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(54) **Descender for abseiling.**

(57) A descender for use when abseiling down a rope, the descender including a self acting brake mechanism (63,36), which will slow the rate of descent unless the brake is held in the release position, and a manually operated braking mechanism (95,31) which will slow the rate of descent when a handle (17) is operated. The descender has two braking surfaces (36,95) in substantially fixed locations and a pair of sheaves or projections (30,31) extending from a support member (32) which is pivotable about an axis passing through a lower one of the sheaves (30) such that a rope passing around the lower sheave (30), between the two sheaves (30,31) around the upper sheave (31) and finally between the upper sheave (31) and the first of the two braking surfaces (36), will cause the pivotable member to be pivoted to press the rope between the upper sheave (31) and the braking surface (36) when a tension is applied to the upper end of the rope (15). The descender is also provided with a handle (17) to reduce the braking force by pivoting the upper sheave (31) away from the first braking surface (36) and toward the second braking surface (95). Further movement of the handle will cause the rope to be pressed between the upper sheave (31) and the second braking surface (95) to enable manual braking of the descender. The second braking surface (95) while being in a fixed location, is pivotable to allow proper alignment with the rope passing

through the descender. A retaining plate (39) is also provided, which is pivotable between a position in which the rope (15) is retained in the descender and a position in which the rope is able to be inserted into and removed from the descender.

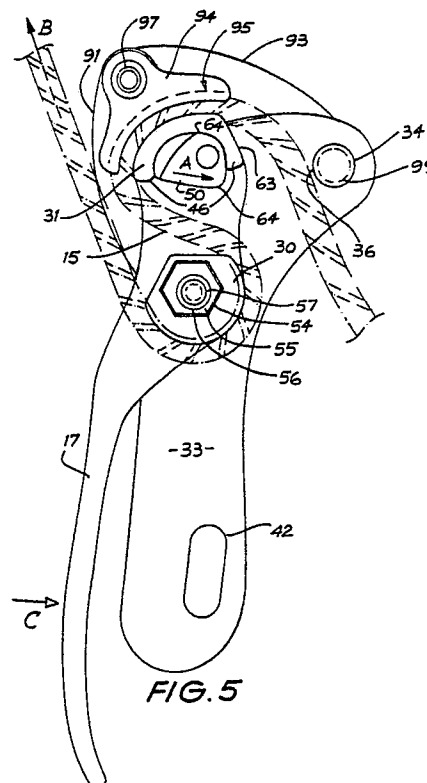


FIG. 5

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DESCENDER FOR ABSEILING

The present invention relates to "descenders" for use when abseiling and in particular to an improved descender of the type which incorporates a self acting brake.

Abseiling is a technique used to descend steep surfaces, such as cliff faces, and is often used by persons involved in activities such as mountain climbing, canyoning and caving. In order to abseil down a cliff face, one end of a rope is made fast at the top of the cliff and the person making the descent then slides down the rope. The rope is passed either around the body of the person or more usually through a descender attached to a harness worn by the person, such that the passage of the rope around the body or through the descender provides sufficient friction to slow the rate of descent to a safe speed. A descender comprises rope engaging surfaces over which the rope travels to provide frictional engagement between the rope and the descender. The rate of descent is normally controlled by holding the free end of the rope to control the tension on the rope where it enters the descender, and thereby to control the degree of frictional engagement between the rope and the descender which in turn controls the rate of descent.

Descenders used in abseiling vary greatly in performance and complexity, there being a variety of relatively simple devices which rely on frictional engagement between the rope and metal rings or racks about which the rope is wrapped and a number of more complex descenders which incorporate a braking mechanism, thereby enabling the friction between the rope and the descender to be varied. The earliest of these more complex devices had a handle or lever which, when operated, tended to increase the friction between the descender and the rope, however, this type of descender was not a great improvement over the more simple devices, as the brake was not self engaging, and therefore if the user was knocked unconscious he would fall in the same way as the user of the earlier devices.

The present invention belongs to a class of descender wherein the variable braking action of the descender increases when the handle is released. Usually the force required to initiate the braking action is provided by the frictional engagement of the descender with the rope travelling therethrough, however, it is also possible to have arrangements which are operated by springs. Spring operated arrangements have the disadvantage that the restoring force of the spring may reduce with age or the spring may become damaged without this being noticed by the user, thereby

decreasing the effectiveness of the descender.

Many prior art descenders incorporating non-sprung self-engaging braking suffer from the problem that the maximum friction achieved by the descender when the brake actuates itself is not always sufficient to completely stop a person who is falling, such as when the person has been knocked unconscious. Examples of such prior art descenders may be studied in French Patent Publication Nos. 2,394,303, 2,430,388, 2,451,752 and 2,478,475 in the names Paul and Pierre Petzl, and West German Patent Publication No. 2,439,678 in the name Wolfgang Siersch. Examples of other lowering devices and rope brakes are described in U.S. Patent No. 1,370,306 in the name H.J. Griest, U.S. Patent No. 933,685 in the name J.H. Wray, British Patent No. 1,125,774 in the name Marcel Jules Odilon Lobelle and British Patent No. 1,568,614 in the name CATU SA, however, none of these prior art devices provide the simplicity of construction or operation which is achieved with the descender of the present invention.

Another difficulty with prior art descenders provided with self actuating brakes is that in some instances inexperienced users might operate the lever to release the brake, and then in panic squeeze the lever more tightly, causing them to descend too rapidly.

The present invention consists in a double acting descender for use when abseiling, in use the descender being connected between a rope and a harness, the descender comprising: a base; a pivotal member mounted on the base about a pivotal axis extending perpendicular thereto; first and second projections for engaging the rope, the projections extending perpendicularly from the pivotable member; means mounted on the base for connection to the harness; wherein the first projection is disposed about said axis and the second projection projects from said pivotable member in a direction substantially parallel to said axis, the second projection being located substantially on the opposite side of the first projection with respect to the means for connection of the base to the harness; first and second braking surfaces on respective stop members projecting substantially perpendicularly relative to said base and located adjacent to the second projection; wherein when the rope passes around the first projection, between the first and second projections, between the second projection and the second braking surface, around the second projection and between the second projection and the first braking surface, the rope is pressed between the second projection and one or other of the braking surfaces when the second

projection is pivoted toward the respective braking surface; and

handle means extending from said pivotal member in a plane substantially perpendicular to the axis, said handle means being positioned such that upon urging the handle in one direction the second projection moves away from the first stop member allowing the rope to slip through the descender and further urging the handle in the same direction presses the rope between the second projection and the second braking surface to provide a manual braking function.

Preferably an embodiment of the invention will also include retention means adapted to prevent a rope which is passing through the descender from jumping out during the descent.

The rope engaging projections will preferably be of sufficient mass to enable a high degree of heat storage before the temperature rise becomes unacceptable. In this regard the temperature of the rope engaging projections will reach an unacceptable level when they approach the softening temperature of the material from which the rope is made.

The retention means should also be adapted to allow the rope to be inserted and removed easily when hooking up before the descent and when unhooking after the descent.

All rope engaging surfaces of the descender are preferably smooth to prevent excessive rope wear, with no sharp edges or abrupt corners around which the rope must pass.

In the preferred embodiment of the invention the base comprises a first plate which is flat in the region adjacent to the projections, the pivotal member abuts said first plate and carries a pair of sheave like projections, the member being pivotable about the axis of said first projection, and a second plate abuts the first sheave like projection and is pivotable about the axis thereof, the second plate being adapted to cover the gap between the first and second projections when in a first pivotal position and to uncover the gap when in a second pivotal position. The first and second plates each include a hole at one extremity thereof for attachment to a harness, the hole in the second plate being aligned with the hole in the first plate when the second plate covers the gap between the pair of projections.

Preferably the first braking surface will be provided by a post extending from the first plate, parallel to the axes of the pair of projections, and the second braking surface is formed on a second pivotable member projecting substantially perpendicularly relative to the base such that the angle of the braking surface will conform to the angle of the rope passing around the second projection and is spaced from the second sheave such that move-

ment of the second sheave away from the first braking surface will ultimately bring the rope into contact with the second braking surface and further movement of the sheave will produce a braking force on the rope as it passes through the descender. The second plate will also cover the gap between the second projection and the post when the attachment holes of the first and second plates are aligned.

Embodiments of the invention will now be described in detail with reference to the accompanying drawings in which:-

Fig. 1 illustrates a first embodiment of the present invention;

Fig. 2 illustrates the embodiment of Fig. 1 with the top plate removed to reveal the path of a rope through the descender;

Fig. 3 illustrates the embodiment of Fig. 1 as viewed from one side;

Fig. 4 illustrates a second embodiment of the invention viewed from the top;

Fig. 5 illustrates the embodiment of Fig. 4 with the top plate removed;

Fig. 6 illustrates a connecting member for the Fig. 4 embodiment, shown in plan and elevation;

Fig. 7 illustrates the embodiment of Fig. 4 when viewed from the side;

Fig. 8 illustrates a side view of a third embodiment of the invention which is adapted to accept a double rope; and

Fig. 9 illustrates the embodiment of Fig. 4 when viewed from underneath.

Referring first to Fig. 2 the descender includes two sheaves 10 and 11 non-rotatably attached to a pivotal member 12. The member 12 is pivotably mounted to a base plate 13, the first sheave 10 being co-axial with the pivotal axis. A post 14 projects from the base plate 13 to provide a first braking surface 16 such that when the second sheave 11 is pivoted in the direction A towards the post 14, the rope 15 is pressed between the sheave 11 and the braking surface 16.

A second braking surface 86 is formed by attaching a folded plate 84 to the back of the base plate 13 with the braking surface positioned such that movement of the sheave 11 in the direction of arrow E will ultimately cause the rope 15 to be pressed between the sheave 11 and the braking surface 86 to produce a braking force on the rope 18 as it passes through the descender. While the braking surface 86 may take various forms, it has been found that the best effect is achieved with a surface contoured to the path of the rope to give a relatively large braking surface.

The force required to pivot the second sheave 11 towards the post 14 to achieve the automatic braking function, is provided by the frictional en-

gagement of the rope 15 with the sheaves 10 and 11 as the rope travels in the direction B. Additional pivoting force is provided by tension on the tail of the rope 18, the tension in the tail being controlled by the person using the descender and being contributed to by the weight of the tail 18. The total pivotal force acting on the pivotal member 12 is given by the couple of the forces applied to the pivotal member by the two ends of the rope, this couple being applied about the pivotal axis of the pivotal member 12.

The pivotable member 12 extends away from the second sheave 11 to provide a lever handle 17 which, when moved in the direction C with regard to the base plate 13, reduces the braking force provided by the friction of the rope 15 with the sheaves 10 and 11 and the braking surface 16, until a state of minimum braking force is reached when the rope is no longer contacting the braking surface 16.

It will be recognised, however, that even under the minimum braking situation described, the speed of travel of the rope 15 through the descender can be controlled by varying the tension on the tail 18 of the rope. Further movement of the lever handle 17 in direction C will ultimately bring the rope 18 into contact with the second braking surface 86 and then by applying pressure to the lever 17 a braking force can be generated to slow the descent of the user. This mode of operation allows the user to place his hand around the lower part of the descender and to squeeze the lever to slow descent, an action which is found preferably by some users, and which provides an additional safety factor against a user panicking and accidentally releasing the descender.

Turning to Fig. 1, a rope retention plate 19 pivotable about the same axis as the member 12 allows the rope to be inserted into and removed from the descender when in the open position shown. However, when pivoted to a closed position where the hole 21 in the retention plate 19 and hole 22 in the base plate 13 are aligned the retention plate 19 covers the gap between the two sheaves 10 and 11 and the gap between the second sheave 11 and the post 14, to prevent the rope from accidentally jumping out of the descender during the descent. When in the closed position a slot 23 in the retention plate 19 engages with a circumferential groove (not shown) in the post 14 to provide added support for the retention plate 19, thereby reducing any tendency for the plate 19 to twist due to side loading of the descender by the rope. The hole 22 in base plate 13 is used to attach the descender to a harness by means of a carabinier and the hole 21 in retention plate 19 is so positioned that it is aligned with the hole 22 when the retention plate is in the closed position,

thereby allowing the carabinier to be inserted through both holes, ensuring that the retention plate 19 is securely held in the closed position during a descent.

Returning to Figure 2, the sheaves 10 and 22 have their upper adjacent edges 25 and 26 cut away to allow the rope 15 to be easily inserted therebetween, the cut-away edges being slightly offset with regard to one another in order to reduce any tendency for the rope 15 to slip out under tension.

Referring to Figures 2 and 3 the preferred method of attaching the plate 84 to the descender, to provide the second braking surface 86, is to mount the plate 84 under the head of the bolt 87 and under the nut 88 which are provided to attach the pivotable member 12 and the post 14 respectively.

Referring now to Figs. 4-7, a second embodiment of the invention is illustrated, wherein the pivotal member 32 is a cast part with bosses 30 and 32 (see Fig. 5) and lever 17 forming integral parts of the casting. The second braking surface 95 is in this case provided on a pivotable braking member 94 which is carried by three mounting arms 91, 92, 93 extending substantially parallel to the base plate 33 and the retention plate 39. The pivotal member 32 is pivotably connected between a base plate 33 and a retention plate 39 by a bolt 58 and a threaded member 52 having an internally threaded sleeve 53 and a head 59 (see Fig. 6). The bolt 58 has a threaded portion 57 extending through holes in two of the three mounting arms 91, 92, the base plate 33, the pivotal member 32 and a retention plate 39. The hole in the pivotal member 32 passes through the boss 30, and accommodates the sleeve of the threaded member 52 which co-operates with the threaded portion 57 of the bolt 58. A coil spring (not shown) is provided about the pivotal axis of the pivotal member 32 to bias the boss 31 away from the post 34. The fulcrum of the pivotal member 32 is made to be variable by the provision of a hexagonal insert 55 which is located in a suitably sized hexagonal opening 54 in the boss 30, the hexagonal insert 55 having an off centre hole 56 through which the threaded portions 57 and 53 pass, the hole 56 defining the pivotal axis of the pivotal member 32 and the position of the pivotal axis being varied by rotating the hexagonal insert 55 to the desired position within the opening 54 during assembly of the descender. Variation of the pivotal axis alters the effective transverse distance between the pivotal axis of the pivotal member 32 and the point of application of the force in the upper rope portion on the first boss 30, without significantly altering the distance between the pivotal axis and the point of application of the force in the tail 18 of the rope on

the second boss 31.

The method employed to achieve a transversely variable pivotal axis of the pivotal member 32 also involves some longitudinal movement of the axis and in view of this, the second boss 31 is provided with a peripheral portion 63 which cooperates with the braking surface 36 and is substantially straight, such that the angle of the pivotal member 32 with respect to the base plate 33 when the rope is wedged between the boss 31 and the braking surface 36 is substantially constant for varying pivotal axes.

Referring to Figs. 4, 5 and 9 the secondary braking member 94 is pivotably mounted between the first mounting arm 91 extending from the top side of the descender and the second and third mounting arms 92, 93 extending from the underside of the descender. The pivotable braking member 94 is retained in position by a bolt and threaded sleeve 97, 98 which are similar in design to the fasteners used to mount the pivotal member 32 and illustrated in Figure 6. The pivotable braking member 94 enables the braking surface 95 to be correctly aligned for different positions of the pivotal member 32 (i.e. different amounts of applied pressure) and for different rope thicknesses.

The boss 31 also has a cut away face 46 which allows easy insertion of a rope between the bosses 30 and 31.

The base plate 33 is provided with an elongated hole 42 by which the descender can be permanently connected to a harness during use, the connection being generally made by way of a carabinier. The retention plate 39 is provided with a slot 41 which opens through one edge of the plate 39, this slot being closed off by a closure member 60 pivotably connected to the plate 39 by a rivet 62 and a spring 61 being provided to bias the closure member 60 to the closed position. To move the retention plate to the closed position, the closure member 60 is pivoted in direction D and the carabinier which is already connected through hole 42 is passed through the opening into the slot 41. The closure member 60 is then released to retain the carabinier in the slot 41. To reopen the descender, the closure member 60 is again depressed in the direction D and the carabinier removed from the slot 41 as the retention plate is pivoted to the open position (as shown in Fig. 4).

The base plate 33 and the retention plate 39 are also provided with holes 50 and 51 respectively such that the braking action of the descender may be inhibited by passing a suitably sized pin through the hole 50, the opening 64 in the centre of boss 31 and the hole 51 to hold the pivotal member 32 and the rope 15 away from the braking surface 36 of the post 34, while at the same time allowing the pivotal member 32 to press the rope 15 against the

second braking surface 95 to provide the manual braking function.

Comparing the embodiment of Figure 1 with that of Figure 4, it will be noted that in Figure 4 the retention plate 39 pivots in the opposite direction to the retention plate 19 of Figure 1 in order to open the descender. This also results in the necessity to change the orientation of slot 23 in Figure 1 to that of slot 43 in Figure 4 which engages with a circumferential groove 99 in the post 34 when the descender is closed.

Referring to Fig. 8, the double rope embodiment illustrated is substantially the same as the embodiment described with reference to Figs. 4-7 except that the bosses 70 and 71 are approximately double the height of the bosses 30 and 31 of the single rope embodiment and two secondary braking members 94, 96 are provided. Similarly, the bolt 58, the threaded member 52, the braking post 34 must be longer in the double rope embodiment.

The double rope embodiment of Fig. 8 is particularly useful for mountain climbers, who after descending one section of mountain will want to retrieve their ropes before descending the next section. This is achieved by descending a doubled rope and then pulling one end of the doubled rope to retrieve it.

It is preferred that bosses 31 and 71 have grooves which are substantially V-shaped rather than rounded, as there is a tendency for the rope to be excessively flattened under the braking surface 16, 36 when rounded grooves are employed. However, grooves on the lower bosses 30 and 70 remain rounded to obtain a better distribution of frictional forces.

The use of a U-shaped groove on bosses 31 and 71 also improves the operation of the descender when used with thinner ropes, making it possible to use the descender with a length of thin rope which can be easily stored and carried for use in emergency situations. It is possible to produce embodiments of the present invention which will work with a full range of rope sizes, including ropes having a diameter as small as 6-7 millimeters, whereas prior art descenders are generally not suitable for use with such small ropes. Typically ropes used in descenders are in the range of 11-12 millimeters diameter.

Although the description of the embodiments illustrated in Figs. 4-9 refers to the pivotal member as a cast part wherein the bosses 30, 70 and 31, 71 and the lever 17 are cast integrally with the pivotal member 32, production may be simplified by casting the lever and pivotal member 32 and then attaching the bosses 30, 70 and 31, 71 which can be fabricated by turning or any other suitable technique.

Claims

1. A double acting descender for use when abseiling, in use the descender being connected between a rope and a harness, the descender comprising: a base; a pivotal member mounted on the base about a pivotal axis extending perpendicular thereto; first and second projections for engaging the rope, the projections extending perpendicularly from the pivotable member; means mounted on the base for connection to the harness; wherein the first projection is disposed about said axis and the second projection projects from said pivotable member in a direction substantially parallel to said axis, the second projection being located substantially on the opposite side of the first projection with respect to the means for connection of the base to the harness;

first and second braking surfaces on respective stop members projecting substantially perpendicularly relative to said base and located adjacent to the second projection; wherein when the rope passes around the first projection, between the first and second projections, between the second projection and the second braking surface, around the second projection and between the second projection and the first braking surface, the rope is pressed between the second projection and one or other of the braking surfaces when the second projection is pivoted toward the respective braking surface; and

handle means extending from said pivotal member in a plane substantially perpendicular to the axis, said handle means being positioned such that upon urging the handle in one direction the second projection moves away from the first stop member allowing the rope to slip through the descender and further urging the handle in the same direction presses the rope between the second projection and the second braking surface to provide a manual braking function.

2. The descender of claim 1 wherein the base comprises a first plate which is flat in the region adjacent to said sheaves, the pivotable member abuts said first plate and carries a pair of sheave like projections, the member being pivotable about the axis of said first projection, and a second plate abuts the first sheave like projection and is pivotable about the axis thereof the second plate being adapted to cover the gap between the first and second projections when in a first pivotal position and to uncover the gap when in a second pivotal position. The first and second plates each include a hole at one extremity thereof for attachment to a harness, the hole in the second plate being aligned with the hole in the first plate when the second plate covers the gap between the pair of projections.

3. The descender according to claim 1 or 2 wherein the second braking surface is pivotable relative to the base plate to enable proper alignment of the braking surface with the rope with which it is engaging.

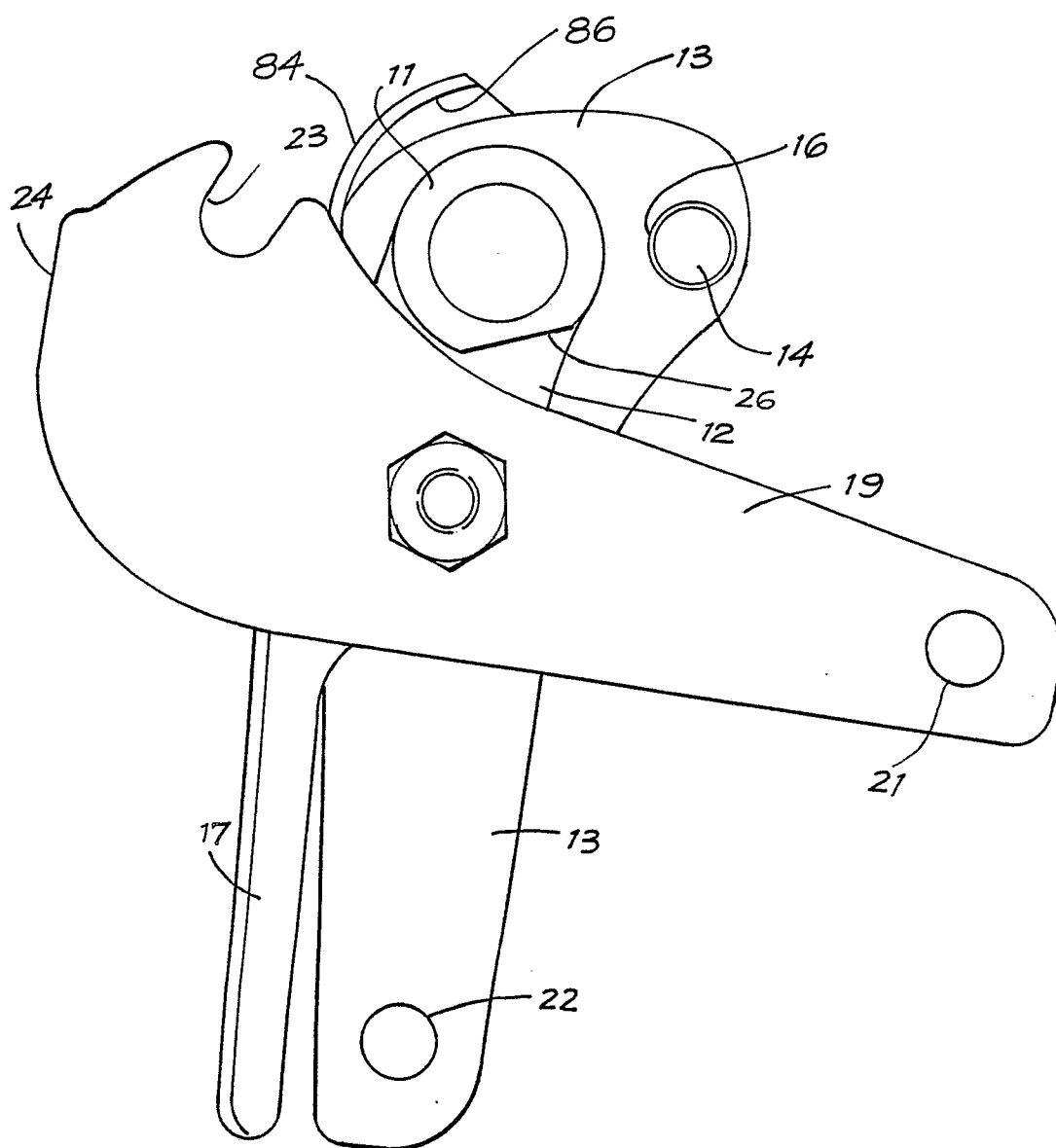
4. The descender according to any one of the preceding claims wherein the first braking surface is a substantially circular post extending from the first plate in a direction substantially parallel to the axes of the pair of projections.

5. The descender according to any one of the preceding claims wherein retention means are provided to retain the rope correctly in position around the sleeves and between the second sheave and the respective braking surfaces.

6. The descender of claim 5 wherein the retention means comprises a plate pivotable between a closed position in which it covers the spaces between the two sleeves and between the second sheave and the first braking surfaces and an open position in which said spaces are uncovered to allow free insertion and removal of the rope to and from the descender.

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FIG. 1



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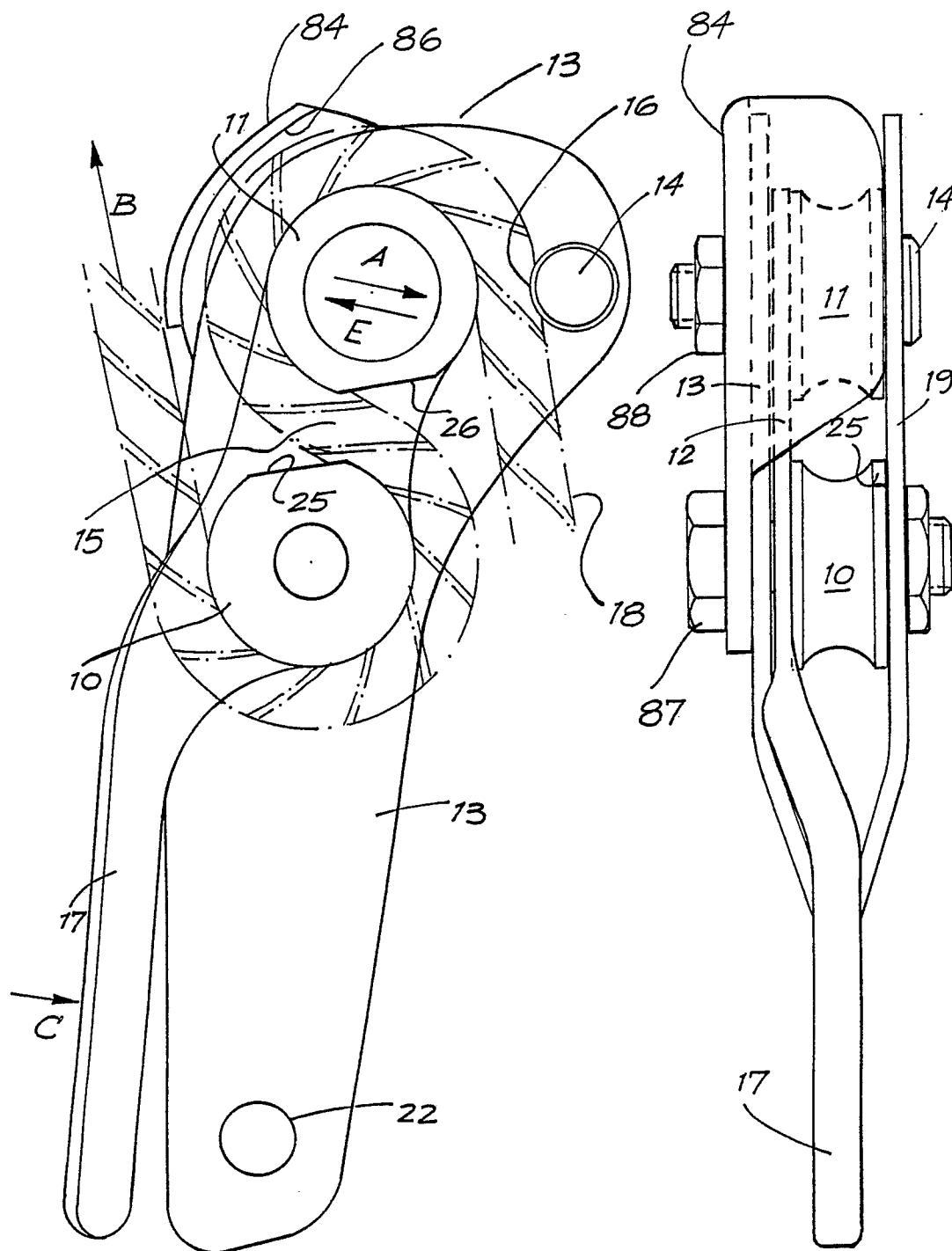
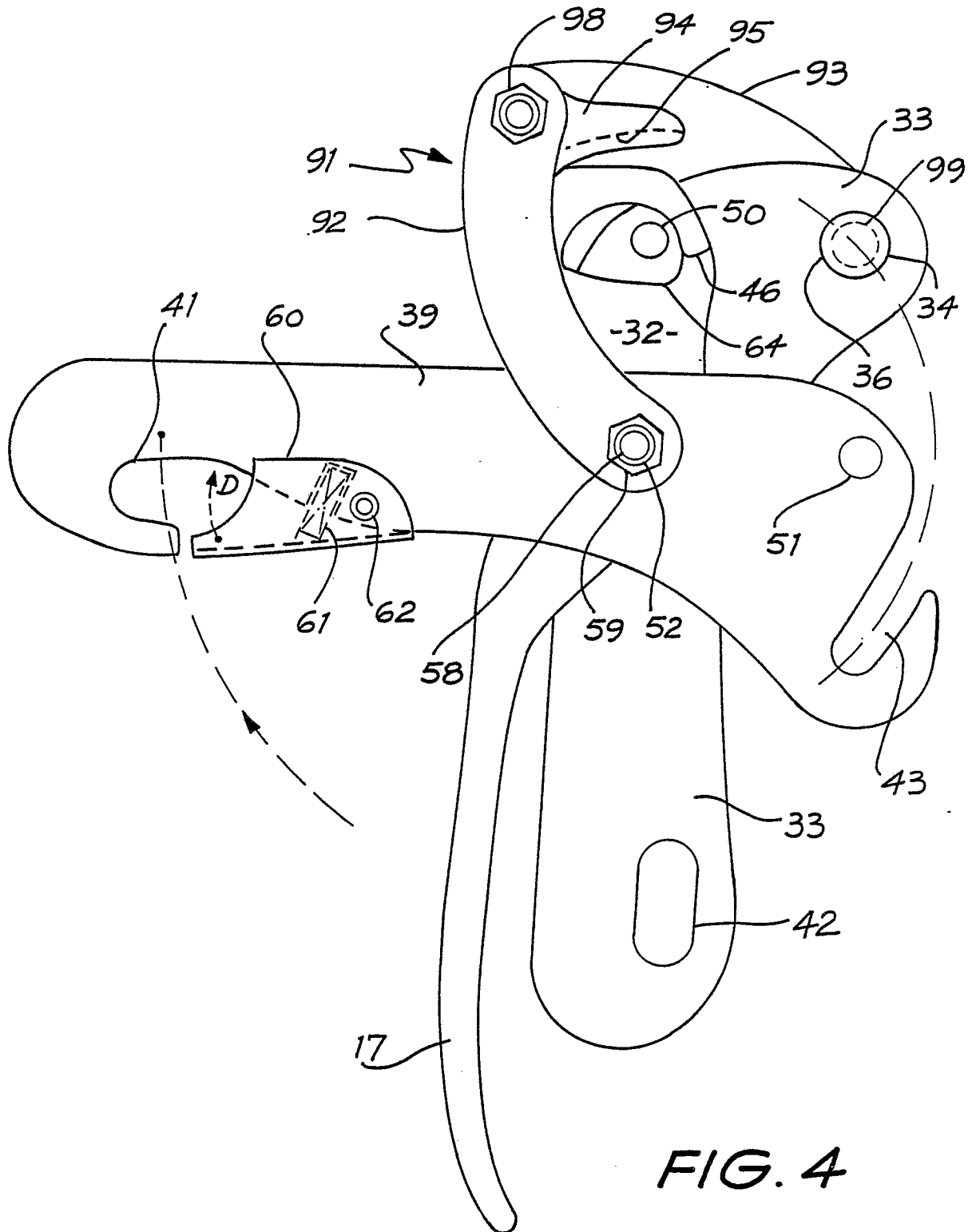


FIG. 2

FIG. 3

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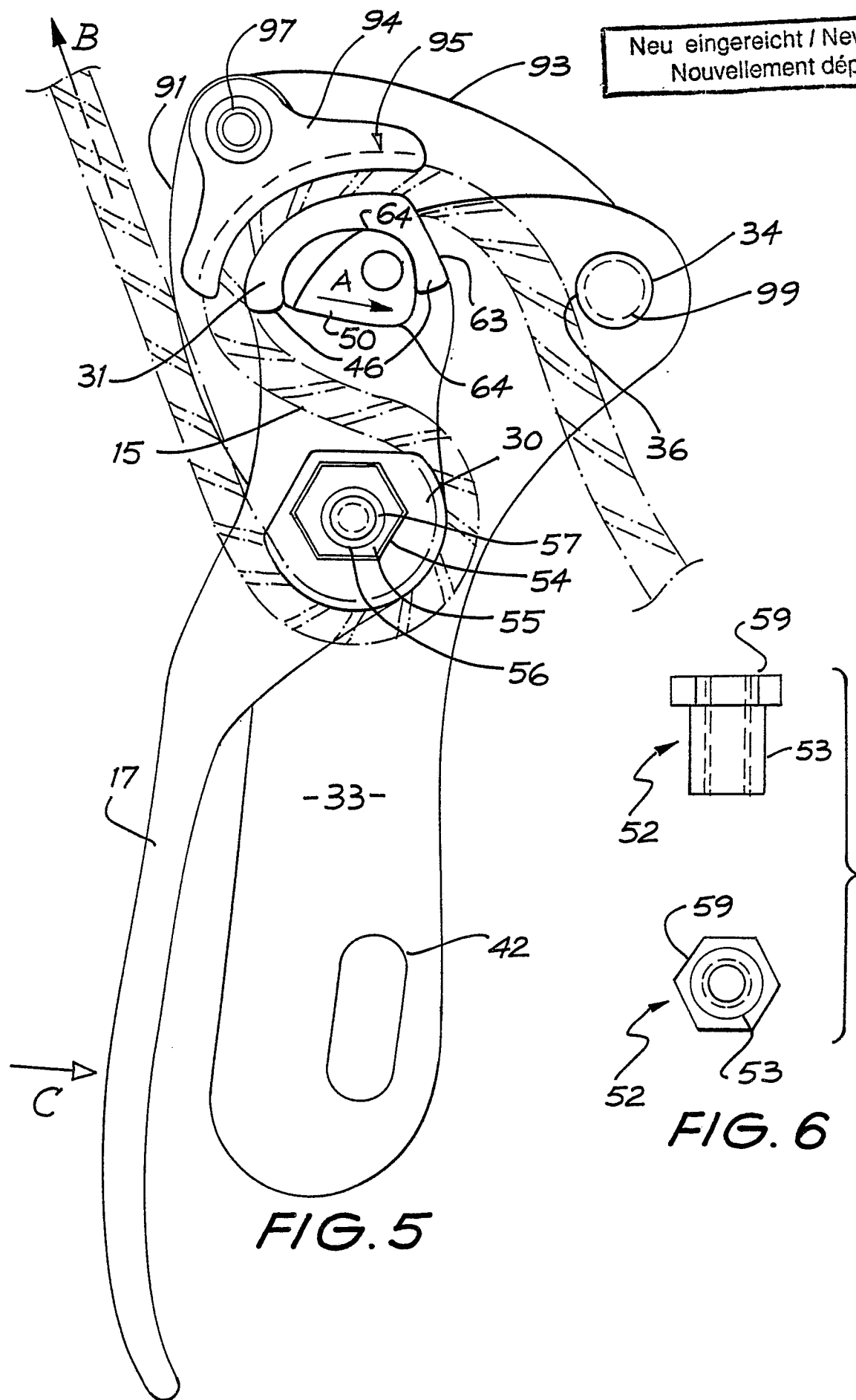
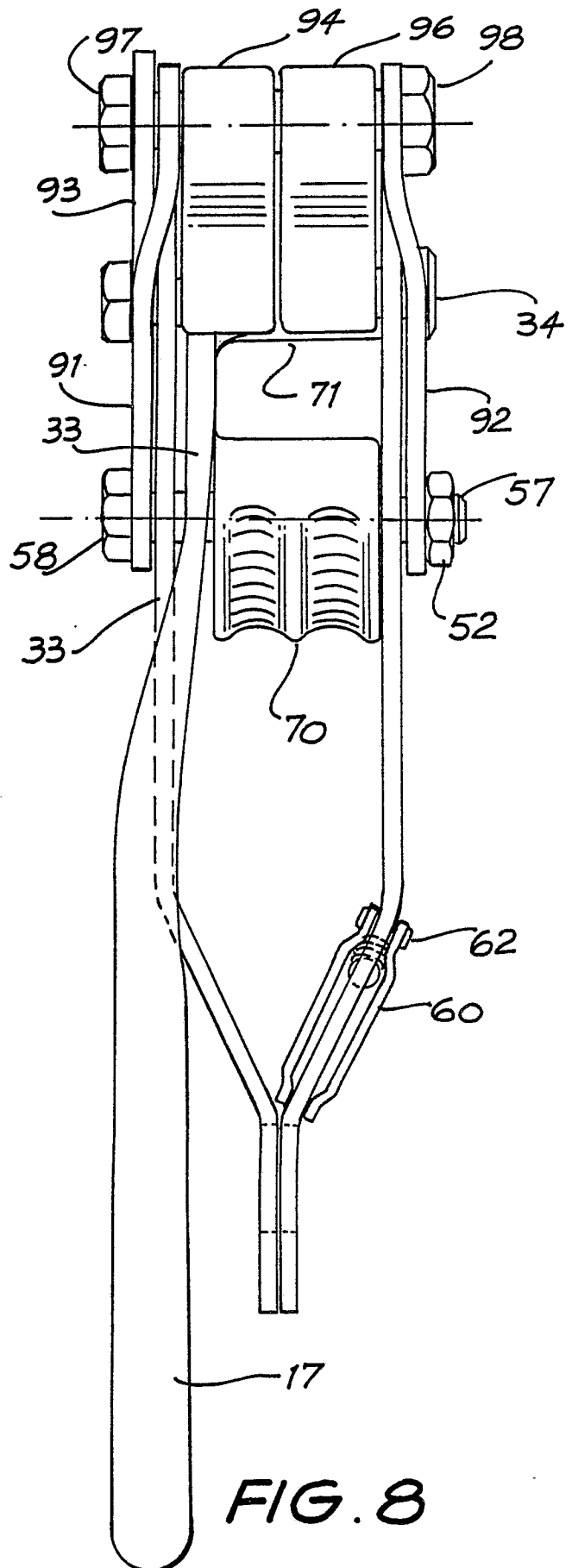
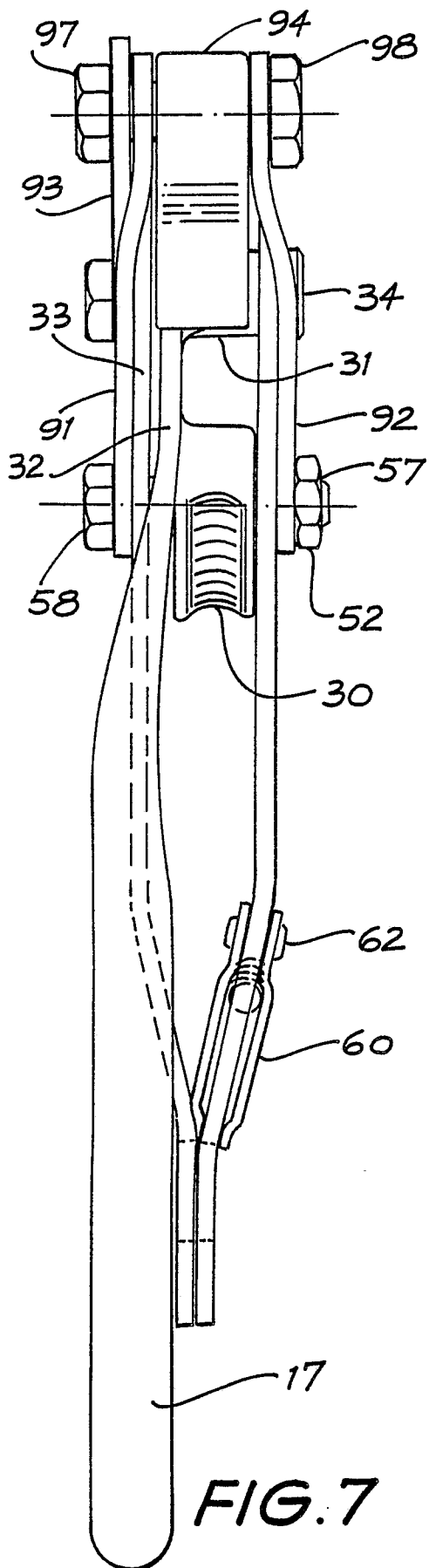


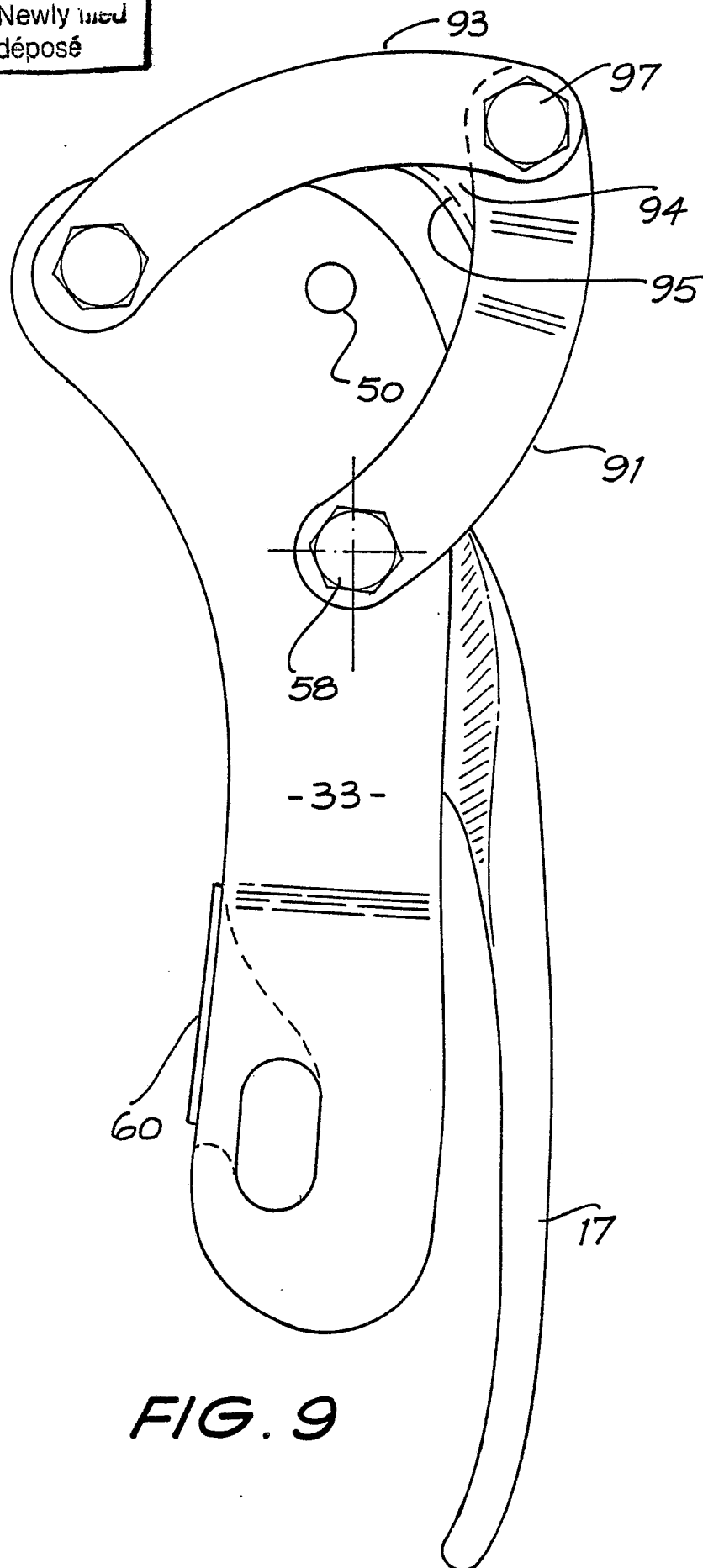
FIG. 5

FIG. 6

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FIG. 9



DOCUMENTS CONSIDERED TO BE RELEVANT			EP 88307145.8
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	<u>GB - A - 2 044 414</u> (PETZL) * Totality * --	1,2,5,6	A 63 B 29/00 A 63 B 29/02
A	<u>FR - A1 - 2 448 910</u> (DRESSLER) * Totality * --	1	
A	<u>GB - A - 1 125 774</u> (AVIATION) * Fig. 1; claim 1; lines 49-107 * --	1,3	
D,A	<u>FR - B1 - 2 430 388</u> (PETZL) * Fig. 3-6 and belonging text * ----	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			A 63 B 29/00 F 16 G 11/00
The present search report has been drawn up for all claims			
Place of search VIENNA		Date of completion of the search 24-10-1988	Examiner SCHÖNWÄLDER
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	