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(54) Body armour

(57) Body armour formed from a piece of fabric (1) comprising a plurality of layers of strong fabric with layers of film adhesive interposed between at least two adjacent ones of said layers of fabric. The layers of fabric are compressed together in at least one region. A rigid, e.g. ceramic, plate (4) is bonded to the fabric in said at least one region.

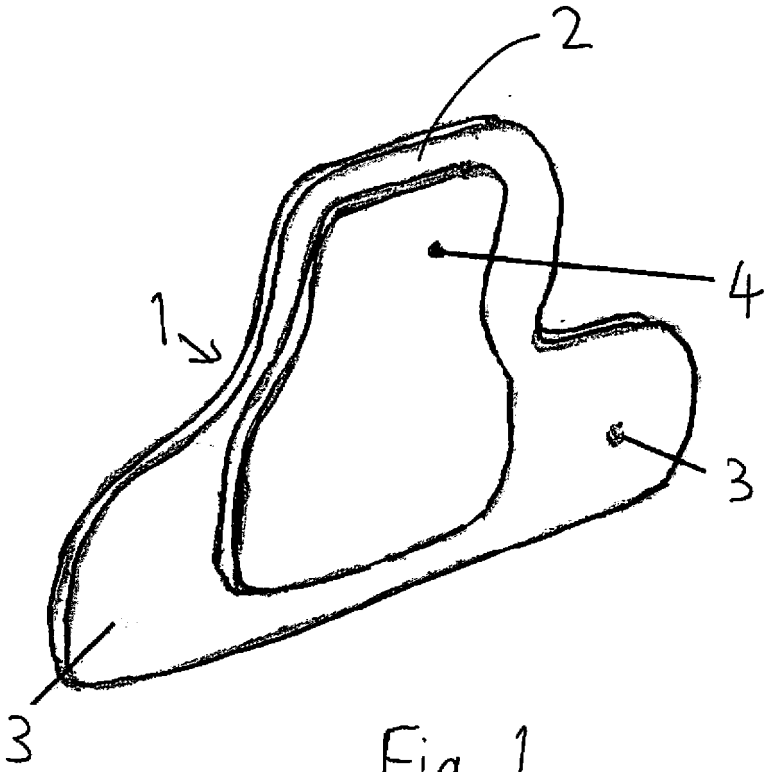

Fig. 1

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Description

[0001] This invention relates to body armour.

[0002] Known soft body armour is made from strong fabric, such as aramid, and is capable of stopping low-velocity fragments and soft-headed bullets. In order to upgrade this soft body armour so as to stop high-velocity fragments and armour-piercing rounds, a hard-faced plate is inserted into a pocket in the soft body armour. The plate is usually made from a ceramic material backed by a strong fabric such as aramid. The soft body armour can be in the form of a garment and can include more than one pocket, each pocket being arranged to contain a rigid plate.

[0003] This known combination of rigid and soft armour is effective, but is relatively thick, heavy and expensive to manufacture.

[0004] With the aim of alleviating these disadvantages, the present invention provides body armour comprising a piece of soft, strong fabric, and at least one rigid armour plate bonded to a portion only of said piece of fabric.

[0005] The piece of fabric may comprise a plurality of layers, e.g. of aramid fabric. In the region in which the rigid plate is bonded thereto, said layers may be compressed together. A film of adhesive may be disposed between each two adjacent layers of fabric, at least in the region in which the rigid plate is bonded to the piece of fabric.

[0006] The at least one rigid armour plate may comprise ceramic material.

[0007] In an embodiment of the invention, the rigid armour plate is bonded to a central region of the piece of fabric, which is arranged to cover a wearer's chest and abdomen, lateral regions of the piece of fabric being arranged to cover the wearer's sides.

[0008] The invention also provides a method of forming body armour, comprising the steps of: forming a piece of fabric from a plurality of layers of string fabric with layers of film adhesive interposed between at least two adjacent ones of said layers of fabric; heating said layers and compressing them together in a direction of their thickness in at least one region thereof; and bonding a rigid plate to the fabric in said at least one region.

[0009] The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings, in which:

[0010] Figure 1 shows a unit of body armour according to an embodiment of the invention; and

[0011] Figure 2 shows a garment incorporating two units of Figure 1.

[0012] The drawing shows a protector comprising a flexible piece of fabric 1, having a central portion 2 (e.g. a chest/abdomen portion) and two side flaps 3. In this example, the fabric 1 is aramid fabric formed in a plurality of layers, e.g. 10 to 30 layers.

[0013] At least in the chest/abdomen portion 1 layers of film adhesive, such as urethane or other suitable adhesive, is disposed between every two adjacent layers of aramid fabric. In this region a hard amour plate 4 is bonded.

[0014] Manufacture of the protector includes a step of compressing the layers of aramid fabric together in the direction of the thickness of the armour, with the application of heat, with a tool of size and shape similar to the "footprint" of the plate 4. The fabric becomes rigid in this particular region.

[0015] Subsequently, the hard armour plate 4 - in this example formed of a ceramic material - is bonded to the compressed region of the fabric 1 with an adhesive such as urethane, epoxy or other suitable adhesive. The compressed layers of fabric afford to the rigid plate the same rigid backing as is provided by the aramid, ultra-high-molecular-weight polyethylene, or glass backing of the known removable plate.

[0016] In the present invention, the rigid plate 4 is permanently bonded to the soft fabric 1. In some military situations, regulations prohibit such removal of the plate and in such circumstances the permanent bond may be advantageous.

[0017] The protector can be provided with one or more straps, zips, buttons and/or other fasteners or suspension means either for suspending it from the neck or arms or for attachment to a garment. It is intended to be worn with the rigid plate 4 on the outer side.

[0018] As shown in Figure 2, two protectors of the type depicted in Figure 1 can be attached together by means of shoulder straps 5. They then form a tabard-style garment that can be placed over the wearer's head and fastened at the sides with a fastener such hook-and-loop closures such as Velcro ® 6, optionally arranged on straps 7. The plates 4 provide both front and rear protection.

[0019] In a modification of the protector, additional hard armour plates are bonded to side regions of the fabric 1, such as the side flaps 3, for side protection. Ultra-high-molecular-weight polyethylene fabric could be used instead of aramid. Other modifications are feasible within the scope of the claims.

[0020] The body armour of the invention provides a similar ballistic performance to the known body armour, but has a reduced thickness and weight and is less expensive to manufacture. The fabric is also simpler as it is not necessary to form a pocket for housing the rigid plate.

Claims

1. Body armour comprising a piece of soft, strong fabric (1), and at least one rigid armour plate (4) bonded to a region of said piece of fabric.

2. Body armour according to claim 1, wherein the fabric (1) is aramid or ultra- high-molecular-weight polyethylene fabric.

3. Body armour according to claim 1 or 2, wherein the piece of fabric (1) comprises a plurality of layers.

4. Body armour according to claim 3, wherein, in the region in which the rigid plate (4) is bonded to the fabric (1), said layers are compressed together.

5. Body armour according to any preceding claim, wherein said region of said piece of fabric (1) is a rigid region.

6. Body armour according to claim 3, 4 or 5, wherein a film of adhesive is disposed between each two adjacent layers of fabric, at least in the region in which the rigid plate is bonded to the piece of fabric (1).

7. Body armour according to any preceding claim, wherein the at least one rigid armour plate (4) comprises ceramic material.

8. Body armour according to any preceding claim, wherein the rigid armour plate (4) is bonded to a central region (2) of the piece of fabric (1), which is arranged to cover a wearer's chest and abdomen or a wearer's back, lateral regions (3) of the piece of fabric being arranged to overlie the wearer's sides.

9. Body armour according to claim 8, including rigid armour side plates bonded to said lateral regions.

10. A method of forming body armour, comprising the steps of: providing a piece of fabric (1) comprising a plurality of layers of strong fabric with layers of film adhesive interposed between at least two adjacent ones of said layers of fabric; heating said layers and compressing them together in a direction of their thickness in at least one region thereof; and bonding a rigid plate (4) to the fabric (1) in said at least one region.

11. A method according to claim 10, wherein the fabric (1) is aramid or ultra-high-molecular-weight polyethylene fabric.

12. A method according to claim 10 or 11, wherein the rigid armour plate (4) comprises ceramic material.

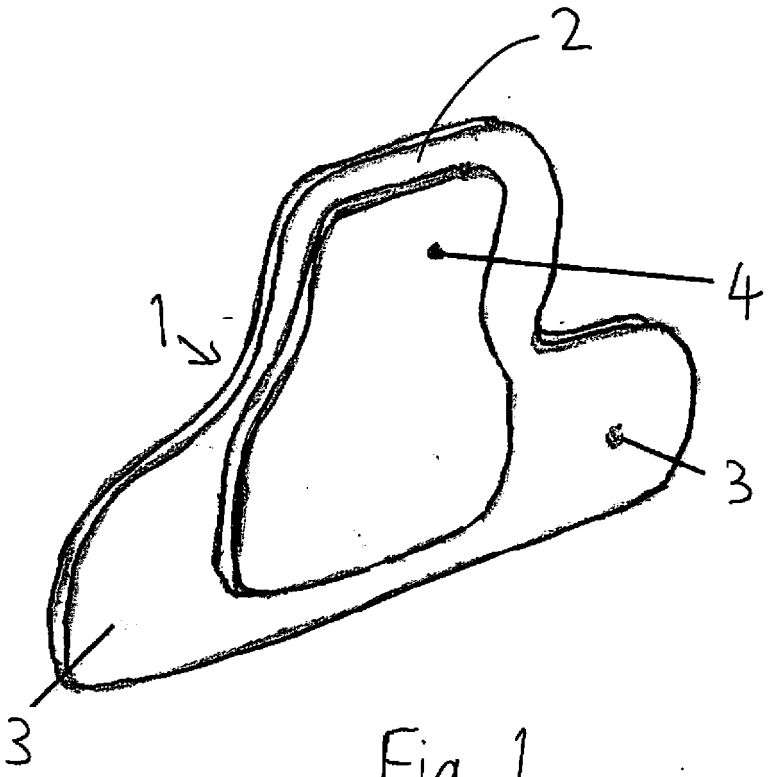

Fig. 1

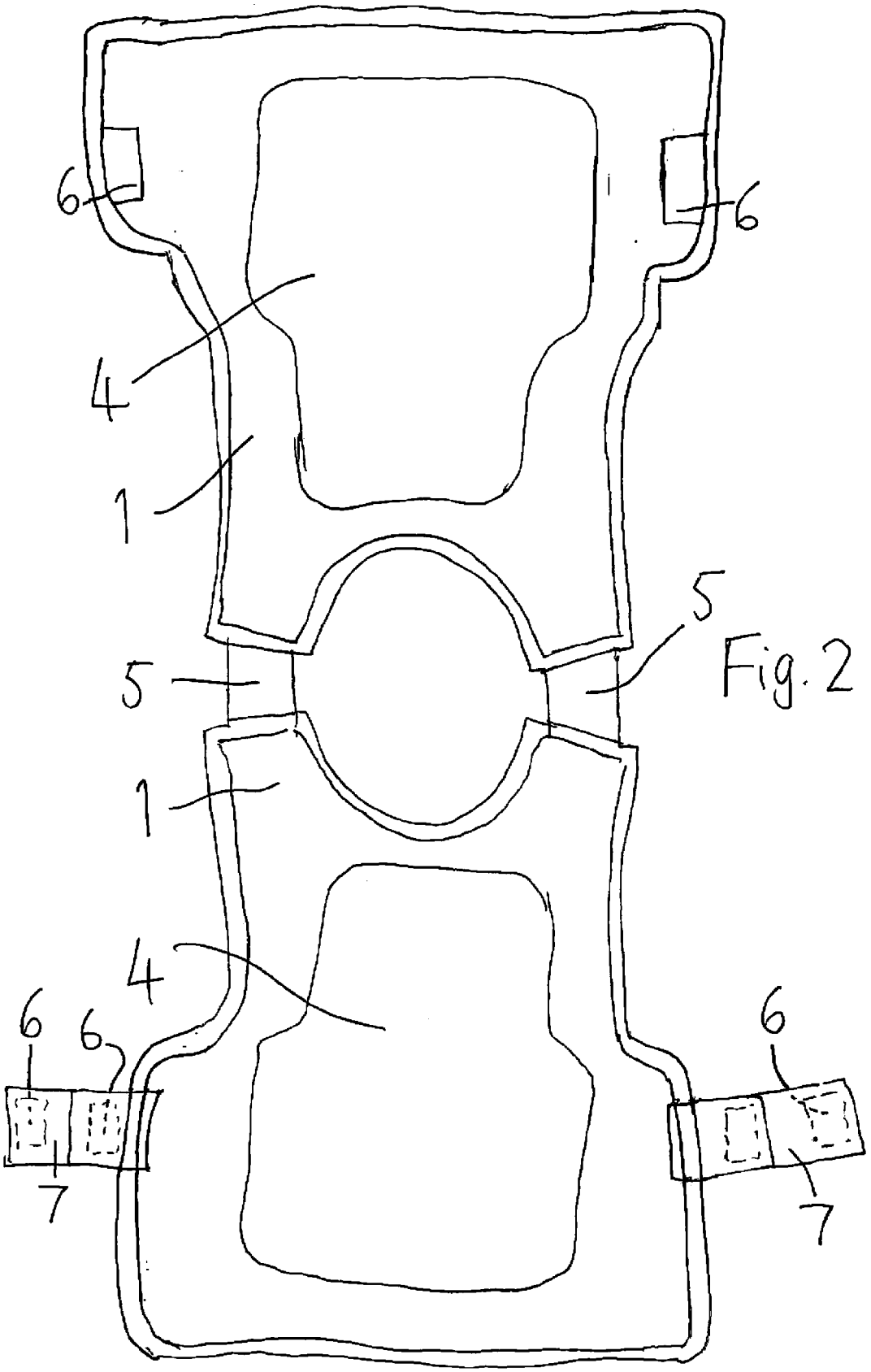

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 11 15 5777

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 Y	US 5 198 280 A (HARPELL GARY A [US] ET AL) 30 March 1993 (1993-03-30) * column 1, lines 7-13 * * column 8, lines 54-68 * * column 10, line 52 - column 15, line 47 * * figures 1-5 *	1-3,7-9 4-6	INV. F41H1/02 F41H5/013 F41H5/04
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A	US 3 722 355 A (KING H) 27 March 1973 (1973-03-27) * column 3, lines 3-23; claim 5; figures 4, 5 *	1,10	

TECHNICAL FIELDS SEARCHED (IPC)
F41H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	13 May 2011	Kasten, Klaus

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 11 15 5777

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82