United States Patent [19]

Brda

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[54] **MULTIPURPOSE DEVICE FOR MOVING PERSONS OR LOADS OVER A HEIGHT DIFFERENCE**

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[30] **Foreign Application Priority Data**

Dec. 31, 1970 Germany ..... P 20 64 761.4

[52] **U.S. Cl.** **182/7**

[51] **Int. Cl.** **A62b 1/08**

[58] **Field of Search** 182/5, 6, 7, 191–193; 254/151, 155, 154

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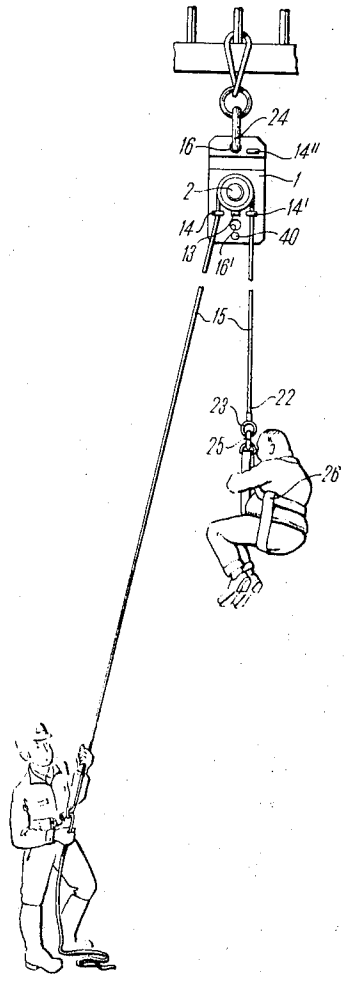
[57] **ABSTRACT**

A device for roping down persons and/or loads from a certain height above the ground, comprising a supporting member, on which a cylinder is supported by a free-wheeling bearing such that the cylinder can be rotated in one direction only and its rotation is blocked in the other direction of rotation. A rope is wound around the periphery of said cylinder at least one and a half times and on one end thereof there are provided means for connecting a load or person, this one end acting on the cylinder in the direction, in which the rotation of the cylinder is blocked. Thus, by gradually releasing the other end of the rope a load or person can be lowered down to the ground and a braking action is effected by friction generated between the rope and the periphery of the cylinder. In a second embodiment, the person to be roped down is connected to the supporting member, one end of the rope is connected to the place, from which the person or load is to be roped down, and the rope is wound around the cylinder at least once.

12 Claims, 8 Drawing Figures



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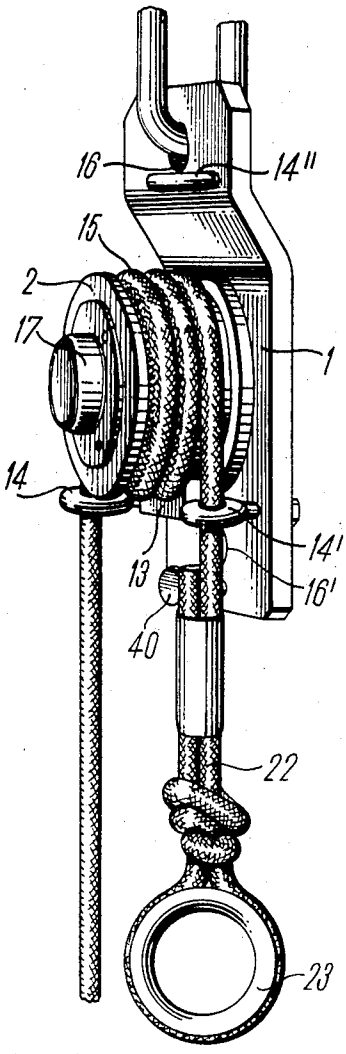

Fig. 1

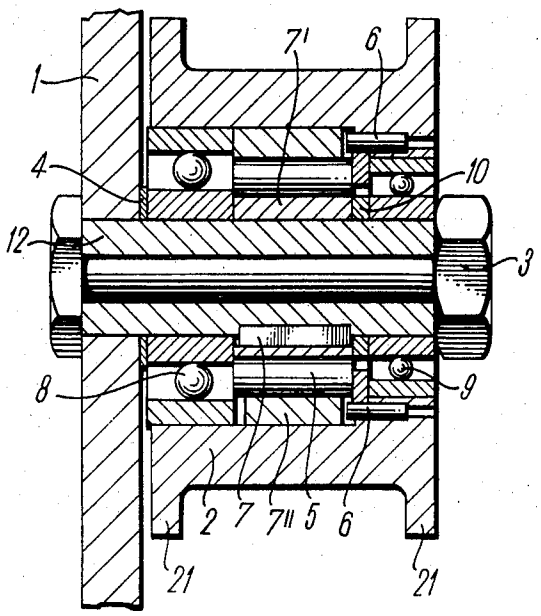

Fig. 4

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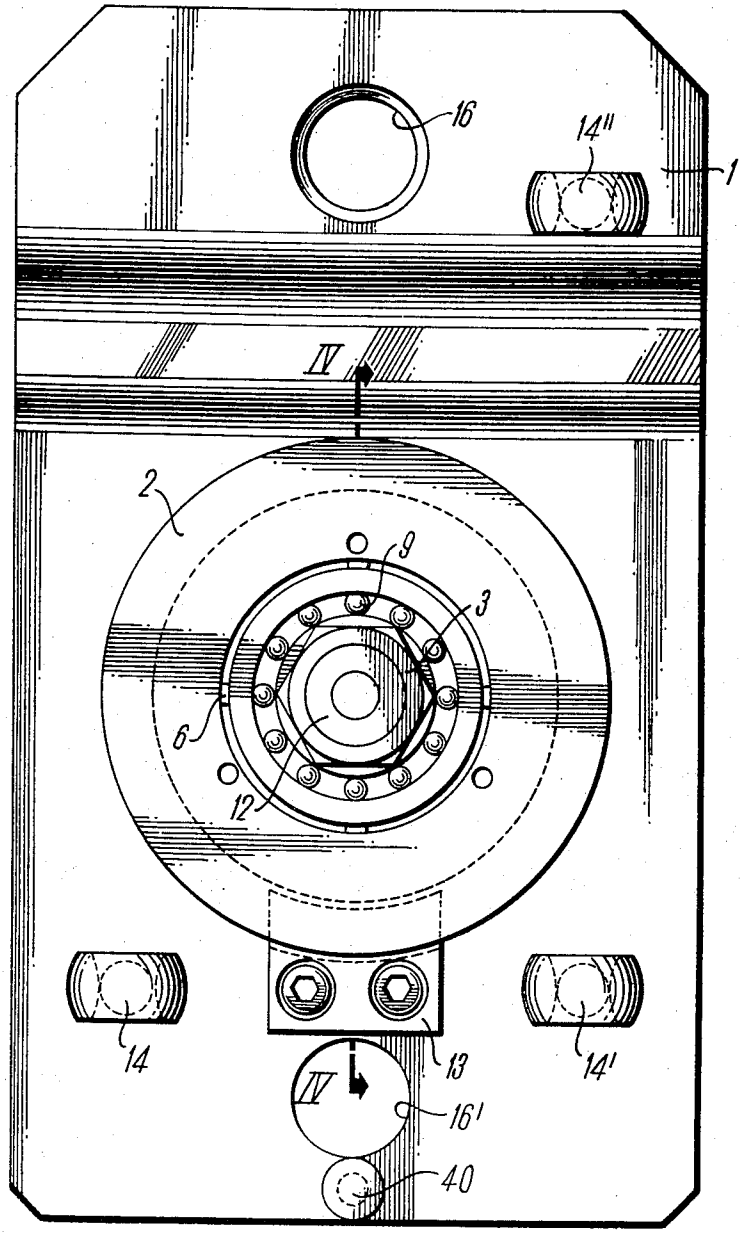

Fig.2

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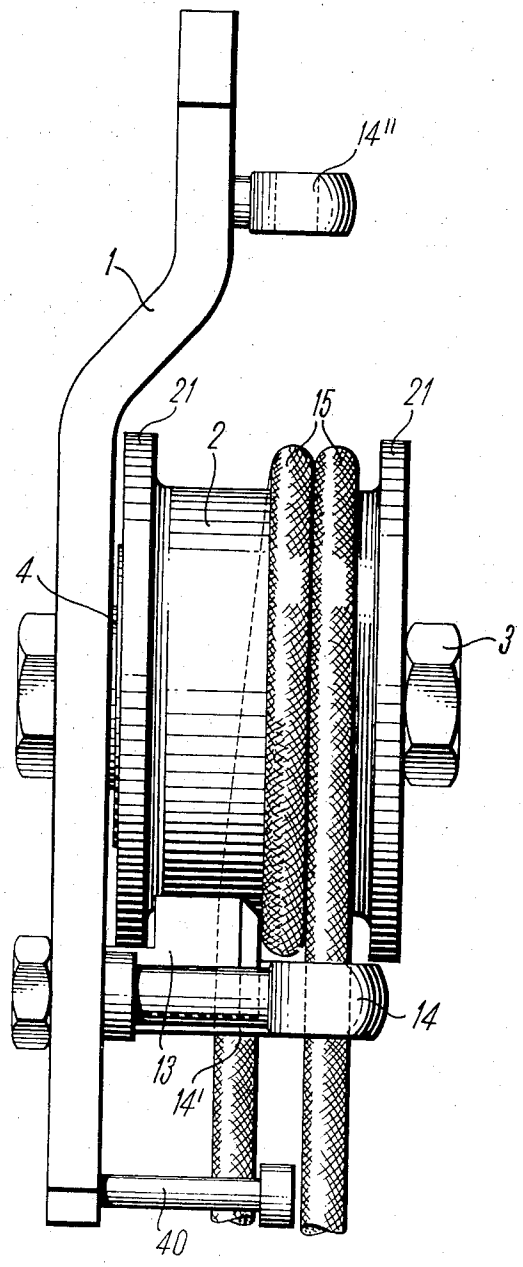

Fig. 3

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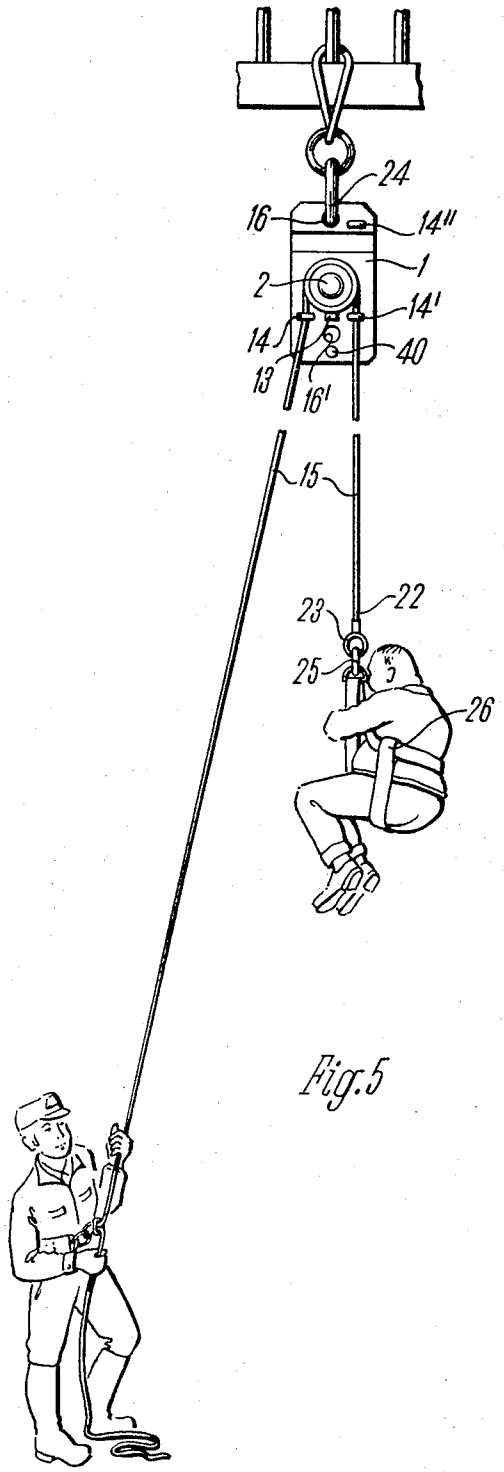

Fig.5

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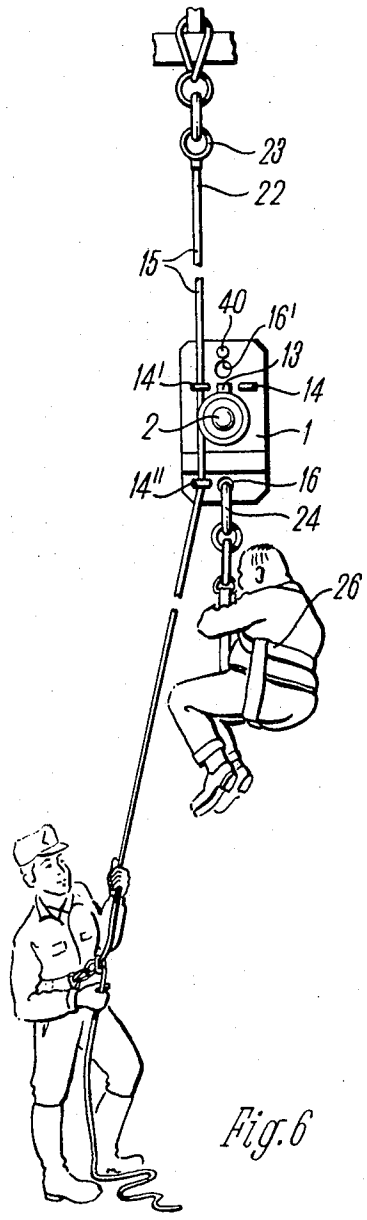

Fig. 6

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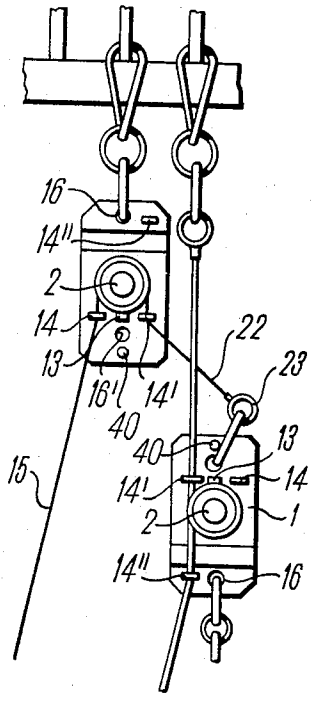

Fig.7

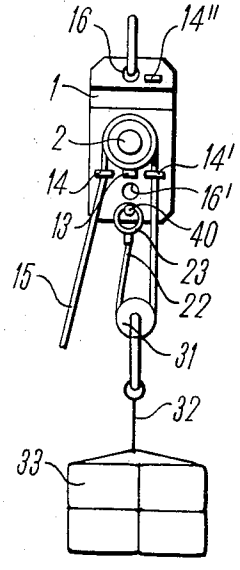

Fig.8

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MULTIPURPOSE DEVICE FOR MOVING PERSONS OR LOADS OVER A HEIGHT DIFFERENCE

BACKGROUND OF THE INVENTION

The invention relates to a device for roping down persons and/or loads from a certain height above the ground and especially for lowering down persons from places, to which normal access in the form of ladders is not available. Thus, the device in accordance with the invention is useful in emergency situations in buildings or the like, when the use of the means normally providing access to a certain place is not possible because of fire or other emergency-creating events. However, the device in accordance to the present invention is not only useful to bring down persons and/or loads from places at which an emergency exists but in all instances, in which the difficulty of access is inherent in the construction of such a place, e.g. platforms used in construction scaffoldings and the like. Further, The invention may be used to transport persons from the upper cabins of cranes or other elevated structures, when they become unconscious and can not climb down the available ladders and cannot be transported thereon. The present invention is also useful in the connection with lowering down persons from airborne platforms, such as helicopters or the like. In the same manner, the device according to the present invention can generally be used to rope down loads from elevated places.

The invention can be used in instances, in which heretofore movable fire ladders have been used. The use of the device in accordance to the invention, especially in instances where the height difference is substantial, in comparison with these ladders is safer, more reliable, and less costly.

Further, the invention can be used, wherever heretofore pulleys have been used for roping down loads and/or persons or for balancing rather large pulling forces by a much lower controlling force. The disadvantage of pulleys is a consequence of the loose arrangement of various rollers on a rope, which maintain their positions only when the ropes are tightened. The various parts are likely to dissassemble in their relation to each other during the preparation of the operation. This makes the pulleys unsafe and difficult to handle. This is especially important when persons are to be transported.

OBJECTS OF THE INVENTION

In view of the forgoing it is the aim of the invention to achieve the following objects, singly or in combination:

It is an object of the invention to provide a device, with which person or loads can be roped down from a certain height, and which is safe in operation, simple in construction and easy to handle, and especially a device, which is useful in roping down persons and/or loads over a large height difference.

It is a further object of the invention to provide a device for roping down persons and/or loads in which the position of the ropes in relation to the device is always precise and not susceptible to tangling or misalignment during operation.

It is an object of the invention to provide a device for roping persons and/or loads, in which a much smaller force than the weight of the person or load to be roped down is necessary to balance said weight, and in which said force can easily be adjusted to different weights.

Further, it is an object of the invention, to provide a device, which can be used generally in all instances, in which heretofore pulleys have been used, without the danger of a tangling of the ropes and without the dangers to safety and reliability resulting therefrom.

It is an object of the invention to provide a device for roping persons and/or loads, which can be used in such a manner, that the part of the rope, which is above the momentary position of the person to be roped down, doesn't move during the roping down such that it can contact other parts of the surrounding environment, such as e.g. protruding edges of rocks, when the device is used to rescue mountain climbers, without the hazzard of beeing cut through by relative movement between the rope and such rocks.

At is a still further object of the invention to provide a device, which is generally useful in a roping down persons and/or loads from elevated structures, especially from moving platforms, such as cranes or helicopters.

It is an further object of the invention to provide a device for roping down persons and/or loads which by a simple change of the arrangement of its parts can be used as a pulley-like arrangement to lift loads or persons as well.

SUMMARY OF THE INVENTION

The device for roping down persons or loads over a height difference in accordance to the present invention comprises a supporting member, to which bolt means are connected. The bolt means support cylinder means which are rotatable in one direction only, whereas they are blocked in the other direction of rotation. Around the cylinder means there are wound rope means, such that, when the first end of the rope means is pulled, the cylinder thereby is rotated, whereas, when the second end of the rope is pulled, the rope slides over the fixed surface of the cylinder, thereby generating a braking frictional force between the cylinder and the rope, which effects a braking action on a person or load connected to said second end of the rope, whereby it becomes possible to control the speed of the downward movement of the load or person by gradually releasing said first end of the rope and applying a relatively small force only to this first end.

In a second embodiment, the means for connecting a load or person are provided on the supporting member, whilst the second end of the rope is connected to the place, from which the person or load is to be roped down.

In a third embodiment, the first end of the rope is connected to the supporting member and a roller is inserted in the loop formed by this first embodiment such that by releasing the second end, the load can be lowered, combining the effect of a conventional pulley and the device in accordance to the present invention.

BRIEF FIGURE DESCRIPTION

FIG. 1 is a perspective view of the device in accordance to the invention;

FIG. 2 is a front view of the device according to FIG. 1;

FIG. 3 is a side view of the device in accordance to FIG. 1;

FIG. 4 is a cross sectional view of the device along the line IV—IV in FIG. 2;

FIG. 5 describes one mode of operation of the present invention;

FIG. 6 describes a second mode of operation of the present invention;

FIG. 7 describes a third mode of operation of the present invention;

FIG. 8 describes a fourth mode of operation of the present invention.

DESCRIPTION OF EXAMPLE

As can be seen from FIG. 1, the device in accordance to the present invention comprises a supporting member 1, a cylinder 2 connected thereto, and a rope 15 wound around the cylinder 2.

On the supporting member 1, there is fastened a bolt 12, on which the cylinder 2 is supported by a free-wheeling bearing, connected thereto by a screw-nut 3. The construction of such free-wheeling bearings is well known in the art. Such a bearing essentially consists of an inner hub 7' and an outer hub 7'', between which clamping rollers 5 are provided. The inner hub 7' is fixed to the bolt 12 by a wedge 7. The outer hub 7'' is connected to the cylinder 2 by keys 6. The free-wheeling bearing further comprises a clamping ring (not shown), positioned between the hubs 7' and 7'', which is shaped such that in one direction of rotation of the inner hub 7' with respect to the other hub 7'' the clamping rollers 5 are moving to exert a wedging force between the clamping ring and the hubs of the bearing and thereby block the rotation of both hubs in relation to each other. In the other direction of rotation, as a consequence of the construction of the clamping ring, no such wedging action occurs such that the cylinder 2 connected to the outer hub 7'' can freely rotate. Numerals 8 and 9 indicate roller bearings inserted between the bolt 12 and the cylinder 2 along that portion of the bolt, along which the free-wheeling bearing does not extend. Further, there are provided distance rings 10 and 4, which serve to provide a certain distance between the cylinder 2 and the supporting member 1.

The cylinder 2 further is provided with flanges 21 in order to limit the movement of a rope 15 on the surface of the cylinder 2 in the direction parallel to the axis of rotation of the cylinder 2.

As it can be seen from FIG. 1 and 3, a rope 15 is wound around the cylinder 2 at least one and a half times. In the embodiment shown, it is wound around the cylinder 2 two and a half times. How many times it is wound around the cylinder depends on the desired relation of the weights to be roped down with the device and the force available to control their downward movement. As can be seen from FIG. 1, the number of windings can easily be changed, since the bracket or supporting member 1 does not interfere with the removal of a turn of rope from the cylinder or drum 2. As a consequence of the described construction of the bearing of the cylinder 2, the cylinder 2 can be moved to rotate in one direction by pulling the first end of the rope whereas, when the other end 23 of the rope is pulled, no rotation of cylinder 2 takes place and the frictional force generated between the rope and the surface of the cylinder 2 effects a braking action. Thus, the rope 15 can only be moved along the non-rotation surface of the cylinder 2 by overcoming this frictional force, which depends on the force active at the other end, the circumferential angle, along which the rope is wound around the cylinder, and the friction characteristics of the rope and the surface of the cylinder. This relation is well known.

To the end 22 of the rope 15, which in accordance with the above definition is the second end, there is connected a ring 23, which in one mode of operation of the invention, serves to connect a load or person thereto. The other end, as will be described later, either is provided with similar connecting means or is left free in order to be handled by a person.

Further, there are provided on the supporting member 1 guiding means 14,14' and 14'', which serve to guide the ends of the rope 15 to and away from the cylinder 2 at a predetermined position. A still further guiding means 13 is connected to the supporting member 1 and, as can be seen from FIG. 3 serves to prevent a displacement of rope 15 along the surface of the cylinder 2 in a direction parallel to the axis of its rotation when that cylinder is rotated. It rests against one winding of the rope 15, which otherwise, when the cylinder 2 is rotated, would tend to slowly move in the direction of the axis of the cylinder 2. Thus, a tangling of the rope 15 on the surface of the cylinder is prevented. The guiding means 14'', in one mode of operation, are used instead of the guiding means 14. The guiding means 14,14',14'' are formed by rings connected to the supporting member 1 in any suitable manner such as welding.

The supporting member 1 further is provided with two holes 16,16', which are adapted to receive spring safety hooks. One such spring safety hook 24 is shown in FIG. 1.

Further, on the supporting member 1 there is provide a knoblike protrusion 40, which is used in the operation described in connection with FIG. 8. As shown in FIG. 1, the cap 17 serves to protect the screw nut 3, by which the bearing supporting the cylinder 2 is connected to the bolt 12.

As a material for the cylinder 2, an Aluminum alloy of the type AlCuMgPb has proved satisfactory. Its heat-conductivity is large enough to prevent the cylinder, when in operation, to become heated to such an extent that the strength of the material, of which the rope 15 is made, is essentially affected. As a material for the rope 15, a polyamid, as available under the registered trade mark "perlon", has been satisfactory. A suitable diameter of the rope 15 is 9 mm.

OPERATION

First, the operation as shown in FIG. 5 will be described. At the end 22 of the rope 15, connected to the ring 23 by means of a suitable spring-safety hook 25, there is fastened a belt 26, in which a person to be roped down is supported. The end 22 of the rope 15 is the end, which, when pulled by the weight of the person to be rescued, does not effect a rotation of the cylinder 2, since the free-wheeling bearing means are such that the rotation of the cylinder 2 is blocked in the direction, in which the weight of the person to be rescued would tend to rotate the cylinder.

Via the spring safety hook 24 the supporting member 1 is connected to the place, from which the person has to be roped down. Such means for connecting the supporting member to such a place may be further rope means provided with suitable rings and hooks, as indicated in FIG. 5. The place, from which a person can be roped down, may be any place, from which such rescuing action may be desirable, such as a crane, a con-

struction platform on a construction scaffold, a building, in which an emergency situation is present, or an airborne platform, such as a helicopter or the like. In principle, the device for roping down persons or loads over a height difference in accordance to the present invention is suitable for a variety of applications, for which only some examples have been given.

At the other end of the rope **15** a person, which assists in the operation of roping down, controls the speed, with which the person sitting in the belt **26** is moved down. The weight of the person, sitting in the belt **26**, thus can be controlled by a much smaller force.

When the persons sitting in the belt **26** has been brought to the ground, the end **22** with the spring safety hook **25** and the belt **26** may be pulled up again; that is easily possible, since in the direction, in which it then is moved, the cylinder **2** is freely rotatable and rotates with the rope **15** when pulled by the person standing on the ground.

If the person sitting in the belt **26** still is able to assist in the operation, he can himself hold the rope and control the gradual release of its other end and thereby balance the force of his own weight. Further, the release of the end of the rope **15**, opposite to the end **22**, can be done from any desired position, including the place, from which a person has to be rescued, since the guiding means **14** always serve to direct the rope end at predetermined positions to and away from the cylinder **2** such that no tangling of the rope **15** can occur.

A second possible mode of operation is shown in FIG. **6**, where the person to be roped down is connected to the supporting member **1**, by suitable rope means connected to the hole **16** provided therein. The end **22** of the rope **15**, which, when pulled, tends to act on the cylinder in the direction of rotation, in which a rotation is blocked, is connected to the place, from which the person has to be roped down. The force applied to the other end of the rope by a person standing on the ground or by the person to be roped down himself controls the speed with which the device **1** moves down the rope.

The operation as described in connection with FIG. **6**, has been proved useful, when the height difference, from which the person sitting in the belt **26** has to be roped down, is very large. In such an instance it can happen that the weight of the rope **15**, especially when the operation of roping down occurs in rainy weather and the rope therefor is wet, is so large, that by its own weight, it may bring the downward movement of the person sitting in the belt **26** to a complete stop. Of course it would be possible to look for suitable materials which would not be come soaked with water when exposed to rain or to provide correspondingly lieghter and exchangeable ropes **15**. But the operation as shown in FIG. **6** has been proved to be the best. It is thereby possible to turn the rope **15** around the cylinder **2** once or twice, as desired and thereby correspondingly adjust the frictional force between the cylinder **2** and the rope **15** as it is generated by a movement of the rope **15** on the surface of the blocked cylinder **2**, whereas in the operation as shown in FIG. **5**, the rope **15** must be wound around the cylinder **2** one and a half times or two and a half times, since both rope ends leave the cylinder in the same direction. A further advantage of operating the device in the manner described above is that the part of the rope above the device, during the operation, does not move. Thus, when the device e.g. is used to rescue mountain climbers and the rope rests against some rocks or the like, the danger of the rope being cut by moving along a sharp edge of a rock or similar part of the environment, in which the device is used, does not occur as it would be present when conventional pulleys are use.

A still further way of operating the disclosed device for roping down a person and/or loads can be seen from FIG. **7**. In FIG. **7**, two devices in accordance to the invention are used. The first device is used in the same manner as described in connection with FIG. **6**. The person to be roped down (not shown) is connected to the hole **16** provided in the supporting member **1**. The operation is the same as described in connection with FIG. **6**. A second device (at left in FIG. **7**) is used as safety-device. It is operated in the same manner as described in the connection with FIG. **5**, the first device being connected in the same manner to the second device, in which in FIG. **5** the person to be roped down has been connected to the end **22** of the rope **15**.

For this second device, which operates only for safety purposes and for securing the downward movement of the first device, a much smaller rope, for example with a diameter of **5,5** mm can be used whereas the normal diameter of the rope **15** is approximately **11** mm.

After finishing the operation of roping down the first device (at right in FIG. **7**) the second one can be used to pull the first one up again.

Obviously, while the operation of a device for roping down loads or persons has been described in the forgoing paragraphs in connection with rescuing persons, it also is useful for moving down loads over a substantial height difference. The operation is much safer and more reliable than with the pulleys known heretofore for such purposes, the arrangement of a rope on various rollers is too unreliable; the danger for a tangling of the rope or of the rope slipping out of the grooves provided in the rollers is too high.

Nevertheless, the advantages of a pulley for moving loads in an upward direction can easily be combined with the advantages of the device as disclosed in the foregoing paragraphs as can be seen from FIG. **8**.

When the ring **23** is connected to the end **22** of the rope **15** is put over the knob **40** and a roller **31** is inserted in the loop formed between the end **22** of the rope **15** and the guiding means **14'**, and, further, by means of a suitable rope **32** a load **33** is connected to the roller **31**, a load **33** can also be pulled upward by suitable action on the first end of the rope pulled upward by suitable action on the first end of the rope **15** (opposite to the end **22**), since the cylinder **2** is freely rotatable in the direction, in which it is turned when the end opposed to the end **22** is pulled, such that the device for the purpose of moving certain loads upwards acts in the same manner as a usual pulley, whereas the advantages for balancing a weight much larger than the force available for controlling its downward movement, as described in connection with FIG. **5** to **8**, are maintained.

Thus, in a more general sense, the invention creates a universially applicable device which can be used for moving persons or loads over a substantial height difference and which particularly is adapted to rope down persons from a places or platforms, from which other means for leaving are not available.

What I claim is:

1. A multipurpose device for moving loads or persons over a height difference, comprising:
a. a supporting plate having first and second ends;
b. bolt means fixedly connected at one end thereof to one side of said plate and extending transversely therefrom;
c. a cylinder radially surrounding said fixed bolt means whereby one end of said cylinder is free;
d. bearing means for rotatably supporting said cylinder on said fixed bolt means, said bearing means including roller locking friction clutch means for preventing the rotation of the cylinder with respect to the bolt means in one direction of the rotation and allowing free rotation of the cylinder on the bolt means in the opposite direction of rotation;
e. a rope having a first end and a second end and rope guide means affixed to said plate for guiding said rope relative to said rotatable cylinder;
f. said rope being wound around said cylinder at least one and a half times, whereby when said first end of said rope is pulled the cylinder rotates and when the second end of the rope is pulled the rotation of the cylinder is blocked and a braking action is effected by the frictional force generated between the rope and the surface of the cylinder; and
g. means for connecting said first or second end of the supporting plate to a fixed point or to the load, whereby the device may be used for lowering and lifting as well as for moving the device along the rope.

2. The device according to claim 1, wherein said roller locking friction clutch means comprises a plurality of wedging rollers.

3. The device according to claim 1, wherein said rope guide means are arranged below and adjacent to both sides of the rotatable cylinder whereby both rope ends extend downwardly from said rotatable cylinder for holding said first rope end, said device further comprising means for connecting said second rope end to said load or person.

4. The device according to claim 1, comprising further guide means for guiding said rope above and below said rotatable cylinder whereby the rope ends extend away from said cylinder in opposite directions, means for connecting said first rope end to said fixed point and means for connecting a load or person to said supporting plate at one end thereof.

5. The device according to claim 1, further comprising a pulley, wherein both rope ends extend downwardly from said rotatable cylinder for pulling said first rope end downwardly, means for connecting the second rope end to said supporting plate to form a rope loop, said pulley being located in said rope loop, and means for connecting said pulley to said load or person.

6. The device according to claim 5, wherein said guide means comprise two guide members attached to said supporting plate in positions below said rotatable cylinder for guiding said rope ends in parallel to each other and in the same direction away from said cylinder.

7. The device according to claim 1, comprising a rope guide block affixed to said supporting plate and extending to the surface of said rotatable cylinder for preventing movement of the rope in the longitudinal direction of the cylinder surface.

8. The device according to claim 1, wherein said supporting plate comprises two plate portions and a slanted plate section inter-connecting said plate portions whereby the plate portions extend in parallel planes, said cylinder being attached to one of said two plate portions so that the slanted plate section and the other plate portion extend partially over the cylinder.

9. The device according to claim 8, wherein said means for connecting a plate end to a fixed point are located in a plane substantially coinciding with a plane extending perpendicularly to the supporting plate and through the longitudinal axis of said cylinder.

10. The device according to claim 8, wherein said guide means comprise a first guide member located substantially in the plane of said other plate portion below and to one side of said cylinder, and a further guide member located substantially adjacent to said free end of said cylinder.

11. A device for moving loads or persons over a height difference, comprising:
a. a supporting plate;
b. a cylinder support member connected at one end thereof to said supporting plate;
c. cylinder means, free wheeling bearing means for supporting said cylinder means on said cylinder supporting member, roller locking friction clutch means arranged between said cylinder means and said cylinder supporting member such that said cylinder means are rotatable in one direction of rotation only and the rotation is essentially blocked in the other direction;
d. rope means wound around said cylinder means such that, when a first end of said rope means is pulled, the cylinder means are rotated, and when a second end of said rope means is pulled, a frictional movement of said rope means along the surface of said cylinder means is effected;
e. means for fastening the second end of said rope means to the supporting slate;
f. pulley means inserted in a loop formed by the rope means between its second end, when fastened to said fastening means, and the position at which they are led to and away from said cylinder means;
g. means for connecting a load or person to the said pulley means, such that by gradually releasing the first end of said rope means, a load or person can be lowered down and said lowering operation can be controlled by a force substantially less than the weight of the load or person, and a load or person can be lifted by pulling said first end of the rope means with the force less than the weight of the load or person.

12. A device for roping down persons or loads over a height difference, comprising:
a. first and second supporting plates;
b. a separate bolt fixedly connected to one side of each of said plates;
c. separate cylinder means, free wheeling bearing means for supporting the respective cylinder means on each of said bolts, said bearing means including roller locking friction clutches for preventing the rotation of the respective cylinder on its bolt in one direction of rotation and allowing free rotation of the cylinders on their bolts in the other direction of rotation, whereby one end of each cylinder is exposed;
d. a first rope extending from a fixed support above the first supporting plate and wrapped around the

corresponding cylinder at least one and a half times and thence extending downwardly;

e. means for connecting a load or person to the first plate;

f. means for supporting said second plate; and

g. a second rope extending from said first plate at least one and a half times around the cylinder rotatably supoorted by the second plate and thence extending downwardly; whereby the cylinders are rotatable when the respective ropes extending downwardly therefrom are pulled, the rotation of the cylinder on the first plate is blocked and a braking action is effected by frictional force generated between the first rope and the surface of the respective cylinder by the load connected to the first plate, the rotation of the cylinder on the second plate is blocked and a braking action is effected by the frictional force generated between the second rope and a surface of the respective cylinder by a force acting thereon due to the connection of the second rope to the first plate, such that by gradually releasing the downwardly extending end of the first rope, the respective supporting plate and the load connected thereto can be roped down and the second rope is controllable as a safety device for the lowering of said load.

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