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ULTRA-SHORT WAVE DIRECTIVE ANTENNA

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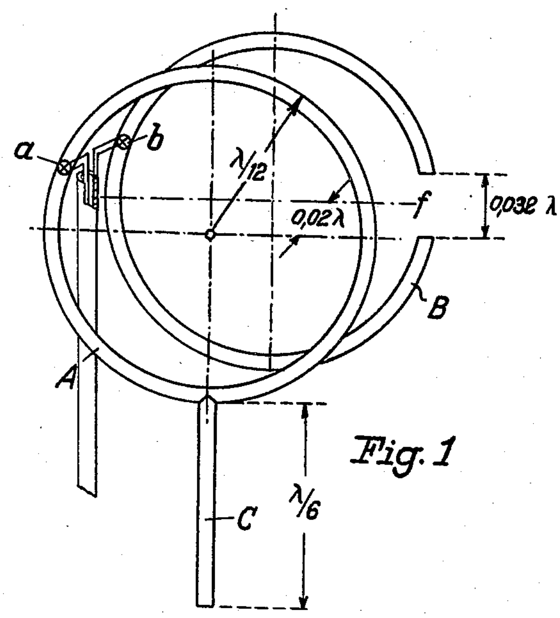
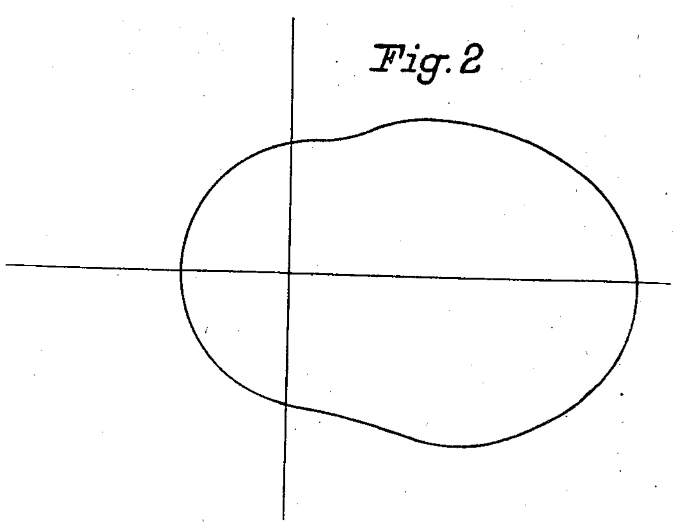


Fig. 1

Fig. 2



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ULTRA-SHORT WAVE DIRECTIVE ANTENNA

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5 Claims. (Cl. 250—11)

The invention relates to ultra-short wave directive antennae, intended especially for television receivers, and consists in certain features of novelty which will appear from the following description and be particularly pointed out in the appended claims, reference being had to the accompanying drawing, in which

Fig. 1 is a diagrammatic perspective view showing one embodiment of the invention, while Fig. 2 is the radiation diagram of arrangements as provided by the invention.

Arrangements concerned with ultra-short wave radiation sometimes require their antennae to be given a directive effect. For instance, in the case of television reception it is desirable to have antennae arranged to be sensitive in the direction of the television transmitter only in order thereby to improve the ratio between useful voltage and interfering voltage, such ratio being sometimes rather bad. Prior arrangements of this kind have a dipole or a number thereof combined with one or several reflecting antennae or reflectors. In systems of this type such a reflector is coupled to the receiving dipole proper by a radiation pattern in well known manner. The reflector acts to increase the potential of the dipole in consequence of the phase displacement to which the voltages of the reflector and dipole are subjected and which is caused by the two being spaced apart by a distance equal to a quarter-wavelength. However, such reflectors are not capable of raising the voltage to a value greater than $\sqrt{2}$. Furthermore, these systems are not very suitable for use in connection with purchasable television receiving apparatus because they are too large, their largest width being about 1¾ meters, and because they have drawbacks in view of which they should not be mounted on the roofs of dwelling houses.

In arrangements as provided by the invention the disadvantages peculiar to these antennae are avoided by using antenna structures in which a main radiator and an auxiliary radiator or one of the two does not extend along a straight line as axis but along any other suitable line or curve located in a plane or of spatial shape. This fundamental idea is likewise known, the so-called folded aerials being an embodiment of it. However, from a physical viewpoint the sole advantage of such folded aerials is the directional effect peculiar to them. Also their small space requirements are of interest.

The inventive idea is so to combine two or more such receiving or transmitting radiators that they shall act upon each other not alone by radiation but at the same time by the coupling effect between them and in such manner that the resulting voltage at the delivery point shall be greater than the voltage obtainable by means of one radiator. In order to achieve this measures may be adopted which are based on the following consideration.

As is well known, a dipole of the usual construction operates by means of a purely circular magnetic field, which extends around the dipole, and of a polar electric field. On folding an electric dipole in such manner that the ends thereof are brought to face each other the electric field intensity will always act in tangential direction with respect to such radiating dipole. The electric field intensity is in this way caused to be in the nature of a circular function with respect to which the magnetic field intensity is of substantially vertical direction. In the case of such an antenna therefore the vector of the electromagnetic field distribution behaves perfectly like that of an electric dipole. A field antenna closed in itself thus constitutes a magnetic dipole whereas a folded open antenna is in the nature of an electric dipole.

The invention is concerned with a combination of these two kinds of dipoles. Such combination, however, is not of the type employed in long-wave direction finding systems, these having a frame aerial combined with a non-directional bar-shaped antenna, but is of the kind shown in Fig. 1.

In Fig. 1 ring A represents a magnetic dipole while ring B represents a folded electric dipole. It can be shown that the ring B has a directional effect which is such that the maximum reception is in the direction of the gap f. Ring A likewise has a directive effect, which however is symmetrical by 180 degrees. By combining the two rings a directive effect is obtained which as distinguished from magnetic dipoles alone is only unilateral toward the transmitter, the radiation pattern being of the kind illustrated in Fig. 2. The ratio between maximum and minimum is about 1:3. On the basis of known formulae it is possible to find the respective formula for the length of a magnetic dipole as compared with an electric dipole. In order, however, to avoid undesirable dimensions it is also possible for the magnetic dipole to be in its turn galvanically coupled to an electric dipole, such as bar C represented in Fig. 1. The addition of the bar-shaped antenna C allows of reducing the diameter of ring A without changing the voltage at the delivery point. The voltage distribution on the ring A is affected in the first place by the dipole B being arranged in close proximity to ring A, which is inductively and capacitively coupled to B, and is affected also by antenna C. With a cable of low surge impedance, as 130 ohms or the like, joined to the points a (cable core) and b (cable sheathing), the position of which is approximately that represented in Fig. 1, the total effect of such a structure, namely a structure which is smaller than an ordinary reflecting antenna, is that the resulting voltage is at least by $\sqrt{2}$ greater than the voltage obtained by means of a properly matched electric dipole alone, the experimental conditions being the same in both cases. Experiments have resulted in a value greater than $\sqrt{2}$, a fact which is presumably due to the electric dipole not having been tuned to the same frequency as the novel structure.

It will thus be seen that the novel antenna has the same effect as an ordinary reflecting antenna while being of considerably smaller space requirements. The dimensions indicated in Fig. 1 are those intended for the frequency of the television transmitter at Berlin, that is, for 48.8 megahertz, that is, a wavelength $\lambda=6.28$ meters.

In the case of an ordinary reflecting antenna the ratio of the maximum value to the minimum value is equal to infinite, being 1:0. The value, however, can never be attained because differences of this kind are rendered impossible by the influence of neighbouring secondary radiators which are present in each case. It will therefore be obvious that the described combination of a magnetic dipole with an electric dipole and an additional bar antenna, joined to the magnetical dipole, has the following advantages over prior arrangements:

(1) The space requirements are smaller.

(2) The construction is simpler. The additional bar antenna may be a part of the carrier mast or may be formed by this mast as a whole.

(3) The appearance is more pleasing.

These advantages are not accompanied by any drawback because the efficiency is quite the same as with a reflecting antenna composed of two electric dipoles which are spaced apart by a distance equal to a quarter-wavelength.

What is claimed is:

1. An ultra-short wave directive antenna system, a first conductor shaped as a closed loop forming a magnetic dipole, and a second conductor shaped as a loop of substantially the same curvature as said first loop open at one point and spaced therefrom forming an electric dipole, the open point of said second conductor being arranged substantially along the direction of desired maximum radiant action.

2. An ultra-short wave antenna according to claim 1, further comprising conductive means coupled to said conductors for connecting them to other apparatus.

3. An ultra-short wave antenna according to claim 1, wherein said first conductor is provided with an extending straight conductor fastened to a point thereon, to modify the resonant characteristics of said magnetic dipole.

4. An ultra-short wave antenna according to claim 1, wherein said first conductor is provided with an extending straight conductor fastened to a point thereon, to modify the resonant characteristics of said magnetic dipole, said straight conductor serving as a supporting mast.

5. An ultra-short wave antenna according to claim 1, wherein said first and second conductors are detuned with respect to one another.

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