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(54) **Two-piece adaptable protection suit**

(57) A two-piece adaptable protection suit 1 is described. The suit 1 is constructed from fire and/or specific chemical retardant fabric and offers full body protection coverage in the event of fire and/or chemical attack. The jacket part 2 and the trouser part 3 of the two-piece suit 1 are connected by the use of a first fastening means 4 and second fastening means 5. The combination of these two fastening means provide the two-piece suit 1 with the required protection levels. In addition, the described two-piece suit 1 exhibits the advantage that it can be removed or opened in part only, as necessary, in order to minimise the effects of heat exhaustion and to allow the wearer to use the lavatory.

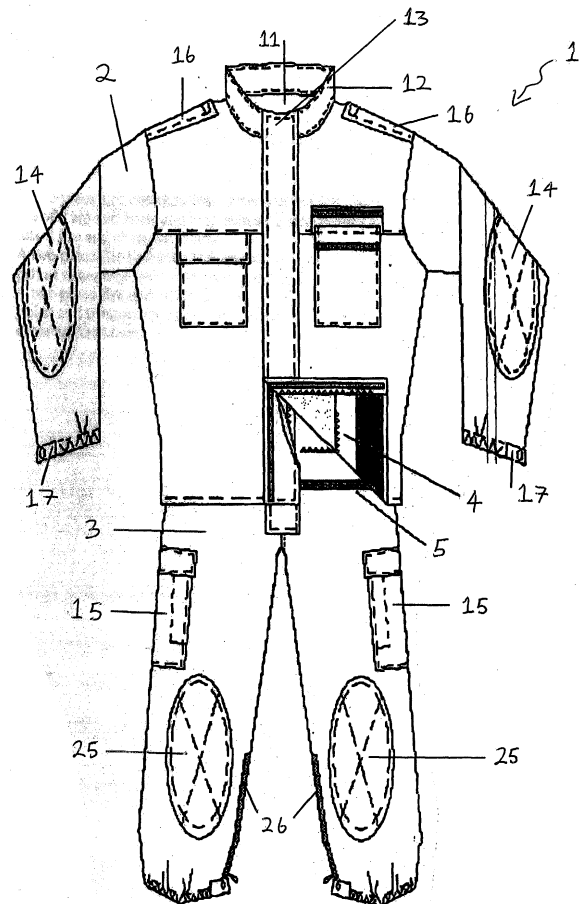


FIGURE 1

## Description

**[0001]** The present invention relates to protective suits employed to provide a wearer with flame and/or chemical protection. In particular it relates to a two-piece adaptable protection suit that provides the wearer with full body flame protection and/or specified chemical protection.

**[0002]** Protection suits in the form of a one piece coverall are well known in the art. In particular US Patent No. US 5,048,124 teaches of a one piece protective overall that provides protection to the wearer in a hazardous environment. In order to put on and take off the suit the wearer is required to employ a slit-like opening extending downwardly from a neck opening that is controllably opened and closed by a zip.

**[0003]** As is apparent to the man skilled in the art one-piece suits exhibit several inherent disadvantages. For example in order to relieve heat exhaustion the whole suit must be removed. Similarly the whole suit must also be removed for lavatory purposes. Removal of the whole suit can also require the time-consuming removal of leg protection armour that is often worn under the suit.

**[0004]** The most obvious solution to the above problems is to consider a two-piece suit. However, the concept of a two-piece fire and/or chemical protection suit has proven difficult to develop due to the risks associated with any potential gap between the two pieces of clothing.

**[0005]** The object of this invention is to provide a two-piece protection suit, that when combined in this particular fashion, gives all the fire and or chemical protective benefits of a one-piece coverall.

**[0006]** It is a further object of an aspect of the present invention to provide a two-piece protection suit that does not require complete removal in order to reduce the risk of heat exhaustion, or for the wearer to use the lavatory.

**[0007]** According to a first aspect of the present invention there is provided a two-piece protection suit for protection against fire or chemical attack comprising a jacket part and a trouser part characterised in that the protection suit further comprises a first fastening means and a second fastening means, wherein the first and second fastening means securably attach the jacket part to the trouser part.

**[0008]** The invention according to this first aspect provides the benefits of being able to remove only the jacket part or the trouser part to allow the body to cool, or to remove, or partially remove, only the trouser part where necessary while being able to seal the jacket part to the trouser part so as to create a fire or chemical barrier for the protection of the wearer.

**[0009]** Preferably the first fastening means is located between the second fastening means and a waist of the trouser part.

**[0010]** Preferably the first and second fastening means extend substantially around the full perimeter of the trouser part.

**[0011]** Preferably the second fastening means comprises a hook and loop fastening tape wherein the hook and loop fastening tape provides a first protection barrier between the jacket part and the trouser part.

5 **[0012]** Most preferably the first fastening means comprises a zip wherein the zip provides a second protection barrier between the jacket part and the trouser part.

**[0013]** The two-piece suit offers a double sealing means employed to join the jacket part to the trousers part. In a preferred embodiment the double sealing means comprises a full, body circumference zip and a full, body circumference hook and loop tape. Both sealing means are located under the jacket part so as to provide added protection due to the overlap of the jacket part and the trouser part.

10 **[0014]** Preferably the jacket part further comprises a two-way zip and a storm flap suitable for fastening over the two-way zip, wherein when the storm flap is fastened the two-way zip is concealed and protected.

15 **[0015]** Optionally the jacket part further comprises one or more additional material sections associated with at least one elbow area of the jacket part, wherein the additional material sections provide additional protection against the effects of fire or chemicals.

20 **[0016]** Optionally the jacket part further comprises adjustable cuffs.

25 **[0017]** Preferably the jacket part further comprises an adjustable fastening collar wherein the adjustable fastening collar provides for protection against the effects of fire or chemicals between the jacket part and a helmet worn by a wearer.

30 **[0018]** Optionally the jacket part further comprises one or more pleats associated with a shoulder area of the jacket part, wherein each of the one or more pleats provide a degree of freedom of movement for a wearer.

35 **[0019]** Optionally the jacket part or the trouser part comprises one or more foldable pockets.

**[0020]** Preferably the foldable pockets comprise a pocket area and a flap suitable for fastening over an open end of the pocket area, wherein the fastening of the flap causes the open end of the pocket area to be folded over.

40 **[0021]** Optionally the jacket part further comprises one or fastening epaulettes.

45 **[0022]** Optionally the trouser part further comprises one or more additional material sections associated with at least one knee area of the trouser part, wherein the additional material sections provide additional protection against the effects of fire or chemicals.

50 **[0023]** Preferably the trouser part further comprises a leg fastening means associated with either trouser leg located between a knee area and a hem of the trouser leg wherein the opening of the leg fastening means assists in the donning and doffing of the trouser part.

55 **[0024]** Preferably the waist and the hems of the trouser part are adjustable so as to aid the fitting of the trouser part to the wearer.

**[0025]** Optionally the trouser part further comprises a

plurality of belt loops so suitable for retaining a belt fastening means.

**[0026]** According to a second aspect of the present invention there is provided a method of connecting a jacket part and a trouser part so as to form a protection suit characterised in that the method comprises the steps of:

- 1) Closing a first fastening means to produce a second protection barrier between the jacket part and the trouser part; and
- 2) Closing a second fastening means to produce a first protection barrier between the jacket part and the trouser part.

**[0027]** Aspects and advantages of the present invention will become apparent upon reading the following detailed description and upon reference to the following drawings in which:

Figure 1 Presents a two-piece protection suit in accordance with an aspect of the present invention;

Figure 2 Presents:

- a) a front view; and
- b) a rear view,

of a jacket part of the two-piece protection suit of Figure 1;

Figure 3 Presents:

- a) a front view; and
- b) a rear view,

of a trouser part of the two-piece protection suit of Figure 1;

**[0028]** Figure 1 presents a two-piece protection suit 1 that offers full body flame protection to British Standards EN 531 A, B2, C1, EN 483 and EN 468, and/or specified chemical protection to British Standard EN 368. The two-piece protection suit 1 can be seen to comprise a jacket part 2 and a trouser part 3. The jacket part 2 and the trouser part 3 are secured together through the employment of a zip 4 and a first hook and loop fastening tape 5, further details of which are described below.

**[0029]** A front and rear view of the jacket part 2 is provided in Figure 2. The inside hem of the jacket part 2 can be seen to comprise a band of hook fastening tape 6 while located above the hook fastening tape 6 is a first side 7 of the zip 4.

**[0030]** In Figure 2(a), the left hand hem of the jacket part 2 has been folded back to reveal a two-way zip 8 that fastens vertically so as to close the jacket part 2. The two-way zip 8 is concealed and protected under a

double layer storm flap 9, fastening left over right, this flap 9 being secured with a second hook and loop tape 10 that extends the full length of the flap 9.

**[0031]** The jacket part 2 offers extended protection to the neck area 11 through the inclusion of a stand collar 12. The stand collar 12 fastens at the front with a double storm neck flap 13. Such a design allows for the stand collar 12 to sit under a helmet (not shown) so as to give maximum fire and chemical protection to a wearer.

**[0032]** An advantage of the described jacket part is that the inclusion of the two-way zip 8 allows for access to the trouser part 3 by a wearer without any requirement for the wearer to open the jacket part 2 at the neck area 11.

**[0033]** The jacket part 2 can be seen to further comprise two elbow protection pads 14, two folding pockets 15 and two hook and loop fastening epaulettes 16. The elbow protection pads 14 comprise additional layers of fabric so as to provide extra protection against fire or chemical attack at an area known by those skilled in the art to be particularly at risk.

**[0034]** The hook and loop tape fastening epaulettes 16 allow the use of insignia sleeves (not shown) with the protection suit 1. This feature is of particular benefit for use of the protection suit by the military or the emergency services since the insignia sleeves can be slotted over the epaulettes 16 and fastened in position with hook and loop tape.

**[0035]** A further design feature of the jacket part 2 is the inclusion of elasticated cuffs 17 so as to provide a close fit at the wrist area of the wearer. The flexibility of the cuffs 17 is further enhanced by the use of adjustable, stud fastening tabs 18 at the underarm/cuff point. These tabs 18 allow for the fit of the cuffs 17 to be tightened as necessary so as to allow the wearing of gloves.

**[0036]** From Figure 2(b) it can be seen that the rear of the jacket part 2 comprises a pleat 19 over each shoulder area. Each of these pleats 19 provide the wearer with a degree of freedom of movement across the back of the jacket part 2 when reaching, therefore putting less stress on other seams of the jacket part 2.

**[0037]** As shown in Figure 3, the trouser part 3 can be seen to comprise a loop fastening tape 20 and a second side 21 of the zip 4 located above the loop fastening tape 20. An elasticated waistband 22 is incorporated to allow for a secure but adjustable fit while allowing the wearer to move freely without the restriction of a rigid waistband. The waistband 22 also carries belt loops 23 to allow for the secure addition of a belt to further enhance the fit of the garment.

**[0038]** Below the waistband is located a trouser zip 24 that fastens vertically downwards and is incorporated to aid the wearer donning and doffing the trouser part 3 and for using the lavatory. The trouser zip 24 is concealed and protected under a double layer storm flap, fastening left over right. This flap is secured with a hook and loop tape the full length of the flap.

**[0039]** The trouser part 3 can be seen to further com-

prise two knee protection pads 25, two folding pockets 15 and two leg zips 26 that extend from the knee area to the associated hem 27. The knee protection pads 25 comprise additional layers of fabric so as to provide extra protection against fire or chemical attack at an area known by those skilled in the art to be particularly at risk. Incorporation of the leg zips 26 allows access to any inner leg armour protection employed by the wearer for its easy adjustment or removal.

**[0040]** The hems 27 of the trouser part 3 are also elasticated so as to give a close fit at the ankle area. The flexibility of the hems 27 is further enhanced by the use of adjustable, stud fastening tabs 18 at the inside leg point that allow for the fit to be tightened as necessary to allow the wearing of boots.

**[0041]** The folding pockets 15 of the jacket and trouser parts, 2 and 3 respectively, comprise a pocket area 28, a flap 29 and a pocket hook and loop fastening tape 30. The pocket areas 28 extends up and overlap with their associated flaps 29 (when the folding pocket is in an open position). Therefore, when the flap 29 is folded down and sealed with the hook and loop tape 30, the top of the pocket area 28 is also fold over to give added protection to the contents of the folding pocket 15.

**[0042]** Further detail of the method of connecting the trouser part 3 to the jacket part 2 will now be described. Initially the first side 7 of the zip 4, located on the jacket part 2, is attached to the second side 21 of the zip 2, located on the trouser part 3. Fastening the zip 4 creates a secure bond between the two garments that extends around their outer perimeter and which cannot be pulled apart in the course of normal wear.

**[0043]** The second stage of the connection process is to connect the hook fastening tape 6, located on the jacket part 2, to the loop fastening tape 20, located on the trouser part 3. The width of the hook fastening tape 6 and the loop fastening tape 20 are chosen so as to allow a variation in the placement and attachment of the hook and loop fastening tape in consideration of body fit. For example in this embodiment the width of the hook fastening tape 6 and the loop fastening tape 20 are chosen to be 50mm and 20 mm, respectively.

**[0044]** Once the zip 4 and hook and loop fastening tape 5 have been secured then the two-piece protection suit 1 effectively becomes a one-piece coverall with all the inherent benefits. It is the combination of the zip 4 and the hook and loop fastening tape 5 that creates the required physical seal between the parts but which allows the suit 1 to be separated as required by the wearer.

**[0045]** It is envisaged that the seal of these two garments provides a protective suit 1 that would be suitable for use by a Police force during times of public disorder. At such times the wearer can come under attack from both chemicals and fire e.g. Petrol bombs. It is further envisaged that the protective suit may also be readily deployed by fire fighting services, oil-rig workers, and aviation fuel operators during times when there is the

possibility of physical contact from fire or hazardous chemical products. In all of the above examples removal of one or more sections of the suit 1 can be undertaken in order to cool the body after strenuous exertion or at times when the wearer requires to use the lavatory.

**[0046]** The foregoing description of the invention has been presented for purposes of illustration and description and is not intended to be exhaustive or to limit the invention to the precise form disclosed. The described embodiments were chosen and described in order to best explain the principles of the invention and its practical application to thereby enable others skilled in the art to best utilise the invention in various embodiments and with various modifications as are suited to the particular use contemplated. Therefore, further modifications or improvements may be incorporated without departing from the scope of the invention as defined by the appended claims.

## Claims

1. A two-piece protection suit 1 for protection against fire or chemical attack comprising a jacket part 2 and a trouser part 3 **characterised in that** the protection suit 1 further comprises a first fastening means 4 and a second fastening means 5, wherein the first 4 and second fastening means 5 securably attach the jacket part 2 to the trouser part 3.
2. A two-piece protection suit 1 as claimed in Claim 1 wherein the first fastening means 4 is located between the second fastening means 5 and a waist 22 of the trouser part 3.
3. A two-piece protection suit 1 as claimed in Claim 1 or Claim 2 wherein the first 4 and second fastening means 5 extend substantially around the full perimeter of the trouser part 3.
4. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the second fastening means 5 comprises a hook and loop fastening tape wherein the hook and loop fastening tape provides a first protection barrier between the jacket part 2 and the trouser part 3.
5. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the first fastening means 4 comprises a zip wherein the zip provides a second protection barrier between the jacket part 2 and the trouser part 3.
6. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part 2 further comprises a two-way zip 8 for fastening the jacket part 2 and a storm flap suitable 9 for fastening over the two-way zip 8, wherein when the storm flap

9 is fastened the two-way zip 8 is concealed and protected.

7. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part 2 further comprises one or more additional material sections 14 associated with at least one elbow area of the jacket part 2, wherein the additional material sections 14 provide additional protection against the effects of fire or chemicals. 5
8. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part 2 further comprises adjustable cuffs 17. 10
9. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part further comprises an adjustable fastening collar 12 wherein the adjustable fastening collar 12 provides for protection against the effects of fire or chemicals between the jacket part 2 and a helmet worn by a wearer. 15
10. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part 2 further comprises one or more pleats 19 associated with a shoulder area of the jacket part, wherein each of the one or more pleats 19 provide for a degree of freedom of movement for a wearer. 20
11. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the protection suit 1 further comprises one or more foldable pockets 15 comprising a pocket area 28 and a flap 29 suitable for fastening over an open end of the pocket area 28, wherein the fastening of the flap 29 causes the open end of the pocket area 28 to be folded over. 25
12. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the jacket part 2 further comprises one or more fastening epaulettes 16. 30
13. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the trouser part 3 further comprises one or more additional material sections 25 associated with at least one knee area of the trouser part 3, wherein the additional material sections 25 provide additional protection against the effects of fire or chemicals. 35
14. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the trouser part 3 further comprises a leg fastening means 26 associated with either trouser leg located between a knee area and a hem 27 of the trouser leg wherein the opening of the leg fastening means 26 assists in the donning and doffing of the trouser part 3. 40

15. A two-piece protection suit 1 as claimed in any of the preceding Claims wherein the waist 22 and the hems 27 of the trouser part 3 are adjustable so as to aid the fitting of the trouser part 3 to the wearer. 45

16. A method of connecting a jacket part 2 and a trouser part 3 so as to form a protection suit 1 **characterised in that** the method comprises the steps of: 50

- 1) Closing a first fastening means 4 to produce a second protection barrier between the jacket part 2 and the trouser part 3; and
- 2) Closing a second fastening means 5 to produce a first protection barrier between the jacket part 2 and the trouser part 3. 55

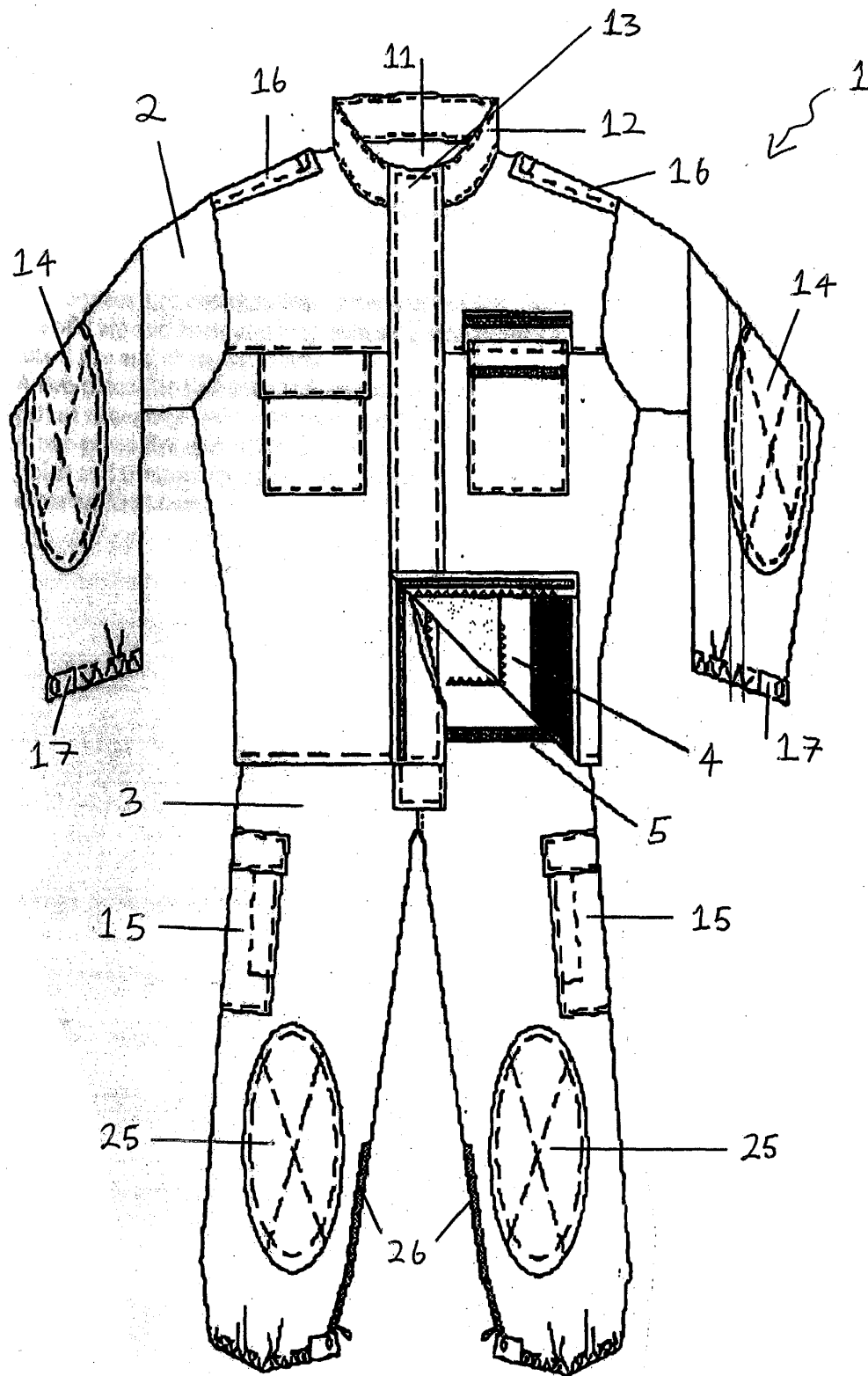


FIGURE 1

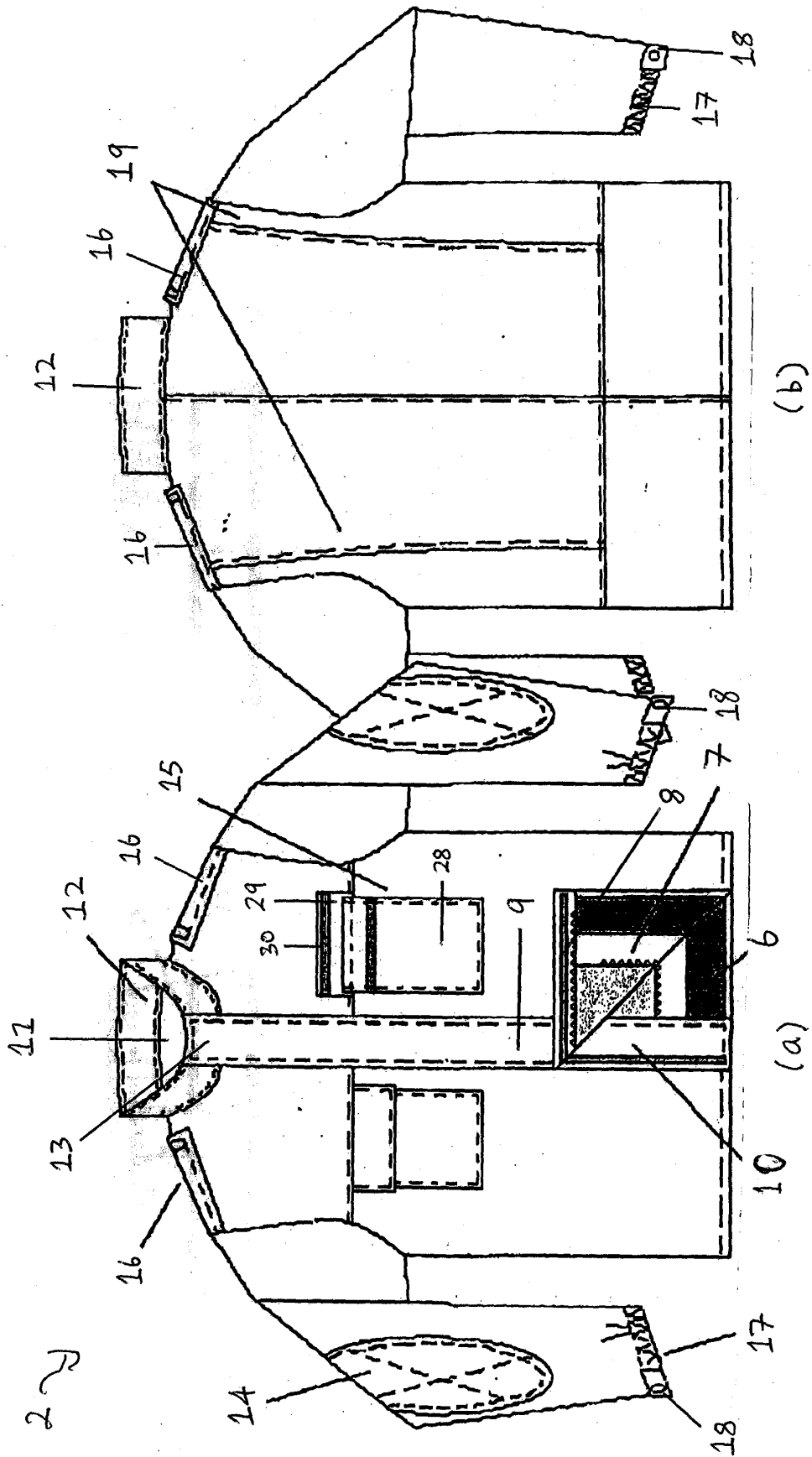
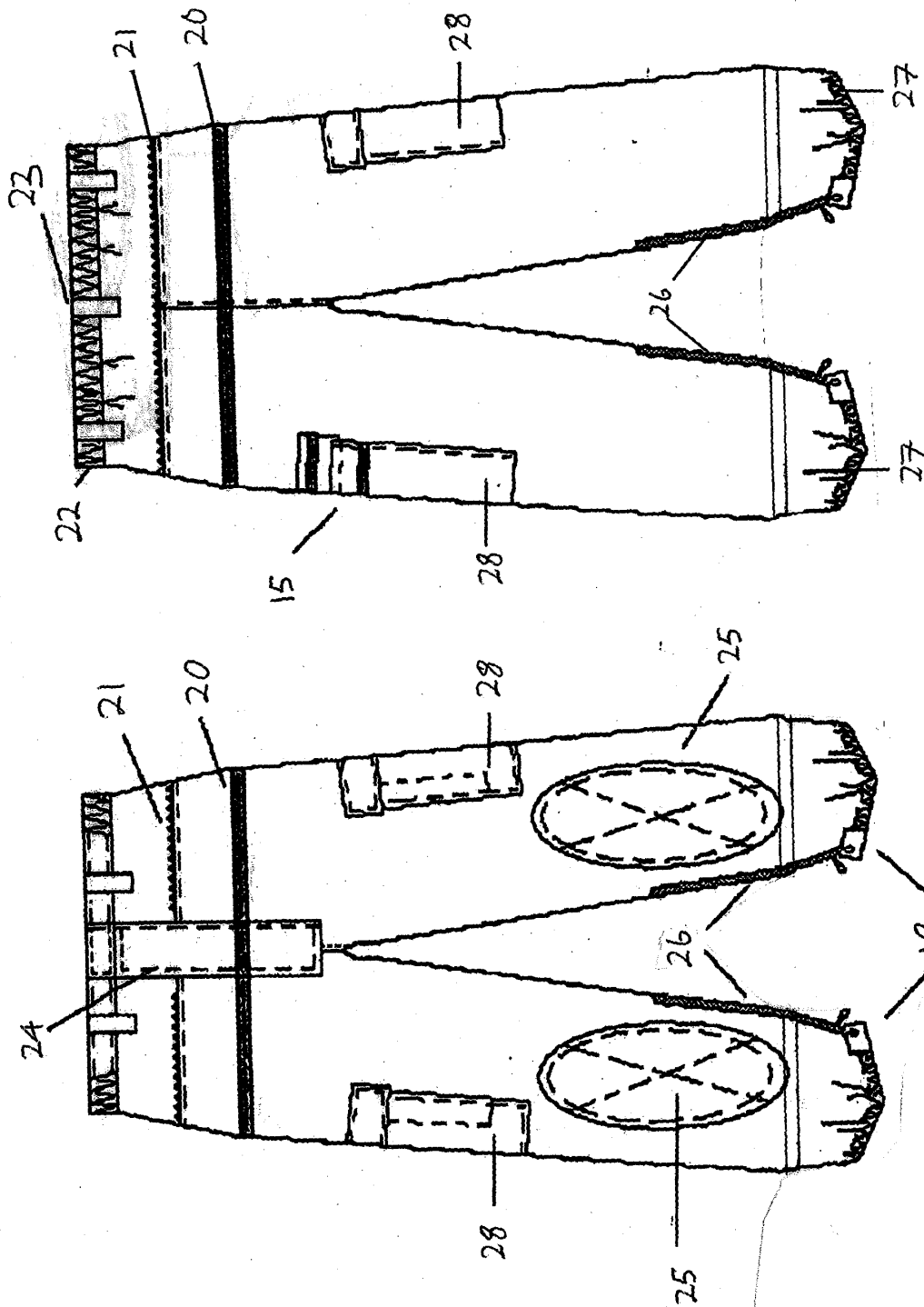


FIGURE 2



(b)

FIGURE 3

(a)



European Patent  
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EUROPEAN SEARCH REPORT

Application Number  
EP 03 25 4005

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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Place of search	Date of completion of the search	Examiner	
THE HAGUE	31 October 2003	Neiller, F	
CATEGORY OF CITED DOCUMENTS		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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EPO FORM 1503 03.82 (P04C01)

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

EP 03 25 4005

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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31-10-2003

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