

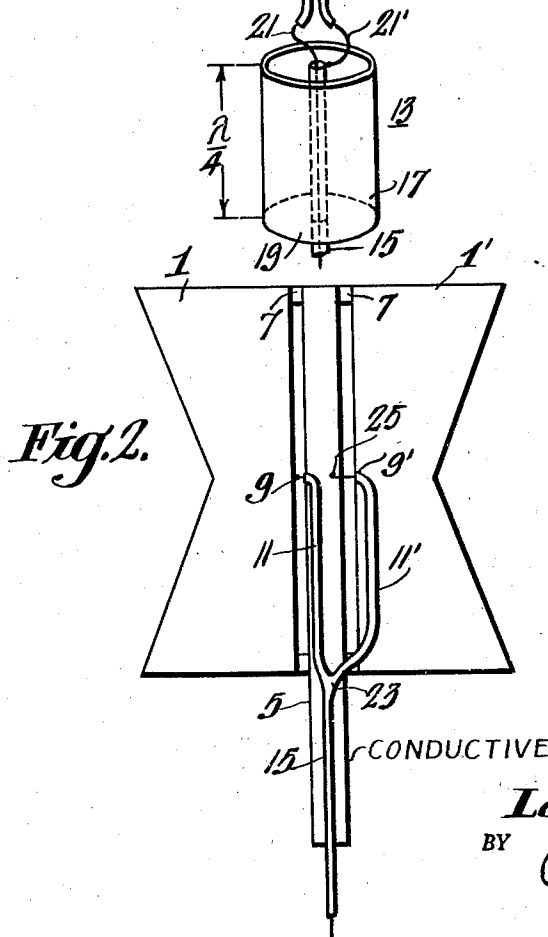
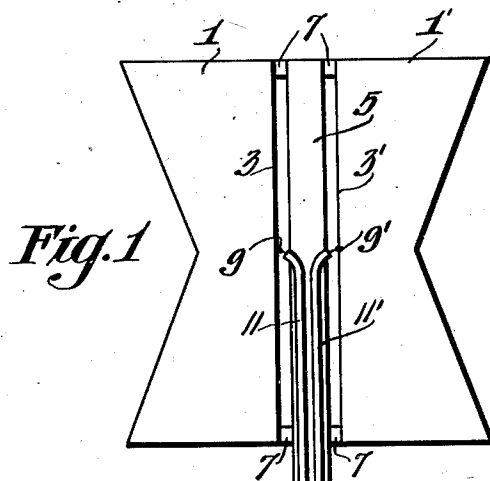
Dec. 23, 1947.

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2,433,183

ANTENNA SYSTEM

Filed Feb. 27, 1945



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2,433,183

ANTENNA SYSTEM

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Application February 27, 1945, Serial No. 579,983

7 Claims. (Cl. 250—33)

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This invention relates to antenna systems, and has for its principal object the provision of improved feed means for antennas of the sheet radiator type, such as those described in copending U. S. applications Ser. Nos. 574,898 and 574,899, filed January 27, 1945, by Robert W. Masters and entitled Antenna.

The invention will be described with reference to the accompanying drawing, of which

Figure 1 is a schematic view in elevation of an antenna of the aforementioned type, with a substantially conventional feed system in accordance with prior art, and

Figure 2 is a view similar to Figure 1 showing a sheet radiator antenna with improved feed means embodying the instant invention.

Referring to Figure 1, a dipole antenna of the type described in the above-mentioned copending applications is shown comprising a pair of flat conductive sheet radiator members 1 and 1', each including a substantially rectilinear longitudinal edge 3 and 3' respectively. The radiator elements 1 and 1' are supported upon a conductive mast 5 by means of brackets 7, at the upper and lower ends of the edges 3 and 3'. In addition to supporting the radiator elements, the brackets 7, 7 also serve to ground the upper and lower ends of the edges 3 and 3'. The radiators 1 and 1' are fed at the midpoints 9 and 9' of the respective edges 3 and 3' through coaxial transmission lines 11 and 11' respectively.

As in the more conventional types of dipole antennas, the two feed points must be energized 180° out of phase with one another. One prior art method of doing this includes the use of a line balance converter 13, including an unbalanced input line 15 and a pair of balanced line output terminals connected to the lines 9 and 9'. In the present illustration, the converter 13 comprises a tubular sleeve 17 surrounding the final quarter wave-length portion of the input line 15, and connected to the outer conductor thereof by a disc 19. The ends 21 and 21' of the inner and outer conductors respectively of the line 15 constitute the balanced output terminals of the converter 13.

In the operation of the system of Figure 1, energy applied to the unbalanced line 15 produces equal and opposite potentials at the points 21 and 21', in a manner well known to those skilled in the art. The points 9 and 9' are thereby energized through the lines 11 and 11' in phase opposition, as is required for proper operation of the antenna.

The outer sleeve 17 of the converter 13 co-

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operates with the outer conductor of the unbalanced line 15 to act as a short-circuited quarter wave coaxial line section connected between the terminal 21' and ground. At the resonant frequency of the converter, the impedance of this line section is substantially infinite, and therefore has no effect on the operation. However, at frequencies other than that at which the sleeve 17 is exactly one-quarter wavelength long, the reactance decreases to a value of the same order as the impedances of the lines 11, 11' and 15, causing unbalance of the voltages appearing at the points 21 and 21'. This effect may be compensated to some extent by any of several well known methods, but it is found that in substantially every such case, the band width throughout which the system will operate efficiently is limited by the use of the line balance converter. Also since the converter must necessarily be appreciably larger in diameter than the lines 11, 11' and 15, it is ordinarily necessary to place the converter at a point some distance from the radiators 1 and 1', extending both lines 11 and 11' to this point.

In accordance with the present invention, the line balance converter and any equivalent external apparatus is omitted, and the line 15 is extended up the mast 5 to a point 23 adjacent the lower ends of the radiators 1 and 1', as shown in Figure 2. The feed line 11 is connected as before to the midpoint of the radiator 1 and is connected to the main feed line 15 at the point 23. The feed line 11' however, is now brought across the lower bracket 7 to the surface of the radiator 1' and extends along the lower portion of the surface to the feed point 9'. At this point the outer conductor of the line 11' is connected to the radiator 1'. The inner conductor of the line 11' extends across to a point 25 on the mast 5, adjacent the point 9'.

In the operation of the system of Figure 2, the point 9 is fed directly from the main feed line 15 through the line 11. The radiator 1' is fed as follows: Current can flow from the point 23 through the inner conductor of the line 11' to the point 25 only to the extent that current flows in the opposite direction on the inner surface of the outer conductor of the line 11'. This return current must come from the radiator element 1' at the point 9'. Similarly, when current is flowing down from the point 25 to the point 23, an equal current must flow up the inside of the outer conductor of the line 11 to the feed point 9'. The line sections 11 and 11' are made of equal lengths. Thus the points 9 and 9' are excited in opposite phase. Since the outer conductor of the line 11'

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is connected to the surface of the radiator 1' between the lower bracket 7 and the feed point 9', it is in effect a part of the radiator 1', so that the same impedance is presented between the point 9' and ground as appears between the point 9 and ground. Practically the same result will be obtained if the line 11' is connected only to the point 9', providing it lies fairly close to the surface of the radiator 1'.

The invention has been described as an improved feed system for dipole antennas of the sheet radiator type, wherein the use of a line balance convertor or equivalent additional structure is not required. The necessary conversion is obtained by interchanging the connections at the radiator end of one of the feed lines, connecting the outer conductor to the radiator and grounding the inner conductor. The feed point end of the outer conductor is isolated from ground by placing the line along the surface of the radiator element so that the normal impedance of the radiator appears between the end of the outer conductor and ground. Although the invention has been illustrated as embodied in a particular type of sheet structure, it will be apparent without further description that the invention may be applied equally well to other types of sheet radiator dipoles, or any dipole structure wherein each of the radiator elements is grounded at at least one point and fed at another point.

I claim as my invention:

1. A radio antenna including a pair of sheet radiator elements with respective feed points to be fed 180 degrees out of phase with each other, a coaxial line having its inner conductor connected to said feed point of one of said radiator elements, a second coaxial line extending along the surface of the other of said radiator elements with its outer conductor connected to the feed point of said other element and its inner conductor connected to the outer conductor of said first coaxial line, and a transmission line connected to both of said coaxial lines in parallel.

2. A radio antenna including at least one pair of radiator elements, each having at least one grounded point and one feed point, a coaxial line having its outer conductor grounded at one of said ground points and its inner conductor connected to one of said feed points, a second coaxial line with its outer conductor grounded at the other of said ground points and disposed along the corresponding radiator, with its outer conductor also connected to the feed point of said radiator, and its inner conductor grounded at a point adjacent said feed point of said radiator, and common feed means connected to both of said coaxial lines.

3. A radio antenna including at least one pair of radiator elements, each having at least one grounded point and one feed point, a coaxial line having its outer conductor grounded at one of said ground points and its inner conductor connected to one of said feed points, a second coaxial line with its outer conductor grounded at the other of said ground points and disposed along and connected to the corresponding radiator, with its outer conductor also connected to the feed point of said radiator, and its inner conductor grounded at a point adjacent said feed point of said radiator, and common feed means connected to both of said coaxial lines.

4. An antenna system including a common feed point, a pair of radiator elements each having at

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least one grounded point and one feed point, a coaxial line including an inner conductor connected to said common feed point and to the feed point of the first of said radiator elements, and a grounded outer conductor, a second coaxial line including an inner conductor connected at one end to said common feed point and at the other end to ground at a position adjacent the feed point of the second of said radiator elements, and an outer conductor grounded at its end adjacent said common feed point and connected to the feed point of said second radiator element.

5. A radio antenna including at least one pair of radiator elements, each of said elements having at least one substantially rectilinear edge, conductive means for supporting said elements with said respective rectilinear edges adjacent one another, a coaxial transmission line extending along said supporting means, with the end of its inner conductor connected to the midpoint of the rectilinear edge of one of said elements, a second coaxial transmission line extending along the surface of the other of said elements with its outer conductor connected to said surface and its inner conductor connected to said supporting means at a point adjacent the midpoints of said rectilinear edges, and common feed means connected to both of said coaxial lines.

6. A radio antenna including at least one pair of radiator elements, each of said elements having at least one substantially rectilinear longitudinal edge, conductive means for supporting said elements with said respective rectilinear edges parallel and adjacent one another, a coaxial transmission line extending along said supporting means, with the end of its inner conductor connected to the midpoint of the rectilinear edge of one of said elements, a second coaxial transmission line extending along the surface of the other of said elements with its outer conductor connected to said surface and its inner conductor connected to said supporting means at a point adjacent the midpoints of said longitudinal edges, and common feed means connected to both of said coaxial lines.

7. A radio antenna including at least one pair of coplanar flat sheet radiator elements, each of said elements having at least one substantially rectilinear longitudinal edge, conductive means for supporting said elements with said respective rectilinear edges parallel and adjacent one another, a coaxial transmission line extending along said supporting means, with the end of its inner conductor connected to the midpoint of the rectilinear edge of one of said elements, a second coaxial transmission line extending along the surface of the other of said elements with its outer conductor connected to said surface and its inner conductor connected to said supporting means at a point adjacent the midpoints of said longitudinal edges, and transmission line means connected to both of said coaxial lines in parallel.

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