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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.

THE LONGEST SPAN BRIDGE IN THE WORLD.

There is now under construction across the St. Laurence at Quebec a cantilever bridge which when completed will contain the longest span of any bridge yet erected, not even excluding the great cantilevers of the Forth Bridge in Scotland. The structure is of the cantilever type, and consists of two approach spans, of 210 feet each, two shore arms, each 500 feet in length, and a great central span, 1,800 feet in length. The total length of the bridge is 4,220 feet, and although in extreme dimensions it does not compare with the Firth of Forth Bridge, which is about one mile in total length, it has the distinction of having the longest span in the world by 90 feet, the two cantilevers of the Forth Bridge being each 1,710 feet in length. The total width of the floor is 80 feet, and provision is made for a double-track railway, two roadways for vehicles, and two sidewalks. In a cantilever of this magnitude the individual members are necessarily of huge proportions, the main posts, for instance, being 325 feet in length, and each weighing 750 tons.

RECORD RUN OF A STEAM TURBINE.

On the morning following the close of the St. Louis Exposition, great interest attached to the shutdown and inspection of the 600-horse-power steam turbine generating unit in the Palace of Machinery after a continuous run of over 3,962 hours—a performance which has had no parallel in steam turbine history. This machine, which is of the Westinghouse-Parsons type, was started on its long run on the morning of Monday, June 20, shortly after its installation at the Fair, and was stopped on the morning of Friday, December 2. During the five and a half months that the unit was in operation, it supplied current for light and power in various buildings of the Exposition. Several engineers connected with the builders of the turbine and with the Machinery Department of the World's Fair were present when the engine was stopped and examined. It was found to be in perfect condition, as shown by the fact that there were no signs of wear, and that the bearings still retained the tool marks which they carried when they came from the shops. The remarkable feature of this performance, of course, was the maintenance under load of a speed of 3,600 revolutions per minute for such a long period. Every day from half past eight o'clock in the morning to half past ten in the evening during this continuous run, the load carried varied from 25 per cent underload to 25 per cent overload. The total number of revolutions was but little below one billion.

A SEA-LEVEL CANAL AT PANAMA.

The investigations of the United States engineers along the route of the Panama Canal and in the watershed of the Chagres River have raised the question as to whether it would not be more to the ultimate advantage of the United States, and of sea-going commerce in general, to build the canal on a broader scale to meet the rapidly growing dimensions of steamships, and also whether it would not be wiser to build it with a lower summit level, or abolish the lockage system altogether, and cut the canal through at one level from ocean to ocean. Mr. Wallace, Chief Engineer of the Isthmian Canal Commission, has recently given testimony before the House Committee on Interstate and Foreign Commerce, in which he discussed the relative advantage of four distinct plans for building the canal. Incidentally, it was shown by his testimony that the engineering difficulties at the site of the Bohio dam would be greater than was formerly estimated, the more elaborate borings that are now being made having shown that the rock bottom is much lower than was supposed, the later borings having been carried down to an average depth of 163 feet without reaching bedrock.

The first plan is the one favored by the former Canal Commission, which calls for a dam at Bohio and a high-level canal with an elevation of 90 feet above sea level.

The second plan calls for a 60-foot summit level, with a dam 60 feet high at Bohio, or else the construction of a dam of the same height at Gatun, about half way from Bohio to Colon, the Atlantic terminus of the canal. The adoption of a 60-foot level will involve constructing a dam at Gamboa to furnish water for the summit level. The Gamboa dam would control the Chagres River; but it would necessitate the provision of a spillway in the shape of a tunnel eight miles in length through the divide, to discharge the surplus water of the Chagres into the Pacific, or a tunnel four miles long to carry these waters to the Atlantic. The four-mile tunnel would involve the construction of an auxiliary channel for the Chagres from Gatun to the sea, in order to carry its flood waters away in safety.

The third alternative plan contemplates a 30-foot summit level, with a single lock at Miraflores, near the Pacific, and a single lock at Bohio. This plan would also involve the construction of the Gamboa dam above referred to.

The fourth plan contemplates the construction of a sea-level canal with a tidal lock at Miraflores, this lock being necessitated by the fact that there is an extreme range in the tide of twenty feet on the Pacific side, whereas the fluctuation is less than two feet on the Atlantic side. If no locks were built on the Pacific end, the variations in tide levels would produce strong currents in the canal, which would render navigation difficult.

The 90-foot level canal would cost $200,000,000 and take about ten years to complete; the 60-foot level canal would cost $225,000,000, and it could be opened for traffic in ten years and completed in twelve years; the 30-foot level canal, which would cost $250,000,000, could be opened for traffic in twelve years and completed in fifteen years; while the sea-level canal would cost $300,000,000, could be opened for traffic in fifteen years, but would take twenty years to complete. In all these estimates the controlling factor, both as to cost and time of completion, is the great cut through the mountain divide at Culebra, the amount of material that would have to be removed increasing rapidly with every foot that the summit level of the canal is lowered.

The determination as to which of these alternative schemes should be adopted, will call for most mature consideration. The problem must be looked at from the broadest possible standpoint, and it must be treated in a duly international spirit, and with a strict eye to the future. Ships are now building that call for a full-load draft of between 36 and 37 feet, and two of these vessels are to have an extreme breadth of 87 feet 6 inches. The two most important questions relating to the canal, if due consideration is given to the inevitable growth in the size of steamships and in the volume of traffic, are its section, that is to say, its width and breadth, and its summit elevation. Of the two, the canal section is the more important, and if the finances of the country will admit, the canal should be cut on dimensions sufficient, not merely for existing deep-sea vessels, but for the larger vessels of the future. The question of summit level, as far as it affects future operation of the canal, is not of such vital importance, since the difference between a canal with locks and one without is mainly a question of the time occupied in transit.

It is certain that the raising by the chief engineer of the question of alternative plans, among which a sea-level canal is given prominence, will result in an agitation for the construction of a great sea-level waterway, which, by the way, was the original de Lesseps idea. There is much to recommend the larger plan. It gets rid of the Bohio dam problem, now of stupendous proportions; it abolishes the summit locks and the necessity for providing a supply of water to feed the canal; and it simplifies both maintenance and operation. But what of the cost and the delay!

TECHNICAL DESCRIPTION OF THE "CZAREVITCH" IN ACTION.

In the current issue of the Supplement will be found the first reliable and expert description of the sortie of the Russian fleet on August 10, and the damage received by the flagship "Czarevitch" from the concentrated fire of the Japanese fleet. The article, which is a translation from the leading German naval journal, Marine Rundschau, is marked by that detailed and careful observation which characterizes German literature of this kind, and it is accompanied by over a dozen illustrations showing by photograph and diagram the tactics employed by the combatants and the nature of the damage done on the "Czarevitch." This vessel, being the flagship and at the head of the line, was made the target for the concentrated fire of the enemy, and she was struck by at least fourteen 12-inch shells. The record of the damage done by a 12-inch shell that struck the conning tower shows how completely a modern warship may be disabled by a single well-placed shot. All the inmates of the conning tower were killed or disabled; the wheel was turned hard to port, and jammed in that position, causing the ship to leave the line and commence running in a circle; the compass was destroyed; the electrical wiring for signals was destroyed, and the engine room telegraph was broken. The smokestacks were so badly blown apart, with consequent loss of draft, that the ship could only make four or five knots, and this with a big coal consumption and the emission of vast volumes of smoke. In spite of the many hits made by 12-inch shells, the armor was nowhere penetrated, nor were any of the guns that were emplaced behind armor disabled. The article, which is too long for insertion or even lengthy review in the Scientific American, will prove particularly interesting as a study of ironclads in action.

THE SECOND EXTENSION OF THE SUBWAY.

The granting by the Rapid Transit Commission of a franchise for the construction of a subway below Sixth Avenue to Thirty-third Street, and below Ninth Street to Fourth Avenue, marks the second addition to the original rapid transit system, and it is logically the next extension that should be made. That portion of the subway now in operation serves Manhattan Island and the Bronx. The extension, which is under construction and about half completed, running from the City Hall in Manhattan to Flatbush and Atlantic Avenues in Brooklyn, connects the Manhattan system with Long Island; and the extension for which franchises have just been granted will give similar connection between Manhattan and New Jersey. These two subways will be practically extensions of the New Jersey trolley system, connection being made by way of the tunnel below the North River from Jersey City to Christopher Street. The New York & Jersey Railroad Company, the builders of the tunnel, will extend their lines as a double track system from the tunnel terminus at Greenwich and Christopher Streets below Sixth Avenue to Thirty-third Street and from the same terminus to Fourth Avenue. The franchises will run for a first period of twenty years, and then there will be a re-valuation of the terms on which they are to be continued. The tunnels are to be 40 feet below the surface, to permit the building of municipal subways above them, and the entrances will be made under private property, so as to avoid the encroachment of entrance kiosks upon the sidewalk space. The city reserves the right to acquire the tunnels at the end of twenty years at an appraised value.

A new method of laying electric cables has been adopted in the Poplar district of London, in lieu of the general system of inclosing the cable in an iron or earthenware conduit. The cables are laid separately in a corresponding number of light steel pipes. These pipes are coated upon the exterior with a special preparation in which paraffin wax predominates. They are made in 5-foot lengths, and are jointed by ends which screw into one another, leaving a flush surface, until a tube of 200 feet has been formed. This length of tubing is then laid in the trench, and covered all round with a layer of concrete, which is allowed to set. This accomplished, the steel pipes, which only serve as a mandrel on which to form the concrete duct, are withdrawn by the application of steam, which is driven into them under pressure. The heat thus applied melts the preparation around the pipes, and as this also acts as a lubricant, the pipes can be withdrawn quickly and easily by winch and rope. As each 5-foot section of piping is withdrawn, it is unscrewed and coated again for further use. By this ingenious process a concrete conduit of perfectly symmetrical form is obtained for the accommodation of the cables. These are drawn into the duct in the usual manner, the lubricant remaining inside considerably facilitating the operation. More than 100,000 feet of cables have been laid in this manner in Poplar, the process having proved completely successful.

The French submarine "X" has been launched at Cherbourg. This vessel constitutes one of the three experimental submarine vessels known as "X," "Y," and "Z" respectively, in which efforts are being made to combine the advantages of the submarine and the submersible, at the same time eliminating their disadvantages. Though of the same type and class, the three vessels are not uniform or of the same displacement, being relatively of 168 tons, 213 tons, and 202 tons. The submarine "X" measures 122.72 feet in length; beam, 10.23 feet; and draft aft, 7.54 feet. The vessel will be fitted with electric accumulators for propelling purposes when submerged, and gas or vapor engines for surface propulsion. The latter engines are to develop 220 horse-power, capable of giving a speed of 10.5 knots.