

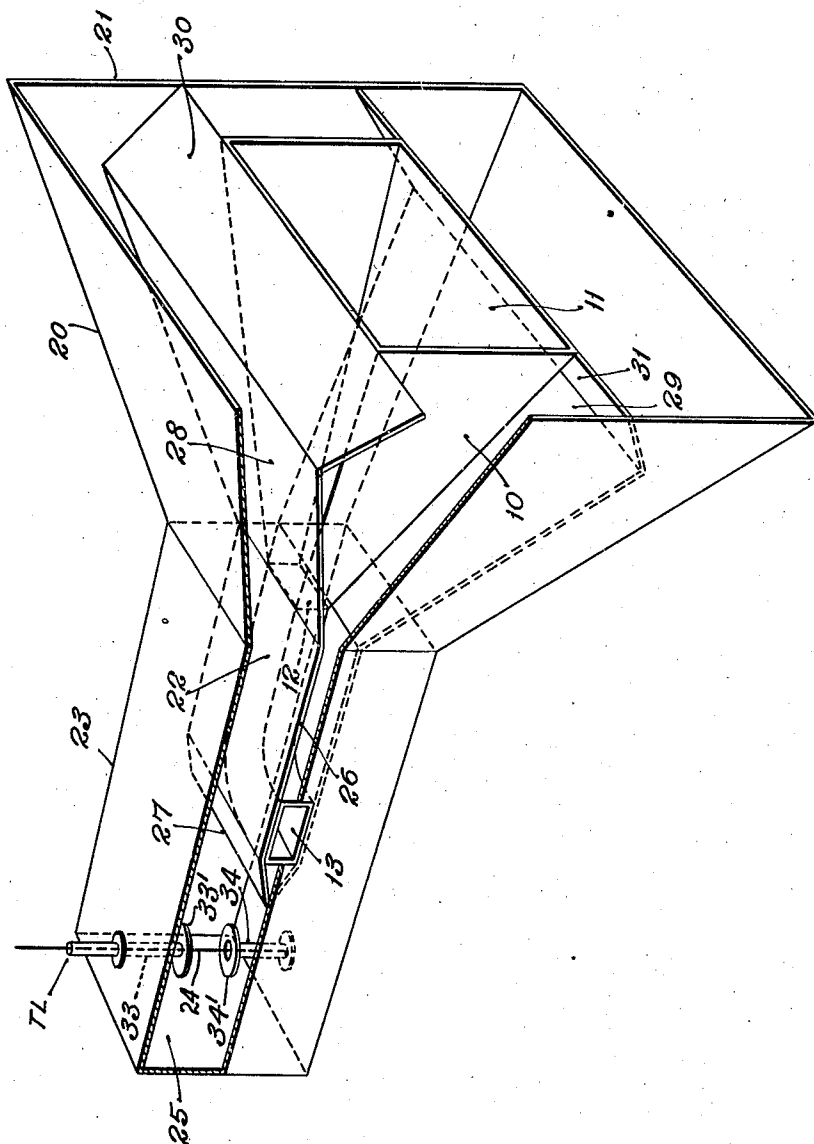
Aug. 12, 1947.

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2,425,488

HORN ANTENNA

Filed July 3, 1943



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UNITED STATES PATENT OFFICE

2,425,488

HORN ANTENNA

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Application July 3, 1943, Serial No. 493,366

4 Claims. (Cl. 250—11)

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The present invention relates to antennas and, more particularly, to horn antennas operative in the ultra high frequency spectrum.

In the past, as far as we are aware, antennas of the horn type have been designed for a single frequency. Hence, the simultaneous radiation or reception of two frequencies usually requires two separate horns. Since antennas for ultra high frequencies are usually located as high as possible above the earth the supporting structure requirements are increased by the requirement that a separate horn be used for each separate frequency.

An object of the present invention is to provide a single antenna structure which will radiate or receive two different frequencies each independently of the other.

Another object of the present invention is the provision of an antenna structure for plural frequency use which does not require complex supporting structure.

Still another object of the present invention is the improvement of the directivity of horn radiators.

A further object of the present invention is the provision of a simplified antenna structure for use on a plurality of frequencies.

The foregoing objects, and others which may appear from the following detailed description, are accomplished in a single horn structure by providing a pair of tapered wave guide structures, one for each of the two frequencies and placing the higher frequency wave guide structure within the lower frequency wave guide structure. The combination of the two structures is so arranged that the maximum direction of radiation or reception is directly ahead of the flared portion of the horn.

The present invention will be more fully understood by reference to the following detailed description which is accompanied by a drawing in which there is shown, in perspective, and partly in section, one specific embodiment of the invention.

In the figure there is shown a horn 10 having a mouth aperture 11 and a throat 12 for radiating or receiving the higher frequency of the pair of frequencies for which the system is designed. Horn 10 is located coaxially within the outer or low frequency horn 20. Horn 20 is provided with a large mouth aperture 21 and a smaller throat aperture 22. The high frequency horn is fed by a wave guide 13 connected to the throat aperture 12 and brought out to the desired transducer equipment. To the throat aperture 22 of

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the low frequency horn is connected one end of a wave guide structure 23, said wave guide being closed at the other end by a wall 25. In front of wall 25 is located an antenna 24 connected by means of transmission line TL to the desired transducer equipment for the lower frequency. The antenna element 24 is so located in front of wall 25 as to provide a proper termination of the concentric transmission line TL. Since it is desirable that the radiating element be rigidly screwed in a symmetrical position with respect to the interior partition 26 of wave guide 23, the outer shell of transmission line TL extends inwardly from the upper and lower walls of the guide 23 as indicated at 33 and 34. A desired length of the inner conductor is exposed in the central part to form the radiator 24. In order to electrically free the ends of radiator 24, the inner extending portions of the outer shell 33, 34, are arranged to have a length of the order of one quarter wavelength. Since the vertical height of wave guide 23 may not differ greatly from one half wavelength, in order to expose a sufficient portion of the inner conductor for radiator 24, part of the length of shell portions 33, 34 may be provided by discs 33' and 34'.

The low frequency wave guide 23 is divided into two ducts over a portion of its length by an inner horizontal dividing wall 26. The ducts extend horizontally from wall to wall of the wave guide 23 and are of uniform thickness up to the throat aperture 22 of the low frequency horn 20. The horizontal dividing wall 26 is preferably of such thickness that the wave guide 13 associated with the high frequency horn may be accommodated therewithin, thus preventing any irregularities or discontinuities within wave guide 23 which would tend to adversely affect its operation. For the same reason the dividing wall 26 at the end facing antenna 24 is provided with a tapered leading edge 27. The upper and lower ducts within wave guide 23, as has been mentioned, are of uniform thickness at the throat 22. Within horn 20 partitions 28 and 29 are provided to maintain this uniform thickness of the ducts as they approach the mouth of horn 20. At a suitable distance from mouth 21 of horn 20 the partitions 28 and 29 are bent toward each other, as indicated at 30 and 31, to provide a mouth flare so that each duct within horn 20 actually operates as a separate smaller horn, the two operating in parallel. While not so indicated, the open spaces between the vertical edges of horns 10 and 20 may be closed in the plane of mouth 21 by vertical walls to prevent undesired

resonance effects from the enclosed cavities formed at either side of horn 10. The higher frequency horn 10 operates in the usual manner well understood in the art. The lower frequency horn operates essentially as two horns in parallel. The two horns are in phase due to their common feed from antenna 24 and the identical lengths of the wave guide feeding the flared portions of the horns.

The example shown in the drawing is so disposed as to radiate or receive vertically polarized waves. The vertical directivity of the low frequency horn 20 is sharper on the main lobe than if the high frequency horn 10 were not present. By rotating the complete antenna system 90 degrees around the longitudinal axis, horizontally polarized waves may be radiated or received. In this case, the horizontal directivity of the low frequency horn is sharper on the main lobe than if the high frequency horn 10 were not present.

If it is desired to operate the present invention on a single frequency and obtain the sharper directivity feature just mentioned with respect to the low frequency horns, the higher frequency horn 10 may be omitted, thus resulting in a single frequency horn and associated wave guide divided into a plurality of smaller wave guides and horns energized in a parallel relationship.

While I have illustrated a particular embodiment of the present invention it should be clearly understood that it is not limited thereto since many modifications may be made in the several elements employed and in their arrangement and it is, therefore, contemplated by the appended claims to cover any such modifications as fall in the sphere and scope of the invention.

We claim:

1. A dual frequency horn radiator for ultra high frequency electromagnetic waves, including separate tapered horns each having mouth and throat apertures, said horns being located in coaxial interfitting relationship, means associated with the lower frequency one of said horns for dividing said lower frequency horn into a plurality of separate horns operating in parallel, wave guide structure and energy transducing means coupled to said throat aperture of said low frequency horn, means for dividing said wave guide structure into a pair of parallel guides, one associated with each of the said plurality of separate horns and wave guide structure coupled to the high frequency one of said horns and passing along said dividing means to the exterior of said first mentioned wave guide for coupling transducer equipment to said high frequency horn.

2. A dual frequency horn radiator for ultra high frequency electromagnetic waves, including separate tapered horns each having mouth and

throat apertures, said horns being located in coaxial interfitting relationship, means associated with the lower frequency one of said horns for dividing said lower frequency horn into a plurality of separate horns operating in parallel, wave guide structure and energy transducing means coupled to said throat aperture of said low frequency horn, means for dividing said wave guide structure into a pair of parallel guides, one associated with each of the said plurality of separate horns and wave guide structure coupled to the high frequency one of said horns and passing through said dividing means to the exterior of said first mentioned wave guide for coupling transducer equipment to said frequency horn.

3. A tapered horn radiator having mouth and throat apertures, wave guide and energy transducing means coupled to said throat aperture and transverse partitions across said horn and at least a portion of said wave guide structure for dividing said horn into a plurality of paths for electromagnetic energy operating in a parallel relationship, and a second horn radiator arranged between a pair of said transverse partitions in a coaxial intermitting relationship with said first mentioned horn radiator and means for coupling said second horn to energy transducing means.

4. A tapered horn radiator having mouth and throat apertures, wave guide and energy transducing means coupled to said throat aperture, transverse partitions being provided across said horn and at least a portion of said wave guide structure for dividing said horn into a plurality of paths for electromagnetic energy operating in a parallel relationship, a second horn radiator arranged between a pair of said transverse partitions in a coaxial interfitting relationship with said first mentioned horn radiator and means for coupling said second horn to energy transducing means, said last mentioned means including a wave guide structure coupled to the throat aperture of said high frequency horn and passing between the partitions in said first mentioned wave guide structure to the exterior thereof.

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