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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.

A GREAT ENGINEERING FEAT COMPLETED.

With the laying, on the first day of the present month, of the last coping stone of the great dam across the River Nile at Assouan the ancient land of the Pharaohs sees the completion of a national work, which is not only the greatest of its kind in existence, but in its beneficent results will probably outrank any scheme carried out in Egypt, either in ancient or modern times. The completion of this dam and a similar structure at Assoiut will provide in the Nile valley a vast reservoir capable of supplying over a billion cubic yards of water every year. The surplus waters of the river will be stored during the flood season, and then drawn upon for the irrigation of wide tracts of land which for many centuries past have lain waste for want of water. As a result of the new system of irrigation, there are extensive tracts of land which henceforth will bear two crops a year where formerly they bore but one; while the area devoted to sugar cultivation will be greatly increased. The Assouan dam itself is one of the greatest engineering works in existence. It is no less than 1¼ miles in length and it is pierced by 180 sluice gates 25 feet in height and 7 feet in width, by means of which the regulation of the waters will be secured. The total cost of the two dams will be about $25,000,000, and the work has already proved itself to be an important economic feature in the life of the Egyptian people, for no less than 14,000 natives have found continuous employment during the progress of the work. The inauguration and rapid development of this great scheme have been due entirely to the enterprise of a western race, entirely alien to the Egyptian people; and there is something peculiarly fitting in the fact that Egypt, which contributed so largely in its earlier days to the world's arts and sciences, should in these later times be thus richly endowed by the highly-developed engineering skill of our modern civilization.

THE HALIFAX ROUTE TO EUROPE.

It was an inevitable outcome of the powerful shipping combine which has recently been brought about among the steamship companies plying between the United States and Europe that some attempt should be made to develop a rival combination with facilities that would enable it successfully to compete for the transatlantic trade. Inasmuch as the strength of the position held by the combine lies in the fact that it has the great railroad systems of the United States at the back of it, it was evident from the first that any competing interests must also have behind them a transcontinental road. Such a road exists in the great Canadian Pacific system, which provides a through transcontinental service from Vancouver on the Pacific to Halifax on the Atlantic. The latter port of call has a distinct advantage over the port of New York in the fact that it is over a day's steaming by the fastest liners nearer to Europe, and that it is readily accessible from deep water at all states of the tide.

In view of these facts it is not a matter of surprise that the Canadian government should have recently approached the British Parliament with the suggestion that a line of steamers should be established between Halifax and Liverpool, and that a subsidy of from three to four million dollars should be provided jointly by the Canadian and British governments. The proposal has provoked a natural enthusiasm in Canada, and it seems probable, at the present writing, that it will receive the favorable consideration of the English government. If Halifax be selected as the terminal port, passengers and mails will reach the United States about one day earlier than they do by the fastest ships of the German line at the present time. The speed of the proposed fleet of steamers has not been definitely determined upon, but it will not be less than twenty and may be as high as twenty-three knots an hour, the probabilities pointing to a sustained sea speed of twenty knots for the faster boats. To the average transatlantic passenger the proposed line should prove particularly attractive, since the competition thus established will serve to preserve passenger rates at their present figure and check that tendency on the part of the steamship combine to raise the rates, which, as we have lately pointed out in these columns, is giving uncomfortable proof of its activity.

THE MARCONI DISCLAIMER.

To the man who is at all familiar with British and American patent practice, the comments which have appeared in the newspapers on the announcement that Marconi has amended his British patent application in order that Marquis Solari might receive due credit for a certain contrivance, must appear decidedly unjust to the inventor to whom, more than to any other, the practical success of wireless telegraphy is due. Marconi has been placed in an apparently awkward position simply by reason of the peculiar rules that govern patents in Great Britain.

Probably one of Marconi's claims covered Solari's device; and in order that he might not invalidate a patent in which other devices were described, Marconi filed the necessary disclaimer. In the United States, where the filing of a disclaimer is optional, the patent would probably have passed to issue without any gratuitous newspaper criticism. Its validity would have been passed upon by the federal courts in a patent infringement suit; and even if it then transpired that a device covered in one of the claims had been invented by another the remaining claims would still be valid and their infringement would be enjoined by a Court of Equity.

From the meager accounts which have been received it does not very clearly appear what is the nature of Solari's invention. Even if Solari is the inventor of the mercury-coherer, used in combination with a telephone, which is said to have been employed in transatlantic signaling, it still remains to be proved that the entire system which Marconi uses is the result of another's work. Moreover, he announced that the coherer has been abandoned for transatlantic telegraphy. Marconi has so far shown himself an indefatigable and modest scientific investigator, who has spared neither time nor money in practically applying the discoveries of Heinrich Hertz. Although it is true that Branly invented the coherer, that Popoff first used the tall mast, and that many of the important elements of the usual wireless telegraphy apparatus had been invented before Marconi was heralded as the inventor of a new form of long-distance communication, nevertheless the fact remains that to him and to him alone the scientific success of space telegraphy is due; and to him perhaps will its eventual commercial success be credited.

It is not difficult to find a parallel to the battle which Marconi is now waging for recognition of his rights as an inventor. No one would now dispute the title of Morse to the telegraph, and yet the elements of the invention had been devised long before by Prof. Joseph Henry and others. Many an experimenter had labored long in endeavoring to produce an apparatus by means of which it would be possible to converse through long distances. Still, to Prof. Alexander Graham Bell justly belongs the credit of having furnished us with the telephone that bears his name. Given a number of old devices, an inventor ingenious and broad-minded enough to see their possibilities, and persistent enough to combine them into an apparatus capable of performing new functions, and a horde of claimants for the honor of having invented the apparatus evolved will forthwith arise. Such is evidently the usual experience of the successful inventor. Despite the persistent and bitter attacks of Sylvanus Thompson, and the cool disregard of German scientists for the work of Marconi, it seems reasonably certain that he will eventually receive his full meed of credit. A patent infringement suit is generally a thing to be avoided; but in Marconi's case it is almost to be welcomed, for only after a painstaking analysis by a United States Court will it be possible to appreciate fully how great has been the contribution of Marconi to wireless telegraphy.

FUTURE TRANSIT FACILITIES OF NEW YORK CITY.

The series of weekly discussions of municipal affairs by Mayor Low of this city have shown that he possesses a very thorough grasp of the municipal problems of America's greatest city. A striking instance of this is afforded by his last utterances on the subject of the future transit facilities of New York city, in which he carefully reviews the whole field and indicates in what direction the present various transit system must be enlarged, what connections must be made between them, and what new lines must be opened to accommodate a freight and passenger traffic whose growth is without parallel in any of the great cities of the world.

In reading over the nine pages of Mayor Low's typewritten statement we agree with him in his estimate of the transit situation, with the single exception of his indorsement of the possible abolition of the terminal loop below Forty-second Street station. We cannot but think that the New York Central Company's first design, embracing an electrically-operated terminal loop for suburban traffic, is the best possible solution of the problem at that point.

The paper discusses the whole subject broadly under three heads: Inter-borough communication between Manhattan Island and Long Island; communication with Manhattan Island from the north; and the improvement of the city's commercial facilities by the development of the water front of Manhattan Island.

Under the head of inter-borough communication, the Brooklyn Bridge naturally receives the first attention, and the keynote to the problem is sounded when the Mayor affirms that all bridges, and the Brooklyn Bridge in particular, should be treated as thoroughfares. "They must not only arrive; they must lead somewhere." If our readers will refer to the early accounts of the new East River Bridge, or the Williamsburg Bridge, as it is now called, published in the SCIENTIFIC AMERICAN, they will find that we strongly advocated the treatment of the new bridge as a thoroughfare, and not as a mere short length of railroad connecting two terminal points. Unfortunately, the present Brooklyn Bridge was built on the latter plan, its traffic to be carried by a system of shuttle trains; but the inexorable demands of traffic have practically, as Mayor Low shows in his address, converted the Brooklyn structure into a great railroad thoroughfare. Such it is to-day, such it will ever remain; and, therefore, in view of the fact that the present suspended roadway is loaded up to its safe limits, the proper thing to do is to rebuild the roadway, bringing its carrying capacity up to the strength of the cables and towers, which can sustain much greater dead and live loads than they do at present. The Brooklyn Bridge should be connected directly with the downtown financial districts to the south, with the Hudson River ferries to the west, and with the Williamsburg Bridge to the north. Of these connections a subway road between the Brooklyn and Williamsburg bridges is rightly considered to be the most urgently needed, and should be the first to be constructed. The northern connection is very important, not only as increasing the value of the Brooklyn Bridge, but as bringing the new Williamsburg Bridge, which will probably be opened by the autumn of 1903, in touch with the City Hall, thereby rendering that bridge, in its turn, a railroad thoroughfare. The new suspension bridge No. 3, which will be known as Manhattan Bridge, is to extend in Manhattan Island to the neighborhood of Canal Street and the Bowery, and we agree with the Mayor that the railroads of this bridge should be extended across the city so as to make connections with the west side elevated systems, as well as with those upon the east side. But we think that such connection should be carried underground and not by an elevated structure.

The new Blackwell's Island Bridge terminates at Seventh Avenue and will inevitably make connections with the elevated road, the natural agent for using the Blackwell's Island Bridge being the Manhattan Elevated Railroad, just as the natural agent for using as railroad thoroughfares, the Brooklyn Bridge, the Williamsburg Bridge and the Manhattan Bridge is the Brooklyn Rapid Transit system. The Brooklyn Rapid Transit Company is also the natural agent for using the second Brooklyn tunnel, which should be located so far as practicable to meet the views of that corporation; provided, of course, that the company will do its part in developing such thoroughfare traffic.

In the Mayor's opinion it lies with the New York Central & Hudson River Railroad to solve the problem of giving adequate connection between Manhattan Island and the suburban country to the north of it, and he states that he is authorized by the president of the New York Central Railroad to say that that road is ready to enter into a stipulation with the city (provided the city will approve the changes that they now wish to make at the Grand Central Station) to substitute electricity for steam, not only for their suburban, but also for their through traffic, and that they will sign a contract for the erection of power houses adequate for both of these purposes immediately after the approval by the city of their terminal plans. The company furthermore pledges itself to co-operate with the city in developing at some point or points in the Borough of the Bronx a union station or stations, at which passengers can change from their suburban and through trains to the Subway and to the various elevated roads running to the south. The Mayor thinks that such a union station and transfer system would obviate the necessity for the underground loop station at Forty-second Street; but it seems to us that while a large part of the suburban travel on the New York Central would be transferred at such a union station, there would still be a large proportion of the suburban travelers who would wish to continue directly to Forty-second Street

without change of cars. This number will steadily increase with the increasing growth of the northern districts, and, therefore, we think that the arguments in favor of a terminal loop would remain practically unaffected by the provision of a union station in the Bronx.

Finally, the Mayor suggests that in view of the splendid system of piers already constructed by the Dock Department, and the extensive additions which are about to be made, and, also, in view of the fact that adjoining the piers there will be a water front street, 250 feet in width, extending ultimately from Cortlandt Street to Thirty-eighth Street, an elevated railroad might easily be carried from the lower part of the island to a connection with the New York Central at Thirtieth Street, and that a connection would naturally, if this road were built, be made with the proposed Pennsylvania Railroad tunnel beneath Manhattan Island. With such a road constructed, every transatlantic steamship pier on the western side of Manhattan Island would be directly connected with the New York Central and the Pennsylvania Railroad systems. We agree with the Mayor that such a road, if built by the city, would ultimately prove to be a very fruitful source of revenue.

The improvements above outlined are conceived in the broad spirit and with the far-sighted outlook which has characterized all of the proceedings of that most admirable body, the Rapid Transit Commission; and we would urge the point that, so far as the city's debt limit will allow, the necessary legislation for these improvements should be immediately secured and the work put in hand. If there is one lesson more than another that the history of New York City's Rapid Transit teaches it is that it is best to be beforehand rather than behindhand in providing transit facilities. The city's traffic grows at such a phenomenal rate that the possibility of providing more facilities than are necessary is exceedingly remote.

SIMPLON TUNNEL.

BY OUR FRENCH CORRESPONDENT.

The Bulletin of the Societe des Ingéneurs Civils contains an account of the recent work on the Simplon Tunnel, as brought out in the last quarterly report for the state of the work on the 31st of December last. It is on the southern side that the work has been interrupted by the great outflow of water from the subterranean reservoirs. On the north side but little water was encountered, but on the south side no less than twelve springs were found. The enormous pressure which some of these springs showed on their first appearance is no doubt due to the presence of a subterranean basin existing in the fissures of the gneiss and limestone, but especially the latter. It is easy to imagine the formidable disturbance which the piercing of the tunnel brings about in opening a water passage at a level of 2,000 feet below the surface of a basin which up to the present has been in a state of complete stability, traversed only by the currents of an internal circulation. A basin of this kind produces an output which increases with the number of openings, and this output will remain practically constant from the moment when no new openings are made. This is the case at present, and since the beginning of November the quantity of water has been nearly constant at 250 to 270 gallons per second. But the diminution of certain springs which has occurred recently shows what is likely to arrive for the others, owing to the lowering of the basin level. As soon as the subterranean reservoir becomes emptied there will no doubt be a rapid decrease in the volume of water, and the affluent water will then come out directly by the openings. The approach of this period is indicated by the increased cooling of the water. The affluents come neither from the Avino or the Cairasca lakes, as has been proved by the coloration test which was made on the 3d of December, but the reservoir is supplied from the water collected by the Leggiolo and the valley of the Alpe di Valle. This surface receives enough rain water and snow to feed a spring of 1,500 gallons per minute and it is noteworthy that a group of springs of this capacity existed at the Alpe Membro, on the right bank of the Cairasca, at 4,000 feet altitude. This spring, which still flowed abundantly up to the 29th of October last, had completely dried up before the 20th of November, thus proving the existence of a subterranean reservoir whose overflow was at an altitude of 4,000 feet at least. The influence thus exerted upon the spring by the piercing of the tunnel shows the enormous extent of the subterranean water system, as the tunnel is at a horizontal distance of 1¼ miles from the spring and over 2,000 feet below its level. The formation of the underground canals is no doubt due to the disintegration produced by the water. The water-circulation, which is supposed to pass from the surface of the water down to perhaps a thousand feet below the level of the tunnel, is caused by the subterranean heat, which makes the hot water mount to the surface, like the action of a thermo-siphon. This explains the difference of temperature in the different streams coming but a short distance from each other. There must be currents of hot water mounting and currents of cold water descending. The differences in the density of the water is explained by its passage through layers which are alternately calcareous or gypsum-like. As to the general cooling of the water which manifests itself as the flow continues, this seems to be due to the rapid lowering of the basin, which is a relatively stable body, and is being replaced by supplies of colder water coming directly from the surface. When the reservoir becomes completely emptied, these springs will no doubt give the outflow its minimum temperature.

It is expected that the exhaustion of the reservoir will coincide with a rapid decrease in the volume of outflow. If the Membro spring, above mentioned, is the only system which served as an outlet for the reservoir, this volume will then be between 25 and 40 gallons per second. If other springs, such as those of Prese de Gebbo, are suppressed in turn, which is at least probable, we must expect a permanent flow of 85 gallons per second. In any case, it seems certain that the volume of water now flowing in the two galleries of the tunnel is exceptional and will last only until the basin is emptied. Prof. Schardt, the geologist of the Simplon Tunnel, treats the same question in a conference held before the Société Vaudoise de Sciences Naturelles at Lausanne, and gives some interesting figures. He remarks that this deplorable outflow of water coincided with the approach of the limestone, and that, contrary to what usually happens, the temperature of these springs has fallen with the advancement of the tunnel, and that the new springs which are found increase in coldness. Moreover, the same springs continue to become colder, and fall as low as 11.5 deg. C., when the normal temperature of the water should be from 36 to 37 degrees. Besides, the water showed, simultaneously with these modifications of temperature, a general increase in density which has reached from 30 to 75 degrees *hydrotimetric* (one such degree corresponds to the presence of a centigramme of limestone or 0.014 gramme of sulphate of lime per liter). The greatest outflow of water occurred in the limestone between the 260th and 265th mile points of the tunnel. From the 1st of October to date (19th of February) there has flowed out of the mountain more than 350 million cubic feet of water. The average outflow he gives as 210 gallons per second, which gives in round numbers 108,000 cubic feet per hour, or nearly 2,600,000 per 24 hours. This volume of water would suffice largely to supply a city of 150,000 to 200,000 inhabitants. Taking account of the difference of level of the basin and the tunnel, this average output if 210 gallons per second falling from that height would represent a work of 7,700 horse power.

As to the work of piercing the tunnel, the advance of the northern side during the month of February was 524 feet, which brings the length of the gallery to 20,700 feet. Here the tunnel passed through the gneiss and crystalline schist in which the mean rate of cutting was 18 feet per day. The length of the southeast gallery is 13,660 feet, which has not varied, so that the total length now pierced reaches 34,360 feet, which is 55 per cent of the total length of the tunnel, or 60,834 feet. To show how the work is progressing, the tunnel company made a communication to the Secolo, of Milan, contradicting the unfavorable reports received by the Italian press as to the state of the work. The following figures show the annual advancement:

		Annual feet.	Total feet.
1st year,	Nov. 13, 1898 to Nov. 13, 1899	7,400	7,400
2nd "	" " 1899 " " " 1900	11,410	18.810
3rd "	" " 1900 " " " 1901	12,640	31,150
4th "	" " 1901 " " " 1902	14,180	45,330
5th "	" " 1902 " " " 1903	15,200	60,530
6th " last months of	1903 to May 14, 1904	—	

The last six months will be devoted to finishing the excavations, building revetment walls, etc. The tunnel will have a total length of 60,530 feet. According to the programme, approved by the concessionary company of the Jura-Simplon, the tunnel should now be at the 35,770 point, while 34,380 feet have been pierced; the difference, or 1,350 feet, is but slight and is less than a month's work. Since there is a margin of some months in the last half year it cannot be said that the programme is not being carried out. Two years remain to finish the work and cut 26,500 feet, which comes to 36.4 feet per day for the two galleries. This is quite possible, given the nature of the rock according to the official geological profile, which cannot be inexact except in details. On the Brigue side, where the work goes on regularly according to the plans, the advance is always 18 feet per day. The same progress will be made on the Italian side as soon as the present difficulties are overcome.

According to the data furnished by the last monthly report which has been received since writing the above, the progress made during the month of March has been 543 feet on the north side of the tunnel and 40 feet on the south, or in all 583 feet, which brings the total cutting to 34,940 feet. On the southern side the work had already passed through the loose mica schists which formed a bad portion extending over 60 feet. In this part were placed 43 metallic frames since the 18th of January, including 17 in the month of March. On the 17th of March was blown the first mine pierced in the front of the southern attack, after a period of four months of hand cutting. It was expected to recommence the mechanical drilling about the middle of April. According to this report the streams of water, although they are quite abundant (representing a mean of 200 gallons per second) do not at present hinder the work.

SCIENCE NOTES.

A communication by M. Berthelot in Comptes Rendus shows that the Chaldeans and Babylonians were possessed of considerable metallurgical skill. A Babylonian statuette was found to consist of a copper alloy containing 79.5 per cent of copper, 1.25 per cent of tin, and 0.8 per cent of iron. A statuette from Chaldea, estimated to be 2200 years old, was composed of nearly pure copper containing only a slight proportion of iron, whereas another Chaldean statuette, some 400 years older, consisted mainly of an alloy of four parts of copper with one part of lead and a trace of sulphur.

Some interesting experiments for the purpose of obtaining data regarding the earth's rotation have been carried out by the two emiment French scientists, MM. Berbet and Camille Flammarion, with the Foucault pendulum on exhibition in the Panthéon, Paris. This pendulum is the largest ever made. It consists of a ball of lead weighing 56 pounds, attached to the end of a specially-made fine piano-string approximately 210 feet in length—the longest piano-wire ever drawn. The oscillation lasts eight seconds in either direction—sixteen seconds in all—and the pendulum apparently displaces itself in the opposite direction to the movement of the earth's rotation. The pendulum affords one of the most comprehensive lessons in astronomy that has ever been given to the public.

In speaking on the interference of sound recently, before the Royal Institution of London, Lord Rayleigh described some of his experiments with fog-horns made for Trinity House. Fog-horns with elliptic cones instead of circular cones were tried, the major axis being about four times longer than the minor. The experiments showed that the sound was best spread in a horizontal direction when the long axis was exactly vertical. It appears to be doubtful whether the phenomenon of the silent area is really due to interference between waves of sound reaching the spot directly and those reflected from the sea. If the effect were due mainly to interference in this way it ought to be possible to recover the sound by the listener's changing his altitude above the sea surface, but Lord Rayleigh has on several occasions tried this on board the "Irene" and has not recovered the sound.

A new detonator has been devised by a Berlin inventor for firing explosives, consisting of pulverized aluminium mixed with detonating and oxygen-yielding substances. The aluminium is used in the shape of powder as an ingredient in detonating compositions, and especially of those mixtures for filling detonating or percussion caps for starting the detonation of explosives. The detonation composition varies according to the explosives employed, but in each instance it is essential to utilize the thermic properties of aluminium, which produces a very high temperature when burnt with oxygen-yielding substances, in consequence of which the mechanical energy developed is much higher than that obtainable with the compositions containing no aluminium. Owing to this peculiar property, a small quantity of aluminium composition is sufficient for detonating explosives, on which the compositions hitherto used free from aluminium have little or no effect.

Two French explorers, M. Pierre de Jecquer and M. Watlin, have been carrying out some interesting excavations for archæological purposes in Persia, and have made several valuable discoveries. At Susa they unearthed a large black marble column, covered from head to foot with cuneiform inscriptions, which should throw much light on the history of that ancient capital. According to the terms the explorers have made with the Persian government, they are not compelled to examine their treasures at Susa, but are permitted to transport them to France. Originally the concession permitted them only to share equally with the Persian government, but they were molested and attacked by the natives at Susa, and by way of compensation they obtained the right to take everything they require from Susa. In other parts of Persia the Shah claims his share. Generally the explorers work four or five months at Susa, and then before the winter in Susiana becomes intolerable, they migrate to the northern parts of the country, where there are ample fields for exploration. In this way they are gradually unfolding the history of past ages, and at the same time adding considerably to the present incomplete knowledge of Persian geography.