THE TELEGRAPHIC SYSTEM OF FRENCH WEST AFRICA.

FOR many years past, public opinion in France has been alive, and very properly, to the ever increasing extension of the English submarine telegraphic system, which, at present, seems like a vast net thrown over the world.

Our own colonies, as well as those of Portugal, Germany, Holland and Spain, correspond with their respective metropolises solely through these English channels, which it would be very easy to interrupt at any moment and for any length of time.

Such enforced tutelage will bear hard upon us as long as private enterprise will not be able to obtain the confidence of the French treasury and to displace the capital still given so foolishly to foreign shadowy corporations.

A slight movement is manifesting itself in this direction. North and Central America, and even Brazil, are communicating with Brest without borrowing British cables, and the new organization will soon receive certain improvements.

A similar work is slowly elaborating on the west coast of Africa. It is certain that the day on which the cable from Saint Louis to Teneriffe is definitely acquired by France, our possessions, which extend from the White Cape to the mouth of the Niger, will have nothing to ask from the companies on the other side of the English Channel.

Without entering into considerations of political order, it is well to set forth the fact that commerce and the administration will not be slow to benefit by this new state of things through the sensible reduction of tariffs. Thus, at present, French Guinea, which was paying the West African Company 585 francs per word, is now sending its telegrams at 18 francs solely, say a diminution of 405 francs. The fact must not be lost sight of that this company receives, in addition, from our government, for each of the offices of Konakry, Grand Bassam, Kotonou and Libreville, an annual subsidy of 75,000 francs. Portuguese Guinea, which probably finds itself in the same situation, is thinking of asking for authority to connect her Bonlam, Favin and Jeba counting houses with the telegraph line constructed last year in Casamance, a province of Senegal to the south of the Gambia.

The German and English merchants established upon the Gold Coast, at Togoland and Lagos, who are very practical people, as every one knows, will not themselves hesitate to remit their numerous dispatches to our land lines if the tariff of the submarine lines is not changed. But such fine and desirable results will be attained, and especially preserved, only at the cost of a hearty support on the part of the colonies interested.

Our readers will certainly thank us for adding a few words concerning the progressive formation of this African system, the total length of which will exceed 4,800 miles.

In the first place, and up to a recent date, the different governors who succeeded each other, both in Senegal and the Soudan, merely took into consideration the possibility of giving their administrative orders a quick transmission. In measure with the effective conquest of the country, the lines were elongated. Thus, in 1862, Faidherbe, in order to maintain Cayor, which was continually in commotion, constructed the first line between Dakar and Saint Louis, and, after this, Colonel Pinet Laprorde, along about 1868, undertook to connect with Saint Louis the military posts which were situated along the river and were too distant from headquarters.

It took ten years to force the aborigines, principally the Toucouleurs of Abdul Boubakar, our irreconcilable enemy, to allow telegraph poles to be set up around their villages.

Medina, a station founded in 1855, and which a few years afterward had to sustain a memorable siege against the bands of the prophet El Hadj Oumer, did not, in fact, communicate electrically with Saint Louis until 1885, after the laying of a cable between Barbary Point and Teneriffe.

Our expansion toward the Niger, directed by the successors of Faidherbe, the Borgni-Desbordes, the Gallienis, and the Archinards, necessitated, as long ago as 1880, the establishment of electric conductors, which now radiate as far as to Segou and Nioro, connect with the Guinea system, and will soon join the lines of Dahomey and the Ivory Coast. This is the object that is now being pursued by Governor-General Chaudie, Colonel de Trentinian, and M. Ballot, governor of Dahomey, where the lines of the coast and those of Abomey, the immediate fruit of General Dodd's campaign, are continued to Carnotville.

Senegal, under the impulsion of its then governor, M. de Lamothé, began in 1893 the doubling of its communications with the Soudan, the correspondence of which was encumbering the sole existing line.

M. Bourrel, director of posts and telegraphs, and M. Magne, subinspector, had charge of this work, which they finished during the first month of last year.

These officials, who have just arrived in France on a sick leave, likewise, in a few months, successfully constructed a line from Konakry to Timbo and the Niger. The cost attending the execution of these vast projects is not so great as one might imagine. On the two last lines, those of Casamance-Boudon and French Guinea, the net cost per mile, inclusive of the purchase of all the exploiting material, did not exceed \$40, while at home work of the same nature costs, upon an average, over \$100.

It would take too long to enumerate the multiple causes of this great difference, but let us say in brief that it is due especially to the ease with which the supply of poles may be obtained right on the spot. Although sand prevails between Dakar and Saint Louis, and although alluviums are found in the deltas and upon the banks of the Senegal, in Saloum and Gambia, ferruginous stones form the elevations and about half the soil in the interior of Senegambia and French Guinea. The excavation of holes of from thirty inches to three feet in depth in this rock requires great effort, since the latter is so compact that it dulls the jumpers. So the wire is frequently strung upon high trees, as shown in our engraving.

All of the operations connected with the construction of the line are performed by the natives, among whom there are sometimes some superior men, such as the old

chief superintendent N'Dene N'Diaye, who, as long ago as 1862, participated in the establishment of the first line in Senegal, and was still traversing the forests of Fouta-Djallon at the head of his men last April. He is an energetic and gentle patriarch whom his men obey with veneration. Of a different character, but possessing remarkable firmness and intelligence, a second chief, Amadou Sar, has the faculty of giving endurance to the laborers, who never tire under his eyes.

Temperaments of this nature know no danger. So they did not flinch when last year the inhabitants of the fortified town of Sonkounda, who had promised to arrest the work of construction, refused to give a single bottle of water to the fagged-out gangs, and made the pirogues leave the shore of the Gambia, hoping thus to prevent the crossing of the country.

The recruiting of watchmen for the ulterior maintenance of the lines is effected from among the laborers who have shown aptitude and devotion. Devotion and courage are especially indispensable to men who, often in a foreign country (Senegal alone has up to the present furnished the personnel of this category), have to keep important sections in a proper state in districts that are sometimes mountainous, as Fouta-Djallon, or arid and desert, like Boudon. Under such conditions, white men could not endure the fatigue occasioned by a continual go and come.—L'Illustration.

AN IMPROVED SYSTEM OF OVERHEAD CONNECTION FOR ELECTRIC TRACTION.

THE trolley system with overhead connection has many disadvantages, among which figures chiefly the danger to which the public is exposed in case any of the wire should break. Besides, the system necessitates the use of an unsightly net of suspending and guard wires, which do not by any means add to the appearance of the locality where the cars are run. In spite of these and other faults, the overhead system is still the most frequently used, owing to the high cost of the installation of the underground connections. Recently, however, M. Bochet has brought out an invention which, while avoiding the guard and trolley wires, yet retains all the advantages of the overhead system. He couples two or three cars together and furnishes his train with a conducting rail, which passes certain points of contact with the second terminal in such manner that a constant current is sent through the motors. This result was attained by placing posts connected to the second terminal at such intervals that, as soon as the

ROTTSIEPER'S NEW TRACTION SYSTEM.

rear end of the rail left one contact, it became connected with the next at the front end. There is one serious drawback to this system, namely, that it requires a great number of posts along the track. Nor would it always be convenient to run several cars together. But based on a similar principle, another device was lately devised by a German, Herr Rottsieper. His arrangement offers the full advantages of M. Bochet's system, while only a few posts are required. In this German system a secondary battery is placed on the car and is charged fully at the terminal stations, while at places where a short stop is made as much current is sent into the accumulator as time permits. The advantages of this system are evident. Only a few isolated posts are necessary, there are no guard wires and the accumulators used may be of very light description, since they are recharged at comparatively short intervals.

Our illustration shows some details of the system. The accumulator on the car is connected to the rail, b; this rail touches the contact rolls, c, which are themselves in communication with the second terminal. The cable carrying the current is, of course, underground. At each stop there is a post under which the car is automatically brought into the circuit. The rail, b, is hinged so that it can be flapped down into the position indicated by the dotted lines, b 1. This merely for convenience. Instead of placing the rail on the top of the car, one might also attach one to each side of the car, flapping down the one not in use.

A modification of this system has the rail on the post, instead of on the car. In cases where cars have already been run on the old system, this modification will be made use of with advantage, if the guard wires and the posts are to be discarded, for the old rods by which the current was formerly carried from wire to motor may still be used, so that one change on the car can be dispensed with.

Our engraving is from Uhland's Wochenschrift.

THE ORIGIN OF THE TELEPHONE.

OUR contemporary, L'Electricien, in an article under the above heading, seems to have taken it to heart that no French name has been connected with the invention of the telephone. It has, however, succeeded in satisfying itself that Charles Bourseul nearly invented it in 1854, some seven years before Reis. In an article published in L'Illustration of August 26, 1854, Bourseul raised the question of the possibility of transmitting speech by means of electric currents along a wire. The following passages, which occur in Bourseul's article, certainly show that he started work in the right

direction. ". . . Imagine that one speaks near a movable plate which is so flexible that it does not lose any of the vibrations produced by the voice, and that this plate successively makes and breaks connection with a battery. You might have at a distance another plate which would make the same vibrations at the same time. It is true that the intensity of the sounds produced will be variable at the point of departure where the plate is vibrated by the voice, and constant at the point of arrival where it is vibrated by electricity, but it has been shown that this cannot alter the sounds. It is evident, at first sight, that the sounds will be reproduced at the same height in the gamut. The present state of acoustic science does not enable me to say a priori that it would be the same with syllables articulated by the human voice. . . . Any but the deaf and dumb would be able to use this means of transmission, which would require no apparatus of any sort. An electric battery, two vibrating plates, and a metallic wire would suffice. . . . Whatever happens, it is certain that, in the not very far distant future, speech will be transmitted by electricity. I have begun experiments in this direction. They are delicate, and require time and patience, but the approximations I have obtained make me anticipate a favorable result."—The Electrician.

THE SOLENOID ELECTROMAGNET.

By H. N. WARREN, Principal Liverpool Research Laboratory.

THIS powerful type of electromagnets, which, after a lengthy and exhaustive research, has just been perfected at the Research Laboratory, differs from all other magnets in the construction of the iron core; they being intended for either supporting great weights in general or the accommodation of spherical bodies, for which reception a hollow cavity is cut from each

extremity, the section of each cavity representing a semicircle.

For the construction of the iron core, iron oxides, free from sulphides, silicates, and carbonaceous matter, were selected, and reduced in an atmosphere of hydrogen, puddled through a hot blast Siemens furnace, and drawn into bars. The bars are next embedded in quicklime, brought to a full white heat, and allowed to cool in that substance. After cooling, each limb, before yoking, is drilled to within half an inch of its circumference and one-quarter of its total length (if the bar be less than half an inch from starting, a corresponding allowance has naturally to be made).

The diagram above illustrates the section of a magnet with its accompanying keeper, the separate parts being further described in the specified table. The magnet was constructed to suspend a weight of ten tons, and required to be excited by a current obtainable from twenty-five boron carbon cells only.

From the above diagram it will be readily observed that when the keeper is applied with its two iron projections, B B, which are constructed of such dimensions as to exactly coincide with the openings, A A, not only is the magnetic power fully utilized, but any side slipping of the keeper is absolutely impossible. All the magnets thus described were wound with No. 14 double cotton covered wire, the winding afterward being covered with paraffined insulation, wound with thread, and varnished with best electro shellac varnish. They are at present doing excellent service in researches on diamagnetism and polarization of light.

The subjoined table will better explain a few of the more important magnets thus constructed, and giving approximate quantities of their component parts:

Length and Diameter of Core.	Weight of Primary.	Voltage Required.	Weight Supported.
2 inches $\times$ $\frac{1}{4}$	4 oz.	6	8 lb.
6 " $\times$ $\frac{1}{2}$	1 lb.	10	80 "
28 " $\times$ 2	9 "	50	5 cwts.
28 " $\times$ 4	100 "	50	2 tons.
36 " $\times$ $4\frac{1}{2}$	112 "	50	10 "

—The Chemical News.