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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 TWO IMPORTANT PROBLEMS OF THE PANAMA CANAL.

Ever since the recent Act of Congress authorizing the President to take such steps as may be necessary to acquire a clear title to the property of the Panama Canal Company and to arrange treaty rights with the Colombian government and to appoint a commission for the construction of the canal, it is with no little pride that it is recalled that during the past three or four years the SCIENTIFIC AMERICAN has persistently maintained that, all things considered, the Panama route seemed to be the most feasible and presented the greatest advantages from a practical point of view. It was about four years ago that the merits of this route were set forth in our columns, and we believe that the SCIENTIFIC AMERICAN has done its share in the work of education and in the removal of perhaps perfectly natural prejudice. It is not that we believe that there do not exist in the way of the completion of the work gigantic difficulties; but of the two routes, we believe the difficulties to be encountered in the Panama route are much less than at the Isthmus of Nicaragua.

There are two to be especially noted. One is a strictly engineering problem, and the other a question of sanitation. Taking the latter first—for if a work of this enormous magnitude is to be pushed through to completion, it is evident that we must make sure that it is possible for skilled and unskilled labor to live upon the Isthmus at Panama—we would impress upon our readers the fact that there is no respect in which the Panama Canal has been more unjustly assailed than in its reputed unhealthiness. It is unhealthy. But it is not by any means the "graveyard" which the opponents of the canal have persistently represented it to be. When the canal work was first started, and the proper methods of sanitation and the best means of fighting the local diseases were not understood, there was undoubtedly a frightful mortality; but of late years, by the employment of colored labor from the West Indies, most of which is immune from the local diseases, and by the exercise of great care on the part of the white population, it has been found possible to keep down the death rate to a reasonable figure. Now, we fully believe when the United States gets hold of the canal, there will be a still further and considerable lowering of the death rate. We base this belief upon the remarkably successful work which we have done in the new countries which came under our care after the Spanish war. The most notable instance of this is the fever-stricken and indescribably filthy city of Havana, where, after it had been for centuries in the grip of yellow fever, a few years of sanitation carried out according to American ideas sufficed to clean out the dread disease almost absolutely, and to turn a notoriously unsanitary city into one of decent cleanliness. As the Panama work proceeds, because of the unhealthiness of the locality there will, of course, be a certain amount of trouble, but the "graveyard" bugaboo will be found to have been grossly exaggerated.

The other great problem of the canal is of an engineering kind, and it will be found at the site of the great Bohio Dam, the most important structure on the whole work. The dam proposed by the Panama Company was to have been of clay founded upon hard clay, soft clay, sand and gravel. When the Isthmian Canal Commission made its investigation, it decided that for a work of this importance, security was a prime object to be aimed at. Hence they decided that as the sub-strata were of a more or less porous material, it was necessary to build either a masonry dam founded throughout upon rock, or an earth dam with a masonry core extending everywhere to rock; either of which structures would prevent seepage and effectually close the valley. Preference was given to a core-wall-and-earth dam. The structure as designed is to be 2540 feet in length along its crest, and its core wall will be carried down everywhere to rock, which in places will be reached at a depth of 128 feet below sea level. From sea level for a distance of 30 feet down cofferdams will be used in making the excavation, and from —30 to —128 feet the pneumatic process will be employed. The cost of the dam will be $6,370,000; and as it will probably take ten years to build, it will be the controlling feature in the question of the time of construction of the canal. Once built, in the manner suggested, however, it will be a structure that will stand for all time. A great deal has been said, and much will yet be heard, about the risks and even the impossibility of building such a structure by the pneumatic process; but while the work is, in some respects, unprecedented, there is no feature of it which is of such an untried character as to give any reasonable doubt to engineers as to the feasibility of the structure. Moreover, ten years in the development of engineering in the United States is a very long period, and we confidently expect that improved methods of construction devised by our ingenious American engineers and contractors will result in a considerable shortening of the period of construction below that estimated by the Commission.

Then again, it should be noted with a certain amount of satisfaction that the selection of Panama has been welcomed by the English press as an exceedingly wise and judicious selection. The future prosperity of the canal will certainly greatly depend upon the amount of European commerce which will pass through its waters after it is completed. A very large proportion of trade will, of course, be obtained through Great Britain and her colonies. It is gratifying to know, therefore, that in a commercial sense the principal engineering and marine papers of Great Britain believe the Panama route unquestionably a superior route from every point of view.

THE RAPID DEVELOPMENT OF THE SHIPBUILDING INDUSTRY OF JAPAN.

The development of the mercantile shipbuilding industry of Japan, noteworthy though it has been throughout the past few years, promises to be more remarkable in the future, if the present healthy outlook affords any criterion. The Japanese government is stimulating the enterprise by a subsidy of $10 per gross ton on vessels of 1,000 tons and on all vessels built in native yards and a lesser subsidy on smaller vessels. To this substantial encouragement must be added an additional subsidy of $2.50 per indicated horse power for propelling machinery. These are very material inducements, and they have naturally assisted in the development of the shipbuilding industry, which to the Japanese nation, owing to its insular position, is of paramount importance.

Coal is plentiful and consequently cheap, and so is labor. Skilled native artisans are employed for a wage of less than 50 cents per day. Strikes, lockouts and the domineering interference of trade unions are phases of civilization which as yet are practically unknown in the Far East. The average workman also is quite content to work on Sundays at the ordinary rate of wages. These advantages constitute a very substantial factor in the question of Japan's becoming her own ship constructor. All the shipbuilding yards in Japan, both government and private, would seem to have their origin in ship repairing, and from the ship-repairing industry to that of shipbuilding is a very natural transition. There are at present five important private shipyards in Japan, of which two are at Uraga, the others being situated at Nagasaki, Kobe and Osaka.

During the year 1901 the output of merchant shipping was under 7,000 tons, but as each succeeding ship is easier to build than her predecessor, on account of the plant provided, and the education gained by workmen and managers, it is with all Japanese yards rather premature to attempt to gage their future possibilities by the light of past performances. Baron Iwasaki, head of the Mitsu Bishi Company, of Nagasaki, has realized that even what is generally described as unskilled labor can be rendered more productive by education. He has, therefore, provided a school for the technical instruction of his workmen. Fifty lads ranging in age from 12 to 17 years are admitted each year, and they pass through a five years' course of instruction in shipbuilding, ship repairing and engineering. The education provided is free, and no pledge is exacted, or promise made, that the lads will, on the expiration of their pupil apprenticeship, engage in shipbuilding work.

PHOTOGRAPHY OF SOUND WAVES.

Mr. H. S. Allen, of the Blythswood Observatory (Scotland), has been carrying out some interesting experiments in connection with the photography of sound waves, and other disturbances of the air. The method of striæ devised by Toepler more than thirty years ago makes it possible, by suitable optical arrangements, to render visible disturbances in which the refractive index differs but little from that of air. In working this method for photographic purposes the source of light and its image must be of finite width, and the adjustments made so that a certain fraction of the width of the image falls on the screen, while the light from the remaining portion passes through the lens and gives rise to a uniform field. In these circumstances the upper part of the region of greater density appears against a light field, and the sensitiveness of the method depends on the relative proportion of the light stopped by the screen, and the light that enters the lens. One of the most striking applications of the method is the photography of sound waves—waves of compression set up by sudden electric discharges. The compression in one of these waves is considerable compared with that due to an ordinary musical sound. Attempts made to photograph the train of waves due to a musical note were successful, as were also efforts to secure a record of the notes from a shrill whistle, and a siren blown by a pair of foot bellows; but a number of photographs were obtained of the wave front of a train of waves from the oscillatory discharge of a condenser through a circuit possessing self-induction. In the latter case only the first wave front was secured; but although the attempt to photograph a train of waves was also in this case a failure, the result was not without interest, as it brought out very clearly the difference in character between the first discharge and the surgings that follow it when the spark is an oscillatory one. Several photographs were taken to show the formation of a vortex ring of heated air, from which it is seen that the air appears first of all to issue from the orifice in the form of a column, but the tail is gradually left behind, while the whirlpool motion of the head is accentuated. The appearance of some of these photographs showing vortex motion, as well as those of atmospheric disturbances caused by the burning of a spirit lamp and of a gas jet, resemble the published photographs of the nebulæ of the heavens.

EXHIBITION OF SCIENTIFIC DEVICES IN PARIS.

The Société Française de Physique recently held its annual exhibition in Paris, when a large variety of the inventions of the numerous ramifications of science, devised during the past year, were displayed. Notwithstanding the apparently exclusive name which it bears, this institution is international in its operations.

Some novel and interesting devices were exhibited. One contrivance was a wall of rippling and constantly changing colors of light, the effect being produced by a different series of electric lights, alternately switched on and off by a revolving wheel. This was intended as a startling attraction for fêtes or advertisement purposes.

One room was devoted to a practical exhibition of the varied utilizations of acetylene gas, among which the acetylene blow-pipe stood prominent. A practical example of how well acetylene gas is adapted for welding steel was given by an engineer. His eyes were protected with goggles similar to those utilized by automobilists. The blow-pipe was then brought to bear upon the requisite pieces of metals to be welded, and so terrific was the heat produced that the operation was accomplished in a few moments.

The two most valuable contributions to the show, however, were the devices of Prof. Curie and Prof. Pellat respectively. The former, who has long been engaged in the investigation of radium, exhibited the peculiar luminous properties of the substance. He had a small piece of radium measuring about one cubic inch, and which had cost $2,000 to produce. A German firm, when they received news of Prof. Curie's discovery some months ago, offered to extract a sufficient quantity of the substance from the salts of barium, at their own expense for the purpose of this exhibition. Several tons of the salt were required to produce even a cubic inch. This substance shines like a lamp, and also imparts a phosphorescent effect upon certain materials with which it is brought into contact, such as zinc sulphide. This is not a chemical, but purely a physical, influence. Prof. Curie displayed a retort containing a quantity of zinc sulphide, and connected the upper tube of the vessel with another retort containing a solution of radium. Immediately the zinc sulphide emitted a bright light. A small particle of radium renders phosphorescent a volume of zinc sulphide a thousand times its bulk. Another curious feature of the substance is that the zinc sulphide retains its phosphorescence for some time after the radium has been removed.

Prof. Pellat suspended a Crookes tube between two magnets. The effect produced was exactly the same as that which he obtained by transmitting a current through the tube. The colors in the tube varied, as the latter was turned one way or the other, thus showing the direction of the magnetic field.

Among the various X-ray contrivances exhibited was M. Benoit's "radiochromometer," an ingenious device for registering the degree of the penetration of the Roentgen rays. This invention consists of a series of disks of aluminium of various thicknesses, each layer being numbered consecutively from one to twelve. The