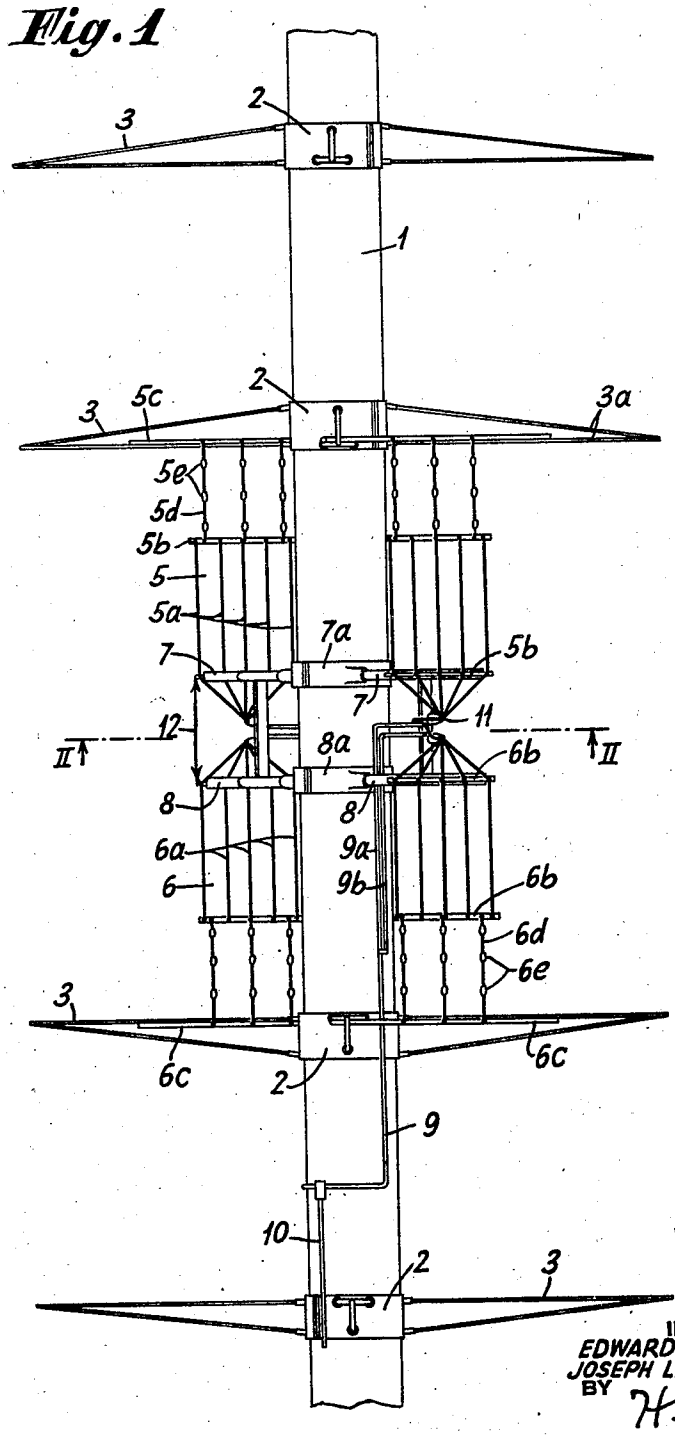
June 9, 1942. E. C. CORK ET AL 2,285,395

AERIAL OR AERIAL SYSTEM

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Fig. 1



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Fig. 2

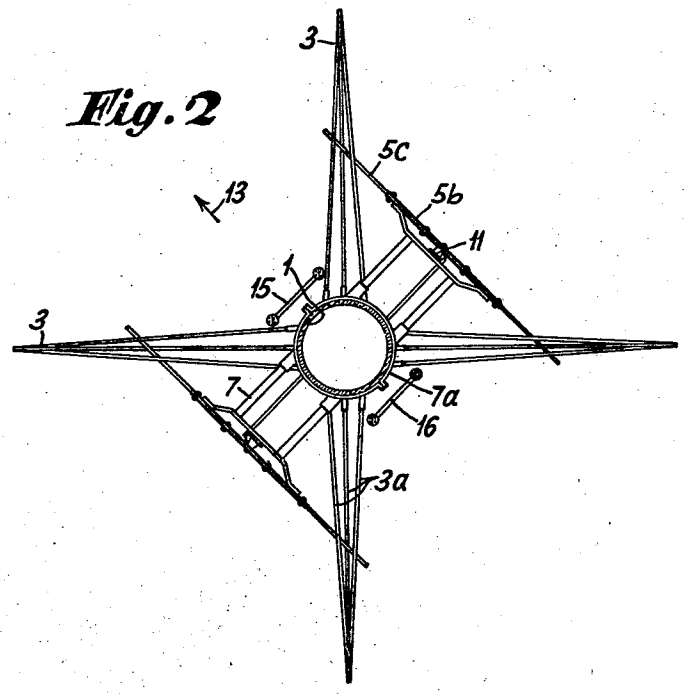
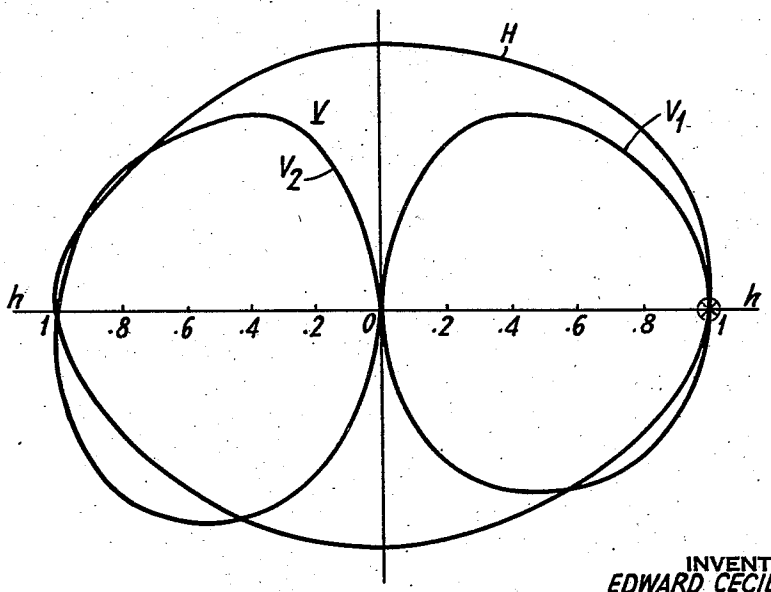


Fig. 3



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UNITED STATES PATENT OFFICE

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AERIAL OR AERIAL SYSTEM

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Application November 29, 1939, Serial No. 306,594
In Great Britain December 19, 1938

13 Claims. (Cl. 250—33)

The present invention relates to aerials and aerial systems for radio transmitters or receivers and is more especially but not exclusively applicable to aerials or aerial systems for use in the transmission and reception of signals in the so-called ultra-short wave bands, for example, such as are used in television signal transmission.

In the specification of our co-pending patent application No. 279,244, filed June 15, 1939, aerials or aerial systems are described comprising a single tubular shell or a plurality of shells or a conductor system equivalent to a tubular shell or shells surrounding a metal mast. These aerials or aerial systems are primarily intended for use on ships and in installing them, in some cases, difficulties have been experienced owing to the necessity of providing space for ladders to afford passage-way up and down the mast.

The object of the present invention is to provide an aerial or aerial system for ultra-short wave working which may be mounted on a single metal mast in such manner as to be capable of radiating signals in all directions horizontally at useful strength, and to allow for the accommodation of ladders or other obstruction on the mast in the vicinity of the aerial or aerial system.

According to the present invention an aerial system for transmitting or receiving signals over a wide band of frequencies is provided comprising a pair or pairs of radiating elements mounted on an electrically conducting mast, the units of each pair being disposed about the mast on opposite sides thereof and each element presenting a large area in a direction perpendicular to a diametral plane through the mast.

In a preferred form of the invention an aerial system for transmitting or receiving signals over a wide band of frequencies is provided comprising a pair or pairs of oppositely disposed radiating elements mounted on an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being small compared with said wave length and the transverse dimensions of the elements being large relative to said spacing, the arrangement being such that in operation the aerial system has a circular or nearly circular radiation diagram in a plane perpendicular to the axis of the mast in respect of signals in said band of frequencies.

The nature of the invention and the method of carrying the invention into effect will be fully understood from the following description of a specific example with reference to the accompanying drawings of which—

Figure 1 is a side elevational view of an aerial system according to the invention and its supporting mast.

Figure 2 is a plan view in section through the line II—II of Figure 1, and

Figure 3 is a graph showing the directional characteristics of the radiation obtained using an aerial as shown in the preceding figures.

Referring to Figures 1 and 2, and more especially to Figure 1, it will be seen that the aerial is supported on a tubular steel mast 1, which has mounted on it four collars 2 from each of which project four structures 3 which each constitute a quarter wave earthing bar. The separation between each of the two uppermost and the two lowermost collars 2 is one quarter wave length and the separation between the intermediate pair of collars 2 is somewhat greater than one half wave length.

Supported between adjacent pairs of the intermediate earthing bar structure 3 are upper and lower sets 5 and 6 of aerial conductors each approximately one eighth of a wave length long and each set comprising five conductors 5*a* or 6*a* (see Figure 1), assembled between pairs of cross-bars 5*b* and 6*b* in such manner that each set forms a rectangular mat-like structure simulating a continuous conductive surface. The upper cross-bars 5*b* of aerials 5 are each suspended from a rod 5*c* supported on an adjacent pair of the upper intermediate earthing bar structure 3 by means of insulated suspension wires 5*d* provided with egg insulators 5*e*, whilst the lower cross-bars 5*b* of aerials 5 are supported on brackets 7 extending from clamping ring 7*a* secured on the mast, the length of suspension wires 5*d* and the position of clamping ring 7*a* being such that the conductors 5*a* are held under sufficient tension to maintain them extended.

The upper cross-bars 6*b* of aerials 6 are carried on brackets 8 extending from a clamping ring 8*a* similar to the arms 7 and ring 7*a* provided for the lower bars 5*b*, and the lower cross-bars 6*b* are connected to rods 6*c* by insulated wires 6*d* having egg insulators 6*e* similar to the wires 5*d* and insulators 5*e* by which the aerials 5 are suspended, aerial conductors 6*a* being also maintained under sufficient tension to keep them extended.

The lower ends of aerial conductors 5*a* and the upper ends of aerial conductors 6*a* are connected to branches 9*a* and 9*b* respectively of quarter wave length feeders 9 of the concentric

conductor type which extend one up each side of the mast 1 from a common feeder 10, each branch 9a and 9b being one quarter of a wavelength long and only the branch 9a being provided with a core. The connections of the feeders 9 to the aerials 5 and 6 respectively, is effected at the anchorages afforded by insulators 11 provided on the mast as shown in Figure 1, the method of connection being as illustrated in Figure 2 of United States Patent No. 2,127,088, granted August 16, 1938, to W. S. Percival et al., whereby transmission of current down the outside of either feeder 9 is prevented.

The aerials 5 and 6 are supported at a distance of approximately one tenth of a wave length from the mast 1, the gap such as 12 in Figure 1 between each aerial 5 and the corresponding aerial 6 being approximately one eighth of a wave length, and the distance between the outer conductors 5a or 6a as the case may be, being slightly greater than the diameter of mast 1, and such that outer parts of the aerial mats 5 and 6 are located at a distance of an eighth of wavelength from the mast 1.

With the above arrangement voltage antinodes tend to be set up in the region of the intermediate collars but are substantially suppressed due to the earthing effect of the structures 3. Similarly the potential fluctuations in the vicinity of the upper and lower collars 2 are suppressed and transmission of energy along the mast beyond these collars is substantially prevented.

As the distance between mast 1 and aerials 5 and 6 is about one tenth of a wave length and the aerials are plane and symmetrically disposed about the mast, the side elements 5a and 6a of the aerials 5 and 6 will be spaced from the mast 1 by approximately one eighth of a wave length, so that, owing to the reflective effect of the mast 1, the radiation from the side elements of each aerial 5 or 6 is a maximum. Effective radiation also takes place from the part of the mast 1 between the rings 7a and 8a. The net result is to give a horizontal radiation diagram for the aerial system shown of the form indicated by the curve H in Figure 3. In this figure the horizontal axis Oh corresponds with the direction indicated by arrow 13 in Figure 2.

A typical vertical radiation characteristic is shown by the curve V having lobes V_1 and V_2.

With the arrangement described above ladders may be arranged at either side of the mast, for example, at 15 or 16 (see Figure 2) without interfering with the aerial structure in any way.

As will be seen from Figures 1 and 2 the structures 3 each consist of three rods 3a radiating from the associated collar 2, the rods 3a being joined at their tips to form an elongated triangular pyramid shape structure. There is arranged in the tips of each pyramid structure 3 a conducting rod (not shown), for example, of brass, which may be screwed or slid in or out to adjust the effective length of the structure 3 to secure the most effective earthing of the mast thereby. A structure such as 3 may also be used for other purposes besides earthing.

Figures 1 and 2 are drawings approximately to scale of a specific form of the invention in which the diameter of the mast 1 is one foot and the radiation frequency of the aerial is 75 megacycles.

It will be appreciated that the scope of the invention is not restricted to the details of construction shown in the drawings. For example, aerials 5 or 6 may be formed of continuous conductive sheets or gauze. Moreover, different forms of earthing bars 3 may be used.

We claim:

1. An aerial system for transmitting or receiving signals over a wide band of frequencies, said systems comprising one or more pairs of radiating elements mounted on an electrically conducting mast, the elements of each pair being disposed about the mast on opposite sides thereof and each element comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end, the length of said conductors being of the order of an eighth of the mean operating wavelength.

2. An aerial system for transmitting or receiving signals over a wide band of frequencies, said systems comprising one or more pairs of radiating elements mounted on an electrically conducting mast, the elements of each pair being disposed about the mast on opposite sides thereof and each element comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end, the length of said conductors being of the order of an eighth of the mean operating wavelength and means for energizing said element connected to one end thereof, said mast being effectively earthed at points located at distances of a quarter and a half of the mean operating wavelength above and below the level of the connection of said energizing means.

3. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of dipole radiators mounted on an electrically conducting mast, the dipoles of each pair being disposed about the mast on opposite sides thereof and each dipole comprising a pair of groups of parallel co-planar conductors, the conductors of one group being arranged in an end-on relationship with respect to the conductors of the other group, the conductors of each group being conductively connected at each end, the length of said conductors being of the order of an eighth of the mean operating wavelength.

4. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of dipole radiators mounted on an electrically conducting mast and parallel thereto, the dipoles of each pair being disposed about the mast on opposite sides thereof and each dipole comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end, the length of said conductors being of the order of an eighth of the mean operating wavelength and means for energizing said radiator connected to adjacent ends of said groups of conductors.

5. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed radiating elements mounted on an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being substantially less than a quarter of the mean operating wavelength and the transverse dimensions of said elements being of the order of said spacing, each of said elements comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end.

the length of said conductors being of the order of an eighth of the mean operating wavelength.

6. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed radiating elements mounted on an electrically conducting mast which also serves as a radiator, each of said elements comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end, the length of said conductors, the spacing of each element from the mast, the diameter of the mast and the transverse dimensions of said elements being of the order of an eighth of the mean operating wavelength and means for energizing each of said elements connected to one end thereof.

7. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed dipole radiators mounted parallel to an electrically conducting mast which also serves as a radiator, each of said dipole radiators comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end, the length of said conductors, the spacing of each element from the mast, the diameter of the mast and the transverse dimensions of said dipole radiators being substantially of the order of an eighth of the mean operating wavelength.

8. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed dipole radiators mounted parallel to an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being of the order of an eighth of the mean operating wavelength and the transverse dimensions of said dipole radiators being substantially of the order of said spacing, each of said dipole radiators comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end and means for energizing each of said radiators connected to adjacent ends of the groups of conductors of each radiator, said mast being effectively earthed at points located at distances of a quarter and a half of the mean operating wavelength above and below the level of the connection of said energizing means.

9. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed radiating elements mounted on an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being substantially less than a quarter of the mean operating wavelength and the transverse dimensions of said elements being of the order of said spacing, each of said elements comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end.

10. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed radiating elements mounted on an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being small compared to the wavelength at the mid-frequency of said band and the transverse dimensions of said elements being of the order of said spacing, each of said elements comprising a plurality of parallel co-planar conductors, said conductors being conductively connected at each end.

11. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed dipole radiators mounted parallel to an electrically conducting mast which also serves as a radiator, each of said dipole radiators comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end, the length of said conductors, the spacing of each element from the mast, the diameter of the mast and the transverse dimensions of said dipole radiators being small compared to the wavelength at the mid-frequency of said band.

12. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed dipole radiators mounted parallel to an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being small compared to the wavelength at the mid-frequency of said band and the transserve dimensions of said dipole radiators being substantially of the order of said spacing, each of said dipole radiators comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end and means for energizing each of said radiators connected to adjacent ends of the groups of conductors of each radiator.

13. An aerial system for transmitting or receiving signals over a wide band of frequencies, said system comprising one or more pairs of oppositely disposed dipole radiators mounted parallel to an electrically conducting mast which also serves as a radiator, the spacing of each element from the mast and the diameter of the mast being small compared to the wavelength at the mid-frequency of said band and the transverse dimensions of said dipole radiators being substantially of the order of said spacing, each of said dipole radiators comprising a pair of groups of parallel co-planar conductors, the conductors of one group being co-linearly arranged with respect to the conductors of the other group, the conductors of each group being conductively connected at each end and means for energizing each of said radiators connected to adjacent ends of the groups of conductors of each radiator, said mast being effectively earthed at points located at distances of a quarter and a half of the means operating wavelength above and below the level of the connection of said energizing means.

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