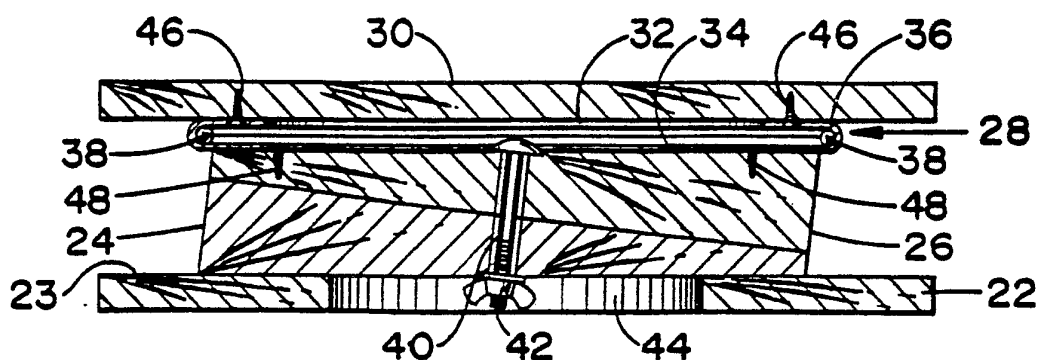




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(21) International Application Number: PCT/US86/02639 (22) International Filing Date: 3 December 1986 (03.12.86) (31) Priority Application Number: 806,652 (32) Priority Date: 6 December 1985 (06.12.85) (33) Priority Country: US (60) Parent Application or Grant (63) Related by Continuation US 806,652 (CIP) Filed on 6 December 1985 (06.12.85) (71)(72) Applicant and Inventor: HARTZ, Billy, J. [US/US]; 4016 Northeast 110th, Seattle, WA 98125 (US).		(74) Agent: GARRISON, David, L.; Garrison & Stratton, Suite 2100 Westin Building, 2001 Sixth Avenue, Seat- tle, WA 98121 (US). (81) Designated States: AT (European patent), AU, BE (Eu- ropean patent), CH (European patent), DE (Euro- pean patent), FR (European patent), GB (European patent), IT (European patent), JP, LU (European pa- tent), NL (European patent), SE (European patent), US. Published <i>Without international search report and to be repu- blished upon receipt of that report.</i>

(54) Title: TILTING ROTATIONAL RECREATIONAL DEVICE**(57) Abstract**

A tilting rotational recreational device which has a platform (30) on which the user stands, which platform (30) is freely rotatable upon a bearing (28). The angle of the platform (30) with respect to the horizontal may be adjusted so that a user standing or sitting on the platform (30) may induce rotational movement of the platform (30) easily by shifting his or her center of mass. One or more additional bearings placed internally in the device optionally provide random and unpredictable rotational movements of the platform (30), depending on the nature of the user's shift of mass. The device may be locked into a particular angle adjustment, and all internal parts may be held securely together to facilitate safe and reliable use.

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10 Title: TILTING ROTATIONAL RECREATIONAL DEVICE

TECHNICAL FIELD

15 This invention relates to the field of recreational devices and more particularly to motor skill oriented devices of the type using a rotationally mounted table upon which the user stands. More particularly this invention concerns a floor supported rotationally mounted platform
20 the rotational axis of which may be angled from the perpendicular so that the platform assumes an attitude not parallel to the floor or other surface supporting the device.

BACKGROUND ART

25 It is well known in prior devices to mount a platform as a support surface upon a bearing means so that the platform can rotate in a horizontal plane. The devices are used as exercise devices or playthings by a user standing
30 on the rotationally mounted platform by swinging his or her arms and other body parts so that a swivel motion occurs. These devices have been touted as providing exercise simulating downhill skiing and as a means to provide body conditioning helpful for the downhill skier.

35 While simulating some of the movements encountered in downhill skiing, all but one of the devices do not provide

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any simulation of the downhill attitude assumed by skis in use. When one practices with most of the prior art devices and then indulges in alpine or downhill skiing activities, the practice on the prior art device induces muscular and balancing actions which cause the skis to point uphill rather than down the fall line as is desired. It is theorized that the configuration of the prior art device, being horizontal, conditions the user's muscles so that a natural response upon encountering an inclined surface is to cause the skis to be pointed around to the horizontal attitude. While the reason for this response is not fully understood it is noted that in all but one of the prior art devices, locating or shifting body weight to a location eccentric to the axis of rotation of the device does not induce a rotational moment about the axis.

In the one prior art device in which a shifting of body weight to a location eccentric to the axis of the rotation of the device induces a rotational moment about the axis, the members of the device which effectuate the angling of the rotational axis from the perpendicular are not capable of being locked together during use of the device and thus the angular adjustment may slip and change, and the entire device can come apart during vigorous use.

None of the prior art devices contain more than one bearing means to introduce an element of unpredictability to the rotation of the platform.

DISCLOSURE OF INVENTION

The present invention differs from most of the prior art in that locating a weight eccentrically to the axis of rotation of the rotationally mounted platform of the invention causes a rotational moment to be applied to induce rotation of the platform and a user standing thereon.

The recreational device of this invention comprises a base member having means therein to mount a weight supporting bearing means which may be angled with respect to the horizontal. The bearing means carries a rotatable

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platform thereon and is adapted for rotation with respect to the base and may be angled so that the axis of rotation is non-vertical.

5 In a preferred embodiment of this invention this angle is variable so that a user may set the desired angle to suit his or her particular needs, be it for recreational gaming type use or serious exercise or in preparation for alpine or downhill skiing. Alternately, two or more users may set the angle needed and simultaneously use the
10 device. In another mode of operation two or more users may each simultaneously use individual devices and compete or cooperate in games and exercises.

The angle is set in the preferred embodiment by manipulating elements of the base means so that the mount
15 of the bearing is angled with respect to, but still in a weight supporting relationship with, the floor engaging lower surface of the base means. With the bearing and the platform mounted thereon thus angled, the device permits the user to induce rotational movement by deliberately
20 shifting body weight or center of mass to cause controlled rotation of both platform and user. Both the rate of rotation and whether or not the user performs complete rotations or swings or other indicia of performance are thus controllable by the user by merely shifting his center
25 of mass away from the axis of rotation. Individuals or partner-type activities can be undertaken as either games or exercise activities by using one or more of the rotational devices. The single bearing device used singly simulates the motions encountered in downhill skiing more
30 closely than having the device positioned with its rotational platform parallel to the support surface.

The structure of this invention also departs from prior art in which an eccentrically located weight brings about rotation of the platform and the user standing on it, in
35 that this invention is so constructed that the elements for changing the angle of the rotating platform may be easily manipulated to create new angles, but during use those elements may be locked into place and thereby any potentially dangerous vertical, lateral, or rotational

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displacement of the angle adjusting elements with respect to one other during use is prevented.

In addition, the structure of this invention departs from all known prior art in that one embodiment of the invention comprises one or more additional bearing means. This additional bearing means when unlocked and allowed free rotation makes possible a totally different kind of movement in a rotating recreational device, which movement is unpredictably variable and therefore recreationally very challenging.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a perspective view of the device of this invention in use.

Fig. 2 is a larger perspective view of one embodiment of this invention.

Fig. 3 is an exploded perspective view of the device shown in Fig. 2.

Fig. 4 is a cross sectional view of the apparatus shown in Fig. 2 taken along line 4-4 of Fig. 2.

Fig. 5 is a schematic side view of the apparatus shown in Fig. 2 with the base positioned in the horizontal platform mode.

Fig. 6 and 7 are views like Fig. 5 with the base elements rotated to various angular positions so that the platform is angled.

Fig. 8 is another embodiment of this invention.

Fig. 9 is another embodiment of this invention.

Fig. 10 is yet another embodiment.

Fig. 11 is a side view of the apparatus of Fig. 10 with the base elements rotated into the horizontal platform mode.

Fig. 12 is another side view of the apparatus shown in Fig. 10 with the base elements rotated into the maximum incline mode.

Fig. 13 is a cross sectional view of another embodiment of the invention which view is similarly derived as in Fig.

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4, with the addition of a second weight supporting bearing means.

Fig. 14 is an exploded perspective view of the angle adjusting means of another embodiment of the apparatus shown in Fig. 2.

Fig. 15 is an exploded perspective detail view of an alternate embodiment of the angle adjusting means of Figs. 14 and 2.

Fig. 16 is a schematic side view of another embodiment of the invention shown in Fig. 9.

Fig. 17a is an exploded perspective detail view of another embodiment of the invention.

Fig. 17b is a cross sectional detail view of the apparatus shown in Fig. 17a.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring specifically to the drawings, wherein like numerals indicate like parts, there is seen in Figs. 1-7 a first and preferred embodiment of this invention, which may be constructed of wooden, plastic, metal or other materials, shown resting on a support surface 20. Base plate 22 engages and is supported by surface 20 and has mounted upon its upper surface 23, a lower skew cut column member 24. Column member 24 engages and supports a superjacent upper skew cut column member 26 positioned for rotation upon the upper surface of lower skew cut column member 24. The two column members 24 and 26 are held together in an axially aligned relationship by bolt 40 secured by wingnut 42. Bolt 40 runs through coaxial bores in column members 24 and 26 which are sufficiently greater in diameter than the bolt, as shown in Fig. 4, that whenever wingnut 42 is loosened, column members 24 and 26 can be easily rotated with respect to each other so that the skew cut configuration enables the desired change in the inclination of the weight support surface of the device.

To permit the upper rotatable platform 30 to turn, a bearing mechanism 28 is attached to the upper surface of

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the upper skew cut column member 26 by fasteners 48. The fasteners 48 extend downwardly through lower bearing plate 34 which is thus firmly attached to the column member 26. Ball bearings 38 run in raceway 36 in a well known turntable or swivel type bearing structure. The upper bearing plate is supported upon the ball bearing 38 and carries platform 30 firmly attached thereto by fasteners 46. Base plate 22 has an axial aperture 44 to house and permit access to wingnut 42.

10 In the preferred embodiment a plurality of plywood cylindrical elements were first glued together in stacked fashion to form a cylinder approximately 12 inches in diameter and three inches thick. This cylinder was then cut along a plane which was not perpendicular to the axis of the cylinder. The resulting skew cut cylindrical sections were then reversed in their positions so that a smooth, uncut surface of each engaged the other. When assembled the cylindrical column sections 24 and 26 assume the slightly canted appearance as shown in the side views of the drawings. Of course, other materials may be used to construct the device, especially injection molded plastics.

20 In use the apparatus of this invention is first positioned on a support surface such as a floor or slab and the angular relationship between the base plate 22 and the platform 30 set. In the preferred embodiment shown in Figs. 1-7 the angular relationship is established by loosening the wingnut 42 and rotating upper skew cut column 26 with respect to lower skew cut column 24. When the desired inclination of platform 30 is achieved, wingnut 42 is tightened to hold the parts of the device firmly together and thus prevent any potentially dangerous or recreationally disruptive lateral, vertical, or rotational displacement of the column members relative to each other. The user then mounts the platform and by moving parts of her body so as to change her center of mass, causes the platform and the user to rotate, either partially or continuously. By timed movements, the user can accelerate or decelerate angular motion as desired.

In Figs. 8-12 and 16 there are shown several different embodiments of the invention, each having a different means for altering the angular relationship between the base plate 22 and the rotatable platform 30. In Fig. 8 a hinged structure is used in which a prop 50 is placed into one of several possible positions at various distances from hinge 52. The angle assumed by the rotatable platform 30 depends upon how close the prop is placed to the hinge.

Figure 9 shows a simple hinged structure for the means to set the angle of the platform 30. In this embodiment hinge 62 permits the platform to be tilted with respect to the base 22 with the hinged link 64 providing the support for the upper hinged portion 66 of the base, either at the lower position with link 64 positioned horizontally or in the steeply angled position with link 64 upright. In both the embodiment shown in Fig. 8 and in Fig. 9 the separate elements of the respective angle adjusting means are located in place during use by the weight of the user upon the rotational means, such that it is not possible to alter or change the angle of the rotating platform while the user is standing upon it.

Fig. 16 shows an alternate embodiment to the invention shown in Fig. 9. Both hinges 62 and 65 are spring loaded with a bias toward the closed position of the hinge. Upper hinged portion 66 of the base contains a depression into which the top part of hinged link 64 fits snugly such that even with relatively light weight users standing upon the rotating platform, the spring bias of the spring loaded hinges 65 and 62 and the snug fit of link 64 into hinge portion 66 additionally assures that there can be no displacement of the angle adjusting elements during use of the device. A fail safe elastic means 90 is also shown for the purpose of holding upper hinge portion 66 under tension against the resistance of hinge link 64 to base 22. Fig. 16 shows one additional hinged link 64' with spring loaded hinge 65' which is placed at a point intermediate hinge link 64 and hinge 62 in order to provide a variable means of adjusting the angle of the rotating platform in this embodiment of the invention.

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Another embodiment, shown in Figs. 10-12, uses pairs of inclined wedges which cooperate rotatively to set the angle of inclination of platform 70. In fig. 10 an end elevational view is shown in which the maximum inclination of platform 70 is achieved by having the pairs of inclined wedges 71 and 72 positioned parallel to wedges 73 and 74. Wedges 71 and 72 each rest on the floor and carry support ring 78, inclined with respect to the floor on their upper surface. Disc 80 fits inside ring 78 and rides on wedges 71 and 72, while carrying wedges 73 and 74 firmly attached to its upper surface. Wedges 73 and 74 may thus be rotated as a unit with respect to wedges 71 and 72. Wedges 73 and 74 have a turntable bearing attached to carry the rotatable platform 70. Thus by rotating the upper wedges 73 and 74 with respect to the lower wedges 71 and 72 the platform angle can be varied from that shown in Fig. 11 with the platform 70 in a substantially horizontal attitude to a maximum inclination of that shown in Fig. 12. In use it has been found that the maximum inclination for satisfactory operation of the device under normal operating conditions is approximately 20 degrees from the horizontal. However, for certain applications, such as for simulation and training in steep downhill or alpine skiing, a maximum inclination of about 30 degrees from the horizontal can be used.

An alternate embodiment of this invention utilizes a plurality of bearing means, at least one above and at least one below the means for adjusting the angle of the axis of the device. A detail of this embodiment showing a second bearing means 281 is contained in Fig. 13. In this more complex configuration an element of uncertainty is introduced in operation since the user will not know which bearing means will operate under any given motion so that the device is more difficult to operate and will require the development of skills in operation beyond that necessary to operate the device of Figs. 2-7. A locking means 282 is shown to hold stationary this second bearing means so that this embodiment may be operated at the user's option in the same manner as the preferred embodiment described above.

Figs. 14 and 15 contain details of the angle adjusting columns 24 and 26 not shown in previous figures. These details relate to an improved method of holding column members 24 and 26 together as a unit during use of the device. Fig. 14 shows the mating surfaces of members 24 and 26 each with dependent rings of teeth 242 and 262 respectively, such that when the members 24 and 26 come together the respective rings of teeth mesh perfectly and prevent any rotational displacement of the two members with respect to one another when locked in place by the clamping means. As alternatives to the toothed ring means shown in Fig. 14, Fig. 15 shows two additional means of insuring that the column members 24 and 26 do not move rotationally with respect to each other during use of the device. One means comprises cross hatching 25 in both mating surfaces of members 24 and 26 by some suitable mechanical means, or if the parts are injection molded, by plastic cross hatchings molded into the mating surfaces of members 24 and 26. A second means comprises a friction layer means 27 attached to each of the mating surfaces of members 24 and 26 shown generally in Fig. 15 as depending from and coextensive with its respective column member. In either the case of the cross hatching or the friction layer means, the two column members may be axially clamped together with a relatively light pressure and still assure that there is no rotational movement therebetween.

In Fig. 14 there is additionally shown an axial locking means which is an alternative to the bolt 40 and wingnut 42 of Fig. 3. What is shown is a schematic representation of a releasable two part axial link 80 of well known type. When the two parts are released by manipulating a pull ring or a push knob with the thumb and fingers of a single hand, the two part axial link 80 may be separated, at least to the extent that the various friction or tooth ring means may be disengaged and the column members may thus be turned to effect the adjustment of the angle of the rotating platform before snapping together the two parts of axial link 80 to relock the column members together again.

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Fig. 17a and 17b show yet another alternative to the bolt and wingnut or the two part releasable axial clamp 80. In all of the embodiments described above the device must be turned on its edge or upside down in order to effect adjustment of the angle adjusting means. In this embodiment a hollow two part axial means 100 which is flanged on both ends and internally spring loaded holds the column members 24 and 26 immovably together when the axle 100 is compressed. A foot pedal 120 and a rod 110 serve to actuate a cam 170 and an expander link 150 to elongate the axle means 100 and thereby release the pressure of the flanges against the respective column members so that the user, while standing upon the foot pedal, may with the aid of the two handles on the upper column member lift it slightly and turn it to the desired angular position. Then by simply stepping off of the foot pedal, the user allows the column members to once again become fixed in relation to one another and locked in place by the spring tension action of the internal spring and the axle means.

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INDUSTRIAL APPLICABILITY

The invention described herein finds use as a recreational device wherein the motor skills of the user are tested and honed in the operation thereof. The apparatus may be used as a game type device or as a serious exercise and physical training device for athletes as well as for individuals with physical disabilities. The unique combination of the rotational movement coupled with and complemented by the angled or inclined orientation of the upper platform results in physical movements for the user not heretofore encountered. This is especially so in the embodiment with the multiple bearing means.

In all embodiments of this invention, the elements of the angle adjusting means are held firmly in place during use, thus no disruptive or potentially dangerous lateral, vertical, or rotational displacement of the respective angle adjusting elements relative to one another can occur. The invention thereby provides heightened safety and enjoyment of the recreational use of the device.

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In compliance with statute, the invention has been described in language more or less specific as to structural features. It is to be understood, however, that the invention is not limited to the specific features shown, since the means and construction shown comprise preferred forms of putting the invention into effect. The invention is, therefore, claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims, appropriately interpreted in accordance with the doctrine of equivalents.

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CLAIMS

I claim:

- 5 1. A tilting rotational recreational device comprising:
a base member adapted to be placed upon a support
surface;
an angle adjusting means mounted in said base member,
said angle adjusting means comprising a plurality of
10 elements cooperatively interengaged to permit manipulation
of said elements to adjustably set an angle between the
plane of said support surface and the plane of the upper
surface of said angle adjusting means;
a weight supporting bearing means mounted upon said
15 upper surface of said angle adjusting means;
a platform mounted for rotation upon said weight
supporting bearing means and adapted to support a person
using the device whereby rotation of said platform relative
to said base member upon said bearing means about an axis
20 is freely permitted; and
whereby said platform may be positioned in a plane
angled with respect to the plane of said support surface;
and
a releasable locking means to adjustably hold said
25 elements of said angle adjusting means to each other in a
selected angular alignment whereby, when said locking means
is engaged, said elements can suffer neither lateral,
vertical, nor rotational displacement relative to one
another and said device will not come apart during vigorous
30 recreational use, and whereby, when said locking means is
released, said elements of said angle adjusting means may
be freely manipulated to set said angle as desired.
- 35 2. The apparatus of claim 1 wherein said angle adjusting
means in said base member comprises rotatably interengaged
upper and lower skew cut column members, each of said
members having upper and lower surfaces in nonparallel
planes wherein the lower surface of said lower column

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member is mounted upon said base member and said bearing means is mounted upon the upper surface of said upper column member, whereby rotation of one column member with respect to said other column member alters the angle
5 assumed by said platform with respect to said support surface.

3. The apparatus of claim 1 wherein said angle adjusting
10 means in said base member comprises an upper plate upon which is mounted said bearing means on the upper surface of said plate, said plate hingably mounted to said base member by a hinge means to raise said upper plate and thereby adjust the angle of said platform with respect to said base
15 member.

4. The apparatus of claim 1 wherein said base member and angle adjusting means further comprise inclined upper and
20 lower paired wedge members, each said pair of wedge members rotatable as a unit with respect to said other pair by mounting the upper surfaces of said lower wedge pair to the lower surface of a first annular support member that is adapted to receive and support in turn a second support
25 member rotatably interengaged within said first support member wherein the lower surfaces of said upper wedge pair are mounted to the upper surface of said second support member and said bearing means is mounted to the upper surfaces of said upper wedge pair, whereby the angle of
30 said platform with respect to said support surface may be adjusted by rotating said wedge pairs and their respective said support members relative to one other.

5. The apparatus of claim 3 wherein said means positioned
35 opposite said hinge means comprises a hinged link movable from a horizontal position to an engaged position so that the platform is angled from the horizontal.

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6. The apparatus of claim 2 further including grasping means mounted upon said upper column member to facilitate rotation of said upper column member with respect to said lower column member.

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7. The apparatus of claim 2 wherein said locking means further comprises a fastener means interconnecting said upper and lower column members along said axis of rotation of said column members, wherein said axially positioned fastener is engaged in a coaxial bore of diameter substantially larger than the diameter of said fastener, whereby said upper and lower column members may rotate freely relative to each other without said fastener interfering with the walls of said bore.

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8. The apparatus of claim 1 further comprising at least one additional weight supporting bearing means wherein said additional bearing means is positioned within or above said base member.

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9. The apparatus of claim 8 wherein at least one of said additional weight supporting bearing means is positioned between said angle adjusting means and said base member.

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10. The apparatus of claim 9 further comprising a means to prevent the rotation of said additional weight bearing means and thereby lock said angle adjusting means to said member as a relatively rigid unit.

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11. The apparatus of claim 7 further comprising a multi-denticulated pair of circumferentially placed annular surfaces such that each of the mating and interengaged column member surfaces of said angle adjusting means contain an axially depending ring of denticulations at the

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circumference of each of said surfaces that mesh and interengage with each other such that, when not clamped into position by said locking means, the two column members of said angle adjusting means may be manually separated
5 from each other and thus allow for an adjustment of angle by repositioning once circumferential ring of denticulations with respect to the other.

10 12. The apparatus of claim 11 in which said locking means further comprises a well known type of two part spring loaded separable fastener which can be separated by the manipulation of the fingers and thumb of one hand such that when said fastener is fastened together and when such a
15 fastener contains suitable flanges at both ends of said fastener said column member surfaces are held substantially in a mated interengaged relationship, and wherein the user operated portion of said fastener means is located in a counter sunk portion of said base member, such that the
20 recreational user can release the clamp with one hand while holding the device in the other hand and thereby easily reposition said interengaging denticulations before reconnecting the fastener to hold the teeth in their engaged positions.

25

13. The apparatus of claim 7 further comprising friction increasing means upon each of the mating and interengaged column member surfaces of said angle adjusting means such
30 that, when not clamped into position by said locking means, the surfaces of said column members are relatively free to rotatably slide one upon the other and thus allow a change in the angle of said rotating platform with respect to said base member of said device, but when clamped by said
35 locking means under relatively light pressure, said column members are frictionally held together as a unit.

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14. The apparatus of claim 13 in which said friction increasing means further comprises a layer of well known frictional surface material such as sandpaper or non-slip rubber which is adhesively bonded to the respective
5 surfaces of said column members.

15. The apparatus of claim 13 wherein said friction increasing means further comprises mechanically etched or
10 cast in cross hatching upon each of said mated and interengaged column member surfaces, such that said cross hatching creates such irregularities of the surfaces that one surface thereby has a grip upon the other surface when suitably clamped under relatively light pressure by said
15 locking means.

16. The apparatus of claim 5 further comprising at least one additional hinged link which is also moveable from the
20 horizontal position to an engaged position such that the platform may be angled from the horizontal at an angle different from the effected by the use of the first said hinged link.

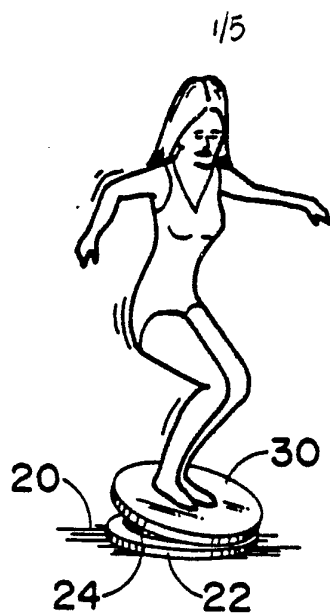
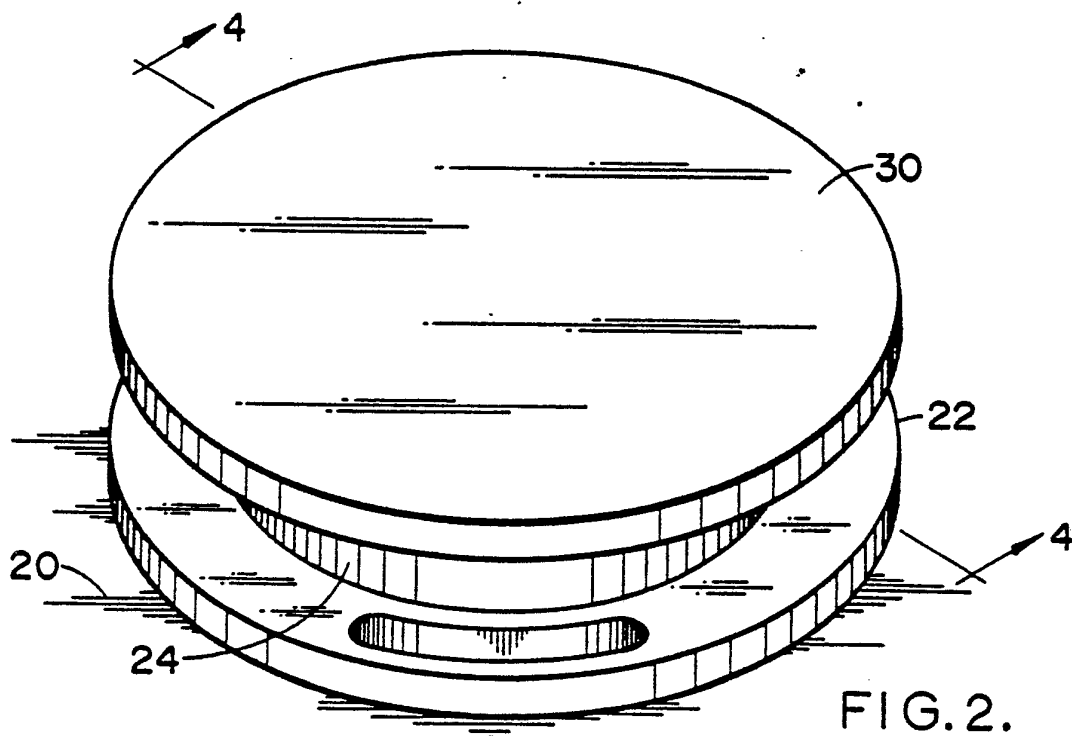
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17. The apparatus of claim 16 further comprising:
spring loaded hinges on all of said hinged links and on
said upper plate, such that all of said hinges are
biased toward the closed position, and such that said
30 upper plate is held against said appropriate hinged link by the tension of the spring hinges;
one or more depressions in the bottom of said upper plate into which the respective tops of said hinged links fit snugly along at least one dimension of said
35 respective hinged links;
and a suitable well known elastic means connecting the upper most edge of said upper plate to said base member under tension when said upper plate is raised to any position upon one of said hinged links.

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18. The apparatus of claim 2 wherein said releasable locking means further comprises:

- 5 a foot pedal actuated rod which rotates in a bore placed radially in said lower column member and which terminates in a cam member;
- 10 a two piece hollow closed cylindrical axle member where each end of said closed cylindrical axle member contains substantial flanges radially projecting from its end surface and where each of said two pieces of said axle member is slidably engaged one within the other so that the length of said axle member is variable depending upon the position of one of said pieces with respect to the other of said pieces;
- 15 within said axle member, an off center upwardly protruding tab fastened or integrally attached to the bottom inner surface of said axle member in which is a pivotal bore in which said rod is free to rotate and turn said cam member;
- 20 also within said axle member, a suitable tension coil spring with one end attached to the upper most portion of said tab and the other end attached to the inner surface of the upper end of said axle member such that the normal tendency of the flanges of said axle member is to draw together and thus clamp said column members together;
- 25 and also within said axle member, an expander link connected to an upper lobe of said cam and to the upper end surface of said axle member;
- 30 whereby the depression of the foot lever by the user's foot causes said cam and expander link to spread the two pieces of said axle member apart against the tension of the internal spring, and thereby to release the clamping effect of the flanges of said axle member; and whereby the user while standing on said pedal may
- 35 then manually turn said upper column member by said grasping means without turning the device over.

FIG. 1.FIG. 2.

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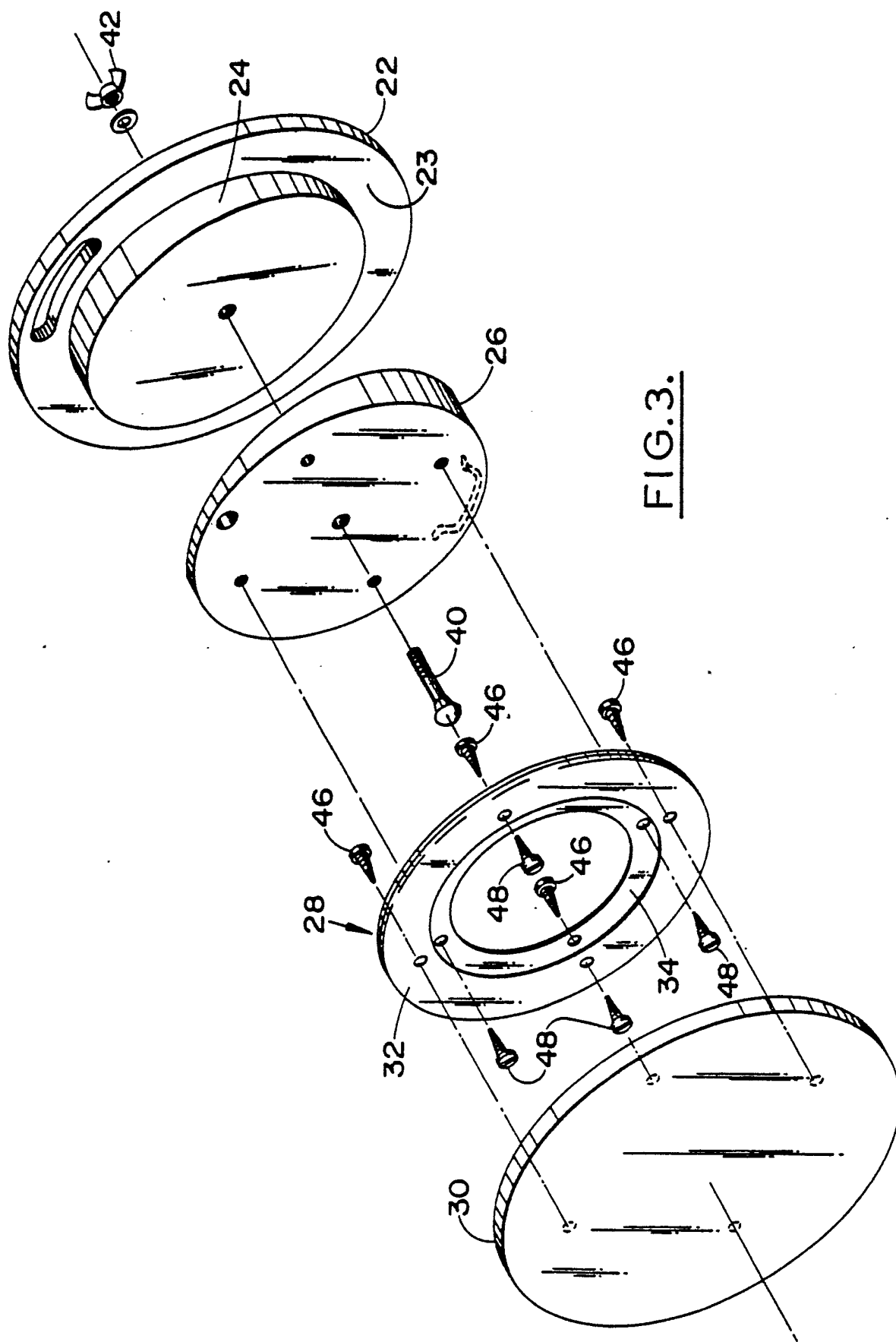


FIG. 3.

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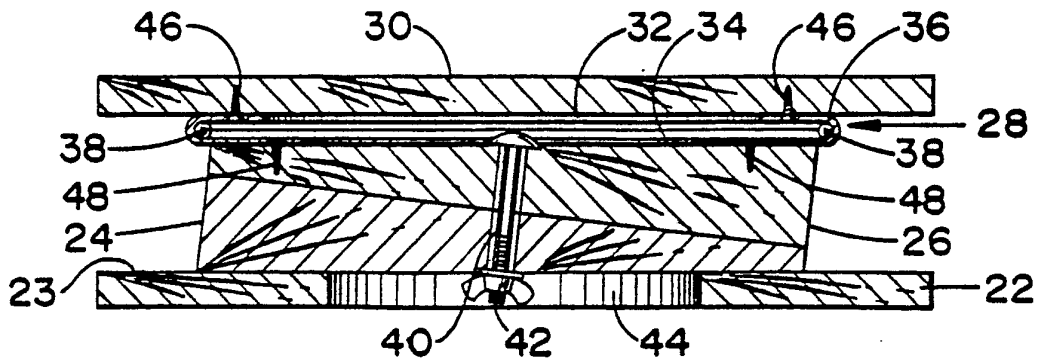


FIG. 4.

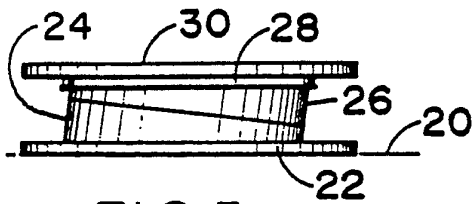


FIG. 5.

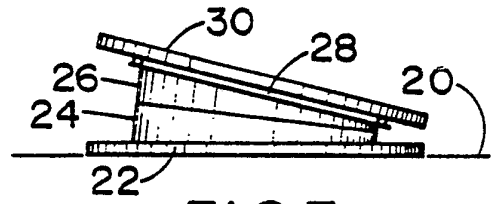


FIG. 7.

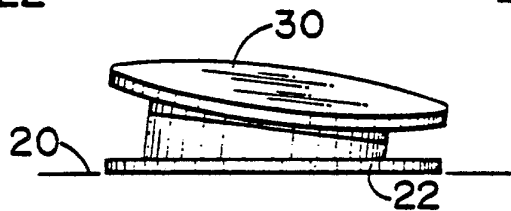


FIG. 6.

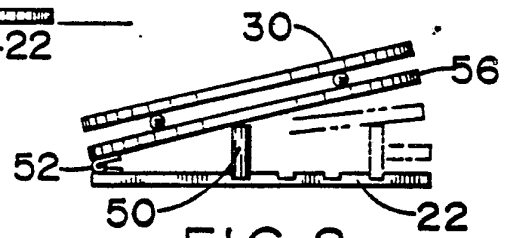


FIG. 8.

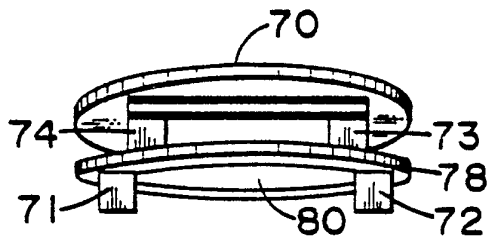


FIG. 10.

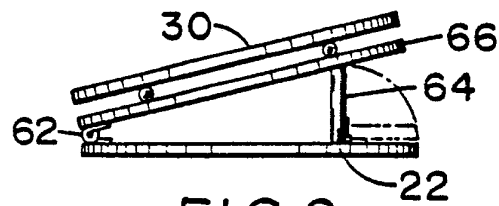


FIG. 9.



FIG. 11.

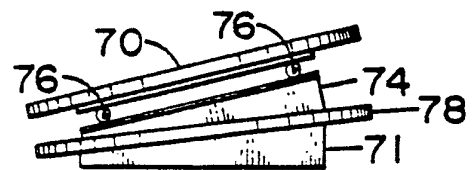


FIG. 12.

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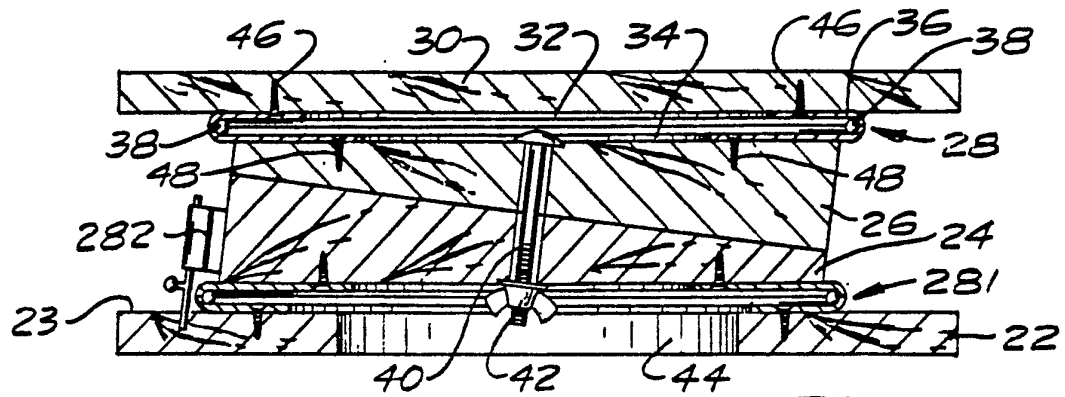


FIG. 13

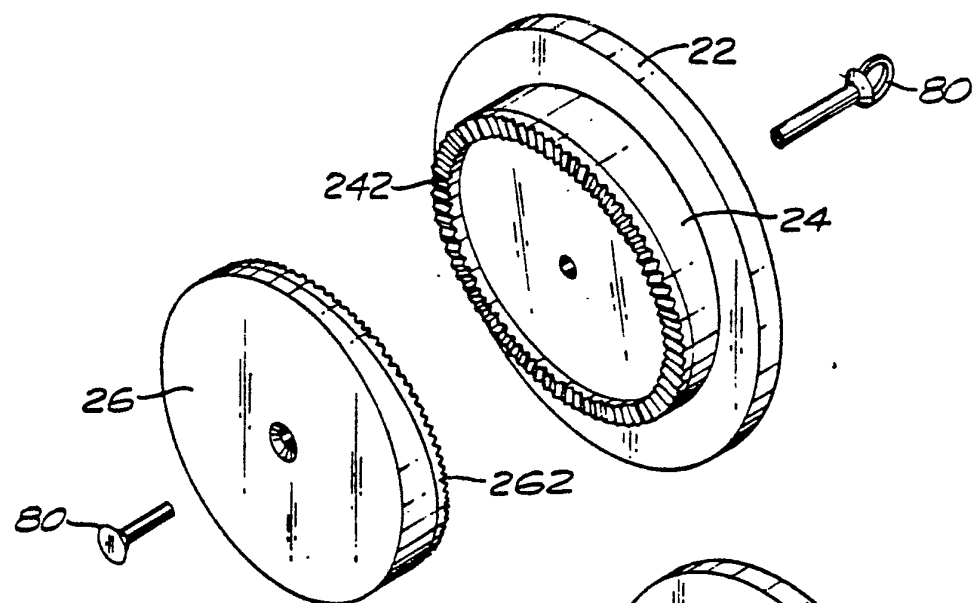


FIG. 14

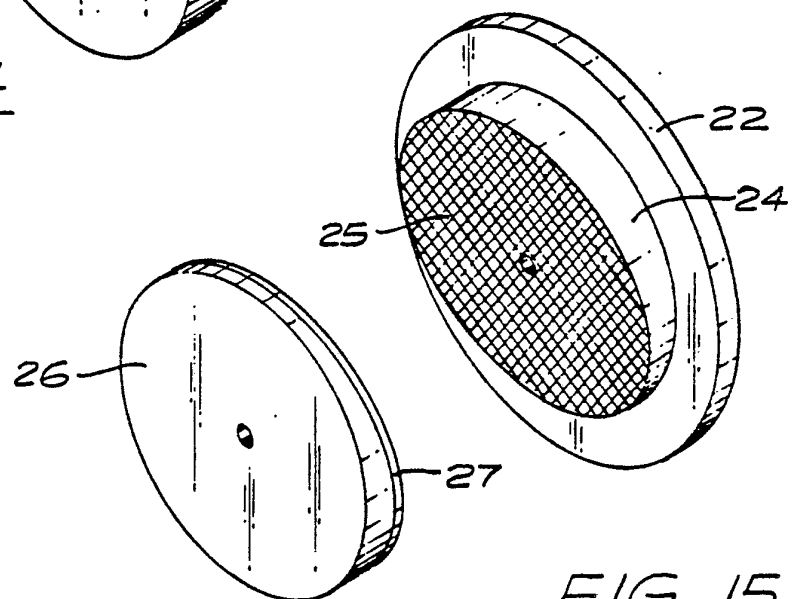


FIG. 15

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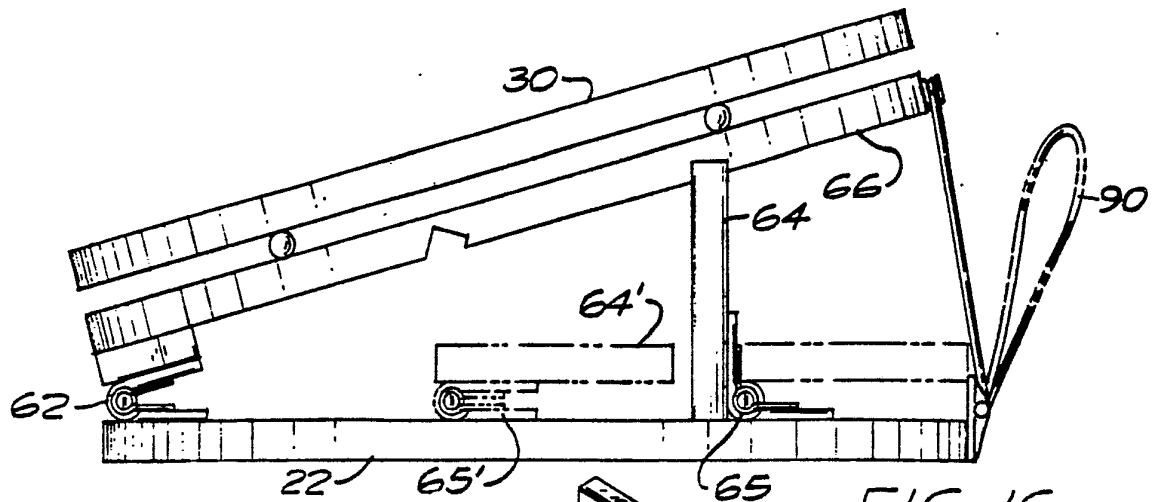


FIG. 16

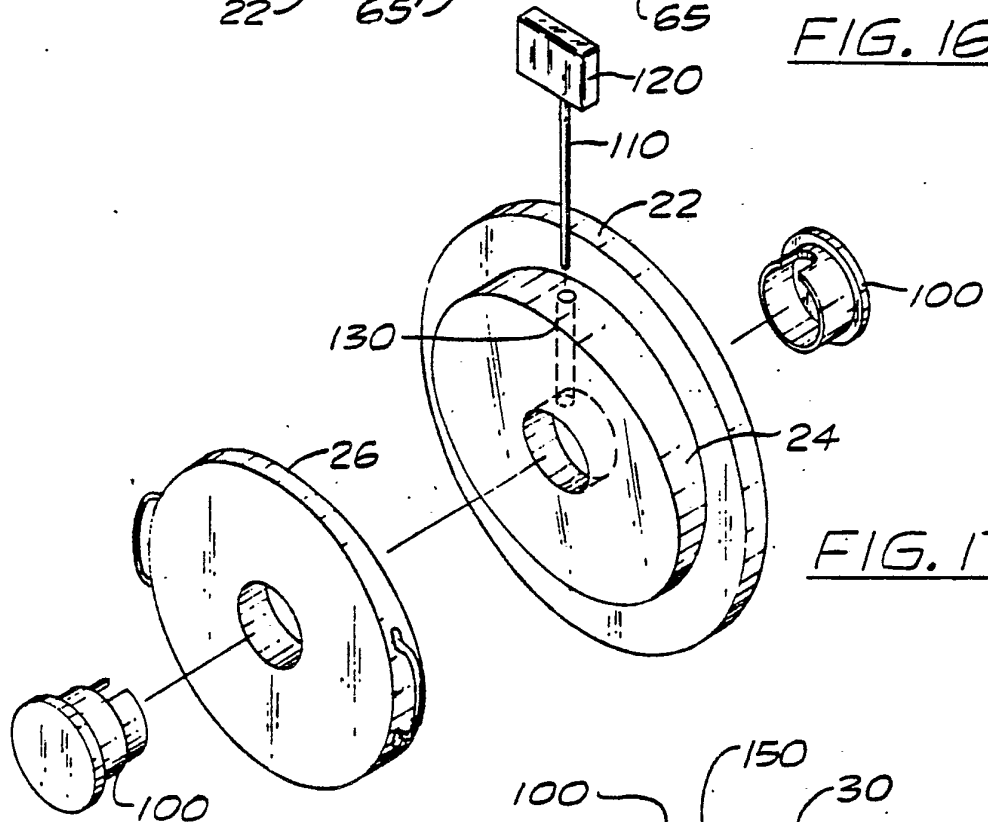


FIG. 17a

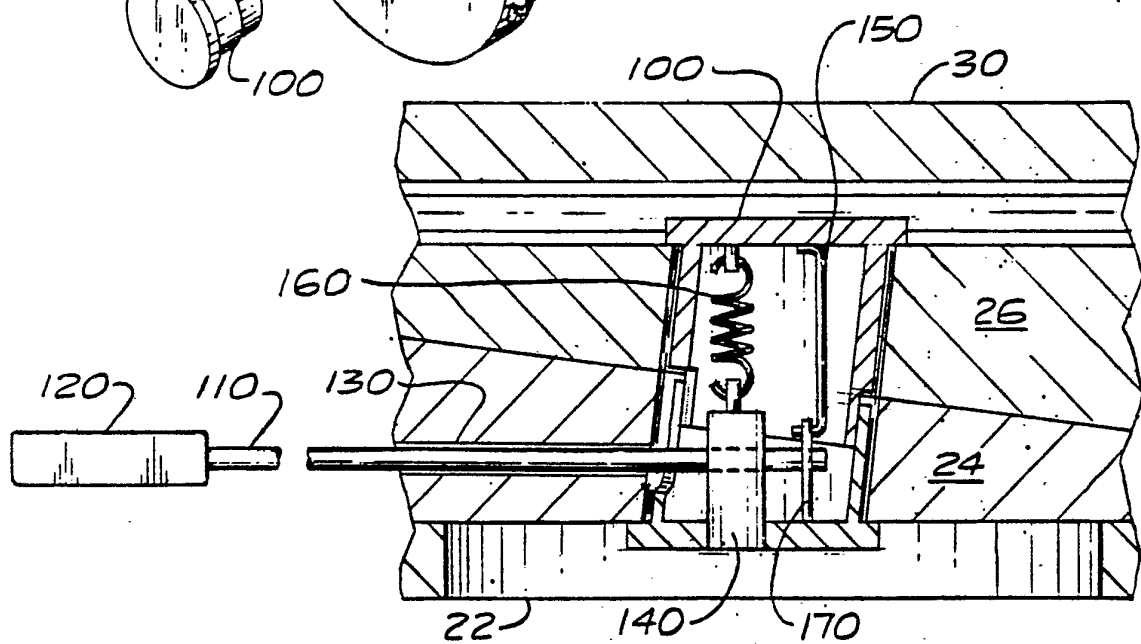


FIG. 17b