

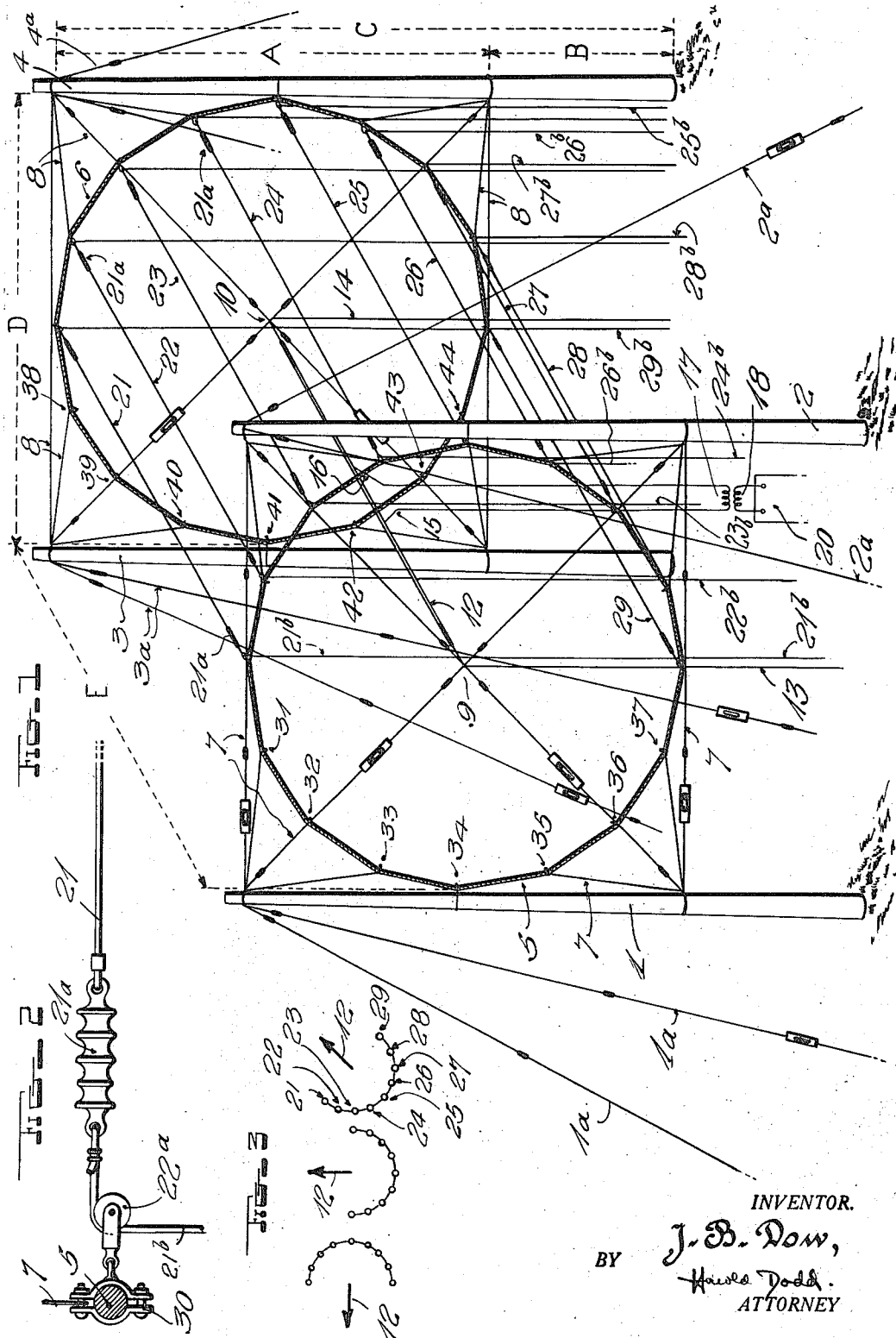
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ANTENNA SYSTEM

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1,928,645

ANTENNA SYSTEM

Jennings B. Dow, Alexandria, Va.

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5 Claims. (Cl. 250—11)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

My invention relates broadly to directional radio communication systems and more particularly to the construction of an antenna for use in such systems.

5 One of the objects of my invention is to provide a construction of beam antenna system for operation in directional signaling systems having a minimum number of parts and adapted to be readily erected and adjusted.

10 Another object of my invention is to provide a simplified construction of beam antenna for directive signaling systems adapted to be readily adjusted for both long and short wave transmission and having means for adjusting the direction in which the antenna may be selectively operated.

Still another object of my invention is to provide a construction of beam antenna wherein a multiplicity of reradiator elements may be supported adjacent an antenna in such manner that the position thereof may be readily changed for selectively fixing the direction in which the antenna is effective.

20 A further object of my invention is to provide a construction of beam antenna which may have the directional characteristic thereof selectively adjusted by altering the position of reradiating elements adjacent the antenna conductor in different angular relationships for effecting the signaling characteristic of the antenna.

Other and further objects of my invention reside in the construction of a beam antenna system as set forth more fully in the specification hereinafter following by reference to the accompanying drawing, in which:

35 Fig. 1 is a perspective view of the beam antenna system of my invention; Fig. 2 is a fragmentary view showing one method which I employ for removably supporting the reradiator elements of the beam antenna system; and Fig. 3 is a theoretical view illustrating the position of the reradiator conductors for selectively fixing the directional characteristics of the antenna.

45 The beam antenna system of my invention has been developed for use in the directional signaling system set forth more fully in my application No. 470,162, filed July 23, 1930. The beam antenna of my invention is adapted for both transmission and reception directionally. For purposes of explaining the construction of the antenna system of my invention I shall describe the beam antenna particularly in connection with a transmission system.

55 The beam antenna of my invention requires only four rigid supporting members for the erection of the beam antenna for the longest waves likely to be used. Heretofore it has been proposed to erect large structures which are actually shifted on a car running upon rails for the purpose of changing the directional characteristics of the antenna. My invention contemplates the erection of rigid supports without the necessity of erecting a system of rails and mounting the antenna upon a moving car structure operative upon such rails. The directivity of the beam antenna of my invention is controlled by a multiplicity of reradiator elements which are disposed in a portion of a cylindrical envelope surrounding the antenna conductor. The reradiator elements are removable from one position to another about the antenna conductor for selectively fixing the directional characteristics of the antenna.

Referring to the drawing in more detail, the four rigid supports employed in the beam antenna system of my invention are shown in the form of masts erected at 1, 2, 3 and 4 in the ground. I provide means for supporting a substantially circular frame member 5 between masts 1 and 2. A similar frame member is supported between masts 3 and 4 as represented at 6. The frame members 5 and 6 may be formed from wire or rope suspended in substantially cylindrical contour as shown. This is accomplished by means of the guys or stays 7 and 8 extending from the opposite masts and connected to a multiplicity of points about the frame members as shown. By providing a substantial network of guys or stays 7 and 8 between masts 1 and 2 and masts 3 and 4, the shape of frames 5 and 6 is made to more nearly approach a circle. The stays 7 connect with the frame 5 tending to stretch frame 5 in a substantially circular shape. Similarly the stays 8 extending from masts 3 and 4 suspend the frame 6 in a substantially circular shape and by increasing the number of such stays the shape is made to more nearly approach a circle. The mast 1 is maintained in a vertical position by guys represented at 1a suitably broken at intervals with insulators. The mast 2 is suitably erected by guys 2a broken at intervals by insulators. Similarly mast 3 is erected by means of guys 3a, and mast 4 is erected by guys 4a suitably broken by insulators. The stays 7 and 8 intersect each other at the positions indicated at 9 and 10 and at these points of juncture I provide means for suspending the antenna conductor 12. Suitable pulleys are suspended between stays 7 and 8 at the positions 9 and 10 through which the ropes or halyards 13 and 14

pass for raising the antenna conductor 12 in substantially horizontal position. The antenna conductor is insulated at opposite ends as indicated. Leads 15 and 16 connect with the antenna conductor 12 and lead downwardly to the coupling inductance 17 which is coupled with inductance 18 leading to the circuit of the signaling apparatus 20.

In the arrangement illustrated the antenna is connected as a doublet for transmission of signaling energy. Other forms of connection between the antenna and the signaling apparatus may be employed if desired. The reradiator elements are adapted to be hoisted into position at selected intervals around the frame members 5 and 6. I have indicated the reradiator elements at 21, 22, 23, 24, 25, 26, 27, 28 and 29. Each reradiator element is constituted by a horizontally disposed conductor extending parallel to the antenna conductor 12. The reradiator elements are all adapted to be individually and removably mounted between the frame members 5 and 6 by halyards passing over pulleys and insulatingly connected with the ends of the reradiator elements. The reradiator element 21 is connected to insulators 21a at each end thereof. The halyards 21b are connected to the end of each of the insulators adjacent the remote ends of the reradiator element 21 as shown more clearly in Fig. 2. The pulley 22a is secured to frame member 5 by means of clamp 30. A similar arrangement is provided at the opposite end of the antenna system so that each reradiator element may be readily hoisted into position or removed from position for installation in another angular position with respect to the antenna conductor. For this purpose halyards are provided for each of the reradiator elements represented at 22b, 23b, 24b, 25b, 26b, 27b, 28b and 29b. Pulleys of the kind illustrated at 22a in Fig. 2 may be mounted at each point of intersection of the stays 7 with the frame member 5, and at each point of intersection of the stays 8 with frame member 6 as I have represented at 31, 32, 33, 34, 35, 36 and 37 with respect to frame member 5, and at 38, 39, 40, 41, 42, 43 and 44 with respect to frame member 6. Such an installation facilitates the removal of a reradiator element from one position, and the installation of such a reradiator element in another position according to the direction at which the signaling energy is to be propagated as represented in the several examples indicated at Fig. 3. In Fig. 3, the antenna conductor is represented at 12 and the arrow extending therefrom serves to indicate the direction of propagation of the signaling energy due to the effect of the reradiator elements upon the antenna conductor.

The dimensions of the antenna system of my invention depend upon the frequency at which the system must operate. The minimum dimension indicated at A is substantially one half of the longest radio wave length for which the screen is designed. I have found it convenient to make dimension D substantially equal to A. Dimension B should preferably be great enough to permit the radiated beam to clear nearby objects such as buildings, etc., which might otherwise deflect the beam. The overall length of the antenna and screen in a horizontal direction is indicated by the dimension E.

While I have shown the antenna erected upon a horizontal axis, it will be understood that the antenna may be mounted on a vertical axis with the screen surrounding the antenna conductor and the directivity of the antenna controlled by

changing the positions of the reradiator elements. It will be observed that the antenna structure of my invention differs radically from beam antenna systems heretofore employed in that I provide an arrangement for shifting the individual reradiator elements constituting the screen, whereas heretofore elaborate structures have been required for shifting the entire mass of a reflector adjacent the antenna conductor.

The antenna system of my invention has proven highly practical in its construction and successful in its operation, and while I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and that no limitations upon my invention are intended other than are imposed by the scope of the appended claims.

The invention herein described may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. A directive antenna system comprising supporting means, a pair of substantially circular frame members carried by said supporting means, an antenna conductor extending axially of said frame members, pulley devices secured at spaced intervals around each of said circular frame members and a multiplicity of independently removable conductors insulatingly suspended through said pulley devices between said frame members, from each end thereof for controlling the directive signaling properties of said antenna conductor.

2. A directive antenna system comprising supporting means erected at spaced intervals, substantially circular frames carried by said supporting means, pulley devices secured at spaced intervals around each of said circular frames in alignment with each other an antenna conductor extending axially of said substantially circular frames, and a plurality of independently removable auxiliary conductors suspended by said pulley devices and disposed around the peripheries of said substantially circular frames equidistant from said antenna conductor, for controlling the directive signaling properties of said antenna conductor.

3. A directive antenna system comprising supporting means erected at spaced intervals, substantially circular frames carried by said supporting means and disposed in substantially vertical planes parallel one to another, pulley devices mounted at spaced intervals around said circular frames an antenna conductor extending axially between said frames in substantially horizontal direction, and a plurality of independently removable auxiliary conductors individually suspended by said pulley devices as elements of a circular cylinder defined by said circular frames and insulated one from another, for controlling the directional properties of said antenna conductor.

4. A directive antenna system comprising supporting means erected at spaced intervals, a pair of substantially circular frames carried by said supporting means, a plurality of pulley devices secured at spaced intervals in similar positions around each of said circular frames, a plurality of independent reflecting conductor elements, a plurality of halyards equal in number to twice the number of reflecting conductor ele-

ments, each of said reflecting conductor elements being supported at each end by one of said halyards, each of said halyards passing through and being supported by a corresponding one of said pulley devices, whereby any of said reflecting conductor elements may be selectively brought into or removed from effective reflecting position by operating said halyards.

5. In a directive antenna system, supporting means erected at spaced intervals, a pair of substantially circular frames carried by said supporting means, an antenna element extending axially of said circular frames and normal to the planes thereof, a plurality of wire attachment

members disposed at spaced intervals in corresponding positions around each of said circular frames, a plurality of wire elements, each of said wire elements being connected at opposite ends thereof to the wire attachment members on said circular frames at spaced intervals one with respect to the other around said circular frames, and means for selectively mounting or removing said wire elements from said wire attachment members for selectively fixing the direction of propagation of electromagnetic waves from said antenna element.

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