THE HOLLAND SUBMARINE TORPEDO BOAT.

The idea of a submarine vessel for purposes of attack originated long before the time the SCIENTIFIC AMERICAN was founded. In the days of the revolution David Bushnell built one near Peekskill. His old barn, which was still standing some years ago, was the last reminder of his futile attempt. Robert Fulton bent his energies in the same direction and exhibited to Napoleon, in the harbor of Brest, a boat which, sailing on the surface, could be submerged and could be propelled under water for a long time. Napoleon put an old hulk at his disposition, which was successfully destroyed by submarine attack, but as the speed under water was only two knots an hour, the emperor failed to avail himself of the invention. Bushnell's was in actual service, and nearly destroyed, in 1776, the British sixty-four gun ship Eagle. Sergt. Ezra Lee, who was alone on the submarine boat, would probably have been successful in his attempt to sink the vessel, but was unable to successfully attach his torpedo to the bottom of the ship.

In our present issue we illustrate a boat now under construction by contract for the United States government which will go far to show the value of this means of attack. Mr. J. P. Holland, an adopted citizen of the United States and a native of Ireland, for nearly twenty years has been working on this subject—submarine navigation—and has built three boats, the first of which was begun in 1877. Ten years later he proved his plan to be so far practical as to be able to interest the naval department, which issued a circular to inventors calling for designs. Meanwhile in foreign countries other submarine boats were being tried, none of them seeming to prove entirely successful, or at least not succeeding in winning the desired confidence of the naval authorities. But at last in the present boat we have a bona fide war vessel being built under contract for the United States government, and one which it is hard to believe will not be a valuable auxiliary to the navy.

The Holland vessel is of cigar shape, with frames 3½×3½ inches, weighing 12 pounds to the foot. Her outside plating is ½ inch thick, tapering to ⅜ inch at the extreme ends of the vessel; for a portion of her length she is double skinned. She is propelled by triple expansion engines actuating triple screws as long as the smoke stack is above the surface; and for her diving operations, when the smoke stack has to be completely housed, the residual pressure of the steam will be used for her propulsion, water heated under pressure evolving steam for a long time. Then, when this fails, she will have her storage batteries and electric motors to operate the propellers.

Three stages of flotation are provided for; in her light condition with the hull well above the water she is to make 13½ knots per hour; her next stage is that termed the "awash" condition. For this the body of hull is submerged, an armored superstructure, including a conning tower with 8 inch Harveyized steel plates, projecting above the surface, while, concentrically placed, the air tube and the smoke stack rise above the whole. The superstructure is carried forward and aft, and pointed at both ends to give a clean entrance and run, so as to interfere as little as possible with the speed. Her speed under these conditions is to be 12½ knots an hour. Her third stage is the submerged condition. For this the smoke stack and air tube are housed, the opening through which they projected is hermetically closed, and the vessel is in condition to be sunk to a depth not exceeding 45 feet, her strength of construction being sufficient to enable her to resist the pressure of the water at this depth. She still has flotation, there being a margin of 375 pounds of buoyancy in her favor, the submersion being obtained by special devices. Submerged she is to make 6½ knots per hour.

The submersion is to be effected in two ways. At her stern she carries horizontal rudders. If the vessel in moving, by inclining these rudders the bow is caused to pitch downward and the vessel runs down an inclined plane determined by her axis, the inclined plane really representing the resultant of her buoyancy as a vertical upward component and her inclination of axis as a downward acting component. This diving action is similar to that used in the old Tuck submarine boat Peacemaker, which has been several times described in our columns. But the vessel is also to be able to dive from a state of rest. To secure this power she carries at her bow and stern two screws with vertical axes actuated by electric motors. By working these screws in one or the other direction, at varying rapidity, the vessel can be sunk rapidly, can be maintained at any desired level, can be rapidly drawn upward to the surface, or its approach to the surface can be made as slow as desired.

It having at last been settled that ocular navigation is impracticable under water, a tube is provided to be raised above the surface when the vessel is submerged, which tube is to carry an inclined mirror or prism, camera lucida fashion, by which the commander will be able to watch the enemy and guide his course. In the restricted volume of the boat a compass cannot be used, owing to the proximity of so much iron and steel. An attempt is to be made to hold her mechanically in a straight course by a triangular drag. The theory of this is that she should be started on a proper course by ocular methods, with the drag set astern of her when on such course, any inclination from the desired direction causing the drag to pull to one side or the other, actuating the rudder so as to bring her back to her original course.

She is to carry five automobile torpedoes, two expulsion tubes and the necessary air plant for operating them. When diving, she must be able to reach a depth of 20 feet below the surface of the water within one minute from the light condition; when awash, she must be able to dive to the same depth within 30 seconds. She has an automatic pressure diaphragm which governs her submersion so that she cannot exceed the safe depth.

The general distribution of machinery is shown in the sectional view, while the bow and stern views and side elevation are also given. Another view shows her in light condition and awash, while the submarine attack is illustrated in another cut.

The air supply is primarily obtained from reservoirs where it is stored under 2,000 lb. pressure. Moreover, a float with air tube is provided which can be allowed to ascend to the surface, when air can be pumped down through the tube into the hull.

The following are the dimensions:

Length	80	feet.
Diameter	11	"
Displacement, light	118·5	tons.
" awash	137·84	"
" submerged	138·5	"
Reserve buoyancy submerged by motion or awash	0·66	"
" " " lying still	375	pounds.
Horsepower of engines	1,800	

Provision is to be made for the escape of the crew in case of accident. This will take the shape of buoyant diving helmets or suits, and a method of opening the hatch so as to escape if the boat remains submerged.

The Cotton Mills of Japan.

According to a Japanese native paper, the number of spindles in the cotton mills of Japan now exceeds 1,000,000. In consequence, the supply of yarns is exceeding the demand, and some of the spinners are of opinion that it is a risky attempt to start new mills at present, as there will be caused many difficulties in the way of obtaining raw cotton and maintaining the equilibrium of supply and demand. According to the returns prepared by the Cotton Spinners' Union; Osaka, the number of spinning concerns in the union and of their spindles are as follows:

	No. of Concerns.	No. of Spindles.
Actively working	58	632,130
Not yet opened or being established	6	352,427
Total	64	984,557

Besides these are several concerns outside the union. Among them the Kyoto Spinning Company has 10,000 spindles, of which 2,000 are actively working; the Heian (10,000 spindles), the Fushimi (10,000 spindles), the Bizen (5,000 spindles), the Nishinari (15,000 spindles), the Kawachi (10,000 spindles) and the Tokwa (75,000 spindles, to be established in Shanghai), are all being established. The number of spindles throughout the country, active and inactive, is put at 1,119,557.—Industrial Record.

Methods of Closing Cracks in Cast Iron.

Many methods for closing cracks or pores in cast iron have been devised, according to Industries and Iron. Chemical or other products, such as salammoniac or urine, are often used to cause the formation of an iron salt, easily oxidizable, which in a short time gives a certain quantity of hydrated oxide of iron. This is made use of very often to stop up leaks which develop in metallic cylinders. This method is, however, a somewhat lengthy one, several days being oftentimes necessary to obtain satisfactory results; that is to say, entire absence from leakage. A method of closing cracks or pores in a more rapid and certain manner has lately been devised by M. A. Demalght, of Brussels. The method is described as follows: The cylinder is filled with a certain quantity of perchloride of iron. The liquid is then compressed until globules appear on the external surface. The cylinder is then impregnated with perchloride of iron right through, as regards its thickness. Any perchloride in the cylinder is then emptied out, the cylinder being then wiped until the polished surface is again made brilliant. It is then filled with ammonia at 22 degrees Baume, this also being subjected to compression. The effect of this operation is soon noticeable, the perchloride of iron in the metal becomes transformed under the influence of the ammonia into hydrated oxide of iron, at first somewhat frothy in character, and afterward, under the influence of the external pressure, rough and compact. Some hydrochlorate of ammonia also remains, which will soon afterward react on the iron, which will eventually be converted into an oxide compound, adding itself to the first. The leaks marked at the commencement of the operation will be entirely stopped as soon as the ammonia commences to move out externally, the whole operation not occupying more than a couple of hours. One advantage of the new process is that leaks are stopped by an independent injection of hydrate of iron, while in the many processes at present in use the result is obtained at the expense of the iron in the cylinder, that is to say, one part has to lose that which another portion gains.—Railway Review.

A Metol and Hydroquinone Developer.

Mr. John Russell says our old friend pyro is an exceedingly valuable developer, with, however, a tendency to give too dense a deposit in the high lights before the half-tones are well out; it also stains the hands and plates, giving slow printing negatives, and sometimes produces color fog. Hydroquinone, though excellent in many respects, frequently gives exaggerated contrasts, and in cold weather works so slowly as to inconveniently prolong development. For correctly exposed plates amidol works splendidly; but with full exposure fails to give printing density. Eikonogen and rodinal also, though very powerful, fail in the same direction. Metol is, perhaps, the most powerful developer we possess, and comes nearest to pyro as a density giver, its only fault being a tendency toward oversoft results.

Efforts have been made to combine developers of opposite characteristics, such as hydroquinone and eikonogen, in the hope of securing the advantages of both by neutralizing the faults of each, and the most perfect arrangement of this kind is a combination of metol and hydroquinone. These agents work remarkably well together, the tendency of hydroquinone toward undue hardness neutralizing and being neutralized by the fault of metol in the direction of oversoftness. By this combination we get a developer which keeps well, works rapidly, with perfect freedom from fog or stain, brings out all available detail with true gradation, gives good printing negatives without undue opacity, and is capable of considerable modification. It is, therefore, the nearest approach to an ideal developer, and has, after many varied trials, become my favorite. The formula I have adopted is as follows:

Metol	80 grains.
Hydroquinone	45 "
Sodium sulphite	640 "
Sodium carbonate	640 "
Distilled water	20 oz.

The metol and hydroquinone should first be dissolved in hot water; when cold the other ingredients may be added.

Though this is a so-called single solution developer, it can be modified to suit any requirement by dilution and the employment of a 10 per cent solution of potassium bromide.

For very short exposures it should be used full strength. For normal exposures it may be diluted with an equal bulk of water, plus 1 grain of bromide per ounce. Further dilution, with still more bromide, will be necessary for overexposure. Dilution gives contrast; concentration gives power and density with reduced contrast. The same solution may be used for several plates, and development must be continued until the apparent density is much greater than is usual with pyro.

In the hands of careful workers the convenience, power, and ease of working with this combination, and its capability of giving excellent results, will always make it a favorite developer. — The Photographic News.

Bacteria in the Treatment of Flax.

The ancient and familiar process used in the manufacture of linen, and known as the "retting" of flax, has long eluded all endeavors to place it upon a sound scientific basis. Prof. Winogradsky, of St. Petersburg, has, however, recently shown that it is directly dependent upon the action of particular bacteria. Considerable difficulty was experienced in discovering the special microbes responsible for the process, and several different varieties were isolated by means of gelatine plate culture from the retted or fermented flax; but in no case, when inoculated on to sterilized flax, did retting ensue. When, however, portions of retted flax were added to the sterilized flax, vigorous fermentation was set up in from twelve to fifteen hours. In the next series of experiments, pieces of sterilized flax were inoculated, placed in tubes containing water, the surface of which was sealed from the air by means of a film of oil. In this manner, after a long series of successive inoculations, a somewhat large, spore forming bacillus was discovered, which subsequent experiments proved to be the specific microbe responsible for the retting of flax. It was obtained in a condition of undoubted purity by anærobic cultivation on slices of potato which were rubbed over with chalk, and from these cultures the retting of sterilized flax was accomplished with the greatest ease. Prof. Winogradsky is of opinion that the so-called pectic fermentation, by which is understood the transformation during retting of insoluble pectic substances into soluble, must now be regarded as a fermentation process in the strict bacteriological sense of the word.—Nature.

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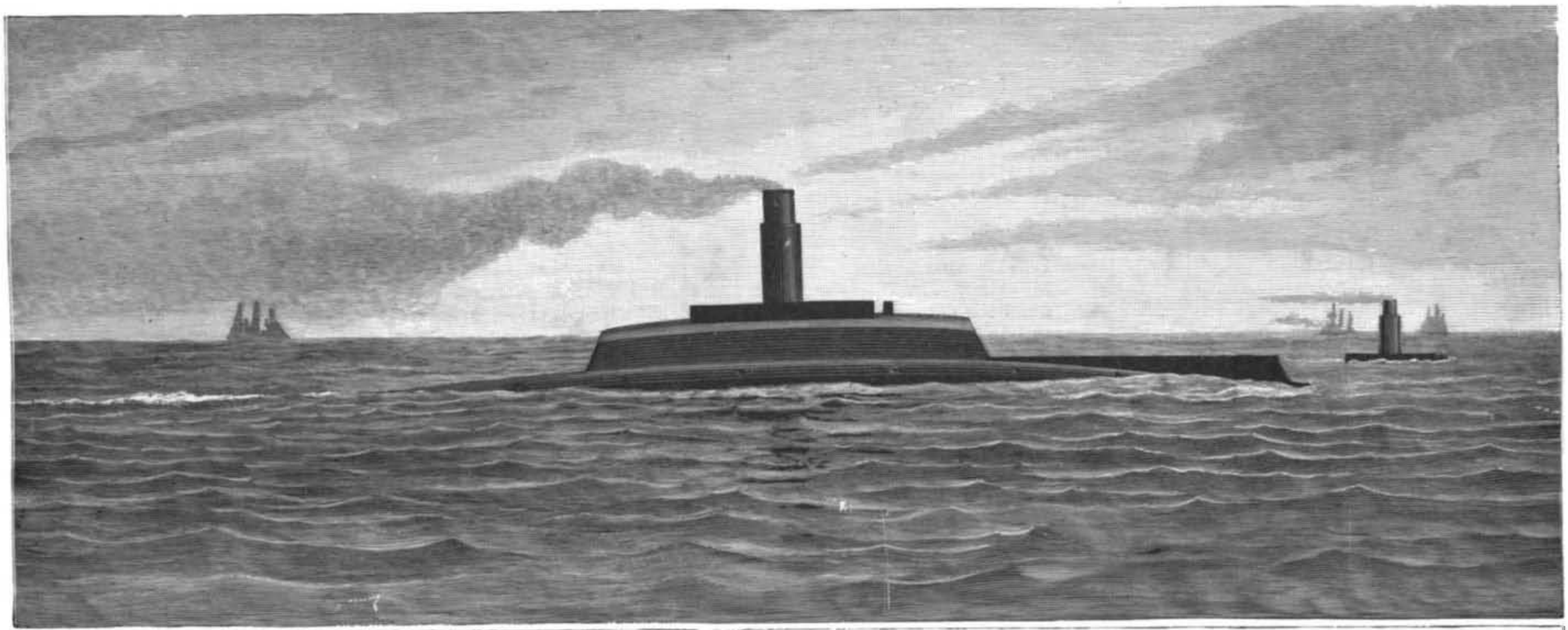

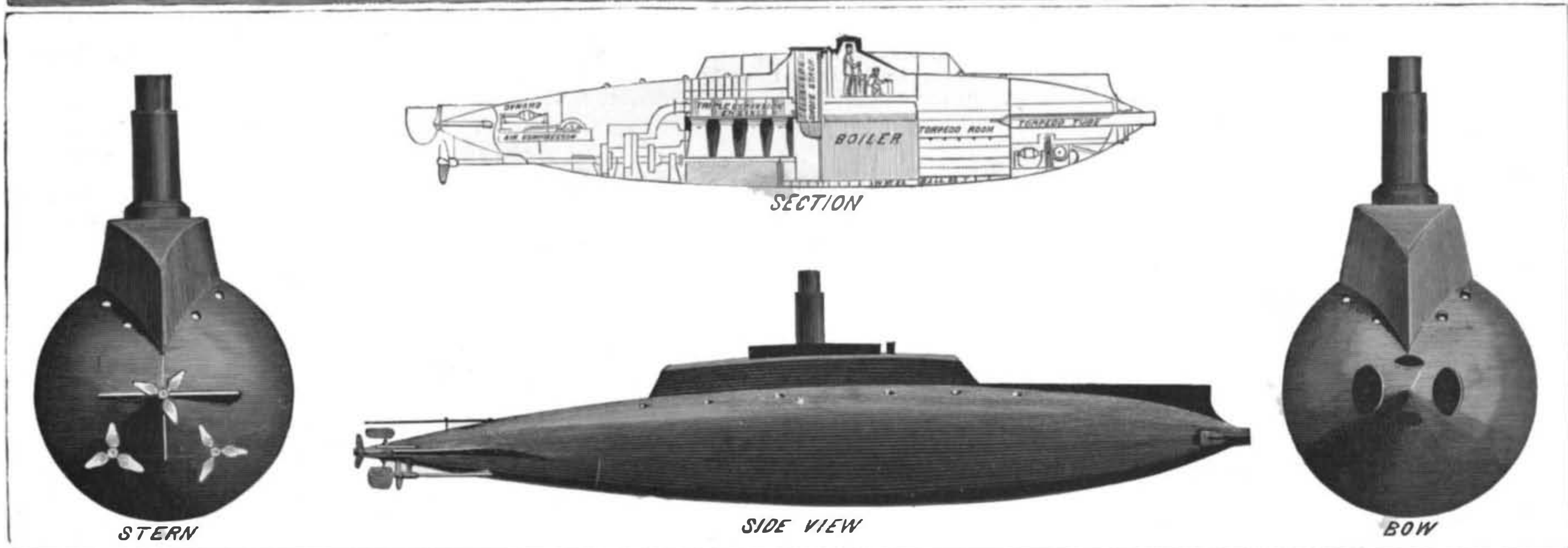

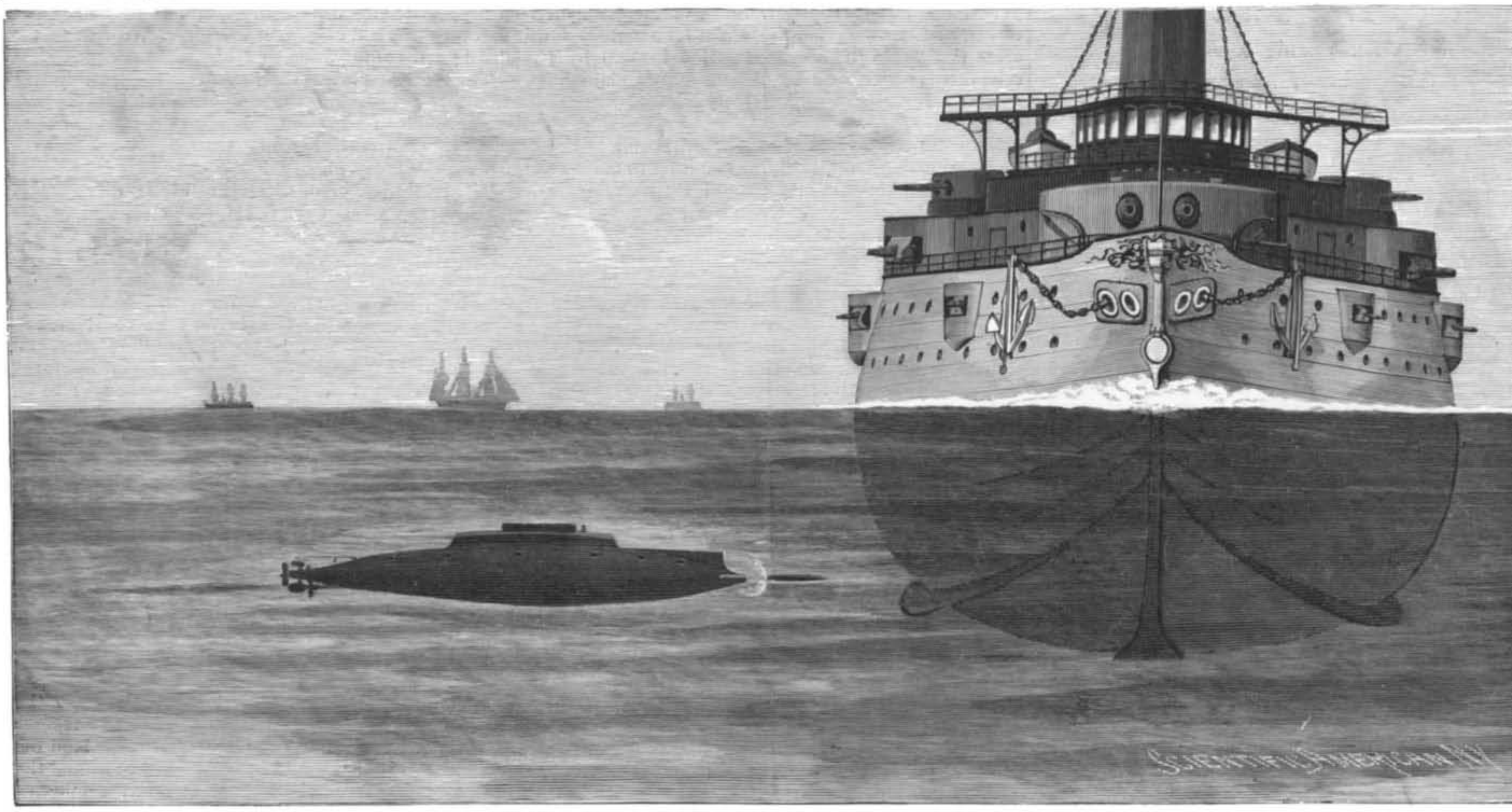

Sections and elevations of hull. The vessel in light condition and awash. The attack under water.

THE HOLLAND SUBMARINE TORPEDO BOAT.—[See page 263.]