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Rope descent regulator

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GB2024912 A

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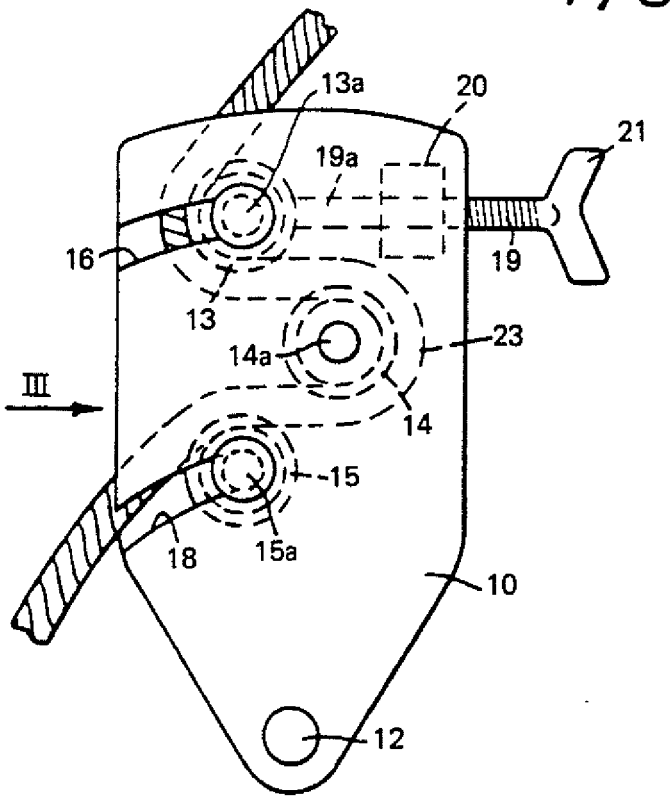

FIG. 1

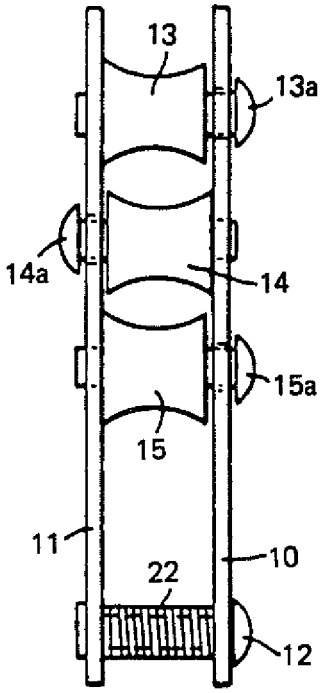

FIG. 3

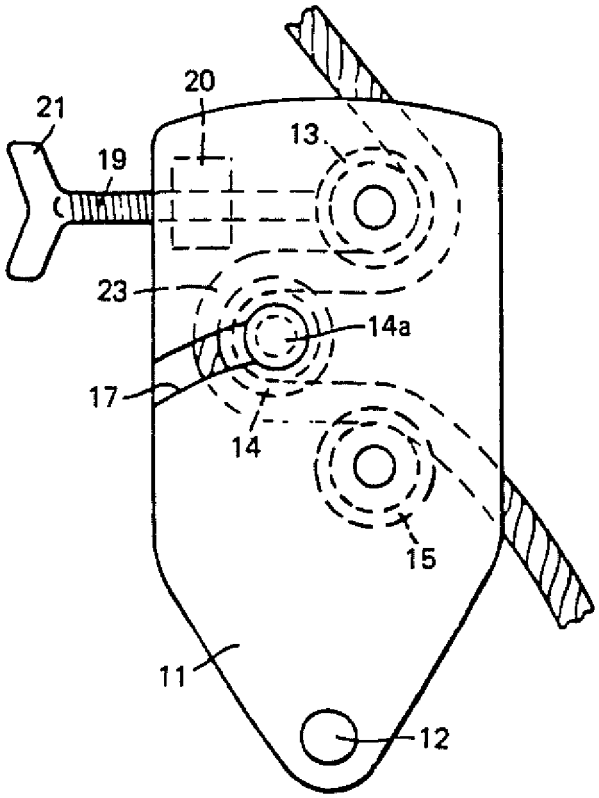

FIG. 2

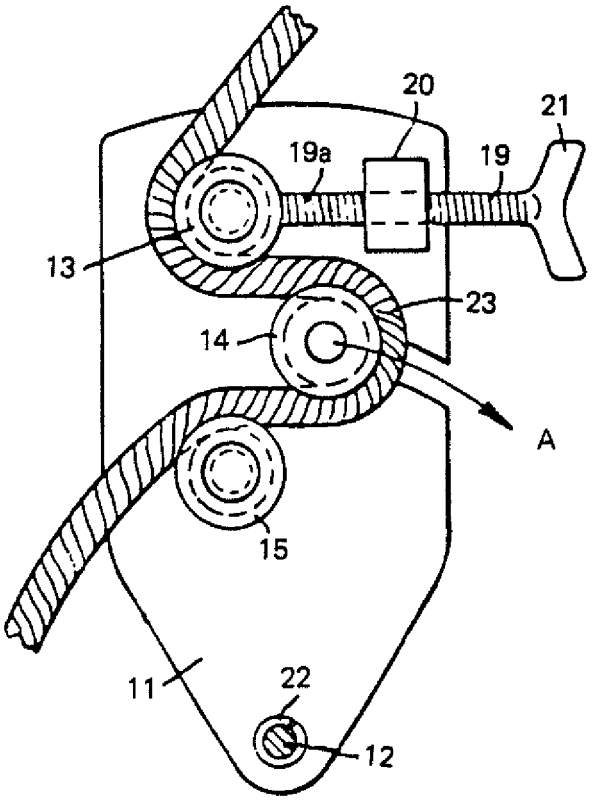

FIG. 4

FIG. 6

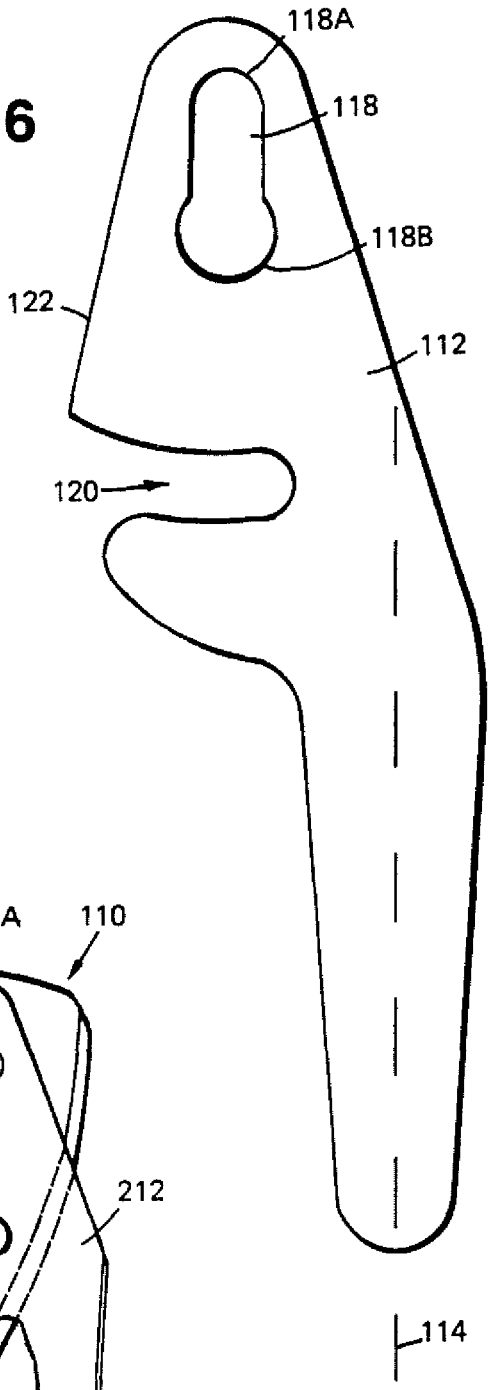

FIG. 7

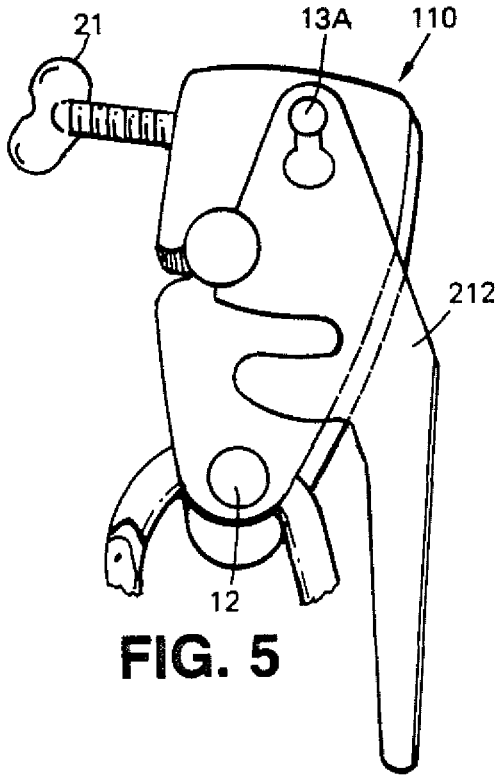

FIG. 5

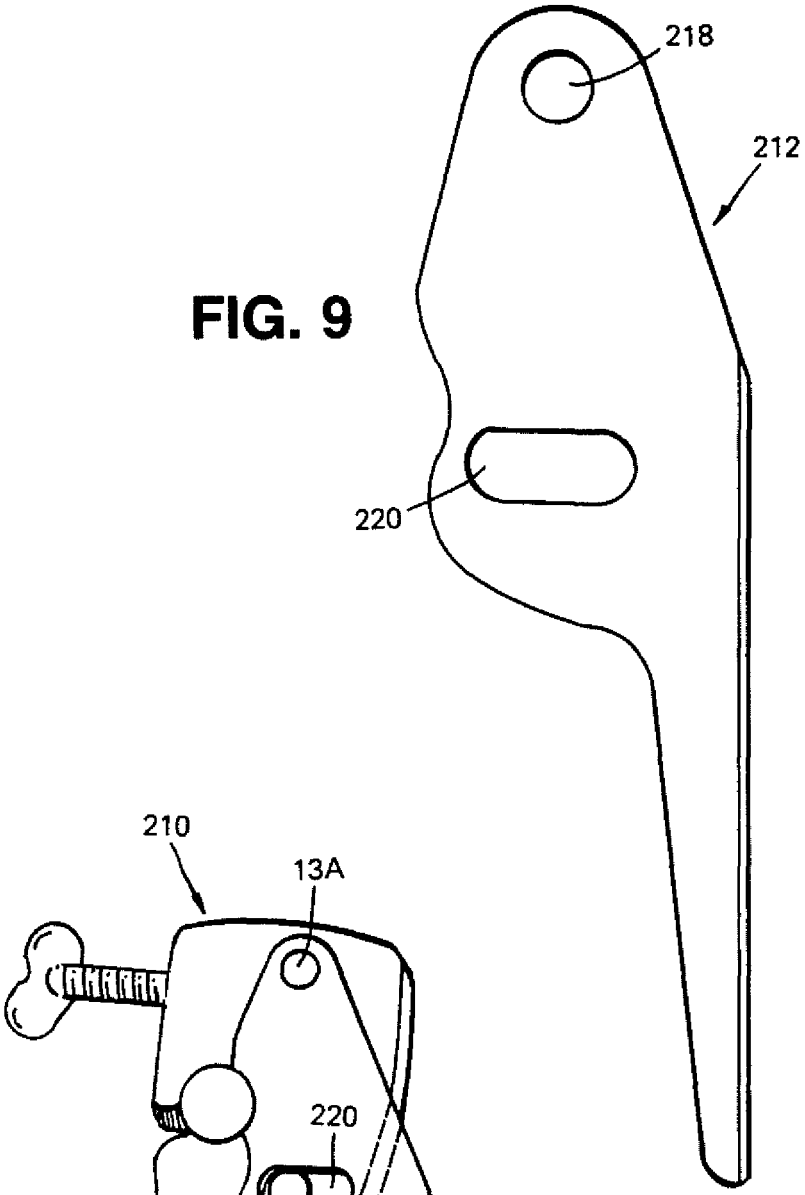

FIG. 9

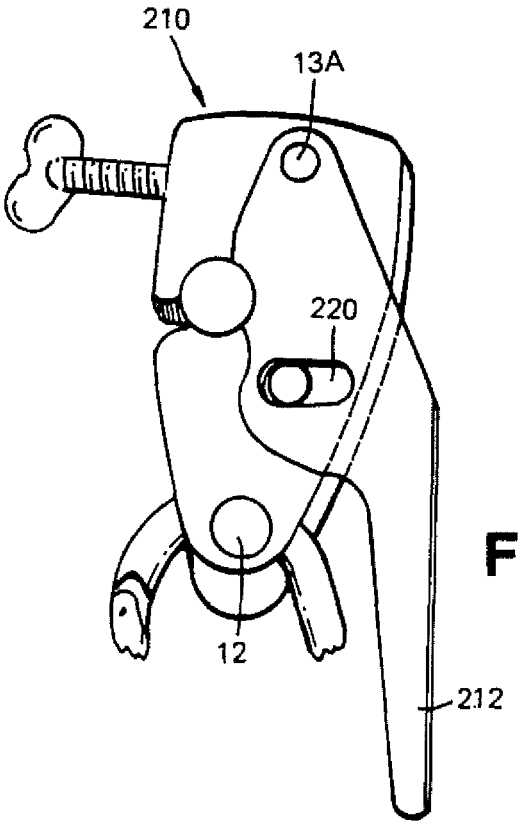

FIG. 8

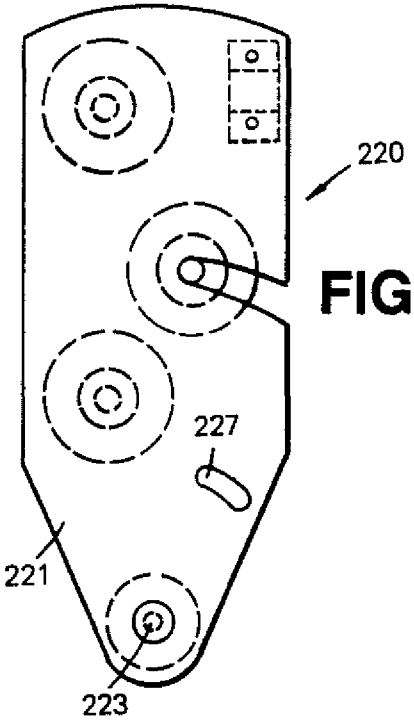

FIG. 10

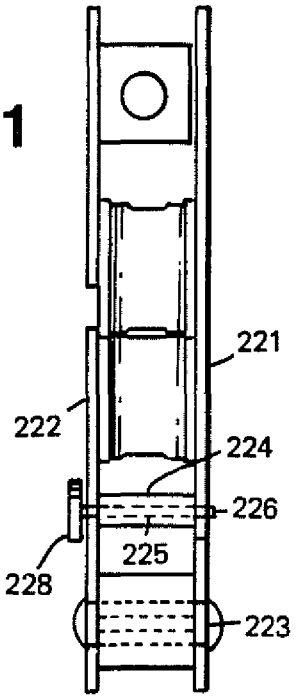

FIG. 11

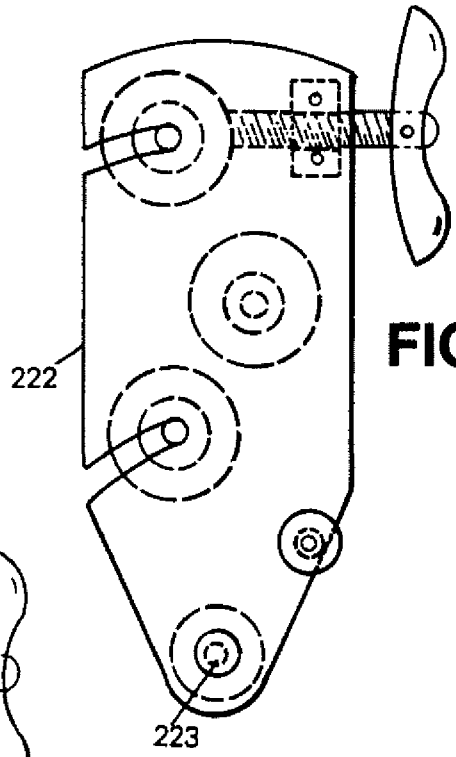

FIG. 12

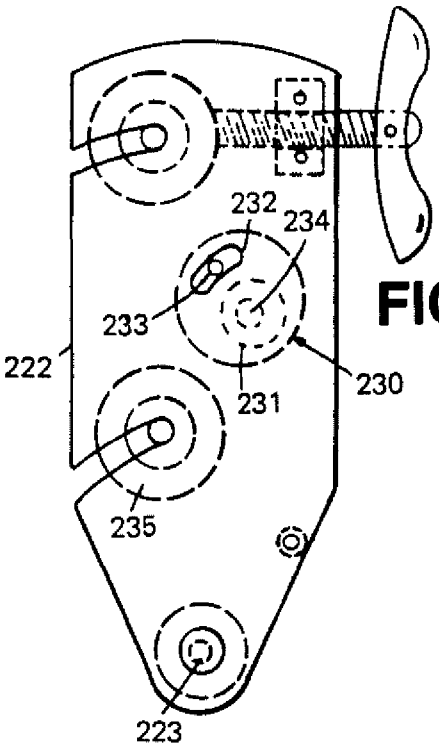

FIG. 13

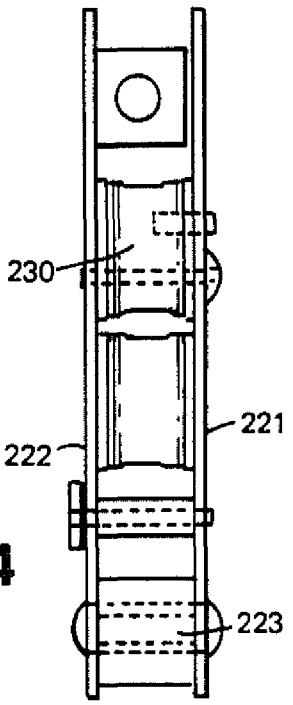

FIG. 14

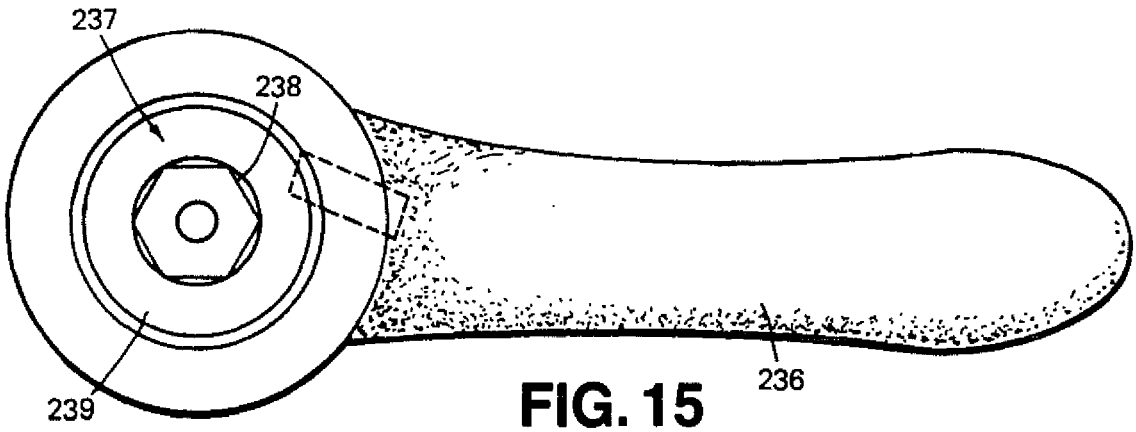

FIG. 15

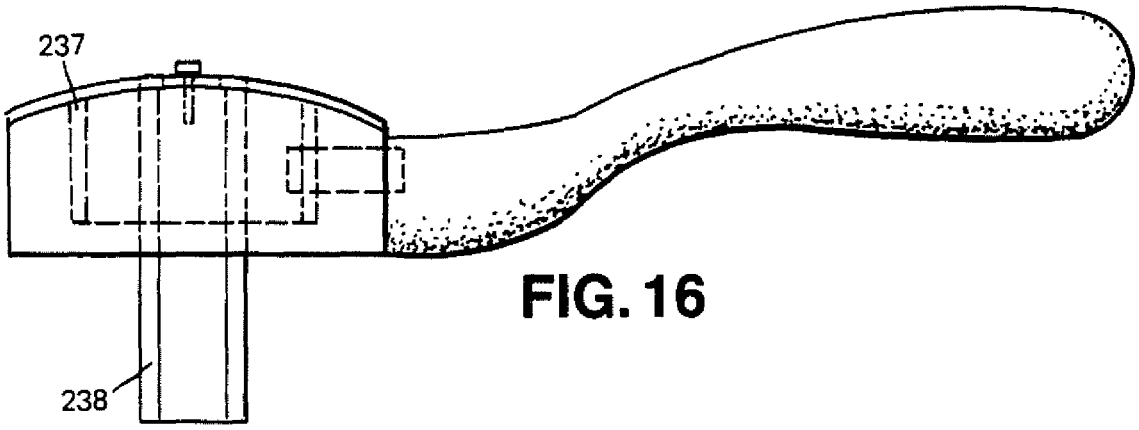

FIG. 16

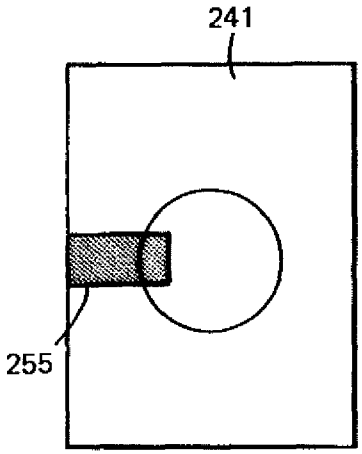

FIG. 17A

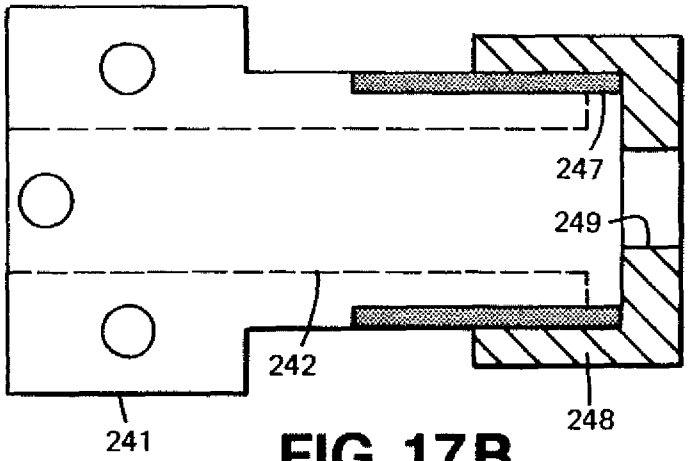

FIG. 17B

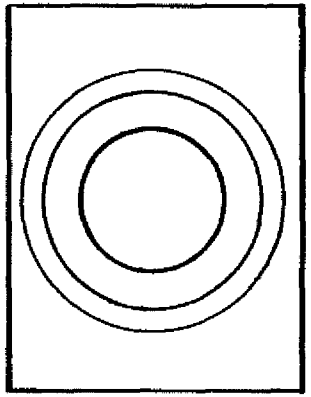

FIG. 17C

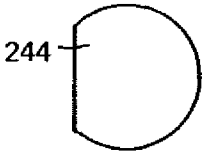

FIG. 18B

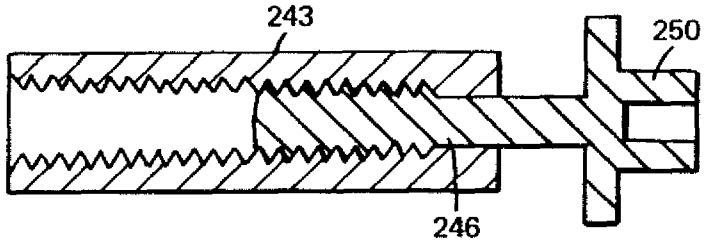

FIG. 18A

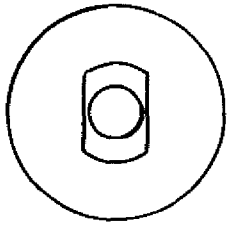

FIG. 18C

Rope Descent Regulator

This invention relates to a rope descent regulator, for controlling the speed of descent of a person or load down a rope.

A rope descent regulator, or "descender" may be used for example in descent by abseiling, and in its simplest form may comprise a sheaf block through which the rope is threaded, and the block secured to the user by harness or the like. The tension of the rope, and thus the friction in the block is controlled by manipulation by the user of the rope "tail" below the block. This requires skill and experience, and does not leave the user free to perform other operations while descending such as controlling a stretcher, geological exploration etc.

There has been proposed (Lewis, British Patent Application No: 2 024 912) a descender comprising fixed sheaf elements between side plates, and a third sheaf element which is mounted on an arm of a lever pivoted to the plates, and the other arm of which is formed as a handle. The third sheaf element is displaceable relative to the other two, thereby controlling the friction on the rope in the descender, and thus the rate of descent. In practice, this descender must be continuously controlled.

There has also been proposed in British Patent No: 2 206 373 (Alphin Rescue Equipment Limited) a descender comprising two fixed sheaf elements, a third sheaf element which is displaceable relative to the fixed sheaf elements, and continuously adjustable means for presettably varying the position of the third sheaf element relative to the fixed sheaf elements. The user can preset the friction between the rope and the regulator so that a load can be lowered at a steady rate. However the user does not have a readily available means of control should the rate of descent vary.

An object of the present invention is to provide a descent regulator which enables the friction between the rope and regulator to be preset so that a load can be lowered at a steady rate, and to provide a variable continuous control of the regulator if required.

A further object of the present invention is to provide a descent regulator in which the function between the rope and the regulator can be preset to lock the regulator to the rope, and to provide a control to release the regulator from the regulator, to control the descent of the regulator, and to allow the regulator to lock on the rope when the control is released.

The load could be a user who wishes to concentrate on other matters, such as controlling the descent of a stretcher, or

studying rock formations, etc or an inexperienced abseiler, a slightly injured casualty, or a passive load such as a stretcher and casualty which may be lowered from a structure with free space below the point of descent.

From a first aspect the invention provides a rope descent regulator comprising a body having two fixed sheaf elements, a third sheaf element which is displaceable relative to the fixed sheaf elements, first adjustment means for presettably varying the position of the third sheaf element relative to the fixed sheaf elements, and second adjustment means to continuously vary the position of the third sheaf element. The fixed sheaf elements are preferably mounted on a first side plate, and the third, moveable sheaf element is presently mounted on a second side plate, the side plates being pivoted together so that they lie in and are relatively displaceable in parallel planes. The pivot is preferably spring loaded to bias the side plates to overlie each other.

Preferably the first adjustment means for relatively displacing the fixed and moveable sheaf elements comprises a threaded rod or screw, bearing on one of the fixed sheaf elements, the rod being rotatable axially in a counter threaded block on the second side plate, whereby rotation of the rod in one sense will tend to open the plates apart against the bias of the spring, th reducing the penetration of the third sheaf element between

fixed sheaf, and rotation of the rod in the other sense will tend to close the plates with the bias of the spring, thus increasing penetration of the third sheaf element between the fixed sheaf elements.

From another aspect, the invention provides a rope descent regulator comprising a first side plate, and a second side plate, said side plates being disposed in parallel spaced apart planes, and pivotally connected in one end region of said plates, said plates being biassed into any overlying position wherein each plate overlies the other, by means of a torsion spring acting on said pivot, said first plate mounting two spaced apart sheaf elements between said plates, said second plate mounting a third sheaf element in a position wherein said third sheaf element can move relative to said two sheaf elements on an arc centred on said pivot and passing between said two sheaf elements, continuously adjustable means bearing on the third sheaf element, and first adjustment means on said second side plate complementary to said continuously adjustable means to enable the relative positions of said two sheaf elements and said third sheaf element to be adjustable and maintained after adjustment, thereby selecting and maintaining a desired degree of friction on a rope when reeved over and between said sheaf elements, and second adjustment means to continuously vary the position of the third sheaf element.

The second adjustment means can comprise a lever which is

rotatably mountable on the first side plate, and arranged to engage the moveable sheaf element on the second side plate.

Preferred embodiments of rope descent regulator according to the invention will now be described, with reference to the accompanying drawings, wherein:

Figure 1 is an elevation view of one face of a known form of rope descent regulator;

Figure 2 is a corresponding elevation view of the regulator from the opposite side to figure 1;

Figure 3 is an end elevation from the direction of arrow III in figure 1;

Figure 4 is a side view similar to figure 1 with one side plate removed;

Figure 5 is an elevation of one face of a rope regulator according to the present invention;

Figure 6 is an elevation of a lever of the regulator shown in figure 5;

Figure 7 is a view on arrow A in figure 6;

Figure 8 is an elevation of one face of a further form of regulator according to the present invention;

Figure 9 is an elevation to a larger scale of the lever to that shown in figure 8;

Figure 10 is a front elevation of a second rope regulator of the invention;

Figure 11 is an end elevation of the regulator of figure 10;

Figure 12 is a rear elevation of the regulator of figures 10 and 11;

Figure 13 is a front elevation of a third embodiment of descent regulator of the invention;

Figure 14 is an end elevation of the regulator of figure 13;

Figure 15 is a plan view of a part of a descent regulator which can be used in combination with a regulator of figures 13 and 14;

Figure 16 is a side elevation of the handle of figure 16;

Figure 17 is a side elevation illustrating a modified control element of the regulator of the invention; and

Figure 18 is a similar view illustrating a core of the mechanism shown in figure 17.

As illustrated in the drawings, a known rope descent regulator is in the general form of a sheaf block, comprising a first side plate (10), and a second side plate (11), which is pivotally connected at one end by a pivot pin (12). Non-rotable sheaf elements (13(, (14) and (15) are mounted on the first side plate (10), and having mushroom headed studs (13A), (15A) sliding in arcuate slots (16) and (18) in the second side plate (11). Sheaf element (14) is mounted on the second side plate (11), and has a mushroom headed stud (14A) slidable in an arcuate slot (17) in the first side plate (10). The slots (16), (17) and (18) lie on arcs centred on the axis of pivot pin (12).

A threaded rod (19), adapted to run in a counter-threaded bore in a block (20) has an end (19A) which bears on a surface of sheaf element (13). Sheaf element (13) is the radially outermost of the sheaf elements from pivot block (12). Block (20) is fixed to the inner surface of the second side plate (11), and the rod (19) is provided with a winged head (21), so that the rod can be rotated manually. Rotation of the rod (19) so that it displaces in the direction of sheaf element (13) forces the side plates (10) and (11) apart, against the force of a torsion spring (22) on the pivot pin (12), the spring acting to bias the side plates to overlie one another, thus causing sheaf element (14) to be

displaced relative to sheaf elements (13) and (15) along the arc of arrow A (figure 4).

In use, the plates are pivoted apart and held while a loop of rope (23) is placed about sheaf element (14), and between sheaf elements (13) and (15). The spring (22) is allowed to return the side plates to their closed position. Friction on the rope (23) is varied by displacing the sheaf element (14) relative to the sheaf elements (13) and (15) by using the screw threaded rod (19). The rod (19) is screwed in to move sheaf element (14) to the right in figure 4, thus increasing the length of the loop in the regulator and decreasing friction on the rope; and conversely screwed out to displace the sheaf element (14) to the left in figure 4 towards the outer sheaf elements, shortening the loop, and increasing friction.

Referring to figures 5, 6 and 7 a rope descent regulator (110) is identical in form and construction to the regulator (10) described with reference to figures 1 to 4 inclusive, apart from the provision of a lever (112), and the corresponding components of the regulator (110) have been given the same references as used in the above description.

Referring particularly to figure 5, which corresponds to figure 2, the lever (112) is formed from a shaped metal plate folded

over a line (114) to form a handle (116). The lever (112) has a key-hole shaped slot (118) having one end (118A) which corresponds in diameter to the stud (13A), and an enlarged end (118B) which is larger in diameter than the end (118A).

An arcuate slot (120), the centre of radius of which is the centre of the end (118A) formed in the lever (112), and the width of the slot is slightly greater than the diameter of the stud (15A). The lever has a surface (122) which bears against the head (14A) of the stud on which the moveable sheaf (14) is mounted.

Referring to figures 8 and 9, there is shown a descent regulator (210) which is similar in construction to the regulator (110) except for the provision of a modified form of lever (212) which replaces the lever (112). The lever (212) is similar in form to the lever (112), but can be attached permanently to the regulator (210). The lever (212) has a round hole (218) instead of the keyhole slot (118), and a slot (220) which is closed off at its end. The lever (212) is assembled on the regulator (21) by positioning the sheaf element (14) in the slot (220) and a bolt or other securing means passing through the hole (218) to attach the lever to the side plate (11).

The descent regulator (210) is set for use in the same way as the regulator (10) and is used in a similar way to that described

above. If during descent, the rate of descent varies or the user wishes to vary the rate of descent without having to use the threaded rod, the lever (112) is attached to the regulator if it has not already been placed in position, or the lever (212) is permanently attached to the regulator.

The lever (112) is attached by locating the opening (118) over the stud (13A) so that the stud (13A) is positioned in the end (118A) of the opening (118) and the stud (15A) is located in the slot (120). The surface (122) contacts the head (14A) of the sheaf (14), and using the handle (116), the sheaf (14) can be further displaced in the direction of arrow C in figure 5.

The lever (218) is attached to the regulator in the manner as described above.

In distinction from known rope descent regulators, using the rope descent regulator according to the invention, and making use of the screw rod (19), the degree of friction, and thus the rate of descent can be preset, and this can be maintained until the setting of the screw is altered, or the lever (112) or (212) is used to vary the rate of descent without having to use the rod (19). The provision of the lever (112) or the lever (212) enables the rate of descent to be varied rapidly and easily, since attempting to control the rate of descent using the rod (19) could be difficult and inconvenient, whilst a descent is

taking place.

The descent regulator (110) and the lever (112), or the regulator (210) and the lever (212) can also be used in the following manner. The rod (19) is operated to lock the regulator to the rope. The lever (112) or the lever (212) can then be used to release the regulator from the rope and to control the rate of descent. It will be appreciated that if the lever (112) or (212) is released, the regulator will automatically lock the regulator (110) or (210) to the rope, thereby providing a safety feature should the lever be inadvertently released, or if the lever has to be released.

Referring now to figures 10, 11 and 12, it will be seen that the descent regulator of figures 1 to 9 can be modified so as to prevent inadvertent separation of the two plates. In this embodiment of descent regulator (220) a front plate (221) and a rear plate (222) are pivoted at (223) as previous. Mounted on plate (222) is a boss (224) in which is slidable a pin (225). Pin (225) is spring loaded to the right in figure 11 so that its free end portion (226) can engage in slot (227).

The end portion (226) moving in slot (227) allows the plates (221) and (222) to pivot sufficiently to allow the user to regulate his descent in accordance with the embodiment shown in figures 5 to 9 or in figures 13 to 16, but prevents complete

separation of the plates (221) and (222) (and hence separation of the plates from the rope) without deliberate action by the user. When the user does wish to separate the plates so as to release the rope it is necessary to actuate the head (228) to move the pin to the left in figure 11 to withdraw portion (226) from the slot (227). Withdrawal can be against the strength of the aforesaid spring loaded movement. Alternatively, the pin (225) could be a threaded pin and (228) could be rotated to remove its end portion from the slot (227).

Figures 13 to 16 illustrate a second possible mechanism whereby the friction applied to the rope (and hence the rate of descent) can be varied at will by the user. This is an alternative to the embodiment shown in figures 5 to 9. In this embodiment a descent regulator (229) is similar to the regulator (220) in that it has a front plate (221), a rear plate (222) and pivot (223).

Back plate (221) carries a single sheaf element (230). The sheaf element (230) is mounted on plate (222) the eccentric which slides within a slot in the front plate. Pivoting of the sheaf element (230) about the axis of turret (231) is limited by an arcuate slot (232) in the turret which co-operates with a fixed pin (233) protruding from the plate (222). Centrally the turret (231) is provided with an aperture (234) which is of non-circular cross section, to enable it to be turned by an inserted shaft. The position and length of the slot (232)

is chosen in combination with the size of the pin (233) so that the force of the descending load applied by the rope tends to rotate the sheaf element towards the sheaf element (234) to element (235) on the plate. This increases the friction applied to the rope and therefore tends to slow down the user. In the absence of any external force acting on the sheaf element (230) a device automatically moves towards its maximum friction ie slowest speed condition.

To enable a user to modify the rate of descent by turning turret (231) a handle (236) is provided. The handle (236) has a boss (237) from which protrudes a shaft (238) which is compatible with the hole (234). The boss (237) also contains a ratchet mechanism including a ratchet wheel (239) and a pawl (240).

A user can have the handle separate from the descent regulating device is desired or, in certain circumstances, may use the device with the handle permanently in position.

In use viewed from the direction of figure 13, the sheaf element (230) will move in an anticlockwise direction about the turret (231) under the influence of the rope. To increase the descent speed the user need only apply force in a clockwise direction. To this end, and in order to impart a further advantage the ratchet and pawl mechanism (230) and (240) attached to the boss (237) is provided so that the shaft (238) when inserted can be

turned in a clockwise direction to alter the position of the sheaf element (230) but can not be turned in a anticlockwise direction. This means that the handle (236) can be turned in a anticlockwise direction so as to rest in any convenient position relative to the descent regulator. This can be a great advantage to the user who can store the handle, attach to the regulator in a position where it does not interfere with other actions during the descent.

Figures 17 and 18 describe a modification which can be applied to the "preset" mechanism which in the embodiment shown in figures 1 to 4 is exemplified by the thumb screw (19), (21) passing through block (20) and engaging sheaf.

In the modification shown in figures 17 and 18 the mechanism shown in figure 1 for presetting the basic descent is replaced by a more compact device.

The block (20) is replaced by a comparable slide block (241). Block (241) has a smooth bore (242) within which can slide a rod (243). Rod (243) has a flat (244) or a comparable slot into which a grub screw (245) engages to prevent rotation of the rod (243). The rod (243) is internally threaded and is screwed connected with a threaded control screw (246). Control screw (246) is prevented from axially movement by being engaged in an annular groove (247) defined between the end of the block (241) and a

screw cap (248). A boss (250) on the screw (246) protrudes through an aperture (249). The boss (250) is threaded or otherwise formed to receive a control knob (not shown). By rotation of the screw (246) using such control knob the axial position of the cylindrical rod (243) can be adjusted. The left hand end (in the drawing) of the rod (243) bears on the sheaf in the same way as the end of the screw (19) as shown in figure 1 thus determining the basic frictional force applied by the device to a rope and hence setting out upper limit to the possible speed of descent on the rope.

During variation of such speed by presetting using the control knob the position of the control knob does not change and the screw (21) does not form a protrusion which can interfere with the rope and/or operation of the device by a user. If desired and this may be particular useful when inexperience persons or children are using the device) the control knob can be removable so that it us not possible for the basic preset tension to be altered without use of the control knob which can be retained by an instructor or the like.

Thus a regulator according to the present invention enables the rate of descent to be preset, and to be varied easily and quickly whilst a descent is being performed.

The invention is not limited to the precise details of the foregoing and variations can be made thereto within the scope of the invention.

Claims

1. A rope descent regulator comprising a body having two fixed sheaf elements, a third sheaf element which is displaceable relative to the fixed sheaf elements, first adjustment means for presettably varying the position of the third sheaf element relative to the fixed sheaf elements, and second adjustment means to continuously vary the position of the third sheaf element.

2. A regulator as claimed in claim 1 wherein the fixed sheaf elements are mounted on a first side plate, and the third, moveable sheaf element is mounted on a second side plate.

3. A regulator as claimed in claim 2, wherein the side plates are pivoted together so that they lie in and are relatively displaceable in parallel planes.

4. A regulator as claimed in claim 3 wherein the pivot is spring loaded to bias the side plates to overlie each other.

5. A regulator as claimed in any preceding claim wherein the first adjustment means for relatively displacing the fixed and moveable sheaf elements comprises a threaded rod bearing on one of the fixed sheaf elements, the rod being rotatable axially in a counter-threaded block on the second

side plate, whereby rotation of the rod in one sense will tend to open the plates apart against the bias of the spring, thus reducing the penetration of the third sheaf element between the fixed sheaf elements, and rotation of the rod in the other sense will tend to close the plates with the bias of the spring, thus increasing penetration of the third sheaf element between the fixed sheaf elements.

6. A regulator as claimed in claim 5 wherein the rod carries a thumb screw on one end.

7. A regulator as claimed in any of claims 1 to 4 wherein the first adjustment means includes a pair of threadedly interconnected members, one of which is axially fixed and rotatable, the other of which is secure against rotation and is axially movable to effect relative displacement of the sheaf elements.

8. A rope descent regulator comprising a first side plate, and a second side plate, said side plates being disposed in parallel spaced apart planes, and pivotally connected in one end region of said plates, said plates being biassed into an overlying position wherein each plate overlies the other, by means of a torsion spring acting on said pivot, said first plate mounting two spaced apart fixedsheaf elements between said plates, said second plate mounting a third

sheaf element in a position wherein said third sheaf element can move relative to said two sheaf elements on an arc centred on said pivot and passing between said two sheaf elements, continuously adjustable means bearing on the third sheaf element, and first adjustment means on said second side plate complementary to said continuously adjustable means to enable the relative positions of said two sheaf elements and said third sheaf element to be adjustable and maintained after adjustment, thereby selecting and maintaining a desired degree of friction on a rope when reeved over and between said sheaf elements, and second adjustment means to continuously vary the position of the third sheaf element.

9. A regulator as claimed in claim 8 wherein the second adjustment means comprises a lever rotatably mountable on the first side plate, and arranged to engage the moveable sheaf element on the second side plate.

10. A regulator as claimed in claim 9 wherein said second adjustment means is constituted by the third sheaf element being eccentrically mounted and arranged to be pivotable about an axis so as to vary its effective friction position relative to the first and second sheaf element.

11. A regulator as claimed in claim 10 wherein the eccentrically mounted third sheaf element has means whereby it can be rotated about its axis.

12. A regulator as claimed in claim 11 wherein the means is constituted by a socket in a turret of the eccentric, which socket can be engaged by an non-circular shaft on a handle.

13. A regulator as claimed in claim 12 wherein the handle and the shaft are interconnected by a pawl and ratchet arrangement allowing the handle to be arranged in any desired radial position relative to the axis so that its position, in use, can be varied.

14. A regulator as claimed in claim 12 or 13 wherein means for pivoting the third sheaf element is fixed to the regulator.

15. a regulator as claimed in claim 12 or 13 wherein the handle and shaft are movable from the regulator.

16. A regulator as claimed in any of claims 12 to 15 wherein the degree of pivoting of the third sheaf member about its eccentric axis is limited by operation by a pin and a slot.

17. A regulator as claimed in any one of the preceding claims including means to limit relative pivotal movement between the two fixed sheaf elements and the third sheaf element sufficient to allow a limited axial relative movement, the axial movement being insufficient to allow the sheaf elements to separate to release the rope, said means being manually actuable to allow such further separation.

18. A regular as claimed in claim 17 wherein said means comprises a member mounted on one of the plates and limitedly pivotable in a slot in the other plate.

19. A regulator as claimed in claim 18 wherein the pin can be withdrawn to allow separation of the two plates.

20. A rope descent regulator constructed and arranged for use and operation substantially as herein described and with reference to the accompanying drawings.