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(54) **PERSONAL HARNESS FOR CARRYING PACKS**

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(57) **ABSTRACT**

Equipment that enables people to carry substantial pack loads have the problems that the body is under load from the shoulders down and packs bearing against the body prevent evaporation of perspiration which generates discomfort and fatigue. An eccentric backpack load exacerbates these problems. The subject invention is a wearable harness that transfers pack loads directly to the person's hips, bypassing the shoulders and upper body. Two over-the-shoulder, inverted "U" beams have attachment points for back and front packs and maintain a ventilation space beneath both. Balanced front and back packs can eliminate load eccentricity. Each beam is supported at the bottom (front and back) by a wide belt that goes over the hip. The harness is kept in place circumferentially at the waist by an ordinary belt around the waist. A distinctive hip is an important advantage; therefore, the invention is applicable mostly to women.

PERSONAL HARNESS FOR CARRYING PACKS : R.S. HIGGINS

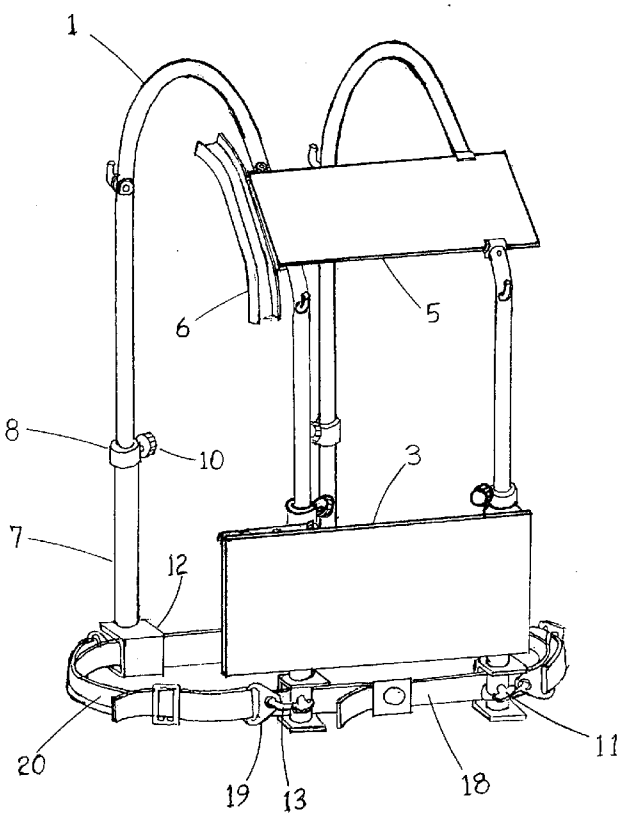

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FIG. 1B

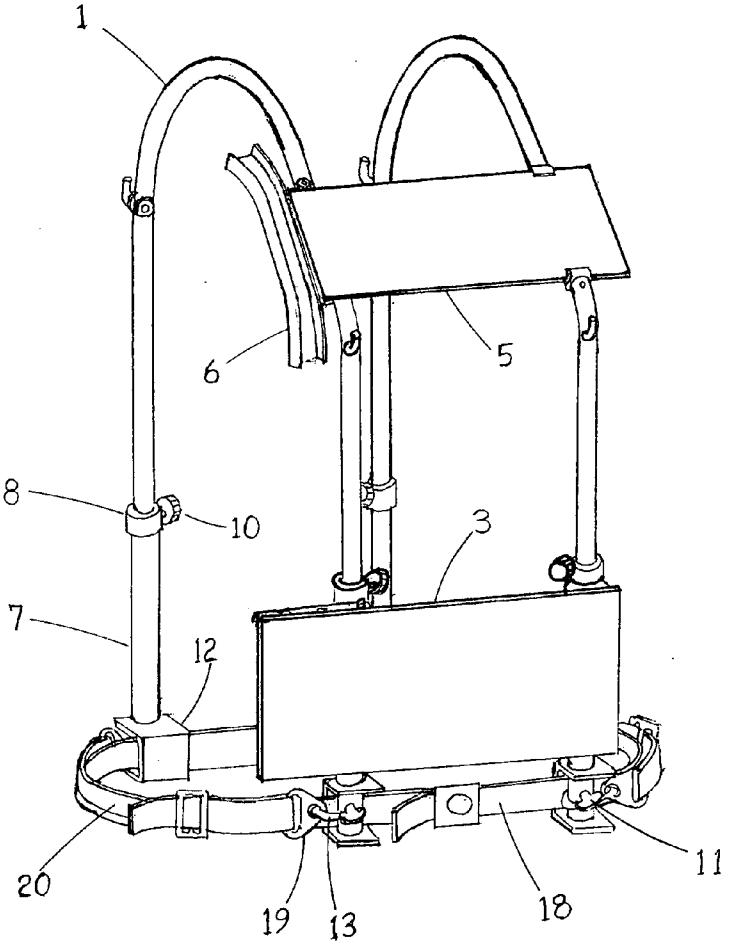

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FIG. 2B

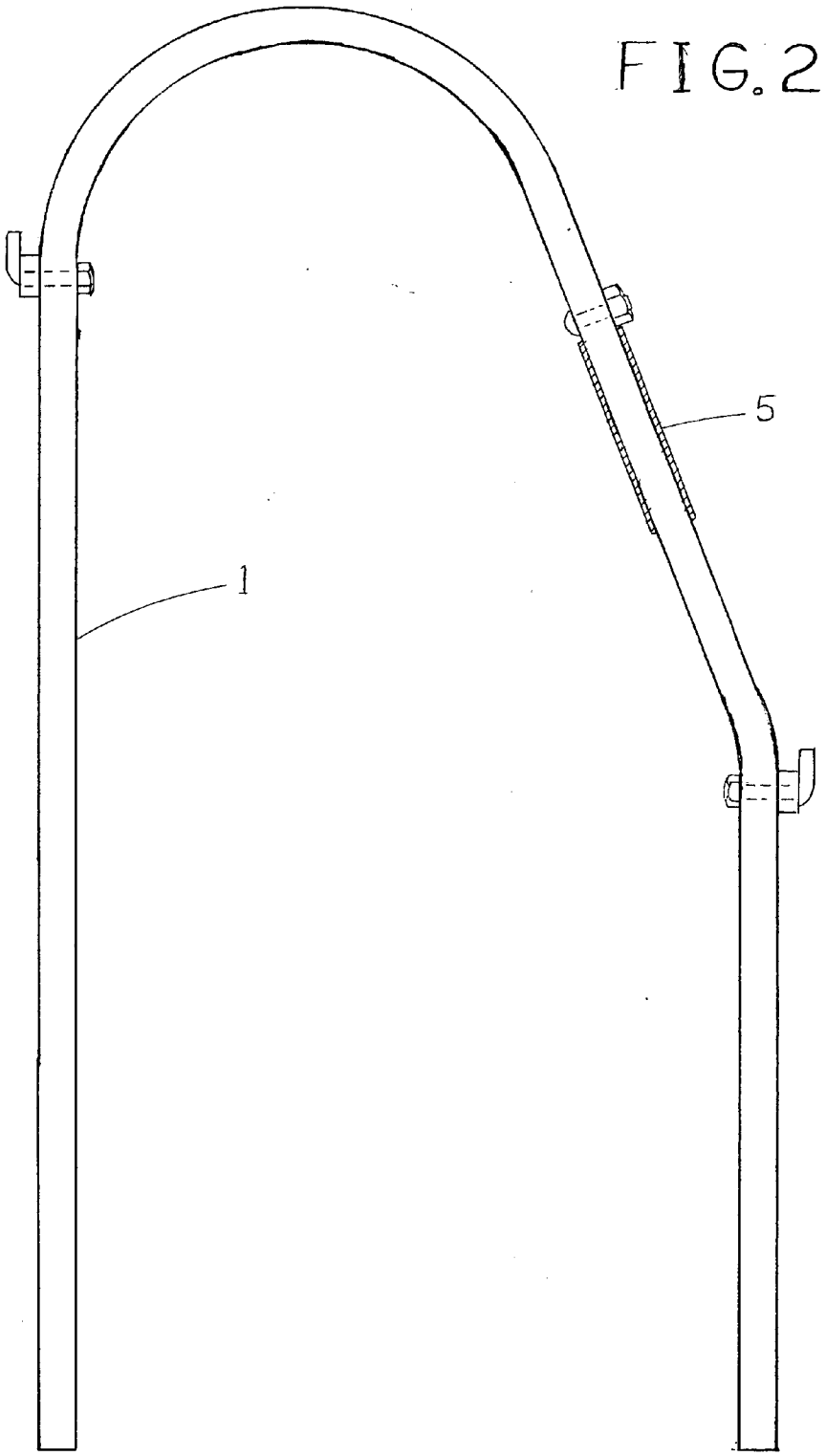

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FIG. 3B

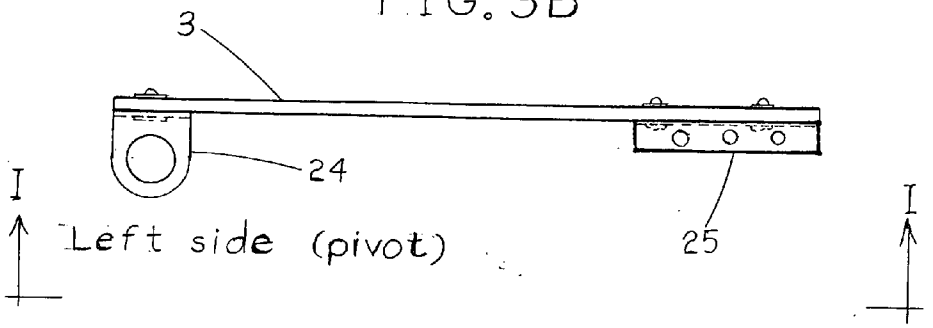
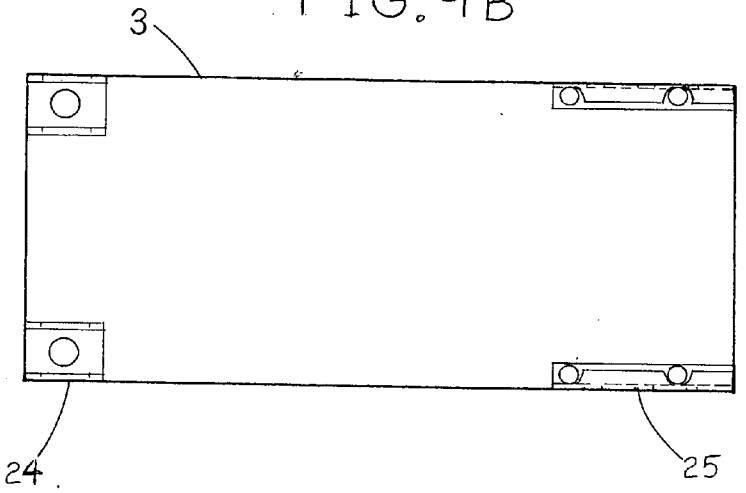


FIG. 4B



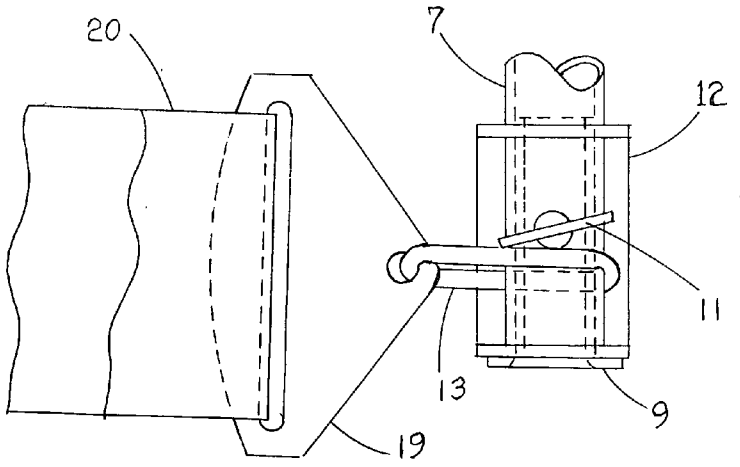


FIG. 7B

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FIG. 5B

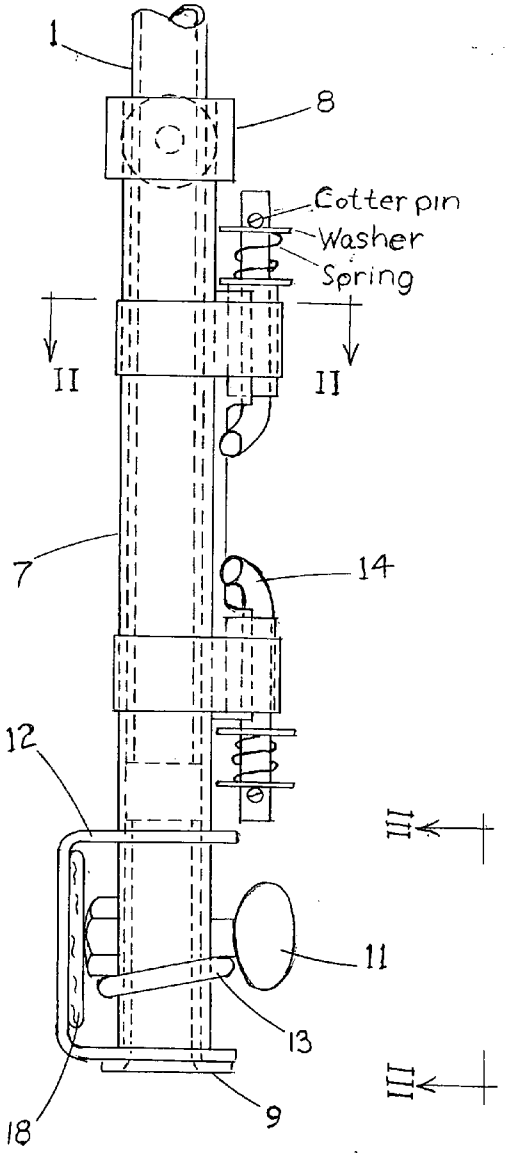

FIG. 6B

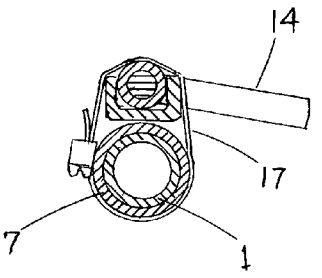

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FIG. 10 B

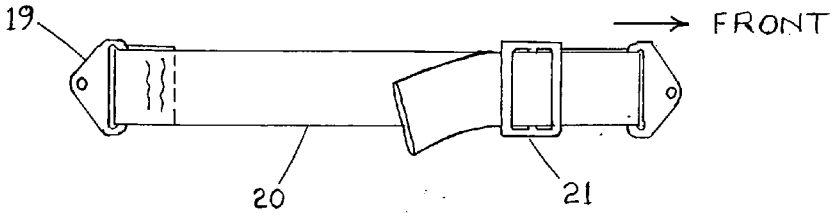
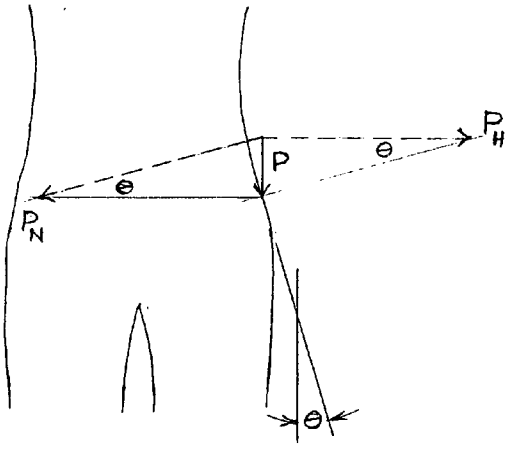


FIG. 24



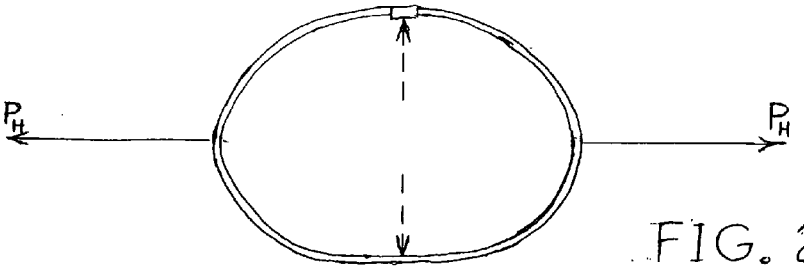


FIG. 25

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FIG. 11B

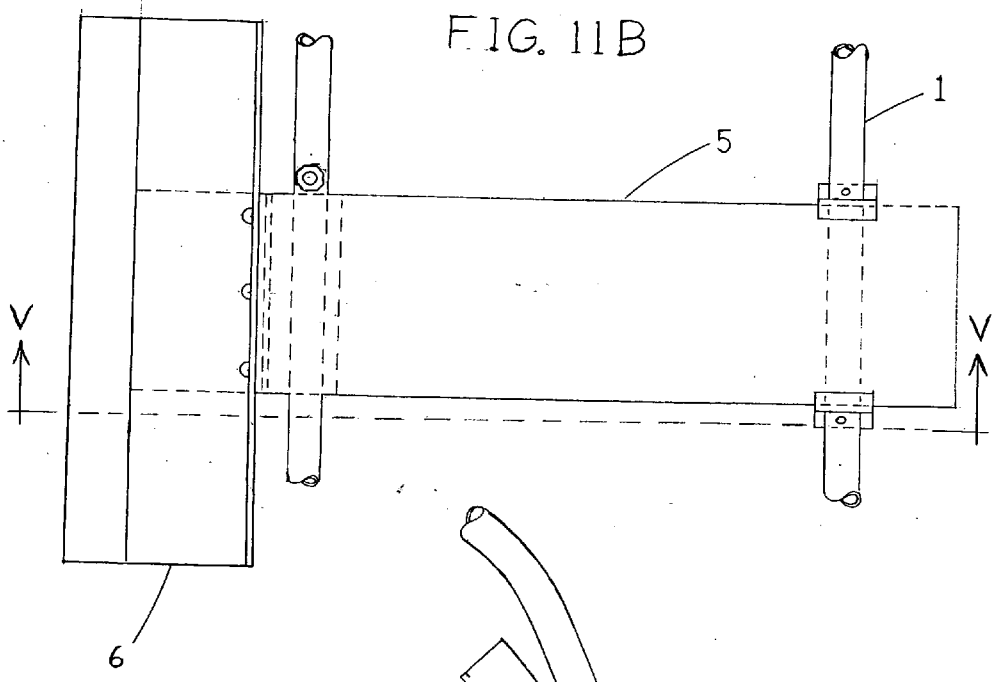


FIG. 12B

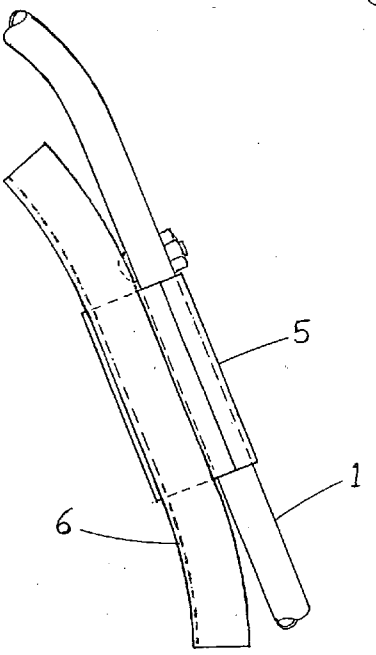
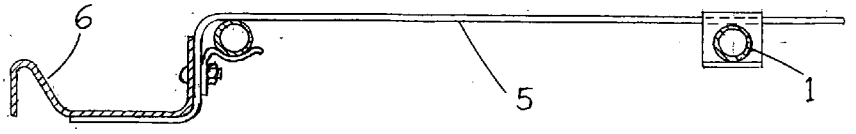


FIG. 13B



PERSONAL HARNESS FOR CARRYING PACKS

REFERENCES

[0001] An application was made to the Canadian Intellectual Property Office for a patent on the subject invention.

[0002] Application no. 2433252

[0003] International Classification: A45F-3/10

[0004] File date: Jun. 23, 2003

[0005] Laid open date: Dec. 24, 2004

[0006] Patent searching found only one patent application (PCT) containing a similar feature to the basic feature of the subject invention.

[0007] International Publication No. WO 01/22847 A

[0008] Publication date: Apr. 5, 2001

[0009] Two references are cited as verification of the need for the subject invention.

[0010] International Publication No. WO 03/055349

[0011] NTIS publication ADA300692 "Symptoms During Load Carrying: Effects of Mass and Load Distribution . . . "

BACKGROUND OF THE INVENTION

[0012] This invention provides to a man or a woman a personal harness that facilitates the carrying of luggage packs on his/her back and front and is therefore called a "Personal Harness for Carrying Packs". It deals with the following problems with the current designs of back/front pack equipment. These apparati invariably place all or some of the pack load onto the shoulders. Most of those designed for heavy load are based on a belt that is wide at the hips and back and include a flexible foam base for transferring most of the load from the pack to the hips. The pack often includes an interior or exterior frame to convey the load to the belt. The configuration of these back pack devices inevitably results in serious work and discomfort in carrying heavy back packs for a long time. The first reason is that such packs load a person's body eccentrically from the back, causing the person to bend forward to compensate, which puts considerable load onto the back instead of the hips. Secondly, the pack bears upon the back, preventing evaporation of perspiration. Because of the stress placed on the upper body by heavy packs, women are especially burdened. To be effective, the waist belt must be kept tight at all times and this tightness tends to build up heat and generate discomfort. The pressing of packs against the body also prevents heat loss and causes discomfort and fatigue. The subject invention employs two inverted "U" beams, vertically oriented, that make a dual rail platform for the packs to bear against, instead of bearing directly against the body. Transferring the vertical loads in the rails onto the hips of the wearer is the main challenge that is solved by the invention.

[0013] The problem is that only the horizontal component of bearing area on the hips can be relied upon to react vertical loads. This area depends on the slope of the upper hip, that is, the angle to the vertical (theta). **FIG. 24** of the drawings shows a force analysis at the hip. Force P represents the vertical load conveyed by one of the "U" rails, that is, half of the total pack load. Reaction by friction force is ignored because of the difficulty in setting up an effective, reliable friction force. The softness of the skin and pliability of clothing discourage a constant normal force which is necessary for generation of a friction force. In addition, the jostling of the load when a person constantly moves destroys the reliability of friction force. Instead, the load P is resolved into force Pn, which can be reacted by a bearing force normal to the body at that location, and force Ph, which can be reacted by tension in the cincture belt (around the waist). The magnitudes of these forces depends on the angle theta as follows. (Recall that P=½ L where L=total pack load).

P/Pn=sine(theta), so that $Pn=(\frac{1}{2}L)/\text{sine(theta)}$

Also,

P/Ph=tan(theta), so that $Ph=(\frac{1}{2}\ L)/\text{tan(theta)}$

EXAMPLE

[0014] If pack load L is 60 lbs and angle theta is 10 deg. Then load normal to each hip, Pn, is 173 lbs and Ph is 170 lbs.

[0015] The problem with conveying pack loads directly to the hips of a person comes down to transmitting the high load Pn into the hip without causing injury or skin irritation resulting from constant movement of the load as the person walks. Also, Ph causes high tension load in the cincture belt which could cause stretch, or slip at the buckle (see **FIG. 25**). Accelerations of the packs as the person maneuvers over rough terrain can cause momentary increase in the load P which exacerbates these problems. I suppose that military forces in various countries have been trying to design better methods of carrying packs for at least two centuries. As I see it the stumbling block with using rigid structure to put the load directly onto the hip is the problem just discussed. Furthermore, with most men having a low value of theta (**FIG. 24**) this factor must have been discouraging. For this reason I suggest that my invention is more useful to women. For example, if theta is 25 deg, then Pn=71 lbs and Ph=64 lbs.

BRIEF SUMMARY OF THE INVENTION

[0016] The subject invention consists of two vertical, substantially rigid, inverted "U" shaped beams that go above the shoulders of the wearer, down the front and back of the body and have attachment points for both front and back packs. These can be balanced to bring the center of gravity of the total load to the middle of the body, over the person's legs. When carrying such front and back packs the person walks upright. In addition, the packs mount on the beams, leaving some space for ventilation between the pack and the person's body.

[0017] The loads from the beams are transferred directly to the tops of the hips by means of a wide belt, e.g., 2 inch, that connects to a load beam at the front and goes over the top of the hip, making a significant angle (>10 deg) to the vertical and connecting to the same beam at the back. Similarly on the other side of the body. A standard belt around the waist initially holds the apparatus in place, permitting adjustments if necessary, and aids in limiting slippage up or down the body. The beam structure, which does not touch the shoulders, plus the special waistband, effectively transfer all of the pack load to the hips, leaving the upper body unstressed and remote from the packs. It should therefore be practical for a woman to carry similar pack loads as a man.

[0018] The invention includes a horizontal beam spanning the said vertical beams at the front and having a receptacle cup to receive the butt of a rifle and absorb the recoil from the gun by spreading its effect through bending of the crossbeam and vertical beams, by transferring momentum to the mass of the packs carried, and by compression of clothing, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0019] There are 11 drawings illustrating 16 numbered parts in this embodiment of the invention plus two sketches as an aid in discussing underlying theory.

[0020] **FIG. 1B** is an approximately ¼ size three dimensional view of the entire harness.

[0021] **FIG. 2B-4B** are approximately ½ size and are described as follows.

[0022] **FIG. 2B**—side view of one over-the-shoulder beam (**1**) on the right side.

[0023] **FIG. 3B**—downward view of the front plate (**3**) that stabilizes the two vertical beams (**1**) at the front.

[0024] **FIG. 4B**—Section I-I view of the front plate (**3**) on **FIG. 3B**

[0025] **FIG. 5B-7B** are approximately full size illustrations showing:

[0026] **FIG. 5B**—tubular receiver (**7**) for the bottom of the vertical beam (**1**), and the lower bracket (**12**) for connection to the belts (**18** and **20**). Front right assembly is shown, including the closing attachment for front plate (**3**).

[0027] **FIG. 6B**—Section II-II view of latch mechanism in **FIG. 5B**

[0028] **FIG. 7B**—frontal view (section III-III) of lower bracket (**12**) in FIG. SB and connecting links **13** & **19**

[0029] **FIG. 10B**—is an approx. ¼ size view of load belt (**20**) on the right side. Left side is mirror image

[0030] **FIG. 11B-13B** are approximately ½ size illustrations showing:

[0031] **FIG. 11B**—frontal view of the gun support structure.

[0032] **FIG. 12B**—side view from the right of the gun support structure.

[0033] **FIG. 13B**—section V-V from **FIG. 11B**

[0034] FIGS. **24** & **25**—diagrams to support force analysis discussion

DETAILED DESCRIPTION OF THE INVENTION

[0035] The primary structure, namely the over-the-shoulder beams **1**, are shown in **FIGS. 1B & 2B**. Each is a round cross-section aluminum tube, bent in **2** places, but other cross sections, materials and bend configuration could be made to work. A front pack can be attached to the load beams **1** if it is constructed with a matching ring (not shown) that goes over the attachment hook, with straps or elastic cords from the pack going around the beams and secured back at the pack, e.g., by Velcro or hook. The load beams **1** have similar connectors on the backs of the load beams **1**, to be utilized in the same way for a back pack. The front plate **3**, when connected shut at the right side, prevents relative motion of the load beams **1** in the plane of the plate, thereby bringing basic stability to the load structure. The plate could also fulfill this purpose if placed at the back. The front plate also makes a rigid link at the front for balancing the high horizontal force components from the sides. In addition, the large bearing area of the plate against the body enables the fore-aft component of tension force in belt **20** to be borne comfortably at the soft front of the body (see **FIG. 25**). In this embodiment the plate is made from semi-rigid plastic, such as UHMW polyethylene.

[0036] Referring to **FIGS. 3B & 4B**, the front plate **3** is hinged at the left side to tube receiver **7** by Part **24** and fastens at the right side by connector **25** and retractable pins **14** (See **FIGS. 5B & 6B**). There are several holes in connector **25** to permit adjustment of width. The retractable pins are housed in simple journal bearings of common commercial design and kept aligned in a common link such as the channel shown. This sub-structure is secured to tube **7** by such conventional means as the metal straps shown (**17**). In this embodiment, tube **7** is standard aluminum tube but other strong material could be made to work.

[0037] The load beams **1** transfer their loads to the load belts **20** via receiver tubes **7** into which the beams telescope (**FIG. 5B**), and lower bracket **12** where short link **13** encircles tube **7** at one end and passes through the hole in the load belt end connector **19** at the other. Link **13** can be made from a link of decorative chain. The receiver tube **7** allows adjustability to the length of the torso and once fitted, the set screw is hand tightened by the knob and driven through collar **8** and receiver tube **7** into load tube **1**, as illustrated in **FIGS. 1B & 5B**. Receiver tube **7** is secured to bracket **12** by flange-ended insert **9** and transmits down load by pushing chain link **13** downward, which pulls load belt **20** taut over the top of the hip. In this embodiment collar **8** is a segment of plastic tube, e.g. electrical conduit, and part **12** is made from aluminum plate or channel. Part **9** is a swaged short metal tube and part **11** a standard steel set screw. Other materials of sufficient strength and stiffness could be made to work.

[0038] The arrangement of the load belt **20** is shown in **FIG. 10B** and there is one on each side of the body. It connects to link **13** at the back and goes over the top of the hip and connects to link **13** at the front. In this embodiment it is standard polypropylene belt, but other material could be made to work. At the top of the hip it must have a substantial horizontal orientation so that the pressure from the hip onto the belt has enough vertical component to counteract the vertical loads from the packs. Therefore, it must make an angle of at least 10 deg. and preferably over 20 deg. to the vertical. Such distinct configuration of the hip is common with women but not with men. Consequently, it can be expected that this invention will be much more applicable to women. Indeed, by bypassing the upper body when supporting loaded packs, the personal harness will enable women to carry similar loads as a man.

[0039] With the first-time use of the harness the person determines the best separation of the load beams **1** by trying the various settings for this at the front plate (there are three shown in this embodiment). The best is when the beams are sufficiently inboard to optimize the position of the load belt

20 over the hips while not making contact with the neck under any maneuver, nor interfering with head movement. The waist part of the apparatus is positioned below the top of the hip and kept in place by doing up the cincture belt **18**. The load beams **1** should be moved along the cincture belt **18** until they are centered on the spine. Then the thumb bolts **11** should be tightened to fix the lower bracket **12** on the cincture belt **18**. Similarly, at the front, these thumb bolts should be tightened. The load belts **20** should be positioned over the hips and tightened snugly using the trench coat buckles **21**. The load beams **1** should be adjusted in their receiver tubes **7** so that the beams are two fingers width above the tops of the shoulders. The set screws at the tops of the receiver tubes **7** are then manually tightened to fix this setting. All these settings should then be good for subsequent wearing by the same person wearing clothing of similar bulk.

[**0040**] The packs must be designed for the hook design on the load beams and may require an internal, horizontal beam to fix the separation of the load beams at the attachment. Also, the hook design may be changed to suit the attachment mechanism on the pack. An attachment device could be added near the bottom of the load beams **1** or the receiver tubes **7** for attaching packs. Padding could be added under the load belt for a commercial design.

[**0041**] The gun butt support structure **5**, shown in **FIG. 11B-13B**, is first pushed through the clips on the left side load beam and then pushed over the right side beam **1** so that the bent plate embraces it. This structure must be removed before the harness can be removed from the body.

PRIOR ART

[**0042**] Prior art that comes closest to the subject invention is WIPO application WO 01/22847, which differs in the following regards. That invention employs a closed "substantially rigid" rod that goes over the shoulder and against the side of the wearer to bring vertical load from a pack to a single point on the wearer's hip. It appears that only the top part of the rod is available for hanging packs. Therefore, the rod configuration cannot maintain a ventilation route under the packs.

[**0043**] The subject invention (CIPO no. 2433252) places the load on the wearer's hip by a wide belt that is tensioned by the loads from one rail **1** connecting at the front and back. This belt spreads the load over a much wider area at the top of the hip. The benefit of this is evident from the force analysis at the hip. **FIG. 24** shows the vertical load P from packs being resolved into a force Pn that acts normal to the hip and is reacted by pressure from the body to load belt **20**. It also shows horizontal force Ph that acts on belt **20**. The angle theta is the angle between the body and the vertical and has a profound effect on the magnitude of forces Pn and Ph. For a heavy pack load of 60 lbs and theta of 10 degrees, representing a man with a somewhat distinct hip, then Pn=173 lbs and Ph=170 lbs. They apply to both hips. The 'prior art' invention of WO 01/22847 applies force Pn by the steel ring part of the eye bolt through a flexible leather pad. Pressure on the wearer's skin and hip bone will be correspondingly high in that area. Inasmuch as this local pressure on the hip is the limiting factor in weight that can be carried, the invention of WO 01/22847 has much lower capacity than the subject invention (CIPO no. 2433252).

[**0044**] In invention WO 01/22847 the horizontal force Ph acting on the cincture belt is likely to pull it into the soft front of the body, as indicated in **FIG. 25**, which would cause slippage of the leather pad down the hip. In the subject invention (CIPO no. 2433252) the front plate has a comparatively large area for transmitting that force.

What is claimed is:

1. A harness that is worn by a person to alleviate the stress and discomfort of carrying packs, such harness consisting of inverted "U" beams (**1**) going over the shoulders of the wearer but not touching them, and vertically oriented so as to provide a base at the back and front of the torso for attaching packs, and connecting to the ends of flexible load belts, one on each side of the body, such that each belt is tensioned by the load from its attaching beam (**1**) and thereby transfers that load to an area of the hip where there is enough horizontal orientation to provide an upward pressure load equal to the vertical load from the packs.

2. A harness according to claim 1 that employs a connecting plate (**3**), having sufficient in-plane strength and rigidity, between the said beams (**1**) to prevent relative movement of the beams of claim 1 in the vertical plane, such as relative up-down movement or rotation about fore-aft axes at the waist (support) level.

3. A harness according to claim 1 that allows suitably designed luggage pack(s) to be mounted on the front and/or back of the wearer such that a ventilation path is provided between the pack(s) and the wearer's body to facilitate the rejection of heat from the body.

4. An accessory for a harness according to claim 1, consisting of an essentially horizontal beam (**5**) that attaches to the vertical beams of claim 1, such beam incorporating a suitably constructed trough (**6**) in front of the wearer's shoulder for accepting the butt of a rifle and absorbing the recoil when it is fired by transferring the force to the vertical beams of claim 1.

* * * * *