

Scientific.

FIELD TELEGRAPHS.

In an article on "Field Telegraph without Battery" the *Electrical Review* gives a summary of some of the principal systems in use. In certain cases, under favourable conditions, telegraph lines can be extended to the battle fields. However, notwithstanding their lightness, they cannot be moved easily enough to follow up the manoeuvres, and very frequently their fragility would render their preservation a matter of difficulty in the midst of military operations. On the other hand, it would be useless to employ the telegraph at a less distance than six kilometres from the front of an army in action, because it would be quicker to send messengers, and, moreover, it could not be worked under fire. However, for communications between the main guard and sentinels and between the batteries and posts of observation, endeavours have been made to fit up light telegraphs, capable of being conveyed by a few men, and these may be called advanced-post telegraphs. Each installation contains 1 kilometre of cable, which enables lines 2 kilometres in extent to be filled up between two stations. At the time of the discovery of the telephone it was thought it was destined to take the place of these telegraphs; but the experiments during the Russian-Turkish War showed that the noise of an army almost always, except in the silence of night, prevents the voice from being heard. The most perfect instruments, however, at that time were the Siemens and the Gower. The microphone even does not amplify sounds sufficiently to render them perceptible under all conditions. It requires a battery, which is cumbersome, and the necessity of a certain regulation of position in relation to the vertical is inconvenient; finally, it must be placed in a fixed stand, for it produces deep sounds when vibrations are communicated to its supports. It has therefore been rejected altogether. The telephone, it has been admitted, can be of service, and in the greater number of armies it has been added to the light telegraphs already in use. The Prussian telegraph of Bückoltz is employed by the Company of Belgian Campaigning Telegraph Operation. This apparatus has a return wire and is worked by a continuous current, that is, when there is no transmission the current passes through the line, and gears the clockwork mechanism; the signals are then produced by the interruption of the current, which throws the mechanism out of gear; consequently, directly the cable is cut the operators are aware of the fact. The instruments work together, the despatch being recorded simultaneously at the two stations. The Russian system of Dereviankine is very similar, but the earth is employed as return conductor. These are the only field telegraphs in use which give permanent signals. In America, on almost all the permanent lines, the despatches are sent by sound alone, and in campaign telegraphy it is very seldom that important orders are transmitted of which it is necessary to keep a copy. The optical systems employed are the Trouvé, which is a miniature, about the size of a watch, of an ordinary dial telegraph; the Wheatstone one-needle system employed by the Spanish army; the Prussian needle telegraph with earth battery, used in the war of 1870, the current being supplied by two pieces of zinc and copper buried in damp earth. Of the above the Trouvé is very delicate; the two others are more solid and better suited for military operations; but it is difficult to read the Morse signals indicated by a needle, and it cannot be used at night. As a sound can be heard at any time, sounders are preferable to optical instruments. The sounders adopted are—The Caton, used exclusively in the military telegraph of the United States. It is simply a magnet, the armature of which forms the sounder. It is contained in a moderately small compact case, and the battery is composed of sulphate of copper elements. The sounder of the French army is very like it but smaller in size, and a wet or reversible battery is employed. Dereviankine's Russian sounder is similar; as is also the Spanish sounder. The Trouvé sounder has the appearance of a large watch, and its accessories are the same as those of the portable telegraph by the same inventor. All these sounders have the inconvenience of requiring a somewhat powerful, and consequently cumbersome battery. At the time when it was shown by experiment that the telephone was of little use to reproduce speech of the vanguard of an army, it was found that under the influence of battery currents, and especially of the high tension currents of induction coils, this apparatus gave sounds of great intensity. When a current is sent into the circuit of a telephone the magnetism of the magnet which constitutes it

varies, and the result is a variation in the action of this magnet on its diaphragm of soft iron; two different sounds are then heard, one when the current is established, the other when it ceases, and thus long emissions can be distinguished from short ones, as in the Morse sounder. In order to produce a sound of greater intensity, serving to warn the correspondent that the transmission is about to commence, the interrupted current of a little Ruhmkorff coil is employed; a continuous current can also be sent into the line, the interruptions being produced by the plate of the telephone itself by arranging it like the armature of a trembling bell. The instruments constructed according to these principles are Racagni-Guglielmini, in which the induction coil is either arranged in the handle of one of the telephones, which also contains the manipulator, or on the reversible battery, which has the form of a cartridge-box. The Manganot is identical in principle with the preceding, but the inventor, recognising the inconvenience of this battery, proposes to substitute Clarke's machine, and in the event of its proving impracticable to hear sounds, he suggests the receiving of the same by the sense of touch, by placing the lips on the terminal of connection of the telephone. A very skilful telegraph operator in 1870 received a message in this manner by a cable across the Seine, but this feat would require no common degree of skill to perform. All these instruments have the drawback of requiring cumbersome batteries which the slightest accident would render useless. M. Manganot proposes to substitute for this class an induction machine, which, however, is very heavy, and presents the disadvantage of requiring a man to turn the handle. The solution of the problem will be probably found in telephonic sounders without batteries. Of this class is Colonel Jacobi's telekal, which requires for its complete installation a long-distance telephone, and a case called the telekal weighing from five to seven kilos. It is furnished with a Morse manipulator, worked in the ordinary way, and by means of a little handle the manipulator can be made to ring a bell to call the correspondent; or the trumpet call with which long-distanced telephones are commonly supplied can be used. The telekal, however, is clearly both heavy and bulky, and we have still to look for some apparatus which should offer the like advantages, but with less weight and bulk. The magneto-sounder constructed by Richez of Brussels, has much promise. The apparatus only weighs 200 grammes more than the magnet which forms part of it, or 750 grammes in all; it can be contained in a box about a foot long. In order to use it a terminal is connected to the line and to one of the poles of a Bell Telephone, the other pole being connected to earth. When used in active service the magneto-sounder is suspended on the breast by a strap, and the hilt of a sword stuck into the damp soil forms an earth. The operator then works with his right hand, as with the Morse, and applies the telephone to his ear with his left hand. The new apparatus can be, it is said, substituted for the Morse sounder in all its applications. It has the advantages of being very light, of not requiring any battery, and of being very sensitive. Finally it comprises a telephone which can be used in the ordinary manner. An account of this instrument has been published in the *Revue Belge de Technologie Militaire*, by Lieut. Wissenbruch.

A RAINFALL RECORDER.—An ingenious apparatus for recording the total duration of rainfall in the course of a day or a still longer time, has been devised by M. Schmeltz, formerly professor at the Lycée de Lille. It consists of a box having a rain funnel in its top, by which the rain can enter and drop upon a band of travelling paper which passes below within the box. This paper is the usual Morse strip treated in a solution of sulphate of iron and dried carefully, then brushed with tannic acid or powdered cyano-ferride of potassium mixed with resin. A roll of it is placed within the box, and it is unwound on to another roller outside the box. The latter is driven by a chain from the hour-hand of a common clock, so that it rotates once in an hour. In this time, therefore, the paper has been pulled along beneath the rain funnel a length equal to the circumference of the roller. The falling drops dye the paper and indicate where the rain began and left off. Correction is made for the increasing diameter of the winding roller as the paper is wound upon it. The instrument is said to work well, and to indicate fine showers, which are lost upon the ordinary pluviometer.

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