THE MASSIE WIRELESS TELEGRAPH SYSTEM.*

By A. Frederick Collins.

That there is still room for improvement in apparatus utilized in wireless telegraphy is plainly evinced by the constant stream of patents granted to inventors in this class. Some of these are designed to cover entire systems, others are for specific parts, but all are devised for the purpose of furthering the efficiency of the equipment and economy of the art.

At the present time there are two distinct types of transmitters in general use, namely, *a*, the induction coil, which utilizes a direct current, and converts this into an alternating current by means of an interrupter, and *b*, the transformer, using as its energizing medium a simple alternating current. Both of these types are built in many forms, but in any event the fundamental principle underlying their operation is identical in so far as the conversion of current electricity into electric waves is concerned, in that they both produce this result through the disruptive discharge.

In the matter of receptors, there are likewise two general classes that have found favor according to the requirements of the case, the first employing a detector having a wide range of resistivity in combination

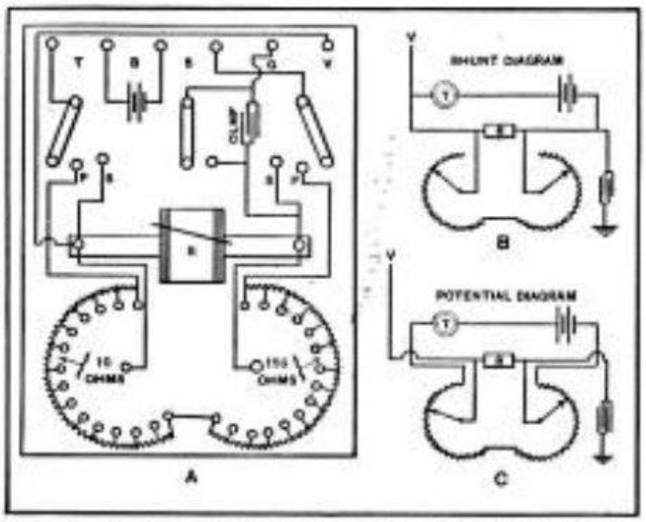

Fig. 1.—DIAGRAM OF THE MASSIE SYSTEM.

with a relay and Morse register, and the second a detector of limited resistance variability, and used in connection with a telephone receiver. The former is in accordance with European, and the latter with American practice; but though the Marconi, the telefunken (Slaby-Arco-Braun), etc., systems advocate the filings coherer and Morse register type, they also furnish detectors and indicators of the telephone type, while the Fessenden and De Forrest companies supply those of the latter-named type only.

Both the above-enumerated types have their advantages and disadvantages, to wit, the coherer, relay, and Morse register will not pick up, translate, and indicate the telegraphic code at as great a distance as the auto detector and telephone, while the latter requires the constant attention of an operator, for its indications are only feebly audible. To combine the advantages of both these types, and eliminate their individual untoward features, has been the aim of Walter W. Massie, a young inventor of Providence, R. I.

In order to achieve this much-to-be-desired result,

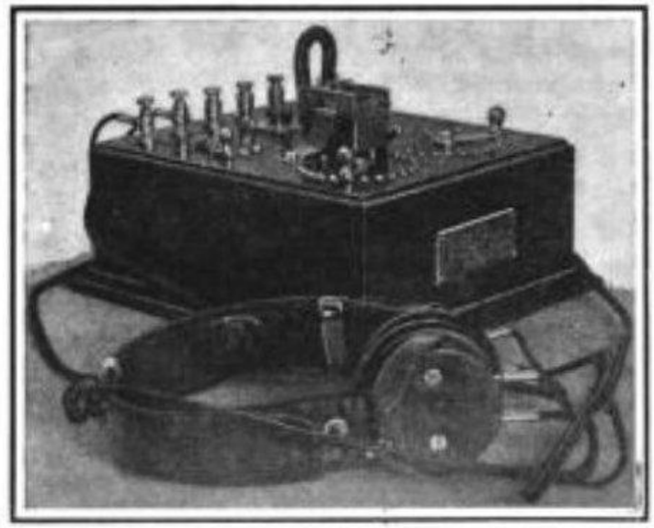

Fig. 2.—MASSIE MICROPHONE DETECTOR AND RECEIVER.

Massie employs an auto-detector for the reception of messages in combination with a new form of magnetic coherer for the purpose of signaling. Simplicity has been obtained by so designing the instruments that they require practically no adjustment after they are once assembled, no care or renewal of parts. Efficiency is guaranteed by placing in the hands of the operator a system that is limited in speed only by the proficiency of the operator, while all the circuits, both internal and external, are controlled by a single mechanism.

Just now a great deal of attention is being given to the development of the electrolytic wave detector, both

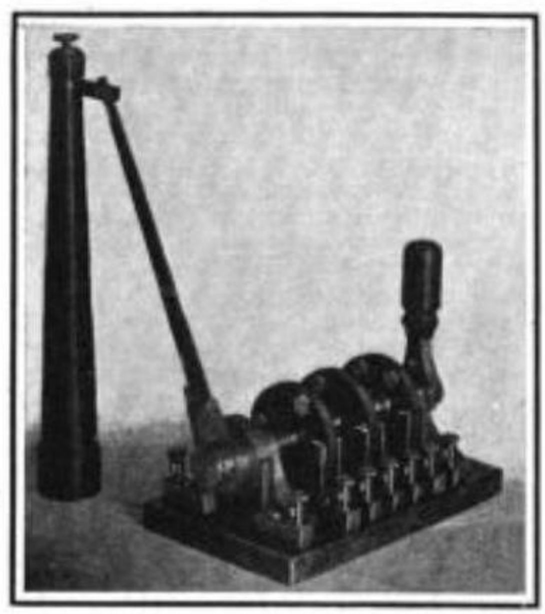

Fig. 3.—MASSIE SWITCHING DEVICE.

at home and abroad, and it is in truth an instrument of great sensitiveness. The new Massie detector compares not only very favorably with it in long-distance work under trying circumstances, but it possesses the very decided advantage of retaining its stability, which the other does not.

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The Massie detector is an auto-coherer of the steel and carbon type, and owing to its remarkable character of constancy, it will work through all kinds of interference without failure, and at the same time it will receive over greater distances than any other, for reasons which will presently be apparent. Fig. 1, *A*, is a diagram of the *oscillophone*, as Massie calls his detector, and its auxiliary apparatus and circuits, while Fig. 1, *B*, is a diagram of the shunt, and Fig. 1, *C*, is a diagram of the potential circuits.

The oscillophone is constructed in such a manner that its resistance can be used as a shunt or as a regulator of the potential across the detector; the shunt method is used when receiving at close range, the potential method for long distances. As may be observed by referring to Fig. 2, the terminals of the oscillophone are made of flat pieces of carbon, specially prepared for the purpose and ground to a knife edge;

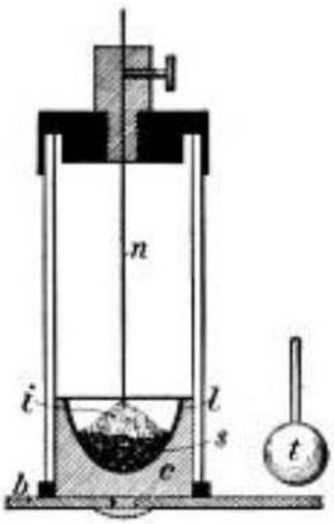

FIG. 4.—MASSIE ELECTRIC WAVE DETECTOR.

the bridging element is formed of a highly-tempered steel wire of proper size and weight.

The bridging wire is held in place by a permanent steel magnet, which not only prevents rolling and other movements that affect the indicators, but causes the wire to maintain a certain definite pressure on the carbons, which insures in turn readings that are absolutely accurate. The normal resistance of the oscillophone is about 43,000 ohms, this dropping after the passage of the electric oscillations to approximately 700 ohms. The telephone receivers used in connection with this detector have their magnets wound to 1,500 ohms.

One side of the potentiometer or variable resistance is wound in 10-ohm steps, while the opposite arm has fifteen coils wound to 150 ohms each, so that a total of 1,650 ohms may be thrown in if necessary. The connections are so arranged that the battery can be treated without removing them from the box in which they are inclosed. A condenser having a capacity of 0.01 microfarad is also contained within the case forming the base of the oscillophone, and is connected in series with the ground terminal of the resonator or receiving wire; it is used in connection with an induction coil, so that the system may be properly tuned.

The bell alarm attachment, which is an especial feature in this receptor, is in a circuit separate and distinct from the oscillophone set, the latter being used only for the reception and indication of the incoming messages. The connections between the aerial and earth wires, the transmitter, the bell alarm, and the oscillophone are made through an ingenious controlling switch. This is shown in Fig. 3, and all the circuits are thrown in and out of action by the simple manipulation of the handle at the right of the device.

When the induction coil of the transmitter is in operation, the receiving circuits of both the bell alarm and oscillophone are opened; and when these are short-circuited, the transmitting energy is cut off. This enables the operator to change from the sending to the receiving instruments quicker, with less trouble and more certainty than by the use of spring jacks, double-throw switches, or other forms of devices usually supplied with wireless telegraph outfits.

The detector used in the bell-ringing attachment is different from that used in the oscillophone, in that it is a filings coherer, yet it is pointed out by Massie that it is unlike the ordinary coherer, i. e., where the filings are placed between horizontal conductor plugs, the oscillatory current has to overcome the force of gravity on the filings before it can cohere them. The Massie coherer involves new principles as well as merely a new form; it is shown diagrammatically in Fig. 4; the complete alarm device is indicated in the photograph, Fig. 5, and in the lower left-hand corner the little vertical coherer may be seen.

Referring again to Fig. 4, the principles upon which the coherer is based may be had at a glance. A metal bridge, *b*, constitutes one terminal of the coherer, and also serves to support the cup, *c*, the latter having a silver lining, *l*; this contains a layer of non-magnetic filings preferably of silver, *s*; an adjustable magnetized needle, *n*, joins the other and opposite conductor terminal, its magnetic energy serving to sustain a layer of magnetizable filings, *i*, of soft Norway iron.

The magnetized iron filings being superposed on the silver filings form an imperfect electrical contact having an infinitely thin insulating film of air between them. Since the filings of these two different metals

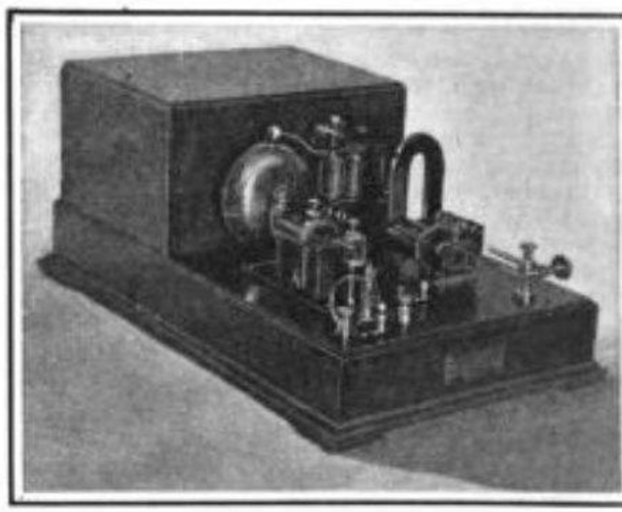

FIG. 5.—COHERER AND CALL BELL.

are oppositely disposed and in a line at right angles to the surface of the earth, the effect of cohesion produced by the oscillatory current and gravitational force is exerted in the same direction.

This being a fact, the electric energy required to break down the air gaps is reduced to a minimum; again, the total mass of filings is not necessarily cohered, as the oscillatory current takes the path of the least resistance, which is radially across the surface to the sides of the silver cup. The tapper, *t*, decoheres the filings by striking gently on the brass bridge, b; the electro-mechanical portions are a little different than in the usual types, the magnets of a sounder being utilized to furnish the means for making and breaking the circuit automatically.

This form of coherer is not only more durable, but more reliable than other forms. Its normal resistance may be arbitrarily varied between wide limits by the quantity of filings used; when cohered, its resistance is very low—from 30 to 50 ohms—rendering the use of

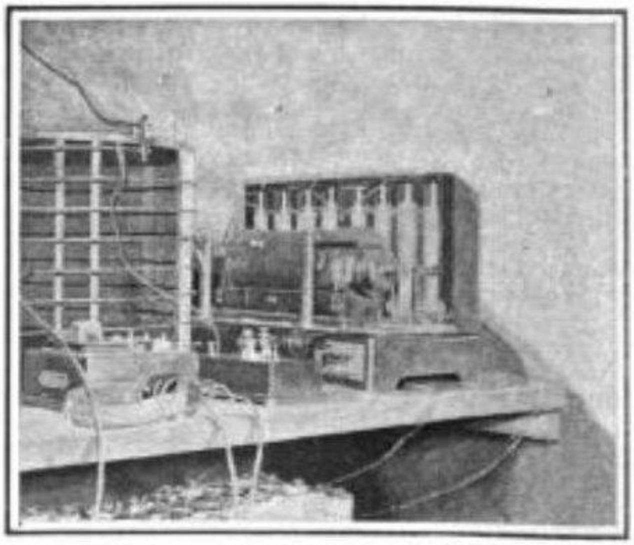

FIG. 6.—MASSIE WIRELESS TELEGRAPH STATION.

a very inexpensive relay possible and yet obtaining quite satisfactory results. The coherer responds to any signals that can be read with an ordinary detector of almost any form, and in conjunction with the alarm bell furnishes a most valuable adjunct to the system.

The transmitter shown in Fig. 6, comprising the usual inductance coil, special key, inductance coils, and cylindrical condensers for tuning the oscillation circuits, is used in the Massie apparatus for distances up to 100 miles, but for covering greater ranges a transformer operating on a 110-volt 60-cycle single-phase current is used.

The above statements are based on the actual performance of the Massie system in every-day practice. It is used at the Block Island and Point Judith stations by the Providence Journal, and at the Wilson Point station, which controls Long Island Sound, in working with the boats of the New York, New Haven and Hartford Railroad. The latter company adopted this system a year ago, and has operated it since that time with the most satisfactory results.

The instruments have worked continuously since their installation through all kinds of weather and atmospheric conditions. Lightning discharges produce only a slight click in the oscillophone, and do not affect or throw it out of adjustment to the slightest degree. During the preceding summer, boats and stations have successfully worked with thunder storms directly between them. Before erecting a permanent station at Wilson's Point, Mr. Massie tested the location by fitting up a temporary equipment.

The location is surrounded by a chain of islands, which it was thought might interfere to some extent with the operation of a station at that point. To test the conditions, a switchman's shanty was pressed into service as an instrument room, and a 50-foot pole was erected to support the two vertical wires forming the aerial. Grounds were obtained by using two 3-foot lengths of railroad iron to which were attached 50-foot lengths of No. 6 bare copper wire thrown out into the water. Dry cells were utilized to provide the initial energy, and with this crude arrangement a remarkably long distance was covered when the temporary equipment was converted into a permanent station.

The new stations have 180-foot masts, and instead of dry cells the coils are energized by 36 Edison-Lalande cells of 600 ampere-hour capacity, the writer having been informed by Mr. Massie that these have rendered most excellent service and given complete satisfaction; the batteries require renewal about twice a year. Boat installations obtain their power from the lighting circuits, the voltage being reduced by a suitable resistance.

Opportunity is provided by the Block Island station to test the sensitiveness of the oscillophone receptor, as the west-bound ocean liners are heard from the time they first get into touch with the Nantucket Shoal lightship. This is 90 miles east of Block Island; and assuming that the ships are working over a distance of only 60 miles, this makes a total of 150 miles the ether waves have to travel before they are received by the sensitive oscillophone.