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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN, BUILDING EDITION.

(Illustrated articles are marked with an asterisk.)

Subscription, $2.50 a year. Single copies, 25 cents.

THE NEED FOR MORE ARMORED CRUISERS IN OUR NAVY.

We feel constrained to urge again the necessity for the addition of more armored cruisers to our navy. The naval appropriation bill this year is, we believe, not yet past the stage where it is possible for changes to be made, and we are firmly convinced that the interests of the country will be served by the reconsideration of this very important question. We think that the bill, as finally signed by the President, ought certainly to include provision for at least two or three of this invaluable type of ship. Even if they were to be included at the cost of some of the coast defense monitors already provided for in the bill, we are strongly of the opinion that the new programme of construction would gain in strength. If it is considered that the monitors are imperatively needed, the appropriation, large though it already is, should be increased to the extent necessary for the construction of more of these serviceable ships.

The fact that Spain has a fleet of 20-knot, heavily armed and armored cruisers at sea, threatening to strike at one of half a dozen important points, and capable, after striking a blow, of escaping by virtue of its superior speed from our powerful battleships and monitors, emphasizes the value of this type of vessel both for offense and defense. For it is evident that the proper safeguard against a fleet of armored cruisers is a fleet of the same kind, having the same combinations of high speed, powerful guns and good protection. At present we have only the "Brooklyn" and the "New York." If we had but twice this number, we could dispatch the quartet against the Cape Verde fleet, with the certainty that they could catch and destroy it. But, as matters stand, we have no two armored ships with sufficient speed to enable them to cruise in company with the "Brooklyn" and "New York" and join with them in a full speed pursuit of the enemy.

Beyond all doubt the most pressing need of the navy is the addition of more "Brooklyns" and "New Yorks" to its fighting line. In the United States navy there are now built, building or authorized thirteen battleships and ten monitors, making a total of twenty-three heavily armored vessels. If any general criticism can be made of this, our first line of defense, it is that it lacks in mobility—that while it is admirable for defense, it is not capable of those swift movements which at a critical time may turn the fortunes of a campaign. The addition of two or three 20-knot armored ships, however, would remove this defect and render us capable of making a swift concentration of powerful ships at any desired point, either for attack or defense. Such a fleet distributed among our seacoast cities and capable of quick assembling would effectually dispose of the bugbear of bombardment by the enemy.

It should be borne in mind that unless provision is made in the present bill for additional armored cruisers, it will probably be four years before we shall have any more of this class afloat. One year, at least, will intervene before the matter can again come up for consideration, and it would probably take three years after authorization before they could be put in commission.

We cannot but feel that should the changes suggested above not be made, our navy of the year 1901 will be very ill balanced in its composition.

THE CAPE VERDE FLEET AND THE "OREGON."

What is the probable destination of the fleet of armored cruisers and torpedo boat destroyers which recently set sail from the Cape Verde Islands? Has it gone north to effect a junction with the second division of Spanish ships now about to sail from the mainland? Is it on its way to cruise along our northern coasts and inflict what damage it can upon our less strongly fortified cities? Will it attempt to make Porto Rico and shelter itself inside the harbor mines and beneath the guns of the fortifications and await there the arrival of the second squadron; or, is it now off the coast of Brazil, strung out in scouting order across the track of the "Oregon," waiting to close in, on sighting her, and crush the ship by the sheer force of numbers?

There has been much fear expressed that the last is the move which has been undertaken, and that, before any reinforcements can reach her, the "Oregon," with her little consort the "Marietta" and the unprotected "Buffalo" ("Nictheroy"), will find herself confronted by an overwhelmingly superior force. It seems to us, however, that, in spite of the tempting opportunity presented to get rid of one of our four first-class battleships, the cost of victory will appear too great to warrant the attempt. Leaving out of consideration the unarmored and unprotected "Marietta" and "Buffalo," which would only invite destruction by coming within range of the 11-inch guns of the Spanish cruisers, we think that the tremendous offensive and defensive powers of the "Oregon" should enable her to sink one or two of the enemy and seriously cripple the others before she was sent to the bottom, for it goes without saying that no American flag will ever be struck in the present war.

The Spanish fleet consists of four cruisers: the "Cristobal Colon," "Oquendo," "Maria Teresa" and "Vizcaya." The first ship is, we think, the best of the four, and, taken all round, is perhaps the most formidable, though by no means the largest, in the Spanish navy. She is an Italian built ship of 6,840 tons and 20 knots speed, and carries a complete belt from stem to stern of 6-inch Harveyized steel, while above this is a continuous armored redoubt of 6-inch Harveyized steel which protects a battery of ten 6-inch rapid-fire guns. Above this again is another battery of six 4·7-inch rapid-fire guns protected with 2-inch plates and revolving shields. The heaviest armament consists of two 10-inch armor-piercing guns in 6-inch barbettes. There is a secondary battery of ten 6-pounders and ten 1-pounders. The three others are sister ships. Two of them are familiar to residents of New York, the "Maria Teresa" having lain in the North River during the Grant dedication and the "Vizcaya" visiting this port shortly after the "Maine" was destroyed. Each ship is of 7,000 tons displacement and twenty knots speed, with a 3-inch deck, 12-inch waterline belt and 10½ inches of steel protecting the heavy guns. Each is armed with two 11-inch guns, ten 5½-inch quick-fire guns, and fourteen 6-pounders and 1-pounders. The three destroyers are of about 400 tons displacement and 30 knots speed.

Now, what has the "Oregon" to oppose to the four cruisers (we will suppose that the "Buffalo" and the "Marietta" can take care of the destroyers) in a battle upon the high seas? To the two 10-inch and six 11-inch armor-piercing guns, whose total energy is 132,000 foot-tons, she could reply with four 13-inch armor-piercing guns, with a total energy of 134,500 foot-tons. In addition to this, if the attacking ships ranged on one side of the "Oregon," she could reply with four 8-inch guns of 32.000 foot-tons energy, and if on two sides, she could reply with eight 8-inch guns of 64,000 foot-tons combined energy. In ability to pierce the vitals of the enemy, it will be seen our ship has an advantage of 34,500 foot-tons over the combined Spanish fleet. In respect of protection, the "Oregon" is even stronger than she is in heavy gun fire. To reach her 13-inch guns, the 11-inch shells of the enemy must penetrate at least 15 inches of face-hardened Harveyized steel. To get into the engine or boiler rooms they must pass through 18 inches of the same protection. Now, the Spanish 11-inch gun is barely able to penetrate 15 inches of common steel at 2,000 yards (the probable fighting range), and it can do this only if it strikes at right angles to the surface of the target and if the steel plate is of the ordinary quality. The "Oregon's" steel armor, however, is face-hardened, and would easily break up or resist complete perforation by such few shells as might strike normal to the surface. We are now speaking of the vitals and the main gun positions, and, turning to the Spanish cruisers, we find that they have only 10½ and 12 inches of an inferior grade of armor (i. e., inferior to our Harveyized steel) to oppose to our 13-inch guns, which are capable of penetrating 20 inches of steel at 2,000 yards. Now, these guns, because of their excellent protection, could fight for hours with little likelihood of being disabled, and the question arises what would become of the Spanish barbettes and waterline belts in the meantime? Under the excellent marksmanship which characterizes our gunners, it is safe to say that in a stand-up fight of any duration the "Oregon" would disable every heavy gun of the enemy and place her 13-inch shells in the vitals of every cruiser.

There are other elements of strength and weakness, however, which must be considered. In the matter of heavy rapid-fire guns, the advantage would be the other way, the cruisers being able to open fire from one broadside with five 6-inch, fifteen 5½-inch and three 4·7-inch rapid-firers. To this we could oppose from one broadside two 6-inch slow-firers. Taking the average assumed speed of fire per minute for each type of gun, the energy of the metal thrown by the cruisers in one minute would be about 500,000 foot-tons against 10,000 foot-tons for the slow-firers of the "Oregon." The effect of this awful hail of bursting shells would depend upon the accuracy of the Spanish gunners and the part or parts of the "Oregon" against which it was directed. It would be harmless against the 17-inch barbettes, the 15-inch turrets or the 18-inch belt. If it were directed against the thin plating beneath the 8-inch gun barbettes the guns would, of course, be put out of action. The real danger would be that it would be aimed at the unarmored ends of the vessel beyond the armor belt, which would be blown away and admit water above the protective deck, throwing the ship off an even keel and interfering with the working of the main guns.

The greatest danger, however, to the "Oregon" would be from the ram, and it is probable that the swift cruisers would close in from opposite sides in the effort to deliver the fatal blow before they had themselves received a mortal blow from her powerful guns. It is certain she could be sunk by these tactics, but it is more than probable that she would cripple all of her antagonists and eventually take one or more of them with her to the bottom.

Unless the Spanish naval authorities are criminally

ignorant of the fighting powers of our individual ships, they already foresee that the sinking of the "Oregon" would be a worse than fruitless victory, and would cripple their first line of battle beyond all future hope of meeting our fleet successfully in a general engagement. There would be nothing left for the crippled ships but to get home to the dry dock as best they could, and it would be months before Spain would be ready for active operations.

All the probabilities point to a combination of the late Cape Verde squadron with the home squadron which is gathering at Cadiz. This will probably include the battleship "Pelayo," 9,000 tons; the armored cruisers "Carlos V.," 9,235 tons; the "Cisneros," "Cataluna" and "Asturias," 7,000 tons, three sister ships to the "Vizcaya;" the protected cruisers "Alphonso XIII." and "Lepanto," 5,000 tons; and the two reconstructed iron battleships "Numancia" and "Vitoria," of 7,300 tons, which have been re-engined and armed with modern rapid-fire batteries. Not all of these ships are immediately available; but from a careful comparison of foreign references to their condition, it looks as though they would be ready for sea in two or three weeks. In view of the great strength of our fleet, it is not likely that Spain will send out her ships to be beaten in detail. A careful review of the situation leads us to believe that, if we do not take the initiative, Spain will send a modern armada of some thirteen warships across the Atlantic within the next thirty or forty days.

It would be a formidable fleet of thirteen ships; but with the memory of Dewey and Manila fresh in our minds, we have no misgiving as to the result.

TO OUR SCIENTIFIC AMERICAN SUPPLEMENT SUBSCRIBERS.

We feel that an apology is due to those subscribers of the SCIENTIFIC AMERICAN SUPPLEMENT whose copies of the Special Navy Edition may have put in a belated appearance. When we arranged to bring out the Navy Special as the regular edition of the SUPPLEMENT, we did not anticipate that the edition would create the extraordinary demand which has arisen. In spite of the fact, however, that we had made what we considered ample provision for an increased sale, the demand at once ran far beyond our expectations; and this fact, coupled with the unusual size of the edition, the preparation of the map, and the desire on the part of the editors to collect the very latest and most exact information regarding the navy, is answerable for a delay which, much to our regret, our best efforts have been unable to prevent.

Our readers may be interested to know that, judging from the inquiries which come into this office, public interest in the navy is not limited to any one section of the country. For some years many have thought that outside of the Eastern States there was little concern in the building up of our new navy. It appears, however, from the communications which we have received from the Pacific coast, the States of the middle West and from the South, that the whole country is earnestly desirous of getting reliable information concerning our first line of defense.

THE NEW YORK ELECTRICAL EXHIBITION.

The exhibition opened on Monday evening, May 2, at the Madison Square Garden, and was crowded with interested visitors and guests, who listened to the opening address by the Hon. Chauncey M. Depew with eager attention. Mr. Depew spoke of the marvelous development in the industrial applications of electricity, introducing many humorous and patriotic epigrams, and, finally, concluded by stating that he would fire a Spanish gun by a wireless telegraph system, which is one of the latest developments in electrical science. The experiment was successfully done, and out of a Sims pneumatic dynamite gun were shot portions of American and Cuban flags. He then illustrated how the "Maine" was blown up by exploding a miniature bomb in the fountain in the center of the hall, by a direct circuit, which threw up in the air a miniature model of the vessel. But, since the opening night, the bomb is exploded regularly, four or five times a day, indirectly through the wireless telegraph system, and is rather puzzling to those who do not understand it. We have had an opportunity ourselves to make the explosion, which is very effectual and certain. Briefly, the electrical waves passing through the air cause the coherer located near the fountain to close its relay, which puts into operation a local battery circuit, and heats the bomb fuse to redness, when the bomb immediately explodes.

President McKinley, from the White House, at Washington, sent a congratulatory telegram which was read by Mr. Depew, and at 8:47 p. m. the President pressed the key at Washington which opened the exhibition. Vice President Hobart sent a message by telephone which was recorded on a phonograph cylinder as delivered and then repeated during the evening by the phonograph.

On the main floor of the hall may be seen numerous forms of heavy electrical apparatus, such as large dynamos for electrical railways, pumping outfits, electrical heating apparatus and the practical application of electricity for uses of the household, including automatic electric elevators, electrical cooking utensils, hair curling irons, soldering irons, laundry irons, etc. There is also a novel display of the use of electricity for transportation purposes, such as four different kinds of electric vehicles operated by the storage battery system, on one of which was the placard that it had traveled 3,000 miles.

The bodies of most of the vehicles were capacious and of the piano-box plan for the purpose of providing storage room under and beyond the seats for the driving battery, but otherwise their appearance resembled that of an elegant victoria, surrey, trap, cab or a covered dry goods delivery wagon. One noted departure from these expensive styles is a carriage which has three wheels, the single front driving wheel being about three feet six inches in diameter and carrying a frame on each side for the support of the storage batteries as well as the motor. The pinion of this motor gears into a cog rack near the periphery of the wheel, at which point the power is applied. The promoters claim that thereby there is not so much leverage to overcome as when the power is applied to the axle. The controller and steering handles are hinged to turn one side when the occupant enters or departs from the carriage. The front wheel supporting the batteries presents a very queer appearance and would, we think, be likely to frighten horses. But, on the score of economy, it is an interesting application of electricity and may become popular.

Near this display of electric carriages is a full sized Stephenson electric street car, running on a track raised three feet from the floor and about fifty feet long, showing the complete construction and working of the underground trolley system as now adopted by the New York Metropolitan Street Railway. It is most effective in showing the practical possibilities of this system.

At the east end of the hall is a beautiful model twenty-five foot electric launch, which has the storage batteries and motor under the floor, and is furnished with six very comfortable chairs and a table. It might be termed a new form of house boat, so handsomely and conveniently is it equipped. Nothing but the steering wheel in the bow indicates that there is any machinery about it.

There is a large exhibit of mammoth storage batteries, now so generally used in electric lighting plants.

In the north basement are three types of gas-engine-driven dynamos, for lighting purposes, which demonstrate their economy over steam and adaptability for local lighting plants. These we shall allude to at some future time.

In one of the upper rooms of the building is arranged a very novel exhibit of the application of Mr. D. McFarland Moore's novel plan of lighting by means of vacuum tubes. He has arranged a room about 20 feet long by 10 feet wide to represent the interior of a small chapel, having an altar and organ at one end and pews on each side of a center aisle. There are eight Gothic arches, each one having electric luminous vacuum tubes formed to fit the curve of the arch, while one long tube made in two parts extends the length of the chapel under the ridge of the supposed roof. The lighting gives one the impression of twilight; it is bright enough to read print by, yet very soft, pleasant and agreeable. This, no doubt, is one of the attractions of the exhibition. In an adjoining room to the chapel is a working model of the third-rail system as applied to steam railroads.

The practical working of wireless telegraphy as at present perfected is one of the curiosities and novelties of the exhibition. In a glass case on one side of the hall is placed a storage battery and the transmitting instrument automatically operated by an electric motor and a switch wheel arranged to make the Morse alphabet signal of N and Y. The induced current from the induction coil is, at these intervals, discharged between the ball terminals, and coincident with the discharges one hears the ringing of an electric gong on the opposite side of the hall, about three hundred feet distant. Wires connect each instrument to the earth, but there is no connection through the air. We were informed that preparations are being made to send signals from the tower of the building to a receiver located in Jersey City, about five miles distant, and shall hope to be able to record the success of the experiment.

The New York Telephone Company has a model set of cabinets and exchange installations, while at one side is what is called the "theaterphone," a series of telephones connected to different theaters, by which one can hear the performance by telephone, a transmitter, of course, being located on the stage.

The exhibition will remain open afternoon and evening till May 31. It should attract many visitors, as there are many interesting and instructive exhibits.

Record from Honolulu Broken.

The steamer "Mariposa" arrived at San Francisco May 3 from Australia and Honolulu. She broke the record from Honolulu, making the trip in five days and twenty-three hours.

THE AMERICAN ISLANDS.

Mr. Alexander D. Anderson has an article in The Review of Reviews, in which he gives exact data respecting the ownership of the islands off our Atlantic coast.

	No. of Islands.	Area Sq. Miles.
Spain	2	39,562
American republics	1	26,247
Great Britain	54	11,570
France	3	1,103
Netherlands	5	434
Denmark	3	223
United States	0	0
Total	68	81,140

The above comprises simply the islands large enough to be named in atlases or cyclopedias. Looking at this list, it is amusing to recall the position taken by foreigners that the United States have no right to desire a transfer of any of these islands to her control, no reason to look askance at this line of foreign and always hostile possessions, and no interests that make these islands necessary to us! The question is often asked, Why is there so much hostile feeling among Americans toward England? and the answer is plain enough. Great Britain is the only nation that is arming herself against this country. We consider her course in this respect foolish, and one that she will pay a heavy price for some day, whatever the cost may be to us. It is, however, consistent with her policy in other parts of the globe and one that has led to great disturbance. Some comprehension of the dangers of such a course seems to have come to Lord Salisbury, who said in defending his policy in China: "I believe there is danger in our public opinion of a reaction to the doctrine of thirty or forty years ago, when it was thought that it was our duty to fight everybody and take everything. I think that a very dangerous doctrine, not merely because we would thereby excite other nations against us—and the reputation we now enjoy in Europe is not by any means pleasant or advantageous—but because there is a much more serious danger of overtaxing our strength. However strong we may be, there is a point beyond which our strength does not go. It is courage and wisdom to exert that strength to its attainable limit, but madness and ruin to pass it." As we see the situation on this side of the Atlantic, these words are pertinent to the course of the English in fortifying her islands.

The subject of Mr. Anderson's article is the American republics, says The Army and Navy Journal, and he shows that in January, 1800, ours was the only republic in the new world and its area was only 5 per cent of the surface of the two Americas, or, as he calls them, the three Americas. Spain held 7,028,628 sq. m., or 45·7 per cent; Great Britain, 3,719,109, or 24·2 per cent; Portugal, 3,209,878, or 20·9 per cent; United States, 827,844, or 5·4 per cent; Russia, 577,390, or 3·8 per cent; France, 29,352, or 0·01 per cent; Netherlands, 433, or 0·0 per cent; Denmark, 223, or 0·0 per cent. Total, three Americas, 15,392,858 sq. m. Spain's folly has lost to her nearly 7,000,000 sq. m. of her colonies, every mile of which has been republicanized, and now the distribution is: American republics, 11,632,426 sq. m., or 75·6 per cent; Great Britain, 3,626,352, or 23·6 per cent; France, 47,800, or 3 per cent; Netherlands, 46,494, or 3 per cent; Spain, 39,563, or 2 per cent; Denmark, 233, or 0·0 per cent. Total, 15,392,858. Our own growth has been from 827,844 to 3,602,990 sq. m., or from 5·4 to 23·4 per cent of the whole.

NEW TRANSATLANTIC RECORDS.

The magnificent fleet of liners that carry on the transatlantic traffic are steadily reducing the time which it takes to pass from the old to the new world. The great feat of the North German Lloyd steamship "Kaiser Wilhelm der Grosse," of last autumn, when she crossed at an average speed of 22·35 knots, still stands unchallenged; but some remarkably fast all day runs have since been made, one by this same ship and the other by the "Lucania," of the Cunard line. The latter vessel was queen of the seas previous to the arrival of the "Kaiser Wilhelm," having an average hourly record for the whole trip of 22·01 knots. This was eclipsed by the North German Lloyd ship when she maintained an average for the eastward trip to Southampton of 22·35 knots. About a month ago the "Lucania" eclipsed all previous records by maintaining 22·92 knots on an all-day's run, and this has now been surpassed by the German ship, which on its last westward trip maintained an average speed of over 23 knots for one whole day.

THE St. Petersburg correspondent of The Times writes, stating that he has had an opportunity of inspecting the first through train de luxe to be dispatched direct to Tomsk over the Siberian line, which in a few years more will run right on to Port Arthur. It is, he states, composed of four splendid cars built at Moscow and fitted with all the latest improvements and conveniences, including an open saloon, a dining car, a bath room, a library, telephones, electric lighting, refrigerators and ventilating apparatus, a piano, and means of gymnastic exercise.