

SCIENTIFIC AMERICAN

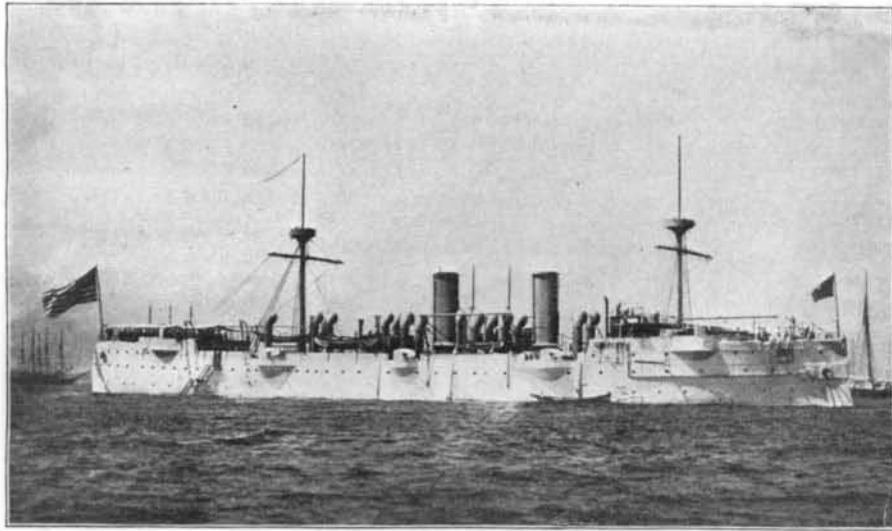
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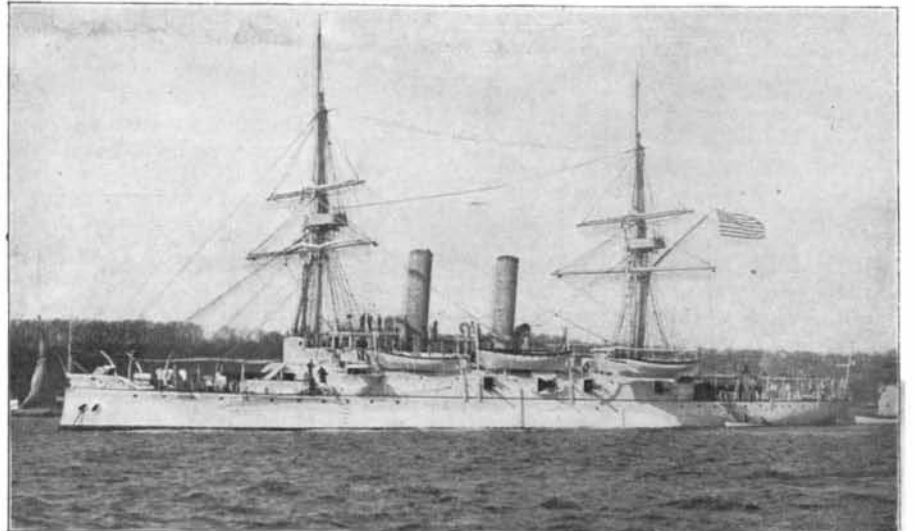
NEW YORK, SEPTEMBER 30, 1899.

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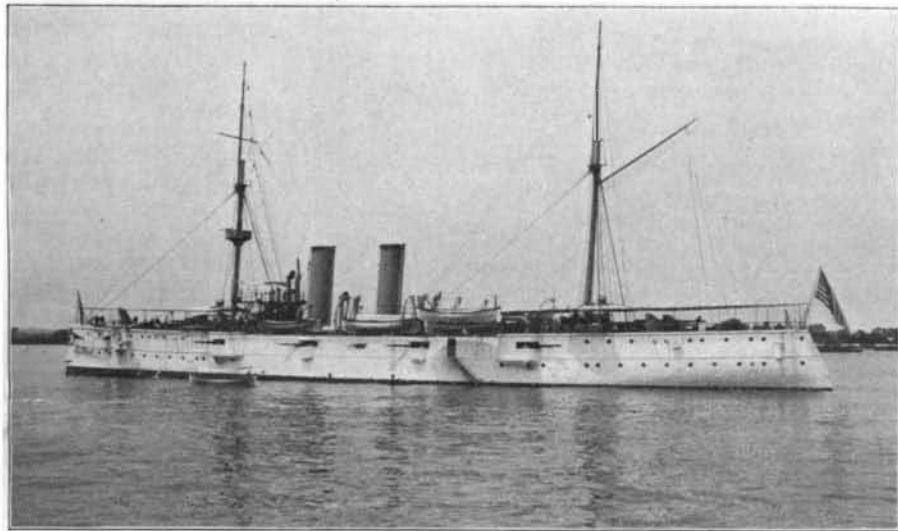
1.—Protected Cruiser "Baltimore."

Displacement, 4,413 tons. Speed, 20.1 knots. Maximum Coal Supply, 1,144 tons. Armor: Deck, 2½ inches on flat, 4 inches on slopes. Guns: Four 8-inch, six 6-inch B. L. rifles, fifteen 6-pounders and machine guns. Complement, 386. Date, 1888.



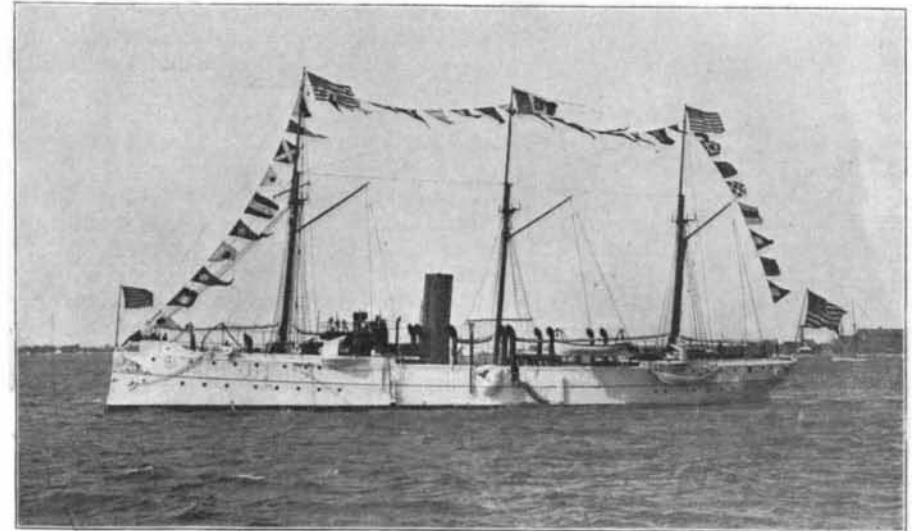
2.—Semi-protected Cruiser "Boston."

Displacement, 3,000 tons. Speed, 15.6 knots. Maximum Coal Supply, 496 tons. Armor: 1½-inch deck amidships. Guns: Two 8-inch, six 6-inch B. L. rifles, thirteen 6-pounders and machine guns. Complement, 278. Date, 1884.



Copyrighted, 1896, by W. H. Rau. 3.—Protected Cruiser "Raleigh."

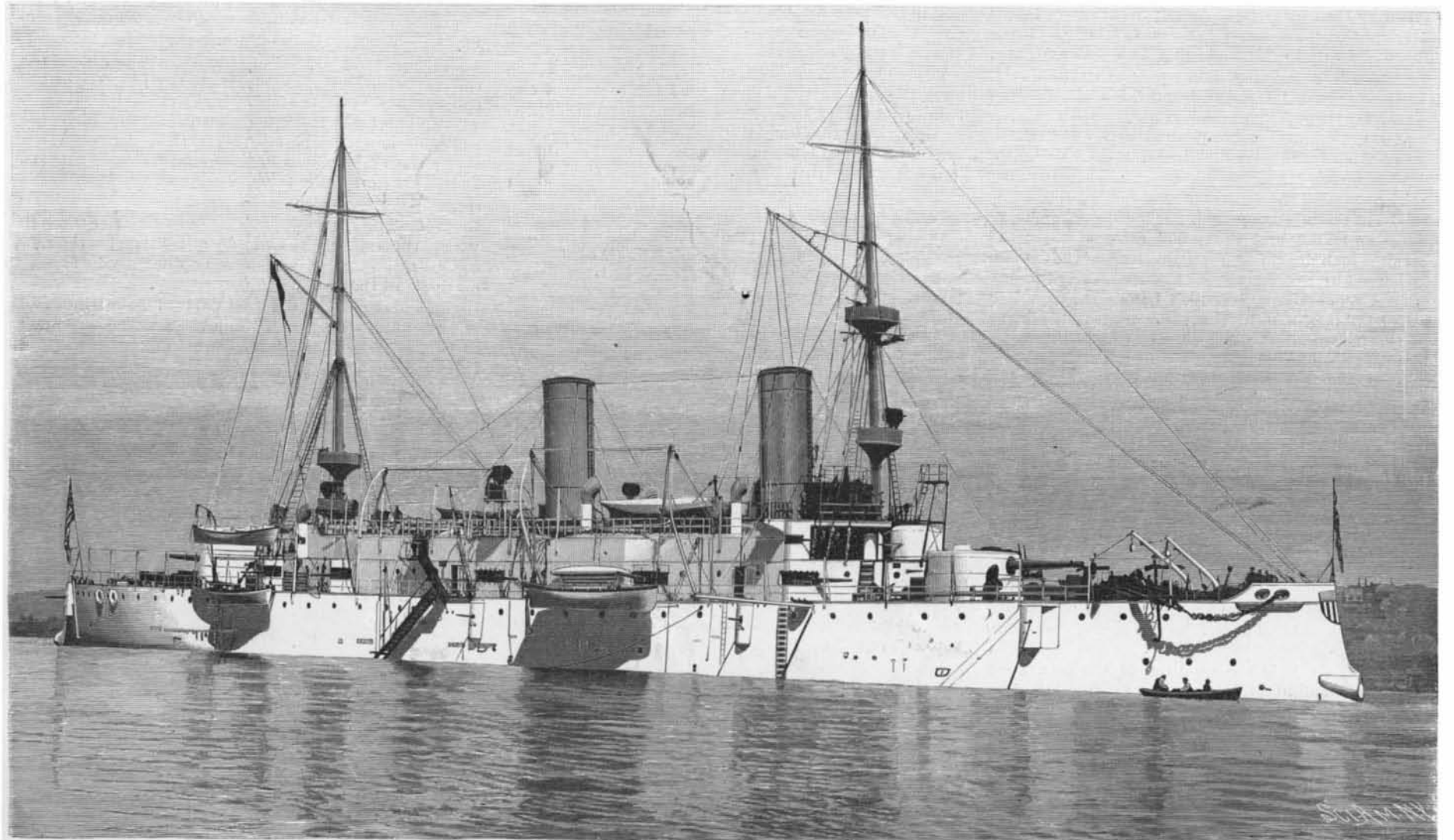
Displacement, 3,213 tons. Speed, 19 knots. Maximum Coal Supply, 460 tons. Armor: Protective deck, 1 inch on flat, 2½ inches on slopes. Guns: One 6-inch B. L. rifle, ten 5-inch rapid-fire guns, and thirteen 6-pounders and smaller guns. Torpedo Tubes, two. Complement, 313. Date, 1892.



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4.—Gunboat "Concord."

Displacement, 1,170 tons. Speed, 16.8 knots. Maximum Coal Supply, 401 tons. Guns: Six 6-inch B. L. rifles, nine 6-pounders and smaller guns. Complement, 194. Date, 1890.



5.—Protected Cruiser "Olympia"—Admiral Dewey's Flagship at Manila.

Displacement, 5,870 tons. Speed, 21.7 knots. Maximum Coal Supply, 1,170 tons. Armor: Turrets, 3½ inches; barbets and casemates, 4 inches; protective deck, 2 inches on flat, 4¾ inches on slopes. Guns: Four 8-inch B. L. rifles, ten 5-inch rapid-fire guns, twenty-four 6-pounders and smaller guns. Torpedo Tubes, six. Complement, 450. Date, 1892.

THE UNITED STATES NAVY—VIII. DEWEY'S FLEET AT MANILA.—[See page 216.]

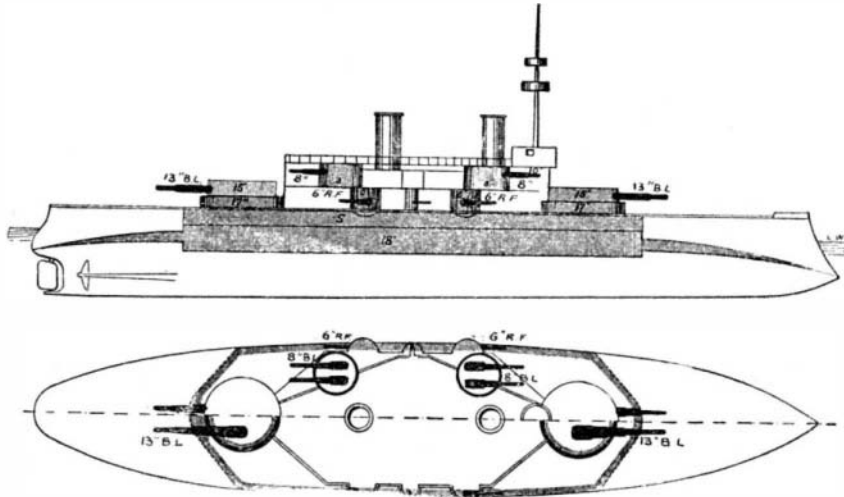
NAVIES OF THE WORLD.

VIII.—UNITED STATES.

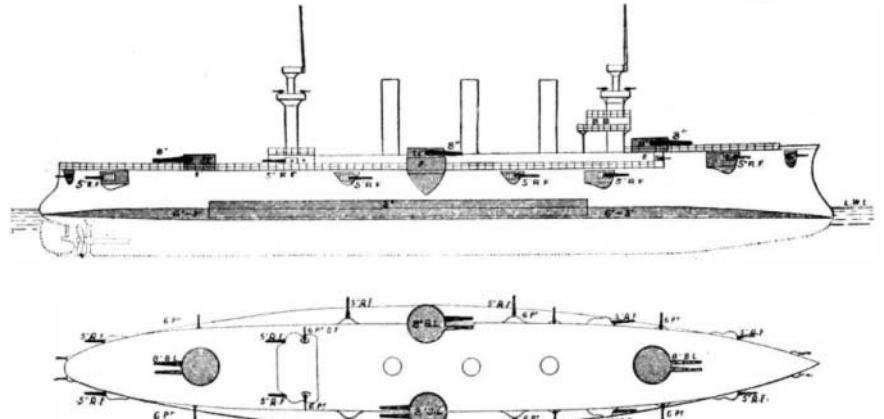
With the present article on the United States navy, we bring to a close the series on the navies of the world which has appeared in the SCIENTIFIC AMERICAN at regular intervals during the past few months. The return of Admiral Dewey and the completion of the two

strength of the various navies as represented by the ships that were either built or building at the beginning of the year 1899. In that comparison we found that judged on a basis of total displacement and reckoning only ships that were fairly well up-to-date, the United States stood fourth in rank, the number of ships and total displacements being as follows :

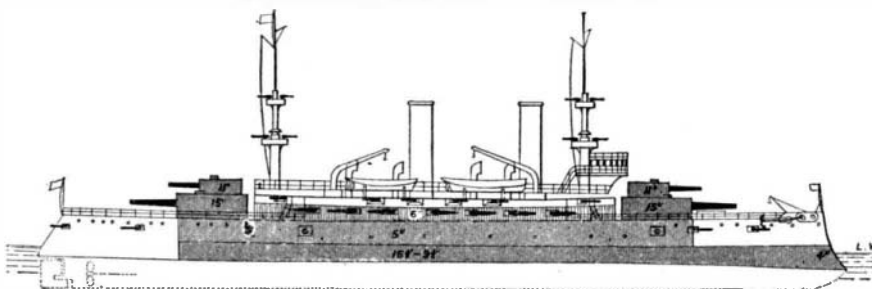
placement represents armored vessels. Of the total displacement, 200,806 tons consists of battleships, monitors, and armored cruisers, while the unprotected cruisers and gunboats represent a total of 110,904 tons. That the new navy should be strong in defensive qualities was to be expected, seeing that in the first decade of its construction our naval policy was laid



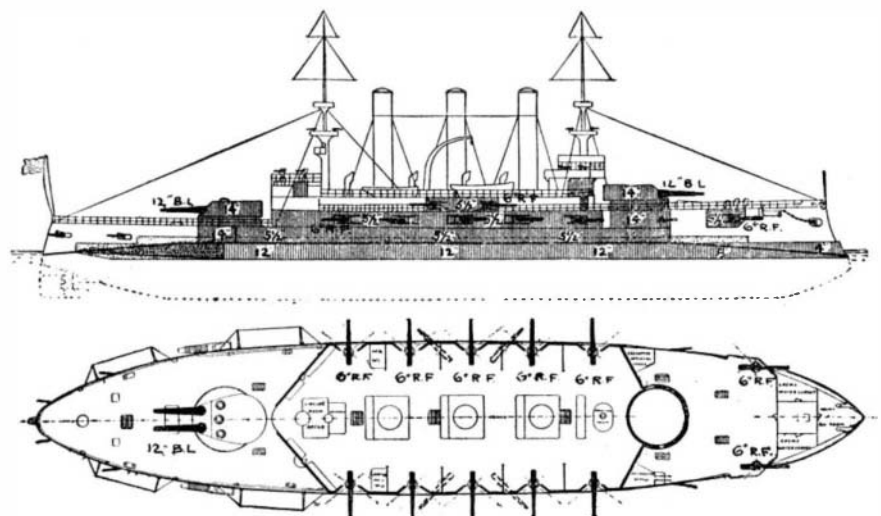
First-class Battleship "Oregon." Class of Three Ships.
Displacement, 10,288 tons. Speed, 16.8 knots.



Armored Cruiser "Brooklyn."
Displacement, 9,215 tons. Speed, 21.9 knots.



First-class Battleships "Kearsarge" and "Kentucky."
Displacement, 11,525 tons. Speed, 17.5 knots.



First-class Battleship "Maine." Class of Three Ships.
Displacement, 12,500 tons. Speed, 18 knots. Maximum Coal Supply, 2,000 tons. Armor: Belt, 12 inches; barbettes, 15 inches; turrets, 17 inches; deck, 2 3/4 inches on flat, 3 and 4 inches on slopes. Armament: Four 12-inch breech-loading rifles, sixteen 6-inch rapid-fire guns, twenty 6-pounders, eleven smaller guns. Torpedo Tubes, two (submerged). Complement, 500. Date, 1899.

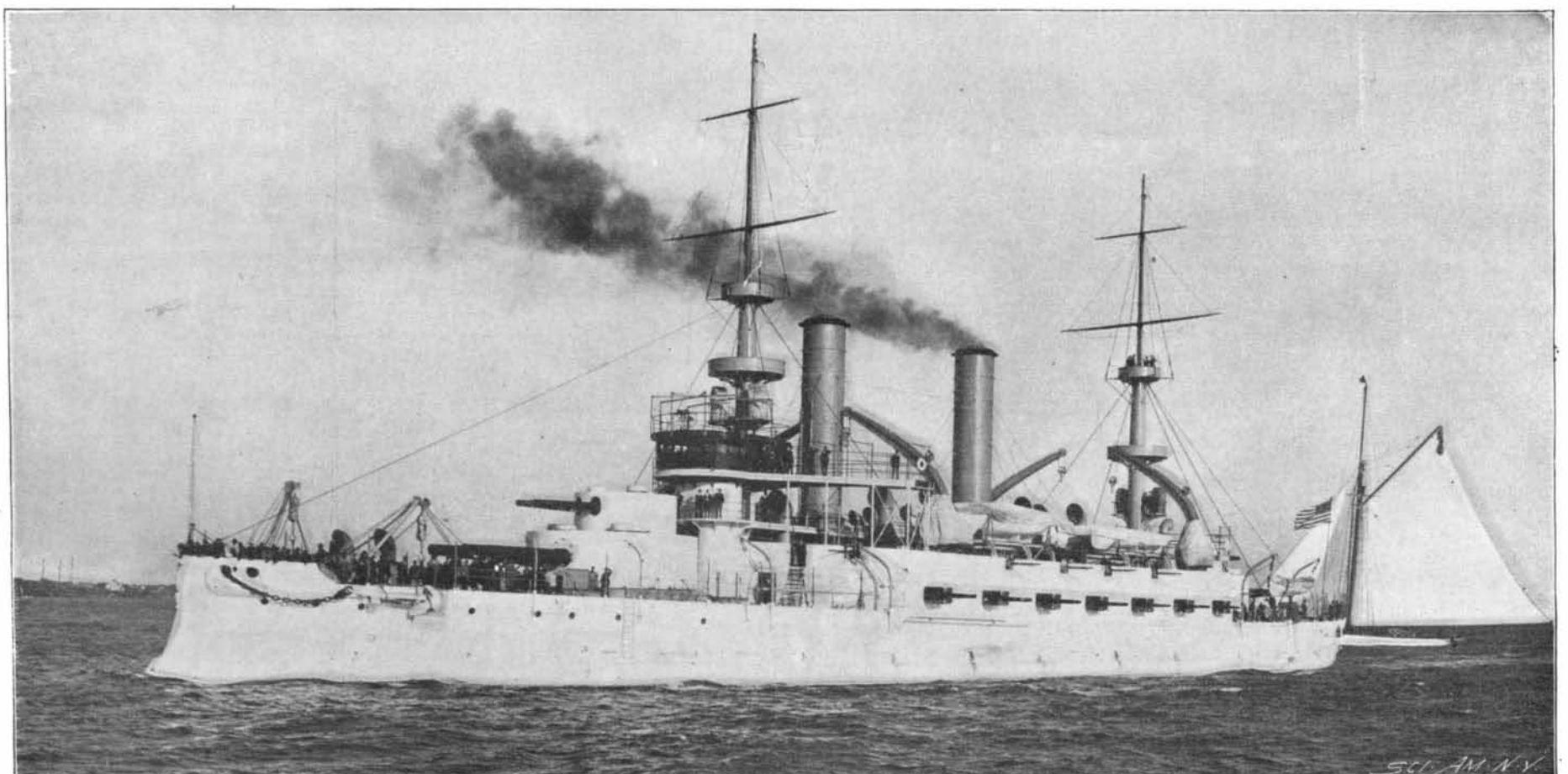
latest battleships of the new navy form a conjunction of circumstances that renders the publication of an article on the American navy particularly opportune, the one event calling to mind the men and the other the material that have united to raise the American navy to its present high standing among the navies of the world.

It will be remembered that, as an introductory article to this series, we published a comparison of the

Great Britain, 290 ships, total displacement 1,557,522 tons; France, 144 ships, 751,629 tons; Russia, 86 ships, 453,899 tons; United States, 67 ships, 303,070 tons; Germany, 73 ships, 299,637 tons; Italy, 65 ships, 286,175 tons; and Japan, 46 ships, with a total displacement of 211,857 tons.

BATTLESHIPS.—In looking over the accompanying table of the ships of the United States navy, one is struck with the fact that the major portion of the dis-

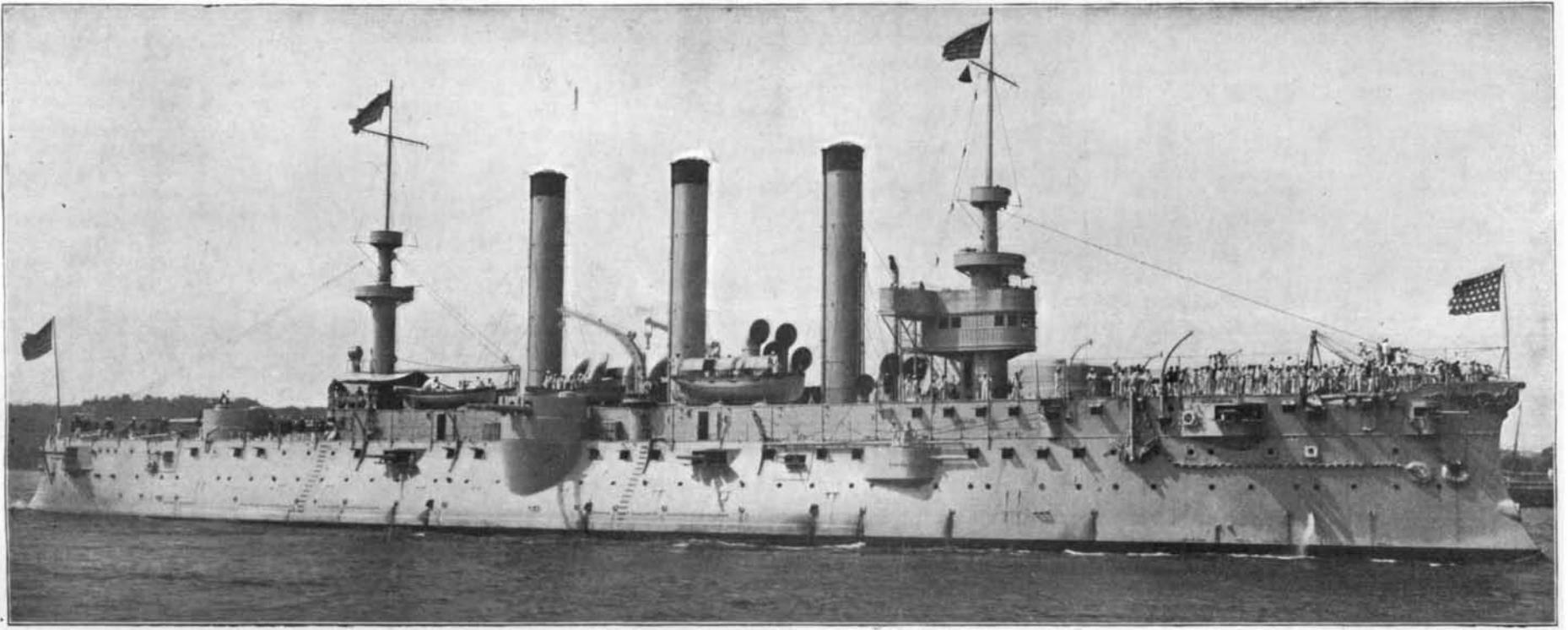
down on purely defensive lines, and our earliest first-class battleships of the "Oregon" type were officially listed as "coast-line battleships." So also the monitors, five of which were a legacy from the post-bellum and pre-reconstruction period, constitute a purely defensive fleet, a fact which was half understood before the Spanish war, and needed only the test of war to make it a certainty. Latterly, however, the Navy Department has paid special attention to sea-going and



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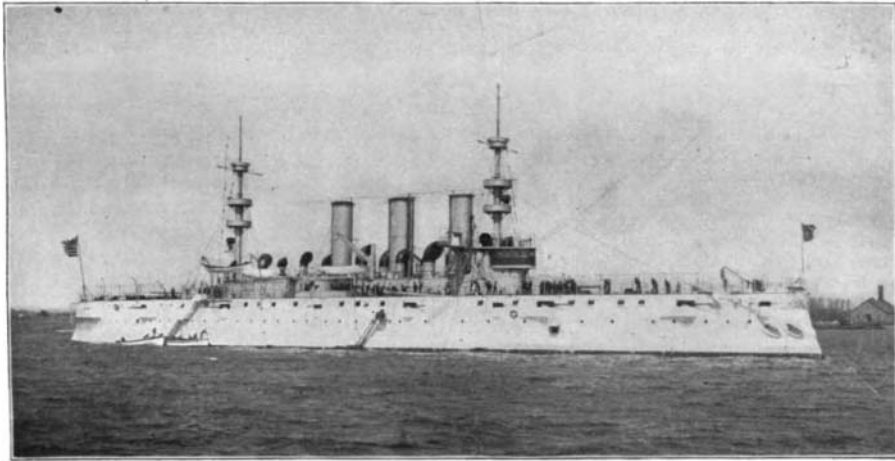
First-class Battleship "Kearsarge." Also "Kentucky."
Displacement, 11,525 tons. Speed, 17.5 knots. Maximum Coal Supply, 1,645 tons. Armor: Belt, 9 1/2 to 16 1/2 inches; deck, 2 3/4 inches on flat, 3 to 5 inches on slopes; barbettes, 15 inches; turrets, 17 inches. Guns: Main battery, four 13-inch, four 8-inch B. L. rifles, fourteen 5-inch rapid-fire; secondary rapid fire battery, twenty 6-pounders, six 1-pounders, four Colts, two field guns. Torpedo Tubes, four. Complement, 511. Date, 1898.

NAVIES OF THE WORLD—VIII. UNITED STATES.



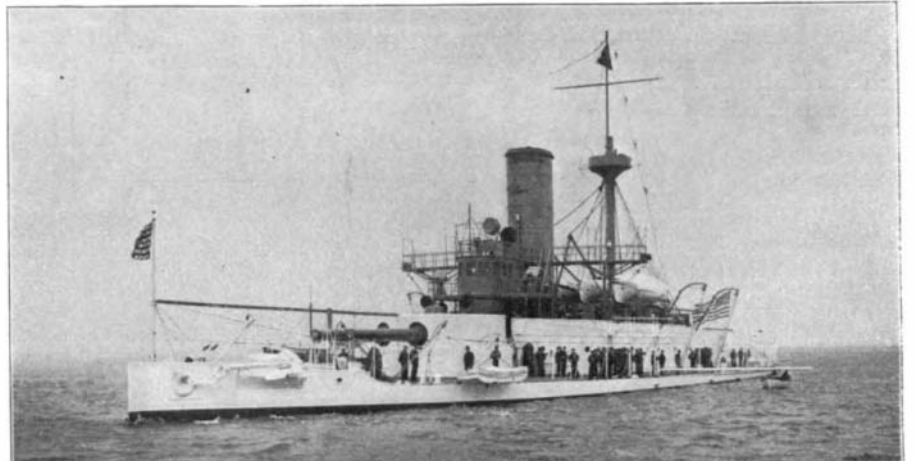
6.—Armored Cruiser "Brooklyn."

Displacement, 9,215 tons. Speed, 21.9 knots. Maximum Coal Supply, 1,461 tons. Armor: Belt, 8 inches; deck, 3 to 6 inches; barbettes, 8 inches; turrets, 5½ inches. Guns: Main battery, eight 8-inch B. L. rifles, twelve 6-inch rapid-fire; secondary battery, twelve 6-pounders, four 1-pounders, four Colts, two field guns. Torpedo Tubes, four. Complement, 516. Date, 1895.



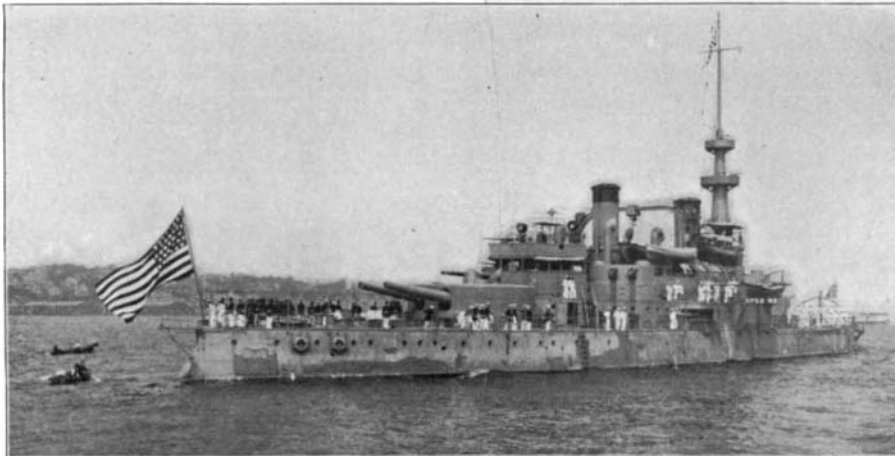
7.—Armored Cruiser "New York."

Displacement, 8,200 tons. Speed, 21 knots. Maximum Coal Supply, 1,290 tons. Armor: Belt, 4 inches; deck, 3 to 6 inches; barbettes, 10 inches; turrets, 5½ inches. Guns: Main battery, six 8-inch B. L. rifles, twelve 4-inch rapid-fire; secondary rapid-fire battery, eight 6-pounders, two 1-pounders, four Gatlings, two field guns. Torpedo Tubes, two. Complement, 558. Date, 1891.



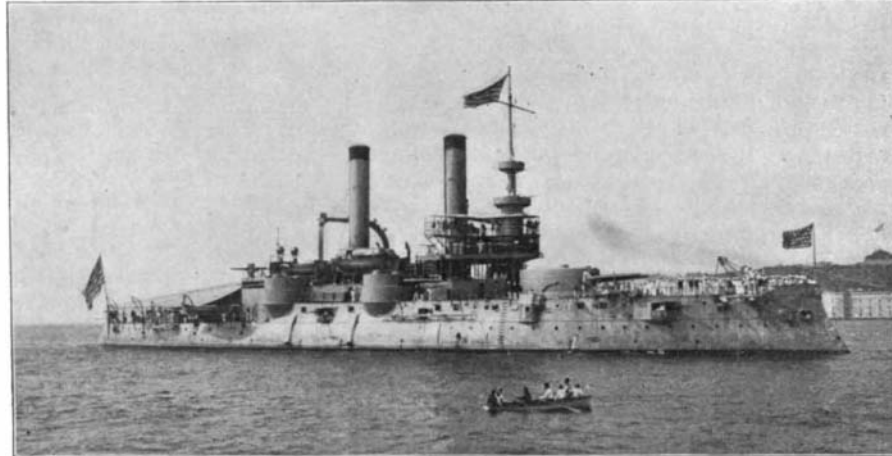
8.—Monitor "Puritan." Class of Ten Ships.

Displacement, 6,060 tons. Speed, 12.4 knots. Maximum Coal Supply, 314 tons. Armor: Belt, 14 to 6 inches; barbettes, 14 inches; turrets, 8 inches; deck, 2 inches. Guns: Four 12-inch breech-loading rifles, six 4-inch rapid-fire guns, eleven 6-pounders and smaller guns. Complement, 230. Date, 1873 to 1882.



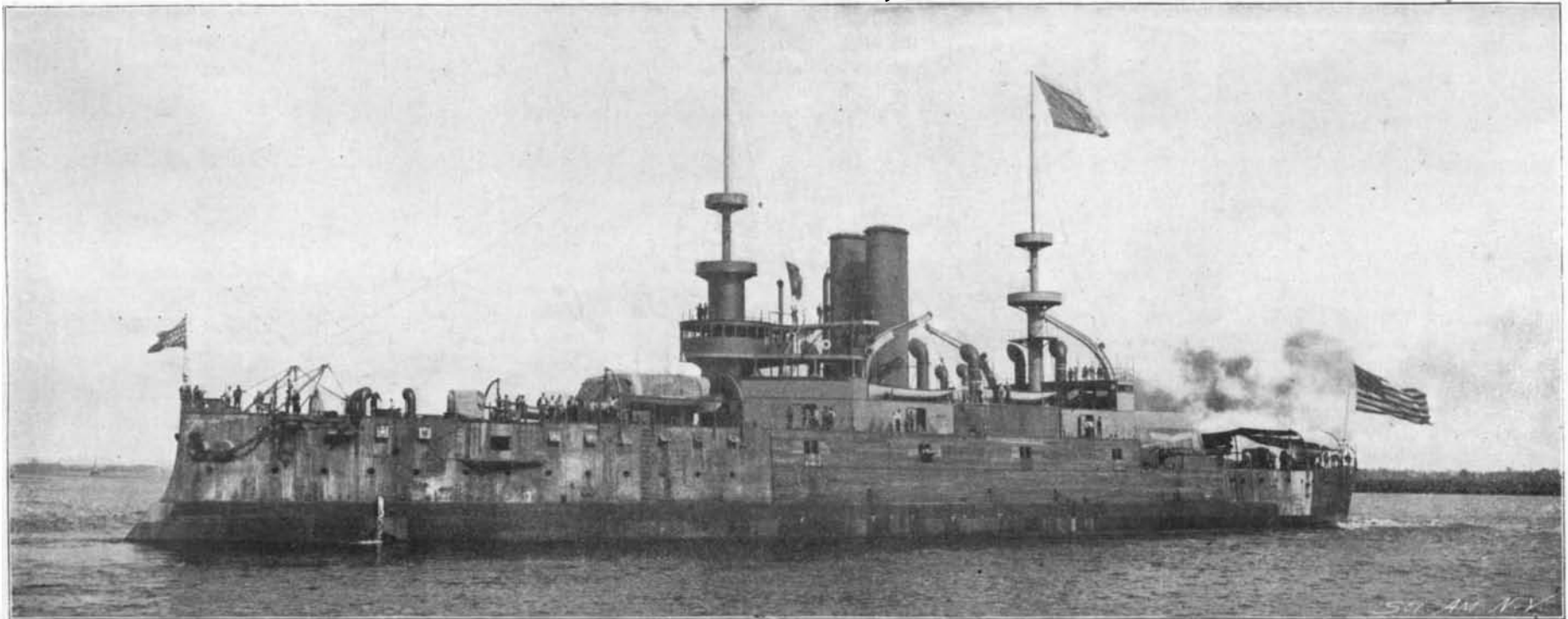
9.—First-class Battleship "Oregon." Also "Indiana" and "Massachusetts."

Displacement, 10,288 tons. Speed, 16.8 knots. Maximum Coal Supply, 1,594 tons. Armor: Belt, 18 inches; deck, 2¾ inches; barbettes, 17 inches; turrets, 15 inches; casemates, 6 inches. Guns: Main battery, four 13-inch B. L. rifles, eight 8-inch, four rapid-fire 6-inch; secondary rapid-fire battery, twenty 6-pounders, six 1-pounders, four Gatlings, two field guns. Torpedo Tubes, three. Complement, 473. Date, 1890.



10.—First-class Sea-going Battleship "Iowa."

Displacement, 11,340 tons. Speed, 17.1 knots. Maximum Coal Supply, 1,795 tons. Armor: Belt, 14 inches; deck, 2¾ inches; barbettes, 15 inches; turrets, 15 inches; casemates, 6 inches. Guns: Main battery, four 12-inch, eight 8-inch, six 4-inch rapid-fire; secondary rapid-fire battery, twenty 6-pounders, four 1-pounders, four Colts, two field guns. Torpedo Tubes, four. Complement, 505. Date, 1896.



11.—First-class Battleship "Alabama." Also "Wisconsin" and "Illinois."

Displacement, 11,525 tons. Speed, 17 knots. Maximum Coal Supply, 1,600 tons. Armor: Belt, 9½ to 16½ inches; deck, 2¾ inches; barbettes, 15 inches; turrets, 14 inches. Guns: Main battery, four 13-inch, fourteen 6-inch rapid-fire; secondary rapid-fire battery, sixteen 6-pounders, four 1-pounders, one Colt, two field guns. Torpedo Tubes, four. Complement, 489. Date, 1886.

NAVIES OF THE WORLD—VIII. UNITED STATES.

TABLE OF SHIPS BUILT OR BUILDING IN THE UNITED STATES NAVY.

DESCRIPTION OF TYPE.	Number of Ships.	Average Displacement.	Total Displacement.	Average Speed.
Battleships, 10 years or less.	13	11,010	143,130	16.7
Battleships, 10 to 20 years.	.....	.....	.....	.....
Battleships, Old or refitted.	.....	.....	.....	.....
Totals.....	13	.....	143,130	.....
Coast Defense Vessels.	11	3,551	40,261	12.2
Armored Cruisers, 9,000 tons and up.	1	.....	9,215	21.9
Armored Cruisers, 7,000 to 9,000 tons.	1	.....	8,201	21.0
Armored Cruisers, below 7,000 tons.	.....	.....	.....	.....
Totals.....	2	.....	17,415	.....
Protected Cruisers, 10,000 tons and up.	.....	.....	.....	.....
Protected Cruisers, 7,000 to 10,000 tons.	2	7,375	14,750	22.9
Protected Cruisers, 4,000 to 7,000 tons.	6	4,539	27,234	19.6
Cruisers, 2,000 to 4,000 tons.	11	2,974	32,710	18.4
Totals.....	19	.....	74,694	.....
Small Cruisers and Gunboats.	22	1,237	27,210	16.0
Grand totals.....	67	.....	303,070	.....

sea-keeping qualities, with the result that in the fine vessels of the "Alabama," "Maine," and "New Jersey" classes we shall possess ships of the line which will be the match of any foreign battleships either for offense, defense, or ability to keep the sea in all weathers.

An excellent feature of our fleet of battleships is the fact that they are all in the class "ten years old or less;" moreover, twelve out of the thirteen are of the first class. The only second-class battleship is the "Texas," of 6,315 tons displacement and 17.8 knots trial speed. She was built at the Norfolk navy yard, the keel being laid in 1889 and the ship going into commission in 1895. Her plans were purchased abroad and subsequently modified before and during the construction of the ship. A strange fatality seemed to attend her earlier history, and the popular prejudice engendered by her many mishaps was not removed until she demonstrated her good fighting qualities during the bombardment of Santiago and the destruction of Cervera's fleet, in both of which she played a prominent part. It was at the close of a single-handed engagement with the Socapa battery that the "Texas" received a shell through her port bow which killed one of her crew and temporarily put the whole 6-pounder forward battery out of action. In the naval battle of a few weeks later, she was severely damaged in her superstructure by a 5.5-inch shell from one of Cervera's cruisers. The "Texas" is an excellent sea boat, thanks to her lofty freeboard; but her arrangement of battery is somewhat out of date. The two 12-inch guns are placed "en echelon" within a central redoubt of 12-inch steel amidships, each gun being carried in a turret protected by 12-inch armor. She has a partial 12-inch belt and a 2-inch protective deck. The intermediate battery consists of six 6-inch guns, and the secondary battery is made up of twelve 6-pounders, six 1-pounders, four Hotchkiss guns, and two Colts. She has two torpedo tubes and carries a complement of 389 officers and men.

The earliest and best known first-class battleships of the navy are the "Oregon," "Indiana," and "Massachusetts." Designed for coast-line service, where they would be within comparatively easy reach of a coaling port, they exhibit a high development of offensive and defensive qualities in the way of guns and armor at the expense of sea-going qualities, as represented by high freeboard, large coal supply, and liberal berthing accommodation for the crew. At the time of their launch they were, for their displacement, the most heavily armed and armored ships afloat; and even today it is only the introduction of the rapid-fire gun that enables more modern battleships to show a greater total energy of gun-fire in a given time. Taking the "Oregon" as being probably the best constructed vessel of the three, if we may judge by actual performances in service, we note that on a displacement of 10,288 tons she combines the following features: A waterline belt amidships of 18-inch Harvey steel, with main barbettes and turrets of 17 and 15-inch and secondary turrets of 6-inch steel. In the two main turrets are four 13-inch guns, and within each of the four secondary turrets is a pair of 8-inch guns carried at a height of 26 feet above the waterline. The intermediate battery also includes four 6-inch rapid-fire guns carried amidships on the main deck. The secondary battery is made up of twenty-nine 6 and 1-pounders and ma-

chine guns, carried chiefly upon the boat deck. While this is a tremendous combination of offensive and defensive elements, it is liable to be severely handicapped by the very low freeboard of 12 to 13 feet, which in a seaway would bring the 13-inch and 6-inch guns into uncomfortable proximity to green water. Not that these vessels are for a moment to be spoken of as unseaworthy—the 14,000-mile run of the "Oregon" from the Pacific to the Atlantic settled this question for good—but as compared with ships of 20 to 25 feet freeboard, carrying all their heavy guns at heights even greater than this, the "Oregon" and her class would be at a decided disadvantage considered as gun platforms. A comparison of the accompanying illustrations of the "Oregon" and the "Alabama" will show the great gain secured in the latter ship by the addition of a lofty spar deck extending from the bow aft for two-thirds of the ship's length.

The next battleship to be built after the completion of the "Oregon" class was the "Iowa." As compared with the "Oregon" she is of about 1,000 tons more displacement and 17 knots trial speed, and to her was given a right to the title of "sea-going," by the provision of a spar deck with a freeboard of about 20 feet. The total bunker capacity was increased from 1,597 to 1,795 tons. On the other hand, the main battery was decreased in power by substituting 12-inch for 13-inch guns, while six 4-inch rapid-fire guns took the place of the four 6-inch guns of the "Oregon" class. The "Iowa," like the "Oregon," is now in Pacific waters, and like her she was conspicuous in the operations of the Spanish war.

Following the "Iowa" come the two battleships "Kearsarge" and "Kentucky," the first of which is now undergoing her official trials, and the other rapidly approaching completion at Newport News. As compared with the "Oregon," the "Kearsarge" is about 1,200 tons larger, displacing 11,525 tons, and her contract speed is one knot greater, being 16 as against 15 knots. The "Oregon," however, made 16.8 knots on her trial, and the preliminary trials of the "Kearsarge" indicate that she will probably make 17.5 or 17.75 knots on her official test. In the "Kearsarge" the good features of the "Oregon" are retained and the faults are remedied. The freeboard is a foot or two greater than that of the "Oregon," or say 14 feet—not as much as one could wish, especially in view of the concentration of weight near the bow and stern, due to the double turrets, but still an improvement over the earlier ships; the weight of the intermediate battery of 8-inch guns has been reduced about two-thirds by throwing out four guns and two turrets altogether and mounting the other two turrets upon the roof of the 13-inch gun turrets; and the intermediate battery has been strengthened by the substitution of fourteen 5-inch rapid-fire guns, which are carried behind a 6-inch armored casemate amidships on the main deck.

The double-turret is an innovation as daring as it is novel, and it has been a fruitful source of discussion among naval officers and architects. That the device is economical in weights may be judged from the fact that the all-round fire of the four 8-inch guns is as great as that of the eight guns on the "Oregon," the latter ship never being able to fire its 8-inch guns dead ahead or astern because of interference with the 13-inch guns. Moreover, the turning machinery and ammunition hoists are so superbly protected by the 15-inch armor of the 13-inch turrets that their chances of being disabled are extremely slight. On the other hand it must be admitted that a well-directed shell might disable all four guns of a double turret at once, and the crowding of four sets of hoisting gear so closely together is undesirable and might lead to serious delay in all four guns of the system. Only the test of service can determine the actual merits of the device. The principal particulars of the armor, batteries, etc., of this fine ship will be found below the half-tone engraving of the vessel. Special attention should be drawn to the fact that the waterline armor is carried right up to the stern, being four inches thick at this point.

Following the "Kearsarge" and "Kentucky" come the three sea-going battleships of the "Alabama" class. The "Alabama" was launched in 1898 and has recently undergone a builder's trial. She is of the same displacement, coal capacity and contract speed as the "Kearsarge," but there the likeness ceases. In the first place a lofty spar deck with a freeboard of about 20 feet as in the "Iowa" extends from the bow for two-thirds of the length, and above this is carried the forward pair of 13-inch guns at an elevation of about 24 feet above the water. This deck not only improves the sea-going qualities, but it also affords splendid berthing accommodations for the crew. The 8-inch gun has disappeared altogether and the intermediate battery is made up of fourteen 6-inch rapid-fire guns, with the result that the total energy of gun-fire per minute is greatly increased though the destructiveness of the 6-inch shell is far less than that of the 8-inch. The 6-inch rapid-fire battery is distributed on two decks. Eight of these guns are carried on the main deck within a central citadel protected with 6 inches of steel, two are mounted forward in 6-inch casemates, one on each bow, and two amidships in case-

mates on each beam on the spar deck. The after pair of 13-inch guns is carried on the main deck. The armor is 16½ inches on the belt, 5½ or 6 inches on the sides above the belt, 14 inches on the turrets and 15 inches on the barbets. The contract speed is 16 knots and will probably reach 17 knots or more on the official trial.

The "Alabama" must always be a notable battleship for the reason that she is the first of a type which seems likely to become permanent. The type has been reached by a process of selection; and it represents the embodiment of the experience of our own and other warship builders the world over. The later ships, of the "Maine" and "New Jersey" classes, are simply improved "Alabamas," incorporating as they do the later ideas as to speed, armor, and batteries, with such increase in displacement as is rendered necessary.

Thus the plans of the "Maine," which originally called for a 16-knot ship, have been changed to admit of her making the more modern speed of 18 knots. Twenty feet were added to the length, and 1,000 tons to the displacement. This enlargement, together with the reduction in thickness of the armor, due to its higher resisting qualities, and the saving in weight due to the substitution of the 12-inch for the 13-inch gun, have enabled the coal capacity to be increased and a more liberal amount of stores to be carried. The bunker capacity is 2,000 tons, and two additional 6-inch guns appear in the intermediate battery, making sixteen of this type in all. The three vessels of the "New Jersey" class, authorized last Congress, and purposely "held up" as to their construction by the tactics of a few politicians who succeeded in imposing impossible restrictions as to armor, will conform in general to the "Alabama" and the "Maine," but will contain some new features of interest, which were illustrated in our issue of September 9, 1899. As they are not yet under construction these ships are not included in the table of the navy above given. The plans have not been finally decided upon, but the particulars will probably be as follows: Displacement, 13,500 tons; speed, 18 knots; coal supply, 2,000 tons. Armor: belt, 9 to 4 inches; central casemate, 6 inches; 14-pounder battery, 3 inches; main turrets, 12 inches; 8-inch turrets, 6 inches. Battery: Four 12-inch, four 8-inch, twelve 6-inch rapid-fire; sixteen 3-inch rapid-fire, and sixteen 3-pounders, besides many smaller guns. The personnel throughout the navy will welcome the return of the 8-inch gun. The four guns of this caliber will be carried in turrets one on each beam amidships. All the guns of these ships and the "Maine" class will be of the new, long-caliber smokeless-powder type, with improved breech mechanism, and the energy and rapidity of fire will be increased proportionately.

The adjoining table, for the particulars of which we are indebted to the courtesy of Rear-Admiral O'Neil, shows what an increase of energy and decrease of weight has been effected by the improvements which have taken place during the past decade in the ballistics of our naval guns. Thus, we find that the use of smaller calibers, higher velocities, and rapid-fire breech mechanism has not only raised the total muzzle energy of the guns of the main battery in one minute's firing from 137,015 foot-tons in the "Oregon" to 337,716 foot-tons in the "New Jersey," but the proportion of the weight of these guns to the displacement has been reduced from 3.60 per cent in the former to 2.78 per cent in the latter vessel.

COMPARISON OF MAIN BATTERIES.

1.	2.	3.	4.	5.	6.	7.
Name.	Normal Displacement in Tons.	Description of Guns of Main Battery.	Total Weight of Guns of Main Battery in Tons.	Muzzle Energy of Guns of Main Battery in One Minute in Foot-Tons.	Weight of Metal Thrown in One Minute by Guns of Main Battery in Pounds.	Proportion of Weight of Guns of Main Battery to the Displacement.
"Oregon" and Class.....	10,288	4 13-in. of 35 cal. 8 8-in. of 35 cal. 4 6-in. of 40 cal.	371	137,016	3,458	3.6%
"Iowa".....	11,340	4 12-in. of 35 cal. 8 8-in. of 35 cal. 6 4-in. of 40 cal.	294	111,582	3,119	2.53%
"Kearsarge" and Class.....	11,525	4 13-in. of 35 cal. 4 8-in. of 35 cal. 14 5-in. of 40 cal.	338	200,984	4,558	2.92%
"Alabama" and Class.....	11,525	4 13-in. of 35 cal. 14 6-in. of 40 cal.	326	235,764	5,458	2.82%
"Maine" and Class.....	12,500	4 12-in. of 40 cal. 16 6-in. of 50 cal.	336	357,852	5,929	2.68%
"New Jersey" and Class.....	13,500	4 12-in. of 40 cal. 4 8-in. of 45 cal. 12 6-in. of 50 cal.	376	337,716	5,229	2.78%

MONITORS.—The monitor is a legacy of the civil war, and the fact that as recently as last year Congress authorized the construction of four of this archaic type of vessel proves how largely, even in such a weighty matter as warship construction, a legislative body may be swayed by sentiment and tradition. Including the new monitors now under construction, we have a dozen of these home-keeping craft. With these, as being more like them than it is like any other ships in the

navy, we have included in our table the armored ram "Katahdin." Four of the monitors are of the "Miantonomoh" type, and one, the "Puritan," is an enlarged "Miantonomoh." Their keels were laid as long ago as 1874, and after ten years had elapsed only the iron hulls and old-fashioned engines were completed. Subsequently to 1875 they were again taken in hand, modern armor being placed in position, and modern breech-loading rifles mounted in the turrets. The "Miantonomoh," "Monadnock," and "Terror," are sister ships of 3,990 tons and 10.5 knots speed. The armament consists of four 10-inch breech-loading rifles carried in two turrets, besides two 4-inch rapid-fire guns and eight smaller rapid-fire guns and machine guns carried on the superstructure. The side armor is 9 inches thick amidships and 5 inches at the ends. The barbetstes carry 11½-inch and the turrets 7½-inch armor. The "Puritan" is a much larger vessel than these, with a displacement of 6,060 tons and a speed of 12.4 knots. The full particulars are given below the accompanying engraving of the vessel. The "Monterey," which, in common with the "Monadnock," is now in the Philippines, the two vessels having crossed the Pacific under their own steam, is a modern vessel in all particulars. She is of 4,084 tons displacement, 13.6 knots speed, carries a 13-inch belt and 8 inches on the turrets, and carries a main armament of two 12-inch and two 10-inch guns. The four monitors of the "Arkansas" class, which are now under construction, are considerably smaller than the vessels above mentioned, and must necessarily be confined strictly to harbor defense. On a displacement of 2,755 tons, they will have a speed of 12 knots and will carry two modern 12-inch guns in a barbettes turret armored with 10 inches and 12 inches of steel. There will be a battery of four 4-inch guns carried at the four angles of the superstructure. The "harbor-defense ram" "Katahdin," as she is officially known, was built purely for ramming. She has an armored turtleback deck, varying from 3 to 6 inches in thickness, and when her total weight of 2,155 tons is being driven against the enemy at a speed of 16 knots she is supposed to be a very formidable weapon. Among the officers of the navy, however, she has always been an unpopular craft, and it is not likely that her design will ever be repeated.

ARMORED CRUISERS.—In the class of armored cruisers we have at present only two vessels, the "New York" and the "Brooklyn," although three powerful ships of 12,000 tons were authorized by the last Congress. Both the "New York" and the "Brooklyn" were brought into special prominence in the late war. The "New York" was the flagship of Admiral Sampson, and as such she was a conspicuous vessel in the blockade of Havana, the bombardments of San Juan and the Santiago forts and the blockade of Santiago Harbor. The "Brooklyn" as flagship for Admiral Schley was first identified with the flying squadron at Hampton Roads and later became famous as the vessel picked out by the Spaniards for their concentrated fire when they made their sortie from Santiago, and the leading ship in the long pursuit of the "Cristobal Colon." The full particulars of these vessels are given beneath their respective engravings. Before passing on to a consideration of the protected-cruiser class, attention should be drawn to the fact that it is in the armored-cruiser class that we ought to make the first and largest addition to our navy. These vessels combine the mobility of the cruiser with much of the powers of attack and defense of the battleships. With a sufficient fleet of armored cruisers afloat, we would be prepared to meet a sudden concentration of armored ships in any part of our widely extended possessions.

PROTECTED CRUISERS.—Our earliest efforts in the creation of a new navy were confined entirely to the construction of protected cruisers of high speed and powerful batteries; and though of late years we have somewhat neglected this class and our attention has been directed more to the construction of battleships, gunboats, and torpedo boats, we have a fine fleet of nineteen effective ships of the protected class, ranging in displacement from 2,000 up to 7,375 tons. The largest and fastest are the twin ships "Minneapolis" and "Columbia," of about 23 knots trial speed and 7,375 tons displacement. These were originally built as commerce destroyers, a work for which their speed and enormous cruising radius render them exceptionally qualified. Of ships between 4,000 and 7,000 tons displacement we have six: the "Chicago," 4,500 tons and 18 knots; the "Newark," 4,098 tons and 19 knots; the "Baltimore," 4,413 tons and 20.1 knots; the "Philadelphia," 4,324 tons and 19.7 knots; the "San Francisco," 4,098 tons and 19.5 knots; and the famous "Olympia," Admiral Dewey's flagship at Manila, 5,870 tons and 21.8 knots. The "Chicago," "Baltimore," and "Olympia"

carry, each, four 8-inch guns as their main battery, the intermediate battery consisting in the "Chicago" of fourteen and in the "Olympia" of ten 5-inch rapid-fire guns; in the "Baltimore" the intermediate battery consists of six 6-inch guns. The three other vessels carry a main battery of twelve 6-inch guns. All of these ships have complete protective decks.

By far the most effective of them all is the "Olympia," for in addition to her greater displacement, she has the advantage of about 2 knots greater speed; moreover, she carries her main battery in turrets, and her protective deck is heavier, reaching a thickness of 4½ inches on the slopes. A finer vessel for her size it would be difficult to find, and because of its historic associations the name "Olympia" will take its place as one of the most famous in the annals of the United States navy.

There are eleven cruisers in the navy of from 2,000 to 4,000 tons displacement. These are the "Atlanta" and "Boston," 3,000 tons and 18.2 knots, and the "Charleston," 3,700 tons and 18.2 knots, each carrying two 8-inch and six 6-inch breech-loading rifles; the "Cincinnati" and "Raleigh," 3,213 tons and 19 knots, armed with one 6-inch breech-loading rifle and ten 5-inch rapid-fire guns; the "Detroit," "Marblehead," and "Montgomery," unprotected cruisers of 2,089 tons and 18.5 knots, carrying ten 5-inch rapid-fire guns; and



Photographed by the American Mutoscope and Biograph Company.

ADMIRAL DEWEY ON BOARD THE "OLYMPIA" AT VILLEFRANCHE.

the recently acquired "New Orleans" and "Albany," of 3,600 tons and 21 knots, carrying six 6-inch and four 4.7-inch rapid-fire guns. The latest and most effective of these ships are the two last named, and it is sincerely to be hoped that the revised plans for the six new 3,500-ton cruisers will be based upon the admirable design embodied in these two boats.

SMALL CRUISERS AND GUNBOATS.—In this class are included twenty-two vessels, of an average displacement of 1,237 tons and average speed of 16 knots. The most important of these are the three gunboats "Bennington," "Yorktown," and "Concord," the last of which did excellent work in the battle of Manila Bay. These vessels are of 1,710 tons displacement and 16 to 17 knots speed. The "Concord" and "Bennington" mount six 6-inch breech-loading rifles in the main battery, and the "Yorktown" has been re-armed with six 5-inch rapid-fire guns. Next to these in size are the light-draught gunboats "Helena," "Nashville," and "Wilmington," of 1,362 tons and 15 to 16 knots, carrying each eight 4-inch rapid-fire guns. They were designed for shoal waters and river service, and are admirable vessels for the purpose. The "Castine" and the "Machias" are gunboats of 1,117 tons and 16 knots, armed with eight 4-inch rapid-firers. The "Bancroft," 839 tons and 14.4 knots, carries four 4-inch rapid-firers, and the little "Petrel," 892 tons and 11.8 knots, will ever be memorable as having formed one of the Manila fleet on the 1st of May, 1898, where, at the close of the fight, she was sent into the shoaler waters of Cavité to complete the destruction of the Spanish fleet. She carries four 6-inch

breech-loading rifles. In the unarmored composite gunboats of the "Annapolis" and "Marietta" type we have six useful vessels of 1,000 tons displacement and speeds of from 12 to 13 knots. Each carries a main battery of six 4-inch rapid-fire guns. Other vessels in this class are the "Topeka," 1,700 tons and 16 knots, carrying eight 4-inch rapid-fire guns, a re-armed iron cruiser purchased during the war; the training ship "Chesapeake," 1,175 tons, propelled entirely by sail power; the steel dispatch boat "Dolphin," 915 tons and 15.5 knots, carrying three 4-inch rapid-fire guns, and the "dynamite gunboat" (as she is called) "Vesuvius," armed with three 15-inch dynamite guns.

This brings us to the close of our necessarily brief review of the ships of the modern American navy and to the close of our series on the navies of the world. Comparing our relative strength now with what it was fifteen or sixteen years ago, when we entered in earnest upon the stupendous task of creating from the ground up, as it were, an entirely new navy, we have just cause for congratulation. At that time the United States had no place upon the list of modern navies, or if it had, it was that of a poor sixth; to-day it not only ranks as one of the great navies of the world, but it has outgrown in strength the fleets of Italy and Germany, and ranks easily as fourth in power and efficiency. As to the personnel, it is unnecessary to do more than point to the records of the Spanish war, where both officers and men have shown that dash and good shooting are to-day, as of old, the distinguishing characteristics of our navy.

Lithium Minerals and Their Utilization.

Probably it is not generally known to manufacturing chemists in the United States that this country has vast resources in lithium mineral which have never been exploited. Lithium is classed as one of the rare elements, and is indeed rare in its metallic form, but its compounds are not rare in occurrence or in commerce. We do not know what their usefulness might be if their supply were large and cheap, but at present the use of lithium salts, especially the carbonate, is chiefly in the preparation of lithia water, which is used extensively for medicinal purposes in such diseases as rheumatism, due largely to an excess of uric acid in the system. There are some natural lithia waters, but a good deal of what is sold as such are artificial. The consumption of lithium carbonate for this purpose in the United States is variously estimated at from 40,000 to 200,000 pounds per annum, all of which is obtained from Germany. The average value of the salt at New York in 1898 was \$4.22 per pound. Consequently, it is evident that there is a good business in sight for some one who will undertake its manufacture in this country, although it should not be expected that the price would keep up if the supply were increased largely.—Engineering and Mining Journal.

The Current Supplement.

The current SUPPLEMENT, No. 1239, has many articles which will interest our readers. The front page is taken up by a fine engraving of the design for the National Pavilion at the Paris Exposition. Plans of the Exposition grounds and of Paris showing the methods of communication are also given. "The Automobile Club of France" is an article by Francis P. Mann. "The Prolongation of the Orleans Railway" describes an important engineering work. "In the Philippines" describes some of the interesting scenes which are taking place in our new territory. "How Clay Pipes are Made" describes a novel industry in an attractive manner. "Prehistoric Man in America" is an abstract of an address delivered by the American Association for the Advancement of Science by Dr. F. W. Putnam. "The Beginnings of the Science of Prehistoric Anthropology" is by Prof. Thomas Wilson. "The Present Position of the Investigation of the Malarial Parasite" is a timely article upon a subject which is interesting the scientific world. "The History of the Umbrella" is a curious article.

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