



(51) International Patent Classification:

A45F 5/02 (2006.01) A62B 9/04 (2006.01)
A45F 3/06 (2006.01) A62B 25/00 (2006.01)
A45F 3/08 (2006.01) F41H 1/02 (2006.01)
A45F 3/10 (2006.01) A41D 13/00 (2006.01)
A63B 21/065 (2006.01) A45F 3/04 (2006.01)

(21) International Application Number:

PCT/GB2013/053314

(22) International Filing Date:

17 December 2013 (17.12.2013)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

1222709.6 17 December 2012 (17.12.2012) GB
1302516.8 13 February 2013 (13.02.2013) GB

(71) Applicant: **RIG EQUIPMENT LIMITED** [GB/GB];
Unit 9, Halas Industrial Estate, Forge Lane, Halesowen
West Midlands B62 8EB (GB).

(72) Inventor: **FORMOSA, Ray**; Unit 9, Halas Industrial Es-
tate, Forge Lane, Halesowen West Midlands B62 8EB
(GB).

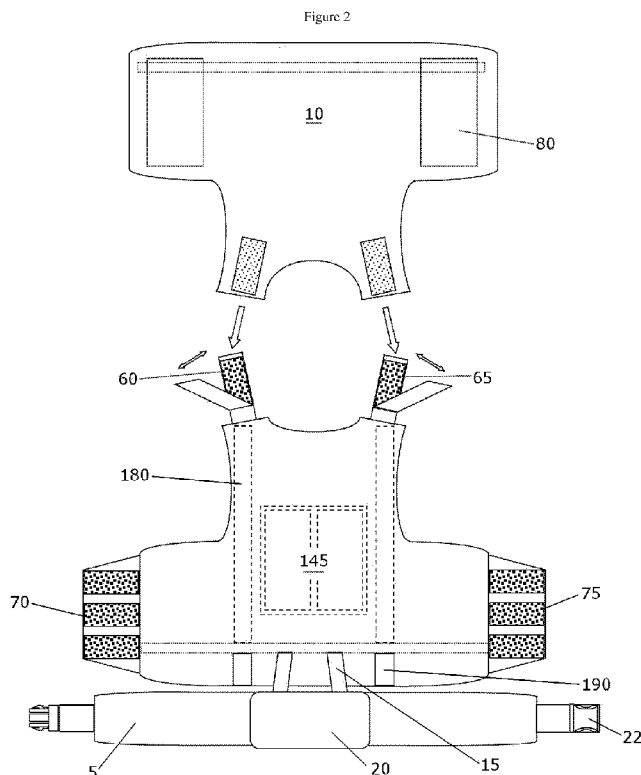
(74) Agents: **WITHERS & ROGERS LLP** et al.; 4 More Lon-
don Riverside, London SE1 2AU (GB).

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

(84) Designated States (unless otherwise indicated, for every
kind of regional protection available): ARIPO (BW, GH,
GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ,
UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ,

[Continued on next page]

(54) Title: VEST



(57) Abstract: A weighted vest comprising a load-bearing belt and/or a mounting plate. The load-bearing belt comprising, an elongate belt-connector for receipt of a load from the weighted vest, a stabilising insert at the back of the belt, and a retainer; the mounting plate comprising one or more retaining clips for engagement with the weighted vest.



TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

- *with international search report (Art. 21(3))*
- *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))*

Vest

Field

The invention relates to a load-bearing belt and a mounting plate for a weighted vest.

Background

A wide range of professional activities require the use of weighted vests of one form or another. These may be weighted training vests, sandwich boards, body armour or vests incorporating supports, mounts, or recesses for bearing external loads such as back-packs, respirators, technical equipment, emergency/rescue provisions or other heavy items.

One problem that has been found with such vests is that the shoulders bear almost the entire weight of the vest. This can cause unnecessary fatigue and can lead to pain or injury in the neck, shoulders and spine, particularly through long term usage. The problem is often further exacerbated in professional situations where the vest is used in combination with additional weighted attachments and carriage systems from a pack such as a back-pack, necessary to transport equipment. For instance, a policeman or woman wearing body armour may also carry an equipment pack containing, for instance, radios and first aid materials. Alternatively, it is common at outdoor events such as concerts for drinks vendors to wear vests with integral refrigerators, the filling of these refrigerators with drinks clearly increases the weight of the vest.

Other, alternative solutions have been explored in the marketplace to address load carrying challenges by redistributing weight towards the hip area. For instance, the problem of excessive weight on the hips, for instance from wearing heavy utility belts, has been identified by companies such as Bauer, who have created an ArmourskinTM Suspension System to reduce the weight born on the hips by adding straps to the utility belt which provide shoulder support. This concept has been taken further by Neibarger, US2010/0294820, who describe a carrier system for weighted vests that redistributes the shoulder borne loads associated with weighted vests to the waist. This is achieved through the provision of a carrier with a belt, and extending from the belt a support member essentially covering the back between the waist and the shoulders, with hooks or tabs at the shoulders to bear at least some of the weight of the vest. The challenge appears as how to

optimise the distribution of weight so as to minimise the pressure on any one area affecting internal organs or skeletal system.

However, it would be desirable to provide a method of redistributing the weight on the shoulders which can not only be used with existing weighted vest systems, but which is lightweight, improves wearer comfort beyond simple reduction of shoulder pressure, removes the need for gender specific vests, and which does not inhibit the lateral movement and rear visibility of the wearer. Thereby increasing overall mobility, agility and oftentimes safety of the user.

Further, many weighted vests are used in combination with additional weighted attachments such as packs, typically carried in harnesses over the weighted vest. These harnesses restrict movement, making it more difficult for the wearer to carry out their chosen activity. Whilst this may simply be undesirable in some cases, it can be potentially fatal for either the wearer or to third parties where the wearer is in a dangerous environment, such where the pack is a combination of air cylinders or a mechanical breathing aid for a respirator and the environment is either full of noxious elements or fumes, or possibly aquatic. In such cases, the need for a restrictive, heavy and cumbersome harness and the resultant impairment in the movement of the wearer, may put their life, or the lives of those around them at risk by reducing the ability of the wearer to react to sudden danger, or to rescue others with sufficient speed.

The invention is intended to overcome or ameliorate at least some aspects of these problems.

Summary

Accordingly, in a first aspect of the invention there is provided a load-bearing belt for a weighted vest, the belt comprising, an elongate belt-connector for receipt of a load and a retainer. The belt of the invention provides a system where the core of the wearer is stabilised via the generally flexible but robust belt, and weight redistributed from the shoulders, reducing fatigue during use and the risk of long-term injury to the shoulders, neck and back of the wearer. The presence of an elongate belt-connector allows these benefits to be provided with minimal loss to lateral movement of the wearer, and only minor, if any, modification to existing vest designs. There is therefore provided a load

bearing belt constructed to support and spread the effects of a (heavy) weight carried on the upper body.

As used herein, the term “weighted vest” is intended to mean any garment covering the upper body and at least one of the chest or back regions; and which is of significantly greater weight than a vest which functions purely as clothing. Such vests include exercise vests where the vest is weighted to help increase muscle strength and endurance to the wearer whilst carrying out exercise programmes such as running or boxing; body armour where the vest has been designed to protect the wearer from projectiles, bladed weapons and blunt instruments; sandwich boards; bandoliers; and chest harnesses. Chest harnesses do not generally provide complete coverage of the front or the back of the torso, but may be considered vests for the purpose of this invention because they will often be weighted due to packs attached to the chest, back or possibly shoulders.

As used herein, the term “pack” is intended to refer to any load of sufficient weight to burden the wearer and is in addition to the weight derived from the vest itself or from items stored, for instance, in pockets on the vest. The pack may be any general package or it could be items such as respirators, armaments, munitions, emergency & rescue equipment or products which are being vended for sale by the wearer, or necessary as part of the work function of the wearer. It will often be the case that the pack will be air cylinders or a mechanical breathing aid for a respirator, and in such cases a mounting plate will generally be present, although a mounting plate may be present with any form of pack, including those described above.

The belt may be said to comprise an elongated band that affixes securely around the body (often meaning forming a closed loop), with one or more belt-connectors as required. The elongate belt-connector typically comprises a substantially rigid portion as this stabilises the weight received and facilitates its re-distribution at least partly to the hips.

The belt-connector is typically substantially rigid to reduce or eliminate instability as a result of the load applied to the belt-connectors when in use. The belt-connector will often be made from materials such as metal, wood, carbon fibre, or rigid plastics materials such as polypropylene, ABS, glass reinforced plastic (GRP), PVC or Kevlar (poly(1,4-

phenylene terephthalamide)) either alone or in combination with each other or other materials. Often, the belt-connector is made from carbon fibre or GRP.

The belt-connector will often comprise a bar in that the bar is formed by the elongate shape of the belt-connector. In use the belt-connector may be configured to extend from the belt in a direction generally upwards in line with the torso of the wearer, this may be in line with the chest, the side of the torso under the arms, or the back, although generally the belt-connector will extend in a direction generally in line with the back of the wearer. Often this direction will be substantially parallel to the torso of the wearer. There may be one belt-connector, two, three, four or more although often there will be one, two or three belt-connectors. Where there is one belt-connector, this will generally be of a rigid construction and broader than where there is more than one belt-connector. For instance the width of the bar may be in the range of 50 - 60 mm as opposed to 20 - 40 mm, or 25 - 35 mm where there are two or more belt-connectors. Depths of the bars would typically be in the range 3 - 8 mm, often 4 - 6 mm, or around 5 ± 0.25 mm. The presence of a single belt-connector simplifies manufacture and allows for easy retro-fit of the belt into existing weighted vest systems; however it is important where only a single belt-connector is present that this be sufficiently robust to support the load stably and to maintain integrity for the lifetime of the product.

Often there will be, multiple belt-connectors, for instance, two, sometimes three, belt-connectors most often there will be two belt-connectors as this number has been found to offer a good balance between the ability of the connectors to support the load and simplicity of design. An advantage of having two belt-connectors is that each connector may be smaller and lighter than where there is only single belt-connector and, the combination of two belt-connectors has been found to stabilise the load effectively without wobbling and with minimal reduction in lateral movement to the wearer. Typically, where there is more than one belt-connector, these will be arranged so that they each extend upwards towards the back of the wearer and, where appropriate, interface directly with the weighted vest into a back portion of the vest. The belt-connector or connectors can connect to (be received by) the vest or with the load (such as a pack) where there is an external load present, or with both. Typically, the belt-connector, or connectors are for the receipt of a

load from the weighted vest. In such cases the loads are generally received by the vest and connect with the vest.

It has been found that where there are two belt-connectors, there are advantages to having these in the form of an A-frame, an X-frame or, or substantially parallel. As used herein the term A-frame is intended to mean a construction wherein the belt-connectors form the two long sides of the A without a cross-bar being present. Most often, the belt-connectors will be in the form of an A-frame or an X-frame, as these configurations have been found to stabilise the weight, allowing its re-distribution effectively with minimal reduction in lateral movement compared to a parallel arrangement of two belt-connectors. Of the A-frame and the X-frame, the A-frame is beneficial as it is of simpler construction and offers the least reduction in lateral movement in use. Whilst still maintaining structure, integrity and stability of the load.

The belt-connectors may be available in different lengths, such that the appropriate length for the wearer is selected prior to first wearing. For instance, they may be available in lengths in the range 37.5 - 52.5 cm, in some cases in the range 40 - 50 cm. It may be, for instance, that the belt-connectors be available in three lengths of about 40, 45 and 50 cm respectively. Alternatively, the belt-connectors may be of adjustable length, by which is meant that the belt-connectors may be adjustable to allow fitting to the torso (including both body length and back width adjustment of the wearer prior to first wearing). The belt-connectors may also be variably adjustable, in that their length may change in use, so as to allow for movement by the wearer. Where the belt-connectors are variably adjustable, they are able to constantly and automatically adjust for lateral movement, independently of each other to support and spread the effects of the weight carried. Typically any variable length adjustment would be in the range 0.1 - 5 cm, often in the range 0.5 - 2 cm.

The belt-connector can be separated from the belt for storage or transport. This also has the benefit that it is simple to replace the connectors at the end of their life, without the need to replace the entire belt.

Often the belt-connectors will be fabric covered to facilitate attaching to the belt and the vest and in order to protect the wearer from injury when connecting the belt to the load. The presence of fabric also acts as padding, improving the comfort of the belt although

further padding material may also be intentionally added to the belt-connectors where, for instance, they are to be placed close to the torso in use. The presence of a fabric covering also protects the rigid portion of the belt-connector from wear and tear as this can be easily replaced or mended, and protects the wearer from injury should the belt-connector be shattered (for instance by impact) in use. Typical fabrics would include poly-propylene, fire retardant fabrics (such as aramids), nylon fabrics or combinations of these.

The belt-connector may be retained in position in the belt through location in a cavity, or receiving pocket. The receiving pocket may be configured to prevent the belt-connectors from moving within the belt, and to provide a positive engagement point with the belt-connector. As the receiving pocket bears and redistributes the weight carried by the belt-connector, it is desirable that it be robust to the pressure exerted on, in particular, the base of the pocket. As a result, it will often be the case that a hard wearing fabric and strong thread be used to form the pockets. For instance, the fabric could be Kevlar, Zylon (poly(*p*-phenylene-2,6-benzobisoxazole), carbon fibre or combinations of these. These fabrics may optionally be further strengthened with a plastics coating, for instance a PVC, silicone or rubber coating. Often the thread will be a nylon thread (typically bonded), although polyester or conventional high strength threads may also be used as may fire retardant threads.

Alternatively, or additionally to the provision of a pocket, the belt-connector may be retained in position in the belt using a wide range of fasteners, such as straps, clips, hook-and-loop fastenings, press studs, buttons, buckles, and combinations of these etc. Often, for ease and rapidity of assembly and disassembly the belt-connector will be retained using press studs and/or hook-and-loop fastenings. Where hook-and-loop fastenings are used, typically the loop fastening will be attached to the belt-connector, and the hook fastening positioned within a cavity or pocket in the belt. This prevents minor injury to the user from scratches from the hook component of the hook-and-loop fastening, and creates a semi-permanent link between the load carrying vest and the belt.

The belt further comprises a retainer, as used herein a retainer is intended to mean any feature of the belt which allows it to be reversibly secured around the waist of the wearer. Often the retainer will be selected from hook-and-loop fastenings, press studs, buttons, zips, clasps, buckle closures and combinations thereof. It will often be the case that the

retainer will comprise hook-and-loop fastenings as these are robust to repeated opening and closing, quick and simple to both open and fasten and can be operated one-handed.

The belt will often further include stabilising inserts to help stabilise the load and the belt-connectors and ensure an even distribution of weight. Generally, the stabilising insert will be formed from materials such as metal, wood, carbon fibre, or rigid plastics materials such as polypropylene, ABS, GRP, PVC or Kevlar either alone or in combination with each other or other materials.

There may be one or more inserts, often there will be 1, 2 or 3 inserts, in many cases, however there will be a single (1) insert. The insert may extend along substantially the entire length of the belt, or along only part of the length. Often the stabilising insert will extend along the back of the belt in use, for instance, covering part of the spine of the wearer (often the lumbar region), often extending around the length of the belt such that it stabilises the region of the belt including the receiving pocket or fastening in which the belt-connector is retained, thereby strengthening this part of the belt. The stabilising insert may be roughly centred on the spine in use, or extend farther from the spine in one direction around the belt than in the other. As in many examples of the belt, the belt-connectors will extend from the belt up the back of the wearer, the stabilising insert may be said, in such cases, to be aligned with the belt-connectors, improving the stability of these.

It will generally be the case that the stabilising insert is centred on the spine, as this provides for a more even distribution of weight in use, and hence greater comfort for the user. However, in some cases, for instance if the belt is adapted to support heavy tools, an uneven extension of the stabilising insert may be desirable. In some examples, the insert will be rectangular with the longer axis in line with the longer axis of the belt, in some examples, the insert will be contoured to follow the contour of the belt. It can be useful for the insert to be of width in the range 10 - 20 cm, or 13 - 16 cm so as to stabilise the region around the belt-connector. At these widths, any reduction in movement, or increase in the severity of injury should the stabilising insert receive an impact, is minimised. Depths may be in the range 5 - 15 cm, often 10 - 12 cm, and thicknesses in the range 4 - 5 mm. Sizes in this range allow for the maintenance of the shape and integrity of the belt, preventing deformation under the weight born by the belt-connectors.

Where there is more than one insert, they may offer the same coverage as described above, but in segments, providing greater flexibility of movement to the wearer, and reducing injury should one of the inserts be damaged through impact (such as from a projectile) in use. This reduction in injury arises as each insert is smaller, and the improved flexibility arises as the fabric between the inserts has greater flexibility than the inserts themselves.

Padding may also be present to improve the comfort of the belt for the wearer and to prevent the stabilising inserts from causing localised discomfort to the wearer. The padding may also aid in shape retention and integrity. The stabilising inserts and padding can be removed for cleaning or replacement, or for substitution with ballistic protection if appropriate.

In addition, the belt may comprise air pockets present to improve air circulation around the belt, reducing heat build-up with perspiration which in turn reduces soiling on the belt and improves comfort to the wearer.

The belt may also contain weights or armoured portions as appropriate for use, as well as or instead of pockets and/or clips to provide storage. Often the belt will be constructed with a fabric covering to provide a product with a relatively smooth and comfortable outer surface and to improve aesthetic appeal.

In a second aspect of the invention there is provided a mounting plate for a pack comprising one or more retaining clips for engagement with a weighted vest. Often the weighted vest will be a garment which covers at least a back region of the wearer, often body armour, although other vests may be used with the mounting plate of this aspect of the invention.

The mounting plate of the invention provides a load bearing system which is light weight, and robust without significantly impeding the movement of the wearer. A conventional harness is not needed with the mounting plate of the invention, and hence the combination of the weighted vest and mounting plate is more comfortable to the wearer as they can move without the restrictions arising from the need to force the harness to flex or pivot. It will also provide for less risk of entanglement or snagging through the retainer straps that would normally exist within a conventional carrying harness of this type. As a result, the

wearer can perform their chosen activity with increased safety, ease, speed, and in many cases with reduced risk of injury, in particular when using rope access tactics. In addition, the presence of a substantially solid plate, typically on either the chest or back, provides added impact protection to the wearer where this is important, for instance where the weighted vest is a protective vest such as body armour. Impact protection is provided through absorption and/or dispersion of impact forces across the plate, reducing the point of contact impact felt by the wearer.

As used herein the term “mounting plate” is intended to mean any roughly planar component which can reversibly receive the pack and be reversibly mounted onto the weighted vest. The mounting plate may be for the front or back of a vest, or possibly the shoulder area; however, as packs are generally carried on the back, in most cases the mounting plate will be configured for use on the back and for mounting onto a rear portion of the vest as worn.

The plate may be of single piece construction, or substantially single piece construction, although this is not essential. The plate may also be contoured to accommodate a wide range of different packs (generic contouring), or a single or limited number of pack types (for instance, to fit the air cylinders/oxygen tanks of respirators, or even of specific brands of respirators). More than one plate design may be provided to accommodate the various different loads that may be carried. The plate may also be contoured to follow the wearers back or the contours of the vest worn, and may be available in one or more sizes, to accommodate wearers of different heights and stature.

The retaining clips of the mounting plate are configured for engagement with a weighted vest, engagement will generally be reversible so as to provide a stable load carrying interface, but to also provide for removal of the plate when not needed, or for substitution of the plate when an alternate load must be carried. As used herein, the term “engagement” is intended to allow for inversion of the weighted vest, once the mounting plate is engaged, without the mounting plate separating from the vest.

The retaining clips may be integral to the plate, offering increased ease of manufacture and improved clip integrity as these are less liable to break when integral to the plate itself. However, separate clips could also be used, and non-reversibly fixed to the plate, for

instance by welding or through the use of adhesive. It is important, however, that the clips be permanently fixed to the plate for the lifetime of the mounting plate in order to provide reliable, stable engagement with the vest, without fear of separation of the clip and the plate in use, and hence disengagement of the plate from the vest at a potentially critical moment.

The retaining clips will generally lock into position relative to the weighted vest. This will generally be through the provision of barbs, which in some designs pass through an engagement band in the vest and prevent the clip from sliding back through the band. Alternative locking methods may be used, such as the use of fasteners (for instance bolts, or even press studs or additional engagement bands should it be deemed that the weight of the pack being carried demands it. However, the use of a barbed clip is advantageous as clips of this design are quick to engage, requiring simple sliding through the engagement band. This provides a plate which is quick and easy to mount onto the vest, but which does not disengage readily, ensuring that it remains securely fastened in critical situations. Further the use of barbed retaining clips allows one person to position the mounting plate on the weighted vest, simplifying the task and allowing wearers who have already donned the weighted vests to assist one another with mounting the plate, a process which is simple and easy as only one person is needed. When removal of the plate is required, this can be done by manually unlocking the barbs from the engagement bands; for instance, by depressing the barb using the thumb.

Often, in order to provide stability to the mounting configuration, there will be an even number of retaining clips, this provides for the arrangement of the clips in pairs, often on opposite sides of the mounting plate when in use. The arrangement of the clips in pairs further stabilises the mounting plate on the vest. Where the mounting plate is longer in one aspect than the other, the opposite sides will often be the longer sides, as split by the central line of this longer axis. As the human back is longer along the vertical in use axis of the plate, than the horizontal, it will often be the case, where the plate is for use on the back, that the sides are split along the vertical axis in use, and the pairs of retaining clips will be positioned on opposite sides of the plate relative to the centre along this vertical axis. As such, the retaining clips will often be arranged along a vertical axis of the plate.

Often there will be multiple pairs of retaining clips, to further stabilise the mounting plate across the face of its engagement with the weighted vest. To facilitate ease of engagement

between the vest and the plate, the retaining clips, in particular where these are of barb design, may be of different lengths, such that the barbs slide into the engagement bands in the weighted vest, and lock with these at different times, simplifying the mounting process as the wearer need only focus on positioning one, or a small number (for instance a pair) of clips relative to the vest at any given time, allowing mounting to occur stepwise, which is simpler (and hence quicker), than aligning all retaining clips with an engagement band (where present) or other receiver on the weighted vest simultaneously which can be difficult and sometimes frustrating. Often the lengths of the retaining clips will be such that the longest clips are at the base of the mounting plate. This will enable the user to engage the first pair using the thumbs of both hands simultaneously so that they engage onto the engagement bands first. When the first set are secured the remaining clips will often engage alternately along the vertical plane as the length of the clips increases proportionately in order to contact the next point of fixing in turn.

The retaining clips will often be placed between the conceptual centre line and the associated edge of the mounting plate, often towards the edge to facilitate central mounting of the pack to the plate, but generally sufficiently spaced from the edge that the structural integrity of the mounting plate is retained, and the edges themselves are not weakened by the presence of a retaining clip directly proximal to the edge of the plate.

Often there will be six retaining clips, arranged vertically in three pairs in use; however there may be four or eight retaining clips, arranged in two or four pairs respectively.

In addition to the retaining clips, the mounting plate will often include at least one stabiliser. The stabiliser is any component which helps to stabilise movement of the mounting plate relative to the vest, but which does not lock in place relative to the vest and will often assist with the location of the plate on the weighted vest via, in many instances the engagement bands of the vest. The stabiliser is therefore of different design to the retaining clip. The use of stabilisers in addition to retaining clips can be beneficial as it allows the number of retaining clips to be selected as appropriate solely to provide engagement with the weighted vest. Whilst the retaining clips also perform a stabilising function, they are generally more complex in design than a stabiliser and the use of more retaining claims than are needed simply to mount the plate can increase manufacturing costs, and mounting time, as more clips would need to be located relative to the vest and

positively engaged. As no positive engagement is needed between the stabilisers and the vest, these can simply be received by the vest, and can be simple protrusions from the plate, which assists in the distribution of weight across a greater number of supports but do not have the capacity to lock on to the engagement bands. In some designs, the stabilisers are of similar configuration to barbed retaining clips, and may also vary in length like their barbed counterparts, but without the barbs, providing for the simple sliding of the stabilisers into engagement bands in the weighted vest.

Often the stabilisers are integral to the plate, although they may also be separate to the plate but permanently fixed thereto using methods such as welding or adhesives. Having a plate where the stabilisers are integral to the plate offers increased ease of manufacture and improved stabiliser integrity as these are less liable to break when integral to the plate itself. As noted above when describing the retaining clips, it is important, however, that the stabilisers be permanently fixed to the plate for the lifetime of the mounting plate in order to provide reliable, stabilisation relative to the vest, without fear of separation of the stabiliser and the plate in use, and hence disengagement of the plate from the vest at a potentially critical moment.

It will often be the case that there is more than one stabiliser, often two, in some cases more than two as appropriate for the size of the plate. The skilled person would be able to select an appropriate number of stabilisers for a given plate, however, for a typical back plate a typical number of stabilisers would be two, often aligned vertically and roughly along the central vertical axis of the plate, when this is designed for use on the back. This is particularly advantageous where the retaining clips are arranged in pairs on either side of this central axis, as the stabilisers act to stabilise and/or locate the mounted plate relative to the middle of the back, which can be hollowed relative to the mounting points. It may be the case there where there are three pairs of retaining clips, that the two stabilisers are arranged one between an upper pair of retaining clips in use, and one between a lower pair of retaining clips in use. This configuration maximises the stabilisation, whilst leaving a central area of the mounting plate free to engage with the pack.

The pack may be engaged with the mounting plate using a wide range of known techniques. Generally the engagement will be reversible in the sense that the pack may be removed from the mounting plate after use, although permanent fixing is also possible.

Typically bolts, screw fixings or additional engagement bands will be used. In some designs of the plate, this will include slots or apertures for receiving the engagement means (such as the bolts), or alternatively, the pack may be clamped to the edges of the mounting plate.

In addition, it will usually be the case that the pack is engaged with the plate before the plate is mounted on the vest. This means that the potentially heavy pack can be pre-engaged with the plate, allowing for quick mounting of the unit onto the vest when needed. The mounting plate may also comprise one or more supports for the pack. As used herein, the term “support” is intended to mean a weight bearing, pack stabilising feature, rather than the means for engaging the mounting plate with the pack. For instance, the support could be a simple shelf protruding from the mounting plate such that in use the pack will rest on the support, or alternatively prongs may extend from the mounting plate, either to act as a shelf for the pack, or to extend through the body of the pack providing support not under the pack, but instead through the pack, perhaps to reduce movement of the pack relative to the plate. In some designs, prongs are provided, so that where in use the pack requires the presence of attachments which protrude from the base of the pack as would be the case with, for instance, air tanks for respirators, these are not blocked by the support. Additionally or alternatively, the support may be removable for use with such packs.

Often the mounting plate will also comprise a surface for carrying additional apparatus. For instance, the mounting plate may be designed such that the pack does not cover the entire surface of the plate in use, and so additional apparatus may be fixed to the mounting plate, so that it functions to support more than just the pack, but also, for instance, other pieces of equipment. The additional apparatus may be fixed using any conventional means to the mounting plate, including in particular clamping to the edges. It is particularly envisaged that the corners of the mounting plate may be visible once the pack has engaged with the mounting plate, and these will often be configured to allow for easy mounting of additional apparatus, through the provision of smooth contours for clamping, apertures for bolting or screw fixing or through a combination of these.

To allow ease of transport of the mounting plate (or mounting plate and pack) by the wearer, and to assist mounting of the plate to the vest, the mounting plate will often include

a handle. The handle will typically be positioned at what will become the top of the plate in use, so that it can be used to lift the plate into position for mounting.

Where the weighted vests and hence mounting plates are sized to be worn by adults, the mounting plate will generally be of maximum size in the range 300 mm wide by 530 mm long. Often the sizes being given the length being the vertical axis of the mounting plate in use. Often the width of the plate will be in the range 250-300 mm, often 270-295 mm or 285-290 mm. Often the length of the mounting plate will be in the range 480-530 mm, often 500-520 mm, often 510-515 mm. This size provides a mounting plate which covers substantially the length of the back from the shoulder blades to the waist, and the central portion of the back. A mounting plate of this size provides for a carrying system with minimal reduction in lateral movement, but which can carry packs of most sizes and weights, and offers additional protection to the back of the wearer. The mounting plate may extend below the waist if necessary to stabilise the load and to accommodate the pack, however, the mounting plate will generally not be fixed to the wearer below the waist, as this would inhibit lateral movement.

Smaller plates may also be used, which do not cover all of the back of the wearer, or which are mounted across the chest or shoulders. Sizes would vary as appropriate for the size of the pack and relative position on the vest/wearer. For instance, a mounting plate on the chest would be in the size range 200-300 mm in each direction, often in the range 210-250 mm in each direction. This does not mean that the mounting plates for the chest need to have the same dimensions in the width and length, simply that both sets of dimensions are likely to be in these ranges. Alternatively, where the mounting plate is a shoulder plate, this may be sized in the range 80-100 mm in width, by 100-140 mm in length.

As described above, often the pack will be a back-pack, respirator, technical equipment, emergency/rescue equipment, armaments, munitions, or products which are being vended for sale by the wearer, or necessary as part of the work function of the wearer. In many cases the mounting plate will be contoured to accommodate the specific type of pack, as this provides for the most effective load distribution and ensures that the specific pack is securely engaged with the weighted vest and stabilised. Often the pack will comprise a respirator, and particular advantages are offered when this is the case as current harnesses for respirators are particularly unwieldy and are almost totally impractical for use with

weighted vests, for instance, there is often a need in emergency situations for the wearer to wear body armour for protection but also a respirator. The combination of the two has typically resulted in extreme restriction of movement and discomfort, the mounting plate of the invention addresses this, by removing the need for a harness entirely.

The mounting plate can be of one piece construction, at least for a body of the plate. The advantages of this are that it is robust, and hence reliable. In addition, manufacture is easy. It is desirable that the material used be light, inert to most chemicals, robust yet capable of flexing, and be able to be contoured as necessary with relative ease. The use of a material that can flex ensures that resilient deformation is observed in use, for instance when the wearer bends or twists or under extreme pack weights. A suitable material would also generally be stable over a wide temperature range, allowing the mounting plate to be used in different environments, a temperature range of -35°C to $+75^{\circ}\text{C}$ is often needed. Often materials with densities in the range 0.8 g/cm^2 to 1.2 g/cm^2 are used, often 0.8 g/cm^2 to 1.0 g/cm^2 .

Plastics materials are often used as these are easily contoured both to the body part where the mounting plate will be worn, and to the pack shape, however, metals may also be used. Often the plate will comprise high density polyethylene, high density polystyrene, high density polypropylene, specialist metals or combinations thereof. The materials above are also easily washable and resistant to acid and alkali conditions. Hence not only will the integrity of the mounting plate be maintained even in extreme conditions (such as sea water, or where the air contains corrosive chemicals), but the mounting plate can be decontaminated easily by immersing in cleaning fluids, without damage. High density polyethylene is most often used for the mounting plates of the invention as this material is resistant to abrasion, lightweight, yet with high strength and good impact resistance.

The thickness of the mounting plate will depend upon the material from which it is constructed, as the thickness will affect the strength of the mounting plate. However, for a high density plastics materials it will generally be in the range 2 mm to 6 mm, often 3 mm to 5 mm or 3.5 mm to 4.5 mm, often around 4 mm. These ranges represent a good balance between the provision of sufficient strength, yet minimising the weight of the mounting plate.

Although the mounting plate will generally be of single piece construction, in some examples the support will be of separate construction and welded or bolted onto the body of the mounting plate. This allows for the removal of the support where, for instance, in use the pack requires the presence of attachments which protrude from the base of the pack, and the presence of the support would present this. As such, a body of the plate will be of single piece construction, but the support may be a second component.

In a third aspect of the invention there is provided a weighted vest comprising a load-bearing belt and/or a mounting plate according to the first aspect of the invention. The incorporation of the belt into any weighted vest ensures stabilisation of the core of the wearer under load by redirection of the weight relative to the wearer and provides for a more even distribution of the weight; this reduces pressure on the neck, spine and shoulders as described above and hence fatigue and the risk of long-term injury. The vest of the invention also offers improved respiration to the wearer as pressure is reduced on the chest. This is of particular advantage where the wearer is expecting to become out of breath such as during strenuous activity whilst wearing exercise/load bearing vests or body armour. The presence of the belt also reduces heat build-up in the vest thus reducing fatigue, perspiration and improving comfort for the wearer. A further benefit is that the vest can be of unisex design as the belt reduces pressure on the shoulders by lifting the entire vest, creating a cavity for the bust which would otherwise need to be specifically provided. The presence of the belt also prevents the vest from riding up should the wearer sit down, a benefit which applies primarily to exercise vests, safety harnesses and body armour. With these three specific types of vest, in the event that the rigidity of the vest causes it to ride up when the wearer is seated, the vest can choke the wearer or at least cause discomfort in the throat. This is prevented by the presence of the belt. Without being bound by theory it is believed that this could be because the belt-connectors stabilise the vest preventing the front section of the vest from pushing the back section down into the seat which would in turn allow the front section to ride up creating a choking effect at the wearer's throat.

The vest will generally comprise receivers for the belt-connector of the load-bearing belt. These may be specifically designed to be within the vest or the receivers may simply be pre-existing cavities in the vest resulting from, for instance, the modular construction of weighted exercise vests and body armour which results in cavities being present which can act as receivers for the belt-connector. The receivers could be walled cavities or areas with

retaining portions such as bands, or one half of a hook-and-loop fastening, to receive the belt-connectors. Often the receiver will be of fabric construction, comprise one or more elasticated or webbed bands, or be a region of one half of a hook-and-loop fastening.

The receiver may be configured as a pocket to prevent the belt-connector from moving within the vest too far upwards and/or side wards and to provide a positive engagement point, providing surety and preventing discomfort to the wearer and these may also include means for fastening the belt-connector to the vest, for instance, straps, clips, hook-and-loop fastenings, press studs, buttons, buckles, and combinations of these.

The receiver may be configured as a region of one half of a hook-and-loop fastening, the belt-connector being fastened to this region either through the incorporation of the other half of the hook-and-loop fastening onto the surface of the belt-connector, or by sandwiching the belt-connector between both halves of the hook-and-loop fastening. Where the belt-connector is being sandwiched in this way, both halves of the hook-and-loop fastening will often be regions, often rectangles or squares of width (in use) in the range 3 to 10 times the width of the belt-connector and height in the range 2 to 5 times the width of the belt-connector. This provides for a strong interaction between the two parts of the hook-and-loop fastening.

Alternatively, the belt-connector may be fixed to a side of the second half of the hook-and-loop fastening away from the hook or loop fastening means, such that no sandwiching occurs, but instead the belt-connectors are held in position by virtue of their being fixed to the second half. In such cases, as with the sandwiching attachment above, the first half will often comprise the loop portion, and the second half typically the hook. The benefit of this mode of fixing is that the strength of the fastening is greater, as the belt-connectors do not interfere with the connection between the hook and the loop, as they will do where sandwiching of the belt-connector between the hook and the loop fastening is used.

Often, the first half of the hook-and-loop fastening, often the loop, may be fixed to the vest, for instance by stitching, gluing, stapling or other conventional methods. The second half, often the hook, may be fixed to a support plate, for instance a plastics or metal support plate to improve rigidity. Often, the second half, with or without the support plate, and whether the belt connector is fixed to a side of the second half away from the fastening, or

a side including the fastening (to allow sandwiching), will be fixed to the belt-connector (or connectors), for instance by stitching, gluing or stapling or other conventional methods. This prevents movement of the belt-connector relative to the receiver and facilitating rapid attachment of the two parts of the hook-and-loop fastening to one another as the second half of the hook-and-loop fastening is in a fixed position relative to the belt-connector, and can be rapidly positioned relative to the first half of the hook-and-loop fastening on the vest. It will be appreciated that arrays of press studs, or buttons could be used to provide a sandwiching effect in a similar way, but that these methods would require longer to position the belt-connector relative to the vest prior to use.

It is therefore clear that as used herein, receiver is intended to be given a functional interpretation and include any means for accepting the elongate belt-connectors including cavities and simple retainers. One advantage of the belt is that where it is intended for use with a vest of modular construction which already incorporates cavities by virtue of its construction or specifically for the receipt of other functional accessories, the belt can easily be retro-fitted onto existing vests providing a dramatic improvement in the product at minimal additional cost. Often, however, the vest and belt will be specifically designed to co-operate with one another to ensure optimal fit.

Typically, the vest will comprise a front and rear portion and a fastening. The front and/or rear portions do not necessarily entirely cover the chest or back; however this will generally be the case within the understanding of the term vest in the clothing industry. The front and rear portion will often be releasably connected via the fastening and there will often be one, two, three or four fastenings. Often the vest will comprise at least two fastenings, the first fastening arranged at a first shoulder and a second fastening arranged at a side of the vest below the first shoulder. This allows the vest to be easily taken off sideways and often with one hand. Therefore the vest can be removed and donned quickly should the need arise. Often there will be four fastenings, a first fastening arranged at a first shoulder, a second fastening arranged at a side of the vest below the first shoulder, a third fastening arranged at a second shoulder and a fourth fastening arranged at a side of the vest below the second shoulder. The presence of four fastenings allows for ambidextrous removal of the vest sideways through two of these or removal over the head through loosening of the two side fastenings or finally in the case where the wearer is

unable to remove the vest himself by release of all four fastenings and the lifting of the front or back portion from the wearer, for instance in cases of injury.

The fastenings will often be selected from hook-and-loop fastenings, press studs, buttons, zips, clasps, buckle closures and combinations thereof. Often the fastenings will be hook-and-loop fastenings, press studs or clasps as these are quick and easy to open and close. Hook and look fastenings are often used as these are not only quick and easy to open and close but can be operated one-handedly and are robust to repeated use.

Often at least one of the fastenings will be adjustable. This allows a vest of a standard size to be adjusted to the size of the wearer, providing improved comfort and mobility.

For some applications, for instance where the vest is a body armour vest, the vest may include protective inserts around the lower region. Often, these will be removable and hidden within pockets in the vest. Where this is the case, the pockets may be retained in position with closures. The closures will often be selected from hook-and-loop fastenings, press studs, buttons, zips, clasps, buckle closures and combinations thereof. In some cases the closures may be reinforced using weight-bearing elements which form part of the vest and are positioned such that if the closure begins to open under the weight of the protective insert, the force will be distributed across the vest, to help prevent opening, and possible damage to the closure under the force applied.

Where a mounting plate is to be present, the vest will also comprise engagement means for mounting the plate to the vest. The specific design of these will depend upon the nature of the engagement, although where the retaining clips are barbed, it will generally be the case that the engagement means will be an engagement band. In other words, a band of fabric or other material, behind which the clip may pass, and which is caught in a barb preventing withdrawal of the clip unless the wearer manually clears the band from the barb. The stabilisers will also typically slide into position between an engagement band and vest, to provide additional support.

The band will often be fixed to the weighted vest, often by stitching although other methods are possible such as gluing, welding or stapling, although it may be integral to the vest.

Often there will be more than one engagement band, typically there will be at least as many engagement bands as there are retaining clips so that all the retaining clips may be used. Typically there will be at least as many engagement bands as the sum of the retaining clips and stabilisers, so that full stabilisation of the mounting plate may also be offered.

The engagement bands may be positioned on the weighted vest such that they can receive the retaining clips and optionally the stabilisers of a specific design of mounting plate, or there may be an array of engagement bands such that a range of different mounting plates may be mounted on the weighted vest in a variety of locations to suit the wearer. This would allow for mounting plates with different numbers or positions of retaining clips and stabilisers, and plates of different sizes. An array also allows the plate to be mounted in different positions on the wearer, providing flexibility and improving comfort for the particular wearer carrying the pack whilst maintaining proper transference of the load to the user irrespective of the size of the user. The array may comprise multiple discrete bands, however an efficient way of forming the array is to provide the weighted vest with strips of the band material, and to form the individual bands from the strips through, for instance, stitching to the weighted vest.

Often the engagement bands will be fabric, although plastics materials may also be used, fabric is more flexible and less likely to be damaged during, for instance, the washing process. Often a resilient non-deforming fabric will be used, as such fabrics will sit tight to the weighted vest after prolonged use and so when not in use will be less likely to sag and catch on other apparatus, and when in use pull the retaining clip towards the weighted vest, providing additional grip on the mounted plate.

According to a fourth aspect of the invention, there is provided for the use of a load-bearing belt according to the first aspect of the invention in the re-distribution of weight applied to a wearer of a weighted-vest. This re-distribution can reduce the weight applied to the shoulders of the wearer as described above and therefore provides for the use of a load-bearing belt according to the first aspect of the invention in the reduction of weight applied to the shoulders of a wearer.

Unless otherwise stated each of the integers described in the invention may be used in combination with any other integer as would be understood by the person skilled in the art. For instance the load-bearing belt of the first aspect of the invention may be a belt for a weighted vest, the belt comprising two substantially rigid fabric covered belt-connectors extending from the belt in a direction substantially parallel to the back of the wearer. Optionally the two belt-connectors will be in the form of an A-frame and they may be fabric covered, and in some cases fixed to the vest through sandwiching between two regions of a hook-and-loop fastening, often with the first half of the hook-and-loop fastening being attached to the vest and belt-connectors being attached to the second half of the hook-and-loop fastening. The belt may comprise a retainer selected from hook-and-loop fastening, padding, a stabiliser, and air pocket all optionally present together individually or in any combination. The mounting plate of the second aspect of the invention may be contoured for a respirator and designed to be mounted on the back. This mounting plate may comprise barbed retaining clips arranged in pairs, and stabilisers, the retaining clips and stabilisers received in an array of resiliently deformable engagement bands formed on at least a rear portion of a weighted vest of the third aspect of the invention. This mounting plate may be of plastics material, with moulded handle and detachable support, often also with smooth moulded regions proximal to at least one corner to provide for the carrying of additional apparatus. The weighted vest of the third aspect of the invention may comprise receivers for the belt-connectors of the load-bearing belt and will generally comprise a front and a rear portion and four fastenings. The first fastening arranged at a first shoulder, a second fastening arranged at a side of the vest below the first shoulder, a third fastening arranged at a second shoulder and a fourth fastening arranged at a side of the vest below the second shoulder. Typically one, two, three or four of these fastenings will be adjustable.

Further, although all aspects of the invention preferably “comprise” the features described in relation to that aspect, it is specifically envisaged that they may “consist” or “consist essentially” of those features outlined in the claims. In addition, all terms, unless specifically defined herein, are intended to be given their commonly understood meaning in the art.

Further, in the discussion of the invention, unless stated to the contrary, the disclosure of alternative values for the upper or lower limit of the permitted range of a parameter, is to be

construed as an implied statement that each intermediate value of said parameter, lying between the smaller and greater of the alternatives, is itself also disclosed as a possible value for the parameter.

In addition, unless otherwise stated, all numerical values appearing in this application are to be understood as being modified by the term “about”.

Brief Description of the Drawings

In order that the present invention may be more readily understood, it will be described further with reference to the figures and to the description hereinafter.

Figure 1 is an schematic representation of a wearer in the belt and vest of the invention;

Figure 2 is a schematic representation of the belt and vest of Figure 1;

Figure 3 is a schematic representation of the belt of the invention;

Figure 4 is an exploded view of a portion of the belt of Figure 3;

Figure 5 is a schematic representation of a belt-connector;

Figure 6 is a schematic representation of part of the vest of Figure 1;

Figure 7a is a schematic representation of an alternative example of a belt of the invention;

Figure 7b is a further schematic representation of the belt of Figure 7a;

Figure 7c is a schematic representation of a belt-connector of the belt of Figure 7a from a first side;

Figure 7d is a schematic representation of the belt-connector of Figure 7c from a second side;

Figure 7e is a schematic representation of the belt of Figure 7a being worn;

Figure 8 is a schematic representation of a vest of the invention, including the belt of Figure 7;

Figure 9 is a schematic representation of the receipt of the belt into the back of the vest;

Figure 10 is a schematic representation of the vest showing waist fastening;

Figure 11 is a schematic representation of a mounting plate of the invention from in front;

Figure 12 is a schematic representation of the mounting plate of Figure 11 from the side;

Figure 13 is an exploded view of a portion of the mounting plate of Figure 11, showing a barbed retaining clip; and

Figure 14 is a schematic representation of the mounting plate of Figure 11 mounted on a weighted vest.

Detailed Description

The invention relates to a belt 5 for a weighted vest 10 as shown in Figure 1 and Figure 2. The belt 5 comprises two belt-connectors 15, extending from the belt 5 in a direction generally upwards and in line with the back of a wearer. In this example, the belt-connectors 15 are received by a weighted vest 10 of the body armour type.

As shown in Figure 3, the belt 5 comprises padded regions 20 and a hook and loop retainer 22. Figure 4 shows in detail, the retention of the belt-connectors 15 within the belt 10, using in this example, elasticated means 25. Figure 5 shows a belt-connector 15 which in this example has two straps 30, 35 extending there from, a first strap 30 of a hook-and-loop construction for fixing within a recess in the belts 10, the second strap 35 which is slightly longer, for receipt in a receiver 40 in the vest 10 as shown in Figure 6. The belt-connectors 15 are secured in position in fabric receiving pockets 40 using buckles 50. The belt-connectors 15 of this example are of fibreglass (the material is fibre glass although it could be carbon fibre if lighter and stronger rods are required) construction and are covered in a hardwearing nylon 55. This nylon 55 covering is also applied to the belt 10 itself, including the belt-connectors 15.

In an alternative example, the two belt connectors 15 may be secured in position using an outer panel 140 and an inner panel 145 of a hook-and-loop fastening (as shown in Figures 7 and 8). Figure 7a shows belt-connectors 15, which in this example are sewn to a first surface 150 of the outer panel 140, a loop fastening panel. The panel 140 comprises an ABS plastic support plate covered on a first surface 150 with a hook-part of a hook-and-loop fastening. Inner panel 145 comprises a loop-part of a hook-and-loop fastening.

In Figures 7a-e, the belt-connectors 15 are received in pockets 155 and fixed in position in the pockets 155 using hook and loop fastenings 160, 165. In Figure 7a, an external covering 168 of the belt 5 has been illustrated using dotted lines to show the interior of the belt 5, Figure 7b provides a schematic representation of the belt 5 as it would be seen. As with all parts of the detailed description, this receiving method in the belt 5 may be combined with any of the other features of the belt 5, mounting plate 85 and vest 10. Figures 7c, 7d and 7e each show the belt-connectors 15 when secured to outer panel 140.

Figure 7c shows one half of a hook-and-loop fastening 200 used to fasten the belt-connectors to the belt 5.

Figure 7a additionally shows the presence of a rectangular stabilising insert 170, in this example the insert is GRP of size 150mm x 110 mm x 4 mm. The insert 170 is held in position relative to the belt connectors 15 and the belt 5 using hook and loop fastening 175. In this example the stabilising insert 170 is positioned within the belt 5 such that it is substantially centralised on the spine of the wearer in use. Figure 7e further shows the belt 5 in use, although without the vest 10 for clarity. It can clearly be seen that the belt-connectors 15 are substantially aligned on either side of the spine, extending upwards roughly parallel to the back of the wearer.

Figure 8 shows the belt-connectors 15 and outer panel 140 of Figure 7 when connected to vest 10. Specifically, the belt-connectors 15 are shown as being stitched to a side of outer panel 140 away from the loop half of the hook-and-loop fastening, the loop side of outer panel 140 being fastened to inner panel (the “hook” half of the hook-and-loop fastening) 145. Figure 8 also shows weight-bearing elements 180 which interact with pocket 185 in the vest that carry protective inserts (not shown), to ensure that pocket 185 remains closed in use. In this example, the weight-bearing elements 180 comprise reinforced fabric webbing straps with hook-and-loop fastenings at the lower end 190, to strengthen the closure 195 of pocket 185.

Figure 9 shows a vest 10 which may be connected to the belt 5, this vest 10 has four fastenings, 60, 65, 70, 75, one at each shoulder 60, 65 and one at each side of the torso at the waist, 70, 75, each of hook-and-loop construction. The fastenings 70, 75 at the waist are enlarged to help increase core stability and the loop portion 80 of the hook-and-loop fastening extends across the entire front of the vest 10, as is also shown in Figure 10.

Figures 11 to 13 shows a mounting plate 85 of the invention, the mounting plate 85 is contoured as a back plate, for carrying respirator apparatus (not shown). The mounting plate 85 is of two-piece construction, comprising a 4mm moulded high density polyethylene plastics plate 90, of width 290 mm at the widest point and length 515 mm at the longest point with metal supports 95 bolted to the plate 90. The mounting plate 85 has been painted to improve aesthetic appeal and to improve damage resistance. The mounting

plate 85 comprises a handle 100, which is at the top of the mounting plate 85 in use, six barbed retaining clips 105 are arranged in pairs on opposite sides of the plate 85 down the vertical axis of the plate 85. Each pair of retaining clips 105 are of differing length so that these engage with the engagement bands 135 at different points during the mounting process. The longest pair of retaining clips 105 is the pair, which, when mounted, appear at the base of the plate 90 with the retaining clips 105 of interim length in the middle position in use and the shortest retaining clips 105 at the upper position in use. Clip 105 lengths will typically be in the range 35-60 mm. In this specific example the longest clips are around 55 mm, the mid-length clips 45 mm and the short clips 35 mm. There are also two stabilisers 110, aligned with the top and bottom pair of retaining clips 105 and sized to match the clips 105 that they are aligned with. A central portion 115 of the mounting plate 85, and a base portion 120 are contoured to receive a respirator tank (not shown), and include slots 125 to allow the tank to be fixed to the mounting plate 85. A detachable two-pronged support 130 is provided.

Figure 14 shows the mounting plate 85 when mounted on a weighted vest 10. The barbed retaining clips 105 are engaged with engagement bands 135 in the vest 10, which includes an array of engagement bands 135 formed from strips of resilient non-deforming material stitched at specifically measured intervals to the weighted vest 10. The stabilisers 110 are also positioned in engagement bands 135, to stabilise the mounting plate 85 in position relative to the vest 10.

It should be appreciated that the belts, vests, mounting plates and uses of the invention are capable of being incorporated in the form of a variety of embodiments, only a few of which have been illustrated and described above.

Claims

1. A load-bearing belt for a weighted vest, the belt comprising, an elongate belt-connector for receipt of a load from the weighted vest, a stabilising insert at the back of the belt, and a retainer.
2. A belt according to claim 1, wherein the belt-connector comprises a substantially rigid portion.
3. A belt according to claim 1 or claim 2, wherein in use the belt-connector extends from the belt in a direction substantially parallel to the back of a wearer.
4. A belt according to any preceding claim, wherein the belt-connector comprises a bar.
5. A belt according to any preceding claim, wherein there are two belt-connectors.
6. A belt according to claim 5, wherein in use the belt-connectors form an A-frame, X-frame or are substantially parallel.
7. A belt according to claim 5, wherein in use the belt-connectors form an A-frame.
8. A belt according to any preceding claim wherein the belt-connector is separable from the belt.
9. A belt according to any preceding claim, wherein the belt-connectors are fabric covered.
10. A belt according to any preceding claim, wherein the retainer is selected from hook-and-loop fastening, press studs, buttons, zips, clasps, buckle closure and combinations thereof.
11. A belt according to any preceding claim, further comprising padding.

12. A belt according to any preceding claim, further comprising air pockets.
13. A mounting plate for a pack comprising one or more retaining clips for engagement with a weighted vest.
14. A mounting plate according to claim 13, wherein the retaining clips are integral to the plate.
15. A mounting plate according to claim 13 or claim 14, wherein the retaining clips include barbs.
16. A mounting plate according to any of claims 13 to 15, wherein there is an even number of retaining clips.
17. A mounting plate according to any of claims 13 to 16, wherein the retaining clips are arranged in pairs.
18. A mounting plate according to claim 17, wherein there are multiple pairs of retaining clips, each pair of different lengths
19. A mounting plate according to any of claims 13 to 18, wherein the retaining clips are arranged along a vertical axis of the plate.
20. A mounting plate according to any of claims 13 to 19, further comprising at least one stabiliser.
21. A mounting plate according to claim 20, wherein the stabilisers are integral to the plate.
22. A mounting plate according to claim 20 or claim 21, wherein there are two or more stabilisers.

23. A mounting plate according to any of claims 13 to 22, comprising a surface for supporting apparatus.
24. A mounting plate according to any of claims 13 to 23, shaped to follow the contour of a wearers back, and/or the pack.
25. A mounting plate according to any of claims 13 to 24, further comprising a support for the pack.
26. A mounting plate according to any of claims 13 to 25, wherein the pack comprises a respirator.
27. A mounting plate according to any of claims 13 to 26, comprising high density polyethylene, aluminium, polystyrene, polypropylene or combinations thereof.
28. A weighted vest comprising a load-bearing belt and/or a mounting plate according to any preceding claim.
29. A vest according to claim 28, comprising receivers for the belt-connectors of the load-bearing belt.
30. A vest according to claim 29, wherein the receivers comprise a hook-and-loop fastening system.
31. A vest according to claim 30, wherein the belt-connectors are sandwiched between the hook and loop parts of the fastening system.
32. A vest according to any one of claims 28 to 31, comprising a front and a rear portion and a fastening.
33. A vest according to claim 32, wherein the front and rear portion are releasably connected.

34. A vest according to claim 32 and claim 33, comprising one, two, three or four fastenings.

35. A vest according to claim 34, comprising at least two fastenings, a first fastening arranged at a first shoulder, and a second fastening arranged at a side of the vest below the first shoulder.

36. A vest according to claim 34 or claim 35, comprising four fastenings, a first fastening arranged at a first shoulder, a second fastening arranged at a side of the vest below the first shoulder, a third fastening arranged at a second shoulder and a fourth fastening arranged at a side of the vest below the second shoulder.

37. A vest according to any of claims 32 to 36, wherein at least one fastening is adjustable.

38. A vest according to any of claims 28 to 37, comprising retainers for the mounting plate on an external surface of the vest.

39. A vest according to claim 38, wherein the retainers are present on the rear portion of the vest.

40. A vest according to claim 38 or claim 39, wherein the number of retainers is equal to or greater than the number of retaining clips.

41. A vest according to any of claims 38 to 40, comprising a web of retainers.

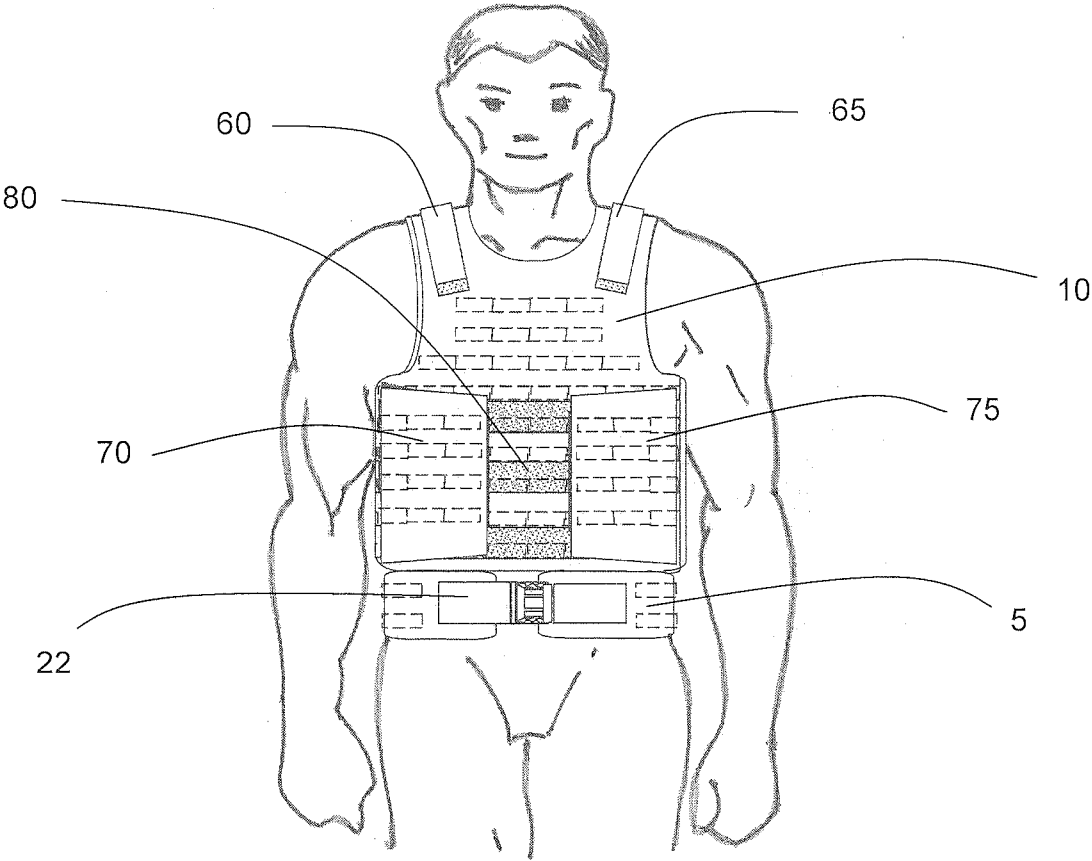
42. A vest according to any of claims 28 to 47, wherein the vest is selected from a weighted exercise vest, body armour, a sandwich board, bandolier and a chest harness.

43. A vest according to claim 42, wherein the vest is body armour.

44. Use of a load-bearing belt according to any of claims 1 to 12, in the redistribution of weight applied to a wearer of a weighted vest.

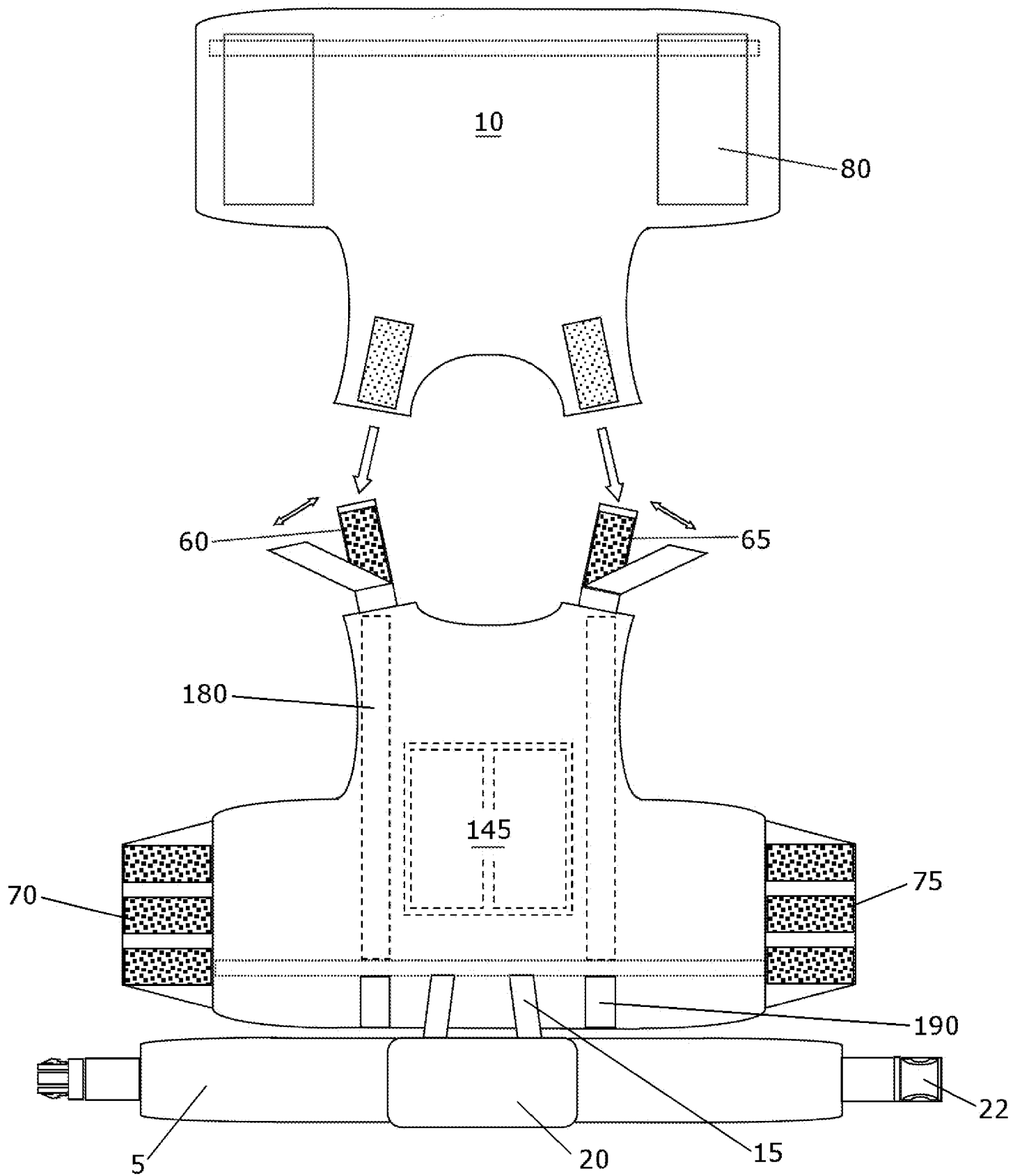
45. Use of a load-bearing belt according to claims 1 to 12, in the reduction of weight applied to the shoulders of a wearer.
46. Use of a mounting plate according to any of claims 13 to 27, comprising mounting the plate onto a vest and locking in position.
47. A belt, mounting plate, vest or use substantially as described herein with reference to the drawings.

Figure 1



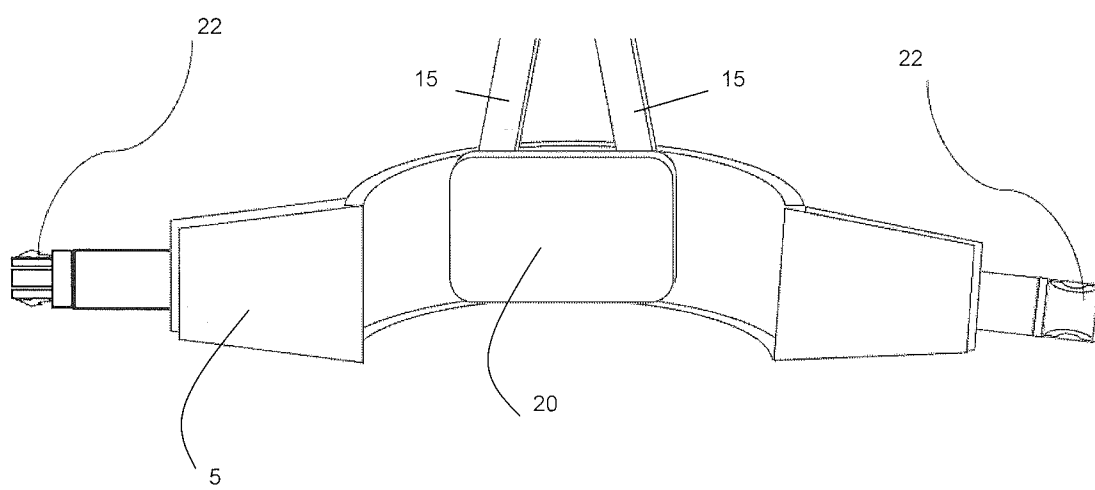
2/17

Figure 2



3/17

Figure 3



4/17

Figure 4

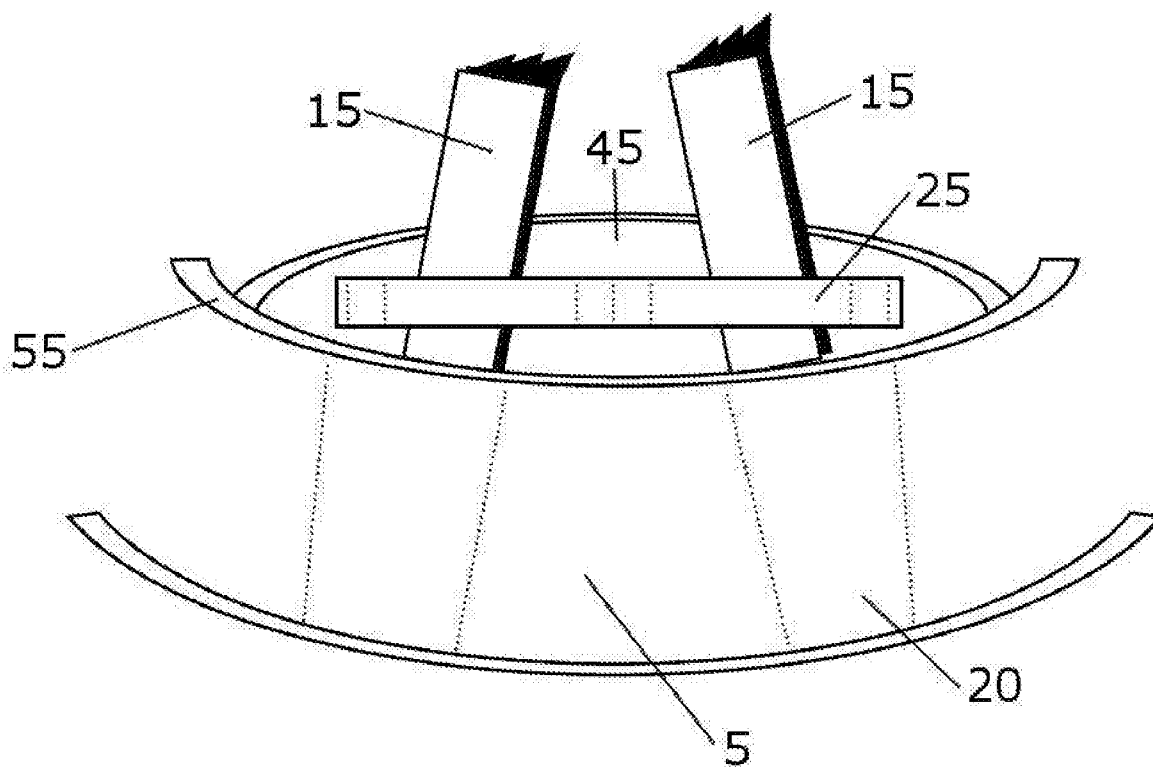


Figure 5

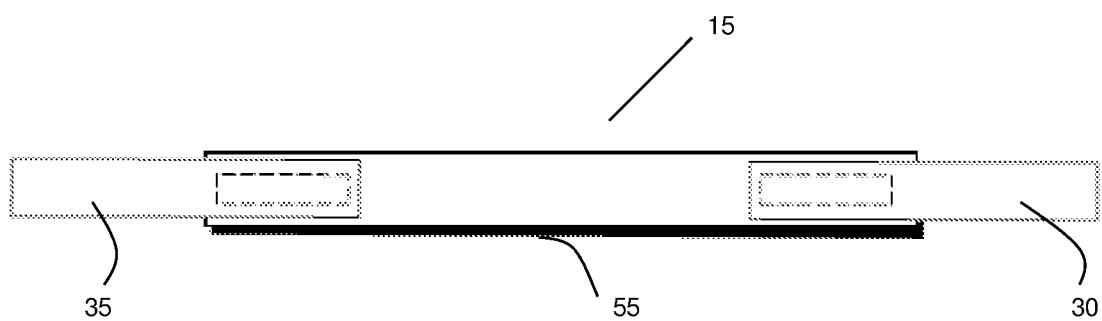


Figure 6

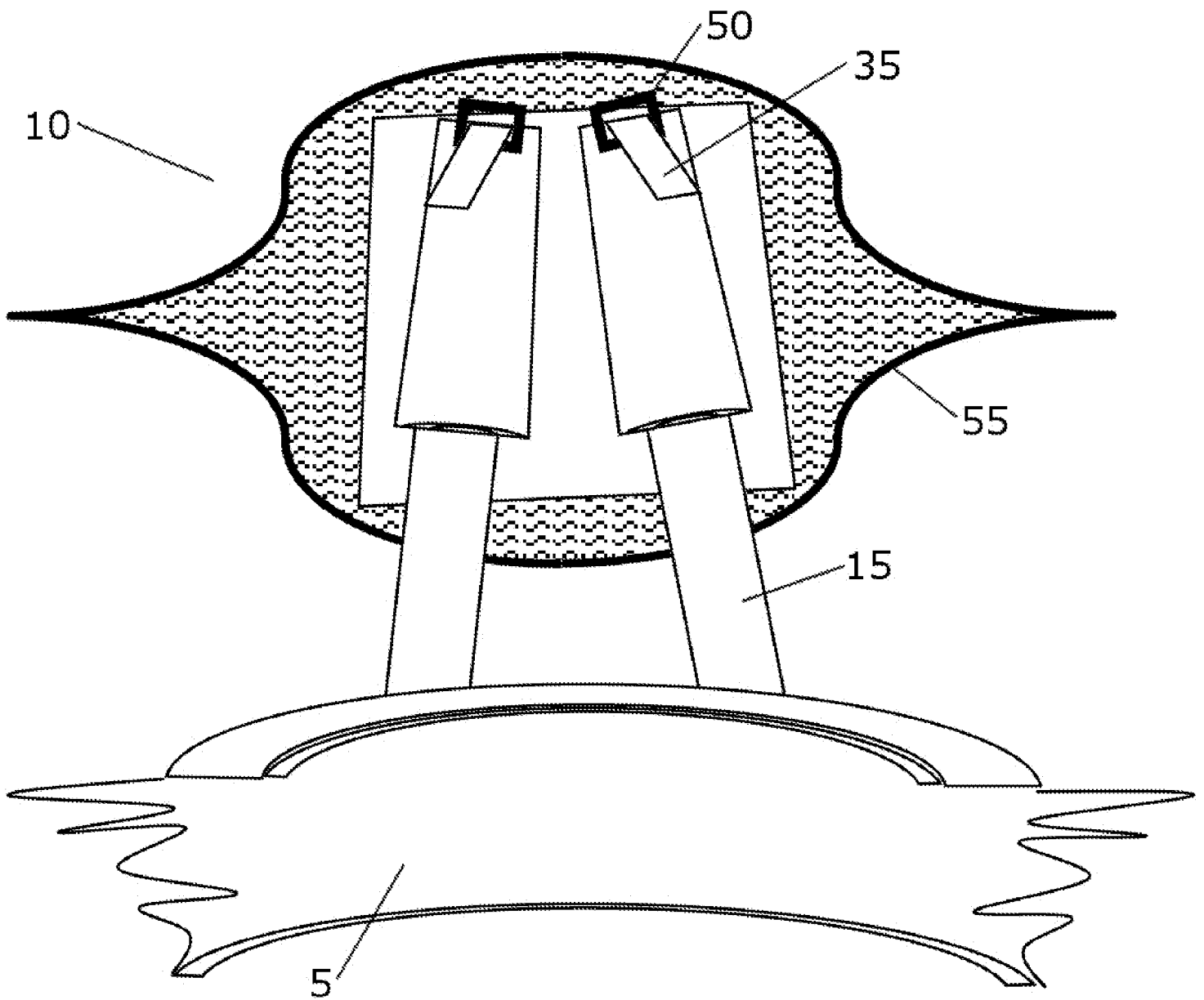
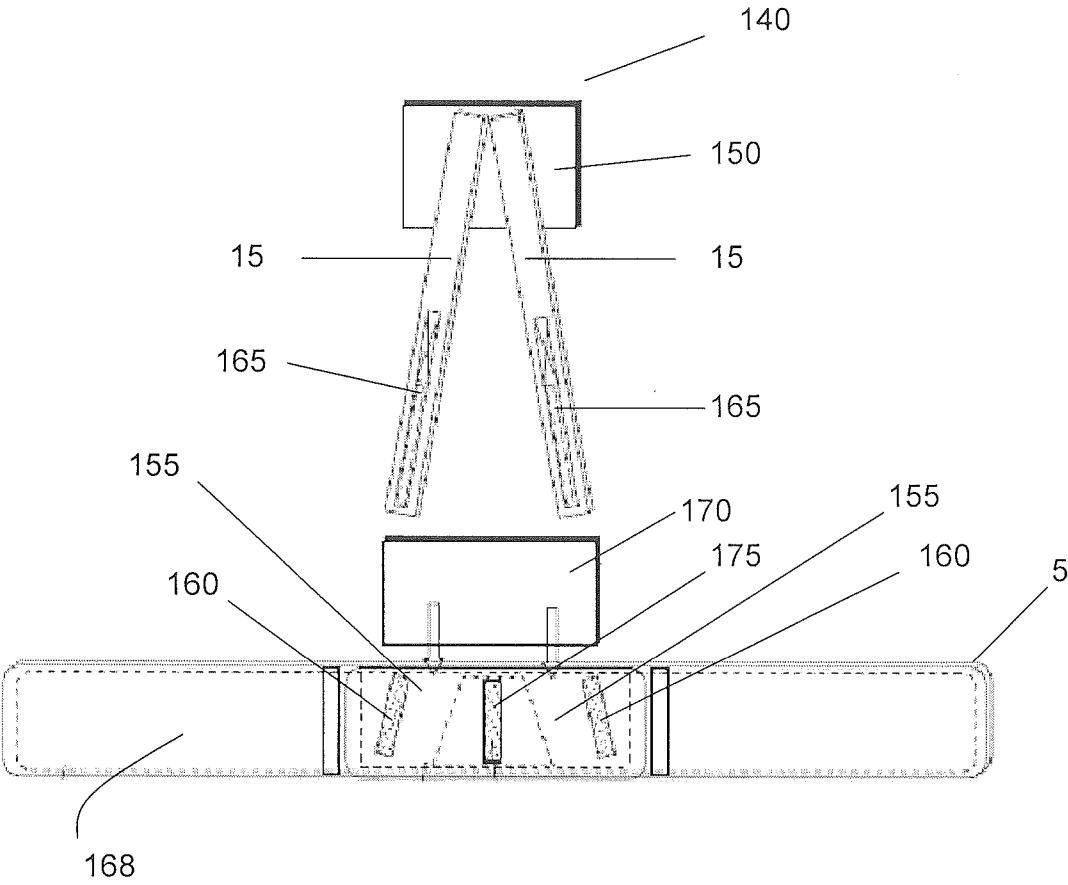
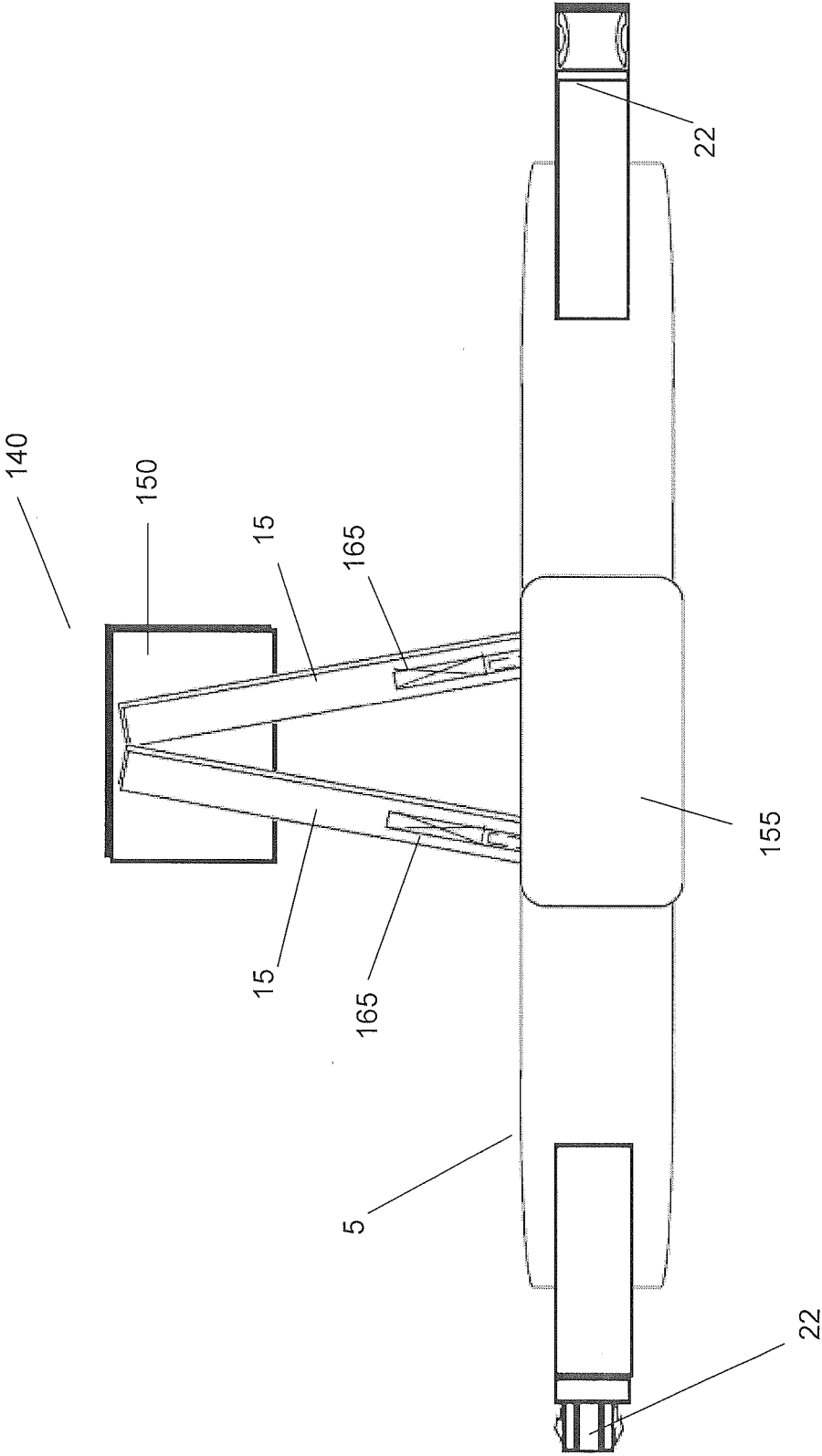


Figure 7a



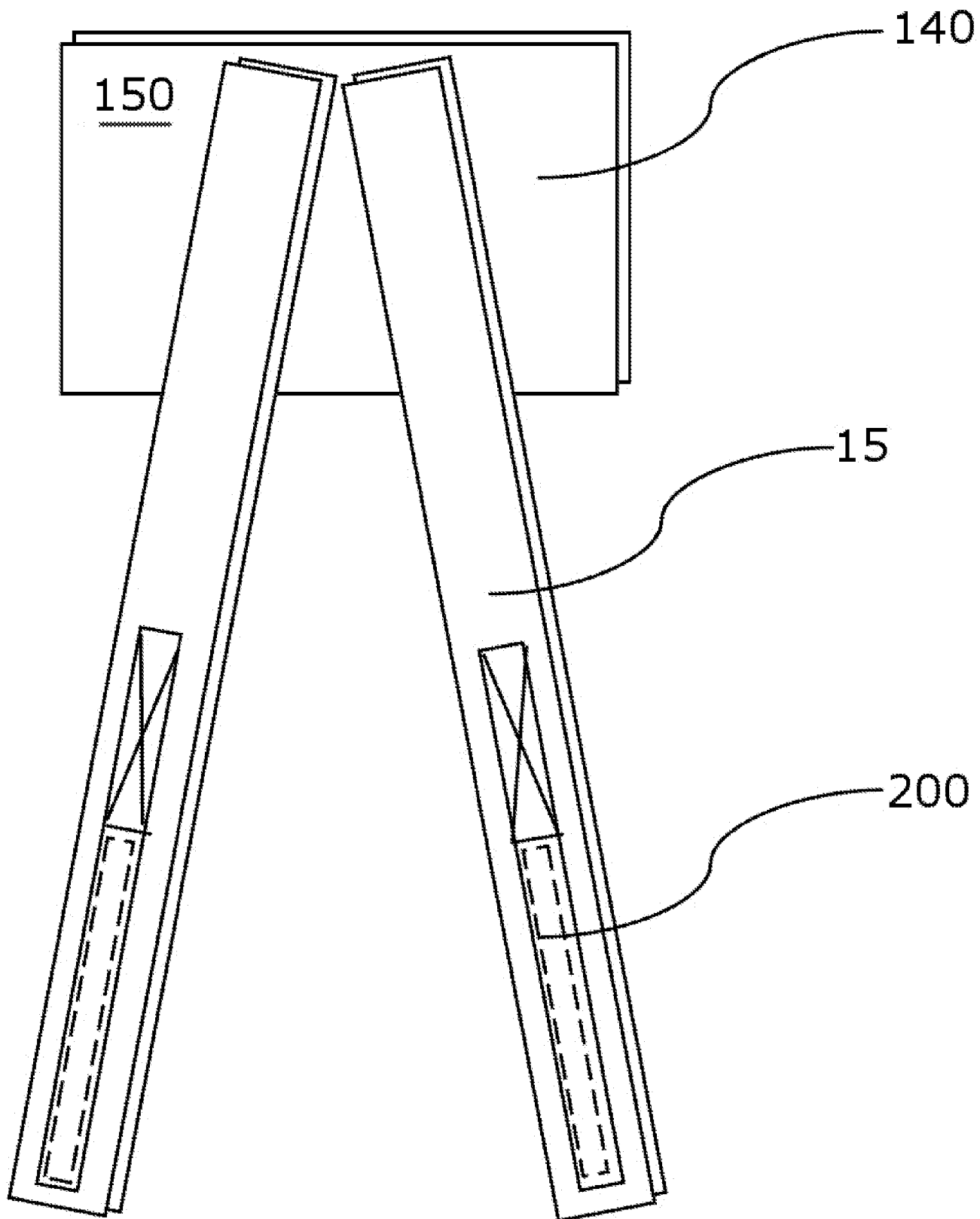
7/17

Figure 7b



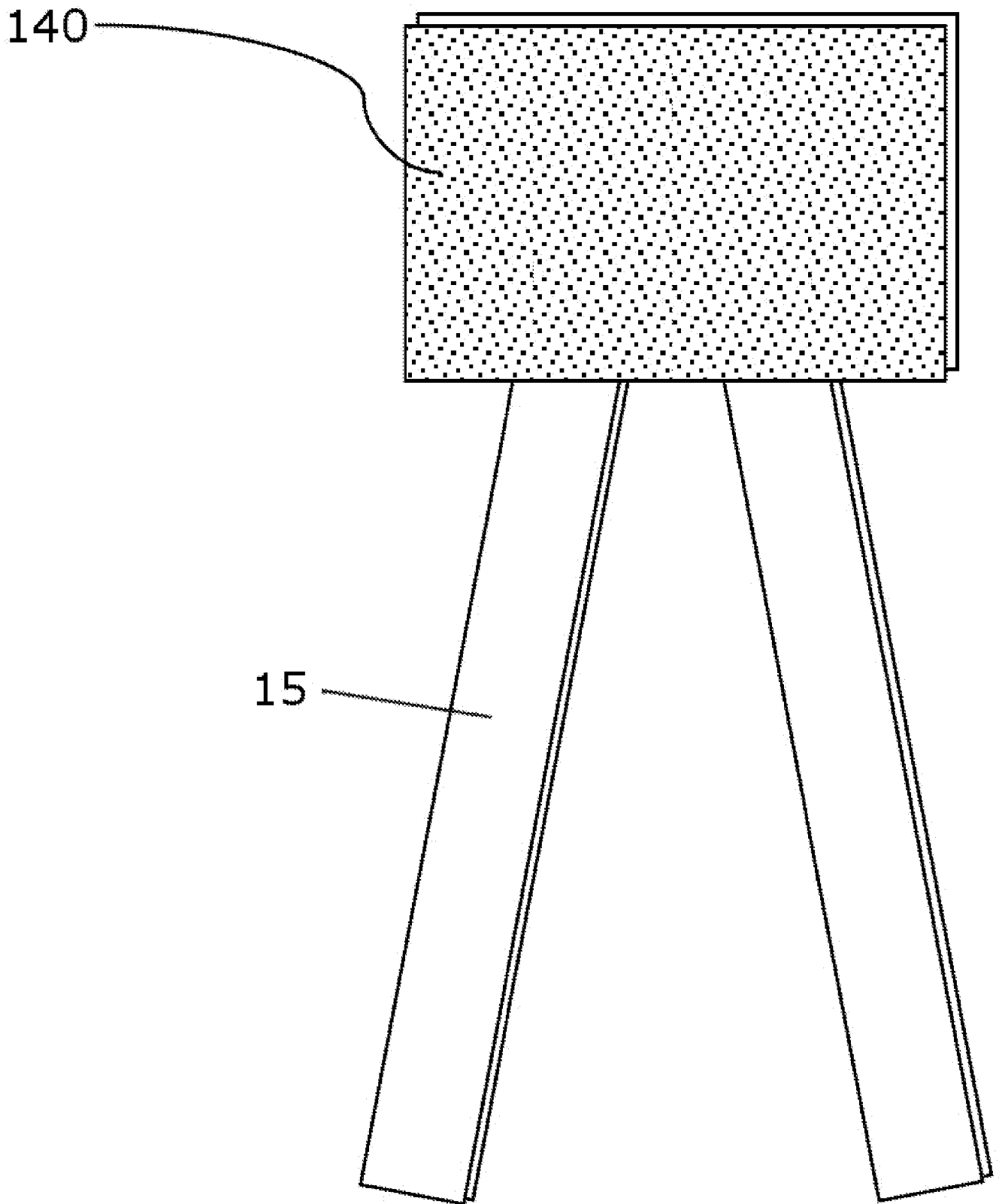
8/17

Figure 7c



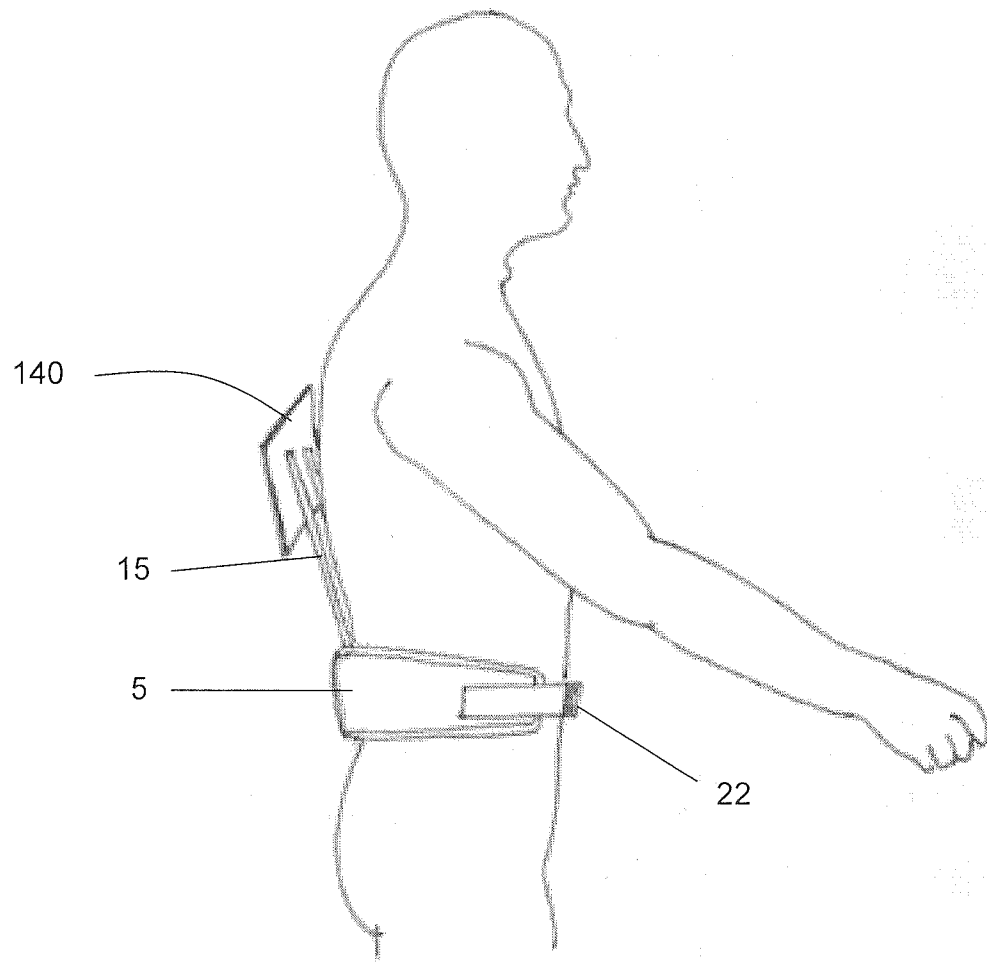
9/17

Figure 7d



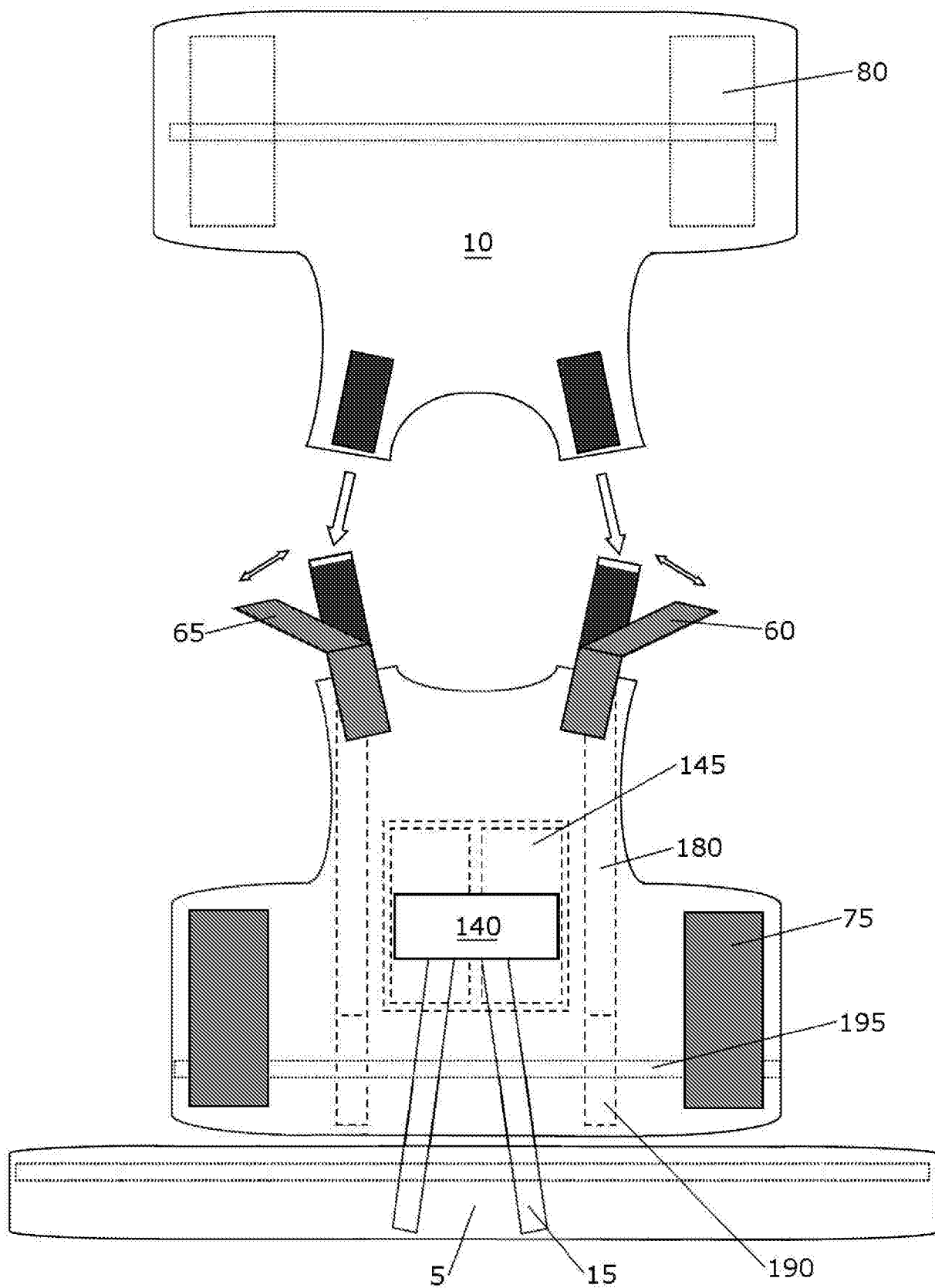
10/17

Figure 7e



11/17

Figure 8



12/17

Figure 9

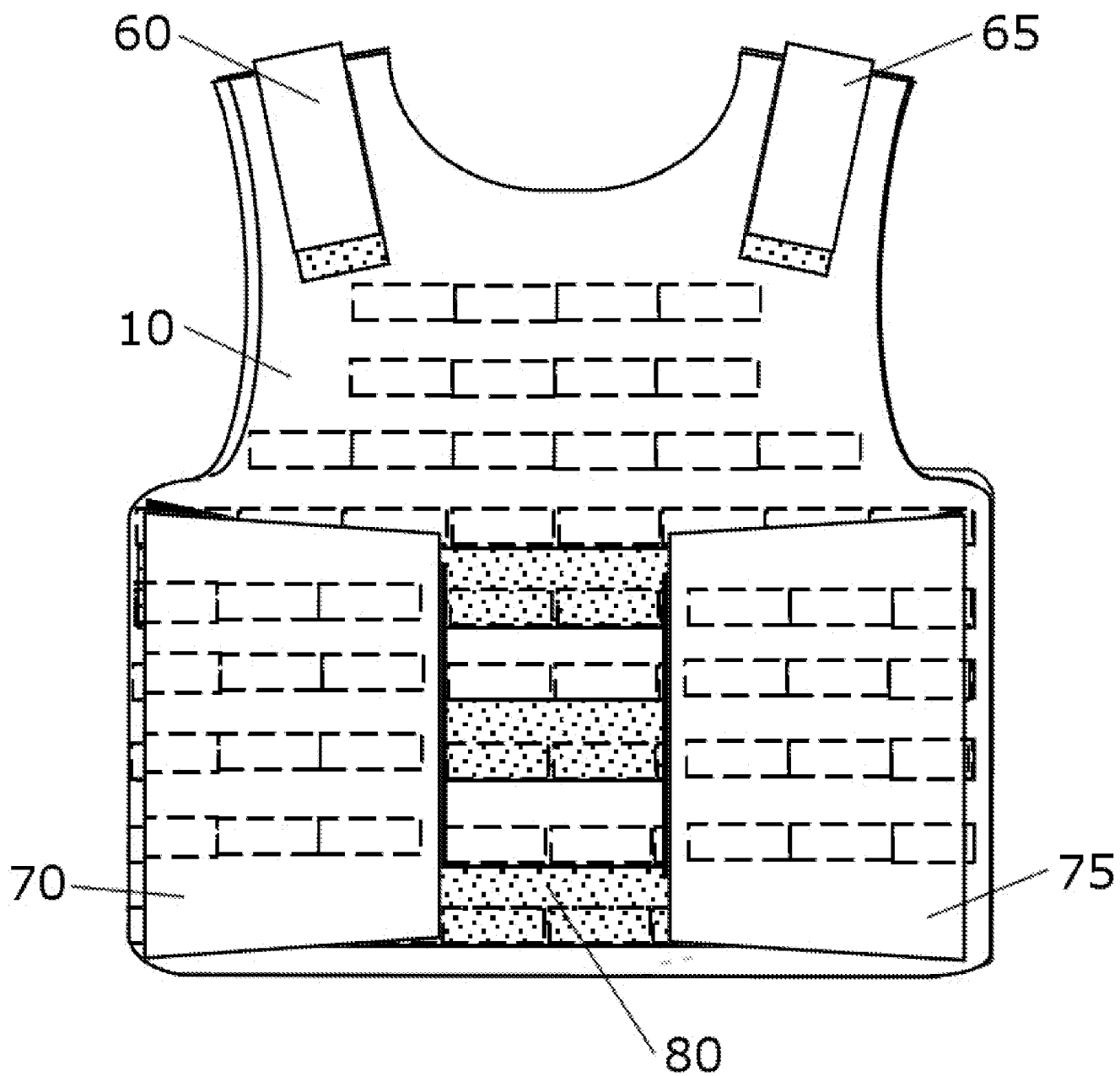
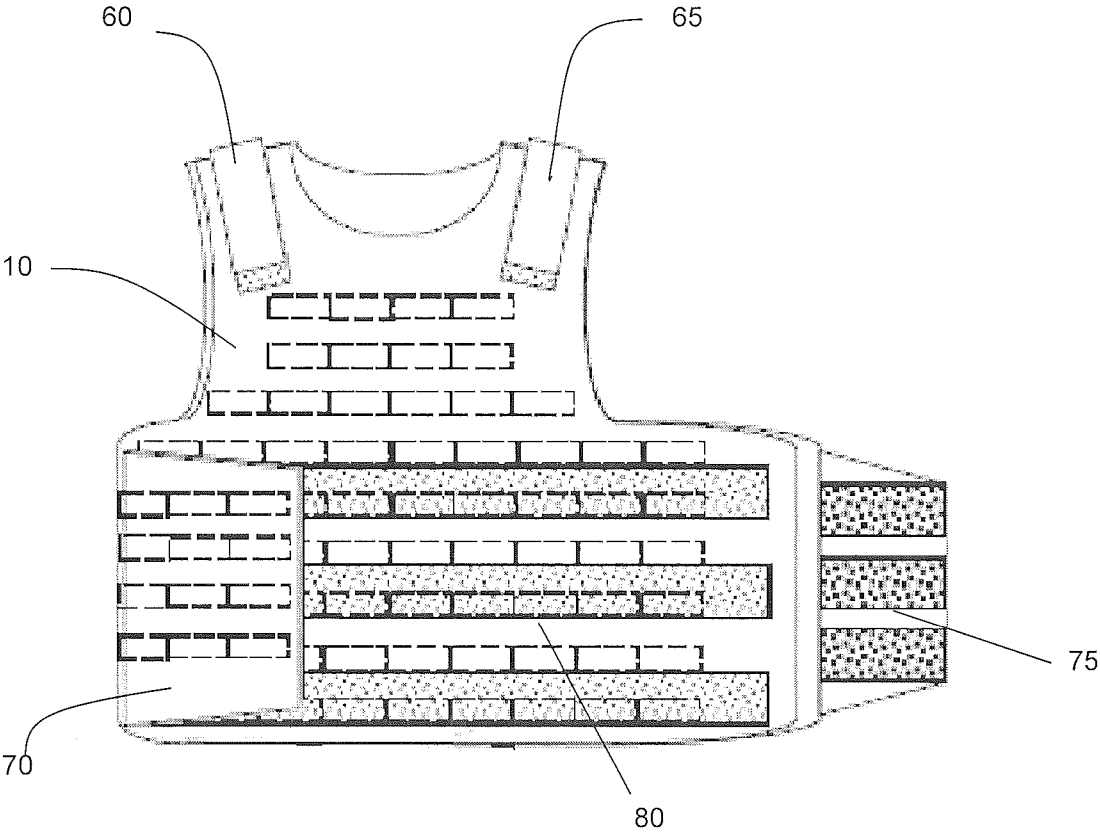
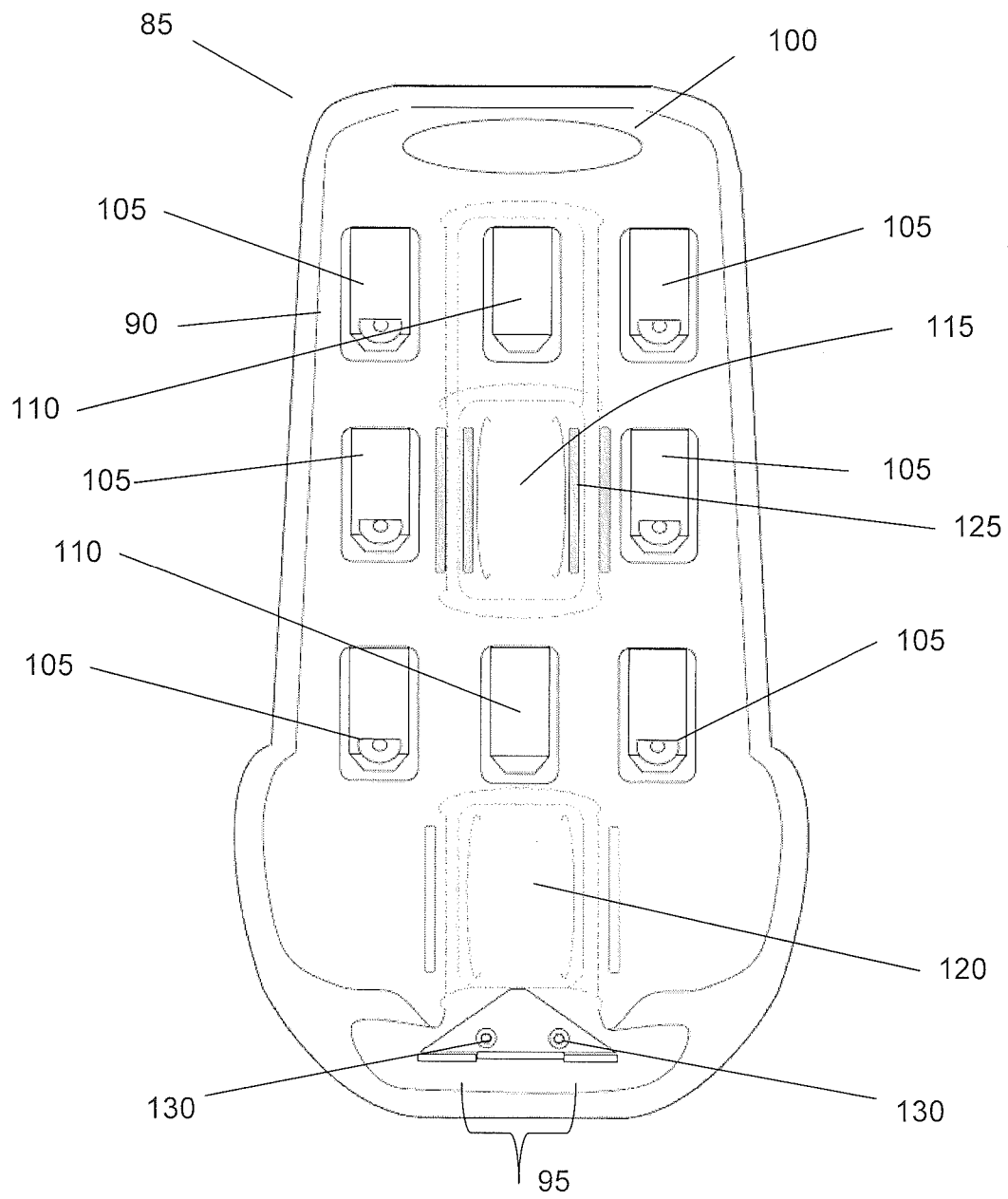


Figure 10



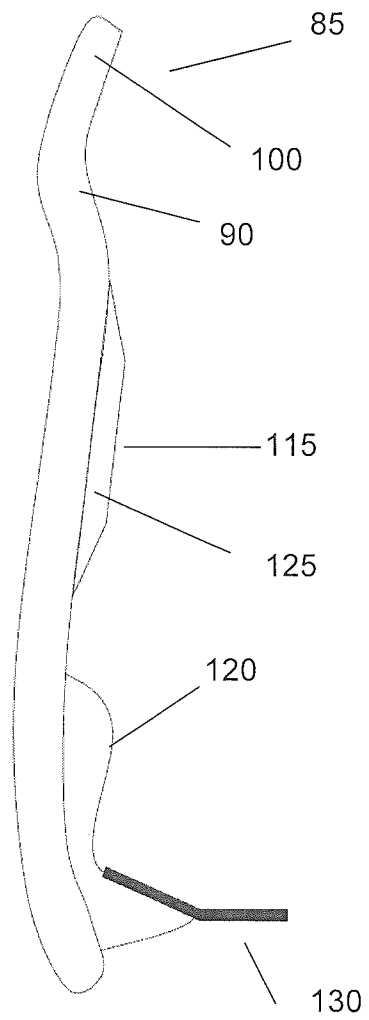
14/17

Figure 11



15/17

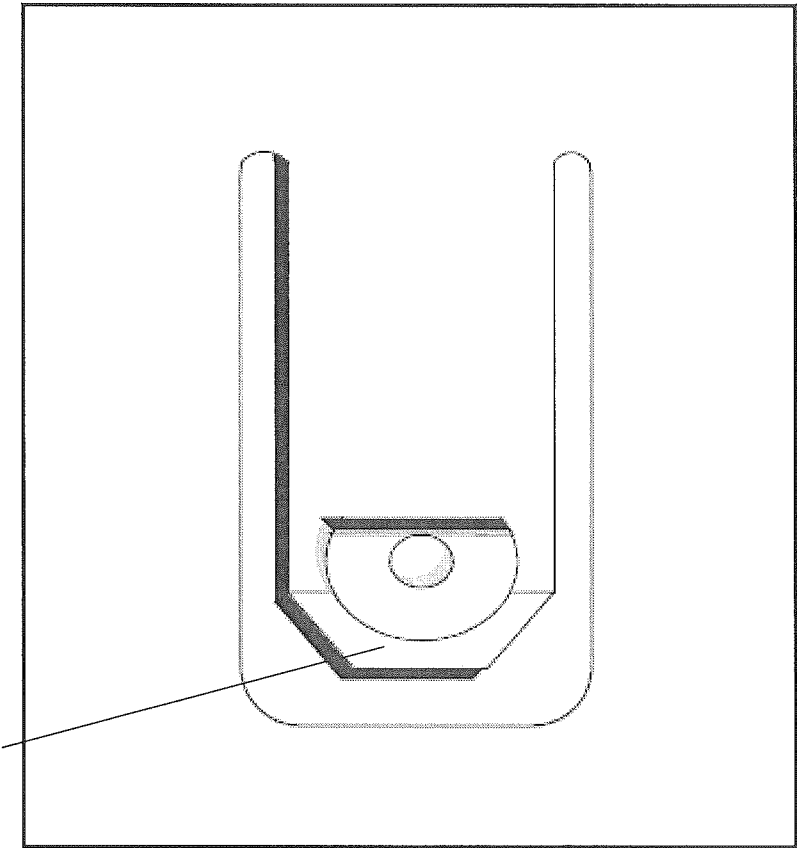
Figure 12



16/17

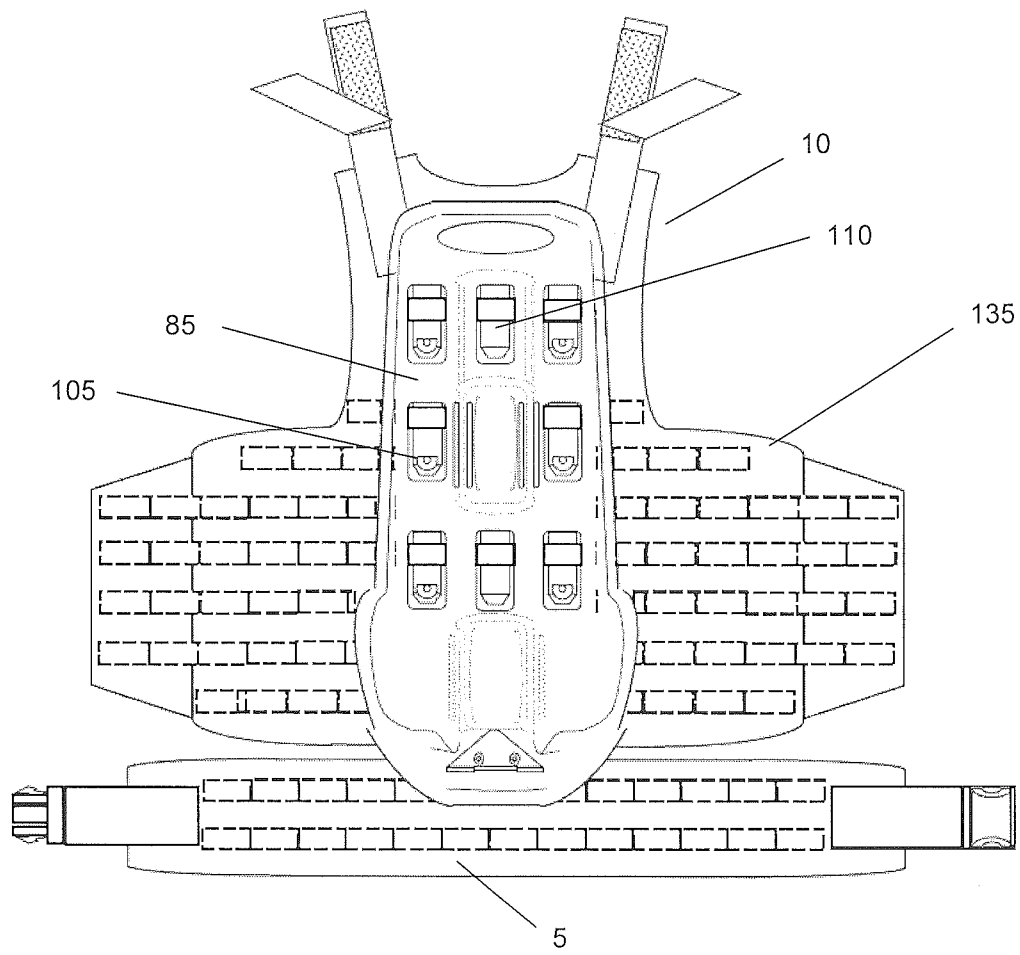
Figure 13

105



17/17

Figure 14



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2013/053314

A. CLASSIFICATION OF SUBJECT MATTER INV. A45F5/02 A45F3/06 A45F3/08 A45F3/10 A63B21/065 A62B9/04 A62B25/00 F41H1/02 A41D13/00 A45F3/04 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) A45F A63B A62B F41H A41D B63C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2012/024924 A1 (HEXELS GERD [DE]) 2 February 2012 (2012-02-02) paragraphs [0013] - [0156]; figures 1-20 -----	1-46
X	WO 2012/152863 A2 (HEXONIA GMBH [DE]; HEXELS GERD [DE]) 15 November 2012 (2012-11-15) page 5, line 16 - page 52, line 8; figures 1-12 -----	1-4,6-46
X	WO 97/49312 A1 (JOHNSON WORLDWIDE ASSOCIATES I [US]) 31 December 1997 (1997-12-31) page 6, line 12 - page 15, line 5; figures 1-19 ----- -/-	1-12, 28-37, 44,45
☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.		
* Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family		
Date of the actual completion of the international search 28 May 2014		Date of mailing of the international search report 06/06/2014
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016		Authorized officer Ionescu, C

INTERNATIONAL SEARCH REPORT

International application No

PCT/GB2013/053314

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 324 731 A2 (PLASAN SASA LTD [IL]) 25 May 2011 (2011-05-25) paragraphs [0003] - [0077]; figures 1-13 -----	1-26, 28-39, 41-46
X	EP 1 654 942 A2 (SAFARI LAND LTD INC [US]) 10 May 2006 (2006-05-10) paragraphs [0004] - [0010]; figures 1-5 -----	13-28, 32-34, 38-43,46

INTERNATIONAL SEARCH REPORT

International application No.
PCT/GB2013/053314

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:
2. ☒ Claims Nos.: 47
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:
see FURTHER INFORMATION sheet PCT/ISA/210
3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

1. ☐ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- ☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- ☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- ☐ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Continuation of Box II.2

Claims Nos.: 47

Rules 6.2(a) and 6.3(a) PCT

The applicant's attention is drawn to the fact that claims relating to inventions in respect of which no international search report has been established need not be the subject of an international preliminary examination (Rule 66.1(e) PCT). The applicant is advised that the EPO policy when acting as an International Preliminary Examining Authority is normally not to carry out a preliminary examination on matter which has not been searched. This is the case irrespective of whether or not the claims are amended following receipt of the search report or during any Chapter II procedure. If the application proceeds into the regional phase before the EPO, the applicant is reminded that a search may be carried out during examination before the EPO (see EPO Guidelines C-IV, 7.2), should the problems which led to the Article 17(2) declaration be overcome.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/GB2013/053314

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2012024924 A1	02-02-2012	DE 102010029035 A1	17-11-2011
		EP 2387909 A2	23-11-2011
		US 2012024924 A1	02-02-2012
		US 2014091124 A1	03-04-2014
WO 2012152863 A2	15-11-2012	DE 102011075683 A1	15-11-2012
		EP 2706884 A2	19-03-2014
		WO 2012152863 A2	15-11-2012
WO 9749312 A1	31-12-1997	AU 3507597 A	14-01-1998
		CA 2258870 A1	31-12-1997
		CN 1225559 A	11-08-1999
		EP 0923325 A1	23-06-1999
		JP 2000513255 A	10-10-2000
		US 5954253 A	21-09-1999
		WO 9749312 A1	31-12-1997
EP 2324731 A2	25-05-2011	AU 2010241472 A1	02-06-2011
		EP 2324731 A2	25-05-2011
		US 2011114684 A1	19-05-2011
EP 1654942 A2	10-05-2006	AU 2005204336 A1	25-05-2006
		CA 2517414 A1	05-05-2006
		EP 1654942 A2	10-05-2006
		JP 2006132076 A	25-05-2006
		NO 326321 B1	10-11-2008
		SG 121939 A1	26-05-2006
		TW I262061 B	21-09-2006
		US 2006096009 A1	11-05-2006