

(19) World Intellectual Property
Organization
International Bureau



(43) International Publication Date
30 June 2005 (30.06.2005)

PCT

(10) International Publication Number
WO 2005/058081 A2

(51) International Patent Classification⁷: **A41D 13/002**,
B64D 10/00, A62B 17/00

[GB/GB]; 28 Grosvenor Avenue, Rhyl, Denbyshire LL18 4HA (GB). **GORDON, Peter, Cronin** [GB/GB]; 10 Hollytree Road, Liverpool L25 5PA (GB).

(21) International Application Number:
PCT/GB2004/005191

(74) Agent: **MATHISEN, MACARA & CO**; The Coach House, 6-8 Swakeleys Road, Ickenham, Uxbridge UB10 8BZ (GB).

(22) International Filing Date: 9 December 2004 (09.12.2004)

(25) Filing Language: English

(81) Designated States (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(26) Publication Language: English

(30) Priority Data:
0329250.5 17 December 2003 (17.12.2003) GB

(71) Applicant (*for all designated States except US*):
SURVITEC GROUP LIMITED [GB/GB]; 1-5 Beaufort Road, Birkenhead, Merseyside CH41 1HQ (GB).

(72) Inventors; and

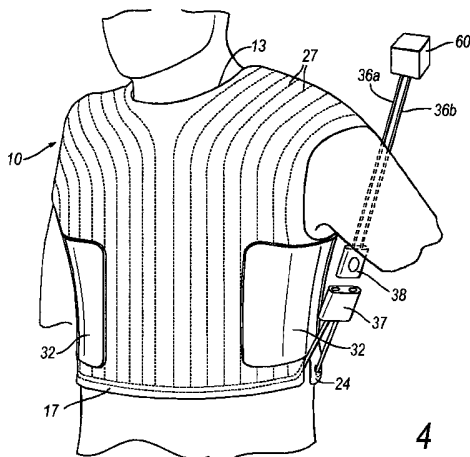
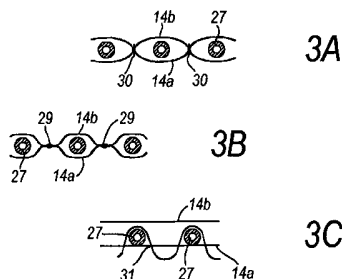
(84) Designated States (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH,

(75) Inventors/Applicants (*for US only*): **OLIVER, Paul**

[Continued on next page]

(54) Title: **CONDITIONING GARMENTS**

(57) Abstract: A conditioning garment has front and rear panels (11, 12) with a neck opening (13) between them. A manifold (17) extends along the lower edge of the front (11) panel and a manifold (24) extends along the lower edge of the rear panel (12). Tubes (27) extend between the manifolds (17, 24) and carry conditioned liquid over the torso of a wearer to heat/cool the torso. The tubes (27) are equally spaced and generally the same length to provide even heating/cooling. The garment (10) is easy to don and remove. The garment (10) can be modified by the addition of various chest compression devices, a neck support and a harness tensioning device. All these are designed to encounter increased +G-forces on the body of a wearer.





GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

CONDITIONING GARMENTS

The invention relates to conditioning garments.

- 5 Conditioning garments are used to heat or cool all or part of the body of a wearer. A conditioning garment covering a torso of a wearer comprises front and rear panels with a neck opening therebetween, two manifolds and tubes extending between the manifolds over the panels for the passage of fluid through the tubes between the manifolds. In this way, heated or cooled liquid is supplied to one of the manifolds,
10 which forms an inlet manifold, and then passes from the manifold to the tubes over the torso of a wearer to the other of the manifolds which thus forms an outlet manifold.

- According to a first aspect of the invention there is provided a conditioning garment for covering a torso of a wearer comprising front and rear panels with a neck opening
15 therebetween, each panel having a lower edge and a manifold extending across the panel in the region of the lower edge, and a plurality of tubes extending between the manifold over the panels for the passage of fluid through the tubes between the manifolds.

- 20 According to a second aspect of the invention there is provided a conditioning garment for covering a torso of a wearer comprising front and rear panels with a neck opening therebetween, two manifolds, tubes extending between the manifolds over the panels for the passage of fluid through the tubes between the manifolds and a chest compression device carried by the garment for compressing the chest of a wearer at
25 increased +G-forces.

According to a third aspect of the invention, there is provided a conditioning garment for covering a torso of a wearer comprising front and rear panels with a neck opening therebetween, two manifolds, tubes extending between the manifolds over the panel

for the passage of fluid through the tubes between the manifolds and a neck support for supporting a neck of a wearer.

According to a fourth aspect of the invention there is provided a conditioning garment for covering a torso of a wearer comprising front and rear panels with a neck opening therebetween, two manifolds, tubes extending between the manifolds over the panels for the passage of fluid through the tubes between the manifolds and a harness tensioning device for increasing tension in a harness worn by a wearer of the garment.

10 The following is a more detailed description of some embodiments of the invention, by way of example, reference being made to the accompanying drawings in which:-

Figure 1 is a plan view of a conditioning garment,

Figure 2 is a cross-section on the line II-II of Figure 1,

15 Figures 3a, 3b and 3c are alternative cross-sections on the line III-III of Figure 1,

Figure 4 is a front view of the conditioning garment of Figure 1 worn by a person and showing a terminal connector,

Figure 5 shows an alternative terminal connector,

Figure 6 is a similar view to Figure 4 but from the rear of a person,

20 Figure 7 is a similar view to Figure 4 but showing the conditioning garment modified by the addition of a first form of chest compression device,

Figure 8 is a partial cross-section through the conditioning garment of Figure 7 with the chest compression device in an inoperative position,

25 Figure 9 is a similar view to Figure 8 but with the chest compression device in an operative position,

Figure 10 is a section on the line X-X of Figure 8 showing a tube for conditioning liquid in a collapsed disposition within an inextensible tube;

Figure 11 is a similar view to Figure 10 but showing the tube in an expanded disposition;

Figure 12 is a partial cross-section through the conditioning garment of Figure 7 showing a second form of chest compression device in an inoperative position,

Figure 13 is a similar view to Figure 12 but showing the second form of chest compression device in an operative position,

Figure 14 is a similar view to Figure 7 but including a third form of chest compression device,

Figure 15 is a partial cross-section of the conditioning garment of Figure 14 in an inoperative position,

Figure 16 is a similar view to Figure 15 but showing the third form of chest compression device in an operative position,

Figure 17 is a similar view to Figure 14 but showing a fourth form of chest compression device,

Figure 18 is a partial cross-sectional view of the garment of Figure 17 showing the fourth form of chest compression device of Figure 17 in an inoperative position,

Figure 19 is a similar view to Figure 18 but showing the fourth form of chest compression device of Figure 18 in an operative position,

Figure 20 is a partial cross-sectional view through a conditioning garment of the kind shown in Figure 17 showing a fifth form of chest compression device, the fifth form of chest compression device being in an inoperative position,

Figure 21 is a similar view to Figure 20 but showing the fifth form of chest compression device in an operative position,

Figure 22 shows a modified form of the conditioning garment of Figure 14 and including a neck support and a harness tensioning device,

Figure 23 is an enlarged view of part of Figure 22 showing the neck support in an operative position and showing, to the left, the harness tensioning device in an inoperative position and, to the right, the harness tensioning device in an operative position,

Figure 24 is a side elevation of the conditioning garment of Figure 22 with the neck support and the harness tensioning device in respective operative positions,

Figure 25 is a similar view to Figure 24 but from the front of a wearer, and

5 Figure 26 is a cross-section through the neck support of Figures 24 and 25 showing inner and outer chambers.

Referring first to Figure 1, the conditioning garment 10 is a one-piece member including a front panel 11 and a rear panel 12 with a neck opening 13 between the
10 front panel 11 and the rear panel 12. The conditioning garment 10 is formed, as seen in Figures 3A, 3B and 3C, by an inner layer of material 14a and an outer layer of material 14b. One of the layers is an inextensible material. The front panel 11 and the rear panel 12 have respective side edges 15a 15b and 16a 16b.

15 A first manifold 17 is located along a lower edge 18 of the front panel 11 and extends across the whole width of the front panel 11 between the side edges 15a, 15b of the front panel 11. As seen in Figure 2, the manifold 17 is formed from a moulded plastics material with a central passage 19 and a plurality of ports, one of which is shown at 20. The first manifold 17 has an outer face 21 and an inner face 22. As
20 seen in Figure 2, the inner face is generally flat to allow the first manifold 17, which is flexible, to conform and lie against the body of a wearer. The passage 19 is closed at one end, and at the other end, leads to a terminal connection 23. This will be described in more detail below.

25 A second manifold 24, constructed and arranged similarly to the first manifold 17, extends across a lower edge 25 of the rear panel 12. The second manifold 24 has a terminal connection 26.

A plurality of tubes 27 extend between the first manifold 17 and the second manifold 24 across the front panel 11 and the rear panel 12 of the conditioning garment 10. Each tube 27 is connected to a respective port 20 of the first manifold 17 and respective port 28 of the second manifold 24. As seen in Figure 1, the ports 20 and 28 are generally equidistantly spaced across the associated manifold 17, 24.

As also seen in that Figure, the tubes 27 extend in paths between the first manifold 17 and the second manifold 24 that have initially straight portions and then curve around the neck opening 13. The straight portions each have a length that is more than 50% of the length of the associated panel 11, 12. The tubes are generally parallel to one another and, in addition, the tubes 27 are all of generally the same length.

The tubes 27 are located relative to the conditioning garment 10 and three possible modes of location are shown in Figures 3A, 3B and 3C. In Figure 3A, the inner layer 14a and the outer layer 14b are stitched together along stitching lines 30 to form pockets with a tube 27 being arranged in each pocket to locate the tube 27 relative to the conditioning garment 10. In Figure 3B, the pockets are formed by lines of heat welding 29. In Figure 3C, stitching 31 is provided over the tubes 27 to connect the tubes 27 to the inner layer 14a. In all of these ways, the tubes 27 are held in fixed positions relative to one another and relative to the conditioning garment 10.

The side edges 16a, 16b of the rear panel 12 are provided with respective projecting flaps 32. These flaps 32 carry touch-close pads. Co-operating touch-close pads 33 extend inwardly from the side edges 15a, 15b of the front panel 11 towards the lower edge 18 of the front panel 11.

The conditioning garment is easily fitted by passing a head of a wearer through the neck opening 13 and arranging the rear panel 12 over a rear of a torso of the wearer and the front panel 11 over the front of the torso of the wearer. The flaps 32 can then

be engaged with the pads 33 to close the garment around the sides of a wearer. This is seen in Figure 4.

Referring to Figure 5, the terminal connectors 23, 26 include male connectors 34a, 34b that plug into a block 35 including female connections (not shown) connecting to respective supply and drain tubes 36a, 36b. As an alternative, as shown in Figure 4, the two terminal connections 23, 26 may meet in a block 37 including respective female connectors and connect to male connectors 38 leading to the supply tube 36a and the drain tube 36b.

The conditioning garment 10 can be used to either to heat or, more commonly, to cool a wearer. For heating, heated liquid is supplied through the supply tube 36a and for cooling, cooled liquid is supplied through the supply tube 36a from a source of heated/cooled liquid 60. The liquid passes to the first manifold 17, which thus forms an inlet manifold, and vents through the ports 20 to pass through the tubes 27 over the torso of a wearer before leaving through the ports 28, the second manifold 24, which thus acts as an outlet manifold, the terminal connector 26 and the drain tube 36b.

The conditioning garment 10 described above with reference to the drawings has a number of advantages. It can be easily donned and removed using the flaps 32 and the pads 33. The connection to the supply tube 36a and the drain tube 36b is easy and convenient. The regular spacing of the tubes 27 across the garment 10, particularly at the manifold 17, 24, means that there are no points on the torso of the wearer where heating/cooling is concentrated. The fact that the tubes 27 are of similar length means that the heating/cooling is even over the torso of the wearer since similar amounts of heat are lost or gained through the tubes 27 along their lengths

There are a number of modifications that may be made to the garment described above with reference to the drawings. It is not necessary for both sides of the garment to be

openable. Accordingly, one side of the garment 10 may be closed permanently and this is preferably the side where the terminal connections 23, 26 are located. It has been found that the garment 10 can still be easily donned with just one side openable. The closures need not use touch-close material. Any suitable form of fastening may be used such as buckles or straps.

Another possibility is to have both sides permanently closed.

The location of the terminal connections 23, 26 at one side of the garment 10 is to allow the terminal connections 23, 26 to communicate with a particular heating/cooling system provided in a particular aircraft. For other aircraft, it may be necessary to locate the terminal connections 23, 26 elsewhere. For example, the terminal connections may be located on the front panel 11 adjacent the lower edge 18.

Referring next to Figures 7, 8, 9, 10 and 11, a first modified form of the conditioning garment 10 includes a first form of chest compression device. Such a device restricts the tendency of the chest wall to expand. This may occur with positive pressure breathing either under elevated +G-forces or at high altitudes. The problem is greater at high altitudes due to the double effect of increased air supply pressure and decreased surrounding pressure. Decreased surrounding pressure may also arise in emergencies such as loss of cabin pressure. The device is in the form of a closed tube 39 arranged in a pocket 40 at one side of the garment 10. The tube 39 is filled with gas under such pressure that, at sea level, the tube has a relatively collapsed disposition. At lower surrounding pressures, the gas in the tube 39 expands and the tube 39 moves from the configuration as shown in Figure 8 to the expanded configuration shown in Figure 9 where the pocket 40 is distended to draw the side edges 15a, 16a of the front panel 11 and the rear panel 12 together and so tighten the garment 10 around the chest of the wearer. Such tightening can help the wearer lower surrounding pressures and the associated increased air supply pressure.

This garment, and the garment described above with reference to Figures 1 to 6, provide chest compression through the tubes 27. As described above, in use a liquid circulates through the tubes 27. This liquid has a mass and at elevated +G-forces the liquid will be forced down the tubes 27 and this will expand the tubes and compress the garment against the chest of a wearer to provide chest compression. This alone may be sufficient chest compression for elevated +G-forces.

The compressive effect may be increased by making the tubes 27 expandable. In this case, as shown in Figures 10 and 11, such flexible tubes 27 may be surrounded by respective tubes 41 of inextensible material. When the tubes 27 are in their normal collapsed disposition, the inextensible tubes 41 elongate to increase the circumferential dimension of the front and back panels 11, 12. Under increased +G-forces, the tubes 27 expand as seen in Figure 11, and conform the inextensible tubes 41 to a circular cross-section. This decreases the circumferential dimension of the front and back panels 11, 12 and so provides chest compression.

A second form of chest compression device is shown in Figures 12 and 13. In these Figures, the device is formed by a plurality of pockets 41, with each pocket extending between an associated pair of conditioning tubes 27. Each pocket contains a respective closed tube 42 containing gas. At normal surrounding pressures, the closed tubes 42 have a smaller dimension but, as seen in Figure 13, at decreased surrounding pressures, the gas in the closed tubes 42 expands to draw the tension of the inner and outer layers 14a, 15b so tightening the conditioning garment 10 around the torso of a wearer.

Of course, in both of these embodiments, as the surrounding pressure increases, the gas pressure reduces so releasing the compression.

A conditioning garment 10 with a third form of chest compression device is shown in Figures 14 to 16. Referring to these Figures, the chest compression device includes a chamber 43 including a portion 44 extending along the lower edges 18, 25 of the front and rear panels 11, 12 and sub-chambers 45 extending up the front panel 11 and the rear panel 12. Each sub-chamber 45 extends between an adjacent pair of conditioning tubes 27. As seen in Figures 15 and 16, each sub-chamber 45 is formed from an extensible portion 46 and an inextensible portion 47. The chamber 43 is connected to a supply of gas under pressure 61 (Figure 14) that is controlled in accordance with sensed or anticipated +G-forces. When increasing +G-forces are sensed or anticipated, gas is supplied through an inlet 48 to the chamber 43 so expanding the sub-chamber 45. The effect of this is to expand the inextensible portion 47 and allow the extensible portion 46 to contract so tightening the conditioning garment 10 around the torso of the wearer.

As seen in Figures 15 and 16, the conditioning garment 10 of this embodiment includes also the gas filled tube 39 described above with reference to Figures 7 to 9.

A conditioning garment 10 including a fourth form of chest compression device is shown in Figures 17 to 19. This conditioning garment 10 has the outer layer 14b inextensible. The chest compression device is formed by a chamber 49 extending around the garment 10 between the inner layer 14a and the outer layer 14b. The chamber 49 has an inlet 50 and is connected to a source of gas under pressure 61 as described above with reference to Figures 14 to 16. When increased +G-forces are sensed or anticipated, gas under pressure is supplied to the chamber 49 through the inlet 50. Since the outer layer 14a is inextensible, the effect of this is to cause the chamber 49 to force the inner layer 14b against the torso of a wearer. This compresses the torso of a wearer to counteract increased +G-forces.

As seen in Figures 20 and 21 and to the right hand side of Figure 17, the chamber need not be a single chamber; it could be formed from a plurality of sub-chambers 51. These operate in the same way as the chamber 49 so that when the sub-chambers 51 are expanded by the supply of gas, the chambers 51 push the inner layer 14a against the torso of a wearer to provide chest compression at increased +G-forces.

Referring next to Figures 22 and 26, the conditioning garment 10 shown in Figures 20 and 21 and to the right hand of Figure 17 is modified to provide neck support and a harness tensioning device. In this conditioning garment 10, the sub-chambers 51 are continued up the front panel 11 and the rear panel 12 to connect with tensioning chambers 52 on the shoulders of the garment 10. As seen in Figures 22 and 23, the shoulder straps 53 of a harness holding the wearer in the seat of, for example, an aircraft, extend over the shoulders and thus over the collapsed tensioning chambers 52. When gas under pressure is supplied from the source 61 to the sub-chambers 51 from the source 61 when increased +G-forces are sensed, the tensioning chambers 52 inflate and force the shoulder straps 53 away from the shoulders of the wearer. The effect of this is to increase the tension in the shoulder straps 53 and so hold the wearer more securely in the seat.

The tensioning chamber 52 leads to an inflatable collar 54 extending around the neck opening 13. The collar 54 is normally in a collapsed disposition around the neck opening as seen in Figure 22. When, however, the sub-chambers 51 are supplied with gas under pressure, this gas also enters the collar 54 and raises it to the erect position as shown in Figure 23. As seen in Figure 24, in this position, the collar 54 supports the chin of a wearer and also holds the head of a wearer against lateral movement as seen in Figure 25. The collar may include an outer portion 55 at higher pressure and a softer inner portion 56 at lower pressure as seen in Figure 26.

It will be appreciated that any of the chest compression devices, the neck support and the harness tensioning device need not be used with the conditioning garment of Figures 1 to 4. They could be used individually or collectively on any other form of conditioning garment.

CLAIMS

1. A conditioning garment for covering a torso of a wearer comprising front and rear panels (11, 12) with a neck opening (13) therebetween, each panel (10, 11)
5 having a lower edge (18, 25) and a manifold (17, 24) extending across the associated panel (11, 12) in the region of the lower edge (18, 25) of the associated panel, and a plurality of tubes (27) extending between the manifolds (17, 24) over the panels (11, 12) for the passage of fluid through the tubes between the manifolds (17, 24).
- 10 2. A garment according to claim 1 wherein the lower edge (18, 25) of each panel (11, 12) extends between respective side edges (15a, 15b; 16a, 16b), each manifold (17, 24) extending across the whole or substantially the whole width of the associated panel (11, 12) between the side edges (15a, 15b; 16a, 16b).
- 15 3. A garment according to claim 1 or claim 2 wherein each tube (27) is connected to the manifolds (17, 24) by respective connections (20, 28), the connections (20, 28) of each manifold (17, 24) being equally spaced along the manifold.
4. A garment according to any one of claim 1 to 3 wherein the tubes (27) are
20 arranged parallel to one another as the tubes (27) extend over the front and rear panels (11, 12).
5. A garment according to any one of claims 1 to 4 wherein each tube (27) includes at least one straight portion.
- 25 6. A garment according to claim 5 wherein each tube (27) includes two straight portions, each straight portion extending from a respective manifold (17, 24) toward the neck opening (13).

7. A garment according to any one of claims 1 to 6 wherein all the tubes (27) are of equal or substantially equal length.

8. A garment according to any one of claims 1 to 6 wherein each manifold (15, 24) terminates in an associated terminal connection (23, 26), the two terminal connections (23, 26) being adjacent one another for connection respectively to a source and sink for fluid for passage between the manifolds along the tubes (27).

9. A garment according to claim 8 wherein the terminal connections (23, 26) are located to the same one side of the garment.

10. A garment according to claim 8 wherein the terminal connections (23, 26) are located at the centre of an associated panel (11, 12).

11. A garment according to any one of claims 1 to 10 and in which the front and rear panels (11, 12) have respective side edges (15a, 15b; 16a, 16b), each side edge (15a, 15b) of one panel (11) being connectable to an adjacent side edge (16az, 16b) of the other panel (12) to hold the garment on a wearer.

12. A garment according to claim 11 wherein the connections at the sides (15a, 15b; 16a, 16b) of the garment are releasable.

13. A garment according to claim 11 wherein the connection at one side (15a, 16a) of the garment is releasable and the connection (15b, 16b) at the other side of the garment is non-releasable.

14. A garment according to claim 13 when dependent on claim 9 wherein the non-releasable connection (15b, 16b) is at the side of the garment where the terminal connections (23, 26) are located.

15. A garment according to any one of claims 1 to 14 wherein at least one manifold (17, 24) is formed by a strip of flexible material, the strip providing a central passage (19) and a plurality of ports (20, 28), each port (20, 28) connecting the passage (19) to an associated tube (27).

5

16. A garment according to claim 15 wherein said manifold (17, 24) of flexible material has a first side (21) and a second side (22), the first side (21) facing outwardly of the associated panel and the second side (22) resting, in use, against a torso of a wearer, the second side (22) being generally flat.

10

17. A garment according to any one of claims 1 to 16 wherein each panel (11, 12) is formed from two layers of material (14a, 14b), the tubes (27) being located between said layers (14a, 14b) and being positioned relative to at least one of said layers (14a, 14b).

15

18. A garment according to claim 17 wherein the two layers (14a, 14b) are connected together between adjacent tubes (27) to form elongate pockets, each pocket containing an associated tube (27) to locate the tube.

20 19. A garment according to claim 18 wherein the connection is by stitching or heat welding.

20. A garment according to claim 17 wherein each tube (27) is connected to an associated one of the layers (14a, 14b) by stitching to locate the tube (27) relative to
25 the layer.

21. A garment according to any one of claims 1 to 20 herein the tubes (27) are expandable at increased +G-forces to tighten the garment around a chest of a wearer to resist chest expansion at such increased +G-forces.

22. A garment according to claim 21 wherein each tube (27) is contained within an associated inextensible outer tube (41), each tube (27) having a normal collapsed disposition to allow the associated outer tube (41) to spread and increase the circumferential length of the garment but expanding at increased +G-forces to contract
5 the associated outer tube (41) to decrease said circumferential length.

23. A conditioning garment for covering a torso of a wearer comprising front and rear panels (11, 12) with a neck (13) opening therebetween, two manifolds (17, 24), tubes (27) extending between the manifolds (17, 24) over the panels (11, 12) for the
10 passage of fluid through the tubes (27) between the manifolds (17, 24) and a chest compression device carried by the garment for compressing the chest of a wearer.

24. A garment according to any one of claims 1 to 22 in combination with a chest compression device carried by the garment for compressing the chest of a wearer.

15 25. A garment according to claim 23 or 24 wherein the front and rear panels (11, 12) are formed of, or include, at least one layer of inextensible material (14a or 14b), the chest compression device acting to tighten at least one layer of inextensible material of the front and rear panels (11, 12) around the torso of a wearer to compress
20 the chest of a wearer.

26. A garment according to claim 25 wherein said chest compression device includes a tube (39; 42) containing a gas, the tube (39; 42) being collapsed at a first surrounding pressure but a reduced surrounding pressure expanding to tighten the at
25 least one inextensible layer (14a or 14b) front and rear panels (11, 12) around the torso of a wearer to counter increased +G-forces.

27. A garment according to claim 26 wherein a single tube (39) is provided at one side of the garment, the tube (39) being held in a pocket (40) such that expansion of

the tube (39) draws the at least one inextensible layer (14a or 14b) of the front and rear panels (11, 12) together to tighten the front and rear panels (11, 12) around the torso of a wearer.

5 28. A garment according to claim 26 or claim 27 wherein a plurality of tubes (42) are provided extending over the front and rear panels (11, 12), such that expansion of each said tube (11, 12) tightens the associated panels (11, 12) around the torso of a wearer.

10 29. A garment according to claim 28 when dependent on claim 4 wherein each gas tube (42) extends between a pair of adjacent conditioning tubes (27).

30. A garment according to any one of claims 24 to 27 wherein the chest compression device includes an expandable chamber (43) connected to a supply of gas under pressure, the gas pressure increasing at increased +G-forces to expand the
15 chamber to tighten the front and rear panels (11, 12) around the torso of a wearer.

31. A garment according to claim 30 wherein the expandable chamber (43) includes a plurality of elongate sub-chambers (45), each sub-chamber (45) extending
20 along an associated panel from a lower edge thereof, the sub-chambers (45) extending generally parallel to one another.

32. A garment according to claim 31 when dependant on claim 4 wherein each sub-chamber (45) extends between a pair of adjacent conditioning tubes (27).

25

33. A garment according to claim 30 wherein the panels (11, 12) are formed from an outer and an inner layer of material (14a, 14b), the outer layer (14b) being inextensible and the chamber (49) being located between the outer and the inner layer (11, 12) so that expansion of the chamber (49) forces the inner layer (14a) against the

torso of a wearer to tighten the front and rear panels (11, 12) around the torso of a wearer.

34. A garment according to claim 33 wherein the chamber (49) extends around the
5 sides of the garment and across the front panel and the rear panel (11, 12).

35. A garment according to claim 33 wherein the chamber (49) includes a plurality
of elongate sub-chambers (51), each sub-chamber (51) extending from a lower edge of
an associated panel (11, 12) towards the neck opening (13).

10 36. A conditioning garment for covering a torso of a wearer comprising front and
rear panels (11, 12) with a neck opening (13) therebetween, two manifolds (17, 24),
tubes (27) extending between the manifolds (17, 24) over the panels (11, 12) for the
passage of fluid through the tubes (27) between the manifolds (17, 24) and a neck
15 support for supporting a neck of a wearer.

37. A garment according to any one of claims 1 to 35 in combination with a neck
support for supporting a neck of a wearer.

20 38. A garment according to claim 36 or claim 37 wherein the neck support is
formed by a member (54) movable from a collapsed inoperative position to an
extended operative position.

39. A garment according to claim 38 wherein the neck support member (54) is
25 moved from the inoperative position to the operative position in response to a trigger.

40. A garment according to claim 39 wherein the trigger is increased +G-forces.

41. A garment according to claim 39 or claim 40 wherein the trigger is actuation of an ejector seat.

42. A garment according to any one of claims 36 to 40 wherein the member
5 comprises an inflatable chamber (54) connected to a source of gas under pressure, gas from said source being fed to said chamber to extend the chamber (54) to said operative position.

43. A garment according to claim 42 wherein the chamber (54) extends around the
10 neck opening (13) and includes an upper edge which, in the operative position, extends under the chin of a wearer and around the back of a neck of a wearer.

44. A garment according to claim 43 wherein the chamber (54) has an inner
15 relatively lower pressure portion (56) for contact with the neck of a wearer and a relatively higher pressure outer portion (55).

45. A garment according to any one of claims 42 to 44 when dependent on claim
41 and including an additional source of gas under pressure, actuation of an ejector
20 seat with the neck support (54) in the operative position connecting the chamber (54) to said additional source of gas under pressure to increase the pressure in the chamber and so increase the stiffness of the chamber.

46. A conditioning garment for covering a torso of a wearer comprising front and
rear panels (11, 12) with a neck opening (13) therebetween, two manifolds (17, 24),
25 tubes (17) extending between the manifolds over the panels for the passage of fluid through the tubes (17) between the manifolds (17, 24) and a harness tensioning device (52) for increasing tension in a harness worn by a wearer of the garment.

47. A garment according to any one of claims 1 to 45 in combination with a harness tensioning device for increasing tensioning in a harness worn by a wearer of the garment.

5 48. A garment according to claim 46 or claim 47 wherein the harness includes two straps (53) for extending over respective shoulders of the wearer, the harness tensioning device (52) acting on said straps (53) to increase the tension of the harness and hold the wearer more securely in a seat.

10 49. A garment according to claim 48 wherein the harness tensioning device (52) is inflatable from a collapsed inoperative position to an inflated operative position in which in use, the device (52) urges the straps (53) away from the shoulders of a wearer to increase the tension in the straps (53).

15 50. A garment according to claim 49 wherein the tensioning device includes two inflatable chambers (52), each chamber (52) being formed on a part of the garment that, in use, is on a respective shoulder of a wearer and, in use, overlaid by a respective harness strap (53).

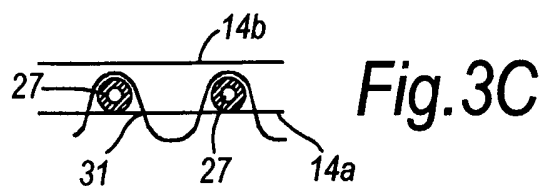
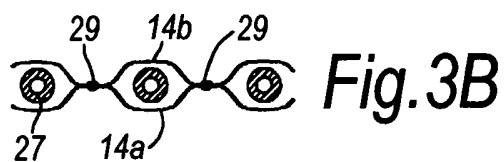
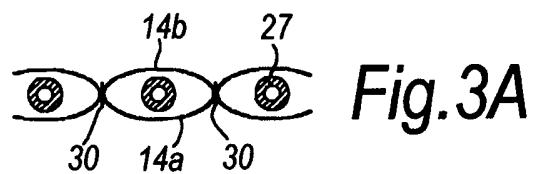
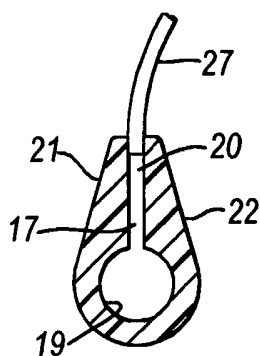
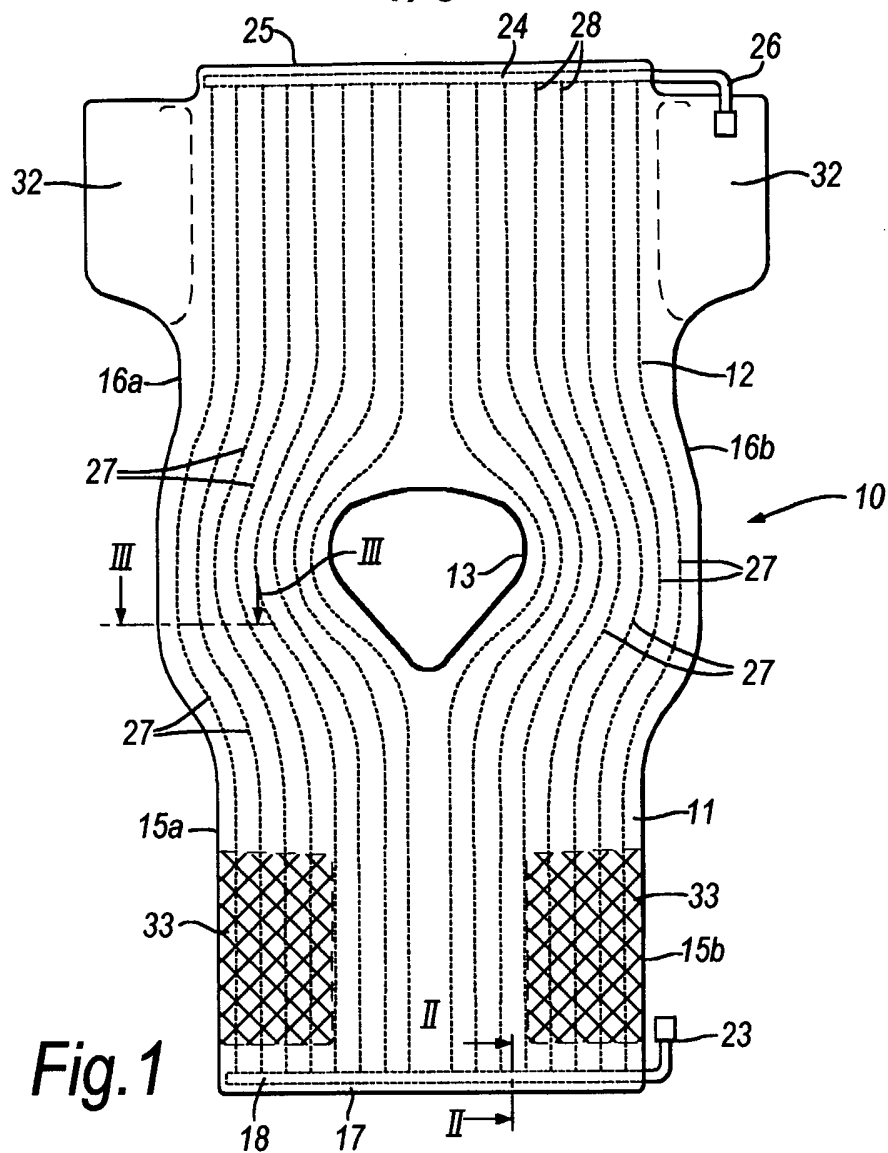
20 51. A garment according to claim 48 or claim 49 in which the tensioning device (52) is inflatable under the control of a source of gas.

25 52. A garment according to claim 51 when dependent on claim 41 wherein the source of gas is the source of gas for the member, the tensioning device being inflated with the member.

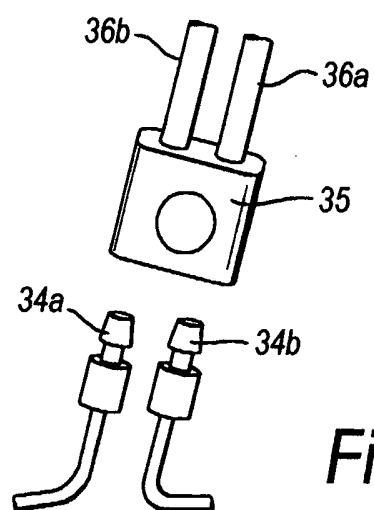
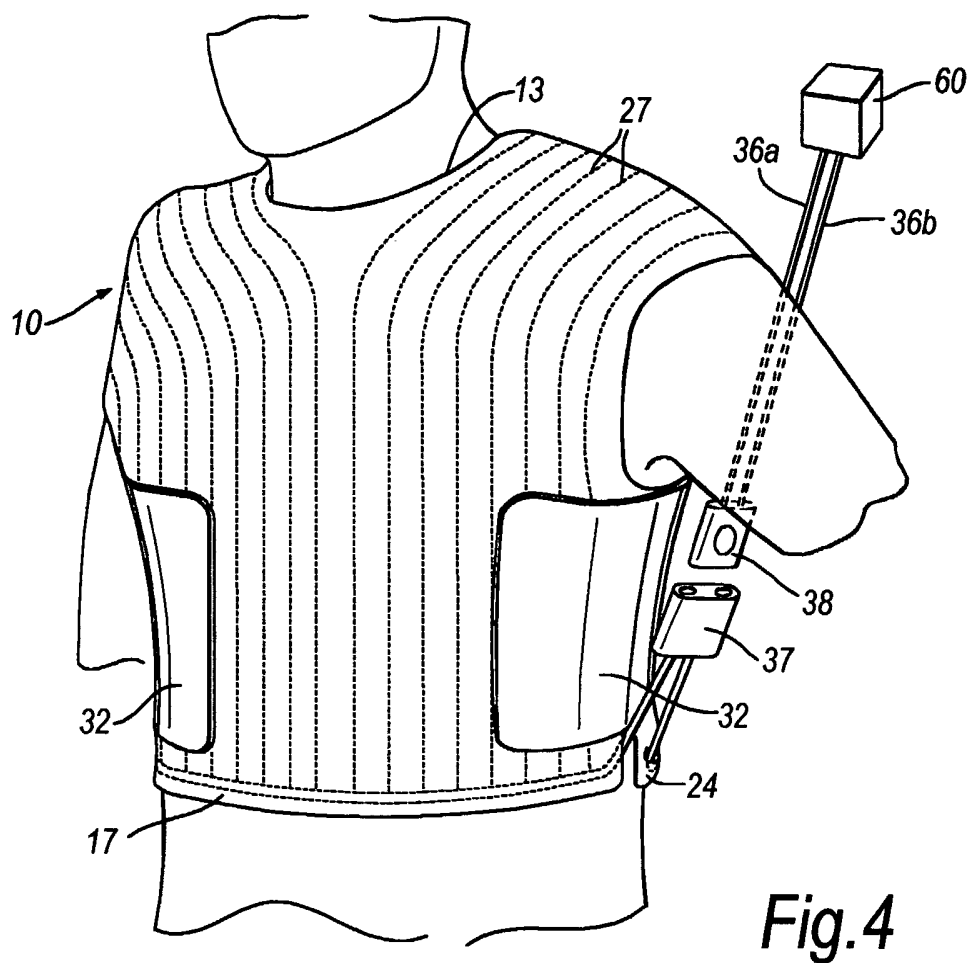
53. A conditioning garment substantially as hereinbefore described with reference to Figures 1 to 6 or to Figures 7 to 9 or to Figures 7 to 9 as modified by Figures 10

and 11 or to Figures 12 and 13 or to Figures 14 to 16 or to Figures 17 to 19 or to Figures 20 and 21 or to Figures 22 to 26 of the accompanying drawings.

1/8



2/8



3/8

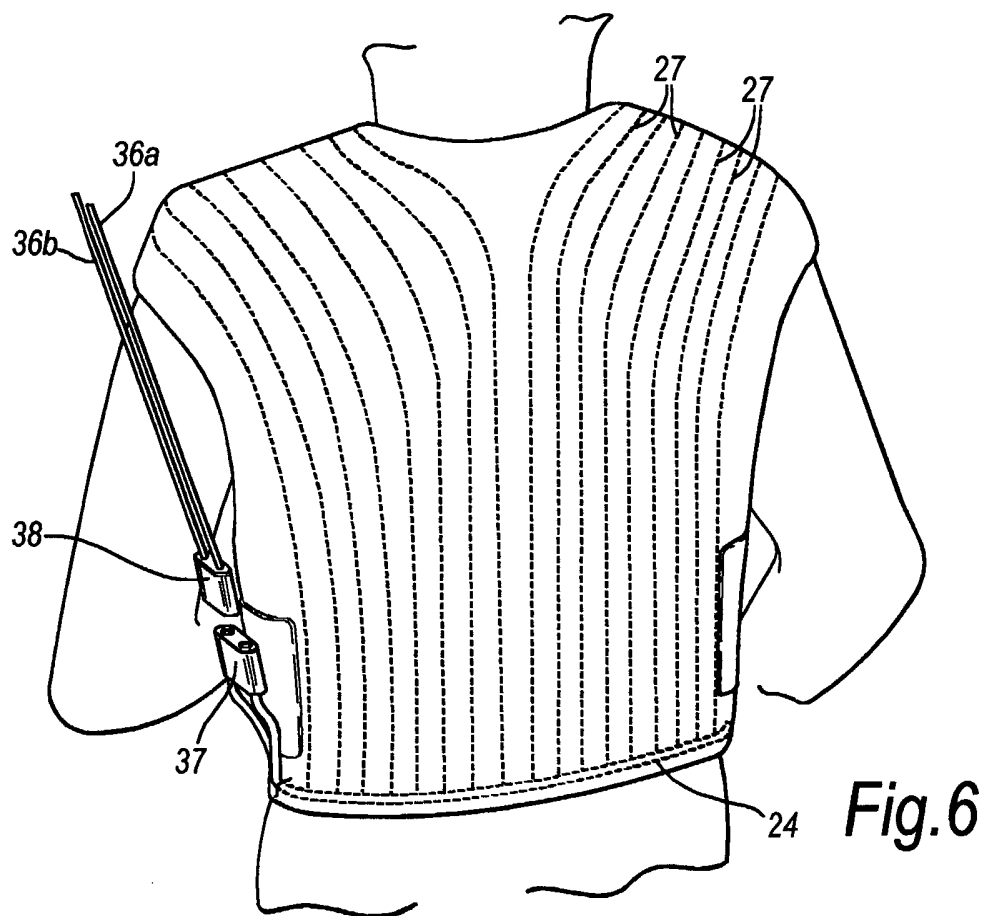


Fig. 6

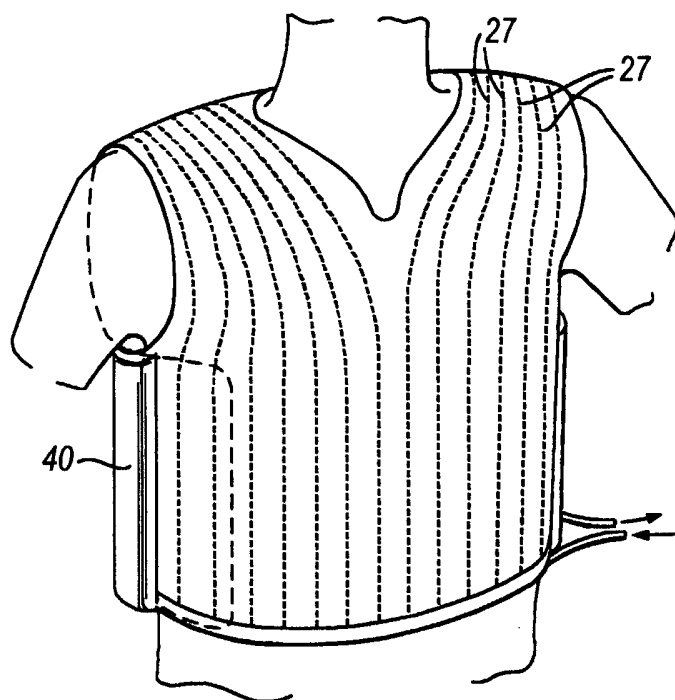


Fig. 7

4/8

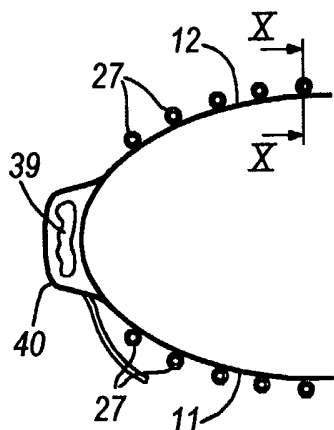


Fig. 8

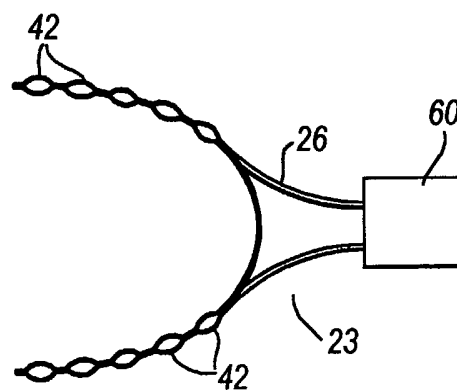


Fig. 12

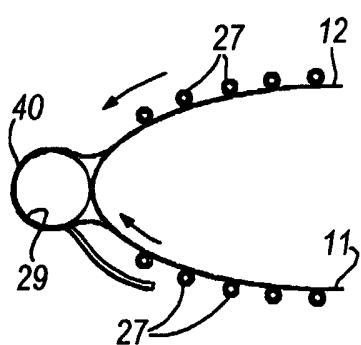


Fig. 9

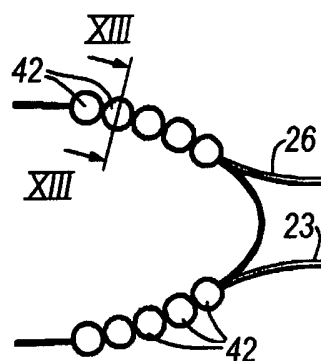


Fig. 13

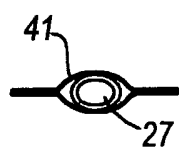


Fig. 10

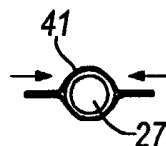


Fig. 11

5/8

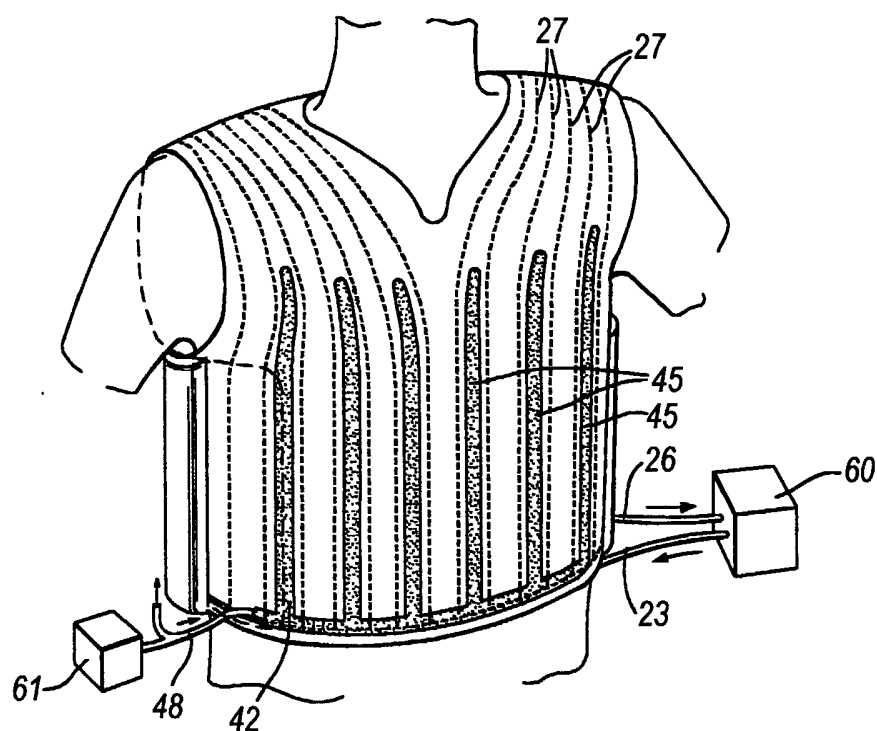


Fig. 14

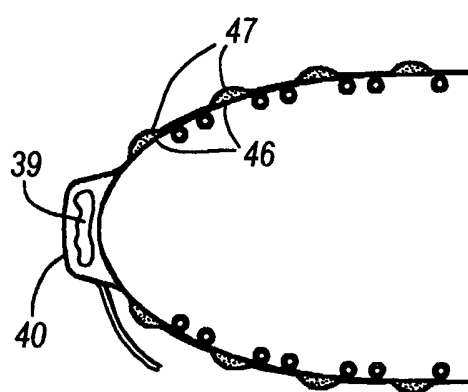


Fig. 15

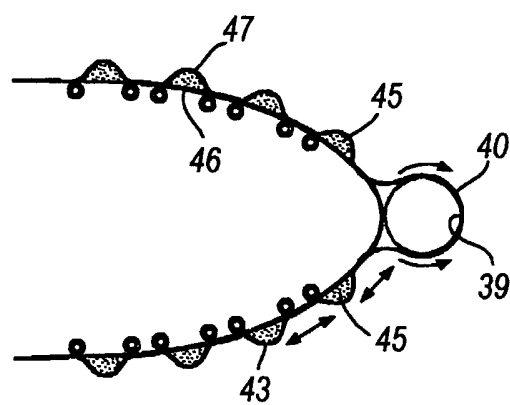


Fig. 16

6/8

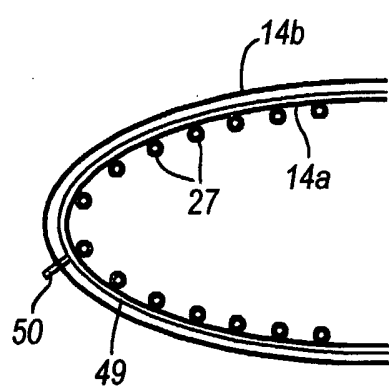
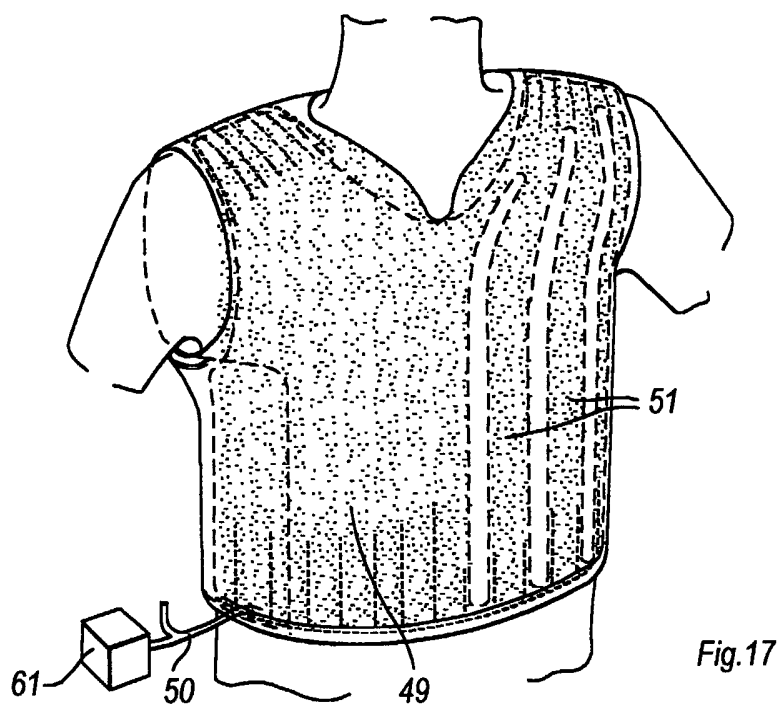


Fig. 18

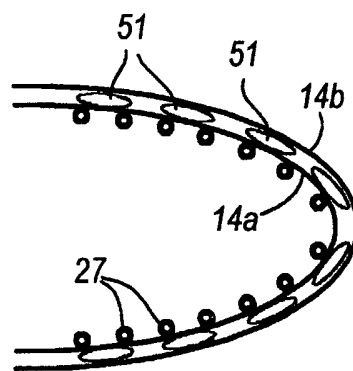


Fig. 20

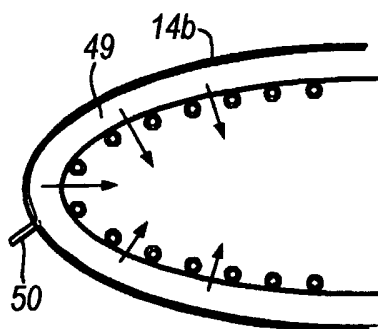


Fig. 19

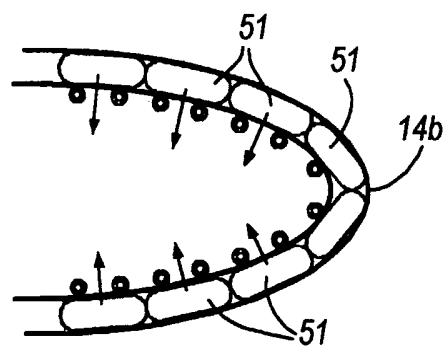


Fig. 21

7/8

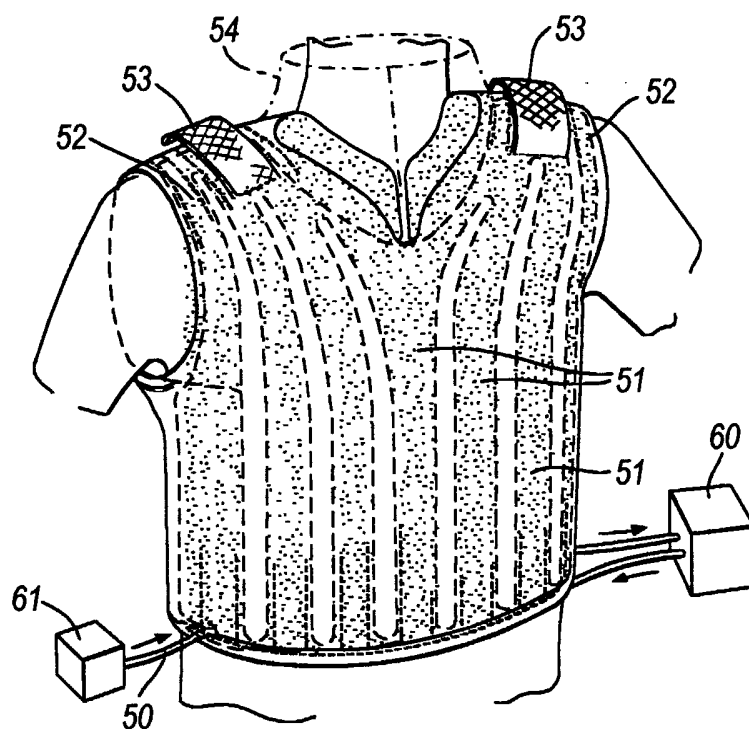


Fig. 22

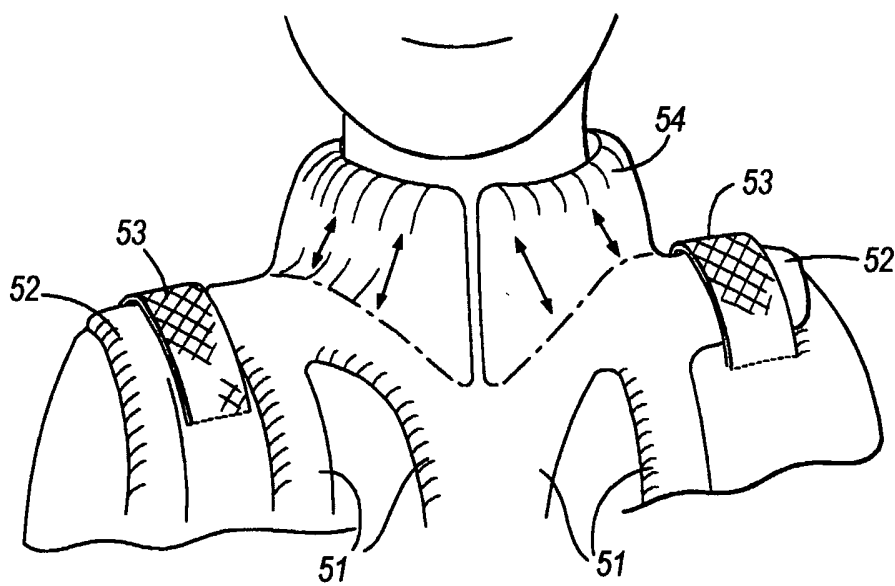


Fig. 23

8/8

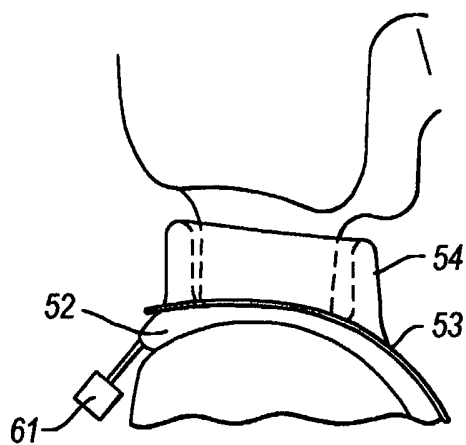


Fig. 24

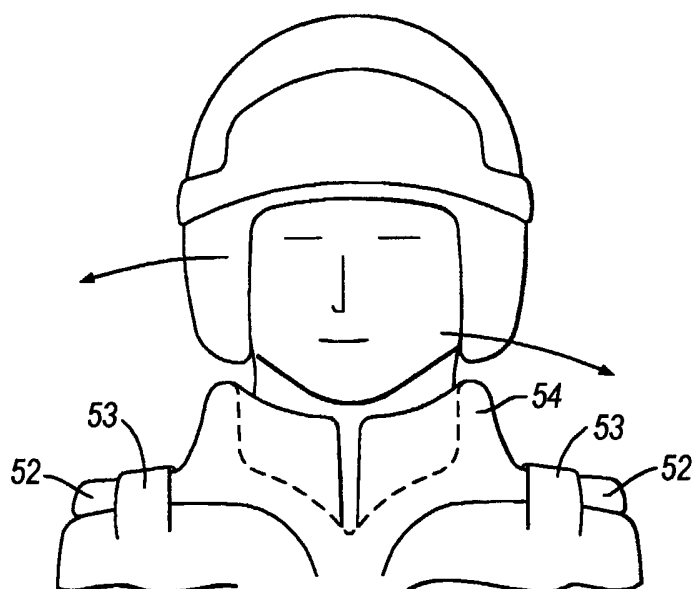


Fig. 25

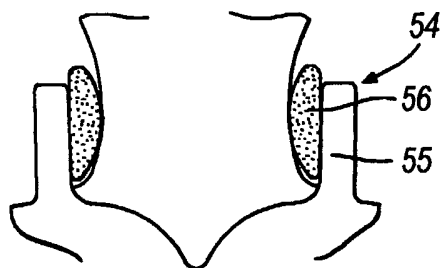


Fig. 26