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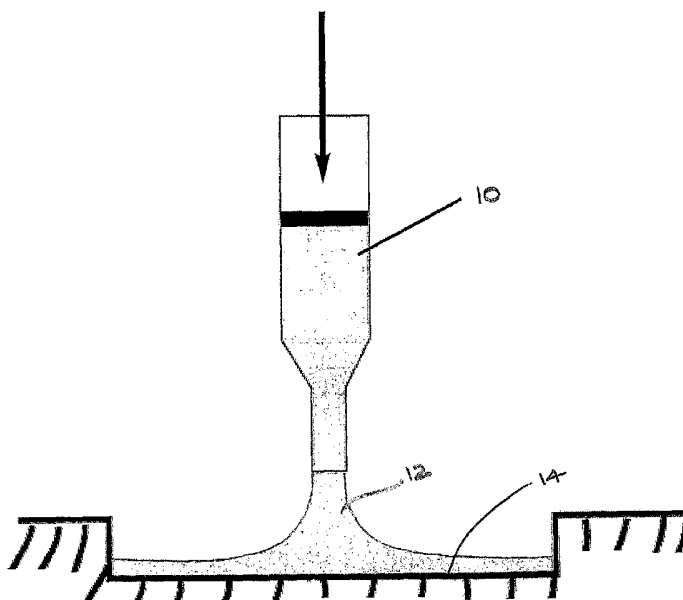
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(54) Title: MICROWAVE-ABSORBING FORM-IN-PLACE PASTE



(57) Abstract: A microwave-absorbing material which can be dispensed from standard form-in-place dispensing equipment combines a liquid resin system with a magnetic or lossy dielectric filler. In a preferred embodiment, the liquid resin system is a silicone resin system and the magnetic filler is iron carbonyl powder. The microwave-absorbing material is dispensed into a housing for electronic equipment. It may be dispensed into a cavity in the housing where it self-levels and cures. Alternatively, it may be dispensed onto a surface in the housing where, because of its thixotropic properties, it holds its shape and forms a pad of cured microwave-absorbing material thereon.



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MICROWAVE-ABSORBING FORM-IN-PLACE PASTEBACKGROUND OF THE INVENTION1. Field of the Invention

The present invention relates to the electronics
5 industry, and more particularly, to the absorption of
undesired radio-frequency (RF) emissions, such as
microwave radiation, from electronic equipment, such as
computers, telecommunications equipment, and the like.

2. Description of the Prior Art

10 Problems caused by stray electromagnetic (EM) fields
and radio frequency (RF) emissions in electronic
equipment, such as computers and telecommunications
equipment, are well known in the art. A variety of
approaches are taken to shield housings for such equipment
15 to reduce the emissions coming from components within the
housings, and to prevent emissions originating outside the
housings from penetrating inside and interfering with the
operation of the components within.

Among the approaches is to reduce radio-frequency
20 (RF) emissions, such as microwave radiation, by including
radiation-absorbing pads within the housings. Pads of this
type have traditionally been cut from large rolls or
sheets of the pad material and sized to fit cavities,
spaces or areas within the housings. The pads may have a

high magnetic permeability and a high electrical resistivity.

The present invention provides an alternative to the pads of the prior art, enabling a housing for electronic
5 equipment to be provided with microwave-absorbing material in a more straightforward and convenient manner.

SUMMARY OF THE INVENTION

Accordingly, the present invention is a microwave-absorbing material which can be dispensed from standard
10 form-in-place dispensing equipment. Such equipment may include a syringe-like applicator of the variety used to produce form-in-place gaskets and the like.

The microwave-absorbing material comprises a liquid resin system and a magnetic or lossy dielectric filler. In
15 a preferred embodiment, the liquid resin system is a silicon resin system and the magnetic filler is iron carbonyl powder.

The present invention is also a method for absorbing radio-frequency (RF) emissions in electronic equipment.
20 The method comprises the steps of providing a liquid resin system; dispersing a magnetic or lossy dielectric filler in the liquid resin system; dispensing the liquid resin system having the filler into a housing for the electronic equipment; and curing the liquid resin system having the

filler thereby forming a radio-frequency (RF) absorbing pad *in situ* in the housing.

The microwave-absorbing material, that is, the liquid resin system having the filler is self-leveling and may be
5 dispensed into a cavity in the housing. Alternatively, because of its thixotropic properties, the microwave-absorbing material may be dispensed onto a surface in the housing, where it will form a pad when cured.

The present invention will now be described in more
10 complete detail, with reference being made to the figures identified hereinbelow.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a dispensing system for the microwave-absorbing material; and

15 Figures 2A and 2B are perspective and side views, respectively, of a dispensing system depositing microwave-absorbing material onto a surface.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Accordingly, the present invention is a microwave-
20 absorbing material which can be dispensed from standard form-in-place dispensing equipment. That is to say, it may be dispensed from a syringe-like applicator of the variety used to produce form-in-place gaskets and the like.

The microwave-absorbing material comprises at least

two components, the first being a liquid resin system, which may be a silicone resin system. Alternatively, the liquid resin system may be a urethane, epoxy or other organic resin system.

5 The other component is a filler, such as a magnetic or lossy dielectric filler. The magnetic filler is a filler material having a high magnetic permeability and a high electrical resistivity. The magnetic filler material may be iron carbonyl powder. Alternatively, the magnetic
10 filler material may be iron powder; iron silicide; a ferrite (a compound of ferric oxide with another oxide); PERMALLOY® (an alloy containing 78.5% nickel and 21.5% iron and having a high magnetic permeability and electrical resistivity); SENDUST (an alloy containing 85%
15 iron, 9.5% silicon and 5.5% aluminum); carbon, that is, conductive carbon powder; fibers, such as graphite or metal fibers; and other fillers with electromagnetic (EM) properties, that is, high magnetic permeability and high electrical resistivity.

20 The microwave-absorbing material is loaded into a dispensing system, such as one incorporating a syringe-like dispenser, in tubes. Such a system is shown in Figure 1, where a dispensing system 10 dispenses the microwave-absorbing material 12 into a cavity 14 in a housing for

electronic equipment. Within the cavity 14, the microwave-absorbing material 12 self-levels to a desired thickness, thereby forming an RF (radio-frequency) absorbing pad in the cavity 14 when cured. The thickness desired is
5 predetermined to be that required to attenuate surface currents and EMI (electromagnetic interference) within the housing.

The microwave-absorbing material 12 of the present invention has a viscosity sufficient to maintain the
10 filler material in a suspended state in the liquid resin system. The amount of filler material used, and the thickness of the microwave-absorbing material 12, deposited in the cavity 14, are controlled to optimize the absorption of microwave energy at a given frequency or
15 frequencies.

The microwave-absorbing material 12 of the present invention also has thixotropic properties. Thixotropy is the ability of certain colloidal gels to liquefy when agitated and to return to the gel form when at rest. In
20 other words, gels of this type hold their shape when at rest and not under pressure, but flow freely on application of slight pressure.

This property may be exploited to produce a pad of the microwave-absorbing material within a housing without

the presence of a cavity. Referring to Figures 2A and 2B, which are perspective and side views, respectively, of a dispensing system 10 depositing microwave-absorbing material 12 onto a surface 16 in a housing for electronic
5 equipment to form a pad 18 thereof. Because of its thixotropic properties, the microwave-absorbing material 12 maintains its shape as a pad 18 on the surface 16 and cures while keeping that shape.

Modifications to the above would be obvious to those
10 of ordinary skill in the art, but would not bring the invention so modified beyond the scope of the appended claims.

What Is Claimed Is:

1. A microwave-absorbing material comprising a liquid resin system and a magnetic or lossy dielectric filler.
2. A microwave-absorbing material as claimed in claim 1 wherein said liquid resin system is selected from the group consisting of silicone, urethane and epoxy resin systems.
3. A microwave-absorbing material as claimed in claim 1 wherein said liquid resin system is an organic resin system.
4. A microwave-absorbing material as claimed in claim 1 wherein said magnetic filler is selected from the group consisting of iron carbonyl; iron powder; iron silicide; ferrite; an alloy of nickel and iron; an alloy of iron, silicon and aluminum; carbon; fibers; and other fillers with electromagnetic (EM) properties.
5. A microwave-absorbing material as claimed in claim 1 wherein said liquid resin system is a silicone resin system and said magnetic filler is iron carbonyl powder.

6. A method for absorbing radio-frequency (RF) emissions in electronic equipment, said method comprising the steps of:

providing a liquid resin system;

dispensing a magnetic or lossy dielectric filler in said liquid resin system;

dispensing said liquid resin system having said filler into a housing for said electronic equipment; and

curing said liquid resin system having said filler thereby forming a radio-frequency (RF) absorbing pad in said housing.

7. A method as claimed in claim 6 wherein said liquid resin system having said filler is self-leveling and is dispensed into a cavity in said housing.

8. A method as claimed in claim 6 wherein said liquid resin system having said filler has thixotropic properties and is dispensed onto a surface in said housing.

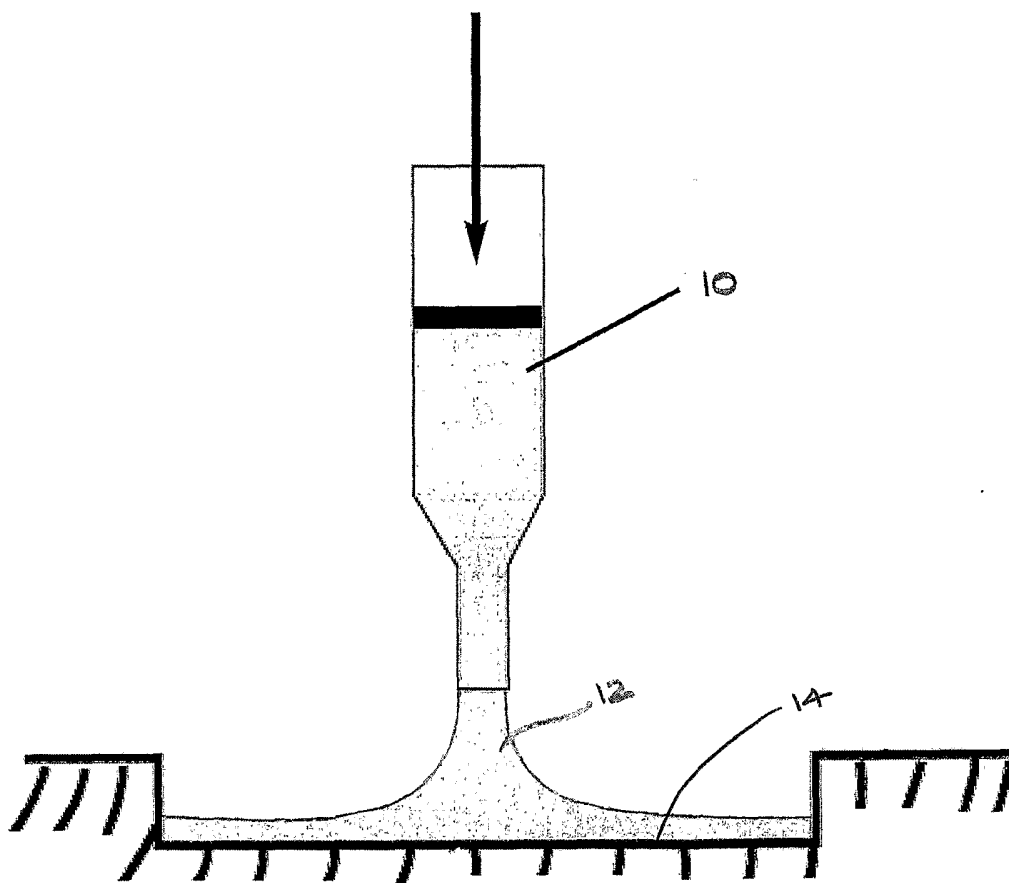


Fig. 1

