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(54) **IMPACT PROTECTOR AND ITS METHOD OF MAKING**

(57) This invention concerns an impact protector designed to form a shock or impact absorbing shell (1) around an item, an object or a part (2) in order to prevent in particular injuries to people contacting said item, object or part, said protector consisting of a rectangular or square shaped plate or sheet (3) of foam material.

Said impact protector is characterized in that said plate or sheet has shape memory properties which makes it wrap or coil itself elastically and automatically into a cylindrical sleeve body (1') around a winding axis (WA) in its rest or stressfree state.

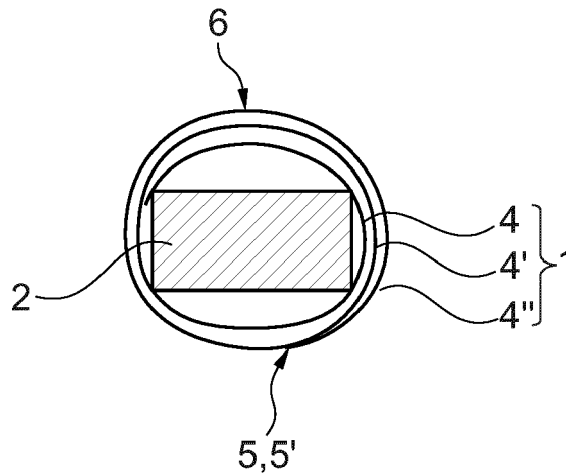


Fig. 6

Description

[0001] The present invention is related to the field of the safety of people, for example staff and visitors, in particular in building sites and in industrial plants, and has as its general objective to provide efficient protection against impact injuries (for example from pillars, columns, posts, frames, edges, corners and the likes).

[0002] The present invention aims more specifically for providing an impact protector device which is able to provide fast and straightforward 360° protection, is easy to put in place and to remove, without need of any integrated or separate fixing means and, whose implementation and use do not lead to any damage or modification to the item, structure or part it is attached to or removed from.

[0003] Nowadays, the function of protection against impacts is fulfilled in different, more or less tedious and costly ways and up to a variable degree of satisfaction, often depending on the work quality and qualification of the operator setting it up.

[0004] One known basic solution consists in wrapping sheet of elastic or dampening material around the item or part which has to be covered and to attach it with adhesive tape. This solution is time consuming, generates waste and is of inconsistent quality.

[0005] Another known solution consists in using specifically shaped foam parts, adapted to the item or part to be covered, and fixing them by gluing. This solution requires a large variety of different shapes and is likely to damage at least the surface of the item or part when removed.

[0006] Tubular sleeves made by extruding foam and intended to be mounted (after having been cut open longitudinally) around ducts for heat insulation purposes are also known in the art. But they are only adapted for a small range of diameters and lose their capacity of abutting closure after having been put on and taken off several times. Moreover, they fit properly only once, often need extra straps or tape in order to achieve good fitting, are easily destroyed, have a poor grey appearance and provide generally at the most only one surrounding layer of foam with poor shock absorbing properties.

[0007] Furthermore, snap around pipe or wire markers are also known, but they are made of thin material, with no cushioning or dampening properties.

[0008] The main aim of the present invention is to propose a new solution allowing to overcome the drawbacks of the state of the art solutions in the field of protection against impact injuries and showing the beneficial aspects exposed before.

[0009] In that respect, the invention proposes an impact protector designed to form a shock or impact absorbing shell around an item, an object or a part in order to prevent in particular injuries to people contacting said item, object or part, said protector consisting of a rectangular or square shaped plate or sheet of foam material, said impact protector being characterized in that said plate or sheet has shape memory properties which

makes it wrap or coil itself elastically and automatically into a cylindrical sleeve body around a winding axis in its rest or stressfree state.

[0010] The invention will be better understood by means of the following description, which relates to preferred embodiments, given by way of non-limiting examples and explained with reference to the accompanying drawings, in which:

- 10 - figure 1 shows a sheet of foamed material prior to its conformation into an impact protector according to the invention;
- figure 2 shows in a sectional view and by way of example the sheet of figure 1 wrapped around a mandrel during its heat treatment to become an impact protector according to the invention;
- 15 - figures 3A to 3C are sectional views, along a plane perpendicular to the winding axis, of three embodiments of an impact protector according to the invention in its stressfree state;
- 20 - figure 4 is a view in a different scale of the detail A of figure 3C;
- figures 5A and 5B are sectional views of examples of items (angle iron/beam with polygonal section)
- 25 which can be shielded with an impact protector of the invention, and
- figure 6 is a sectional view of a rectangular rod shielded with an impact protector according to the invention.

[0011] The invention concerns an impact protector designed to form a shock or impact absorbing shell 1 around an item, an object or a part 2 in order to prevent in particular injuries to people contacting said item, object or part, said protector consisting of a rectangular or square shaped plate or sheet 3 of foam material, which is intended to be wrapped around the article to be shielded or encapsulated.

[0012] According to the invention, said plate or sheet 3 has shape memory properties which makes it wrap or coil itself elastically and automatically into a cylindrical sleeve body 1' around a winding axis WA in its rest or stressfree state (i.e. under normal ambient conditions, and when it is not exposed to any constraint or load and not interacting with any physical body).

[0013] Thus, the invention provides a self-wrapping impact protection which fits a wide range of shapes, sizes and diameters and provides a 360° shielding of the surrounded item, object or part against contact with users, vehicle or any moving body passing in close proximity to it.

[0014] Preferably, the inner diameter D_i of the stress-free coiled sleeve shaped body 1' is at least slightly smaller than the diameter D_{cc} of the circumscribed circle CC of the sectional outline of the elongated item, object or part 2 to be equipped with it, the cylindrical shell 1 formed by the impact protector thus surrounding said item, object or part 2 with at least a minimal elastic clamping force.

[0015] So the surrounding shell 1 forming the impact protector remains attached to the considered item, object or part 2 without any additional fixing means (be it mechanical or adhesive). Furthermore, it does not need any tool for attaching it and it can be removed without any damage or degradation to the item, object or part 2 forming the supporting and surrounded structure.

[0016] Finally, said impact protector can be attached and removed numerous times, theoretically indefinitely, without damage to it and without permanent structural deformation or any reduction of its elastic clamping force (when it is spread under constraint).

[0017] To provide a sufficient clamping force and thus a sufficiently firm attachment of the impact protector cylindrical shell 1 on the considered item, object or part 2, the ratio D_i/D_{cc} may be comprised between 0,40 and 0,95, advantageously between 0,50 and 0,70, preferably around 0,60.

[0018] The shielded item, object or part 2 should be surrounded over its entire circumference at least by no less than one layer of foamed sheet material 3, to provide a 360° uninterrupted protection.

[0019] To achieve this result, the impact protector shows in its stressfree coiled sleeve shape at least two mutually overlapping layer 4, 4' portions, preferably over at least 50% of the circumference of the sleeve shaped body 1' (figures 3A to 3C).

[0020] This can be obtained by taking into account a maximum authorised forced increase of diameter of the cylindrical sleeve body 1' for impact protectors according to the invention of a given size.

[0021] Now, a first improved version of the impact protector may show enhanced shielding at least in an area of the item, object or part 2.

[0022] To obtain such an improved impact protector, the invention may propose that said protector constitutes an absorbing cylindrical shell 1 having at least two superimposed layers 4, 4', 4" over at least 50% of its circumference, preferably over at least 100% of its circumference, when it is wrapped around the item, object or part 2 to encapsulate or shield (figures 3C and 6).

[0023] A further improvement of the impact protector can be achieved when the rectangular or square shaped plate or sheet 3 of foamed material has a winding length, i.e. a length WL in a direction perpendicular to its self-winding axis WA, such that in its stressfree coiled sleeve shape it shows at least two overlapping layers 4, 4' of foam sheet 3 material over its entire circumference, preferably also when wrapped around an item, object or part 2 to be shielded or encapsulated (figure 6).

[0024] According to an other aspect of the invention, in relation to an alternative approach, its stressfree coiled sleeve shape may show two overlapping layers 4, 4' of foam sheet material over a major part of its circumference, for example between 60% and 80% of said circumference, and three such overlapping layers 4, 4', 4" over the remaining part of said circumference (figure 3C).

[0025] A most preferred embodiment of the impact pro-

jector of the invention verifies both of the two last aspects mentioned herein before.

[0026] In order to reduce the risk of unwanted unwrapping of the installed impact protector and also provide a better enclosure of the cylindrical shell 1, the plate or sheet 3 may show, in a strip-like area 5 extending along its edge 5' located outside in the stressfree coiled sleeve shape, a continuously reducing thickness, tapering towards the ridge of said edge 5', so as to form a wedge-like or bevelled outer section 5", having preferably an angle of about 10° (figure 4).

[0027] A secondary function of the impact protector, allowing an increased safety by preventing contact, may be to signal the item, object or part 2 it is mounted on.

[0028] Thus, according to a first embodiment, the plate or sheet 3 of foamed material has a high visibility marking on its face 3' corresponding to the outer-facing surface in its stressfree coiled sleeve shape, preferably a bicoloured striped pattern, for example alternatively black and yellow or red and white.

[0029] According to a second embodiment, the plate or sheet 3 of foamed material is provided, on its face 3' corresponding to the outer-facing surface in its stressfree coiled sleeve shape, with a laminated, visually marked film or foil 6, preferably showing a black and yellow striped pattern, said film or foil 6 being advantageously embossed.

[0030] The visible marking of the outer face of the impact protector will be less impacted by the deformation imposed by the sectional shape of the shielded item, object or part 2 when at least two layers are surrounding said latter.

[0031] As preferred practical embodiments, the foamed material consists of reticulated polyethylene foam having a density between 15 kg/m³ and 50 kg/m³, advantageously between 20 kg/m³ and 40 kg/m³, preferably around 30 kg/m³, and the sheet or plate 3 has a current thickness between 5 mm and 15 mm, advantageously between 6 mm and 10 mm, preferably around 7 mm.

[0032] Furthermore, the laminated film or foil 6 is advantageously a polyethylene film, preferably with a thickness between 100 μm and 150 μm, most preferably around 120 μm.

[0033] The invention also concerns a process for producing an impact protector as described herein before, characterized in that it mainly comprises the steps of:

- producing a rectangular or square shaped sheet or plate 3 of foamed material,
- winding said sheet or plate 3 tightly around a mandrel, a spindle or a similar support body,
- applying a heat treatment to said wound sheet or plate 3 in order to confer shape memory properties to said sheet or plate 3.

[0034] The striped pattern of the marking may, for example, verify the criteria set in the French normative re-

lated to safety signaling as mentioned in the French Decree: "Arrêté du 4 novembre 1993 - version consolidée du 21 août 2019".

[0035] Of course, the invention is not limited to the embodiments described and represented in the accompanying drawings. Modifications remain possible, particularly from the viewpoint of the composition of the various elements or by substitution of technical equivalents without thereby exceeding the field of protection of the invention.

Claims

1. Impact protector designed to form a shock or impact absorbing shell (1) around an item, an object or a part (2) in order to prevent in particular injuries to people contacting said item, object or part, said protector consisting of a rectangular or square shaped plate or sheet (3) of foam material, **characterized in that** said plate or sheet (3) has shape memory properties which makes it wrap or coil itself elastically and automatically into a cylindrical sleeve body (1') around a winding axis (WA) in its rest or stressfree state.
2. Impact protector according to claim 1, **characterized in that** the inner diameter (Di) of the stressfree coiled sleeve shaped body (1') is at least slightly smaller than the diameter (Dcc) of the circumscribed circle (CC) of the sectional outline of the elongated item, object or part (2) to be equipped with it, the cylindrical shell (1) formed by the impact protector thus surrounding said item, object or part (2) with at least a minimal elastic clamping force.
3. Impact protector according to claim 2, **characterized in that** the ratio Di/Dcc is comprised between 0,40 and 0,95, advantageously between 0,50 and 0,70, preferably around 0,60.
4. Impact protector according to anyone of claims 1 to 3, **characterized in that** in its stressfree coiled sleeve shape it shows at least two mutually overlapping layer (4, 4') portions, preferably over at least 50% of the circumference of the sleeve shaped body (1').
5. Impact protector according to anyone of claims 1 to 4, **characterized in that** it constitutes an absorbing cylindrical shell (1) having at least two superimposed layers (4, 4', 4'') over at least 50% of its circumference, preferably over at least 100% of its circumference, when it is wrapped around the item, object or part (2) to encapsulate or shield.
6. Impact protector according to anyone of claims 1 to 5, **characterized in that** the rectangular or square shaped plate or sheet (3) of foamed material has a winding length, i.e. a length (WL) in a direction perpendicular to its self-winding axis (WA), such that in its stressfree coiled sleeve shape it shows at least two overlapping layers (4, 4') of foam sheet (3) material over its entire circumference, preferably also when wrapped around an item, object or part (2) to be shielded or encapsulated.
7. Impact protector according to claim 4, 5 or 6, **characterized in that** in its stressfree coiled sleeve shape it shows two overlapping layers (4, 4') of foam sheet material over a major part of its circumference, for example between 60% and 80% of said circumference, and three such overlapping layers (4, 4', 4'') over the remaining part of said circumference.
8. Impact protector according to anyone of claims 1 to 7, **characterized in that** the plate or sheet (3) of foamed material shows, in a strip-like area (5) extending along its edge (5') located outside in the stressfree coiled sleeve shape, a continuously reducing thickness, tapering towards the ridge of said edge (5'), so as to form a wedge-like or bevelled outer section (5''), having preferably an angle of about 10°.
9. Impact protector according to anyone of claims 1 to 8, **characterized in that** the plate or sheet (3) of foamed material has a high visibility marking on its face (3') corresponding to the outer-facing surface in its stressfree coiled sleeve shape, preferably a bicoloured striped pattern, for example alternatively black and yellow or red and white.
10. Impact protector according to anyone of claims 1 to 9, **characterized in that** the plate or sheet (3) of foamed material is provided, on its face (3') corresponding to the outer-facing surface in its stressfree coiled sleeve shape, with a laminated, visually marked film or foil (6), preferably showing a black and yellow striped pattern, said film or foil (6) being advantageously embossed.
11. Impact protector according to anyone of claims 1 to 10, **characterized in that** the foamed material consists of reticulated polyethylene foam having a density between 15 kg/m³ and 50 kg/m³, advantageously between 20 kg/m³ and 40 kg/m³, preferably around 30 kg/m³, and **in that** the sheet or plate (3) has a current thickness between 5 mm and 15 mm, advantageously between 6 mm and 10 mm, preferably around 7 mm.
12. Impact protector according to claim 10, **characterized in that** the laminated film or foil (6) is a polyethylene film, preferably with a thickness between 100 μm and 150 μm, preferably around 120 μm.

13. Process for producing an impact protector according to anyone of claims 1 to 8, **characterized in that** it mainly comprises the steps of:

- producing a rectangular or square shaped sheet or plate (3) of foamed material, 5
- winding said sheet or plate (3) tightly around a mandrel, a spindle or a similar support body,
- applying a heat treatment to said wound sheet or plate (3) in order to confer shape memory properties to said sheet or plate (3). 10

14. Process according to claim 13, **characterized in that** it consists also in applying a visual marking according to claim 9 or in laminating a visually marked film or foil (6) according to claim 10, for example by gluing or heat welding, onto said sheet or plate (3) of foamed material before it is wound around the mandrel. 15

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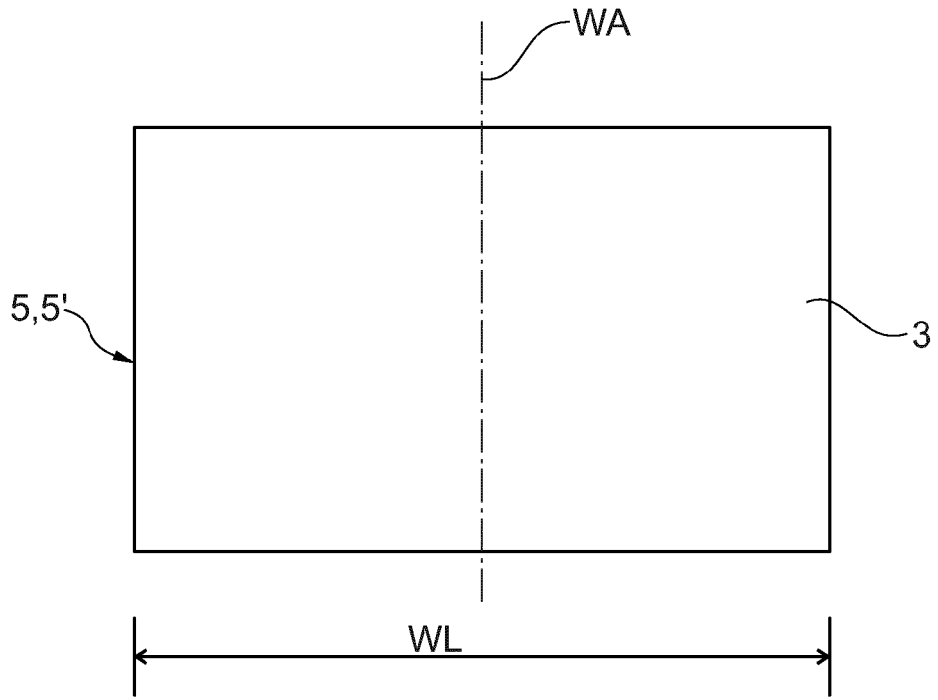


Fig. 1

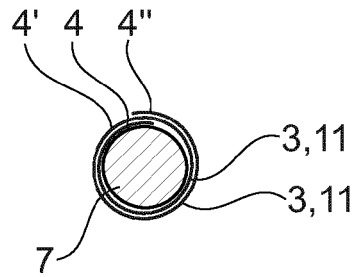


Fig. 2

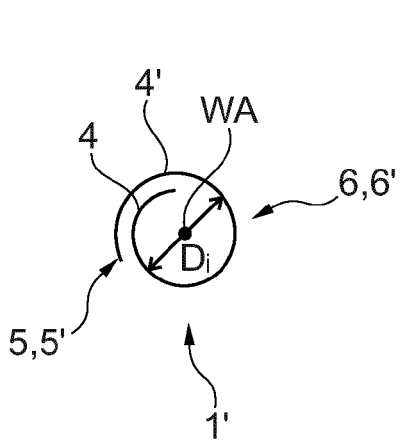


Fig. 3A

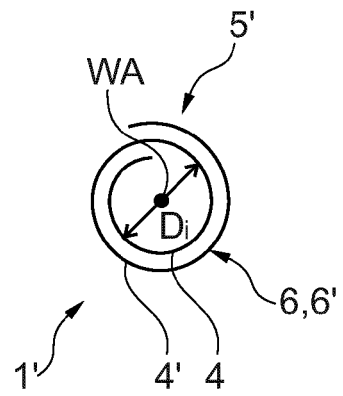


Fig. 3B

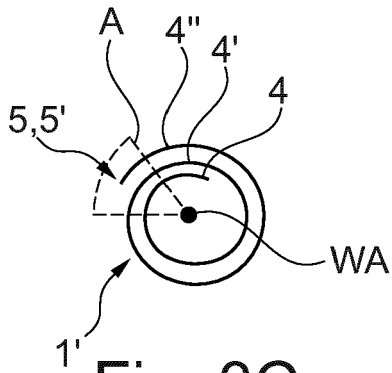


Fig. 3C

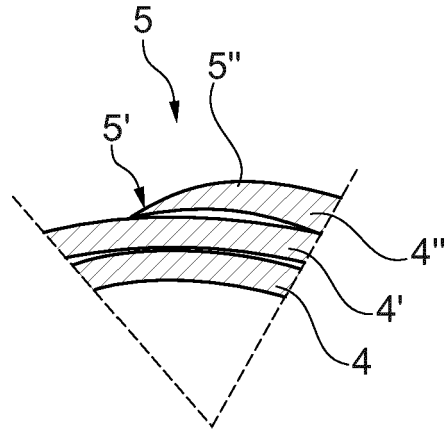


Fig. 4

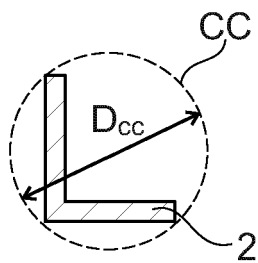


Fig. 5A

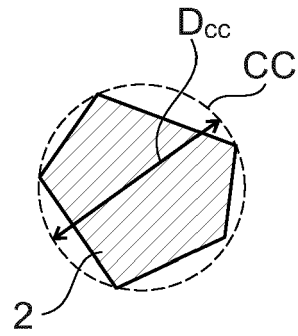


Fig. 5B

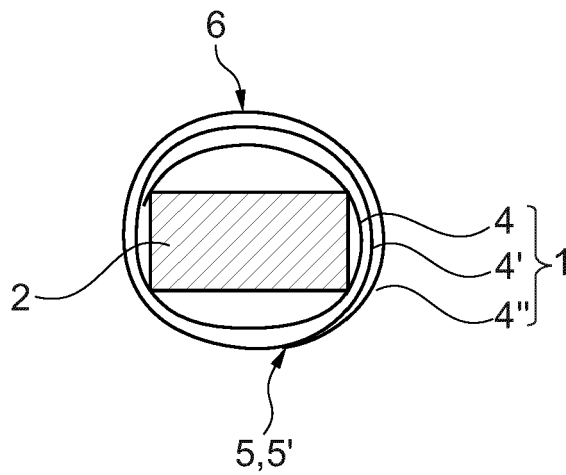


Fig. 6



EUROPEAN SEARCH REPORT

Application Number
EP 19 19 5398

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 9 533 786 B1 (FEINSTEIN PETER A [US]) 3 January 2017 (2017-01-03)	1-3,11	INV. B65D65/10 B65D85/671
A	* abstract; claims 1, 4; figures 1-3 * * column 3, line 12 - line 14 * * column 1, line 26 - line 42 *	4-10, 12-14	
A	----- EP 3 003 717 A1 (3M INNOVATIVE PROPERTIES CO [US]) 13 April 2016 (2016-04-13) * claims 1, 9; figures 1-7B * * paragraph [0032] *	1-14	
A	----- EP 1 882 642 A2 (PORTA ALESSANDRO [IT]) 30 January 2008 (2008-01-30) * claims 1, 2; figures 1-9 *	1-14	
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 16 March 2020	Examiner Huyge, Kevin
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 19 19 5398

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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16-03-2020

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