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a series of metal cylinders, into which are fitted properly constructed rams, or drums, which can be protruded or withdrawn by a simple process, governed and worked by the crew of the vessel, by means similar to those used in steering an ordinary ship.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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NEW YORK, SATURDAY, MARCH 26, 1887.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 586.

For the Week Ending March 26, 1887.

Price 10 cents. For sale by all newsdealers.

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.

The distance which separates the purely scientific from the practical success is so wide, however, and the way is so beset with obstacles, that it is no easy matter to find, or if found to keep, the right road, and so it was that these first experiments, valuable as they were, soon ended, and it remains for the practical man, the experimenter rather than the student, to take up the problem and push it on to a solution. Edison is peculiarly fitted and equipped for this werk. When in good health, he is a close and constant observer, tireless and original. If he succeeds in finding a practical and reliable means of transmitting any kind of intelligible signal through the water between two vessels several miles apart, a principal cause of disaster on the ocean will have been removed. Though many ingenious and admirable contrivances have been thought out of late years to lessen the dangers of ocean travel, nothing has been done to prevent collisions in thick or foggy weather, which may fairly be said to be the most menacing of all.

It has before been explained in these columns that the present system of whistle and horn signaling is reliable only while favorable conditions prevail, to wit, in calm weather. At other times, when two vessels approach one another, only that which is to leeward is likely to hear the warning whistle or horn; and when the wind is abeam or quartering, the direction of the warning signals is so indefinite as to give little or no indication of the point whence danger is to be expected.

Were the sea telephone perfected, however, collision in thick weather could readily be averted. Vessels would keep their telephone warning going, as well as their whistles, and, while the latter only sounded a general alarm, the telephone would give the exact compass course of the direction whence each ship was advancing, and this, too, in time to prevent a meeting.

THE SCIENTIFIC AMERICAN—ARCHITECTS' AND BUILDERS' EDITION.

We call the special attention of our readers to the announcement, published on another page, of this interesting and valuable publication. It has now been issued for about a year and a half, has grown rapidly in popularity, having attained the largest circulation of any periodical of the kind. While in general style of typography it bears a resemblance to the elegance of the SCIENTIFIC AMERICAN, still its contents and subject matter are almost wholly different, and it reaches an entirely distinct and separate circle of readers. It is, in brief, a comprehensive *Magazine of Architecture*, wherein will be found, illustrated in the most beautiful manner, the best examples of buildings and the various subjects thereto pertaining. It is especially full and abundant in its drawings of dwelling houses of moderate cost. In every part of the country are families who look forward to the time when they may possess a home of their own, with all its enjoyments of tranquillity and happiness.

In the selection of plans, and in the supplying of information relative to buildings and materials, this beautiful periodical of ours will be found most useful and valuable.

The New Health Board President.

Mayor Hewitt appointed, a few days ago, Mr. James C. Bayles president of the Board of Health for this city.

The selection of Mr. Bayles for the office is considered by most persons to be a good one; but when it came to the knowledge of the politicians around the City Hall that the appointee was a non-partisan engineer and a Knight of Labor, it created considerable excitement among them—not that this class of politicians are so adverse to the Knights of Labor as their action would imply; but the fact was, they were disappointed that the mayor had the independence to go outside of their circle and appoint a practical engineer instead of a professional politician.

But Mayor Hewitt was equal to the occasion, and when his motive for making the appointment was questioned, made the following manly reply:

"I did not know when I made the appointment that Mr. Bayles was a Knight of Labor, but if I had, that fact alone would not have made any difference to me. I should have appointed him anyway, because I believed him to be a competent man for the position. Had I known that he was a member of the order, I might have asked him if he approved of the methods of the Knights, and the manner in which they acted during the last strike. If he had said he did approve of them, I should certainly not have appointed him as president of the Board of Health. But I believe that Mr. Bayles is opposed to such actions, and would not for a moment tolerate them.

"I am not opposed to trade organizations when they do not violate individual rights. What I am opposed to is their dictation and their assumption of the right to say who shall and who shall not work. Like Cardinal Gibbons, I find the paper declarations of the Knights of Labor to be beautiful. I am opposed to them when they violate these paper declarations. Mr. Bayles I believe to be a sensible man, and I think he will fill the place he now holds creditably. He has a perfect right to belong to any organization he sees fit. What I'm fighting for is liberty of action. If a man wants to join the Knights of Labor, let him do so, but don't let them try to compel other men to join the organization who do not want to have anything to do with it."

Asses' Milk Diet.

In France, where the authorities do so much for the protection of the people at large, by their watchful care to prevent accidents to the work people, and their extensive provision for the protection and maintenance of homeless children and those of miserable parentage, the administration of the hospitals and other public institutions are constantly experimenting in the treatment of their inmates. Quite recently the administration of the Assistance Publique, in Paris, has decided to employ asses' milk at the Hopital des Enfants Assistes. For a while the administration substituted goats' milk for human milk; but the infants did not thrive upon it. The administration has now provided ten asses, which are kept in the stables of the hospital with their young. Each ass is capable of nourishing three children besides its own young for the first three months, and two children for the two following months. After this period it is capable of nourishing one child until the ninth month.

The superior soothing and nourishing qualities of asses' milk over that of the cow, or goats' milk, has been long known, and many persons who have suffered with dyspepsia, and after trying numberless remedies and been abroad for treatment, have returned with health restored, the result attributable to the use of asses' milk taken warm from the udder.

The writer has in mind a lady who had suffered an aggravating form of dyspepsia, until her digestive organs had become so impaired that the simplest diet could not be taken without producing great distress. She had been under the care of physicians of nearly every school of practice in this city, and finally she was taken to a neighboring city and placed under the care of a doctor distinguished for his successful treatment of dyspepsia. His system consisted principally in secluding his patients from their families and friends and requiring them to remain in bed for several weeks. After some three months' perfect rest (for even the reading of books or newspapers was denied her), and the daily application of electricity by an assistant of the distinguished practitioner, and the equally frequent application of oil and rubbing-in process by a faithful female attendant, the lady had become so weak it was with difficulty she could get out of her bed. Her food was specially prepared at the chemist's, under the direction of the doctor, but every variety she tried distressed her, and finally, as soon as a little strength had been restored, she returned to her home and resumed the milk diet, which, from long experience, she had found to produce less distress than any other. The rest cure, as it is called, was, in this lady's case, a failure, and what should be the next experiment to try was a question of serious discussion for some time, and, with many misgivings as to the result, it was decided to try a season abroad, and it was in France the diet of asses' milk was recommended and tried with the most beneficial results.

From the observation of the writer, we believe that suffering dyspeptics and delicate children may be relieved of a great deal of misery and precious lives saved by the more universal use of asses' milk, the virtues of which seem to be better understood on the Continent than by physicians in this country.

Vulcabeston.

This is the name of a new article, intended to combine all the valuable qualities of asbestos and India rubber, of which, as its name indicates, it is mainly composed, although other vulcanizable materials enter into its composition. It forms a substance of the toughness of horn, although it can be made of any degree of flexibility; it is a non-conductor of electricity, and stands the severest test of acids, steam, gases, etc. From its quality of permanently resisting heat, which has been so long known as the characteristic feature of asbestos, it has been adopted by the United States Government for use around steam engines.

One of the most important uses of the new article is as a moulded piston rod packing ring, made to fit any sized rod or stuffing box, and to be sprung in place with a slight pressure, one or more rings being used as desired, and forming a perfectly tight steam joint. These rings do not wear the rod as do metal rings, and they are self-lubricating. The first set made of these rings has been in use over eleven months, in a Hartford, Conn., manufactory, on an engine run at 280 strokes per minute, and is still in perfect order, and said to be in as good condition as when first put in.

Vulcanized asbestos piston rod packing in the form of flexible rope, of all sizes, will not shrink or blow out, and is especially adapted for use on locomotives and ocean steamers, and in other places where loss of time in repacking is of the greatest consequence, and when the use of ordinary steam packings would, consequently, be entirely inadmissible. In consequence of its great strength and durability, it can be used wherever metallic packings have heretofore been necessary.

The new vulcabeston is made into sheet packing, hard, medium, and soft, in sheets or rolls, in all sizes of round and oval gaskets, and in hard and medium moulded piston rod packing rings of all the regular sizes, any special forms being readily made to order. The vulcabeston can, if desired, be made of any color, and is thus well fitted for a variety of ornamental work and other special uses.

Vulcabeston is manufactured exclusively by the Johns-Pratt Company, of Hartford, Conn., Mr. Johns, of the widely known H. W. Johns Manufacturing Co., of New York, and whose name has for more than a quarter of a century been prominently identified with all manufactures of asbestos materials, being at the head of the business.

Proving the Soundness of an Eye.

In a large factory in which were employed several hundred persons, one of the workmen, in wielding his hammer, carelessly allowed it to slip from his hand. It flew half way across the room, and struck a fellow workman in the left eye. The man averred that his eye was blinded by the blow, although a careful examination failed to reveal an injury, there being not a scratch visible. He brought a suit in the courts for compensation for the loss of half of his eyesight, and refused all offers of compromise. Under the law, the owner of the factory was responsible for an injury resulting from an accident of this kind; and although he believed the man was shamming, and that the whole case was an attempt at swindling, he had about made up his mind that he would be compelled to pay the claim. The day of the trial arrived, and in open court an eminent oculist retained by the defense examined the alleged injured member, and gave his opinion that it was as good as the right eye. Upon the plaintiff's loud protest of his inability to see with his left eye, the oculist proved him a perjurer, and satisfied the court and jury of the falsity of his claim. And how do you suppose he did it? Why, simply by knowing that the colors green and red combined make black. He prepared a black card on which a few words were written with green ink. Then the plaintiff was ordered to put on a pair of spectacles with two different glasses, the one for the right eye being red and the one for the left eye consisting of ordinary glass. Then the card was handed him, and he was ordered to read the writing on it. This he did without hesitation, and the cheat was at once exposed. The sound right eye, fitted with the red glass, was unable to distinguish the green writing on the black surface of the card, while the left eye, which he pretended was sightless, was the one with which the reading had to be done.—*Pottery Gazette.*

Oxygen in Vital Phenomena.

Some interesting information is given by Dr. B. W. Richardson respecting the influence, under varying conditions, of oxygen in vital phenomena (*Asclepiad*). It was obtained by inclosing mice in glass chambers containing atmospheres in which the proportion of oxygen varied with the experiment, and observing the time that lapsed before the animals became narcotized at different temperatures. It was found that, at a temperature of 55° F., when oxygen and nitrogen were present in the proportion of 1 and 4 (*i. e.*, common air), the animal became narcotized, and died asleep, in one hour and fifty minutes. In two parts of oxygen and three of nitrogen, as well as in three of oxygen and two of nitrogen, the animal remained free from narcotism thirty minutes longer, but eventually became rapidly narcotized, and died within two minutes of the same time. But with four volumes of oxygen and one of nitrogen, narcotism did not occur for two hours, and then lasted six hours before death took place, while with pure oxygen narcotism was also deferred for two hours, but only lasted four hours.

When an animal was placed in a vessel five times as large as those previously used, containing common air, so that the quantity of oxygen present was equal to the smaller atmosphere of pure oxygen, narcotism did not occur until after nine hours, and death after eleven and a half hours, which indicates the vital value of nitrogen as a diluting agent. In the case of the pure oxygen the larger proportion of the gas remained unchanged, and five similar experiments were made before sufficient carbonic dioxide was formed to cause asphyxia. When the temperature was lowered to 20° F., the effect was to reduce the vital combining power to such an extent that oxygen became practically an anæsthetic gas; in pure oxygen the animal was narcotized in a few minutes and died in half an hour, while in common air the animal remained longer awake, but died in forty-five minutes. When temperature was raised to 70° and 90° F., pure oxygen sustained life longer than common air in equal volume, but at 125° F. coma and death took place in fifteen minutes.