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Wright

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[54] **RADIO ANTENNAE ENCASED IN DIELECTRIC TO REDUCE SIZE**

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[30] **Foreign Application Priority Data**

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[52] U.S. Cl. **343/831**; 343/873

[51] Int. Cl.[2] **H01Q 1/40**; H01Q 9/32

[58] **Field of Search** 343/754, 787, 873, 831

[56] **References Cited**

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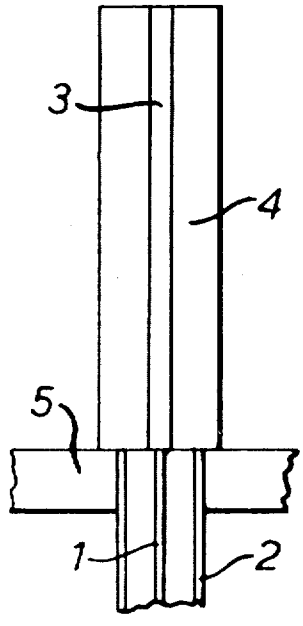
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[57] **ABSTRACT**

A radio antenna in which the length of conductor needed is appreciably reduced by the use of a compacted dielectric material as part of the antenna. Various constructions and various dielectric materials are considered.

7 Claims, 4 Drawing Figures



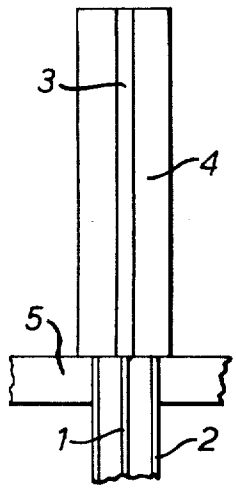


FIG. 1.

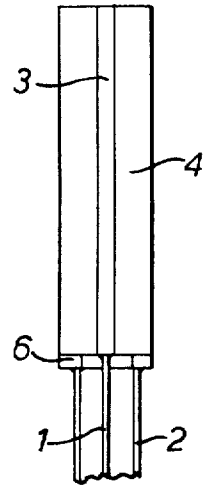


FIG. 2.

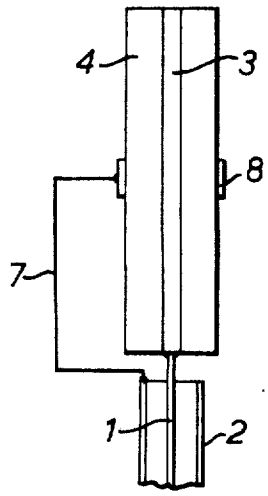


FIG. 3.

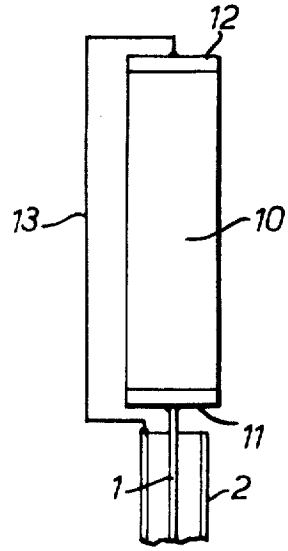


FIG. 4.

RADIO ANTENNAE ENCASED IN DIELECTRIC TO REDUCE SIZE

This invention relates to radio antennae and their manufacture.

It has been found, for example in British patent specification No. 27097/73 dated June 6, 1973, that a workable ratio antenna can be made if an electrical conductor is surrounded by low loss, high permittivity, dielectric material. Such an antenna, which can be used for either transmission or reception, requires a smaller length of conductor for a given frequency than does an antenna with no dielectric. A further advantage of such an antenna lies in the protection from impact and weather which is afforded to the conductor by the surrounding dielectric.

A suitable dielectric material was found to be barium titanate. The material was prepared in powder form, and was held around the conductor by means of a container. For a conductor of 0.3 cm radius, it was found that an internal container radius of about 10 cm was desirable for satisfactory functioning of the antenna.

According to the invention there is provided a radio antenna comprising an electrical conductor in combination with dielectric material, in which the dielectric material is a body of compacted constituents.

The material is prepared from barium carbonate, strontium carbonate and titanium dioxide, which are mixed together in or about the proportion of 460:229:310 parts respectively by weight. Water is added, and the mix is milled for aproximately 1 hour, after which the mix is oven dried and sieved. The sieving yields a powder which is pressed into blocks at around 2 tons per square inch. The blocks are then fired at approximately 1350°C for about 2 hours. During the firing process, the carbonates are converted into the titanates, and carbon dioxide is liberated. After the firing process, the blocks are fragmented by being quenched from 1350°C into water. The fragments are ground and milled until a substantially uniform powder is obtained, the powder being subsequently dried and sieved. This powder is then compacted into rods either hydrostatically or by extrusion. In the hydrostatic method, the powder is subjected to a pressure of 33 tons per square inch and fired at 1200°C. In the extrusion method, the powder is mixed with polyvinyl alcohol.

Rods prepared in this way can be bored to receive a conductor. For a conductor of radius 0.3 cm, a rod radius of less than 10 cm is acceptable.

Various antenna constructions are possible. Four possible constructions are shown in cross section in FIGS. 1–4 respectively of the accompanying drawings.

In each example signals are conveyed to or from the antenna by a coaxial cable, comprising a core **1** and a sleeve **2**. In FIGS. **1, 2, 3** the core **1** is joined to a conducting rod **3** of the antenna. The rod **3** is located in a central bore of a cylinder **4** of compacted dielectric material, conveniently made in the manner just described. The cable sleeve **2** is connected: in FIG. **1** to a conductive ground plate **5** extending at right angles to the rod **3**; in FIG. **2** to a conductive annulus **6** encircling the core **1** where the core joins the rod **3**; and in FIG. **3** by a wire **7** to a conductive band **8** encircling the cylinder **4** near its mid point. In the embodiment of FIG. **4**, the cylinder **10** of dielectric material is solid and has a conductive disc at each end as shown at **11, 12**. The cable core **1** is joined directly to the disc **11**, and the sleeve **2** is joined by a wire **13** to the disc **12**.

Using a compacted mixture of barium strontium titanate as a dielectric in a reception antenna, it has been found possible to make the length of the rod **3** equal to one eighth of the length required for an antenna with no dielectric, the frequency employed being 683MHz. At a frequency of 90MHz, the fraction was one fifth.

When used as for transmitting in the band 400–500MHz, a conductive rod surrounded by dielectric showed a gain of 8db compared with a rod of equal length having no dielectric.

Alternative dielectric materials can be prepared by mixing (a) lanthanum oxide, magnesium carbonate and titanium oxide in or about the proportion of 25:72:25 parts respectively by weight; and (b) calcium oxide, bismuth oxide and titanium oxide in or about the proportion of 23:31:46 parts respectively by weight. With mixture (a) the constituents of the resulting dielectric material are lanthanum titanate and magnesium titanate; and with mixture (b) calcium titanate and bismuth titanate.

It is to be understood that the foregoing description of specific examples of this invention is made by way of example only and is not to be considered as a limitation in its scope.

What is claimed is:

1. A radio antenna comprising an electrical conductor in combination with low-loss high permittivity dielectric material formed of a mixture of titanates compacted under pressure to form a rigid structure, said dielectric material being a single cylindrical body of uniform diameter with a central hold bored therein to receive the electrical conductor along the length thereof.

2. An antenna as claimed in claim **1** in which the constituents are barium titanate and strontium titanate.

3. An antenna as claimed in claim **1** in which the constituents are lanthanum titanate and magnesium titanate.

4. An antenna as claimed in claim **1** in which the constituents are calcium titanate and bismuth titanate.

5. An antenna as claimed in claim **1** which includes a conductive ground plate extending at right angles to the cylinder at one end of the cylinder.

6. An antenna as claimed in claim **1** which includes a conductive annulus at one end of the cylinder.

7. An antenna as claimed in claim **1** which includes a conductive band encircling the cylinder about the midpoint of the cylinder.

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