SOME EXPERIMENTS WITH WIRELESS TELEGRAPHY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

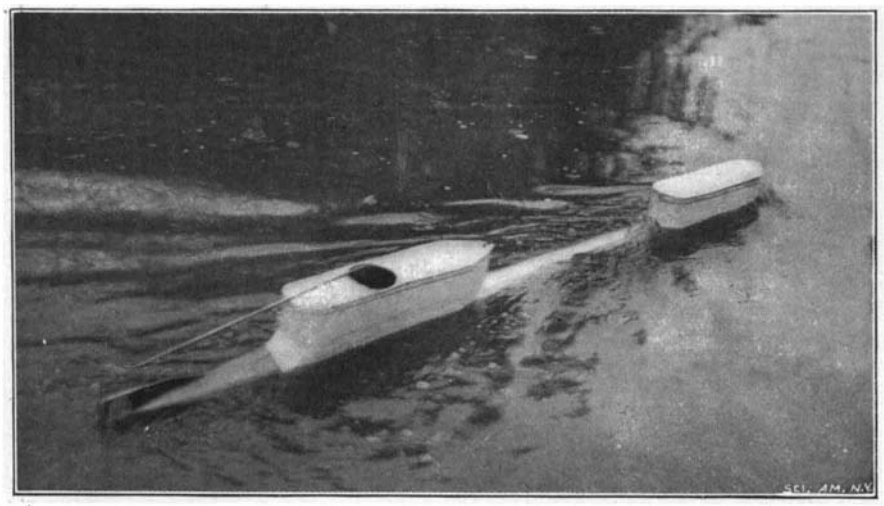
Since we published the description of the Armorl system of wireless telegraphy and process of transmitting electric pulsations from one distant point to another, in a recent issue of the SCIENTIFIC AMERICAN, several important experiments have been made with the apparatus before several prominent electricians and engineers of Great Britain. The naval attachés of the various European governments have also had the practicability and possibilities of the invention demonstrated to them with conspicuous success, and the results of these trials conclusively proved that it will tend to revolutionize certain phases of warfare both on land and sea.

One of the most important contrivances that Messrs. Orling and Armstrong have devised is a new type of submarine boat, which, if necessary, can be controlled from a battleship. Our illustration of the working model of this important arm will best display its salient characteristics. Fore and aft are conning towers, at the base of one of which is the receiving instrument which controls the movements of the rudder. The vessel is equipped with a single screw, which may be driven by any power that may be desired. The importance of this invention is obvious. With the existent submarine vessels the most troublesome factor is the decision of the course which the boat shall take while submerged. Various optical instruments have been devised for the purpose of enabling the commander of the vessel, while traveling under water, to survey the surface and thus to direct his ship in the requisite direction, but so far none of these devices has been found absolutely reliable or practicable. With the Armorl invention, however, the steering is maintained from the conning tower of the battleship to which the submarine is attached. In this instance the commander of the submarine relies entirely upon his superior officer on the battleship for the movement of the submerged craft; and as he is in telephonic or telegraphic communication with the battleship, he is ready to follow immediately any instructions that may be transmitted to him.

In the conning tower of the battleship is a small wheel similar to that utilized for steering the vessel. This small wheel is connected with the Armorl instruments, and as certain movements are made with this wheel certain electric currents are generated which are transmitted to the water by wires and which act in precisely the same way as the two iron stakes utilized in connection with the apparatus upon dry land—the discharge of the electric currents from the transmitting instrument into the sea. Water, however, is a much more sensitive conductor than the earth itself, with the result that the electric pulsations are capable of traveling a much greater distance without losing any of their intensity.

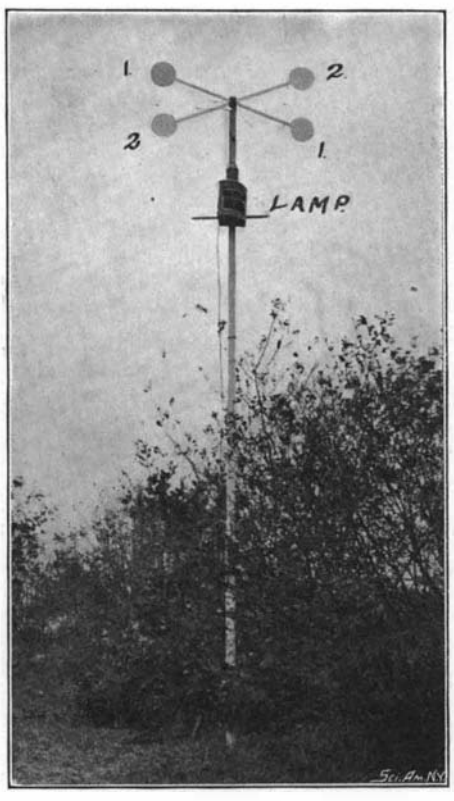
The most prominent feature of this method of electrical communication without wires through water is that no special system of gathering the electric pulsations has to be employed. No matter how deeply the submarine may be submerged beneath the surface, the electro-capillary relay of the receiver within it will feel the effect of the electric discharges in the water, provided of course that the receiver is synchronized to the transmitter. The submarine vessel itself acts as the receiving instrument for the electric waves, which as a rule are arrested at the bow and stern of the craft respectively. In other words, the two extreme points of the boat act as the positive and negative poles respectively. The electric waves travel through the metal hull of the vessel until they reach the electro-capillary relay, the capillary resistance of the mercury within the instrument immediately sets up, and the steering gear of the submarine to which it is attached moves to the degree required by the battleship some miles distant. Not only is the lateral movement of the submarine controlled in this way, however, but the diving and rising motions of the submarine may be manipulated in precisely the same way from a distance if necessary. By this means the submarine vessel is able to continue its journey, being guided from a distance without betraying its presence upon the surface; and the possibility of unexpectedly rising to the surface near the enemy, through error in reconnaissance, is entirely avoided. By means of the wireless telephone or telegraph, the commander of the battleship can keep the captain of the submarine well posted with his course, the distance of the enemy which it is desired to attack, and the psychological moment when to strike, and any other desired information.

One very important feature of the Armorl system is



THE SUBMARINE BOAT TRAVELING ON THE SURFACE WITH CONNECTING ROD FROM ELECTRO-CAPILLARY RELAY TO THE RUDDER, EXPOSED TO SHOW METHOD OF WORKING.

the facility and infallibility of the synchronizing, by which means messages cannot be tapped or interrupted. The receiver and transmitter of each system are tuned to a certain pitch, and it has been continually proved



ELECTRIC LAMP OPERATED BY THE ARMORL SYSTEM.

by the inventors in the course of their demonstrations that no other waves affect a certain receiver unless it is in harmony with the transmitter. Several receivers have been placed at different points, each tuned to a certain distinct pitch. Electric impulses have then been discharged from a transmitter, and the impulses have not affected any of the receivers to the slightest extent in their passage, but have only entered the particular apparatus, the receiver of which was in perfect harmony with the transmitter from which the impulses were discharged. This is a most important factor which will play a prominent part in the success of the invention, since, although synchrony has been secured to a certain degree with the other systems of wireless telegraphy, they have all failed at intervals, thus rendering nugatory their utility. The Armorl instrument, on the other hand, has proved peculiarly successful in this respect. Since there are many gradations of tone to which instruments may be tuned, the possibility of anyone accidentally discovering the particular pitch of an installation and thus intercepting messages is very remote.

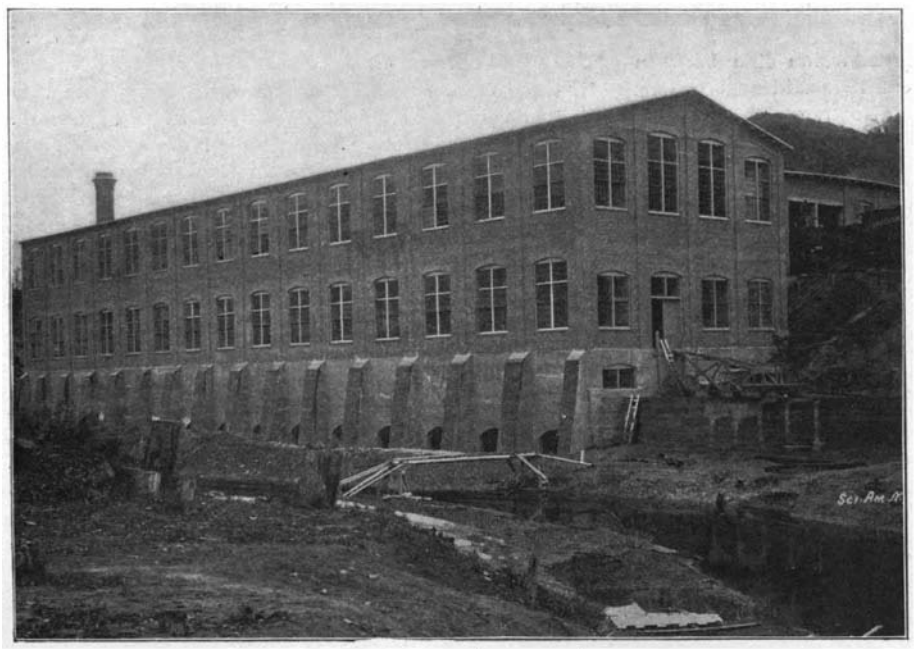
In connection with naval warfare Messrs. Armstrong and Orling have also devised a special torpedo to be utilized in connection with their discovery. In outward appearance it resembles the familiar Whitehead weapon, but its interior arrangements are entirely different. It is approximately six feet in length. The bow is filled with guncotton or other explosive charge, the middle section is occupied by the compressed-air driving engine, and the rear end contains the electrical steering apparatus, comprising the electro-capillary relay, connected to the driving engine. The gyroscope is, of course, dispensed with and the substitution of this intricate mechanism by the Armorl instruments, which are very cheap, results in a considerable economy in the cost of the weapon. It is estimated that the cost of the gyroscopic equipment of a torpedo is about $3,500, or considerably more than half the total cost of the complete weapon.

In the Armorl torpedo steering is not effected by means of a rudder, but by the manipulation of the two propellers with which it is fitted. On the battleship is a small steering wheel similar to that employed with the submarine boat—in fact, the same wheel may be employed—and the movement of this wheel to port or starboard causes either a reduction or increase in the speed of either of the screws upon the torpedo. For instance, if the port screw of the torpedo is reduced to one-half the speed at which the starboard screw is traveling, it will cause the torpedo to wear round to port quickly and easily, and if the starboard screw is manipulated in a similar manner the same result is achieved, only the course is *vice versa*. If the two screws are caused to maintain the same number of revolutions, the weapon will travel in a straight line. Experiments have shown that if a torpedo is operated in this manner, the same effect is produced as if the weapon were equipped with a rudder in the usual way.

If necessary, the compressed-air engines can be stopped entirely, and the torpedo allowed to remain quiescent in the water until a favorable opportunity once more arises for setting it in motion. Or again, under special exigencies, the torpedo could be dropped overboard from the battleship, the latter continuing its journey, and the torpedo started upon its mission at the psychological moment, when perhaps the battleship was some twenty miles distant. It would be as easy to set the torpedo in motion under these conditions as if the vessel were alongside the missile. The Armorl torpedo costs complete $1,000, as compared with $6,000, which is the approximate cost of the latest Whitehead weapon. For military service the invention is appositely adapted for firing mines. The *modus operandi* in this instance is to connect the explosive charge directly with the electro-capillary relay. The mine is buried together with the receiver. The latter is connected with the charge by two short lengths of thick copper wire separated at their lower extremities, which are buried in the explosive. Bridging this gap, however, is a thin hair of copper wire. The electro-capillary relay arrests the electric impulse in its passage through the ground, the electric current passes through the short length of copper wire, and then fuses the thin connection at the lower end, thus detonating the explosive charge. It is a simple operation to fire such a mine, since all that is necessary is to place the two contact screws, projecting from the side of the small box containing the transmitter, in contact with the ground. When the button is

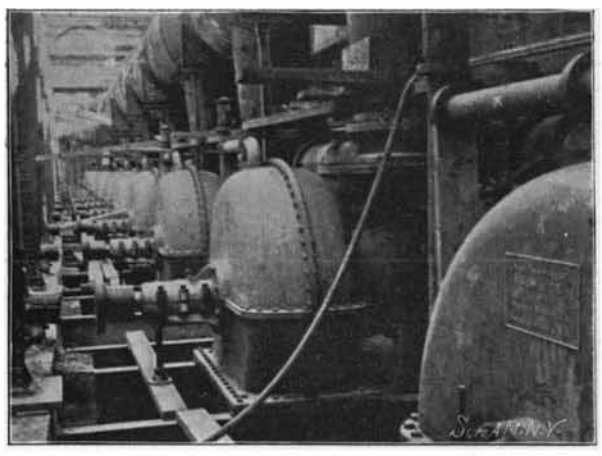
MODEL OF SUBMARINE BOAT CONTROLLED BY WIRELESS TELEGRAPHY.

pressed the electricity flows through the contact screws into the earth and travels to the receiver. No preparations of any description have to be made, and the operation can be readily accomplished from any coign of vantage. The disadvantage of the present



POWER HOUSE OF BELGO-CANADIAN PULP COMPANY—UTILIZING 8,000 TO 10,000 HORSE POWER.

system of land mines is that the presence of the explosive charges is betrayed by the wires on the ground, and, as the war in South Africa has demonstrated, a vigilant enemy can destroy the effect of these mines by crawling up in the dark and cutting the wires. With the Armorl system interruption of the circuit can only be accomplished by the destruction

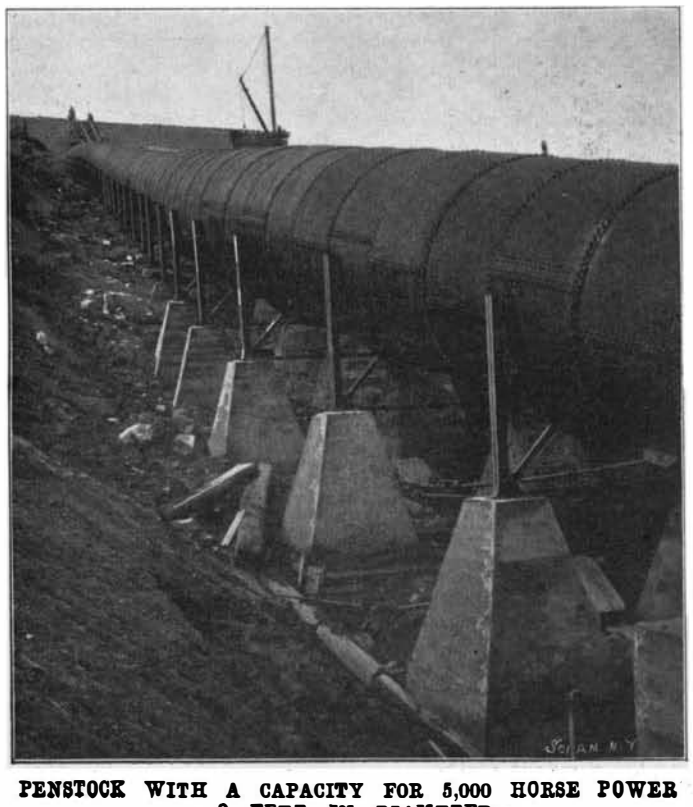


TURBINES OF 8,000 HORSE POWER CAPACITY.

of the receiver or the unearthing of the mine itself, and it would not only be a difficult matter to locate the precise spot at which the charge was buried, but the action of excavating it, even when discovered, would be attended by considerable danger. A vast tract of country might thus be undermined, any one of which mines could be detonated individually, by synchronizing the receiver and transmitter. It might be pointed out that the process of tuning is so simple that a single engineer with one transmitter could fire any number of mines of different tunes, provided he kept a record of the various tunes of the receiver, and adjusted his transmitter accordingly, whenever he wished to explode a particular mine.

While the work of installing the electro-pneumatic system of signaling upon railroads was in progress upon one of the leading trunk roads of Great Britain, the inventors had their attention drawn to the possibility of operating signals by their system. For this purpose an experimental signal was erected at a distance of 1,200 yards from their laboratory, with a view to ascertaining if the idea were at all practicable. At the base of the signal post was placed a small box containing the electro-capillary relay, and connected by wires to two iron rods driven into the ground. From the relay to the arm of the semaphore extended two more wires. Directly the button at the transmitting station was touched the semaphore arm fell, and remained in that position until the transmitter button was again pressed, when it immediately returned to its former position. Since it acted with perfect facility and celerity at 1,200 yards, the inventors repeated their experiments at a distance of five miles with the same conspicuous success. This method of operating signals opens up a vast field in railroad signaling, since it will work to an indefinite distance, possessing none of those limitations inherent to the electro-pneumatic or other processes of actuating signals.

Another important development of the invention is the illuminating of electric lamps. Erected near the top of the experimental signal post is a lamp fitted with two 20 candle power Edi-swan incandescent electric lamps. The transmitter is attached to a battery or accumulator. To light the lamp it is only necessary to depress the transmitting button, and the lamp will remain alight until the battery or supply of electricity is exhausted, or until the key is again touched, when it is immediately extinguished.



PENSTOCK WITH A CAPACITY FOR 5,000 HORSE POWER —9 FEET IN DIAMETER.

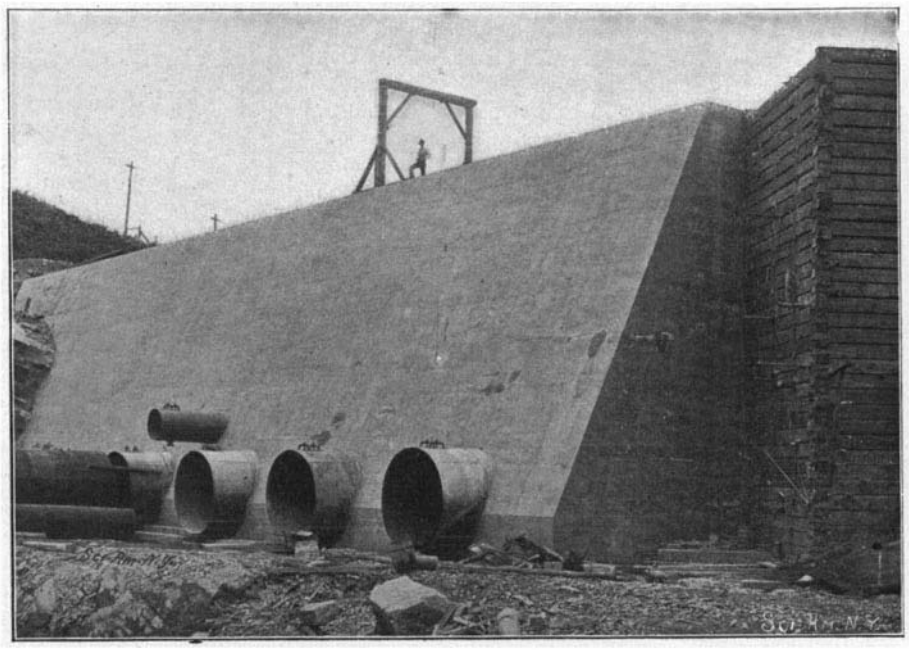
SHAWENEGAN FALLS POWER PLANT.

BY FRANK C. PERKINS.

One of the most important electrical power transmission plants in all Canada is rapidly nearing completion. When it is delivering its full capacity it will undoubtedly supply practically all of the power used in Montreal and Quebec, and will also supply power in the vicinity of Shawenegan Falls to many industrial plants. There is no question but there is a great industrial and commercial future for this little city of 3,000 inhabitants, which two years ago consisted of only a few houses.

The accompanying map shows its location and the general direction of power transmission lines to reach Quebec and Montreal, the former 90 miles distant and the latter 84 miles away. Three Rivers, which is located 21 miles from Shawenegan Falls, will soon have electric service from this power house, as will many of the towns along the Great Northern Railway between Quebec and Montreal. For a number of years the great power of the St. Maurice River has attracted the attention of promoters; but until recently the title to the property and water has been more or less complicated. The Privy Council of England recently decided that the provincial government could dispose of its water powers, and recently it has been selling these privileges with the understanding that the development be immediately commenced.

The Shawenegan Water and Power Company was formed under a charter granted by the provincial government, with the power to develop the water power, manufacture gas and electricity for the purpose of light, heat and motive power, to construct works needed for such purposes, to transmit power generally throughout the Province of Quebec, and to transmit electric power and sell same in the various towns and cities, with the right to expropriate land for its various purposes, including the necessary right of way to any point.



OUTSIDE BULKHEAD, SHAWENEGAN FALLS POWER PLANT, 40 FEET HIGH, 30 FEET THICK AT BASE.

The president of the Shawenegan Water and Power Company is J. N. Greenshields, K. C., of Montreal; the vice-president is John Joyce, of Andover, Mass.; and the treasurer is Mr. J. E. Alfred, of Boston, Mass. For the accompanying illustrations and data in reference to this power plant the writer is indebted to the secretary, Mr. Richard W. Douglas, and the chief

INSIDE PENSTOCK—9 FEET IN DIAMETER.

INSIDE BULKHEAD, SHAWENEGAN FALLS POWER FOREBAY.