July 31, 1945. E. GREEN 2,380,519

DIRECTIONAL AERIAL SYSTEM

Filed Sept. 30, 1943

Fig. 1.

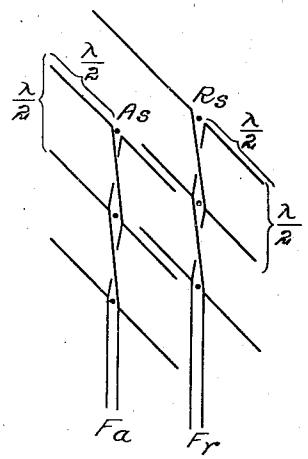


Fig. 2.

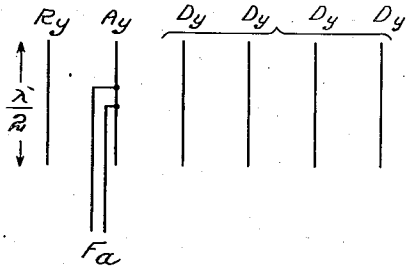


Fig. 4.

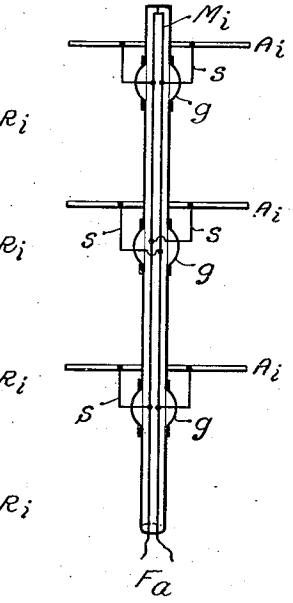


Fig. 3.

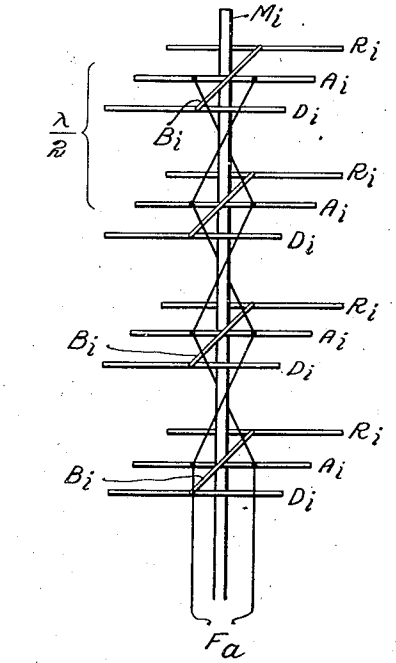
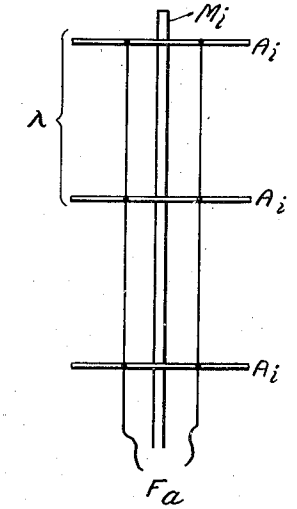


Fig. 5.



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DIRECTIONAL AERIAL SYSTEM

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In Great Britain May 21, 1942

4 Claims. (Cl. 250—11)

The present invention relates to directional aerial systems particularly for ultra high frequency operation.

An object of the present invention is the provision of a directional antenna array for ultra high frequency use.

Another object of the present invention is the provision of an antenna, as aforesaid, which has a simple feeding system.

Still another object of the present invention is the provision of an antenna, as aforesaid, which is of simple mechanical construction.

Still a further object of the present invention is the provision of an antenna, as aforesaid, which does not have limited directional qualities.

Broadly speaking, there are two systems of directional aerial systems used for ultra high frequency operation, namely "stacked" dipoles with reflectors with, usually, primarily excited dipoles and reflectors, and Yagi aerial systems including dipoles with reflectors and directors with primarily excited dipoles and parasitically excited reflectors and directors.

The present invention will be completely understood by reference to the following detailed description which is accompanied by a drawing in which Figures 1 and 2 illustrate diagrammatically, for the purposes of explanation of the present invention, two known types of antenna construction, while Figure 3 illustrates in perspective an embodiment of the present invention, and Figures 4 and 5 illustrate modifications of portions of the embodiment of Figure 3.

In Figure 1, which illustrates a system of "stacked" dipoles with reflectors, the primarily excited dipole aerials are indicated by the reference *As*, and the primarily excited dipole reflectors are indicated by the reference *Rs*. The feeder by which the aerials are excited is indicated by the reference *Fa*, and the feeder by which the reflectors are excited is indicated by reference *Fr*. The spacing between dipoles of either array is indicated as being one half the operating wavelength

$$\left(\frac{\lambda}{2}\right)$$

and the length of each half of any dipole in either array is indicated as being approximately

$$\frac{\lambda}{2}$$

The feeders are crossed over from side to side of their respective arrays, that is corresponding halves of any two adjacent dipoles of either array are connected to a different one of the conductors of the feeder serving that array.

In Figure 2, which illustrates a Yagi aerial system, the dipole aerial is indicated by the reference *Ay*, the reflector by reference *Ry*, and a number of directors by reference *Dy*. The feeder by which the dipole aerial is excited is indicated by reference *Fa*. The dipole aerials and the reflector and directors are arranged in a common plane and are each, as indicated, approximately

$$\frac{\lambda}{2}$$

in length.

The first system has the advantage of good directional qualities but involves a comparatively complicated feeding system which detracts from simple mechanical construction, and the second system has the advantage of simpler mechanical construction but comparatively limited directional qualities.

The directional aerial system of the present invention has better directional qualities than the Yagi system and is of simpler mechanical construction than the "stacked" dipole system. It may be regarded as a development of either of those systems.

According to the invention, a directional aerial system includes a plurality of dipole aerials mounted in spaced relationship relatively to each other with their centres on a common straight line and disposed all in a common plane, there being associated with and disposed parallel to each dipole one reflector and at least one director, all the reflectors being situated on one side of the assemblage of dipole aerials and spaced therefrom and from each other, and all the directors being situated on the other side of the assemblage of dipole aerials and spaced therefrom and from each other, the spacing between adjacent reflectors and between adjacent directors being the same as that between adjacent dipoles and wherein one half of each dipole aerial is connected near its centre to one conductor of a feeder and the other half is connected near its centre to the other conductor of the feeder.

The spacing between adjacent dipole aerials and consequently between adjacent reflectors and between adjacent directors may be substantially half a wavelength at the working frequency and corresponding halves of any two adjacent dipole aerials be connected to a different one of the conductors of the feeder, or the spacing between adjacent dipole aerials and consequently between adjacent reflectors and between adjacent directors may be substantially a whole wavelength at

the working frequency and the corresponding halves of all the dipole aerials be connected to the same conductor of the feeder.

The invention is illustrated in Figures 3, 4 and 5 of the accompanying drawing.

In all these figures, the dipole aerials are indicated by the reference *Ai*, and the feeder by which the dipole aerials are excited is indicated by the reference *Fa*.

In Figure 3, the reflectors are indicated by the reference *Ri*, and the directors by the reference *Di*. The reflectors and directors are not reproduced in Figure 4 or 5.

In Figures 3 and 4, the spacing between adjacent dipole aerials and consequently that between adjacent reflectors and that between adjacent directors is indicated as being one-half of the operating wave-length and corresponding halves of any two adjacent dipole aerials are consequently indicated as being connected to a different one of the conductors of the feeder *Fa*.

In Figure 5, the spacing between adjacent dipole aerials and consequently that between adjacent reflectors and that between adjacent directors is indicated as being one wavelength and corresponding halves of any two adjacent dipole aerials are consequently indicated as being connected to the same one of the conductors of the feeder *Fi*.

The dipole aerials *Ai*, which may be adjustable in length, and may consist of metal rods are shown as fixed at their centres to a mast or standard *Mi* which may be of metal and earthed.

The reflectors *Ri* and directors *Di*, which also may be adjustable in length and may likewise consist of metal rods, are shown as fixed at their centres to brackets *Bi* which may be of metal and supported from the mast or standard.

In Figures 3 and 5, open wire balanced feeders are indicated. The mast or standard may, however, be a hollow metal tube with the feeder accommodated inside the tube, as indicated in Figure 4, insulating glands *g* being provided in the tube whereby connecting stubs *s* may be brought to the outside for connection to the dipole aerials.

The dipole aerials may be disposed horizontally one above the other and a number of systems are arranged side by side and fed, when the systems are in operation for transmission, in phase.

The lengths of reflectors and directors and their spacing from their associated dipoles are adjusted to give the required performance. The directors will usually be shorter than a half wavelength and the spacing from the exciting dipole will be between one-tenth and one-twentieth of the operating wavelength. The reflector will normally be longer than a half wavelength and the spacing from the exciting dipole will be between one-tenth and one-fifth of the operating wavelength.

What is claimed is:

1. A directional aerial system including a plurality of dipole aerials mounted in spaced relationship relatively to each other with their centres on a common straight line and disposed all in a common plane, wherein there is associated with and disposed parallel to each dipole one reflector and at least one director, all the reflectors being situated one one side of the assemblage of dipole aerials and spaced therefrom and from each other, and all the directors being situated on the other side of the assemblage of dipole aerials and spaced therefrom and from each other, the spacing between adjacent reflectors and between adjacent directors being the same as that between adjacent dipoles, and wherein one half of each dipole aerials is connected near its centre to one conductor of a feeder and the other half is connected near its centre to the other conductor of the feeder.

2. A system as claimed in claim 1, wherein the spacing between adjacent dipole aerials and consequently between adjacent reflectors and between adjacent directors is substantially half a wavelength at the working frequency and corresponding halves of any two adjacent dipole aerials are connected to a different one of the conductors of the feeder.

3. A directional aerial system including a plurality of dipole aerials conductively mounted in spaced relationship relatively to each other with their centres along a common vertical supporting mast and disposed all in a common plane, wherein there is associated with and disposed parallel to each dipole one reflector and at least one director, all the reflectors being situated on one side of the assemblage or dipole aerials and spaced therefrom and from each other, and all the directors being situated on the other side of the assemblage of dipole aerials and spaced therefrom and from each other, the spacing between adjacent reflectors and between adjacent directors being the same as that between adjacent dipoles, and wherein one half of each dipole aerial is connected near its centre to one conductor of a feeder and the other half is connected near its centre to the other conductor of the feeder, said directors and reflectors being conductively mounted on conductive arms at substantially their mid-point, said arms being conductively mounted on said mast.

4. A directional aerial system including a plurality of dipole aerials conductively mounted in spaced relationship relatively to each other with their centres along a common vertical supporting mast and disposed all in a common plane, wherein there is associated with and disposed parallel to each dipole one reflector and at least one director, all the reflectors being situated on one side of the assemblage or dipole aerials and spaced therefrom and from each other, and all the directors being situated on the other side of the assemblage of dipole aerials and spaced therefrom and from each other, the spacing between adjacent reflectors and between adjacent directors being the same as that between adjacent dipoles, and wherein one half of each dipole aerial is connected near its centre to one conductor of a feeder and the other half is connected near its centre to the other conductor of the feeder, said mast being hollow, the conductors of said feeder passing longitudinally through the length of said mast.

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