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(54) **Projectile launcher**

(57) A projectile launcher for launching a projectile, the projectile launcher arranged to be connected to a trampoline having a frame and a jumping mat, the jumping mat connected to the frame by resilient members, the projectile launcher including a propulsion element adapt-

ed to provide a motive force to propel a projectile and an energy extraction element arranged to be connected to a trampoline and to extract energy from the action of a user bouncing on the trampoline to provide power to the propulsion element.

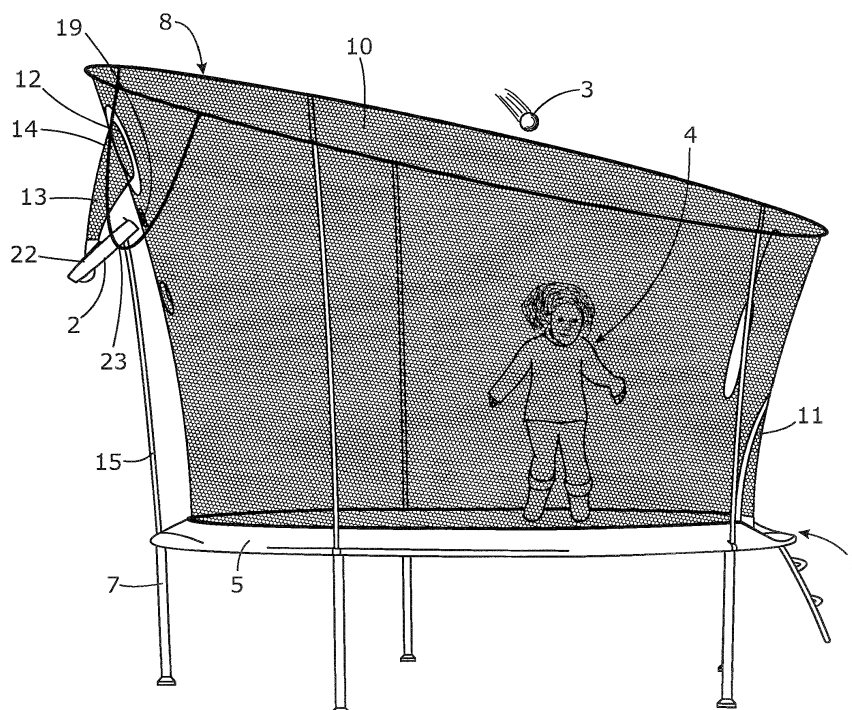


Fig. 1

Description

[0001] This invention relates to a projectile launcher and, in particular, a projectile launcher for attachment to a jumping apparatus, such as a trampoline. It also relates to a jumping apparatus in combination with the projectile launcher. It also relates to a kit of parts for assembly into a jumping apparatus and projectile launcher.

[0002] Trampolines are a type of jumping apparatus that typically comprise a flexible mat connected to a frame by one or more springs or other resilient members such that the flexible mat is held above the ground in tension. Energy stored in the springs when a user jumps on the flexible mat can be used to propel them into the air. Alternatively, the springs and flexible mat may be replaced with an elastic mat, connected to the frame, which stretches and resiles to propel the user into the air. A jumping pillow or inflatable trampoline is further type of jumping apparatus that includes a frame containing a flexible or elastic hollow body that is filled with fluid, such as air. A user compresses the fluid or deforms the body as they jump onto the apparatus to store energy, which can be used to assist in propelling them into the air when they jump from the apparatus. Thus, this jumping apparatus is also arranged to store energy to propel a user into the air when the user jumps onto the jumping apparatus enabling them to bounce.

[0003] According to a first aspect of the invention, we provide a projectile launcher for launching a projectile, the projectile launcher including a propulsion element adapted to provide a motive force to propel a projectile and an energy extraction element arranged to be connected to a jumping apparatus and to extract energy from the action of a user bouncing on the jumping apparatus to provide power to the propulsion element.

[0004] This is advantageous as the projectile launcher can be used with a jumping apparatus, such as a trampoline, to launch projectiles toward the trampoline for the user of the trampoline to catch, which is fun. Further, the projectile launcher is powered by the user bouncing on the trampoline. Thus, the energy extraction element advantageously takes a portion of the energy that would have been stored in the jumping apparatus for propelling the user and uses it to provide power to the propulsion element for use in its propulsion of the projectile.

[0005] Preferably the projectile launcher is arranged to be connected to a jumping apparatus comprising a trampoline having a frame and a jumping mat, the jumping mat connected to the frame by resilient members.

[0006] Preferably the energy extraction element is arranged to be connected to the jumping mat. This is advantageous, as the jumping mat moves relative to the frame as the resilient members stretch and resile with each bounce of the user, which provides a convenient point to extract energy from the trampoline. Alternatively the energy extraction element may be adapted to be connected to one or more of the resilient members.

[0007] Preferably the energy extraction element in-

cludes a cable, arranged to be connected at a first end to the jumping apparatus, and connected at a second end to a ratchet mechanism, the cable arranged to be drawn by the trampoline as a user jumps on the jumping apparatus to actuate the ratchet mechanism.

[0008] Preferably the energy extraction element includes at least one lever element to alter the ratio between the movement of the jumping mat as the user bounces on the trampoline and the movement of the ratchet mechanism. This is advantageous as the lever element can be easily adjusted to tailor the typical displacement of the mat experienced by the trampoline to the operation energy extraction element. Thus, the lever element can be used to adjust the projectile launcher for use with different trampolines, different resilient element strengths and different user weights, for example.

[0009] Preferably the propulsion element includes a spring for providing the motive force and the ratchet mechanism is used to withdraw the spring. Thus, the energy from the energy extraction element powers the withdrawal of the spring so that the projectile can be launched.

[0010] Alternatively the energy extraction element may comprise a pump and the propulsion element may include a pressure reservoir, wherein the pump is arranged to be actuated by the reciprocating motion of the jumping apparatus as a user jumps, and the pressure reservoir is arranged to be charged with pressure by the pump. This is advantageous as the air pressure can be used to propel a projectile.

[0011] The projectile launcher may be arranged to launch a projectile with each bounce of the user on the jumping apparatus. Alternatively, the propulsion element may be arranged to store the energy from the energy extraction element and release it when a predetermined threshold is reached. This is advantageous, as the propulsion element may include a trigger mechanism adapted to release the energy stored in the propulsion element when a predetermined force or pressure is reached.

[0012] Preferably the projectile launcher is constructed and arranged to launch a projectile comprising one of a ball, a rocket, a bubble, or a jet of fluid.

[0013] According to a second aspect of the invention, we provide a jumping apparatus in combination with a projectile launcher for launching a projectile, the projectile launcher including a propulsion element adapted to provide a motive force to propel a projectile and an energy extraction element connected to the jumping apparatus and adapted to extract energy from the action of a user bouncing on the jumping apparatus to provide power to the propulsion element.

[0014] This is advantageous as the combination of the projectile launcher and the jumping apparatus provides entertainment that allows a user to combine the game of jumping with the game of catching.

[0015] Preferably the jumping apparatus includes a jumping mat and a support that extends above the jumping mat for supporting the projectile launcher.

[0016] Preferably the projectile launcher includes a hopper for guiding projectiles into the projectile launcher for propulsion by the propulsion element. Preferably the hopper is adapted to store more than one projectile and feed the projectiles into the projectile launcher one at a time.

[0017] Preferably the jumping apparatus is at least partially surrounded by a screen assembly that at least partially encloses a region above the jumping mat. The screen assembly is advantageous as it may act to prevent a user bouncing off the jumping apparatus, which could lead to injury. Preferably the support forms part of the screen assembly.

[0018] Preferably the projectile launcher includes a hopper for guiding projectiles into the projectile launcher for propulsion by the propulsion element. Preferably the hopper is accessible to receive projectiles through a projectile return aperture in the screen assembly. Preferably the projectile return aperture is located at a position in the screen higher than the projectile launcher. Thus, the projectiles will be guided by the hopper under the influence of gravity.

[0019] The projectile return aperture may be located beneath the projectile launcher and a projectile lifting mechanism may be connected between the projectile return aperture and the hopper, the projectile lifting mechanism arranged to lift the projectile to the hopper. The projectile lifting mechanism may be powered by the energy extraction element or a second energy extraction element. This is advantageous as it allows smaller children to return the projectile to a point that is easily reached, rather than making them struggle to return the projectile to a point which may be far above them.

[0020] The projectile launcher may be arranged to launch projectiles within the bounds of the screen assembly. Alternatively, the projectile launcher may comprise an aiming mechanism so that the user can direct the projectiles to a particular location. This is advantageous as the particular location may be into a further jumping apparatus having a projectile launcher.

[0021] It will be appreciated that the optional features described above in relation to the first aspect of the invention apply equally to the second aspect of the invention.

[0022] According to a third aspect of the invention we provide a kit of parts comprising a jumping apparatus and a projectile launcher as defined in the first aspect of the invention.

[0023] There now follows by way of example only a detailed description of the present invention with reference to the accompanying drawings in which;

Figure 1 shows a first view of an embodiment of a jumping apparatus in combination with a projectile launcher;

Figure 2 shows a second view of the embodiment of Figure 1;

Figure 3 shows a cut away view of the embodiment of the projectile launcher shown in Figures 1 and 2;

Figure 4 shows a side view of an embodiment of the projectile launcher;

Figure 5 shows a perspective view of the projectile launcher shown in Figure 4 with a further part removed;

Figure 6 shows a further perspective view of the other side of the projectile launcher shown in Figure 4 with further parts removed for clarity;

Figure 7 shows the connection between an energy extraction element and a trampoline;

Figure 8 shows a diagrammatic view of a second embodiment of the projectile launcher; and

Figures 9a and 9b show a second embodiment of the energy extraction element and its connection to a trampoline with Figure 9b showing a magnified portion of Figure 9a.

[0024] A trampoline 1 in combination with a projectile launcher 2 is shown in Figure 1. The projectile launcher 2 is adapted to launch a projectile 3 and is powered by a user 4 bouncing on the trampoline. The user 4 may choose to catch or collect the projectile 2 while they are bouncing.

[0025] The trampoline 1 comprises a frame 5 and a jumping mat 6, which may be of materials such as polyethylene or polypropylene. The jumping mat 6 is connected to the frame 5 by one or more resilient members 9 (shown in Figure 7), which, in this embodiment, comprise a plurality of coil springs. It will be understood that other resilient members could be used, for example spring loaded rods or elasticised material. The coil springs hold the jumping mat 6 in tension within the frame 5.

[0026] The frame 5 comprises a plurality of legs 7 that support the jumping mat 6 above the ground. The trampoline 1 includes a screen assembly 8 that extends from around the perimeter of the jumping mat 6 upwardly therefrom. The screen assembly 8 includes a safety screen 10 which acts to prevent the user 4 bouncing off the trampoline and potentially injuring themselves. The safety screen 10 includes a door 11 to allow the user 4 to access to and from the jumping mat 6. The safety screen 10 also includes a projectile return aperture 12 which leads to a hopper 13. The hopper 13 is arranged above the projectile launcher 2 and receives projectiles through the projectile return aperture 12. The hopper 13 guides the projectiles into the projectile launcher 2 for launching. In this embodiment, the hopper 13 is arranged to store a plurality of projectiles for sequential feeding into the projectile launcher 2. Thus, the hopper 13 comprises a wide mouth 14 adjacent the projectile return aperture 12.

erture 12, which narrows to a size corresponding to the projectile 3 so that only one projectile can enter the projectile launcher at any one time. The safety screen also includes a launch aperture 19 through which the projectile launcher 2 propels the projectiles over the jumping mat 6.

[0027] The projectile launcher 2 is supported above the jumping mat 6 by a launcher support 15. The launcher support 15 also houses part of an energy extraction element, as will be described below.

[0028] The projectile launcher 2 comprises a propulsion element 20 for launching the projectile 3 and an energy extraction element 21 for powering the propulsion element 20. The propulsion element 20 and part of the energy extraction element 21 are surrounded by a housing 22 (shown in Figures 1 and 2, but omitted from subsequent Figures for clarity). The housing 22 also includes a tubular barrel portion 23, which guides the projectile 3 out of the projectile launcher 2 when the propulsion element 20 propels the projectile.

[0029] The propulsion element 20 comprises a coil spring 24, which acts on a launching ram 25. The launching ram 25 is mounted at one end of a launching rod 26. The launching ram 25 is arranged to contact the projectile to propel it from the projectile launcher 2 when spring 24 releases its energy. The launching rod 26 is slidably received within a launcher support 27. The spring 24 extends between the ram 25 and the launcher support 27, biasing them apart. Thus, withdrawal of the launching rod 26 into launcher support 27 will cause the launching ram 25 to compress spring 24 against the launcher support 27.

[0030] The energy extraction element 21 comprises a transfer cable 28, a ratchet arm 30 and a withdrawal wheel 31. The withdrawal wheel 31 includes a ratchet gear 32 fixedly secured thereto, which is acted on by ratchet arm 30. The transfer cable 28 is connected to the trampoline 1 at one end and to the ratchet arm 30 at its other end. The ratchet arm 30 and withdrawal wheel 31 are rotatably connected to an axle 33 and can rotate independently of one another. The axle 33 extends between opposed sides of the launcher support 27.

[0031] The ratchet arm 30 can pivot about axle 33 and includes a pawl 34 that acts on the ratchet gear 32. The pawl 34 is rotatably secured to the ratchet arm 30 by an axle 35. The pawl 34 is biased towards engagement with the ratchet gear 32 by a spring (not visible). The ratchet arm 30 is adapted to move between a first position, where it abuts the launcher support 27 (as shown in Figure 4) and a second position when it is rotated in the direction of arrow 29. The ratchet arm 30 is biased to the first position by a return spring 38.

[0032] The withdrawal wheel 31 includes withdrawal pegs 36a, 36b and 36c (shown best in Figure 6). The withdrawal pegs 36a, 36b, 36c are arranged to contact a withdrawal plate 37. The withdrawal plate 37 extends from the launching rod 26 toward the pegs 36a, 36b, 36c. The pegs 36a, 36b, 36c and withdrawal plate are ar-

ranged such that rotation of the withdrawal wheel 31 causes each of the pegs 36a, 36b, 36c to bear against withdrawal plate 37 over a portion of their circular path. The withdrawal pegs thus withdraw the launching rod 26 against the force of spring 24 as the withdrawal wheel 31 rotates. After a predetermined amount of rotation, the pegs will move out of engagement with the withdrawal plate 37, allowing the launching rod 26 and launching ram 25 to shoot forward under the influence of the spring 24.

[0033] The ratchet gear 32 is also acted on by a second pawl 40. The second pawl 40 pivots about an axle 41 that is secured to the launcher support 27.

[0034] Figure 7 shows the connection between the transfer cable 28 and the trampoline 1. The transfer cable 28 is secured to the jumping mat 6 at the same point as one of the resilient members 9. The transfer cable 28 extends through the resilient member 9 and under a guide member 42.

[0035] The guide member 42 is secured to the frame of the trampoline. Thus, when a user 4 jumps on the trampoline jumping mat 6, the resilient members 9 will stretch increasing the distance between the jumping mat 6 and the guide member 42. This will apply a force to the transfer cable 28, which will act to move the ratchet 30 from its first position towards its second position. It will be appreciated that the more force the user applies to the jumping mat 6, the further the angular separation between the first position and the second position. The transfer cable 28 may include an extendable portion (not shown) which increases the length of the cable 28 should a potentially damaging force be placed on the cable. This will prevent damage to the projectile launcher 2. It will be appreciated that the transfer cable 28 could be attached to one or more of the resilient members 9. Further, it may be secured to a belt that passes under the jumping mat 6 and is secured to an opposed side of the frame of the trampoline. Thus, the belt will be moved by the deformation of the jumping mat 6 and will transfer the displacement to the transfer cable 28.

[0036] In use, the projectile launcher 2 will typically have a projectile, such as a ball 3, loaded within it on launching plate 50, adjacent the launching ram 25. As the user bounces on the jumping mat 6, the transfer cable 28 is drawn and released with each bounce and is kept taut by the return spring 38 acting on ratchet arm 30. This reciprocating motion of the transfer cable 28 repeatedly moves the ratchet arm between its first and second positions. The pawl 34 of the ratchet arm 30 will act to rotate the ratchet gear 32 when it moves from its first position to its second position. When the ratchet arm 30 moves back to its first position, the pawl 34 rides over the teeth of the ratchet gear 32. The second pawl 40 acts to prevent the ratchet gear 32 rotating with the ratchet arm 30 when it returns from the second position to the first position. Thus, the ratchet arm 30 converts the reciprocating motion of the transfer cable 28 into rotary motion of the withdrawal wheel 31 in a single direction.

[0037] With reference to Figure 6, rotation of the ratchet gear 32 and therefore also the withdrawal wheel 31 advances pegs 36a, 36b, 36c in the direction of arrow 51. Each peg 36a, 36b, 36c will, in turn, engage the withdrawal plate 37 as the withdrawal wheel 31 is rotated in steps. The withdrawal plate 37 extends between the pegs 36a, 36b, 36c such that rotation of the withdrawal wheel 31 will withdraw the launching rod 26. With further rotation of the withdrawal wheel 31, the peg in contact with the withdrawal plate 37 will move towards the free end 52 of the plate 37. The peg will then move out of engagement with the withdrawal plate 37. On doing so the launching rod 26 is no longer prevented from shooting forward under the force of spring 24 in the direction of arrow 52 to contact the projectile 3 and launch it from the projectile launcher 2. The energy stored in spring 24 is used to launch the projectile. Thus, the length of the withdrawal plate 37 and its interaction with the pegs 36a, 36b, 36c act as a trigger mechanism which determines the amount of withdrawal of the launching rod 26 before it is allowed to launch the projectile 3.

[0038] Figure 8 shows a second embodiment of the projectile launcher 2. The propulsion element 20 comprises a pressure storage vessel 81 and the energy extraction element 21 comprises a pump mechanism.

[0039] The propulsion element 20 uses the air pressure stored in the pressure vessel to propel the projectile 3 from a barrel 80. The propulsion element 20 releases the pressure from the pressure vessel 81 when a trigger mechanism, comprising a pressure release valve 82, reaches a predetermined pressure.

[0040] The pump mechanism 21 uses the reciprocating motion of the transfer cable 28 to drive a lever 83 between a first position (as shown in Figure 8) and a second position. The return spring 38 biases the lever 83 to the first position and keeps the transfer cable 28 taut. Movement of the lever 38 drives a piston 84 within a bore 85. The piston 84 includes a one-way valve (not shown) to draw air into the bore 85. As the piston moves toward the pressure storage vessel 81 it drives the drawn in air into the vessel 81. A second one-way valve 86 maintains the pressure in the pressure storage vessel 81 when the piston 84 is withdrawn. In this embodiment the piston 84, bore 85 and pressure vessel 81 are shown as being housed in a single hollow body, although it will be appreciated that the piston 84 and bore 85 could be separate from the pressure vessel 81.

[0041] In use, each bounce of the user on the jumping mat 6 acts through the cable 28 and the lever 83 to pump air into the pressure storage vessel 81. When a predetermined pressure is reached within the vessel 81, the pressure release valve 82 opens, which allows the pressurized air to vent through a conduit 87 into a base 88 of the barrel 80 behind a projectile 3. The escaping pressurized air provides the motive force to propel the projectile 3 along and out of the barrel 80.

[0042] This embodiment may also include a hopper (not shown in Figure 8) for feeding projectiles into the

projectile launcher 2. The barrel 80 includes a lip 92 to receive projectiles 3 from the hopper. The hopper dispenses the projectile in the direction of arrow 91 on to the lip 92. The projectile 3 can then roll into the barrel 80 for subsequent launching.

[0043] In a modification (not shown) the pump mechanism may be connected directly to the jumping mat 6 and frame 5 instead of via the transfer cable 38. Thus, movement of the jumping mat 6 relative to the frame 5 withdraws and drives the piston 84 within the bore 85. The air pressure from the pump is transported by a conduit to the pressure vessel 81.

[0044] In a modification (not shown) the projectile launcher 2 of Figure 8 may be adapted to launch bubbles rather than balls. Thus, the barrel 80 will be replaced with a bubble generator and bubble liquid reservoir. The bubble liquid reservoir contains a liquid, such as soap solution, from which the bubbles are formed. The air supply conduit 87 is connected to the bubble generator to supply a stream of air for generating the bubbles. The pressure release valve 82 will be set to a lower level for generating bubbles, as less pressure will typically be required for generating bubbles than propelling a ball from a barrel.

[0045] The projectile launcher 2 may include an aiming mechanism so that the user can set where the projectile launcher 2 launches the projectiles. The aiming mechanism may comprise an adjustable bracket between the launcher support 15 and the projectile launcher 2. The adjustable bracket may include means for ensuring that the projectile launcher 2 is aligned with the launch aperture 19, regardless of the position of the aiming mechanism.

[0046] The portion of the safety screen 10 and screen assembly 8 including the projectile return aperture 12 may be separable from the remainder of the screen assembly and may be adapted to retrofit to an existing trampoline with or without a safety screen. Thus, the projectile launcher 2 may form part of a kit of parts for retrofitting to a trampoline, the kit also including the projectile launcher support 15 and hopper 13. The launcher support 15 may include a connector for connecting it to a frame of a trampoline. The kit of parts may include the screen assembly with projectile return aperture 12.

[0047] Figures 9a and 9b shows part of a further embodiment of an energy extraction element 21. This embodiment utilises a lever element comprising a lever 100 for magnifying the displacement of the jumping mat for operating the energy extraction element. Further, the lever element 100 can be adjusted by moving the fulcrum to compensate for different trampolines, the resilient strength of the resilient members or the weight of a user. In this embodiment, the lever 100 is connected to the jumping mat 6 at a first end 101. An opposed end 102 of the lever 100 is connected to a transfer rod 103. The lever 100 is mounted to a pivot point 105 on a guide frame 104 and the guide frame 104 connects to the trampoline frame 5. The guide frame 104 includes a clamp 106 to connect it to the poles that form the frame 5. The transfer

rod 103 connects the lever 100 to a further lever 107 at first end 108, which is located with the remainder of the energy extraction element 21. The further lever 107 is connected to the guide frame 104 at a fulcrum 110. The further lever 107 has a second end 111, opposite the first end 108, which engages a ratchet mechanism in order to withdraw the propulsion element 20. The second end includes a slot 109 that engages with a spigot on an index gear 112 to effect its rotation on movement of the further lever 107. The ratchet mechanism comprises the index gear 112 which engages a spring clutch 114 through a set of inclined teeth 118. The clutch includes a series of grooves 119 in its circumferential surface that engage with a ratchet 115. The index gear 112 drives a firing wheel 113 through the clutch 114. The firing wheel 113 withdraws a toothed rod 115 which forms part of the propulsion element. The firing wheel 113 has a toothed portion 116 and a non-toothed portion 117, wherein the propulsion element is released when the non-toothed portion 117 aligns with toothed rod 115.

[0048] In use, each bounce of the user deforms the mat 6 and draws the first end 101 of lever 100 downward. Accordingly, the opposed end 102 is moved upwards, which pushes the transfer rod 103 upwards. The transfer rod 103 then acts on the first end 108 of the further lever 107 to move it upwards. The second end 111 engages the spigot of the index gear 112 which is rotated by the downward movement of the second end 111. The index wheel 112 incrementally rotates the firing wheel 113 through the clutch 114. As the bouncing mat returns to its original position the second end 111 of the further lever 107 will rise and the set of inclined teeth between the index gear 112 and the spring clutch 114 and the ratchet 115 ensure the mechanism "charges" the propulsion element. The firing wheel 113 and propulsion element are arranged such that the un-toothed portion 117 aligns with the toothed rod 115 when a coil spring (not shown) of the propulsion element is withdrawn. Thus, the firing wheel 113 and toothed rod 115 will be disengaged to allow the energy stored in the coil spring to propel a projectile, as discussed in previous embodiments.

[0049] In a further embodiment, the jumping apparatus comprises a jumping pillow. The energy extraction element is thus modified to extract energy from the jumping pillow. A typical jumping pillow comprises a frame that houses a resiliently compressible hollow body, which is filled with air. The energy extraction element is substantially similar to that shown in the previous embodiments and includes a transfer cable 28. The transfer cable is connected to a pressure plate mechanism, which is mounted between the frame and the hollow body. The pressure plate mechanism includes a first plate element and a second plate element biased apart by a plate spring. The transfer cable is secured between the first and second plate elements. When a user 4 bounces on the hollow body to compress it, the first plate element and second plate element are pressed together against the force of the plate spring. This movement releases

tension in the transfer cable 28 and any slack is taken up by return spring 38. When the hollow body resiles, the first plate element and second plate element separate under the force of the plate spring. This separation of the first plate element and second plate element draws the transfer cable. Accordingly, without the weight of a user on the jumping pillow, the pivot arm 30 adopts its second position. When a user pushes downward to compress the jumping pillow, the pivot arm 30 moves to the first position under the force of return spring 38. When a user jumps from the jumping pillow into the air, the plate spring moves the pivot arm to the second position thereby rotating the withdrawal wheel 31. It will be appreciated that other forms of jumping apparatus could be used and the energy extraction element is arranged to extract energy from the jumping apparatus that would previously have been used to propel the user who bounces on the jumping apparatus.

[0050] Although the present invention has been described as extracting energy from the trampoline when a user bounces on the trampoline, it may be arranged to extract energy when the resilient elements of the trampoline recoil from their extended position. Also, the energy extraction element may store the energy for propelling the ball in any appropriate manner, such as potential energy in a spring or pressure vessel or as electricity generated by a generation means powered by the user bouncing on the trampoline. Further, the energy extraction element may connect to the trampoline in any appropriate manner in order to use the action of user jumping or bouncing to actuate the projectile launcher.

Claims

1. A projectile launcher for launching a projectile, the projectile launcher arranged to be connected to a trampoline having a frame and a jumping mat, the jumping mat connected to the frame by resilient members, the projectile launcher including a propulsion element adapted to provide a motive force to propel a projectile and an energy extraction element arranged to be connected to a trampoline and to extract energy from the action of a user bouncing on the trampoline to provide power to the propulsion element.
2. A projectile launcher according to claim 1, in which the energy extraction element is adapted to be connected to the jumping mat or to one or more of the resilient members.
3. A projectile launcher according to claim 1 or claim 2, in which the energy extraction element includes a cable, arranged to be connected at a first end to the trampoline, and connected at a second end to a ratchet mechanism, the cable arranged to be drawn by the trampoline as a user jumps on the trampoline

to actuate the ratchet mechanism.

4. A projectile launcher according to any preceding claim, in which the energy extraction element includes at least one lever element to alter the ratio between the movement of the jumping mat as the user bounces on the trampoline and the movement of the ratchet mechanism. 5
5. A projectile launcher according to claim 3, in which the propulsion element includes a spring for providing the motive force and the ratchet mechanism is used to withdraw the spring. 10
6. A projectile launcher according to claim 1 or claim 2, in which the energy extraction element comprises a pump and the propulsion element includes a pressure reservoir, wherein the pump is arranged to be actuated by the reciprocating motion of the jumping apparatus as a user jumps, and the pressure reservoir is arranged to be charged with pressure by the pump. 15
7. A projectile launcher according to any preceding claim, in which the projectile launcher is arranged to launch a projectile with each bounce of the user on the jumping apparatus 20
8. A projectile launcher according to any of claims 1 to 6, in which the propulsion element includes a trigger mechanism adapted to release the energy stored in the propulsion element when a predetermined force or pressure is reached or after a predetermined time interval or after a predetermined amount of movement of the energy extraction element, or after a predetermined number of bounces on the trampoline. 25
9. A projectile launcher according to any preceding claim, in which the projectile launcher is arranged to launch a projectile comprising one of a ball, a rocket, a bubble, or a jet of fluid. 30
10. A trampoline in combination with a projectile launcher for launching a projectile, the projectile launcher including a propulsion element adapted to provide a motive force to propel a projectile and an energy extraction element connected to the trampoline and adapted to extract energy from the action of a user bouncing on the trampoline to provide power to the propulsion element. 35
11. A combination according to claim 10, in which the projectile launcher includes a hopper for guiding projectiles into the projectile launcher for propulsion by the propulsion element and wherein the hopper may be adapted to store more than one projectile and feed the projectiles into the projectile launcher one at a time. 40
12. A combination according to claim 10 or 11, in which the trampoline is at least partially surrounded by a screen assembly that at least partially encloses a region above the jumping mat and the hopper is accessible to receive projectiles through a projectile return aperture in the screen assembly. 45
13. A combination according to claim 12, in which the projectile return aperture is located beneath the projectile launcher and a projectile lifting mechanism is connected between the projectile return aperture and the hopper, the projectile lifting mechanism arranged to lift the projectile to the hopper and optionally the projectile lifting mechanism is powered by the energy extraction element or a second energy extraction element. 50
14. A combination according to claim 10, in which the projectile launcher comprises an aiming mechanism so that the user can direct the projectiles to a particular location. 55
15. A kit of parts comprising a trampoline and a projectile launcher as defined in any of claims 1 to 9.

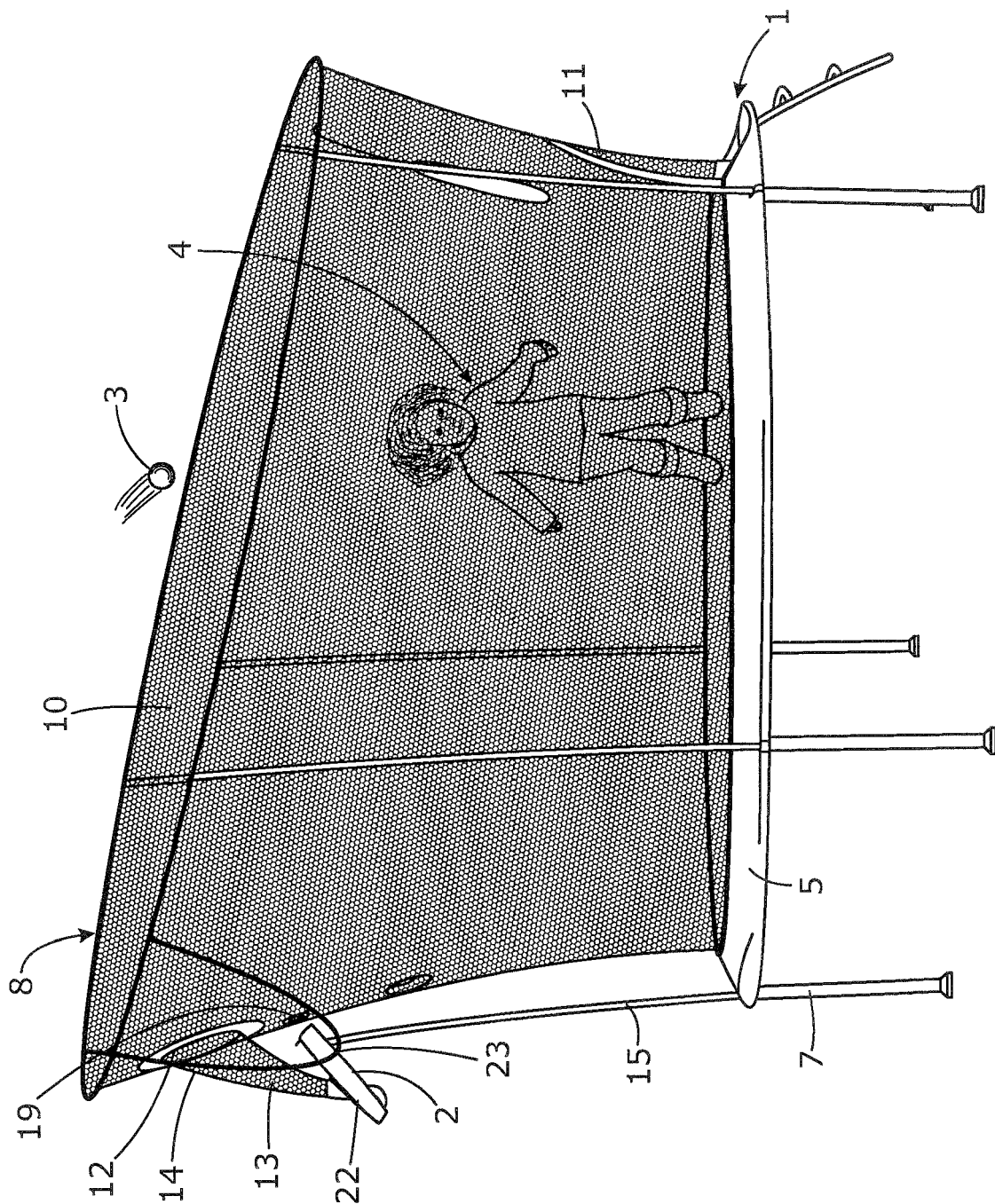


Fig. 1

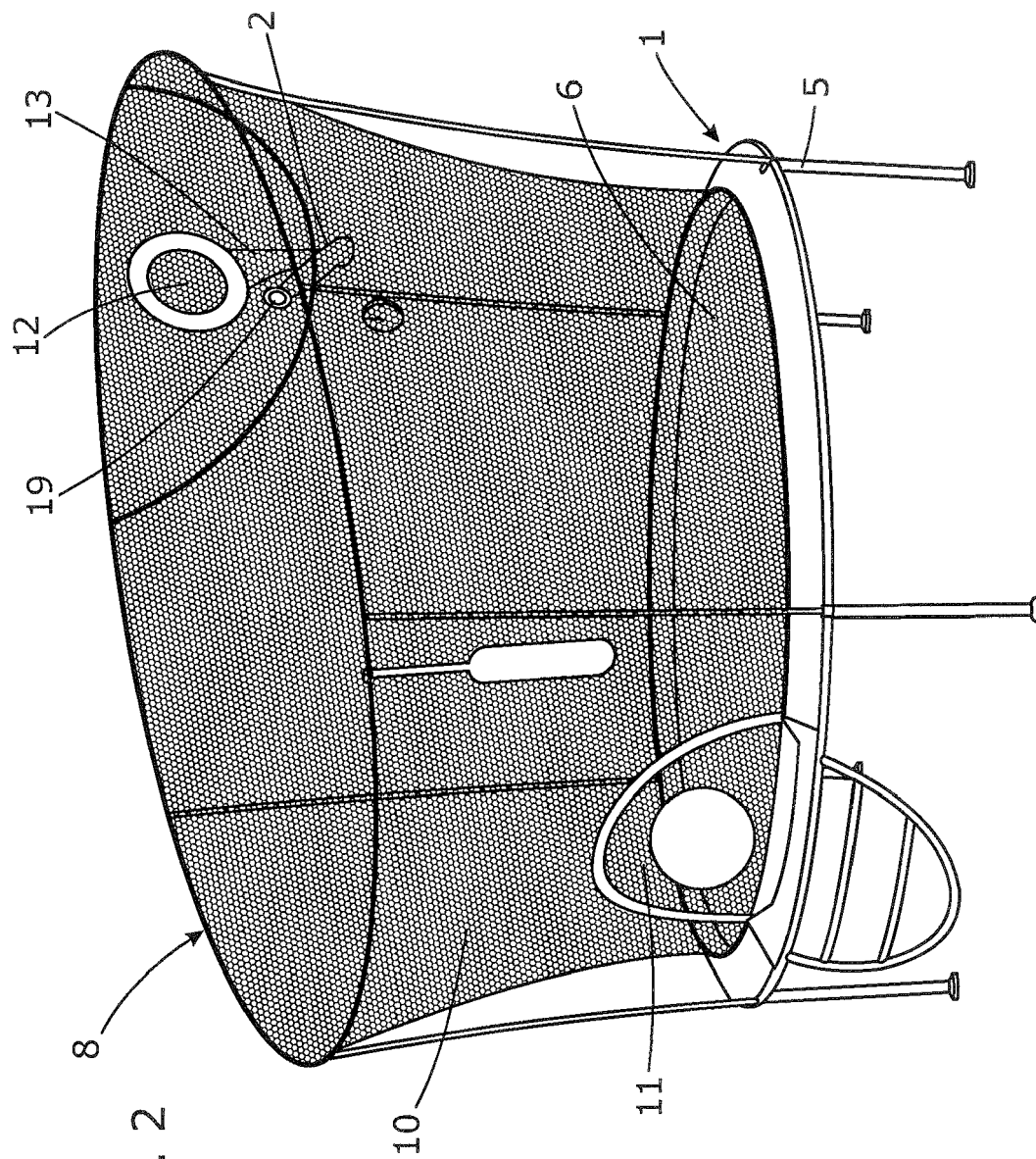
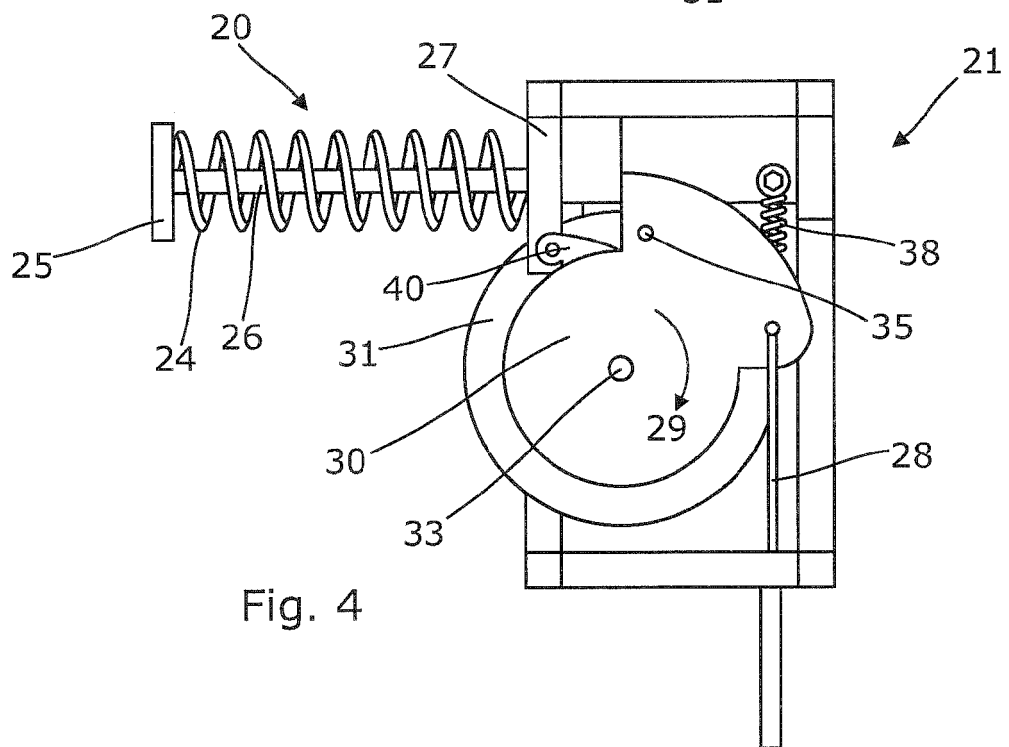
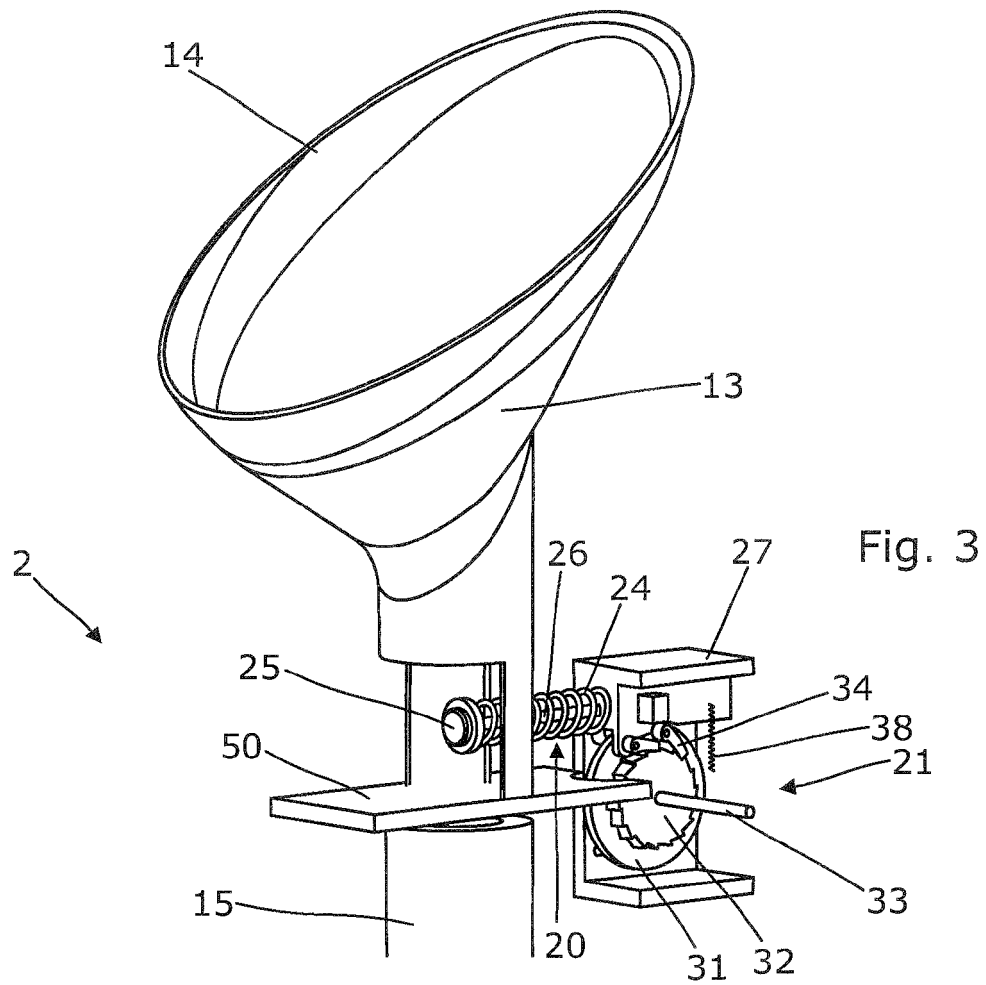


Fig. 2



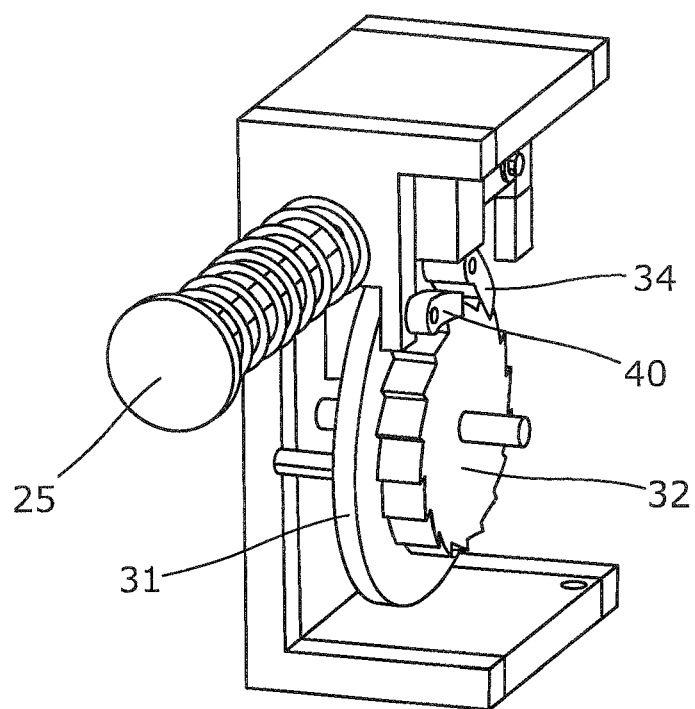


Fig. 5

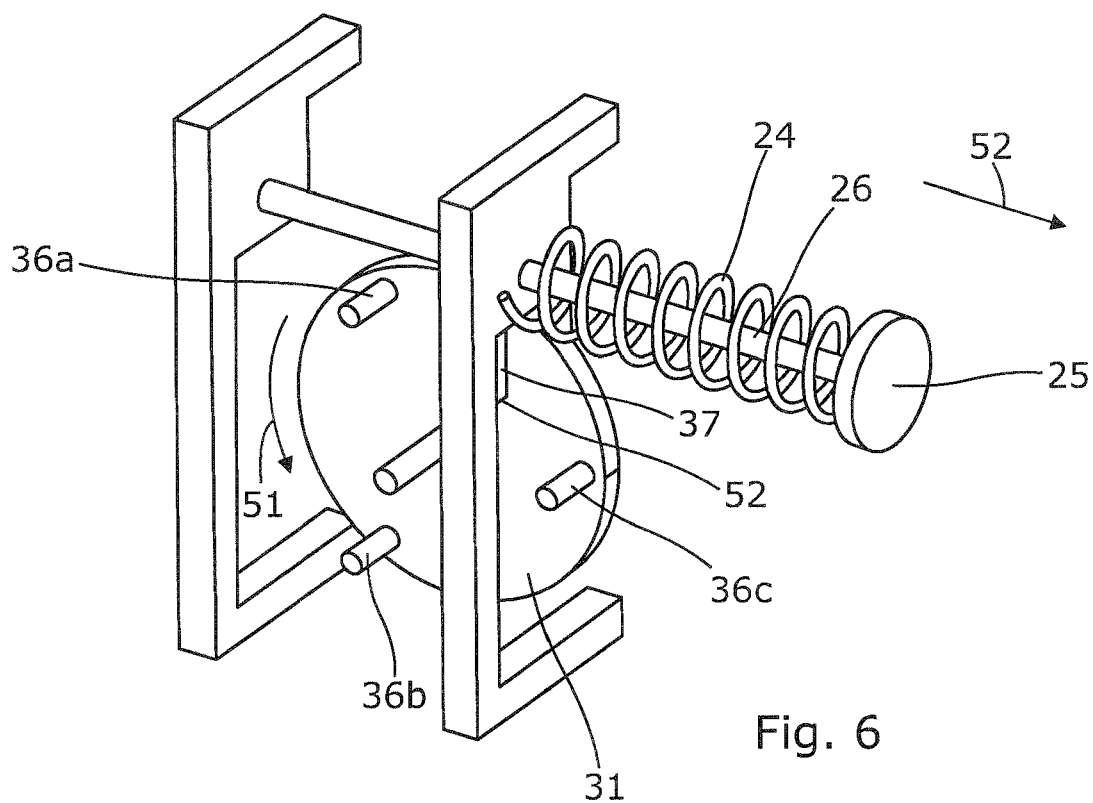


Fig. 6

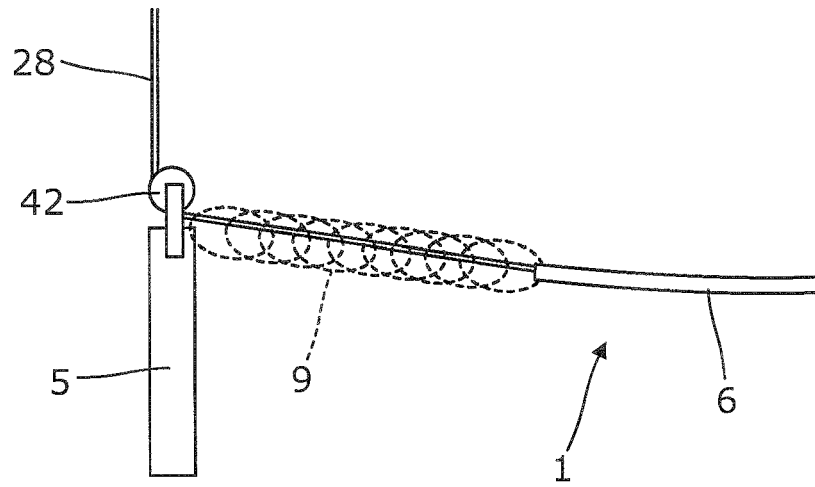


Fig. 7

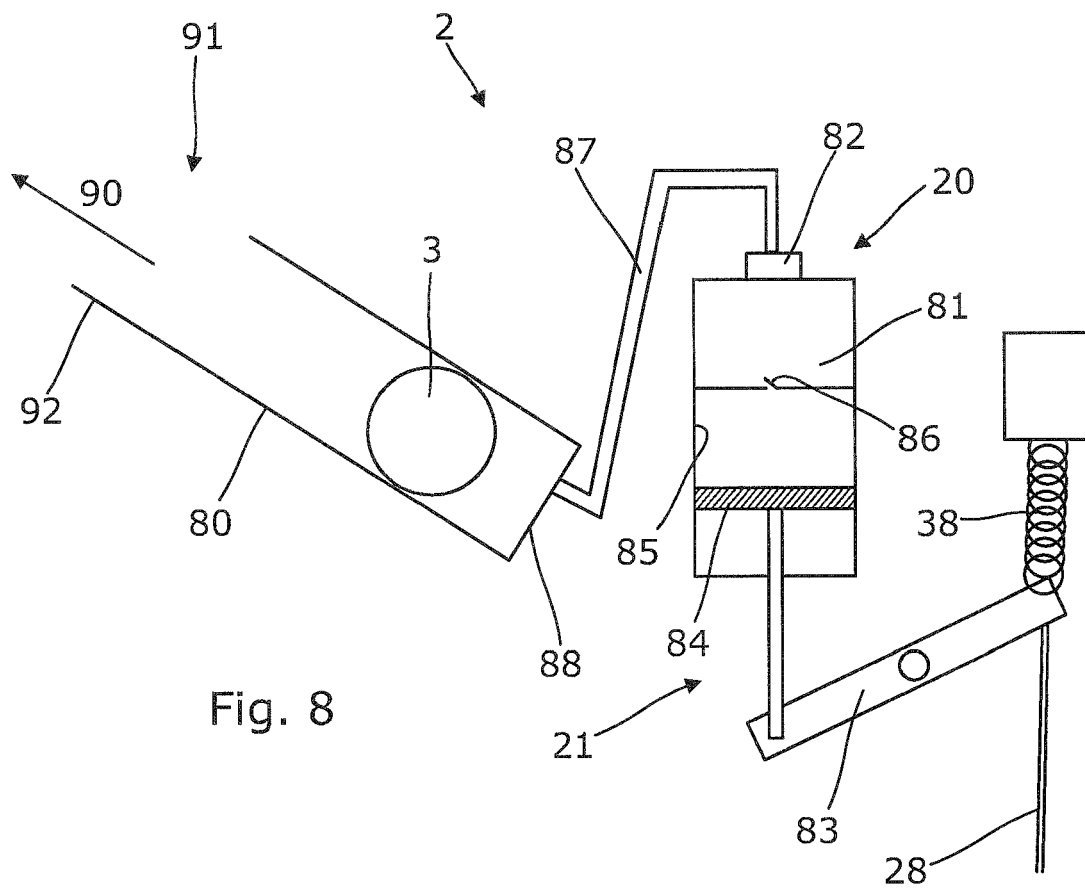


Fig. 8

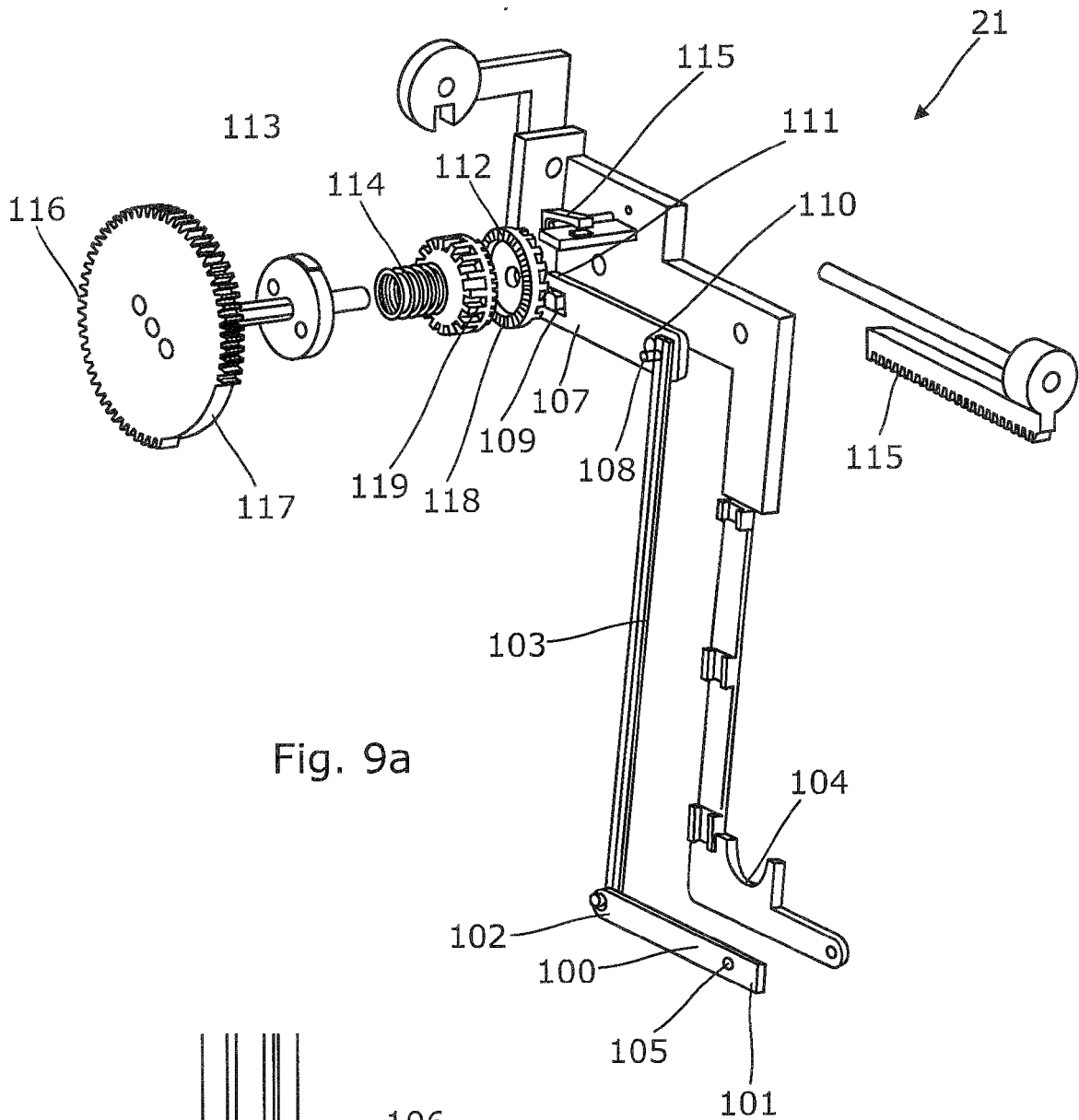


Fig. 9a

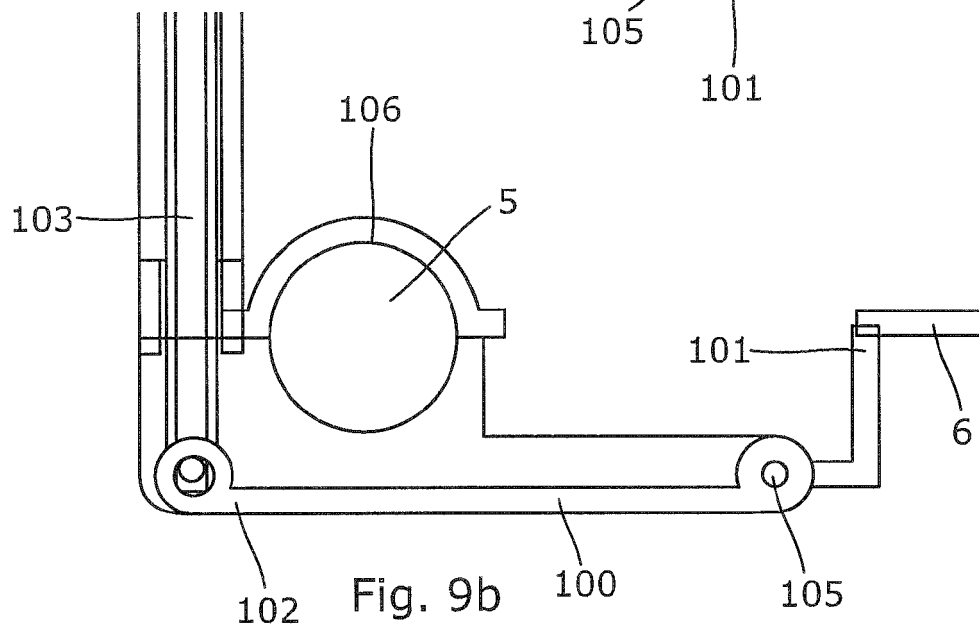


Fig. 9b



EUROPEAN SEARCH REPORT

Application Number
EP 11 17 3111

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		28 September 2011	Millward, Richard
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			

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