



(11) **EP 4 049 735 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
31.08.2022 Bulletin 2022/35

(51) International Patent Classification (IPC):
A63G 21/20 (2006.01) A62B 1/08 (2006.01)
A62B 1/10 (2006.01)

(21) Application number: **2200038.4**

(52) Cooperative Patent Classification (CPC):
A63G 21/22; A62B 1/10; A63G 21/20

(22) Date of filing: **22.02.2022**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Du Cane, Peter**
Exeter, Devon EX4 3RG (GB)

(72) Inventor: **Du Cane, Peter**
Exeter, Devon EX4 3RG (GB)

(74) Representative: **Jones, Graham Henry**
Graham Jones & Company
77 Beaconsfield Road
Blackheath, London SE3 7LG (GB)

(30) Priority: **24.02.2021 GB 202102597**

(54) **APPARATUS FOR BRAKING THE MOVEMENT OF A PERSON THROUGH THE AIR**

(57) Apparatus (2) for braking the movement of a person through the air at a predetermined location after the person (4) has left an elevated position for a lower position, which apparatus (2) comprises:

- (i) a capstan (10);
 - (ii) a single braking line (12) which extends around the capstan (10); and
 - (iii) braking means (14),
- and the apparatus (2) being such that:
- (iv) the braking line (12) has a first end which extends from a first side of the capstan (10);
 - (v) the braking line (12) has a second end which extends from a second side of the capstan (10);
 - (vi) the braking line (12) causes the capstan (10) to rotate consequent upon the movement of the person (4) through the air at the predetermined location;
 - (vii) the rotation of the capstan (10) causes operation of the braking means (14); and
 - (viii) the amount of the braking line (12) extending around the capstan (10) remains constant during the rotation of the capstan (10) consequent upon the person (4) descending from the elevated position to the lower position.

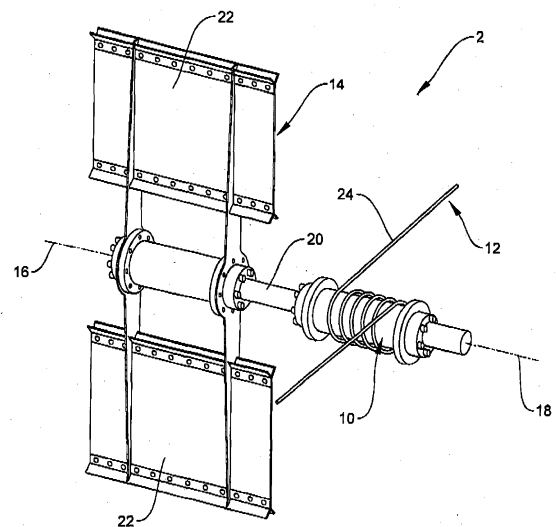


FIG. 1

Description

[0001] This invention relates to apparatus for braking the movement of a person through the air. More especially, this invention relates to apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position.

[0002] Apparatus is known for braking the movement of a person through the air at a predetermined position after the person has left an elevated position for a lower position. The known apparatus has been in use for many years by the United Kingdom Military for parachute training. In this case, the apparatus is such that the descent of the person through the air is typically a vertical descent. In more recent years, the known apparatus has been used in the outdoor pursuits industry. Initially, in the outdoor pursuits industry, the known apparatus was used for vertical descents. Subsequently, the known apparatus was used for long sloping descents, with the apparatus often being known as zip wire braking apparatus.

[0003] The known apparatus comprises a cone-shaped drum, and a line which extends around the cone-shaped drum. In use of the apparatus, the line initially unwinds from a larger diameter part of the cone-shaped drum, and finishes by unwinding from a smaller diameter part of the cone-shaped drum. This means that the descent of the person starts out fast, and then decelerates as the person nears the ground and the line is unwinding from the smaller diameter part of the cone-shaped drum. The known apparatus is disadvantageous in that only a finite length of line can be wrapped around the cone-shaped drum. This finite length of the line limits the length of the descent and thereby the initial height from which the person can commence the descent through the air. In the case of the zip wire braking apparatus, the finite length of line only limits the length of the zip wire braking zone which in turn limits the maximum permissible safe arrival speed at the braking zone. If relatively long descent lengths are required, then the cone-shaped drum has to be made increasingly large in order to accommodate an increasingly long length of line, and this causes the apparatus to become unduly bulky and expensive.

[0004] It is an aim of the present invention to avoid or reduce the above mentioned problem.

[0005] Accordingly, in one non-limiting embodiment of the present invention there is provided apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position, which apparatus comprises;

- (i) a capstan;
- (ii) a single braking line which extends around the capstan; and
- (iii) braking means,

and the apparatus being such that:

(iv) the braking line has a first end which extends from a first side of the capstan;

(v) the braking line has a second end which extends from a second side of the capstan;

(vi) the braking line causes the capstan to rotate consequent upon the movement of the person through the air at the predetermined location;

(vii) the rotation of the capstan causes operation of the braking means; and

(viii) the amount of the line extending around the capstan remains constant during the rotation of the capstan consequent upon the person descending from the elevated position to the lower position.

[0006] With the apparatus of the present invention, the use of the capstan enables long lengths of line for a relatively small diameter capstan. Thus the apparatus of the present invention is able to operate for longer descents than is obtainable for descent using known comparable apparatus. The apparatus of the present invention is also to be manufactured in a more compact and cheaper form than the known comparable apparatus,

[0007] The apparatus may be one in which the capstan includes at least one divider means which divides the capstan into separate receiving zones for receiving different parts of the braking line as the braking line passes over the capstan, and in which the divider means is such that the braking line is able to pass over the divider means and move over the receiving zones. The divider means may be a flange which extends radially outwardly from the circumference of the capstan. Other types of divider means may be employed.

[0008] The apparatus may be one in which there are three of the receiving zones, and in which the three receiving zones are defined by five of the divider means. More or less receiving zones and divider means may be employed.

[0009] The apparatus may include an idler pulley for each one of the receiving zones, and in which the idler pulley is for guiding the braking line over its receiving zone. Preferably the idler pulleys are positioned at an angle to the circumference of the capstan.

[0010] The apparatus may be one in which the braking means has a longitudinal axis which is in line with a longitudinal axis of the capstan. The braking means and the capstan may then be axially mounted in line on a single axle. Two spaced apart in-line axles may however be employed.

[0011] Alternatively, the apparatus may be one in which the braking means has a longitudinal axis which is mounted parallel to and not in line with a longitudinal axis of the capstan. The braking means is then preferably

mounted above the capstan. The braking means may however be mounted at other positions so that it may be mounted, for example, below the capstan or some other relative position with respect to the capstan.

[0012] When the braking means is mounted off-longitudinal axis with respect to the longitudinal axis of the capstan, then the apparatus may be one in which the capstan is connected to the braking means by at least one belt and pulley arrangement. More than one belt and pulley arrangement may be employed if desired. Other types of driving connection means between the capstan and the braking means may be employed.

[0013] Preferably, the braking means is a fan braking means. Other types of braking means may however be employed.

[0014] Preferably, the capstan is a parallel sided cylinder. The capstan may however be non-parallel sided if desired.

[0015] The apparatus may be one which is configured as a vertical descending apparatus. With vertical descending apparatus, the predetermined location for braking the movement of the person may be at any desired moment after the person has commenced the vertical descent.

[0016] Alternatively, the apparatus may be one which is configured as a zip wire descending apparatus. In this case, the predetermined location for braking the movement of the person may be at any desired location between the start and finish of the zip wire. Typically the predetermined location will be towards the end of the descent run of the person on a zip wire forming part of the zip wire descending apparatus. At this predetermined location, the zip wire may still be extending downwardly, or it may be horizontal, or it may be upwardly inclined. If desired, the predetermined location may be such that the zip wire extends in two or more of the downwards, horizontal and upwardly inclined directions.

[0017] The zip wire descending apparatus may be configured for any desired types of descent.

[0018] The apparatus of the present invention may be configured for a wide variety of uses, including use by the military for training purposes, and use by the outdoor pursuits industry for various types of outdoor entertainment pursuits.

[0019] In all embodiments of the invention, the first end of the braking line which extends from the first side of the capstan may be connected directly or indirectly to the anchor point. Similarly, in all embodiments of the invention, the second end of the braking line which extends from the second side of the capstan may be connected directly or indirectly to the person.

[0020] Embodiments of the invention will now be described solely by way of example and with reference to the accompanying drawings in which:

Figure 1 shows first apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position

for a lower position;

Figure 2 shows how the apparatus of Figure 1 may be configured as a vertical descending apparatus; Figure 3 shows how the apparatus of Figure 1 may be configured as a zip wire descending apparatus; Figure 4 shows second apparatus of the present invention for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position;

Figure 5 shows an arrangement like Figure 1 but of first known apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position;

Figure 6 shows an arrangement like Figure 4 but of second known apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position; and

Figure 7 shows apparatus which is like that shown in Figure 1 but which includes divider means and idler pulleys.

[0021] Referring to Figures 1 and 2, there is shown apparatus 2 for braking the movement of a person 4 through the air at a predetermined location after the person has left an elevated position 6 for a lower position 8. The apparatus 2 comprises a capstan 10 and a braking line 12. The braking line 12 extends around the capstan 10. The braking line 12 causes the capstan 10 to rotate consequent upon the person 4 descending from the elevated position 6 for the lower position 8.

[0022] The capstan 10 is in the form of a parallel cylinder which may be solid or hollow as required.

[0023] The braking line 12 has a first end which extends from a first side of the capstan 10. The braking line 12 has a second end which extends from a second side of the capstan 10.

[0024] The amount of the braking line 12 extending around the capstan 10 remains constant during the rotation of the capstan 10 consequent upon the person 4 descending from the elevated position 6 to the lower position 8.

[0025] The apparatus 2 includes braking means 14 for use in controlling the speed of descent of the person 4 from the elevated position 6 to the lower position 8. The braking means 14 is operated by rotation of the capstan 10. More specifically, the braking means 14 has a longitudinal axis 16 which is in line with a longitudinal axis 18 of the capstan 10. The braking means 14 and the capstan 10 are axially mounted in line on a single axle 20.

[0026] The braking means 14 is a fan braking means. More especially, the braking means 14 comprises the axle 20 and a plurality of fan blades 22. Only two fan blades 22 are shown for ease of illustration. Any suitable and required number of fan blades 22 may be employed.

[0027] During use of the apparatus 2, the descent of

the person 4 causes an end portion 24 of the braking line 12 nearest the person 4 to move over the capstan 10. This causes the capstan 10 to rotate. The rotation of the capstan 10 causes rotation of the axle 20. As the person 4 descends, the fan blades 22 catch the wind and they rotate. This rotation is transferred to the part of the axle 20 associated with the braking means 14. Thus the braking means 14 due to the resistance of the air encountered by the fan blades 22 acts to slow rotation of the axle 20. Thus the rotation of the axle 20 as caused by the descent of the person 4 is braked in a controlled manner by the braking means 14 and in particular the air resistance encountered by the fan blades 22.

[0028] The apparatus 2 is able to operate such that the person 4 is able to make a controlled descent through the air from the elevated position 6 to the lower position 8. Advantageously, the length of the braking line 12 does not have to be altered for different lengths of descent and therefore different elevated positions. The length of the braking line 12 simply has to be enough to cause braking of the movement of the person 4 through the air at the required location in order to enable the person to descend in safety from the elevated position 6 for the lower position 8. There is no need for larger or smaller capstans 10 as would be required with known apparatus having the braking line 12 passing around a cone-shaped drum.

[0029] Figure 2 shows the apparatus 2 of Figure 1 configured as a vertical descending apparatus. In Figure 2, the apparatus 2 is shown in end view and in simplified form so that just the braking means 14 is shown. The elevated position 6 is in the form of a platform. The lower position 8 is in the form of the ground. The braking line 12 is shown as a rope and more especially a Dyneema rope. The braking line 12 passes over a redirect pulley 26 and a stop plate 28.

[0030] Figure 2 also shows a further redirect pulley 30 and a further stop plate 32. Because the apparatus 2 has the capstan 10, the apparatus 2 is ready for another use after a first use simply by attaching the person 4 or another person 4 to an end portion 34 of the braking line 12 remote from the end portion 24 of the braking line 12.

[0031] As shown in Figure 2, the braking line 12 is made of two types of material. The central part of the braking line 12 is made of the Dyneema rope. The end portion 24 of the braking line 12 is attached to a bungee 36. The end portion 34 of the braking line 12 is attached to a bungee 38. The bungee 36 has a clip 39 for attaching to the person 4, typically via a harness worn by the person 4. The bungee 38 also has a clip 41. As the person 4 descends, the other end of the braking line remote from the person 4 ascends. The bungee 36 is able to reduce shock loading on the braking means 14 when the person 4 steps off the elevated position 6, for example a platform. The bungee 36 may also give extra excitement by increasing the sensation of free fall in the initial moments of the descent of the person 4. When the person 4 lands at the lower position 8, for example the ground, the capstan 10 stops turning because the weight of the person

4 is then no longer on the braking line 12.

[0032] Figure 3 shows the apparatus 2 configured as zip wire descending apparatus. In Figure 3, the apparatus 2 is again shown in end view so that only the braking means 14 with the fan blades 22 are shown.

[0033] Figure 3 shows the person 4 suspended from a zip wire 40. Also shown are a pulley 42 and a braking line 44. The braking line 44 equates to the braking line 12 shown in Figures 1 and 2. A bungee 46 connects the braking line 44 with a brake trolley 48. The person 4 is shown seated in a sling-type seat 50 which is attached to a zip trolley 52 as shown.

[0034] In Figure 3, the person 4 is shown just before impact with the brake trolley 48. The brake trolley 48 is positioned before an end member 56 for the zip wire 40. The person 4 is thus able to land on a landing platform 58.

[0035] Also shown in Figure 3 are a pulley 60 and a weight 62. Part of the braking line 44 passes over the pulley 60 and around a pulley 64 associated with the weight 62. This part of the braking line 44 together with the pulleys 60, 64 and the weight 62 form reset means for resetting the initial position of the brake trolley 48 ready for a next use of the zip wire descending apparatus when the zip trolley 52 will again connect with the brake trolley 48.

[0036] In Figure 2, the bungee 38 is employed to reduce shock loading on the braking line 12 in order to enable the provision of an initial sensation of free-fall and to increase the descent speed of the person 4 in the early stages of the descent. In Figure 3, the bungee 46 functions to eliminate shock loading of the braking line 44 caused by the zip trolley 52 supporting a person 4 travelling at high speed and contacting the brake trolley 48. In Figure 2, after stepping off the platform 6, the person 4 lands on the ground 8 at a speed regulated by the braking effect of the fan braking means 14. In Figure 3, after commencing a descent, the person 4 lands on the landing platform 58. In Figure 3, the person 4 is able to travel at higher speeds that compared with known zip wire apparatus and yet still travel in safety. Existing zip wire braking apparatus, which is also known as zip line braking apparatus, has a weak link in the braking line which is designed to separate if the person 4 gets to the end of the braking line without stopping. This allows the person 4 to pass safely through the back-up braking system. With the apparatus of the present invention, this weak link is not required.

[0037] In the apparatus 2, the zip trolley 52 and the brake trolley 48 are shown comprising pulleys that run on the zip line 40. The zip trolley 52 and the brake trolley 48 do not contain any internal power or braking source in themselves. The weight 62 functions as tensioner means to prevent the braking line 44 from sagging excessively when the brake trolley 48 changes position on the zip line 40. The weight 62 tensions by falling and thereby automatically repositions the brake trolley 48 ready for a next rider such as the person 4 to arrive. The bungee 46 reduces impact loading on the braking line 44

caused by a rider hitting the braking system at high speed. If a rider such as the person 4 stops short, they can be retrieved to the landing platform 58 by pulling on the braking line 44. The brake trolley 48 can also be repositioned ready for the next rider by pulling on the braking line 44. To provide redundancy for safety purposes and/or to optimise the performance of the braking system, more than one fan/brake trolley/brake line arrangement may be installed on the zip line 40.

[0038] Referring now to Figure 4, there is shown apparatus 70 which is like the apparatus 2. Similar parts have been given the same reference numerals for ease of comparison and understanding. In Figure 4, it will be seen that the apparatus 70 is such that the capstan 10 has an axle 72 and the braking means 14 has an axle 74. The two axles 72, 74 are drivingly connected together by a belt and pulley system 76 comprising two belts 78, 80 passing over pulleys 82, 84 as shown. In the apparatus 70, the braking means 14 is mounted above the capstan 10. Thus the braking means 14 has a longitudinal axis which is mounted parallel to and not in line with a longitudinal axis of the capstan 10.

[0039] Referring now to Figure 5, there is shown first known apparatus 86. The apparatus 86 is for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position. The apparatus 86 may be compared in general constructional terms to the apparatus 2 of the present invention. Thus the apparatus 86 has a braking line 88 and braking means 90. The apparatus 86 does not have the capstan 10 of Figure 1. Instead, the apparatus 86 has a cone-shaped drum 92. In use of the apparatus 86, the braking line 88 initially unwinds from a larger diameter part 94 of the cone-shaped drum 92, and finishes by unwinding from a smaller diameter part 96 of the cone-shaped drum 92. This means that the descent of the person starts out fast, and then decelerates as the person nears the lower position and the braking line 88 is unwinding from the smaller diameter part of the cone-shaped drum 92.

[0040] The apparatus 86 is disadvantageous in that one end portion 97 of the braking line 88 is secured to the cone-shaped drum 92. Thus only a finite length of the braking line 88 can be wrapped around the cone-shaped drum 92. This finite length of the braking line 88 limits the length of the descent and thereby the initial height from which the person can commence their descent through the air. If relatively long descent lengths are required, then the cone-shaped drum 92 has to be made increasingly large in order to accommodate an increasingly long length of the braking line 88, and this causes the apparatus 86 to become unduly bulky and expensive.

[0041] In Figure 5, it will be seen that the apparatus 86 is such that the braking means 90 and the cone-shaped drum 92 are mounted axially in line on a single axle 98. In Figure 6, there is shown second known apparatus 100 which may be compared to the construction in the appa-

ratus 70 of the present invention and as shown in Figure 4. In the apparatus 100, similar parts as in the apparatus 86 have been given the same reference numerals for ease of comparison and understanding. In the apparatus 100, it will be seen that the braking means 90 is positioned above the cone-shaped drum 92. In the apparatus 100, the cone-shaped drum 92 is mounted on an axle 102 and the braking means 90 is mounted on an axle 104.

[0042] In Figure 6, the apparatus 100 is shown with a rewind arrangement 105 comprising two belts 106, 108 passing around pulleys 110, 112 as shown. The apparatus 100 is also shown with the endless belts 80, 82 and the pulleys 82, 84 of the apparatus 70 shown in Figure 4.

[0043] Referring now to Figure 7, there is shown apparatus 114 of the present invention. The apparatus 114 is like the apparatus 2 shown in Figure 1. Similar parts as in the apparatus 2 have been given the same reference numerals for ease of comparison and understanding. In the apparatus 114, the capstan 10 includes divider means in the form of flanges 116 which divide the capstan 10 into three receiving zones 118. The receiving zones 118 receive different parts of the braking line 12 as the braking line 12 passes over the capstan 10. The flanges 116 are such that the braking line 12 is able to pass over the flanges 116 and move into and over the receiving zones 118 as can be appreciated from Figure 7. The flanges 116 extend radially outwardly from the circumference of the capstan 10. Each of the three receiving zones 118 is provided with an idler pulley 120. Each idler pulley 120 is set at an angle to the axle 20 and also at an angle to a transverse plane extending through the axle 20. The braking cable 12 passes over the idler pulleys 120 as shown. The flanges 116, the receiving zones 118 and the idler pulleys 120 enable the braking line 12 to pass with one turn only around the capstan 10 in each of the receiving zones 118. This enables the braking line 12 to pass around the capstan 10 with a minimum of three turns and without the possibility of the braking line 12 jamming on the capstan 10. If desired, the capstan 10 can be provided with more or less than the illustrated three receiving zones, for example two or four of the receiving zones. The angular position of the idler pulleys 120 helps to transfer the braking line 12 over the relatively small flanges 116 and thus between the different receiving zones 118. The number of idler pulleys 120 will normally increase or decrease in dependence upon the number of receiving zones. Typically, there will be one idler pulley 120 for each of the receiving zones, but this may be varied if desired.

[0044] It is to be appreciated that the embodiments of the invention described above with reference to the accompanying drawings have been given by way of example only and that modifications may be effected. Thus, for example, the capstan 10 may be of a different shape. In the apparatus 70, the braking means 14 may be mounted underneath the capstan 10. Different types of endless belt connecting means may be employed to the illustrated belt and pulley system 76. Other types of braking means

14 than the illustrated fan braking means 14 may be employed. The braking line 12 can be made of any suitable and required material including steel cable and rope. Individual components shown in the drawings are not limited to use in their drawings and they may be used in other drawings and in all aspects of the invention. The invention also extends to the individual components mentioned and/or shown above, taken singly or in any combination.

Claims

1. Apparatus for braking the movement of a person through the air at a predetermined location after the person has left an elevated position for a lower position, which apparatus comprises:

- (i) a capstan;
- (ii) a single braking line which extends around the capstan; and
- (iii) braking means,

and the apparatus being such that:

- (iv) the braking line has a first end which extends from a first side of the capstan;
- (v) the braking line has a second end which extends from a second side of the capstan;
- (vi) the braking line causes the capstan to rotate consequent upon the movement of the person through the air at the predetermined location;
- (vii) the rotation of the capstan causes operation of the braking means; and
- (viii) the amount of the line extending around the capstan remains constant during the rotation of the capstan consequent upon the person descending from the elevated position to the lower position.

2. Apparatus according to claim 1 in which the capstan includes at least one divider means which divides the capstan into separate receiving zones for receiving different parts of the braking line as the braking line passes over the capstan, and in which the divider means is such that the braking line is able to pass over the divider means and move over the receiving zones.

3. Apparatus according to claim 2 in which the divider means is a flange which extends radially outwardly from the circumference of the capstan.

4. Apparatus according to claim 2 or claim 3 in which there are three of the receiving zones, and in which the three receiving zones are defined by five of the divider means.

5. Apparatus according to any one of the preceding claims and including an idler pulley for each one of the receiving zones, and in which the idler pulley is for guiding the braking line over its receiving zone.

6. Apparatus according to any one of the preceding claims in which the braking means has a longitudinal axis which is in line with a longitudinal axis of the capstan.

7. Apparatus according to claim 6 in which the braking means and the capstan are axially mounted in line on a single axle.

8. Apparatus according to claim 6 in which the braking means has a longitudinal axis which is mounted parallel to and not in line with a longitudinal axis of the capstan.

9. Apparatus according to claim 8 in which the braking means is mounted above the capstan.

10. Apparatus according to claim 8 or claim 9 in which the capstan is connected to the braking means by at least one belt and pulley arrangement.

11. Apparatus according to any one of the preceding claims in which the braking means is a fan braking means.

12. Apparatus according to any one of the preceding claims in which the apparatus is configured as a vertical descending apparatus.

13. Apparatus according to any one of claims 1 - 11 in which the apparatus is configured as a zip wire descending apparatus.

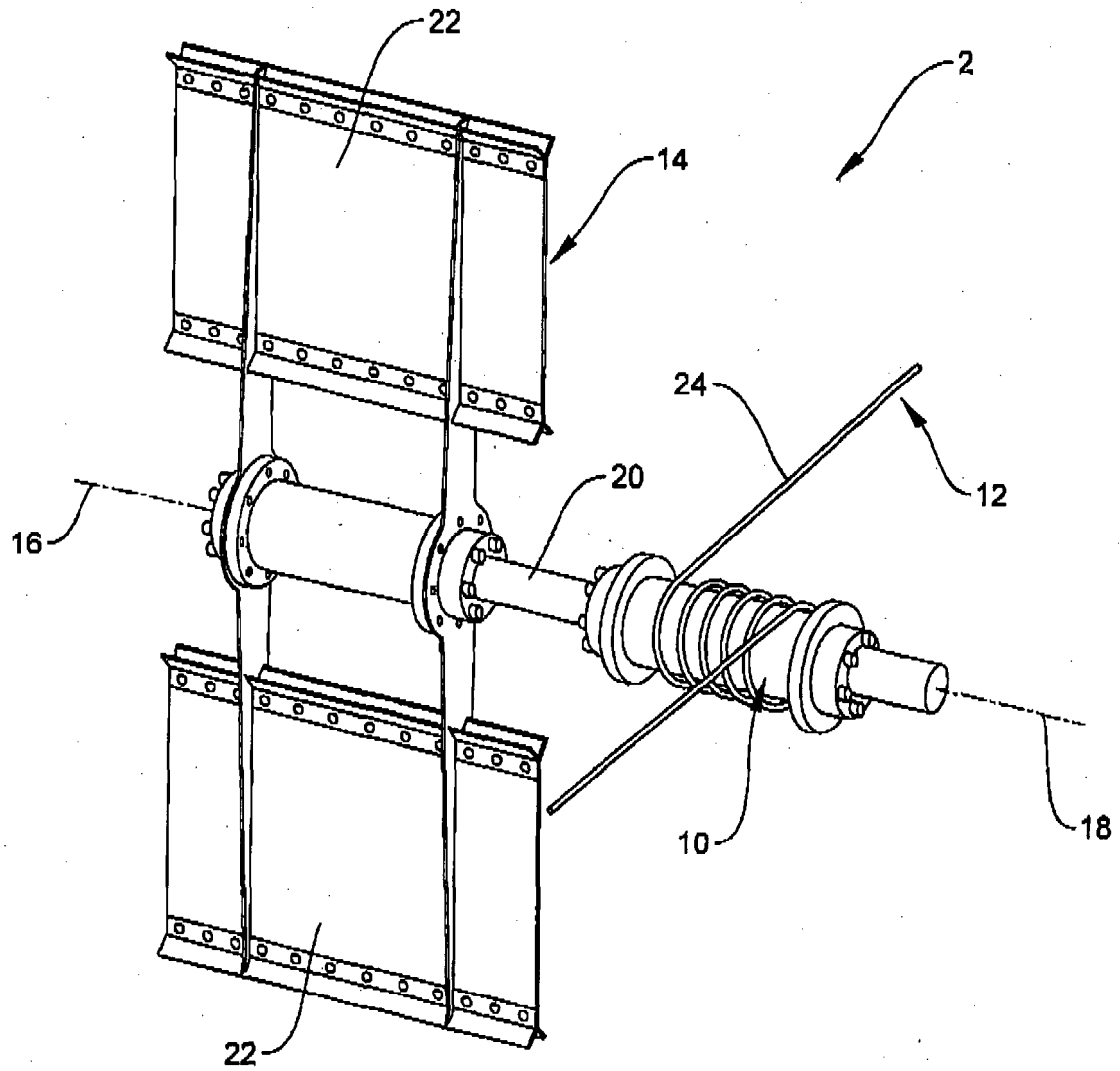


FIG. 1

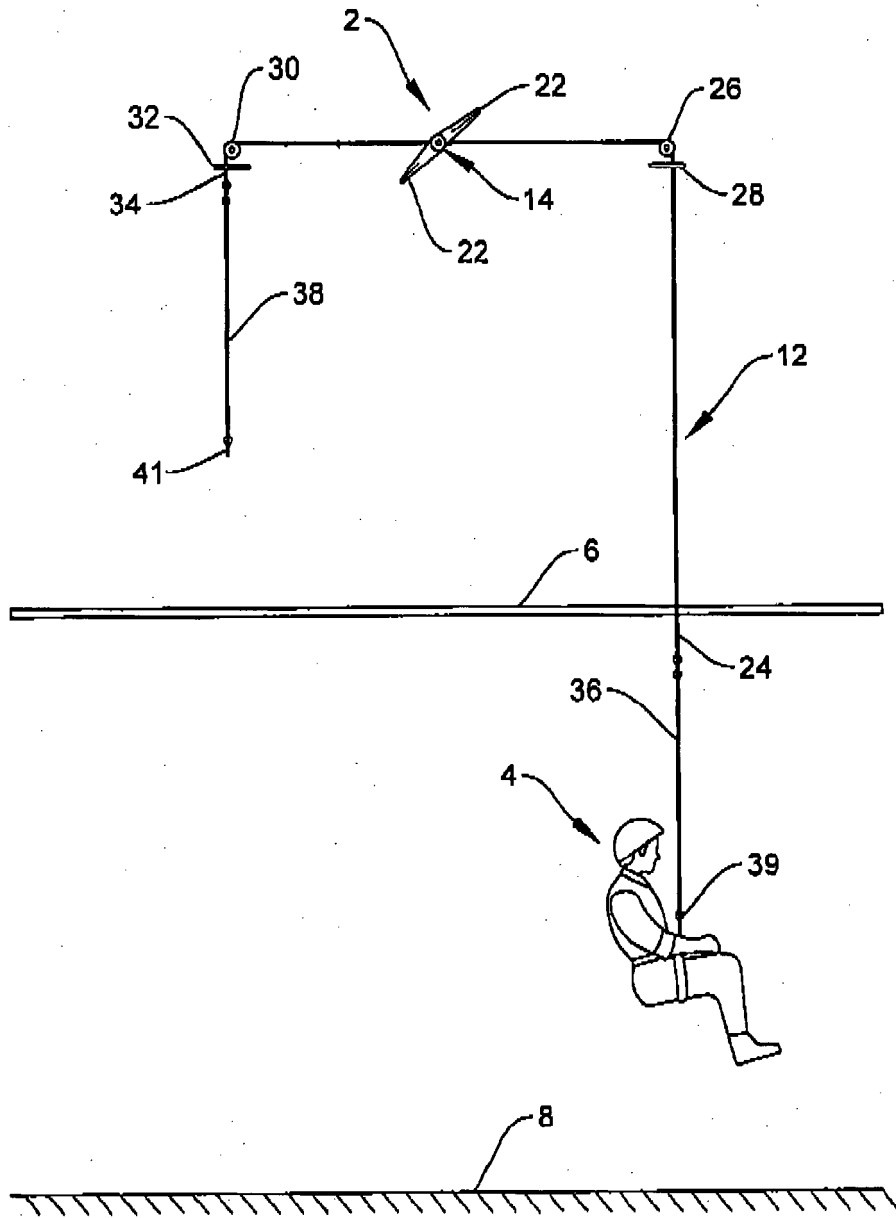


FIG. 2

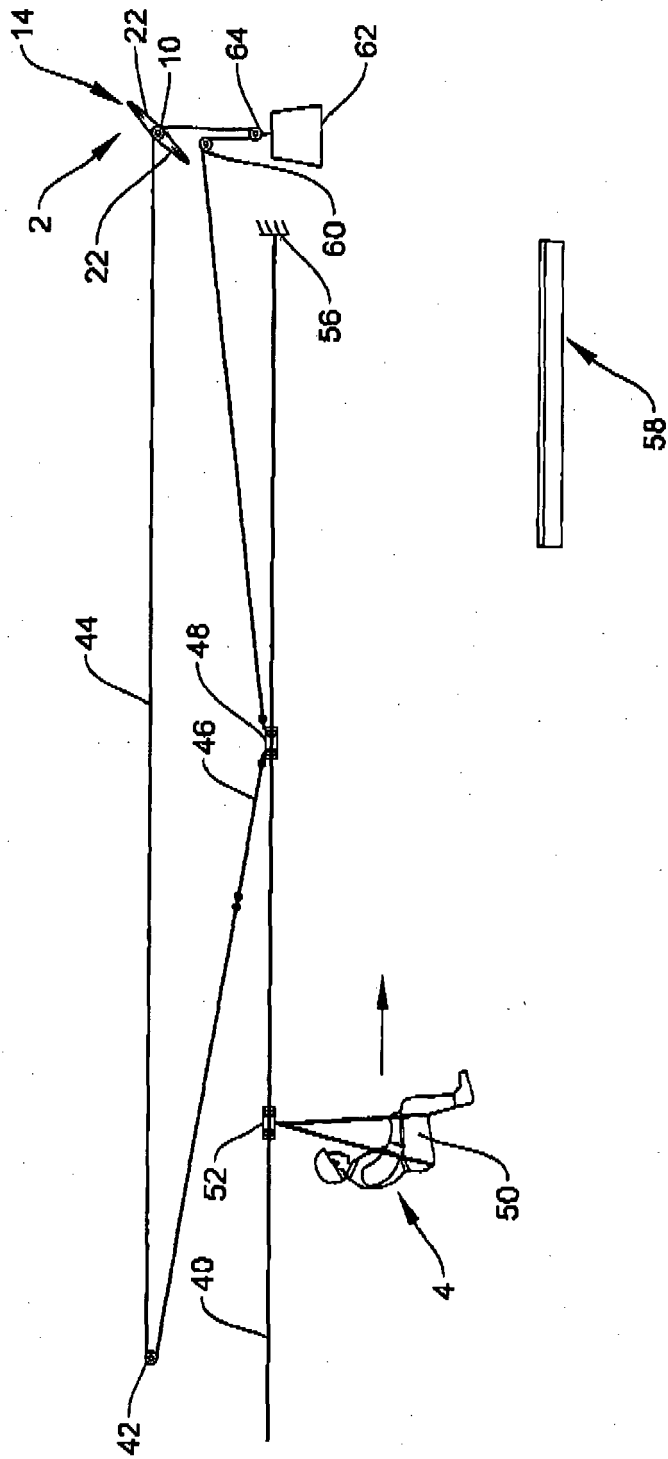


FIG. 3

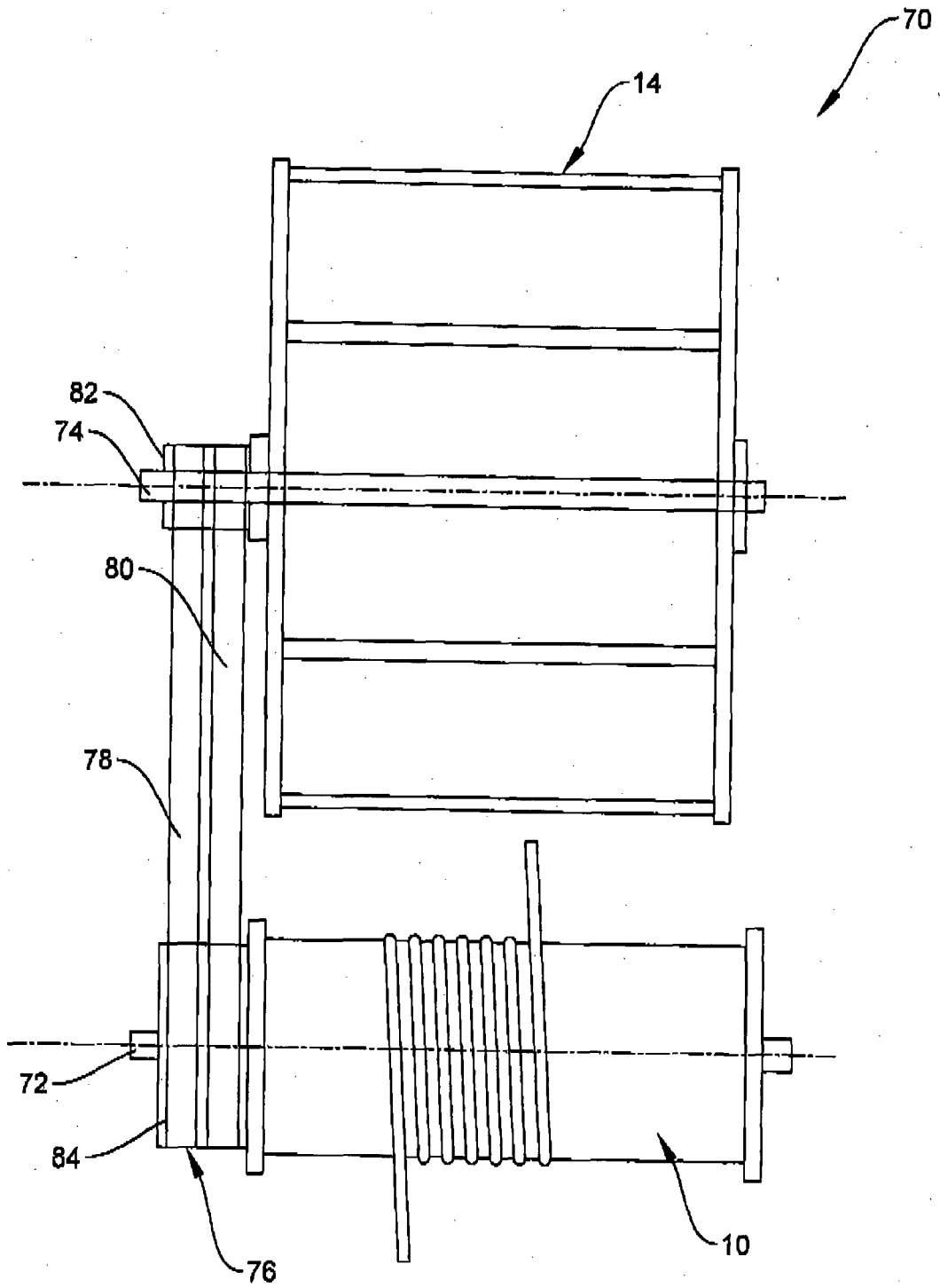


FIG. 4

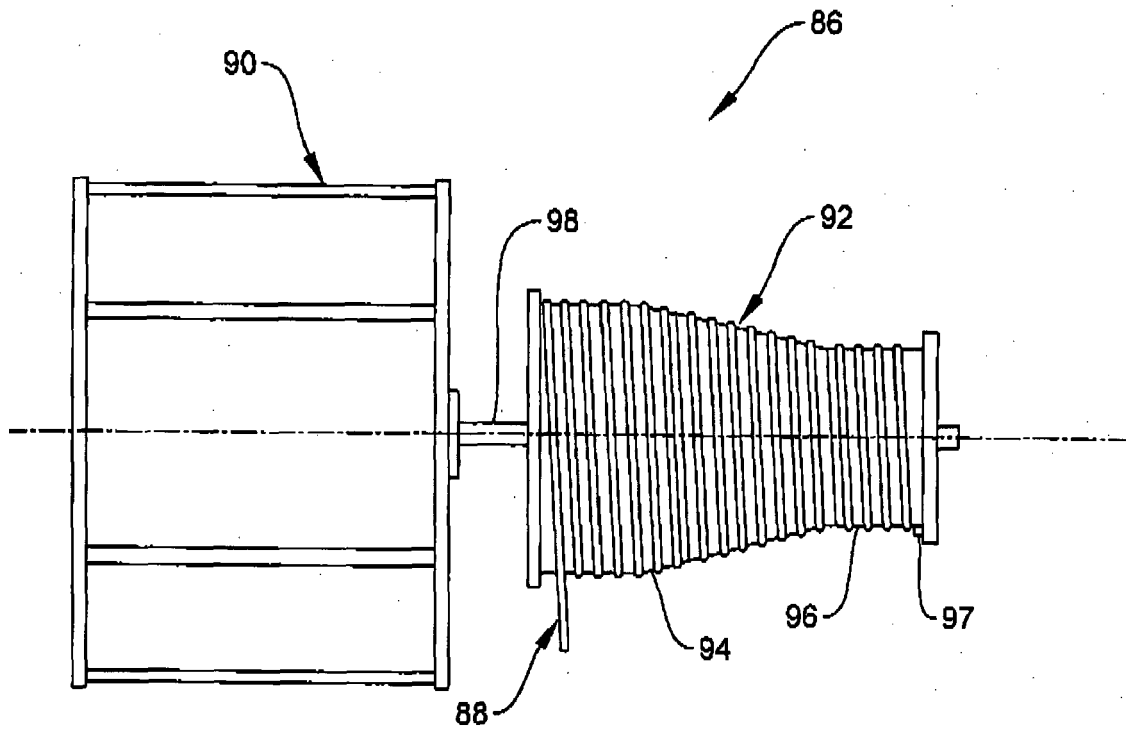


FIG. 5

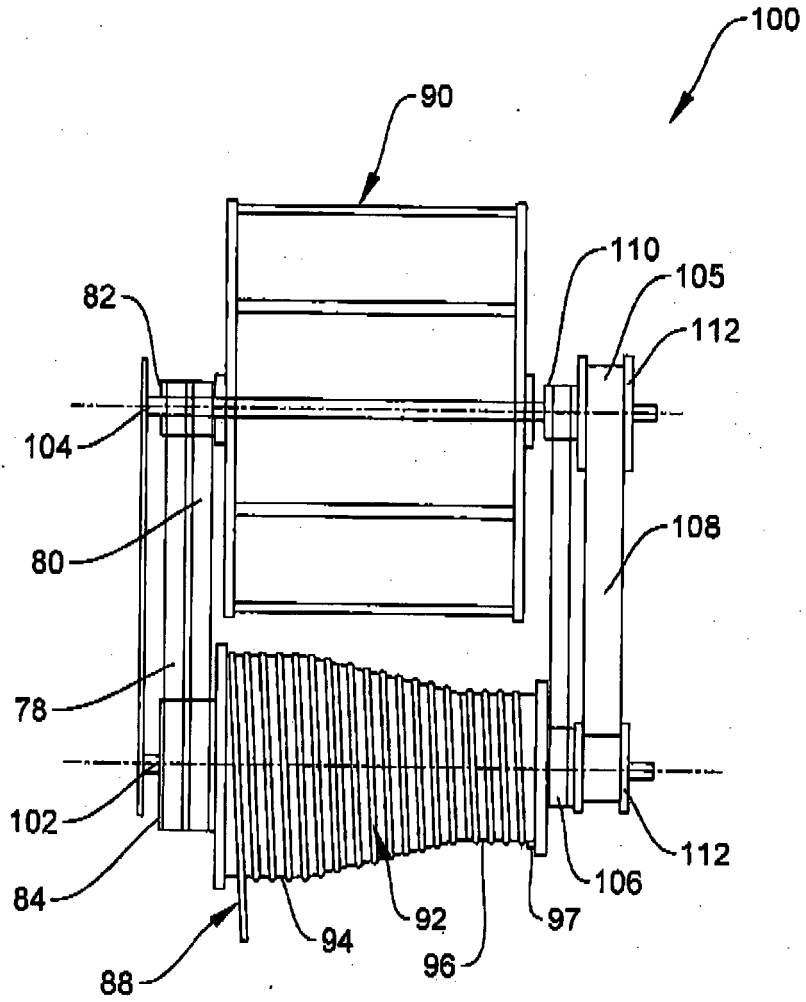


FIG. 6

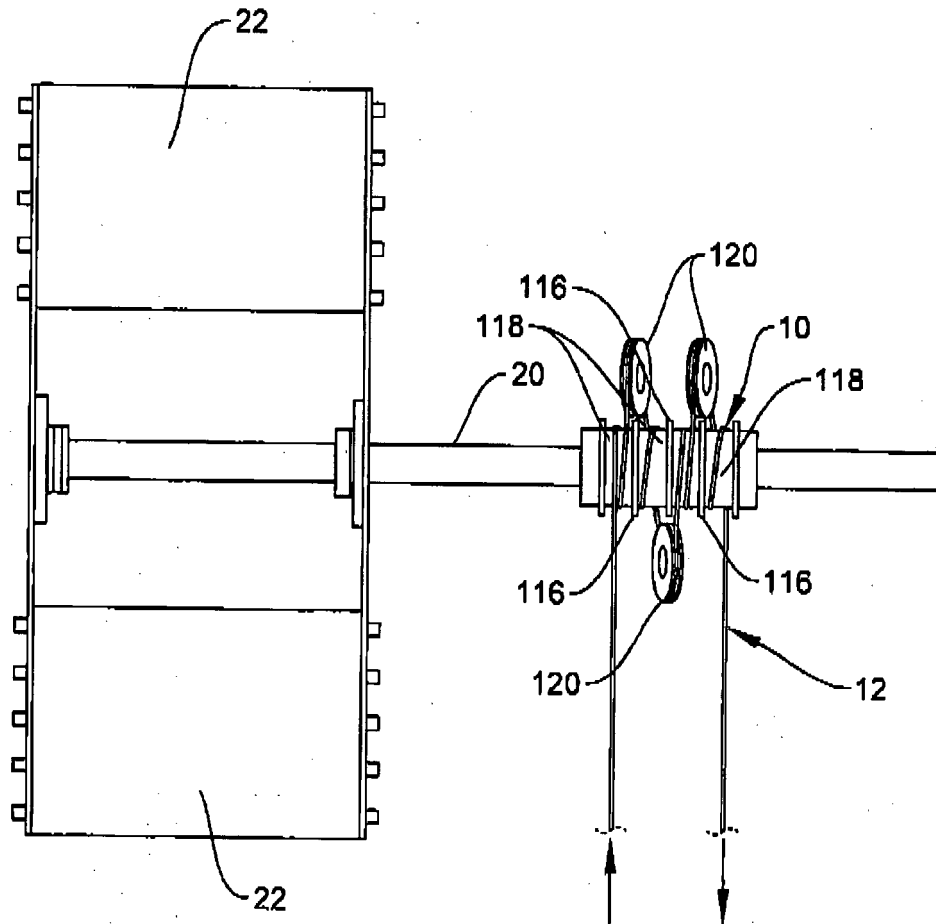


FIG. 7



EUROPEAN SEARCH REPORT

Application Number

EP 22 00 0038

5

DOCUMENTS CONSIDERED TO BE RELEVANT

10

15

20

25

30

35

40

45

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 8 708 109 B2 (STEELE CHARLES Z [CA]; UDOW DAVID E [CA] ET AL.) 29 April 2014 (2014-04-29) * column 4, lines 7-57; figures * * column 6, lines 25-30 * -----	1-13	INV. A63G21/20 A62B1/08 A62B1/10
X	FR 3 033 251 A1 (PAILLARDET [FR]) 9 September 2016 (2016-09-09) * page 4, line 21 - page 6, line 25; figures * -----	1-6, 9, 11-13	
X	US 4 538 703 A (ELLIS J NIGEL [US] ET AL) 3 September 1985 (1985-09-03) * column 3, line 10 - column 4, line 19; figures * * column 5, line 44 - column 6, line 23 * -----	1-10, 12, 13	
X	AT 512 020 A1 (UNIV WIEN TECH [AT]) 15 April 2013 (2013-04-15) * the whole document * -----	1, 6, 7, 12	
A	US 2007/240940 A1 (MORIARTY NICHOLAS [GB]) 18 October 2007 (2007-10-18) * paragraphs [0026], [0034] - [0037], [0042]; figures * -----	1-4, 8-13	TECHNICAL FIELDS SEARCHED (IPC) A63G A63D A62C A62B
A	WO 03/033074 A1 (MELLER MOSHE [IL]; HOLTZ LEONARD [US]) 24 April 2003 (2003-04-24) * figures * -----	1, 6-8, 11, 12	
A	CN 101 972 521 A (UNIV HANGZHOU DIANZI) 16 February 2011 (2011-02-16) * figures 2-5 * -----	2-5	
A	GB 2 229 630 A (KAN HAI CHRISTOPHER) 3 October 1990 (1990-10-03) * figures * -----	2-4	

The present search report has been drawn up for all claims

2

50

Place of search Munich	Date of completion of the search 29 June 2022	Examiner Schultze, Yves
----------------------------------	---	-----------------------------------

55

EPO FORM 1503 03:82 (P04C01)

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

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 22 00 0038

5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

29-06-2022

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 8708109 B2	29-04-2014	AU 2007355523 A1	31-12-2008
		CA 2691610 A1	31-12-2008
		US 2011162917 A1	07-07-2011
		US 2014196990 A1	17-07-2014
		WO 2009000059 A1	31-12-2008
FR 3033251 A1	09-09-2016	NONE	
US 4538703 A	03-09-1985	NONE	
AT 512020 A1	15-04-2013	AT 512020 A1	15-04-2013
		WO 2013044283 A2	04-04-2013
US 2007240940 A1	18-10-2007	AT 477837 T	15-09-2010
		AU 2007228630 A1	27-09-2007
		EP 1996296 A1	03-12-2008
		ES 2352661 T3	22-02-2011
		GB 2436324 A	26-09-2007
		US 2007240940 A1	18-10-2007
WO 2007107746 A1	27-09-2007		
WO 03033074 A1	24-04-2003	NONE	
CN 101972521 A	16-02-2011	NONE	
GB 2229630 A	03-10-1990	NONE	