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TWO NEW REVENUE CUTTERS FOR SPECIAL PURPOSES.

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Read at the fifteenth general meeting of the Society of Naval Architects and Marine Engineers, held in New York, November 21 and 22, 1907.]

The building of a modern navy by the United States has attracted world-wide attention during the past two decades, and has been a source of much gratification to all patriotic citizens. While Congress has provided liberal appropriations for new war vessels of various descriptions, it has not overlooked, entirely, other maritime branches of the Government.

The Revenue-Cutter Service, at the time the rebuilding of the Navy was commenced, was in as bad a condition in its smaller scope, so far as modern and efficient vessels are concerned, as the regular navy. Its vessels were slow, antiquated, and but illy adapted for the diversity of duties required of them. In the past fifteen years, however, over two-thirds of the old fleet of cutters have been replaced by new vessels, modern in every respect, and fitted to perform efficiently their duties as revenue cutters; in addition thereto the larger cutters have been so constructed as to form valuable auxiliaries to the navy in time of war, as evidenced by the effective blockade and despatch duties performed by a number of them during the Spanish-American War. The rebuilding of the fleet is still in progress, and Congress, during its last two sessions, has made appropriations for six additional vessels. Two of these vessels, designated during the progress of construction as Revenue Cutters Nos. 16 and 17, respectively, are designed for such special work as will, undoubtedly, interest not alone the members of this Society, but other maritime interests as well. It is therefore the object of this paper to present brief descriptions, and such reproductions of the principal drawings of these craft, as will, it is hoped, give a fair idea of what has been done in designing vessels for the two fields involved.

REVENUE CUTTER NO. 16.

Before describing this vessel it will be well to make a brief statement as to the causes leading up to the demand made upon the Government for her construction.

Those familiar with conditions existing on the Pacific Coast, with especial reference to the northwestern part of the United States proper, are aware of the extreme hazards of wind, currents and fog encountered by navigators in that locality. The entrance to Puget Sound through the Straits of Juan de Fuca is particularly dangerous, as throughout at least half the year fogs and haze prevail, and at all times erratic currents exist which are but little understood, even by men who navigate these waters constantly. Deep-water soundings may be obtained close inshore, so that not much dependence can be placed on the lead and line, when vessels are headed in the Straits. In point of importance this entrance undoubtedly ranks first on the Pacific Coast, as it is estimated that nearly 6,000,000 tons of shipping pass through it annually. In the past half century nearly seven hundred lives have been lost in the immediate vicinity, to say nothing of millions of dollars worth of property. The climax came in the total loss of the coastwise passenger steamer Valencia, from San Francisco bound to Seattle, which occurred in a dense fog on the night of January 22, 1906. This unfortunate vessel had overrun her distance and, failing to pick up the light at the entrance to the Straits of Juan de Fuca, had piled up on the rocks at the foot of a high cliff on an unsettled portion of the coast of Vancouver Island. One hundred and thirty-six lives were lost, many of which could have been saved had the accident occurred within reach of a life-saving station, or had some vessel fitted with the necessary life-saving apparatus been in the vicinity, as the wreck did not go to pieces until over thirty-six hours after she had struck. At once the public press on the Pacific Coast took up the subject of providing some means for saving lives in those waters. The President appointed a commission to investigate the cause of the wreck, and to recommend some means whereby similar fatalities could be avoided. Numerous schemes were suggested, among them being international life-saving stations along the Vancouver coast. This, however, proved inadvisable, and finally, after mature consideration, the Board, in addition to suggesting additional light-ships, coastwise telegraph and telephone lines, fog signals, wireless telegraph, etc., recommended that "a first-class ocean-going, life-saving steamer or tug, officered and manned by the most skillful life-saving crew available, should be stationed at Neah Bay, which is within 5 miles of Cape Flattery and the entrance to the Straits, and the only available harbor in that vicinity, to be equipped with the best possible appliances of surf-boats and lifeboats, with a wireless telegraph apparatus."

Congress very shortly afterwards made an appropriation of $200,000 to carry out this recommendation; it also provided that the life-saving tug should be constructed and operated by the Revenue-Cutter Service. The proper design of such a boat has presented a number of problems, as the following points had to be considered:—

1. The vessel must be sufficiently large to be seaworthy under all conditions of weather.

2. An ample coal supply must be furnished to enable the vessel to keep the sea for a number of days, as it is presumed that she will be quite often called upon to search for missing vessels.

3. Every known provision must be fitted to equip her for life-saving in the open sea, and for rescuing persons from wrecks on the shore.

A board of officers of the Revenue-Cutter Service was appointed to recommend a design suitable for fulfilling the above conditions, or, in other words, to provide a vessel which would be best adapted to perform the duties required. After a full consideration of the various points to be considered a design was decided upon, and the contract was awarded to the Pusey and Jones Company of Wilmington, Delaware, at its bid of $189,057.00. The salient features of the vessel are as follows: As a sea-going lifeboat was, in this country at least, an entire innovation, the general design of a large sea-going tug was considered to be about the best fitted for the purpose, as this type has been well tried out and found adaptable for almost any duty. Consequently the vessel in external appearance will resemble closely numerous first-class tugs to be found on both the Atlantic and Pacific Coasts. Her interior arrangements and her equipments possess the special features which fit her for the duties to be performed. As Neah Bay, the headquarters of the new craft, is about as dreary and unattractive a place as can well be imagined, considerable attention has also been given to providing as comfortable living quarters for the officers and crew as could be fitted in the limited space available.

The principal dimensions for the tug will be:—

Length over all	152 ft. 0 in.
Length between perpendiculars	139 ft. 6 in.
Breadth of beam, molded	29 ft. 0 in.
Depth at side from base line amidships	17 ft. 6 in.
Displacement to mean draught of 12 feet 4½ inches above base line, with 125 tons of coal and 11,000 gallons of water	795 tons.

The hull will be constructed throughout of mild, open-hearth steel, of the best quality. An inner bottom will extend for the length of the boiler space, which, in addition to being a safeguard in case of grounding, will provide a large tank capacity for water for steaming purposes. The scantlings throughout are made as heavy as practicable in order to provide staunchness and to fit the vessel for rough service. As the climate is very wet, the vessel's main deck will be of the best quality of teak, instead of the usual native pine. The hull will be divided into as many water-tight compartments as is compatible with a vessel of these dimensions. The quarters for officers and crew are of ample size, and well lighted and ventilated; those for the commanding officer will be just abaft the pilot house where he can be at all times in close touch with the management of the vessel. Her boat equipment will consist of two 24-foot metallic lifeboats, one 20-foot otter boat, one 16-foot dinghy, and one 17-foot metallic life raft. It is also probable that a motor lifeboat will be provided. The lifeboats will be of the self-righting and self-bailing type. There will be two pole masts, with a signal yard on the foremast.

For life-saving purposes there will be rigged from the mainmast a breeches-buoy arrangement operated in a precisely similar manner and by the same kind of gear as has been successfully used for coaling ships at sea. It is expected that this gear can be used effectively for a distance of 1,000 feet, which should enable the tug to rescue shipwrecked persons, with safety, from any vessel which may be stranded on a reef or on the beach.

The electrical equipment will be very complete, and will consist, in addition to the usual lighting outfit, of the Ardois system for night-signaling, wireless telegraphy and two powerful searchlights, one at each end of the deckhouse. Current at 110 volts pressure will be furnished by a 15 K. W. direct connected generator.

There will be a steam windlass, a steam steering gear and a steam gypsy for handling towing lines.

The steam machinery will consist of a vertical, direct-acting, triple-expansion single-screw propelling engine, two boilers, one of the Scotch type and one water-tube, an independent air pump, a centrifugal circulating pump, a main and an auxiliary feed pump, fire and wrecking pump, evaporating and distilling apparatus, feed-water heater, and such other auxiliary and supplementary machinery as to make the installation complete in every detail.

The following are some of the principal data:—

Indicated horse-power	1,200.
High-pressure cylinder, diameter	18 inches.
Intermediate-pressure cylinder, diameter	29 inches.
Low-pressure cylinder, diameter	47 inches.
Stroke	30 inches.
Main condenser, cooling surface	1,651 sq. ft.
Vertical, twin, single-acting air pump	8 × 16 × 12.
Main circulating engine, 24″ runner	7″ × 7″ engine.
Main feed pump (duplex)	8 × 5 × 12.
Auxiliary feed pump (duplex)	8 × 5 × 12.
Fire and wrecking pump (duplex)	14 × 8½ × 12.
Bilge pump (single)	8 × 9 × 10.
Feed-water heater, heating surface	120 sq. ft.
Distilling apparatus, capacity 24 hours	1,700 gallons.
Boilers, working pressure	180 pounds.
Scotch boiler, diameter (inside)	13 ft. 6 in.
Length over heads	10 ft. 3 in.
Number of furnaces	3.
Diameter of furnaces (inside)	40 inches.
Total grate surface	60 sq. ft.
Total heating surface	1,803 sq. ft.
Water-tube boiler (Babcock & Wilcox type).	
Length over casing at bottom	10 ft. 4 in.
Width over casing	12 ft. 9 in.
Height to center of drum	13 ft. 3 in.
Total grate surface	78.5 sq. ft.
Length of tubes	9 feet.
Total heating surface	2,565 sq. ft.
Total grate surface, both boilers	138.5 sq. ft.
Total heating surface, both boilers	4,368 sq. ft.

The propeller will be of manganese bronze, 11 feet in diameter, and the mean pitch, which is adjustable, will be 11½ feet. The machinery throughout will be constructed of the highest qualities of material and workmanship, in order to minimize, so far as possible, the chances of derangement or of breakdown. There are but few special features other than that provisions are made for pumping out wrecks, and for extinguishing fires

on other vessels. The fitting of one Scotch and one water-tube boiler has been quite frequently adopted, and has its disadvantages as well as its advantages. In this instance the advantages seem to predominate. The reasons for its adoption are that the vessel will be for fully nine-tenths of the time tied up at the wharf waiting for a signal of distress. If two Scotch boilers were installed, it would be necessary to keep the fires banked under both, as it is not advisable to raise steam in a Scotch boiler of this size under much less than five or six hour's time, that is, if the engineer in charge has any regard for the tightness of the seams. Banked fires in two boilers would be too expensive, so as an alternative it is proposed to keep the fires banked in the Scotch boiler at all times, except when it is necessary to clean the same, and to have the water-tube boiler primed and ready for instant use. Steam can be raised in the water-tube boiler within thirty minutes after the fires are started, so that by the time the tug will be under way from the wharf, and headed on her course, full boiler power should be available. To maintain banked fires in a water-tube boiler requires, as is well known, much closer attention than for shell boilers, owing to the much larger water reservoir in the latter type.

As vessels in that portion of the Pacific Ocean are frequently overdue on account of the great duration of gales, the Revenue-Cutter Service is often called upon to go in search of them, and it is safe to assume that this life-saving tug will at times be called upon for that duty. From data obtained from the log books of other cutters of about the same model and size, it is probable that the new tug will be able to steam 25 knots per ton of coal, at her economical speed. With her bunker capacity she should, therefore, be capable of steaming a distance of about 3,000 knots which should enable her to make a very thorough search for any missing craft. Although the designed speed of the new vessel is but 12 knots, there is little doubt that, with her comparatively large boiler power, she should, in an emergency, be capable of making between 13 and 14 knots.

It is believed that the design contemplates the furnishing of every known device of any practical value, which can be of service in saving life at sea. Summarized, the special equipments of this vessel are as follows:

1. Two self-bailing and self-righting lifeboats.
2. Life raft.
3. Line-throwing gun.
4. Breeches-buoy apparatus.
5. Complete equipment of life-buoys and life-preservers.
6. Wireless telegraphy.

7. Ardois system for night signaling.
8. Additional searchlight.
9. Wrecking apparatus for pumping out vessels.
10. Fire-extinguishing apparatus.

As already stated herein, the designing of so large a vessel for life-saving duty at sea is an entirely new field for naval architects, in this country at least, and while it is not claimed that perfection has been reached by any means, it is thought that every precaution has been taken to make the vessel a success, at least so far as it lies within the practical knowledge and experience of those interested in designing the craft. The saving of life at sea is a subject which should appeal to all persons interested in maritime affairs, and it is hoped that, among the members of this society there may be some who will advance suggestions or criticisms which may be of value.

REVENUE CUTTER NO. 17.

This vessel has been designed and is intended for exclusive use as a derelict destroyer in the North Atlantic Ocean.

Floating wrecks, or derelicts as they are commonly termed, drifting aimlessly in the paths of ocean-going vessels, have been a constant menace to seafaring men for years past. To the men on the bridge of a fast Trans-atlantic passenger steamer, the thought that at any moment they may crash into a half-submerged wreck and cause the loss of their vessel is anything but comforting. Other ships in their path at night are discernible by lights, or can be located by signals in fogs; even icebergs make their presence known by lowering temperatures, but the specter-like derelict gives no indication of its whereabouts. The danger of collision with these floating obstructions is known to all who travel by sea, yet until this time no systematic effort has ever been made to rid the ocean of these menaces to navigation. True it is that at every international maritime conference held within recent years, resolutions have been passed and agreements made that each government represented at the conference would at once take up the matter, but the old saw "What is everybody's business is nobody's business" seems to have overcome good intentions in this respect. In this country special cruises have been made from time to time in search of some particularly dangerous derelict, and within the past few years the Revenue-Cutter Service has systematically blown up all sunken derelicts which have been reported as dangerous to navigation along the Atlantic Coast.

The United States Government, always foremost in any movement to promote the interests of humanity, has finally decided to be the pioneer in what is hoped will be an international system for removal of derelicts from the most frequented paths of ocean travel. To that end Congress recently passed a bill, appropriating $250,000 for the construction of a vessel to be used exclusively for derelict destroying. This was brought about only after the most earnest efforts on the parts of the several maritime associations and the steamship owners of the ports of New York, Boston and Philadelphia; to these organizations is largely due the credit of convincing Congress as to the necessity for such a vessel.

The carrying out of the intention of Congress involves a subject upon which considerable thought will have to be expended. The locations and drift of derelicts have for some time past been noted on the monthly pilot charts issued by the U. S. Hydrographic Office, so that a fair idea can be formed of the field of operations for the new vessel. Generally speaking, it can be said that the greatest number of them will be found in or near the Gulf Stream, in the spherical triangle whose vertices are Nantucket South Shoal Lightship, Fastnet Rock on the Irish Coast, and the Azores. This area, it will readily be seen, includes the lanes traversed by nearly all the Transatlantic steamers. The derelicts which originate outside the above boundaries are rapidly swept by the Gulf Stream into this triangle. As to the methods to be employed in locating these ocean wanderers much will depend upon the experience to be gained in the first few attempts. It is thought, however, that schemes can be devised whereby the destroyer can be unmistakably recognized day or night by passing vessels, so that information can be conveyed to her, through the medium of wireless telegraphy or signaling, as to the whereabouts of the derelict sought, or of others not before reported. This would involve the issuance of comprehensive circulars to all steamers crossing the Atlantic, which will contain a description of the destroyer and her distinctive marks, her call letters by wireless telegraphy, a pre-arranged code for various methods of signaling, and such other information as may from time to time be found advisable for the purpose. It may also prove efficacious if bulletins are issued to all outgoing vessels giving information as to the probable whereabouts of the destroyer and a description of the particular derelict for which she may at the time be in search.

After the derelicts are discovered, the methods of destruction or of removal to be adopted will require excellent judgment on the part of the officer in command of the cutter. It is probable that nearly half of all

floating wrecks encountered in the North Atlantic are lumber laden. Experience has taught the futility of attempting to blow up such obstructions: even if they could be successfully blown up it would tend to aggravate the trouble, for instead of having the mass of timber confined in one hulk, it would ofttimes liberate numberless logs or large sticks of timber, which in themselves constitute dangerous obstructions for fast vessels to strike. It is highly probable then that wrecks containing lumber will have to be towed to the nearest land where they can be beached or securely moored until disposed of otherwise. In some instances it might be found advisable to burn these relics of lumbermen, but even with this method a number of unburned logs would be bound to get adrift. Iron or steel vessels loaded with heavy cargoes can be readily blown up and sunk by carefully placed mines of gun-cotton or dynamite. Many officers of the Revenue-Cutter Service have already had experience in handling mines at sea, and of securing them to wrecks from open boats; hazardous as is this operation the records do not show a single accident from that source. Many instances there are where undamaged and seaworthy vessels have been abandoned at sea through fear of impending shipwreck. Should the destroyer meet with any such, it is more than probable that they would be towed to the nearest port and restored to their owners, thus accomplishing an act beneficial alike to public and private interests.

It will readily be understood that the cardinal features in the designing of a vessel for this purpose must embrace the following:—

1. Seaworthiness, and ability to keep the sea under all conditions.
2. As great a coal endurance as possible, in order to provide a large radius of action.
3. Towing ability.
4. Carefully designed magazines for the safe carrying of high explosives, and efficient gear for handling the same.

At the outset it is well to state that the designers of the vessel were considerably hampered by the limit of cost, which was placed at $250,000, by the act providing for her construction. Those who have had recent experience in placing contracts for ship construction, or in fact for almost anything else, will realize that, owing to the greatly increased cost of labor and materials, $250,000 will not build a very large ship of this type. Consequently the plans as finally adopted contemplate a single-screw vessel of only 1,480 tons displacement, as that was the very largest tonnage which could be built for the money available. The general dimensions of the hull are as follows:—

Length over all	204 ft.
Length between perpendiculars	186 ft.
Breadth of beam molded	34 ft.
Depth at side from base line amidships	25 ft. 9 in.
Mean load draught	15 ft. 6 in.

At the draught given above the vessel will carry 300 tons of coal and 26,500 gallons of fresh water.

The vessel will have a straight stem, an overhanging elliptical stern, three decks, the upper of which or spar deck will be flush fore and aft. Around the spar deck will be a guard rail, which will be formed of galvanized wrought-iron stanchions, a teak top rail and wrought-iron intermediate rails. She will have two pole masts, each 73 feet long; on the foremast there will be a signal yard and a crow's-nest. She will carry a mainsail, main staysail, foresail and fore staysail, all of which will be used for steadying purposes with the wind abeam. There will be a small steel deck-house around the foremast, containing the pilot-house, chart room, and a state-room for the use of the commanding officer in stormy weather.

The hull will be constructed of mild open-hearth steel throughout, and it will be divided into a number of water-tight compartments. As the vessel will be for the greater part of the time continuously cruising at sea, particular attention has been given to arranging the quarters for the officers and crew so that they will have every convenience and comfort which it is possible to provide for them. Separate staterooms are provided for all warrant officers, and for the quartermasters and oilers as well. A large sick bay and a dispensary will be fitted for the care of the sick or injured if any there may be. The berth deck will be large, well lighted and well ventilated. A crew, numbering seventy-five men, can be comfortably swung there in hammocks.

The deck auxiliaries will consist of a steam windlass, steam steering engine, and a steam winch for handling hawsers or for operating the cargo boom. There will be six boats, including a surf-boat and a power launch.

Current for the electric installation will be furnished by two 10-K. W. direct-connected generators, which can be operated independently or together, an equalizer being fitted. In addition to lighting the vessel throughout they will be capable of operating a 24-inch searchlight, three electric motors for the mechanical ventilation of the living quarters, the Ardois system for night signaling, and the wireless telegraph outfit. There

will be, of course, a complete outfit of both steel and manila hawsers, gun-cotton mines, magnetos for exploding purposes, and such other special apparatus which may be deemed necessary or found advisable to enable the vessel to perform the work for which she is intended.

STEAM MACHINERY.

It is not necessary that a vessel designed to search for derelicts should have very high speed. In order to make her coal supply last just as long as possible she should be cruised at her economical speed. An examination of diagrams showing the economical speed of 71 vessels of all classes in the U. S. Navy discloses the fact that, with the exceptions of several torpedo-boats, this averages below 10 knots; the economical speed of the destroyer cannot therefore be in excess of 11 knots with a clean bottom, 10 knots with the bottom in fair condition, and 9 knots when the bottom is ordinarily foul. Therefore it would be advisable to fit an engine capable of driving the vessel not in excess of 11 knots, were cruising conditions only to be considered. However, as the vessel must necessarily be used at times for towing, it was decided to install an engine capable of indicating 1,500 horse-power under maximum conditions, which will give her a speed somewhat in excess of 12 knots should it become necessary to steam her at that rate, and at the same time provide reserve power for towing at lower speeds.

In the design of the main engine great care was taken to secure as economical results as possible for the type decided upon. To that end a cylinder ratio of 1 to 6.76 was adopted, as was also a comparatively long stroke; piston valves are fitted to all three cylinders, and it is believed that by the peculiar arrangement of valve chests (shown on the accompanying drawing) the clearance spaces are reduced to as small an amount as possible, even less than with the ordinary flat slide valves. The air pump, feed pump and bilge pump are operated by beams from the low-pressure crosshead, so that while cruising the only auxiliaries in operation using steam direct will be the circulating pump and the dynamo. At sea the vessel can be steered by the hand gear in order to save the steam used by the steering engine. Steam at 180 pounds working pressure will be furnished by two single-ended boilers of the Scotch type, designed to operate entirely by natural draft.

The following are some of the principal data for the machinery outfit:—

Indicated horsepower	1,500.
Working steam pressure	180 lbs.
High-pressure cylinder, diameter	20 inches.
Intermediate-pressure cylinder, diameter	32 inches.
Low-pressure cylinder, diameter	52 inches
Stroke	36 inches.
Main condenser, cooling surface	2,092 square feet.
Main air pump, attached	21″ × 15″ stroke.
2 main feed pumps, attached	3″ × 15″ stroke.
2 main bilge pumps, attached	$3\frac{1}{2}$″ × 15″ stroke.
Main circulating pump, 26″ runner	8″ × 8″ engine.
Main feed pump (independent duplex)	8″ × 5″ × 12″.
Auxiliary feed pump (independent duplex)	8″ × 5″ × 12″.
Fire and wrecking pump (duplex)	14″ × $8\frac{1}{2}$″ × 12″.
Bilge pump (simplex horizontal)	8″ × 9″ × 10″.
Distiller circulating and flushing pump (simplex)	6″ × 7″ × 7″.
Feed-water heater, heating surface	120 square feet.
Main boilers (two), diameter (inside)	14 feet.
Length over heads	10 feet 3 inches.
Number of furnaces	3.
Grate surface (one boiler)	63 square feet.
Heating surface (one boiler)	1,930 square feet.
Total grate surface	126 square feet.
Total heating surface	3,860 square feet.
Ratio H. S. to G. S.	30.6 : 1.

The propeller will be of the built-up type, having four blades; the diameter will be 11 feet 6 inches, and the pitch adjustable between 13 feet and 15 feet. Suction hose will be fitted to the wrecking pump, so that it can be used for pumping out wrecked vessels, and ample provisions of fire apparatus will be furnished for extinguishlng fire on other vessels, in case such a contingency should arise. An abundant supply of fresh water will be carried in large tanks located in the fore hold, and in the double bottom under the boiler compartment. In addition there will be a complete evaporating and distilling plant, so that in case of necessity fresh water could be furnished to vessels at sea should any such be found whose water supply had run low. It is the intention to equip the destroyer

with a small machine shop, containing a lathe, shaper, drill press and all necessary small tools for making repairs to her own machinery while at sea, and in case of necessity for lending assistance in that respect to other vessels in urgent need.

In time of war the derelict destroyer would prove of value for co-operation with the army in planting mines at the entrances to the various seaports.

As this vessel is the first of the type ever to be constructed, it is not expected that the design is perfect, but there is no doubt but that she will fulfill the object for which she is constructed. A year or more experience in this particular line of duty will unquestionably develop minor faults, but it is hoped that they will be such as can readily be remedied in this first attempt, and serve as a guide for future derelict destroyers which it is expected will be constructed by other maritime powers.

The new vessel, which has not as yet been named, is now being constructed by the Newport News Shipbuilding and Dry Dock Company, and it is confidently expected that she will be completed and ready for duty by July 1, 1908.

DISCUSSION.

MR. ROBERT S. RILEY, *Member:*—In connection with the design of these vessels, they show a very careful study of the requirements, and it is noticed particularly that they are to be used for derelict destroyers, but one of their important functions will not be as destroyers but as savers both of life and property. One of the particulars mentioned is their ability as towing vessels, and it occurs to me one possible criticism of their design might be the omission of towing machines. It would seem that towing machines would add to their capacity in handling derelicts or other disabled vessels in heavy weather. They are very likely to be called on to render assistance of this kind, and that is the time when lines would be snapped unless they had some means for giving and taking under the conditions they are likely to meet.

MR. SPENCER MILLER, *Member:*—We are indebted to Captain McAllister for a very interesting paper, and perhaps if there is any criticism to make it is the fact that he has combined two papers in one? For the purpose of indexing and for future reference it would seem better to divide it, one part to be entitled "A Life-Saving Tug," and the second part to be entitled "A Derelict Destroyer."

It may be a surprise to many to know the extent to which the old-fashioned breeches-buoy apparatus is now found useful in the United States alone. The report of the Life-Saving Service for last year shows that 189 passengers were transported from wreck to shore on the breeches-buoy alone. This seems surprising, in view of the limitations of the breeches-buoy: for example, if the sea is not too rough the lifeboat is sent out and the breeches-buoy not used at all. Again, when the distance from the shore is too great the life-buoy cannot be used. It has happened many times that, the wind being towards the shore, the line could not be shot to the wreck. In spite, therefore of all the limitations, the fact that the breeches-buoy has transported 189 passengers in one year in the United States alone seems to speak volumes for this simple and useful apparatus. Another surprising feature is that no passenger who has ever gotten into a breeches-buoy on a wreck has ever failed to be landed ashore alive. Many of the passengers arrive pretty wet and in some instances nearly drowned, but never, I am told, has a life been lost in transit.

So much cannot be said, however, of lifeboats. With the breeches-buoy apparatus it is worthy of note that no life is placed in peril by its use. This is in contrast to the use of the lifeboat wherein the crew place their own lives in jeopardy in their heroic efforts to save other lives.

We all remember, too, the experience of the steamer Berlin, that was wrecked about a year ago off the Hook of Holland. That ship was so far from the shore that no breeches-buoy could reach it. The sea was so tempestuous that no lifeboat could live in it. A ship was actually sent outside to render assistance, and breeches-buoy apparatus carried. The lines were actually rigged up between the wreck and this ship, and, of course, snapped as fast as they were made fast. The attempt failed for the need of just the device which will be applied to this new revenue cutter.

Captain McAllister says that the breeches-buoy apparatus to be applied to the new revenue cutter is a modification of the marine cableway for coaling warships at sea. Perhaps a better way of expressing it would be to say that this apparatus is the regular breeches-buoy apparatus used along our coast, plus an automatic reel. Without the automatic reel the breeches-buoy would be impracticable between a moving ship and a wreck; with the automatic reel the breeches-buoy apparatus becomes practicable. The function of the automatic reel, therefore, is to maintain a uniform tension in the elevated line or hawser, but permitting its length to vary as the motion of the ship or ships demand. It must pay out the rope without jerks under tension as the ships separate and wind it in rapidly as the ships approach. Furthermore, it must permit the breeches-buoy to be workable at 300 feet from wreck to tug (should the water be deep enough), or 1,000 feet if such should be necessary. This automatic reel will have a maximum in-pulling power of 2,000 pounds, which may be reduced at will. It will wind in the hawser at the rate of 1,000 feet per minute, which is believed to be far in excess of the requirements.

Hardly less in importance to the automatic reel is the means for landing the passengers safely on deck. This is a simple hauling-down device, which has been so successfully employed in the marine cableway for coaling at sea. A pulley runs upon the hawser or upper cable some 40 or 50 feet aft of the mainmast. To this tackle is secured, and when the passenger is approaching the revenue cutter the main hawser will be hauled down to the center of the quarterdeck of the cutter. Not only will this tackle haul the hawser downwardly but inwardly as well. The vessel will be veering about, perhaps to the extent of 180 degrees, which will render it essential to haul the hawser to the center of deck. In such conditions the passenger lands perhaps just above the deck and the crew is thereby enabled to take the passenger out of the breeches-buoy. The passenger in many instances is likely to be so benumbed by the cold as to be utterly unable to help himself. In the case of women passengers it seems that few would be able to get themselves out of the breeches-buoy.

The reason which prompted the offering of this apparatus to the Revenue Service was because of the fact that in every sea trial of the marine cableway for coaling at sea there has been no difference in its operation whether the sea be rough or smooth. This showed its practicability of safely operating in a breeches-buoy in the roughest sea and stormiest weather.

If I may be permitted to "reminisce," I remember being a passenger on the U. S. S. Massachusetts at the time it coaled from the first marine cableway at sea. There were five sea trials. The fifth was a rough-weather test. The sea was so rough that I protested to the captain that the apparatus was built to work in a moderate sea and if he attempted to set the apparatus up in so heavy a sea the Company would not be held responsible for what might happen. Captain Train answered: "Oh, let us try it and see what happens." What happened was, that in this heavy sea the apparatus worked with greater precision and with greater capacity than it had on any previous days when the sea was smooth. The marine cableway had one test in England in over a half-gale of wind. The trials at Italy took place when the towing ship showed her screws to the collier. It was these experiences that have led to the attempt to modify the marine cableway to be used for life-saving.

And is it not a happy coincidence that a device primarily invented to increase the efficiency of a fighting ship should, by a process of evolution, become a humane instrument serving to rescue lives endangered by the tempestuous seas?

COL. E. A. STEVENS, *Vice-President* (Communicated):—I would ask Mr. Miller whether it would not be possible to bend a tackle on to a towing hawser, lead the hauling end of falls to the marine cableway engine and make the tail block fast to the towing bits. If this is done, will not the engine give the requisite spring to the towing hawser to make it work satisfactorily in a heavy sea?

MR. MILLER:—Mr. Stevens' suggestions for using the automatic reel to aid in towing seems reasonable and well worthy of trial. The automatic reel cannot, however, in anywise be regarded as a towing engine. There is a marked difference between the two. For instance, the towing engine yields to an increased strain in the towing hawser, and as the hawser pays out the engine automatically increases the tension on the hawser to prevent it further paying out, and furthermore, at the first slackening of the hawser the towing engine is designed to recover the same number of feet of hawser that it had paid out. The automatic reel allows the length of the line to vary indefinitely while maintaining a uniform tension at all times. If in towing a boat a manila hawser were used, fixed to the bitts of the tug, then the automatic reel with its line could also be used to assist in towing. The effect of this would be to reduce the strain on the main towing hawser by about 2,000 pounds. This would produce some slack in the towing line, and should lessen the danger of snapping the towing line, and might be worth trying. The cost of such tests would be practically nothing because the apparatus would be there in any event.

I sincerely hope that we will have an opportunity to learn whatever may be the outcome of these suggestions.

THE PRESIDENT:—Are there any further remarks to be made on this paper? If not, the discussion will be closed.

We will now pass to paper No. 12, entitled "Two Instances of Unusual Repairs to Vessels," by Assistant Naval Constructor W. B. Ferguson, Jr., U. S. N., Associate.

The paper was presented by Assistant Naval Constructor J. A. Furer, U. S. N., Associate.