(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 522 250 A1

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
14.11.2012 Bulletin 2012/46

(51) Int Cl.:
A45F 3/08 *(2006.01)*

(21) Application number: **12167916.1**

(22) Date of filing: **14.05.2012**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME

(30) Priority: **13.05.2011 GB 201108119**

(71) Applicant: **Berghaus Limited**
London
W1U 3PH (GB)

(72) Inventors:
- **Bruce, Euan**
  Finchley, Greater London N3 2QL (GB)
- **McGeough, Barry**
  Finchley, Greater London N3 2QL (GB)
- **McGill, Christian**
  Finchley, Greater London N3 2QL (GB)

(74) Representative: **Carter, Stephen John et al**
Mewburn Ellis LLP
33 Gutter Lane
London
Greater London EC2V 8AS (GB)

(54) **Load transfer belt**

(57) The present invention provides a load transfer belt (15) for use with a load carrying apparatus (10), to transfer load from the load carrying apparatus (10) to the hips of a user. The load transfer belt (15) has a plurality of load transfer elements (54) positioned along the length of the belt. Each of the load transfer elements (54) are joined to at least one adjacent load transfer element (54) by a rotational joint (57). The rotational joint (57) defines an axis of rotation transverse to the length (L) of the belt. The rotational joint (57) permits the load transfer belt (15) to encircle a user's body.

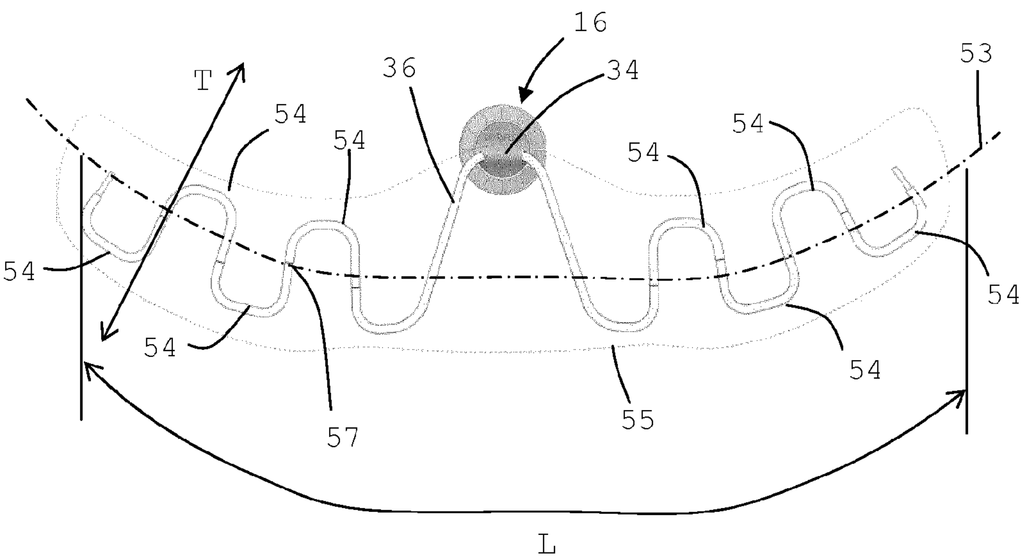

Fig. 16

EP 2 522 250 A1

Description

Field of the invention

[0001] The present invention relates to a load transfer belt for use with a load carrying apparatus to transfer load from the load carrying apparatus to the hips of a user.

Background of the invention

[0002] When rucksacks, a type of load carrying apparatus, were first introduced, the only means for supporting them on a user were shoulder straps. This meant that the load of the rucksack acted only on the shoulders of the user, causing their centre of gravity to move backwards. To compensate for this, the user needed to lean forward when wearing the rucksack. Walking in a leaning position is awkward and tiring, so the user is more easily fatigued, which can result in injury and the inability to traverse the required distance.

[0003] To solve the above problem, rucksacks were introduced which distributed the weight of the load more evenly on the user. One way of doing this was the introduction of hip fins. These were stiff padded elements that were rigidly attached to the frame of the rucksack in a position where they would, during use, rest on the posterior region of a user's hips. The load of the rucksack was then transferred through the frame to both the user's shoulders and the posterior region of the hips. Because the hips are at a lower point, this arrangement stabilised the user's centre of gravity.

[0004] Although stiff fins provide a partial solution to the load transfer problem, stiff fins introduce a disadvantage in terms of comfort of the user. In addition, the size of the pelvis varies from person to person; considering the pelvis to be a truncated cone, the angle of the sides of the cone and the circumference of the cone differs from person to person, particularly between males and females. Thus, the rigid fins are not suited to many pelvis sizes.

[0005] To solve this problem, padded flexible hip belts were introduced. The flexible hip belts provide improved comfort compared to the stiff fins, but their lack of rigidity means they do not effectively transfer load.

[0006] A modified hip belt is disclosed in US 6536641; the hip belt having two rigid plates, one extending either side of a connection with the rucksack along the length of the belt. Also, EP 0570192 discloses a web of stiff plastic mounted in the belt on each side of the connection with the rucksack.

[0007] Accordingly, there is a need to find a balance between efficient transfer of load to a user's hips and the comfort afforded to the user. These are usually considered to be two opposing requirements since an increase in comfort often means an increase in flexibility of the hip belt, which can result in a decrease in load transfer ability and vice versa.

Summary of the invention

[0008] The present invention aims to satisfy what are perceived to be opposing requirements of comfort and enhanced load transfer by providing a load transfer belt that is comfortable for the user and fits a wide range of pelvis sizes, whilst providing enhanced dynamic load transfer from a load carrying apparatus to both the posterior and anterior region of a user's hips.

[0009] Accordingly, in a first aspect the present invention provides a load transfer belt for use with a load carrying apparatus to transfer load from the apparatus to the hips of a user, the load transfer belt having:

a plurality of load transfer elements positioned along the length of the belt;
each load transfer element being joined to at least one adjacent load transfer element by a rotational joint, the rotational joint defining an axis of rotation transverse to the length of the belt, to permit the load transfer belt to encircle a user's body.

[0010] The load transfer elements provide effective load transfer from the load carrying apparatus to the regions of the user's hips that, in use, align with the position of the load transfer elements, whilst the rotational joints permit each load transfer element to rotate by the necessary amount to fit the size of the user's pelvis. This construction permits the load transfer belt to have a range of belt shape configurations to allow the load transfer belt to fit to a wide variety of user body shapes. The provision of a rotational joint provides for freedom of movement instead of the freedom of movement being provided by substantial flexing the load transfer elements. This means that the transfer of load from the load carrying apparatus to the hips of the user is uncompromised.

[0011] The hip belts disclosed in US 6536641 and EP 0570192 do not have load transfer elements connected by a rotational joint. Indeed the belts of the prior art do not have any form of articulated sections, as provided by the present invention. Instead the belts of the prior art provide what is known as living hinges. That is, the load transfer elements themselves flex and conform to the shape of a user's body. As such the load transfer elements of the belts of the prior art need to be more flexible than the load transfer elements of the present invention, i.e. they need to have reduced stiffness.

[0012] A reduction in stiffness of the load transfer elements means they do not achieve the same level of load transfer as accomplished by the present invention. In addition, the comfort of the load transfer belts of the prior art is diminished compared to the present invention because of the need in the belts of the prior art to compromise the flexibility of the load transfer elements so as to achieve both comfort and load transfer.

[0013] The load transfer belt, in use, is positioned to encircle a user's hips, and as such the length of the load transfer belt is measured in terms of the direction of encirclement around the user's hips, the length being measured from a fastener at one end of the belt to a fastener at the other end of the belt. When the belt is used with a load carrying apparatus the majority of the load of the load carrying apparatus is acting in, and therefore the principle loading direction is, a direction transverse to the length of the load transfer belt. A transverse direction means a direction across the width of the belt. A transverse direction may or may not be perpendicular to the length of the belt. Load transfer is achieved by the load transfer elements being formed to have the necessary stiffness in the transverse direction. Stiffness is usually achieved using rigid elements.

[0014] The load transfer elements may extend to an area of the belt corresponding, in use, to the anterior region of the user's hips. Many load carrying apparatus are designed to be positioned on the back (posterior region) of a user. The provision of load transfer elements in an area of the belt corresponding to the anterior region of the hips, permits load transfer from the person's back to the anterior region of the hips. This reduces the load and therefore stress on the lumbar region of the back.

[0015] Preferably, the load transfer elements are joined to form a serpentine configuration. In an embodiment, the load transfer elements may be u-shaped and n-shaped. Preferably, the load transfer elements are u-shaped and n-shaped and are joined so as to have a serpentine configuration.

[0016] The serpentine configuration can be created by an adjacent u-and n-shaped load transfer element. That is, one end of a u-shaped load transfer element connects to one end of an n-shaped load transfer element. The length of the serpentine configuration can be extended by connecting more u- and n-shaped load transfer elements, creating a series of alternating u- and n- shaped elements.

[0017] Advantageously, the serpentine configuration of u-shaped and n-shaped load transfer elements results in sections of the load transfer elements being positioned along a direction transverse to the length of the belt. The alignment of sections of the load transfer elements in the direction of principle loading from the load carrying apparatus further improves load transfer from the load carrying apparatus to the load transfer belt.

[0018] The serpentine configuration is further advantageous because it is lightweight. A user may use the load carrying apparatus to carry heavy loads for long periods of time, therefore, any reductions that can be made to the weight of the load carrying apparatus and load transfer belt will reduce the amount of fatigue a user experiences when carrying the load carrying apparatus.

[0019] The serpentine configuration is also easy to construct. This results in simplified manufacture of the load transfer belt.

[0020] Preferably, the load transfer elements are made from plastic or from metal.

[0021] The serpentine configuration of load transfer elements increases the stiffness of the load transfer belt when compared to load transfer belts of the prior art. In use, (with a load carrying apparatus) in most cases, the load of the load carrying apparatus will distort a load transfer belt in a direction opposite to the direction the load is acting. Referring to Figure 18, in a test, a load transfer belt 15 was fastened at its shortest length in a closed position to create a loop that would in use be positioned around a user's hips. The load carrying apparatus 10 was placed on a flat surface.

[0022] A distance D of 10 cm was measured from the centre of the load transfer belt in a direction opposite to the direction the load would act and perpendicular from the load transfer belt. A calibrated spring balance was then hooked over or through the load transfer belt and whilst the load carrying apparatus was held stationary, the spring balance was pulled to distort the load transfer belt a distance of 10 cm. The load transfer belt of the present invention had a distortion load (i.e. the load required to cause the 10 cm distortion) of more than 4 kg. The distortion load of the tested load transfer belts of the prior art was below 3 kg. Preferred embodiments of the invention will have a distortion load of more than 3 kg.

[0023] Preferably, the belt is linked to the load carrying apparatus using a link member. The link member may be positioned central to the belt. In this case, load transfer elements are positioned on each side of the link member. In the case of load transfer elements having a serpentine configuration, the serpentine configuration is also positioned on each side of the link member.

[0024] The load transfer elements of the serpentine configuration, or otherwise, may be manufactured or arranged such that the spacing between the transverse sections of the load transfer elements are evenly spaced along the serpentine configuration, or along the belt. Even spacing of the transverse sections results in even distribution of load around the load transfer belt. In use, the distribution of load evenly around the hips of a user avoids a high loading in the lumbar region of the back, which is beneficial to the user in terms of improving comfort and limiting fatigue.

[0025] The sections of the serpentine configuration transverse to the length of the belt may have a central axis coincident with the axis of rotation of the rotational joint. Such an arrangement advantageously permits the use of a simple rotational joint, for example, a pivot joint.

[0026] The rotational joint may be a pivot joint for both serpentine and non-serpentine configurations. Optionally, the pivot joint is formed by a male and a female connector. Alternatively, the pivot joint is formed by two male connectors joined by a sleeve. The male-female connector and the two male connector construction of the rotational joint both form a durable joint. The connectors may be formed in the load transfer elements themselves. This advantageously allows the load transfer elements to be easily replaced.

[0027] The load transfer belt may have a panel extending the length of the load transfer belt. The load transfer belt may be padded to further improve comfort for the user. The panel may contain padding for the belt, which may be foam. The load transfer elements may be connected to the panel of the load transfer belt. The panel may connect to the load transfer elements at sections of the load transfer elements orientated along the direction of the length of the belt. In the case of u- and n-shaped load transfer elements, the connection may be at the bottom of the u and the peak of the n shaped elements. The rotational joint may be accessible to the user for ease of replacement of one of the load transfer elements. Alternatively, the load transfer elements may be fully contained within the panel.

[0028] To further improve comfort, preferably the load transfer elements extend a greater distance in a direction transverse to the length of the belt towards the centre of the belt than towards the ends of the belt. In use, this configuration reduces the region at the anterior of the body of the user covered by the load transfer belt.

[0029] The load carrying apparatus may be, for example, any one of: a rucksack, a baby carrier, or a belt pack. The load carrying apparatus may also be back mounted equipment, for example, breathing apparatus.

[0030] In a second aspect, the present invention provides a load transfer element of the load transfer belt of the first aspect.

[0031] In a third aspect, the present invention provides a load carrying apparatus having a load transfer belt according to the first aspect.

[0032] The load carrying apparatus of the third aspect may be, for example, any one of: a rucksack, a baby carrier, or a belt pack. The load carrying apparatus may also be back mounted equipment, for example, breathing apparatus

[0033] In a first option, the load carrying apparatus of the third aspect, further comprises:

a frame;
a rotary connection between the load transfer belt and the frame; and
a hinge connection between the load transfer belt and the frame;
wherein the rotary connection permits the belt to rotate about a rotary axis of rotation and the hinge permits the belt to rotate about a hinge axis of rotation, the hinge axis of rotation being perpendicular to the rotary axis of rotation. As a person (the user) walks, their hips rock from side to side. The provision of a rotary connection advantageously allows the load transfer belt to rotate with the up and down movement of the hips, whilst the hinge connection permits the belt to stay in the same position when the user leans forwards. The provision of a rotary connection distinct from a hinge connection permits the belt to move independently in each of the two degrees of freedom. This independence of movement in each degree of freedom is important because it prevents motion that would cause a transfer of unbalanced load from the load carrying apparatus to the user. Therefore, the load carrying apparatus of the present invention increases the user's feeling of control.

[0034] The load transfer apparatus of the prior art, either provide only a single degree of freedom, through the means of a pivot point, or provide three degrees of freedom though the use of a ball and socket joint. The pivot joint is disadvantageous compared to the present invention, because the advantages of the hinge connection when the user is leaning forward are not realised.

[0035] The ball and socket joint is disadvantageous compared to the present invention because the belt is free to rotate in any direction when a person is walking. This means the belt is able to rotate around the body of a person, this causes the load of the load carrying apparatus to rock between an anterior and posterior position in relation to a user's back, whilst a user is walking. I.e. the load of the load carrying apparatus rocks from side to side, rolling around the body, about an axis in the longitudinal direction (height) of the user. This creates a feeling of unbalance when using the load carrying apparatus. In the present invention, the majority of the rotary motion of the belt, whilst a user is walking, is about the rotary axis of rotation, which prevents the unwanted motion experienced with a ball and socket joint. The provision of a distinct hinge and rotary connection is also beneficial because preventing rotation about an axis in a longitudinal direction with respect to the user's height prevents the feeling of the load carrying apparatus pulling the user down (as the load rolls around the body) when the user bends forwardly to one side, for example, whilst scrambling over rocks.

[0036] Further advantageously, the prevention of unwanted motion (rolling of the load around the body) of the load carried by the load carrying apparatus when a person is walking, but permitting a required range of motion (around the rotary axis of rotation) when walking, means that the energy required to travel a certain distance is reduced when compared to conventional load carrying apparatus. The provision of the aforementioned connection between the load carrying apparatus and the load transfer belt in combination with the load transfer belt of the present invention, further improves efficiency of movement for the user, reducing the energy input required to move a certain distance when compared to load carrying apparatus of the prior art. The combination also allows the load carrying apparatus to be used to carry a heavier load than load carrying apparatus of the prior art.

[0037] In summary, the present invention provides connections between the load carrying apparatus and the load transfer belt that permit unrestricted motion of the load transfer belt (without transferring the motion to the load carrying apparatus), within a range of motion required by the user, and at the same time prevent unwanted motion. This has the result of improved balance and increased energy efficiency of a user.

[0038] In some embodiments, the rotary connection permits the load transfer belt to rotate 360° or more about the rotary axis of rotation, in both a clockwise and an anticlockwise direction. The load transfer belt can rotate a certain degree in one direction and then the rotation can be reversed to the other direction. In some embodiments, the hinge connection permits the load transfer belt to rotate 180° or more about the hinged axis of rotation. In this case, the only practical restriction of movement about the rotary axis of rotation and/or the hinge axis of rotation is the physiology of the user's body.

[0039] Preferably, the rotary axis of rotation is offset above the hinge axis of rotation. Optionally, the rotary connection and the pivot connection are connected. In this case, the rotary axis of rotation can be offset above the hinge axis of rotation such that the rocking motion of the user's hips whilst walking is transferred to the connection at the hinge. This causes the hinge connection to rotate about the rotary axis of rotation. Advantageously, this offset arrangement improves the transfer of rotary motion from a user's hips to the rotary connection. A further additional or alternative option is to offset the rotary axis of rotation above the centre of the load transfer belt. Advantageously, offsetting the rotary axis of rotation from the centre of the load transfer belt permits the belt to move with a rocking motion rather than a purely rotational motion; a rocking motion much more closely resembles the natural movement of the hips.

[0040] The rotary connection only permits substantial rotation about a single axis. In a preferred embodiment, the rotary connection comprises a housing and a hub positioned within a cavity of the housing. The housing is dimensioned such that the hub and the housing can rotate relative to each other. This arrangement of rotary connection only permits movement in one degree of freedom; that is, rotation about the rotary axis of rotation. The relative rotary motion may be provided by rotation of the hub within the cavity of the housing with the housing stationary with respect to the load carrying apparatus. Alternatively, the hub may be stationary with respect to the load carrying apparatus and the housing may rotate. The hub may be a disc. Advantageously, this arrangement of rotary connection has a low profile projection from the frame of the load carrying apparatus. For example, the projection from the frame is lower for the present arrangement of rotary connection than a ball and socket joint.

[0041] Preferably, the hinge is located on the hub. Locating the hinge on the hub improves the transfer of load from the load carrying apparatus to the load transfer belt. Optionally, the hinge and hub may be formed as a single connection component. Such a construction further improves the ease of manufacture of the rotary and hinge connection. Optionally, the hinge may be located on the hub and the rotary axis of rotation may be offset above the hinge axis of rotation. In this case, the hip belt moves with a modified rocking motion which more closely resembles the natural movement of the hips.

[0042] The load carrying apparatus may further comprise a link member linking the load transfer belt to the hub.

[0043] In a second option, the load carrying apparatus of the third aspect may further comprise:

a frame; and
a rotary connection between the load transfer belt and the frame;
wherein the rotary connection comprises a housing and a hub positioned within a cavity of the housing, such that the hub and housing can rotate relative to each other about a rotary axis of rotation; and the rotary axis of rotation is offset above the centre of the load transfer belt.

[0044] Advantageously, this arrangement of rotary connection only permits substantial movement in one degree of freedom; that is, rotation about the rotary axis of rotation. This prevents the load of the load carrying apparatus from rocking between an anterior and posterior position when a user is walking. This advantage is not achieved by a simple pivot joint or ball and socket joint of the prior art.

[0045] Advantageously, the offset of the rotary centre of rotation above the centre of the load transfer belt creates a rocking motion rather than a purely rotational motion about the rotary axis of rotation. A rocking motion much more closely resembles the natural movement of the hips.

[0046] The load carrying apparatus may comprise a link member linking the load transfer belt to the rotary disc.

[0047] In a third option, the load carrying apparatus of the third aspect may further comprise:

a frame; and
a rotary connection between the load transfer belt and the frame;
wherein the rotary connection comprises:

a housing and a hub positioned within a cavity of the housing, such that the hub and housing can rotate relative to each other about a rotary axis of rotation; and
a link member linking the load transfer belt to the hub or the housing.

[0048] Advantageously, this arrangement of rotary connection only permits substantial movement in one degree of freedom; that is, rotation about the rotary axis of rotation. This prevents the load of the load carrying apparatus from rocking between an anterior and posterior position when a user is walking. This advantage not achieved by a simple pivot joint or a ball and socket joint of the prior art.

[0049] Optionally, the link member is offset below the rotary axis of rotation. The link member advantageously transfers the load from the load carrying apparatus to the load transfer belt, whilst also transferring the rotary motion of the load transfer belt, resulting from the motion of the hips, to the rotary connection. The offset of the link member below the rotary axis of rotation modifies the motion of the belt to a modified rocking motion that much more closely resembles the natural motion of the hips.

[0050] The load carrying apparatus of the second and third options may further comprise a hinge connection between the load transfer belt and the frame, the hinge permitting the belt to rotate about a hinge axis of rotation, and wherein the hinge axis of rotation is perpendicular to the rotary axis of rotation.

[0051] As explained for the first option, the provision of a rotary connection distinct from a hinge connection permits the belt to move independently about the two axes of rotation. This independence of movement in each degree of freedom is important because it prevents motion that would cause a transfer of unbalanced load to the user. Therefore, the load carrying apparatus of the present invention increases the user's feeling of control, and reduces the energy input required by the user to walk a certain distance.

[0052] In some embodiments, the rotary connection permits the load transfer belt to rotate 360° or more about the rotary axis of rotation, in both a clockwise and an anticlockwise direction. The load transfer belt can rotate a certain degree in one direction and then the rotation can be reversed to the other direction. In some embodiments, the hinge connection permits the load transfer belt to rotate 180° or more about the hinged axis of rotation. In this case, the only restriction of movement about the rotary axis of rotation and/or the hinge axis of rotation is the physiology of the user's body.

[0053] For the embodiments of the load carrying apparatus having a rotary axis of rotation offset above the centre of the load transfer belt, it is preferred that the rotary axis of rotation is positioned to correspond, in use, to an axis of rotation about which the hips rock when a user is walking. Preferably, the rotary axis of rotation is offset above the centre of the load transfer belt by a distance of between 6 and 10 cm.

[0054] The following features are modifications that can be added or made to the load carrying apparatus of the first, second or third options having a hinge connection.

[0055] The link member may be a pole. The link member may be one pole, or alternatively the link member may be one or more poles. Preferably, the hinge is a channel dimensioned to receive the one or more poles.

[0056] The channel and hub may be moulded as a single component. Alternatively, the channel and the hub may be formed as separate components that snap-fit together. In a further alternative, the channel and hub may be formed as separate components and connected together using joining members. Joining members can be, for example, bolts, self tapping screws, captive nuts or rivets. In the embodiment in which the link member has two or more poles, two of the poles may join in the channel. The joint may be formed using a screw connection. Alternatively, the joint may be formed using a male-female connection. In a further alternative, or additionally, the joint may be formed using a tight-fit tube to link the two poles. The tight-fit tube may be made from plastic.

[0057] The following features are optional features of the any of the first, second or third options.

[0058] The load carrying apparatus may further comprise two shoulder straps for supporting the load carrying apparatus on the user's shoulders.

[0059] The frame of the load carrying apparatus may be constructed using metallic or plastic frame elements. Alternatively, the frame of the load carrying apparatus may be constructed from a plastic sheet. Optionally, the frame may be constructed from a plastic sheet strengthened with metallic or plastic elements. Preferably, the frame converges at the rotational connection, to permit efficient load transfer from the load carrying apparatus to the load transfer belt. Advantageously, such a frame construction effectively transfers load to the belt, but is also lightweight. To further decrease the weight of the frame, the frame members may be tubular.

[0060] Optionally, the frame can be curved. The lower region of the frame, below the rotary connection, may bend away from the load transfer belt. Such a curve will improve the freedom of movement of the belt relative to the frame.

[0061] The load carrying apparatus may further comprise locking straps connecting the load transfer belt to the rear of the load carrying apparatus. The locking straps may be adjustable so that the user can set the range of movement around the rotary axis of rotation that suits their gait and/or comfort requirements or to prevent rotation all together.

Brief Description of the Drawings

[0062] Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings in which:

Figure 1 shows schematically a rear view of a load carrying apparatus;

Figure 2 shows schematically a frame of the load carrying apparatus of Figure 1;

Figure 3 shows schematically the frame of Figure 2;

Figure 4 shows schematically the central connection of frame components of the frame of Figures 2 and 3;

Figure 5 shows schematically a side view of the frame of

Figures 2 and 3;

Figure 6 shows schematically an exploded side view of the rotary connection and hinge connection of the load carrying apparatus of Figure 1;

Figure 7 shows schematically a side view of the rear component of the rotary connection of Figure 6;

Figure 8 shows schematically a side view of the front component of the rotary connection of Figure 6;

Figure 9 shows schematically the hub of the rotary and hinge connection of Figure 6;

Figure 10 shows schematically a front view of the rotary and hinge connection of Figure 6 illustrating positioning the link member through the hinge connection;

Figures 11 to 13 show schematically optional steps in positioning the link member through the hinge connection of Figure 6;

Figure 14 shows schematically a side view of a rotary connection and a hinge connection of Figure 6;

Figure 15 shows schematically a front view of the rotary and hinge connection of Figure 6 and 14;

Figure 16 shows schematically the load transfer belt of the load carrying apparatus of Figure 1; and

Figure 17 shows schematically an exploded view of load transfer elements of the load transfer belt of Figure 16.

Figure 18 shows schematically a test for measuring the distortion load of a load transfer belt as performed on the load carrying apparatus of the present invention.

Detailed Description

[0063] Figure 1 shows schematically a rear view of a load carrying apparatus 10, which in this example is a rucksack. The rucksack of the present example can carry loads in excess of 32 kg. The rucksack has two rear panels 11 and 14 within which a frame 18, not shown in Figure 1, is orientated. The frame extends the height of the rucksack to provide a rigid support to the rucksack. A load carrying compartment, not shown in Figure 1, is secured to the frame and extends to the front of the rucksack. Two shoulder straps 12, partially shown in Figure 1, extend from a connection with the frame, in an upper region of the rucksack, to a lower region of the rear of the rucksack. In use, the shoulder straps support the rucksack on a user's shoulders. A load transfer belt 15 is positioned in the lower region of the rucksack, such that in use the belt can be positioned to encircle a user's hips, for transferring load from the rucksack to the user's hips. A rotary connection 16 and a hinge connection 34 (the hinge connection not shown in Figure 1) connect the load transfer belt to the frame. The rotary connection is positioned between 6 and 10 cm above the centre of the load transfer belt. Rear panel 14 extends to cover the frame, the connection of the shoulder straps to the frame, and the connection of the rotary and hinge connections to the frame.

[0064] Referring to Figures 2 and 3, the frame 18 comprises six tubular poles 19. The frame construction is such that a curved tubular pole 19a forms the upper extent of the frame, and a curved tubular pole 19b forms the lower extent of the frame. Each side of the frame is constructed using two poles 19c, 19d, 19e and 19f, such that each side can converge to the central region of the framed volume. The poles 19e and 19f forming the sides of the frame in the upper region of the frame are longer in length than the poles 19c and 19d forming the sides of the frame in the lower region of the frame, such that the poles on the sides of the frame can converge in a region corresponding to the lumbar region of the back. The poles at the upper and the lower extent are joined to the poles at the sides of the frame using connectors 20. Each connector 20 has a channel sized to tightly receive a tubular pole of the frame. The converging side poles are adjoined using a rear component 22 of the housing of the rotary connection 16. The rear component having two channels 24 configured to tightly receive each of the longer and shorter side poles. Referring to Figure 4, the poles are held in the channels using a recess 26 in the pole, which corresponds to, and when assembled engages with, a protrusion 28 in the channel. Referring to Figure 5, the side tubular components of the frame are curved such that the lower region of the frame, below 17 where the rotary connection connects the frame, bends away from the load transfer belt.

[0065] Figure 6 shows schematically a side exploded view of the rotary connection and the hinge connection of the rucksack of Figure 1. The rotary connection is formed by a rear component 22 and front component 30 that join together (in this example with a screw connection) to form a housing, and the housing has a cavity in which a hub 32, which in the present example is a disc, can be positioned. The cavity is dimension such that the hub is free to rotate within the cavity. Referring to Figures 7 and 8, the screw connection is created by a threaded rim 40 on the front side of the rear component, the rim having a diameter greater than the diameter of the disc (the hub), and a threaded recess 42 of the front component; the threaded rim screwing into the recess to complete the screw connection. In an alternative embodiment, the thread rim could be on the front component and the threaded recess on the rear component. Alternative methods of connection could also be used to adjoin the front and rear components of the housing.

[0066] The hub 32 is supported in the cavity of the housing by a lip 43 that extends around the circumference of the front component and has an internal diameter less than the hub. Advantageously, this lip prevents extensive lateral movement of the hub, restricting it, in use, to rotation about a single axis of rotation. However, the use of a hub 32 inside the cavity of a housing, with no additional restrictions, means that in this example, the hub can be freely rotated by a full 360° for a limitless number of rotations in both a clockwise and anti-clockwise direction.

[0067] The rear component 22 and front component 30 of the housing, and the hub 32 may be manufactured from a high-strength, low-friction or self lubricating plastic. Suitable plastics include polyamides.

[0068] Referring again to Figure 6, the hinge connection 34 is formed on the hub 32 of the rotary connection. The hinge connection is formed by a link member 36 being received in a channel 38 formed by arch 34. In the example shown in Figure 6, the hub and channel are formed as a single component, by plastic moulding. In an alternative construction, the channel can be formed in a separate arched component that is connectable to the hub, an example of which is shown in Figure 9. In this example, the hub 32 is formed with a rectangular hole 44; the hole having stepped sides. The separate arched component has stepped feet 47 and 48. The feet of the arched component interlock with the steps 46 of the sides of the hole to secure the arched component in the hole of the hub. That is the arched component is a snap-fit to the hub. However, alternatively, the arched component may be connected to the hub using bolts, self tapping screws, captive nuts or rivets. For example, 5 bolts may attach the arched component to the hub; two bolts on one elongate side of the channel and three bolts on the other elongate side of the channel.

[0069] The link member 36 received in the channel 38 can be formed as a single component or as two connectable segments. In the case of the link member being formed as two connectable segments, the two segments can connect in the channel, as illustrated in Figure 10. The connection can be formed using a male and female connector 50, or alternatively using a screw connection. In a further alternative, as shown in Figures 11 to 13, the connectable segments of the link member could be connected using a tubular connector 52. The tubular connector 52 can be formed from plastic and dimensioned to tightly fit over the ends of the two segments of the link member, so as to hold them together. The tubular connector is also dimensioned to rotate freely, with the link member, in the channel 38. In an alternative method of construction, the two segments could be joined by a tubular connector fitting around two male connectors.

[0070] Referring to Figures 14 and 15, in use, the rotary connection 16 will permit the link member 36 to rotate about a rotary axis of rotation 33; the rotary motion is illustrated by arrow B (shown in Figure 15). The hinge connection 34 permits the link member 36 to rotate about a hinge axis of rotation 35. The movement of the link member about the hinge axis of rotation is illustrated by arrow A (shown in Figure 14). The rotary axis of rotation is offset 37 above the hinge axis of rotation.

[0071] As shown in Figure 16, the link member 36 connects the rotary connection 16 and the hinge connection 34 to the load transfer belt 15. The load transfer belt has a panel, the perimeter of which is defined by dotted line 55, which also defines the edge profile of the belt. Optionally, the panel is padded, for example with foam, to improve comfort of the user.

[0072] The belt has a central axis 53 and a length L. The length L is measured from a distance of a fastener (not shown) at one end of the belt to the fastener at the other end of the belt. The position of a fastener is preferably adjustable. For example, the fastener may be attached to the load transfer belt using an adjustable strap. Accordingly, the length of the belt is variable. Connected to the panel is a series of load transfer elements 54. In this example there are four load transfer elements connected to either side of the link member 36, but in other examples there could be a different number of load transfer elements on either side of the link member, and/or there could be two, three or five or more load transfer elements on each side of the link member. The load transfer elements are each formed separately so as to form a series of joined but distinct load transfer elements. The joint 57 (only one joint is numbered in Figure 16 for clarity) between each load transfer element is rotational. The series of connected load transfer elements forming a load transfer belt having articulated sections.

[0073] As shown in Figures 16 and 17, each load transfer element 54 is "u" or "n" shaped, joined alternately to form a serpentine configuration. Referring to Figure 17, the serpentine configuration is formed by one end of an n-shaped load transfer element 54a being joined to one end of a u-shaped load transfer element 54b. In this case, the joint is a pivot joint, formed by a male connector 56 being received by a female connector 58. The serpentine configuration can be extended by joining more u-shaped and n-shaped load transfer elements to the series of load transfer elements. The pivot joint formed by the male and female connectors of the u- and n-shaped load transfer elements is a rotational joint. In an alternative example, the pivot joint is formed by two male connectors and a sleeve positioned over both male connectors.

[0074] Referring again to Figure 16, the arrangement of the load transfer elements 54 along the length L of the load transfer belt 15 is such that the load transfer elements have sections in a direction T transverse to the length of the belt. In this case, the transverse direction is perpendicular to the length of the belt. However, transverse does not have to be perpendicular; a transverse direction is a direction that crosses the length direction. In the serpentine configuration of this example, the legs of the "n" and the arms of the "u" are transverse to the length of the belt. The load transfer elements are formed such that when joined to adjacent load transfer elements, the transverse sections of the load transfer elements are equally spaced. The pivot joint joining the load transfer elements defines an axis of rotation which is also transverse to the length of the belt. Indeed, the male and female connections (or alternatively the two male connections) at the ends of the load transfer elements means that the axis of rotation is coincident with the transverse sections of the load transfer elements.

[0075] Although not shown in this example, the load transfer elements 54 can be dimensioned and arranged such that the load transfer elements towards the centre of the load transfer belt extend a greater distance in the transverse direction T than the load transfer elements at the ends of the belt. This construction improves comfort of the user.

[0076] Each load transfer element 54 may be made from a metal tube, or they may be formed from plastic, optionally reinforced plastic.

[0077] As discussed previously, a link member 36 links the load transfer belt 15 to the rotary connection 16 and hinge connection 34. The link member is linked to the load transfer belt using a joint between the link member and two load transfer elements 54. In one example, the link member is made of two components which connect in the centre of the hinge connection. Each component of the link member extends to one side of the load transfer belt and joins to an n-shaped load transfer element. The joint is a rotational joint formed by a male connector on the link member being received by a female connector of the n-shaped load transfer element. Alternatively, a female connector of the link member can receive a male connector of the load transfer element.

[0078] Referring to Figure 13, a security panel 51 may be attached to the panel of the load transfer belt 15. The security panel is shaped to closely resemble a portion of the edges of the link member 36. In this case, the security panel is a trapezoid shape, the side edges of which follow the profile of the link member. The close fit size of the security panel compared to the link member adds reinforcement to the link member to prevent the two components of the link member from separating.

[0079] The load transfer elements 54 can be secured to the panel of the load transfer belt 15 using loops, for example fabric loops, connected to the panel. The load transfer elements 54 can be fitted through the loops. Preferably, the loop is positioned at the peak of the n-shaped load transfer elements and the bottom of the u-shaped load transfer elements. In this way the rotational joints joining the load transfer elements are easily accessible. Thus easy replacement or repair of the load transfer elements is permitted. The loops can also be dimensioned to further secure the load transfer elements so as to prevent the elements separating. In an alternative embodiment, the load transfer elements are fully covered by the panel, such that the panel prevents the elements from separating.

[0080] In use, the shoulder straps 12 are placed over the user's shoulders and the load transfer belt 15 is positioned around the user's hips. The shoulder straps transfer load from the rucksack 10 to the shoulders of the user, and the load transfer belt transfers load from the rucksack to the hips of the user.

[0081] When a user walks with (and without) the rucksack 10, their hips rock from side to side. The provision of a rotary connection 16 between the load transfer belt 15 and the frame 18 permits rotation about the rotary axis of rotation 33 with the movement of the user's hips. A person often needs to bend or lean whilst wearing the rucksack, and the provision of a hinge connection permits the link member 36 to rotate about the hinge axis of rotation 35, which enables the belt to stay in a set position when a person leans forwards, improving both comfort and balance of the user.

[0082] The rotary and hinge connection are formed distinct from each other, such that when a person is walking the rotation of the belt is substantially about the rotary axis of rotation 33, and when a person is leaning forwards, the rotation of the belt is substantially about the hinge axis of rotation.

[0083] The movement of the belt 15 when a person is walking is a modified rocking motion that closely resembles the movement of the hips. This movement is produced by a combination of rotation about the rotary axis of rotation 33, the offset 37 of the connection of the link member to the rotary connection (in this case by the hinge connection), and the offset of the rotary connection from the centre 53 of the belt.

[0084] The load of the load carrying apparatus 10 (in this case a rucksack) is principally in the direction of the height of the user, which corresponds to the transverse direction T on the belt. The arrangement of the load transfer elements 54 in the same direction as the principal loading direction effectively transfers load from the rucksack to the load transfer belt 15. The rotational joints 57 provide flexibility along the length L of the load transfer belt, which permits the belt to encircle the user's hips, but the flexibility is achieved without reduced stiffness of the load transfer elements, which avoids any compromise of load transfer. The flexibility provided by the rotational joints permits the belt to comfortably fit a wide range of pelvis sizes, and allows the belt to move with the hips of the user.

[0085] The serpentine configuration of the load transfer elements 54 is beneficial because it is lightweight and easy to construct. Furthermore, it easily permits even spacing of the load transfer elements in sections of the load transfer belt 15, which leads to an even distribution of load around the belt in both the posterior to anterior regions of the hips; further contributing to increased comfort of the user.

[0086] While the invention has been described in conjunction with the exemplary embodiments described above, many equivalent modifications and variations will be apparent to those skilled in the art when given this disclosure. Accordingly, the exemplary embodiments of the invention set forth above are considered to be illustrative and not limiting. Various changes to the described embodiments may be made without departing from the scope of the invention.

Claims

1. A load transfer belt for use with a load carrying apparatus to transfer load from the apparatus to the hips of a user, the load transfer belt having:

   a plurality of load transfer elements positioned along the length of the belt;
   each load transfer element being joined to at least one adjacent load transfer element by a rotational joint, the rotational joint having an axis of rotation transverse to the length of the belt.

2. The load transfer belt according to claim 1, wherein the load transfer elements are joined to form a serpentine configuration.

3. The load transfer belt according to claim 2, wherein the load transfer elements are u-shaped and n-shaped.

4. The load transfer belt according to claim 2 or 3, wherein sections of the serpentine configuration are transverse to the length of the belt and the central axis of each transverse section is coincident with the axis of rotation of respective rotational joints.

5. The load transfer belt according to any one of the preceding claims, wherein the rotational joint is a pivot joint.

6. The load transfer belt according to any one of the preceding claims wherein the load transfer elements towards the centre of the belt extend a greater distance in a direction transverse to the length of the belt than the load transfer elements towards the ends of the belt.

7. A load transfer element of the load transfer belt of any one of the preceding claims.

8. A load carrying apparatus having a load transfer belt according to any one of claims 1 to 6.

9. The load carrying apparatus according to claim 8, further comprising:

   a frame;
   a rotary connection between the load transfer belt and the frame; and
   hinge connection between the load transfer belt and the frame;
   wherein the rotary connection permits the belt to rotate about a rotary axis of rotation and the hinge permits the belt to rotate about a hinge axis of rotation, the hinge axis of rotation being perpendicular to the rotary axis of rotation.

10. The load carrying apparatus according to claim 9, wherein the rotary axis of rotation is offset above the hinge axis of rotation.

11. The load carrying apparatus according to claim 9 or 10, wherein the rotary axis of rotation is offset above the centre of the load transfer belt.

12. The load carrying apparatus according to any one of claims 9 to 11, wherein the rotary connection comprises a housing and a hub positioned within a cavity of the housing.

13. The load carrying apparatus according to claim 12 wherein the hinge is located on the hub.

14. The load carrying apparatus according to any one of claims 9 to 13, further comprising a link member linking the load transfer belt to the hub.

15. The load carrying apparatus according to claim 14, wherein the link member is one or more poles and the hinge is a channel dimensioned to receive the one or more poles.

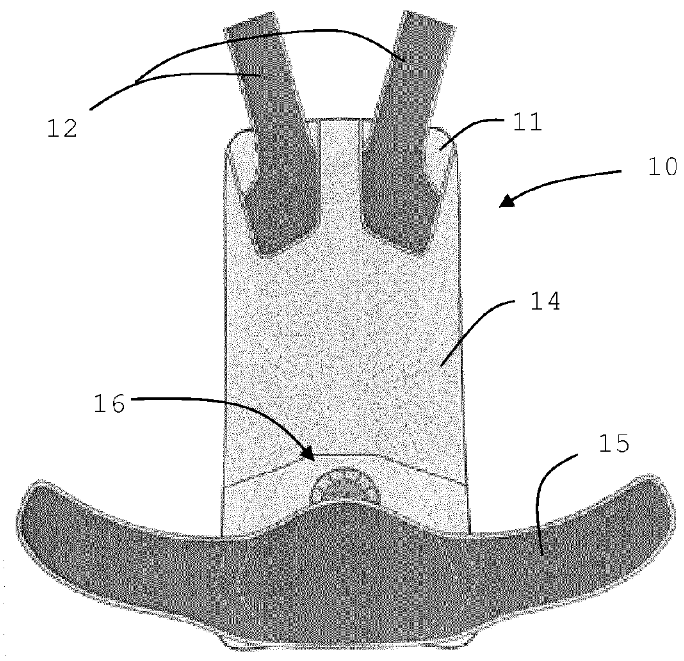

Fig. 1

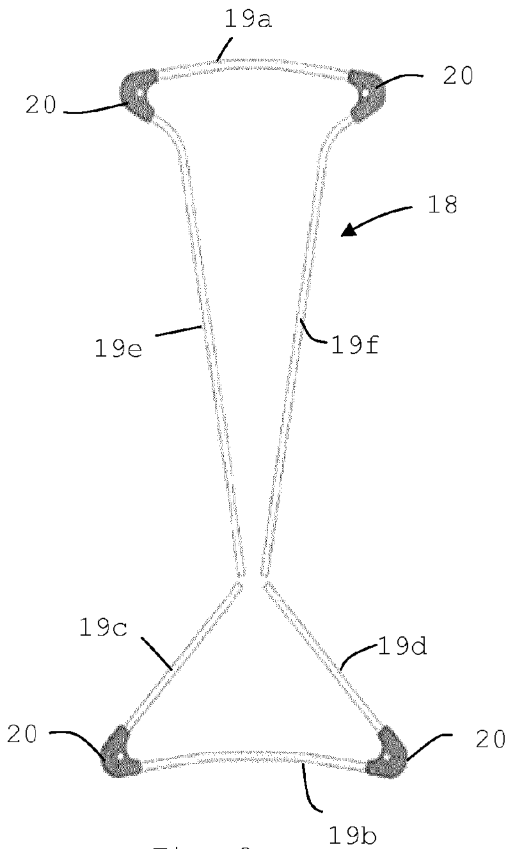

Fig. 2

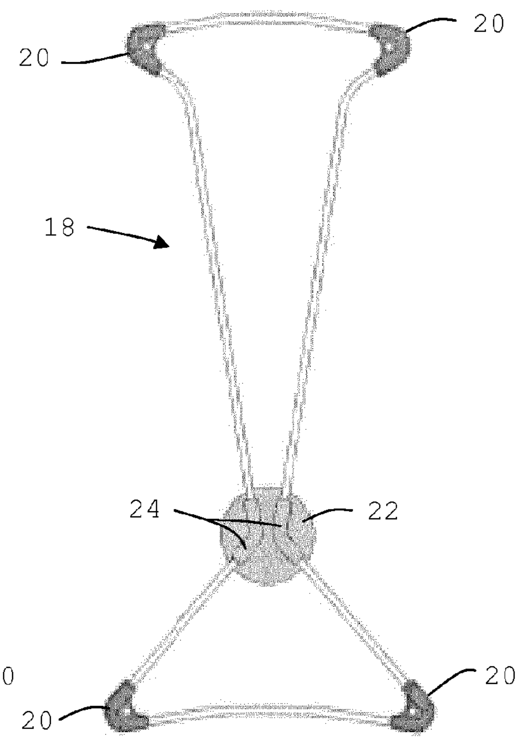

Fig. 3

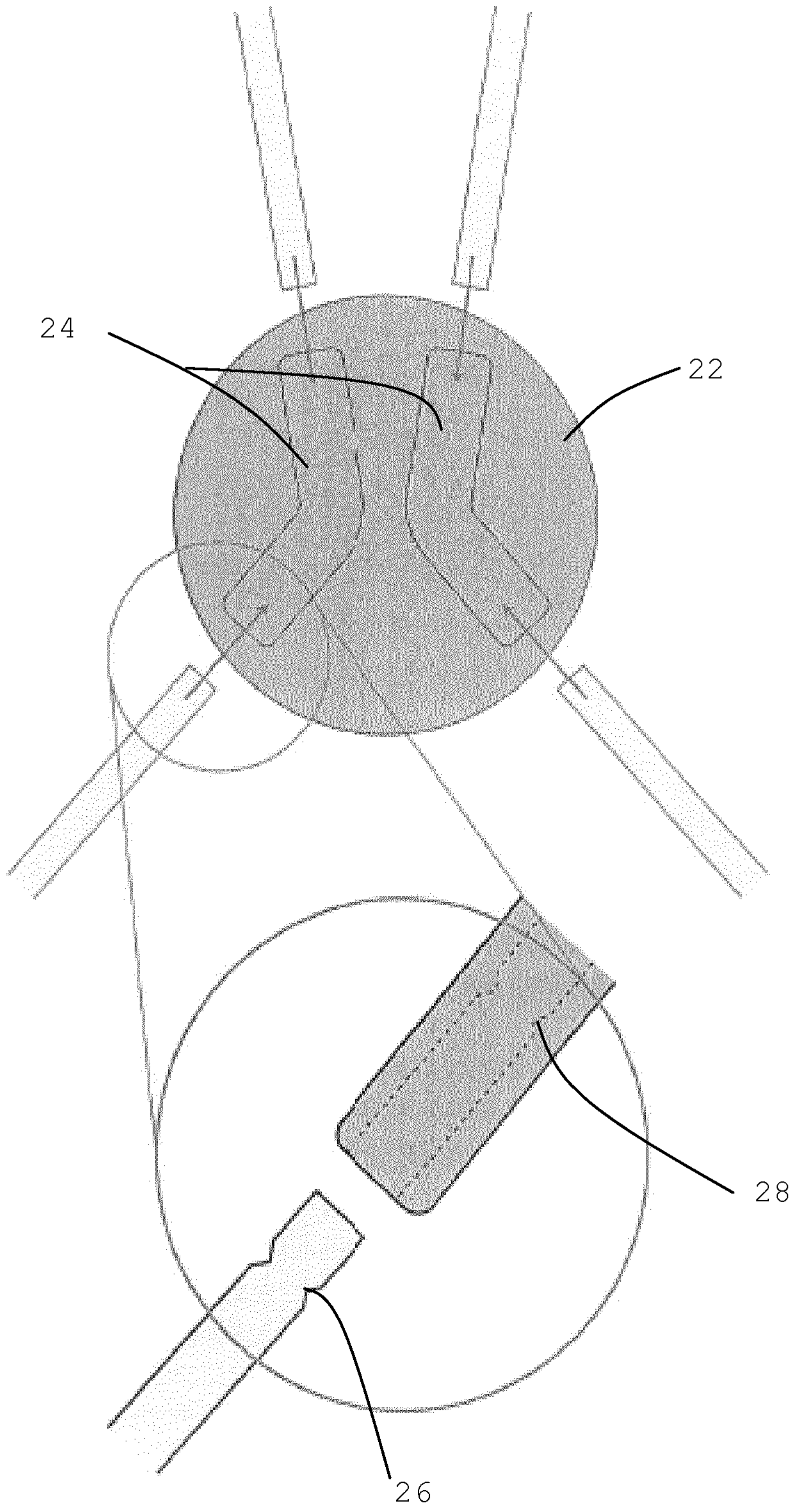

Fig. 4

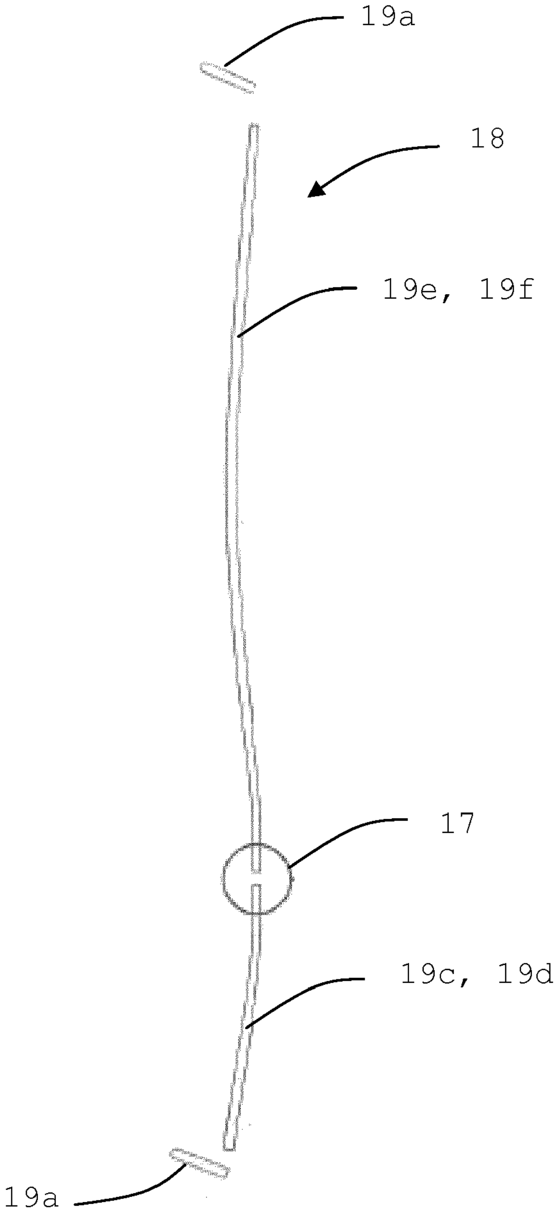

Fig. 5

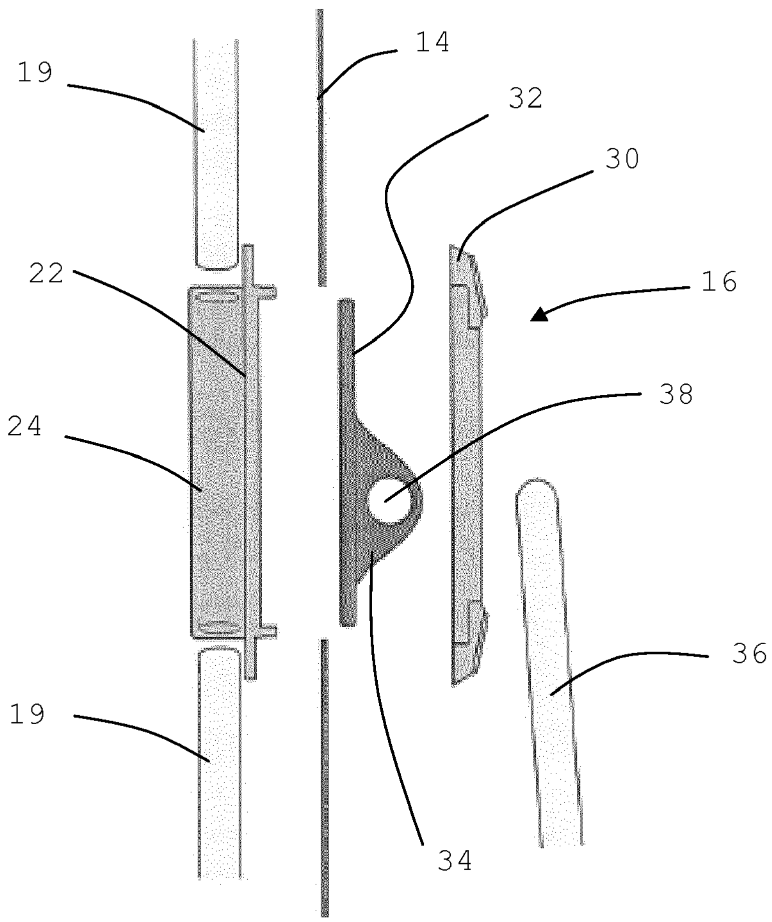

Fig. 6

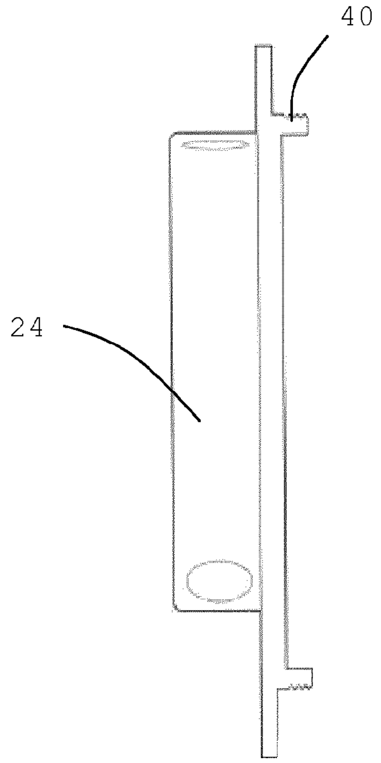

Fig. 7

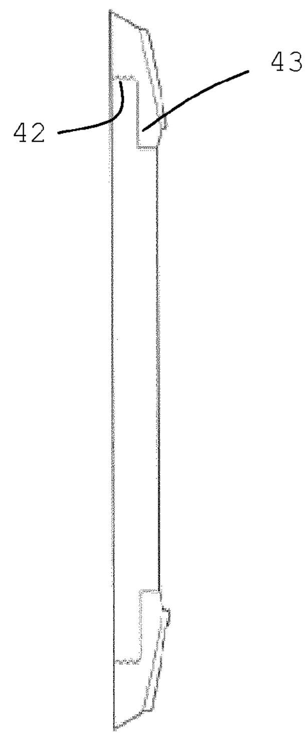

Fig. 8

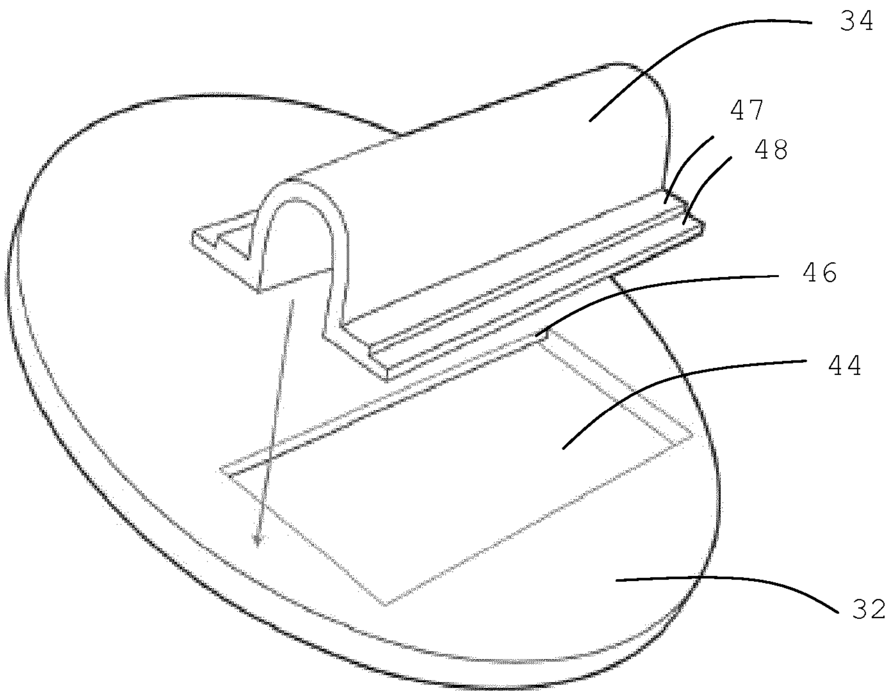

Fig. 9

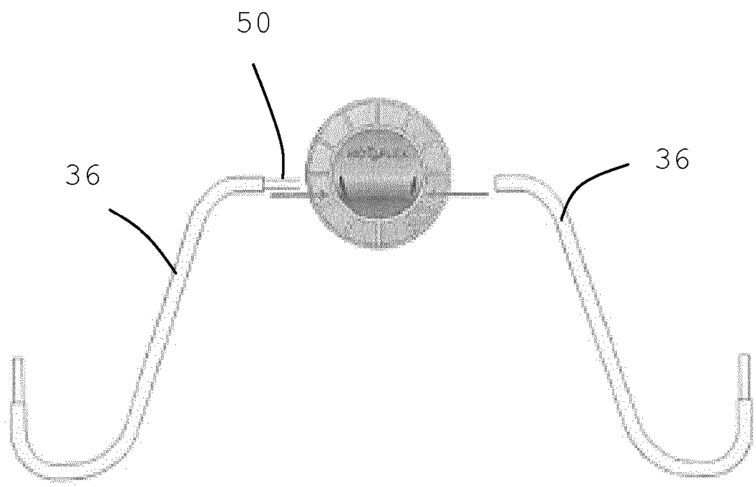

Fig. 10

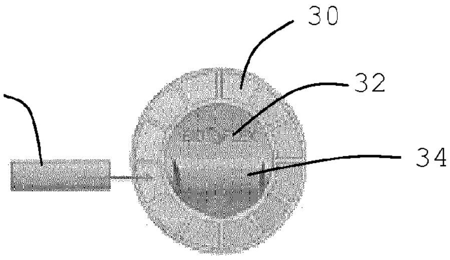

Fig. 11

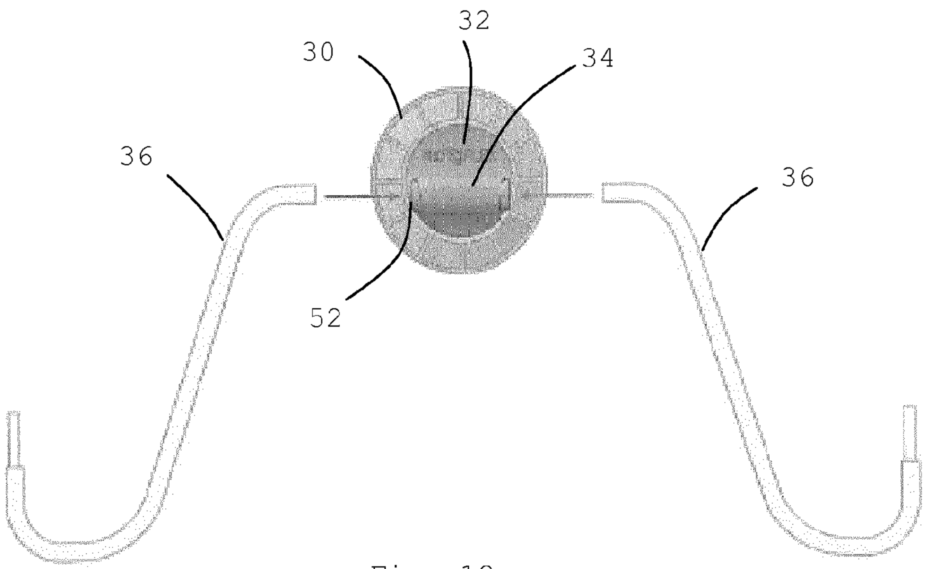

Fig. 12

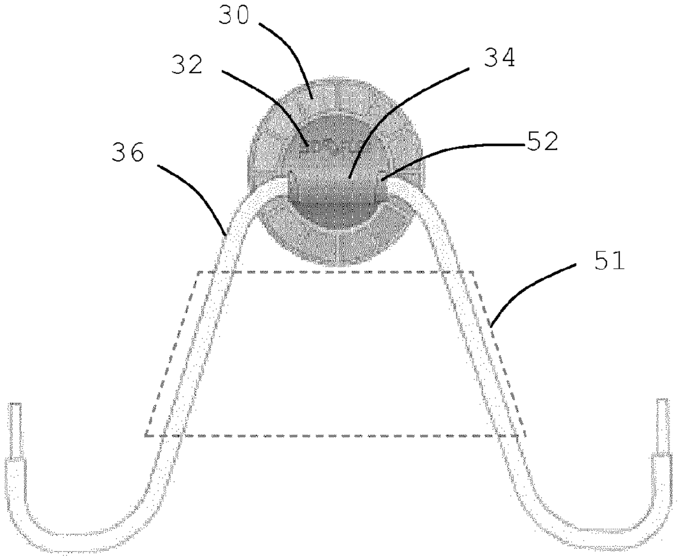

Fig. 13

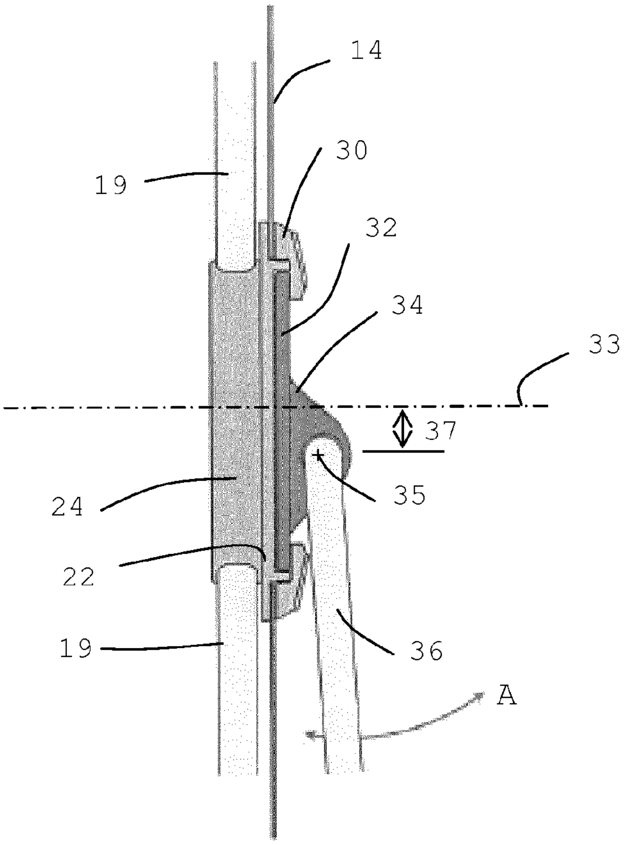

Fig. 14

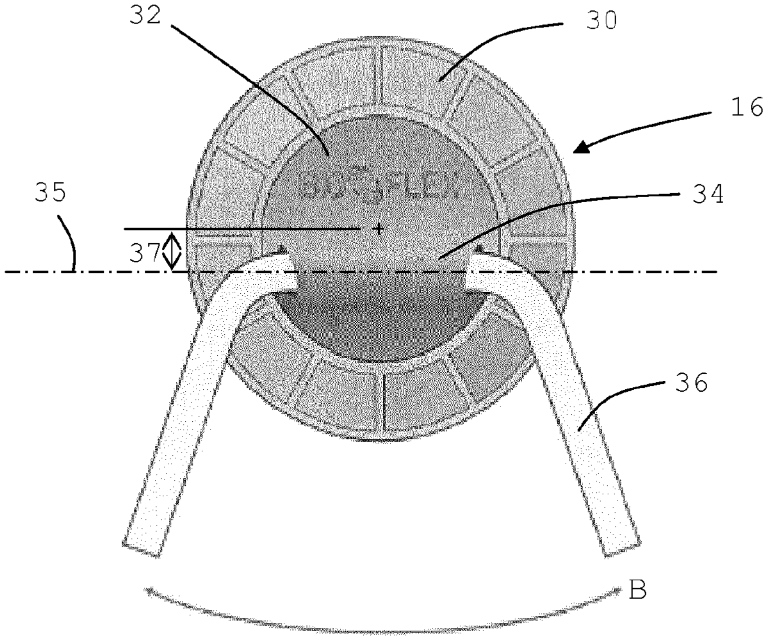

Fig. 15

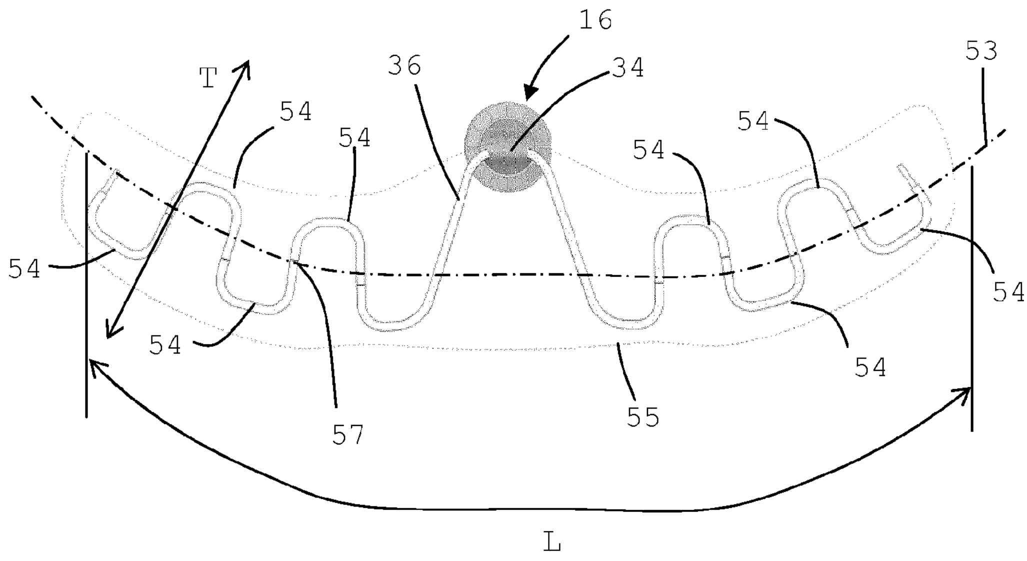

Fig. 16

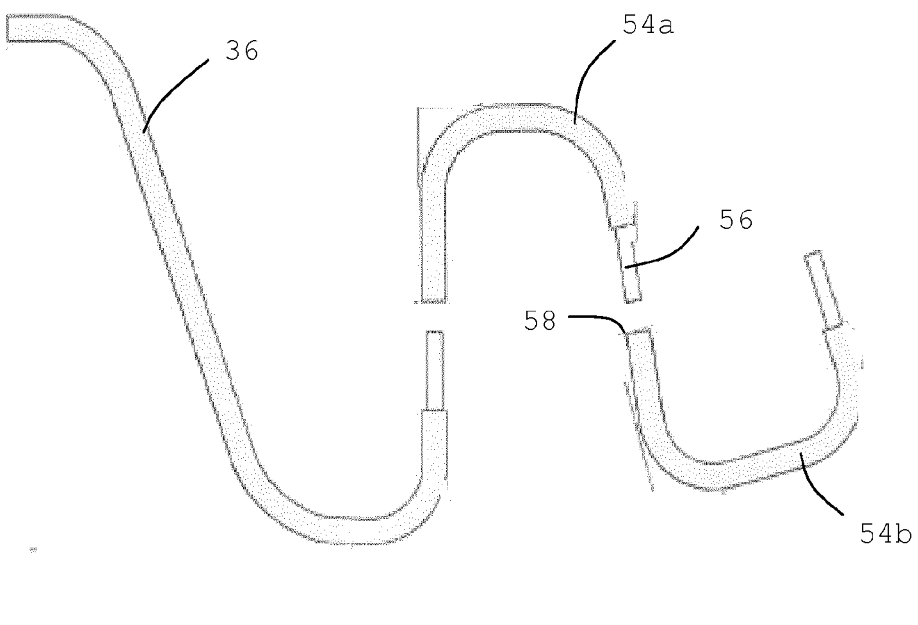

Fig. 17

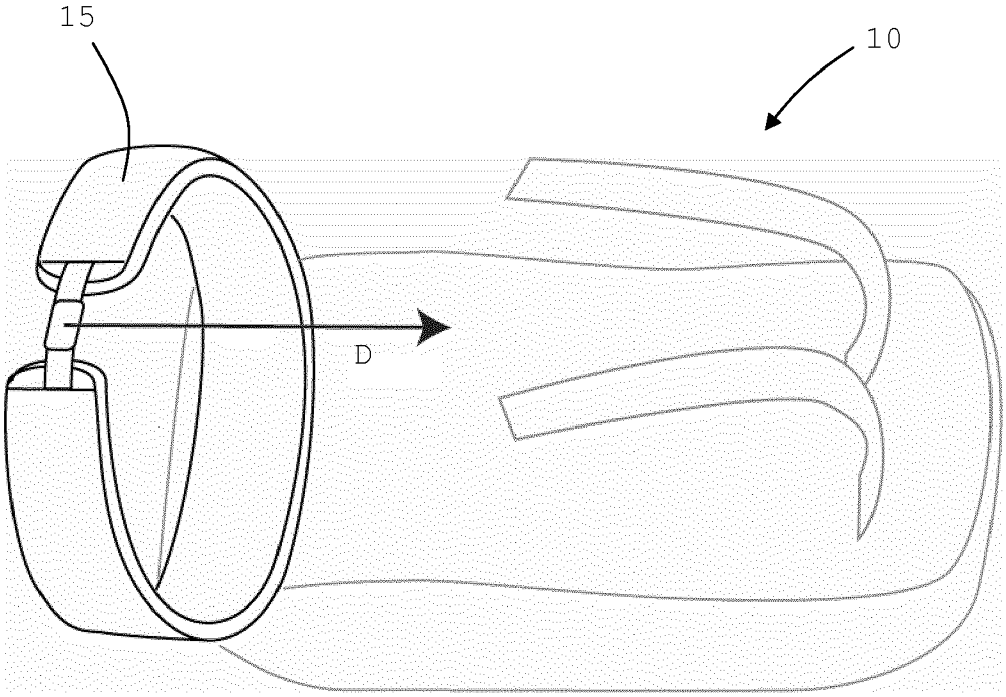

Fig. 18

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 12 16 7916

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y A	US 7 337 935 B1 (GLANVILLE JAMES J [US]) 4 March 2008 (2008-03-04) * column 3, line 45 - column 10, line 3; figures 1, 6a-6c *	1,5-8 9,11-15 2-4,10	INV. A45F3/08
X	WO 2005/072346 A2 (MEYER DESIGN GROUP INC [US]; MEYER DEAN E [US]) 11 August 2005 (2005-08-11) * page 3, line 10 - page 11, line 18; figures 1-8 *	1,5,7,8	
Y	WO 2005/048769 A1 (SANCHEONG CO LTD [KR]; KIM JONG-KEE [KR]) 2 June 2005 (2005-06-02) * page 30, line 18 - page 47, line 16; figures 12-18 *	9,11-15	

TECHNICAL FIELDS SEARCHED (IPC)

A45F
B62B

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	6 September 2012	Ehrsam, Sabine

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 12 16 7916

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

06-09-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 7337935 B1	04-03-2008	NONE	
WO 2005072346 A2	11-08-2005	US 2004262356 A1	30-12-2004
		WO 2005072346 A2	11-08-2005
		WO 2005072348 A2	11-08-2005
WO 2005048769 A1	02-06-2005	EP 1691640 A1	23-08-2006
		JP 4322923 B2	02-09-2009
		JP 2007511319 A	10-05-2007
		US 2007090137 A1	26-04-2007
		WO 2005048769 A1	02-06-2005

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 6536641 B **[0006] [0011]**
- EP 0570192 A **[0006] [0011]**