343-872 CROSS REFERENCE SEARCH ROOM

May 17, 1966 W. GOTTWALD ET AL 3,252,161

INSULATED TUBULAR TOWER WITH METALLIC STIFFENERS FOR SUPPORTING PLURAL DIPOLES INTERNALLY THEREOF WITH MINIMUM INTERFERENCE

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Fig. 1

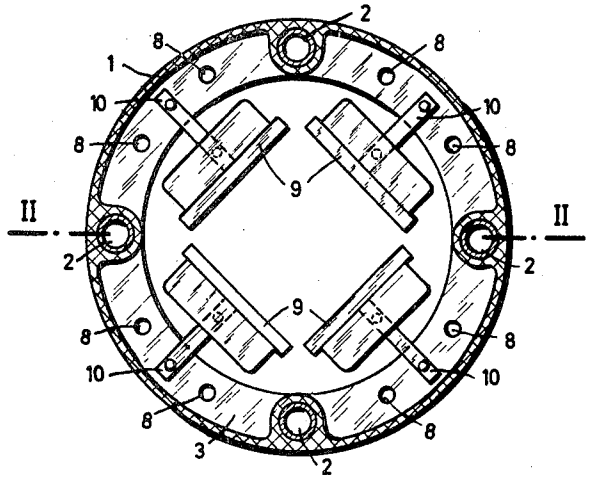
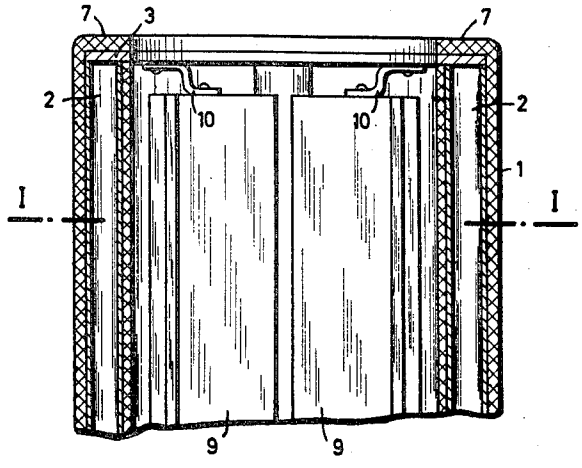


Fig. 2



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Fig. 3

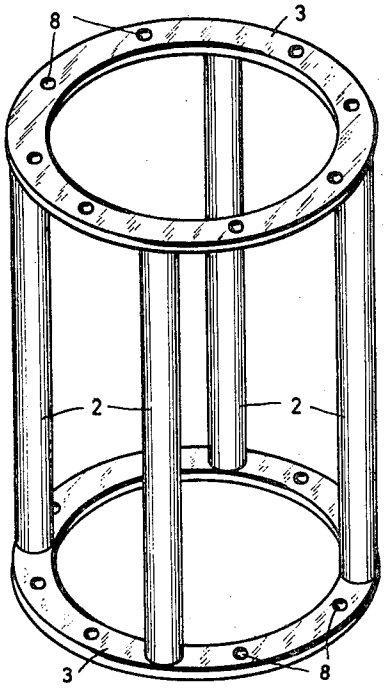


Fig. 4

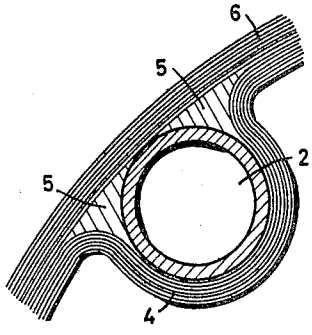
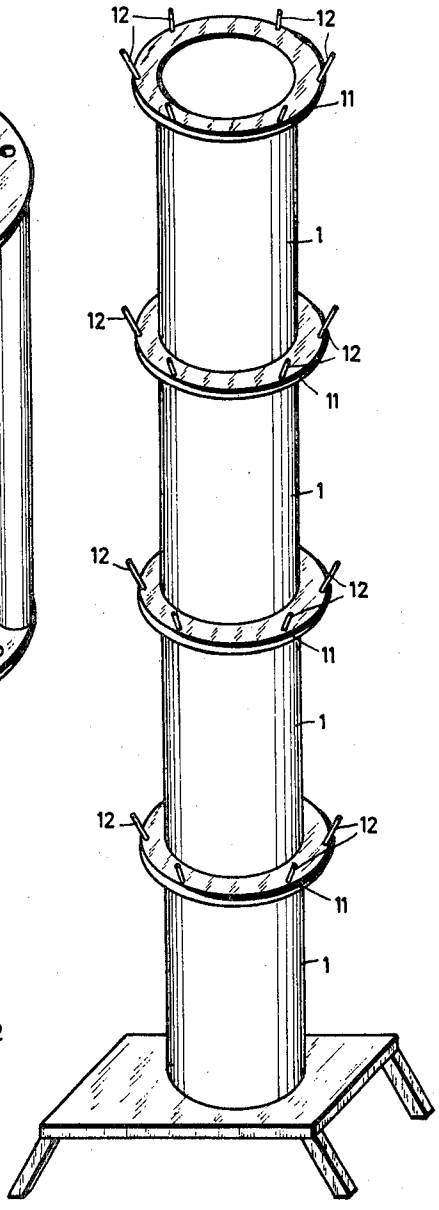


Fig. 5



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3,252,161

INSULATED TUBULAR TOWER WITH METALLIC STIFFENERS FOR SUPPORTING PLURAL DIPOLES INTERNALLY THEREOF WITH MINIMUM INTERFERENCE

Waldemar Gottwald, Munich, Erwin Löbl, Munich-Solln, and Wolfgang Krüger, Munich, Germany, assignors to Siemens & Halske Aktiengesellschaft, Berlin and Munich, Germany, a corporation of Germany

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15 Claims. (Cl. 343—797)

The invention disclosed herein is concerned with a sender antenna comprising dipole fields. The carrier for the dipole fields is made in the form of a tubular insulating body, constructed as a mast, such mast embracing the dipole fields and serving also as weather protection therefor. The dipole fields are fastened to the walls of the mast inside thereof. Antennae of this kind are described in the German Auslegeschriften Nos. 1,078,643 and 1,083,357.

The improvement proposed by the present invention resides in reinforcing the insulating material of the tubular body by enclosing or embedding therein reinforcing inserts made in the form of tubular struts, tubes, bar or rail members and the like, such inserts forming part of the tubular body made of insulating material and being so arranged that they do not affect the radiation of the dipole fields.

The advantages obtained by the provision of reinforcing inserts according to the invention resides in that the wall thickness of the tubular mast can be reduced, thereby effecting savings insofar as highgrade and expensive insulating material is concerned, without impairing the stress properties of the tubular mast structure. The provision of reinforcing inserts according to the invention, which form inseparable parts of sections of the tubular mast, permits using for the dipole fields single-piece mast sections without employing for reinforcing purposes additional inner or outer structural components. The radiation diagram of the dipole fields is in no way impaired; indeed, the radiation is improved owing to the fact that the thickness of the wall of the mast is reduced by the use of the tubular insulating bodies made according to the invention, thereby also reducing attenuation of the radiation.

The reinforcing inserts are advantageously embedded in the walls of the respective tubular insulating bodies so that they extend parallel to the axis thereof. Accordingly, upon erecting the mast of sections each comprising such tubular insulating body, the reinforcing inserts will extend in vertical direction within the insulating material of the corresponding tubular bodies. Stiffening rings are advantageously provided at least at the opposite ends of the respective tubular insulating bodies, and such rings may be joined with the axially extending reinforcing members to form a unitary sectional structure therewith.

According to a feature of the invention, the tubular insulating bodies forming sections of a mast, may be made of layers of insulating material, for example, layers of fiberglass and the like, with the reinforcing and stiffening means wrapped therein and completely enclosed thereby.

Further details of the invention will appear from the description thereof which is rendered below with reference to the accompanying drawings.

FIG. 1 shows in transverse sectional view, taken along lines I—I of FIG. 2, part of an antenna according to the invention, including a cylindrical tubular insulating body provided with reinforcing means;

FIG. 2 is a partial vertical section taken through the structure shown in FIG. 1 along lines II—II thereof;

FIG. 3 illustrates in perspective representation a reinforcing insert;

FIG. 4 indicates on an enlarged scale a sectional view through a reinforcing member which is embedded between layers of a tubular body made of wrapped insulating material; and

FIG. 5 shows in elevational view an antenna assembled of a plurality of tubular bodies made of reinforced insulating material and equipped with dipole fields.

The tubular insulating body **1**, shown in FIGS. 1 and 2, is reinforced by inserts made in the form of steel tubes **2** or the like, which are embedded therein. A stiffening ring **3** is provided at least at each end of the tubular body. Such stiffening rings may be connected with the axially extending tubes **2**, by welding or the like, to a form a unit therewith.

A cage-like reinforcing structure as shown in FIG. 3 is in this manner produced, such structure comprising the flange-like metallic stiffening rings **3** joined with the opposite ends of the metallic reinforcing tubes **2** (or analogously positioned reinforcing members of different desired configuration), such cage-like structure or unit being at least partially embedded in the insulating material of the tubular insulating body.

The manner of producing the tubular insulating body with its reinforcing inserts, may be described with reference to FIG. 4. A number of layers **4** of the insulating material are first placed about the tubes **2** on the inwardly facing sides thereof. The cavities **5** which may be formed thereby, are thereupon filled with insulating material, whereupon further layers **6** are smoothly wrapped about the structure on the outside thereof. If desired, the insulating material may be drawn radially inwardly to cover the respective flange-like rings **3**, as indicated in FIG. 2 by numeral **7**. Holes **8** are formed in the flange-like stiffening rings **3**, through which bolts or the like are extended upon assembling a plurality of units to form a tubular mast.

Inside of the respective tubular insulating bodies or units are disposed known dipole fields **9** which are by means of supports **10** fastened to the flange-like rings **3**, or to other desired parts of the corresponding tubular insulating bodies, thus lying intermediate of the reinforcing members so that the radiation is not affected by such members.

The metallic reinforcing and stiffening inserts embedded in the insulating material of the individual tubular units are, upon assembling a plurality of such units to form the tubular antenna mast, advantageously electrically conductively interconnected, by screws or other suitable means, so that the embedded reinforcing inserts form a continuous lightning arrester cage for the corresponding antenna.

In the embodiment of such antenna, as shown in FIG. 5, there are provided metal parts such as metal rings **11** or the like, which are interposed between the abutting ends of the respective tubular bodies **1**, such metal rings being electrically connected with the reinforcing inserts embedded in the insulating material of the corresponding tubular bodies and projecting laterally outwardly, thus acting as lightning arresters. Lightning arrester pins **12** may be carried by the rings **11** as shown. The utilization of the embedded metallic reinforcing inserts, for lightning arrester purposes, eliminates the need for auxiliary lightning arrester devices such as lightning arrester struts, wires, or the like, on the outside of the tubular antenna mast.

The invention is not inherently limited to the use of the described tubular reinforcing inserts; inserts of different configuration may be used, such as struts, bars, rails or

the like. Tubular bodies of any desired and suitable kind, not necessarily circular tubes as such, are of particular advantage, for example, members with square or rectangular cross section, since they increase the weight of the respective tubular insulating bodies only slightly. The thickness of the wall portions of the tubular cylindrical insulating bodies, extending angularly between the reinforcing members, that is, for example, of the wall portions **1**, in FIG. 1, can be made thinner as compared with the wall thickness of prior structures and reduced to 3 to 10 millimeters, depending upon the overall size of the antenna that may be involved in a given case.

Reinforcing inserts made of non-metallic material, for example, synthetic material, may likewise be used in realizing the invention, despite the fact that electrically conductive inserts offer the advantage of use thereof as lightning arresters. Metallic and non-metallic inserts may also be employed in combination. Reinforcing or stiffening members made of synthetic material, or non-metallic reinforcing members may also be formed as ribs, integral with the tubular insulating body. It is in connection with metallic as well as with non-metallic inserts of advantage, so far as the principle is concerned, to select material for the reinforcing inserts, having a coefficient of expansion which is at least approximately equal to that of the material of the tubular insulating bodies forming the antenna mast. Aluminum is particularly suitable as a material for metallic inserts, and fiberglass or the like, of which the tubular insulating bodies of the antenna mast are made, is particularly suitable as synthetic material for non-metallic inserts.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

We claim:

1. A sender antenna having a tubular mast comprising a tubular insulating body in which are enclosed dipole fields secured to the inner walls thereof, said tubular insulating member thus serving as a carrier for said dipole fields and also serving as weather protection therefor, insert means enclosed within the material of said tubular insulating body, for reinforcing such body, said insert means forming part of said tubular insulating body and being so arranged that the dipole fields are disposed substantially intermediate said insert means whereby the radiation of the dipole fields is not affected thereby.

2. An antenna according to claim **1**, comprising reinforcing inserts embedded in the wall of said tubular insulating body and extending in parallel with the axis thereof.

3. An antenna according to claim **2**, comprising an annular stiffening member disposed at least at the upper and the lower end of said tubular insulating body, said stiffening members being firmly connected with said axially extending reinforcing members and forming a unit therewith.

4. An antenna according to claim **2**, wherein said tubular insulating member is made of wrapped layers of insulating material, said reinforcing inserts being enclosed within said layers.

5. An antenna according to claim **2**, wherein said tubular insulating member is made of wrapped layers of insulating material embracing said inserts on the radially inwardly facing sides thereof, cavities between said layers and said reinforcing inserts being filled with insulating material, and further layers of insulating material wrapped about said reinforcing inserts on the side thereof which faces radially outwardly.

6. An antenna according to claim **2**, comprising an annular stiffening member disposed at least at the upper and the lower end of said tubular insulating body, said stiffening members being firmly connected with said axially extending reinforcing members and forming a unit therewith, said unit being in the configuration of a cage which is at least partially embedded in the material of said tubular insulating body.

7. An antenna according to claim **6**, wherein the material of said tubular insulating body is extended radially inwardly to cover said stiffening members at the respective ends of said tubular insulating body.

8. An antenna according to claim **6**, comprising means for fastening said dipole fields on said stiffening members for disposal intermediate of said reinforcing members.

9. An antenna having a plurality of axially successively arranged tubular insulating bodies constructed according to claim **3**, comprising means for electrically interconnecting the metallic reinforcing and stiffening inserts embedded in the individual tubular insulating bodies, thereby adapting said embedded inserts to form a continuous lightning arrester cage for the antenna.

10. An antenna according to claim **9**, comprising metallic members disposed between adjacent tubular insulating bodies, said members being electrically conductively connected with the inserts embedded in the respective adjacent tubular insulating bodies and extending laterally outwardly therefrom so as to act as lightning arresters.

11. An antenna according to claim **1**, comprising reinforcing ribs provided on said tubular insulating body.

12. An antenna according to claim **1**, wherein the coefficient of expansion of said reinforcing inserts correspond at least approximately to that of the material of said tubular insulating body.

13. An antenna according to claim **1**, comprising reinforcing inserts made of synthetic material of the type of fiberglass.

14. An antenna according to claim **1**, comprising insert means made of aluminum.

15 An antenna according to claim **1**, comprising in combination metallic and non-metallic insert means.

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HERMAN KARL SAALBACH, *Primary Examiner.*

E. LIEBERMAN, *Assistant Examiner.*