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NEW YORK, SATURDAY, FEBRUARY 1, 1902.

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.

RECOMMENDATION OF THE PANAMA ROUTE.

The Isthmian Canal Commission in a supplemental report has recommended that, in view of the new situation brought about by the offer of the Panama Company to sell its properties to the United States for $40,000,000, the sum at which they were appraised by the Commission, these properties be purchased and the canal constructed along the Panama route. This report is in no sense inconsistent with the first report of the Commission in recommendation of Nicaragua, inasmuch as it was clearly stated therein that the Panama route was excluded from consideration by the high valuation placed upon the properties by the old management of the Panama Company. Apart from this consideration, which was, of course, a fatal one, the first report of the Commission was distinctly in favor of Panama on the grounds of engineering, first cost, and cost of maintenance and operation. The findings of the supplemental report in favor of Panama are too lengthy for reproduction here, but they will be found in full in the current issue of the SUPPLEMENT. It is sufficient to say that the points enumerated in favor of Panama are those which, for several years past, we have presented in the columns of this journal.

We are free to confess that the final selection of Panama gives us unbounded satisfaction. The SCIENTIFIC AMERICAN was the first journal to publish the official plans of the location and structures of the new Panama Canal Company. From the very first time that we investigated the subject, we were satisfied that there was no question as to the proper course for the United States government to take in this matter; and we have never had a doubt throughout this long-drawn-out controversy that, when the facts came to be fully investigated, as they have now been, by an impartial and properly qualified commission of experts, final choice would be made of the shorter, better known, and more practicable route.

THE FAULTY EMBANKMENTS OF THE JEROME PARK RESERVOIR.

Too much publicity cannot be given to the present commendable attempt on the part of the Chief Engineer of the Jerome Park Reservoir to have the plans for the construction of a large part of the reservoir embankments revised, and certain portions of the structure rebuilt in accordance with the best engineering practice. It will be remembered that last autumn Mr. Hill, the present Chief Engineer, recommended important changes in the plans, both of these embankments and of the earth-and-core-wall portion of the Croton Dam. The Board of Engineers appointed to investigate the conditions of these two structures passed favorably upon the suggested changes at the Croton Dam, but stated that they considered the existing structures and plans at Jerome Park satisfactory. The Chief Engineer has submitted a reply to that portion of the report affecting Jerome Park Reservoir, in which he gives certain extracts from the diary of the Resident Engineer who had charge of the construction of the embankments which it is proposed to rebuild, which show that the material underlying these embankments is about as bad as it could possibly be.

The embankment under discussion extends along the southerly end and easterly side of the reservoir. Its length is 2,850 feet, and for 1,200 feet, at three different places, it is built upon sand. The balance of the embankment is built upon rock foundation. The southerly end of the wall is built across a natural depression which drains down to the Harlem River. This depression is 270 feet wide, and at its deepest point there is 30 feet of quicksand between the wall and the underlying rock. Great difficulty was experienced in building the foundations across this depression. On May 20, 1897, the Resident Engineer writes in his diary: "In the core-wall trench, quicksand still causes much trouble; a large stream of water boils up in bottom and has caused settlement of the timbers. Bottom also squeezes up there and has to be weighted with planks, etc." On June 3, 1897, he writes in his diary: "Much trouble encountered in excavating, as quicksand runs in from side almost as fast as it is excavated." On September 25, 1897, this engineer enters in his diary that he noticed two hair cracks in the completed core wall; and November 12, 1897, he states that the hair cracks in masonry have opened slightly and are being pointed over with Portland cement.

Commenting on these entries and several more which we do not quote, the Chief Engineer in his reply says: "In my opinion the building of an embankment and core wall for a reservoir upon such material and under the conditions as described is a gross violation of the rules of good practice, which prescribe that a core wall should be built either upon rock or upon solid, impervious material." Mr. Hill contends that this underlying sand is permeable by water, and that when the reservoir is filled with 23 feet of water, there will be leakage under the foundations, which may easily become so serious as to imperil the whole embankment. The facts of the case as presented in the report appear amply to sustain the position of the Chief Engineer; and in view of the importance of the reservoir, and the disastrous results to New York city should there be a failure of its embankments, we trust that the Aqueduct Commissioners will see the wisdom of carrying out the reconstruction of these walls along the lines suggested. We have personally examined some of the material taken out from below the foundations in question, and have no hesitation in saying that the underlying strata at this particular portion of the dam is about the worst that could possibly be imagined. The foundation would be a poor one even if the embankments were enclosed by rising ground; but standing as they do on one of the drainage slopes of the Harlem River, the necessity of carrying the foundations through this quicksand to solid rock should not be questioned.

LONG DISTANCE TRANSMISSION.

To the city of San Francisco is shortly to belong the distinction of being served by considerably the longest transmission of electrical power in the world. Hydraulic-electric power has for several weeks been carried in California for a distance of over two hundred miles. The credit of this installation is due to the Bay Counties Power Company, California, whose line extends from the Colgate power house located in the Sierra Nevada Mountains to Oakland on San Francisco Bay, a distance of 142 miles. At this city the lines connect with those of the Standard Electric Company, which reach from Oakland to San José, a further distance of 42 miles, and thence to Redwood City, which is distant 191 miles from the Colgate power house. At Colgate connection is made with the lines of the Consolidated Light and Power Company, which extend to Burlingame, a further distance of 11 miles. The total distance of transmission thus accomplished is 202 miles. The completion of the high-tension line of the Standard Electric Company to San Francisco, which it was announced would be made this month, will render possible transmission from the power house in the Sierra Nevada Mountains to the sub-station in San Francisco, a distance of 220 miles. This feat, which is quite without a parallel, will be naturally compared with the Lauffen-Frankfort transmission of 110 miles, which was made in 1891, and it will be seen that the distance has been doubled in about a decade. The explanation of the great distance to which transmission has been successfully accomplished in California is to be found partly in the favorable climatic conditions of that State.

ADVANCE OF THE MARINE TURBINE

It was inevitable that the success of the "King Edward" during the past season should encourage the construction of other turbine-propelled vessels; hence, we are not surprised to learn that another river passenger steamer similar to the "King Edward" has been ordered. The new craft will be of large dimensions and will have one knot more speed, or 21½ knots an hour, and the horse power will be about 4,000. The absence of vibration is, of course, a strong recommendation for the application of turbine propulsion to the steam yacht, for here comfort is a prime consideration, and we note that orders have been placed for turbine engines for three yachts of high speed. One of these, which is being built for a New York owner, will be a 1,400-ton yacht of 3,500 horse power. Of the other two, which are being built for British owners, one will be of 700 tons displacement and 15 knots speed, and the other, which is to be constructed on the lines of a torpedo boat, and carry Yarrow water-tube boilers, is to be of 170 tons and will attain a speed of 24 knots. The next step in the application of turbine propulsion should be the construction of an ocean-going steamer of 4,000 or 5,000 tons displacement. With a ship of this size it would be possible to determine with pretty close certainty whether the equipment of a 10,000 or 15,000-ton liner with turbine engines would be a profitable experiment.

THE SHIP SUBSIDY BILL.

It sometimes happens that in response to the question, "What's in a name?" we have to answer, "Just everything." There is now up for discussion in Congress a measure which we do not hesitate to designate as one of the most important ever brought before that body, that is in danger of suffering shipwreck simply and solely because of the unfortunate name which it carries. Unfortunately a large number of the American people have conceived a violent prejudice against the term "subsidy." Apparently they look upon subsidizing as a kind of alms-giving, a sort of feudal scattering of largess, with the difference that the recipients, instead of being supposedly impoverished and helpless, are among the powerful and wealthy of the land. As a matter of fact, shipping subsidies mean nothing of the kind. They are based upon the conviction that between the individual ship-owner and the nation at large there is, in respect of the upbuilding and extending of the shipping industry, with all the indirect and enormous national benefits that are to be derived therefrom, a profound community of interest. It is realized that the assistance given by the nation to the ship-owner is to be temporary only, and that in its intrinsic value it is altogether disproportionate to the great and lasting national advantages to be derived from the rehabilitation of the merchant marine.

In discussing the subject it is best, at the outset, to distinguish clearly between our "lake and coastwise" and our "deep-sea" shipping. The former is wonderfully prosperous; the latter is not; and the difference is due to that very condition of things which the pending subsidy bill is expected to remedy. Our lake and coastwise shipping is protected against foreign competition by an ironclad law which prohibits foreign ships engaging in the lake and coastwise trade; and the stimulating effect of this law is seen in the fact that this branch of the shipping interests of the country is in a flourishing condition, and although it is highly remunerative, there has been a steady reduction of rates. In 1870 it cost as high as $3.50 to transport a ton of freight from Lake Superior to ports on Lake Erie, while to-day the ruling rate is from 60 cents to $1 per ton.

Our merchant marine, on the other hand, is in direct competition with that of foreign nations, who are able to build and operate their ships so much more cheaply than ourselves that it is out of the question to compete successfully against them; and the object of the ship subsidy bill is to make up, by a certain schedule of payments to the ship-owners, the actual loss to which they would be exposed were they to attempt competition on a large scale with foreign ship-owners. The proposal to extend government aid is qualified by the understanding that such assistance is only to be rendered until we have moved up to our proper position among the maritime nations of the world. Long before our deep-sea shipping has increased to the magnitude of the lake and coastwise shipping, the cheapening of the cost of production which we may reasonably expect to follow the introduction of American labor-saving devices into shipyard work, will place us in a position where we can compete successfully with foreign shipyards. By that time the ship-building industry will be strong enough to hold its own without government assistance. The sum spent in subsidies should be looked upon as a very small price to pay for the multiplied benefits that will accrue from the resumption of our former proud position as the leading maritime nation of the world.

Our present disadvantageous position is shown by the following facts: While the raw materials of ship construction cost but little more in this country than abroad, the cost of labor is so much greater that the final cost per ton of the vessel at the time of launching is 20 per cent more here than abroad. From the report of the Commissioner of Navigation on the subject, we learn that the cheapest cargo steamer ever built in this country, the "Pleiades," of 3,750 tons and 9¾ knots speed, cost $275,000, while the British cargo steamer "Masconomo," of 4,200 tons and 10 knots speed, cost only $217,000. The annual charges on the "Pleiades" are $44,000; on the "Masconomo," $34,240. The total annual wages for the crew of the "Pleiades" amount to $14,588; while the total annual wages on the larger ship amount to only $11,751. As a result of the Commissioner of Navigation's inquiry, it was shown that there is an average difference in favor of Great Britain of 20 per cent in the cost of constructing cargo steamers, and of 33½ per cent in the cost of operation.

Under such conditions profitable competition with Europe is simply out of the question, and American capital has naturally found its way into the protected and highly remunerative coastwise shipbuilding and carrying trade. As the result of our withdrawal from, or rather failure to enter, the competition for the world's carrying trade, we are paying out annually the huge sum of $200,000,000 to foreign ship-owners for carrying our great and growing volume of exports to foreign countries. In the presence of this start-

ling fact, we are brought face to face with the question as to whether it is consistent with the dignity, and conducive to the best commercial interests of the country, that we should be indebted to foreign nations for the transportation of the products of our fields and factories, and that we should be paying out this great sum of money to foreign firms, when it might just as well form part of the legitimate annual profits of American industry. There are some Americans, it is true, who frankly assert that they are content to let matters remain as they are; but we must not forget that their attitude means the indefinite postponement of any revival of American deep-sea shipping, and that we, who before the days of our civil war were the greatest deep-sea carrying nation in the world, must be content, in spite of our ever-increasing wealth and importance, to continue to hold an inferior position.

The resuscitation of our merchant marine has an important bearing on our position as a naval power. An adequate merchant marine is necessary to any naval country that is to be in a position to transport its troops with speed and safety to a distant center of operations. We all remember the difficulty which we experienced in carrying troops to Cuba, Porto Rico and the Philippines during the late war; and now that we have extensive foreign possessions, the value of an adequate auxiliary navy has increased enormously. A consideration of the problems of transportation which would suddenly confront us were the Philippines, for instance, made the object of attack by a foreign power, should prove to us the wisdom of subsidizing fast and well-built merchant ships which, in the time of war, could be quickly armed and utilized as consorts to the slower transports, in which troops and munitions of war would be carried.

Lastly, it should be borne in mind that since practically the whole of our foreign trade is carried in foreign bottoms, a war between any of the maritime nations would result in a paralysis of deep-sea commerce and a temporary extinction of our export trade. On the other hand, if we possessed our own merchant fleet, we could view such a struggle in its effect upon our carrying trade with comparative equanimity.

THE SUPPOSED DANGERS OF ELECTRIC TRACTION.

The letter from Mr. George Westinghouse, which recently appeared in one or two papers, calling attention to certain dangers incident to electric traction, has naturally attracted widespread attention. It has, moreover, aroused a considerable amount of apprehension in view of the fact that electric traction seems destined to become adopted for all forms of railroad travel, short of that now carried on over the long-distance trunk lines of the country. This apprehension, while it is proportionate to the great reputation of Mr. Westinghouse, is out of all proportion to the actual facts of the case, for we feel satisfied that the dangers hinted at are neither so many nor so great as the letter of this distinguished engineer might lead the general public to suppose. Mr. Westinghouse believes that not only would the recent tunnel accident have been as likely to occur had electric traction instead of steam traction been employed, but that in an electrically-operated train the risk of accident would be increased rather than diminished, and this in spite of the fact that no injury from escaping steam would be possible. He suggests that in a train of combustible cars, electrically-equipped throughout, there might be an accident so serious as to start "an agitation having for its purpose the abolition of the use of electricity altogether or at least to compel the railway companies to abandon the use of combustible cars fitted with electric motors."

We are satisfied that Mr. Westinghouse's letter is in danger of conveying a stronger impression than the writer ever intended, and that the object of the letter was to utter a warning against careless and slipshod work in the equipment and operation of electric roads, rather than to condemn the whole system of electric traction as such on the ground of its inherent dangers. This we gather to be the opinion of Mr. L. B. Stillwell, the eminent electrical engineer who is responsible for the equipment of the two most important electrical roads now under construction, namely, the Manhattan Elevated system and the New York Rapid Transit Subway. In the course of an interview by a representative of the SCIENTIFIC AMERICAN with Mr. Stillwell, who may justly be regarded as the leading authority on this subject in the United States, the subject was very thoroughly discussed. His views on Mr. Westinghouse's letter and the safety of electric traction summed up concisely, are as follows: With reasonable care in installation and subsequent systematic inspection, there are fewer risks in the operation of an elevated or underground railway by electricity than with steam. When trolley cars occasionally catch fire, it will be found it is invariably due either to poor wiring, carelessness in placing resistance boxes in contact with unprotected woodwork, or to similar causes. A trolley car, electrically equipped with the same care that is insisted upon in the building of a steam locomotive, would be almost absolutely safe from accidents of this kind. As to the suggested danger of a fire resulting from collision, Mr. Stillwell affirms that he has never heard of a single instance of such an occurrence in the case of an electrically-propelled car or train. Such a result might follow collision, but the fire risk would be far less than where a steam locomotive was used. For when steam trains collide there are three distinct sources of danger: (1) the momentum of the train, (2) fire from the engine or the oil or gas lamps, (3) danger of scalding from the steam-heating pipes, or directly from the locomotive; whereas in a collision of an electric train, while the momentum may cause wreck and loss of life, the fire risk is greatly reduced, and the steam risk entirely eliminated.

The fire risk is reduced because it is an easy matter to absolutely and instantly cut off the current from the wiring in the wreck by means of automatic circuit-breaking devices of types that have been proved reliable by years of experience. The burning up of an electrical train in a tunnel at Liverpool was apparently due to the use of open or exposed fuses, which would not be used on an up-to-date equipment. With the use of automatic circuit-breakers, located in iron fireproof compartments, or of any of the properly inclosed fuses of which there are several types on the market, the risk of fire is so small as to be practically eliminated.

In the desire to attain constantly increasing speeds of operation, engineers should be governed by a due measure of conservatism, and by every reasonable precaution that can guarantee the safety of the traveling public. In the craze for high speed, engineers are sometimes in danger of losing sight of certain very practical issues in railway operation; but so long as due regard is given to measures of safety which have been proved by long experience in the operation of high-speed railways to be necessary, the conditions of high-speed electric traction are such, and the art of electrical equipment is so well advanced, that this form of travel could be made as safe as, and indeed much safer than, steam railroad travel.

In the case of an electric train wreck, the risk of fire by short-circuiting is not comparable with the risk of fire when a steam locomotive carries nearly a ton of incandescent coals into the splintered wreck of a passenger car. For in the former case the current is almost certain to be automatically cut off before the woodwork can be ignited. Moreover, in the case of the Manhattan Elevated Railroads, the third rail is divided into sections, each of which is supplied through an automatic circuit-breaker in the sub-station. With assurance thus made doubly sure, the chance of ignition of the woodwork after a smash-up is extremely remote. Applying the above considerations to the tunnel accident, while it cannot be assumed that, had the trains been electrically equipped, there would have been no accident, it is perfectly certain that had there been an accident it could not have been due to the inability of the engineer to see the signal because of smoke in the tunnel. Again, the total weight of the Harlem River train, had it been equipped with motors equal in power to the steam locomotive, would have been considerably less, and the momentum as it struck the New Haven train correspondingly smaller. While the forward cars of the Harlem train might have suffered more in the absence of the engine, it is certain that the passengers in the last car of the New Haven train would not have been killed and maimed as they were; for in an electrically-equipped train there would have been no scalding to death of passengers, and no delay in the work of rescue due to the rush of steam that drove the rescue party back and hindered their work. Finally, Mr. Stillwell combats the idea that the fires which occur now and then on trolley cars are due to collision and wreckage. They are traceable to faulty wiring, and they could be practically eliminated by care in mounting the motors and controllers, by the use of the best systems of insulation, and by systematic inspection and testing.

TWO HUNDRED THOUSAND DOLLARS IN PRIZES FOR AIRSHIPS.

It has been fully and finally determined on the part of the officers of the Louisiana Purchase Exposition Company to have a tournament of airships and an aerostatic congress at the World's Fair at St. Louis in 1903. In order to stimulate inventors along this special line of experiment, prizes aggregating $200,000 will be offered for the most successful contestants. In view of the remarkable results attained by M. Santos-Dumont at Paris last year, when he made a thirty-minute trip around the Eiffel Tower, having his airship under control during the entire journey, the coming tournament is in the line of progress. It is the desire of the officers to achieve better results than those of Santos-Dumont, and for that reason the prize is made a most liberal one.

It was early recognized by officers of the Exposition that the navigation of the air is one of the great problems for scientific solution, and that this Exposition would not fulfill its duty to the world unless it lent its encouragement and furnished an opportunity for those who are skilled in this difficult science to demonstrate the results of their endeavors. The experiments of M. Santos-Dumont have set the inventors to thinking anew upon this most interesting problem, and the tournament at the coming World's Fair will be one of the most novel in history. A cablegram from London says that Sir Hiram S. Maxim, the American inventor, has expressed himself as willing to expend $100,000 in addition to the large sums he has already laid out in experiments in aerial navigation to win in the coming contest, if assured that the prize will be as large as announced. In reply to this, President David R. Francis, of the Louisiana Purchase Exposition, is quoted as follows: "Mr. Maxim will receive all the assurance he desires when the committee on aerial experiments has crystallized the plan for the contest. If he abides by the conditions of the competition and invents an airship that will obey the directions of an operator in midair, as well as develop speed, he will be entitled to be adjudged as a real contestant.

"The total sum of $200,000 has already been set aside by the Executive Committee for the purpose of defraying the expenses of the proposed aerial tournament. Of this sum $100,000 will constitute the award for the successful operation of a craft in the air, $50,000 will be devoted to premiums for races between airships, and $50,000 to defray the expenses of the competition. We have opened correspondence with noted experts in aerial science, and the entire matter of suggestion with reference to the management of the contest will come from that authority."

Secretary Walter B. Stevens of the Exposition Company says: "The recommendation of Director of Exhibits Skiff on the subject of the airship contest has been unqualifiedly indorsed by the entire Executive Committee. Nothing in the way of a suggestion for an exposition feature has received such immediate and strong approval."

The Executive Committee of the Exposition has appointed as a sub-committee in charge of the tournament and congress, Mr. Charles W. Knapp, proprietor of the St. Louis Republic, and Nathan Frank, representing the St. Louis Star. This sub-committee has invited Prof. S. P. Langley, secretary of the Smithsonian Institution, of Washington, D. C., and Octave Chanute, of the Western Society of Engineers, at Chicago, distinguished scientists who have devoted much attention to aerostatics, to visit St. Louis for a conference upon the subject of the aerial tournament and aerostatic congress at the World's Fair. At this conference rules for the event will be determined and a proper division of the $200,000 will be decided upon. It is also probable that they will recommend for appointment a chief of the aerostatic display.

The announcement that such a liberal sum would be set aside for the encouragement of experiments in aerial navigation has stirred up a very lively interest in the science, and many inquiries have been received by mail and wire at Exposition headquarters. Secretary Stevens reports that it is probable there will be at least one hundred entries representing not less than ten countries.

VERDICT IN NEW YORK CENTRAL TUNNEL WRECK INQUEST.

The Coroner's jury, at the inquest into the deaths of the seventeen victims of the late disaster in the New York Central tunnel returned a verdict to the effect that the collision was due to the failure of the engineer of the Harlem train to stop his locomotive at the danger signal at Fifty-ninth Street, which was properly set. The verdict proceeds to say:

"We further find that the said engineer, John M. Wisker, owing to the heavy atmosphere, due to weather conditions, together with the presence of large bodies of steam and smoke escaping from trains passing on various tracks in said tunnel, obscuring said signal, was unable to locate said danger signal.

"We further find faulty management on the part of the officials of the New York Central and Hudson River Railroad, and we hold said officials responsible for the reason that during the past ten years said officials have been repeatedly warned by their locomotive engineers and other employés of the dangerous condition existing in said tunnel, imperiling the lives of thousands of passengers, and they have failed to remedy said conditions; and also for the reason that certain improvements in the way of both visible and audible signals could have been installed, and this disaster thereby have been avoided, and for the further reason that no regulation of speed at which trains should run in said tunnel has been enforced, thereby allowing engineers to exercise their own discretion."

The export of horses and mules from New Orleans to South Africa from October 1, 1899, to November 30, 1901, shows a total valuation of $13,483,052. This is exclusive of feed, which amounted in value to $992,618. The total number of horses and mules shipped is 143,050, of which 75,991 were horses.