Fig. 1

AUTOMATIC DESCENDING DEVICE

The present invention discloses a new descending device based on a common rope friction device, such as figure eight for example, the speed of the rope is automatically controlled at the feeding side of the descending device with a rope speed controller 8. The angle between the rope and the rope friction descender is automatically changed by a rope angle controller 9 to generate the adequate friction that maintains the desired rope speed.
Automatic Descending Device


Technical Field

The present invention relates generally to vertical descending device and particularly to a descending device that automatically generates the same precalibrated descending speed for all permitted loads.

Background Art

Vertical descent devices are well known in the art. These devices basically comprise a rope or cable, a descending device, and some type of harness for supporting a person, in an emergency situation requiring rapid evacuation from a tall building, a person secures himself to the harness and the descending device, hooks an end of the cable to a sturdy, anchored structure on the building. The person then jumps from the building. As the person descends, a braking mechanism breaks the free fall speed so that the person descends at a safe speed down to the ground. Generally there are two major groups of descending devices automatic and manual.

The first group is the automatic descenders, which generally comprises a reel from which a cable or a rope may be spooled and a breaking mechanism that retards the rotation of the cable reel. In this group there are three subgroups that differ in the breaking principle, Centrifugal friction brakes, liquid brakes, fan dynamic brakes.


The major disadvantage of this group of automatic descenders is that the speed depends on the load, different load generates different speed.

A further major disadvantage of this group of automatic descenders is the high self load; which limits the possibility to use these devices as portable descenders and for very high altitude.
Enormous amount of heat is generated by the braking action during descent. This generation of heat can lead to descent speeds above safety thresholds, or worse, to catastrophic failure of the braking mechanism. The result is big and heavy devices that can accumulate the energy and still remain safe.

The second group is the direct friction descenders; known as rope friction descenders, such as figure eight for example, this type of descenders is commonly used for rappelling. The breaking is achieved by direct friction between the rope and the device, this group there are tow subgroups manual and automatic devices. The difference is the speed control mechanism.


The major disadvantage of prior art manual rope friction descenders is that the speed is manually controlled by the user, therefore skilled and trained user is required.

In the automatic direct friction descenders subgroup, the speed is an automatic result, it is the function of the friction and the load. Examples of automatic direct friction descenders are disclosed in U.S. Pat. No. 7,131,515 by Gartsbeyn; U.S. Pat. No. 6,832,668 by Henson; U.S. Pat. No. 6,823,966 by Henson; U.S. Pat. No 6,820,721 by Henson, PCT/GB2007/004719 by Hayhurst. Dutch Patent 8004667. Dutch Patent 9401422 assigned to Boon Safety CV. Russian Patent 1430031.

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**Disclosure of the Invention**

**Objects of the Invention**

The major object of the present invention is to provide a descending device that offers a descending speed which is independent of the load. The device offers the same precalibrated speed for every permitted load within its working range.
A further object of the invention is to provide a descending device which offers automatic speed control.

Still a major object of the invention is to provide a simple, light and compact descending device that will enable the use as a portable devise, even for 1200 fit rope.

Yet it is also an object of the invention to provide a descending device that will offer a very simple usage procedure, and be approved for the use by unskilled and untrained users.

Moreover, it is a major object of the invention to provide a descending device that will automatically control the rope speed from the feeding side to the friction brake. And not from the load side as it is the practice of all known prior art.

Other objects will in part be obvious and will in part appear hereinafter.

**Summary of the Invention**

The present invention seeks to provide a descending device that will accomplish all the above mentioned objects and many more features and advantages as will be shown further.

The present invention discloses a descending device that seeks to automate the well known procedure of descending with manual rappelling descenders, in general the user is changing with his hand the angle between the rope and the friction device, at the feeding side to the friction device, in the present invention the angle is automatically controlled.

The present invention includes a common rope friction device, such as figure eight for example, the speed of the rope is automatically controlled at the feeding side of the descending device with a rope speed controller 8. The angle between the rope and the rope friction descender is automatically changed by a rope angle controller 9 to generate adequate friction that maintains the desired rope speed.

The most important advantage of the present invention is that the speed is independent of the load, the same speed for every permitted load.

A further important advantage of the present invention is that only a very small force is needed to control the speed at the feeding side of the descender. Therefore the rope speed controller absorbs a very small amount of energy and it can be small, light and cheap.

In a preferred embodiment of the present invention the delivery apparatus is a chest bag that holds within it all the parts of the invention, the rope, the automatic descent device, the harness, in the back side of the chest pack there is a compartment that when the
user will open a safety harness (cradle) is released and the user can get into the cradle adjusting it to the body by the shoulders straps, in the front side of the chest pack there is a compartment that the user opens and pulls out a carbineer attached to the rope.

**Brief Description of Drawings**

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which a preferred embodiment of the present invention is disclosed.

*Fig.1* is a simplified pictorial illustration of a descent device of a preferred embodiment of the present invention.

*Fig.2* is a simplified pictorial illustration of an example of the Breaking device of a preferred embodiment of the present invention.

*Fig.3* is a simplified pictorial illustration of another example of the Breaking device of a preferred embodiment of the present invention.

*Fig.4* is a simplified pictorial illustration of a descent device of a preferred embodiment of the present invention in *Rest* position.

*Fig.5* is a simplified pictorial illustration of the descent device of a preferred embodiment of the present invention, in its *Operation* position.

*Fig.6* is a simplified pictorial illustration of a descent device of a preferred embodiment of the present invention, in its *Stop* position.

*Fig.7* is a simplified pictorial illustration of a chest pack constructed and operative in accordance with a preferred embodiment of the present invention, in *Standby* position.

*Fig.8* is a simplified pictorial illustration of the chest pack, in *Operation* position.

**Best mode for carrying out the invention**

In accordance with the teachings of the present invention, a descending device is disclosed; advantages and features for the present invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.
Reference is now made to Fig. 1 which illustrates a descent device 3, constructed and operative in accordance with a preferred embodiment of the present invention, descent device 3 includes a breaking device 4, a rope 5, and a rope bag 6.

Breaking device 4 includes a friction brake 7, a rope speed controller 8, a rope angle controller 9.

The Friction brake 7 is a simple rappelling device that converts the potential energy of the descending load to temperature that is generated by the friction between the rope 5 and the Friction brake 7. In the illustrated embodiment, Friction brake 7 has somewhat a figure eight shape, but any other shape or friction rope descender may also be used, this prior art figure eight, the descending speed is manually controlled, the user changes the angle between the rope and the figure eight as it enters into the figure eight, this is a well known procedure and there are numerous similar types of friction brakes descending devices.

The rope speed controller 8 is a mechanism that controls the speed of the rope 5 as it is being fed from the rope bag 6 into the breaking device 4 at the free side, the rope speed controller limits the rope speed up to a precalibrated maximum value, the rope speed controller 8 can be a linear spring motor or a centrifugal brake or any other mechanism that can result a maximum precalibrated speed, the rope speed controller feeds the rope at a speed up to a predetermined maximum value, the advantage is that only a small increment of the total descent energy is absorbed at the feeding side, thus enabling the use of very small feeding device, still a major advantage is that it is possible to limit the maximum speed to a precalibrated value and the speed will be limited actually for any load permitted. Thereof the result is same speed for every load.

The rope angle controller 9 automatically changes the angle between the rope 5 and the friction brake 7, different angle will result different friction force on the rope 5 and different speed. Fig. 2 and Fig. 3 illustrates two possible configurations of the rope angle controller 9 of the preferred embodiment of the present invention, but any other mechanism that automatically changes the angle of the rope when it is fed into the friction brake 7 may also be used, this Fig. 2 a swiveled plate 11 is anchored to a spring 10 at one end and pressing the rope 5 at the opposite end. In Fig. 3 a plate 11 with two rollers 12 pivotally mounted on it, is attached to a spring in one end, the rope 5 passes between the rollers 12 pushing the plate 11 against the spring 10. In both two examples at one end the rope 5 is fed by the rope speed controller 8 at a precalibrated constant speed, and at the other end the rope 5 enters into the friction brake 7, the rope angle controller 9 automatically changes the angle between the
rope 5 and the friction brake 7 to the desired angle which will cause the adequate friction that keeps the load speed at the precalibrated constant speed of the rope speed controller 8.

Reference is now made to Fig.4 which illustrates a descent device, constructed and operative in accordance with a preferred embodiment of the present invention, in position Rest, at one end the rope 5 is anchored to a fixing point 22 moving through the friction brake 7, over the rope angle controller 9, into the rope speed controller 8, to the rope bag 6. In position Rest there is no tension on the rope 5, the plate 11 is fully pushed/pulled by the spring 10, the rope enters into the friction brake freely enabling the rope 5 to slide freely with no friction through the friction brake 7.

Reference is now made to Fig.5 which illustrates a descent device constructed and operative in accordance with a preferred embodiment of the present invention in position Operation. Tension is implied on the descent device by a load 13, the rope speed controller 8 allows the rope to exit the rope bag 6 at a speed up to a maximum precalibrated value, when the rope 5 reaches the maximum permitted speed, the rope speed controller 8 brakes the rope and allows only the maximum permitted speed, the plate 11 is pushed by the rope 5 and at the same time pulled by the spring 10 changing the angle between the rope 5 and the friction brake 7, until an equilibrium point is automatically achieved, this will result a constant speed of the rope 5. Thus enabling the rope 5 to slide through the friction brake 7 at a speed up to the permitted maximum speed that is allowed by the rope speed controller 8.

Reference is now made to Fig.6 which illustrates a descent device constructed and operative in accordance with a preferred embodiment of the present invention, in position Stop, Tension is implied on the descent device by a load 13, the rope 5 is pushed/pulled by the plate 11 and the angle between the rope 5 and the friction brake 7 is lowered until the rope stops. This can be achieved manually by the user, or automatically by an emergency stop controller, pulling the plate 11, and creating 90 degrees angle between the rope and the friction brake 7.

Reference is now made to Fig.7 which illustrates a simplified pictorial illustration of a chest pack 6 constructed and operative in accordance with a preferred embodiment of the present invention, in position Standby; the chest pack 6 includes main compartment 15, back compartment 17, and top compartment 16.

Reference is now made to Fig.8 which illustrates a simplified pictorial illustration of the chest pack 6 constructed and operative in accordance with a preferred embodiment of the present invention, in position Ready. In ready position the back compartment 17 and top compartment 16 are opened, the harness (cradle) 19, the shoulders
straps 18, the karabiner 23, the Descent device 4, and the rope 5 inside the main compartment are shown. In the illustrated embodiment, the rope bag has somewhat a chest bag shape, but any other shape of bag may also be used.

It will be appreciated by people skilled in the art that the present invention is not limited by what has been particularly shown and described herein above. Rather the scope of the present invention includes both combination and sub combination of the features described herein above as well as modifications and variations thereof which would occur to a person of skill in the art upon reading the forgoing description and which are not in the prior art.

**Industrial Applicability**

The descending device according to the present invention is small in size and light in weight, operation is automatic and simple, and no skill or training is required. The device can advantageously be used by every user in case of need to descent from high elevation. The device is inexpensive to produce so that the device can widely and easily be equipped any structure including a hotel, a residence, stores and the like for easily escaping out in emergency such as fire or terror event.
CLAIMS

What is claimed is:

1. A descending device comprising:
   a rope friction brake such as figure eight; and
   a rope speed controller, said speed controller controls the speed of the rope as it enters into the descending device from the free side, and limits the rope speed up to a maximum precalibrated value; and
   a rope angle controller, said rope angle controller automatically maintains equilibrium and changes the eatery angle between the friction brake and the rope, causing the adequate friction necessary to keep the desired rope speed which is allowed by said rope speed controller.

2. The descending device according to claim 1 and wherein said friction brake is a simple rappelling device such as figure eight for example that converts the potential energy of the descending load to temperature, which is generated by the friction between the rope and said friction brake.

3. The descending device according to claim 1 and wherein said rope speed controller is a linear spring motor or a centrifugal brake or any other mechanism that can result a constant maximum precalibrated speed.

4. The descending device according to claim 1 and wherein said rope angle controller is a plate axially pushed or pulled by a spring, against the rope, and changing the angle between the rope and the rope friction brake as the rope enters into the friction brake.

5. The descending device according to claim 1 and wherein said rope angle controller is a plate horizontally pushed or pulled by a spring, against the rope, and changing the angle between the rope and the rope friction brake as the rope enters into the rope friction brake.

6. The descending device according to claim 1 wherein said descending device is installed within a chest or a back pack.

7. The descending device according to claim 6 comprising a rope and a harness which are stored in said pack.
Fig. 6