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APPLICATION DATED

2nd May, 1919.

Applicant (Assignee of Actual Inventors) ... MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED.

Actual Inventors ... ... GUGLIELMO MARCONI and CHARLES SAMUEL FRANKLIN, Electrical Engineers, Marconi House, Strand, London, England.

Application and Complete Specification ... Lodged 2nd May, 1919.

Application and Complete Specification Accepted 12*th Jan.*, 1920 Acceptance Advertised (Sec. 50) 20 Jan., 1920.

Class 05.5.

Drawing attached.

COMPLETE SPECIFICATION.

"Improvements in reflectors for use in wireless telegraphy and telephony."

We, MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED, Electrical Engineers, of Marconi House, Strand, London, W.C.2., England, hereby declare this invention and the manner in which it is to be performed, to be fully described and ascertained in and by the following statement:—

This invention relates to improvements in reflectors used with transmitters and receivers in wireless telegraphy and telephony.

The use of a reflector for directing the energy of a wireless transmitter in any desired direction has been many times suggested. The advantages to be expected from thus directing the energy in the desired direction (such as increase of range, avoidance of interference of all kinds, and comparative secrecy) are so great that it is rather surprising that since the early work of Hertz and Marconi no practical results have been obtained by the use of reflectors.

Hertz showed that by placing an oscillator in the focus of a reflector bent in the form of a cylindrical parabola the energy was directed sensibly in one direction.

In 1896 Marconi using his improved coherer obtained a range of about three miles with an oscillator placed at the focus of a reflector and the receiving conductor also placed at the focus of a reflector.

In 1901 Braun described a reflector made of two series of parallel rods arranged above each other and in the form of a cylindrical parabolic mirror. The nearer ends of the two sets of rods were connected by means of wires to spark balls, placed in the focus of the mirror. It is stated in the American patent that "it will be evident that as all the rods are excited from the same centre and as the phase difference of the oscillations of the single rods is determined by the length of the corresponding wires, the sets of rods act in such a manner as to generate a wave front which must be in a plane. The wave front therefore will be essentially rectilineal." In fact the construction described simply gives a Hertz oscillator of a peculiar shape which has a wave length much longer than the natural wave length of the separate rods and which has practically no directional properties.

In 1902 de Forest described a reflecting system in combination with a series of wires extending in the direction in which it is desired to send the energy and which it is alleged helps concentration in this direction

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and the system comprised a vertical aerial placed at the focus of a reflecting system consisting of a number of vertical aerials disposed in a parabolic curve, all the aerials being grounded. The inventor states that he believes the grounding of all the aerials to be novel and describes means for increasing the concentration in the desired direction by horizontal wires disposed in various ways.

A reflecting system comprising a number of wires or rods disposed as a cylindrical parabola and all tuned to the same wave length as that of a transmitter placed at the focus thereof is accordingly not novel, while it is also known that in order that the reflected waves and the direct waves should unite their effects in the desired direction the focal length of the reflector should be one, three, or an odd multiple of a quarter wave length. Such a system gives a certain amount of concentration in the desired direction, and we have found that this is strongest if the focal length is one-quarter wave length, weaker if the focal length is three-quarters wave length, and hardly appreciable if the focal length is five-quarters wave length or more. At best with this simple system about 80 per cent. is the maximum increase in range hitherto obtained when using such reflectors both at the transmitting and receiving ends.

According to this invention, a reflector is constructed of two or more sets of rods (which term includes strips and wires) arranged on a parabolic surface around the transmitting or receiving aerial as a focus, each rod being tuned to the aerial and the rods of the different sets being preferably in line with each other. By this means the efficiency and effect of the reflector are increased very largely for example, by making the reflector of three sets of rods arranged on a parabolic surface and having a focal distance of one-quarter wave length, the range may be increased from 400% to 500% as against 80% obtained with the simple reflectors before known.

The reflector may be described in other words as follows:—

On a parabolic surface surrounding a transmitter or receiver and in the correct direction having regard to the polarisation of the transmitted waves is arranged a number of long wires which are divided up into elements each in tune with the transmitter. The length of each element is preferably about half a wave length, but may be made either greater or less than this by inserting in it either a condenser or an inductance. The adjacent ends of these elements may be insulated from each other or joined by inductance coils or condensers, the controlling factor being that each element when in its working position in the reflector is in tune with the aerial.

In practice we find that some of the elements may be removed slightly from the true parabolic surface provided that those elements of the reflector which are nearer the focus than they would be if on the parabolic surface are tuned to a rather longer wave, and those elements which are farther to a rather shorter wave.

For very short waves no earth connections are required or desirable, but for longer waves it is an advantage to earth the aerial and the lower elements of the reflector.

Very good results can be obtained by arranging the elements on a cylindrical parabolic surface, but better results can be obtained by arranging them on a true paraboloid, particularly when using a reflector having a focal length equal to three-quarter wave length or more.

Our invention is illustrated by the accompanying drawings.—

Figure 1 is a plan,

Figure 2 a rear view, and

Figure 3 a side view of a reflector constructed in accordance with this invention and having three sets of parallel rods **a** arranged on a cylindrical parabolic surface; with an aerial or antenna **b** at the focus this arrangement is for concentrating vertically polarised waves in the horizontal direction.

Figures 4, 5, and 6 are similar views of an arrangement for concentrating horizontally polarised waves in the horizontal direction.

Figures 7, 8 and 9 are similar views of a reflector having three sets of parallel rods arranged on a true paraboloid instead of a cylindrical parabola; this will concentrate both vertically and horizontally polarised waves in the horizontal direction.

These figures illustrate reflectors made with three sets of parallel rods, or, stated otherwise, reflectors made up of a number of wires each divided into three elements, each element being in tune with the transmitted or received wave. As illustrated, each of these elements should be nearly half a wave length long; alternatively each of these wires may be divided up into a larger number of elements connected together by condensers.

Figure 10 shows one wire divided into three elements each in tune with the desired wave.

Figure 11 shows one wire divided into a number of shorter elements connected together by condensers. The capacity of each condenser must be such that if joined in circuit with the inductance of the wire joining it to the next condenser it would form a circuit in tune with the desired wave.

Having now fully described and ascertained our said invention and the manner in which it is to be performed, we declare that what we claim is:—

1. In wireless telegraphy, a reflector consisting of two or more sets of rods arranged on a parabolic surface around a transmitting or receiving aerial as a focus each rod being in tune with the aerial, substantially as described.

2. A modification of the reflector claimed in Claim 1, in which some of the elements are slightly removed from the parabolic surface, those which are brought nearer to the aerial being tuned to a longer wave and those which are removed further from it being tuned to a shorter wave.

Dated this 1st day of May, 1919.

EDWD. WATERS & SONS,
Patent Attorneys for
MARCONI'S WIRELESS TELEGRAPH
COMPANY LIMITED.

Witness—Percy Johnston.

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MARCONI'S WIRELESS TELEGRAPH COMPANY, LIMITED. *Reflectors.*

Fig. 2.

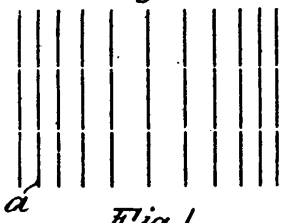

Fig. 5.

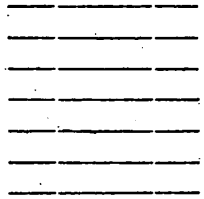

Fig. 1.

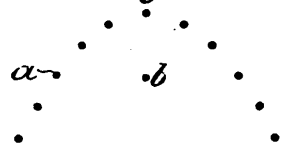

Fig. 3.

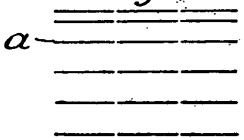

Fig. 4.

Fig. 6.

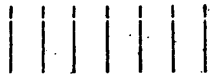

Fig. 8.

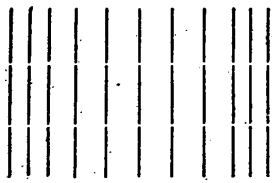

Fig. 7.

Fig. 9.

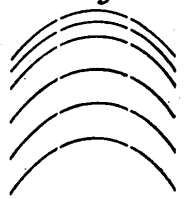

Fig. 10.

Fig. 11.