THE LODGE-MUIRHEAD SYSTEM OF WIRELESS TELEGRAPHY.

BY H. C. FYFE, LONDON.

Through the courtesy of Sir Oliver Lodge and Dr. Alexander Muirhead I was enabled the other day to inspect the working of the Elmer's End to Downe wireless telegraph installation in Kent. For some years past experiments have been carried out quietly in a shed at Elmer's End, adjoining the works of Messrs. Muirhead & Co., and also in another shed situated at Downe, some eight miles away.

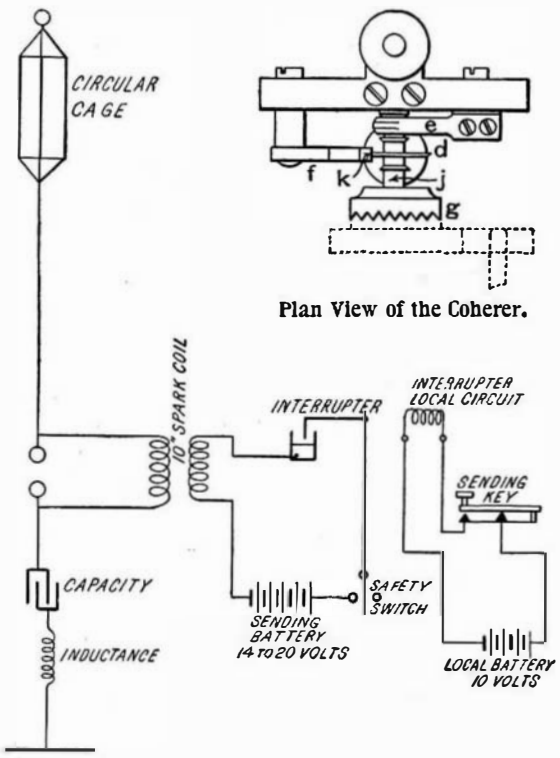


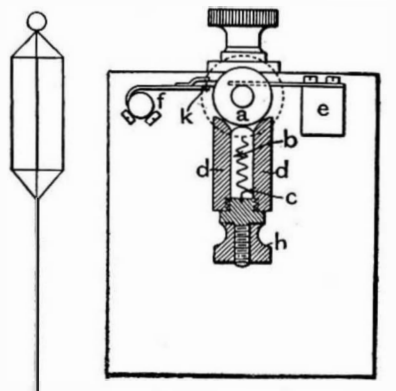
Diagram of the Receiving Station.

Plan View of the Coherer.

Between these two stations signals have been exchanged for a considerable period, but it was only quite recently that the inventors were sufficiently satisfied with their system to bring it before the notice of the cable companies. After a searching series of trials, the experts of the Eastern Extension Australasia and China Telegraph Company reported favorably on the new method, and as a result Lodge-Muirhead wireless telegraph installations have been sent out on the two new cable ships "Restorer" and "Patrol," belonging to the above-mentioned company, which have recently been dispatched to lay the new cable ordered by the Dutch government for use between Balikpapae, in Borneo, and Metado in the Celebes.

This, it may be noted, is the first commercial application of the new system which we propose now to describe.

The Lodge-Muirhead receiver consists of a small fine-edged steel disk which is kept rotating by clockwork on a globule of mercury, from which it is separated by a thin film of oil. The construction of the receiver may be better understood by reference to the detail views, in which the disk is designated by the letter *a*. The mercury, *b*, is contained in a cup, *d*. Electrical connection is made therewith through binding screw, *h*, and the platinum wire, *c*. A copper brush which bears on the shaft, *j*, communicates current to the disk, *a*. A small cushion of felt, *k*, held in a spring support, *f*, serves to keep the edge of the disk clean. The disk is coupled to a clock mechanism by the ebonite clutch, *g*. The film of oil which covers the mercury acts as an insulator and prevents the passing of the current in the local circuit. The ef-



Vertical Section Showing Coherer Details.

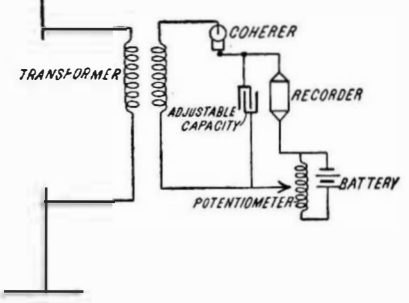
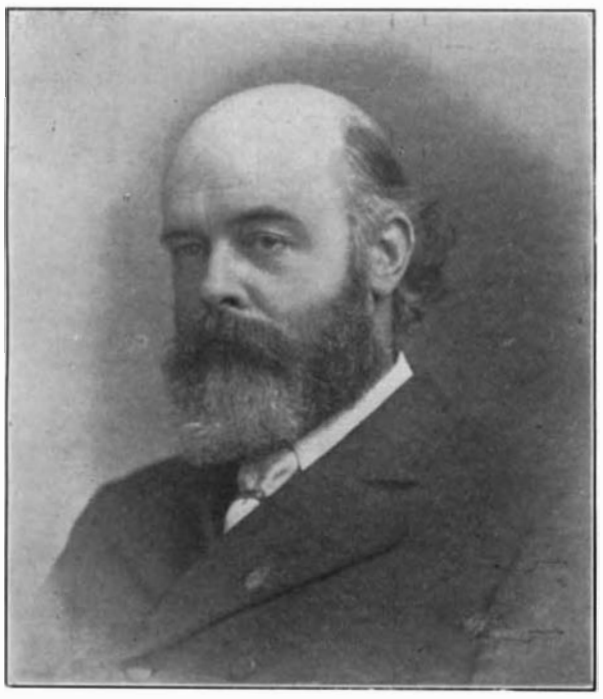
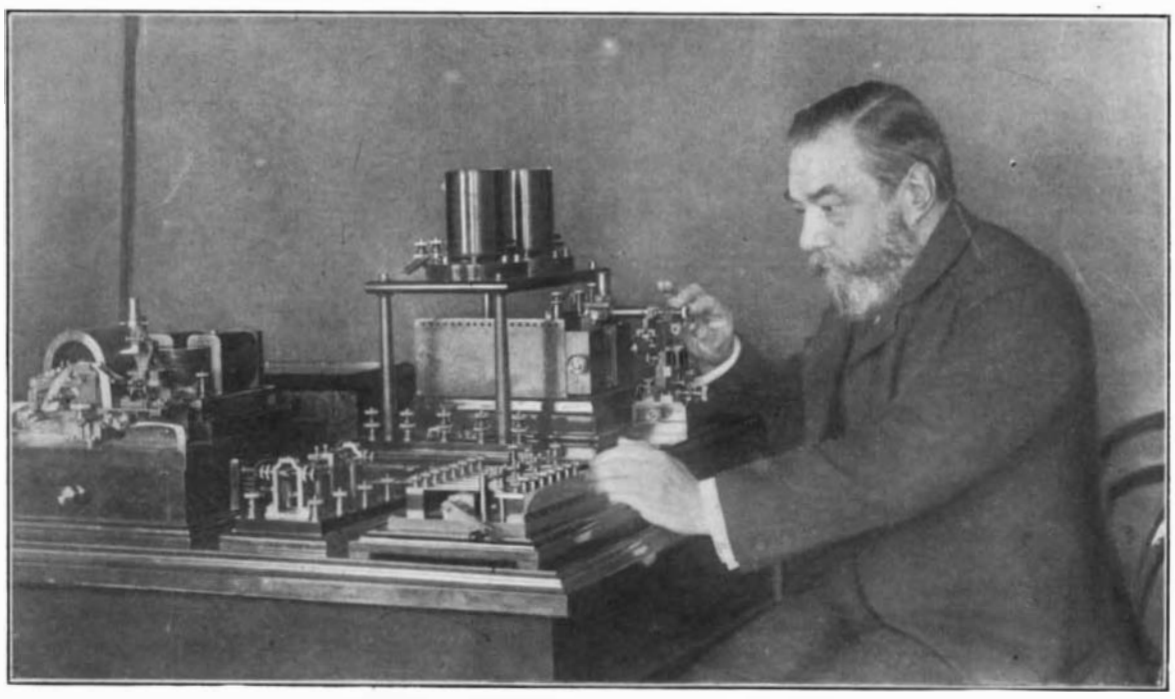


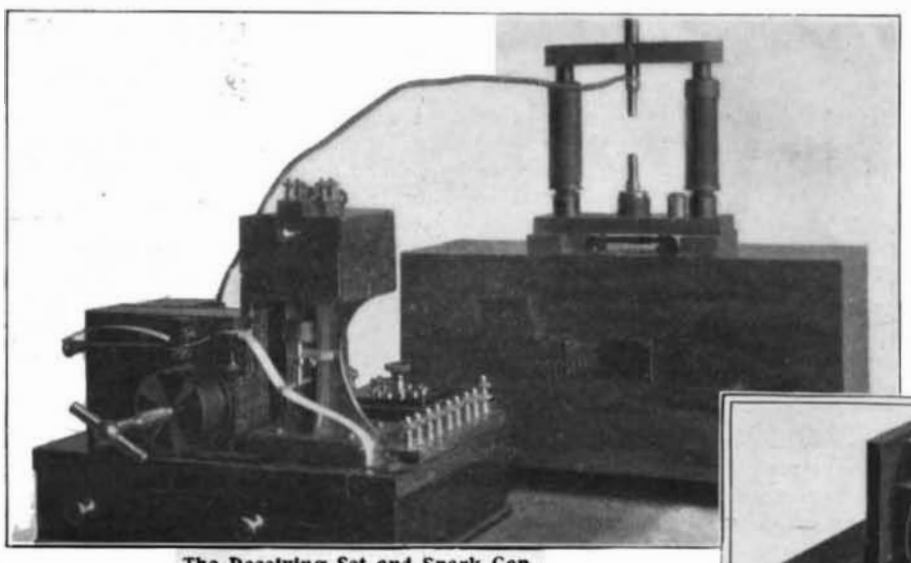
Diagram of the Sending Station.



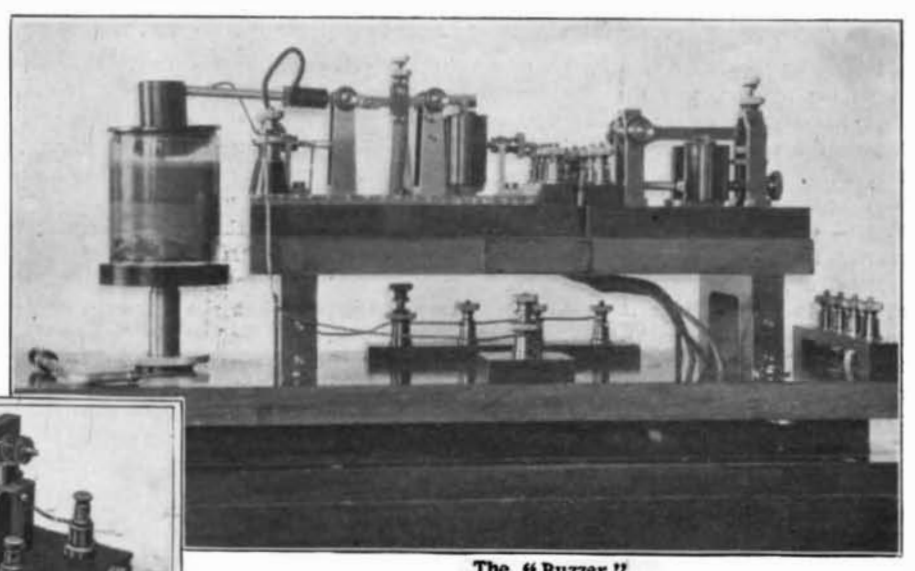
Sir Oliver Lodge.



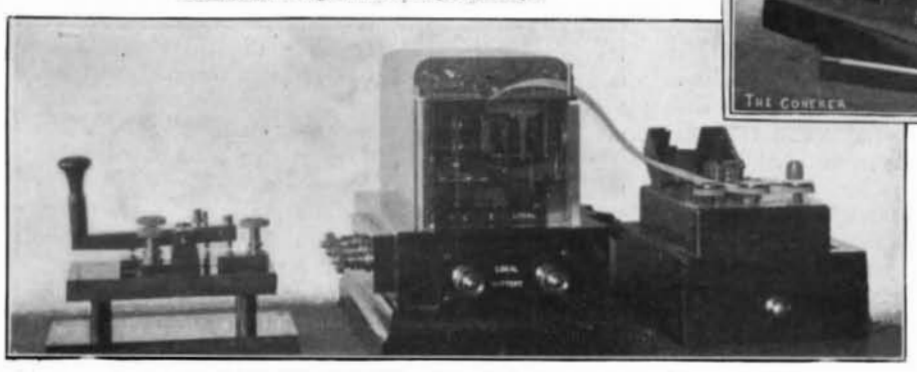
Dr. Muirhead Adjusting the Delicate Coherer.



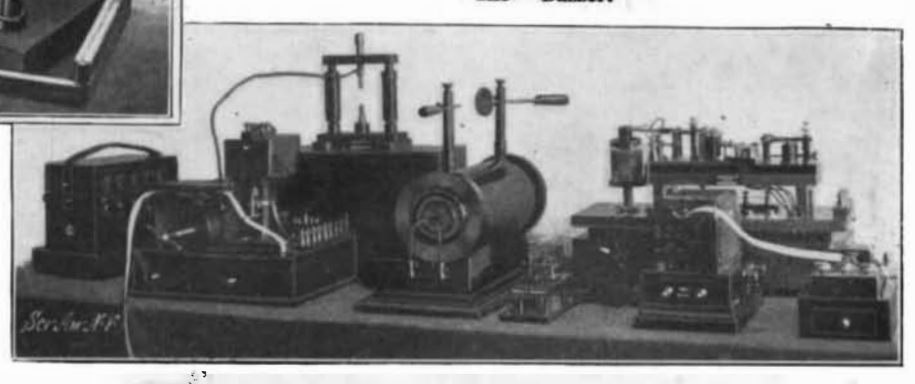
The Receiving Set and Spark Gap.



The "Buzzer."



The Automatic Transmitter with Perforator.



Complete Station, Comprising Transmitting and Receiving Sets.

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fect of the oscillations sent out from the transmitting station is to break down the film of oil which covers the mercury and to establish contact between the disk and the mercury, thus completing the circuit of the receiving instrument. No tapper is required, as the coherer automatically decoheres, and no relay is needed, as the current is quite strong enough to work the Muirhead siphon recorder; the clockwork draws the slip on which the signals are pivoted, as well as driving the disk.

The plan of the receiving station can be seen in one of our diagrams. The vertical wire used at the Elmer's End station is 80 feet high, and on it is hung a light wire cage or capacity; an increase in the size of the capacity is necessary when larger distances require to be bridged for wireless communication. The cage is made up of four copper wires strung on to wooden loops with a copper ball above. One end of the wire is led through a capacity and inductance, and is connected up to the shed itself instead of being earthed. The other is led through the secondary coil of the transformer to the coherer.

The current passing through the coherer is led through an adjustable capacity to the Muirhead siphon recorder. The remaining apparatus at the receiving station comprises a local battery, and a potentiometer to regulate the potential of the coherer. The employment of a transformer in the receiving circuit was one of Sir Oliver Lodge's earliest improvements and one which is made use of by Marconi in all his long distance work.

The apparatus employed in the transmitting set consists of a local battery of 10 volts, a sending key and an interrupter for the local circuit. The sending battery may have a voltage of from 14 to 20. A novel feature is the use of a "buzzer," viz., a couple of telegraphic sounders acting reciprocally, which operate a mercury make and break for the 10-inch spark coil. To one of the sounders is attached an aluminium needle dipping into the mercury. This forms a uniform and easily adjustable interrupter for the induction coil, allows the operator to have perfect control of the sparking frequency, and also does away with the possibility of his receiving shocks, which are liable to occur when the primary of the induction coil is directly broken by the key. After passing through the coil the current is led to two small brass rods between the ends of which sparking takes place.

Sir Oliver Lodge, F. R. S., the principal of Birmingham University, has been experimenting with Hertzian waves for a great many years past. On February 24, 1899, he delivered a lecture on coherers at the Royal Institution. A coherer was defined as an instrument which responds to electric waves somewhat in the same manner as a microphone responds to sound waves. Many different forms of coherer were shown, but no mention was made of the steel disk rotating on mercury, as this had not been discovered at the time. On June 1, 1894, Dr. Lodge delivered a lecture at the Royal Institution on "The Work of Hertz," and showed for the first time in England that electric Hertzian waves could be detected by means of suitable receivers through walls and closed doors, when set up by a transmitting or exciting apparatus some hundreds of yards away. In 1897 Mr. Marconi arrived in England with his system, and though Sir Oliver Lodge has kept his results secret until now, he has been working on the subject ever since his lecture in 1894. His first trials were over distances of 40 yards, and now the Lodge-Muirhead system has been operated perfectly at distances of 60 miles. The system was temporarily installed between Holyhead, in the Isle of Anglesea, and Howth, in Ireland.

"God save the King" was the message that passed hundreds of times between the transmitting and receiving stations.

It may be noted that the Cunard liners using the Marconi apparatus often intercepted the signals. The inventors are now working on the question of tuning or syntonization, and they have succeeded in tuning the oscillations passing between two stations so that only the properly tuned receiver shall respond to its own special transmitter.

They are of opinion that their devices, which I am not at present at liberty to make public, will neutralize the interference from any station not less than 10 miles distant, and will also prevent their signals from being read by any other station the same distance away.

The 8-mile Elmer's End to Downe circuit is a very difficult one, owing to the intervening hills, and it would correspond to a sea circuit of quite 60 miles.

During a voyage of the Liverpool steamship "Vedamore" across the Atlantic, signals were exchanged between the ships and the shore over considerable distances, and the system was also tried with success between Washington and Baltimore, a distance of 45 miles. The actual distance which can be covered is of course mainly a question of electric power.

The fact that the cable companies, which have never one of them adopted the Marconi system, have approved the Lodge-Muirhead system and are installing it on their cable ships is a splendid testimonial for the new method.

The telegraphic experts have not been satisfied with the filing-tube coherer used by Mr. Marconi. At every Marconi station it is customary to have on hand some thirty or forty of these tubes, as they have a mysterious habit of getting out of order, and it is impossible often to get them to receive signals at all. Possibly the continuous tapping has something to do with the lack of reliability of the filing-tube coherer; we have seen that in the Lodge-Muirhead receiver no tapping action is necessary.

Sir Oliver Lodge and Dr. Muirhead believe that they have got a system which will work regularly and without a hitch in all weathers; the coherer employed is regular and simple in action and quite easy to adjust, for it can be taken to pieces in a few seconds and any defects can be easily removed.

It may be mentioned that the disk coherer prefers long and slow oscillations to the sharp discharges which other coherers require, and the former are more convenient to work, especially in long-distance transmission. It is so sensitive that a long stroke or dash of the Morse code reveals the actual rate of sparking by the slight quivering of the line. The record on the tape is strong and clear and quite equal to the best submarine cable working.

Among other new features in the Lodge-Muirhead system, mention should be made of an automatic device for short-circuiting the coherer when the vertical wire is switched on to the transmitter, which obviates the necessity of burying it in a sealed metal case. Another new feature is the application of an ordinary automatic signaling machine to the sender. so that the message can be delivered perfectly spaced from a perforated tape, as in the British post-office machines.

THE NEW AMERICAN-BUILT LINER "MINNESOTA."

The first to take the water of the two mammoth freight and passenger steamships that have been building for several years at the New London yards, is the "Minnesota," of which we present a very striking picture on the front page of this issue. Measured on the basis of maximum displacement at extreme load draft, she is the third largest steamship in the world, being exceeded only by the "Celtic" and "Cedric" of the White Star Line. This vessel, which has just been launched, and her sister ship, which is still upon the ways, have been built by the Eastern Shipbuilding Company, which was organized for the purpose of constructing them. It is a curious and certainly unprecedented fact that this company took the contract for two of the largest vessels in the world before it was in the possession of either a plant, or even of the ground on which to build them. After carefully considering all available sites, the present location, opposite New London, Conn., was chosen.

The dimensions of the new vessel are: Length over all, 630 feet; breadth, 73 feet 6 inches; molded depth from keel to upper deck, 56 feet. On a draft of 33 feet the displacement is 33,000 tons, and on a maximum draft of 36½ feet, to which the vessel can be loaded whenever the depth of our harbors will admit of it, the displacement will be 37,000 tons. As compared with the "Cedric," the new ship is 70 feet less in length and 18 inches less in beam, but the molded depth is greater by the height of one deck, the plating being carried up, throughout the whole length of the ship, to the upper deck, which extends without a break from stem to stern. Although the dimensions of the "Minnesota" are less than those of the "Cedric," the fact that she approaches within about 1,000 tons of that vessel in displacement, is to be attributed to the much greater fullness of the New London boat, her bow and stern being considerably bluffer.

The space occupied by machinery is the smallest practicable, so that space for cargo may be as large as possible. In order that cargo may be readily stowed, the ordinary type of hold pillar has been dispensed with, and large box-shaped columns are fitted, supporting heavy girders which run longitudinally under the transverse beams which carry the decks. These columns are widely spaced, and in some cases only one is fitted in a hold, whereas by the older method ten pillars would be required. A longitudinal bulkhead is fitted the whole length of the ship; this divides each hold into two separate compartments, and therefore the hatches are fitted in pairs, one to each hold. Some of the hatches are so large that bulky freight, such as a locomotive or freight car, or large marine or land boilers, can be lowered right down into the hold. Every hatch can be loaded or discharged simultaneously if desired.

The cargo-handling plant on this vessel is very complete, and designed so as to cut down the number of men to a minimum. Two winches and two booms are fitted to handle cargo at each hatch. The booms, 34 in number, are built of steel. Two heavy booms are fitted to lift weights of from 30 to 50 tons. The winches for cargo handling are 34 in number, all electrically operated. One hold in the ship is devoted to carrying frozen meat, and is completely insulated; its capacity being about 2,500 tons. The insulation is so arranged that ordinary cargo can be carried on return trip.

The arrangement of coal bunkers is a novel feature on this ship, and, like the construction of the center longitudinal bulkhead and girders, is a departure which, as far as we know, the Eastern Shipbuilding Company have been the first to make in an ocean vessel. The bunkers are located above the boilers; the ends of the bunkers are inclined in such a manner that the bulk of the coal will gravitate through chutes and be deposited on the firing platform. The capacity of the permanent bunker is over 4,000 tons, and a reserve bunker is fitted contiguous to the boiler room, having a capacity for about 2,000 tons of coal.

The "Minnesota" has 16 Niclausse water-tube boilers, having a working pressure of 260 pounds per square inch. They will supply steam to two main engines of the triple-expansion type, which are arranged side by side, working separate shafts. The propeller wheels are 20 feet in diameter, and revolve 78 times per minute. The horse power of the engines will be about 10,000, and they will drive the ship at a speed of about 14 knots per hour.

The imposing appearance of the "Minnesota" is well shown by our engraving, which is supposed to be taken from the deck of a harbor tug, when the ship is entering an eastern port. In order to emphasize the great height of the vessel above the water, she is supposed to be running light, and even in this condition there is nearly 20 feet of the hull submerged. To realize the great size of the ship, we herewith recapitulate the various decks, platforms, etc., from the keel to the topmost bridge. First there is the outer bottom of the ship; 6 feet above that is the inner bottom or floor; then within the molded or plated structure of the vessel are the orlop, lower, between, main, and upper decks. All of these decks are of steel plating, and the whole structure of the ship from the bottom to the upper deck is 56 feet in height, the upper deck running, as we have said, in an unbroken sweep the whole 630 feet length of the vessel. Above the upper deck are the promenade deck, the upper promenade deck, and the boat deck, this last being about 80 feet above the keel, while 8 feet above this, or 88 feet above the keel, is the captain's bridge. Now, since the vessel at her lightest draft draws 17 feet of water, the captain's bridge, when the vessel is running light, will be over 70 feet above the water, and the passengers on the topmost upper deck will be between 60 and 70 feet above the water. From this elevated platform, they will be able to look down upon the crests of the heaviest seas that are ever known in the Pacific, and the broad beam and great mass of the vessel will cause her movement to be slow and regular, so that none but the most sensitive passengers should ever be troubled with seasickness. The "Minnesota" and her sister ship will be engaged in the Pacific trade, running from the home port, Seattle, by way of Honolulu to Yokohama. The distance from Seattle to Honolulu, the first stopping point, is about 2,300 miles, and from Honolulu to Yokohama 3,500 miles.

Several interesting experiments have been carried out by the Austrian army to obtain reliable data relative to the possibility of disabling a balloon when floating in the air, by either rifle or gun fire. For the purpose of the experiments a balloon was anchored at the height of about 7,000 feet, and the gunners, kept in ignorance of the range, were then commanded to disable the balloon. The difficulty of hitting the balloon when in midair can be realized from the fact that the gunners fired twenty-two shots before the approximate range was found, and that it was not till the sixty-fourth round that the balloon was hit, and then only slightly. The small tear in the gas bag, however, was sufficient to cause the balloon to descend slowly.

First Land Wireless Newspaper.

The only daily newspaper in the world publishing "sure-enough" dispatches transmitted by wireless telegraph had its birth on March 25, at Avalon, Santa Catalina Island. The event is important in the history of journalism and marks the beginning of an epoch in the dissemination of news in isolated places. The name of the infant journal is The Wireless, appropriately so called on account of the method by which it receives the news of the busy world. The unique sheet begins its career in the shape of a three-column folio, the exact size of the pages being 11 by 8 inches. In this convenient form is crowded, in addition to the local news of Avalon, an epitome of the local and general news appearing simultaneously in The Los Angeles Times, thus giving the residents of the island and visitors to its lovely shores a comprehensive synopsis of all the principal news of the world, hours before the arrival of the steamer from the mainland with the Los Angeles morning paper.