of spruce, 16 feet long.

Sails.—The sails are made of boat drilling, and have the following dimensions: Mainsail luff, 13 feet; leach, 17½ feet; head, 7 feet; foot, 11¼ feet; jib-leach, 10½ feet; foot, 4 feet; luff, 11½ feet.

Painter.—The painter is manilla rope, 25 feet long, 2¼ inches in circumference.

19. DORIES.

The dories are of the ordinary type used in the Bank fisheries, so far as form is concerned. The frames, stern, stem, and gunwales are of oak, the bottom of pine, and the planking of seasoned white swamp-cedar. They are fastened with galvanized wrought-iron nails, and built with four streaks instead of three as is the common rule. Each dory has three adjustable thwarts and three partition boards or kid boards of pine. The length is 15 feet on the bottom, and about 19 feet 4 inches over all.

Each boat is provided with the following equipment: three pairs of 9-foot ash oars; eighteen oak thole-pins; one bailing scoop; one white oak, brass-bound, 2-gallon water breaker; a painter, 5 fathoms long, of

2-inch manilla rope; stern becket of the same kind of rope. Bottom plug made to fit into 1½ inch hole, provided with plug-line and becket; one mast, of spruce, 15 feet long; one spruce sprit 15 feet long, and one loose-footed sprit sail of white cotton drilling, having the following dimensions: Leach, 16½ feet; luff, 13 feet; foot, 14 feet; head, 6 feet.

20. LIVE-CARS.*

There are three of these cars, each a duplicate of the others. The length on the bottom is 13 feet; the construction the same as that of the dories. The shape is like the dory, except that the stern is sharp, being a duplicate of the bow, and the beam and depth are somewhat greater in proportion to the length.

The frames, gunwales, stem, and stern-post are oak; planking, white cedar $\frac{9}{16}$-inch thick; fastening, galvanized iron. They are provided with chafe-ribbands from stem to stern on each side along the outside of gunwales.

Each car is fitted with a cover of heavy netting, made of four-cord marline, which fastens to brass screw-eyes underneath the gunwales, the eyes being placed six inches apart. The forward end of this net cover is so arranged that it can be quickly and easily loosened to admit fish.

There are six $\frac{7}{8}$-inch holes in the bottom and as many similar holes on each side of each car to admit a free circulation of water.

D.—APPARATUS FOR FISHING, COLLECTING, ETC.

21. BEAM TRAWL.

(Plates XV and XVI.)

The net and head-irons for the beam trawl were imported from Grimsby, England, and are of the usual pattern employed in the fisheries of the North Sea. They are intended to fit a 30 foot beam, and are smaller than those used on the larger class vessels which carry a trawl-beam of from 45 to 50 feet in length.

The head-irons serve the various purposes of weights to sink the net and beam, of runners to facilitate the passage of the apparatus over the

* The live-cars were built for the purpose of keeping alive cod and other fish which might be caught on trawl-lines. It was intended that they should be used in connection with dories, being held alongside of the latter while the lines were hauled in, so that the fish might be easily put into them.

It was found on trial, however, that they were difficult to manage in a rough sea, such as is commonly met with in winter, off the New England coast, where it was necessary to use the cars. Being full of water, and therefore heavy and loggy, they would bump heavily into the dories, and, when taken alongside the vessel, would frequently dive beneath her bottom as she rose on a sea, and were hard to handle and hoist on deck. After using them a short time, they were superseded by stout net bags, which proved eminently satisfactory and serviceable.

For other fishing, these boat-shaped live-cars are useful, and are found especially so for sea bass, scup, and lobsters.

Report U. S. F. C. 1887.—(To face page 34.) Collins. Grampus.

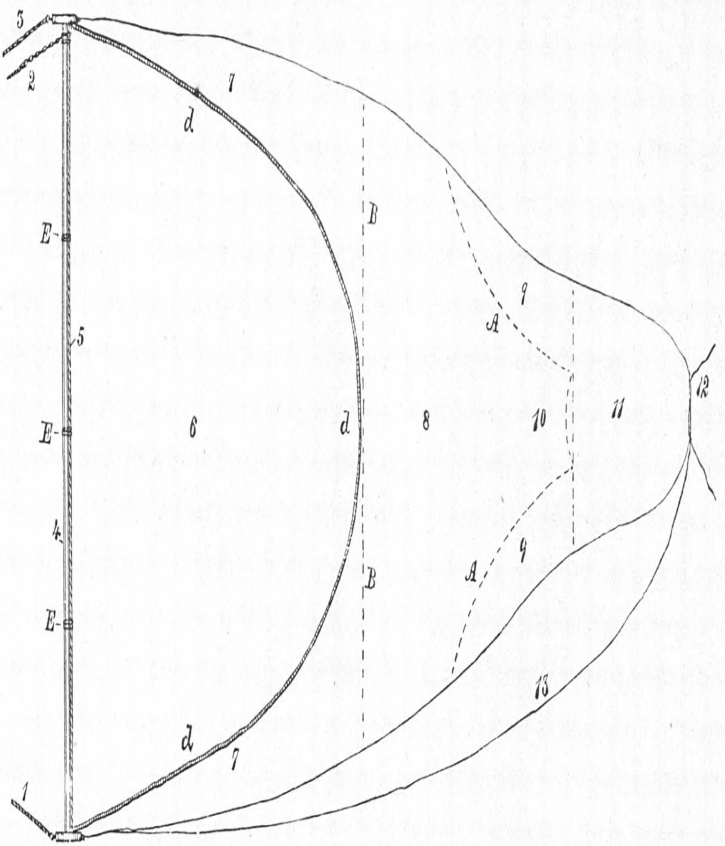


DIAGRAM OF BEAM-TRAWL.

1. Forward bridle.
2. Dandy bridle.
3. After bridle.
4. Beam.
5. Head line.
6. Square of net.
7-7. Wings.
8. Baiting on top, belly underneath.
9-9. Pockets.
10. Flapper.
11. Cod-end.
12. Poke-line.
13. Cod-line.

A, *A*. Where the net is sewed together to form pockets.
B, *B*. Where the square joins the baitings.
d, *d*, *d*. Foot rope.
E, *E*, *E*. Grommets.

Drawn by J. W. Collins.

ground, and of a support to keep the beam above the bottom and distend the mouth of the net.

The beam is of oak, 30 feet in length and 6 inches diameter. The appearance of the trawl, when rigged, and its several sections are shown in Plates XV and XVI.

The object of having a beam trawl of this size is that the utility of this form of apparatus for commercial fishing off our Atlantic coast might be fairly tested by the *Grampus*. Reference is made to Vol. VII, Bull. U. S. Fish Commission, pages 289 to 407, for information concerning the beam trawl and its use in European waters.

22. THE PURSE-SEINE.*

The purse-seine is similar to those used by the New England fishermen for the capture of mackerel. It is 150 fathoms long, as hung, and is 700 meshes deep, the mesh being 2 inches, stretch measure. The seine is composed of several sections. A small section in the middle termed the "bailing piece," which is 500 meshes long by 200 meshes deep, is made of number 20–12 twine. The rest of the bunt is made of number 20–9 twine. On each side of the bunt is a narrow strip 150 meshes wide by 685 meshes deep of number 16–6 twine. The wings are made of number 20–6 twine, each of them being 165 yards long in the web, and 685 meshes deep. There is a border along the lower edge of the wings 15 meshes deep made of number 20–9 twine.

The seine was tanned and then tarred to preserve it. The object of doing this was to prevent it from heating, which might be the case if tar only was used. It is hung in the usual manner. Small galvanized iron pulleys or purse-blocks† are used on the bottom instead of rings, for the purse-line to reeve through.

The following are the approximate weights of the various items entering into the construction of the seine, exclusive of the purse-blocks:

	Pounds.
Web	350
Corks, 1,500 No. 2	135
Manilla rope	75
Purse-rope	125
Leads on foot	50
Tar	400

This makes a total of 1,135 pounds. If we add to that the probable weight of the purse-blocks, about 50 pounds, it will make a total of 1,185 pounds. The net, when it is put into the water and wet through, will weigh from 400 to 600 pounds more.

*The purse-seine used on the *Grampus* was orginally made for the *Albatross*. It was not, however, used by the latter vessel, and when the *Grampus* was built it was transferred to her by the Commissioner.

All of the twine is hawser laid twine, made of the best Sea Island cotton.

†These are the invention of Captain George Merchant, jr., who made the seine.

23. DREDGE.

The dredge used on the *Grampus* is the ordinary type employed by naturalists, a pattern which was long since adopted in Europe and America. It is of the size commonly called "boat dredge," being smaller than the "ship's dredge," from which it differs only in dimensions. It is composed of an iron frame to which is attached a net bag, the latter being covered by a bottomless canvas shield to protect the net from injury by chafing on the sea bottom when being towed.

The frame consists of two jaws joined together by an iron stud at each end, which is welded to the jaws, the latter being so arranged that they flare at an angle of about 12 degrees.

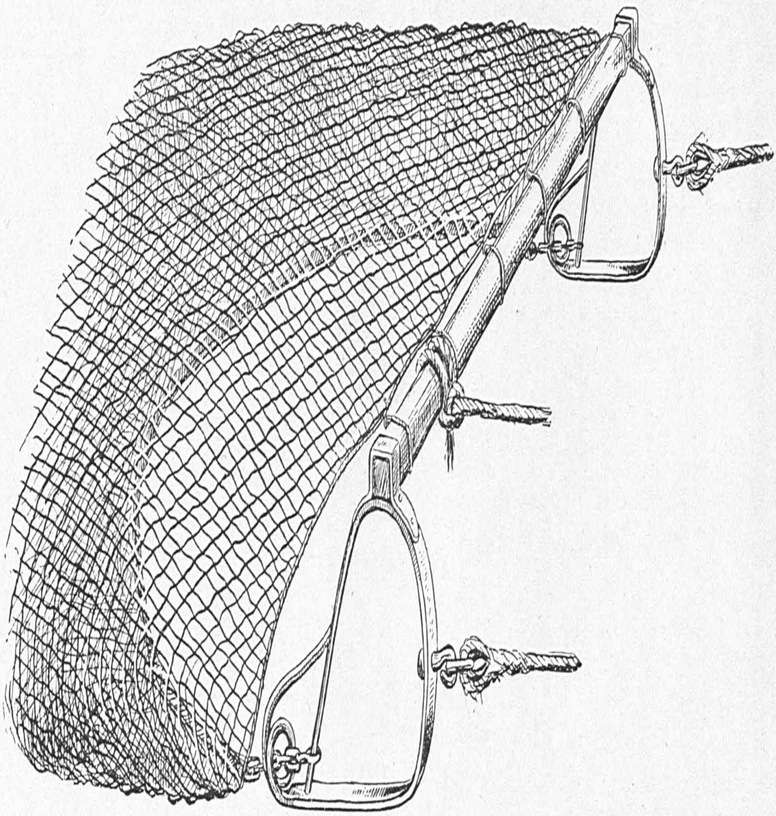
The frame is 18 inches in length, 5½ inches inside, and 7½ inches between the edges. The jaws are 2½ inches wide and one-half inch thick; the bridles are 16 inches long.

The net is 2½ feet long, has 2 or 3 meshes to the linear inch, and is closed at the lower end, so that it is approximately conical in form. The net is fastened to the iron frame by a lacing that passes through a series of holes in the back of the jaws. The canvas shield which protects the net from chafing is laced through the same holes.

The towing-line is bent to one of the bridles only, the other bridle being held by a smaller piece of line, or by a seizing, to the tow-rope or the bridle it is fastened to. This arrangement is necessary to prevent the loss of the apparatus when it comes in contact with stones or other obstructions on the bottom, since the seizing will break under a heavy strain and thus allow the dredge to be pulled up end on, in which position it is most liable to free itself.

24. "GRAMPUS" TOWING-NET. (See fig. 4.)

The large surface towing-net used on board of the *Grampus* was devised by the writer with the object of securing an apparatus which would be convenient to stow away on board the vessel, and one which would also prevent the escape of such animals as entered it. It consists of a hoop-shaped frame made of ⅝-inch iron, jointed in the middle so that it may be folded together for convenience in stowage. The diameter of the hoop is 5 feet. The net, the mouth of which is laced to the hoop by a roving, is cone-shaped, with an interior funnel-shaped net that forms a pocket at the lower end for preventing the escape of such animals as enter the apparatus. The lower end of the net is 9 inches broad when open, and is so arranged that it can be tied up with a string that passes through the meshes on the border, and is intended to be unloosed to let out the contents. The mesh of the net is ¾-inch, stretch measure, next the hoop, tapering to ½-inch at the lower end or apex of the cone. The two lower rows of meshes are made of heavy twine to stand the strain of being tied up. When in use a rope bridle is attached to the hoop with a thimble in the center for the towing-rope to bend into.



TRAWL-HEADS, BEAM, MOUTH OF NET, ETC. SHOWS HOW BRIDLES ARE ATTACHED.

25. CIRCULAR HAND SIEVES.

Hand sieves are used on the *Grampus* for washing such material as is brought up in the dredges.

"In working over small quantities of material, especially in search of the smaller organisms, circular hand sieves; in nests, have been employed by the United States Fish Commission, of the same general pattern as those described by Sir Wyville Thomson, in Depths of the Sea. These have usually been constructed with wooden frames, in nests of three to five sieves. Quite recently the wooden frames have been

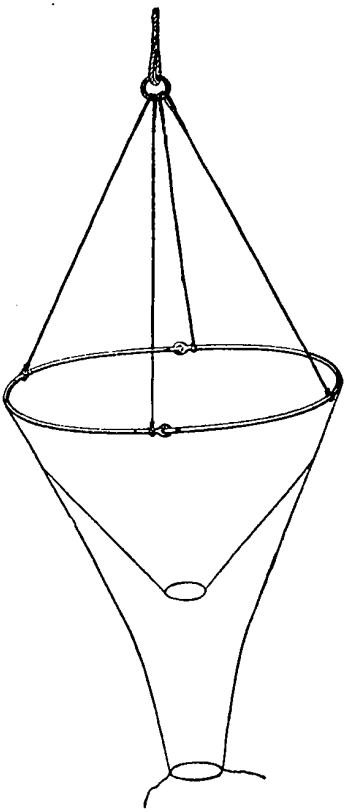


FIG. 4.—Grampus towing-net.

changed for others of galvanized sheet-iron, with good results. The old style of wooden frames, after a little use, lose their regular shape, will not nest snugly, and the beading, which runs above the wire bottom, is constantly becoming loosened and catching and concealing many small objects. The metal sieves are made in nests of three or four, one of the former and smaller nests being exhibited. In this, the lower sieve measures 10 inches in diameter in the inside, the middle sieve 9¾ inches, and the upper one 9½ inches, the difference between these diam-

eters being equal to about the thickness of the iron. The lower sieve has a height of 3¼ inches, the middle sieve 2¾ inches, and the upper sieve 4¾ inches. In the lower sieve the netting is raised three-fourths of an inch above the bottom, but in the other two it is flush with it. The lower netting is of copper, with 38 meshes to the linear inch, and on account of its lightness is strengthened underneath by a cross framework of moderately heavy wire; the second netting is also of copper wire, with 8 meshes to the linear inch, and the upper is of galvanized iron wire, with two meshes to the linear inch. The several sieves are smooth and without angular projections on their inner surfaces, and fit snugly together. They are prevented from nesting too deeply by means of a wire bent in around the outer sides of the two upper sieves, 1½ inches above the bottom. This affords interspaces of about an inch between the nettings of the several sieves. The rims of the sieves are strengthened with wire, and the handles, which stand upright, are of such lengths that when the sieves are nested they reach to the same height, and can be grasped together. The nests of three sieves may be worked in a large bucket of water, but those of four sieves are larger, and require at least a small tub for their use."—Rathbun, Bull. 27, U. S. Nat. Mus., 1883, 576.

26. TANNER SOUNDING MACHINE.

This machine, which is the invention of Lieut.-Commander Z. L. Tanner, U. S. N., was originally designed by him for service on board of the U. S. Fish Commission steamer *Fish Hawk*, where it was used in depths not exceeding 800 fathoms. On the *Grampus* it is not used in depths beyond 600 fathoms. It is located, when in use, a little forward of the starboard main rigging, but owing to the fact that it is liable to injury in that position it is generally kept below, excepting when required for sounding. This apparatus has been fully described and figured by the inventor in the annual report of the U. S. Fish Commission for 1881, pages 22 to 24, inclusive, and in the annual report for 1883, pages 57 to 63, inclusive. Reference is therefore made to those descriptions of its construction, use, and accessories.

27. THERMOMETERS.

The Miller-Casella and Negretti and Zambra deep-sea thermometers are used on the *Grampus*, as on all other vessels of the Commission, for taking temperatures of the sea. For full details of these instruments and their use reference is made to the annual report of the U. S. Fish Commission for 1881, pages 25 to 28; also annual report of the Commission for 1883, pages 71 to 77.

28. ADDITIONAL APPARATUS.

In addition to the specially noticeable forms of apparatus, which have been mentioned in greater or less detail, there is an extensive outfit for fishing and collecting, for laboratory equipment, for the purposes of navigation, and for medical outfit, etc.

a. Fishing lines rigged for use.

Skates halibut trawl lines (each skate rigged with 150 hooks)	8
Skates cod trawl lines (each rigged with 500 hooks)	11
Tubs haddock trawl lines (each rigged with 500 hooks)	5
Cod hand lines for boats, 3 pound leads	5
Cod hand lines for boats, 4-pound leads	5
George's bank cod hand lines, 7½-pound leads	10
Pollock hand lines, 3-pound leads	16
Bluefish lines for trolling	6
Sea-bass lines	10
Squid lines	3
Whiting lines	10
Mackerel lines	42

Besides the lines rigged for use, there is on board a quantity of spare unrigged lines, hooks, etc., to replace gear which may be lost or rendered worthless by use. There is also much miscellaneous material used in fishing. The kinds and quantities of this unclassified apparatus commonly kept in reserve or for current use, is as follows:

b. Miscellaneous apparatus used in fishing.

Anchors, Chester's folding net	1
Anchors, Chester's folding trawl	16
Baskets, fishing bait	6
Blocks, double, 12-inch wooden, for handling beam trawl	2
Buoys, halibut trawl	8
Buoys, cod trawl and net	12
Buoy-lines, fathoms	3,450
Compasses, dory	3
Fish forks	4
Fish pews	2
Gaffs, deck, cod	5
Gaffs, dory, cod	3
Gaffs, iron, halibut	10
Gob-sticks, wooden	3
Guns, whale	1
Harpoons, whale	1
Harpoons, swordfish	2
Harpoons, porpoise	1
Hooks, cod, hand line, No. 10, center draught, dozens	42
Hooks, cod, hand line, No. 12, center draught, dozens	12
Hooks, cod trawl, No. 14, center draught, eyed, dozens	144
Hooks, haddock trawl, No. 16, center draught, eyed, dozens	132
Hooks, haddock trawl, No. 17, center draught, eyed, dozens	204
Hooks, halibut trawl, Kirby-bend, No. 6,283, dozens	36
Hooks, mackerel, do	24
Hooks, miscellaneous, small, do	24
Hooks, shark, each	4
Hurdy-gurdies, or trawl winches, galvanized	3
Ice tongs	1
Jigs, mackerel	20
Jigs, squid	10
Knives, bait	7
Knives, codfish splitting	3
Knives, codfish throating	3
Knives, haddock ripping	2
Knives, halibut	4
Knives, mackerel splitting	5
Lances, explosive bomb	15
Lances, whale	1
Leads, fishing, 1¼-pound	6
Leads, fishing, 4-pound, Lothrop's	3
Leads, fishing, 7½-pound, Lothrop's	4
Leads, sounding, 8-pound	2
Leads, sounding, 10-pound	2
Leads, sounding, 12-pound	2
Leads, sounding, 16-pound	2
Leads, sounding, 25-pound	3
Lines, cod, hand lines, skeins	10
Lines, cod trawl, ground, do	52
Lines, cod trawl, ganging, do	10
Lines, haddock trawl, ground, do	50
Lines, haddock trawl, ganging, do	24
Lines, halibut trawl, ground, do	72
Lines, halibut trawl, ganging, do	10
Lines, snapper, do	6
Line, whale, 1¼-inch manilla rope, fathoms	150
Mill for grinding toll-bait	1
Mold for mackerel jigs	1
Nippers, woolen, hand, pairs	15

Powter, for makerel jigs..pounds..	5	Splicers, iron line	5
Pulpit, swordfish	1	Swivels, snood	6
Rasps, for making jigs, etc	1	Swivels, slot	13
Reels, small fishing line	12	Swivels, hawse	6
Scoops, bait	4	Swivels, buoy	8
Scoops, ice	1	Trawl rollers, patent	3
Sinkers, lead, for small fishing lines.	24	Trawl-warp (Italian hemp, 3¼ inches)..... fathoms..	300
Sinkers, lead, for net lead line, pounds.....	150	Tubs, dressing, fish	3
Shovels, ice, salt, etc	4	Tubs, gib	
Sling-ding spreaders, for cod hand-line gear	6	Twine, manilla, lobster..pounds..	12
		Weights, purse seine	2

c. Gill-nets and seines.

Kinds.	No.	Length.	Depth.	Size mesh.	Twine.
		Fath.	*Fath.*	*Inches.*	
Trammel nets	2	15	2½	{ 2 / 6	35-3 / 12-16
Mackerel gill-net	1	30	2½	3¾	16-6
Do	1	30	2½	3	16-6
Do	1	30	2½	2½	16-6
Menhaden gill-net	1	15	2	3½	16-6
Do	1	15	2	2½	16-6
Herring gill-net	2	20	2½	2¾	20-6
Do	2	20	2½	2½	20-6
Cod gill-net	1	100	2	7	40-10
Do	1	100	2	8	40-10
Capelin seine	1	40	2½	{ 0¾ / 2¼	12-6

d. Dip and scoop nets.

Kinds.	No.	Diameter of bow.	Length of handle.
		Inches.	*Feet.*
Dip-net for mackerel purse seine	1	29	11
Dip-nets for removing fish from well	2	20	13
Scoop-nets with round bows	2	15	5

E.—LIBRARY

The library contains over one hundred volumes, but of necessity (for lack of space) is limited to such works as are of special importance for reference. They relate chiefly to the fisheries, science, and navigation. Among them are twenty-seven volumes published by the U. S. Fish Commission, thirty-eight volumes issued by the Smithsonian Institution and National Museum, and twenty-seven relating to navigation, nautical astronomy, coast lights, etc.

F.—LABORATORY OUTFIT.*

Acid, muriatic.
Acid, nitric.
Acid, picric.
Alcohol.
Arsenic.
Axe.
Bags, canvas (collecting game bags) (3).
Boxes, wooden, assorted (in nests).
Brushes, wire, for cleaning shot-guns (2).
Barrels, fish.
Case of taxidermist's instruments (1).
Cartridges, rifle, ball, 50 caliber.
Cartridges, revolver, ball, 38 caliber.
Cartridges, shot-gun.
Cartridges, small collecting gun.
Chisels, cold.
Chisels, mortising.
Claw bar, iron (1).
Cleaning rods, for shot-guns (2).
Cleaning sticks, for shot-guns (3).
Cloth, cheese, cotton.
Corks, rubber, assorted.
Cotton batting.
Crimpers, for loading cartridges (2).
Cutters, wire (1).
Decapping pins (3).
Dishes, assorted, glass and earthenware.
Drills, assorted.
Extractors (rings), for extracting cartridges from shot-guns (3).
Files, assorted.
Forceps (2).
Grindstone (1).
Gun covers, canvas (3).
Hammers, riveting (1).
Hatchet (1).
Ice-pounders, or breakers (2).
Ice-tongs (1).
Jars, with corks, assorted sizes.
Jars, butter, 2-pound, 4-pound.
Jars, fruit, 1-pint, 1-quart, 2-quart.
Knives, dissecting (2).
Ladles, lead (1).
Loaders, shot-gun (2).
Needles, sewing.
Needles, taxidermist (3).
Nets, surface, silk bolting cloth.
Nets, surface, linen scrim.
Nippers, steel.
Paper, straw.
Paper, manilla.
Pans.
Plaster for molds, casts, etc.
Powder, small-arm.
Powder chargers for loading cartridges (2).
Recappers (2).
Revolver, 38 caliber (1).
Rifles, Springfield, 50 caliber (2).
Rifle-covers, canvas (2).
Rule, common 2-foot (1).
Scissors, common.
Scissors, taxidermist's (1).
Shot-chargers (2).
Shot-gun, small, single-barrel, collecting (1).
Shot-gun, double-barrel, 12-bore (2).
Shot-gun, double-barrel, 10-bore (1).
Soldering iron (1).
Solder, soft.
Spades, common (1).
Sponges.
Syringe, rubber, injecting (1).
Tanks, copper, alcohol, 16-gallons (2).
Tank boxes (2).
Twine.
Tags.
Vials, homœopathic, assorted.
Vise, amateur swivel (1).
Vise, hand (1).
Wads, for shot-guns.
Weighing balance (1).
Wire, iron, annealed.
Wire, steel, music No. 21.
Whetstones (6).

* The list given under this head embraces such material as may properly be included in the outfit for making collections for scientific purposes and for preserving and storing them; it is additional to the fishing and fish cultural apparatus mentioned elsewhere, which also to a considerable extent constitutes part of the laboratory equipment. To insure convenience of reference the articles have been alphabetically arranged, though this method interferes with any such classification as would naturally be followed if the special uses of the material received primary consideration.

There is so much variation in the quantity of some of the things that the enumeration of the amounts has been omitted in many cases.

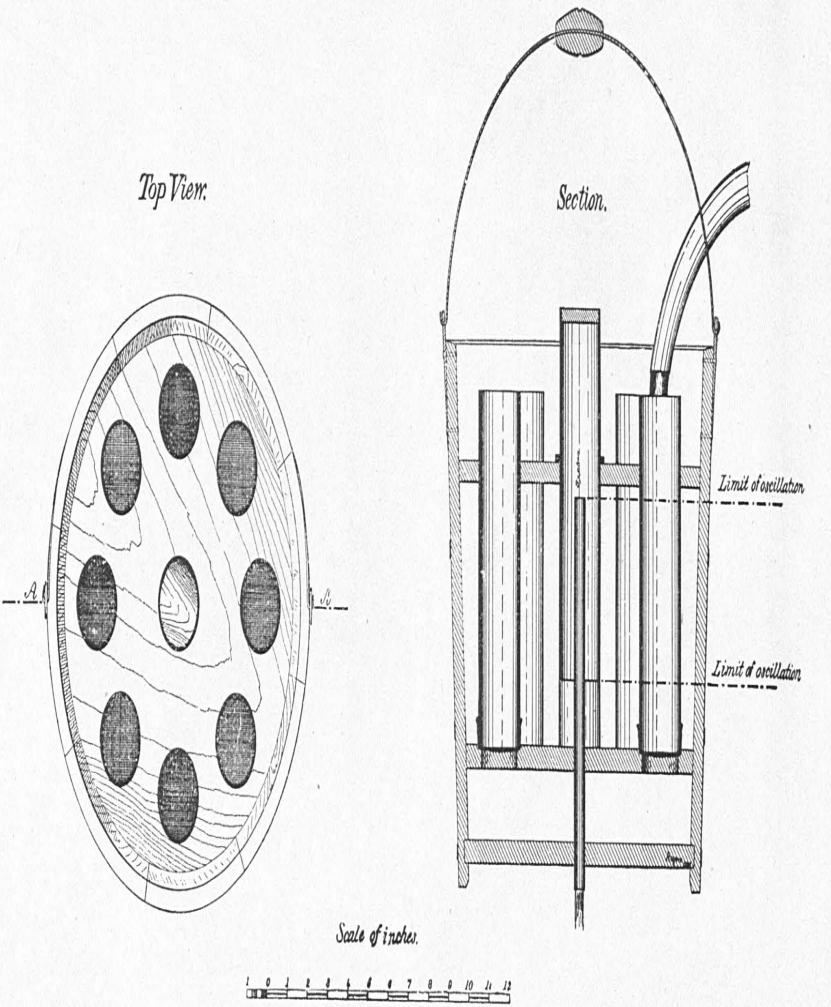
G.—MEDICAL OUTFIT.

The medical outfit is quite elaborate for a small vessel, and besides the articles enumerated under the head of "Medical Stores," includes two publications, namely; "Manual of Medicine" (Hartshorne) and "Hints for Emergencies," by Dr. J. H. Kidder.

The following is a list of medical stores:

Powdered gum arabic.
Acetic acid c. p.
Nitric acid c. p.
Carbolic acid, crystallized.
Muriatic acid c. p.
Citric acid, crystallized.
Alcohol, 95 per cent.
Alum.
Extract belladonna.
Castor oil.
Blue pills.
Brandy.
Borax.
Camphor.
Fly-blister plasters.
Capsicum.
Chloral.
Collodion.
Chloroform for external use.
Chloroform for inhalation.
Compound cathartic pills.
Aloin pills.
Salicylic acid pills.
Cosmoline.
Cocoa butter.
Ether (Squibbs).
Flax-seed meal.
Extract gentian.
Extract ginger.
Tartrate iron and potassa.
Iodoform.
Tincture of iodine.
Liquor sulphate of iron.
Tincture chloride of iron.
Syrup of ipecac.
Laudanum.
Licorice.
Licorice, fluid extract.
Lime.
Magnesia.
Sulphate of morphia.
Mercurial ointment.
Olive oil.
Naphthaline.
Sweet spirits of niter.
Paregoric.
Bromide potassium.
Iodide potassium.
Huxanis tincture.
Quinine sulphate.
Quinine pills, 3 gross each.
Nitrate silver, crystals.
Nitrate silver, fused (L. C.).
Soap liniment.
Bicarbonate soda.
Syrup of squills.
White sugar.
Sulphur.
Oil of turpentine.
Whisky.
Carbonate of zinc.
Sulphate of zinc.
Mustard plasters, No. 1.
Stomach pump.
Pocket case.
Goulard's lotion.
Bandages.
Lint.
Urinometer.
Rubber tracheotomy tube.
Tourniquet.
Tape measure.
Wire ligature, silver.
Cotton suspensory bandages.
Belladona plasters.
Alcock's porous plasters.
Benson's capcine plasters.
Plaster skins.
Silk ligatures.
Adhesive plasters.
Isinglass.
Small sponges.
Small syringes.
Absorbent cotton.
Self-injecting syringes.
Binders' boards.
White wrapping-paper.
Oiled muslin.
Bougies.
Black rubber tubing.
Twine.
Spatulas.

Report U. S. F. C. 1887.—(To face page 42.) Collins. Grampus.



PLANS OF McDONALD'S HATCHING-BUCKET.

Drawn by E. I. Rogers.

Scissors.
Sealing-wax.
Pill-boxes.
Table-spoons.
Tea-spoons.
Pill tile.
Labels.
Gallipots.
Corks.
Hard rubber funnels.
W. W. mortar and pestle.
4-ounce measure (1-1 dram measure).
Spirit lamp.
Spirit stove.
Tumblers.
Wine glasses.
Assorted phials.
Plaster of Paris.
Bottle clasps.
Scales and weights, "Navy pattern."
Dispensing bottles with glass labels.

H.—FISH-CULTURAL AND TRANSPORTING APPARATUS.

29. COLLINS' EGG-PAN (see fig. 5).

This pan was devised by the writer for collecting fish-eggs at sea. It was found in practice that the ordinary tin pan commonly used for collecting fish-eggs on shore was unfit for collecting eggs when it had to be used on board of boats and vessels in a sea-way, where there was much motion, and also had to be passed from boats to vessels, or *vice versa*.

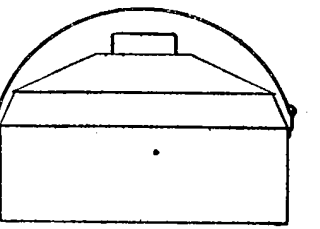


FIG. 5—Collins' egg-pan.

The pan is oblong in form, with a tumbler in top, provided with an iron bail and tin cover, the latter preventing the loss of eggs from slopping out and the former facilitating the handling of the apparatus in the boat. The pan is 18½ inches long, 10¼ inches wide, and 8½ inches high exclusive of the cover. It is made of tin and covered with asphaltum inside to prevent corrosion from contact with the sea-water.

30. McDONALD'S HATCHING BUCKET.

(Plates XVII and XVIII.)

This device was invented by Col. Marshall McDonald, U. S. Commissioner of Fish and Fisheries, for the purpose of keeping alive, developing, and hatching (if necessary) such floating eggs of pelagic fishes as might be taken on board the *Grampus* in the towing nets.

The device consists of an ordinary iron-bound pine bucket, provided with an iron bail and fitted inside with two perforated wooden diaphragms; one of these is placed near the top of the pail and the other about 1½ inches from the bottom, each resting on a wooden flange screwed to the inside of the bucket. There are nine holes in each diaphragm, one of them being in the center and the others arranged in a circle around it. These holes are large enough to receive glass tubes 2 inches in diameter and 7 inches long, these being the same as those

commonly used on argand burners. The holes in the lower diaphragm are made with flanges so that the glass tubes can rest upon them. When in use, the eight tubes around the side of the bucket have their lower ends covered with cheese cloth, so that, while the escape of eggs will be prevented, there is no hindrance to the proper circulation of water. In the center of the bucket is placed an automatic syphon so arranged that when it is connected with a hose bringing water into the bucket, it will break the flow when it has reached a certain height, and will thus cause a regular ebb and flow motion, or "tide motion," as it is commonly called.

The bucket is located in the laboratory of the *Grampus*, and is connected by rubber hose with the well, from which an ample supply of water is obtained, while the surplus water is carried by another hose into the bilge of the vessel and taken out with the bilge pumps.

When floating eggs are obtained, one or more buckets are put in operation, and the eggs are immediately transferred into the glass tubes. They can be kept in a condition of development until the vessel reaches one of the coast stations, when the eggs are put into hatching-troughs on shore.

The buckets used are 10 inches high, 13 inches in diameter at the top, and about 11¾ inches diameter at the bottom, the staves being three-quarters of an inch thick. They are coated on the inside with asphaltum.

31. MISCELLANEOUS MATERIAL.

Buckets, wooden, (6).
Dippers, tin (3).
Hatching-jars, Chester's (4).
Pans, tin (6).
Tubs, wash, wooden (3).
Tubes, brass (1).

I.—METHODS OF FISHING, DREDGING, ETC.

32. FOR LIVE CODFISH.

As has been mentioned, an important part of the work performed by the *Grampus* is the collection of living gravid cod, pollock, and other species of *Gadidæ* for the marine hatcheries on the New England coast. The season extends from October to May, and the method of fishing varies with season and species.

The grounds resorted to are chiefly about No Man's Land, on Nantucket shoals, and off Gloucester, in Massachusetts Bay. Sometimes the cod grounds in Ipswich Bay and on the shoal grounds east of Cape Ann are visited.

a. HAND-LINE FISHING.

In the fall the cod which gather on the grounds near No Man's Land, to the south and east of Nantucket, and on the small rocky patches in Massachusetts Bay, can most readily be taken with hand-lines. The

pollock, which frequent Massachusetts Bay in autumn (at which season they are gravid), are also caught with hand-lines specially prepared for that purpose.

The vessel is first anchored so that she will "tail" on to a shallow rocky patch (if fishing off Cape Ann), when sufficient cable has been payed out. It requires skillful handling to anchor so that she will "swing" exactly over a shoal, which is usually of such small dimensions that its location has to be determined by leading marks on the land.

The lines are immediately put out, part of the crew usually fishing from each side of the vessel. As fast as fish are hauled in they are carefully unhooked and dropped into the well, where they remain until the vessel returns to the hatching station. Sometimes the fish are kept in the well several days. If any of the fish die they are immediately removed, so that they will not decompose and contaminate the water in the well.

It is frequently found advantageous in Massachusetts Bay to send part of the crew out in dories to fish at a little distance from the vessel. In such cases the men take with them net bags of coarse twine (elsewhere referred to), which are hung to the outside of each boat to receive the fish. If the wind is blowing fresh, as is commonly the case, each dory has a line leading to the vessel, by which it can be hauled alongside, since it is not practicable to row a boat against a stiff breeze and tow the net-bag containing the fish. As soon as a dory reaches the schooner the bag is hoisted on board and its contents are dumped into the well.

On the grounds off Nantucket and No Man's Land all the men fish from the vessel's deck for cod, as a rule. Occasionally it is found desirable to "fish at a drift," the vessel being hove to under mainsail and foresail, and all hands fishing from the weather side. But this is seldom done.

When pollock fishing, it is generally necessary to anchor with the "pollock fleet," which gathers in a cluster on a shoal where fish abound, the vessels lying close together, swinging with the wind, and usually with mainsails set. The crew fish from the deck, and sometimes pollock are so numerous and so eager to bite that they come near the surface and may be rapidly caught.

They are quickly unhooked and put into the well. But it is specially difficult to keep this species alive, owing to the fact that its swim bladder (sound) and the membraneous lining of its gill covers, etc., become easily inflated with air, which prevents it from keeping under water. It will not live well either if crimped.

b. TRAWL-LINE FISHING.

The vessel is kept under sail when trawling, and generally "flying-sets" are made, though occasionally it is found most advantageous to set the trawls one day and haul them the next.

The lines are baited and all ready to set before the vessel reaches the fishing ground. As soon as she arrives at the desired position the dories (with the lines and other necessary gear in them) are hoisted out, the vessel stands along, dropping the boats about 100 to 200 fathoms apart. Immediately on leaving the schooner the men proceed to set the gear, usually running the lines to leeward, unless the direction of the current makes it necessary to set across the wind.

As soon as the trawls are out the vessel runs down and shoots to, to deaden her way, alongside of each boat, which comes on board and is hoisted on deck or left to tow astern, as circumstances seem to dictate. As soon as all the dories are picked up the schooner beats back to the weather-buoys, near which she continues to jog back and forth on opposite tacks, with head-sails to windward, until the time arrives to haul the lines. She then stands along close to windward of the buoys, and a dory is let go at each. As soon as this is done she tacks and jogs again with head-sails to windward.

The men promptly begin hauling. As soon as the buoy line and first anchor are in, they hang the fish-bag over the boat's side, and then begin to haul in on the trawl-line. The fish are quickly and carefully unhooked and put into the bag, where they are kept until the lines are all in. An oar is then held up by the men on the dory as a signal to the officers who are closely watching the boats from the vessel. The latter then steers for the boat, and going a little to leeward shoots to close alongside so that a line can easily be thrown. A stout strap is put around the mouth of the fish-bag, which is quickly hoisted on board and its contents emptied into the well.

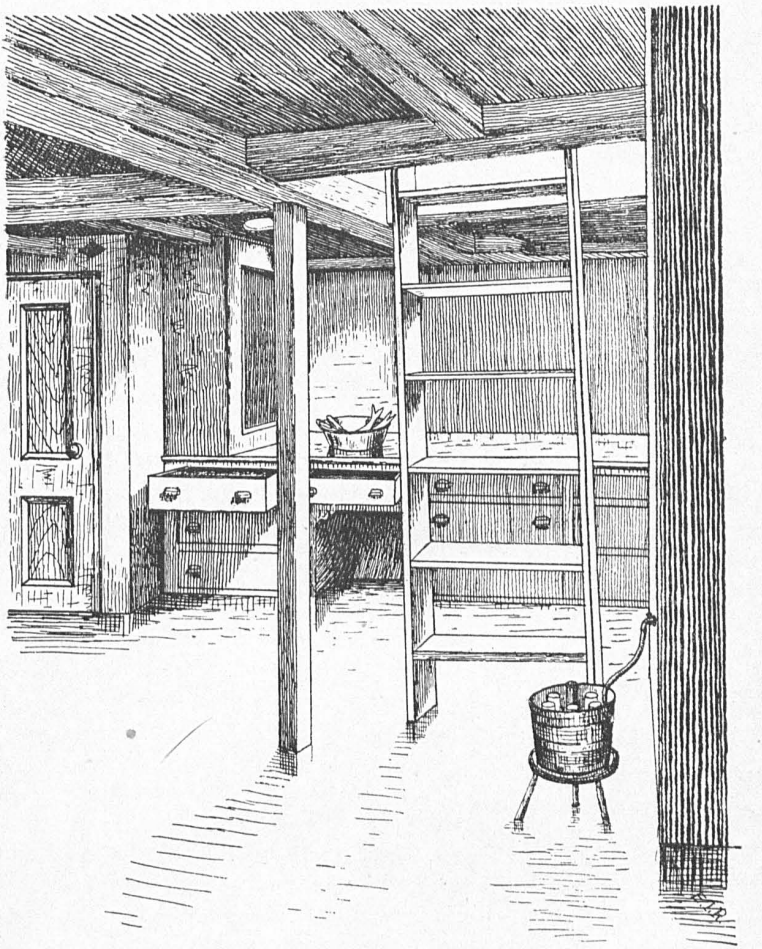
After all the dories have been picked up in this manner the vessel steers for the harbor unless the lines are to be set to remain out over night. When this is done a "second set" of lines are baited and made ready beforehand, and as soon as the hauling is completed these are run out in the manner already described. Care is observed to note the bearings of headlands, or the "marks" by which the location of the lines can be definitely determined when the vessel again goes for them, which may not be for several days, because of stormy weather.

c. Removing fish from the well.

Sometimes the fish are taken from the well on the same day they are caught, but generally this can not conveniently be done, either because the vessel does not return to the hatching station until she has fished several days, or it is most expedient to wait until a storm (which occurs frequently enough in winter) keeps her in port.

The fish are taken from the well with long-handled dip-nets. The peculiar shape of the well makes it possible to reach any part of it without difficulty. But after the majority of the fish are dipped out those remaining grow very shy and hard to catch.

As they are taken out each fish is examined to ascertain if milt or



VIEW IN LABORATORY OF GRAMPUS, WITH MCDONALD'S HATCHING-BUCKET IN OPERATION.

Drawn by E. I. Rogers.

eggs can be obtained. Those that are ripe are spawned, and then they are put into the live cars with the others, since the cod develops only a portion of its eggs at once.

33. FOR LIVE HALIBUT.

Trawl-lines are the only form of apparatus used to catch halibut for the purpose of taking them to the hatcheries alive. These are set "flying," while the vessel remains under sail. The operation is similar to that already described, with the exception that the depth of water in which the lines are placed is often from 100 to 300 fathoms. When practicable, the trawls are hauled on board of the vessel, which is maneuvered to facilitate the work. In the latter case the halibut are carefully lifted over the side, unhooked, and put into the well.

34. MACKEREL.

a. TOLL BAIT AND HAND-LINES.

In the course of the investigations made by the *Grampus* to ascertain the movements of mackerel during their migrations, and their whereabouts in other localities where they have been sought, the system of tolling them, for capture with hand-lines, has been frequently adopted. By this method the vessel is hove to on the starboard tack, with the headsails hauled down, the mainsail guyed out, the fore-sheet eased off so that the sail will not stand full, and the helm put hard down. In this way the vessel makes a square drift to leeward. Ground bait or "stosh" of menhaden, herring, or mackerel is then thrown out systematically, as was formerly the custom pursued by the hook-and-line mackerel fishermen. This is generally continued from forty-five minutes to an hour, then if the mackerel do not "rise" it is assumed that they are not in the locality or are disinclined to take bait. The vessel is therefore got under way again, and proceeds to a new locality. The hand-lines used are the ordinary mackerel lines and jigs commonly employed in the hook-and-line mackerel fishery when that method was in vogue for commercial fishing. While the vessel is drifting these are thrown out on the weather side, so that in case any mackerel are tolled up they are liable to take the bait on the jigs.

b. GILL-NETTING.

In order to trace the movements of migratory species such as the mackerel, menhaden, alewife, etc., gill-nets are frequently set at night when the vessel is cruising at sea in the regions crossed by the pelagic fishes. When nets are to be set the vessel is hove to, according to the force of the wind, either under her mainsail alone or under her mainsail and foresail as she would lay to for catching mackerel. The nets are then payed out on the weather side, and the nearest one to the vessel is usually 40 to 60 fathoms distant, being attached to the end of a

stout manilla warp called the net-swing, that is commonly made fast near the middle of the schooner somewhere about the mainmast. The nets may be set at different depths, according to the judgment of the commanding officer, or the person having charge of the investigation, so that while the upper edge of some of them may be on a level with the surface of the water others may be sunk from 5 to 10 fathoms deep.

The nets are sometimes hauled in the night, but quite as frequently are left out until morning. Generally, the crew are able to pull them in, hand over hand, without difficulty, but if this can not be done the net-swing can be taken through a block and led to the windlass, where more purchase can be obtained for heaving it in.

c. SEINE.

For obtaining mackerel for the purposes of propagation, the purse-seine is the best form of apparatus to employ, since, if a school of fish can be found, they may be surrounded and quantities of them dipped alive into the well, where they can be kept until transported to one of the coast hatching-stations. The method of catching mackerel with a purse-seine on the *Grampus* is precisely similar to that adopted on board of the vessels employed in the purse-seine mackerel fishery. Briefly stated, it consists of keeping a sharp lookout from aloft for schools of fish. When a school is seen, the crew, with the exception of the ship-keepers, who are generally an officer and the cook, jump into the seine-boat and the dory and pull away toward the fish. When the seine-boat approaches the school, if the fish are not moving too rapidly, some of the men immediately begin to throw out the net, while the others pull the boat as rapidly as possible around the school, the object being to make a complete circuit of the fish with the apparatus. As soon as the first end of the net is thrown out, it is taken hold of by the two men in the dory, who are ready to run a small line to the seine-boat in case she fails to complete the circle with the net. When the seine is out all (the men in the dory, as well as others) immediately proceed to purse up the seine, that is, to gather in on the purse-line which reeves through blocks at the bottom of the net. This closes the lower part of the seine and forms it into a purse, or bag, which securely holds the fish from escape, providing they have not already taken fright and sunk out of sight before the operation of pursing is completed. If they still remain in the net the slack web of the seine is gathered in and the fish are "dried up," as it is termed. When this has been sufficiently accomplished, the captain and several of the men go on board of the vessel, which has been lying by in the immediate vicinity, and after filling away, shoot her to alongside of the seine-boat in such a manner that her headway is nearly done by the time she reaches the boat, to which lines are thrown; the edge of the seine is then got over the rail of the schooner. The fish are "dried up" as much as practicable so that they are brought into a compact mass, when they can be dipped out of the seine with a large dip-net and transferred to the well.

35. MISCELLANEOUS FISHING.

The miscellaneous fishing carried on by the *Grampus* in the course of her investigations embraces the adoption of various forms of apparatus and methods. Generally speaking, however, hand-lines are most commonly employed, these ranging from the size of a mackerel line, which is, perhaps, less than the thirty-second of an inch in diameter, up to a line for catching sharks and other large fish. Besides these there are the lines and harpoons adapted to the capture of sword-fish, porpoises and whales. Red snappers, groupers, and other bottom-feeding species, which frequent the Gulf of Mexico and adjacent waters, are taken with hand-lines somewhat similar to those employed for the capture of cod-fish. When red-snapper fishing, the vessel is generally hove to, as she would be for mackerel. In making an investigation of the southern fishing grounds she usually stands along on a given course for a distance of five or ten miles between trials. If the wind is sufficiently moderate a lead sinker, with baited hooks attached, is being constantly thrown out, as is the practice on board of vessels engaged in the red-snapper fishery, and in this way the presence of fish is determined.

Squid are caught on the common form of squid jig by bobbing it in the water at night, or in the day if squid are sufficiently abundant to bite at that time.

For the capture of sword-fish a pulpit is rigged on the jib-boom end, where a man stands to harpoon the fish as the vessel approaches them.

Porpoises are also harpooned from the jib-boom end or the head-rigging, but as they usually "play" under the bow, it is not always necessary to go far beyond the knight-heads to strike them. When one is struck the vessel immediately luffs to, the line is veered out until the vessel comes to the wind. As soon as her headway is stopped, the crew pull in on the line and bring the porpoise alongside; by the assistance of gaffs, or a strap and tackle, he is taken on board.

36. COLLECTING FISH EGGS.

To supply the hatcheries on the coast it has often been found necessary to obtain eggs from cod that were caught by the fishermen. The following description of this method is from a paper read by the writer before the Biological Society at Washington:

"It has frequently been found most advantageous to the work of the Commission for the *Grampus* to collect eggs from the cod which the fishermen catch, rather than to depend upon the procurement of eggs from the fish she would be able to take herself. When carrying on this work she generally has on board one or more expert spawn-takers. If the weather is favorable for fishing, the *Grampus* gets under way in the early morning, about the same time that the fishing vessels leave Gloucester Harbor, and proceeds with them to the fishing grounds, from 5 to 40 miles distant. There she cruises about among the boats to as-

certain where the most fish are being taken. This having been learned, her dories are sent on board the fishing schooners most liable to have large catches. In each boat are two seamen, who may be those who have been trained in taking eggs, and besides there may be in one or more of the dories one of our expert spawn-takers, sent out from the hatching station. An equipment of collecting pans, dippers, etc., is carried, the pans being peculiar in shape and specially designed for this outside work. Reaching the side of the fishing schooner, and watching the proper opportunity as the dory rises upon a wave, the men scramble over the vessel's rail and climb on board, taking with them their pans and other apparatus.

"Soon the schooner's dories arrive alongside, and their catch is thrown upon the vessel's deck. This is the opportunity for the Fish Commission men, who handle the fish as rapidly as practicable, selecting those that are ripe and immediately taking the eggs from them. This is continued until the last of the fish are thrown upon the deck and all the eggs are obtained which can be secured at the time. The men then quickly climb into their dory, and pull away for the *Grampus*, unless they see an opportunity of securing additional collections on board of some other vessel which has been longer delayed in hauling her gear. When the day's collection is ended and the dories have all returned to the *Grampus*, which in the mean time has been cruising back and forth, her officers watching every movement, she heads away for the harbor, where she anchors close to the hatchery on Ten Pound Island, and the eggs are quickly transferred to the hatching boxes, or shipped by rail to Wood's Holl."

The eggs of other species, including those of the mackerel, are sometimes taken in fine tow-nets. These are attached to the stern of the vessel, being towed from each side when she is going slowly through the water. The eggs thus obtained are immediately put into water, after being brought on board, and transferred to a hatching bucket described in another paragraph.

37. YOUNG FISH.

Young fish are taken chiefly in a large tow-net 6 feet in diameter, which is commonly towed from the end of the main boom when the boom is guyed well out over the vessel's quarter so that the net may be in water not disturbed by the schooner passing through it.

38. DREDGING.

The dredges are seldom used in depths exceeding 100 fathoms. They are bent to the end of the whale warp, and usually one or more 20-pound sounding leads are attached to the line from 5 to 10 fathoms above the dredge, so as to carry the latter to the bottom. The dredge is pulled in by hand.

39. SOUNDING.

For sounding on fishing grounds in moderate depths, an ordinary deep-sea sounding line is used, this being marked at every 5 or 10 fathoms. In the deeper waters off the edge of the fishing banks, where halibut occur, and where the depth ranges from 200 to 400 fathoms, soundings are obtained with the Tanner sounding machine. This apparatus is also used in shallow water where much accuracy is required. When sounding on a fishing ground, where it is not essential to have absolute accuracy, the vessel is simply brought head to the wind, without taking in any sail, and allowed to shoot until her headway is decreased, when the lead is thrown from the bow, the forward motion of the schooner bringing the line about plumb from the stern by the time the sinker reaches the bottom. Considerable skill and experience are required to insure success in sounding by this method, but in depths less than 100 fathoms it is practicable to obtain nearly accurate results, except in rough weather.

When trials for fish with hand-lines are to be made, the vessel is usually hove to before a sounding is taken.

When the Tanner sounding machine is used, the schooner is hove to on the starboard tack, in the same manner as when fishing for mackerel. Unless the wind is blowing strong, the drift is so small that the lead "strays" very little from a vertical position, and there is seldom any difficulty in obtaining accurate soundings.

J.—REMARKS CONCERNING THE GENERAL EQUIPMENT.

In addition to the special forms of apparatus, which have been described in detail, the general equipment of the *Grampus* includes much material intended for specific uses, besides that which is too miscellaneous to be specified. It is believed the following remarks are sufficiently explicit to convey the necessary information concerning it:

The outfit for navigation purposes includes, in addition to what has already been mentioned—

1 sextant.
2 marine clocks.
2 liquid compasses.
1 Azimuth compass.
1 Tell-tale compass.
1 Bliss patent taffrail log.
1 Aneroid barometer.
2 pairs of dividers.
2 parallel rulers (1 patent, 1 common).
1 pair binocular glasses.
1 fog bell.
1 watch bell.

The chart list includes three hundred and twenty-eight sheets of the Atlantic Coast and Harbors, covering the region extending from Labrador to the West Indies. There are several Coast Pilots covering the same territory.*

* The charts, with the exception of nine, have been supplied to the Commission by the U. S. Hydrographic Office and the U. S. Coast and Geodetic Survey, and the Survey has also furnished the Coast Pilots.

The log-books are obtained from time to time from the Bureau of Navigation of the Navy Department, and are the same as those carried on naval vessels.

The outfit of illuminating apparatus includes, among other things—

1 white signal or riding light (Tuft's patent lantern).	1 automatic flash torch.
2 running lights (1 green and 1 red).	A series of Coston's signals.
8 deck lanterns.	10 swinging lamps for cabin, laboratory, etc.

Fifteen cork jackets and two life-buoys are carried, the latter being fastened, one to each davit, where they can be most readily thrown overboard in case of need; the former being distributed in the sleeping berths, where they may be conveniently to hand in case of an emergency. In this connection, mention may properly be made of the fact that the mattresses are all of the life-saving Ostermoor pattern, and the pillows are made of the same material as that used in the beds.

The bedding and mess furniture, both forward and aft, was furnished by the Commission, and the same attention has been given to insure the safety and comfort of the seamen as the officers or others who may be on the vessel. Indeed, it has been found necessary to have only one mess on board, and though the seamen, cook and cabin boy berth and eat forward, they are supplied in all respects with the same food as that furnished to the cabin table.

The cabin and forcastle are carpeted, and the cabin is heated by a stove which sits in the center. The outfit of mess furniture, while being serviceable, is plain and unostentatious. It is also necessarily less elaborate than it might be on a larger vessel, but is sufficient to insure the comfort of those on board.

The specialists who are detailed to accompany the vessel from time to time are supplied with bedding and other necessary mess furniture.

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