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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.

JAPAN'S LOSSES ON THE SEA.

As the result of the most successful and artistic way in which the Japanese government has managed to conceal the exact extent of its naval losses and damage, it is difficult to say with any certainty just what these amount to. It is claimed by the Russian government that altogether half a dozen battleships and cruisers have been lost beyond recovery, and the indications are that this estimate is not too large. It is known that the battleship "Hatsuse" was sunk by a mine ten miles off Port Arthur, in deep water from which she cannot be recovered. There also appeared a few weeks ago, in the dispatches from Tokio, an acknowledgment, which was said to be official, that the battleship "Yashima" was struck by a mine off Dalny last summer and lost. Subsequently there has been some contradiction of this report; although the consensus of opinion to-day is, that she too has been wrecked beyond recovery. The Japanese also acknowledge the loss of the protected cruisers "Yoshino" and "Miyako," and the cruiser "Sai-Yen," formerly the Chinese "Tsi-Yuen," and also the "Hei-Yen," another old coast-defense vessel captured from the Chinese, and the gunboat "Kaimon." These, with the exception of the "Yoshino," which was sunk by collision, all fell victims to the deadly mine. The "Chiyoda" was also struck by a mine. It is claimed by the Russians also (and their estimates of naval damage have generally been since verified) that they have altogether, in the course of the war, damaged or sunk sixteen destroyers and torpedo boats. It is significant that one of the eight armored cruisers of the Japanese has not been mentioned for several months in the dispatches, and it is possible Japan is short of the services of one of these vessels. If this is the case, she can now put in the fighting line four battleships and seven armored cruisers of modern and thoroughly up-to-date construction. Against these Russia can put in her first fighting line four very powerful and well-protected battleships of the "Borodino" type, and two older battleships of doubtful value. These vessels form the principal elements of the Baltic fleet. If repairs have been completed on the armored cruisers "Rossia" and "Gromoboi," now at Vladivostock, these vessels may also be counted in; but they will only be available in the event, either that they can escape from Vladivostock and effect a junction with Rojestvensky's ships, or that the Baltic fleet can reach Vladivostock, before the encounter with Togo's fleet takes place. Meanwhile the Japanese admiral has been reported as passing Singapore with a fleet of twenty-one vessels.

A SEA-LEVEL CANAL AT PANAMA.

A distinguished European engineer, after visiting this country to study the secrets of our industrial success, stated, as the result of his observations, that we owed much of our rapid advancement to the free use which we make of the scrap heap. The observation was that of a shrewd observer; for there can be no doubt that the readiness of the American people to sacrifice machinery, plant, and buildings, just as soon as it is realized that the substitution of later and more improved methods and construction will more than pay for the cost of making the change, has been one of the most fruitful sources of our industrial progress. There are some fields of work, however, and notably those which fall within the province of the civil engineer, to which the above considerations do not, or should not, apply. Both the common dictates of prudence and the dearly-bought experience of the past, teach us that, in the construction of railways, canals, reservoirs, and all heavy and costly works of a similar character, everything should be planned with a strict regard for the demands, not merely of the immediate future, but of that remoter time, of which, in the construction of works of less importance, no thought would be taken. There are some national works which, like the national constitution, should be planned for all time.

These considerations apply with special emphasis to that great engineering problem to which the United States has committed itself in the construction of a ship canal across the Isthmus of Panama. From whatever standpoint we look at it, the conviction is brought home to every thoughtful mind that this is destined to become in due time, and rather sooner than later, the most important artificial waterway in the world. Therefore, it should be constructed with a view to rendering it available for all the shipping and for any size of vessel, that may wish to pass through; moreover, it should be so constructed as to offer the minimum of risk and the speediest transit possible, to the great and ever-increasing tonnage that will make use of it.

There can be little doubt that it is considerations of this nature that have produced the growing sentiment among engineers and in Congress, in favor of the construction of a sea-level canal rather than of one with locks and a summit level; and the feeling has been strengthened by the opportune report recently made to the Isthmian Canal Commission by their Engineering Committee, in which it is shown that recent developments at the Isthmus indicate that a sea-level canal can be constructed in from ten to twelve years, at a cost not to exceed $230,500,000. This is only $52,462,000 more than the estimated cost of a canal with locks, with a summit level of 60 feet above mean tide. Moreover, the sea-level canal would take only from two to four years longer to construct; if completed on the generous dimensions proposed by the engineers, it would be sufficient to accommodate the largest ships that would be built for many years to come; and it would present the great advantage that deepening and widening of the canal could be carried on at any time without the least interference with navigation.

The recommendations of the committee call for a sea-level canal, with a bottom width of 150 feet and a minimum depth of water throughout of 35 feet, with twin tidal locks at Miraflores to accommodate the rise and fall of the tide, the locks to be 100 feet in width and 1,000 feet in length. The total estimated cost of $230,500,000 includes an allowance for administration, engineering sanitation, and various contingencies amounting to $38,450,000; but makes no allowance for interest during construction, expense of zone government, and collateral expenses. It is recommended that the Chagres River be controlled by a dam at Gamboa built to a height to crest of 200 feet, the surplus waters of the lake thus created to be carried off to the sea by means of tunnels through the divide. The work on the foundations of the dam will require from one to one and a half years, and in the opinion of the committee, it should be begun at once.

It is satisfactory to know that the estimate of cost is based upon the probable cost of excavation of the Culebra cut, which in a sea-level canal would constitute the main obstacle to be overcome. For the cost of operation in the cut has been accurately determined in the work of excavation with American machinery and methods that has been carried on by the government for several months past. It has been found that the entire excavation can be done at a cost of fifty cents a cubic yard. The former Isthmian Canal Commission estimated this cost at eighty cents a yard. This reduction amounts to a total for the whole work of $15,000,000; and it is this great reduction in a class of work which will constitute by far the largest element of cost in the sea-level canal, that is given by the committee as a justification of the larger scheme. Furthermore, it is pointed out that the results thus far obtained in the Culebra cut have been reached under disadvantageous conditions of organization of both plant and force; and the Chief Engineer estimates that with one hundred steam shovels installed, and with a complete system of tracks to serve them, a yearly record of 30,000,000 cubic yards of excavation may be reached, without requiring a greater output per steam shovel or greater speed in working than has already been attained.

Finally, by way of emphasizing the necessity for building the canal with ample dimensions, that may be readily increased at any time in the future without interfering with navigation, we may mention that there are two transatlantic steamers now under construction, which are to have a draft of 35 feet and a total length of just under 800 feet. Twelve years from this time, when the canal is opened, there will be vessels afloat exceeding even these dimensions.

THE TIDES AT COLON AND PANAMA.

The great difference in the amount of rise and fall of the tides at the two ends of the Panama Canal has been a source of considerable surprise to many persons unacquainted with the facts.

At Colon, the Caribbean terminus, the mean range is 0.6 foot, while at Panama, the Pacific terminus, it is 12.6 feet. This is the official record of the Coast and Geodetic Survey. Rear Admiral Chester, of the U. S. navy, who has spent several years on and near the Isthmus, gives the difference of tide as 8 feet and 32 feet on the Atlantic and Pacific sides, respectively. Gen. Peter C. Haines, U. S. army, in a recently published article on the Panama Canal, says the rise and fall of tide at Panama, or the Pacific side, is 20 feet, and at Colon, the Atlantic side, one foot; so that while the mean level of the two oceans is precisely the same, the level at Panama is 10 feet higher at high tide and 10 feet lower at low tide, than it is at Colon; and of course this occurs twice every day.

It is here proposed to briefly state how this condition is brought about.

In the first place, it may be said that the tidal oscillation, whose period is one day, will not be considered. The extreme fortnightly range of this oscillation is about 1.2 feet at either Colon or Panama. We are here concerned with the ordinary semi-daily tides.

The semi-daily tides along the outer coast of the United States from Martha's Vineyard to Cape Canaveral, Florida, occur at nearly one and the same time. The average range of tide generally lies between 3 and 7 feet for this coast. The simultaneous occurrence of the tide at once suggests the existence of an area containing a stationary wave, and extending southeasterly from the United States toward the opening between eastern Brazil and western Africa. By the term "stationary wave" is meant an oscillation, or periodic movement, of a body of water, as when it is high water at one point, it is then high water over a large portion of the body, and correspondingly low water over the remaining portion. The lines bounding the middle portion of the area between the limits of greatest rise and fall are called nodal lines. Thus, near such lines the rise and fall is slight, but the horizontal movement across them is considerable. As a simple, practical illustration, let a basin which is partly filled with water be oscillated vertically; the water will rise on one side of the basin as it falls on the other, while in the middle portion of the body of water there will be scarcely any vertical movement. Now, applying this to the case in hand, it will be seen that on the line before referred to as extending southeasterly from the Atlantic coast of the United States, when it is high water on the said coast, it will be low water in the region northeast of Brazil, while halfway between these limits there will be a stationary wave. That is to say, at halfway points, or along the middle of the line referred to, there will be little rise and fall, and hence small ranges of tide.

Observation shows that at St. Thomas Island, a little east of Porto Rico, the range is only 0.3 foot, and the range is small for all of the Leeward Islands. Thus we are enabled to say with considerable certainty that a stationary wave exists extending southeasterly from the United States, and with its first nodal line ending in the Leeward Islands. This circumstance is very important, because it explains why it is that the Atlantic Ocean tide does not enter the Caribbean Sea with sufficient range to cause a fair-sized derived tide at Colon. The tide at Colon is chiefly due to the tide produced in the Caribbean Sea by the direct action of the tidal forces, and is nearly independent of the tides of the Atlantic. Its range and time of occurrence correspond well with this assumption. If there were a considerable tide along the Lesser Antilles and other adjacent islands, it would find ample space between the islands to enter the Caribbean Sea, and would of course be almost if not equally strong at Colon; but as it is, the Caribbean Sea is left to itself, so to speak, and responds but feebly to the moon's attractive force.

The relatively high tides at Panama are due chiefly to a stationary wave or oscillation contained, for the most part, in a large triangular area which constitutes the whole of the North Pacific Ocean.

It is known that in triangular areas, the angles usually have large ranges of tide. If again, for a simple illustration, one will oscillate vertically a basin of triangular form, partly filled with water, this will be sufficiently demonstrated. Panama lies at one of the grand Pacific angles, the Gulf of Alaska marks another, and the eastern coast of the Philippines marks the third. Moreover, there is a gradual shoaling from the mouth to the head of Panama Bay, and this increases the range somewhat. The conformation of the land, or the curve of the shore line to the southward from Panama, is another element in the case, for it tends to form an angle and a bay favoring the higher rise of tide. The tides along the Pacific coast of Panama and Central America occur at one and the same time, very nearly. This suggests a stationary wave. But the diminution of the range of tide from 12.6 feet at the port of Panama to 1.2 feet at Acapulco, Mexico, gives further evidence of this stationary wave. Other evidence is obtained from different parts of the Pacific Ocean. Thus, in the immense basin of the Pacific, the tides are high at the points or angles of the great triangle before indicated, and slight at other intermediate points or at what are technically denominated nodal lines. Those desiring a further discussion of the subject, should consult the Reports of the Coast and Geodetic Survey for the years 1900 and 1904; but enough has been given here to show in a general way how it happens that the tides at the two termini