

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, £0 16s. 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 1878)..... 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, OCTOBER 13, 1900.

EXTENSION OF THE RAPID TRANSIT TUNNEL TO BROOKLYN.

One of the most important steps ever taken in connection with the scheme for underground rapid transit in New York is the adoption by the Rapid Transit Board of the route and plans for the construction of the system to Brooklyn by means of a tunnel beneath the East River. The plan contemplates the extension of the tunnel from its present proposed terminus at City Hall Park to Bowling Green, and thence by way of Whitehall Street to the East River. The line will be carried below the river from the foot of Whitehall Street to the foot of Joralemon Street, Brooklyn, beneath which it will run as far as the City Hall, where there will be a station. From the City Hall it will be carried beneath Fulton Street to Flatbush and Atlantic Avenues, which will constitute the present terminus of the line. That section of the extension which lies beneath the river, together with its approaches on either side, will consist of two 15-foot cast iron tubes which will provide two separate tunnels, one for each track. At the Brooklyn City Hall two loops will be constructed, one above the other. Of these, one will be used for the New York trains, and the other will be built in anticipation of the time when the development of underground tunnels in Brooklyn will call for the running of local trains. The new plan also contemplates another loop on the New York system, which is to commence beneath Broadway, near Exchange Place, and be carried beneath Bowling Green, State Street, Battery Park, and Whitehall Street, returning to Broadway. The length of the Brooklyn extension will be $4\frac{1}{2}$ miles, of which about a mile and a half will be of cast-iron tube construction. It is estimated that the trip from one city hall to the other will occupy eight minutes.

In view of the fact that it is probable that delays incidental to obtaining the authority of the Municipal Assembly and the approval of property owners will prevent the commencing of work on this extension for twelve months or more, the Rapid Transit Board is to be congratulated on having so promptly adopted the plans of its chief engineer. There is no question of the wisdom of extending the New York tunnel to the southern extremity of Manhattan Island; and no system of rapid transit designed for the accommodation of Greater New York would be adequate that did not include the Borough of Brooklyn and rapidly growing suburbs of Long Island. The natural features of the site on which New York is built render it inevitable that ultimately the great tide of suburban home-seekers will flow out on to Long Island, in preference to moving over the congested roads of travel which extend northward through Manhattan Island. While the completion of the underground tunnel will lead to the rapid settling up of the suburban districts north of the Harlem River, the accessibility of the Boroughs of Brooklyn and Queens is certain to attract an enormous number of home-seekers, when once the travel on the Brooklyn Bridge has been relieved by the construction of the new rapid transit tunnel to the south, and the new East River Bridge to the north, of that overcrowded structure.

RAILROAD SPEEDS IN 1899.

In a recent letter to The London Times, a correspondent, who has evidently gone into the subject with great care, has compiled several tables, showing the fastest trains, the distances they run, and their speeds, on the leading railroads of the world. The tables will be in some respects particularly gratifying to American readers, although it must be confessed that in respect to the total number of fast long-distance trains, France, which of late years has made wonderful strides in the development of her railroads, easily holds the premier position. Under the table of the fastest booked speeds, from start to stop, this country heads the list with four notable trains which are run on the Philadelphia and Reading and Pennsylvania Railroads, from Camden to Atlantic City. The two Philadelphia and Reading trains cover the dis-

tance of $55\frac{1}{2}$ miles at the rate of 66.6 miles an hour, while the two Pennsylvania Railroad trains run between the same points a distance of 59 miles at the rate of 64.3 miles an hour. Following these is a French train, which runs the distance from Moreaux to Bordeaux, 67 $\frac{1}{4}$ miles, at the rate of 61.6 miles per hour, and next to this are four trains on the Camden-Atlantic City lines, with speeds of 61 and 60.5 miles an hour. Then follows a train on the Paris-Amiens route, which covers $81\frac{1}{4}$ miles at a speed of 60.5 miles an hour. The next two fast runs are short ones of 15 miles from Dorchester to Wareham in England, which are booked to be made at a speed of 60.1 miles an hour. It is a significant fact that out of forty-three expresses, with a speed of over 55.5 miles an hour, these Dorchester-Wareham trains and three trains on the Caledonian Railroad, two of which cover $32\frac{1}{2}$ miles at 59.1 miles an hour and 56.5 miles an hour, and the third, $89\frac{1}{4}$ miles at 55.6 miles an hour, are the only ones that represent the English railroads; although it is but a few years ago that English roads were supreme in the matter of speed among the railroads of the world. Out of a total of 57 trains given in this table, there are only three other English trains which have a speed of 55 miles an hour or over. Summing up, we find that America heads the list in point of speed, with twenty-three trains, while France has twenty-six trains and England eight in the table referred to.

The credit for running the fastest long distance train in the world is due to the Orleans and Midi Railroad, whose train from Paris to Bayonne, a distance of $486\frac{1}{4}$ miles, is run at a speed, including six stops, of 54.13 miles an hour. This is better than the Empire State Express, which runs from New York to Buffalo, 440 miles, at a rate, including four stops, of 53.33 miles an hour. The best work of the English railroads is that done on the Great Northern from King's Cross to Edinburgh, a distance of 393 $\frac{1}{2}$ miles, which is covered at an average speed, including three stops, of 50.7 miles per hour.

We have said that by virtue of the high average speed and great number of its long-distance express trains, France holds the premier position to-day, a statement which is borne out by the fact that there are thirteen expresses which are booked to run at average speeds, including stops, of from 51.3 to 57.7 miles per hour, over distances of from 123 to $486\frac{1}{4}$ miles. The fastest of these, which runs from Bayonne to Bordeaux, covers a distance of 123 miles at 57.7 miles per hour, with two stops; while the most creditable run is one from Paris to Bayonne, of $486\frac{1}{4}$ miles, at 54.1 miles an hour, above referred to. The letter to the Times, with its valuable tables, will be found in full in the current issue of the SUPPLEMENT.

Commenting upon this very interesting and impartial communication, The Engineer and Engineering have taken very different and very characteristic points of view. Engineering accepts the situation with the remark that it is "mortifying to observe what an extremely poor show is made by Great Britain in a field in which she was long pre-eminent," and adds that "if we take into account the special conditions in each case, the American performances are made to appear even more extraordinary than is at first apparent." The Engineer, on the other hand, states that "the occasion has been seized as a favorable opportunity for drawing invidious comparisons between the railways of the United States and of this country." The latter contemporary takes occasion to felicitate itself on the fact that "it has done something to prevent the perpetuation of the preposterous statements as to enormous speeds attained on American railways." In view of the fact that the speeds as given are absolutely correct, there is something highly diverting to American readers of The Engineer in the persistency with which it has endeavored to escape from facts which have long been recognized by the world at large.

THE WORLD'S NAVAL PROGRESS FOR 1900.

The most important contribution, and the one possessing the most popular interest, in "Notes on Naval Progress for 1900," which have recently been published under the direction of Capt. C. B. Sigsbee, chief intelligence officer of the navy, is an article by Lieut. Wm. M. Howard, entitled "Increase in Naval Strength as shown by the Naval Budgets." One cannot turn over the pages of this work without feeling that there is little evidence that the feverish naval activity of the past few years is abating. A study of the budgets and programmes of construction of the various naval powers indicates that in the early years of the coming century the great navies of the world will continue to add to their fleets with increasing rapidity.

As usual, it is Great Britain which leads the way by voting the largest sum of any of the Powers for the support and increase of her navy. So rapid, however, has been the growth of other navies which may at any time become her combined opponents, that the progressive element in naval affairs in that country considers that the Admiralty programme for this year is altogether inadequate. In laying it down as the prin-

ciple for her guidance that the British navy must be more than equal to any other two navies combined, England has set herself a truly stupendous task, the magnitude of which can best be appreciated when we look at the extraordinary development taking place in the German, French, and Russian navies. The British programme calls for the laying down this year of two battleships, six first-class armored cruisers, one second-class cruiser and half a dozen sloops, gunboats and torpedo boats. Including these, the number of vessels under construction in 1900 is seventeen battleships (only one less than the total number of battleships already constructed, building, or proposed for our own navy), twenty armored cruisers, one first-class protected cruiser, two second-class protected cruisers, one third-class cruiser, eight sloops, four torpedo boats, twenty-one destroyers, and one royal yacht. In 1899, England added nineteen vessels with an aggregate tonnage of 122,322 tons to her fleet, while in 1898 she added thirty ships with a total tonnage of 140,988 tons. This year's budget provides for an increase of 4,240 in the personnel; an addition which will bring the total strength up to 114,880 officers and men. The total naval estimates for the year 1900-1901 amounted to \$137,613,000.

The French shipbuilding programme of 1896, which covered a period extending to 1907, called for the construction of 220 vessels. In addition to this, the programme for this year authorizes the construction of the following types of vessels, which are considered necessary to render the French fleet more homogeneous than it is at present: Six battleships, five armored cruisers, twenty-eight destroyers, one hundred and twelve torpedo boats, and twenty-six submarine torpedo boats. When the programme is completed, the French fleet will consist of twenty-eight battleships, twenty-four armored cruisers, fifty-two destroyers, two hundred and sixty-three torpedo boats and thirty-eight submarine boats. The total cost of the old and the additional programme will be \$142,440,000.

The expressed determination of Germany to become a great naval power lends particular interest to that part of the report which deals with her navy. The policy of the Emperor is "to provide the German empire with a navy so strong that no power will dispute with her upon the high seas." Although there is considerable opposition to the bill to carry into effect the latest proposals for an increase, it is pointed out in the report that even if these proposals should fail to be put through, the programme as already authorized insures possession by Germany in the early part of the coming century of an extremely powerful fleet. In 1900 it consists of seventeen battleships, ten large cruisers, twenty small cruisers, twelve divisions of torpedo boats. In 1908 Germany will possess twenty-nine battleships, twenty large cruisers, fifty-one small cruisers, and sixteen divisions of torpedo boats; while in 1916 she will possess thirty-eight battleships, twenty large cruisers, forty-five small cruisers and sixteen divisions of torpedo boats.

The naval budget of Italy for the year 1900-1901 amounts to \$24,435,000, while an annual expenditure of \$2,000,000 has been authorized for the period ending in 1903. Italy has at present on the stocks four first-class battleships, three armored cruisers, three small cruisers, ten destroyers, and three first-class torpedo boats, in addition to two first-class battleships of what is known as Admiral Bettolo's naval programme.

The activity of Japan is shown in the fact that the 117 warships called for by the naval programme of 1895 have been completed, or are under construction, and it is likely that a new programme will shortly be laid down. The budget for 1900 calls for the expenditure of \$46,946,000.

Russia, like Germany and France, has now formulated a programme of naval construction. The sum of \$45,000,000 was voted in 1898 for the completion in six years of ten armored cruisers, ten second-class cruisers, and twenty destroyers. This was a special programme, additional to the regular annual naval estimates. Although Russia's naval budget has increased from \$29,000,000 in 1897 to \$45,000,000 in 1900, it is reported that the government will shortly announce a new programme for the increase of her fleet.

Spain is selling her obsolete warships, and with the money thus secured two vessels of about 2,000 tons displacement are to be constructed and used for the training of officers and men. The money voted under the budget of this year is to be spent in completing and increasing the crews of the "Pelayo," "Carlos V.," "Numancia," "Vittoria," and "Nautilus."

Comparing our own progress with that of the other naval powers, it is evident that there must be no relaxation in our naval activity. Although we have not laid down programmes of construction extending over several years, our present system of authorizing a certain number of ships each year, if maintained at the rate which has marked our recent progress, will enable us to retain our position as fourth naval power; but it is evident that any relaxation, such as would be caused by the failure of Congress to vote naval appropriations in any particular year, would cause us to lose our present creditable standing.