WIRELESS TELEGRAPHY AT THE YACHT RACES.

In a recent issue we described the arrangements made by The New York Herald, for reporting the international yacht races by the Marconi system of wireless telegraphy. The earlier races, or attempted races, were reported from the steamship "Ponce," and the later races from the steamship "La Grande Duchesse," which was sent out under the joint auspices of the Plant Line and The Marine Journal, of this city. By the courtesy of The Herald and Captain Geo. L. Norton, the editor of The Marine Journal, our artist was enabled to accompany Marconi and make the sketches of the installation on the "Duchesse" which appear on the front page of this issue.

AETHERIC TELEGRAPHY.—If we place in the primary circuit of an ordinary induction coil a Morse key, and arrange the secondary circuit to end in a radiator composed of two metallic spheres, or two capacity areas, every time the key is depressed and a spark passes between the spheres, electro-magnetic waves of enormously high frequency will be thrown out through the ether from the spheres or capacity areas in every direction. These electric waves are transmitted through space in exactly the same way as light. Their existence was suggested by Maxwell, and Hertz by his brilliant experiments succeeded in detecting their presence and measuring them. Hence, they are known as the Hertzian waves.

Now, since they are flung out into space as often and as long as the Morse key is depressed, it was evident that if a suitable receiver and recorder could be devised, these electro magnetic waves would lend themselves to the transmission of ordinary dot and dash telegraph messages, the ether taking the place of the cable as a medium of transmission. Such a receiver was discovered by Prof. Calzecchi Onesti, of Fermo, and after modifications by Branly, Lodge, and others, was brought to its present perfection by Marconi. The receiver consists essentially of a small glass tube called the coherer, about 1½ inches in length, into the ends of which are inserted two silver pole pieces, which fit the tube, but whose ends are about $\frac{1}{50}$ inch apart. The space between the ends is filled with a mixture composed of fine nickel and silver filings and a mere trace of mercury, and the other ends of the pole pieces are attached to the wires of a local circuit. In the normal condition the metallic filings have an enormous resistance, and constitute a practical insulator, preventing the flow of the local current; but if they are influenced by electric waves, coherence takes place and the resistance falls, allowing the local current to pass. The coherence will continue until the filings are mechanically shaken, when they will at once fall apart, as it were, insulation will be established, and the current will be broken. If, then a coherer be brought within the influence of the electric waves thrown out from a transmitter, coherence will occur whenever the key of the transmitter at the distant station is depressed. Mr. Marconi has devised an ingenious arrangement, in which a small hammer is made to rap continuously upon the coherer by the action of the local circuit which is closed when the Hertzian waves pass through the metal filings. As soon as the waves cease, the hammer gives its last rap and the tube is left in the decohered condition ready for the next transmission of waves. It is evident that by making the local circuit operate a relay, in the circuit of which is a standard recording instrument, the messages may be recorded on a tape in the usual way.

In addition to the valuable work that Marconi has done in perfecting the coherer and rendering it amenable to the practical manipulation of the Morse code, it must be understood that by introducing the vertical wire he has added an absolutely essential feature to successful wireless telegraphy. He has not only demonstrated that it is essential to the sending and receiving of messages over long distances, but he has formulated the law which governs the relation between the height of the wire and the distance at which its outflowing waves may be received and recorded. This he has ascertained to vary as the square of the vertical height of the wire, measured from the top of the wire to the level of the transmitter and receiver below.

The method of sending the reports of the yacht races was as follows: The foremast of the "Grande Duchesse" carried an auxiliary mast of sufficient length to give the desired vertical height of 120 feet to a wire, which reached from a short yard on the mast to the table of the operating room below, on which the sending and receiving apparatus was placed. A similar wire was suspended from the foremast of the Bennett-Mackay cable steamer, which was anchored near the Sandy Hook lightship, the starting and finishing point of the races, and also from a mast at the Navesink Highlands. The cable ship and the Highlands had temporary cable connections with New York. The "Grande Duchesse" accompanied the yachts over the course, and the momentary details of the race, as observed from her decks, were flashed to the cable ship, from which they were sent over the cable to New York, and thence telegraphed throughout the world. Thus was London practically enabled to keep its eyes upon the competing yachts as they covered the course.

One of our illustrations, which is reproduced from an excellent photograph of the inventor, shows Marconi with his hand upon the transmitter. The other illustration shows the vertical wire leading down from the masthead through the skylight to connect with the transmitter and the receiver in the operating room. The transmitter is on the right hand side of the table, and the receiver is in one of the rectangular boxes on the left. The recorder, on which a message from the cable steamer at Sandy Hook is being printed, stands on the table near Marconi's left hand. It should be explained that each rectangular box contains a complete receiver, one being in reserve in case of accident. Through the window of the operating room may be seen the Sandy Hook lightship, with "Shamrock" and "Columbia" in the act of crossing the line.

To assist our readers to a clearer understanding of the Marconi apparatus, we have included the small diagrams shown on the front page, of which the following is a description: The letters, *d*, *d*, indicate the spheres of the transmitter, which are connected, one to the vertical wire, *w*, the other to earth, and both by wires, c^1c^1, to the terminals of the secondary winding of induction coil, *c*. In the primary circuit is the key, *b*. The coherer, *j*, has two metal pole pieces, j^1j^2, separated by silver and nickel filings. One end of the tube is connected to earth, the other to the vertical wire, *w*, and the coherer itself forms part of a circuit containing the local cell, *g*, and a sensitive telegraph relay actuating another circuit, which circuit works a trembler, *p*, of which *o* is the decohering tapper or hammer. When the electric waves pass from *w* to j^1j^2 the resistance falls, and the current from *g* actuates the relay, *n*, the choking coils, k^1k^1, lying between the coherer and the relay, compelling the electric waves to traverse the coherer instead of flowing through the relay. The relay, *n*, in its turn, causes the more powerful battery, *r*, to pass a current through the tapper, and also through the electromagnet of the recording instrument, *h*.

The alternate cohering by the waves and decohering by the tapper continues uninterruptedly as long as the transmitting key at the distant station is depressed. The armature of the recording instrument, however, because of its inertia, cannot rise and fall in unison with the rapid coherence and decoherence of the receiver, and hence it remains down and makes a stroke upon the tape as long as the sending key is depressed. Hence, applying this description to the present case, our readers will understand that by the manipulation of the sending key on the "Grande Duchesse," the operator was able to produce the dot and dash characters of the Morse code on the tape of the recording instrument on the Bennett-Mackay many miles distant from the competing yachts.

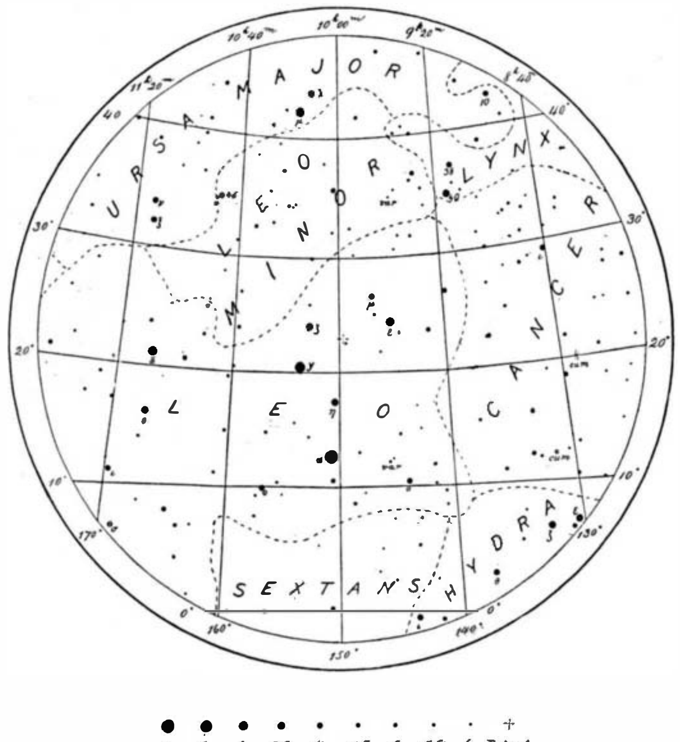
Such is the Marconi system, as successfully operated for the first time in this country. Using the same methods, the distinguished inventor has transmitted messages between ships of the British navy that were separated by eighty miles of water; and, more remarkable yet, he has sent messages successfully from Chelmsford, in England, to Boulogne, in France, a distance of 110 miles. On this occasion the curvature of the earth amounted to over one thousand feet.

DEPOSITS of alluvial or placer copper from the White River country of Alaska has been sent to Chicago. This nugget is of pure metal and weighs 147 pounds.

THE NOVEMBER METEORS OF 1899.

BY PROF. E. C. PICKERING.

The predicted time of maximum of the November meteors is November 15, 1899, at 18 h. Greenwich mean time. As a similar shower may not occur again for thirty years, no pains should be spared to secure the best possible observations. The most useful observations that can be made by amateurs are those which will serve to determine the number of meteors visible per hour throughout the entire duration of the shower. They should be made on November 15, and also on the two preceding and following evenings. The most important time for observation is from midnight until dawn, as comparatively few meteors are expected earlier. Observations are particularly needed at hours when they cannot be made at the observatories of Europe and America. In general, the time required for ten or more meteors to appear in the region covered by the accompanying map, should be recorded. This observation should be repeated every hour or half hour. If the meteors are too numerous to count all those appearing upon the map, the observer should confine his attention exclusively to some small region such as that included between the stars μ Ursae Majoris, 40 Lyncis, δ and α Leonis. If the meteors occur but seldom, one every five minutes, for instance, the time and class of each meteor should be recorded, Also note the time during which the sky was watched and no meteors seen, and the time during which that portion of the sky was obscured by clouds. Passing clouds or haze, during the time of observation should also be recorded. The date should be the astronomical day, beginning at noon, that is, the date of early morning observations should be that of the preceding evening. Specify what time is used, as Greenwich, standard, or local time. When a meteor bursts, make a second observation of its light and color, and when it leaves a trail, record the motion of the latter by charting the neighboring stars, and sketching its position among them at short intervals until it disappears, noting the time of each observation. If the path of a meteor is surely curved, record it carefully upon the map.



REGION OF METEORS.

On November 14, 1898, thirty-four photographs were obtained of eleven different meteors. Their discussion has led to results of unexpected value. The greatest number of meteors photographed by one instrument was five. Only two meteors were photographed which passed outside of the region covered by the map, although the total region covered was three or four times as great. No meteors fainter than the second magnitude were photographed.

Photographs may be taken, first, by leaving the camera at rest, when the images of the stars will trail over the plate and appear as lines, or secondly, attaching the camera to an equatorial telescope moved by clockwork, when a chart of the sky will be formed, in which the stars will appear as points. A rapid-rectilinear lens is to be preferred in the first case, a wide-angle lens in the second. The full aperture should be used, and as large a plate as can be covered. The most rapid plates are best for this work; they should be changed once an hour, and the exact times of starting and stopping recorded. Care should be taken to stiffen the camera by braces, so that the focus will not be changed when the instrument is pointed to different portions of the sky, especially if the lens is heavy. If the first method is employed, the position of the camera should be changed after each plate, so as to include as much as possible of the region of the map on each photograph. If pointed a little southeast of ε Leonis, the radiant will reach the center of the field about the middle af the exposure. A watch of the region should also be kept, and the exact time of appearance and path of each meteor as bright as the Pole Star should be recorded. The plates should be numbered on the film side with a pencil, and should be sent to the Harvard Observatory with accompanying notes and other observations. After measurement there, they will be returned if desired. The value of the results will be much increased if similar photographs can be obtained by a second camera from ten to forty miles distant, and preferably north or south of the other.

Harvard College Observatory.

THE Indiana State Geologist in his annual report says that during the last five years pipe lines have been extending toward the heart of the natural gas field. Until now the center is less than 150 square miles. All the gas producing rock is now more or less intimately connected, and whatever tends to reduce the supply in one part of the field has the same effect on all parts. This is shown by a remarkable reduction in pressure In three years the pressure sank from 264 to 181 pounds and the average pressure at which a well has to be abandoned is between 130 and 150 pounds. Petroleum will probably replace the gas in the greater portion of the rock and while it lasts can be used as fuel, but the supply like that of natural gas is limited.