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(71) Applicant and
(72) Inventor: **STONE, Kevin R.** [US/US]; c/o The Stone Clinic, 3727 Buchanan Street, San Francisco, California 94123 (US).

(74) Agent: **POWERS, Elizabeth E.**; Powers Law Firm, 1484 Pollard Road, Suite 162, Los Gatos, CA 95032 (US).

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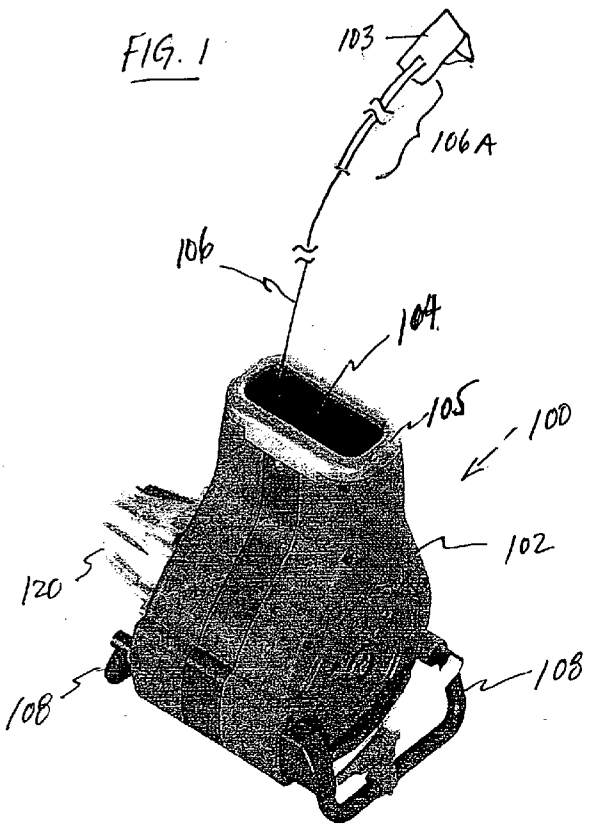
(54) **Title:** PERSONAL ESCAPE DEVICE AND METHODS FOR USING SAME



(57) **Abstract:** The invention presents devices for controlled descent from buildings. Such a device includes a housing having a primary spool about which a cord is wound, a payload coupler for attaching a harness assembly to the housing, and an unwind control assembly for controlling the rate of exit of the cord from the housing. An inventive device kit may include a convertible storage unit used to protectively store a device and which, upon deployment, may be used as a protective helmet. In using an inventive device, a user attaches the device to a fixture in a building, dons a harness and the converted helmet, attaches the device to the harness, and exits the building from a window or roof.

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PERSONAL ESCAPE DEVICE AND METHODS FOR USING SAME

CLAIM OF PRIORITY

This application claims priority to U.S. provisional application Ser. No. 60/950,451, filed July 18, 2007, incorporated herein fully by reference.

FIELD OF THE INVENTION

The present invention relates to emergency equipment and personal safety devices involving exiting a tall building in event of an emergency.

BACKGROUND

Each year, an estimated ten thousand fires occur in buildings that are seven stories or higher. Hundreds of firefighters and police risk their life every day by entering burning buildings to save trapped civilians. Additionally, terrorism, hostage situations, and violent crime rampages worldwide are increasing, often leaving people trapped high above the streets, waiting for rescue.

An estimated 2,726 people died on September 11, 2001, at the World Trade Center in New York City. Of that number, 343 were firemen who entered the building to save lives. An estimated 200 people were trapped civilians who willingly jumped from the buildings before the buildings collapsed. Though 9/11 was an extreme situation, it is not uncommon for victims of high rise fires to jump as a last resort to escape smoke and fire. For many fire victims, exit routes are too slow or inaccessible due to extremely hot flames and smoke. For overweight or physically impaired individuals, stairs are not an option. Too frequently victims are trapped and forced to wait for rescue.

Over the years, many devices have been created attempting to address the problem of controlled descent in an emergency situation, either to prevent work-related falls or for emergency descent from buildings. Many of these prior art devices rely solely upon hydraulic or other fluid braking systems. Such devices have a relatively short life, depending on the nature of the fluid, and risk failure due to low or insufficient fluid levels. Because emergency situations rarely occur, and even more rarely occur more than once for a single building, emergency devices must be able to be stored for extended periods of time without maintenance without any risk of degradation of functionality.

Other prior art devices are manual in nature. U.S. Pat. No. 5,842,542, uses a manual braking system, such as a rope windlass system, to slow the passage of a rope as the person descends. However, wear on the rope caused by the friction of the manual braking system makes such a system dependent upon the abilities of the user, thus are less reliable for members of the population who do not have the capacity to exert sufficient force to slow the descent.

Yet other prior art devices include a complexity of mechanics to make them unwieldy and inherently less reliable. Such devices are found in U.S. Pat. No. 3,946,989, and U.S. Pat. No. 6,745,872. Not only are such complex mechanisms expensive to manufacture, the multiple parts makes them inherently unreliable. Similarly, prior art devices that include spring mechanisms, such as that found in U.S. Pat. No. 3,760,910, include an element that may not store over time, may break under certain heavier weights, or may not extend sufficiently under certain lighter weights.

Thus, there remains a need for a reliable device for enabling the controlled descent of persons of a range of ages, weights, and abilities from high buildings in emergency situations.

SUMMARY OF THE INVENTION

The present invention provides a personal escape device, which can be used by men, women, children, and physically disabled persons to descend in a controlled and secure manner from high structures, such as office buildings, homes, and the like.

A device of the present invention includes a housing, having a port therein. A primary spool extends along a central axis within the housing opposing the port, and is rotatably coupled to the housing to permit rotation of the primary spool about the central axis. An inventive device further includes an elongated cord, wound around the primary spool, having its proximal end affixed to the primary spool and the distal end extending through the port. An inventive device further includes an anchor assembly extending from the distal end of the cord, which assembly includes some means for coupling the distal end to an external object, such as a door, structural beam or pillar, or other secure structural object in a building.

A payload coupler is affixed to the housing for attaching or otherwise receiving a harness assembly designed to support a payload, such as an individual. An inventive device includes an unwind control assembly, which includes means for

controlling the rate of exit of the cord from the housing at a predetermined function rate in response to a substantially constant pulling force on the distal end of the cord.

An unwind control assembly of the device may include a centrifugal clutch, a hydraulic damper, an air damper, a user-controllable disc or drum brake, a hysteresis brake, an electromagnetic brake, an eddy current brake, or other similar assemblies generally commercially available. Unwind control assemblies may be disposed on an idler shaft coupled to the housing and extending parallel to the central axis, and may be connected by a coupling assembly between the primary spool and housing. Coupling assemblies may include a direct connection, a gear assembly, a chain and sprocket assembly, a belt and pulley assembly, or other similarly functioning coupling assemblies generally known and commercially available.

An elongated cord of the present invention may consist of a high strength cable made of a high abrasion resistance material or having a high abrasion resistance coating. In an embodiment, the cord has a portion at or near the distal end manufactured from or coated with a relatively high abrasion resistance compared to the remainder of the cord.

A payload coupler of the device may include an impact-absorbing member adapted to be coupled in line between the housing and a harness assembly. The impact absorbing member may be a resilient elastic cord, such as that used in a robust bungee cord. The payload coupler may be attached to a harness coupler for attaching a payload-supporting harness. The harness may include a net, platform, universal step-in harness assembly, or other means of securing a payload, such as a human, animal, or inanimate objects. The harness coupler may be selectively operable, so that a user may self-attach the harness to the payload coupler.

An inventive device may further include a secondary spool on an idler shaft extending along an axis parallel to the central axis. In such a device, the cord is wound at least once around the secondary spool between the primary spool and the port. An inventive device may include a dashpot coupled between the primary spool and the housing.

A device of the present invention may be employed by a user to escape from, or evacuate, a building in times of emergencies, such as those associated with the 9/11 event. To escape from a building, the anchor assembly is affixed to a structurally secure object or connection in the building. Then, the user opens or breaks open a

window, and employs the escape device of the invention. Next, the user attaches a harness assembly to the payload coupler (if not already attached). Next, the user enters the harness assembly and, while holding the housing of the escape device, exits through the window. In response to the gravity-induced (by the weight of the user) force on the distal end of the cord, the cord exits through the port in a controlled manner, allowing the user in the harness assembly (and the housing) to descend, at a controlled rate to ensure a controlled descent.

The present invention further provides a personal escape kit, including a personal escape device together with a convertible storage unit. The storage unit includes an outer impact-resistant storage housing, which may be converted to a helmet-like head protector for a user. By way of example, when the storage unit is a "clam-shell" structure having two opposed sections connected on one side by a hinge, the user may separate the two sections and place one section on his/her head, using it as a protective helmet. In such embodiments, the section-to-be-used-as-a-helmet includes an inner structure adapted to couple the helmet to a user's head with an energy-absorbing structure such as a plastic "harness" or foam pads as might be found in a football helmet. With this structure employed, a user might safely descend from a high floor in a building while using the "helmet" to protect his/her head from falling debris. Preferably, the outer contour of the storage housing is shaped so that a plurality of such storage housings (each including an escape device of the invention) may nest together for compact storage.

Although the present invention is defined broadly above, it will be appreciated by those skilled in the relevant art that it is not limited thereto but includes embodiments of which the description provides examples.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of a personal escape device in accordance with certain embodiments of the invention.

FIG. 2 is an exploded perspective view of the personal escape device of **FIG 1.**

FIG. 2A is an exploded perspective view of an exemplary unwind control assembly and coupler assembly of the personal escape device of the invention.

FIG. 3 is a perspective view of a harness assembly of a personal escape device in accordance with certain embodiments of the invention.

FIG. 4 is a top perspective view of a hysteresis brake assembly for use in a personal escape device in accordance with certain embodiments of the invention.

FIG. 4A shows a plan view of an exemplary coupling assembly.

FIG. 5 is a perspective view of a small drum or disc brake assembly for use in a personal escape device in accordance with certain embodiments of the invention.

FIG. 5A shows a plan view of an exemplary coupling between a disc brake and the handle of the embodiment of **FIG. 1**.

FIG. 6A is a perspective view of a hydraulic damper system for use in a personal escape device in accordance with certain embodiments of the invention.

FIGs. 6B-6E are illustrations of hydraulic damper configurations for use in a personal escape device in accordance with certain embodiments of the invention.

FIG. 7 is an expanded perspective view of a personal escape device in accordance with certain embodiments of the invention.

FIG. 8 is a partial cut-away view of a personal escape device in accordance with certain embodiments of the invention, showing a secondary braking mechanism.

FIG. 9A is a top perspective view of a personal escape device in accordance with certain embodiments of the invention.

FIG. 9B is a top perspective view of the personal escape device of **FIG. 5A**.

FIG. 9C is a perspective view of the personal escape device of **FIG. 5A** and **5B**.

FIG. 10 illustrates a portion of the cord of the personal escape assembly of the present invention.

FIG. 11 is a perspective view of personal escape kit of the present invention, including a convertible storage unit together with a personal escape device.

FIG. 12 is a perspective view of personal escape kit of the present invention, including a convertible storage unit together with a personal escape device and a communication device.

FIG. 13 is an illustration of a user of a personal escape device of the present invention, securing the distal end of the cord in accordance with a method of practicing the present invention.

FIG. 14 is an illustration of a personal escape device of the present invention secured to a user and a harness assembly, showing the distal end of the cord attached to an external object, and the user leaning out of a building window just prior to escaping the building in accordance with a method of practicing the present invention.

FIG. 15 is an illustration of a user descending along the outside wall of a building in accordance with a method of practicing the present invention.

DETAILED DESCRIPTION OF THE INVENTION

The present invention is a personal escape device that allows a person, animal, or inanimate object to be lowered in a controlled or controllable manner from a high location. The device is designed for a relatively low-cost, small size which may be used by payloads of variable weights.

An embodiment of the personal escape device of the present invention is illustrated in **FIG. 1**. As shown, the personal escape device **100** includes a housing or casing **102** manufactured from substantially rigid, formable or moldable materials, such as fiberglass, plastics, rigid metals, or other materials generally commercially available. The housing material should be of sufficient strength to withstand both force applied by the weight of the payload during deployment, and by the friction of the cord as it is deployed.

As described below, a primary spool **110**, rotatable about a central axis **A**, is disposed within the housing **102**, although not shown in **FIG 1**. A cord **106** is wound around spool **110**, with its proximal end affixed to the spool **110** and its distal end coupled to an anchoring assembly **103**. The housing includes a port **104** of sufficient size to enable a cord **106** to extend therethrough.

In the illustrated embodiment of **FIG. 1**, the port **104** is oblong shaped to permit the cord **106** to travel across the aperture length. Depending on the materials of the housing and of the cord, the port shape may be adapted to accommodate lateral movement of the cord during deployment. Allowing some lateral movement of the cord **106** as it is deployed reduces the amount of friction by the port edges on the cord during deployment and helps prevent jamming of the cord **106** as it is unrolled from the spool **110**. Alternatively, the port **104** may be round or oval in shape. The external edges of the port may be reinforced with a port guard **105**, made of a low friction material, for example, a Teflon material, to minimize frictional wear of the

edge and the cord during payout of the cord from spool **110** in deployment of the device **100**.

Also as shown in **FIG. 1**, the device **100** includes user handles **108** on one or both sides of the housing. During deployment, the user may hold onto these handles **108** for stability. These handles may be in any shape or type sufficient for a user to place his/her hands during descent. In those events of long descent (e.g., 100 stories), these handles assist the user in executing a non-rotational descent. In alternative embodiments, external handles may be omitted and the housing may include integral extensions for the user's hand support, or the user may hold onto the casing directly.

As shown further in **FIG. 2**, the housing **102** may be manufactured from two halves for ease of assembly. Alternatively, the housing **102** may be die cast or otherwise manufactured in one or more pieces. As shown in the illustrated embodiment, the device includes a spool **110**, extending along a central axis **A**, around which the cord **106** is wound for pre-deployment storage. The outermost diameter of cord wound on the spool **110** will vary depending upon the length of cord which it holds. The spool **110** is rotatably mounted to and extends between the two halves of the housing **102**, such that as the cord **106** is pulled by the weight of a user during deployment, the spool **110** rotates around central axis **A** sympathetically with the weight to release length of cord **106** at a controlled rate.

The inventive device **100** may include a dashpot **120** coupling the primary spool **110** to the housing **102**. The dashpot **120** resists motion of the spool **110** via viscous friction to further enhance controlled payout of the cord **106** during use. The resulting force from inclusion of the dashpot **120** is proportional to the velocity, but acts in the opposite direction, slowing the motion and absorbing energy.

Also as illustrated in **FIG. 2**, the housing **102** includes a payload coupler **112**, such as a carabiner, for selectively attaching a harness 114, such as shown in **FIG. 3**. The coupler **112** may be secured to the housing **102**, to the handles **108**, or may be an aperture integral with the housing **102**. The coupler **112** is of sufficient strength and durability to securely attach a payload-bearing harness **114** to the housing **102**.

The distal end of cord **106** is coupled to anchor assembly **103** which, in the illustrated embodiment, is in the form of a "hook-like" structure for attachment to the hinged edge of a door of a building. Other forms of the anchor assembly may be used

in other embodiments, for example a resilient arm C-clip might be used to couple the distal end to a hook extending from a structural beam of a building.

In the embodiment of **FIG. 1**, the portion **106A** of cord **106** near its distal is characterized by a high abrasion resistance, compared to the remainder of cord **106**.

The illustrated harness **114** of **FIG. 3** may be an easy step-in type harness that is adjustable to various weights and sizes of users. Such harnesses are generally available and may be of the type used by rock climbers or by rescue teams. They may be of a sling-type for carrying animals and inanimate objects, or secure harnesses such as the type shown. A harness **114** of the present invention has some hook, loop, strap, aperture, or other means of attaching to the payload coupler **112** of the inventive device. Preferably, such harness is manufactured from or treated with a fire-retardant material.

The inventive personal escape device **100** further includes an unwind control assembly **200** that controls the rate of exit, or payout, of the cord **106** from around the spool **110** to be at a controlled rate, for example, predetermined function of time in response to a substantially constant pull force at the distal end of the cord, such as gravity-generated by any payload in the harness during deployment. The controlled rate may have a specific time profile or it may be any rate subject to or below a predetermined maximal value.

An embodiment of the unwind control assembly **200** of the inventive device includes a geared centrifugal clutch system **210** effecting a dynamic braking mechanism. In that embodiment, a centrifugal clutch is disposed on an idler shaft **212** coupled to the housing **102**. In the illustrated embodiment, the clutch system **210** is connected to the spool **110** by a coupler assembly **214**, which may be a gear assembly (planetary or helical), direct connection, chain and sprocket assembly, belt and pulley assembly, or other assembly generally available. An exemplary chain and sprocket coupling assembly for assembly **214** resides within the housing **102** (not shown in **FIG. 2**, but shown in plan view in **FIG. 4A**.) Equivalent gear assemblies and belt and pulley assemblies may readily be made and used in place thereof.

FIG. 2A shows an embodiment of the invention having an unwind control assembly **200** including a centrifugal clutch system **210** and coupler assembly **214**. In the illustrated embodiment, the coupler assembly includes planetary gear assembly **216** disposed in a gearbox formed by a gearbox base **218** and gearbox cover **222**. Ball

bearing **220** is illustrative of the bearings of both spool **110** and the idler shaft supporting centrifugal clutch system **210**.

In an embodiment, the coupling assembly **214** steps up the rpm of the spool **110** using gears, chain and sprocket, or belt and pulley configurations. The centrifugal clutch system **210** enables braking force to increase as the spool rpm increases. Thus, during deployment of the device **100**, the geared centrifugal clutch system **210** steps up the rpm of the spool enabling smaller and lighter centrifugal clutch systems to be used in the device **100**. In addition, the centrifugal clutch system **210** enables the creation of drastically different braking forces with little changes in descent speed. For example, the spool **110** may spin at 1000 RPM and the clutch **210** at 4000 rpm (4 times the spool speed). If the spool **110** rpm increases to 1500 rpm, then the rpm of clutch **210** would increase to 6000 rpm. The 2000 rpm increase in clutch speed for only 500 rpm increase in spool speed allows for a much higher production of brake forces. By steepening the rpm curve, the braking force increases dramatically as the spool rpm increases. This geared centrifugal clutch system **210** allows the device **100** to handle a wide range of user weights without adjustment with consistent descent speeds. Such geared centrifugal clutch systems **210** are generally commercially available from a variety of sources.

Alternative unwind control assemblies **200** may include hydraulic or air damper systems, centrifugal clutch systems, user-controllable disc or drum brakes, electromagnetic brakes, eddy current brakes, and other common friction braking systems known or available. In addition, a planetary or helical gearbox may be used in an unwind control assembly 200 to alter braking torque and rpm.

Another unwind control assembly **200** that may be used in the inventive device **100** is a hysteresis brake **300** shown in **FIG. 4**. Magnetic hysteresis brakes include magnet assemblies surrounding a hysteresis disc, and work on the principle that when like poles face each other, they produce maximum magnetic saturation, forcing lines of flux to travel circumferentially through the hysteresis disc. This movement produces maximum torque (translating to braking forces.) An exemplary chain and sprocket form for coupling assembly 214, with exemplary step-up, is shown in **FIG. 4A**.

In addition to unwind control assembly **200**, the illustrated embodiment of **FIG. 5** includes a manually- (or user-) operated brake system **310**. That system **310**

may be in the form of a disc brake system (as illustrated) or any drum brake system, both as commonly found on a motorcycle. These types of brake systems **310** are designed to handle high torque loads and to dissipate the heat generated by use of device **100**. The strength of a brake system **310** of this type allows for gearing up the system to slow the brake rotor. The brake system **310** may be operated by a user using handle **311**. An exemplary chain and sprocket form for coupling the disc brake system **310** to the handle **311** is shown in **FIG. 5A**.

Another unwind control assembly **200** that may be used in the inventive device **100** includes a hydraulic damper assembly **312**, shown in **FIG. 6A**. In one embodiment, as shown in **FIGs. 6B – 6E**, two hydraulic dampers **314a**, **314b** (shock absorbers) are configured in a 50/50 compression/rebound ratio and are attached at a 90 degree angle to a crankshaft **316**. At the very top and bottom of the damper stroke, shown in **FIG. 6B**, there is no resistance as the crankshaft **316** moves perpendicular to the damper **314c**. However, as the other damper **314a**, **314b** rotate and become mounted 90 degrees to the crankshaft **316**, it places the damper **314c** in a position to handle the payload from the cord **106**. The result is a smooth and constant motion.

In the illustrated embodiment of **FIG.s 1-2**, the spool **110** is disposed along a central axis **A**. The unwind control assembly **200** and the brake system **310** are disposed on an idler shaft **212** which is substantially parallel to the central axis **A**, coupled by coupler assembly **214**. In alternative embodiments, all of these elements could be disposed on a single shaft along central axis **A**.

FIG. 7 shows an alternative form of the inventive device **100**, having a secondary spool **116**. Depending on the spool geometry and the amount of cord required, a secondary spool **116** may be included on idler shaft **212** that extends parallel to central axis A. The secondary spool **116** enables the spool **110** diameter to change as cord **106** is unwound from the spool **110** during deployment, without changing the torque applied by the payload onto the unwind control assembly **200**. The amount of cord **106** required to descend from, for example, 100 stories, is significant and creates a large spool **110** diameter when fully wound. There are one or more windings of cord **106** on the secondary spool **116**, preferably all disposed in a single layer, between spool **110** and port **104**. Shaft **212** and the secondary spool **116** are coupled to the unwind control assembly **200** (by way of coupling assembly **214**) using direct connection, a gear assembly, a chain and sprocket assembly, a belt and

pulley assembly, or the like. The secondary spool **116** may alternatively be disposed on a separate idler shaft **118**.

The inventive device **100** illustrated in **FIG. 7**, includes a (user-operated) secondary braking mechanism **320**. As in the earlier described embodiment, this secondary braking mechanism **320** allows a user to slow or stop at any point in their descent to avoid people or obstacles that may be encountered along the way down. The illustrated braking mechanism **320** is a hydraulic brake, including a standard braking disc in connection with a brake caliper **324**. A brake lever **326** is mounted to a handle **108** for convenient access to the user.

FIG. 8 shows a cutaway view of device **100**, more clearly showing a secondary braking mechanism **320**.

FIGs. 9A – 9C show alternate perspectives of an embodiment of the inventive device **100**. The housing **102** is of a different configuration and shape from the housing shown in **FIG. 1**, because it is to be used for lower buildings. Thus, the housing **102** may be shaped and sized to adapt to different building heights.

The cord **106** preferably is manufactured from a Kevlar core material or other non-elastic material preferably with load-bearing capacity of 50 – 300 pounds. The tensile strength for a 3mm diameter cord typically is 3200 lbs. In alternate embodiments, heat-resistant rope may be used, such as Technora/Kevlar core with a nylon sheath. Due to the diameter of some such ropes, the use of rope may increase the size of the required housing **102**, thus the overall size of the device, by a significant amount. Carbon nanotubes and other nano and synthetic cables and cords may be used both for strength and small diameter. Cable of small diameter and high tensile strength allows the size of the device to remain small and reliable. Other materials, such as cords manufactured with Technora, with high tensile strength and high melting point, or Spectra, which is a very high molecular density form of polyethylene, may be used.

Cord lengths could vary depending upon the height of the building with which the device **100** is intended to be used. Because one use of the device **100** is for rappelling-like use from building windows that may need to be broken to effectuate an exit from the building, the cord **106** may at its distal end have relatively high abrasion resistance (illustrated by portion **106A** in **FIG. 1** and section **400** in **FIG. 10**, to prevent cable wear and breakage from bending the cord over sharp corners of the

building exterior. Since a user might traverse somewhat laterally during descent, the high abrasion resistance portion would prevent where as the cord might move in a transverse direction. Thus, including abrasion-resistant portions **106A** and **400** at the distal end closest to the building, significant damage to the cord may be avoided. Abrasion resistant portions of cords can be short (e.g., 10-30 foot sections) links of a higher strength cable, metal cable, or sections employing a protective cover. Although the entire cord may be made of or coated with an abrasive resistant material, limiting the amount of abrasive resistant material to a portion of the entire cord length enables more cord to be wound and stored per spool. For taller buildings, it will be desirable for a device **100** to include more length of cord **106** than a device designed for shorter buildings. Devices **100** designed for use in taller buildings may be more compact if the cord **106** can be wound efficiently around the spool **110**.

In an embodiment of the inventive device **100**, the device includes an impact absorbing member **410** at the proximal end of the cord **106**. For example, the impact absorber may be a short elastic "bungee" section **420** provided between the harness **114** and the payload coupler **112**. The impact absorbing member **410** reduces the impact forces associated with sudden movements and short falls. By lowering impact forces, a lighter weight cable can be used. Limiting the elastic section **420** to the proximal portion of the cord allows the cord **106** to be wound more compactly about the spool **110**, thus enabling the device **100** to include more cord length per device.

The present invention includes a personal escape assembly, as shown in **FIG. 11**, which includes a personal escape device **100** described herein, together with a convertible storage unit **510**. The storage unit **510** includes an outer impact-resistant storage housing in a two-piece configuration (**512A** and **512B**) coupled by a hinge about axis **H**. The storage housing **512** may be of any durable material, including fire-resistant material. It may be shaped in any shape convenient for storage of the assembly 500, and of sufficient size to house a personal escape device **100** therein.

As shown in **FIG. 12**, the storage unit **510** further includes an interior formable impact-absorbent lining assembly **514**. This lining assembly **514** is formable about the personal escape device **100**, either using malleable, formable materials, or other materials that may be pre-shaped to secure a device **100** stored therein. The lining assembly **514** may be adaptable to form a user-protective portion **516** that allows the user to use the storage unit **510** as a protective helmet during

deployment of the device **100**. Straps **516A** may be used with mating clasps **516B** at their distal ends, for securing the piece **512B** to a user's head. Alternatively, the user-protective portion **516** may be a series of straps, or other assembly of the type found in bicycle helmets and other commercially available safety helmets. The lining assembly **514** and the user-protective portion **516** may be the same, whereby the lining assembly converts completely or in part into a user-protective portion **516**.

One embodiment of the personal escape assembly **500** includes a communication device **518**. The communication device **518** may be a two-way or one-way radio communication system of the type generally commercially available. The device **518** may be selectively attachable to or integral with the outer storage housing **512** or the personal escape device housing **102**. Alternatively, the communication device **518** may be generally available, without any attachment, within the storage unit **510**.

In deploying the personal escape device **100** of the present invention, a user breaks or otherwise opens a window or other exit to a building which the user desires to leave. Once an opening is made, the user opens the convertible storage unit **500** and removes the personal escape device **100**. If the user is using a personal escape kit, the user may pull a hinge pin from the hinge, separating pieces **512A** and **512B**, and don the piece **512B** and couple the clasps **516B**, thereby turning piece **512B** into a protective helmet prior to engaging the device **100**.

Next, and as shown in **FIG. 13**, the user secures the distal end of the cord **106** to a fixed object. The distal end of the cord includes a cord attachment element **122**. This element **122** preferably is quick and easy to use in any situation, without the need for any installation. As shown in **FIG. 13**, the element **122** may be a door clip secured around the edge of a door. Alternatively, the element **122** may include a bar form that uses the strength of all three door hinges, or a mechanism that clips to some other common office feature such as a file cabinet, ventilation vent, and the like. Alternatively, the element **122** may include an explosive cap that, when struck against a surface or otherwise activated, forceably projects a molly-bolt or other element into a floor or wall to securely engage the cord. Such devices, and those of a similar nature, are commercially available and known. Alternatively, a resilient finger clip can be used to secure the distal end to rings rigidly affixed to secure structural elements of the building.

Once the cord attachment element **122** is in position, the user dons the harness **114**, and attaches the personal escape device **100** to the harness **114** using the payload coupler **112**, as shown in **FIG. 14**. The user then backs up until perched on the window ledge or other identified exit and, in a rapelling manner, as shown in **FIG. 15**, descends down the side of the building.

The foregoing detailed description has been provided for a better understanding of the invention only, and some modifications will be apparent to those skilled in the art without deviating from the spirit and scope of the appended claims.

I claim:

1. A personal escape device, comprising:
   A. a housing having a port,
   B. a primary spool extending along a central axis and disposed within said housing opposite said port, said primary spool being rotatably coupled to said housing to permit rotation of said primary spool about said central axis,
   C. an elongated cord having a proximal end and a distal and, said proximal end being affixed to said primary spool and said distal end extending through said port, said cord including a plurality of windings around said primary spool,
   D. an anchor assembly extending from said distal end of said cord, including means for selectively coupling said distal end of said cord to an external object,
   E. a payload coupler affixed to said housing for receiving a harness assembly for supporting a payload, and
   F. an unwind control assembly including means for controlling the rate of exit of said cord from said housing to be a predetermined function of time in response to a substantially constant pulling force on said distal end.
2. A device according to claim 1 wherein said unwind control assembly includes a centrifugal clutch connected by a coupling assembly between said primary spool and said housing.
3. A device according to claim 2 wherein said centrifugal clutch is disposed on an idler shaft coupled to said housing and extending parallel to said central axis.
4. A device according to claim 3 wherein said coupling assembly is one from the group consisting of a direct connection, a gear assembly, a chain and sprocket assembly, and a belt and pulley assembly.
5. A device according to claim 1 wherein said unwind control assembly includes a hydraulic damper connected by a coupling assembly between said primary spool and said housing.

6. A device according to claim 5 wherein said hydraulic damper is disposed on an idler shaft coupled to said housing and extending parallel to said central axis.

7. A device according to claim 6 wherein said coupling assembly is one from the group consisting of a direct connection, a gear assembly, a chain assembly, and a belt assembly.

8. A device according to claim 1 wherein said unwind control assembly includes an air damper connected by a coupling assembly between said primary spool and said housing.

9. A device according to claim 8 wherein said air damper is disposed on an idler shaft coupled to said housing and extending parallel to said central axis.

10. A device according to claim 9 wherein said coupling assembly is one from the group consisting of a direct connection, a gear assembly, a chain assembly, and a belt assembly.

11. A device according to claim 1 wherein said unwind control assembly includes a user controllable disc brake connected by a coupling assembly between said primary spool and said housing.

12. A device according to claim 11 wherein said disc break is disposed on an idler shaft coupled to said housing and extending parallel to said central axis.

13. A device according to claim 12 wherein said coupling assembly is one from the group consisting of a direct connection, a gear assembly, a chain assembly, and a belt assembly.

14. A device according to claim 1 wherein a portion of said cord at or near said distal end has a relatively high abrasion resistance compared to the remainder of said cord.

15. A device according to claim 1 wherein said payload coupler includes an impact absorbing member adapted to be coupled in line between said distal end of said cord and a harness assembly received thereto.

16. A device according to claim 15 wherein said impact absorbing member is a resilient elastic cord.

17. A device according to claim 3 further including a secondary spool on a secondary idler shaft extending along an axis parallel to said central axis, and

wherein said cord includes at least one winding around said secondary spool between said primary spool and said port.

18. A device according to claim 17 wherein said secondary idler shaft is said idler shaft.

19. A device according to claim 1, further comprising a harness adapted for supporting a payload, said harness including a harness coupler for attaching said harness assembly to said payload coupler.

20. A device according to claim 19 wherein said harness coupler is selectively operable to attach said harness assembly to said payload coupler.

21. A device according to claim 1 further comprising a dashpot coupled between said primary spool and said housing.

22. A device according to claim 1 wherein said unwind control assembly includes a hysteresis brake.

23. A device according to claim 1 wherein said unwind control assembly includes an electromagnetic brake.

24. A device according to claim 1 wherein said unwind control assembly includes an eddy current brake.

25. A personal escape kit, comprising:

a personal escape device, said device comprising:

a housing having a port,

a primary spool extending along a central axis and disposed within said housing opposite said port, said primary spool being rotatably coupled to said housing to permit rotation of said primary spool about said central axis,

an elongated cord having a proximal end and a distal and, said proximal end being affixed to said primary spool and said distal end extending through said port, said cord including a plurality of windings around said primary spool,

an anchor assembly extending from said distal end of said cord, including means for selectively coupling said distal end of said cord to an external object,

a payload coupler affixed to said housing for receiving a harness assembly for supporting a payload,

an unwind control assembly including means for controlling the rate of exit of said cord from said housing to be a predetermined function of time in response to a substantially constant pulling force on said distal end, and

a convertible storage unit, comprising

an outer impact-resistant storage housing,

an interior formable impact-absorbant lining assembly, wherein said lining assembly further comprises a retaining portion adaptable to securely retain said personal escape device therein and further adaptable to secure said storage unit on a user's head.

26. The personal escape kit of claim 25, further comprising a communications device attachable to said convertible storage unit.

27. The personal escape kit of claim 26 wherein the communications device enables one-way communication to the device from an external source.

28. The personal escape kit of claim 27 wherein the communications device is adapted to receive communications signals from an external emergency broadcast system.

29. The personal escape kit of claim 26 wherein the communications device enables two-way communication to the device between said communication device and an external communication device.

30. The personal escape kit of claim 25, wherein said convertible storage unit has an outer contour adapted for nested stacking of similarly shaped convertible storage units.

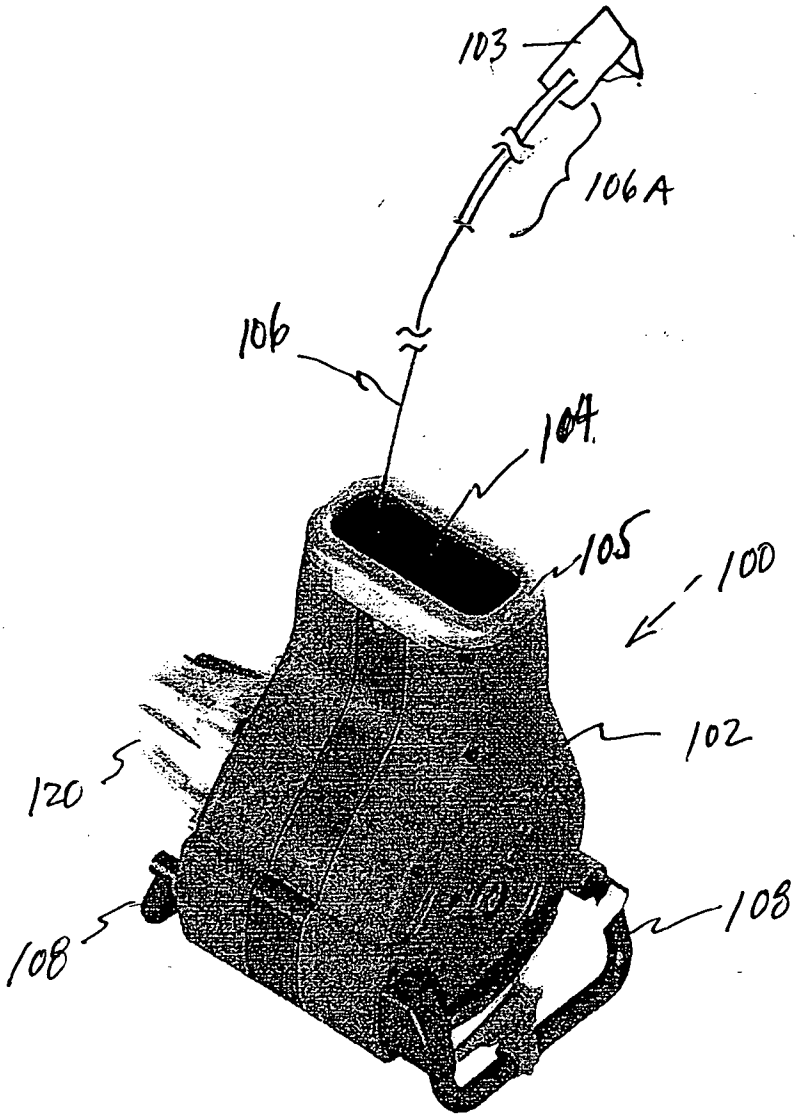

FIG. 1

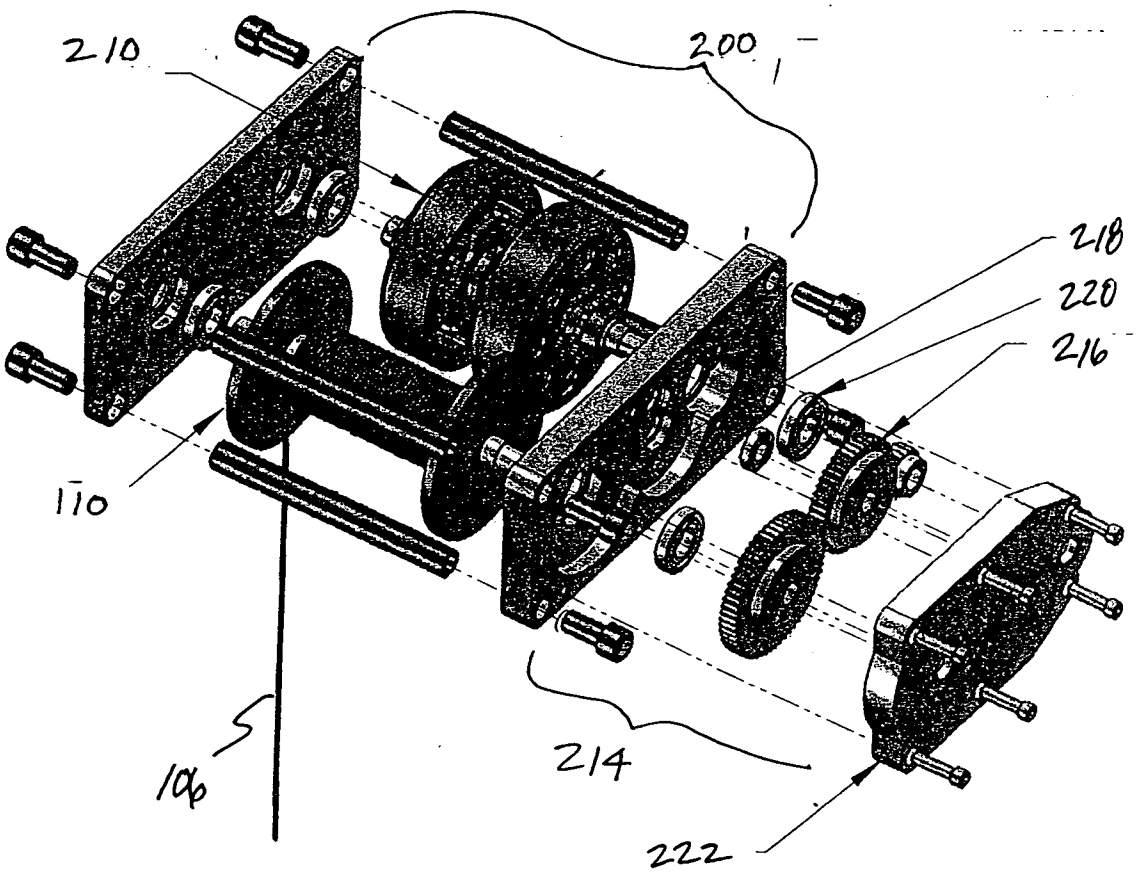

FIG. 2A

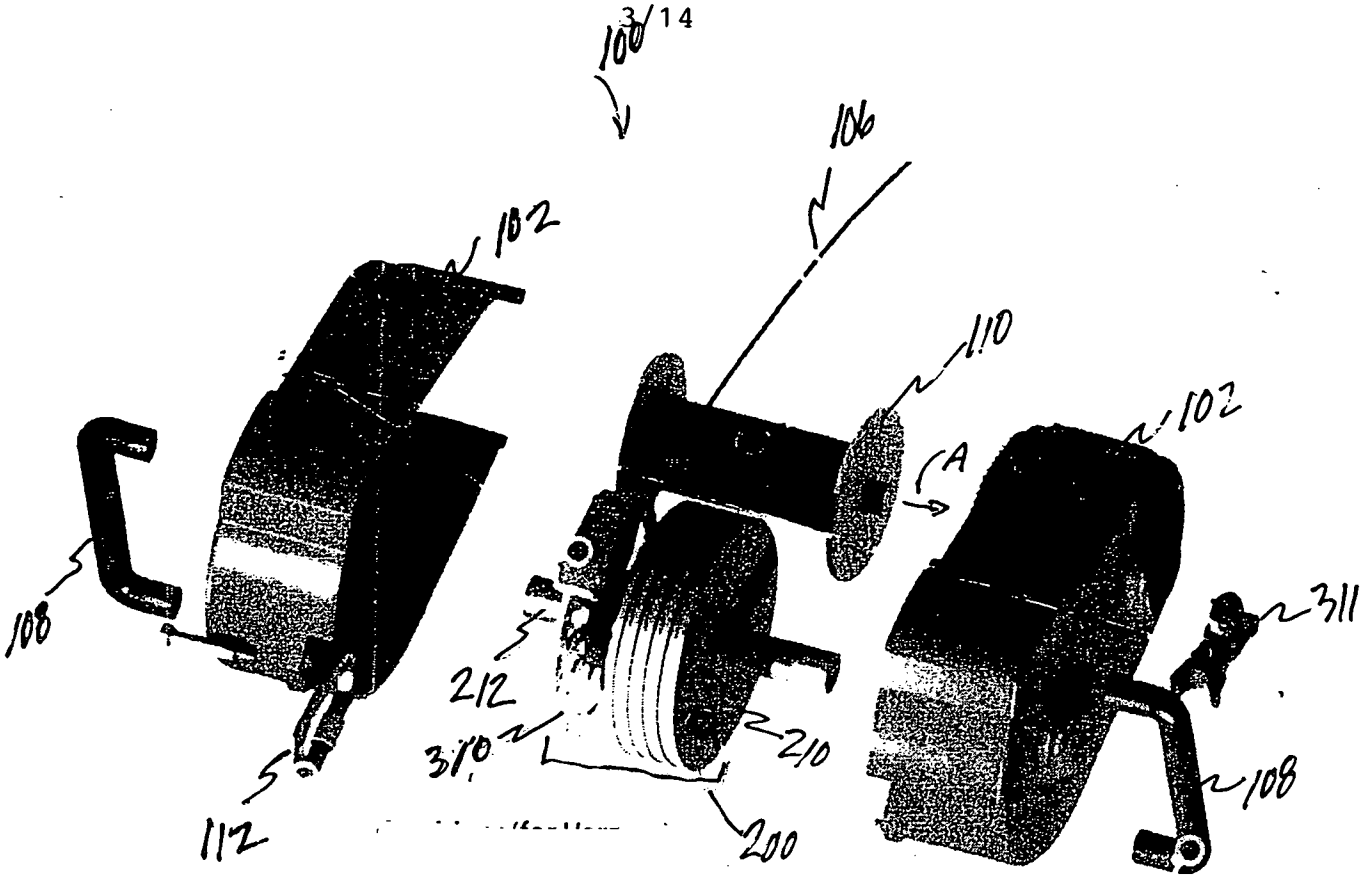

FIG. 2

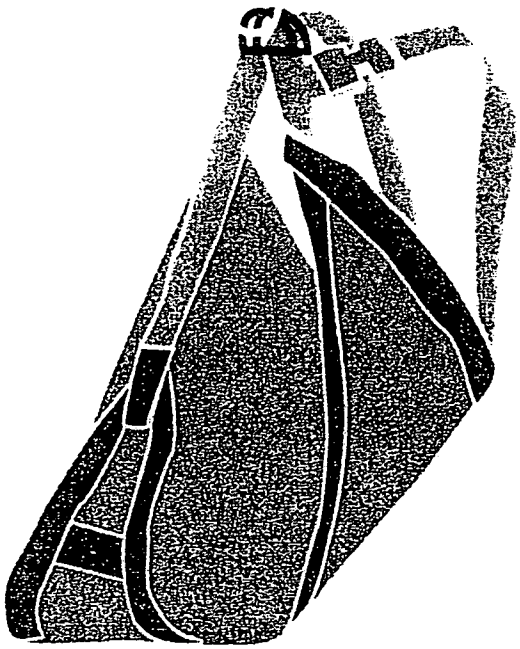

FIG. 3

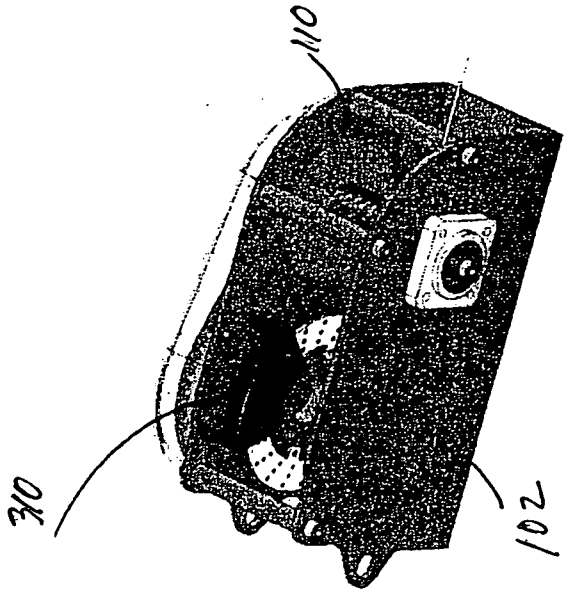

FIG. 5

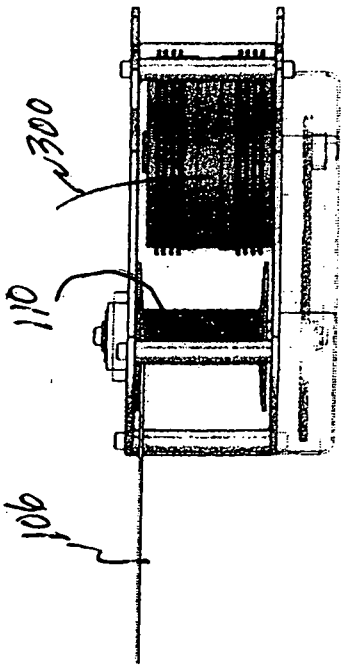

FIG. 4

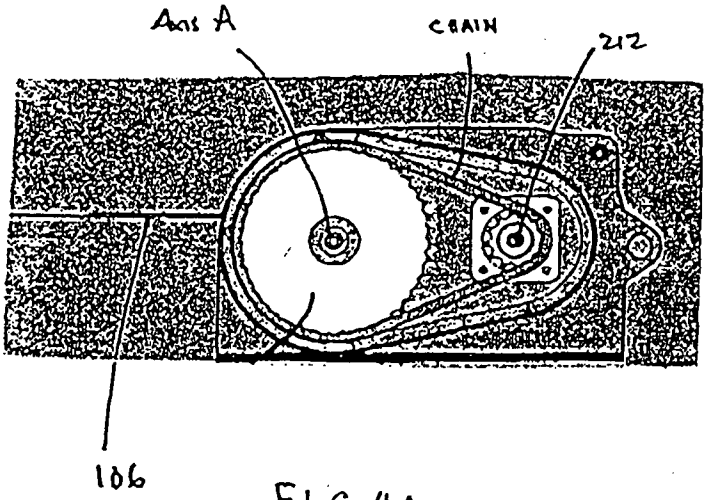

FIG 4A

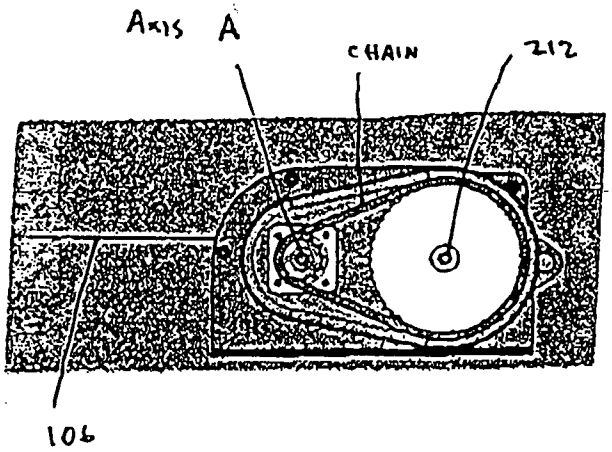

FIG 5A

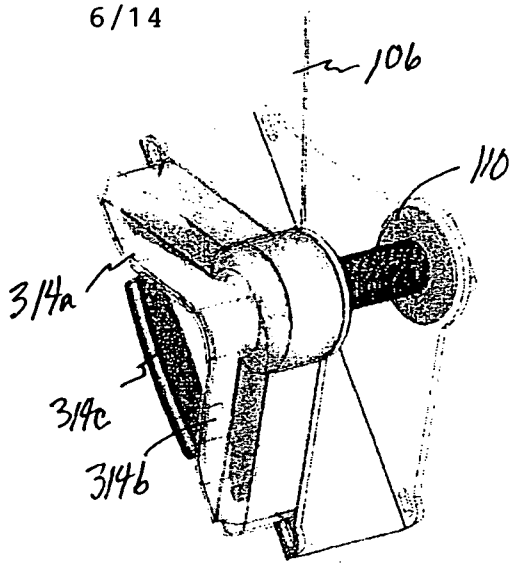

FIG. 6A

Position 1

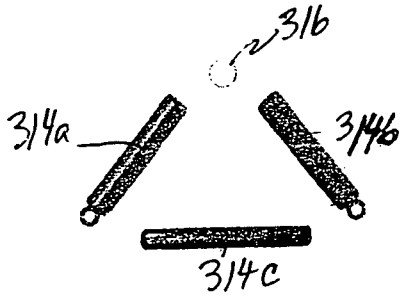

FIG. 6B

Position 2

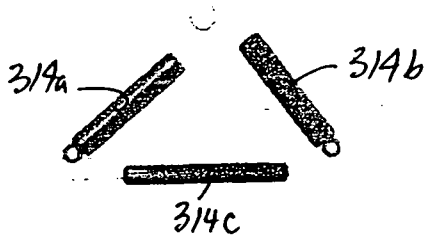

FIG. 6C

Position 3

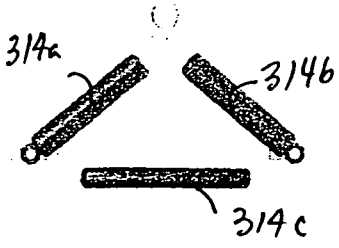

FIG. 6D

Position 4

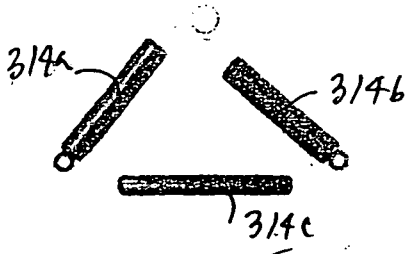

FIG. 6E

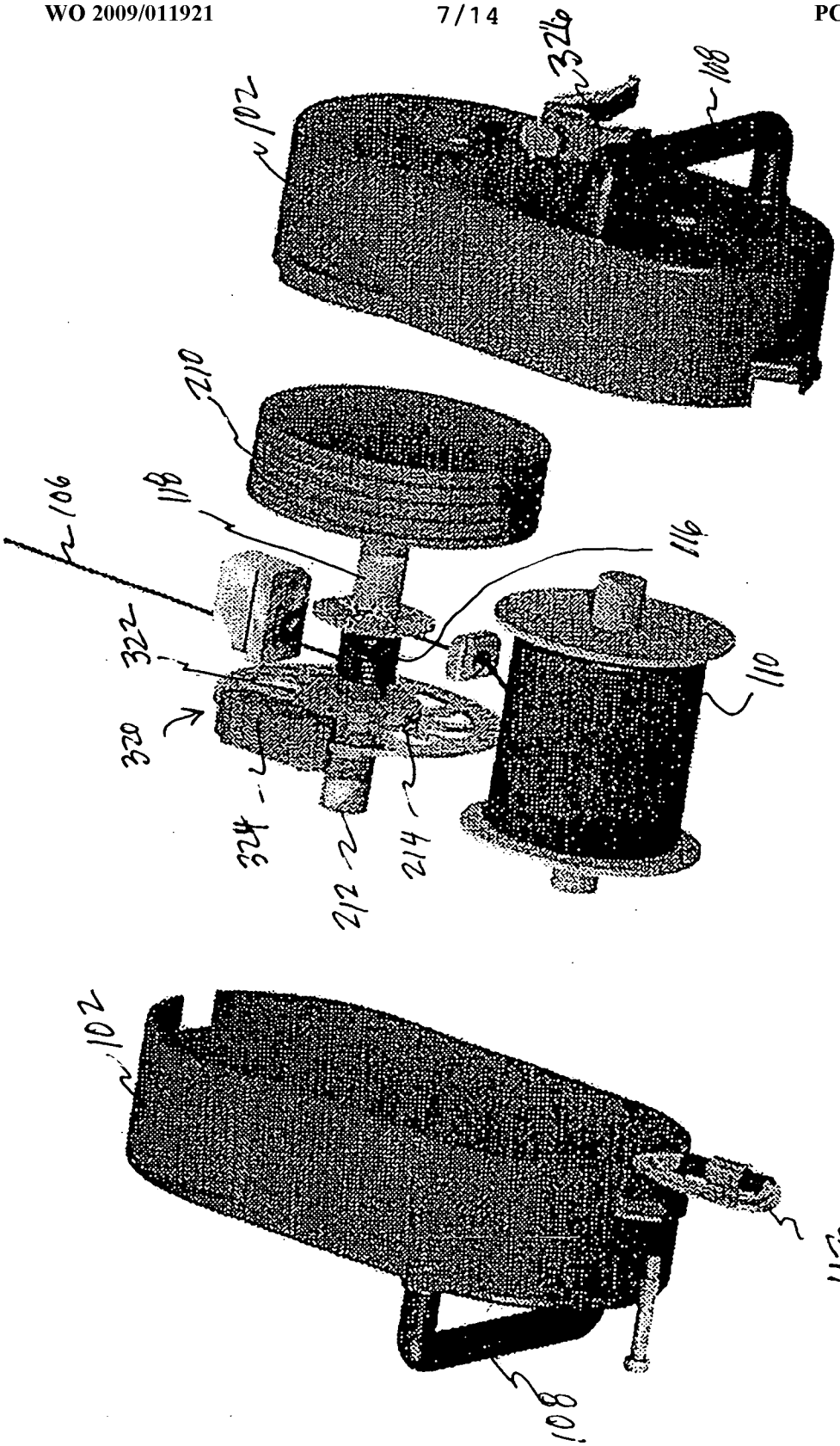

FIG. 7

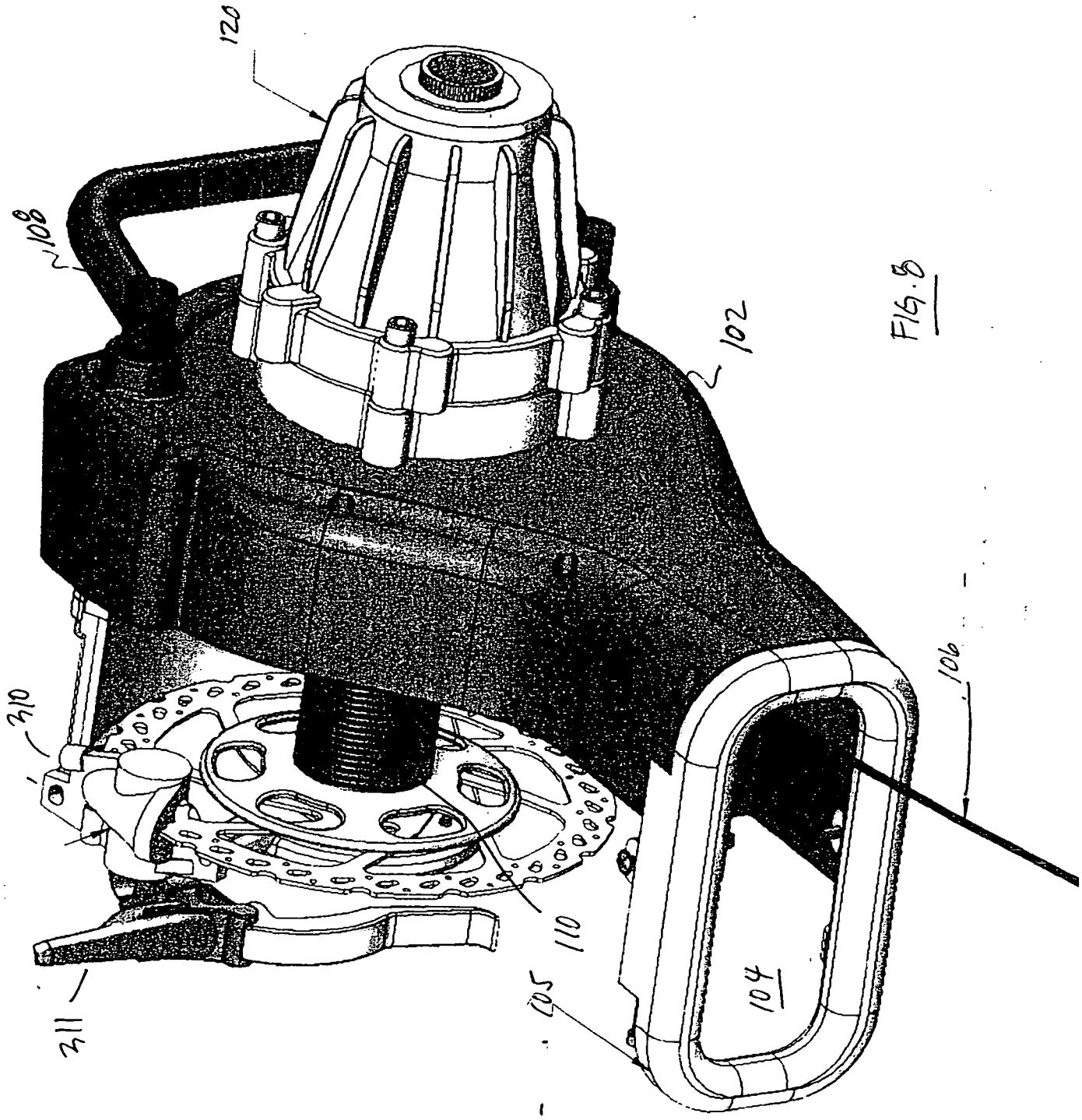

FIG. 8

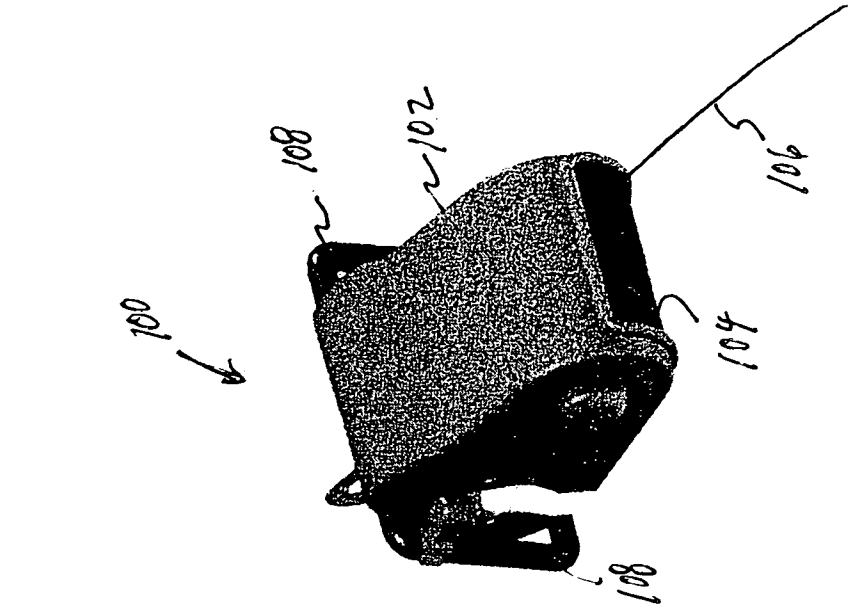

FIG. 9C

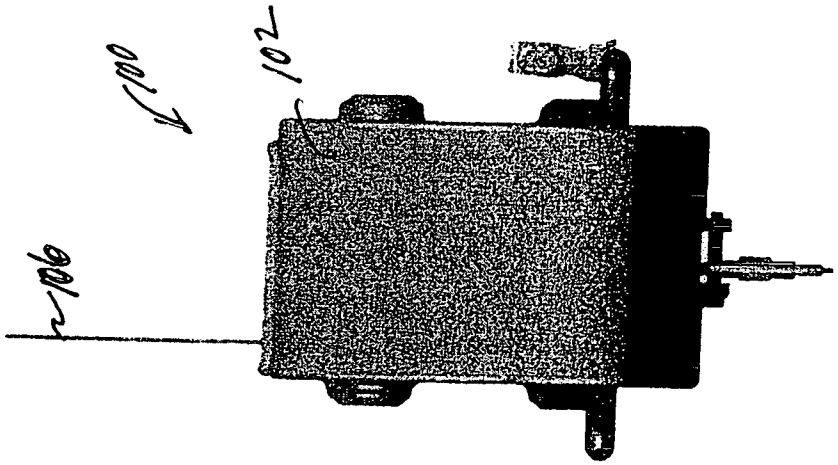

FIG. 9B

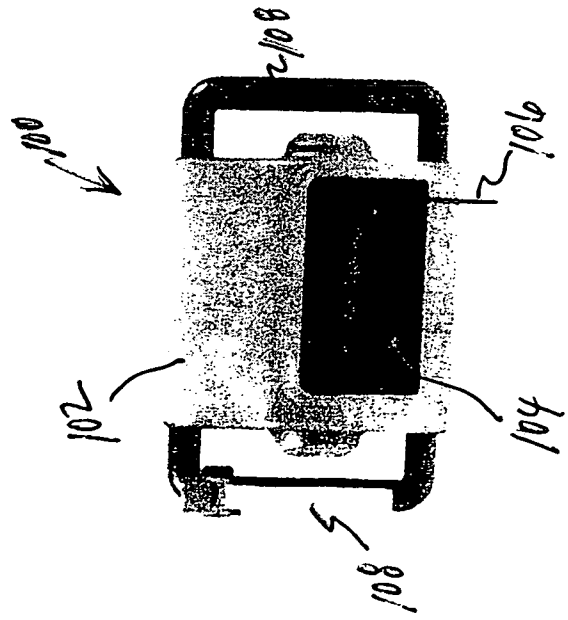

FIG. 9A

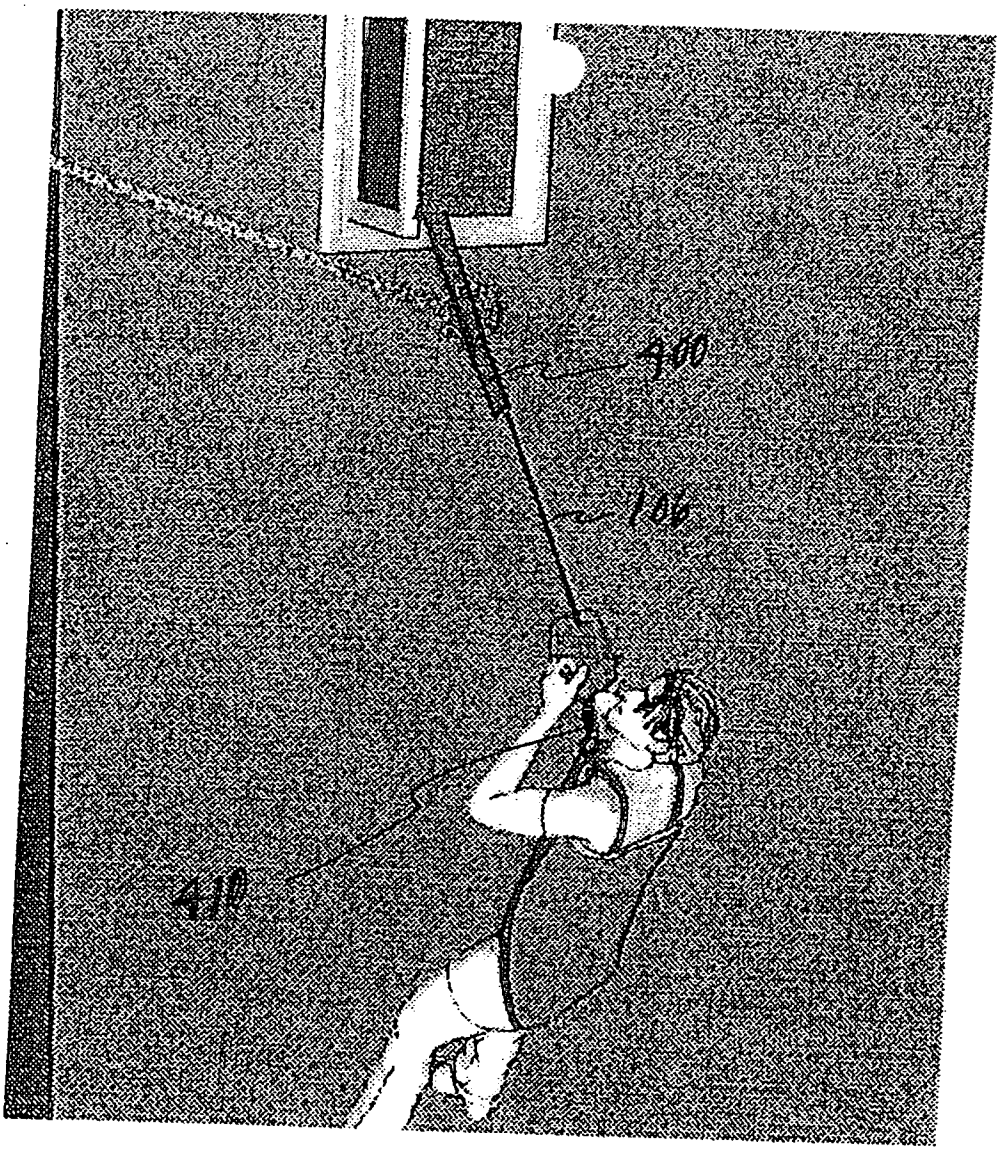

FIG. 10

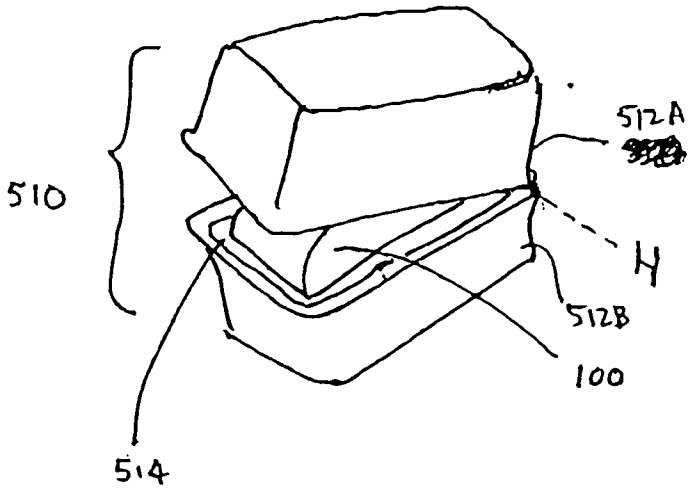

FIG 11

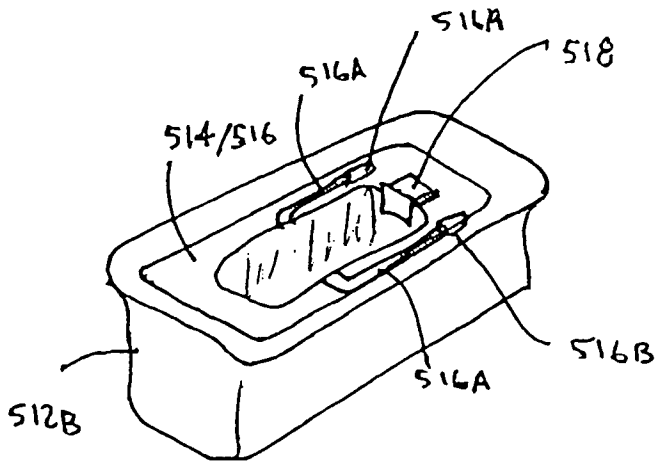

FIG 12

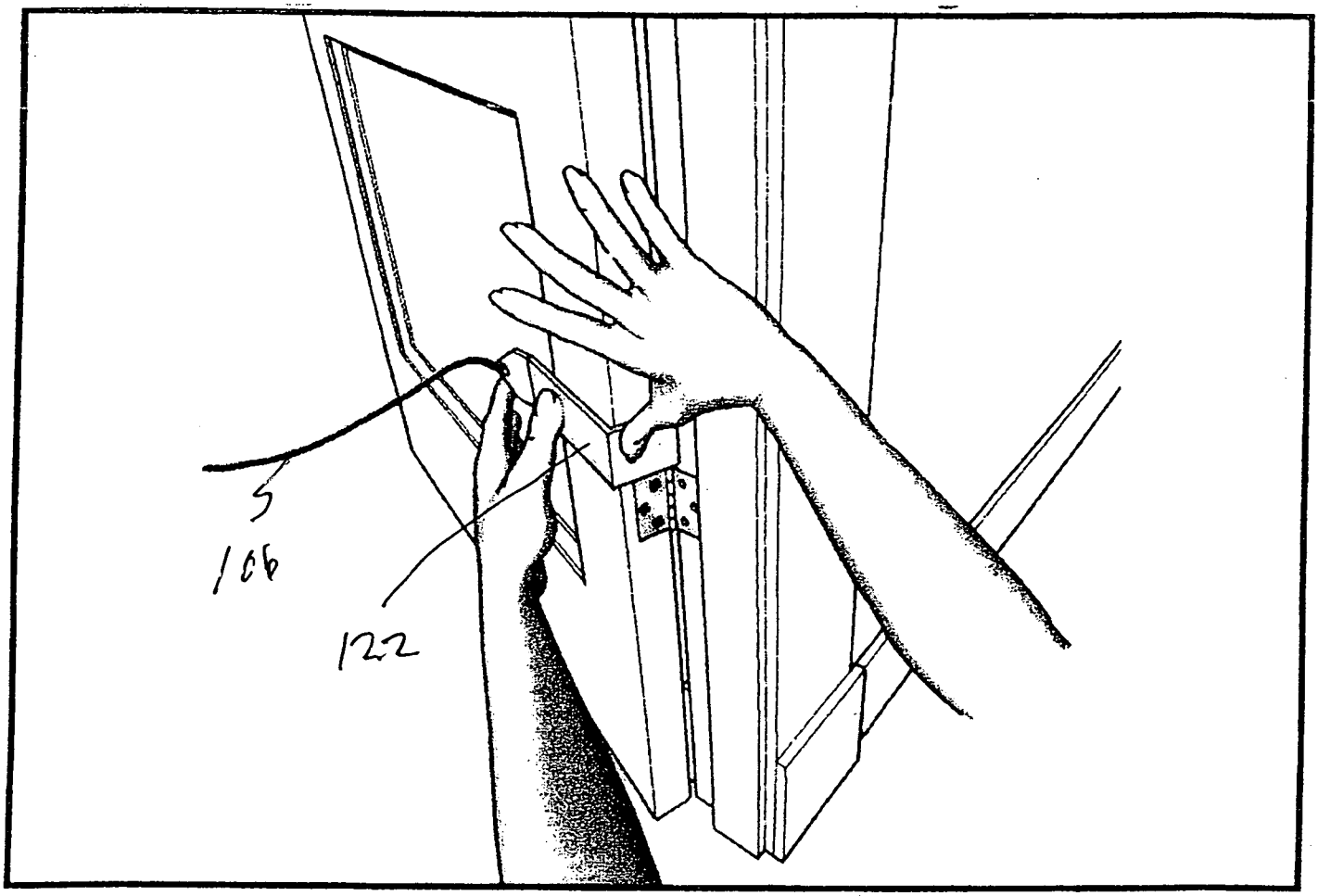

FIG. 13

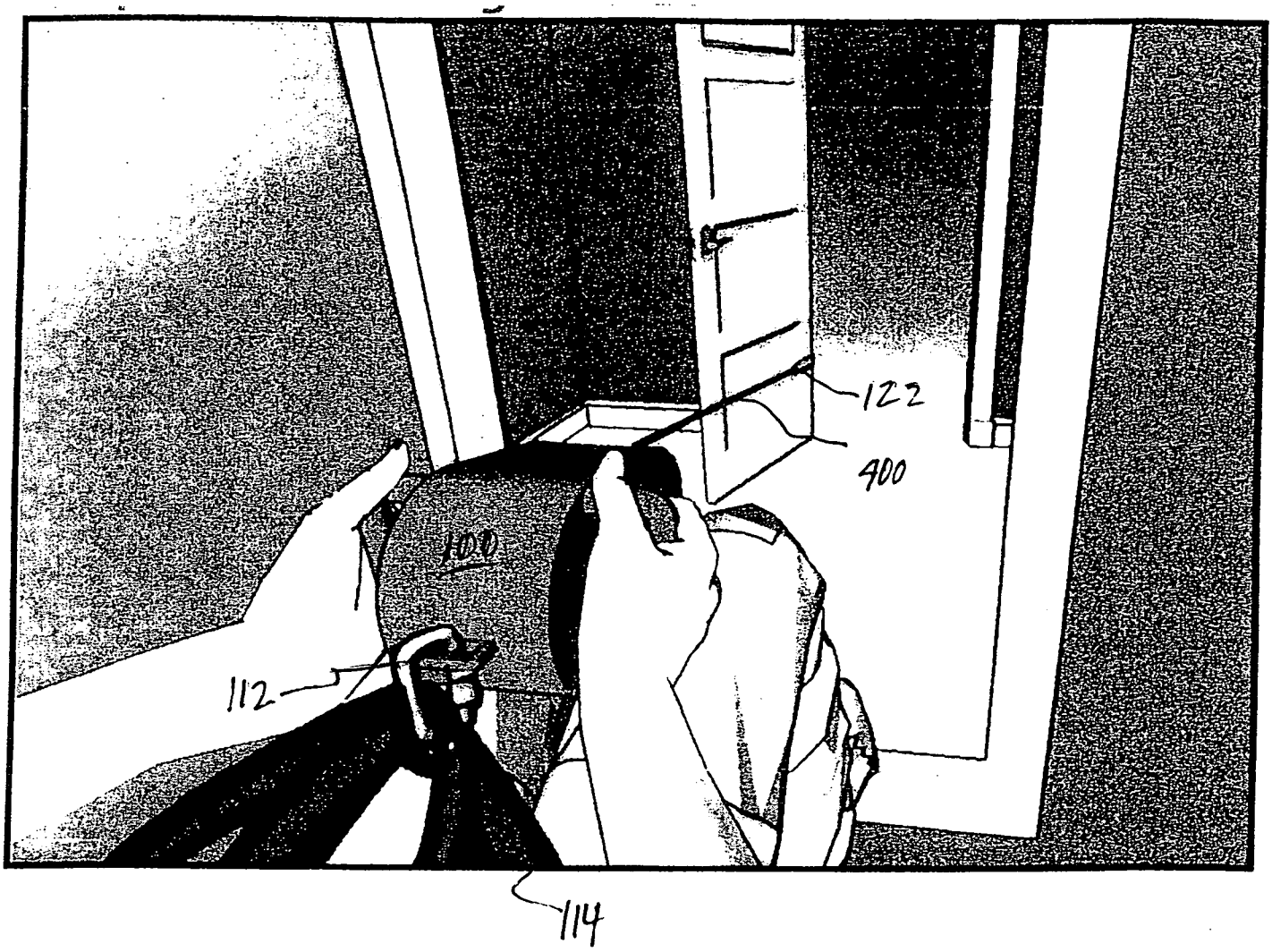

FIG. 14

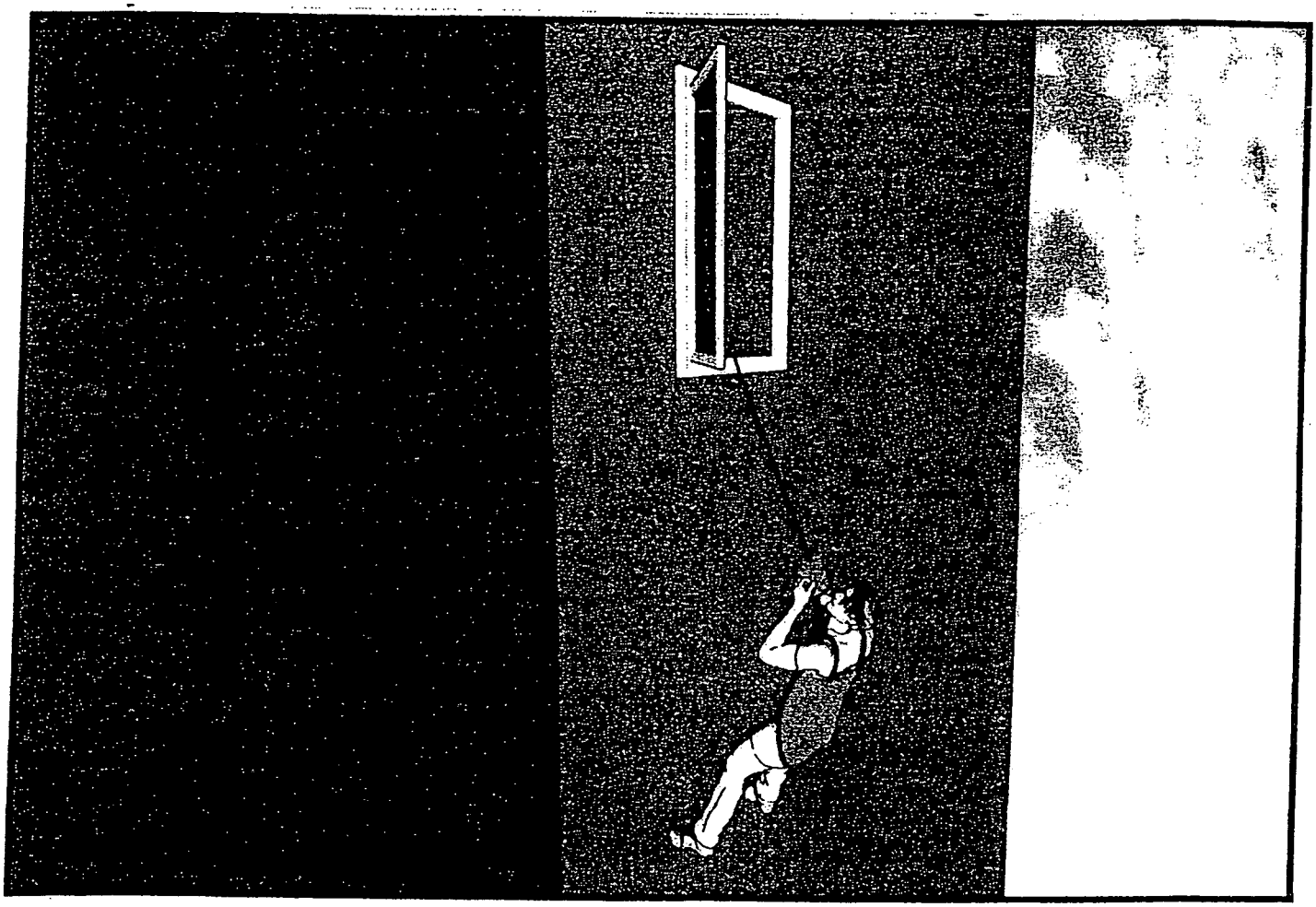

FIG. 15

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2008/008819

A. CLASSIFICATION OF SUBJECT MATTER
IPC(8) - A62B 1/06 (2008.04)
USPC - 182/75
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC(8) - A62B 1/06 (2008.04)
USPC - 182/75

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
MicroPatent, IP.com, Google Patents, Google Scholar

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/0039981 A1 (WOOSTER et al) 24 February 2005 (24.02.2005) entire document	1-4, 11-16, 19-21, 25, 30
Y		5-10, 17-18, 22-24, 26-29
Y	US 4,493,396 A (BORGIA V) 15 January 1985 (15.01.1985) entire document	8-10
Y	US 6,868,942 B2 (BARZILAI et al) 22 March 2005 (22.03.2005) entire document	17-18
Y	US 4,714,208 A (HOLAHAN et al) 22 December 1987 (22.12.1987) entire document	22.
Y	US 6,962,235 B2 (LEON) 08 November 2005 (08.11.2005) entire document	23-24
Y	US 6,363,244 B1 (MCGHEE et al) 26 March 2002 (26.03.2002) entire document	26-29
Y	US 2006/0065485 A1 (REED) 30 March 2006 (30.03.2006) entire document	5-7

☐ Further documents are listed in the continuation of Box C. ☐

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 October 2008	12 NOV 2008
Name and mailing address of the ISA/US Mail Stop PCT, Attn: ISA/US, Commissioner for Patents P.O. Box 1450, Alexandria, Virginia 22313-1450 Facsimile No. 571-273-3201	Authorized officer: Blaine R. Copenheaver PCT Helpdesk: 571-272-4300 PCT OSP: 571-272-7774

Form PCT/ISA/210 (second sheet) (April 2005)