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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

REINFORCEMENT OF THE BROOKLYN SUBWAY TUNNELS.

In view of the popular distrust of the Subway tunnels to Brooklyn, which was aroused at a certain period during their construction, a distrust which it took several weeks of successful operation to dissipate, we present some details of the method of strengthening the tunnels during construction, which should be sufficient to satisfy the public once and for all not only that the tubes are "safe" but that they are stronger than as originally designed.

The irregularity in the grades of a certain part of the tunnel and the deformation of the cast-iron shell were caused by faulty control of the shield in the process of driving, coupled with an undoubted weakness of the cast-iron tube for the stresses it was called upon to sustain when it entered the loose material below the river. The irregularities of grade and weakness of the shell were, fortunately, capable of correction; and the engineers of the Interborough Company spared neither time nor expense in repairing the defects and putting this portion of the tubes in first-class condition. To prevent any tendency of the tubes to sag in the direction of their length, 20-inch steel-and-concrete piles were sunk, in pairs, at 30-foot intervals longitudinally of the tube, the piles being carried down to solid rock or other firm material. The grade was corrected by enlarging the tunnel at the top or bottom, as might be required, until a perfectly true grade was established. An immense amount of work was done also to strengthen the tubes against distortion where they passed through the soft material. The concrete lining was here made thick enough to extend 3 inches beyond the flanges of the lining plates, and it was specially increased in thickness at the top of the tunnel and the sides, by making the outline flat instead of circular at these places. Inside of this extra concrete and around the top of the arch for a distance of 120 degrees circumferentially, there were imbedded three 1¼-inch round rods to each segmental ring of the tubes. Also, at the top of the tunnel there were imbedded sixteen longitudinal 1¼-inch round rods connected at their ends by turnbuckles. A similar number of circumferential rods were imbedded in the bottom concrete of the tubes. On each side of the tubes, lapping the circumferential rods at the top and bottom, were placed two 1-inch square rods to each ring. It will be seen that the cast-iron lining of the tunnel is thus reinforced by what is practically a second shell of steel and concrete. So closely assembled are the steel bars and rods, that in some cases the concrete had to be put in place by hand, and extreme care was taken to secure a thorough bond between the materials. Whatever grounds for anxiety may have once existed as to the stability of the tunnel have by these precautions been entirely removed.

THE PANIC AND THE RAILROADS.

Few people who are not directly connected with the railroad interests of this country appreciate how seriously they were affected by the panic at the close of last year. It came at a time when the development of our railroad system, in the extent of its mileage, the magnitude of its rolling stock, and the enormous extent of its freight and passenger traffic, had reached a point that was undreamed of a few years ago, even by our most optimistic railroad men. In spite of the fact, as shown by the Interstate Commerce Commission reports, that there were over 223,000 miles of line in the country served by nearly 2,000,000 freight cars of 70,000,000 tons aggregate capacity, there was no little anxiety lest another car famine, similar to that of a few years before, should occur. In the closing months of last year, however, the tide of new construction and increasing freight and passenger traffic was suddenly halted and commenced to swiftly ebb—how swiftly is shown by the fact that at the opening of the present year there were over 300,000 idle freight cars on the various railroads, while the returns made to the Interstate Commerce Commission reveal that, in the last three months of 1907, while the ratio of expenses to earnings had risen from 67 per cent to 76 per cent, there had been a decrease of earnings per mile of 31 per cent. According to an estimate of Mr. S. Thompson, prepared for the General Managers' Association of Chicago, there were recently about 340,000 railway employees out of work, whose idleness directly affected, probably, not less than 1,500,000 people. On the other hand, it is gratifying to learn from a statement issued by the Chief of the Bureau of Immigration that, as the result of several hundred thousand inquiries sent out by his office, to determine the present industrial conditions and the probability of demand for labor, he found in almost every industrial center and particularly in the farming districts signs of a steady return of activity and the probability during the next few months of a steadily increasing demand for labor.

REPORT ON THE QUEBEC BRIDGE DISASTER.

Probably no great engineering disaster has been made the subject of such an exhaustive inquiry as the fall of the Quebec Bridge. For five months the Royal Commission of Inquiry was continuously engaged in its investigations, and the report which has recently been made public is one of the most voluminous and valuable documents of the kind ever presented. In the current issue of the SUPPLEMENT will be found a lengthy summary of the conclusions reached by the Commission, which finds that the collapse of the bridge was due to the failure of the lower chords in the anchor arm, near the main pier, and that the failure of these chords was due to their defective design. The stresses that caused failure did not result from abnormal weather conditions or accident, but were such as might be expected in the regular course of erection. The work done by the bridge company in making the detail drawings, in planning and carrying out the erection, and in fabricating the material was good, and the steel used was of good quality. The Commission finds that the failure cannot be attributed to any cause otlier than errors of judgment on the part of the designing and the consulting engineers connected with the construction of the bridge; although they state that these errors of judgment cannot be attributed either to lack of common professional knowledge, the neglect of duty, or to the desire to economize. The ability of the two engineers was tried in one of the most difficult professional problems of the day, and proved to be insufficient. The Commission considers that the specifications were not satisfactory, the unit stresses employed being higher than any established by past practice. A grave error was made in assuming the dead load at too low a value. This error alone was of sufficient magnitude to have required the condemnation of the bridge, even if the details of the lower chords had been of sufficient strength; for the actual stresses in the completed bridge would have been considerably greater even than the high stresses permitted by the specification. There is one clause which will be of particular interest to bridge engineers, and we are inclined to think will call forth no little protest. This occurs toward the close of the report, where the Commission states that the professional knowledge of the present day concerning the action of steel columns under load is not sufficient to enable engineers to economically design such structures as the Quebec Bridge. Now, although the SCIENTIFIC AMERICAN is free to admit that our knowledge of the strength of large steel compression members is not as accurate as might be desired, we are satisfied that, if the weight of steel which was used in the bottom chord member that failed had been built up in a form better adapted to resist compressive loads, the bridge would have been standing to-day—though subjected, of course, to higher stresses than are sanctioned by the best modern practice.

URGENT NEED OF FOREST PRESERVATION.

We direct attention to the article on another page of this issue describing the practical work of the Bureau of Forestry. That the case is urgent is shown by the estimate made by the Forest Service of the United States that, at the present rate of consumption, and taking no account of renewals of growth, which require on an average about thirty-five years, the timber supply of this country will be totally exhausted in fourteen years. This is based on an estimate that the total stand of timber in the United States is 1,400 billion and that the annual use of timber to-day is one-fourteenth of this amount or 100 billion feet. The Forest Service is directing its efforts to the preservation of this timber supply by creating national forests and disseminating information as to the best way in which forest resources may be utilized. According to Mr. Herbert M. Wilson, of the United States Geological Survey, the great hope for the preservation of our timber supplies lies in teaching the people how to scientifically manage the forest and prevent waste; and he summarizes the method to be adopted as follows: The putting to use of every part of each tree that is cut; the stopping of forest fires; the prevention of wasteful bark cutting, and the employment of means to preserve the life of the timber after cutting in the various uses to which it is put. It is encouraging to learn that prompt action, such as is being encouraged by the Bureau of Forestry, may place this country in an even better position than European countries, whose forest resources were practically depleted before remedial measures were taken. It is also expected that the rapidly-extending use of concrete in place of wood will serve as a powerful agent in preventing the extermination of our forests.

THE BRITISH NAVAL PROGRAMME FOR 1908.

Though the naval appropriation made by the British government for the year 1908 represents a slight increase upon the estimate of last year it is considerably below what it was four years ago, which marked the high-water mark in British naval production. For the current year the total sum to be devoted to naval purposes is $161,597,500, of which $37,726,010 is to be expended upon new construction. The new programme, which in the words of the First Lord of the Admiralty is "exceedingly modest," comprises the building of one battleship of the improved "Dreadnought" class, one large armored cruiser, six fast protected cruisers, sixteen torpedo-boat destroyers, and a number of submarines to the estimated value of $2,500,000. In regard to the latter the Admiralty has entered upon a new policy, that is the construction of this class of craft in the government dockyards, the object being thereby to keep a check upon private contracts. Moreover the department has come to an arrangement with the leading armor-plate manufacturers whereby a considerable reduction in the price of armor has been effected and this development will exercise an appreciable reduction in the cost of warship construction.

Though only one vessel of the "Dreadnought" class is to be laid down during the present year the British Admiralty has already, including vessels of the "Lord Nelson" and "Agamemnon" class which coincide with the all-big-gun type of warship, nine of these vessels launched, while three are in course of construction and two more are authorized, making fourteen units of this type in all.

Between April 1, 1907, and March 31, 1908, twenty-six warships have been completed and placed in commission. These comprise one battleship ("Lord Nelson"), three armored cruisers, three torpedo-boat destroyers of the new ocean-going 33-knot turbine type, ten torpedo boats of the coastal class, eight submarines, and the repair ship "Cyclops." At the present time there are also building sixty further vessels—seven battleships, four armored cruisers, one unarmored cruiser, ten torpedo-boat destroyers, twenty torpedo boats, and eighteen submarines.

The present government is continuing the general lines of the policy of the former administration, the results of which are now commencing to bear fruit. The nucleus-crew system has proved highly satisfactory and is to be continued. Under this arrangement the chief executive officers and more important ratings are always on board the vessels when out of commission. From time to time the full crews are made up and are subjected to a course of sea-going practice, while the machinery and boilers are always maintained in first-rate condition. The result is that such vessels are always ready for instant mobilization, and the wisdom of this arrangement has been strongly exemplified during the past few months, when vessels with such nucleus crews have been suddenly called out for an emergency and have been able to reply to the summons with the minimum of delay.

In regard to the establishment of the new dockyard at Rosyth on the east coast of Great Britain, $17,250,000 is to be devoted during the current year toward the construction and equipment of this strategical point. The property acquired aggregates 1,184.2 acres with 285 acres of foreshore. A superintendent engineer was appointed for the purpose of studying the various great dockyards throughout the world together with their equipment, so that Rosyth might be replete with the most modern appliances and when completed constitute the finest and largest naval port extant. As a result of his investigations a general scheme has been drawn up in such a manner that any section or sections might be carried to fulfillment at once without interfering with the general aspect of the whole idea. The Admiralty proposes to push forward with the construction of a great graving dock, closed basin, and an entrance lock with a depot for