WIRELESS SYSTEMS OF TO-DAY

1. THE MASSIE

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OF the many experimenters in the wireless field that I have chanced to meet, few, if any, knew what were the essential features of the various wireless systems of to-day. It is the purpose of a series of articles, of which this is the first, to carefully describe and illustrate the different systems that have proven themselves practical in the public eye.

This article treats of the Massie system, invented by Mr. Walter W. Massie of Providence, R. I. While not claiming to be a master of theory, like Professor Fessenden for instance, he possesses adaptability, and it is this trait that, combined with his twelve years' study of the wireless telegraph problem, has enabled him to devise a simple, strong, compact, and thoroughly reliable system. It is the old story of the unfinished work of the theorist being completed by the practical man.

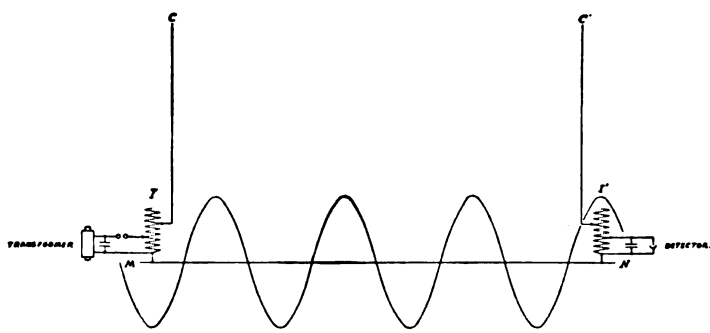

Fig. 1. Circuits of Massie System

Figure 1 shows the circuits of the system. It is controlled entirely by a simple switch. To use the powerful transmitting apparatus the switch must be so placed that the delicate receiver is entirely separated and insulated from the antenna, the battery circuits broken, and the detector short-circuited; when the switch is placed so as to throw in the receiver, the transmitter circuits must likewise be broken. This device enables an operator to change quickly from transmitting to receiving; in fact, the speed of operation is as fast as the land telegraph. Another strong word in its favor is the fact that it acts as a protective device to the entire apparatus; it being impossible to send while receiving, and *vice-versa*. The receiving antenna is separated from the transmitting apparatus by means of an insulated microscopic air gap called an "anchor gap." If this were not done, the antenna would be grounded through the sending helix. Although this small gap is enough to insulate the antenna when receiving, it proves practically to be a short circuit when transmitting.

The transmitting equipment consists of the usual spark-gap, transmitting key, helix or inductance coil, transformer, condenser, interrupter (if direct current is used), and source of energy. Some of these parts deserve special mention.

The spark-gap bridges a long gap on the road towards the perfection of a constantly cool pair of electrodes. It consists of a hollow wheel slotted on its face, which is revolved by means of a motor between two electrodes. Air is drawn inside the wheel by a fan arrangement connected on the shaft, such as is used on blowers, and forced out through the slots on the face of the wheel. In this manner a simple and efficient means is found whereby the spark-gap may be kept constantly cool. This entire apparatus is mounted in a box through which the shaft projects to the motor. Openings in the box covered with colored glass are also provided to enable an operator to inspect the quality of the spark without danger of injuring his eyes.

In his inductance coil Mr. Massie has a very compact tuning device. The wire is wound in the usual manner on a wooden

Fig. 2. Massie Detector

frame, on the top of which is placed the hot wire ammeter and anchor gap. Tuning is obtained in this system by the formula: —

$$X = 2\pi V \sqrt{LC}$$

where

X = wave length
V = velocity of light
L = inductance
C = capacity

Every station is furnished with a table giving the capacity of the condensers; and by means of this table used in connection with the hot wire ammeter, sharp tuning can be obtained.

Condensers of the plate form are used and have proven themselves to be very efficient and of long life. They are built up of plates of glass kept in racks on which are secured sheets of tin-foil and are so constructed that either glass or air may be used as a dielectric. They can easily and quickly be adjusted to various capacities by means of a spring contact.

In low-power stations an ordinary Morse key is used, and is connected directly in circuit with the primary of the transformer. A mechanical interrupter is also inserted in the circuit if a direct current generator is used as a source of energy. In a high-power station, where the current becomes difficult to handle, the key is simply used to operate a battery circuit which closes an electromagnetic switch in the primary circuit.

The Massie detector is shown in Fig. 2 and is of the electrolytic type: the silicon also being used in some installations. In the "resonaphone," as it is termed, the top notch of constructional simplicity has been reached. The entire receiving apparatus is enclosed in a box which measures only 8 x 6 x 4 inches.

Referring again to the photograph, two levers are seen on the front of the device. One is for the tuning coil, the other for the condenser, which is of the intermeshing disk type. A little above is seen the potentiometer lever. The detector is shown at the rear of the photograph, the switches being on either side, as shown, and used for the purposes designated on each. On the right side are seen two small spring jacks to insert

the telephone terminals. Graduated scales are also provided for both potentiometer and tuning coil levers, so that any station may be instantly found, once its wave length is known. This entire device is fully protected by patents, and is now in use with great success in many of the company's installations.

messages and the use of telephones. Figure 4 shows the rear of the switchboard and the generator.

The telephones used in this system are of the watchcase 1500-ohm double head-band type. Exceptionally thin diaphragms are used and make a very sensitive receiver, yet able to withstand hard usage. The tele-

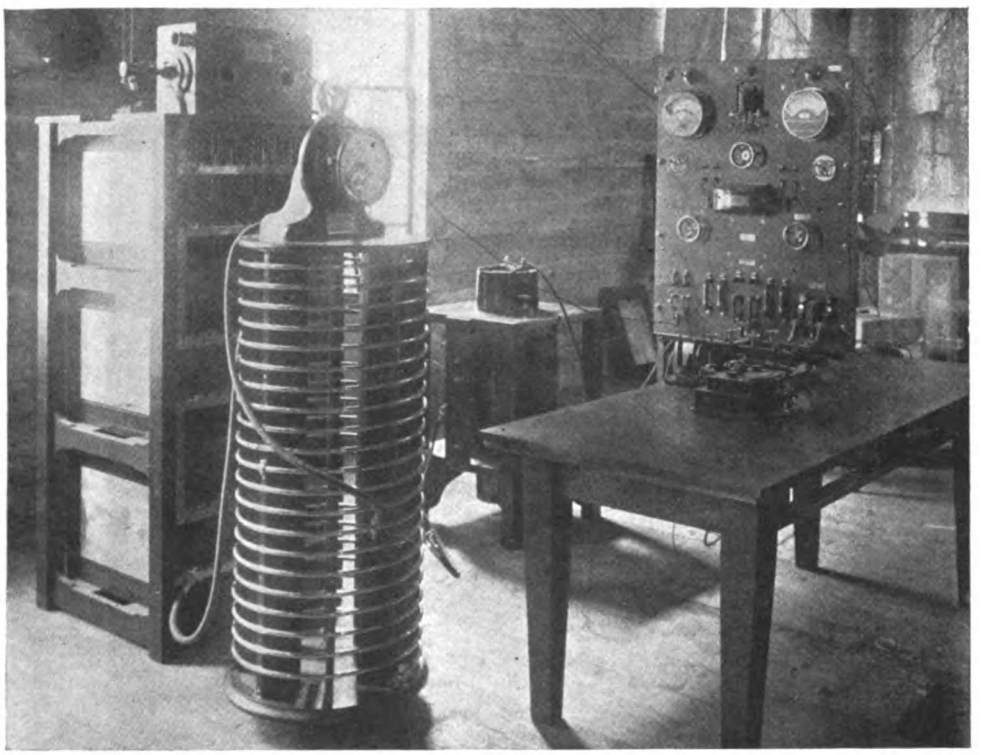

Fig. 3. Parts of 10-Kilowatt Outfit for United States Signal Corps, Alaska

Views of a 10-kilowatt outfit for use by the United States Signal Corps in Alaska are clearly shown in Figs. 3 and 4. Referring to Fig. 3, the racks of condensers are seen to the extreme left of the photograph with the rotary spark-gap and motor on top of the same. Directly in front of the condensers is the helix with the hot wire ammeter and anchor gap. A little to the right, standing on the floor, is seen the transformer. The switchboard is at the extreme right. On the table are the sending key, controlling switch, and resonaphone. From this photograph the fact is easily perceived that the Massie system leaves much more room on the operating table than any other system. There is plenty of room for the writing of

phones are well shown in Figs. 5 and 6. Beauty in design and precision in workmanship are characteristic of the apparatus used in the Massie system. In practice it has worked well. The Massie Company has already furnished the government with apparatus as follows: —

	2	portable sets
Signal Corps	5	10 kilowatt sets for use in Alaska
Coast and Geodetic Survey	3	sets
Navy Department		
Charleston, S. C.	1	5 kilowatt
Beaufort, N. C.	1	5 kilowatt
Cape Henlopen, Del.	1	3 kilowatt
Navy Yard, Wash., D. C.	1	15 kilowatt

Also eight sets ranging in power from 3 kilowatts to 10 kilowatts for use on the Pacific Coast.

In addition to the government stations on the Pacific Coast; so many private ships have been equipped with the Massie system, that in reality the latter can be said to control the Pacific Coast, no less than eighteen sets being installed there. The following boats plying on the Pacific Coast have been furnished with Massie 3-kilowatt outfits.

The Pacific Steamship Co: —
SS. "Governor."
SS. "Queen."
SS. "City of Peubla."
SS. "President."
(This boat holds the record for the Massie system, its radius being 1300 miles.)
Matson Navigation Co.:—
SS. "Lurlyne."
Northern Pacific Steamship Co.:—
SS. "Roanoke."

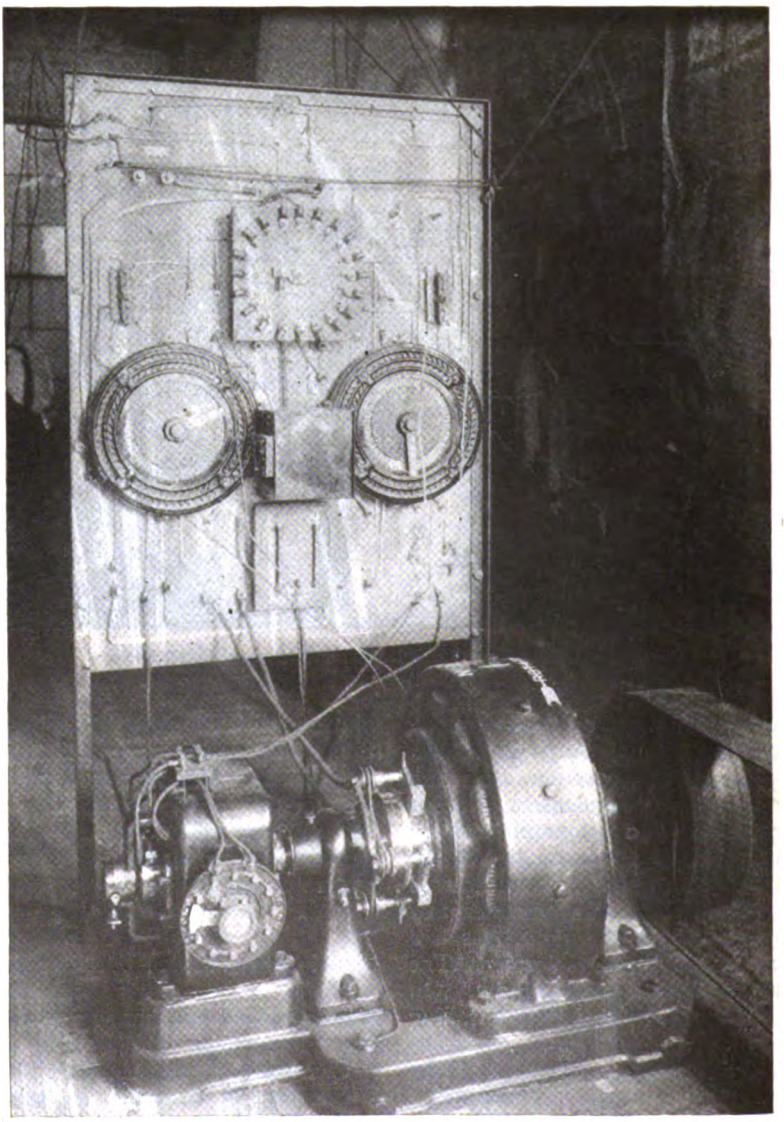

Fig. 4. Parts of 10-Kilowatt Outfit for United States Signal Corps, Alaska

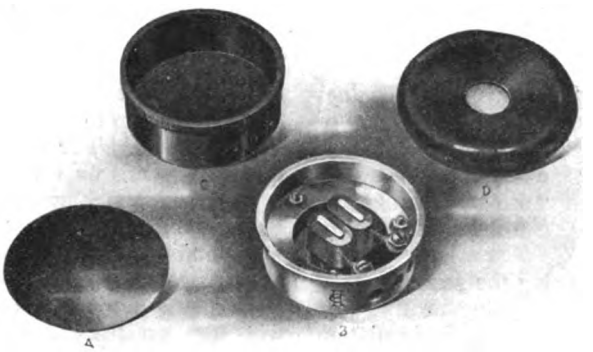

Fig. 5

SS. "G. W. Elder."
San Francisco and Portland Steamship Co.: —
SS. "Rose City."
Commercial stations have been established at; —
Point Judith, R. I.
Wilson Point, Conn.
Cape May, N. J.

In 1905 the New York, New Haven, and Hartford Railroad Company adopted this system and installed it on the boats of the Fall River, Providence, New London, and New Haven lines and the apparatus has been operated since with the most satisfactory results. Messages are accepted from passengers for transmission and sent from the steamer to either the Point Judith or the Wilson Point Station, where they are relayed to all points reached by the Western Union lines. A charge of fifty cents is made for every ten words sent.

Absolute secrecy for his system is not claimed by Mr. Massie, but he claims to be able to shut out all messages where the difference in frequency is not more than ten per cent, and this statement has repeatedly been proven in practice.