The torpedo, says the *Illustrated London News*, to which we are indebted for the illustration and description, may be relied upon to do its deadly work, if it strikes; but it cannot be relied upon to strike, when sent long distances. It is subject to the attack of machine guns, and may be turned from its course by currents of water; while naval commanders have learnt not to lay their ships broadside to a point from which it may come, but to keep stem on, so that, at sight of the line of air bubbles which mark the torpedo's approach, a turn of the wheel will send it swishing off through the water. In fact, the torpedo can be of little use, unless brought by an unseen agency within actual striking distance of the vessel to be attacked.

So Mr. Andrew Campbell bethought himself how to construct a boat, of any dimensions, which could be readily submerged or floated in a safe and simple manner, leaving nothing to chance, and not depending on the power used for propulsion—a boat practically indestructible, efficient in any climate, and ready at any moment. How to do this was the problem. The notion that it could be done by simply increasing or decreasing the weight had failed; so had that of propelling the boat down nose foremost, for as soon as the machinery stopped, she found an even keel, and floated to the surface. Nor did Mr. Campbell think finality and absolute success had been reached by that better method adopted by Mr. Nordenfeldt, by which the boat is forced down by means of propellers or screws working horizontally at the side of the boat; for the capital fault still remains that submersion is dependent upon the machinery. The subtle is often explained by the simple, and it occurred to Mr. Campbell to study nature a little. Fishes and other animals living in water rise and sink without using their fins or any method of propulsion; it is done simply by contraction or expansion.

Then the question came, Is it possible to give this same expansion and contraction to such a rigid structure as a boat? The idea occurred, and was carried out, of placing in the hull of a water-tight vessel a series of metal cylinders, into which are fitted properly constructed rams, or drums, which can be protruded or withdrawn by a simple process, governed and worked by the crew of the vessel, by means similar to those used in steering an ordinary ship. The speed of rising or falling is easily and perfectly regulated; an even keel is always maintained, and perfect safety is assured. A torpedo may not simply be taken within striking distance, but may be attached and fired from a point of safety. The inventor claims that he has produced a boat which is perfectly under control; which can be kept at any given depth; which can be raised or sunk rapidly or slowly; and can be propelled at ten knots an hour, or floated, or submerged, and may be kept for hours or days in any position without using a fraction of the stored propelling power.

The Nautilus is a cigar-shaped vessel, 60 feet long and 8 feet in diameter amidships, built of Siemens-Martin steel three-eighths of an inch thick. She is propelled noiselessly by twin screws, worked by electric engines supplied from storage batteries of large capacity. For safety she is divided into four compartments, all the projectors and machinery being contained in one of these, so as to render them under easy control. Besides the projectors, she is fitted with water ballast as well as horizontal rudders; and, in case of an absolute breakdown, such as might be caused by a collision or a similar accident, a turn of a bolt will enable the crew to release a heavy weight, and so raise her to the surface. Thus everything is believed to have been done to insure absolute safety to all lives within her.

The inventor is so satisfied with the numerous trials of the vessel, which have taken place in the presence of many experts of the British and foreign governments, that it is proposed immediately to lay down several vessels of from 130 ft. to 150 ft. length, and of proportionate beam. Vessels of this size would be able to keep at sea for several days, and to contain permanent accommodation for officers and crew. Air, under pressure, is stored on board the Nautilus to an amount sufficient for three days' supply, and electric glow lamps supply light when the boat is submerged.

When lying on the surface of the water, only about ten inches of the central upper portion of the boat is visible above water line, and this is surmounted by a steel conning tower about 12 in. high and 15 in. diameter, and pierced with four sight holes. Entrance and exit are obtained by means of a manhole on the deck, which is secured by a water tight joint, and there is room for six persons in the central portion of the boat.

THE Page Belting Co., of Concord, N. H., has issued a pamphlet on the kinds and grades of belting to use for different kinds of work, which is calculated to be of much practical advantage to those dealing in or putting up belts to run machinery. It has formulæ to aid in determining the belting required to transmit a given amount of power, suggestions as to the proper way of putting up shafts and pulleys, and other valuable and interesting information.

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THE DEFENSE OF NEW YORK HARBOR WITHIN THIRTY DAYS.

We recently suggested a problem for solution—the defense of New York Harbor, and destruction of a fleet attacking it, all operations to be comprised within thirty days. A number of communications have been received in reference to this subject, but very few of the writers have fully appreciated the conditions. The thirty day limit has been generally overlooked.

One writer describes a gunboat with turrets, protected by rollers, intended to deflect the balls. Another proposes submarine boats. Various more or less elaborate plans for establishing fortifications are suggested. Some plans sufficiently novel and ingenious may be especially noted. The utilization of the oil stored in large quantity about our city is proposed. Pipes are to be laid under the waters of the harbor and bay, and are to be provided with open jets. On the approach of a hostile fleet, oil is to be forced out through the proper lines of pipe, so as to confront or surround the invader with floating oil. By fire boats or projectiles, the oil is to be ignited. A sea of fire is thus produced, through which it may certainly be doubted if a fleet could penetrate. As a variation on this plan, the substitution for the oil in such a system of pipes of gas, natural or manufactured, is described. The air surrounding the vessels could be charged with enough gas to form an explosive mixture, which would ignite from the boiler fires of the ships themselves. The gas also would overcome and render insensible the crews, if it attained such proportions in the atmosphere. The barges and other such vessels, some writers suggest, should be loaded with stone and sunk on each side of the channel, so as to narrow it. The channel thus narrowed could be filled with torpedoes. A fleet entering the harbor would necessarily come directly over them, and could then be blown up. A circular floating battery rotated by the tangential discharge of water, and carrying combined wood and steel turrets, is another suggestion.

But as will be seen from this *resume*, the full problem not been grappled with. The port of New York was to be assumed in its present condition. Within thirty days the defense was to be organized, only the material available on such short notice being employed. This includes the fleet of harbor and river vessels of every type, the scows and floats of the larger sizes, tug boats, and even canal barges. Extemporized torpedo systems might be provided. Neither should it be forgotten that we are but a few hours from Pittsburg, with its supplies of iron and steel, and that timber in endless quantity could be sent down the Hudson River. With these existing resources, we believe much could be done within the stipulated time. What we wished to elicit was an organized plan for utilizing these ready resources only.

Now, owing to the action of Congress in providing large appropriations, it seems probable that the creation of a navy is but a question of a few years for us. The action of this Congress will doubtless influence its successor, and soon the United States may be a rival of England in the production of ironclad ships of war and torpedo boats.

SEA TELEPHONY.

A report from Fort Myers, Florida, where Mr. Edison is sojourning, says that he is working on his sea telephone. The inventor says that already he can transmit sound between two vessels from three to four miles distant, the one from the other, and he seems confident, now the principle is established, that he will be able to increase the distance between his stations as the apparatus becomes more perfect.

The Florida waters are peculiarly favorable for experiments of this nature, because of the absence of steamers upon them or other disturbing sounds on the adjacent shores—resembling in their quiet repose the waters of the open sea, where the invention he is striving to perfect will find its most important application.

Up to the present time, Mr. Edison has not succeeded in transmitting articulate speech through his sea telephone, nor is this essential to the success of the system. By means of submarine explosions, he is enabled to form a series of short and long sounds in sequence, and by these, as in the Morse system of telegraphy, words and sentences can readily be transmitted.

In the original experiments in this direction, made by Prof. Trowbridge, and from which these have sprung, two vessels, each furnished with an electric generator and a steam, engine, were anchored a mile or two apart in quiet waters; wires charged with the current were hung over their sides into the water, the upper ends being connected with the telephonic transmitter and receptor. It was sought to send articulate speech between them, and when the two were quite near together, this, it is said, was readily accomplished. Later, however, this seems to have been regarded as impracticable, and the system, now experimented upon by Mr. Edison, of transmitting short and long sounds was adopted, and, up to a certain point, gave no little promise.