Jan. 28, 1958

S. FUCCI

2,821,709

ANTENNAS

Filed March 21, 1952

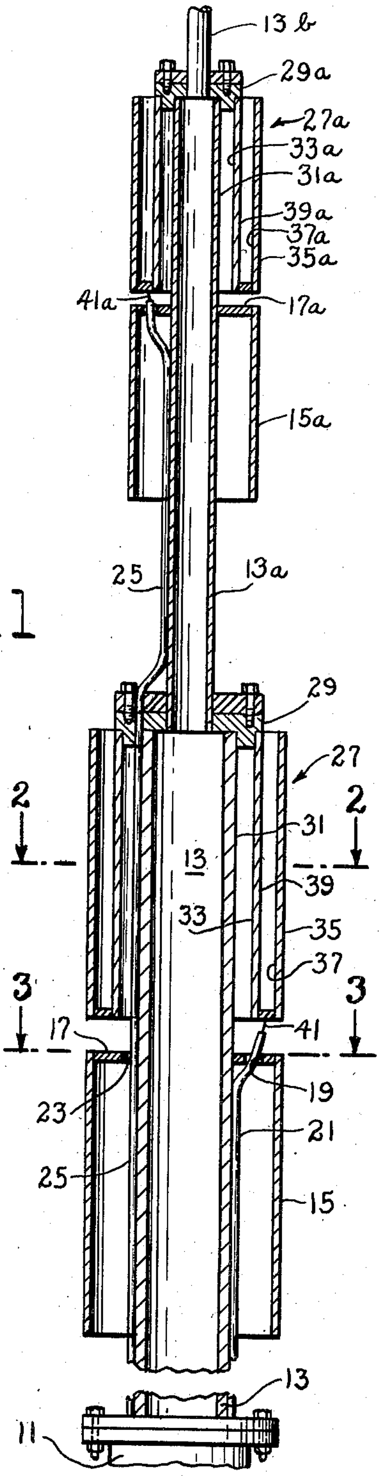

Fig. 1

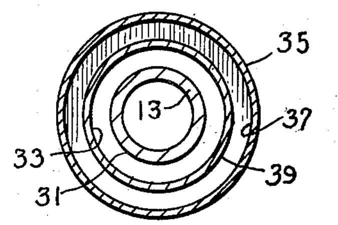

Fig. 2

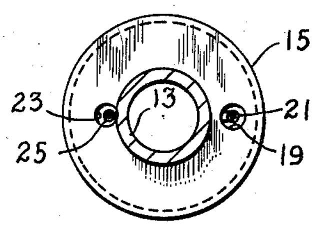

Fig. 3

INVENTOR.
SALVATORE FUCCI
BY D. C. Snyder
Roderick B. Jones
HIS ATTORNEYS

United States Patent Office | 2,821,709 | Patented Jan. 28, 1958

2,821,709

ANTENNAS

Salvatore Fucci, New London, Conn.

Application March 21, 1952, Serial No. 277,889

7 Claims. (Cl. 343—793)

(Granted under Title 35, U. S. Code (1952), sec. 266)

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.

This invention relates to improvements in antennas, and more particularly pertains to improvements in very high and ultra high frequency around-the-mast antennas.

Antennas constructed for use on surface craft, aircraft or land installations, and conventional submarine antennas, are not sufficiently pressureproof and do not meet the minimum requirements of structural rigidity that are desired of an antenna employed in submarine operations. Multiple antennas heretofore installed on submarines employed an insulator to separate the upper and lower radiating elements, but such an insulator subjects the device to the serious disadvantages of weakening the antenna mechanically and complicating inordinately the problem of pressureproofing. In such antennas, the sole support for the upper radiating section of the antenna is the inner conductor of the transmission line, which extends through the insulator. In such structure, extension of the antenna mast is not feasible, and multiple antenna arrays cannot be provided conveniently.

The subject device overcomes the foregoing disadvantages of the prior structures and provides a pressureproof, structurally rigid multiple radiator adapted for use on extensible submarine antenna masts. These results are accomplished by substituting a quarter-wave isolating section between the upper and lower radiating elements for the insulator heretofore employed, such section also serving to compensate for the reactive component of the antenna and to assist in extending the frequency range of a single unit; by the folding back of the upper radiating element to form another quarter-wave section that isolates this upper radiating element electrically from the extended mast, thus permitting the stacking of additional antennas on the single mast; and by feeding the antenna off center by means of a separate cable, thereby eliminating the need of breaking the mast at the center.

The principal object of this invention is to provide an around-the-mast antenna that meets the pressureproofing and structural rigidity optimum requirements of extensible multiple-stack submarine antenna.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

Fig. 1 is a fragmentary longitudinal cross section of an around-the-mast antenna, showing a preferred embodiment of the invention;

Fig. 2 is a section taken on the line 2—2 of Fig. 1; and

Fig. 3 is a section taken on the line 3—3 of Fig. 1.

Similar numerals refer to similar parts throughout the several views.

The antenna is supported on a retractable mast **11**, which is a cylinder adapted to receive telescopically a cylinder **13** of smaller diameter, part of said cylinder **13** extending beyond the end of the mast **11**.

A tubular radiator **15** is formed as an inverted or open-bottomed cup and the conductive closed end **17** of said cup is secured to the cylinder **13** in any suitable manner. Said closed end **17** is provided with a first small bore or aperture **19** through which a first coaxial conductor **21** is passed, and a second small bore or aperture **23** through which a second coaxial conductor **25** is passed. A second tubular radiator **27** is secured to the cylinder **13** in any suitable manner, such as by means of conductive mounting ring **29**. Said radiator **27** is isolated from cylinder **13** by means of a quarter wavelength section of coaxial transmission line formed by the portion **31** of the outer surface of the cylinder **13** projecting above the closed end **17** and the inner surface **33** of the coaxially disposed portion of the radiator **27**.

The radiator **27** has a folded back portion **35** that serves as a radiating element. A second quarter wavelength isolating section is formed by the coaxial line section comprising the inner surface **37** of the folded back portion **35** and the outer surface **39** of the coaxially disposed portion of the radiator **27**, thereby insuring that no radiation from the radiator **27** spills over around the edge of said radiator.

Direct off-center feed is accomplished by connecting the inner conductor **41** of the coaxial cable **21** at a point on the junction of the folded back portion **35** and the coaxially disposed portion of radiator **27**. The outer conductor of cable **21** is connected to the radiator at the closed end **17**, as shown in Fig. 1. Said cable **21** is secured upon cylinder **13**.

A similar antenna can be mounted on the cylinder **13** and disposed vertically above the radiator hereinbefore described. Such superstructure can be of the same construction as the antenna described hereinabove, except that it is preferably scaled down in physical dimensions to be resonant at a desired higher frequency. Such similar antenna is fed through conductor **25**. The elements of such superstructure are designated in the drawing by the reference numerals of their corresponding elements in the radiator described hereinabove, but with the subscript *a* added to each such designation.

It is apparent that as many such radiators as are desired can be mounted as above described in superposed relation. For example, still another cylinder 13*b* for mounting a third antenna can be secured by means of the mounting ring 29*a*. It is also apparent that the radiating sections can be conical, or can have other shapes suited to the production of desired frequency characteristics, and that other geometric configurations to produce directionality can be employed in lieu of the described structure that provides a substantially omnidirectional radiation pattern. Since the antenna described requires no insulation to be introduced at any point in its construction, very high structural strength can be achieved and pressureproofing is facile in view of the fact that only the end seals of the external feed cables need to be pressureproofed.

Obviously many modifications and variations of the present invention are possible in the light of the 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.

I claim:

1. An ultra-high-frequency antenna for a high-frequency energy transducer comprising a support, a first tubular radiator mounted on said support, a second tubular radiator mounted on said support coaxially with said first radiator, conductive elements coupling one end of each radiator to said support, high-frequency isolating

means between said support and one of said radiators, and transmission line means connecting said radiators to such transducer.

2. The antenna as defined in claim 1 wherein said support is coaxially disposed relative said first and second radiators.

3. The antenna as defined in claim 1 wherein said transmission line means comprise a coaxial conductor having an inner conductor connected to one of said radiators and an outer conductor connected to the other radiator, said coaxial conductor being secured on said support.

4. An ultra-high-frequency antenna system for a high-frequency energy transducer comprising a stacked coaxial arrangement of tubular radiators, pairs of said radiators being adapted to be energized at frequencies of operation different from that of other pairs, transmission means coupled to said radiators, a common support disposed coaxially with respect to said radiators, said radiators being mounted in vertical alignment on said support, and conductive elements coupling similarly disposed ends of each of said radiators to said support.

5. The system as defined in claim 4 further comprising wave-trap means comprising quarter wavelength sections of high-frequency transmission lines for isolatingly spacing alternate radiators from said support.

6. An ultra-high frequency broadband antenna system for an energy transducer comprising a conductive supporting mast, a first tubular quarter-wave radiator attached to said mast by means of a conductive disc at the end of said radiator distal the base of said mast, a second tubular quarter-wave radiator, a third tubular isolating cylinder concentric with said second radiator, said second radiator being attached to said mast by means of a conductive disc at the similar end thereof through said third cylinder, and transmission line means connecting said radiators to such transducer.

7. An ultra-high frequency broadband antenna system for an energy transducer comprising a conductive supporting mast and a plurality of spaced antenna arrays mounted on said mast in spaced relation, each array comprising a first tubular quarter-wave radiator attached to said mast by means of a conductive disc at the end of said radiator distal the base of said mast, a second tubular quarter-wave radiator, a third tubular isolating cylinder concentric with said second radiator, said second radiator being attached to said mast by means of a conductive disc at the similar end thereof through said third cylinder, and transmission line means connecting said radiators to such transducer.

References Cited in the file of this patent

UNITED STATES PATENTS

2,113,136	Hansell et al.	Apr. 5, 1938
2,234,234	Cork et al.	Mar. 11, 1941
2,323,641	Bailey	July 6, 1943
2,385,783	Alford et al.	Oct. 2, 1945
2,496,242	Bradley	Jan. 31, 1950