

tors and safety apparatus constantly under his eyes. The arrangement of this experimental vehicle is still defective, since it is far from being comfortable, and the mechanical parts are juxtaposed without any regard to appearances. But the principal point is that, although a little primitive, it has been found to operate satisfactorily. Thorough demonstration has been given of its practicability, and it can now be said that the ether motor has become practical and constitutes a new resource for the industry, the existence of which has been threatened by the constantly increasing cost of fuel. A motor of an organic efficiency greatly superior to that furnished by steam or explosive gases, and permitting of a great saving in fuel, cannot fail to be well received, especially if its mechanical arrangements are rational. Such is the case with the ether generator applied at first to navigation in 1852 by Du Tremblay, and improved and rendered practical by Desvignes de Malapert, who has succeeded in surmounting all the difficulties of the problem. Perhaps we are on the eve of a genuine industrial revolution, and shall, in a near future, witness the complete revolution of the process now in use for cheaply producing motive power.—*La Nature* and *La Locomotion*.

A NEW SYSTEM OF WIRELESS TELEGRAPHY.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

An interesting new system of telegraphing without wires has been invented by Mr. Axel Orling, a young Swedish electrician, and Mr. J. Tarbotton Armstrong, a well-known engineer of London, which is dissimilar from either the Marconi, Tesla, or other systems now in use. The invention was patented long before that of Marconi, but the inventors refrained from bringing it before the public until it had been developed and brought to a satisfactory state of perfection to render it available for commercial exigencies.

The advantages claimed for the Armori instrument are its simplicity, portability, the low cost of installation, and facility of manipulation. The Marconi and other systems at present practised, broadly speaking, consist of discharging induced high potential currents from a transmitter into the atmosphere, finally arresting them at their destination by means of a sensitive receiver. In the Armori system the earth is utilized as the conductor, and the currents discharged are of very low potential. The efficiency of the conductivity of the earth may be adequately realized from the fact that in order to transmit a message twenty miles, a current with a pressure of only eight volts is utilized, while even a pressure of four volts has been found sufficient to travel the same distance with complete satisfaction.

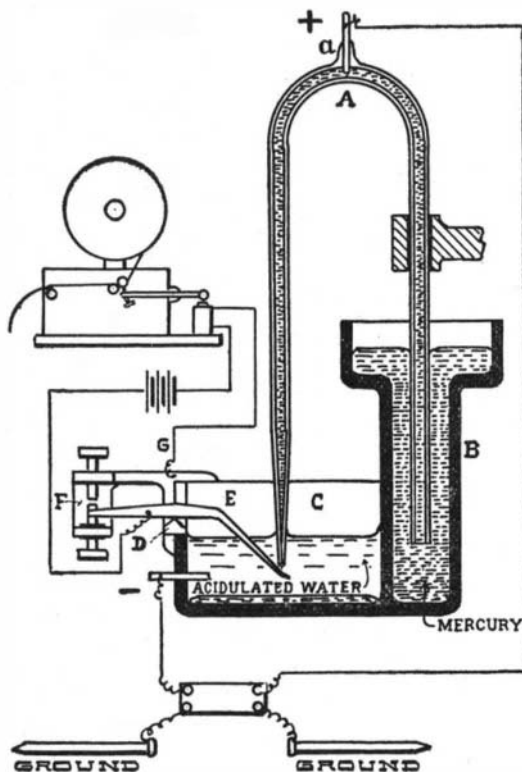
In the Armori invention induction coils, coherers, high masts and various other impediments incidental to the prevalent systems of telegraphing without wires are entirely dispensed with. The Armori apparatus is so small and compact that it can be compressed within the compass of a small box measuring seven inches in length by four inches in width, and eight inches in depth, and weighs from five to six pounds.

These interesting results have been achieved by the invention of a new receiver and transmitter, the former of which supplants the coherer. Hitherto the telephone receiver has been considered the most susceptible to electric currents, but this receiver has proven far more highly sensitive. It is described as the electro-capillary relay, and is an entirely new method of receiving electric currents. Through the courtesy of the inventor we are enabled to publish a sectional diagram of the device, and to describe its fundamental principles of working.

It is based upon the capillary attraction of mercury due to the electric currents. A is a small glass tube with one leg terminating in a finely-drawn point, while each is open at the end. At the top of the head of the tube is a small neck, *a*, fitted with a stopper, and to which the positive wire is attached. This instrument, which is only about four inches in total height, works on the principle of a siphon. One leg is inserted in the cell, B, which is filled with mercury, while the other point terminates in another cell, C, filled with a solution of acid and water. Upon the outer edge of this cell, C, is fixed an agate pivot, D, and upon this is delicately poised a sensitive balance, E, one end of which descends into the cell, C, immediately below, and almost touching the end of the capillary tube, while the other end extends outward to a small contact point, F, almost touching it, and to which is attached the wire connecting to the Morse tape machine or whatever other instrument it is desired to operate. The consequence is that whenever the end of the balance in the cell is depressed, even if it be ever so slightly, it causes the outer extremity to fly upward, and to come into contact with the point, F, just above it. The capillary tube, A, is filled with mercury. The positive current wire is connected to the stopper, *a*, while the negative current wire runs to a pole in the acidulated water solution. As the current enters the capillary tube, through the point, *a*, it sets up capillary attraction of the mercury

within the tube, with the result that a certain quantity of the mercury, varying according to the intensity of the current, exudes from the tube in cell, C, and drops on to the end of the balance. This immediately depresses this end of the beam and causes the opposite end to rise until it touches the contact point, F, and the current is conducted along the wire, G, to its requisite destination. As the balance, E, falls by the weight of the mercury, the latter is deposited upon the floor of the cell.

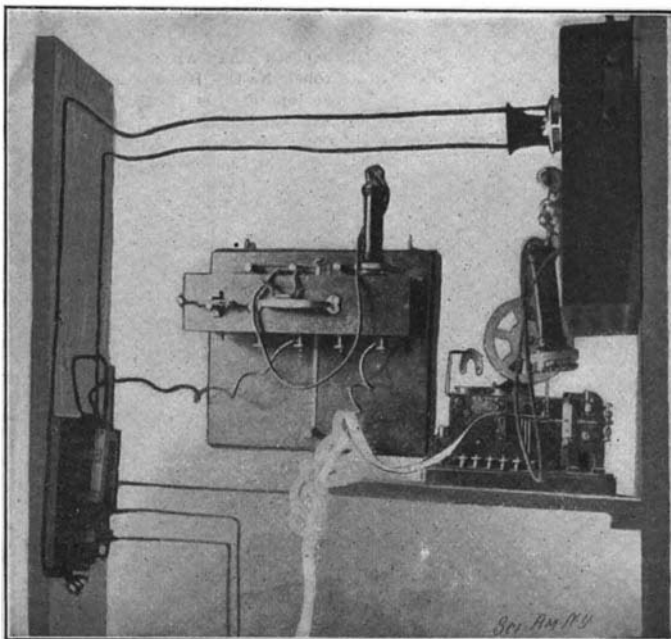
The balance of the beam, E, upon the agate pivot, D, is so delicate that the smallest quantity of mercury falling from the tube sets it in motion; and as the capillary attraction of the mercury within the tube is set up by even the faintest current of electricity, an adequate idea of the sensitiveness and delicacy of the device may be gathered. Electric currents which the most sensitive galvanometers fail to record, or



THE ARMORI SYSTEM OF WIRELESS TELEGRAPHY.

which will not affect the receiver of the telephone, will actuate this receiver, so that there is no possibility of a current entering the apparatus without moving the balance, E. For instance, if a cent piece is wetted, a dime placed upon it, and a wire from the coins is conveyed to the point, *a*, the faint and almost imperceptible current that is thus generated will be recorded. Another prominent feature of the apparatus also is that no self-induction is set up, which is the case with the existing type of relay. It may be contended that the embodiment of such a delicate mechanism within a portable box, which might be subjected to rough handling, would render it liable to be deranged, especially in field work, but the device is carefully and securely packed to obviate any such mishap.

The complete apparatus comprises this receiver and a small battery of eight volts packed in a case, which is provided upon the outside with two contact screws. Two pointed iron stakes are driven into the ground to a depth of approximately eighteen inches, and about twelve feet apart. To each of these a wire is attached connecting the negative and positive poles respectively of the instrument. A small key similar to that usually employed for dispatching Morse code signals is



COMPLETE APPARATUS FOR WIRELESS TELEGRAPHY.

attached, together with a telephone receiver. The current thus set up flows through these wires and stakes into the ground. The operator holds a telephone receiver to his ear with one hand while he transmits the message with the other in the ordinary manner. At the opposite station, where similar iron stakes are placed to receive the impulses, if necessary, the receiver can be connected to a Morse tape printing machine, and the messages printed as they are received.

The inventors have rendered the employment of wireless telegraphic communication somewhat nugatory, however, by the discovery of a similar method of telephoning through the ground. The adaptation of this system, however, is quite recent and the results of their experiments have not yet enabled them to supply a sufficiently practicable system for commercial purposes. Although the sounds transmitted are received with perfect clearness at present they are somewhat faint, and the inventors are completing a small device for intensifying the sounds when received by the receiver.

The greatest distance over which these inventors have endeavored to transmit these electric impulses has been 20 miles with an 8-volt battery. The success of the experiments up to this distance, however, has convinced them that this is by no means the maximum distance, but at present they intend to establish this as their limit. For long distance telegraphing they have conceived an ingenious idea. At intervals of 20 miles they sink into the ground out of sight a small device enclosed in an iron box, consisting mainly of the capillary relay. The message when dispatched from the first station is arrested in its passage at the termination of the first 20 miles by this small apparatus, and then instantly, as received, dispatched on a new lease of life over the intervening 20 miles to the second relay. Thus, for instance, if it is desired to send a message 100 miles, in addition to the terminal stations at either end, there would be four intermediate relays. As each of these relays costs only approximately three dollars, the economy of the system is a strong recommendation.

If one is traveling in a conveyance, however, such as a carriage with metal flanges round the wheels, the person riding can establish and maintain telegraphic or telephonic communication, without descending from or stopping the vehicle. In this instance, the wheels take the place of the iron stakes to conduct the electric impulses from the instrument to the earth. A metal roller suspended from a metal bracket rests upon the wheel of the carriage, and to this bracket is connected the apparatus by means of a thin wire. The weight of the carriage upon the wheels ensures constant contact of the latter with the earth.

Automatic Train Signaling.

It is reported that the Pennsylvania Railroad Company is considering the adoption of an automatic electric-signal system on its locomotives, says the Western Electrician. The system was recently tested by the Chicago and Eastern Illinois Railroad, between Dolton and Momence, Ill., a distance of 63 miles. The result of the experiment was very satisfactory and seemed to show that the electric signals were far better than the ordinary block system.

In the experiments conducted by the Chicago and Eastern Illinois, the line was divided into block sections of suitable length, and adjacent block sections were separated by an insulated track section one rail in length. The track batteries were placed at these points, the positive wire leading to the insulated rail and the negative wire to the block section in the rear. The rails in each block were bonded in the usual way. In the engine cab were located two incandescent signal lamps, one white and the other red. One or the other of these is always burning. Current was supplied by battery on the engine or tender, and was switched from one lamp to the other by an instrument operated by the track circuit. Each locomotive axle had electrical connection with a conductor leading to the instrument on the engine. When the wheels entered the insulated section (if the stop signal was to be given) the current passed from the rail through the wheel conductor and cab instrument, switching the lighting circuit to the red lamp.

In this system the signal is always given two blocks back from the obstructed block, or the train-order signal, so that when the red lamp burns the engineer knows that he has one clear block in which to stop his train. The red lamp burns when a switch is open, a block section occupied or a train-order signal displayed.

The projected European plant of the J. G. Brill Car Building Company will be at Preston, one of the most flourishing cities of Lancashire, England. The new works will be equipped almost entirely with machinery from the United States and will have a capacity of 1,000 cars and 4,000 car trucks per year. About 500 men will be given employment.