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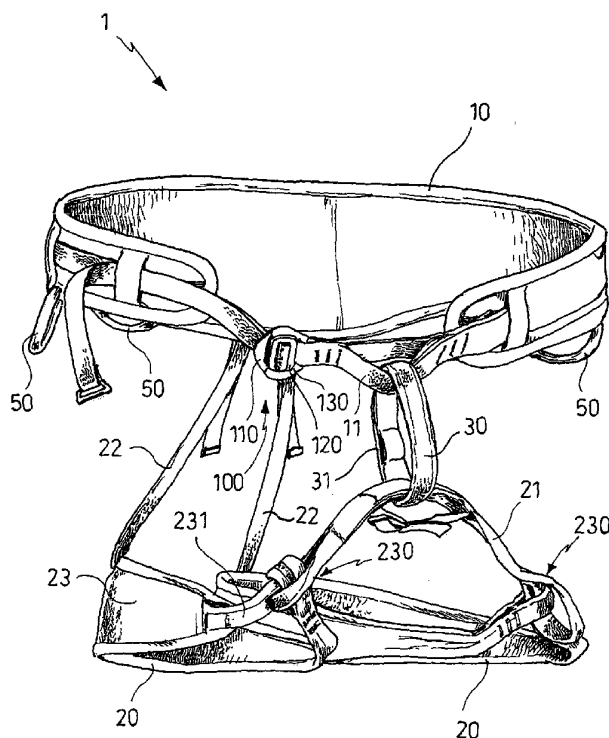
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(54) **Harness**

(57) According to one aspect thereof, the invention relates to a harness (1) for securing a user, comprising a waist belt (10) connected to two leg loops (20) and a belay ring (30). The waist belt comprises at least one sequence (140) of slits (14) in the lumbar area of the outer covering (13) which are arranged such as to provide

an integrated buckle (12) into the covering (13). Each of the leg loops (20) comprises an adjusting system (230) allowing the leg loop to alternatively take a predetermined maximum size and a predetermined minimum size when the latter is subjected to stress. The belay ring (30) comprises a loop (31) adapted to wrap a portion (41) of a carabiner (40).



**FIG.1**

## Description

[0001] . The object of the present invention is a harness for securing a user, for example for the securing during either sports or professional activities exposing the user to the possibility of falling such as the mountaineering activities, the operations at height within the ambit of either work or mountain rescue, the acrobatic routes at height.

[0002] . A known example of harness comprises a waist belt and a pair of leg loops. The waist belt and the leg loops are joined to each other by a tape on the front side thereof and by a pair of bands on the back side thereof, being preferably elastic. A belay ring allows the user to have an attachment point being substantially at barycentre-level, after the harness has been worn. The safety rope can be connected to this attachment point by means of a suitable carabiner. Thereby, the rope traction, if any, is distributed onto the waist belt and the leg loops. Accordingly, the user can effectively resist the traction on the rope due to the possibility that a rope-climbing partner may fall.

[0003] . This type of harness is particularly appreciated for performing mountaineering activities such as the rock climbing, the progression on either ice or rock-ice mixed ground, for performing either mountain skiing activities or even speleological, mountain-rescue and acrobatic-route at height activities because of the safety and comfort it ensures.

[0004] . However, the harness described above is not free from drawbacks.

[0005] . First of all, the rock-climbing safety can be compromised by the accidental movement of the carabiner coupled with the belay ring.

[0006] . The carabiner which is usually used for this purpose is of the so-called sleeve or "screwgate"-type. This screwgate carabiner is usually of a pseudo-oval shape, with a bend of a longer radius and a bend of a shorter radius arranged along the major axis. The two bends are connected to each other by means of a fixed branch and a movable branch called carabiner gate. The carabiner opens and closes - respectively - by moving the gate. The screwgate is a safety device. The gate can be locked in the closed position by screwing the screwgate in order to avoid accidental openings of the carabiner.

[0007] . The screwgate carabiner is designed for traction working along the major axis thereof, with the closed gate and the screwed screwgate. In this configuration, the carabiner offers the maximum tensile stress resistance thereof and ensures the maximum load limit thereof. If the screwgate carabiner should be accidentally traction working along the minor axis thereof, or with the gate opened, it ensures a drastically lower load limit, which is equal to about a third of the maximum one.

[0008] . In order to secure a rope-climbing partner, the user has to fasten the rope to his/her own harness described above and usually proceeds such as described

herein below: the gate of the screwgate carabiner is opened, the carabiner is passed into the belay ring, the gate is closed and locked by screwing the screwgate.

[0009] . The shorter-radius bend is arranged such as to accommodate the harness belay ring. On the other hand, the rope is fastened onto the longer-diameter bend, for example by means of a suitable sliding knot or hitch. In order to fasten the rope to the carabiner, the use of suitable safety devices instead of the sliding knot is also possible. As this does not involve any difference with regard to the present invention, reference will be generally made herein below to the use of the sliding knot.

[0010] . During the ascent of the rope-climbing partner, the user has to follow the action and progress thereof and needs to cause the knot to consequently slide along the rope. Thereby, it is possible for the user to give the proper free-rope length to the partner. Therefore, the user does not have time to worry about the sliding knot, except for the beginning.

[0011] . In consequence of the rope movements and jerks, nothing prevents the screwgate carabiner from rotating within the plane thereof so as to be arranged in a wrong position.

[0012] . A wrong position is for example the one where the harness belay ring rests on the closed gate and the sliding knot on the fixed branch or vice versa. In these conditions, the carabiner works along the minor axis instead of along the major axis as per design and therefore it offers a resistance which is much lower than the one expected.

[0013] . In the case where a safety device is used instead of the sliding knot, in consequence of the carabiner misplacement, the same safety device may be transversally positioned to the carabiner. Since the safety device is usually metallic, it can potentially cause either the damage or the break of the carabiner screwgate. In these conditions, the carabiner gate is free to open and release the safety connection between the harness and the rope.

[0014] . Moreover, however much it may be unlikely, it is also certainly possible that the sliding knot may be located around the screwgate and that the rope sliding may tend to unscrew the same screwgate, thus freeing the gate movement, with the carabiner which is wrongly arranged. It should be understood that such an event may be dangerous and therefore it may need to be avoided at all costs, since it potentially brings to the carabiner opening.

[0015] . The harnesses of the known type further comprise some buckles intended to adjustably accommodate the bands, being preferably elastic, connecting the leg loops to the same waist belt. These buckles can be fastened onto the back of either the waist belt or the leg loops and therefore they are located at the back of the user, during the use.

[0016] . If the buckles are fastened onto the back of the waist belt, i.e. on the lumbar area, they can be particularly tiresome in the fairly frequent case where the user wears a knapsack, besides the harness. In this case,

in fact, the buckles may give rise to tiresome pressures situated on the lumbar area, because of the dimensions thereof.

[0017] . Furthermore, the though least projection of the buckles can make them become a hindrance. For example, the simple operation of either wearing or taking off the knapsack may become complicated if one of the several knapsack straps gets entangled in one of the buckles.

[0018] . Furthermore, the rock climber may sometimes be facing some particular climbing passages called "chimneys". Said passages are characterized in that the rock climber advances within a wide fissure in the rock, being thus surrounded by rock faces on three sides.

[0019] . In some chimneys the progression technique requires that the back is rested on a rock face and that pressure is made with the feet on the opposite face. Particularly in these cases and more generally if there is a rock face behind the rock climber, it is definitely inadvisable to have either projections or encumbrances particularly at the back and lumbar area. These projections and these encumbrances may get entangled in the rock irregularities and cause, in any case, particularly tiresome pressures in the chimney progression, especially if they are situated on the lumbar area.

[0020] . The contact, rubbing and impacts with the rock may further cause either the damage or break of the same buckles.

[0021] . Finally, the harnesses of the known type are manufactured according to market sizes which are defined based on the average anthropometric measures of the population practising mountaineering. Many of the harnesses available on the market have a fixed circumference of the leg loops which is determined based on their respective size, so that the user's leg may be comfortably accommodated.

[0022] . Then there are harnesses having the leg loops adjustable to different measures. To the cost of the constructive complication required for setting the adjusting apparatus, these adjustable leg loops certainly enable a better adaptation to the specific anthropometric measures of the single user.

[0023] . However, the experience in the mountaineering field teaches that during the progression step a leg loop with a circumference that is slightly wider than the thigh circumference is preferred, such as not to cause a hindrance to the movements and to ensure, on the other hand, a feeling of comfort to the user.

[0024] . Contextually, experience also shows, on the other hand, that during the suspension step in which the user is hanging, a leg loop with a circumference which is slightly narrower, more tight-fitting to the thigh circumference is preferred, such as to better distribute the user's weight, of course without absolutely limiting the blood flow.

[0025] . In the light of these observations, it is understood that the fixed leg loops cannot completely meet the user's needs.

[0026] . Moreover, within the same run of use, for example within the same rock route or mountain ascent, the user can shift from the progression step to the suspension step and vice versa several times. In the light of this, it is understood that not even the adjustable leg loops can completely meet the user's needs, being absolutely impossible that the adjustability occur every time the user shifts from the progression step to the suspension step or vice versa.

[0027] . The object of the present invention is to provide a harness having such structural and functional characteristics as to overcome said drawbacks mentioned with reference to the prior art.

[0028] . A task of the present invention is to provide a harness preventing dangerous accidental movements of the screwgate carabiner, typically preventing the rotation of the carabiner within the plane thereof.

[0029] . Another task of the present invention is to provide a harness limiting the encumbrances and projections on the back as much as possible, especially on the lumbar area.

[0030] . Also a task of the present invention is to provide a harness having comfortable leg loops as much during the progression step as during the suspension step.

[0031] . These tasks are achieved by means of a belay ring in accordance with claim 1, by means of a leg loop in accordance with claim 9 and by means of a waist belt comprising an integrated buckle in accordance with claim 20, respectively.

[0032] . This object and these tasks are achieved by means of a harness in accordance with claim 25 to 30.

[0033] . The dependent claims relate to further aspects or embodiments of the present invention.

[0034] . Further characteristics and the advantages of the harness and the components thereof according to the invention will be understood from the description of a preferred exemplary embodiment thereof as set forth herein below, which is given by way of indicative and non-limiting example, with reference to the enclosed figures, in which:

[0035] . Fig. 1 shows an overall and front perspective view of a harness according to the invention;

[0036] . Fig. 2 shows an overall and rear perspective view of a harness according to the invention;

[0037] . Fig. 3.a shows in detail the belay ring of a harness according to the invention;

[0038] . Fig. 3.b shows in detail the belay ring of a harness according to the invention with a carabiner inserted;

[0039] . Fig. 4 shows a detail of the leg loop of a harness according to the invention;

[0040] . Fig. 5 shows in detail the buckles integrated into the waist belt of a harness according to the invention;

[0041] . Figs. 6.a, 6.b, and 6.c sectionally show the detail of the coupling between a carabiner and three different belay rings according to the invention.

[0042] . With reference to said figures, a harness for securing a user, for sports activities such as the moun-

taineering activities, has been indicated with 1 as a whole.

**[0043]** . In accordance with the embodiment shown in the enclosed figures, the harness 1 comprises a waist belt 10 and a pair of leg loops 20. The leg loops 20 are joined to each other by a tape 21 on the front side thereof and are connected to the waist belt 10 by bands 22 being preferably elastic. The harness 1 further comprises a belay ring 30. The belay ring 30 is closed around a strap 11 of the waist belt 10 and around the tape 21.

**[0044]** . The waist belt 10, leg loops 20, strap 11, tape 21 and belay ring 30 are structural elements; in other words, they are adapted to resist the inertial forces generated by a user, even in case of a fall.

**[0045]** . This characteristic make the structural elements clearly different from other additional elements provided on the harnesses such as for example the gear loops 50, the coupling 51 for the chalk bag or the same bands 22. These additional elements are absolutely not adapted to resist the inertial forces generated by a user, especially in case of a fall.

**[0046]** . The structural elements are manufactured of strong textile, for example either of nylon or Cordura®, and they are connected to one another by means of sewing or bonding which are also strong, such as to be adapted to support a user without danger even in case of a fall.

**[0047]** . As it is *per se* known, said construction allows the user to find an attachment point in the belay ring 30 arranged substantially at barycentre-level, once the harness has been worn. A rope can be fastened to this attachment point either by means of a suitable knot or by means of a screwgate carabiner 40 (see for example Fig. 3.b). Thereby, the possible rope stress is distributed onto the waist belt 10 and the leg loops 20.

**[0048]** . Furthermore, each of the leg loops 20 is connected to the waist belt 10 on the rear side thereof by a band 22. These bands 22 are not structural elements. In other words, the bands 22 are not intended to bear even partly the user's weight but to simply support the leg loops 20 and keep them in a comfortable position for the user. In order to be better used for this purpose, the bands 22 are preferably elastic.

**[0049]** . The belay ring 30 comprises a loop 31. The loop 31 is adapted to wrap the portion 41 of a carabiner 40. In other words, the loop 31 is adapted to adhere to the portion 41 of the carabiner 40 along a wide portion of the section external extension. This portion can be preferably greater than the half of the section external extension.

**[0050]** . The belay ring 30 is of a substantially planar shape and therefore an X-X-axis can be defined being perpendicular to the midplane of the belay ring 30. The loop 31 defines, in turn, an X'-X'-axis.

**[0051]** . X-X and X'-X' axes show the preferential direction along which the user arranges the end of a safety element (for example either the end of a rope or the end of an opened carabiner) in order to cause them to pass through the belay ring 30 and the loop 30, respectively.

**[0052]** . In accordance with an embodiment, X'-X' axis

is parallel to X-X axis.

**[0053]** . As may be seen in Figs. 6.a to 6.c, the loop 31 may have different shapes but all of them being adapted to match the shape of the section of the portion 41 of the carabiner 40. The extension of the internal portion 32 of the loop 31 is substantially equal to the outside circumference of the portion 41. When needed, the extension of the internal portion 32 of the loop 31 slightly extends due to the partial cross compliance of the textile of which the loop 31 is made.

**[0054]** . The carabiner 40 can be threaded up into the loop 31 starting from the end of the bigger bend 43 which can be made easy to reach after the carabiner 40 has been opened and arranging this end along X'-X' axis of the loop 31. By applying a slight force, the carabiner 40 can be caused to slide along the loop 31 up to house the smaller bend 42 within the loop 31.

**[0055]** . After the carabiner has been placed in the proper position relative to the loop 31, the spring-back of the internal portion 32 of the loop 31 causes the wrapping on the portion 41 of the carabiner 40 by the loop 31 to produce a predetermined radial pressure on the outside surface of the portion 41 of the carabiner 40.

**[0056]** . Due to this wrapping and due to the friction originating between the internal portion 32 of the loop 31 and the portion 41 of the carabiner 40, the carabiner 40 is prevented from accidentally rotating within the plane thereof relative to the belay ring 30. On the other hand, the carabiner 40 is allowed to perform all the other movements allowing it to be arranged along the proper direction in order to react to the rope traction. Particularly, the carabiner 40 is allowed to rotate around X'-X'-axis.

**[0057]** . The loop 31 is adapted, in use, to keep the carabiner 40 in such a position that the midplane of the carabiner 40 is arranged substantially perpendicular to the midplane of the belay ring 30.

**[0058]** . Thereby, the carabiner 40 is not allowed to rotate within the plane thereof and to be accidentally arranged in a wrong position and hence a dangerous one.

**[0059]** . The screwgate carabineres 40 adapted to connect the harness 1 to the safety rope are usually obtained by subsequent processing of aluminium alloy rods. The diameter of these rods usually ranges between 9mm and 13mm, preferably 11mm. In first approximation, it can be assumed that, following the required processing, the section of the portion 41 of the carabiner 40 is equal to the one of the rod from which it has been obtained.

**[0060]** . In consequence of what has been stated above, in accordance with an embodiment, the loop 31 is adapted to wrap a portion 41 of a carabiner 40 having a section ranging between 60 mm<sup>2</sup> and 135 mm<sup>2</sup>.

**[0061]** . In accordance with another embodiment, the loop 31 is adapted to wrap a portion 41 of a carabiner 40 having a section ranging between 90 mm<sup>2</sup> and 100 mm<sup>2</sup>, preferably about 95 mm<sup>2</sup>.

**[0062]** . In accordance with an embodiment, the internal portion 32 of the loop 31 comprises elastomeric material. This material can be present in the form of woven

fibres in the fabric strip which is used for obtaining the same loop 31 within the belay ring 30. Otherwise, the elastomeric material can be coated, casted, glued or otherwise inserted onto either part or the whole of the surface of the internal portion 32 of the loop 31.

[0063] . Thereby, a higher compliance is given to the loop 31 which allows the latter to be adapted to carabiners of a bigger section and, simultaneously, a higher spring-back is given to the loop 31 which allows the latter to obtain a higher radial pressure from the wrapping to the outside surface of the portion 41 of the carabiner 40.

[0064] . Moreover, the presence of the elastomeric material within the loop 31 increases the friction coefficient between the outside surface of the portion 41 of the carabiner 40 and the surface of the internal portion 32 of the loop 31.

[0065] . In accordance with an embodiment, the band 22 is connected to the waist belt 10 by means of an integrated buckle 12 of the type of the ones shown in Fig. 5. The integrated buckle 12 is directly obtained on the covering 13 providing the outside surface of the waist belt 10.

[0066] . The covering 13, although ensuring a good level of comfort for the user, needs at the same time to meet some requirements of strength and resistance to wear and the particularly intense stresses of the mountaineering use. Typically, the covering 13 has to resist the abrasion caused by the possible rubbing on the rock, it has to resist the exposure to strong ultraviolet radiations, it has to resist the high temperature ranges, and so on.

[0067] . For the reasons stated above, the covering 13 is usually provided either with a highly-resistant fabric, or with a composite material obtained for example by a lamination process. The matrix of the composite material may be either of a thermoplastic polymer or of an elastomer, or mixed, whereas the reinforcement can be of a polyamide or polyaramide fiber, or the like.

[0068] . In accordance with an embodiment of the invention, integrated buckles 12 of the type of the ones shown in Fig. 5 are obtained on the covering 13 of the waist belt 10.

[0069] . Each of the integrated buckles 12 comprises a sequence 140 of slits 14 directly obtained within the covering 13 of the waist belt 10. The single sequence 140 preferably comprises three slits 14. The slits of a single sequence 140 are preferably parallel to one another.

[0070] . A hollow space is provided near the sequence 140 of slits 14, between the outer covering 13 and the waist belt 10. The slits 14 are further adapted to accommodate the band 22, to cause the latter to enter the hollow space or to cause the latter to come out from the hollow space.

[0071] . As it is known, the band 22 is then passed, in a *per se* known manner, in succession into the slits 14. Thereby, a firm and easy to be adjusted connection is obtained between the waist belt 10 and the band 22 sewn

to the leg loop 20.

[0072] . Therefore, the thickness of the integrated buckle 12 and the band 22 connected to the latter is least. Moreover, the integrated buckle 12 does not have either any projection or any size outside the waist belt 10.

[0073] . The skilled person can immediately understand how the use of integrated buckles 12 according to the invention avoids all the known problems associated with the use of the traditional outside buckles.

[0074] . From what has been stated above it is understood, for example, how the integrated buckles 12 are in no way tiresome when the user wears a knapsack over the harness 1. In fact, in this case, unlike the outside buckles, the integrated buckles 12 do not give rise to any tiresome pressure situated on the lumbar area.

[0075] . Furthermore, the absence of any projections of the integrated buckles 12 avoids that they may become a hindrance. For example, in the operation of either wearing or taking off the knapsack, no one of the multiple knapsack straps can get entangled in the integrated buckles 12 as it happens, on the other hand, with the traditional outside buckles.

[0076] . Finally, in the progression in a chimney and more generally if there is a rock face behind the rock climber, the use of a harness equipped with integrated buckles 12, thus free of either projections or encumbrances at the back and particularly at the lumbar area is definitely more comfortable. The absence of projections and encumbrances avoids that the integrated buckles 12 may get entangled in the rock irregularities and may generate any pressure on the lumbar area, in the progression in a chimney.

[0077] . The use of the integrated buckles further avoids any possibility of either damage or break of the same buckle in the case of contact with, rubbing on or impact against the rock.

[0078] . In accordance with another embodiment of the invention not shown in the enclosed figures, the integrated buckles are obtained on the covering of the leg loops 20 instead on the covering 13 of the waist belt 10. Thereby, a firm and easy to be adjusted connection is obtained between the leg loop 20 and the band 22 sewn to the waist belt 10.

[0079] . In accordance with a further embodiment of the invention not shown in the enclosed figures, the integrated buckles are obtained both on the covering of the leg loops 20 and on the covering 13 of the waist belt 10. Thereby, a firm and easy to be adjusted connection is obtained between the leg loop 20 and the band 22 and between the waist belt 10 and the band 22.

[0080] . In a *per se* known manner, each of the leg loops 20 is formed by a closed-loop shaped band 23. In accordance with an embodiment of the harness 1 according to the invention, the shaped band 23 of each leg loop 20 is closed-loop by means of an adjusting system 230.

[0081] . An adjusting system 230 according to the invention is shown in Figs. 1 and 2 and, in greater detail,

in Fig. 4.

[0082] . The shaped band 23 has a first end 231 connected to the tape 21 and a second end 232 slidably connected to the first end 231. Therefore, the second end can move between an open position (which has been indicated with I in Fig. 4) in which the ring formed by the shaped band 23 takes a predetermined maximum size and a constraint position (which has been indicated with II) in which the ring takes a predetermined minimum size.

[0083] . In accordance with an embodiment, the first end 231 of the shaped band 23 comprises a first eyelet 233. The second end 232 of the shaped band 23 is connected to the first end 231 such that it may slide within the first eyelet 233.

[0084] . For example, the second end 232 of the shaped band 23 is wound around the first end 231, within the first eyelet 233, such as to form a second eyelet 234 embracing the first end 231.

[0085] . Therefore, the second end 232 can slide along the first end 231 as far as it is allowed by the length of the first eyelet 233. Particularly, the second end 232 may slide along the direction indicated with A from Fig. 4, between the first open position (which has been indicated with I) and the second constraint position (which has been indicated with II).

[0086] . Due to the adjusting system 230, the ring formed by the shaped band 23 may change the sizes thereof according to the position that the second end 232 takes along the first end 231. Particularly, also with reference to Fig. 4, if the second end 232 is placed at the end of the first eyelet 233 near the tape 21, i.e., in the first open position I, the leg loop 20 takes the maximum size thereof. On the other hand, if the second end 232 is placed at the end of the first eyelet 233 opposite the tape 21, i.e., in the second constraint position II, the leg loop 20 takes the minimum size thereof.

[0087] . Therefore, the adjusting system 230 allows the ring formed by the band 23 to alternatively take either a predetermined maximum size or a predetermined minimum size, when the leg loop 20 is subjected to stress.

[0088] . In accordance with an embodiment, the adjusting system 230 further comprises a return spring mean 235, for example an elastic. The elastic 235 is connected to the second end 232 and to the end of the first eyelet 233 near the tape 21. Thereby, when the leg loop is at rest, the second end 232 is placed near the open position, at the end of the first eyelet 233 near the tape 21, thus giving a size which is near the maximum one to the leg loop 20.

[0089] . During the progression step, the mountain climber autonomously bears his own weight with hands and feet. Therefore, the harness 1 generally and the leg loop 20 particularly are not subject to stresses by the rope and hence they are substantially at rest. As the leg loop 20 is at rest, the adjusting system 230 gives the possibility to extend to the leg loop 20 during the progression step.

[0090] . Particularly, the elastic 235 ensures that the

leg loop 20 may take a size which is near the maximum one, where present.

[0091] . During the suspension step, the mountain climber's weight is supported by the rope. Therefore, the harness 1 and the leg loop 20 particularly, are subject to the rope traction and hence they are stressed. As the leg loop 20 is stressed, the adjusting system 230 gives the leg loop 20 the possibility to narrow up during the suspension step so as to take the minimum size

[0092] . Therefore, the presence of this adjusting system 230 allows the leg loop 20 of the harness 1 according to the invention to overcome the drawbacks associated with the known leg loops. In fact, during the progression step, the leg loop 20 takes a circumference which is slightly wider than the thigh circumference such as not to provide a hindrance to the movements and to give a feeling of comfort to the user.

[0093] . Contextually, however, the leg loop 20 takes a circumference which is slightly more tight-fitting to the thigh circumference during the suspension step, such as to better distribute the user's weight of course without absolutely limiting the blood flow.

[0094] . In accordance with an embodiment, the leg loop 20 also comprises a known adjusting apparatus, besides the adjusting system 230 described above. The adjusting apparatus enables a better adaptation to the specific anthropometric measures of the single user.

[0095] . In accordance with an embodiment, the harness 1 also comprises a buckle 100 for stopping the strap 11 of the waist belt 10.

[0096] . In accordance with a preferred embodiment, the buckle 100 is of the type described in the Italian Patent Application No. MI2005A000565 filed in the name of the same Applicant on 5<sup>th</sup> April 2005. It is described herein below a brief description of the buckle 100, whereas for a detailed description reference is made to the above-mentioned application.

[0097] . The buckle 100 comprises a plate 110 on which an opening 111 and a per se known fastening system to the first end of the strap 11 are provided.

[0098] . The buckle 100 further comprises a plaque 120 having a known fastening system to the second end of the strap 11. The plaque 120 is adapted to take a use position and an engaging position allowing the latter to pass through the opening 111 being provided on the plate 110.

[0099] . The buckle further comprises a mask 130 movable between a first position in which it enables the complete accessibility to the opening 111 provided on the plate 110 and a second position in which, on the contrary, it partially limits the accessibility to the opening 111.

[0100] . In order to fasten the buckle 100, the user places the mask 130 in the first position in which it enables the complete accessibility to the opening 111 being provided on the plate 110; he places the plaque 120 in the engaging position and then passes the latter through the opening 111; then, he places the mask 130 in the second position in which it partially limits the accessibility to the

opening 111; finally, he places the plaque 120 in the use position.

[0101] . The buckle 100 enables an extremely safe fastening of the two ends of the strap 11, thanks to the structure thereof and the method of use described above. In fact, once the mask 130 has been placed in the second position in which it partially limits the accessibility to the opening 111, the plaque 120 cannot pass through the opening 111 any more, thus avoiding accidental openings of the buckle 100.

[0102] . To the embodiments of the harness, the belay ring, the integrated buckle and the leg loop described above, those skilled in the art, aiming at satisfying contingent and specific needs, will be able to carry out several modifications, adjustments and replacements of elements with other elements being functionally equivalent thereto, without thus departing from the scope of the following claims.

### Claims

1. A harness (1) for securing a user, comprising a belay ring (30) adapted to resist the inertial forces generated by a user, **characterized in that** said belay ring (30) comprises a loop (31) adapted to wrap an portion (41) of a carabiner (40).
2. The harness (1) in accordance with claim 1, wherein the internal portion (32) of said loop (31) is adapted to generate a predetermined radial pressure on the outside surface of a portion (41) of a carabiner (40) .
3. The harness (1) in accordance with claim 1 or 2, wherein the internal portion (32) of said loop (31) is adapted to adhere to a wide portion of the outside surface of a portion (41) of a carabiner (40).
4. The harness (1) in accordance with claim 3, wherein said wide portion is greater than the half of the outside surface of a portion (41) of a carabiner (40) .
5. The harness (1) in accordance with any preceding claims, wherein said loop (31) is adapted to keep said carabiner in such a position that a midplane defined by said carabiner (40) is substantially arranged perpendicular to a midplane defined by said belay ring (30).
6. The harness (1) in accordance with any preceding claims, wherein said loop (31) is adapted to wrap a portion (41) of a carabiner (40) having a section ranging between 60 mm<sup>2</sup> and 135 mm<sup>2</sup>, preferably having a section ranging between 90 mm<sup>2</sup> and 100 mm<sup>2</sup>.
7. The harness (1) in accordance with any preceding claims, wherein the inside portion of said loop (31) comprises an elastomeric material.
8. The harness (1) in accordance with any preceding claims, wherein the inside of said loop (31) is at least partially covered with elastomeric material.
9. The harness (1) in accordance with any preceding claims, wherein said loop (31) defines an (X'-X') axis being substantially parallel to (X-X) axis defined by said belay ring (30).
10. A harness (1) for securing a user, having at least one leg loop (20) comprising a closed-loop shaped band (23), and an adjusting system (230), **characterized in that** said adjusting system (230) allows said ring to take a predetermined maximum size, and to take a predetermined minimum size when said leg loop (20) is subjected to stress.
11. A harness (1) for securing a user, having at least one leg loop (20) comprising a shaped band (23) having a first end (231) and a second end (232), **characterized in that** said second end (232) is slidably connected to said first end (231) such as to slide between an open position (I) in which said ring takes a predetermined maximum size, and a constraint position (II) in which said ring takes a predetermined minimum size.
12. The harness (1) in accordance with claim 11, wherein said first end (231) comprises a first eyelet (233) and said second end (232) is connected to said first end (231) such as to slide within said first eyelet (233).
13. The harness (1) in accordance with claim 11 or 12, wherein said first end (231) is connected to a tape (21), said tape being, in turn, connected to a belay ring (30).
14. The harness (1) in accordance with any one of the claims 11 to 13, wherein said second end (232) is wound around said first end (231) thus providing a second eyelet (233).
15. The harness (1) in accordance with any one of the claims 11 to 14, further comprising a return spring means (235), an end of said return spring means (235) being connected to said second end (232) and another end of said return spring means (235) being connected near said open position (I).
16. The harness (1) in accordance with claim 15, wherein said return spring means (235) is adapted to bring said second end (232) to a position which is near said open position (I) when said leg loop (20) is unloaded.
17. The harness (1) in accordance with any claim 10 to 16, wherein said at least one leg loop (20) is provided

with an outer covering comprising at least one sequence of slits being arranged such as to provide a buckle integrated into said covering.

18. The harness (1) in accordance with claim 17, wherein a hollow space which is easy to be reached by a band is provided between said covering and said leg loop, near said sequence of slits. 5
19. The harness (1) in accordance with claim 17 or 18, wherein said slits of said sequence are substantially parallel to one another. 10
20. The harness (1) in accordance with any one of the claims 17 to 19, wherein said sequence comprises three slits. 15
21. The harness (1) in accordance with any claim 10 to 20, wherein said leg loop also comprises an adjusting apparatus adapted to allow said leg loop (20) to be adapted to predetermined specific anthropometric measures. 20
22. A harness (1) for securing a user, having a waist belt (10) comprising an outer covering (13), **characterized in that** said outer covering (13) comprises at least one sequence (140) of slits (14) being arranged along the lumbar area of said waist belt (10) such as to provide an integrated buckle (12) in said covering (13). 25
23. The harness (1) according to claim 22, wherein a hollow space (130) which is easy to be reached by a band (22) is provided between said covering (13) and said waist belt (10), near said sequence (140) of slits (14). 30
24. The harness (1) according to claim 22 or 23, wherein said covering (13) comprises two sequences of slits (14). 35
25. The harness (1) according to any one of the claims 22 to 24, wherein said slits (14) of said sequence (140) are substantially parallel to one another. 40
26. The harness (1) according to any one of the claims 22 to 25, wherein said sequence (140) comprises three slits (14). 45
27. The harness (1) according to any one of the preceding claims, further having a buckle (100) comprising:  
- a plate (110) having an opening (111) and a system adapted to fasten to a first end of a strap (11); 50  
- a plaque (120) having a system adapted to fasten to a second end of a strap (11), said plaque (120) being adapted to take an engaging 55

position allowing the latter to pass through said opening (111), and a use position; and  
- a mask (130) movable between a first position in which it enables the complete accessibility to said opening (111) and a second position in which it partially limits the accessibility to said opening (111).

28. A belay ring (30) for a harness, adapted to resist the inertial forces generated by a user, **characterized in that** it comprises a loop (31) adapted to wrap a portion (41) of a carabiner (40).
29. A leg loop (20) for a harness, comprising a closed-loop shaped band (23), and an adjusting system (230), **characterized in that** said adjusting system (230) allows said ring to take a predetermined maximum size, and to take a predetermined minimum size when said leg loop (20) is subjected to stress.
30. A leg loop (20) for a harness, comprising a shaped band (23) having a first end (231) and a second end (232), **characterized in that** said second end (232) is slidably connected to said first end (231) such as to slide between an open position (I) in which said ring takes a predetermined maximum size, and a constraint position (II) in which said ring takes a predetermined minimum size.
31. A leg loop (20) for a harness, comprising an outer covering, **characterized in that** said outer covering comprises at least one sequence of slits being arranged such as to provide a buckle integrated into said covering.
32. A waist belt (10) comprising an outer covering (13), **characterized in that** said outer covering (13) comprises at least one sequence (140) of slits (14) being arranged along the lumbar area of said waist belt such as to provide an integrated buckle (12) into said covering (13).



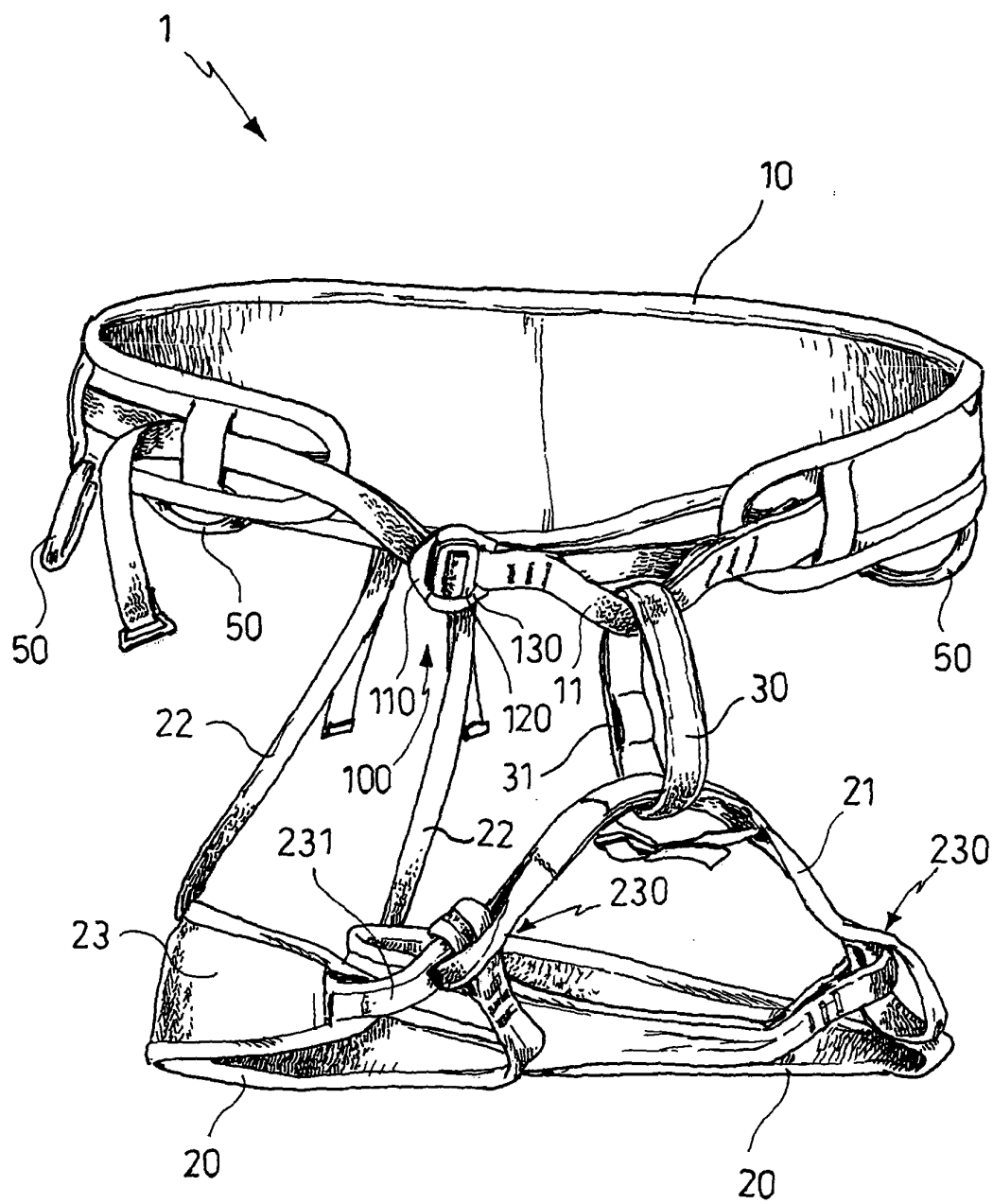


FIG. 1

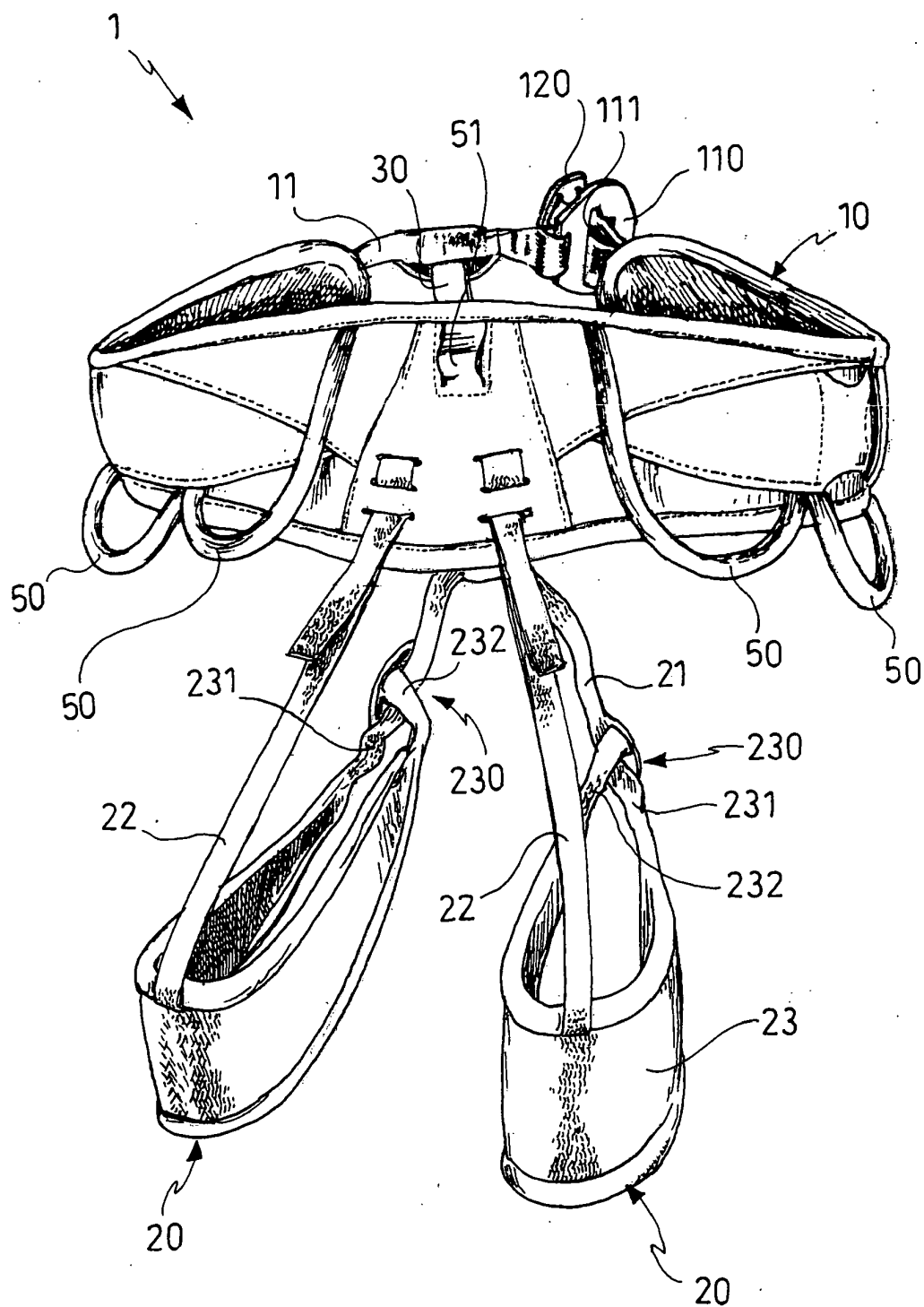


FIG. 2

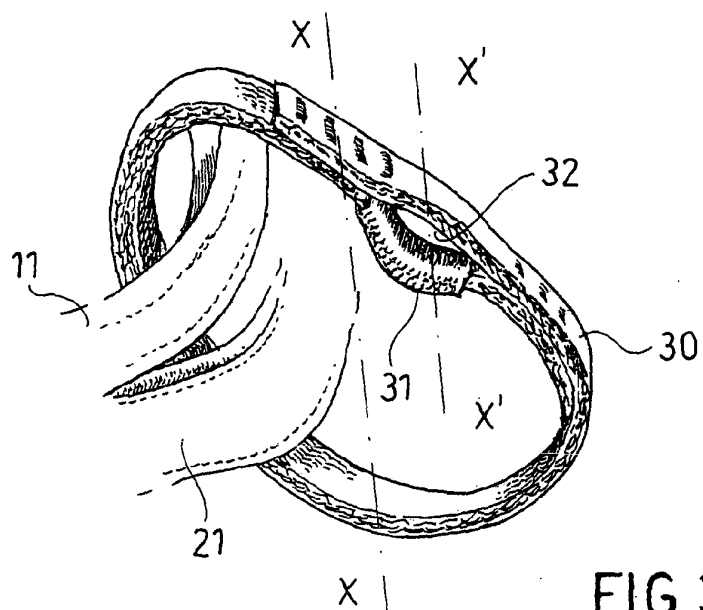


FIG. 3a

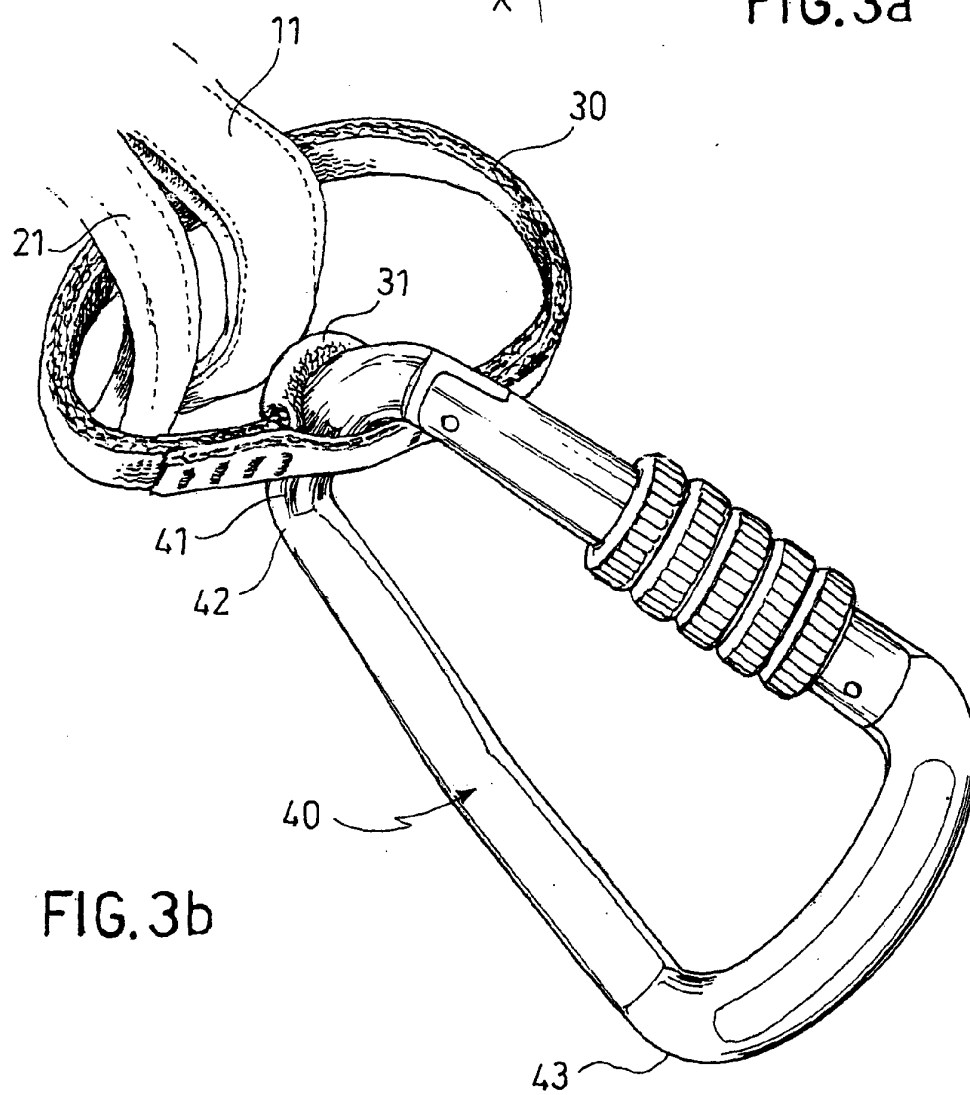


FIG. 3b

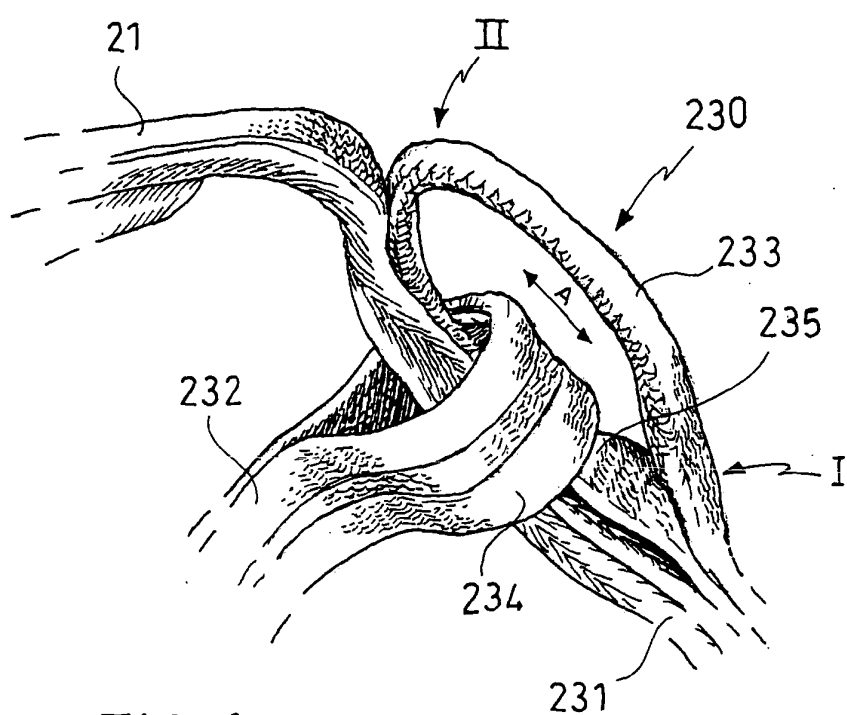


FIG. 4

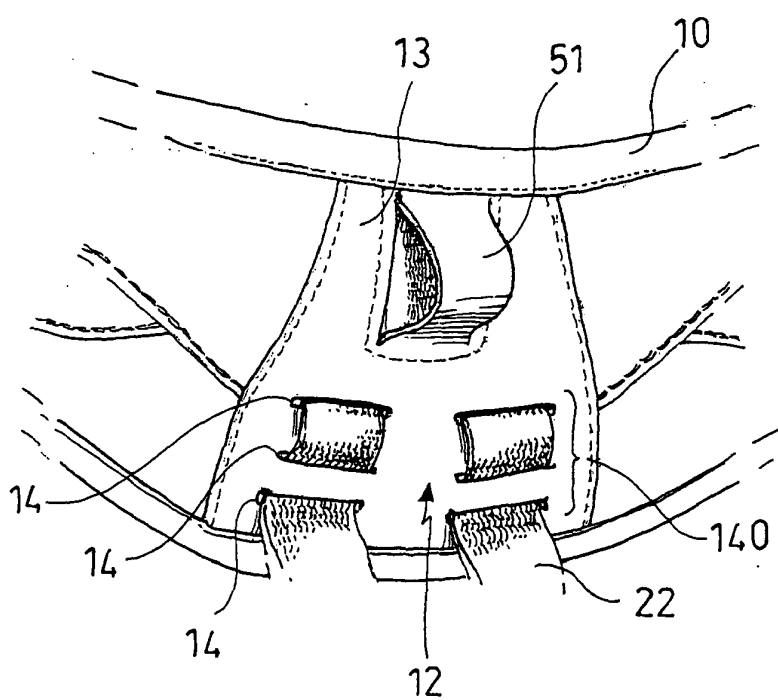


FIG. 5

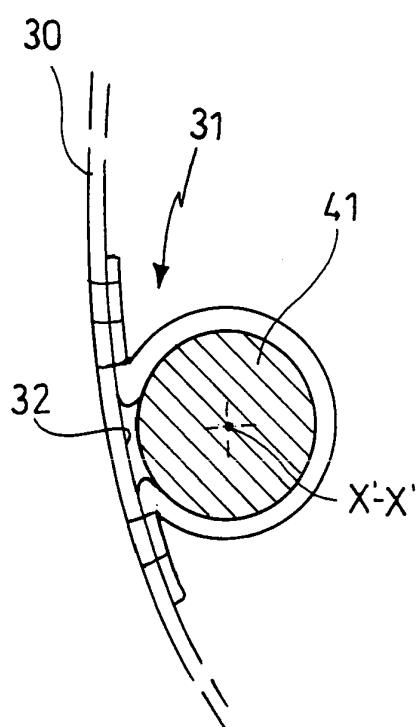


FIG. 6a

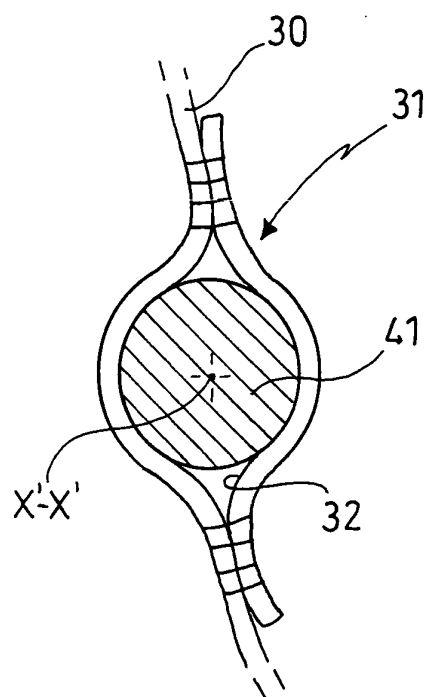


FIG. 6b

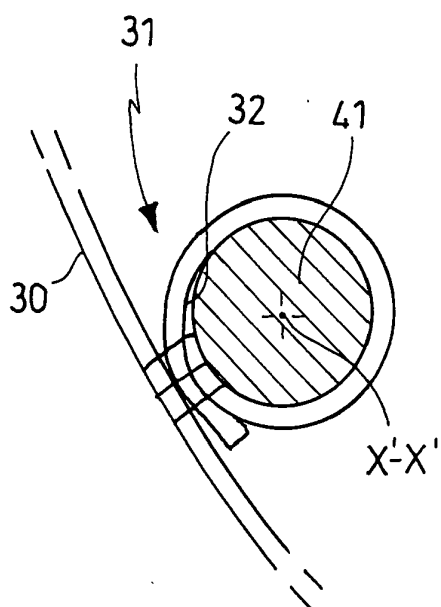


FIG. 6c

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

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