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(54) **Anti-trauma pad**

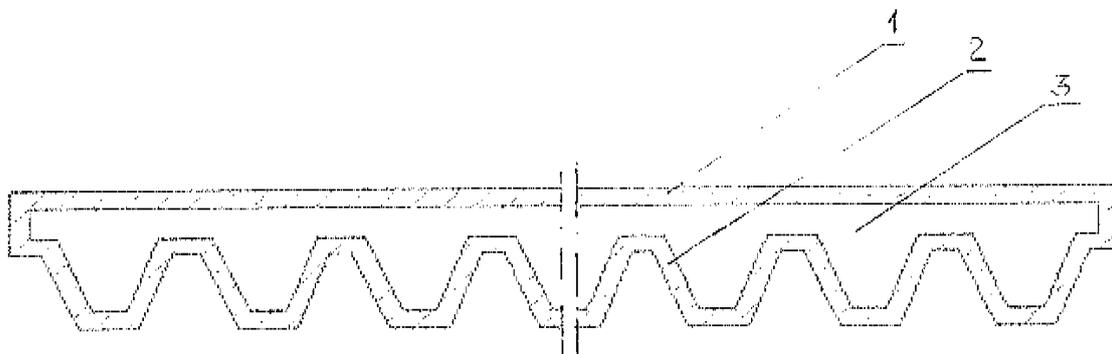
(57) The subject of the invention is the anti-trauma pad dedicated for use in the personal armours together with the ballistic panels.

The pad of the shape of plate made of elastomeric material, has one exterior side flat (1) while the other is equipped with the protrusions, identical and distributed evenly next to each other (2). Inside the plate there is a

closet chamber (3) of the shape corresponding to the outer contour of the plate, filled with the dilation liquid.

Preferably the elastomeric material of the pad contains an additive in the form of spheres filled with an inert gas.

The highly energy-absorbing pad reduces the deflection of ballistic panel when shot.



**Fig.2**

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## Description

[0001] The subject of the invention is the elastomeric anti-trauma pad dedicated for use in the personal armours, together with a ballistic panel.

[0002] Ballistic panels that save lives or limit the wearer's injuries after a hit of a projectile from firearms are widely known and used. A ballistic panel undergoes deflection upon a projectile hit, causing deformation of a basis, which transfers into the severity of an injury. Since ballistic panels are heavy and expensive, providing adequate security and usage comfort without increasing the load is an important issue.

To improve the usage comfort, sometimes the additional elastomer inserts of foam structure are applied together with the ballistic panel.

[0003] The essence of the solution according to the invention consists in developing a light structure strongly absorbing the energy, to be used as a pad under a ballistic panel, causing a decrease in the deflection of ballistic panel upon a shot.

[0004] The anti-trauma pad is a flexible plate made of an elastomeric material, comprising a closed inner chamber which occupies up to 90% vol. of the plate, wherein one exterior side of the plate is flat, while the other is equipped with the arrangement of protrusions, distributed evenly over its entire area.

Number of the protrusions amounts from 1500 up to 3000 / m<sup>2</sup>, and the minimum thickness of the pad measured between the protrusions is not less than 7mm, while including the protrusions it is up to 27 mm maximum. Preferably, the height of the protrusions is from 2 up to 15 mm. The pad may contain a dilatation liquid of up to 90% vol., introduced uniformly into the structure of the elastomer and/or to the inner chamber.

As an example of the dilatation liquid, a suspension is used, which contains from 15 up to 30% vol. of fumed silica of the grain diameter of 5 to 15 nm with 70 up to 85% vol. of the polypropylene glycol.

Preferably, the elastomeric material of pad comprises an additive in the form of spheres in an amount of up to 5%, filled with an inert gas, while the diameter of the spheres fits in the range from 1 nm up to 990 μm.

Reduction in deflection of a ballistic panel for use in personal armours has a significant impact on reducing the internal injuries upon a shot.

The deformation of base upon a hit with the 7,62x39 mm PS bullet, determined according to the requirements of PN-V-87001:2011 Standard is reduced by 60-70% for the arrangement of ballistic composite with the pad, compared to a test performed on the panel without the pad.

[0005] The anti-trauma pad according to the invention is shown in the drawings, where **Fig.1** shows a view of the pad from the bottom, and **Fig.2** - a fragment of the pad's cross-section.

[0006] The pad has one outer side flat **1**, while the other side has protrusions **2** which are identical, regularly spaced and positioned next to each other. Inside the plate

there is a closed chamber **3** of a shape corresponding to the outer outline of the plate and filled with the dilatation liquid.

### 5 Embodiment example I.

[0007] The pad in the form of plate with one side flat, and the other with protrusions in the shape of truncated pyramids, manufactured of equal amounts of two components of silicone ZA 22 MOULD (resin base and accelerator) from Amod, Poland, has an internal chamber containing the dilatation liquid of the following composition: 25% vol. of fumed silica of 7 nm diameter and 75% vol. of the polypropylene glycol. The anti-trauma pad with dimensions of 300x250 mm, maximum thickness 17 mm and minimum thickness 8,6 mm, has 168 protrusions. The pad contains 300g of dilatation liquid and the total mass of pad is 980 g.

[0008] Deformation of basis of the system of pad with a panel of ballistic composite made of non-woven sheets of UHMWPE fibres, shot with 7,62x39 mm PS bullets, according to the PN-V-87000:2011 Standard, at the temperature of 23°C, exhibits the maximum deflection of 9,3 mm, while the reference ballistic panel without the pad - 30,8 mm. Reduction of deflection compared to the reference model is 69%.

### Embodiment example II.

[0009] The pad as that in example I, containing the 1,2% addition of microspheres 461 DET 40 d25 from AKZO Nobel, Holland in the structure of silicon, with the total maximum thickness of 16 mm and minimum of 8 mm, has total mass of 800 g, including 280 g of dilatation liquid. The panel together with the pad, exhibit maximum deflection of 12,0 mm, when shot with 7,62x39 mm PS bullet.

Reduction in deflection, compared to the reference ballistic panel without the pad is 61%.

## Claims

1. The anti-trauma pad made of elastomeric material, dedicated for use in the personal armours together with the ballistic panels, **characterised in that** it has a form of elastomeric pad, comprising a closed inner chamber (**3**), wherein the top exterior surface of the pad (**1**) is flat, while the bottom one comprises a system of protrusions (**2**) distributed evenly over its entire area in the amount of from 1500 to 3000 /m<sup>2</sup> and of the height from 2 mm to 15 mm.
2. The pad according to claim 1, **characterised in that** its minimum thickness between protrusions (**2**) is not less than 7 mm, and the maximum including the protrusions (**2**) is up to 27 mm.

3. The pad according to claim 1, **characterised in that** the protrusions (2) on its bottom side have the form of truncated pyramids.
4. The pad according to claim 1, **characterised in that**, the silicon is used as the elastomeric material. 5
5. The pad according to claim 1, **characterised in that** the elastomeric material in its structure comprises the spheres in the amount of up to 5% of weight, filled with the inert gas. 10
6. The pad according to claim 1, **characterised in that** the diameters of the spheres are in the range of 1 nm to 990  $\mu\text{m}$ . 15
7. The pad according to claim 1, **characterised in that** the closed inner chamber (3) occupies up to 90 % of the plate volume. 20
8. The pad according to claim 1, **characterised in that** it comprises up to 90% vol. of dilation fluid.
9. The pad according to claim 1, **characterised in that** the dilation fluid comprises a suspension of 15-30% vol. of the fumed silica, of the grain diameter in the range of 5-16 nm with 70-85% vol. of the polypropylene glycol. 25
10. The pad according to claim 1, **characterised in that** the dilation fluid is homogenously introduced into the structure of elastomer and/or to the internal closed chamber (3). 30
11. The pad according to claim 1, **characterised in that** applying it together with a panel of ballistic composite causes reduction of base deformation upon a shot, by 60-70%, as measured by the magnitude of deflection. 35

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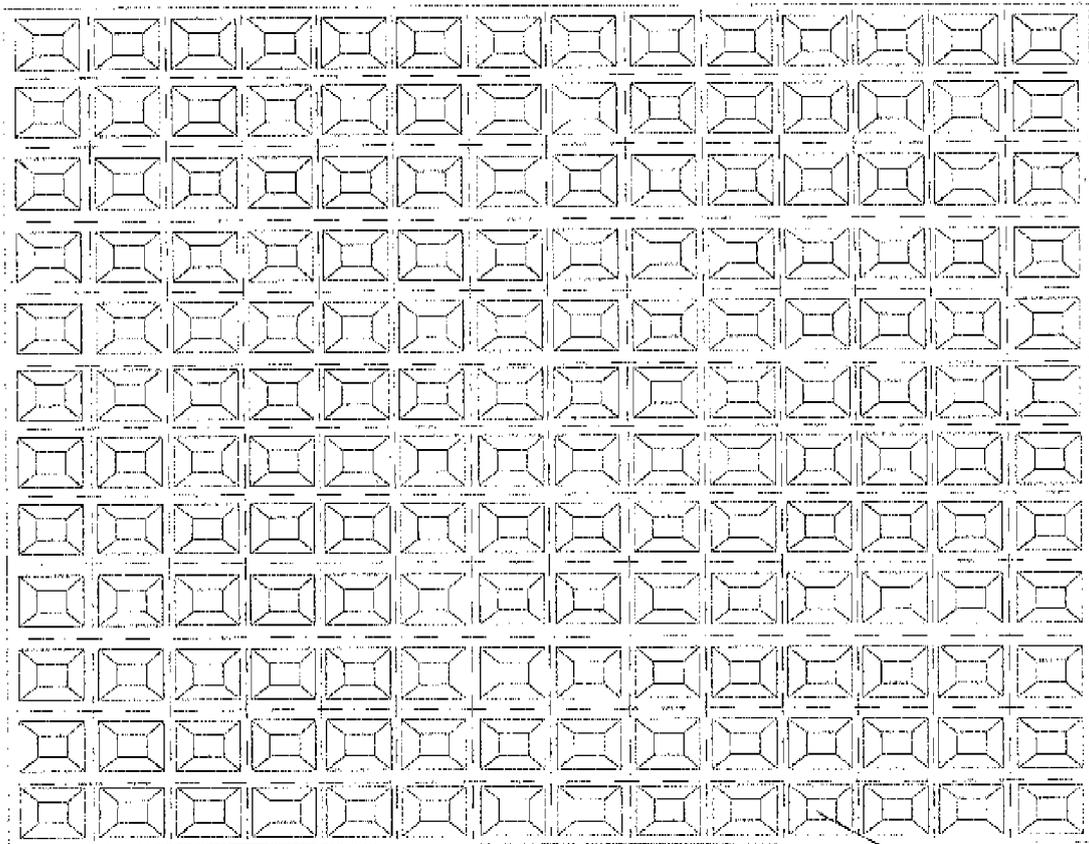


Fig.1

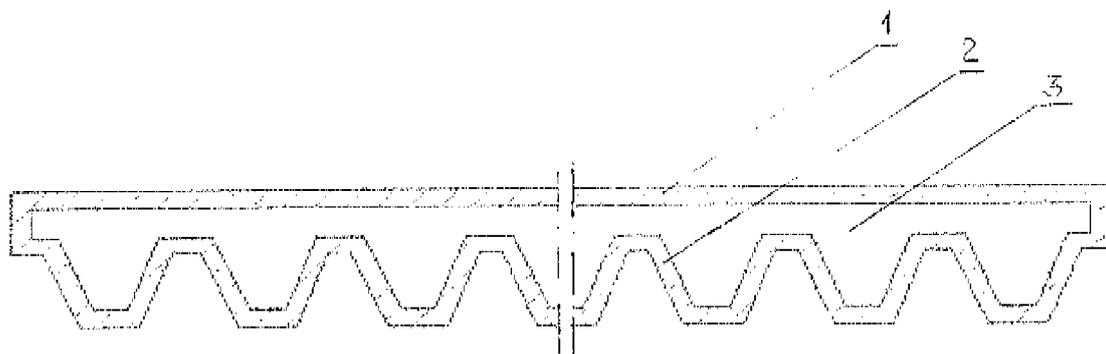


Fig.2



EUROPEAN SEARCH REPORT

Application Number  
EP 14 46 0076

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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 25 March 2015	Examiner Van Leeuwen, Erik
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ANNEX TO THE EUROPEAN SEARCH REPORT  
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The members are as contained in the European Patent Office EDP file on  
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82