ABSTRACT

A backpack employs a collapsible stretcher and a collapsible wheel assembly. The backpack may be transformed from a compact mode suitable for portability of the backpack to an extended mode wherein the stretcher is extended. A pair of wheels are inflated so that the wheels at one end contact the terrain and at the other end the stretcher is engaged to the backpack to provide for an efficient transport of an injured individual placed in the stretcher.
CARRIER WITH COLLAPSIBLE WHEEL ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATION


BACKGROUND OF THE TECHNOLOGY

[0002] The technology relates generally to backpacks such as may be employed by hikers, search and rescue workers and soldiers, and to stretchers such as may be employed for rescue by military personnel, hikers and rescuers in remote locations. In addition, the technology relates to a collapsible wheel assembly such as may be employed in stretchers, gurneys and game carriers used by hunters.

SUMMARY

[0003] Briefly stated, a backpack comprises a main frame and a strap assembly connecting the main frame. A collapsible stretcher is mounted to the frame and is transformable from a compact storage mode for portability with the main frame to an extended mode for usage of the stretcher for transportation purposes. In the extended mode, the stretcher may be supported at a proximal end by the main frame and is adapted to carry an individual with a distal end assembly engaging the terrain. The stretcher comprises a pair of telescopic rails. A flexible carrier connects the rails. A crossbar connects at one end of each rail pair. An axle assembly connects a second end of each rail pair and is extendable to provide a pair of wheels which are transversely spaced from the rails. In the extended mode, the crossbar is hingedly connected to the main frame, and the rails and axle assembly are extended so that the wheels are engaged with the terrain to permit efficient transport of a person placed on the stretcher by a single individual to whom the main frame is mounted.

[0004] In the compact mode, the stretcher is configured in a collapsed stretcher frame and is attached to the main frame. The proximal end of the stretcher is hingedly connected to the main frame at a first location. The rails are retracted and are secured to the main frame at a second location. A spring urges the rails to pivot away from the main frame. The rails are secured by a releasable connector to the top of the main frame, and the connector is releasable so that the rails pivot under the bias of the spring. When the rails pivot, an extension of the axial assembly is projected transversely, and the rails are slidably extended to an extended mode.

[0005] The axle assembly comprises a spring loaded extension axle and a toroidal bladder which is rotatably mounted to the extension axle. The stretcher is transformed to the extended mode wherein the extension axle is automatically transversely projected and the wheel is automatically inflated. A gas cylinder has a valve which is opened to inflate the wheel. There is a spring loaded extension axle for each wheel. A carbon dioxide cartridge with a valve preferably inflates each of the wheels.

[0006] A carrier assembly comprises a pair of support members and an axle assembly which is mounted to an end of the members. The axle assembly comprises a tube and a spring loaded extension axle is received in the tube. The axle extension mounts a journal bearing which mounts a bladder.

A gas cartridge has a valve which is in fluid communication with the bladder. When the valve is opened, the bladder is inflated to form a wheel rotatable about the extension axle. The extension axle is projected transversely and the bladder is also projected transversely from the tube and the valve is automatically opened to inflate the bladder. A second spring loaded extension axle is received in the tube at an axially opposite location. The second extension axle also mounts a second journal bearing which mounts a second bladder and a second gas cartridge having a valve in fluid communication with the second bladder. When the second valve is opened, the bladder is inflated to form a second wheel rotatable about the second extension axle. A flexible carrier may connect between the support members. The gas cartridge preferably contains pressurized carbon dioxide.

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 is a representative view illustrating a backpack, a stretcher and a wheel assembly as used to transport an injured person;

[0008] FIGS. 2A, 2B, 2C and 2D are perspective views illustrating how the backpack may be deployed from a compact storage condition to an extended configuration for transporting an individual;

[0009] FIGS. 3A, 3B, 3C and 3D are fragmentary views, partly in diagram form, illustrating the mechanical structures for withdrawing the stretcher from the pack;

[0010] FIG. 4A and 4B are enlarged fragmentary views, partly in section and partly in phantom, illustrating the activation of the collapsible wheel assembly;

[0011] FIG. 4C is an enlarged fragmentary perspective view of a portion of the wheel assembly upon inflation;

[0012] FIGS. 5A and 5B are enlarged sectional views, illustrating structure of a collapsible wheel;

[0013] FIG. 6 is an enlarged perspective view of an inflated collapsible wheel and an inflation assembly.

DETAILED DESCRIPTION

[0014] With reference to the drawings wherein like numerals represent like components throughout the figures, a backpack 10 with straps 11 comprises three main sub-assemblies: a pack frame 12, a collapsible stretcher 14 and a pack 16. In the normal backpack storage mode, the pack frame 12, the stretcher 14 and the pack 16 are integrated and secured to form a backpack 10 which has an outward compact configuration similar to any other backpack or military rucksack except for the modifications described herein. As illustrated in FIG. 2A, the backpack 10 can thus be employed and transported by a hiker, a search and rescue worker or soldier or other similar personnel in the same fashion as a backpack may be employed for non-rescue use.

[0015] The pack frame 12 preferably includes upper and lower cross members 13 and 15, respectively, and transversely spaced side supports 17 and 19.

[0016] In the compact mode, the stretcher 12 forms a collapsed stretcher frame designated by the numeral 22. The stretcher 12 comprises two main telescopic rails 50 and 52, a crossbar 54, which may be telescopic, and a telescopic or hinged axle assembly designated generally by the numeral 60. One end of the rails 50 and 52 connects with the crossbar 54 and the opposite end connects with the axle assembly 60. A flexible carrier 56, which may have a mesh fabric and other suitable construction, connects with rails 50 and 52. The axle
assembly 60 is employed first either by telescopic or hinged sections 62 and 64 that are received in an axle tube 70, thus creating an envelope space for bladders 78 which ultimately transforms to high flotation self-inflating wheels 80.

[0017] The stretcherv frame 22 is positioned against the pack frame 12 so that the axle assembly 60 is generally adjacent frame member 13, crossbar 54 is adjacent and pivotally connected to frame member 15, and rails 50 and 52 are adjacent supports 17 and 19, respectively. The 22 frame is covered by the pack 16. The upper portion of the frame 22 is secured to the pack frame 12 by lanyards 20 or other releasable connectors.

[0018] When usage of the stretcherv 14 is required, the stretcherv frame 22 is withdrawn from the pack 16 and frame 12, and the stretcherv is transversely suspended from lower member 18 and expanded to an extended mode for usage (FIGS. 1; 2D). The stretcherv may be partially supported by the frame for transporting an injured person (See FIG. 2D). Upon termination of usage, the stretcherv may be collapsed and returned with the pack to the compact storage mode (FIG. 2A).

[0019] When the stretcherv 14 is required, the wearer of the backpack pulls on two lanyards (rip cords 20), thus releasing a top portion of the collapsible stretcherv 14 from the pack frame 12. With reference to FIGS. 3A to 3D, the collapsed stretcherv frame 22, which is now approximately the same length as the pack frame 12, tilts away from the pack frame due to a spring 28 biased to rotate in a pivotal motion about the crossbar 54/crossmember 15 hinge connection at the lower portion of the pack frame 12. The stretcherv frame 22 remains connected to the pack frame via two large hooks 30 and 32 at the base of the pack frame. The hooks also provide a hinge function as the stretcherv frame falls and pivots away from the pack frame.

[0020] As the stretcherv frame 22 separates from the pack frame 12, multiple tethers 26 permanently fixed to the back pack frame are placed in tension and cause pins 74 to be pulled from the axle assembly 60 of the stretcherv frame (FIG. 4A). The removal of the tether pins 26 from the axle tube 70 allow axles 62 and 64 to spring out under the urging of a coil spring 66 (FIG. 4B) and provide a wide stable wheel base (FIG. 2D) for the stretcherv. As the axle assembly 60 extends transversely, it triggers carbon dioxide (CO₂) cartridges 72 associated with bladder or to provide pressure required for wheel inflation.

[0021] The travel of this outward extension can be a telescoping action and/or a pivotal movement about a hinge (not illustrated). The outward movement of the axles 62 and 64 also concurrently trigger the opening of valves 73 of the compressed carbon dioxide (CO₂) cartridges 72, thus inflating the collapsed bladders 78 to form inflated wheels on either side of the axle (FIG. 5B; FIG. 6). The wheel is secured to the axles 62 or 64 by cotter pins 63 or other suitable means. Within seconds the wheel side of the stretcherv has fallen to the ground behind the user and two high flotation wheels 80 have been deployed and inflated.

[0022] The wheels have a relatively low diameter-to-width ratio which results in a quasi-hulbous shape. In one embodiment, the width of the wheel is approximately 9 inches and the diameter is approximately 12 inches. For one preferred range, the diameter/width ratio varies from 0.70 to 2.50. For the FIG. 6 embodiment, the ratio of the diameter to the width of wheels 80 is approximately 2.00.

[0023] Each wheel 80 is constructed by attaching the toroidal bladder 78 to a low profile, high aspect ratio journal bearing 90. The inner diameter of the journal bearing then receives an axle shaft of the extension axle 62 or 64 to allow relative rotational movement/motion between the two components. The toroidal bladder 78 is attached to the journal bearing 90 which essentially has no rim structure or any radial structure. The radial flaps 92 extend downward from the sidewall of the toroidal bladder 78 to the outside diameter of the journal bearing. These flaps 92 are then clamped to the journal bearing tightly to prevent slippage axially outward.

[0024] Alternatively, the exterior surfaces of the toroidal bladder 78 may be covered with a fabric or other flexible cover 94 (FIG. 4D) that will enhance abrasion and puncture resistance. The cover 94 provides the anchoring between the bladder 78 and the journal 90. The cover 94 may be manufactured from fabric or other materials which will protect the bladder from puncture or other damage. The inflated wheel again has no rim, no spokes and no fixed rigid radial support structure.

[0025] Force transfer via tether line 76 or rip cord, either by hand or by actuation by some sort of primary application, such as the movement of the extension axle relative to the axle tube 70, causes a valve 73 to open and high pressure gauge gas, such as compressed carbon dioxide (CO₂), to escape from a small pressure vessel and enter the toroidal bladder 78 of the wheel. The toroidal bladder inflates to a designated pressure (FIG. 6). The designated pressure can be achieved in one of two ways: first, by calculation of the pressure and the volume of a small pressure vessel as compared to the high volume and lower pressure of the toroidal bladder, or second, by regulating the pressure via a regulator pressure release valve. After the designated pressure is reached, the wheel 80 is ready for use.

[0026] The CO₂ gas may be substituted with other gases or a thermost forming material that will harden to a round shape inside of the toroidal bladder but allows the wheel to work with no rigid structural supporting members. The low aspect ratio results from the wheel being very wide and having a high width-to-diameter ratio (or low diameter-to-width ratio) compared to many of the related typical wheels. This allows for a high load carrying capacity without requiring structural support of the sidewall, i.e. the wheels are resistant to buckling under heavy loads.

[0027] The backpack 10 has straps 11 and provides all the normal functions of a typical external frame backpack while having the additional ability to rapidly deploy a rescue stretcher after activating the deployment lanyards 20 attached to the release and deployment mechanisms. This combination assembly is ideal for hikers, search and rescue workers and soldiers since they can transport either normal military or hiking items in the backpack for normal non-rescue use. When an injury or other event occurs that requires transport, the rescue stretcherv 14 can be deployed in under 20 seconds for a rapid evacuation. Further, the stretcherv can be operated by a single person for rescue of a partner when only two people are present in a given remote location. The stretcherv 14 can also be operated in a hands free mode to allow an injured hiker to use his hands for traversing rough terrain or to allow a soldier to carry and fire a weapon while in the middle of a rescue situation (FIG. 2D).

[0028] The pair of collapsible wheels 80, at least in the given environment, is inherently more efficient than related collapsible wheel designs. A primary application of the col-
lapsible wheel feature is in conjunction with the collapsible stretcher 14 as described. However, the collapsible wheel features may have a wide range of applications apart from the described collapsible stretcher. Because in the inflated state the wheel has a wide profile and high flotation characteristics, it can easily traverse muddy, wet, snowy or sandy terrain. In addition, the wheel can be deployed in a matter of seconds and does not require any special tools. It can also be automatically deployed and incorporated into various other applications.

[0029] The substantial hands free features provide improved capabilities since the load from the stretcher is now distributed to the pack frame which provides better and more comfortable load carrying capability. In the expanded state, the stretcher 14 can be integrated with the pack frame 12. In addition, the inflatable wheels can also be deployed in a highly efficient fashion to provide a versatile structure. The deployed assembly provides very wide and high width to diameter ratios for the wheels which allow for high load carrying capability without requiring structural support for the sidewall.

[0030] After usage the stretcher, including the wheel assembly, may be efficiently collapsed and reattached to the frame for subsequent usage as previously described. The wheels 80 are collapsed by opening the valve 73 to the atmosphere or by applying a vacuum to the bladder interior.

[0031] While preferred embodiments have been set forth for descriptive purposes, the foregoing description should not be deemed a limitation of the invention herein. Accordingly, various modifications, adaptations and alternatives may occur to one skilled in the art without departing from the spirit and scope of the invention.

1. A carrier assembly comprising:
   a pair of rail members; and
   an axle assembly mounted to an end of said members, said axle assembly comprising:
   a tube;
   a spring loaded extension axle received in said tube;
   a journal bearing mounted to said extension axle;
   a bladder mounted to said journal bearing; and
   a gas cartridge having a valve and in fluid communication with said bladder, when said valve is opened, said bladder is inflated to form a wheel rotatable about said extension axle.

2. The carrier assembly of claim 1 wherein said extension axle is projected transversely and said bladder is projected transversely so that said bladder is projected from said tube and said valve is opened to inflate said bladder.

3. The carrier assembly of claim 1 wherein said axle assembly further comprises a second spring loaded axle extension received in a tube at an axially opposite location thereof and mounting a second journal bearing which mounts a second bladder; and a second gas cartridge having a valve in fluid communication with said second bladder wherein when said second valve is open, said second bladder is inflated to form a second wheel rotatable about the extension axle.

4. The carrier assembly of claim 1 wherein a flexible carrier connects between said rail members.

5. The carrier assembly of claim 1 wherein said gas cartridge is pressurized carbon dioxide.

6. The carrier assembly of claim 1 wherein the wheel upon inflation has a width and diameter and the ratio of the diameter to the width is in the range of approximately 0.70 to 2.50.

7. The carrier assembly of claim 4 wherein the ratio is approximately 2.00.

8. The carrier assembly of claim 1 wherein the bearing has a central axis and a generally cylindrical mounting surface with no radially projecting structure.

9. A carrier assembly comprising:
   a pair of supports; and
   an axle assembly mounted to an end of said supports, said axle assembly comprising:
   a pair of extension axles movable from a storage position to an extended position;
   a journal bearing mounted to each said extension axle;
   a bladder mounted to each said journal bearing; and
   a gas cartridge having a valve and in fluid communication with said bladder, which when said valve is opened, said bladder is inflated to form a wheel rotatable about a said extension axle.

10. The carrier assembly of claim 9 wherein when a said extension axle is moved to an extended position, said valve is automatically opened to inflate said bladder.

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