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(54) Title: EXPANDING MATERIAL IN NONWOVEN 3-D STRUCTURE

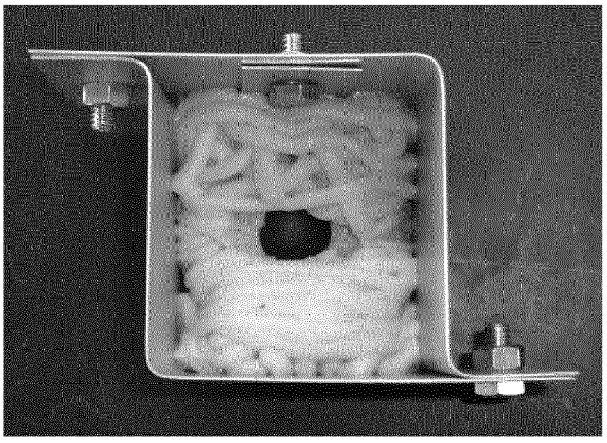

Fig. 1B

(57) Abstract: The present application is directed at continuous filament non-woven webs, wherein the filaments of the web comprise an expandable thermoplastic material and mattings fabricated from said continuous filament non-woven web. The web or matting can advantageously be used in sealing applications as it can be cut into the desired dimensions and inserted into a cavity. At that stage the web or matting allows for the introduction and drainage of further fluids in and from said cavity, while at a later stage the extendable thermoplastic material can be activated and foamed to fill a part of or the entire cavity. The sealing prevents air, water or noise from intruding into the cavity and a space behind that cavity.

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Expanding Material in nonwoven 3-D Structure

Description

Field of the invention

The invention is directed at continuous filament non-woven webs wherein the filaments of the webs comprise an expandable thermoplastic material. A further aspect of the invention is directed at a matting comprising a continuous filament non-woven web as identified above. Both above-mentioned embodiments of the invention can advantageously be used as sealing materials for cavities into which liquids such as cleaners and coatings can be introduced and drained off prior to sealing the cavity with the web or matting. Further aspects of the invention are directed at a process for fabricating said non-woven webs by extruding a thermally expandable thermoplastic material at a temperature below the activation temperature of a propellant comprised therein and a process for sealing a cavity comprising inserting the above-mentioned filament or matting into said cavity and activating a propellant in the thermoplastic material of the non-woven web by heat or electromagnetic irradiation to expand the material.

Background

Dry, pre-formed heat-reactive expandable sealers require unique application designs in order to be applied to a vehicle during the vehicle assembly. In particular, it has to be ensured that the sealers do not interfere with the assembly process (i.e. welding steps) and with any cleaning and coating processes that provide corrosion protection to the vehicle. These designs can become rather sophisticated and costly depending on the part of the vehicle and the cavity to be sealed. Past and current designs had to compensate via design in order to ensure that the introduction of a sealer in no way hinders or interferes with the cleaning and coating process of the vehicle during assembly. This includes drainage of cleaner(s) and coating(s) during a "body-in-white" assembly process, which utilizes immersion dip baths; when the vehicle exits these baths, all unused fluids need to be drained out the vehicle as quickly as possible.

Continuous filament non-woven web materials and mattings comprising such materials have previously been used in other field of technology, e.g. in the fields of mattings for use as floor covers. For example, US 5,811,186 describes a multi-component filament wherein the individual fibers have a sheath-core structure with an inner high melting polymer as the core which is covered with a second thermoplastic polymer with a lower melting point. This construction allows the individual filament fibers to be bonded to each other by heating to a temperature above the melting temperature of the outer polymer, but below that of the core polymer. Thus the surface of a fiber sufficiently softens to fuse with another fiber at contact points of the fibers, while the non-melted core of the fiber ensures that it maintains its shape.

US 5,972,463 describes mattings of the type used as floor coverings or doormats based on a filaments having a central core of an ethylene-propylene butene copolymer and a sheath of a second thermoplastic ethylene vinyl acetate copolymer blended with ethylene-methyl acrylate polymer wherein the individual filaments in the matting have a linear density of greater than 200 denier per filament and are durably melt-bonded at their points of intersection and contact.

Finally, US 6,080,482 describes multi-component filaments of a sheath-core structure having a linear density of 500 to 20000 denier per filament wherein the central core of the filaments is fabricated from polypropylene and ethylene-propylene-butene copolymers while the outer sheath copolymer is an ethylene-vinyl acetate copolymer blended with ethylene-methyl acrylate copolymer.

Continuous filament non-woven webs have also been used in medical applications as described for example in US 2001/0000352 A1. In these applications, the web possesses, without the necessity for adhesive binders, adjuncts, or post-extrusion melt processing, a cohesive shear strength exceeding 0.8 MPa when tension is loaded as a lap-shear sandwich joint. In this invention, the webs are preferably fabricated from biocompatible materials such as poly(glycolide)/poly(trimethylenecarbonate)triblock copolymers, as within medical applications the webs have to be bio-degradable at least to some extent.

Finally, continuous filament non-woven webs of a similar structure as utilized in this application have been described in US 5,055,151 and have in the meantime

been commercialized for use in covering steel or plastic pipes against damage by rocks as Tuff-N-Nuff® (Greenstreak group Inc.). Tuff-N-Nuff is advertised as a protective wrapping for underground piping and during the back-filling process and in these applications has to be flexible, while at the same time the material must have voids for post installation quality testing such as cathodic probe testing. The Tuff-N-Nuff material is made of flexible PVC and has been suggested for use as antislip mattings, anti-microbial protection matting and, due to non-conducting nature of PVC, cathodic protection.

Summary

In accordance with an exemplary embodiment, a continuous filament non-woven web is disclosed, comprising: filaments of the web, which include an expandable thermoplastic material.

In accordance with another aspect, a process is disclosed for fabricating a continuous filament non-woven web, which includes melt spinning or extruding an expandable thermoplastic material at a temperature below an activation temperature of a propellant within the thermoplastic material.

In accordance with a further aspect, a process for sealing a cavity is disclosed, which includes inserting a continuous filament non-woven web in the cavity in combination with a matting, wherein filaments of the web include an expandable thermoplastic material; and activating a propellant in the thermoplastic material of the non-woven web or the matting by heat or electromagnetic irradiation for a time sufficient to expand the thermoplastic material.

In accordance with another aspect, a process is disclosed for sealing a cavity, which includes inserting a continuous filament non-woven web having an expandable thermoplastic material, in combination with a matting, in the cavity; and activating a propellant in the thermoplastic material of the non-woven web or matting by heat or electromagnetic irradiation for a time sufficient to expand the thermoplastic material.

In accordance with a further aspect, a method is disclosed for sealing a cavity, which includes applying a continuous filament non-woven web having an expandable thermoplastic material into the cavity.

Brief description of the drawing

Exemplary embodiments will be described in detail with respect to the drawings, wherein:

Figure 1A depicts an exemplary sheet of filament non-woven web, which is positioned in a hollow profile orthogonal to the hollow space;

Figure 1B depicts an exemplary thermoplastic material in which, after expansion of the expandable thermoplastic material, the material fills the profile as shown from one side;

Figure 1C depicts an exemplary thermoplastic material in which, after expansion of the expandable thermoplastic material, the material fills the profile as seen from the opposite side;

Figure 1D depicts another aspect in which an exemplary thermoplastic material is positioned in a hollow profile diagonally to the hollow space;

Figure 1E depicts a hollow profile from one side after expansion of an exemplary expandable thermoplastic material; and

Figure 1F depicts another hollow profile from an opposite side after expansion of an exemplary expandable thermoplastic material.

Description of the preferred embodiments

In sealing technology, and especially in the automotive field, there remains a need for a sealing material which can be inserted into a cavity to be sealed in the final product at a relatively early stage of the assembly process and can be activated to seal the cavity at a relatively late stage. For this purpose, the sealing material has to have initial dimensions which do not fill the entire cavity to allow for the application of cleaner(s) and coating(s) during the "body-in-white" assembly process and for rapid draining out of these liquids after application to a part. Moreover, the material needs to be available in a form suitable for processing in order to form the final part configuration (i.e. extrusion). The product lines usually used for sealing applications are heat-expandable thermoplastic materials that are typically either injection-moulded or profile-extruded into, often times, complicated three-dimensional parts. One problem associated with such parts is that it is usually not possible to apply and drain liquids used for e.g. cleaning and coating inside the cavities when e.g. a body of a vehicle moves through the assembly process. Due to this requirement, draining points are de-

signed into the injection-moulded part. It would therefore be desirable to have a material which does not require complex pre-configuration such as fitting the same with draining points as specific positions.

One aspect of the present invention is to address the need for fluid drainage during customers final assembly process.

Another aspect of the present invention is to eliminate complex designs and therefore expensive tooling used for injection moulding or profile-extruding parts as well as to allow part communization, i.e. to use one part or material for different sealing applications, as this results in a simplification of manufacturing and a reduction of the part number.

Another aspect of the present invention is to reduce the materials used for sealing vehicle cavities, such as e.g. nylon carriers produced through 2-component molding or overmolding.

The problems indicated above are solved by a continuous filament non-woven web according to the present application, wherein the filaments of the web comprise an expandable thermoplastic material. The continuous filament non-woven web according to the present application can be inserted into a cavity and at that stage allows fluids to move through the cavity with little or no resistance. At a later stage the expandable thermoplastic material can then be activated, such as e.g. by heat during a primer and paint curing process, to seal the applied areas against air, water, or noise intrusion, the latter being of importance for passenger compartments in vehicles. The concept of the present application allows a significant simplification of pre-from designs in that the sealants are introduced in form of a continuous filament in non-woven web of a heat- or irradiation-reactive material which has a certain amount of entanglement and produces a sheet-stock of a thickness optimal for insertion into the respective cavities. Typical shaping methods such as thermo-forming, die-cut, water jet cutting and laser cutting can be used to bring the respective sheet-stock into a suitable form to ensure 100% sealing of the intended cavity area. Advantageously, the expansion of the sealant can be effected during for example a paint or primer heat curing process of a vehicle during manufacturing.

The continuous filament in non-woven webs according to the present application are preferably prepared by a process which comprises melt spinning or extruding a thermally expandable thermoplastic material at a temperature below the activation temperature of a propellant comprised therein. As a starting material, for example pellets of a thermally expandable thermoplastic material can be used. These pellets can then be processed further preferably into a "random loop" configuration to ultimately produce a web of a filament non-woven. The thickness of this web can be varied based on applying changes to the process; such as manipulation of conveyor speed and/or material throughput during the process.

In a preferred embodiment, the filaments of the continuous filament non-woven web consist essentially of the expandable thermoplastic material. It is also preferred that the web consists essentially of the mentioned filaments.

The base material of the expandable thermoplastic material is a thermoplastic polymer. This base-polymer is usually an organic polymer having a melting point in the range of 20 to 400°C, however, it is desirable, that the base polymer sufficiently softens at a temperature which is below the activation temperature of a propellant in the material so that deformation of the polymer is possible during a foaming process. When the activation temperature is reached, the base polymer is foamed. It is particularly preferred, that the base-polymer has a melting point in the range of 60 to 200°C.

Suitable base-polymers are well-known to the skilled practitioner. It is preferred however, that the base-polymer in the context of the present application is selected from the group comprising ethylene vinyl acetate, polyolefine, polyvinyl chloride, XPS (crosslinked polystyrene) and polyamide (nylon). Especially preferred are base-polymers selected from polyvinyl chloride and polyamide. Preferred polyolefin are polymers based on ethylene or propylene. A particularly suitable ethylene polymer is low density polyethylene. In the practice of the present application, the use of an ethylene vinyl acetate copolymer is particularly preferred. Mixtures of the mentioned polymers can also be used, depending on the properties required for the sealant in the desired application.

The base-polymer in most cases is the main component of the expandable thermoplastic material wherein the amount of base-polymer with regard to the sum of all components of the expandable thermoplastic material is preferably more than

50 % by weight. It is particularly preferred if the content of the base-polymer is in the range of 65 to 95 % by weight, in particular in the range of 70 to 90 % by weight, and most preferably in the range of 75 to 85 % by weight.

The expandable thermoplastic material can be activated and expanded, resulting effectively in the formation of a foam, by heating or by subjection to electromagnetic irradiation. For this purpose, the expandable thermoplastic material typically contains a chemical or physical propellant. Chemical propellants are organic or inorganic compounds, which degrade under the influence of temperature, moisture or electromatic irradiation and wherein at least one of the degradation products is a gas. Physical propellants for example are compounds, which at higher temperatures form a gas. Thus, both chemical and physical propellants can trigger the formation of a foamed structure within the polymer blend.

In the practice of the present application, it is preferred if the expandable thermoplastic material can be activated by the subjection to heat, preferably by heating the material to a temperature of less than or equal to 250°C. More preferably, the material is activated at a temperature in the range of 100 to 230°C and in particular in the range of 140 to 200°C. It is further preferred, that chemical propellants are used for the expansion. Suitable chemical propellants are in particular azodicarbonamides, sulphohydrazides, hydrogen carbonates or carbonates. A suitable azodicarbonamide is for example azobisformamide. Suitable sulphohydrazides are for example p-toluene sulphonhydrazide, benzolsulphohydrazide and p,p'-oxybisbenzol sulphonyl hydrazide. A suitable bicarbonate is sodiumbicarbonate. Particularly preferred propellants are azobisformamide and the p,p'-oxobisbenzene sulphohydrazide. Suitable propellants are also commercially available under the trade names Expancell® from Akzo Nobel, Netherlands, the trade name Celogen® of Chemtura Corp., USA, or under the trade name Unicell® from Tramaco, Germany.

The heat required for activation and foaming can be delivered by external or internal heat sources such as for example an exothermic chemical reaction.

With regard to the content of the propellant in the expandable thermoplastic material, the present application is not particularly limited. However, it has proven advantageous, if the propellant is comprised in the expandable thermoplastic material in an amount ranging from 2 of 20 % by weight, in particular in the range

of 10 to 18 % by weight, and most preferred in the range of 12 to 16 % by weight, based on the total weight of the expandable thermoplastic material. In cases wherein a lower expansion of the material is desired, the content can also be lower such as for example in the range of 2 to 10 % by weight.

In a further aspect of the present application it has proven advantageous if the expandable thermoplastic material is stabilized and consolidated during foam formation. This can for example be achieved by the addition of crosslinkers, which preferably are activated by degradation products of the propellant which initiate crosslinking of the resulting foam. Preferably, the crosslinking of the expandable thermoplastic material takes place at a temperature which is equal to or above the activation temperature as otherwise crosslinking of the expandable thermoplastic material occurs before the foaming and it can thus not be ensured that the expandable thermoplastic material fills the entire cavity before the foam hardens and assumes a compact structure.

With regard to the crosslinking of the obtained expanded thermoplastic material, the present application is not particularly limited. Crosslinking of the foam in particular is possible with crosslinking agents which do not react with the base polymer such as e.g. epoxy-based crosslinking agents, or with crosslinkers which react with the base polymer. An example for such crosslinking agents are peroxide crosslinkers. In the context of the present application, crosslinking with peroxide crosslinkers or crosslinking with epoxides is preferred.

When crosslinking with peroxides is employed, conventional organic peroxides such as for example dibenzoyl peroxide, dicumyl peroxide, 2,5-di-(t-butylperoxyl)-2,5-dimethylhexane, t-butycumylperoxide, α,α'-bis(t-butylperoxy) diisopropylbenzene isomeric mixture, di-(t-amyl)peroxide, di-(t-butyl)peroxide, 2,5-di-(t-butylperoxy)-2,5-dimethyl-3-hexine, 1,1-di(t-butylperoxy)-3,3,5-trimethylcyclohexane, n-butyl 4,4-di-(t-butylperoxy)valerate, ethyl 3,3-di-(t-amylperoxy)-butanoate, or t-butyperoxy-3,5,5-trimethylhexanoate can be used. A preferred peroxide is dicumylperoxide.

If epoxy-based crosslinkers are used, a mixture of an epoxy containing polymer and a maleic anhydride containing polymer has proven as particular advantageous. It is preferred, that the epoxy containing polymer is a copolymer of ethylene and glycidylmethacrylate having a preferred content of glycidyl monomer in

the range of 4 to 12% by weight based on the weight of the copolymer. The maleic anhydride group containing polymer preferably is a terpolymer of ethylene, an alkyl acrylate or methacrylate, in particular on the basis of an alkyl alcohol with 2 to 10 carbon atoms, and maleic anhydride. The content of a maleic anhydride in the terpolymer is preferably in the range of 1.5 to 5% based on the total weight of the terpolymer. It is particularly preferred if the two crosslinking components are present in a ratio of from 2:1 to 1:2, in particular about 1:1.

The above polymer combination is particularly suitable in combination with propellants, which upon heating release water or alcohol, as the evolving water or alcohol hydrolyzes the maleic anhydride to maleic acid which then allows for a reaction of with the epoxy groups of the epoxy containing polymers resulting in crosslinking.

In the thermally expandable thermoplastic material, the crosslinking agent is preferably present in a content ranging from 1 to 25% by weight, based on the total weight of the expandable thermoplastic material, in particular in the range of 2 to 18 % by weight and most preferably in the range of 2 to 10% by weight. In case a peroxide is used as a crosslinking agent, the concentration can be lower, in particular in the range of 1 to 5 % by weight, and more preferably in the range of 1 to 2 % by weight.

In a further embodiment of the invention, the thermally expandable thermoplastic material does not contain a crosslinker.

The thermally expandable thermoplastic material should preferably contain sufficient propellant to allow for an expansion of at least about 20 %, in particular at least about 100 %, and more preferably at least about 500 %, even more preferably at least about 1000 % and most preferably at least about 1500 % of its non-expanded volume. On the other hand, the maximum expansion should not exceed 20000 %, preferably 5000 % and most preferably 2500 % of its non-expanded volume.

The dimensions of the individual filaments in the non-woven web should preferably be such that the filaments have a thickness in the range of from 0.5 to 3 mm, in particular 0.75 to 2 mm and most preferably 1 to 1.5 mm.

A further aspect of the present application is a matting comprising a continuous filament non-woven web as described above. Such matting is easy to handle in an assembly of for example automotive parts and can either be die-cut into the desired dimensions or slit into strips, depending on the engineering requirements. The resulting die-cut parts or strips can then be processed even further to include assembly aids such as nylon attachments or adhesives for the attachments to the body-in-white steel frame.

The matting according to the present application preferably has a thickness in the range of 0.01 to 10 mm, more preferably in the range of 0.60 to 6 mm, and in particular in the range of 1.5 to 4.5 mm. Further, it is preferred that the matting has a surface weight in the range of from 0.1 to 5 kg/m^2, more preferred in the range of from 0.3 to 3 kg/m^2, and in particular in the range of from 0.5 to 2.5 kg/m^2.

The matting may consist essentially of the expandable thermoplastic material, or may comprise a base material onto which the expandable thermoplastic material is applied. Such base material can consist preferably of the wire mesh, in particular a wire mesh based on nylon. The resulting matting will have the advantage of drainage, high surface area for heating and would be of particular use in automative or construction fields.

A yet further aspect of the present application is a hollow article having a cavity, into which a non-woven web or matting as described above has been inserted and expanded to fill at least part of the cavity. In one preferred embodiment, the non-woven web or matting has been expanded to substantially fill the entire cavity. In another preferred embodiment, the non-woven web or matting has been expanded such that only part of the hollow article is filled, but that air or liquid cannot pass from one side of the article to the other passing through the expanded material

A further embodiment of the present application is a process for fabricating a continuous filament non-woven web as described above comprising melt spinning or extruding an expandable thermoplastic material at a temperature below the activation temperature of a propellant comprised therein into the shape of a continuous filament non-woven web. In the practice of the present application, extruding is preferred in the above-mentioned process. Suitable devices and param-

eters for this process are well-known to the skilled practitioner and are for example described in US 5,055,151 or US 2011/0293764 A1.

A further embodiment of the present application is a process for sealing a cavity comprising

- inserting a continuous filament non-woven web or a matting as described above into a cavity and
- activating a propellant in the thermoplastic material of the non-woven web or matting by heat or electromagnetic irradiation for a time sufficient to expand the thermoplastic material.

As already indicated above, the continuous filament non-woven web can be cut into the desired shape for the cavity to be filled by die cutting or slitting into appropriate strips depending on the shape of the cavity. Alternatively, the web could be brought into the desired shape by bending or thermoforming at a temperature below the activation temperature of the propellant. For example, the material could be rolled into a tube or bent with multiple angles.

A further aspect of the present application is directed at the use of a continuous filament non-woven web or a matting as described above for sealing applications, preferably for automotive applications and in particular for sealing vehicle cavities. Another aspect of the present application is directed at the use of a continuous filament non-woven web or a matting as described above for concrete expansion joint sealing.

Yet another aspect of the present application is directed at the use of a continuous filament non-woven web or a matting as described above in non-drain applications such as a gap between concrete plates, or for pothole repair. In these applications, the propellant can advantageously be activated by indirect heat such as by heat of rolled asphalt being applied together with or onto the filament non-woven web or matting.

Claims

1. A continuous filament non-woven web, wherein the filaments of the web comprise an expandable thermoplastic material.

2. Non-woven web according to claim 1, wherein the filaments consist essentially of the expandable thermoplastic material.

3. Non-woven web according to claim 1 or 2, wherein the individual filaments are arranged in a random loop configuration.

4. Non-woven web according to any one of claims 1 to 3, wherein the thermally expandable thermoplastic material is characterized by a maximum expansion of at least about 100 %, preferably at least about 500 % and in particular at least about 1000 % of its non expanded volume.

5. Non-woven web according to any one of claims 1 to 4, wherein the thermoplastic material comprises ethylene-vinylacetate, polyolefine, polyvinylchloride, crosslinked polystyrene, polyamide, or a combination thereof.

6. Non-woven web according to any one of claims 1 to 5, wherein the filaments have a thickness in the range of 0.5 to 3 mm, preferably 0.75 to 2 mm and in particular 1 to 1.5 mm.

7. Non-woven web according to any one of claims 1 to 6 comprising a propellant, preferably a chemical propellant which is selected from the group consisting of azodicarbamides, sulphohydrazides, hydrogen carbonates and carbonates.

8. Non-woven web according to any one of claims 1 to 7, wherein the thermoplastic material comprises a crosslinking agent.

9. A matting comprising a continuous filament non-woven web according to any one of claims 1 to 8.

10. A matting according to claim 9, having a thickness in the range of 0.01 to 10 mm, preferably 0.60 to 6 mm and in particular 1.5 to 4.5 mm.

11. A matting according to claim 9 or 10, having a surface weight in the range of 0.1 to 5 kg/m^2, preferably 0.3 to 3 kg/m^2 and in particular 0.6 to 1.5 kg/m^2.

12. A hollow article having a cavity, into which a non-woven web according to any one of claims 1 to 8 or a matting according to any one of claims 9 to 11 has been inserted and expanded to fill at least part of the cavity.

13. A process for fabricating a continuous filament non-woven web according to any one of claims 1 to 8 comprising melt spinning or extruding an expandable thermoplastic material at a temperature below the activation temperature of a propellant comprised therein.

14. A process for sealing a cavity comprising
- inserting a continuous filament non-woven web according to any one of claims 1 to 8 or a matting according to any one of claims 9 to 11 in said cavity and
- activating a propellant in the thermoplastic material of the non-woven web or matting by heat or electromagnetic irradiation for a time sufficient to expand the thermoplastic material.

15. Use of a continuous filament non-woven web according to any one of claims 1 to 8 or a matting according to any one of claims 9 to 11 for sealing applications, preferably for sealing vehicle cavities and for concrete expansion joint sealing.

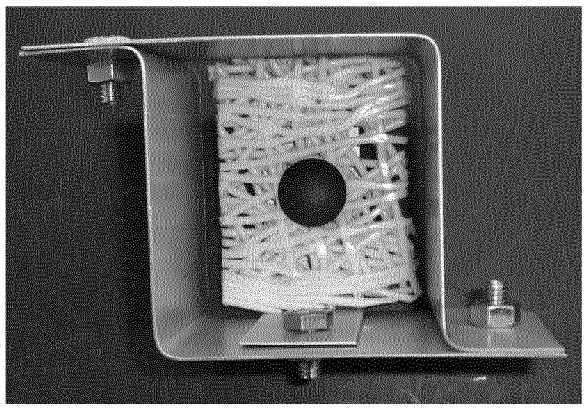

Fig. 1A

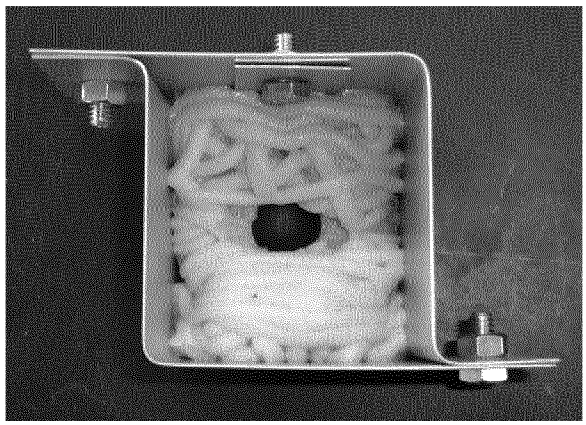

Fig. 1B

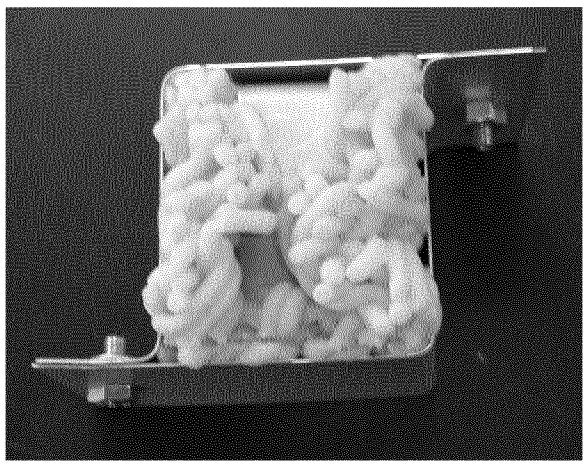

Fig. 1C

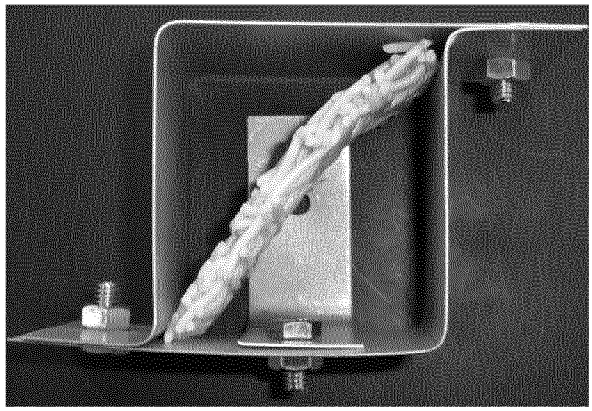

Fig. 1D

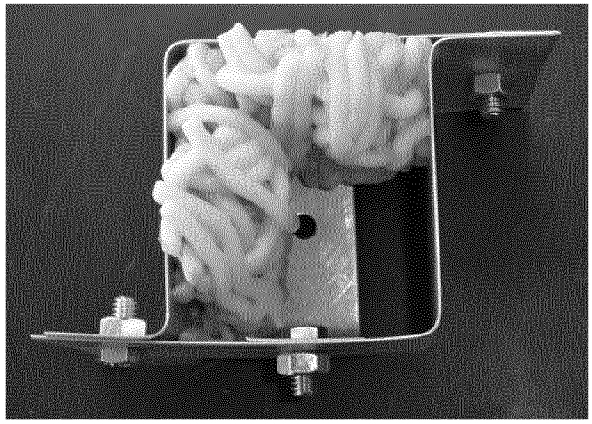

Fig. 1E

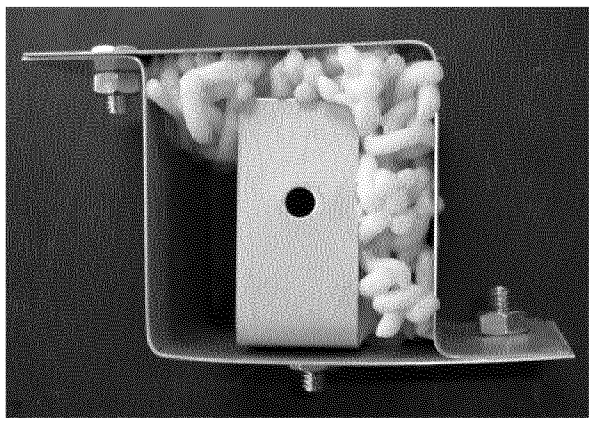

Fig. 1F

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2013/066716

A. CLASSIFICATION OF SUBJECT MATTER
INV. D04H1/42 D04H1/50 D04H3/005 D04H3/03
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
D04H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 775 232 A (GOMORY P) 27 November 1973 (1973-11-27)	1,2, 4-11,13, 15
A	column 3, line 18 - column 4, line 32; claims 1-6; examples I-II column 7, line 65 - column 8, line 17	3,12,14

X	US 3 694 873 A (CROWLEY RICHARD P) 3 October 1972 (1972-10-03)	1,2, 4-11,13
A	the whole document	3,12,14, 15

A	DE 38 25 987 A1 (KISS G H [DE] LIGNOTOCK GMBH [DE]) 1 February 1990 (1990-02-01) column 3, line 53 - column 4, line 66; claims 1-6; figures 1-4	1-15

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
27 September 2013	09/10/2013

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

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PCT/EP2013/066716

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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A	US 2003/138594 A1 (LOBOVSKY ALEX [US] ET AL) 24 July 2003 (2003-07-24) claims 1-25; figures 2a, 2b; example 1	1-15
A	WO 95/08661 A1 (GORE & ASS [US]) 30 March 1995 (1995-03-30) claims 1-32; figures 1,2,10; examples 1-8	1-15
A	WO 2006/068574 A1 (AKZO NOBEL NV [NL]; EKA CHEMICALS AB [SE]; NORDIN JAN [SE]; GRATZ SUSA) 29 June 2006 (2006-06-29) the whole document	1-15

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Information on patent family members

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