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(54) **RUCKSACKS**

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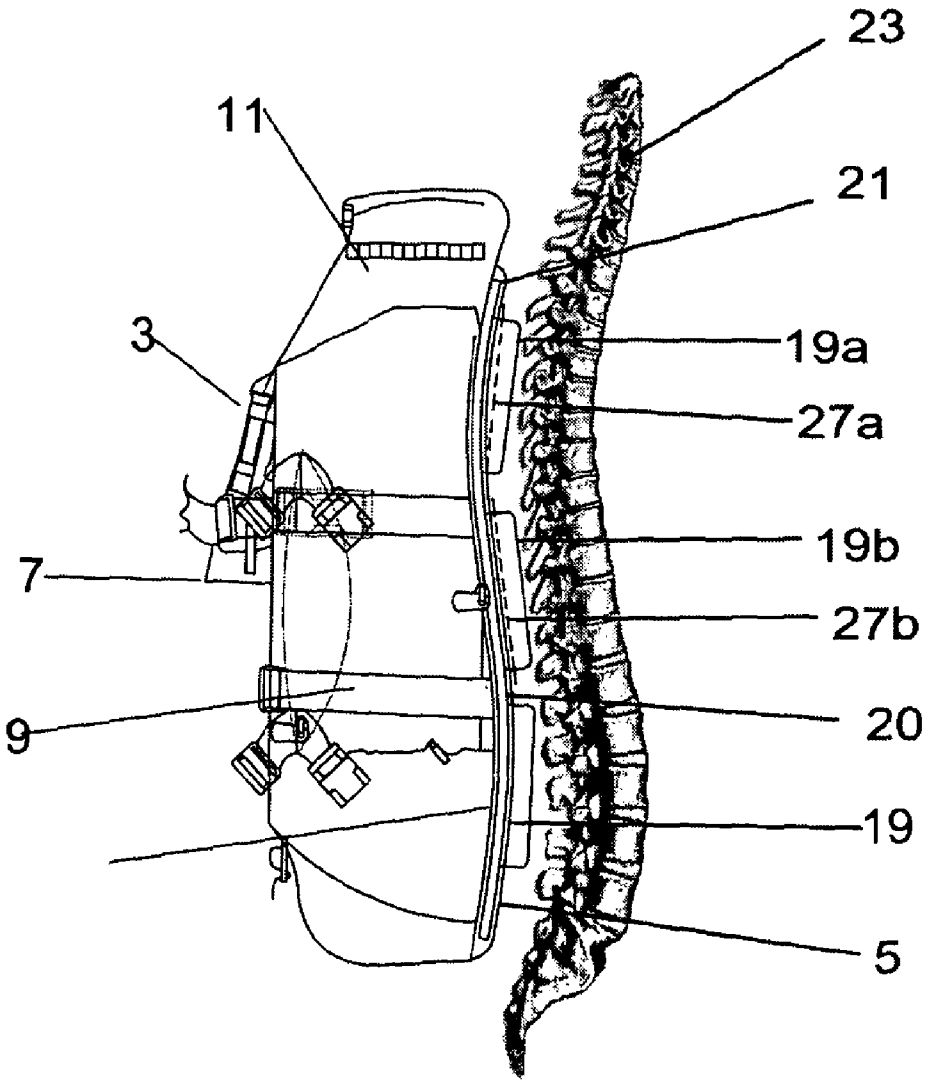
(57) **ABSTRACT**

A rucksack comprises a load-carrying bag (**3**) having a rear wall (**5**), and a harness (**15**) arranged to permit the load-carrying bag to be carried by a user with the rear wall adjacent the back of the user. The rear wall includes a plurality of projecting padded panels (**19**). The rucksack further includes a chassis (**21**) shaped such that in use each padded panel contacts the back of the user. The rucksack may alternatively, or additionally, include a pair of attachment (**37**) members on opposed sides of the rucksack, which are connected together through or adjacent the rear wall.



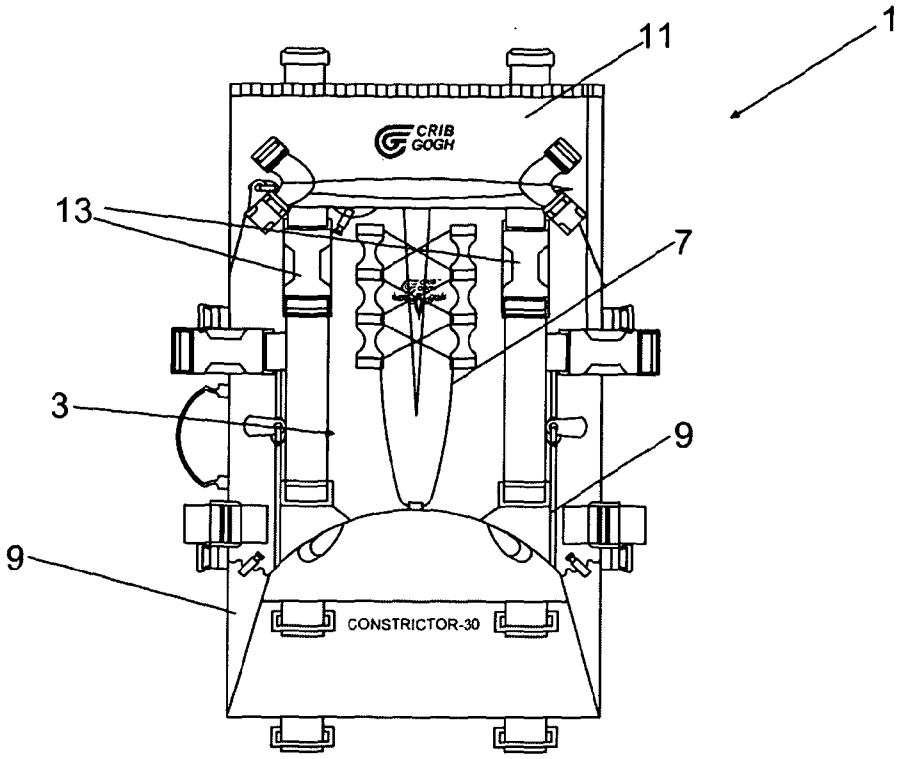


Figure 1

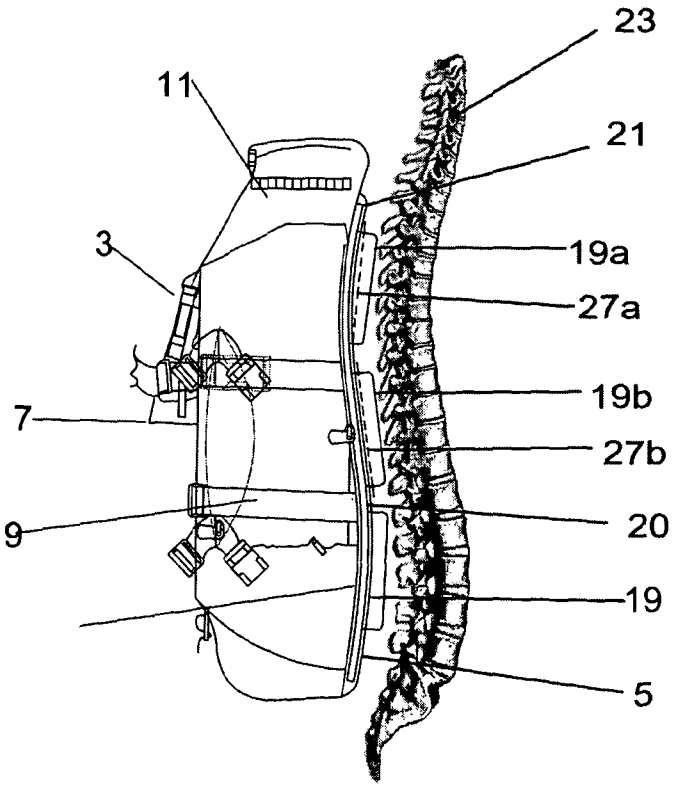


Figure 2

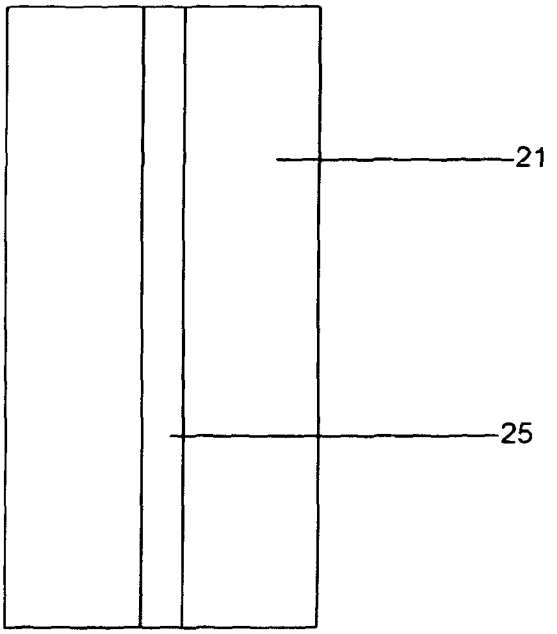


Figure 3

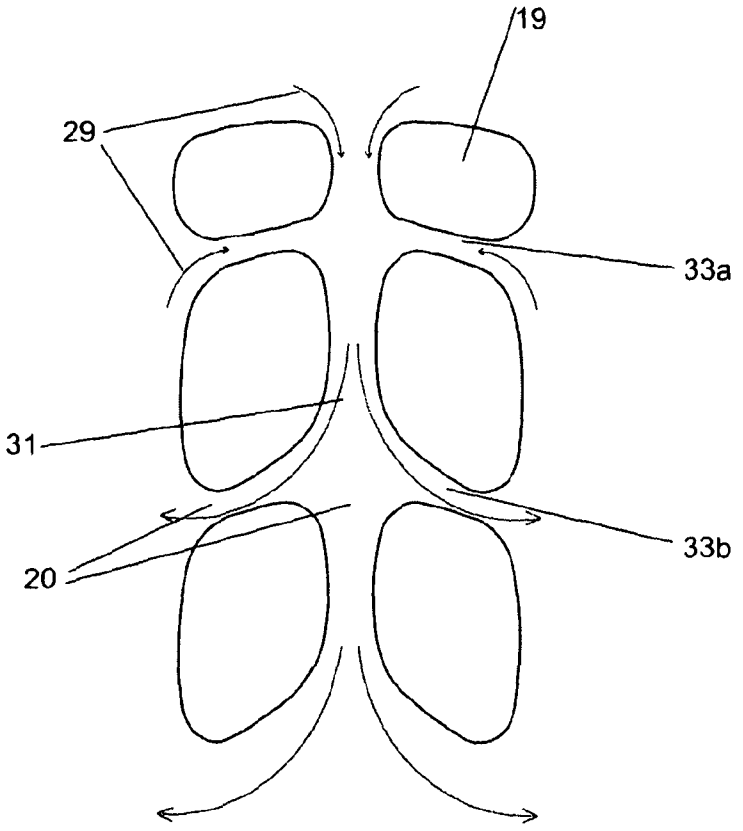


Figure 4

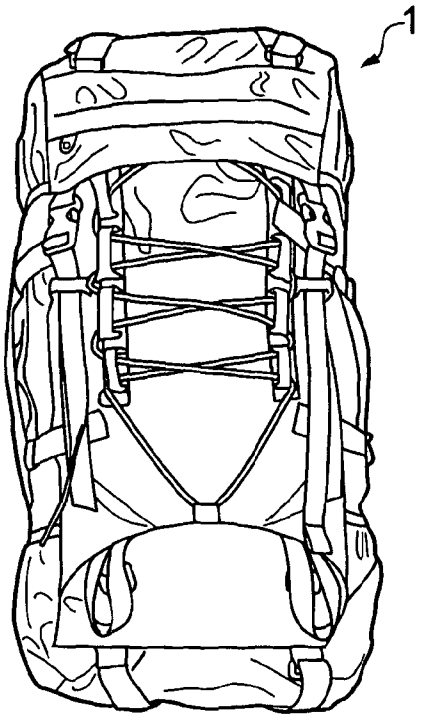


FIG. 5

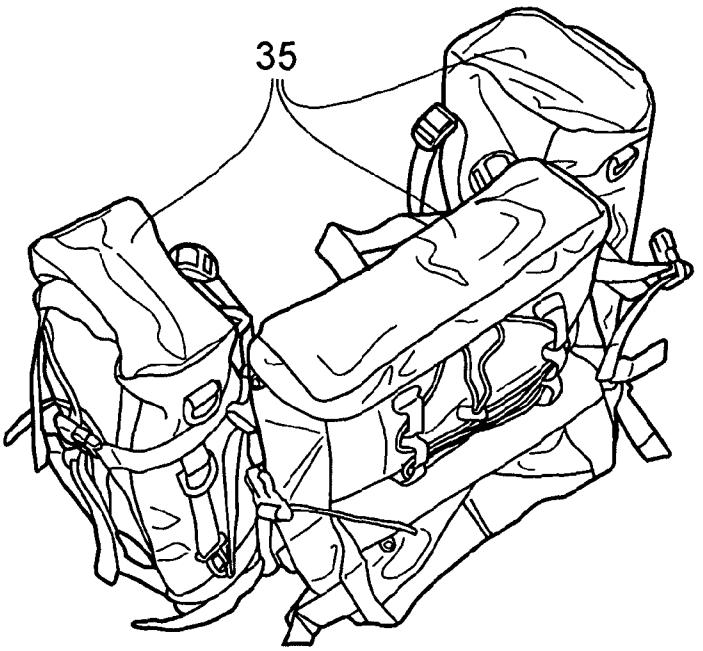


FIG. 6

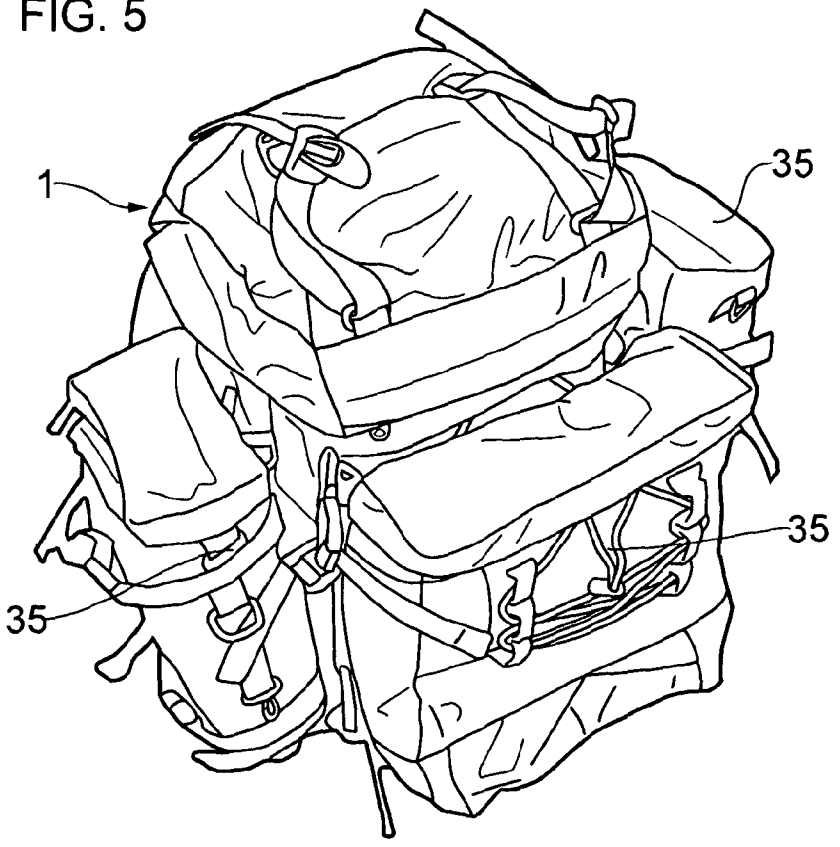


FIG. 7

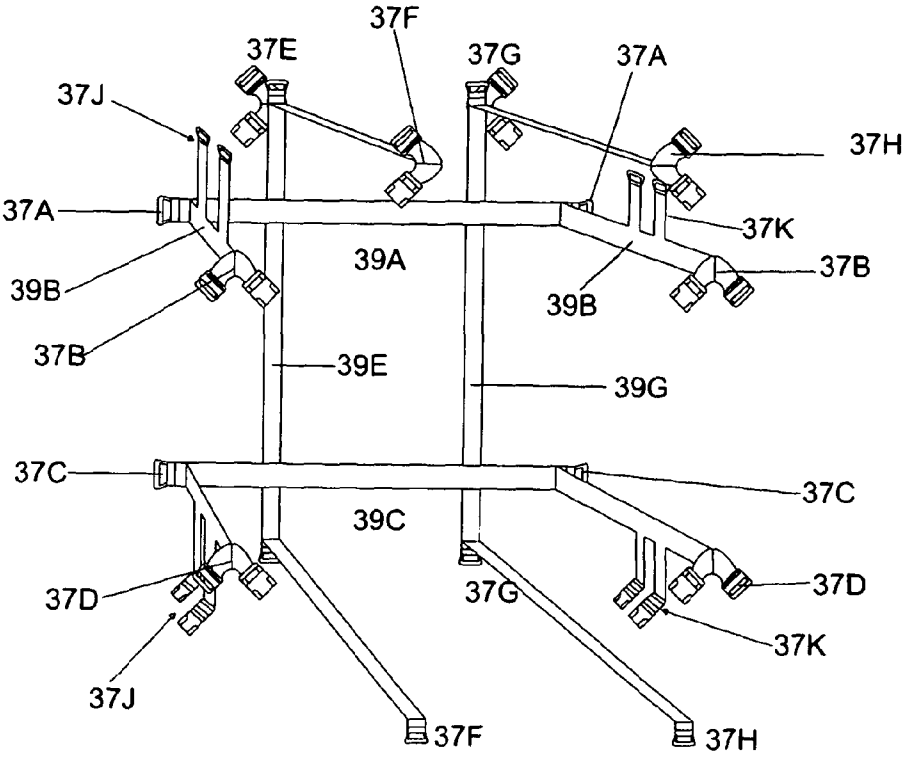


Figure 8

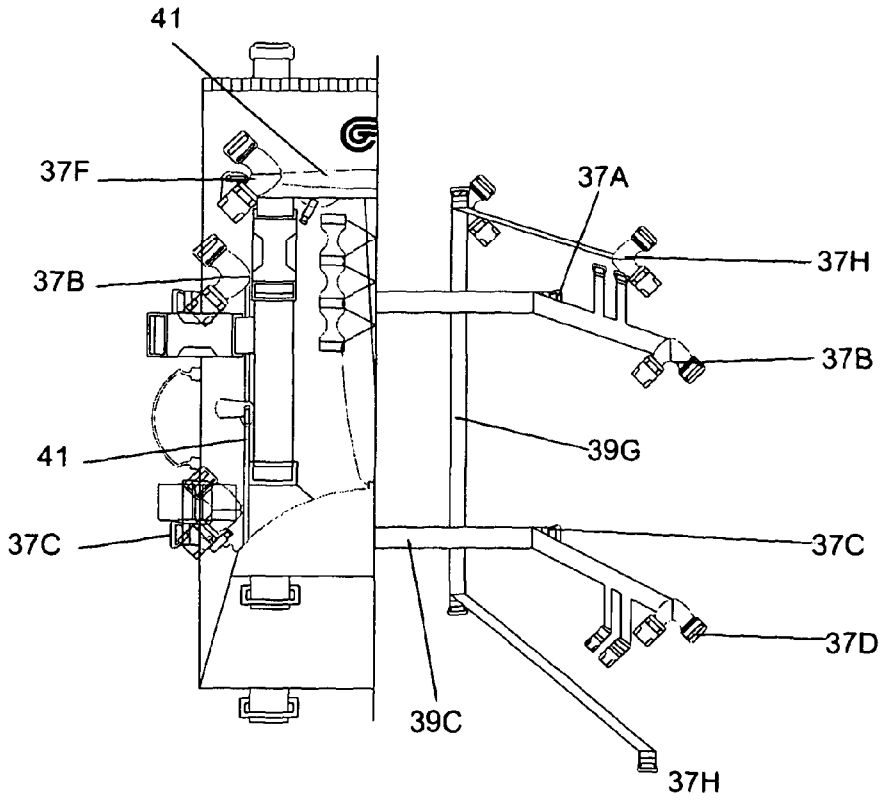


Figure 9

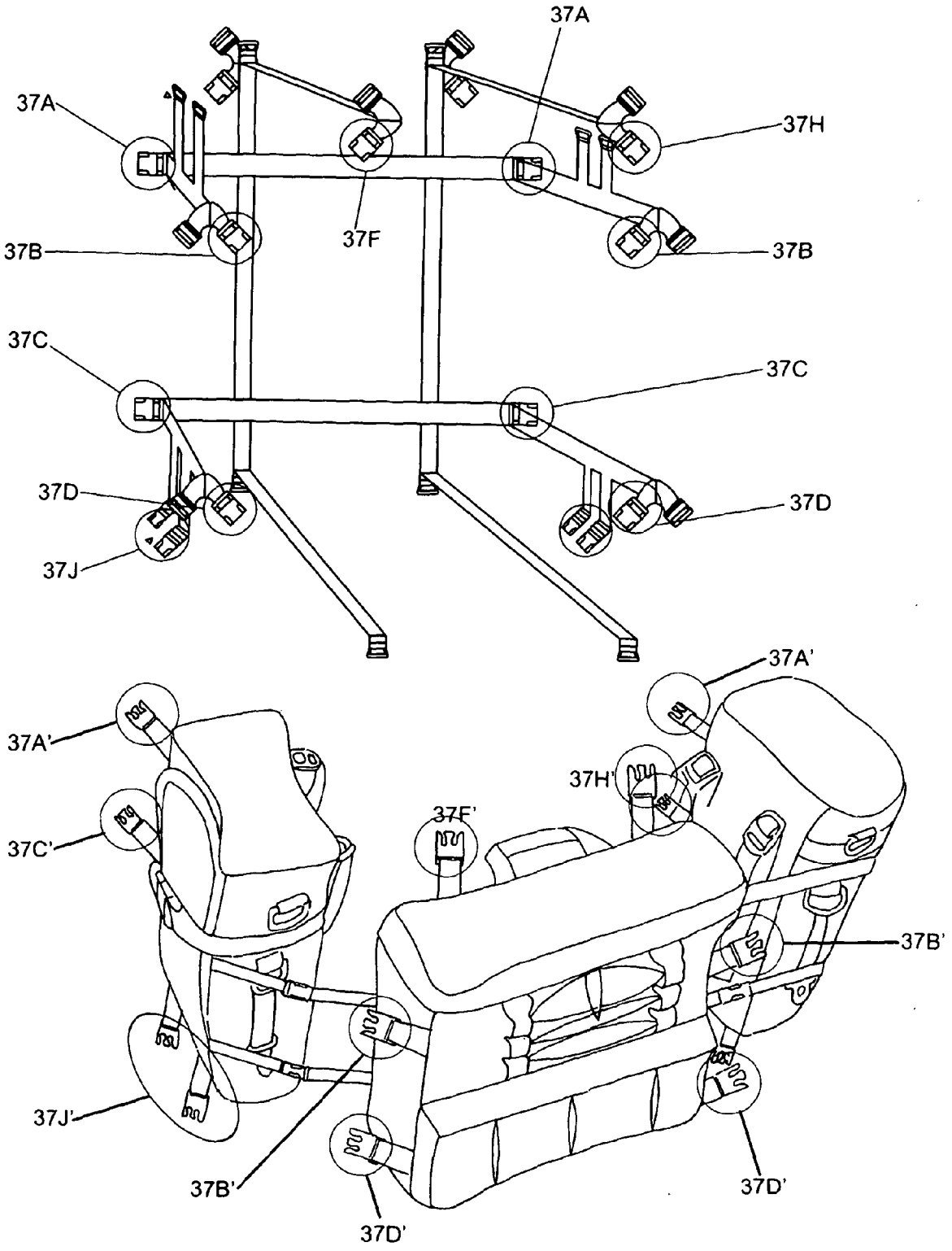

37A
37A
37H
37F
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Figure 10

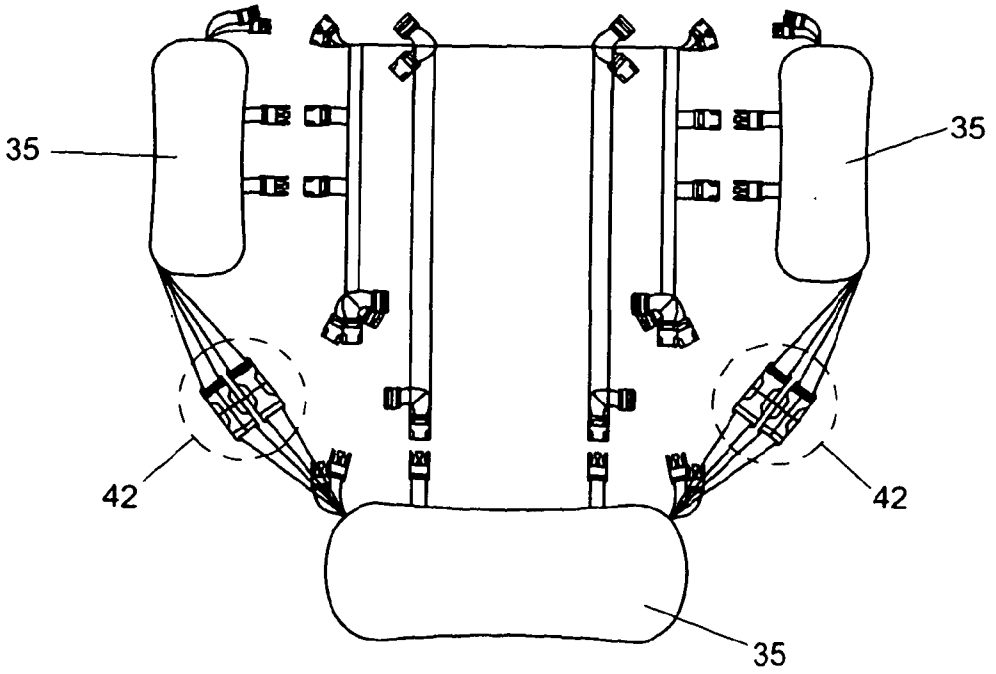
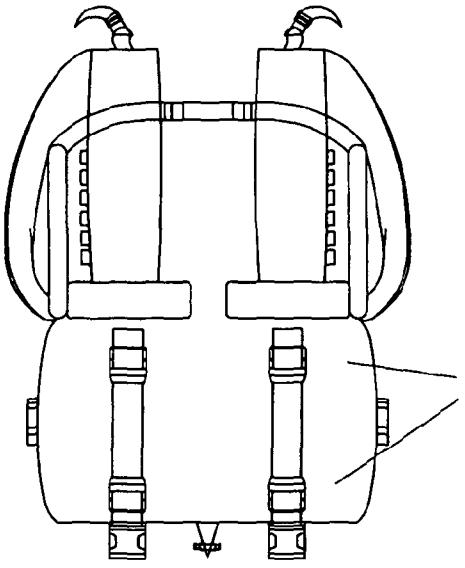
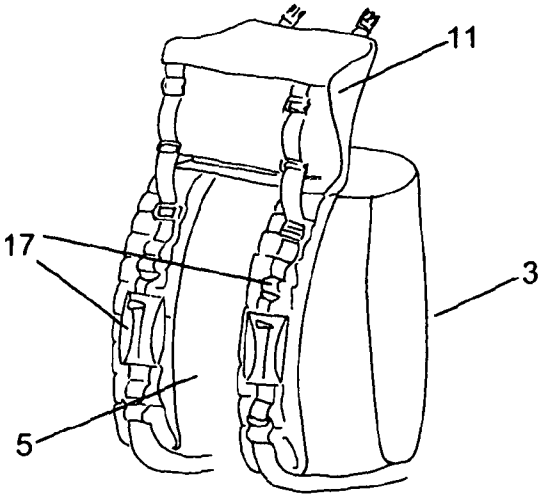


Figure 11





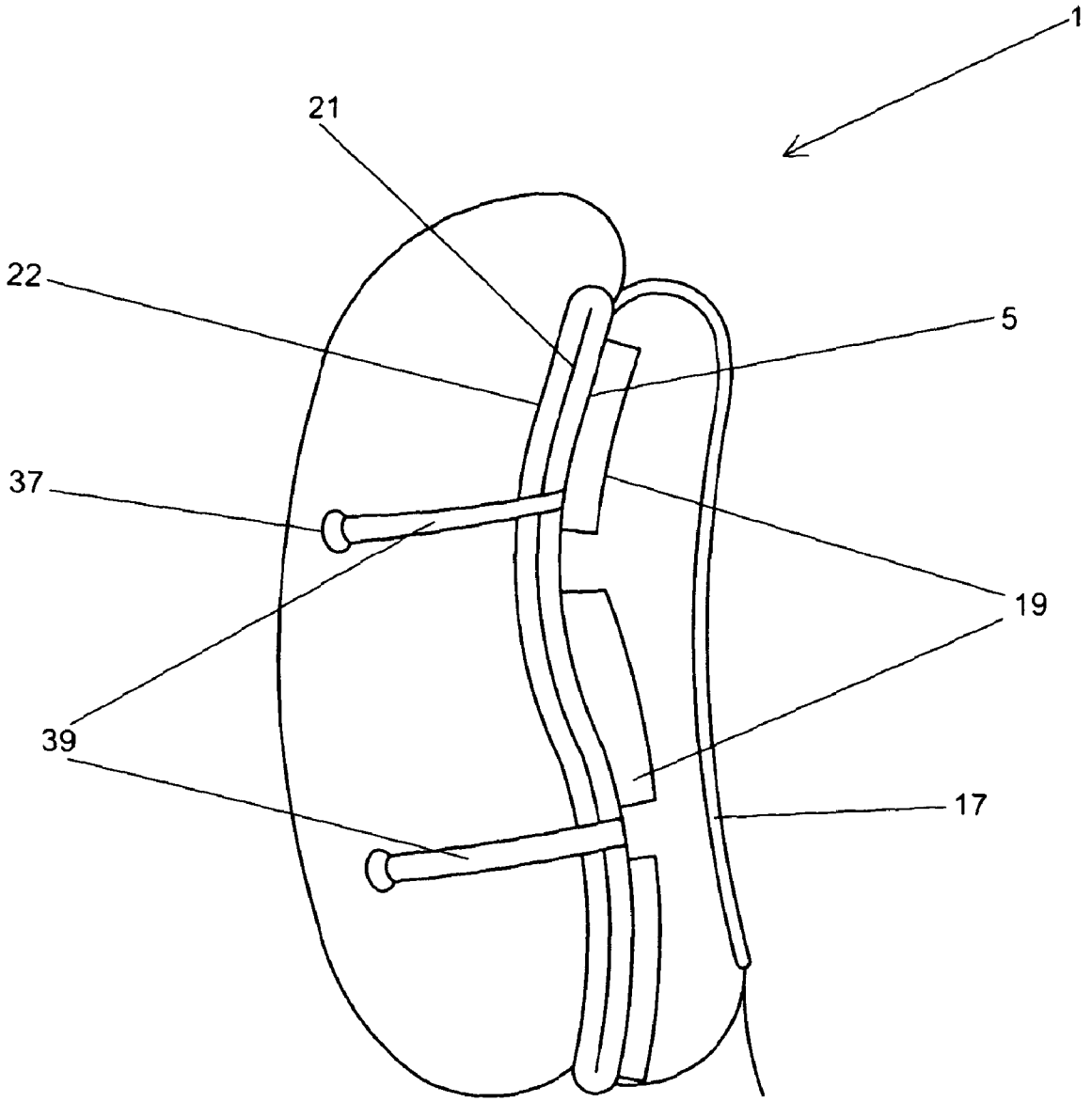


Figure 14

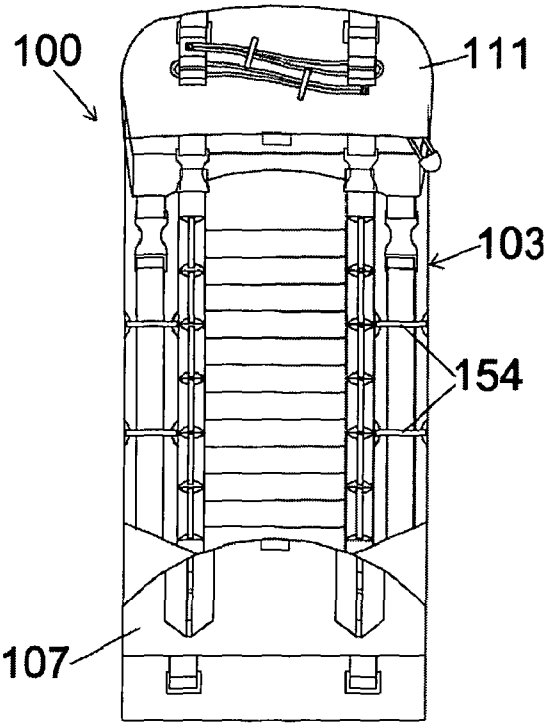


Figure 15

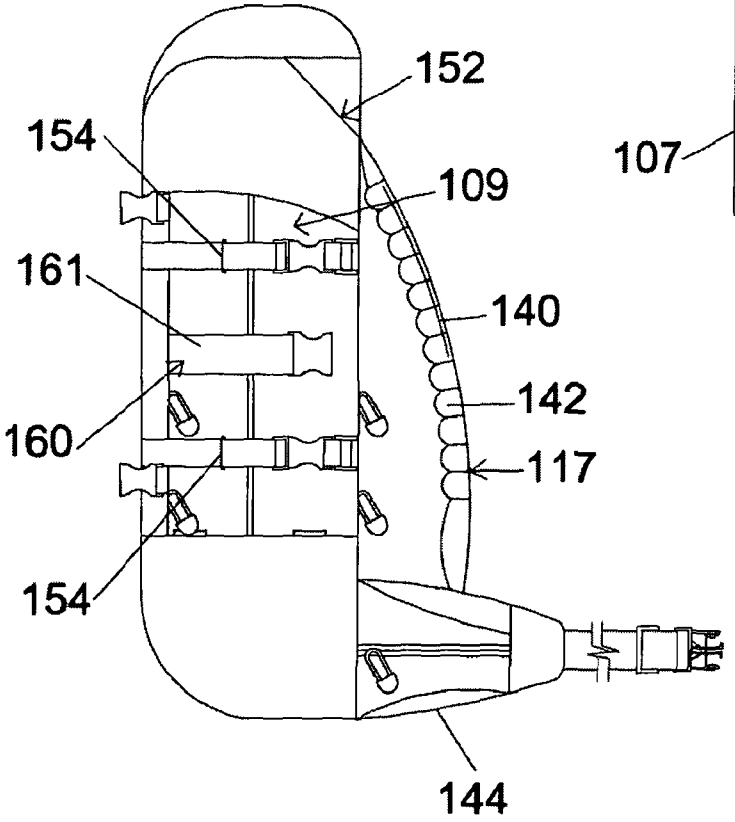


Figure 16

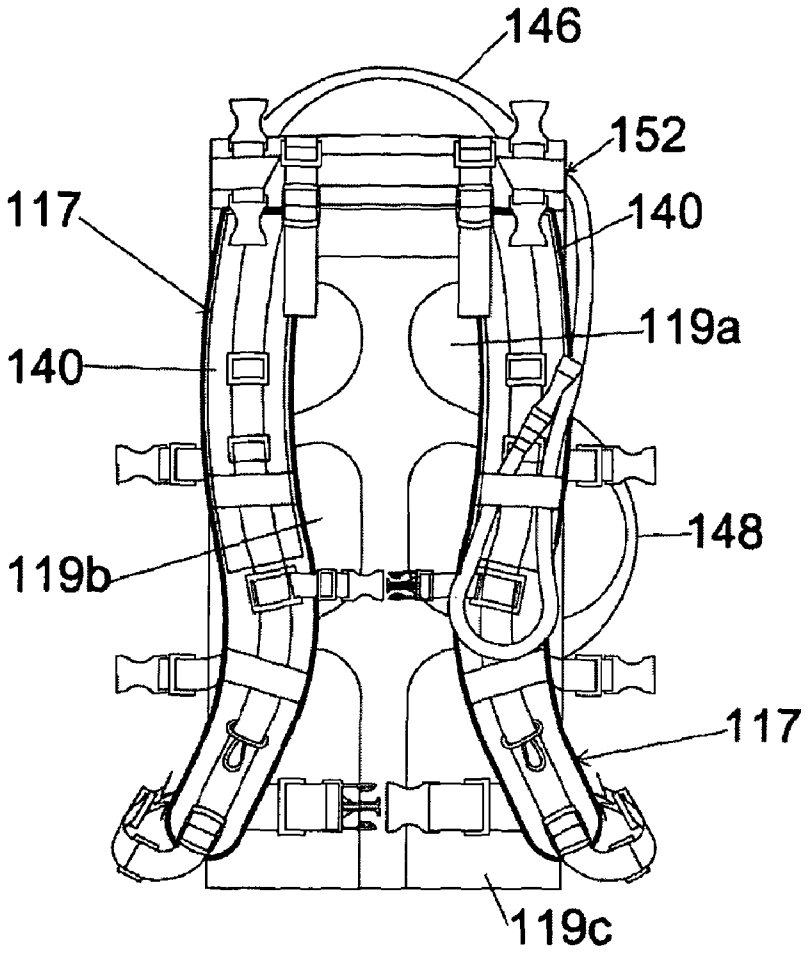


Figure 17

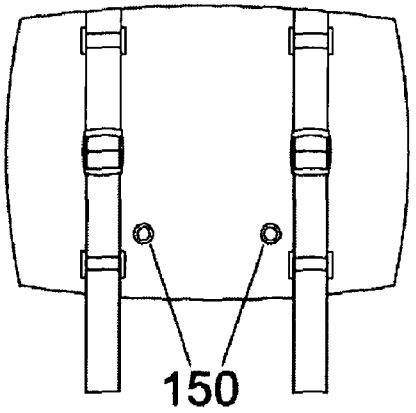


Figure 18

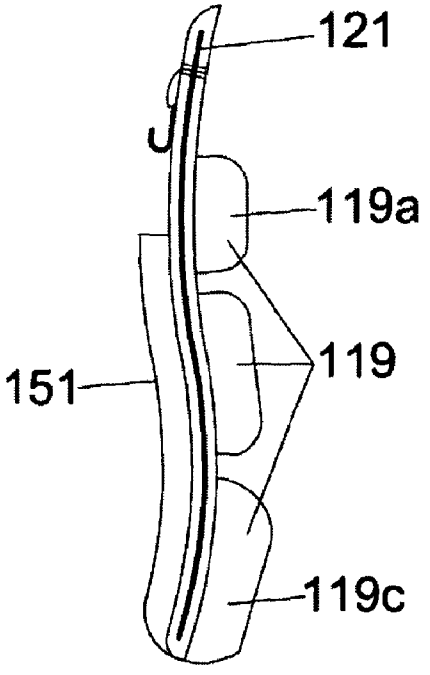
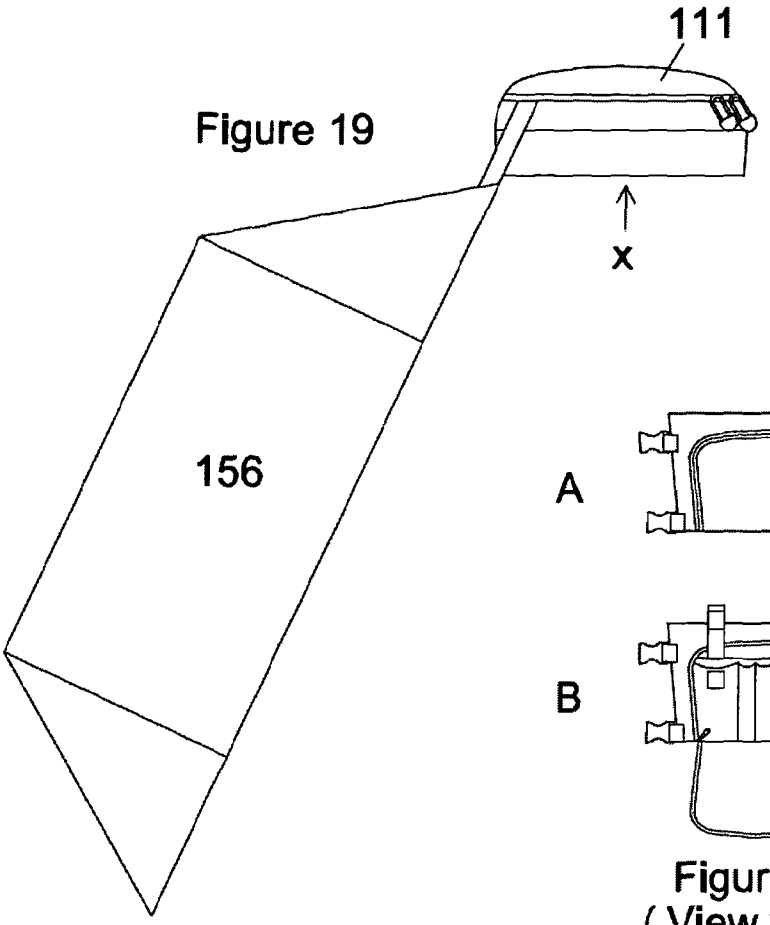


Figure 17a

Figure 19



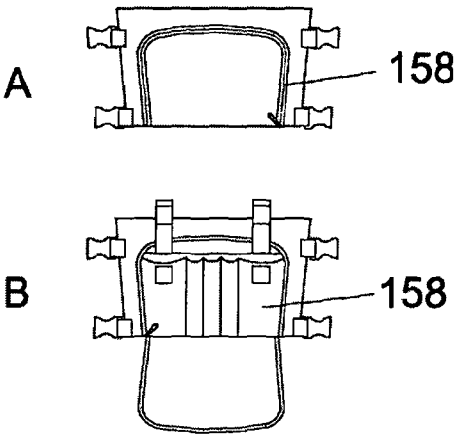


Figure 20
(View from x)

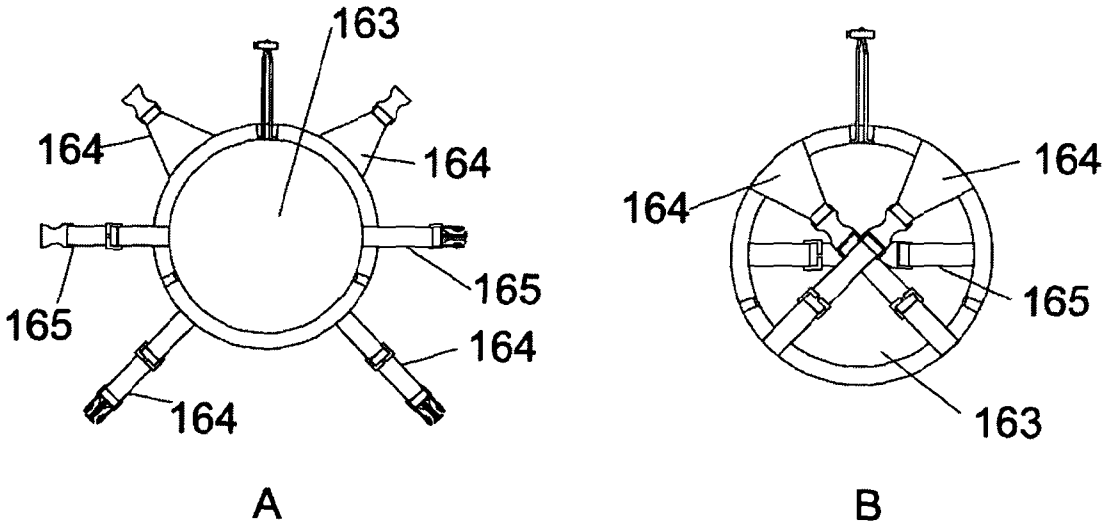


Figure 21

RUCKSACKS

[0001] The present invention relates to rucksacks. As used herein, the term 'rucksack' includes backpacks and other bags for carrying a load on the back and one or more shoulders of a human user.

[0002] Conventionally, a rucksack comprises a load-carrying bag and a harness attached to the load-carrying bag. The harness generally comprises one or two, usually two, shoulder straps arranged to be worn in use over the shoulders of a user. The harness may further comprise a chest strap to connect the two straps across the chest of a user when the rucksack is in use. The harness may further comprise a belt arranged to be worn in use around the hips or waist of a user.

[0003] According to a first aspect of the invention there is provided a rucksack comprising a load-carrying bag having a rear wall, and a harness arranged in use to permit the load-carrying bag to be carried by a user with the rear wall adjacent the back of the user, wherein the rear wall comprises a plurality of projecting padded panels, and the rucksack further comprises a chassis shaped such that in use each of the padded panels contacts the back of the user.

[0004] Some designs of rucksack are arranged so that the majority of the weight of a load in the load-carrying bag is carried on the shoulders of a user. A user of such a rucksack may quickly become tired, and so many modern rucksacks attempt to transfer as much of the weight of a load as possible to the hips and lumbar spine of a user, as the hips can comfortably carry more weight than the shoulders.

[0005] We have determined that doing that is not always beneficial. That is because the lumbar spine is one of the most mobile regions of the spine. Carrying excessive weight on that region of the spine can reduce the mobility of a user, by reducing the ability of the spine to twist and flex. Furthermore, the lumbar region is the region of the spine most prone to injury and degenerative disc diseases.

[0006] With a rucksack in accordance with the invention the weight of a load is spread over the back, and so carried in a more central region of the back, reducing the risk of lumbar spine injury.

[0007] The rucksack may be arranged to flex in a similar way to the back of a user.

[0008] The chassis of the rucksack may be substantially S-shaped in longitudinal cross-section.

[0009] The chassis of the rucksack may comprise a flexible panel which is substantially the same size as the rear wall of the rucksack. The panel may be removable from the rucksack, for example from a pocket provided on or in the rear wall of the rucksack, and may be formed from polycarbonate.

[0010] The chassis of the rucksack may be integral with the rear wall.

[0011] The chassis may comprise a reinforcing member extending longitudinally, wherein the reinforcing member is less flexible than the remainder of the chassis. The reinforcing member may extend along the centre of the chassis. The reinforcing member may be substantially rigid. Such an arrangement allows the chassis to flex and twist about the reinforcing member in a similar manner to the back twisting and flexing about the spine, whilst still remaining strong enough to support a heavy load

[0012] The padded panels may be separated by substantially unpadded regions, such that adjacent padded panels can move relative to one another. Thus in use two adjacent padded panels may be positioned such that those panels are in different orientations. For example, where each panel is substantially planar, a central plane of one panel may be at an angle to a similar central plane of an adjacent panel. Alternatively, or additionally, the unpadded regions may be arranged to collapse, compress, bend, stretch or similar, such that two adjacent panels can move towards and/or away from one another.

[0013] With such an arrangement, as the user moves, adjacent panels of the rucksack may move relative to each other. Thus the weight in the rucksack may remain distributed on the user's back in a substantially continuous way even whilst the user's spine twists or flexes. This increases the comfort of the rucksack, because a user will not feel the weight of the rucksack shift around on his/her back when he moves as much as he/she would with a more conventional rucksack. Such increased stability may reduce the risk of spinal injury. Furthermore, the unpadded regions provide channels through which air may flow, cooling a user's back.

[0014] The substantially unpadded regions may be between 10 and 100 mm wide. The substantially unpadded regions may be between 20 and 50 mm wide.

[0015] The padded panels may be arranged so as to provide a central unpadded channel, arranged in use to be located above a user's spine, to minimise weight applied directly onto a user's spine.

[0016] There may be six padded panels. The panels may be provided in a two-by-three arrangement, distributed with three panels on either side of the central channel. The padded panels may be between 10 and 60 mm thick, for example between 20 and 50 mm thick. The lower pair of panels (adjacent the base of the rucksack) may comprise thicker padding (e.g. 45 mm) than the upper panels (e.g. 35 mm).

[0017] The chassis may comprise body armour, and may be formed of an armoured material such as Kevlar™. The chassis may be between approximately 1 mm and 30 mm thick, for example 2 mm if unarmoured, or 20 mm if armoured.

[0018] The rucksack may further comprise a pair of attachment members, comprising a first attachment member on one side of the load-carrying bag and a second attachment member on an opposite side of the load carrying bag, wherein the pair of attachment members are connected together, for example by a tape extending, through or adjacent the rear wall and/or chassis of the rucksack.

[0019] According to another aspect of the invention there is provided a rucksack comprising a load-carrying bag having a rear wall, and a harness arranged in use to permit the load-carrying bag to be carried by a user with the rear wall adjacent the back of the user, wherein the rucksack further comprises a pair of attachment members, comprising a first attachment member on one side of the load-carrying bag and a second attachment member on an opposite side of the load carrying bag, wherein the pair of attachment members are connected together through or adjacent the rear wall of the rucksack.

[0020] The rucksack may comprise a plurality of pairs of attachment members, for example, four, six, eight or ten pairs.

[0021] The or each pair of attachment members may be connected together by a tape. The tapes may together form a webbed chassis extending through or adjacent the rear wall and/or chassis.

[0022] The attachment members may comprises one or more lash points such as D-loops, or buckles, for example side squeeze buckles. More than one pair of attachment members may be connected by the same tape.

[0023] The rucksack may further comprise a chassis. The chassis may be mounted adjacent the rear wall, for example in a pocket located on the rear wall, which may be internal to the load carrying bag. The chassis of the rucksack may be integral with the rear wall.

[0024] The tape may extend through or adjacent (for example sewn to) the rear wall of the rucksack, so as to extend around the chassis. The tapes may extend through the chassis itself, or be connected to the chassis, for example by stitching, glue, or any other suitable means.

[0025] In this way each pair of attachment members is connected to or around the chassis of the rucksack. This means that the weight of an item that is attached to the attachment members is borne by the chassis, the strongest part of the rucksack, rather than by the fabric of the load-bearing bag.

[0026] The rear wall may comprise a plurality of padded panels, and the rucksack chassis may be shaped such that in use each of the padded panels contacts the back of the user. The chassis may be substantially S-shaped.

[0027] The load bearing bag of the rucksack may be arranged to collapse substantially flat, such that an object can be strapped against the rear wall and/or chassis of the rucksack.

[0028] A rucksack in accordance with the present invention may be more versatile than conventional rucksacks, as the capacity of the rucksack can be increased when desired. For example, pockets may be attached to the rucksack to increase its capacity in order to carry a load to a base camp. Once at the camp the pockets can be detached leaving the user with a smaller rucksack suitable for day-to-day use.

[0029] It is known to provide a rucksack with attachable pockets, such as the MOLLE™ (Modular Lightweight Load Carrying Equipment) rucksack used by the US Army and Marine Corps. The MOLLE rucksack is provided on its outer surface with webbing. Portions of the webbing are stitched to the rucksack such that a tape can be woven beneath unstitched portions of the webbing so as to attach an item to the rucksack.

[0030] Fixing the attachment members to or around the chassis of the rucksack in accordance with the invention rather than to the side or front walls of the rucksack means that the attachment members may bear a heavier weight. In addition, it is possible to attach an object to the rucksack when the rucksack itself is empty. This may allow, for example, a large and irregularly shaped object to be carried using the rucksack, even when it would not have been possible to carry such an object in the load-carrying bag of the rucksack. It is further possible to use the attachment members to carry items across the front of a user, such as body armour.

[0031] It will be appreciated that features described with respect to the first aspect of the invention may be used in the second aspect of the invention, and vice versa.

[0032] The following further features may be provided in either the rucksack of the first aspect of the invention or the rucksack of the second aspect of the invention.

[0033] The rucksack may comprise a carry handle provided on a side of the rucksack.

[0034] The rucksack may comprise drainage holes, for example for water, in a base wall of the rucksack.

[0035] The rucksack may comprise substantially S-shaped straps. Each strap may comprise a reinforcing strip which may be internal, and may be flexible, such as a polycarbonate or plastics panel. The reinforcing strip may extend across the full width of the strap.

[0036] The rucksack may comprise a pair of compression straps arranged to extend from the rear wall to the front wall of the rucksack across the mouth of the rucksack, wherein the compression straps are arranged to cross.

[0037] The rucksack lid may comprise an internal organiser pocket, which may comprise a plurality of further pockets.

[0038] The present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

[0039] FIG. **1** shows schematically a front view of a rucksack in accordance with the invention;

[0040] FIG. **2** shows schematically a side view of the rucksack of FIG. **1**;

[0041] FIG. **3** is a front view of a rucksack chassis;

[0042] FIG. **4** is a schematic view of a rucksack back system;

[0043] FIG. **5** is a perspective view of a rucksack in accordance with invention;

[0044] FIG. **6** is a perspective view of one embodiment of a rucksack expansion system;

[0045] FIG. **7** is a perspective view of the rucksack of FIG. **5** with the rucksack expansion system of FIG. **6** attached;

[0046] FIG. **8** is a schematic view of a rucksack attachment system;

[0047] FIG. **9** is a schematic front view of a rucksack in accordance with the invention that has been cut away to reveal the attachment system of FIG. **8**;

[0048] FIG. **10** schematically depicts the attachment of a rucksack expansion system;

[0049] FIG. **11** is a plan view showing further detail of the attachment of a rucksack expansion system;

[0050] FIG. **12** shows a bottom view of a rucksack;

[0051] FIG. **13** shows a perspective view of a rucksack top and straps; and

[0052] FIG. **14** is a schematic side view of a rucksack, partially cut away to reveal the chassis; and

[0053] FIG. **15** to **21** show various views of an alternative rucksack.

[0054] Referring to FIGS. **1** and **2**, a rucksack **1** comprises a load-carrying bag **3** having a rear wall **5**, as well as a front wall **7** and two side walls **9** together forming an open-ended bag into which a load may be placed. The rucksack **1** shown has a capacity of 30 litres, meaning that in use a user may pack the load-carrying bag with contents having a volume of up to 30 litres. The rucksack comprises a lid **11** attached to a top portion of the rear wall **5**. The lid and the front wall **7** are each provided with fastenings **13** which cooperate in use to secure the lid over the opening at the top of the bag. The rucksack is constructed from a hardwearing fabric, such as 600-1000 denier Cordura® fabrics.

[0055] The rucksack further comprises a harness **15** (see for example FIG. **13**) arranged in use to permit the load-carrying bag **3** to be carried by a user with the rear wall **5** adjacent the back of the user. The harness comprises padded straps **17** for placing over the shoulders of the user and a hip belt (not shown) for fastening around the hips of the user.

[0056] The rear wall **5** of the rucksack **1** comprises a plurality of padded panels **19** projecting from the rear wall. In this embodiment, six panels are provided, arranged in a two-by-three formation, as shown in more detail in FIG. **4**. The panels are of a generally rhomboid shape and may be formed from any suitable material. In this case, the panels comprise three-layer foam, having a soft upper layer for contacting the user's back and a firmer lower layer to provide additional

support. Each panel is between 10 and 60 mm thick, and in this example each panel is approximately 35 mm thick.

[0057] The panels transfer the weight of a load carried in the rucksack to specific regions of the back of a user, as described in more detail later. The padded panels also provide additional comfort to a user of the rucksack.

[0058] The panels are separated by substantially unpadded regions **20** which comprise no padding, or much less padding than the padded panels **19**, such that adjacent padded panels can move relative to one another. In the example shown, the substantially unpadded regions comprise a small amount of padding which is approximately 3 mm thick. The substantially unpadded regions may be between 10 and 100 mm wide, and in the embodiment shown in FIG. **4** are between 20 and 50 mm wide.

[0059] The rucksack further comprises a chassis **21**. The chassis **21** is shaped such that in use each of the padded panels **19** contacts the back of the user. With reference to FIG. **2**, the chassis **21** is shaped to follow a similar curve to the human spine **23**, which helps ensure that each pad **19** is in contact with a user's back. It can be seen that the chassis is substantially S-shaped. In particular, the upper region of the chassis follows a substantially kyphotic curve to correspond with the curve of a rucksack user's thoracic spine, and the lower region of the chassis follows a substantially lordotic curve to follow the lumbar spine. The chassis is located adjacent the rear wall **5** of the rucksack, and in this embodiment is located in a pocket **22** provided in the rear wall **5**. The pocket is located so that in use, the chassis extends from in the region of the user's C7 (i.e. lower cervical) vertebra to the iliac line (i.e. the line across the back extending between the iliac crests on the hips).

[0060] The unpadded regions **20** of the rucksack are more flexible than the padded panels, such that the unpadded regions are able to bend, guided by the curve of the chassis, to allow two adjacent padded panels to be positioned in different orientations. For example, referring to FIG. **2**, it can be seen that a central plane **27***a* of one panel **19***a* is at an angle (that is, is not parallel to) to a similar central plane **27***b* of an adjacent panel **19***b*. This arrangement spreads the weight of a load within the rucksack over the user's back, because each of the six pads will transfer a portion of the weight to the back.

[0061] The chassis **21** of the rucksack is shown in more detail in FIG. **3**. It can be seen that in this embodiment the chassis is substantially rectangular in plan view, such that the chassis **21** is a panel substantially the same size as the rear wall **5** of the rucksack. The chassis is made from a suitable strong, flexible and lightweight material, such as polycarbonate. The chassis comprises a longitudinal reinforcing member **25**, for example a steel strip, extending along a centre line of the chassis. The reinforcing member **25** is less flexible than the remainder of the chassis, and in this embodiment is substantially rigid, and so removes some of the flexibility from the chassis in the locality in which it is located. In the embodiment shown the chassis is able to twist and flex about the reinforcing member, but is substantially unable to bend or fold across the reinforcing member. The reinforcing member also serves to hold the chassis in its S-shaped curve.

[0062] We have found that, when in use, such a design of chassis provides strength in a longitudinal direction, so as to ensure the rucksack holds its shape enough to perform its function of distributing a load across a user's back. However, such a chassis also permits some torsion, meaning the rucksack may move with a user's back when the user bends or twists. This combination of rigidity and flexibility results in a rucksack which is comfortable to wear and which permits a greater freedom of movement that other rucksacks of comparable size.

[0063] The flexibility of the unpadded regions also allows them to collapse, bend, compress and/or stretch, such that two adjacent panels can move towards and/or away from one another, when the rucksack is in use. This permits the padded panels to move with the chassis, such the weight in the rucksack remains distributed on the user's back in a substantially continuous way whilst the user's spine twists or flexes.

[0064] Furthermore, the unpadded regions provide channels through which air may flow, cooling a user's back, as shown by arrows **29** in FIG. **4**. An active cooling system, such as a thermoelectric cooling system, may be provided in or adjacent the unpadded regions if required.

[0065] The two-by-three arrangement of panels shown in FIG. **4** has been found to be advantageous because it mimics the natural shape of the human back. Distributing the panels in three rows of two provides a central channel **31** which lies over the spine when the rucksack is in use, avoiding pressure being applied directly onto the vertebrae of the spine.

[0066] The top two padded panels are located so as to substantially rest on, and transfer weight to, the trapezius and the upper part of the latissimus dorsi muscles of a rucksack user. The bottom two padded panels are located so as to substantially rest on, and transfer weight to, an upper part of the user's gluteus maximus. The centre two padded panels rest substantially on the central, thoracic, region of the back, including the erector spinae muscles. With such a distribution, each of two transverse channels **33** are located near or substantially at the apex of a spinal curve, when the rucksack is correctly fitted, which means that the flexible, unpadded regions **20** are provided in the area of the rear wall that is likely to be required to bend to the most.

[0067] Referring now to FIGS. **5** to **11**, and **14**, a modular attachment system is described.

[0068] FIG. **5** shows a perspective view of a rucksack **1** similar to that of FIGS. **1** to **4**. FIG. **6** shows a rucksack expansion system in the form of a set of modular pockets **35** adapted to be attached to the rucksack. FIG. **7** show the rucksack **1** of FIG. **5** with the modular pockets **35** of FIG. **6** attached.

[0069] With the modular system described below, it is possible to significantly increase the capacity of the rucksack, for example to more than 100 litres, perhaps up to 120 litres or 130 litres. The back system of the rucksack **1** described above allows more weight to be carried by the rucksack than would traditionally result from a 30 litre load. Depending on what it comprises, such a load is unlikely to weigh more than 10 kilos. However, the rucksack described herein has been designed so that a user can carry loads of up to 45 kilograms ergonomically, and up to 100 kilograms is necessary, so that the rucksack is still comfortable to carry when it is used with the modular expansion system discussed below.

[0070] As shown best in FIGS. **8** to **11**, the rucksack comprises a plurality of attachment members **37**, in the form of various buckles and D-loops. The buckles on the rucksack are female side squeeze buckles, to cooperate with male side squeeze buckles provided on the rucksack expansion systems. Alternatively, or additionally, the D loops can be used to tie or otherwise attach an item not comprising male side squeeze buckles to the rucksack.

[0071] The attachment members **37** are primarily provided in pairs. Each pair comprises a first attachment member on one side of the rucksack, and a second attachment member on an opposite side of the rucksack, wherein the pair of attachment members are connected together through or adjacent the rear wall of the rucksack, in particular by a tape **39** extending through or adjacent the rear wall. The tape may be secured to the chassis of the rucksack, for example by sewing or gluing the tape onto either a front side or a rear side of the chassis. Alternatively, or additionally, the tape may be passed through one or more holes in the chassis, or the tape may be fused to the chassis, for example by moulding the chassis around the tape.

[0072] In the embodiment shown (see FIG. **14**), the chassis **21** is held in a pocket **22** provided on the rear wall **5** of the rucksack. The tapes extend adjacent to the chassis, but are not fixed to the chassis. Instead the tapes are sewn to or within the rear wall, such that they extend around the chassis, and together comprise a webbed chassis.

[0073] In FIG. **8**, the chassis is not shown so that the tapes connecting respective pairs of attachment members can be seen. A first pair of attachment members **37**A, each comprising a D-loop, is connected by a tape **39**A. A second pair of attachment members **37**B, each comprising a D-loop and a side-squeeze buckle, is connected by extensions **39**B of the tape **39**A. The tapes **39**A and **39**B may be portions of a single continuous tape, or may be sewn together so as to form a continuous tape.

[0074] In a similar way, pairs of attachment members **37**C and **37**D, **37**E and **37**F, and **37**G and **37**H, are connected respectively by tapes **39**C, **39**E and **39**G.

[0075] The tapes may extend through or adjacent (for example sewn to) the rear wall of the rucksack, so as to extend around the chassis. The tapes may extend through the chassis itself, or be connected to the chassis, for example by stitching, glue, or any other suitable means. The tapes are made from a strong and durable material, such as polypropylene.

[0076] In this way each pair of attachment members is connected to or around the chassis of the rucksack. This means that the weight of an extension that is attached to the rucksack is borne by the chassis, the strongest part of the rucksack, rather than by the fabric of the load-bearing bag.

[0077] Furthermore, it is possible to attach an item to the rucksack when the rucksack itself is completely empty. The load bearing bag of the rucksack is arranged to collapse substantially flat, such that an object can be strapped directly to the chassis of a rucksack using tapes comprising appropriate female side squeeze buckles (for connection to the male side squeeze buckles) or using a rope, tape, bungee cord or similar (for connection to the D-loops). This is particularly useful if a large irregularly shaped object must be carried, that cannot easily fit inside the load-carrying bag.

[0078] Additional pairs of attachment members **37**J and **37**K are provided to assist in stabilising and supporting loads strapped to the side of a rucksack.

[0079] When not in use, the attachment members can be concealed in zipped pockets **41** in appropriate locations on the rucksack, as shown, for example, in FIG. **9**.

[0080] FIGS. **10** and **11** illustrate in more detail how to connect an expansion system comprising three pockets **35** to the rucksack **1**. It will be appreciated that it is not necessary to connect all three pockets to the rucksack. If desired a single pocket, such as the front pocket, could be connected. To do that, the front pocket should be disconnected from the two side pockets, by releasing the buckles **42**, and connecting the pocket as shown.

[0081] To connect a side pocket without the front pocket, for extra stability, the buckles **42** may be connected to the rucksack **1** using attachment members **37**B and **37**D.

[0082] FIGS. **15** to **21** show an alternative rucksack **100**. The rucksack **100** is similar to the rucksack **1**, and so only the differences will be described in detail below.

[0083] As before, the rucksack **100** comprises a load-carrying bag **103** having a rear wall **105** (visible in FIG. **17**), a front wall **107** and two side walls **109**. The rucksack further comprises a curved, substantially S-shaped, chassis **121** in an internal pocket, as shown in FIG. **17***a*, and an expansion/attachment system extending through the rear wall, similar to that described above.

[0084] The rucksack **100** includes the following additional features:

[0085] S-shaped shoulder straps **117**, best shown in rear view in FIG. **17**. The shoulder straps **117** include reinforcing in the form of a flexible strip schematically illustrated at **140** in FIGS. **16** and **17**. The strip **140** extends across the full width of the straps, and is in this example located in the interior of the straps. A layer of padding **142** is provided on the underside of each strap, such that it is located between the reinforcing strap and the body of a user when the rucksack is in use. The reinforcing may be formed of any suitable flexible but strong material, such as polycarbonate. The reinforcing has the effect of spreading the weight of the load more evenly, particularly across the user's trapezius muscles. The padding is, in this example, approximately 25 mm thick.

[0086] A padded hip belt **144** shown in side view in FIG. **16**. The hip belt comprises a similar level of padding to the lower padded regions located on the rear wall, so that the weight of the load is evenly borne around the hips.

[0087] Variable thicknesses of padding in the rear padded regions **119**. In particular, the lower pair of padded regions **119***c* have thicker padding (in this example in the region of 45 mm thick) than the upper and middle padded regions **119***a* and **119***b* (which, as before, comprise approximately 35 mm of padding). Increasing the padding in the lower regions provides increased comfort.

[0088] Carry handles, in particular, an upper carry handle **146** is provided, as is a side carry handle **148**. The carry handles are joined to the rucksack rear wall at an edge region of the rear wall, and are dimensioned for use with padded gloves.

[0089] Anchor points for chest armour **160**, best shown in FIG. **16**. The pair of anchor points **160** are linked together through or around the chassis of the rucksack in a similar way to the attachment members **37**, but are located on the rucksack so as to allow an item such as armour to be connected to the rucksack across the user's chest. In particular, the anchor points include tapes **161** and attachment regions **162** in the form of buckles. The tapes are located so that the buckles extend back towards the rear wall and the harness of the rucksack, so that an item can be attached to the rucksack across the chest.

[0090] A reinforced chassis **121**, suitable for use as personal protective equipment, or body armour. In this example, the chassis **121** is formed of a material designed to withstand a ballistic impact, such as Kevlar™. The chassis is approxi-

mately 10 mm thick. The padded regions **119** further act to spread and dissipate the force of an impact directed a user's back.

[0091] Compression straps **164**, extending in use across the mouth **163** of the rucksack bag. The straps **164** are shown open in FIG. **21**A, and closed FIG. **21**B. The straps are arranged so as to each extend across the mouth **163** of the rucksack on a diagonal, such that the straps cross. This helps improve weight distribution as well as compression in a poorly packed bag. A third lateral compression strap **165** may also be provided.

[0092] Drainage holes **150** are provided in a lower wall of the rucksack.

[0093] An internal pocket **151** and access holes **152** are provided to make the rucksack compatible with the use of a hydration system, such as a water bladder and hose.

[0094] Retaining loops **154** are provided to maintain loose tapes of the rucksack closures, compression straps and/or attachment members in a predetermined location.

[0095] A rain cover **156** is provided in an internal pocket of the lid **111**, such that it can be folded out when required. The lid **111** also comprises a personal organiser **158** in the form of an internal pocket comprising a plurality of smaller pockets shaped to hold regularly required items such as pens, snacks, money, keys etc.

[0096] It will be appreciated that various modifications may be made to the rucksacks described without departing from the scope of the invention.

[0097] For example, the rucksack expansion system is not limited to the number, size and shape of pockets shown herein. Pockets could be provided in any suitable shape or size. A harness with suitable buckles might be provided for attaching bulky objects to the rucksack.

[0098] It will be appreciated that the chassis could be integral with the rear wall if desired. Furthermore, it will be appreciated that a chassis for use with the attachment system described need not be substantially S-shaped as described, but could be planar, or substantially C-shaped.

[0099] Whilst endeavouring in the foregoing specification to draw attention to those features of the invention believed to be of particular importance it should be understood that the applicant claims protection in respect of any patentable feature or combination of features hereinbefore referred to and/or shown in the drawings whether or not particular emphasis has been placed thereon.

1. A rucksack comprising a load-carrying bag having a rear wall, and a harness arranged in use to permit the load-carrying bag to be carried by a user with the rear wall adjacent the back of the user, wherein the rear wall comprises a plurality of projecting padded panels, and the rucksack further comprises a chassis shaped such that in use each of the padded panels contacts the back of the user.

2. A rucksack in accordance with claim **1**, wherein the chassis of the rucksack is substantially S-shaped in longitudinal cross-section.

3. A rucksack in accordance with claim **1**, wherein the chassis of the rucksack comprises a flexible panel, the flexible panel may be substantially the same size as the rear wall of the rucksack, and the panel may be removable from the rucksack.

4-5. (canceled)

6. A rucksack in accordance with claim **1**, wherein the chassis is integral with the rear wall of the rucksack.

7. A rucksack in accordance with claim **1**, wherein the chassis is formed from polycarbonate, and the chassis may be between approximately 1 mm and 30 mm thick.

8. A rucksack in accordance with any claim **1**, wherein the chassis comprises a reinforcing member extending longitudinally, wherein the reinforcing member is less flexible than the remainder of the chassis, wherein the reinforcing member may extend along the centre of the chassis, wherein the reinforcing member may be substantially rigid, and may be a steel strip, the reinforcing member may remove some of the flexibility from the chassis in the locality in which it is located, the chassis may be able to twist and flex about the reinforcing member, but is substantially unable to bend or fold across the reinforcing member, and the reinforcing member may serve to hold the chassis in an S-shaped curve in longitudinal cross-section.

9-10. (canceled)

11. A rucksack in accordance with claim **1**, wherein the padded panels are separated by substantially unpadded regions, and the unpadded regions may be arranged to collapse, compress, bend or stretch such that adjacent padded panels can move relative to one another, and the unpadded regions may be provided in the area of the rear wall that is likely to be required to bend the most.

12. (canceled)

13. A rucksack in accordance with claim **11**, wherein the unpadded regions provide channels through which air flows, cooling a user's back, the substantially unpadded regions may be between 10 and 100 mm wide, and may be between 20 and 50 mm wide.

14-15. (canceled)

16. A rucksack in accordance with claim **1**, wherein there are six padded panels, the panels are provided in a two-by-three arrangement, distributed with three panels on either side of a central channel, providing two top, two centre and two bottom panels, and the panels may be arranged to spread the weight of a load within the rucksack over the user's back, because each of the six panels will transfer a portion of the weight to the back.

17. (canceled)

18. A rucksack in accordance with claim **1**, wherein the padded panels are between 10 and 60 mm thick, and may be between 20 and 50 mm thick.

19. (canceled)

20. A rucksack in accordance with claim **16**, wherein the lower panels adjacent the base of the rucksack comprise thicker padding than the upper panels.

21-49. (canceled)

50. A rucksack in accordance with claim **1**, wherein the chassis is substantially rectangular in plan view.

51. A rucksack in accordance with claim **1**, wherein the chassis of the rucksack is located adjacent the rear wall, the chassis may be located in a pocket provided in the rear wall, and the pocket may be located so that in use, the chassis extends from in the region of the user's C7 (lower cervical) vertebra to the iliac line (the line across the back extending between the iliac crests on the hips).

52. A rucksack in accordance with claim **1**, wherein the chassis is shaped to follow a similar curve to the human spine, wherein an upper region of the chassis may follow a substantially kyphotic curve to correspond with the curve of a rucksack user's thoracic spine, and the lower region of the chassis may follow a substantially lordotic curve to follow the lumbar spine.

53. A rucksack in accordance with claim **1**, wherein the panels comprise three-layer foam, having a soft upper layer for contacting the user's back and a firmer lower layer to provide additional support.

54. A rucksack in accordance with claim **1**, wherein the padded panels move with the chassis, such that the weight in the rucksack remains distributed on the user's back in a substantially continuous way whilst the user's spine twists or flexes.

55. A rucksack in accordance with claim **11**, wherein the unpadded regions of the rucksack are more flexible than the padded panels, such that the unpadded regions are able to bend, guided by the curve of the chassis, to allow two adjacent padded panels to be positioned in different orientations.

56. A rucksack in accordance with claim **11**, wherein an active cooling system, such as a thermoelectric cooling system, is provided in or adjacent the unpadded regions.

57. A rucksack in accordance with claim **16**, wherein the top two padded panels are located so as to substantially rest on, and transfer weight to, the trapezius and the upper part of the latissimus dorsi muscles of a rucksack user, the bottom two padded panels may be located so as to substantially rest on, and transfer weight to, an upper part of the user's gluteus maximus, and the centre two padded panels may rest substantially on the central, thoracic, region of the back, including the erector spinae muscles.

58. A rucksack in accordance with claim **16**, wherein the two-by-three arrangement of panels mimics the natural shape of the human back, and the distribution of the panels in three rows of two may provide a central channel which lies over the spine when the rucksack is in use, avoiding pressure being applied directly onto the vertebrae of the spine.

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