

once exceeded 32 pounds per mile, while the cost of maintaining the engine in working efficiency has averaged 3.56 cents per mile run. Owing to the system of standardization which is a feature of the Crewe Works, the enforced idleness of the engine consequent upon renewals and repairs has only averaged 12 per cent of working time. This huge mileage has been covered without the slightest mishap of any kind. Although the speed of many trains upon this system has been considerably augmented during the past few years, yet this express hauled by "Charles Dickens" still remains one of the fastest upon the system, and owing to the present excellent condition and running of the locomotive, it will probably still be retained upon the 387-mile daily run for some time to come.

LAUNCHING OF THE "CONNECTICUT" AND "MILWAUKEE."

On September 29, eighteen months after the laying of her keel, the United States battleship "Connecticut," which shares with the British battleships of the "King Edward" class the distinction of being the largest yet constructed, was launched at the New York navy yard, Brooklyn. The event was marked by the customary ceremonies, and it was witnessed by a great crowd of visitors, who had been admitted to the grand stand and inclosures of the navy yard by tickets of invitation. It is an historical fact, deserving of mention in this connection, that the "Connecticut" was launched from the very spot at which the old prison ship "Jersey" was beached, after she had performed her notorious duties during the Revolutionary war; and when the piling was being driven for the building ways, no little difficulty was experienced in getting it down through the remains of the sunken vessel.

The "Connecticut," and the sister ship "Louisiana," which was launched a month ago at the Newport News yard, were authorized by act of Congress on July 1, 1902, and under the terms of the act the contract for one of these vessels was to be let to a private firm, and the other ship was to be built in a government yard. The determination of Congress to renew the practice of building warships at the navy yards was brought about by the urgent representation of the Navy Department, which claimed that with its present plant and fine organization, such a yard as that at New York was thoroughly equipped for the speedy and economical construction of warships. Consequently, the construction of the "Connecticut," being undertaken at the same time as that of the "Louisiana," has been watched with the keenest interest; and it is extremely gratifying to the government that she should have been completed in practically the same space of time as the contract-built vessel.

The "Connecticut" is 450 feet in length on the waterline, 76 feet 10 inches in beam; and when the ship is fully equipped ready for sea, with all stores on board and a normal supply of coal in the bunkers, she displaces 16,000 tons on a draft of 24 feet 6 inches. Her full load displacement with her bunkers filled and stores aboard for an extended cruise is 17,666 tons. She is propelled by twin-screw, vertical, triple-expansion engines, of 16,500 indicated horse-power, which are designed to drive her at a speed of 18 knots an hour. The normal coal supply is 900 tons, but her bunker capacity is 2,200 tons. When the ship is fully loaded, her maximum draft aft is 26 feet 9¼ inches. Her boilers are of the Babcock & Wilcox type, and she carries enough coal to enable her to steam at a speed of 10 knots an hour continuously for a distance of 5,275 miles.

Officially, the "Connecticut" is known as a sea-going battleship with two 12-inch and four 8-inch barbette turrets. She is remarkable for her great offensive and defensive powers, in both of which she is unexcelled by any foreign ship. All of her armor is of the best Krupp face-hardened type. The protection consists of a waterline belt, which extends from stem to stern. For one-third of her length amidships, the belt is 11 inches thick at the top and 9 inches thick at the bottom, and from these dimensions it tapers fore and aft to an even thickness of 4 inches at the bow and stern. Above the main belt, and for the distance between the main barbettes, there is a continuous wall of side armor 7 inches in thickness reaching from the main belt to the main deck. At the ends of this armor, bulkheads of 7-inch armor extend athwartship to a connection with the main barbettes. There is a continuous protective deck, which is 1 inch thick on the flat and 2½ inches thick forward and aft, the thickness of the side slopes being 3 inches. The main barbettes are protected by 10 inches of armor, and the main turrets by 12 inches. The four turrets of the 8-inch guns are protected by 8 inches of armor, while the barbettes below carry 6 inches.

The unusually powerful battery is composed of four 12-inch 40-caliber guns in two turrets fore and aft, eight 8-inch 45-caliber guns in four turrets, two on each broadside, the two forward turrets having an arc of fire from dead ahead to a point well aft of

the beam, and the after pair of turrets is similarly able to fire from forward of abeam to dead astern. On the gun deck, and firing through casemates in the 7-inch side armor, is a powerful battery of twelve 7-inch, 50-caliber guns. The 7-inch gun is a new piece of high velocity and great penetration, that in these vessels takes the place of the usual 6-inch guns. This piece has a velocity of 2,900 feet a second and a muzzle energy of 9,646 foot-tons. It fires a projectile of 165 pounds with sufficient energy to penetrate 28.7 inches of iron at the muzzle. This is a great advance over the 6-inch guns which will be mounted on the "Georgia" class, the smaller weapon having the same velocity and firing a 100-pound projectile with a muzzle energy of 5,840 foot-tons and a penetration of iron at the muzzle of 24.2 inches. The armament also includes twelve 3-inch 14-pounder rapid-fire guns, six of them mounted on the gun deck, two in the bow and four at the stern, and firing through casemates protected by 2 inches of armor, the other six being mounted on the main deck in broadside between the 8-inch gun turrets, with 2 inches of protection on the casemates. There are also twelve 3-pounders and fourteen machine guns distributed on the roof of the turrets, the superstructure, the bridges, and in the fighting tops. The forward conning tower, which incloses the base of the military mast, is protected with 9 inches of Krupp steel, and the after conning tower, sometimes known as the signal tower, which is located beneath the after bridge, has 5 inches of protection. As originally designed, the "Connecticut" does not carry any submerged torpedoes, but in consequence of agitation of the subject it was subsequently decided to provide her with four such tubes, two located in a compartment forward and two in a compartment aft, in a position slightly forward and aft, respectively, of the 12-inch turrets.

Although she is not such an important vessel as the "Connecticut," the "Milwaukee," of 9,700 tons displacement, which was launched on the tenth of the same month at the yards of the Union Iron Works, San Francisco, is a vessel which a few years ago would have excited widespread attention.

She is a twin-screw protected cruiser, and a sister ship to the "St. Louis" and the (new) "Charleston," now building at the yards of Neafe & Levy and the Newport News Shipbuilding and Dry Dock Company. The dimensions of the "Milwaukee" are: Length on normal load waterline, 424 feet; breadth, extreme, 66 feet; mean draft, 22 feet 6 inches; displacement, about 9,700 tons; speed, 22 knots; bunker capacity, 1,500 tons.

The "Milwaukee" will have a protective deck of nickel-steel the entire length of the ship, 1½ inches thick on flat and 2½ inches on slopes. The nickel-steel plates are laid on ½-inch steel plating, giving the deck a total thickness of 2 and 3 inches. The main side armor belt is 7 feet 6 inches wide and 4 inches thick, and is placed abreast of boilers and engines for a distance of about 196 feet. Above the main belt is the lower casemate, with a uniform thickness of 4 inches, protecting the central portion of the hull for a distance of about 196 feet, and extending up to the gun deck. Above the lower casemate is the upper casemate, with a uniform thickness of 4 inches, protecting the central portion of the hull for a distance of about 136 feet, and extending up to the main deck. At each end on the berth and gun decks, and worked in to meet the ends of the side armor, is athwartship armor 3 inches in thickness. There will be worked in from the protective deck to above the waterline the usual cellulose cofferdam.

The main battery consists of fourteen 6-inch breech-loading rapid-fire rifles of 50 calibers in length. Of these, six are mounted on the main deck, and eight are mounted on the gun deck. The secondary battery consists of eighteen 3-inch breech-loading rapid-fire rifles, of 50 calibers in length; twelve 3-pounder semi-automatic guns; four 1-pounder automatic guns; and eight 1-pounder rapid-fire guns; there are also two 3-inch field guns, two machine guns 0.30 caliber, and eight automatic guns 0.30 caliber.

The "Milwaukee" will have twin engines of the vertical, inverted-cylinder, direct-acting, triple-expansion type, each with a high-pressure cylinder 36 inches, an intermediate-pressure cylinder 59 inches, and two low-pressure cylinders 69 inches in diameter; the stroke of all pistons being 45 inches. The order of the cylinders, beginning forward, is: Forward low-pressure, high-pressure, intermediate-pressure, and after low-pressure. The framing of the engines consists of forged-steel columns trussed by forged-steel stays; the bedplates are of cast steel. The indicated horse-power of both engines will be 21,000 when making about 133 revolutions per minute and with steam pressure of 250 pounds at the throttle. The designed speed on trial is 22 knots.

There will be sixteen boilers of the water-tube type, placed in four water-tight compartments forward of the engine rooms; the forced draft system will con-

sist of blowers discharging into closed ashpits, there being one blower for each boiler. There will be a complete electric plant on board, consisting of two 150-kilowatt and three 50-kilowatt generators, direct-connected to compound engines, using steam at 150 pounds. Over 78 electric motors will be installed, of from one to thirty horse-power; they will be used to operate boat cranes, deck winches, blowers for ventilation, ammunition hoists, etc.

The "Milwaukee" will have a complement of 645 officers and men.

A few years ago the "Milwaukee" would have ranked as an armored cruiser; but to-day, because of the unprotected ends at the waterline, and the weakness of the side armor (only 4 inches in thickness), she is classed in the navy list only as a protected cruiser.

Automobile Notes.

The crowning racing event of the year in this country will take place on Long Island, October 8. The race is known as the Vanderbilt Cup race, and it is an international race for a trophy presented by Mr. William K. Vanderbilt, Jr. It will be run on a 30.24-mile course, which will be traversed ten times by the competing cars. Some of the best European cars are found among the eighteen entries, while but few leading American makes are represented. Among the latter are two 60-horse-power Pope-Toledo racers, the Packard 30-horse-power "Gray Wolf," a 30-horse-power Royal Tourist, and a 75-horse-power Simplex. The French team consists of three 90-horse-power Panhards and one Renault of the same power, besides a De Dietrich and a Clement-Bayard 80-horse-power car. Five 60-horse-power Mercedes cars will represent Germany, and two 90-horse-power Fiat machines Italy. In order to entirely do away with dust, the course will be thoroughly sprinkled with oil throughout the entire distance, and it is estimated that 100,000 gallons of crude petroleum will be needed for this purpose. The course has a number of very sharp turns, which it will require skillful driving to round without mishap.

A 614-mile reliability test of light cars has just been held in England. The test consisted of a 50-mile run out from Hereford and back again, or 100 miles in all per day, besides hill-climbing, stopping, and starting on grades as high as 15 per cent. Twenty minutes was allowed each morning for adjusting the cars. Out of thirty-eight cars that started, twenty-six finished successfully, while but four managed to make absolute non-stop runs throughout. Of these, two were 6-horse-power Wolseley and Siddely cars, which sell for about \$875 each; and the remaining two were a 6-horse-power De Dion and an 8 to 10-horse-power Croxton, valued at \$1,000 each. Nearly all of the cars were of the light, two-passenger type. Besides the four cars mentioned, four others—a 6½-horse-power Wolseley, two 7½-horse-power Humbers, and another 6-horse-power De Dion—made eleven out of a possible twelve non-stop runs. The two Wolseleys and the two De Dions were run as teams, and it speaks very well for the former that but 10 minutes time was lost between them during this long road test, while the only troubles with the De Dion cars happened to the second one, driven by Miss Dorothy Levitt, which was detained an hour and a quarter during the last 50-mile run by the needle-valve sticking in the carbureter. The trials have shown very well the possibilities of the runabout automobile for touring purposes, and have again demonstrated the reliability and lack of tire trouble which are the features of this type of car.

The Current Supplement.

The current SUPPLEMENT, No. 1500, is opened with an excellently illustrated article by our St. Louis correspondent entitled "The United States Commission of Fish and Fisheries Building." Of technological importance are an instructive contribution on the practical production of bronze leather, a *résumé* of the action of explosives, and a very exhaustive paper on artificial stone. Mr. Harold Busbridge writes on the shrinkage and warping of timber, illustrating his opinions with many striking illustrations. "Art and Engineering" is the title of a discourse upon a subject of considerable importance, in so far as it affects American municipalities. Prof. Robert MacDougall outlines in an interesting way the evolution of the human hand. The Porta Volta electric supply station of Milan is noteworthy, in so far as it embodies a 5,000-horse-power three-phase turbo-alternator of new design. A fully illustrated article on the plant is published in the SUPPLEMENT. The Prime Minister of England, Mr. Henry A. Balfour, delivered a splendid address before the British Association for the Advancement of Science, a discourse in which he outlines the development of modern anthropology. One of those practical articles in which the construction of experimental apparatus is described, and for which the SUPPLEMENT is noted, is also published. It bears the title, "The Construction of an Indicating or Recording Tin Plate Aneroid Barometer." It is written by Dr. N. Monroe Hopkins.

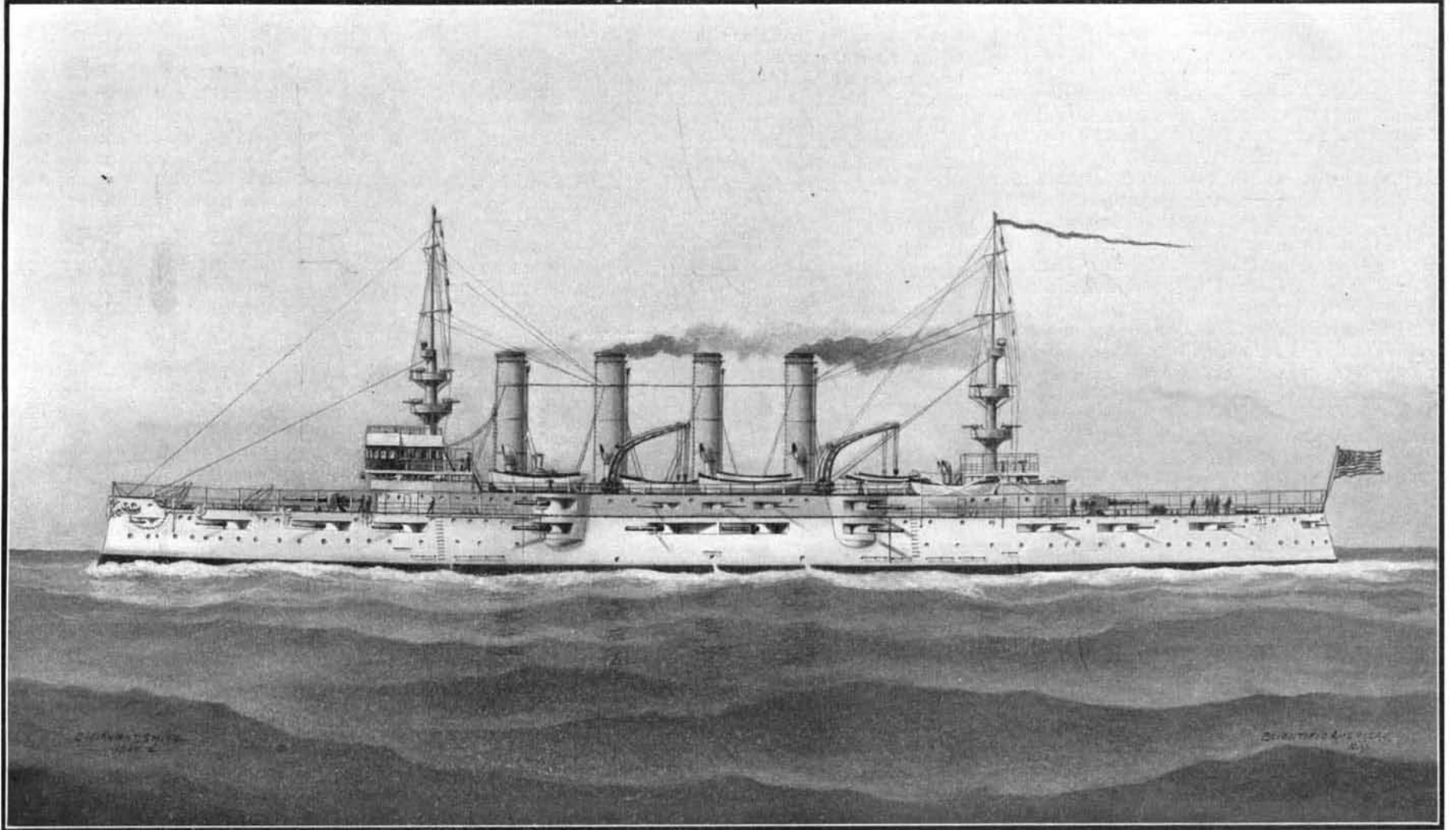
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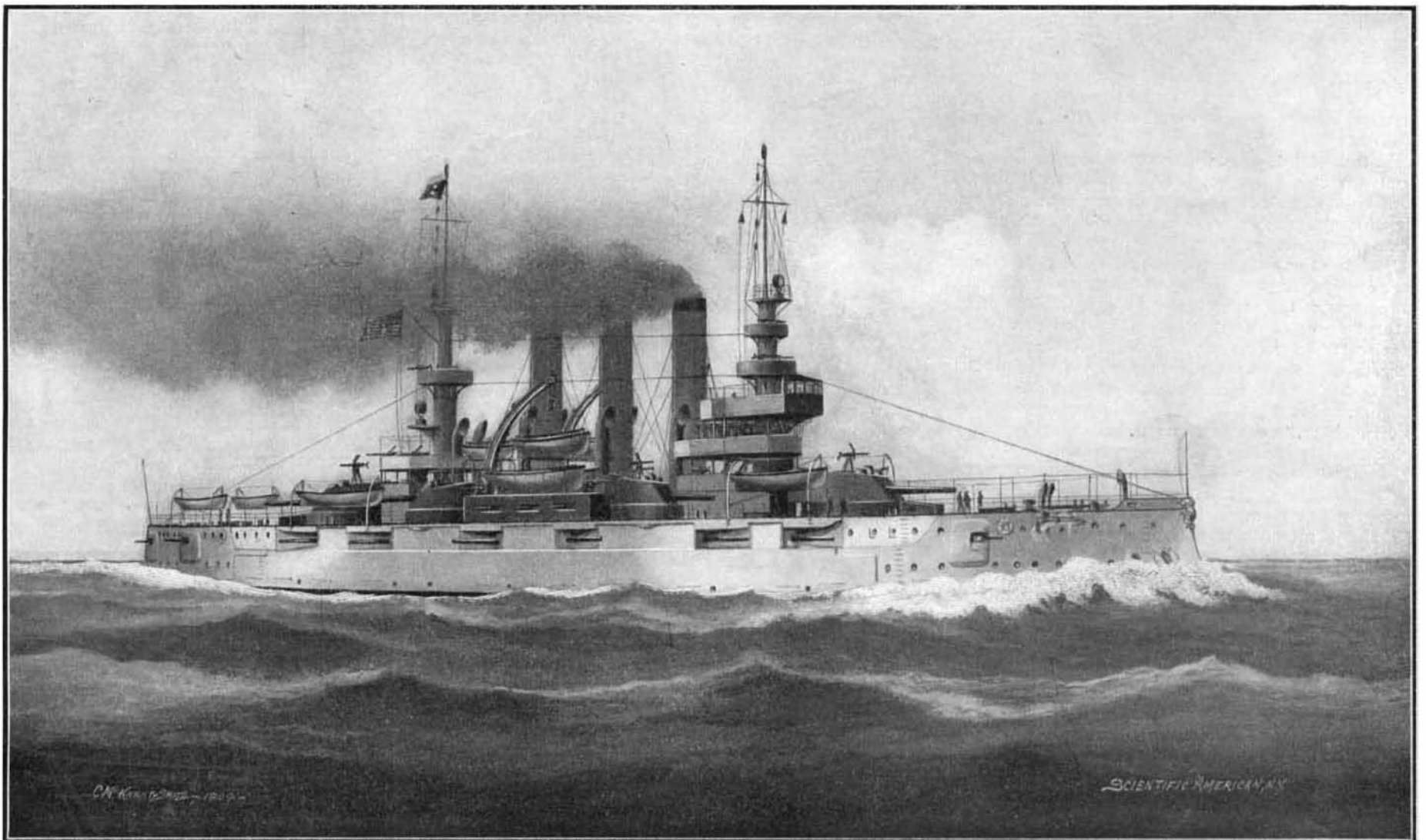
NEW YORK, OCTOBER 1, 1904.

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Displacement, 9,700 tons. Speed, 22 knots. Bunker Capacity, 1,500 tons. Armor: Belt, 4 inches; topsides, 4 inches; deck, flat, 2 inches; slopes, 3 inches. **Armament:** Fourteen 6-inch R. F.; eighteen 3-inch R. F.; twelve 3-pounder semi-automatic; four 1-pounder automatic; two 3-inch field guns; two 0.30-caliber machine guns; eight 0.30-caliber automatics. **Complement, 645.**

PROTECTED CRUISER "MILWAUKEE," LAUNCHED SEPTEMBER 10, AT UNION IRON WORKS, SAN FRANCISCO.



Displacement, 16,000 tons. Speed, 18 knots. Coal Supply, 2,200 tons. Armor: Belt, 11 inches to 4 inches; casemates, 7 inches; main turrets, 12 inches; secondary turrets, 8 inches; deck, 3 inches. **Armament:** Four 12-inch, eight 8-inch, twelve 7-inch, twelve 3-inch rapid-fire guns, 28 smaller guns. **Torpedo Tubes, 4 submerged. Complement, 803.**

BATTLESHIP "CONNECTICUT," LAUNCHED SEPTEMBER 29, AT THE BROOKLYN NAVY YARD.--[See page 231.]