



“A Note on the Effect of Daylight upon the Propagation of Electromagnetic Impulses over Long Distances.” By G. MARCONI, M.I.E.E. Communicated by Dr. J. A. FLEMING, F.R.S. Received June 10,—Read June 12, 1902.

During some long-distance space telegraphy tests carried out towards the end of February last between a transmitting station situated at Poldhu, on the coast of Cornwall, and a receiving station on board the U.S. s.s. “Philadelphia” travelling from Southampton to New York, I had the opportunity of noticing for the first time in my experience, considerable differences in the distances at which it was possible to detect the received oscillations during daylight, as compared with the distances at which the effects could be obtained at night.

Before describing the results obtained, it may be useful if I give a

brief description of the nature of the apparatus used at the transmitting and receiving stations.

The transmitter at Poldhu was similar in principle to that used by me in previous work,\* but the elevated conductor at the transmitting station was much larger, and the potential to which it was charged at the peak of each electrical oscillation very much in excess of any that had been previously employed. The transmitting elevated conductor consisted of fifty almost vertical naked copper wires, suspended at the top by a horizontal wire stretched between two poles each 48 metres high and placed 60 metres apart.

These wires were separated from each other by a space of about 1 metre at the top, and, after converging together, were all connected to the transmitting instruments at the bottom. The potential to which these conductors were charged during transmission was sufficient to cause sparking between the top of the said wires and an earthed conductor across a space of 30 cm.†

The general engineering arrangements of the electric-power station erected at Poldhu for creating the electric waves of the frequency which I desired to use, were made by Dr. J. A. Fleming, F.R.S., who also devised many of the details of the appliances for producing and controlling the electric oscillations. These, together with devices introduced by me and my special system of syntonisation of inductive circuits, have provided an electric-wave generating plant more powerful than any hitherto constructed.

At the receiving station on the ship, one of my receivers, as described in the Society of Arts paper above referred to, was employed, and the signals were recorded on the tape of a Morse recording instrument.

A receiving transformer accurately tuned to the period of the electrical oscillations radiated from the transmitting station at Poldhu was connected to the coherer in the usual manner.

The receiving elevated conductor was constituted of four almost vertical wires sustained in position by the ship's mast, the summit of which wires was about 60 metres above the sea-level. At their lower end they were all connected to the receiving instrument.

My assistants at Poldhu had received instructions to send a succession of Ss and a short message at a certain pre-arranged speed, every ten minutes, alternating with five minutes of rest, during the following hours:—From 12 to 1 A.M., from 6 to 7 A.M., from 12 to 1 P.M., and from 6 to 7 P.M., Greenwich mean time, every day from the 23rd

\* See 'Journal of the Society of Arts,' vol. 29, pp. 506—517.

† *Note, added July 5, 1902.* The spark-length here stated to be 30 cm. was, by a misunderstanding on the part of the communicator of the paper, altered to 50 mm., which appeared on the first proof. It was correctly stated as 30 cm. in the original MS.

February to 1st March inclusive. On board the "Philadelphia," I did not notice any apparent difference between the signals received in the day and those received at night-time, until after the vessel had reached a distance of 500 statute miles from Poldhu. At distances of over 700 miles, however, the signals transmitted during the day failed entirely, while those sent at night remained quite strong up to 1551 miles, and were even clearly decipherable up to a distance of 2099 miles from Poldhu.

It is interesting to note that at the time of the year at which these experiments took place, daylight at Poldhu was rapidly increasing between the hours of 6 and 7 A.M., and on the "Philadelphia," I noticed that at distances of over 700 miles from the sending station, the signals at 6 A.M. were quite clear and distinct, whereas by 7 A.M. they had grown weak almost to total disappearance, their strength thus apparently diminishing in proportion as daylight increased at Poldhu. No such weakening of the signals was noticeable between the hours of 12 midnight and 1 A.M.

With a view to further tests in this same connection, I carried out other experiments between the station at Poldhu and a receiving station (in all respects similar to the one on the "Philadelphia") situated at the North Haven, Poole, Dorset. The distance between the North Haven and Poldhu is about 152 statute miles, of which 109 are over sea and 43 over high land. It was found that the signals from Poldhu could be perfectly well received at the North Haven during the night when four vertical wires 12.1 metres high were used in connection with the receiving instruments, whilst, all other conditions being the same, during the day the height of the wires required to be 18.5 metres in order to receive the same signals with equal clearness.

The cause of these observed differences in the effects obtained by night as compared with those noticed by day may be due to the dis-electrification of the transmitting elevated conductor, operated by the influence of daylight. The electrical oscillations in the transmitting elevated conductor may thus be prevented by the discharging influence of light from acquiring so great an amplitude as they attain during darkness.

The dis-electrification of negatively charged metallic bodies by light has been noticed by many observers,\* and as each alternate half-oscillation in the transmitting elevated conductor must necessarily charge it negatively, the dissipating effect of light on each alternate oscillation of the electrical wave in the transmitting wire may be sufficient to cause a material decrease in the amplitude of the oscillations.

\* See papers by Messrs. Elster and Geitel in Wiedemann's 'Annalen,' pp. 38—40, also p. 497; also remarks of Professor Righi in 'Comptes Rendus,' vol. 107, p. 559.

Other tests were instituted with the object of ascertaining whether the illumination of the spark-gap of the transmitter had any effect upon the impulses transmitted, and accordingly the ball dischargers were inclosed in a box opaque to light. No perceptible difference, however, was noticed in the strength of the signals received, whether the spark-balls were or were not exposed to daylight.

It would be interesting to ascertain whether the same effects are to be observed when using transmitting elevated conductors covered with insulating material opaque to ordinary light.

I have never noticed any appreciable difference in the distances over which signals are obtainable during the day and the night respectively in the course of all the other numerous experiments which I have carried out with installations not designed for very long distances, and in which the electrical power used at the sending station has been small compared with that used at the Poldhu installation.

Probably the much higher potential to which the elevated conductor at Poldhu was charged may have greatly increased the facility with which losses might occur, due to diselectrification through the influence of daylight.

I hope to be able to make a complete study of the effects described in this note, in the course of further long-distance tests which are likely to be undertaken shortly.