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(56) Documents cited

GB 2196483 A

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US 4792812 A

US 4725395 A

(58) Field of search

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Online databases: WPI, CLAIMS

(54) **Moulded antenna rod**

(57) An antenna (1), comprises a radiating element (2) passing inside the antenna (1) and a layer (3) of polymeric material encapsulating the radiating element. The process for manufacturing the rod comprises the encapsulating of the radiating element (2) passing longitudinally in the antenna (1) with polymeric material layer (3) whereby the radiating element (2) is inserted in the cavity of the casting mould, which is substantially of the shape of the antenna (1), and the cavity (11) of the casting mould is filled with a curing polymeric material (3). The radiating element (2) can be reinforced for casting by providing it with a support structure (4), for instance by winding it to form a helical coil around the support structure (4).

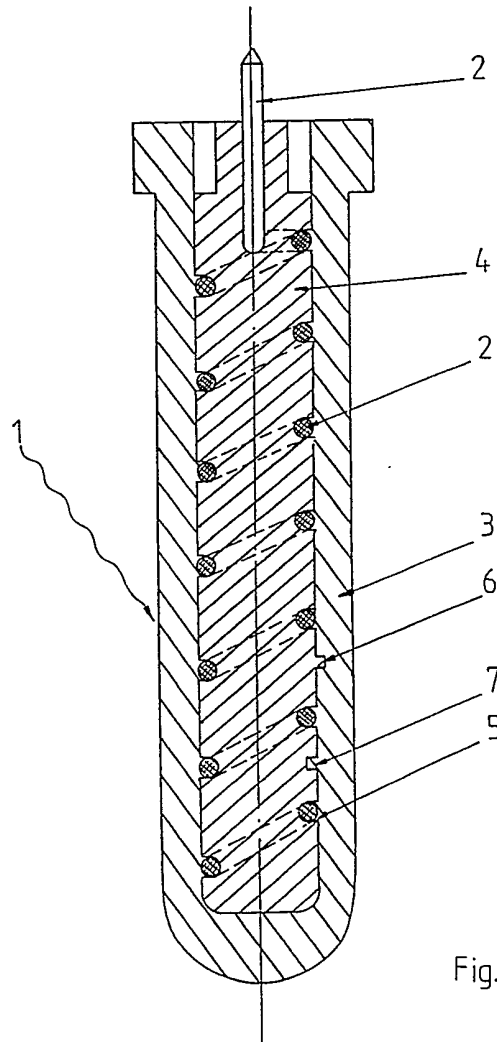


Fig. 1

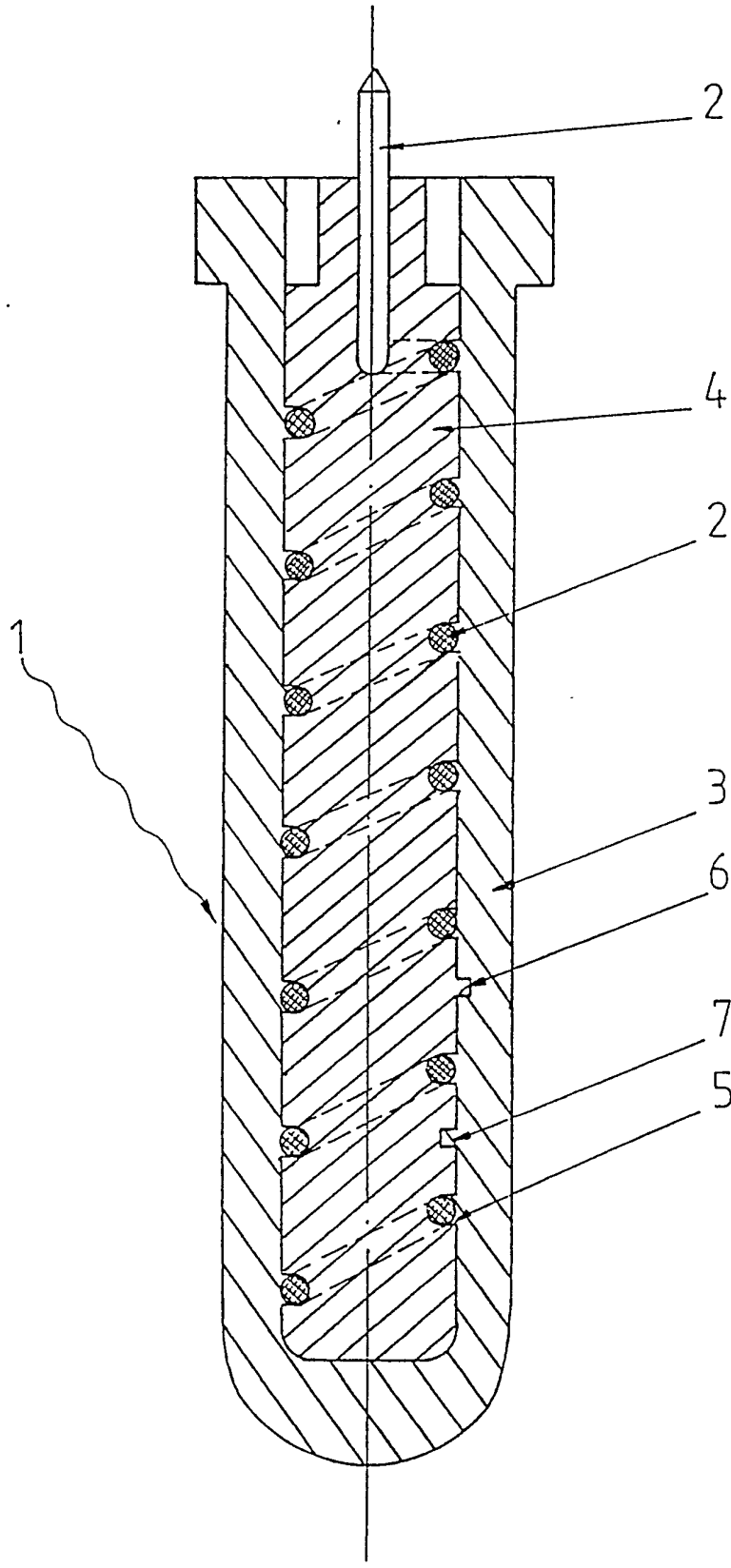


Fig. 1

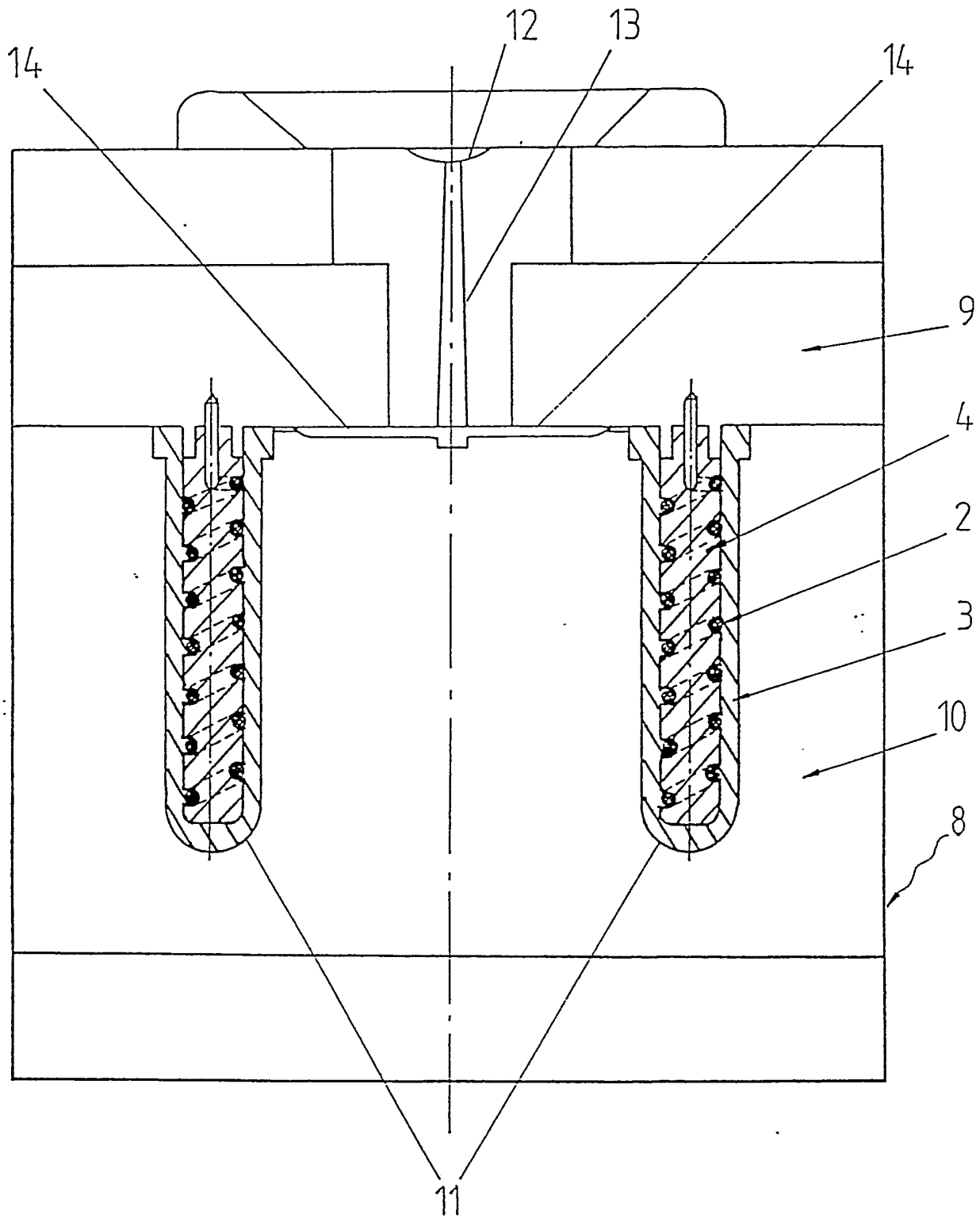


Fig. 2

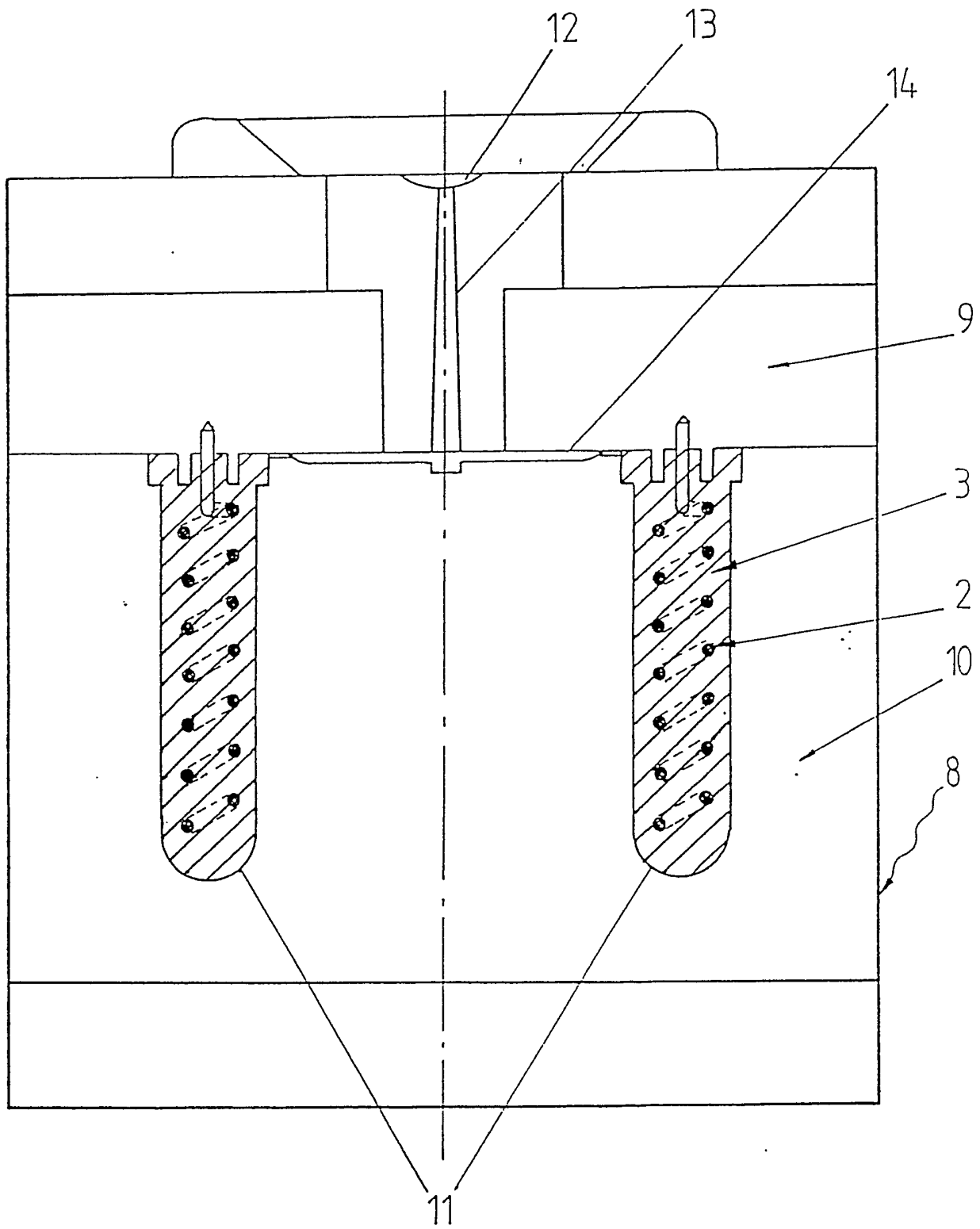


Fig. 3

An antenna and process for manufacturing same

The present invention relates to an antenna, for, for example, radios or cellular radio telephones and to a process for manufacturing such an antenna.

Known antennae have a structure which has been provided by making them mechanically of several separate components. Antenna structures composed of separate mechanical components have been less reliable in use, and their manufacture by joining them e.g. by glueing or pressing, into one has caused a great number of mistakes. In addition, the earlier antennae using a spiral coil as the antenna radiating element have been stiff, resisting poorly against impacts.

According to a first aspect of the present invention, there is provided a process for manufacturing an antenna comprising a radiating element, the process comprising the steps of inserting the lead into the cavity of a mould, the cavity having substantially the shape of the antenna filling the cavity with a curable polymeric material to encapsulate the lead curing said polymeric material, and removing the cured polymeric material with the lead encapsulated therein from the cavity.

According to a second aspect of the present invention, there is provided an antenna comprising an antenna radiating element encapsulated by an elongate outer member of cured polymeric material.

Thus there is produced an antenna in which the antenna radiating element is solidly attached to a polymeric material layer thereoutside, which is therefore as reliable in use as possible and at the same time,

resilient and impact-resistant. The process is also simple and reliable.

The invention will now be described, by way of example only, with reference to the accompanying drawings, of which:

Fig. 1 is a vertical cross section through an antenna of the invention;

Fig. 2 is a vertical cross-section through a casting mould for use in manufacturing an antenna rod according to the invention with antenna rods therein; and

Fig. 3 is a vertical cross-section through a casting mould for use in manufacturing a second embodiment of the antenna according to the invention with the antenna therein.

The antenna 1 in Fig. 1 consists of an antenna radiating element 2 wound around a support structure 4 and a polymeric material layer 3 encapsulating the antenna radiating element 2 and support structure 4. Because the radiating element 2 is often poor in make, the radiating element 2 is reinforced with this support structure 4 located within the antenna 1. As shown in Figure 1, the support structure 4 is a rod which is smaller than the antenna 1, around which the antenna radiating element lead 2 is wound in the form of helical coil. The antenna radiating element 2 terminates in a socket or equivalent as seen in the upper part of Figure 1, which can be inserted into a radio or radio telephone (not shown). The support structure 4 is provided with a groove 5 within which the antenna radiating element is located. The support structure 4 is also provided with a projection 6 or a recess 7 to catch the polymeric material layer so that

the support structure 4 (with the antenna radiating element 2) remains steadily in place in relation to the polymeric material layer 3.

The antenna radiating element 2 can be of any shape, but it is preferred that it is shaped into a helical coil passing within the antenna.

The antenna radiating element 2 can be totally encapsulated by the polymeric material layer without a support structure if the antenna radiating element 2 is rigid enough to withstand encapsulation during manufacture to an antenna produce which essentially consists only of a rod-shaped polymeric material matrix and an antenna radiating element 2 encapsulated therein.

It is required that the antenna is resilient but firm. This sets particular requirements for the material, especially for the polymeric material layer.

The polymeric material can be e.g. rubber or plastic, whereby it is made of a flexible thermoplast. The support structure 4 can be made of any appropriate material, but it is advantageous that it is of flexible thermoplast, too, having the same or different properties compared with the polymeric material 3 of the layer therearound.

The antenna 1 of the present invention is manufactured using injection moulding techniques. The injection casting mould 8 in Fig. 2 consists of at least two mould halves 9 and 10, which at the beginning of an injection moulding cycle are separated. One of the mould halves 10 is provided with two antenna shaped cavities 11, the other mould half 9 is provided with a shape appropriate for moulding the head of the antenna

1 which is to be attached to the radio or radio telephone.

The injection mould 8 is furthermore provided with a receiving head 12 for the injection nozzle, an inlet channel 13 for the polymeric material, and distribution channels 14 for conducting the polymeric material into the mould cavities 11.

To produce an antenna 1 according to the invention, the antenna radiating elements 2, with the support structures 4, are secured in the mould half 9 when the mould is open. The mould is then closed, for instance, by moving the mould half 10 to the mould half 9, whereby the antenna radiating elements 2 with the support structures 4 are located in the middle of the mould cavities 11. The antenna radiating element/support structure-entities 2,4 are now surrounded by an empty space. A press nozzle (not shown) is then inserted close to the receiving head 12 of the mould 8, and liquid polymeric material (either a liquid pre-thermoset or molten thermoplast) is injected through the nozzle, the inlet channel 13 and the conducting channels 14 into the cavities 11 of the mould 8 so that each entity consisting of the antenna radiating element 2 and the support structure 4 are entirely surrounded by the plastic.

After the plastic injected into the mould cavities 11 has been cured (either by reactance or by cooling), the casting mould 8 is opened by separating the halves 9 and 10. Finally, the completed antennas 1 are detached and separated off from the compression channel remains.

If the antenna radiating element 2 is too soft to keep its shape when filling the cavity with the polymeric material, it can be joined to the support structure 4

and then inserted with the support structure 4 in the cavity 11 of the cast mould 8, this being essentially of the shape of the antenna 1. It is therefore obvious that the dimensions of the support structure 4 are smaller than those of the antenna 1, and the support structure 4 becomes entirely encapsulated by the polymeric material 3. In the first step of the manufacturing process, the antenna radiating element 2 is joined to the rod-like support structure 4, which is provided with a groove 5 on its surface, into which the antenna radiating element 2 is located. In this regard, the support structure 4 may also be cast, preferably by injection moulding, with the antenna radiating element 2 prior to insertion into the antenna shaped cavity 11 of the cast mould 8. As discussed above, for the polymeric material and preferably also for the support structure material, flexible thermoplast material is preferably used, this being appropriate also for injection moulding, and the support structure 4 may also be provided with a projection or a recess to catch polymeric material layer while being cast.

If the antenna radiating element 2 used in the manufacturing process is rigid enough to be able to maintain its shape when the cavity 11 of the casting mould 8 is filled with polymeric material 3, it can be placed into the cavity 11 without a support structure and the cavity filled with a curing polymeric material. Hereby an antenna 1 is produced which is composed of a rod-shaped polymeric material matrix into which a rigid antenna radiating element has been immersed.

A casting mould 8 is shown in Fig. 3 in which an antenna radiating element 2 is used where no support structure is needed. It is therefore obvious that the mould cavities 11 are filled with such amount of

polymeric material which is equivalent to the total of the support structure layer and the polymer material layer. Thus, an antenna shaped polymer matrix is formed, in which merely the antenna radiating element 2 has been immersed, without any support structure.

The antenna radiating element 2 is advantageously formed into a helical coil positioned in the longitudinal direction of the cavity. Then both the requisite resilience and appropriate length can be provided in the antennaradiating element.

From the foregoing description, it will be evident to a person skilled in the art that various modifications may be made within the scope of the present invention, for example other techniques for encapsulating the antenna lead apart from injection moulding are envisaged.

CLAIMS

1. A process for manufacturing an antenna comprising a radiating element, the process comprising the steps of:

inserting the radiating element into the cavity of a mould, the cavity having substantially the shape of the antenna;

filling the cavity with a curable polymeric material to encapsulate the radiating element;

curing said polymeric material and;

removing the cured polymeric material with the radiating element encapsulated therein from the cavity.

2. A process according to claim 1 wherein the radiating element is first mounted on a support structure prior to insertion in the cavity.

3. A process according to claim 2 wherein the radiating element is wound around the support structure in a helical configuration.

4. A process according to claim 3 wherein the radiating element is wound around the support structure located in a helical groove made thereon.

5. A process according to any of claims 2 to 4 wherein the support structure is cast with the antenna radiating element prior to insertion in the cavity.

6. A process according to claim 5 wherein the support structure is cast using injection moulding.

7. A process according to any of claims 2 to 6 wherein the support structure is provided with a polymeric material.
8. A process according to any of claims 2 to 6 wherein the support structure is provided with a recess to catch the polymeric material.
9. A process according to any of claims 2 to 8 wherein the support structure is made from a polymeric material.
10. A process according to claim 9 wherein the support structure polymeric material is flexible thermoplast.
11. A process according to claim 1 wherein the radiating element is inserted into the cavity without a support structure.
12. A process according to any preceding claim wherein the cavity is filled using injection moulding.
13. A process according to any preceding claim wherein the polymeric material for filling the cavity is flexible thermoplast.
14. An antenna rod comprising an antenna radiating element encapsulated by an elongate outer member of cured polymeric material.
15. An antenna rod according to claim 14 wherein the radiating element is carried on a support structure.
16. An antenna rod according to claim 15 wherein the radiating element is wound around the support structure in a helical configuration.

17. An antenna rod according to claim 16 wherein the radiating element is wound around the support structure located in helical groove made thereon.

18. An antenna rod according to any of claims 15 to 17 wherein the support structure is made of a polymeric material.

19. An antenna rod according to claim 18 wherein the support structure polymeric materials is flexible thermoplast.

20. An antenna rod according to any of claims 14 to 19 wherein the outer member polymeric material is flexible thermoplast.

21. An antenna rod herein before described with reference to the accompanying drawings.

22. A process as herein before described with reference to the accompanying drawings.

Patents Act 1977
 Examiner's report to the Comptroller under
 Section 17 (The Search Report)

-10- Application number

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Relevant Technical fields

(i) UK Cl (Edition K) H1Q (DP, JH)

(ii) Int Cl (Edition 5) H01Q (1/40)

Search Examiner

MR J L FREEMAN

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASE: WPI, CLAIMS

Date of Search

27 JULY 1992

Documents considered relevant following a search in respect of claims

1 TO 23

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2196483 A (C & S ANTENNAS) the figure	1,2,12, 14 and 15
X	WO 90/04319 A (ROGERS CORP) the figure (=GB 2237452)	1,2,12, 14 and 15
X	US 4792812 A (W R RINEHART) column 3 line 24	1,2,12, 14 and 15
X	US 4725395 A (B V GASPARATAIS ET AL) all figures	1,2,12, 14 and 15



Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

- X: Document indicating lack of novelty or of inventive step.
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- P: Document published on or after the declared priority date but before the filing date of the present application.
- E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.
- &: Member of the same patent family, corresponding document.

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).