United States Patent

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[54] HF SUPERSTRUCTURE DISCONE ANTENNA

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[51] **Int. Cl.** **H01q 1/34**

[58] **Field of Search** 343/709, 710, 773, 846, 908

[56] **References Cited**

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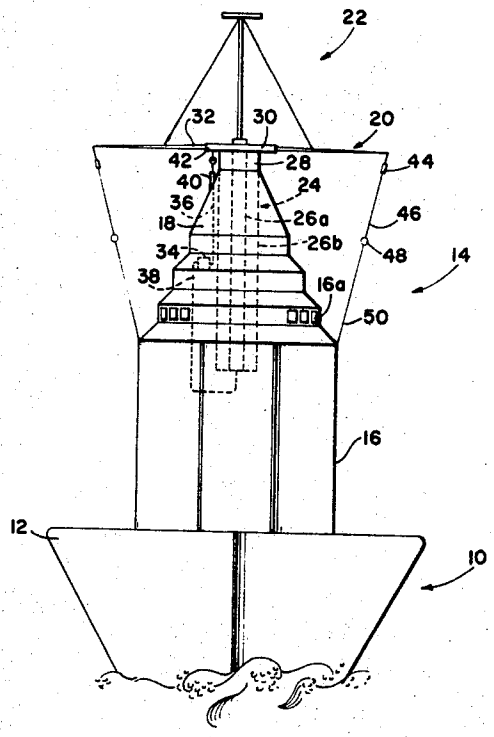
Primary Examiner—Eli Lieberman

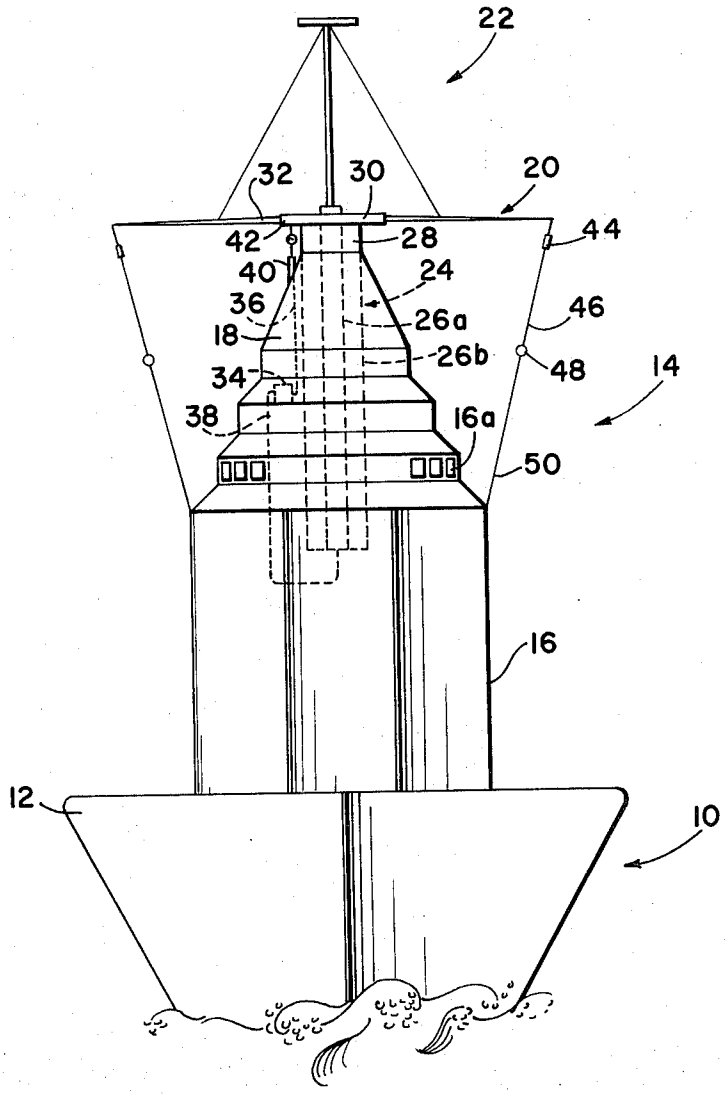
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[57] **ABSTRACT**

A superstructure discone HF antenna comprising a vertically oriented ship's superstructure and a discone antenna connected to and rigidly supported and mounted upon the top thereof to form a unitary radiating structure. By using a self-supporting superstructure as an integral component of the antenna, the number of possible HF parasitic radiators is reduced and limited topside space available on naval ships is more efficiently utilized.

4 Claims, 1 Drawing Figure





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AN HF SUPERSTRUCTURE DISCONE ANTENNA

STATEMENT OF GOVERNMENT INTEREST

The invention described herein 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 or therefor.

BACKGROUND OF THE INVENTION

Modern sophisticated naval ships include increasing numbers of electronic equipments and mechanical structures which must be located on the deck of ships. As more and more equipment and structures are required the availability of topside space necessarily becomes critical, consequently it has become necessary to design combined function equipment and to utilize topside existing structures to perform required electronic functions. In this respect, superstructures, masts, and towers on ships have been used to mount various HF radiators thereupon. The resulting environment of major parasitic radiators, however, has resulted in unacceptable radiation pattern control on most ships. Consequently it is an object of the present invention to disclose the concept for using a self-supporting superstructure on a ship as an integral component of a unitary HF antenna which can be used in a limited space environment on a ship's deck.

SUMMARY OF THE INVENTION

A unitary, self-supporting superstructure discone HF antenna is disclosed. The antenna comprises a vertically oriented superstructure having a selectively predetermined geometrical configuration upon which is mounted a discone antenna. The discone antenna which is electrically connected to the superstructure comprises a conically shaped component, a horizontally disposed disc, and a shunting stub consisting of two concentric hollow cylinders having a selectively predetermined length and a diameter ratio with respect to each other to thereby provide a shunt reactance which will allow the antenna to be matched to, for example, a 3:1 VSWR over approximately a 2 to 5.6 MHz frequency range. The superstructure can comprise any of several superstructures typically found on naval ships whereby the antenna disclosed herein can be used to advantage on ship decks where space requirements are critical. Other HF radiators can be mounted on or around the surface of the superstructure as has been done in the prior art.

OBJECTS OF THE INVENTION

It is the primary object of the present invention to provide a broadband HF antenna which includes a ship superstructure as an integral component thereof.

It is another object of the present invention to provide a superstructure discone antenna which can be used effectively in a limited space environment on a naval ship deck.

It is another object of the present invention to provide a superstructure discone antenna having improved radiation pattern characteristics achieved by reducing the number of mechanical structures acting as major parasitic radiators in the HF range.

Other objects, advantages and novel features of the invention will become apparent from the following detailed description of the invention when considered in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

The FIGURE is a simplified front-view of a naval ship having mounted upon the deck thereof broadband HF antenna embodying the present inventive concept.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The FIGURE is a simplified front-view of a naval ship **10** having mounted upon the deck **12** thereof broadband HF antenna **14** embodying the present inventive concept. The HF

antenna **14** essentially comprises a superstructure **16** of the type normally found on naval ships. The superstructure, which has a conductive surface, can have any of several geometrical configurations; in the preferred embodiment, an octagonal shaped superstructure **16** is shown. Electrically and mechanically connected to and rigidly mounted upon the top of the superstructure **16** is a discone antenna **18** which includes a disc **20**, as is well known to those skilled in the art. In the FIGURE, a conventional conical antenna **22** having a trussed mast is shown mounted upon the superstructure discone antenna **14** to achieve a dual band HF capability. In the FIGURE, the water level comprises the preferred ground plane.

It should be appreciated that the entire volume of the superstructure **16** can be utilized as access, equipment, living, or operating space. For example, superstructure **16** includes a plurality of bridges **16*a*** having bridge windows **16*b***. The bridges **16*a*** can be utilized by the ship's personnel to perform their required daily functions.

The upper structure **18** is connected to the lower structure by means of an impedance matching shunting stub **24** which comprises two concentric hollow cylinders **26*a*** and **26*b***. The shunting stub has an electrically predetermined length, and the ratio of the diameters of the cylinders **26*a*** and **26*b*** is likewise a selectively predetermined value whereby the characteristic impedance of the shunt stub which appears in parallel across the superstructure antenna can be made equal to a value which, for example, will allow a series capacitor to match the antenna **14** to a 3:1 VSWR over a 2 to 5.6 MHz range. Likewise the conical angle θ of the conical section **18** of the discone antenna is critical in that is used to determine the characteristic impedance of the entire antenna structure **14**. The combined impedance effect of the superstructure **16** and the shunt stub **24** determines the impedance "seen" at the termination **40**.

The upper portion of the shunting stub **28** located between the conical section **18** and the disc **20** comprises an insulator portion **28**. Mounted symmetrically on the top of insulator **28** is a support platform **30** from which a plurality of radials **32** which comprise the disc **20** radiate in a symmetrical manner. In the preferred embodiment sixteen radials are utilized.

Sending apparatus **34** are shown located in a bridge **16*a***. The sending apparatus can comprise transmitter or receiver means having coaxial cables **36** and **38**. The cable **36** is shown connected between the sending apparatus **34** and a coaxial termination **40**, which is used to feed the discone antenna at the energy feedpoint **42**. Cable **38** is used when a conical antenna **22** as shown is used to achieve a dual band capability. In this instance, cable **38** would be routed through the center of the shunting stub **24** up to the energy feedpoint of the conical antenna **22** (not shown).

Each of the 16 radials **32** of the disc **20** are terminated in a 50-ohm resistor **44** from which a conductor wire **46** is connected to an insulator **48**. Guy wires **50** or rope of a non-conductive material are connected between each insulator **48** and the structure **16** to thereby support and maintain the wires **46** in a selectively predetermined configuration.

At the lower portion of the shunting stub **24**, the inner and the outer cylinders **26*a*** and **26*b***, respectively, are both electrically and mechanically connected to the superstructure **16** which, as previously mentioned, comprises a conductive surface, as does the conical section **18**. At the upper portion of the shunting stub, the inner cylinder **26*a*** is electrically and mechanically connected to the disc **20** and the outer cylinder **26*b*** is mechanically, but not electrically, connected to the disc by the insulator **28** which is also mechanically connected to the cone **18**, the outer cylinder **26*b*** is electrically and mechanically connected to the cone **18**.

The outer cylinder **26*b*** may be electrically and mechanically connected to any part of the superstructure **16** by means of, for example, a bulkhead within the superstructure to thereby rigidly support and maintain the stub **24** in a predetermined position.

Experimentation has shown that by means of conventional exiting multi-couplers and multi-coupler techniques, the composite structure **14**, including the conical antenna **22** can provide simultaneous operation of up to as many as 16 transmitters and forty receivers, for example, in the 2 to 15 MHz band. Furthermore the single structure antenna **14** can be installed on a variety of ships wherein the superstructure can also perform those functions normally required of ships' superstructures. This antenna thus comprises a major contribution to ship space utilization in terms of efficient use of topside space and especially in the reduction of parasitic radiators. Consequently it can be appreciated that an entire large superstructure can be made into a broadband HF antenna on which other radiators such as those for radar functions can be mounted in a concentric or co-linear manner on the surface of the superstructure (not shown). This capability to support these other radiators thereby eliminates much of the antenna blockage which occurs on existing ships due to the presence of platforms and equipments.

The conducting surfaces of the superstructure can be formed of electrically conducting solid sheets, welded pipe, or wires spaced at suitable intervals depending on mechanical requirements and upon requirements for weather-tight internal spaces.

The desired characteristic impedance match as previously mentioned is obtained by selectively predetermining the dimensions of the shunt stub and the conical angle θ. The diameter of the disc and the overall height of the structure are determined in part by the desired low-frequency response.

The superstructure **16** itself can comprise either a rectangular, pyramidical, or cylindrical, or conical geometrical configuration; however the cylindrical conical shape has been found to be optimum for overall symmetry. The conical shape is shown distorted in the figure to accommodate other functions such as windows for the bridges. Furthermore equipment such as conformal radar arrays and platforms can be easily installed external to the conducting surfaces, although this capability is limited by the tolerance of discontinuities resulting in impedance perturbation.

The conical antenna **22** located above the disc is not a critical part of the discone superstructure concept, however it is shown in the figure to show how easily the present invention could be modified to provide a dual band HF capability within a unitary structure and without requiring more of the critical space topside of the ship. Thus it can be appreciated that a new and novel combined function HF antenna for use on topside ship environments where space is critical and including as an integral component thereof, a ship's superstructure has been disclosed.

Obviously many modifications and variations of the present invention are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. An HF antenna for use in limited space environments on naval ship decks comprising:

a superstructure having a selectively predetermined configuration and an electrically conductive surface;

discone antenna rigidly mounted and supported upon the top of said superstructure and being electrically connected to said superstructure by means of a shunt stub extending symmetrically through said discone antenna and a selectively predetermined length of said superstructure, said discone antenna having an electrically conductive surface also.

2. The apparatus of claim **1** wherein said discone antenna comprises:

a conical portion mounted atop of said superstructure;

an insulator portion at the top thereof, and a disc connected at the top of said insulator in a symmetrical manner with respect to said insulator, said insulator being symmetrically disposed about said shunt stub.

3. The apparatus of claim **1** wherein said shunt stub comprises:

two hollow concentric cylinders symmetrically disposed within each other and about the center of said superstructure.

4. A dual-band HF antenna for use on decks of naval ships comprising:

a superstructure having a predetermined geometrical configuration;

a discone antenna mounted and rigidly connected to said superstructure by means of a shunt stub extending therebetween; and

a conical antenna having a trussed mast mounted atop said discone antenna.

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