

Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - EDITORS AND PROPRIETORS.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico, \$3.00
 One copy, one year, to any foreign country, postage prepaid, 20 lbs. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....\$3.00 a year.
 Scientific American Supplement (Established 1876)..... 5.00
 Scientific American Building Edition (Established 1885)..... 2.50
 Scientific American Export Edition (Established 1873)..... 3.00

The combined subscription rates and rates to foreign countries will be furnished upon application.
 Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, JULY 28, 1900.

THE END-OF-THE-CENTURY STEAMSHIP.

The performance of the "Deutschland" in exceeding on her maiden trip all previous records for the westward passage across the Atlantic suggests that marine engineering has by no means reached the limit of its possibilities. Great as the development of the fast Atlantic steamship has been in the closing years of the nineteenth century, the present indications are that in size, speed, and, above all, in economy of performance, each successive vessel in the opening years of the twentieth century will continue to show the same all-round improvement over its predecessors.

By the courtesy of the Vulcan Iron Works, Stettin, the builders of the "Deutschland" and of Mr. Emil L. Boas, the General Manager of the Hamburg-American Company, we are enabled to give further particulars of the performance of this vessel, both on her trial trip and on her maiden Atlantic voyage. On the long distance, deep-sea trial, from the mouth of the Oder to the mouth of the Elbe, the mean indicated horse power was 35,200. On the run from Plymouth to New York, the average indicated horse power for twenty-four hours was 34,200. The merit of this performance is greatly enhanced by the fact that the total consumption of fuel for the twenty-four hours was 550 tons, which works out at the remarkably low figure of 1.5 pounds per horse-power-hour. The low consumption of fuel is attributed by the builders largely to the Howden system of forced draught with which the "Deutschland" is fitted. The draught, before entering the furnace, passes around a nest of tubes through which the hot furnace gases are drawn on their way to the smokestacks, the draught entering the furnaces after lowering the temperature of the uptake between 200 and 300 degrees. As to the possibilities of the future, it is probable that the "Deutschland," by the time these lines are before our readers, will have exceeded the eastward record, of which the average speed, made by the "Kaiser Wilhelm," stands at 22.6 knots; and when her engines have been limbered up by further service we may look for an average of 23 knots for the whole passage.

That the Atlantic steamship will continue to grow in size and speed is suggested by the three great ships which are now being built, two of them at the Vulcan Yards, Stettin, for the North German Lloyd Company, and one by Harland & Wolff, at Belfast, for the White Star Line. The particulars of these vessels are herewith tabulated in comparison with those of recent Atlantic liners.

ATLANTIC STEAMSHIPS BUILT AND BUILDING.

Name.	Owners.	Length in Feet.	Displacement in Tons.	Horse Power.	Speed, in Knots.
Kaiser Wilhelm.....	N. G. Lloyd.....	649	20,000	28,000	23½
Oceanic.....	White Star.....	704	28,500	28,000	20½
Deutschland.....	Hamburg American.....	686	23,000	54,200	23
Kronprinz.....	N. G. Lloyd.....	663	21,500	32,000	23
Kaiser Wilhelm II.....	N. G. Lloyd.....	705	26,000	38,000	23½
Unnamed.....	White Star.....	750	32,000	(?)	(?)

The North German Lloyd Company will first place in service a vessel, the "Kronprinz," which in size will come between the "Kaiser Wilhelm" and the "Deutschland," and in speed will equal the latter. She will be 660 feet long, of 21,500 tons displacement, and is to show a sea speed of 23 knots with 32,000 horse power. The other vessel, to be known as "Kaiser Wilhelm II.," is to be 705 feet long, of 26,000 tons displacement, with an indicated horse power of 38,000, and is to maintain a sea speed of 23½ knots. The North German Lloyd Company have not favored the use of superheated forced draught; but if, as is not unlikely, they are moved by the economical steaming of the "Deutschland" to substitute forced for natural draught, we shall expect to see this vessel average 24 knots after she has been a few months in service.

Although the "Kaiser Wilhelm II." will slightly exceed the "Oceanic" in length, her displacement, owing to her finer lines and shallower draught, will be less by about 2,500 tons. The White Star Company have never been greatly affected by contemporary

practice in marine engineering, and have always followed a policy that was strictly individual and consistent. A quarter of a century ago they built, in the "Britannic" and "Germanic," the prototypes of the long, narrow, and speedy Atlantic liner of to-day. Recently, in the "Oceanic," they have instituted another distinct type, in which high speed and extravagant demand for boiler and engine space have given way to great cargo capacity and more generous passenger accommodation; while no attempt has been made to attain the exceptional speeds which have characterized the fast ships of the Cunard and the German lines. Hence, it is not probable that the huge vessel which is now being built at Belfast for this company will be any faster than the "Oceanic," although she will greatly exceed her in size. She is to be about 50 feet longer and 5 feet broader, with 3,500 tons increase in displacement on a draught of 32 feet 6 inches. Her length on deck will thus be 750 feet, beam 73 feet, and displacement 32,000 tons. In the absence of any statement to the contrary, however, the public will be curious to know whether the Belfast firm will be instructed to place sufficient engine power in this vessel to make her the swiftest as well as the largest of ocean liners.

OUR VAST RAILWAY SYSTEM.

The statistical report of the Interstate Commerce Commission shows that there has been a steady extension of the railway system of the United States, and a marked increase in traffic, both freight and passenger; while the more healthy condition of railroad finances is shown by the large reduction that has taken place during the year in the number of railways in the hands of receivers, there being but seventy-one such roads on June 30, 1899, as compared with ninety-four on the corresponding date of the previous year.

On June 30, 1899, the total single-track railway mileage of the United States totaled 189,895 miles, an increase during the year of 2,898 miles, which is greater than that of any other year since 1893. The total number of locomotives was 36,703, an increase of 469 over last year. The total number of cars of all classes in the service of the railways was 1,375,916, an increase of 49,742. Of these 33,850 were passenger cars, 1,295,510 were freight cars and 46,556 were devoted to the direct service of railroads. It must be remembered, however, that cars owned by private companies and firms, used by railways, are not included in these returns.

The number of employes was 928,924, an increase of 54,366. Of this total number the service of 34,900 employes was required for general administration, 287,000 for maintenance of way and structures, 181,000 for maintenance of equipment, and 418,000 for conducting transportation.

The total amount of railway capital outstanding was over \$11,000,000,000, representing a capitalization of \$60,566 per mile of line. The total amount of dividends declared during the year was \$111,900,822, which would be produced by an average rate of 4.96 per cent on the stock on which some dividend was declared.

The gross earnings were \$1,313,610,118, an increase of over \$66,000,000 for the year. The operating expenses were \$856,968,999, an increase of \$39,000,000. The amount of dividends declared during the year was \$111,000,000, leaving a surplus of \$53,000,000, the corresponding surplus of the preceding year being \$44,000,000.

The total number of casualties during the year was 51,743, of which 7,123 were killed and 44,620 were injured. The number of passengers killed during the year was 239 and the number of injured was 3,442. During the year no less than 4,040 trespassers were killed, and a slightly larger number injured. At highway crossings alone 693 were killed and 1,125 injured. The statistics of injuries to railway employes continue to be the painful feature in the annual statistics, for with reference to trainmen, in which term are included engine-men, firemen, conductors and other trainmen, it is shown that 1 out of every 155 was killed and that 1 out of every 11 employed was injured. In view of the great risks run by employes, it is gratifying to note that, thanks to the efforts of the Commission, the work of equipping cars with automatic couplers and other attachments calculated to reduce the list of casualties, is proceeding rapidly, for, of the 1,295,510 cars in the freight service, 730,670 were fitted with train brakes and 1,067,000 with automatic couplers.

INCREASE OF OUR NAVY SINCE THE SPANISH WAR.

A request from a subscriber for a statement of the new vessels that have been authorized for our navy since the publication of the SCIENTIFIC AMERICAN NAVY SUPPLEMENT, suggests to the editor that this information will be generally welcomed by those of our readers who include the NAVY SUPPLEMENT in their files.

BATTLESHIPS.—Beginning, then, with the battleship class, we have the "Maine," "Missouri," and "Ohio," authorized May 4, 1898. They are of 12,300 tons displacement and 18 knots speed; are protected with 11-inch armor on the belt, and 12-inch on the barbettes and turrets; and will carry four 12-inch B. L. rifles and

sixteen 6-inch rapid-fire guns besides twenty-six 6-pounders and automatics.

Following these come the ships of the "Georgia" class, the "Georgia," "New Jersey," and "Pennsylvania," authorized March 3, 1899. These vessels are to be of 14,650 tons displacement and 19 knots speed. The belt will have a maximum thickness of 11 inches, and the gun positions will be protected with from 11 to 6½ inches of armor. After lengthy discussion, it has been decided to provide these vessels with the double-deck turret, arranged as in the "Kearsarge," and the armament will consist of four 12-inch and four 8-inch B. L. rifles; fourteen 6-inch and twelve 3-inch rapid-fire guns, besides thirty 3-pounders and machine guns.

The present Congress has recently authorized the construction of two more battleships of equal size, to be known as the "Virginia" and "Rhode Island." In them a return is to be made to the turret system of the "Oregon" and "Iowa," the intermediate 8-inch battery being mounted in four separate turrets at the four corners of the central citadel. The particulars of these vessels will be 14,650 tons displacement; 19 knots speed; 11-inch belt; 11 to 6½-inch armor on gun positions; main battery, four 12 inch; intermediate battery, eight 8-inch; secondary battery, twelve 6-inch, and twelve 3-inch rapid-fire guns, besides 30 smaller guns.

The five battleships last mentioned are at present on paper the most powerful and best protected ships in the world.

ARMORED CRUISERS.—On March 3, 1899, Congress authorized the construction of three large armored cruisers of 13,000 tons displacement and 22 knots speed, to be named the "California," "Nebraska," and "West Virginia." Three more of the same size and speed, which were authorized by the Congress of 1899-1900, are to be called the "Maryland," "Colorado" and "South Dakota." The Board on Construction has been so preoccupied with the discussion of the battleship designs that the details of these vessels are not even yet definitely decided, but it is probable that the whole six will be built from the same plans and embody the following features: Displacement, 13,000 tons; speed, 22 knots; protection, a curved deck associated with a continuous belt of 6-inch armor; armament, four 10-inch long-caliber rifles mounted in two turrets fore and aft, and sixteen 6-inch guns mounted within casemates in broadside. These vessels will have an exceptional steaming radius. The last Congress also authorized the construction of three 8,000-ton protected cruisers. These vessels will carry, probably (the matter is not definitely settled), four 8-inch rifles in two turrets fore and aft, and either twelve or fourteen 6-inch rapid-fire guns in broadside casemates. In working out the plans of these ships an effort will be made to reserve sufficient displacement for armor to allow a continuous belt to be used at the waterline, thus placing these fine vessels, which are to be of 22 knots speed, in the armored cruiser class.

HARBOR DEFENSE MONITORS.—On May 4, 1898, the construction was authorized of the four single-turret monitors, "Arkansas," "Connecticut," "Florida," and "Wyoming," of 3,235 tons displacement, and 11½ knots speed, with 11 inches of armor on sides and barbets, and armed with two 12-inch rifles and four 4-inch rapid-fire guns.

SEMI-PROTECTED CRUISERS.—On March 3, 1899, a batch of six somewhat nondescript vessels was authorized, which, although they appear in the official list as protected cruisers, are not really so—the protective deck extending only throughout the middle portion of the vessels, the ends of the deck, as in the early "Chicago" and "Atlanta," being unarmored. These vessels moreover, because of their extremely low speed, are scarcely eligible to be classed in the cruiser classes, where the speed is invariably in new vessels from 21 to 23 knots. The six vessels are known as "Chattanooga," "Cleveland," "Denver," "Des Moines," "Galveston" and "Tacoma." They are 3,200 tons displacement, 16.5 knots speed, and carry a battery of ten 5-inch rapid-fire guns and a dozen 6-pounders and machine guns.

TORPEDO BOAT DESTROYERS, ETC.—The same bill of May 4, 1898, mentioned above, included sixteen torpedo-boat destroyers and twelve torpedo boats, all of which are now either nearing completion or afloat. The destroyers are seagoing craft of 420 to 433 tons displacement and 28 to 30 knots speed; the torpedo boats are from 157 to 340 tons displacement, and vary in speed from 26 to 30 knots.

SUBMARINE BOATS.—The last Congress, impressed by a somewhat favorable report by a board appointed to test the capabilities of the Holland submarine boat, authorized the construction of six vessels of this type, but enlarged and improved.

Of the fleet of vessels outlined above, sixty-one in all, it may be said that as far as the battleships, armored cruisers, and torpedo craft are concerned, the designs leave little to be desired. The armored vessels are particularly fine, being large, fast, amply protected, powerfully armed, and possessing great coal capacity; but one regrets that the appropriation voted and being expended on the monitors, submarine boats, and semi-