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(54) Abstract Title

**Body protection incorporating inflatable buoyancy means**

(57) A protective body garment containing body armour 106, 107, 108 and 109 and a gas inflatable bladder 110, between the armour and the wearer's body, so as to be shielded by the armour, whilst being arranged not to harm the wearer when the bladder inflates. Protection from inflation pressure is, preferably, facilitated by regulating the inflation pressure, and/or by providing expansion joints (fig 2, 114 and fig 3, 115) in the garment, that allow the armour to move away from the wearer's body, to make room for the inflated bladder. Armour may include a metal mesh, and trauma reducing padding. The garment may comprise an inner vest and outer jacket, connectable by zip means.

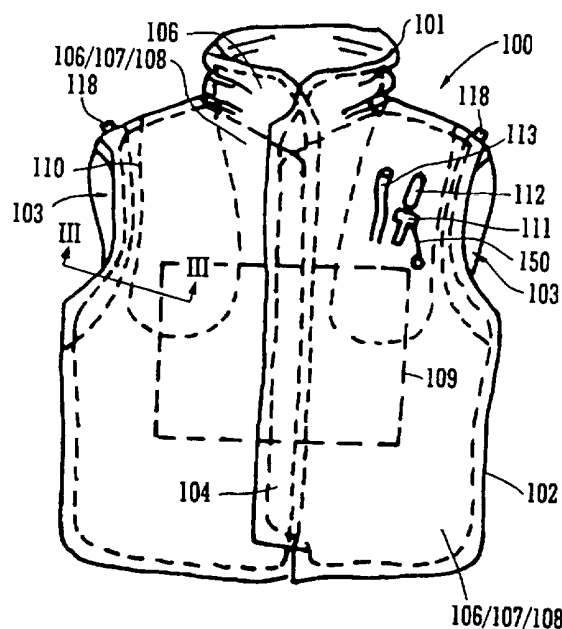


FIG. 1

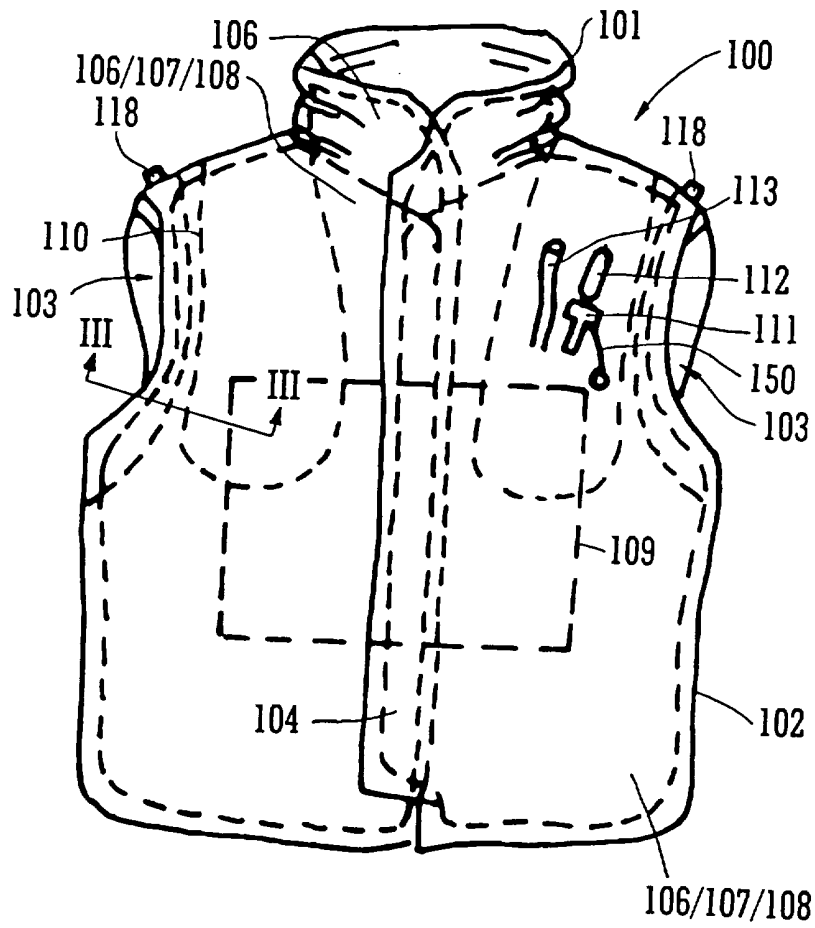
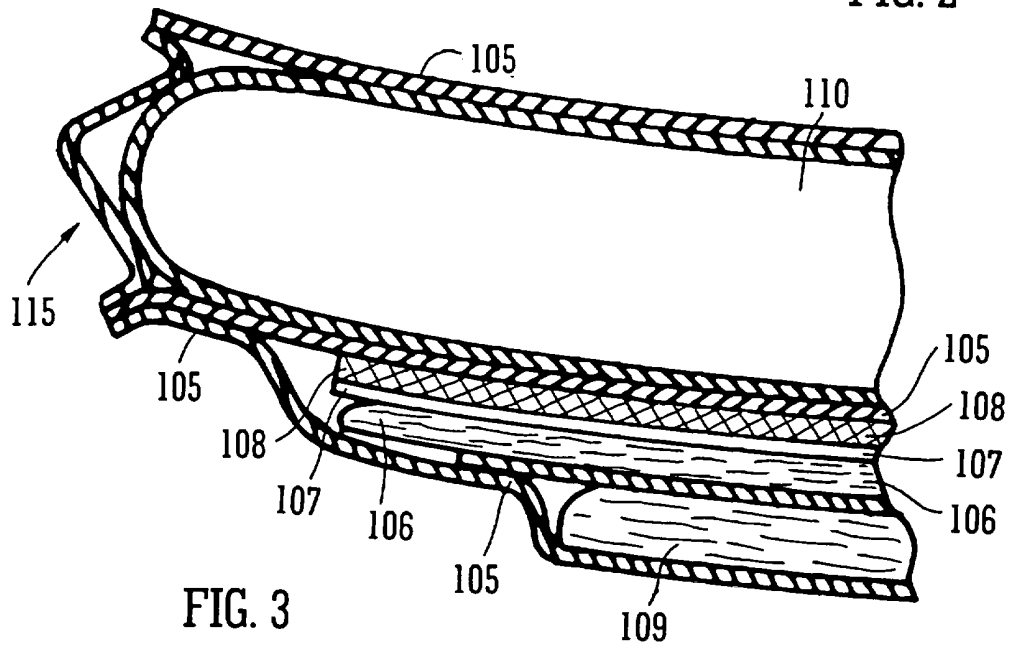
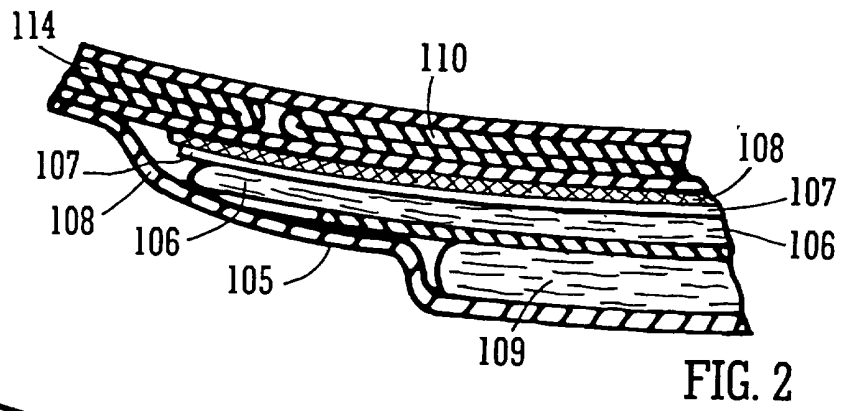


FIG. 1





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### PROTECTIVE GARMENT

This invention relates to a garment comprising body armour. Such a garment might be worn by a member of the armed forces, police and so on.

A known protective garment comprises of flexible body armour with a facility for increasing protection by way of a ceramic plate. The provision of buoyancy is useful in some situations and one type of body armour utilising foam can provide this. However, buoyant foam provides only light protection, it would not support the weight of high level protective armour, e.g. ceramic plates or large quantities of flexible body armour.

It is one object of the invention to provide an improved body protection.

According to the invention in one aspect there is provided a protective body garment containing:

- i) armour resistant to ballistic and/or stab attacks;
- ii) a gas inflatable bag arranged to inflate on immersion in water to provide buoyancy to the wearer;

the bag being shielded by the armour in the garment, and the garment including means for avoiding harm to the wearer by pressure on the body when the bag is inflated.

Preferably the body armour comprises a plurality of components which are either flexible or flexibly connected together, whereby the armour expands on inflation of the gas bag. In one option the body armour includes a metal mesh. In another padding may be present to reduce trauma.

Preferably valve means is present for each bag and includes a manual override facility.

In one preferred aspect the garment comprises an inner vest connectable to an outer jacket. Preferably the bags of the vest and the jacket are each self regulating and are arranged to control the total extent of inflation. Preferably the vest and jacket are connectable by zip means.

According to the present invention in a more specific aspect there is provided a multi-purpose inflatable body armour garment comprising of an outer weatherproof jacket, an inner jacket or vest capable of being utilised without the outer jacket and having a vest with body armour and a separate inflation unit. The inflation units are preferably of the type which will automatically inflate upon water immersion or by way of a manual override.

A specific embodiment of the invention will now be described by way of example with reference to the accompanying drawing in which:

Figure 1 is a front elevation of a protective sleeveless jacket or "vest";

Figure 2 is a section on the line III-III in Figure 1, and

Figure 3 corresponds to Figure 2 but showing a bladder used in the vest in its inflated state.

Figure 4 is a front elevation of a weatherproof jacket worn in association with the Figure 1 vest.

The sleeveless jacket or vest 100 of Figures 1 to 3 comprises a high collar 101 and a body 102 with armholes 103. The vest is openable down the front by way of a Velcro <sup>RTM</sup> or zip fastener (not shown) concealed behind an overlapping lapel 104 on one side of the vest. At the sides of the vest, below the arm-holes 103 there could be provided 5 adjustment means (not shown) for example openable seems joined by Velcro <sup>RTM</sup> fasteners.

The vest comprises layers of material 105 such as Nylon or p.v.c. enclosing flexible body armour. The body armour comprises padding 106, made up of layers of Kevlar, <sup>RTM</sup> a layer of relatively flexible plastics material 107, and a layer of steel mesh 108. The <sup>RTM</sup> Kevlar padding (and plastics material if desired) extends up into the collar 101 whilst the steel mesh stops just below the collar. However, there could be a separate padding member or rigid bullet-proof member (not shown) that can be removably fitted in the collar. The plastics material 107 which could be backed with semi-rigid plastics foam (not shown) acts as a so-called trauma pack, i.e. which spreads the pressure due to weapon contacts and helps reduce bruising. The mesh 108 helps to resist knife attacks. As well as the flexible body armour respective rigid bullet-proof plates or shells 109 can be removably fitted in pockets formed in the front and back of the vest. These plates could comprise ceramic or steel for example. Further padding or rigid armour members

(not shown) can be fitted over the shoulders of a wearer of the vest 100, appropriate fasteners (e.g. VELCRO strips) 108 being provided on the shoulders of the vest.

The particular make up of the body armour can be chosen as desired. For example, the steel mesh 107 may not be appropriate sometimes or the armour could comprise plastics foam material (not shown). The rigid plates 109 may not be necessary or the pockets for them can be fitted so that the wearer can use the plates if he wants to, or if not, he can just leave the relevant pocket empty.

Also incorporated into the vest, there is an inflatable flotation bladder 110 which extends up from the front of the vest at one side then over the shoulder at this side and across to the other side of the vest at the top of the wearer's back, then back over the other shoulder and down at the other side of the front of the vest. When required, the bladder can be inflated by an immersion-responsive automatic inflation device 111, incorporating a compressed-gas bottle 112 and a manual override facility, such as a pull cord 150. The device 111 automatically inflates the bladder 110 when the device 111 is immersed but not if only splashed by spray or a wave. Meanwhile, if required, the cord pull can be operated to cause the device 111 to inflate the bladder 110 even if it is not immersed. The device 111 may be of the kind known and commercially available for use in inflatable life jackets. The bladder may also be inflated or topped-up when necessary by a mouth tube 113 with a non-return valve (not shown). Both the device 111 and tube 113 are mounted on the front of the vest so as to be easily available for operation by the wearer but, if preferred, could be concealed, say in or behind suitable pockets or flaps (not shown) provided in the vest.

The bladder 110 is located between the body armour 106 and the internal surface of the vest, i.e. between the armour and the body of the wearer, so as to lessen the chance of weapon damage to the bladder. To provide room for the bladder to inflate and expand inwardly folded strips of material 114 are provided around the armholes 103 to form expansion joints 115 as shown best in Figures 3 and 4. When the bladder 110 inflates, the strips 114 are unfolded and pushed outwardly by the bladder. These joints enable the armour 106 to move away from the wearer's body and permit the bladder 110 to expand outwards and sideways as shown. Further expansion joints like the joints 115 may be provided elsewhere, for example, at the back of the vest just below the collar 101.

The bladder is designed, specifically by extending round the back of the jacket just below collar 101 and down at each side of the jacket front, to tend to self-right an unconscious person wearing the vest.

Referring to Figure 4, if required, the vest 100 may be worn under a weatherproof outer jacket 200 which comprises a peaked brim detachable hood 201 made of super strength microfibre having adjustable draw cords 202 for the hood. The jacket 200 comprises a high collar 203 made of Polartec<sup>RTM</sup> fleece and having adjustable draw cords 204. The jacket has a concealed front zip 205 and sealed seams 206 to maximise water protection, an elasticated waist 207 for maximum movement, and adjustable cuffs 208. It also has Polartec<sup>RTM</sup> lined hand warmer pockets 209 and large bellows pockets 210 with drain holes (not shown). An inner fleece lining 211 is present for thermal protection.

If required, the jacket 200 and vest 100 could be connected together by a zip for Velcro<sup>RTM</sup> fastener (not shown), i.e. the vest can be formed as an inner liner to the outer jacket 200.

Like the vest 100, the jacket 200 comprises a flotation bladder 212 which extends round behind the top of the back of the jacket and down at each side of the jacket front. The bladder 212 is provided with an immersion sensitive automatic inflation device 213 with compressed gas bottle 214 and a pull cord 160 for manual override. The bladder is also provided with a mouth-tube 215 connected to the bladder via a non-return valve (not shown) for inflating or topping-up the bladder orally. The bladder 212, device 213 and tube 215 are similar to the corresponding parts 110, 111 and 113 of the vest 100. As with the vest, the device 213 and tube 215 of the jacket 200 can be mounted on the front of the jacket for easy availability or concealed behind a suitable flap or in a pocket or the like.

For preference, each inflation device 111 and 213 comprises a sensitive servo-valve that regulates the pressure in the respective bladder. Then the two inflation devices and corresponding valves can operate together while better regulating the overall buoyancy effect and avoiding over-pressure.

The outer jacket could also comprise relatively soft body armour and/or rigid bullet-proof plates if desired. If so, then the jacket may be provided with expansion joints similar to the joints 115 shown in Figures 1 to 3.

The inner bladder is protected from bullet fragmentation, stab attack or the like by the body armour.

Upon the inflation units being activated they will expand with the body armour being raised to allow expansion of surrounding body armour. In the event of a wearer using an item or being subject to other confined conditions, the armour will not inflate to an extent as to crush the occupant.

Whether or not both inflation bladders are provided, the inflation device being operable as a pressure regulating servo-valve is useful because it prevents over inflation in say the case of the vest 100 and prevents harm to the wearer of the vest. In other words, regulation of bladder pressure by the servo-valve forms an additional or alternative means, over and above the expansion joints 115, for preventing or ameliorating harm to the wearer.

CLAIMS

1. A protective body garment containing:
  - i) armour resistant to ballistic and/or stab attacks;
  - ii) a gas inflatable bag arranged to inflate on immersion in water to provide buoyancy to the wearer;

the bag being shielded by the armour in the garment, the arrangement being such as to minimise harm to the wearer by pressure on the body when the bag is inflated.
2. A garment according to claim 1, wherein the body armour comprises a plurality of components which are either flexible or flexibly connected together, whereby the armour expands on inflation of the gas bag.
3. A garment according to any preceding Claim, wherein the body armour includes a metal mesh.
4. A garment according to any preceding Claim, including padding to reduce trauma.

5. A garment according to any preceding Claim, including valve means for each bag, which includes a manual override facility.
6. A garment according to any preceding Claim comprising an inner vest connectable to an outer jacket.
7. A garment according to Claim 6, wherein the bags of the vest and the jacket are each self regulating and are arranged to control the total extent of inflation.
8. A garment according to Claim 6 or 7, wherein the vest and jacket are connectable by zip means.



Application No: GB 9908337.0  
Claims searched: 1-8

Examiner: Richard Collins  
Date of search: 10 May 1999

**Patents Act 1977**  
**Search Report under Section 17**

**Databases searched:**

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.Q): A3V

Int Cl (Ed.6): A41D 13/00; F41H 1/00, 1/02.

Other: Online WPI

**Documents considered to be relevant:**

Category	Identity of document and relevant passage	Relevant to claims
Y	US 5584737 A (LUHTALA) figures 1 to 5 and column 5, lines 5 to 27.	1
Y	WO 96/24816 A1 (PIERRE DE LA BRIERE) figures 1 and 5 and page 3, lines 29 to 33.	1

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
& Member of the same patent family

A Document indicating technological background and/or state of the art.  
P Document published on or after the declared priority date but before the filing date of this invention.  
E Patent document published on or after, but with priority date earlier than, the filing date of this application.