PUBLISHED
MAY 25, 1943.
BY A. P. C.

P. P. GAMET
MULTIPLE STRAND AERIALS
Filed March 27, 1942

Serial No.
436,535

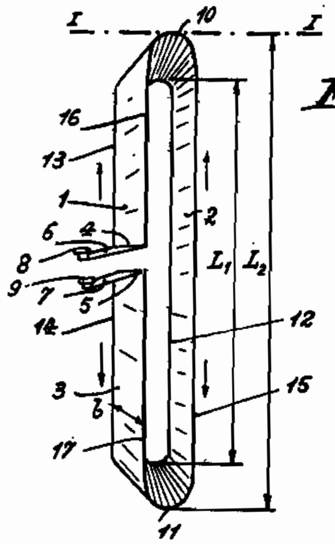

Fig. 1.

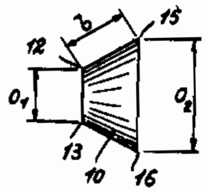

Fig. 2

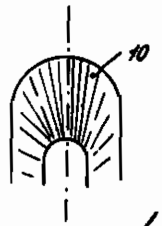

Fig. 3

Fig. 4

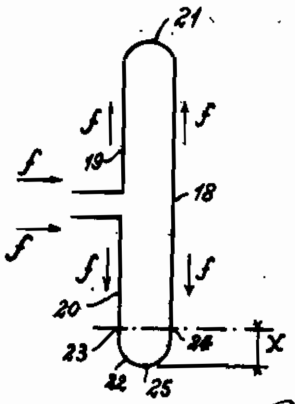

Fig. 5

Inventor

Pierre Paul Gamet

by Ben J. Chromy Attorney

Published May 25, 1943 **Serial No. 436,535**

ALIEN PROPERTY CUSTODIAN

MULTIPLE STRAND AERIALS

Pierre Paul Gamet, Paris, France; vested in the Alien Property Custodian

Application filed March 27, 1942

The present invention relates to improvements to multiple strand aerials.

The invention relates more particularly to aerials or aerial systems having a high efficiency and a large aperiodicity for the emission or the reception of radio-electric waves; it is applicable together to reception and to emission aerials and it relates more particularly to the aerials which are used for short and very short waves.

With aerials of this type already used, the experience shows that one can rely on a certain aperiodicity only when the attack of the said aerials is effected in the best conditions of coupling and of adaptation of impedance with the feeding main, which obliges to modify the circuits of adaptation when working with a plurality of wave lengths.

On the other hand, aerials are generally located at inaccessible places (for instance on the top of a mast or of a building) and, in any case, one encounters great difficulties for modifying the aerial box or the feeding main once they are set up. However, it is most desirable to be able to use such a unit in a predetermined range of wave lengths, the aerial retaining in the said range the same properties of radiation and the same characteristic features from the point of view of the emission or reception apparatus with which it is coupled.

The present invention offers this latter advantage without making it necessary, by no means, to modify the mechanical and electrical characteristics of the aerial and of the circuit of adaptation once their are set up and mounted, the said aerial being designed so as to obtain a large aperiodicity the output radiated by this aerial remaining constant in a large range of wave lengths and its optimum operation being such that it does not require a circuit of attack insuring the best conditions of coupling and of adaptation of impedance.

The improved aerial permitting to attain the above mentioned objects shows the characteristic features which result from the following description and more particularly from the appended claims.

Aerials according to the invention are shown by way of examples in the appended drawings, in which:

Figure 1 is a general view of the aerial.

Figure 2 is a plane view of the aerial across the line I—I of Figure 1.

Figure 3 shows a detail of the loop.

Figure 4 shows the spreading out of the loop on a plane.

Figure 5 is a diagram of the elementary aerial.

The aerial is formed of a flat conducing band 1, a second flat conducing band 2 parallel to band 1 and a flat conducing band 3 parallel to band 2 and in line with band 1; these bands 1 and 3, on the one hand, and 2, on the other hand, are spaced from another by a distance which is small with respect to the emitted or received wave length.

The extremities 4 of band 1 and 5 of band 3 are bent for instance to a right angle at 6 and 7 and carry terminals 8 and 9 for securing both wires of the feeding main or the connection wires of the coupling bos.

The bands 1 and 2, on the one hand, and 3 and 2, on the other hand, are connected together by a band 10 and by a band 11 respectively, which are bent in the form of a loop which is such that when spread out on a plane it forms a parabolic surface.

The electrical constant of the aerial depend upon the following dimensions:

L^1 the length of the branch 2 and of the branch 1 with the branch 3, measured on the edges 12, 13 and 14.

L^2 the length of the branches 2 and 1 with 3 measured on the edges 15, 16 and 17.

O^1 the distance between the edges 13 and 14, on the one hand, and 12, on the other hand, of the branches 1, 3 and 2.

O^2 the distance between the edges 16 or 17, on the one hand, and 15, on the other hand, of the branches 1, 3 and 2.

b the thickness of the aerial.

The dimensions L^1, L^2, O^2 and b can vary in large proportions according to the desired range of aperiodicity and the scale of frequencies to be transmitted or received. From this fact, the general form of the aerial can be considerably modified according to the choose of the preceding dimensions.

An aerial of the described type possesses a comparatively low impedance; it is necessary to attack it while passing through the medium of a conventional circuit of adaptation.

This aerial works as follows:

It is comparable to an infinity of aerials joined side by side and strongly coupled together and formed (see Figure 5) of a strand 18, on the one hand, and two strands 19 and 20, on the other hand, of rectilinear form, parallel and separated from another by a distance which is small with respect to the emitted or received wave length. These strands are connected at their extremities by loops 21 and 22.

The length of each of these elementary aerials varies progressively within the limits L^1, L^2; the distance between each of the strands 19 and 20, on the one hand, and 18, on the other hand, varies progressively between O^1 and O^2.

Suppose two points 23, 24 of the wires of the aerial at the same height X over point **25**. The value of the currents I^1 I^2 is given with a first approximation by the following expression:

$$I^1 = A \sin 2\left(\frac{t}{T}+\frac{X}{\lambda}\right)$$

$$I^2 = A \sin 2\left(\frac{t}{T}-\frac{X}{\lambda}\right)$$

where A is a constant, T the period of the oscillations, λ the wave length and t the time.

These equations are true with the sole assumption that the loops do not modify the propagation of the waves and experience confirms this fact.

One sees that both these equations are identical in their form with the sole exception of the sign of the term

$$\frac{X}{\lambda}$$

From the point of view of the field produced at a great distance and since the distance between both strands is small with respect to the wave length, the radiation is identical to that of a single conductor the intensity of which would be the sum of both preceding intensities, which sum has for its expression:

$$I = I^1 + I^2 = 2A \sin 2\pi \cos 2\,\pi\frac{t}{T}$$

One sees that this intensity is homogeneous with that of a dipole tuned on the wave length the intensity of which at the loop of current is equal to twice the intensity in each branch. This calculation shows well the radiation power of this elementary aerial and experience confirms it entirely.

The aerial according to the invention being formed of an infinity of these elementary aerials it has a radiation value which can be considered for a given frequency as the sum of the partial radiations of each elementary aerial while taking into account their mutual inductions.

Experience shows that the radiation resistance of this unit is nearly constant on a large scale of wave lengths and that, on the other hand, its aperiodicity is obtained within large limits even then when the circuit of attack does not correspond to the best conditions of coupling and of adaptation of the impedance.

The invention is of an absolutely general character and can be applied to all the aerials comprising systems of any antennae (radiogoniometers, radiobeacons); it is more particularly advantageous for transmitters with a large traffic scale or for transmitting aerials or reception aerials using large passing bands, in order to obtain the minimum of distorsion (transmission or reception, image in television).

PIERRE PAUL GAMET.