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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.

## SEISMIC DISTURBANCES AND THE ISTHMIAN CANAL.

The question of the construction of the Isthmian Canal, assuming of course that considerations of a commercial and political nature have been disposed of, is first and last one of civil engineering. Were this canal to be constructed in a locality in which the conditions are normal, the problems confronting the engineer, while they might be more or less complicated, would yet be such as any first-class engineer or body of engineers could satisfactorily solve. In planning a structure of the magnitude of an inter-oceanic canal, the stability of *terra firma*, as such, would be one of the axiomatic assumptions upon which the whole work would be laid out; and it is certain that were it suddenly discovered that the very earth itself was liable to violent concussions, upheavals, changes of level, or changes of form by the deposit of so many cubic miles of material flung heavenward to descend as a solid rain or traveling for miles in the form of a molten or boiling torrent—upon such a discovery we can well believe that the engineer would consider that his problem was solved by being suddenly consigned to the region of the absolutely impossible.

We feel that the lesson of St. Pierre's disaster will have been very poorly learned if it does not lead to a more thorough examination of the seismic conditions along the two alternative routes of the Isthmian Canal, and in our issue of May 24 we drew attention to the fact that the recent eruption renders the construction of the Nicaragua Canal, which runs through a highly volcanic district, more unlikely than ever. Our remarks on this subject have called forth a protest from a correspondent, Dr. Eugene Murray-Aaron, which is published elsewhere in this paper. The writer, who reminds us that he speaks with authority as one having lived on the Isthmus, would have us believe that Panama is a perfect tempest of seismic convulsions, experiencing "sudden shocks and quivers that would crack the pyramid of Cheops in twain," and that Nicaragua, so far from being menaced, is positively protected by its volcanic surroundings. On reading his letter we must confess to a feeling that the Doctor proves too much. For, if earthquakes that would "crack the pyramid of Cheops in twain" are not an infrequent occurrence at Panama, how comes it that for close upon a half century there has been a railroad in continuous operation through that region from sea to sea? Either Cheops must be wonderfully fragile, or else the steel bridges, masonry culverts, and the embankments of the Panama Railroad must be possessed of a strength and stability beyond anything seen or even dreamed of in any other part of the world. The foundations of these bridges and other railroad structures do not "go down 150 feet below sea level," and yet they have stood these mighty perturbations to which the Doctor refers, for fifty long years, and they are standing yet and apparently likely to stand until nature, by its normal processes, brings about decay. On the other hand, if the volcano is the best friend of man and his works, then Nicaragua should be an ideal location for a Canal. But what about St. Pierre and St. Vincent? To carry the "safety-valve" argument out to its logical conclusion, we shall have to believe that, the nearer one could place the Canal to a chain of volcanoes, the better for its permanence. Yet, we cannot but remember that at the present moment a whole islandful of people are clamoring for escape from a volcano-protected region, while the government of France is seriously considering an order for complete evacuation. While it is probable that the relief afforded by eruptions tends to mitigate the violence of earthquake shock, it must not be forgotten that the enormous outflow of matter from the crater's mouth is frequently accompanied by a serious subsidence of the land in the neighborhood. Now absolute permanence of level is a fundamental requirement for a canal, for it would take but little increase or decrease

of elevation to ruin such a waterway beyond chances of repair. The construction and continuous operation of the Panama Railroad are the very best argument for the construction and operation of a canal in the same region. At Nicaragua, on the other hand, there are absolutely no engineering works that can testify by their condition to the absence of seismic disturbances of a fatal character, while we have a terrific object-lesson in the existence of earthquake disturbances in the ruin, a few decades ago, of the city of Rivas, situated five miles from the Pacific terminus of the Nicaragua Canal.

## A SCIENTIFIC WITNESS OF PELEE'S ERUPTION.

It is satisfactory to know that Prof. Robert T. Hill, who is at the head of the expedition which was sent to Martinique by the National Geographical Society, succeeded in getting a near view of Mont Pelee just at the time when the last violent explosion occurred. He reached Morne Rouge, the summer resort of St. Pierre, where he obtained a series of valuable photographs. Prof. Hill states that at 7 o'clock on Monday evening he witnessed from a point near St. Pierre, a frightful explosion of Mont Pelee, and was able to take note of the accompanying phenomena. He states that following the salvos of detonations from the mountain, gigantic mushroom-shaped columns of smoke and cinders ascended into the clear, scarlet sky and then spread in a vast black sheet to the south and directly over his head. Through this sheet, which extended to a distance of ten miles from the crater, vivid and awful lightning-like bolts flashed with alarming frequency; they differed from lightning in that they were horizontal and not perpendicular. This Prof. Hill considers to be indisputable evidence of the explosive oxidation of the gases after they left the crater—a most important observation and a phenomenon which is entirely new in volcanic history and goes a long way to explain the awful character of the catastrophe.

## SENSIBLE VIEW OF THE STEAMSHIP COMBINE.

We note that the General Director of the North German Lloyd Company, in an interview with the Berlin correspondent of the New Yorker Staats Zeitung, has given it as his opinion that the feeling against the shipping combine which prevails more or less in Germany and England, is altogether unwarranted. In the director's opinion, Mr. Morgan in organizing the combine had no intention of controlling the German lines, and he predicts that before the end of the year events will prove that the union is one of the healthiest developments in the history of transportation, since no party to the contract obtains advantages over others. We believe that this sensible view of the matter will be found to be the correct one. It was only a question of time before the various shipping companies came together in an endeavor to handle transatlantic traffic on some basis of mutual concessions and accommodations. There was much to be gained and nothing to be lost by such a move. As long as the various lines were working independently there was bound to be a considerable amount of wasted energy, a loss which can now be avoided by a schedule of steamer sailings, which will make it possible to carry a maximum number of passengers on more convenient and better distributed days of sailing and for a less cost. This will certainly mean a better service, and may mean a cheaper one; so that while the profits of the shareholders will be increased, the purse of the traveling public may also reap a corresponding advantage in cheaper fares.

## THE HOUSE NAVAL BILL.

The important amendment to the Naval Appropriation bill recently adopted by the House calls for the construction of three warships in the government yards, the ships to consist of one battleship, one cruiser and one gun-boat. As the bill previously stood, the question was left to the discretionary power of the Secretary of the Navy; but by the provisions of the bill in its present form, it is obligatory upon him to apportion warship construction to the government yards in the manner indicated above. As we have already stated in these columns, we believe that the measure which has thus passed the House is an eminently wise one, and that it will prove to be not merely a safeguard for the interests of the navy, but a stimulus to the private shipbuilding firms, which will ultimately redound to their own advantage. The apportioning of some of the warships of each year's programme to the government yards cannot deprive the private yards of work which they would otherwise secure, or rather work which they would otherwise perform, for the reason that the yards that are capable of constructing warships are already full of orders, and many of them are considerably behind their contract time on government work. The measure, as we understand it, is not in any sense hostile to private builders; it was conceived and carried through the House with the single object of preserving intact the

splendid working staff of our navy yards, and by providing alternative work in the shape of new construction, preventing the annual disruption of that staff which has hitherto taken place whenever repair work became scarce. We are, therefore, of the opinion that the adoption by the House of an amendment which provides that the Secretary of the Navy may build all of the new ships in government yards, if he thinks that there is evidence of combination among private bidders, was unnecessary. So far from there having been any collusion to keep up prices, the indications are that there has been rivalry in securing government work of the kind. If prices have been high, it has been largely because of inexperience in work in which severe exactions are required by the government inspectors. The division of naval construction between government and private yards is practised in every country but our own, and the fact that the custom has been followed for many years would indicate that the system works satisfactorily. There is no reason to doubt that it will show just as good results here as abroad.

## TUBES VERSUS SHALLOW-TUNNEL RAILROADS.

BY OUR ENGLISH CORRESPONDENT.

Now that the success of underground rapid transit by tubes in London has been established, the British Board of Trade are desirous of extending and developing the system. In order to ascertain the relative advantages and drawbacks of both the deep-level tubes and the shallow tunnels, the Board of Trade dispatched its special railroad inspector, Lieut.-Col. H. A. Yorke, of the Royal Engineers, to Paris, to investigate the construction and working arrangements of the Chemin de Fer Métropolitain, two short branches of which have been completed, totaling 6.6 miles. The railroad has proved a great success, 36,000,000 passengers having traveled upon it during the ten and one-half months it has been opened. These lines are the first cords of a web that is to link all the different suburbs of Paris. When the system is complete, there will be a total length of 38.86 miles of track, of which seven-tenths will be laid in shallow tunnels, and the remainder in open cuttings or on viaducts. The cost of the whole scheme is computed at \$60,000,000.

Two classes of travelers are carried. The authorized fares are 5 cents first-class, and 3 cents second-class, whatever the length of the journey. Second-class round-trip tickets are issued at 4 cents up to nine A. M., and the return half is available for the remainder of the day.

According to Lieut.-Col. Yorke's report, which has been issued in a Parliamentary paper, much trouble was caused during the construction of the tunnels by the lines of sewers and water-pipes which were moved from the centers to the sides of the streets. It apparently failed to strike the authorities that these conduits might advantageously be laid along the subways themselves. The tunnels were made as near the surface as possible, and for the most part the tops of the rubble masonry arches, by which they are lined, are about 3 feet 6 inches below the level of the thoroughfare. An attempt was made to accomplish the excavation by means of shields; but ultimately this method, which has obvious disadvantages followed so near the upper crust, was abandoned in favor of the old-fashioned "cut-and-cover" plan.

An interesting feature is that each section of the system will be self-contained, and will end in loops, so that shunting may be obviated. No trains will run from any one distinct section of line into any other, but the systems meet in central stations where a change can conveniently be made. This arrangement has its disadvantages, but on the other hand, it avoids the danger of the whole system being thrown out of working order by a breakdown of any single branch; it does away with junctions and crossings and the attendant need for complicated signaling installations; and it enables a rapid service to be maintained with punctuality and regularity on each section.

Lieut.-Col. Yorke thinks, as the result of his investigations of the Paris system, that as regards convenience of passengers and economy of working, the balance of advantage lies with the shallow tunnel, or subway, as compared with the deep-level tube. But he considers the plan impracticable in busy cities, such as London, owing to the dislocation of the street traffic while the roadways are in process of being undermined. The difficulties in the way of adopting the tunnel system in the principal streets would, he says, be formidable, and he considers them prohibitive. Where, however, new thoroughfares are being made, the obstacles presented to the construction of shallow subways are not so serious, and advantage might well be taken of the opportunities so offered to build subterranean channels for tramways and railway purposes—if not even for ordinary vehicular traffic—in the manner proposed by the London County Council along the new street now being made from the Strand to Holborn.