thereon by a spring latch. This cylindrical part may be disengaged from the latch, moved outward, and swung into a right angular position as shown in Fig. 1, to be used as a lever to turn the wrench.

For further information relative to this invention address the patentees, Messrs. Augustus J. O'Neill and Henry Reinhart, in care of Parrot Smelter, Butte City, Montana.

THE DEFENSE OF NEW YORK.

It has for many years been patent to every one that New York City, with the great industrial forces and vast aggregate of wealth concentrated around what is known as the Port of New York, are entirely without defense against such an attack as might be made by the vessels of any first class power with but a few hours' notice. The forts at present guarding the entrance to the harbor would not protect the city from the long-range guns now in use, and in heavy armored vessels, and the high-powered ordnance therefor, by which such attack might be repelled, we have as yet nothing that will compare with the great ironclads of several of the European powers. The matter has for several years had much consideration by eminent engineers of the government War Department, but no complete system, adequate as a permanent and thoroughly effective defense, has yet been decided upon, although the Fortifications Board has declared the urgent need of such work, not only at New York, but at twenty-seven of our seaports, New York coming first on the list, Boston second, and San Francisco third.

The illustrations on our first page present a plan quite unlike anything heretofore attempted anywhere for the construction of forts for the defense of the ocean approach to the city. It has been, in fact, only within a few years that such constructions would have been deemed at all possible, but such have been the recent advances in engineering methods and practice that not only does the plan appear practicable, but engineers are ready to-day to figure on the cost and at once commence the work. The plan we illustrate has been brought forward in its present shape by Mr. John F. Anderson, a New York engineer, and consists in the construction, on artificial islands, of three forts, each with a diameter of 500 feet, between Rockaway Beach, on the Long Island shore, and Sandy Hook point. The bird's eye view afforded by the principal engraving gives a good idea of their proposed location. They would be about two miles apart, and the same distance from each shore, so as to command all the channels of approach, while being from twelve to fifteen miles distant from the city.

At the points where it is proposed to place these forts there is now a depth of water of from twelve to twenty feet, but with deep water on all sides in each case. The manner of their construction is not unlike that of several large engineering undertakings which have been successfully prosecuted by Mr. Anderson. There will first be built, of iron or steel, a double-walled circular caisson having an outside diameter of 500 feet and an inside diameter of 400 feet. The inner and outer shells of the walls of the caisson will be suitably tied together by cross rods and braces, and the bottom of this space will be shaped to form an inner and outer cutting edge, with an intermediate working chamber, as shown in the sectional view at the middle of the page, while vertical working pipes or wells will be placed at frequent intervals. This structure will be towed to the proper position over the shoal where the future island fort is to be made, where it will be sunk by opening valves in the bottom. The space between the outer and inner walls is then to be weighted with concrete, and at the same time the sand underneath the structure is excavated through the wells in the ordinary manner, so that as the excavation proceeds, the caisson will continue to sink evenly, and a solid wall of concrete will be built up within the iron shells.

The excavated material passed up through the working wells would be dumped on the inside, to fill the area inclosed by the walls. The remainder of the interior filling would be readily accomplished by means of steam sand pumps or dredges, which would take up sand from the sea bottom outside the fort, and dump it within the inclosure. Thus the principal materials required for the work are ready at hand.

The plates forming the shell for the walls would not necessarily be carried up further than was required by the sinking of the caisson, but, although the walls of this fort would be fifty feet thick, it is probable that their outer face would be provided with a belt of nickel steel or other approved armor. The guns with which such fortifications would be provided would, of course, be of the heaviest and most effective kind, and they would probably be mounted in armored turrets, whereby the guns and gunners would be protected during loading and training. An oscillating turret for heavy guns, operated by hydraulic rams, is now in use in France, with which a crew of five men and one officer are found sufficient to fire a 100 ton gun twice in three minutes. There are also various methods of mounting heavy guns on disappearing carriages and lifts, whereby the gun will be exposed to an enemy's fire only at the moment of firing, and a fort of the character described would afford facilities for mounting and working such an armament far superior to those which could be provided on the largest war vessels.

Another feature proposed by Mr. Anderson in the plan for these forts is to have a portion of their interior left partially open on the New York side as a harbor for torpedo boats or rams.

In the view at the top of the page one of the proposed forts is shown, presenting a space of about five acres, with temporary buildings occupying a portion of its area, in the manner it would probably be used in time of peace, a bomb-proof magazine being centrally located almost entirely underground. The top of this magazine would be protected with any required number of heavy plates, and underground passages would probably lead from it to each gun or battery.

Mr. Anderson has roughly figured up the cost of building an island such as here described, and estimates that three of them could be built at an expense of about one million dollars each. His approval of the scheme as entirely practicable, and the moderate figure at which the outlay for such defensive works is placed has caused considerable attention to be attracted to the plan. Mr. Anderson now has a contract with the government for building a lighthouse off Cape Hatteras, he has built the foundations of many of the most important bridges in the country, and in the building of the Hawkesbury Bridge, at New South Wales, Australia, he successfully carried down piers 155 feet below the water line and 108 feet below the bottom. It is not expected that the caissons for the proposed island forts would have to be carried to a great depth to obtain a firm foundation.

Taking Care of Ropes.

An article in a recent issue of the Chicago *Journal of Commerce* gives some interesting and valuable information regarding ropes, from which the following extracts are made. It is stated that the reason why it is necessary to take out the "turns" in a new rope, and that it is untwisted when first put to work, is that in making ropes, the fibers are first spun into yarn, this yarn being twisted in a direction called right hand. From twenty to one hundred of these yarns are then put together and twisted in an opposite direction, or left handed.

This forms a single strand or rope; from three to four of these strands are again twisted together, and it will be noticed that as this twisting is again in the right hand direction, it untwists the strands and again twists up the yarn. When a weight is placed upon one end of the rope, its tendency is to untwist and become longer, and the untwisting will continue until the strain of the untwisted strand just equals the strain of the yarn being twisted together.

If it were possible, in making a rope, to put in just enough twist so that these strains should balance each other, then there would be no necessity for taking out the turns when a new rope is put to work. The greater the twist, the harder the rope, and to the contrary, a rope with little twist is much softer and stronger. The reason for this is easily seen, as in a tightly twisted rope the strain does not come as near in the direction of the length of the rope; that is, the fibers lie at a greater angle to the axis of the rope, and weight upon the rope forms a breaking instead of a stretching strain.

Ropes sometimes wear out internally while apparently sound outside. This is caused by bending the rope over a sheave. In doing this the fibers slide a small distance upon each other and eventually wear out. In the best ropes this wearing out is prevented by lubricating the strand with plumbago, mixed with a small quantity of tallow, just sufficient to hold it in place.

In designing pulleys, they should not be made less than forty diameters of the rope; this is the limit of economical wear and they may be made as much larger as practicable. The speed of ropes may vary from 2,500 to 5,000 ft. per minute. If five feet be taken as a minimum diameter of a pulley for a rope one and a half inches in diameter and running 2,500 ft. per minute, the pulley should increase one foot in diameter for each 1,000 added revolutions per minute.

Imitation of Marbles.

Good Portland cement and colors that take on that material are mixed dry and made into a paste with the least quantity of water added. One paste has to be made for each color. The different pastes are placed on top of one another in layers of different thickness. The mass is pressed from all sides and beaten so that the colors of the different parts impress themselves on each other without uniformity. The result is that more or less deep veins penetrate the mass; this is then sawed into plates, which are pressed in a mould for twelve days, during which time it is necessary to keep them moist as long as they are not entirely hardened. The plates are polished in the same way as marble.

Census Adventures in Alaska.

A recent report of progress in taking the census of Alaska has been issued by the U. S. Census Office in the form of a bulletin. It comprises a preliminary report by Mr. Ivan Petroff, special agent in charge of the Alaska division, and embodies a vivid picture of the difficulties encountered in getting results in the northernmost regions of the United States. After a preliminary trip in the mail steamer, a second trip was undertaken from San Francisco to the shores of the Bering Sea, at Nushegak, in a leaky little steamer of only 25 tons burden. Special agents for different sections were appointed and sworn in on these voyages. To reach one special agent a voyage up the Nushegak River was undertaken, but failed, owing to his recalcitrant Indian paddlers. On returning to Nushegak, the U. S. Fish Commissioner's steamer Albatross took the party on board, and after six days landed them on an inhospitable shore, with a crew of Indians, mostly sick from pneumonia. The work, in spite of all obstacles, was accomplished, Mr. Petroff having divided the territory into six districts and organized a force of special agents familiar with the many languages spoken there. His journeys aggregate some 12,000 miles, while the special agents will probably travel over five times as much ground to cover Alaska's 570,000 square miles of territory.

Effect of Copper upon Rubber.

In a paper read before the British Association, Sir William Thomson made interesting remarks relating to the decay of India rubber. The following extract, showing that copper has a marked effect upon rubber when in contact, will be noted with interest: Prof. Dewar observed, accidentally, that metallic copper, when heated to the temperature of boiling water, in contact with the rubber, exerted a destructive effect upon it. With a view of finding whether this was due to the copper *per se*, or to its power of conducting heat more rapidly to the rubber, he laid a sheet of rubber on a plate of glass, and on it placed four clean disks, one of copper, one of platinum, one of zinc, and one of silver. After a few days in an incubator at 150° F., the rubber under the copper had become quite hard, that under the platinum had become slightly affected and hardened at different parts, while the rubber under the silver and under the zinc was quite sound and elastic. This would infer that the pure metallic copper had exerted a great oxidizing effect on the rubber, the platinum had exerted a slight effect, while the zinc and silver respectively had had no injurious influence on it. A still more curious result was this, that the rubber thus hardened by the copper contained no appreciable trace of copper; the copper, therefore, presumably sets up the oxidizing action in the rubber without itself permeating it.

The Use of the Diamond Drill by the Ancient Egyptians.

Mr. W. F. Durfee recently, in connection with his lecture at the Franklin Institute, Philadelphia, investigated the curious question of the ancient use of an annular drill, equivalent in mechanical action to the modern diamond drill. Through the U. S. Secretary of State and the U. S. Consul-General at Cairo, the Hon. Eugene Schuyler, a statement from Mr. Flinders Petrie was secured. It is this last named archæologist who originated the theory. The substance of the statement is as follows: In Mr. Petrie's "Pyramids and Temples of Gizeh" illustrations are given of samples of work, showing in his judgment the use of jewel points in drilling and sawing. Various samples of this work he states are now in his own possession. In Egypt he cites six examples, some in the Bulak Museum and some at Gizeh. One is of special interest. In the granite temple at Gizeh there is found in one of the lintels of a door a drill hole with the core still sticking in it. Almost as interesting as this is a base of a tube drill hole between the feet of a statue of Chefren (Kofra) now preserved in the Bulak Museum.

A Life-Saving Invention for Use at Fires.

Mr. Alfred Harley, of Albany, N. Y., has invented a life-saving apparatus to catch those who are forced to jump from windows in case of fire. A cushion or mattress is carried upon a suitable carriage or running gear. Springs of long range of action are placed intermediately between the mattress and carriage frame. The whole is so light that it can be very speedily dispatched to the scene of conflagration. The springs are not the only feature of construction. Under the stress of a falling body the mattress may descend nearly three feet. This might result in a disastrous rebound. To prevent such action, dashpots or air cushions are applied, as in the well known door checks, so that the mattress gradually rises to its normal level. Deflecting wings are provided that increase the effective area of the apparatus to about 100 square feet. It is claimed that with the ordinary life-saving net the jumper must be an expert as well as the men who catch him as he descends. Mr. Harley's contrivance eliminates to a great extent the expert element, and would seem to be a most useful advance on the old form of net.

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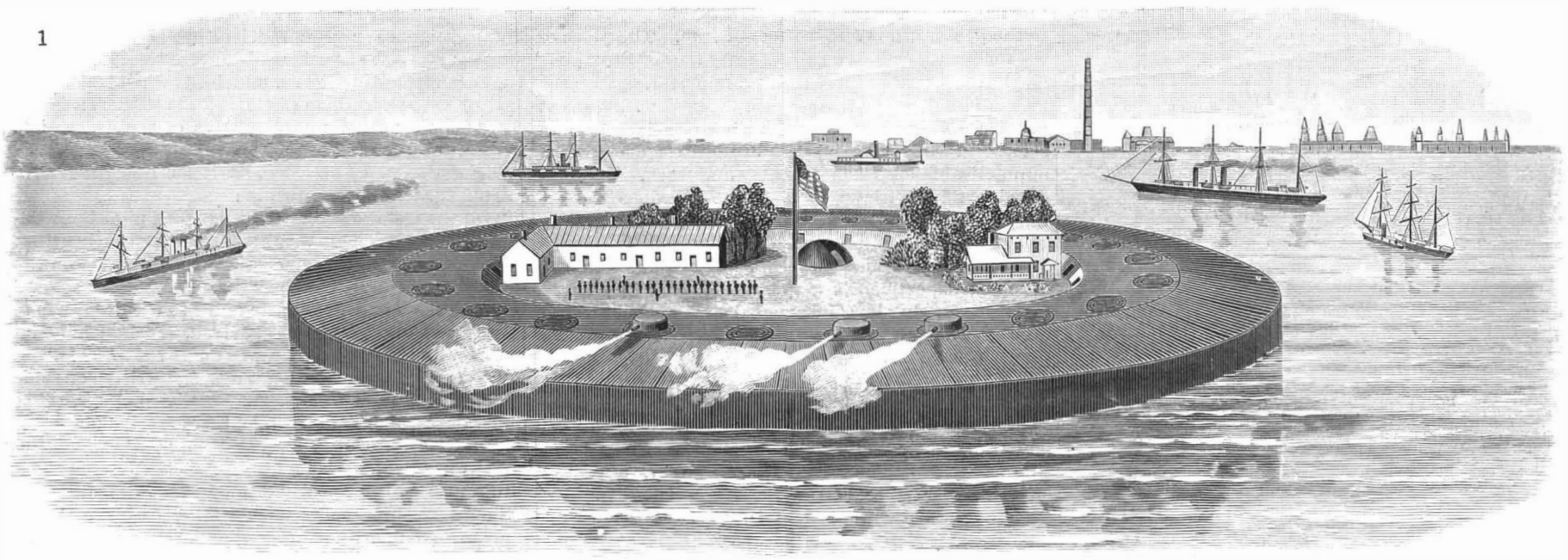

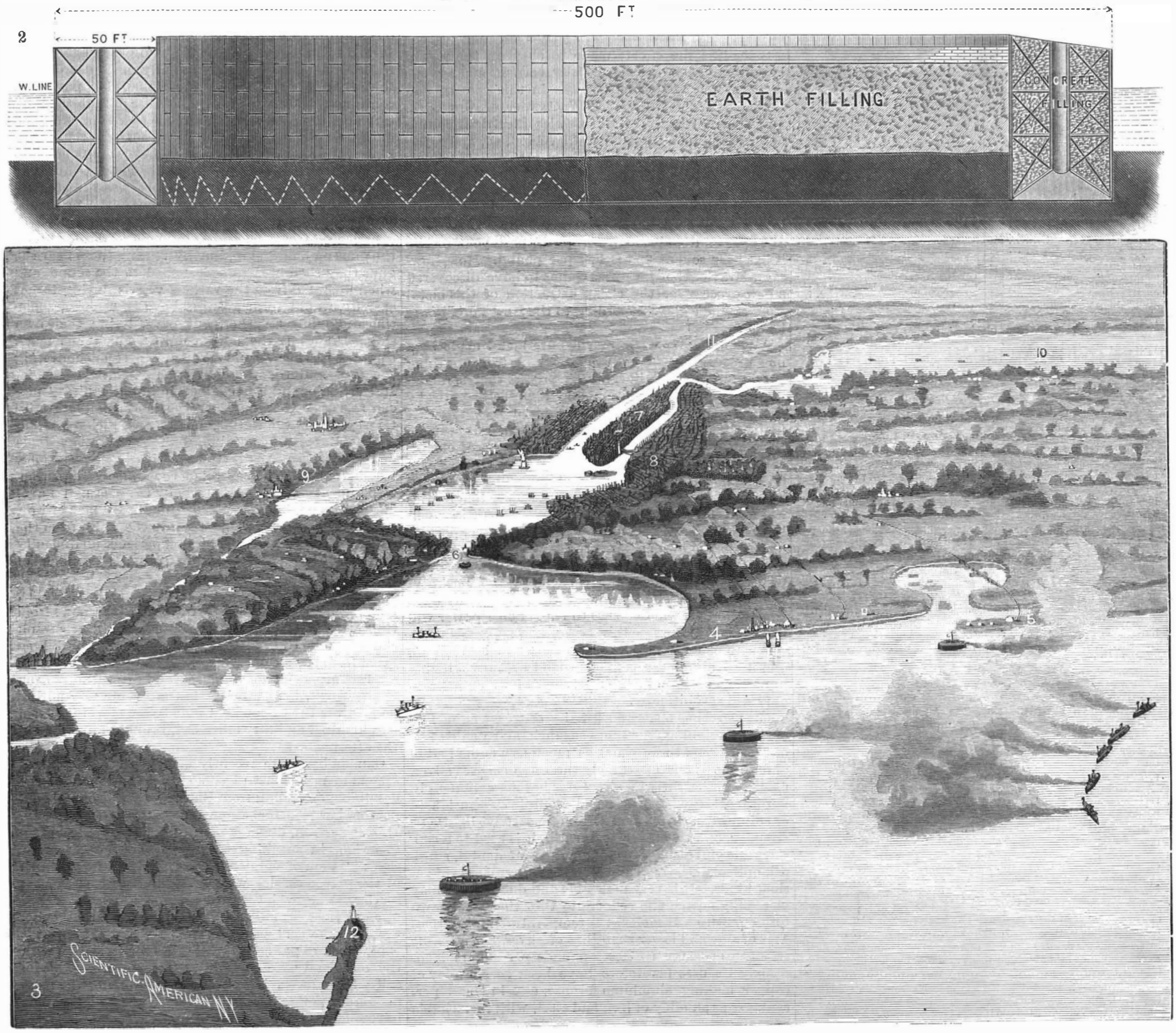

1. A. Anderson fortress. 2. Sectional elevation of the fortress caisson. 3. Bird's eye view of New York harbor and surroundings. 4. Coney Island. 5. Rockaway Beach. 6. The Narrows. 7. New York City. 8. Brooklyn. 9. Newark Bay. 10. Long Island Sound. 11. Hudson River. 12. Sandy Hook.

ANDERSON'S PLAN FOR THE DEFENSE OF NEW YORK.—[See page 356.]