(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 October 2006 (19.10.2006)

PCT

(10) International Publication Number
WO 2006/110764 A1

(51) International Patent Classification:
A61B 5/103 (2006.01)

(21) International Application Number:
PCT/US2006/013510

(22) International Filing Date: 11 April 2006 (11.04.2006)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/670,084 11 April 2005 (11.04.2005) US
60/719,523 22 September 2005 (22.09.2005) US

(71) Applicant: **FALL PREVENTION TECHNOLOGIES, LLC.** [US/US]; d/b/a Balanceback, 2300 NW Corporate Blvd., Suite 141, Boca Raton, FL 33431 (US).

(72) Inventors: **KNECHT, Stephen, M.**; 14075 SW 72nd Court, Miami, FL 33158 (US). **MAK, Patrick**; AVC Medical Technology 6/F, Enterprise Square Three, 39 Wang Chiu Road, Kowloon Bay (HK). **CHAN, Scott**; AVC Medical Technology 6/F, Enterprise Square Three, 39 Wang Chiu Road, Kowloon Bay (HK). **CHEUNG, Leo**; AVC Medical Technology 6/F, Enterprise Square Three, 39 Wang Chiu Road, Kowloon Bay (HK).

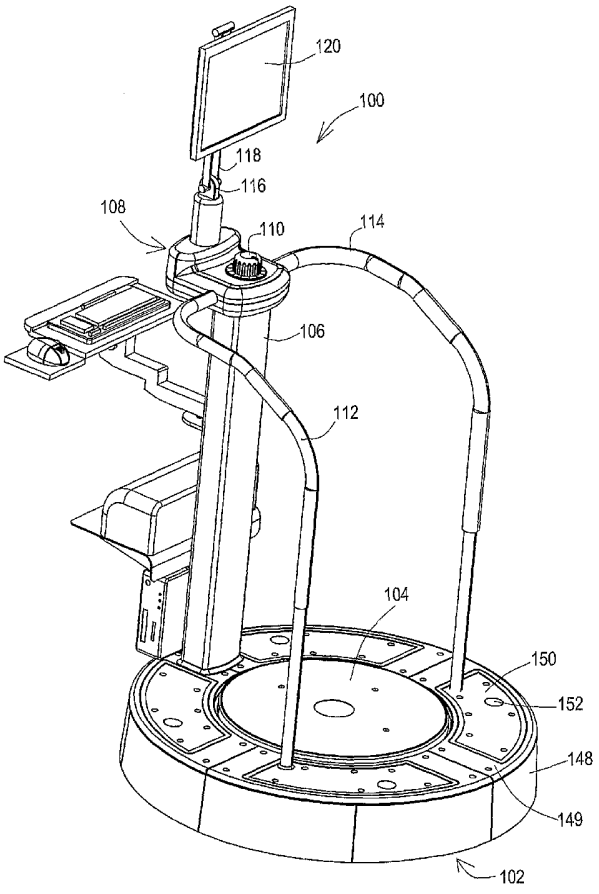
(74) Agent: **WITHERS, James, D.**; Withers & Keys, LLC, P.O. Box 2049, McDonough, GA 30253 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI,

[Continued on next page]

(54) Title: POSTURAL STABILITY PLATFORM



(57) Abstract: Postural stability platforms include at least one movement resistant element Fixed to a base and coupled to a plate. The plate is movable relative to the base but the movement resistant elements resist movement of the plate. Accordingly, subjects standing upon the plate are provided a degree of stability. The movement resistant elements may include springs, hydraulic cylinders, pneumatic cylinders, electromagnetic solenoids, and the like. Furthermore, in certain instances, the degree of resistance offered by a movement resistant element may be adjusted, such as by operation of a valve, so that the stability of the plate upon which the subject stands may vary depending upon the needs of the subject.

WO 2006/110764 A1

FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

POSTURAL STABILITY PLATFORM

RELATED APPLICATIONS

The present application claims priority to U.S. Provisional Application 60/670,084, filed on April 11, 2005, and entitled BALANCE AND VESTIBULAR DISORDER DIAGNOSIS AND REHABILITATION, which is incorporated herein by reference. The present application also claims priority to U.S. Provisional Application 60/719,523, filed on September 22, 2005, and entitled BALANCE AND VESTIBULAR DISORDER DIAGNOSIS AND REHABILITATION, which is also incorporated herein by reference.

TECHNICAL FIELD

The present application is related to postural stability. More particularly, the present application is related to platforms for assessing and/or rehabilitating postural stability.

BACKGROUND

For various reasons, subjects may have the need to assess and/or rehabilitate their balance. For example, professional athletes may wish to improve their balance in order to improve their performance in their chosen sport. As another example, subjects suffering from medical conditions such as vestibular, orthopedic, neuromuscular, or neurological disorders may improve their medical condition through balance assessment and rehabilitation.

Attempts have been made to manufacture postural stability platforms. However, these platforms may have drawbacks. For example, these platforms include a plate upon which the subject stands. This plate is suspended by an air bladder that is inflated and deflated by an air compressor. Among other problems that may arise, the air bladder and the air compressor are subject to malfunctions or failure. Furthermore, the support provided by the air bladder may be less than ideal.

SUMMARY

Embodiments of the present invention address these issues and others by providing stability platforms that utilize one or more movement resistant elements such as hydraulic cylinders and/or springs to provide stability to the plate upon which the subject stands. Furthermore, in certain embodiments the degree of resistance to movement offered by the movement resistant elements is controllable, such as by a control knob that controls a position of a valve or other restrictive element that alters the resistance to movement.

One embodiment is a postural stability platform that includes a base and a plurality of movement resistant elements fixed to the base. The postural stability platform further includes a rigid plate coupled to the movement resistant elements and pivotally coupled to the base such that the movement resistant elements resist movement of the plate relative to the base.

Another embodiment is a stability platform that includes a base and at least one movement resistant element fixed to the base, the at least one movement resistant element containing a flowing substance. The postural stability platform further includes a rigid plate coupled to the at least one movement resistant element and movably coupled to the base such that the movement resistant elements resist movement of the plate relative to the base. The postural stability platform also includes a valve having adjustable positions and being in fluid communication with the at least one movement resistant element such that the position of the valve controls the degree of resistance created by the at least one movement resistant element.

Another embodiment is a postural stability platform that includes a base and a rigid plate pivotally coupled to the base. The postural stability platform further includes at least one movement resistant element fixed to the base, the at least one movement resistant element having a shaft that is pivotally coupled to the rigid plate
such that the movement resistant element resists movement of the plate relative to the base.

DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a front perspective view of one embodiment of a stability platform.

FIG. 2 shows a rear perspective view of one embodiment of a stability platform.

FIG. 3 shows an exploded view of a center hub of one embodiment.

FIG. 4 shows a partially exploded view of a base of one embodiment.

FIG. 5 shows an exploded view of a cylinder head of the one embodiment.

FIG. 6 shows a cross-sectional view of the cylinder head of one embodiment.

FIG. 7 shows a cross-sectional view of a center post of one embodiment

FIG. 8 shows an exploded view of a valve control system of one embodiment.

FIG. 9 shows a schematic of a hydraulic system of one embodiment.

DETAILED DESCRIPTION

Embodiments of postural stability platforms provide one or more movement resistant elements to provide support for the subject standing on a balance plate of the platform. The one or more movement resistant elements may be cylinders that include shafts coupled to the balance plate. In certain embodiments, multiple movement resistant elements are present to provide stability in a number of directions of movement of the balance plate. In certain embodiments,

one or more adjustable valves are present so that the adjustment to the valve alters the degree of resistance to movement.

FIGs. 1 and 2 show one embodiment of a postural stability platform 100. The platform 100 of this example includes many external features. The platform 100 includes a base assembly 102 that has a balance plate 104 coupled thereto. The balance plate 104 is movable relative to the base assembly 102 by the balance plate 104 having a pivot point at or near its center. The details of the pivot point of the balance plate 104 are discussed in more detail below. The balance plate 104 may include a non-skid sheet to prevent subjects from slipping. An example of such a non-skid sheet is the Safety- Walk® model 370 medium grade non-skid sheet by 3M Co. of St. Paul, Minnesota. The balance plate 104 of this example may be made of various rigid materials, such as metal, plastic such as acrylonitrile butadiene styrene (ABS), wood, and so forth. The size of the balance plate 104 is a matter of design choice but the diameter should exceed the largest expected foot size so that the foot of a subject can be entirely located atop the balance plate 104.

The base assembly 102 of this particular example includes various other features as well, such as individual sections 148, top cover plates 149, non-skid sheets 150 applied to the top cover plates 149, and removable plugs 152. The individual sections 148 allow for the base to be easily disassembled into pieces, transported, and reassembled. These individual sections 148 of this example may be made of similar rigid materials to the balance plate 104. The top cover plates 149 of this example, which may of similar materials to the sections 148, overlap between the individual sections to help hold the sections together. The non-skid sheet 150 may be included so that a subject does not slip when stepping onto and off of the base assembly 102. The plugs 152 may be included to plug holes provided in the top cover plates 149. The plugs 152 may be removed so that caster wheel assemblies can be accessed within the base assembly 102 in order to lower or raise the caster wheel assemblies and either mobilize or immobilize the stability platform 100.

To provide support, a member 106 is included that is mounted to the base assembly 102 and extends vertically. The member 106 of this example may be constructed of a rigid material, such as steel or wood, and is attached within the base assembly 102 to a rigid base discussed below. The member 106 provides a stable point upon which left and right support rails 112, 114 can attach. The support rails 112, 114 attach to the base assembly 102 and then extend vertically to attach to a hub 108 mounted atop the member 106. The support rails 112, 114 may be made of various rigid materials such as metal or wood, and these support rails may include a soft covering such as foam rubber, neoprene, etc. to provide a comfortable hand-hold for a subject to

use when stepping onto and off of the base assembly 102 and when steadying oneself while standing on the balance plate 104.

In this example, the hub 108 acts as a point of attachment for the support rails 112, 114 and also for a display mast 118. The hub 108 may be constructed of a rigid material such as metal, wood and so forth and may have a shell made of ABS or other plastics or similar materials. A mounting bracket 116 is attached to the hub to allow the display mast 118 to be mounted in a movable relationship with the hub 108. In this example, the mounting bracket 116 swivels within a hole 138 (shown in FIG. 3) of the hub 108. Furthermore, the bracket 116 has the ability to rotate forward and backward relative to the hub 106. Thus, a video display device 120, such as a liquid crystal display (LCD) screen, can be swiveled to be viewed from the front side or the rear side of the platform 100 and can be rotated forward or backward to improve the angle of viewing. The video display device 120 is attached to the mast 120 via a mounting bracket 136, which also allows the vertical position of the video display device 120 to be altered to adapt to subjects of different heights.

The video display device 120 of this example may be used for various purposes. For example, information about the subject may be displayed. A graphical user interface may be displayed to allow an operator and/or the subject to make selections regarding performing various balance assessment or rehabilitation routines and so forth. Graphical displays may then be provided for viewing by the subject while balancing on the balance plate 104 to produce a response by the subject to thereby assess and/or rehabilitate the balance of the subject.

The stability platform 100 of this particular example is self-contained in that the display 136 as well as corresponding computer equipment is attached to the platform 100. The computer equipment of this embodiment includes a central processing unit (CPU) 124 held in place by a bracket 122 that is attached to the member 106. The CPU 124 is interconnected to the display device 120 to produce the visual displays for the operator and subject to view. The CPU 124 is also connected to a printer 128 resting on a shelf 126 that is attached to the member 106. The printer 128 can be used to print information about the subject and the assessment and/or rehabilitation session.

The CPU 124 is also connected to input devices such as a keyboard 132 and mouse 134 that both rest on a shelf 130 that is attached to the member 106. The keyboard 132 and mouse 134 allows the operator and/or subject to interact with the graphical user interface. Other interface devices are applicable as well, such as remote controls that enables the operator to stand at a distance from the platform and also stand on the front side of the platform so that both the operator and the subject can simultaneously view the display device 120.

The CPU 124 may also be connected to a tilt sensor that is mounted to the balance plate 102. The tilt sensor is discussed in more detail below. However, the CPU 124 may receive data from the tilt sensor that specifies the attitude of the balance plate 104 such that the CPU may monitor the movement of the balance plate 104. Thus, the subject may be given visual feedback of the movement of the balance plate 104 via the display device 120 and this assessment and/or rehabilitation data may be stored for later review or comparison.

In order to accommodate subjects of varying degrees of balance control, the platform 100 of this embodiment includes a mechanism for controlling how stable the balance plate 104 is. For a subject with very poor balance, it is likely necessary to assist the subject by providing a significant amount of stability to the balance plate 104 so that the balance plate 104 does not make large and sudden changes in position that could lead to ineffective assessment and/or rehabilitation sessions.

The mechanism of this example includes a control know 110 mounted upon the hub 108. As shown in FIG. 3, a center rod 140 passes up through the bottom of the hub 108. This center rod 140 extends down the member 106 and into the base where it is then connected to a gear assembly as discussed below. At the hub 108, the center rod 140 has a pin 141 running perpendicularly through it, and a metal insert 142 fits over the rod 140 and couples to the pin 141. A spring 146 and ball 145 are positioned between the metal insert 142 and a plate 139 having holes 143. The knob 110 fits over the metal insert 142 and thereby is coupled to the center rod 140 such that rotation of the knob 110 results in rotation of the center rod 140.

As discussed below, there may be various stability settings that can be selected by the knob 110. To provide for these settings, the spring-biased ball 145 rests in one of the holes 143 of the plate 139. Each hole 143 corresponds to a different stability setting as they center rod 140 must be rotated to move the ball 145 from one hole 143 to another. Markings may be provided on the plate 139 to illustrate the different settings, such as 0-11 plus a lock as the 12^{th} position. Zero indicates a free balance plate 104 having the least stability. The lock at the 12^{th} position indicates fixed balance plate 104 having complete stability for purposes of stepping onto and off of the balance plate 104.

As shown in FIG. 4, the base assembly 102 includes the individual sections 148, each having an internal support structure 154 that includes holes for receiving the member 106 and for allowing the caster wheel assemblies 174 to be accessed. The torus-like shape of sections 148 rests upon and is fixed to a base plate 156.

The base plate 156 includes holes 182 that allow caster wheels 180 to be raised and lowered to immobilize or mobile that platform 100. The caster wheels 180 are suspended by a bracket 176 mounted to the base plate 156 and having a bolt 178 threaded into it. The bolt 178

is coupled to the caster wheel 180 and extends up through the hole of section 148 to be exposed upon removal of the plug 152. Turning the bolt 178 causes the caster wheel 180 to be raised or lowered.

The stabilization mechanism of this example also includes a set of movement resistant elements that are coupled to the base plate 156 and to the balance plate 104. The movement resistant elements may be of many forms. Some examples include springs, hydraulic cylinders, pneumatic cylinders, electromagnetic solenoids, and the like. As shown in this example, there are a set of cylinders 170, 196, 197, and 198. These cylinders may be hydraulic or pneumatic in nature. In this example, each of these cylinders includes a cylinder head 172 which pivotally coupled each cylinder to a support plate 158. The balance plate 104 is then mounted to the support plate 158. Examples of the cylinder head 172 and a hydraulic system are discussed in more detail below.

The support plate is suspended over the base plate 156 by a center post 199 having a post head assembly 195 that also attached to the support plate 158. The center post 199 provides a ball and socket type of joint with the post head assembly 195 as seen in FIG. 7. Thus, the support plate 158, and hence the balance plate 104, is free to pivot over a 360 degree range relative to the base plate 156, and thus relative to the entire base assembly 102. While this example provides for a pivotal connection of the support plate 158 that allows for a full 360 degrees of movement, the pivotal connection could be limited such as to a single axis in other embodiments. For example, the pivotal connection could restrict movement to an anterior-posterior axis of rotation of the balance plate 104, or like wise, a left-right axis of rotation.

In addition to the cylinders 170, 196, 197, and 198, this example provides a spring assembly 160 including springs 166, 168 spaced about a peripheral set of rings 162, 164. The lower ring 164 is mounted via a bracket 165 to the base plate 156. The balance plate 104 rests upon the upper ring 162. The springs 166, 168 provide additional movement resistance but once compressed, assist the subject in returning the balance plate 104 to its neutral position.

As shown, the springs alternate in length with one spring 168 having a greater length that extends from the upper ring 162 to the lower ring 164 while adjacent rings 166 have a shorter length such that compression of the longer spring 168 must take place prior to the shorter adjacent springs 166 becoming a factor in the movement of the subject. One example of springs are made of stainless steel of a gauge of 2.6 millimeters, a pitch of 10 degrees, and an inside diameter of 47 millimeters. In one embodiment, the longer spring 168 is 170 millimeters in uncompressed length while the shorter spring 166 is 100 millimeters in uncompressed length.

Additional springs (not shown) may be included such as by placing them nearby the cylinders and coupling them to the base plate 158. Furthermore, skirts (not shown) may be

placed on the inside and/or outside of the rings 162, 164 to help support the springs hold them in place between the rings 162, 164.

In order to limit the amount of travel of the balance plate 104, posts 171 may be included and spaced about the periphery. These posts 171 limit the amount of movement possible by the support plate 158. A torus-like rubber bumper (not shown) may be positioned atop the posts 171 to provide 360 degrees of potential contact zones for the support plate 158.

A tilt sensor 105 is mounted to the support plate 158 so that data signals are produced that are indicative of the attitude of the balance plate 104 upon which the subject is standing. As discussed above, a computer system may receive these data signals and use them to provide immediate visual feedback to the subject, to compute characteristics of the balance capabilities of the subject, and to store for later review and analysis. The tilt sensor 105 may be of various types. One example is the SQ-SI-360DA Solid-State MEMS Inclinometer by Signal Quest of Lebanon, New Hampshire.

Returning to hydraulic system of this particular example, FIGs. 5 and 6 show a cylinder head assembly 172. The hydraulic cylinder 170 has a shaft 171 that extends vertically. Atop the shaft 171 sits a ball 186 and socket 184 joint that has external threads. A retaining member 188 has two concentric apertures of differing diameters. The smaller diameter aperture faces the cylinder 170 while the larger diameter aperture faces the support plate 158. The smaller diameter aperture has a diameter larger than that of the connection of the socket join to the shaft 171.

A first ball bearing 190 that has a diameter smaller than the large diameter aperture but larger than the small diameter aperture sits within the large diameter aperture of the retaining member 188. A ball bearing retaining disk 192 has a channel on each side and sits atop the first ball bearing 190 with the first ball bearing 190 being positioned within the bottom channel. A second ball bearing 194 sits atop the ball bearing retaining disk 192 and is positioned within the top channel. The retaining disk 192 has a threaded aperture that is tightened upon the threads of the socket 184. The retaining disk 192 also sits within the large diameter aperture of the retaining member 188. The retaining disk 192 has a smaller outside diameter than the diameter of the large aperture of the retaining member 188 which allows the retaining member 188 to have 360 degrees of movement relative to the shaft 171.

The retaining member 188 directly attaches to the support plate 158. In doing so, the top ball bearings 194 contact the underside of the support plate 158 while the bottom ball bearings contact the retaining member 188 to thereby maintain a snug coupling of the shaft 171 to the support plate 158 while also allowing the support plate 158 to change its angle relative to the shaft 171 without binding.

Returning to the mechanism for controlling the amount of stability provided to the balance plate 104, the connection of the center rod 140 to adjustable valves 202, 204 is shown in FIG. 8. The center rod 140 extends down the member 106 until it reaches the interior of the particular base section 148 upon which the member 106 is mounted. Within that particular base section 148, a gearbox assembly 201 is included to interconnect the center rod 140 to the adjustable valves 202, 204.

In this example, the gearbox includes a large drive gear 240 that is coupled to the center rod 140 via a ring 238, a washer 242, and a clamp 244. Two smaller diameter spur gears 234, 236 are coupled to the shafts of the valves 204, 202 respectively to thereby provide a gear amplification from the center rod 140 to the valves 202, 204. In one example, the large drive gear 240 has a diameter of 102 millimeters while the spur gears 234, 236 have a diameter of 18 millimeters. The center rod 140, valves 202, 204, gears 234, 236 are held in place by a support plate 232 and a mounting bracket 230 that is fixed to the base section 148.

Thus, rotation of the center rod 140 results in rotation of the control shafts of the valves 202, 204 to thereby change the degree to which the fluid channel of the valves 202, 204 is open. As the degree of opening increases, the resistance to the flow of fluid decreases. The resistance of the flow of the fluid provides the resistance to movement of the balance plate 104. As discussed above, in one embodiment the control knob 110 has 12 positions, ranging from completely open valves and a free balance plate 104 to completely closed valves and a fixed balance plate 104.

FIG. 9 illustrates the hydraulic configuration of this example. It will be appreciated that there are other configurations possible, involving either fewer or more cylinders, fewer or more valves, and so forth. For example, there could be a single cylinder used for the anterior-posterior axis and a single cylinder used for the left-right axis. It will also be appreciated that the routing of the fluid lines may be changed. As shown, the top chamber of a cylinder of one axis is in fluid communication with the top chamber of an opposite cylinder of the same axis, and the likewise for the bottom chambers. It will be appreciated that the top chamber of a cylinder could instead be in fluid communication with a bottom chamber of the same cylinder, especially where a single cylinder is used for a given axis.

In this particular example shown, the valve 202 is located in the fluid pathway between a bottom chamber 208 of cylinder 196 and bottom chamber 216 of cylinder 198. This provides resistance in the anterior-posterior axis of movement. Likewise, the valve 204 is located in the fluid pathway between a bottom chamber 218 of cylinder 197 and a bottom chamber 212 of cylinder 170. This provides resistance in the left-right axis of movement. The top chamber 206 of cylinder 196 is in fluid communication with the top chamber 214 of cylinder 198 while the

top chamber 220 of cylinder 197 is in fluid communication with the top chamber 210 of cylinder 170. The hydraulic hoses 229 that provide the fluid pathways are placed within the base assembly 102 and may be routed between the springs 166, 168.

This particular example also includes various three-way connectors 222, 224, 226, and 228 that have valves as well. These three-way connectors with valves allows the hydraulic fluid to be injected into the fluid channels to fill the hoses 229 each of the chambers of the cylinders 170, 196, 197, and 198. One example of such hydraulic fluid is the Tellus® 37 weight oil by Shell Oil Co., of Houston, Texas. Pressure gauges may be connected to these three-way connectors 222, 224, 226, and 228 with valves to pressurize the hydraulic system and to bleed away trapped air within the hydraulic system. For example, the hydraulic system may be pressurized to 150 pounds per square inch and then the balance plate 104 may be worked for about 30 minutes to bleed the air from the hydraulic system.

Examples of the components of the hydraulic system of FIG. 8 include model 160S-16SD25N50 hydraulic cylinders by TAIYO LTD of Osaka, Japan. Other examples include model FT1251 proportional valves and high pressure hoses by Kam Kee of Hong Kong.

While the invention has been particularly shown and described with reference to various embodiments thereof, it will be understood by those skilled in the art that various other changes in the form and details may be made therein without departing from the spirit and scope of the invention

CLAIMS

What is claimed is:

1. A stability platform, comprising:

a base;

a plurality of movement resistant elements fixed to the base;

a rigid plate coupled to the movement resistant elements and pivotally coupled to the base such that the movement resistant elements resist movement of the plate relative to the base.

2. The stability platform of claim 1, wherein the plurality of movement resistant elements comprise cylinders.

3. The stability platform of claim 2, wherein the cylinders are hydraulic cylinders.

4. The stability platform of claim 3, wherein there are at least four hydraulic cylinders, a first hydraulic cylinder is coupled to a front portion of the plate, a second hydraulic cylinder is coupled to a rear portion of the plate, a third hydraulic cylinder is coupled to a left portion of the plate, and a fourth hydraulic cylinder is coupled to a right portion of the base.

5. The stability platform of claim 4, wherein a top chamber of the first hydraulic cylinder is hydraulically interconnected to a top chamber of the second hydraulic cylinder, a bottom chamber of the first hydraulic cylinder is hydraulically interconnected to a bottom chamber of the second hydraulic cylinder, a top chamber of the third hydraulic cylinder is hydraulically interconnected to a top chamber of the fourth hydraulic cylinder, a bottom chamber of the third hydraulic cylinder is hydraulically interconnected to a bottom chamber of the fourth hydraulic cylinder.

6. The stability platform of claim 5, further comprising:

a first valve disposed within the hydraulic interconnection of the first and second hydraulic cylinders; and

a second valve disposed within the hydraulic interconnection of the third and fourth hydraulic cylinders.

7. The stability platform of claim 6, further comprising:

a control mechanically interconnected to the first and second valves, wherein manipulation of the control adjusts the degree of opening of the first and second valves.

8. The stability platform of claim 1, further comprising:

a control interconnected to the plurality of movement resistant elements, wherein manipulation of the control adjusts the amount of resistance provided by the plurality of movement resistant elements.

9. The stability platform of claim 2, wherein the movement resistant elements further comprise springs spaced about the periphery of the plate.

10. The stability platform of claim 1, wherein the movement resistant elements comprise springs spaced about the periphery of the plate.

11. The stability platform, wherein the base comprises a step adjacent to the plate.

12. The stability platform of claim 1, further comprising a first vertically elongated member extending upward from the base.

13. The stability platform of claim 12, further comprising first and second rails extending upward from opposing sides of the base to a top portion of the first vertically elongated member.

14. The stability platform of claim 12, further comprising:

a hub fixed to the top of the first vertically elongated member; and

a second vertically elongated member extending upward from the top of the first vertically elongated member, the second vertically elongated member being rotatable about a longitudinal axis in relation to the hub.

15. The stability platform of claim 14, further comprising:

a control disposed on the hub and interconnected to the plurality of movement resistant elements, wherein manipulation of the control adjusts the amount of resistance provided by the plurality of movement resistant elements.

16. The stability platform of claim 12, further comprising at least one shelf fixed to the first vertically elongated member.

17. The stability platform of claim 16, further comprising:

a tilt sensor coupled to the plate; and

a computer located on the at least one shelf, the computer being in electrical communication with the tilt sensor.

18. The stability platform of claim 1, wherein each movement resistant element includes a shaft with a pivotal connection to the plate.

19. The stability platform of claim 18, wherein the pivotal connection comprises:

a retaining member having a first aperture of a first diameter and having a second aperture of a second diameter that is greater than the first diameter, the apertures being concentric, the shaft of the movement resistant element extending through the first and second apertures;

first and second ball bearings; and

a bearing retaining disk having a disk diameter less than the second diameter and larger than the first diameter, the retaining disk having a channel on each side with the first ball bearing seated in one channel of the retaining disk and with the second ball bearing seated in the other channel of the retaining disk, the retaining disk being disposed within the second aperture and being movable within the second aperture, the retaining disk having a ball and socket joint wherein a socket portion of the ball and socket joint is fixed relative to the retaining disk while the ball portion pivots relative to the socket, the ball portion being affixed to the shaft of the movement resistant element.

20. A stability platform, comprising:

a base;

at least one movement resistant element fixed to the base, the at least one movement resistant element containing a flowing substance;

a rigid plate coupled to the at least one movement resistant element and pivotally coupled to the base such that the movement resistant elements resist movement of the plate relative to the base; and

a valve having adjustable positions and being in fluid communication with the at least one movement resistant element such that the position of the valve controls the degree of resistance created by the at least one movement resistant element.

21. The stability platform of claim 20, wherein the at least one movement resistant element is a hydraulic cylinder.

22. The stability platform of claim 20, further comprising a control knob mechanically coupled to the valve such that rotation of the control knob adjusts the position of the valve.

23. The stability platform of claim 20, further comprising a tilt sensor coupled to the plate.

24. The stability platform of claim 20, wherein the at least one movement resistant element has a shaft that has a pivotal connection to the plate.

25. The stability platform of claim 24, wherein the pivotal connection comprises:

a retaining member having a first aperture of a first diameter and having a second aperture of a second diameter that is greater than the first diameter, the apertures being concentric, the shaft of the movement resistant element extending through the first and second apertures;

first and second ball bearings; and

a bearing retaining disk having a disk diameter less than the second diameter and larger than the first diameter, the retaining disk having a channel on each side with the first ball bearing seated in one channel of the retaining disk and with the second ball bearing seated in the other channel of the retaining disk, the retaining disk being disposed within the second aperture and being movable within the second aperture, the retaining disk having a ball and socket joint wherein a socket portion of the ball and socket joint is fixed relative to the retaining disk while the ball portion pivots relative to the socket, the ball portion being affixed to the shaft of the movement resistant element.

26. A stability platform, comprising:

a base;

a rigid plate pivotally coupled to the base;

at least one movement resistant element fixed to the base, the at least one movement resistant element having a shaft that has a pivotal connection to the rigid plate such that the movement resistant element resists movement of the plate relative to the base.

27. The stability platform of claim 26,

a valve having adjustable positions and being in fluid communication with the at least one movement resistant element such that the position of the valve controls the degree of resistance created by the at least one movement resistant element.

28. The stability platform of claim 26, wherein the pivotal connection comprises:

a retaining member having a first aperture of a first diameter and having a second aperture of a second diameter that is greater than the first diameter, the apertures being concentric, the shaft of the movement resistant element extending through the first and second apertures;

first and second ball bearings; and

a bearing retaining disk having a disk diameter less than the second diameter and larger than the first diameter, the retaining disk having a channel on each side with the first ball bearing seated in one channel of the retaining disk and with the second ball bearing seated in the other channel of the retaining disk, the retaining disk being disposed within the second aperture and being movable within the second aperture, the retaining disk having a ball and socket joint wherein a socket portion of the ball and socket joint is fixed relative to the retaining disk while the ball portion pivots relative to the socket, the ball portion being affixed to the shaft of the movement resistant element.

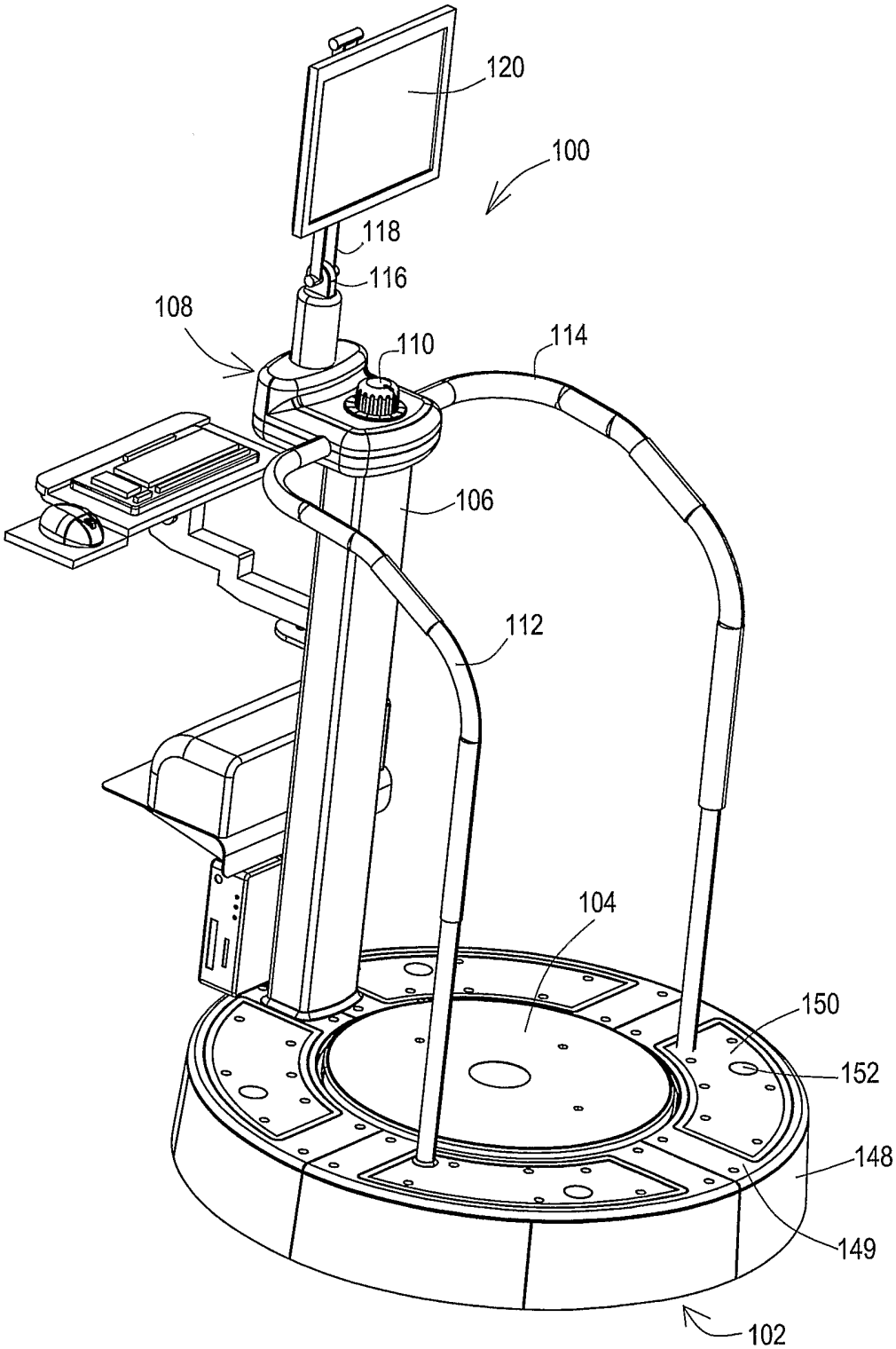


FIG. 1

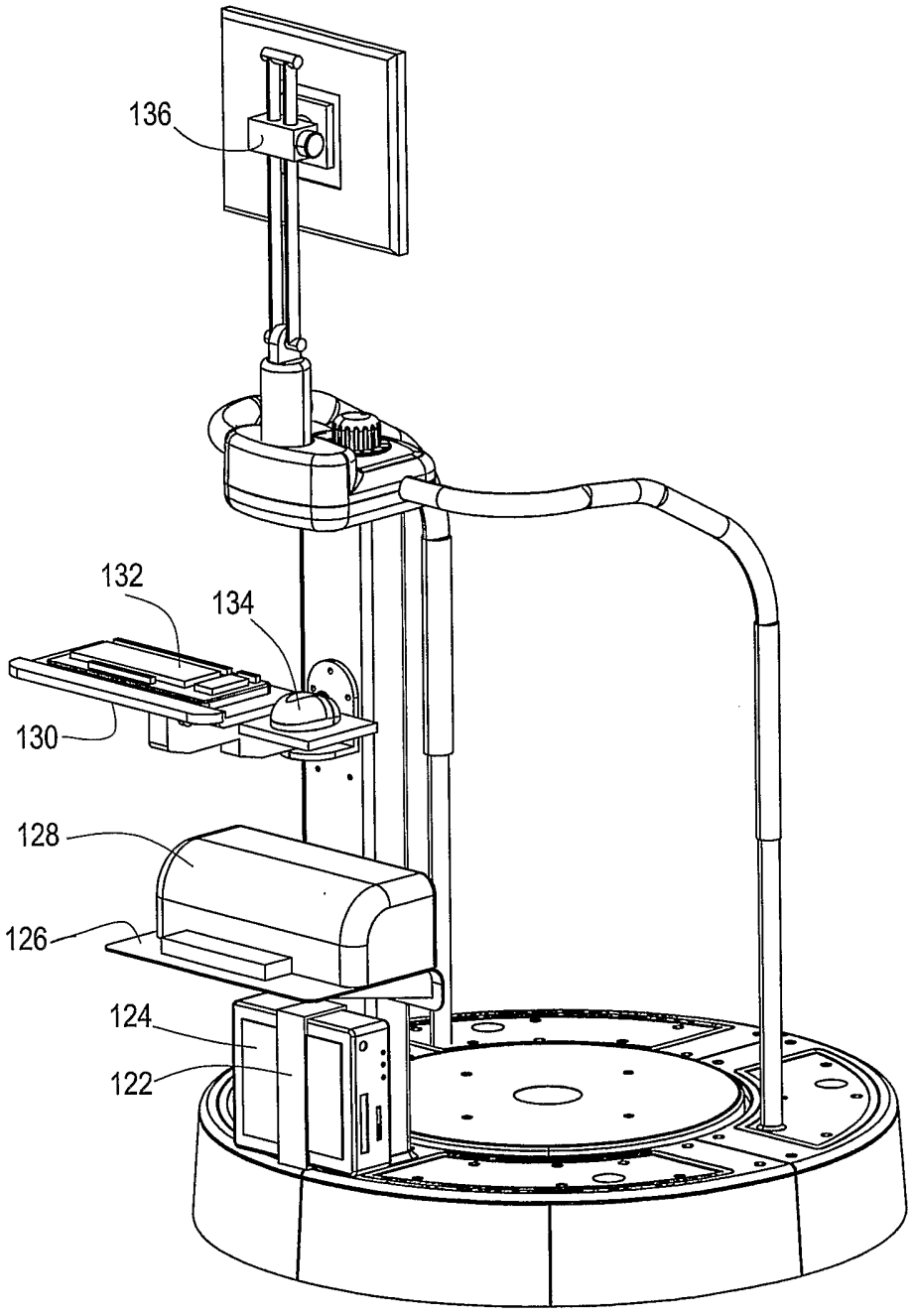


FIG. 2

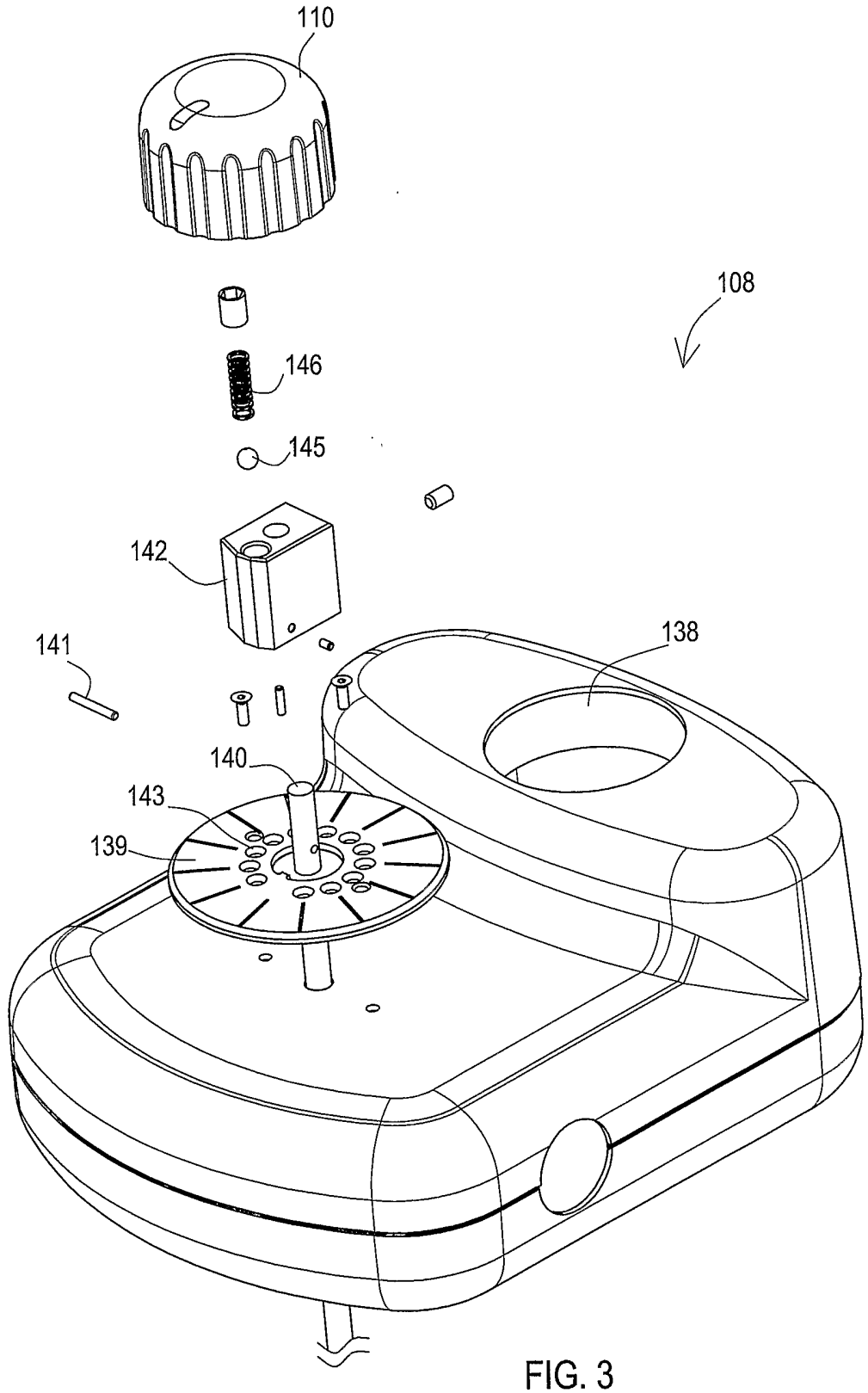


FIG. 3

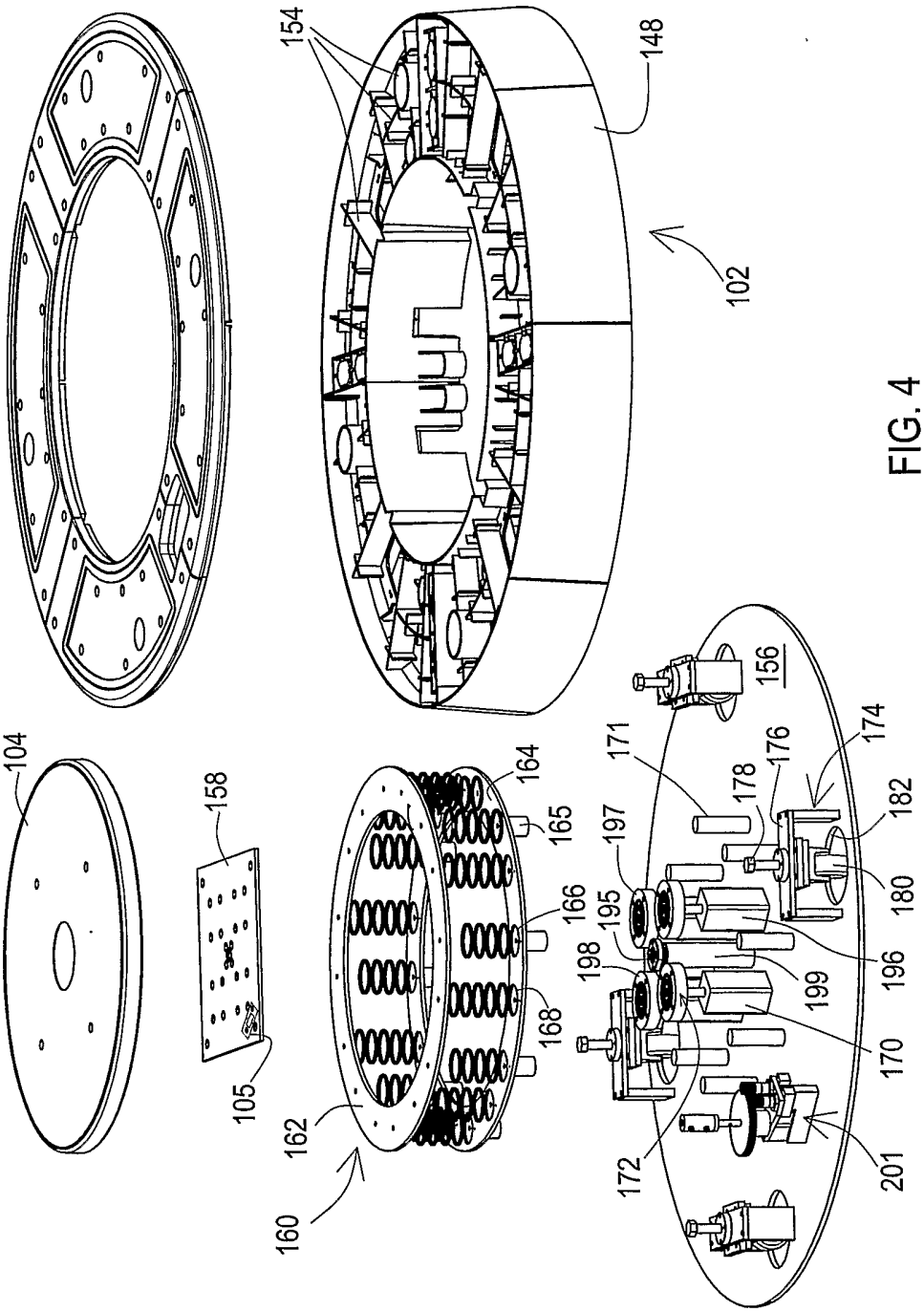

154
148
102
104
158
164
165
166
168
162
160
105
156
171
176
174
178
182
197
180
195
198
196
199
170
172
201

FIG. 4

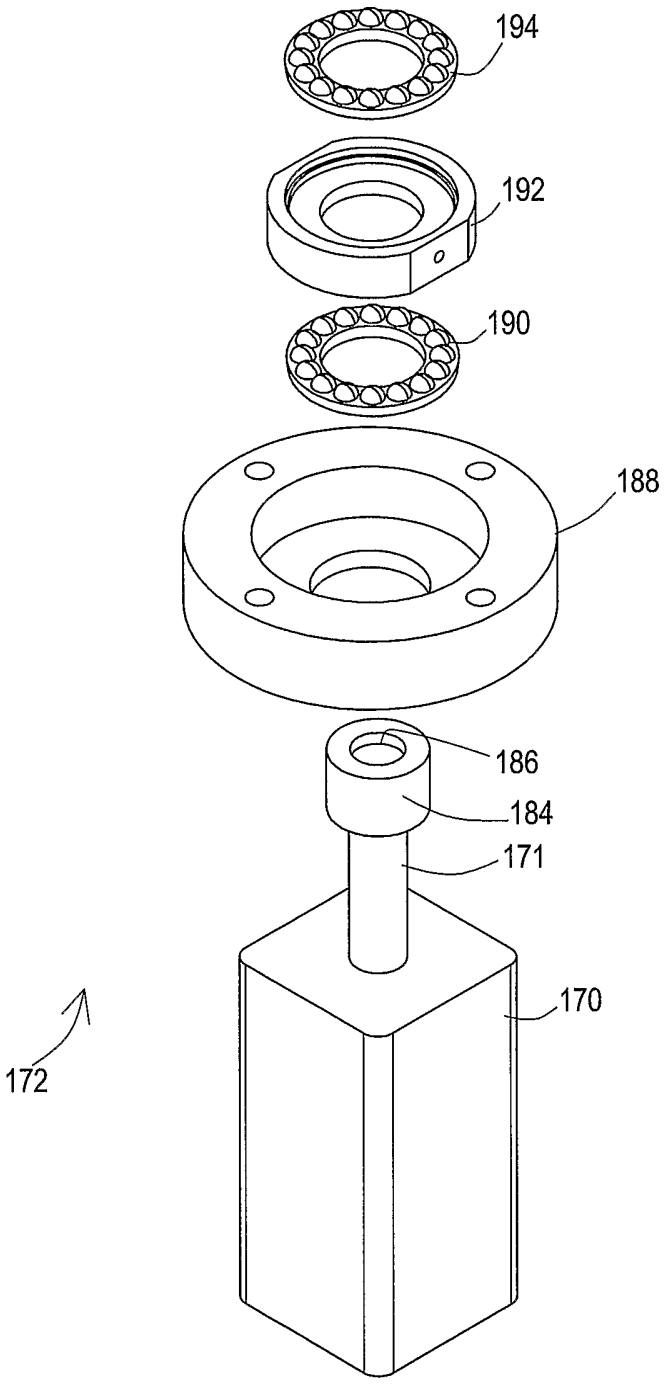


FIG. 5

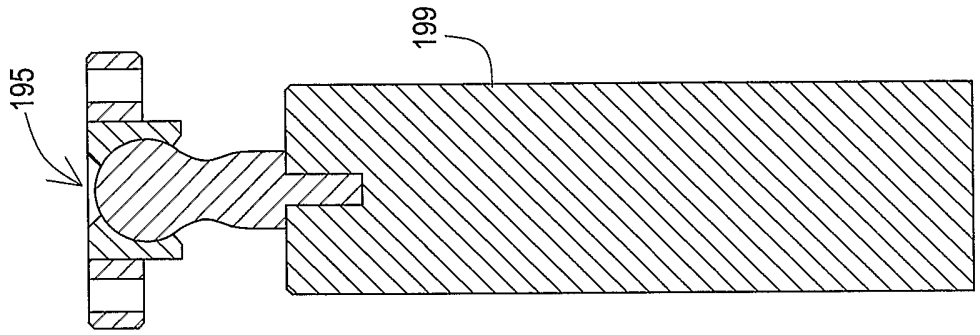


FIG. 7

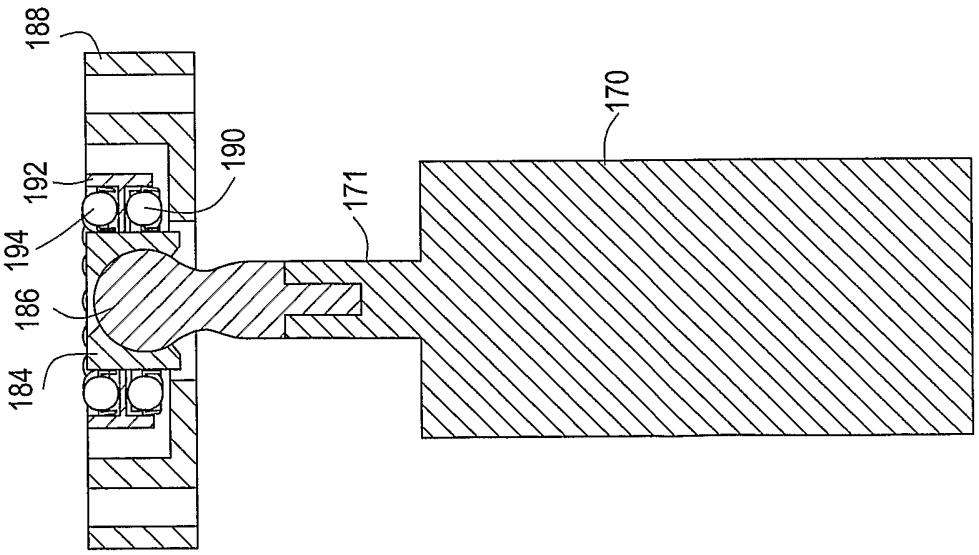


FIG. 6

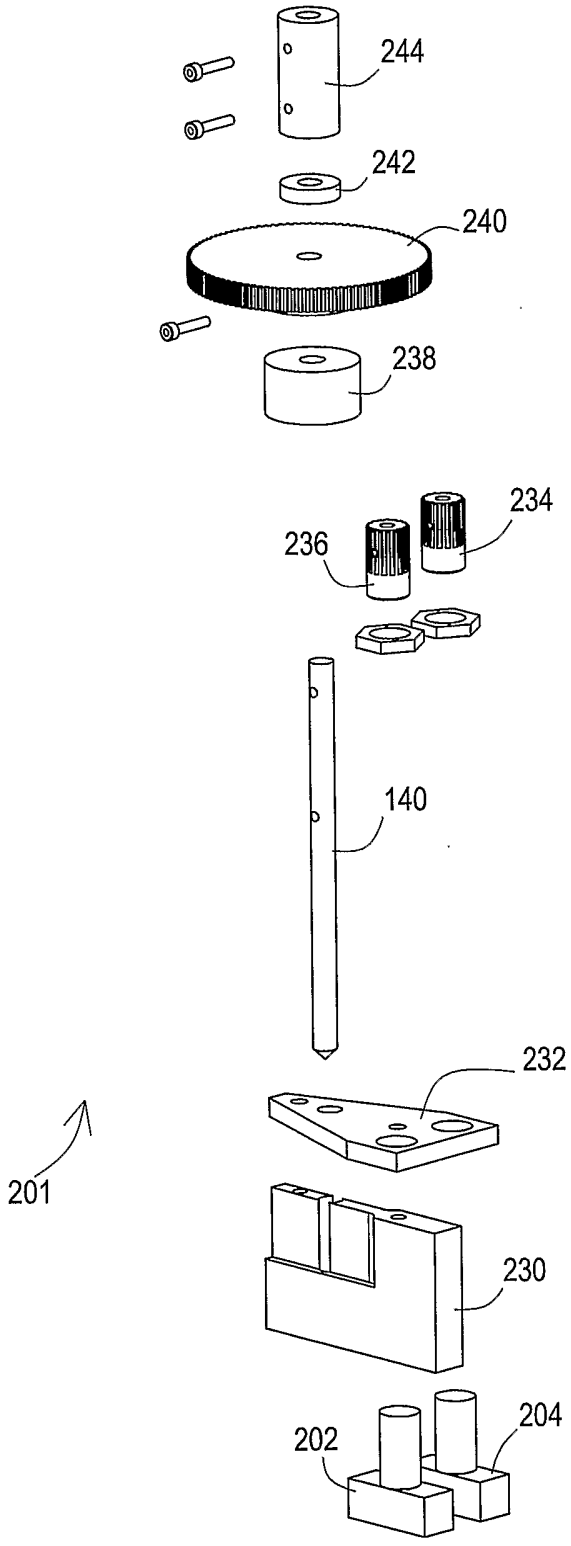


FIG. 8

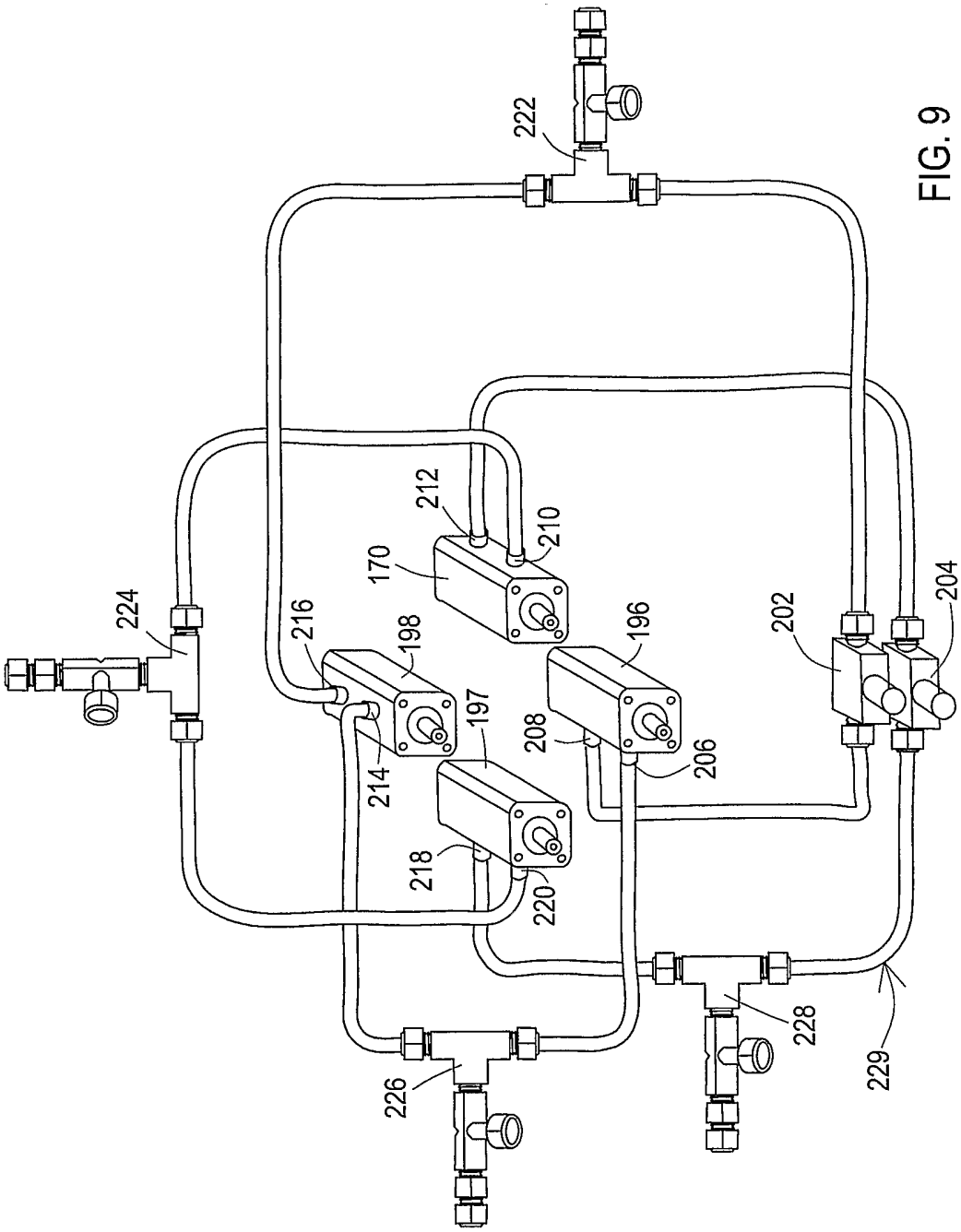

222
212
210
170
224
216
198
196
202
204
197
208
214
206
218
220
228
229
226

FIG. 9

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2006/013510

A. CLASSIFICATION OF SUBJECT MATTER
INV. A61B5/103

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A61B A63B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 195 02 838 A1 (OERTEL, ACHIM, DIPL.-ING. , 83026 ROSENHEIM, DE) 1 August 1996 (1996-08-01)	1-8,11, 18, 20-24, 26,27
Y	column 3, line 25 - column 6, line 56; figures	12-17
X	US 4 605 220 A (TROXEL ET AL) 12 August 1986 (1986-08-12)	1-4,8, 11,12, 18,26
A	column 2, line 46 - column 3, line 41	20,21,24
Y	US 5 080 109 A (ARME, JR. ET AL) 14 January 1992 (1992-01-14) column 3, line 13 - line 41; figures	12-17
X	DE 40 04 554 A1 (ABC COMPUTER GMBH, 8000 MUENCHEN, DE) 22 August 1991 (1991-08-22) the whole document	1,10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
25 July 2006	08/08/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Manschot, J

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/US2006/013510

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19502838 A1	01-08-1996	NONE	
US 4605220 A	12-08-1986	NONE	
US 5080109 A	14-01-1992	NONE	
DE 4004554 A1	22-08-1991	DE 9001739 U1	13-06-1991