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(54) Antenna foot for movable antenna and method for the manufacture hereof.

(57) An antenna foot for a movable antenna comprises a dish-shaped holder (1) of magnetizable material and a securing element (2) for an antenna (3) on the top of the holder. In the dish-shaped holder there is placed an annular, permanent magnet (4) secured at a distance from a central magnet yoke (5) and at a distance from the edge of the dish-shaped holder.

Permanently secured along the edge of the dish-shaped holder is an encircling protective element (6) of yielding material, preferably in one with the binding material (11) which secures the magnet (4) at a distance from the edge of the holder (1).

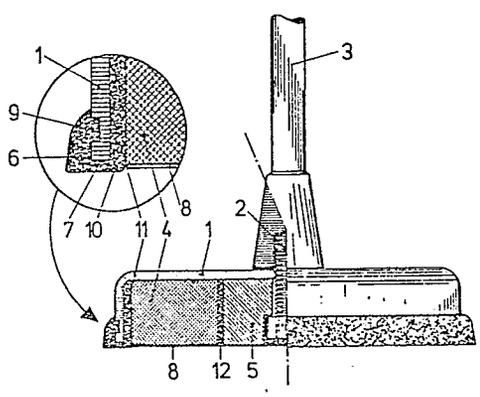

Fig.2

EP 0 346 315 A2

Description

ANTENNA FOOT FOR MOVABLE ANTENNA AND METHOD FOR THE MANUFACTURE HEREOF:

The invention relates to an antenna foot of the kind disclosed in the preamble to claim 1.

This type of antenna foot is used to a great extent for movable antennae in connection with radio and/or radio telephone antennae for cars. With the known types, the side facing the car roof is covered with a cap of plastic or rubber, thus preventing the roof of the car from being scratched or damaged in any way when the antenna is mounted, taken off or moved. It is necessary for the protective cap to be relatively thin on the side facing the car, hereby excluding the formation of too great a gap between the magnet poles and the metal roof of the car, which would otherwise reduce the magnetic forces which secure the foot of the antenna to the car roof.

In practice, the known types of protective caps have proved to be easily damaged, in that the downwards-facing edge of the antenna foot's dish-shaped metal holder penetrates the cap, thus giving rise to the possibility of direct contact with and consequent damage to the car roof, especially if the antenna is moved or removed without due care, e.g. by pulling on the antenna cable.

The object of the invention is to provide an antenna foot of this kind which is arranged in such a manner that damage to the roof of the car is excluded, regardless of the way in which the antenna with the antenna foot is removed or mounted on the car roof.

This object is achieved by configuring the antenna foot according to the invention as disclosed and characterized in claim 1. The permanently secured protective element ensures that the downwards-facing edge of the antenna foot's dish-shaped holder can never come into contact with the roof of the car, and at the same time determines the distance of the antenna foot's magnet poles from the metal roof. The protective element is configured as an annular, flexible or yielding item of half-hard material which is incapable of scratching or damaging the car roof. The distance between the metal parts of the antenna foot and the car roof is thus not established by these parts being separated by a thin membrane of rubber or plastic. Moreover, the permanent securing prevents any ingress of water in between the protective element and the holder.

The permanent securing ensures that the antenna foot is always provided with the protective element, and one avoids the frequent situation with the known constructions, i.e. the protective cap gets lost and, for reasons of lack of time, it is necessary to use the antenna foot without the protective element and with consequent damage to the roof of the car.

When the antenna foot according to the invention is configured as disclosed and characterized in claim 2, maximum security is achieved against damage to the car roof in connection with the use of the antenna foot.

The antenna foot according to the invention is preferably configured as disclosed and characterized in claim 3, whereby increased securing possibilities for the protective element are achieved, hereby enabling it to surround and adhere to the full extent of the edge of the dish-shaped holder.

If the antenna foot according to the invention is configured as disclosed and characterized in claim 4, a number of advantages are achieved from the view of production technique, in that the manufacture of the antenna foot can be simplified, and one and the same material is used for both the assembly operation and the formation of the protective element, and these operations can therefore be effected simultaneously. It is a considerable technical simplification and a cost-reducing advantage to be able to assemble and join all of the parts together in one operation, e.g. in an injection moulding operation.

Other embodiments of the invention, particularly with regard to the configuration and securing of the protective element, are disclosed and characterized in claims 5-7. The embodiment desired for use can, for example, depend on the type of production equipment at disposal, and also on the technology over which one has most control. For example, with the embodiment disclosed and characterized in claim 6, the antenna foot can be provided with a surface of non-magnetic material over the dish-shaped holder, and with the embodiment disclosed and characterized in claim 7, one completely avoids having to undertake an external surface treatment of the dish-shaped holder, which is covered and protected by the protective element. A completely finished product is obtained via one injection moulding process. More over, the holder can be manufactured with less precision, in that the moulding equalizes production tolerances and conceals marks and irregularities which arise in the production of the dish-shaped holder.

A preferred practical embodiment of the invention is disclosed and characterized in claim 8. The annular slots with binding materal ensure that the magnetic circuit becomes completely as desired, i.e. with the main part of the field opposite the underside of the antenna foot so that strong magnetic fields are established through the metal roof of the car. The same securing element secures both the magnet yoke and the antenna itself, which simplifies both the construction and the assembly hereof.

The invention also relates to a method for the manufacture of the antenna foot according to the invention. The method is preferably as disclosed and characterized in claim 9, i.e. all of the individual parts of the antenna foot are disposed and positioned in an injection mould arranged for this purpose, after which the moulding is effected so that at one and the same time the moulding is carried out of the protective element and a casting of the magnet item during the centering and formation of distance slots.

After the preliminary work on the antenna foot according to the invention has been completed, the magnet item is magentized. This is preferably a ring magnet which is magnetized so that the one pole

faces towards that side of the dish-shaped holder which is in direct contact with the ring magnet, and the other magnet pole faces away from the underside, i.e. down towards the car roof.

The underside of the antenna foot according to the invention can be finished in the final working as disclosed and characterized in claim 10. The coating can be an application of lacquer, paint or other coating, or be a foil, for example a self-adhesive foil, which is applied so that the product is given an area printed with information for the user, advertisement etc.

The invention will now be described in more detail with reference to the drawing, in that

fig. 1 shows an antenna foot according to the invention according to a first embodiment,

fig. 2 shows the same antenna as in fig. 1 but seen partly in section,

fig. 3 shows an antenna foot according to a second embodiment, and

fig. 4 is a sketch of the moulding tools for use in the manufacture of the antenna foot according to figs. 1 and 2, and for use in the manufacture of a third embodiment.

In figs. 1 and 2 is seen a preferred embodiment of the antenna foot according to the invention. The antenna foot consists of a dish-shaped holder 1 formed in 1-3mm thick iron plate with a central threaded hole through which a screw 2 secures an antenna 3 on the top of the holder. In the normal position of use, the dish-shaped holder 1 is thus open down towards that surface, e.g. a car roof, on which the antenna is to be placed. The screw 2 also secures and centres a central soft-iron yoke 5. Around the yoke 5 there is disposed a ring magnet 4, separated by a concentric mass 12, and thus an annular slot exists between the yoke 5 and the magnet 4. Around the magnet 4 there is also an annular slot filled out with a binding material 11 which, as shown in fig. 2, extends over into an annular outer profile 6 via an area 10 running under the lower edge 7 of the dish-shaped holder 1, and thus the whole of the annular edge on the holder 1 is covered. In order to increase the stiffness of the annular profile 6 and to increase the adherence to the holder 1, its outer edge can be configured with an annular groove 9 or a similar arrangement, e.g. a series of annularly-extending holes, which will increase the adherence.

The underside of the antenna foot is covered with a foil 8, e.g. a self-adhesive foil. In fig. 2 it will be seen that the lower edge 7 of the holder 1 will normally be slightly raised in relation to the lower edge of the ring magnet 4 and the foil 8, and that the lower edge of the annular profile 6 is slightly lower than the underside of the foil 8.

The moulding or binding material, which comprises the protective element 6 with underpart 10 and the annular distance slots 11 and 12, is configured, for example, of thermoplastic rubber, artificial rubber or synthetic resin, for example Perstorp Dryflex type DF, DFG or mixtures hereof; Akzo - Armitel injection moulding plastic; Polyurethane - the elastomer Elastogran or similiar materials.

In fig. 3 is seen a second embodiment of the invention, where a further cap 13, e.g. of metal, is used instead of a groove 9 to secure the annular protective element 6, which can be in one with the annular moulding material between the magnet 4 and the holder 1, but which as shown can also be configured as an independent, encircling profile ring secured to the outer side of the holder 1 and reinforced and secured by the outer cap 13. The protective element 6 is thus an independent, encircling profile ring which is mounted and secured after the rest of the antenna foot has been produced in the normal manner by casting of the magnet item. In this embodiment, the profile ring 6 can be produced of the same material as the binding material 11 or of another material with other characteristics.

It is also possible to configure the encircling protective element in such a manner that it surrounds the whole of the outer side of the holder 1, whereby a large contact surface is achieved and herewith a particularly strong adherence to the outer side of the holder 1, see right-hand half of fig. 4. This embodiment is described in more detail later in connection with the method for the manufacture of the antenna foot.

It will also probably be sufficient to have an encircling protective element 6, e.g. as shown in fig. 2, and also without the element extending in under the lower edge 7 of the holder 1, in which case an extremely careful securing is required around the whole of the edge, and in such a way that it is ensured that the edge 7 is held at the desired distance from the car roof.

The left-hand side of fig. 4 shows a sketch of a tool for use in the assembly of an antenna foot according to the invention and of the kind which is shown in figs. 1 and 2 of the drawing, and in the right-hand side is seen a sketch of a tool for use in the assembly of an embodiment where the moulded material completely surrounds the outer side of the antenna foot. Firstly, the bolt 2 is screwed through the yoke 5 firmly into the threaded hole in the holder 1, thus securing the yoke firmly in place centrally in the holder. A ring magnet 4 is then mounted as shown, positioned with an annular distance slot in towards the yoke, and similarly so that an annular distance slot arises between the magnet and the edge of the holder. The parts are now placed in the mould part 14 as shown, and the mould parts 15 and 16 are closed against the part 14, whereby the ring magnet 4 is secured in place. A normal injection moulding can now be carried out with a suitable binding material through an inlet hole 17 in the mould part 16. In one operation there is hereby moulded both the encircling protective element around the edge of the holder 1, and the annular distance slots are formed around the magnet 4, which is hereby secured in the dish-shaped holder.

With the tool in the right-hand half, the outer side of the holder 1 is also covered with a layer of moulding material 18, for example 1.5 mm thick, ex cept for the area blocked by the ring mandrel 19 where the antenna is subsequently mounted. As shown, it is possible to provide blow holes 20 in the

holder 1, so that the moulding material fills out the mould cavities more quickly and effectively. With this construction, it is possible for the annular groove 9 in the holder 1 to be dispensed with.

The underside of the antenna foot can hereafter be finished if necessary, and covered with a coating 8 which, for example, is a self-adhesive foil, and the magnet item 4 is excited.

It will be obvious to those familiar with the art that the mould can be arranged otherwise than shown in fig. 4. Normally, the mould will be arranged for the moulding of several units simultaneously, possibly in different sizes so that optimum use is gained from the injection moulding machine.

Claims

1. Antenna foot for movable antenna comprising a dish-shaped holder (1) of magnetizable material and with securing element (2) for an antenna (3) on the top side, a permanent magnet (4) secured in the dish-shaped holder and a magnet yoke (5), and where the underside of the antenna foot is provided with a protective element, **characterized** in that the protective element comprises at least one encircling item (6) of yielding material permanently secured to the dish-shaped holder (1), and configured in such a manner that it extends out over the lower edge (7) of the holder.

2. Antenna foot according to claim 1, **characterized** in that the item (6) of yielding material is configured with such a cross-sectional profile (6,10) that it covers the annular lower edge (7) of the dish-shaped holder and is permanently secured hereto.

3. Antenna foot according to claim 1 or 2, **characterized** in that the item (6) is configured in one with the means (11) which is used to position and secure the permanent magnet (4), which is an annular magnet.

4. Antenna foot according to claim 3, **characterized** in that the item (6) and the means (11) are of the same material, preferably a thermoplastic rubber or resin.

5. Antenna foot according to claim 1 or 2, **char acterized** in that the item (6) is an independent, encircling profile ring which is permanently secured to the holder (1), e.g. by gluing or hot welding.

6. Antenna foot according to claim 1 or 2, **characterized** in that the item (6) is an independent, encircling profile ring (fig. 3) which is secured by a further dish-shaped holder (13) which wholly or partly surrounds the first-mentioned dish-shaped holder (1).

7. Antenna foot according to claim 1 or 2, **characterized** in that the item (6) is configured in such a manner that wholly or partly it surrounds and covers the whole of the upwardly-turning outer side of the dish-shaped holder (1).

8. Antenna foot according to claim 1, **characterized** in that the magnet is a ring magnet (4), and in that centrally herein there is disposed a magnet yoke (5) which, together with the holder (1), comprises the magnetic circuit, and that between the parts there are annular slots filled out with binding material (11,12), and in that the yoke (5) has a central hole for a securing element (2) for an antenna (3), said securing element also securing and positioning the yoke (5).

9. Method for the manufacture of an antenna foot according to claims 1-4 or 8, **characterized** in that the dish-shaped holder (1), a magnet item (4) and the magnet yoke (5) with securing element (2) are placed and positioned in a mould (14), after which the mould is closed with the mould parts (15,16) arranged so that the parts are cast in by injection moulding at the same time that the encircling item (6) is formed.

10. Method according to claim 9, **characterized** in that the underside of the antenna foot within the encircling item (6) is cleaned and possibly turned, after which the area is covered with a thin foil or coating and the magnet item is excited.

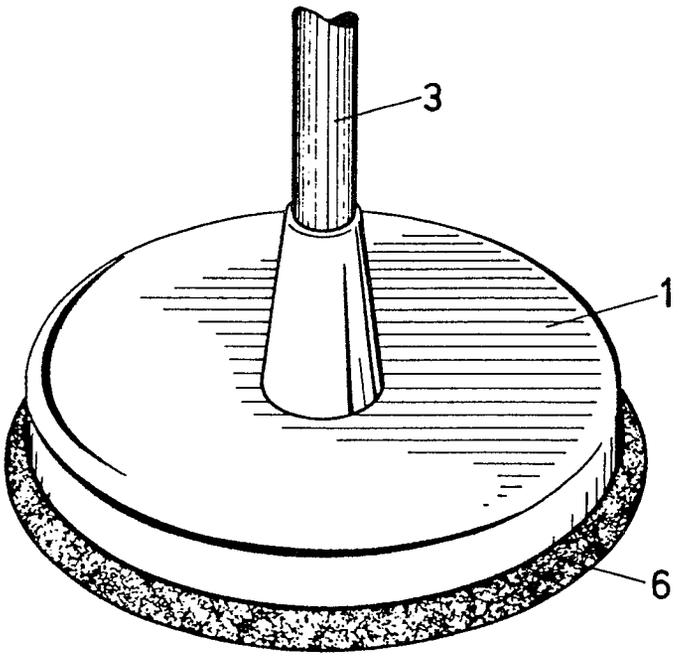

Fig.1

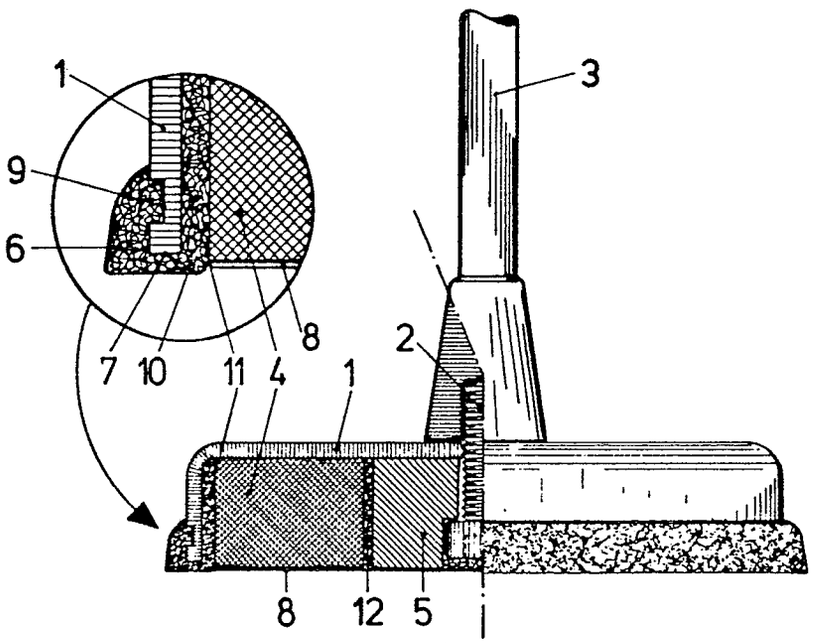

Fig.2

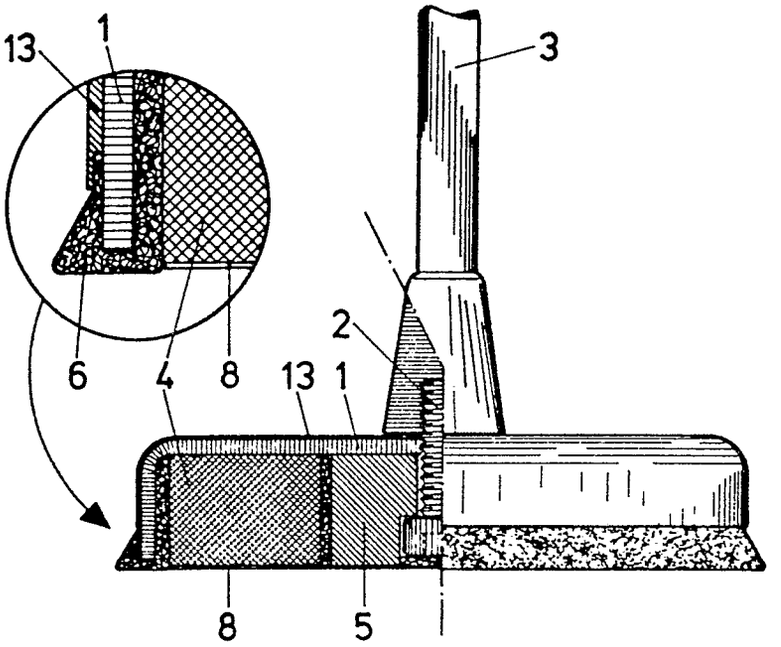

Fig. 3

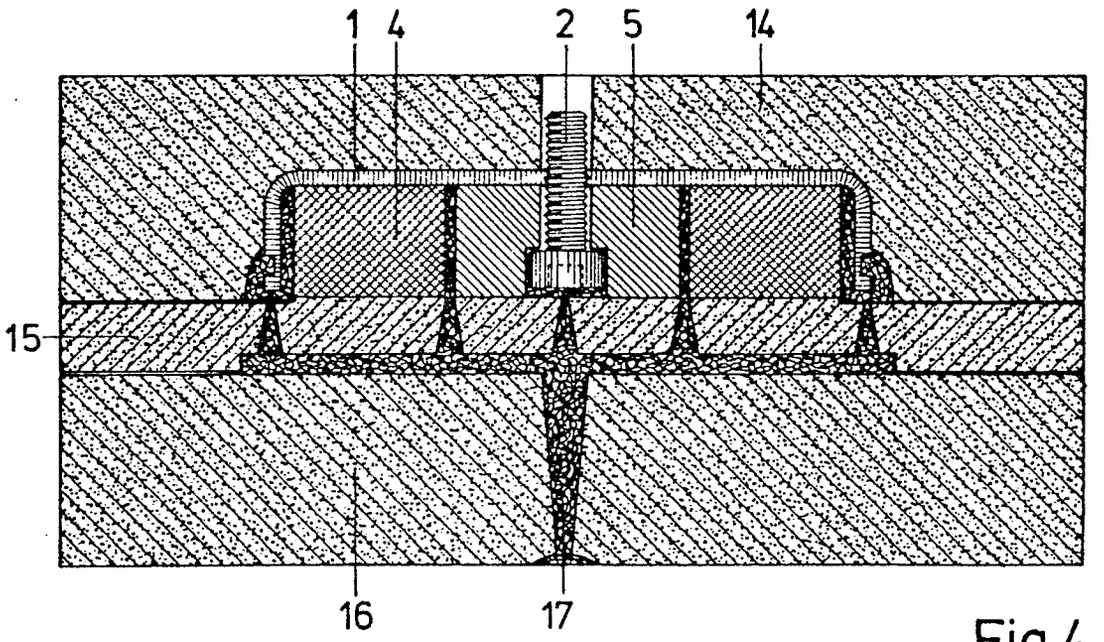

Fig. 4