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NEW YORK, SATURDAY, NOVEMBER 29, 1902.

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.

REPORT OF THE CHIEF OF THE BUREAU OF ORDNANCE.

It is always with pleasure that we take up the Annual Report of the Chief of the Bureau of Ordnance, for there is no branch of the navy that is able to show at the end of each twelvemonth more uniformly satisfactory results. From the very inception of our new navy, the work of this Bureau has been marked by almost uniform success. Although at the time of the Spanish war we had dropped considerably behind the rest of the world in the matter of smokeless powder and high-velocity guns, the lost ground has been more than made up, and to-day our guns, gun mounts, powder and shells are among the best in the world; while the prestige that accrued to us from our invention and manufacture of Harveyized armor will remain to our credit as long as armor-plate manufacture endures.

Although, as the Report suggests, no striking developments have occurred in the improvement of guns and armor, there has been satisfactory progress all along the line, and the manufacture of material has fully kept pace with the demand for it. The most interesting of the new guns just now is the 7-inch, 45-caliber piece, twelve of which are to form the secondary battery of each of our two great battleships "Louisiana" and "Connecticut." This gun, designed for a muzzle velocity of 2,900 foot-seconds within a limit of chamber pressure of 17 tons per square inch, has developed a muzzle velocity of 3,035 foot-seconds with a chamber pressure of only 16 1-3 tons, a most creditable result, not equaled or excelled by any gun of the same class. It is interesting to learn that the Bureau has recently ordered the manufacture of a 6-inch, 50-caliber gun to weigh about 8 tons, from which a muzzle velocity of 3,400 to 3,500 foot-seconds is expected with a 100-pound projectile. It is gratifying to know that the work of converting the old gravity-return mounts of the 6-inch guns of our earlier cruisers is being carried on, and that, shortly, practically all of the guns of this class will have the increased rate of fire and additional handiness due to reconversion. The "Baltimore," which has been undergoing reconstruction and refitting at the New York Navy Yard, is being rearmed with 6-inch, 45-caliber guns, and a similar change is to be made on the "Newark." The British-built cruisers "New Orleans" and "Albany" are to have their Armstrong guns replaced by 5-inch, 50-caliber, rapid-fire guns of American make, chiefly for the purpose of securing uniformity of guns and ammunition.

During the past year 7,612 tons of armor have been delivered at the various shipyards. The Report states that no improvement worth speaking of seems to have been made of late in the quality of the armor; a matter of regret, since guns, powder and projectiles have each made a decided advance. Rear-Admiral O'Neil draws attention at considerable length to the fact that the charge of delay in warship construction, due to the non-delivery of armor, has been pressed too far, and he shows that in the case of several of our ships the contract for armor was let many months after the contract for the ships, while in several cases the armor was delivered a year or so before the final completion of the vessel. Thus the "Illinois" was completed in September, 1901, her last armor plate having been delivered August 31, 1900, that is, a year before the final completion of the vessel; moreover, it was placed on the ship October 31, 1900, ten months before the vessel was in all respects completed. In the matter of powder, we learn that with the exception of ignition and shell powder, no black or other than smokeless powder has been purchased or manufactured for the Navy since the Spanish war. As regards the quality of our smokeless powder, we are told that so far as stability is concerned, the results have been most satisfactory.

The public will be greatly interested to learn that the question of improving the warships "Oregon," "Indiana" and "Massachusetts" by taking out their heavy and cumbersome 13-inch gun turrets and substituting electrically-operated balanced 13-inch turrets, and of otherwise improving them, has been under consideration on several occasions. We are of the opinion that this change could be made to very great advantage, for as coast defense vessels these ships will doubtless remain for several decades upon the active list of our Navy. Reference is made in the Report to the new armored cruisers of the "Tennessee" class, of 15,400 tons displacement, over which an earnest controversy was waged on the question of whether to give them 22 or 23 knots speed. Admiral O'Neil states that to give them a knot more speed, or the same speed as that of the British cruisers "Good Hope," "King Alfred" class, would call for machinery which would weigh 379 tons, or the weight of four 10-inch guns, mounts and turrets; even a quarter of a knot would represent the weight of an additional 2 inches of armor over the whole protective deck. As to artillery, the Chief of the Bureau considers that a higher stage of efficiency will be reached in the future than we have gained to-day. Stronger guns of better material, admitting of higher pressures, these pressures obtained probably with smaller charges and quicker powders, are among the possibilities that offer an interesting field of investigation. While a chamber pressure of 15 tons per square inch was until recently considered the maximum pressure that could be safely allowed, we have now a pressure of 17 and 18 tons, and guns designed for working pressures of 20 tons per square inch will soon follow.

CRITICISM OF THE NEW EAST RIVER BRIDGE.

In a recent issue of the New York Sun there appeared a letter from an engineer who was on the staff of the Forth Bridge during the erection of that famous structure, in which the writer, after paying a well-deserved compliment to the bravery of the city Fire Department at the East River Bridge fire, passes on to a general criticism of the careless management which rendered a fire possible, and of the great delay in the completion of the bridge, and closes with an attack upon the general design of the East River Bridge as such, alleging that it is erected on "antiquated and discarded engineering practice." The writer of the letter in question announces himself in his opening sentence as having been one of the staff of engineers that built the Forth Bridge, and he would have us believe that New York city is engaged in the construction of a great municipal work which is wrong in theory, poor in construction, and doomed to early decay. The somber hue of his reflections is evidently deepened by the fact that he was associated with the construction of a bridge which, according to his convictions, is the only type that is recognized by good engineering practice, or that the all-destroying hand of time will spare.

The Scientific American would scarcely have given attention to the letter, were it not that the writer of the letter admits that he was driven to utter his word of warning by an article which appeared in our journal so far back as August, 1897. The article in question contained a detailed description of the bridge, in which, by way of emphasizing its vast proportions, a comparison was made with the great Forth Bridge, which, while greater in its total length and longer in each of its main spans by 110 feet, does not possess any single span that is comparable in its width of suspended roadway or in its vast carrying capacity with the main span of the new East River Bridge. The Forth Bridge was built to carry two lines of railroad track, and permit the running of heavy express trains at their highest speed. This it has proved well able to do, and so far as its proving a link in a great railroad system, over which express trains may run at high speed, is concerned, the Forth Bridge is an admirable piece of engineering. But the carrying of two tracks of railroad is a very simple matter compared with the carrying of six railroad tracks, two of them for the steam cars of the elevated railroad system, and four of them for our heavy, modern electric cars, to say nothing of two 20-foot roadways for heavy city traffic, two footways for passengers, and two bicycle tracks, the whole suspended floor system having a total width of 120 feet. Any single span of the Forth Bridge, compared as to width of floor and carrying capacity with the single span of the East River Bridge, is of very modest capacity.

Our critic next proceeds unwittingly to censure the work of himself and his *confrères* on the Forth Bridge, by saying that, given the necessary platforms and floors, the Forth Bridge could carry, in addition to its present work, the whole traffic of the Brooklyn Bridge without appreciable fatigue. If this is the case, there must have been built into the Forth Bridge some thousands of tons of material which was absolutely unnecessary. We had heard it stated that after completing their calculations for a bridge, English engineers were in the habit of throwing in a whole lot of additional material, merely to be sure that it was "perfectly strong enough;" but not until the fact was so frankly admitted by this correspondent, did we believe that this was anything more than one of the stock jokes of the profession. Now, the American engineer believes that in designing a bridge the first thing to ascertain is the exact amount of duty required of it; and secondly, to select the materials and so dispose them that this duty shall be performed with the use of the least possible amount of steel, disposed in the best possible way for utilizing its compressive and tensile strength. It was in accordance with these principles that the East River Bridge engineers decided to use the suspension in preference to the cantilever principles of construction. For the suspension bridge permits the use of steel wire, the very strongest form of steel known to our modern industries; whereas the cantilever form necessitates the use of a mild steel, whose strength is only about 30 per cent of that of steel wire. Strange to say, the Sun's correspondent is so wrapped up in the conservatism which is so frequently charged against English engineers, that he does not hesitate to commit himself in his letter to the following extraordinary statement: "It is a remarkable fact that . . . a new bridge should have been designed and partly erected on antiquated and discarded engineering practice;" referring, of course, to the use of the steel wire suspension bridge in preference to the cantilever adopted in the Forth Bridge. Now, as a matter of fact, before it was decided to build a suspension bridge, the whole question was very carefully thrashed out by our engineers, and the cantilever form was rejected at once as being altogether too heavy and costly for a span of this magnitude. Our practice, in this country, is to use plate-steel, riveted girders on bridges up to 175-foot spans; riveted or pin-connected trusses for from 175 up to 500-foot spans, cantilevers for from 500 to 1,000 or 1,200-foot spans, and steel wire suspension bridges for everything above that. While it is true that in the smaller suspension railroad bridges the problem of rigidity of floor system is a difficult one to satisfactorily solve, in spans of over 1,200 feet the great mass of the floor system as compared with the moving loads, and the depth of the stiffening trusses, are such that the rigidity of the floor system can be completely assured; and with a perfectly rigid floor system the steel-wire suspension bridge is from every point of view the ideal, and in fact is the only practicable form of bridge that can be used.

The cantilever which our Forth Bridge engineer would have us substitute is so enormously costly and clumsy that the engineer who would use it in America to-day would be, to borrow the phrase of our critic, guilty of "antiquated and discarded engineering practice." To give a few concrete figures as evidence, we quote the results arrived at by a board of engineers appointed a few years ago to make an estimate for a bridge of 3,100-foot span across the Hudson River. This board, which included such eminent men as Messrs. Burr, Cooper and Morison, found that while a suspension bridge would cost $35,367,000, a cantilever bridge of the same capacity would cost not less than $51,128,000, a cost which the Commission very promptly set down as prohibitive.

The great Forth Bridge, with its two spans of 1,710 feet, is a monumental structure which, when we bear in mind the absence of any precedent at the time of its design, some twenty years ago, for a work of such magnitude, reflects the greatest credit upon the courage and resourcefulness of its engineers. At the same time, the "boilershop methods" adopted in its construction would never be used in American practice; for the tubular sections adopted for the compression members involved an enormous amount of labor which could have been avoided by the use of rectangular sections, with which the same strength of structure and a more harmonious effect could have been secured. Of course, at the time of its erection, the Forth Bridge engineers did not have at their command steel with a tensile strength of 223,000 pounds to the square inch, which was the load under which the test wires used in the Brooklyn Bridge cables broke when tested. With such wires in the cable, and with these cables thoroughly saturated with a waterproof composition, wrapped with a triple layer of canvas and an outer covering of steel plate, and the whole carefully painted from year to year, there is no reason why the Brooklyn Bridge cables should not live as long as the Pyramids themselves.

A 200 HORSE POWER MOTOR-PROPELLED BOAT.

M. Emile Altazin is constructing a boat which is to use a 200 horse power gasoline motor. The vessel, which is a fishing boat, will also be provided with sails; it is being built at Boulogne, France, and will be tried next year. Up to the present gasoline motors of over 80 horse power have not been used on boats, and the experiment will therefore be of interest. The boat is 90 feet long, 26 feet wide, and the maximum draft is 14 feet. It is to be used for herring and mackerel fishing with nets, and can carry a load of 250 to 300 tons. On the fishing trip it is to take on board 330 nets, 900 barrels for receiving the fish, 800 boxes for placing the fish on ice, etc. It will also carry 65,000 pounds of ice and the same quantity of salt. Tanks are to be provided