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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.

REVIVAL OF THE OLD HUDSON RIVER TUNNEL SCHEME.

The publication of the plans of the Pennsylvania Railroad Company for the construction of a system of tunnels connecting Manhattan Island with New Jersey and Long Island has naturally revived interest in the old Hudson River tunnel, which, after being completed for some three-quarters of the distance from Jersey City to New York, was abandoned because of the financial embarrassments of the company that had it in hand. What is known as the New York and Jersey Railway Company has recently been incorporated for the purpose of completing this tunnel and building the necessary terminals at either end. For some time past the work of acquiring the land for the terminals has been quietly carried on, and all the needed property has been secured. The present tunnel, which was constructed by an English syndicate, has been constructed beneath the Hudson River for a distance of about 3,900 feet from the starting point on the New Jersey side, and only 1,580 feet remain to be built to connect with the shaft on the New York side. It will also be necessary to build the approaches to bring the tunnel up to street grade on each side of the river. The abandonment of the tunnel was due to purely financial causes, and there was no physical reason why it should not have been pushed through to completion at the original attempt. The difficulties encountered were chiefly due to the fact that the tunnel was laid nearer to the bed of the river than would now be thought desirable for convenience and safety of construction. At one point in the tunnel the extreme looseness of the silt rendered it difficult to keep the head of the tunnel clear of water by the usual pneumatic process, and it was not until a considerable amount of artificial filling has been laid upon the shallow, overlying bed of the river that it was possible to proceed with the work of driving. The difficulty was, however, overcome, and had the necessary capital been at command, there is no doubt that the tunnel would have been finished many years ago.

The tunnels consist of two parallel tubes, which measure internally 18 feet in height by 16 feet in width, and are oval in section. The line of the tunnel, as originally located, commenced in Jersey City at Jersey Avenue and 15th Street, from which point it ran east to Hudson Street; thence it passed beneath the Hudson River to the New York city bulkhead line at the foot of Morton Street; from which point the line swung slightly to the south and was carried to Broadway. From the western terminus, as designed, to Hudson Street, was 3,400 feet. From Hudson Street beneath the Hudson River to Morton Street, was 5,500 feet, and from this point to the eastern terminus at Broadway was another 4,000 feet. The work that has been done upon the tunnel was confined to that portion of it that lies immediately below the Hudson River. Two shafts were sunk near the bulkhead lines in New York and New Jersey and the work of driving was pushed forward on the tunnel from each end. Actual construction commenced in 1874 and was carried on amid many vicissitudes of a financial and physical character until the southern tunnel had been advanced from the Jersey side about three-fourths of the distance across the river, and a start of a few hundred feet had been made on the same tunnel from the New York side. Considerably less work was done on the north tunnel. The terminal station on the New York side will be in the block bounded by Christopher, Tenth, Greenwich and Hudson streets. On both the New Jersey and New York side connections will be made with the street railway lines, and the location of the New York terminal will render it convenient for passengers who wish to transfer to the elevated system.

Originally the tunnel was constructed with a view to giving the trunk railroads that terminate in Jersey City an entrance to Manhattan Island. The plans of the new company contemplate the use of the completed tunnel for street railway purposes only. In view of the fact that the Pennsylvania Railroad tunnels are to be used exclusively by the Pennsylvania Railroad system, one would have expected that the other competing lines, such as the Erie, and Lackawanna, would have taken hold of this tunnel to complete it for their own use. It is certain that these railroads will have to secure some compensating advantage to place them on even terms with the Pennsylvania system as regards the through passenger service to New York city, and we may confidently look for the development of other tunnel schemes in the near future; unless, indeed, these railroads feel that the volume of traffic will warrant them in the joint construction of a Hudson River bridge.

THE DARIEN OR SAN BLAS TUNNEL CANAL ROUTE.

In view of the fact that an expert commission has been engaged for the past two or three years in a thorough examination of all possible routes for a canal across the Isthmus, and that this commission included some of the most distinguished engineers that could be gathered together for the purpose, and in view, further, of the fact that over one million dollars has been expended in making this examination so absolutely thorough as to render any further examination superfluous, one would have thought that the report, as recently given to Congress, would have been accepted as final, and that there would have been an end to suggestions for the sending out of more surveying parties into a territory that has been so thoroughly explored.

Therefore, we much regret to see that a joint resolution has been offered to Congress for the appointment of a Board to examine into the practicability and cost of a tunnel ship canal by what is known as the San Blas route. We regret it, not so much on account of the expense involved, for this is comparatively insignificant, an appropriation of only $15,000 being asked for the purpose, but because the mere proposal that such a survey be made is disturbing, and calculated to confuse the general public. The suggestion that there is anything more to learn about San Blas will be taken at its proper worth by practical engineers, and by that large and increasing section of the public who by studying the canal question for themselves, have grasped its main details, and are able to form an intelligent individual opinion as to where the canal should be built. It is upon the average citizen, who has not the time or opportunity to gain anything more than a superficial knowledge of the canal problem, that this continual agitation of the question of routes is so confusing. Evidence of this is shown in the letters which reach the editor's desk, asking whether a short tide-level canal, with a tunnel through the hills, is not preferable, even to the short and easily-navigated Panama canal. It is impossible to reply to these correspondents in detail, so we take this opportunity of saying that the possibilities of constructing a tide-level canal by tunneling through the hills were thoroughly investigated by the Isthmian Canal Commission, and estimates were given for the cost of such canal at four different routes; one of them at San Blas and three of them on what is known as the Caledonia route. It was found that at San Blas 4.2 miles of tunnel would be necessary; while in the Caledonia district 1.6 miles would be required on the Sassardi location, on the Aglaseniqua location 3.6 miles, and 4 miles of tunnel on the third alternative location. It is certain that the advocates of a tunnel canal have no adequate idea of the stupendous nature of the excavation required. To accommodate steamers of the size that will pass through the Panama Canal a vast cavern would have to be blasted through the mountains (the term tunnel is quite inadequate to express its magnitude, so absolutely insignificant in comparison is the ordinary railroad tunnel), which would be 165 feet in height by 130 feet in width, and the whole of it would have to be lined with a mass of concrete from 5 to 7 or 8 feet in thickness. A single mile of this tunnel would cost $22,500,000 to construct, and the 4.2 miles of tunnel necessary at San Blas would cost alone $94,500,000. The approach to the tunnel at each end would necessitate the construction of an enormous open cut, deeper in places than the Culebra cut at Panama, which, with the other excavation along the 37 miles of the canal, would bring up the total cost of excavation outside of the tunnel to $132,800,000. The total cost of the canal along this route would be $289,770,000.

Now, it is not by any means certain that the estimate of $22,500,000 per mile for the construction of the tunnel would be sufficient to cover the actual cost, for the engineers in making this estimate, assumed that they would meet with material that was favorable for excavation; that is to say, that there would be no material encountered that would tend to slide as soon as it was disturbed by excavating. If such material should be encountered, it is perfectly certain that the engineers would be helpless in the presence of it. In proof of this we refer our readers to the account, in our issue of February 8, of the construction of the Aspen tunnel on the Union Pacific Railroad. In the excavation of this work, which is absolutely insignificant compared with the enormous cavity which would have to be opened up at San Blas, the pressure of the sliding earth was such that twelve-inch shoring timbers were splintered into match-wood and heavy steel I-beams were twisted out of shape. The mere possibility of encountering such conditions would render it absolute folly to commence the construction of a tunnel of this magnitude in any location, and especially in the Central American regions, which are subject to volcanic disturbances.

NAVAL DEVELOPMENT DURING THE NEXT DECADE.

In the current issue of the SUPPLEMENT will be found a reprint of an article, contributed by Rear-Admiral George W. Melville to the Philadelphia Record, in which he indicates the probable line of development of the United States Navy during the coming decade. The writer strikes the true keynote of our naval policy when he says, "Only by right, and not by might, will this nation fulfill her highest destiny"; yet we must always bear in mind that "it is as essential to be in readiness to restrain by military and naval forces the foes that are beyond the boundaries of a country as it is to effectively control, by local police, the turbulent within a community." In reviewing the causes which have contributed to the remarkable development of our navy, the first place is given to the attitude and action of the general press, which has been unanimous in urging the development of our naval power. This advocacy has been supplemented by the lecture field, which has played no inconsiderable part in familiarizing the public with our warships. The ships themselves have been thrown open to the public on every possible occasion, and have greatly conduced to the general interest, as have also the dozen naval stations and navy yards scattered along our seaboard. There are ten shipbuilding firms that build battleships and armored cruisers, over fifty firms that can turn out a gunboat, and several hundred firms that can manufacture naval stores and supplies, and all of these have at least a financial interest in the enlargement of our fleets. The army of tourists and commercial travelers who annually go abroad; the commercial and maritime associations of our leading seaports, and the shipping interests in general are other influences that have worked strenuously toward the same end. Lastly, it must not be forgotten that every Secretary of the Navy and every President, for the past twenty years, has urged the progressive development of this branch of the military service. The annual appropriation has gradually increased, until now it is nearly treble what it was five years ago, the estimates submitted this year calling for about one hundred million dollars.

Our readers will remember that the SCIENTIFIC AMERICAN has always claimed that the possession of the far-distant Philippines, with their thousands of miles of coast-line, must, of necessity, be the dominant factor in determining our future naval policy, and we notice that Rear-Admiral Melville is of the opinion that it will be near the Philippine Islands that we shall have to fight our future decisive battles. "It is certain," he says, "that we must eventually renounce all sovereignty of the Philippines or else prepare ourselves to hold these islands against an efficient naval power whose base of operations may be much nearer than our own." For this reason he urges that we should establish in some harbor in the Philippines large engineering shops, where machinery could be built or repaired and warships docked and built. Other arguments for an increased naval establishment are found in the construction of the Isthmian canal, which, however strongly fortified, would require a powerful navy to insure its safety and neutrality when completed. It is the opinion of the writer that before the end of the present decade we shall rank next to England as a sea-going power, and he suggests that in view of the fact that we may be suddenly required to increase our naval force, it might be the proper thing to make a wholesale purchase of warships from some nation that has "greater temporary need of gold coin than of steel guns." We agree with the Admiral that every increase in the strength of our navy undoubtedly makes for the general peace of the world.

As to the constructive and mechanical progress of the future, development will be in the direction of making the individual unit more formidable, and ships will be built more rapidly. Hitherto it has taken five years to design, build and commission a warship; and unless the private firms are going to show greater celerity in completing their contracts, "the government may undertake the task of building its own warships;" something, by the way, which we think the government ought in any case to do, if it would safeguard the interests of the navy. Armor will continue to improve, and it is probable that in addition to the two establishments that now turn out first-class armor a third firm will soon be in a position to compete for