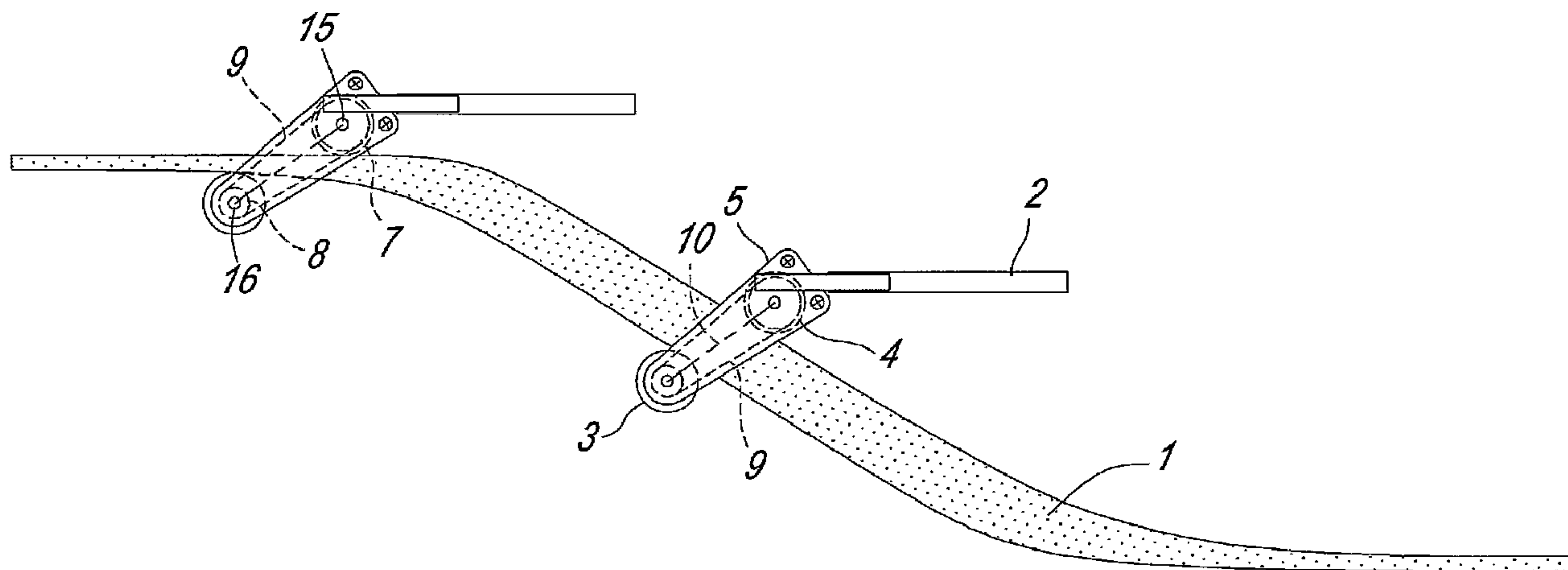




(86) Date de dépôt PCT/PCT Filing Date: 2001/08/21
(87) Date publication PCT/PCT Publication Date: 2002/03/21
(45) Date de délivrance/Issue Date: 2009/11/24
(85) Entrée phase nationale/National Entry: 2003/03/10
(86) N° demande PCT/PCT Application No.: US 2001/026048
(87) N° publication PCT/PCT Publication No.: 2002/022422
(30) Priorité/Priority: 2000/09/11 (US09/659,619)

(51) Cl.Int./Int.Cl. *B66B 9/08* (2006.01),
B61B 13/00 (2006.01)
(72) Inventeur/Inventor:
MINGES, MARCUS C., US
(73) Propriétaire/Owner:
INCLINE ACCESS, LLC., US
(74) Agent: STIKEMAN ELLIOTT LLP

(54) Titre : SYSTEME DE TRANSPORT SUR RAIL
(54) Title: RAIL MOUNTED TRAVERSING TRANSPORT



(57) **Abrégé/Abstract:**

A rail mounted slope traversing system is provided that accommodates varying angles of slope along the path of its movement, while maintaining a level transportation platform without the need of mechanical leveling devices or systems. As desired, the platform may be tilted for loading or unloading, as may be desired. The platform (2) may be connected to the rail (1) by means of wheels, the closest of which to the platform (2) is above the rail, and the other below the rail (1). Accordingly, the platform (2) is torqued downward to maintain contact between the wheels and the rail (1). As the slope of the terrain, and thus the rail (1), increases, the rail (1) is widened to maintain the platform (2) at level. As the slope decreases, the rail (1) is narrowed to the same effect.



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

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
21 March 2002 (21.03.2002)

PCT

(10) International Publication Number
WO 02/22422 A1

(51) International Patent Classification⁷: **B61B 7/06**

(21) International Application Number: PCT/US01/26048

(22) International Filing Date: 21 August 2001 (21.08.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
09/659,619 11 September 2000 (11.09.2000) US

(71) Applicant (for all designated States except US): **INCLINE ACCESS, LLC** [US/US]; Attn: HINTON, James, L., Jr., 4601 Stillman Boulevard, Tuscaloosa, AL (US).

(72) Inventor; and
(75) Inventor/Applicant (for US only): **MINGES, Marcus, C.** [US/US]; 1444 Blenheim Place, Birmingham, AL 35213 (US).

(74) Agent: **JOHNSON, Nathan, W.**; Bradley, Arant, Rose & White, LLP, Suite 1400, 2001 Park Place, Birmingham, AL 35203-2736 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AT (utility model), AU, AZ, BA, BB, BG, BR, BY, BZ, CA,

CH, CN, CO, CR, CU, CZ, CZ (utility model), DE, DE (utility model), DK, DK (utility model), DM, DZ, EC, EE, EE (utility model), ES, FI, FI (utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (utility model), SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

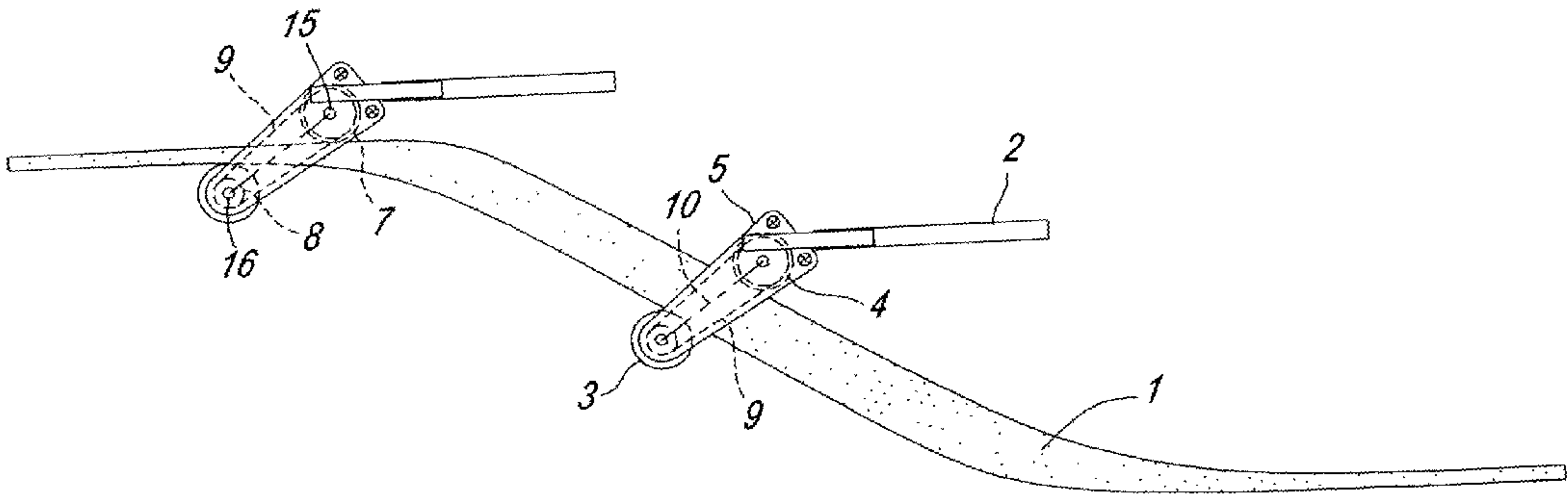
- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for all designations
- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for all designations

Published:

- with international search report

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.

(54) Title: RAIL MOUNTED TRAVERSING TRANSPORT



(57) Abstract: A rail mounted slope traversing system is provided that accommodates varying angles of slope along the path of its movement, while maintaining a level transportation platform without the need of mechanical leveling devices or systems. As desired, the platform may be tilted for loading or unloading, as may be desired. The platform (2) may be connected to the rail (1) by means of wheels, the closest of which to the platform (2) is above the rail, and the other below the rail (1). Accordingly, the platform (2) is torqued downward to maintain contact between the wheels and the rail (1). As the slope of the terrain, and thus the rail (1), increases, the rail (1) is widened to maintain the platform (2) at level. As the slope decreases, the rail (1) is narrowed to the same effect.



WO 02/22422 A1

1 **RAIL MOUNTED TRAVERSING TRANSPORT**

 FIELD OF THE INVENTION

6 This invention relates generally to solutions for moving people or items from one location to a higher or lower location along a variable slope without the need for complex leveling mechanisms. More particularly, the invention is directed toward outdoor transportation devices for moving people and things between elevated lake lots and the waterline in a safe and efficient manner along an incline that may vary substantially in slope.

11 **DESCRIPTION OF RELATED ART**

16 Water-level lake lots are available for purchase with increasing rarity, and at increasingly inflated prices, substantially reducing the affordability of lake lot vacation or residential homes for all but the wealthy. At the same time, the vast majority of property bordering lakes is undeveloped and has heretofore in many cases been deemed undesirable or even undevelopable because of the grade or obstacles present between the waterline and a suitable location for building a house. The difficulties associated with getting to the focal point of such lots - the water - typically prevent the lot from being maximized as a leisure area, or from ever being useable at all for persons with special needs.

21 Numerous solutions have been advanced to address this problem, none of which are entirely acceptable. Such solutions range from the traditional winding stairs, which can be exhausting or even dangerous for the elderly, infants, and those with special needs, to typically traction cable-lift transport designs. Even these mechanical transports are limited in their application, being by their nature confined to either of two models: (1) a constant slope incline model, or (2) mechanically leveled models that involve moving linkages and machinery to maintain the surface of a transport platform at a relatively level position. In addition to these limitations, the inventor believes these solutions have not obtained the greatest degree of safety that potentially may be developed from alternative solutions such as the invention taught herein.

31 With the exception of stairs, the most commonly used transportation device in the art of elevated lake lot traversing is the cable-driven hoist platform. Such hoist platforms are exemplified by U.S. Patent No. 3,168,937 to Redford, et al, which, although here applied to an

1 indoor application, discloses a slope-moving meat cutting platform. Redford employs a constant
slope dual rail design having a platform cantilevered between a wheel residing beneath the rail
and another wheel disposed above the downward portion of the rail. Additionally, as the slope
of the rails is not dependent upon any external factors, Redford shows a constant slope for the
rails and includes no leveling mechanism; the teaching of Redford is therefore limited to
6 extremely narrow applications. Redford's device is cable driven and therefore subject to
heightened maintenance and safety concerns of such cable systems.

The art has recognized that not all applications enjoy a static slope, but has
grappled with the solution. For instance, devices for ascending along stairs frequently must
11 traverse not only fixed inclines, but also cross over flattened areas where landings are
interspersed in the stairway. Designs accommodating variable slopes include the Hein
inventions, U.S. Patent Nos. 5,964,159 and 5,572,930. These stair alternatives incorporate a pair
of rails separated by a constant vertical gauge. Leveling is achieved by rotating wheels that lie
above and below each rail in a manner that keeps the wheels vertically aligned. Other leveling
16 solutions include elevated transports that level loads strictly by gravity, the loads being
suspended from a pivotable linkage, as in U.S. Patent No. 3,935,822 to Kaufmann. Additional
solution concepts for leveling include U.S. Patent Nos. 5,069,141 to Ohara, 4,602,567 to
Hedstrom; and 3,774,548 to Borst, each of which to varying degrees depends upon a hanging
load below the level of the rail. The typical hanging load system requires the weight to be
21 centered on the platform; otherwise, the stability and consistency of leveling will be suspect.
These systems are subject to undesirable swaying motion, particularly at sudden starts and stops.
Additionally of note are solutions for horizontal leveling systems that employ a complex array
of tracks and multiple wheels that variously engage and disengage from their respective tracks
as movement progresses, such as the "traversing elevator" described in U.S. Patent No.
26 4,821,845.

Other developers have noted difficulty with obtaining reliable and consistent grip
between the rails of a transport and the wheels when on a slope. The art has variously attempted
to address this difficulty by use of spring loaded wheels, such as those shown in Ohara et al, U.S.
31 Patent No. 5,069,141, or by gripping teeth, as in U.S. Patent No. 5,398,617, issued to Deandrea.

None of these prior art systems has maximized the potential available for reliable
self leveling traversing devices. It further will be noted by those reasonably skilled in the art that

1 the more complex the leveling, gripping, or safety system becomes, the greater the number of
practical issues that arise, such as the expense of manufacture of additional components and the
fact that additional components increase the potential for unacceptable failure. The present
invention is capable of being practiced without such complexity, though if desired the invention
can be practiced in complex embodiments while still maintaining the spirit of the invention.

6 OBJECTS OF THE INVENTION

The following stated objects of the invention are alternative and exemplary
objects only, and should not be read as required for the practice of the invention, or as an
11 exhaustive listing of objects accomplished.

As suggested by the foregoing discussion, an exemplary and non-exclusive
alternative object of this invention is to provide a transportation device capable of delivering
people and articles between a waterline and an elevated lake lot.

16 A further exemplary and non-exclusive alternative object is to provide a reliable
self-leveling transportation device that does not rely solely upon dynamic control or hanging
suspension to achieve leveling.

21 A still further exemplary and non-exclusive alternative object of the invention is
to provide a self-leveling transportation device in which, following installation, a failure to level
as desired is virtually impossible absent catastrophic damage to the device.

26 A further exemplary and non-exclusive alternative object of the invention is to
provide a transportation device that does not rely upon pulleys or cables.

Yet another exemplary and non-exclusive alternative object of the invention is to
provide a transportation device that is unobtrusive and exhibits a small elevation, profile, and
footprint on a lake-lot slope.

31 The invention additionally may allow, in an exemplary and non-exclusive
alternative, for a more direct route between a lake lot and the waterline, without the need for a
winding path.

1 The invention is further capable in some exemplary and non-exclusive alternative
embodiments of providing an efficient and safe transportation system for adults, children, riders,
and bystanders.

6 The invention is further able to provide in some exemplary and non-exclusive
alternative embodiments a lake-lot transportation system that is conveniently located for easy
boarding and debarking at nearly ground levels at both the top and bottom of a slope.

11 The above objects and advantages are neither exhaustive nor individually critical
to the spirit and practice of the invention. Other or alternative objects and advantages of the
present invention will become apparent to those skilled in the art from the following description
of the invention.

BRIEF SUMMARY OF THE INVENTION

16 The present invention may be basically described as a self leveling transport
device with application for delivering people and their accessories between an elevated lake lot
and the water line. The transport may be adapted to be low profile against the silhouette of a land
slope, increasing attractiveness of the entire surrounding area. The device is able to adjust the
“attitude” of a load or platform by selectively leveling, or causing to be off level, the load or
21 platform (relative to a horizontal plane, the ground, or other selected orientation or parameter).

26 Unlike previous rail-mounted systems, the current invention does not require
either a constant slope of the incline, or a mechanico-electrical leveling-adjustment system.
Rather, within reasonable limits, the rail may, if desired, be run in a straight line (viewed from
the water) from the top of an incline to the bottom, hugging the contour of the earth surface the
entire distance. This lowers the dangers associated with elevated portions of track that may
become necessary for maintaining a constant slope in prior art systems.

31 The present invention employs a support body platform (which may be a floor
bucket, chair, or any other supporting or holding device, including pinchers) connected to a rail
by wheels or other traversing members, such as wheels, rollers, bearings, tracks, skids
(particularly low-friction skids). One traversing member contacts the rail from below, and a
second traversing member contacts the rail from above. Typically, this places the second

1 traversing member both horizontally and vertically offset from and above the first traversing
member, when viewed from the side. The platform is connected to the second traversing
member and extends over the downslope side of the rail. This creates a cantilevered, or torqued
design, in which the center of gravity of the loaded platform is on the opposite side of the second
traversing member from the first traversing member, and in which the platform is above the level
6 of the rail. Accordingly, as weight on the platform is increased, the torque increases the
effectiveness of friction between traversing members and rail. The present invention can
therefore in some embodiments rely wholly upon friction of the traversing members to maintain
location upon the rail within preferred operational parameters. The system is therefore amenable
to cableless direct drive operation in embodiments using wheels or tracks at the traversing
11 members, in contrast to many prior art devices.

It should be noted that the location of the center of gravity of the platform may
change in various states of loading or unloading; it is possible to take advantage of such change
by allowing for a shift of the center of gravity to the opposite side of the second traversing
16 member, allowing for easy removal of the platform, maintenance of the traversing members or
other equipment, storage, etc.

In order to achieve reliable and durable self-leveling, neither the traversing
members nor the angle among the traversing members and the platform needs to be variable;
21 rather each of these can be hard-welded or secured in any other static fashion. Self leveling is
effected in the present invention by varying the vertical gauge of the rail (by "vertical gauge,"
or "gauge" hereinafter, is meant the distance from a point on the upper surface of the rail to the
closest point on the undersurface of the rail). At any given distance between the traversing
members, the cantilever effect causes a wider gauge rail to urge the line between the traversing
26 members to approach perpendicular to the top of the rail. A thinner gauge rail will allow the line
between the traversing members to pivot away from perpendicular to the rail, towards an angle
that is limited in its acuteness by the configuration of the traversing members (e.g., where wheels
are employed as the traversing member, the radial height of the wheels will affect the acuteness
of angle obtainable) and the gauge of the rail. Accordingly, the user can determine from the
31 minimum desired gauge of the rail and the configuration (e.g., minimum radius of wheels) of the
traversing members, how far off of parallel the line between the traversing members will be from
the rail at its most horizontal point. The platform can thereafter be attached to the traversing
members in such a way that the fixed angle among the traversing members and the platform

1 results in a horizontally level platform at the most horizontal point on the rail. As the rail becomes more vertically disposed traveling along its length, the platform may be maintained at a horizontal level by widening the gauge of the rail, which will drive the line – and thus the platform – into a changing relationship with the rail to compensate for the increasing slope.

6 The present invention overcomes the chief limitations of static slope requirement systems, while avoiding complex linkages and mechanical systems.

BRIEF DESCRIPTION OF THE DRAWINGS

11 Figure 1 shows a diagram of the intersection of traversing members, rail, and platform of the current invention in an embodiment in which the traversing members are wheels.

Figure 2 depicts the transport device of the present invention at two distinct locations on the rail, and demonstrates the varying vertical gauge of the rail to effect self-leveling motion of the device.

16

Figure 3 is a schematic of the device of the current invention as viewed from above, in the absence of a supporting rail.

21 Figure 4 is a drawing of a frontal view of the device of the present invention, as seen along the line of view in plane with the rail.

Figure 5 is an alternative embodiment, having two sets of wheels as traversing members and two intersecting housings for allowing the device to travel over and beyond hills according to the principles of the invention.

26

Figure 6 sets forth alternative configurations for wheel-type traversing members of the current invention.

31 Figure 7 demonstrates the mechanism of operation of the invention in a basic format.

1 Figure 8 shows the invention along an elevated landscape profile, with the transportation device depicted at various locations.

DETAILED DESCRIPTION OF THE INVENTION

6 The following is a detailed description of the invention. Those skilled in the art will understand that the specificity provided herein is intended for illustrative purposes with respect to the inventor's preferred and most preferred embodiments, and is not to be interpreted as limiting the scope of the invention. It must be understood without limitation that the term "rail" as used herein encompasses such variants of rails as may be substitutable for rails, such
11 as tracks, beams, planks, pipes, runners, or other weight-bearing guidance configurations; additionally, within the meaning of "rail," a single rail or two separate rails may be used to present an upper surface for meeting the downward component of torque or cantilever forces and a lower surface to meet the upward component of torque or cantilever forces. Furthermore, although these embodiments tend to show wheels as the selected traversing members, it must be
16 understood that other traversing members will work equally well within the scope of the invention. As such, in the following exemplary embodiments, wheels must be understood as substitutable by conveyor tracks, bearings, skids, skis, and rollers or any other traversing member.

21 Turning now to the drawings, Figures 1 and 2 are best viewed together. Figure 1 presents an diagram of the intersection of traversing members, rail, and platform according to the current invention, wherein wheels have been substitutably chosen as traversing members. Figure 2 shows this intersection from a greater distance to demonstrate the built-in leveling of the device along the rail. Rail 1 is shown at a point along its slope. For ease of contrast, rail 1
26 is also shown at a different location by dashed line as rail 1', having a substantially horizontal slope. Considering rail 1 as shown in solid lines, traversing members overwheel 4 and underwheel 3 are in communication with rail 1 on opposite sides. Overwheel 4 and underwheel 3 are retained in substantially fixed relationship to one another by means of housing 5, which may comprise two sides 5a and 5b, disposed in rigid separation from one another, which provide
31 support for and operative restraining of axles 15 and 16 of overwheel 4 and underwheel 3, respectively. The relationship between overwheel 4 and underwheel 3 is characterized by an imaginary line 10 running between the center of each.

1 Housing 5 connects traversing members overwheel 4 and underwheel 3 to a
platform 2. Platform 2 is adapted to support items and persons intended to be transported by the
device, and may accordingly be of any configuration desired. Such desired configurations
frequently will benefit from having a bottom support plane that remains substantially
horizontally level. For convenience of description, platform 2 is here shown as a wide plank.
6 As will be readily understood, when configured as a plank, the plane including the lowest point
of support of materials being transported is coincident with the top of the plank. Disposed
between overwheel 4 and underwheel 3 is rail 1. Viewing Figures 1 and 2, due to the presence
of platform 2 and any load thereon, overwheel 4 acts as a fulcrum resting on rail 1 with respect
to the force exerted by such load. Underwheel 3, in turn, being on the opposite side of the
11 overwheel 4 fulcrum point from the center of gravity of the loaded platform 2, is driven upwards
toward the underside of rail 1. Accordingly, as the load on platform 2 increases, overwheel 4 and
underwheel 3 are driven into increasingly loaded contact with rail 1. The device thus
dynamically responds to loads by increasing wheel-to-rail grip in a manner that obviates the need
for cables or continuous loop friction hoists (though such additional or alternative drives may be
16 included). Rather, when, as here, wheels or conveyor tracks are selected as traversing members,
the wheels may be driven by an on board engine or motor 6. Advantageously, in some
embodiments this may increase the safety factor of the device by avoiding cables that are subject
to high stress and wear in the prior art, and that require constant and diligent maintenance.

21 Figure 7 demonstrates the mechanism of leveling action of the present invention.
Variously positioned overwheels 4' and underwheels 3', having for purposes of this illustration
an identical distance between axes of rotation to that of first-shown overwheel 4 and underwheel
3, are shown at different points along a sloped rail 1' of varying gauge. Imaginary line 10 is
drawn between the axes of rotation of each set of wheels for clarity. At the highest point
26 shown, the gauge of rail 1' is relatively narrow. Because the distance between overwheel 4' and
underwheel 3' is greater than the gauge of rail 1' at this point, imaginary line 10 rotates clockwise
until both overwheel 4' and underwheel 3' are in contact with rail 1'. Moving to the next lower
view of the coupled wheels, the extent of clockwise rotation of imaginary line 10 is reduced due
to a greater gauge of rail 1', which causes overwheel 4' and underwheel 3' to come into contact
31 with rail 1' at an earlier point of rotation. The still next lower view demonstrates that as the
gauge of rail 1' approaches the same value as the closest distance of separation between
overwheel 4' and underwheel 3', imaginary line 10 approaches a slope perpendicular to the top
face of rail 1'. Finally, the lowest view of coupled wheels shows a position in which the gauge

1 of rail 1' is equal to the distance separating the closest points of overwheel 4' and underwheel 3'; in this situation, imaginary line 10 is perpendicular to rail 1'.

6 The basic operative characteristics of the invention as seen in Figure 8 may be summarized as follows. Overwheel 4 and underwheel 3 maintain a substantially constant distance from one another. The angle between platform 2 and imaginary line 10 remains substantially constant, requiring no mechanical leveling apparatus. Rail 1 may at no point of intended travel of the device be wider (the gauge may not be greater) than the distance between overwheel 4 and underwheel 3. As the gauge of rail 1 increases toward this maximum, the amount of rotation of imaginary line 10 about the plane containing rail 1 is affected in the following manner: as rail 1 increases in gauge, the angle between the top of rail 1 (or the tangent of the top of rail 1 where rail 1 is curving) and imaginary line 10 approaches perpendicular (90 degrees). As the gauge of rail 1 decreases from the maximum, the angle between the top of rail 1 and platform 2 will decrease, while the angle between platform 2 and imaginary line 10 remains constant. Thus, by varying the gauge of rail 1 to a coordinating degree as the slope of rail 1 changes, platform 2 may be maintained at horizontal. (Of course, by varying the gauge to a greater or lesser degree may allow different angles of tilt of platform 2 as may be intended for differing purposes).

21 Figure 8 shows how the present invention builds upon the effect demonstrated in Figure 8 a wheel is shown at the end of platform 2 for supporting platform 2 on rail 1 when both rail 1 and platform 2 are horizontally disposed. By increasing the gauge of rail 1 as the slope of the rail increases, platform 2 attached to housing 5 is maintained at level. As described above, the distance between overwheel 4 and underwheel 3 is substantially constant. In one embodiment, when platform 2 is level the top of underwheel 3 and the bottom of overwheel 4 will be separated by a vertical distance (not necessarily the length of imaginary line 10) at least as great as the largest vertical gauge of rail 1 at any point along which the transport device is intended to travel with a level platform 2. If the operator desires that at some point along the path of travel, the end of platform 2 furthest from rail 1 should dip below the end of platform 2 that is closest to rail 1, the vertical separation of overwheel 4 and underwheel 3 should be greater than the gauge of rail 1 at that point. Similarly, if the operator desires that the end of platform 2 furthest from rail 1 be above the end of platform 2 that is closest to rail 1 at some point, the vertical separation of overwheel 4 and underwheel 3 should be less than the gauge of rail 1 at that point.

1 For reliability and efficiency reasons, though not always necessary, a common
embodiment of the invention will not traverse greater than 40 degrees of variations in slope of
rail 1. If the terrain traversed required variations in slope of greater than 40 degrees; the path of
rail 1 may "wind" up the slope by various cut-backs to prevent exceeding a 40 degree slope
change. In a common embodiment, rail 1 will have a gauge of 2 inches at its most horizontal
6 point. This is primarily due to the ready availability and economy of 2 inch square tubing from
which rail 1 may be constructed. If the slope is to increase to a full 40 degrees, a 14 inch gauge
may be used at such 40 degree slope, depending upon the separation configuration of overwheel
4 and underwheel 3 as maintained by housing 5.

11 Without limiting the manner of calculating the variations in gauge, slope, etc., the
actual relationship between gauge and slope may be simplistically derived by diagraming a given
wheel configuration at a point where the most horizontal slope meets the most vertical slope.
Overwheel 4 is in such drawing placed immediately at the intersection of the two slopes on the
upper side of rail 1 with platform 2 level. The proper gauge of rail 1 at the maximum slope for
16 the particular wheel configuration may then be derived by diagraming the underside of rail 1
such that underwheel 3 is in contact there with. As noted above, in a common embodiment, this
will provide for a 2 inch horizontal gauge, and a 14 inch gauge at 40 degree slope. The
relationship between gauge and slope for such configuration is thus 1 inch of gauge change for
every $3.\overline{3}$ inches of slop change. (E.g., rail 1 goes from 2 inches to 14 inches of gauge, a 12
21 inches change, as the slope traverses 40 degrees, meaning that the ratio of change is 12 inch : 40
degrees, or $1 : 3.\overline{3}$ inches : degree.) By this simple process it is possible to derive the desired
variation in gauge at any slope along the path of rail 1. Those in the art will understand that it
is possible to state various formulae and calculations for achieving the same effect, with even
greater precision, but that such mathematics are limited by the chosen fixed relationship. The
26 inventor notes that the relationship between the position of overwheel 4 and underwheel 3 may
be first determined and fixed with reference to a level platform 2 at the most horizontal slope to
be traversed. The relationship between imaginary line 10 and platform 2, as well as the
magnitude of imaginary line 10 can thereafter be treated as fixed values. Of course, by fixing
other values, such as maximum gauge, it is possible to solve for any of other values as may be
31 desired.

1 In one embodiment, when platform 2 is level, the lower angle between platform
2 and imaginary line 10 is no less than 135 degrees (e.g., the angle between imaginary line 10
and level ground is 45 degrees or less).

6 In another aspect of an embodiment, rail 1 is manufactured in segments for easy
transportation and assembly. Preferably, though not necessarily, the segments of rail 1 are
continuous material, such as a beam or pipe. In accordance with the invention, however, a
characteristic of rail 1 (other than those factors that are determined for external safety, code, and
structural reasons) is that the distance between the top of rail 1 and the bottom of rail 1 be
capable of varying. Such varying of the distance may be achieved by adding layers or materials
11 to rail 1 to build it up at desired locations, by "egging" a pipe outward, or by use of a separate
top surface and bottom surface which together would operate as a single rail 1 within the
meaning of the invention. Any other methods as may be known in the art may be used.

16 For purposes of increased simplicity or stability, a single rail 1 of rectangular
cross section may be used, though two or more parallel rails 1 can be employed. Overwheel 4
is in the drawn embodiment a single tire, and is driven directly or by transmission linkage by
motor 6. Attached to axle 15 of overwheel 4 is sprocket 7, which is in turn connected by means
of a drive belt or chain 9 to sprocket 8 on underwheel 3. As motor 6 drives overwheel 4 and thus
sprocket 7, sprocket 8 is accordingly also driven, which allows multiple-wheel drive of the
21 device. Underwheel 3 as shown in this embodiment is achieved by use of two separate flanged
wheels 3', having a radially outer frictional gripping surface for contact with the underside of rail
1, and an axially outer flange for preventing side-to-side slippage relative to rail 1. Applying
such separate wheels 3' allows for a gap which can be positioned to allow passage of ground
supports for rail 1 thereinbetween. Where more than one underwheel 3 is employed, sprockets
26 may connect each underwheel 3' to a driven overwheel 4. The diagramed monorail configuration
allows ready and stable turning.

31 No cables or traction hoists are required with the present invention. Accordingly,
safety is not dependent upon frequency of change and inspection of cables. The increased
traction afforded by the cantilever effect obviates this necessity. Although the drawn
embodiments show the use of an onboard drive configuration, it is possible, of course, to
configure the device to be driven primarily, or as a redundancy, by cable or traction hoist
methods. In such an event, the cable may be housed within rail 1 in a manner allowing constant

1 connection between the transport (preferably housing 5) and the cable, such as by means of a
groove in rail 1. The use of a cable may therefore be added without substantially altering the
operative configuration or external appearance of the device. Variable slope (and variable gauge)
may be accommodated by use of guides and rollers as known in the art to prevent the cable from
exiting rail 1, while still maintaining unimpeded traction hoist effect.

6
In yet another embodiment, safety may be integrated by means of brakes 31 that
remain engaged in the absence of current. As is known, a solenoid 14 may be operated to
electrically hold the brake pads open when current is applied. In the absence of current, such as
battery failure, the brakes return to closed position, preventing uncontrolled descent along the
11 slope of rail 1. The pads of brakes 31 may be positioned to prevent side-to-side slippage of
overwheel 4, much as the flanges on underwheels 3', described above.

Motor 6 may be powered by batteries 13. In order to maximize efficiency, the
system is designed for dynamic braking and to allow descent speed control by braking only,
16 rather than employing the motor for descent. In such a configuration, it is possible and preferable
to use the gravity-driven descent to turn the motor into a generator for charging the batteries.
Accordingly, battery life may be substantially increased and efficiency maximized.

The invention as described above can in alternate embodiments be made to ascend
21 and descend alternately facing slopes by means of creating notches for passing through of partial
underwheels 3', as shown in Figure 5. To effect the alternate slope traversing embodiment, an
additional set of overwheel 4" and underwheel 3" is attached, having an angle of relationship
to platform 2 extending in the opposite direction from first overwheel 4 and first underwheel 3.
Each overwheel 4 and 4" can be made to exert pressure on rail 1 directly above rail 1 that is left
26 between underwheels 3' and 3". At the beginning of the transition from one slope to the
alternating slope, rail 1 is narrowed - preferably by cutouts approximating the path of travel of
underwheels 3' or 3", respectively, through the plane of rail 1. A similar narrowing is
constructed at the end of the transition area (which may overlap with the beginning of the
transition area allowing for only one cutout; as seen in figure 5a). By means of such a
31 construction, the transportation device of the present invention is capable of moving up and down
a series of hills. A similar effect may be achieved by offsetting overwheel 4" and underwheel
3", and by running a rail 1" in a manner that overwheel 4" and underwheel 3" engage or

1 disengaged from rail 1" while overwheel 4 and underwheel 3 are engaged with rail 1, following
which the latter disengage or engage, respectively.

6 Another alternative embodiment builds upon the recognition that even at a
constant slope of rail 1, a user may desire platform 2 to tilt off of level. This may be for purposes
of picking up materials, dropping off materials, or folding away an extended platform (e.g., as
in a configuration having a platform that folds outwards at a hinge or hinges along its length).
Such selective tilting of platform 2 may be achieved by the method of varying the gauge of rail
1 as taught in this invention, but to a greater or lesser degree than is required for maintaining a
horizontal platform.

11

Other embodiments and advantages of the invention will be understood by those
skilled in the art.

WHAT IS CLAIMED IS:

1. A method of maintaining the attitude of a support platform of a rail mounted transportation device comprising:
 - (a) mounting a rail mounted transportation device upon a rail, positioned with at least one wheel above the rail, at least one wheel below the rail, and a support platform above the rail;
 - (b) maintaining a distance between the wheels;
 - (c) maintaining a fixed relationship between the wheels and the support platform; and
 - (d) varying a gauge of a rail upon which said device is mounted as a slope of said rail varies.
2. A rail mounted transportation system comprising a rail and a support body, said rail having an upper surface and a lower surface that are separated by a distance that varies along a length of said rail, said support body being mountable upon said rail for traversing along the length of said rail by an upper traversing member in operable communication with said upper surface and a lower traversing member in operable communication with said lower surface;

wherein said upper traversing member and said lower traversing member are maintained in operable communication with said rail by torque; and

wherein the support body traverses varying slopes along the rail without rotating.
3. A rail mounted transportation system as in Claim 2, wherein said traversing member is a wheel.
4. A rail mounted transportation system as in Claim 3, wherein said distance at a point along the length of said rail is determined by an angle between said rail and a centerline running through the upper and lower wheels, which angle sets the support body at a desired pitch.

5. A rail mounted transportation system as in Claim 4, wherein said angle depends upon a wheel distance separating the upper wheel and the lower wheel; a slope of said rail at said point; and an angle between the centerline and the platform.
6. A rail mounted transportation system as in Claim 4, wherein a slope of said rail varies along the length of said rail.
7. A rail mounted transportation system as in Claim 6, wherein said distance is relative to said slope.
8. A rail mounted transportation system as in Claim 4, wherein an angle between the centerline and the support body is no less than 135 degrees.
9. A rail mounted transportation system comprising a rail and a support body, said support body comprising a load bearing section adapted to hold a load above the rail, a closest wheel, and a furthest wheel,

wherein said closest wheel is adapted to operate as a fulcrum with respect to a weight of said support body,

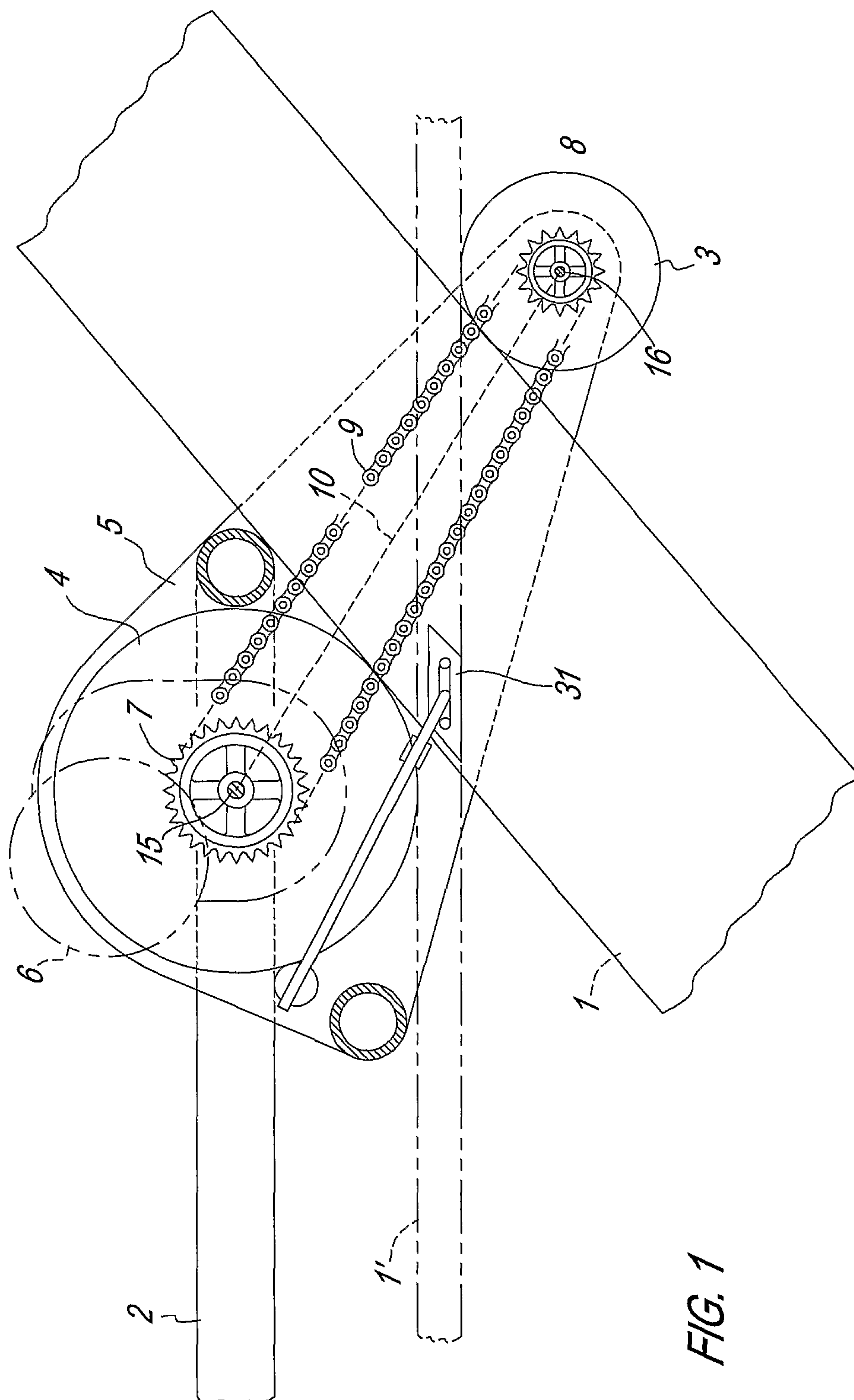
wherein a rotation about said fulcrum is terminated by contact between said furthest wheel and said rail, and

wherein a magnitude of said rotation is relative to a gauge of said rail.
10. A rail mounted transportation system comprising a rail and a support body, said rail having an upper surface and a lower surface, said support body comprising an upper means for movably supporting said support body on the upper surface and a lower means for movably contacting said support body on the lower surface, said support body being thereby mountable upon said rail for traversing along a length of said rail while maintaining a load in a level orientation above the rail; and

wherein said upper supporting means and said lower contacting means are maintained in operable communication with said rail by torque.

11. A rail mounted transportation system comprising:
a rail, and
a support body, said support body comprising:
 - a load bearing platform above the rail and rigidly affixed to a wheel section;
 - within the wheel section, a closest wheel between the rail and the load bearing platform; and
 - a furthest wheel placed at a fixed distance from the closest wheel and separated from the closest wheel by the rail;wherein said closest wheel is adapted to operate as a fulcrum with respect to a weight of said load bearing platform on one side thereof, and the furthest wheel to an opposite side thereof; and
wherein the furthest wheel is adapted to transfer, in response to a weight of the load bearing platform urging the support body to pivot about said fulcrum, an upward force to a lower side of the rail by contact between said furthest wheel and said lower side of the rail.
12. A rail mounted transportation system comprising:
a rail, and
a support body, said support body comprising:
 - an upper wheel positioned to maintain downward force against the rail,
 - a lower wheel positioned to maintain upward force against the rail and separated from the upper wheel by the rail, and
 - a load bearing platform maintained in rigid relationship to the upper wheel and the lower wheel, with the load bearing platform closer to the upper wheel than to the lower wheel;wherein the rail has a first inclined portion and a less inclined portion, in which the first inclined portion has a steeper slope than the less inclined portion, and wherein further the rail is thicker in vertical measurement at the first inclined portion than it is at the less inclined portion.
13. A rail mounted transportation system as in Claim 12, wherein at least a part of the load bearing platform is directly over a downslope side of the rail.

14. A rail mounted transportation system as in Claim 12, wherein there is a fixed angle between the load bearing platform and a line drawn between the upper wheel and the lower wheel.
15. A rail mounted transportation system comprising:
a rail, and
a support body, said support body comprising:
an upper wheel maintained in contact with an upward facing surface of the rail,
a lower wheel maintained in contact with a downward facing surface of the rail and separated from the upper wheel by the rail, and
a load bearing platform, wherein the load bearing platform is closer to the upper wheel than to the lower wheel;
wherein the rail has a greater inclined portion and a lesser inclined portion, in which the greater inclined portion has a steeper slope than the lesser inclined portion, and wherein an orientation, relative to the rail, of a line drawn between an axis of the upper wheel and an axis of the lower wheel, approaches perpendicular as a slope of the rail increases, and wherein further the load bearing platform is maintained in a fixed position relative to the line.



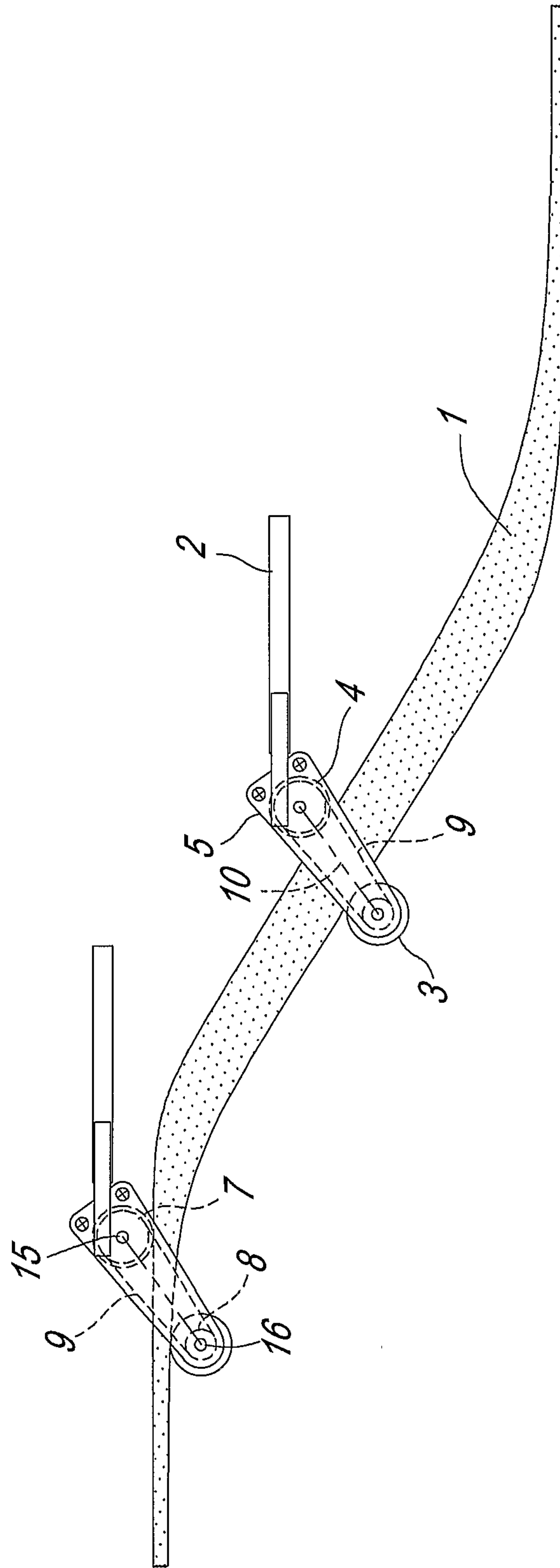


FIG. 2

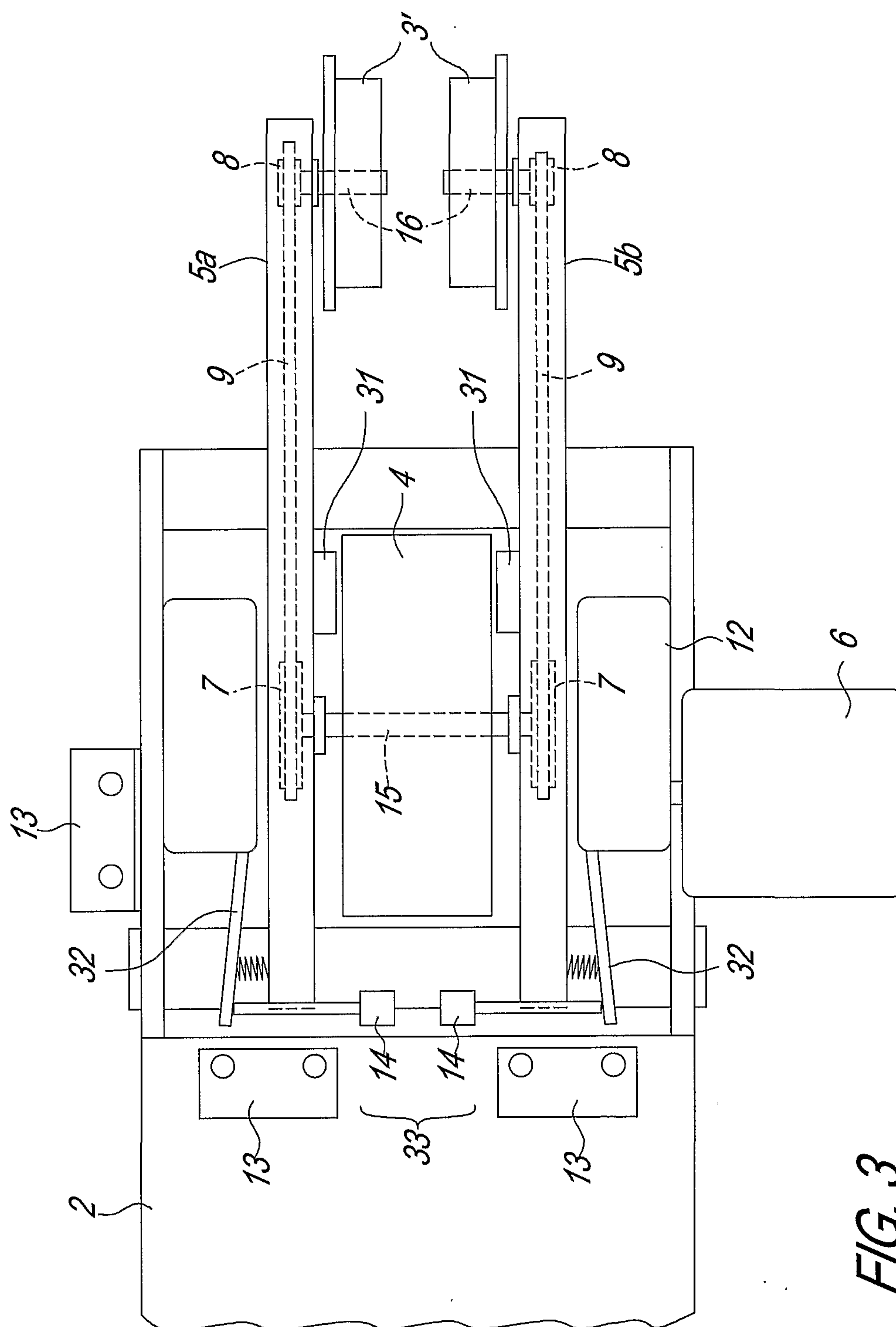
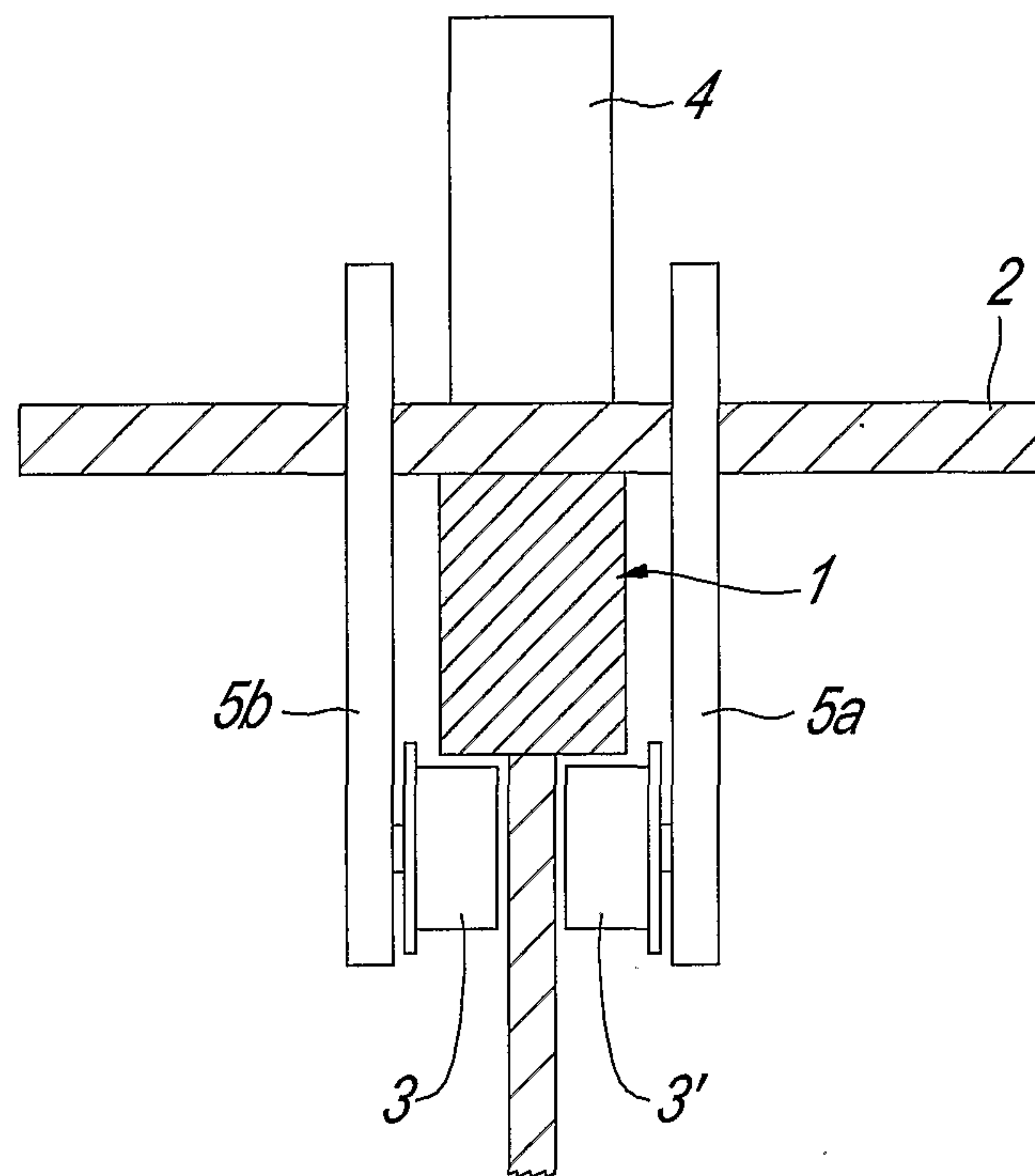


FIG. 3

*FIG. 4*

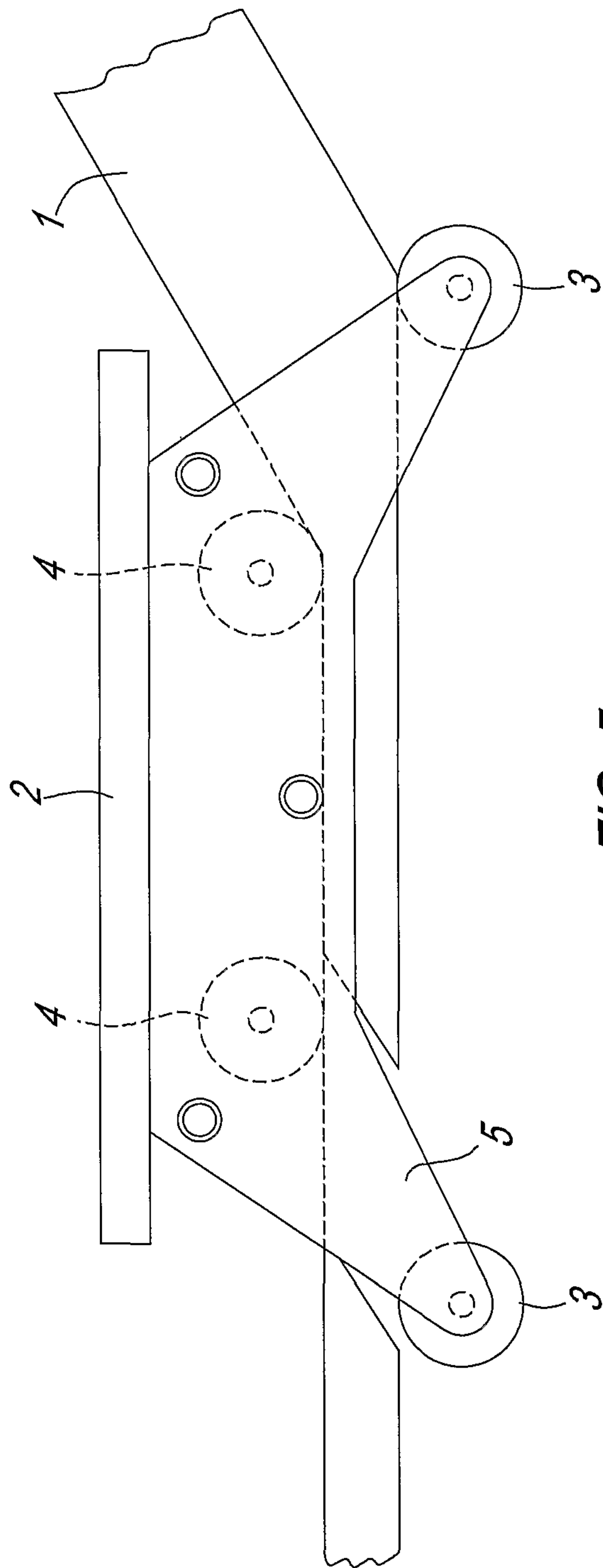


FIG. 5

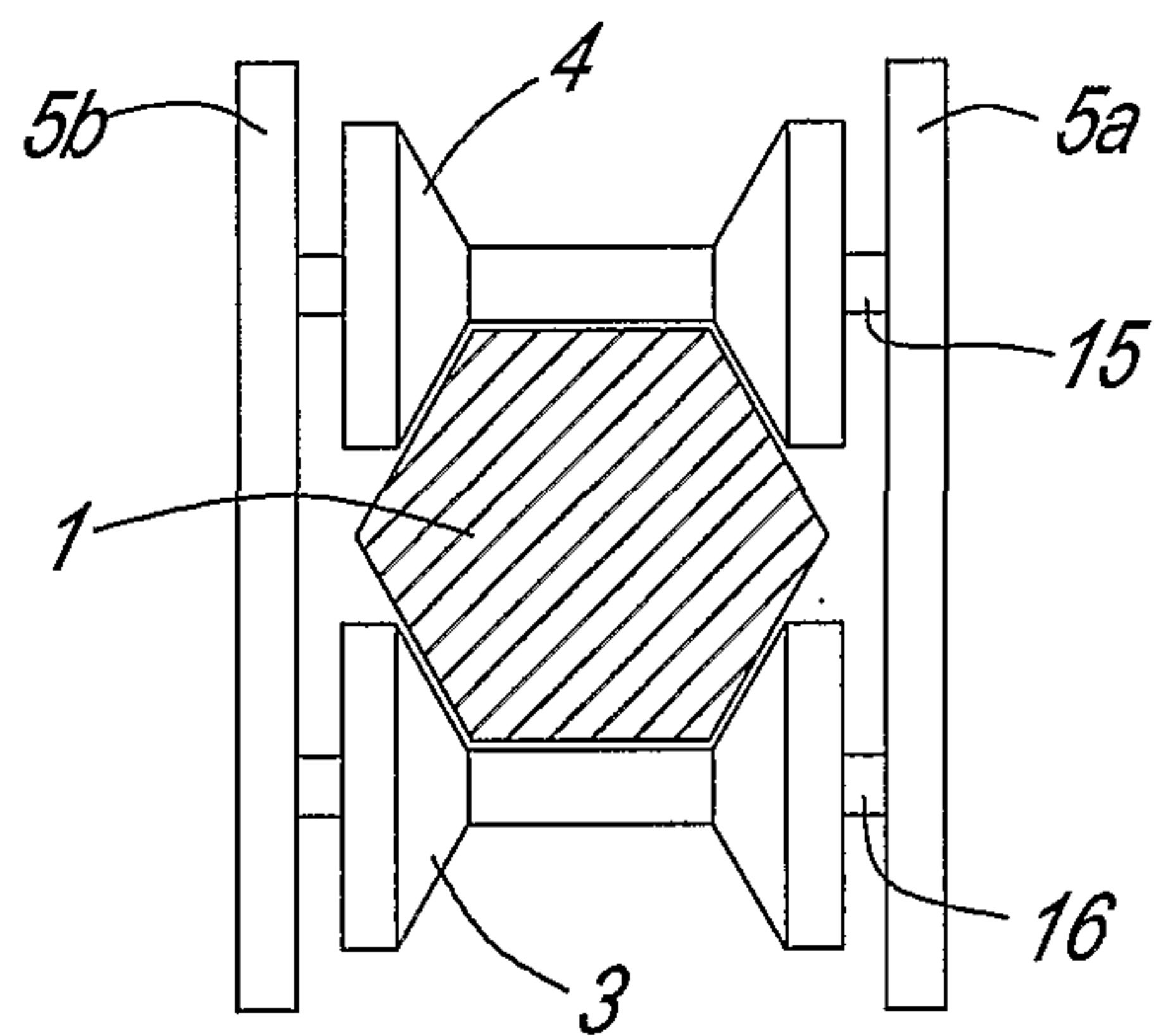


FIG. 6A

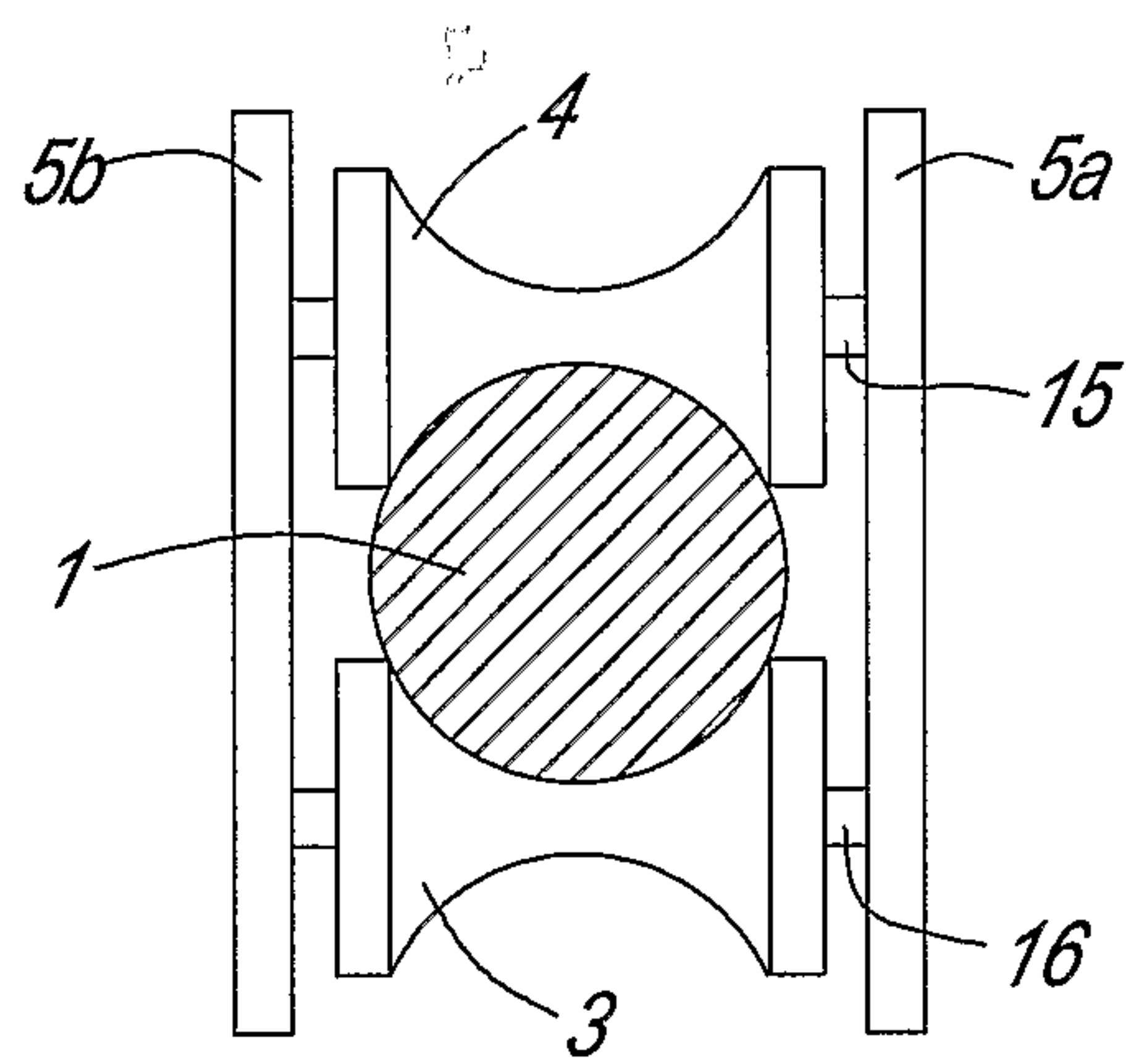


FIG. 6B

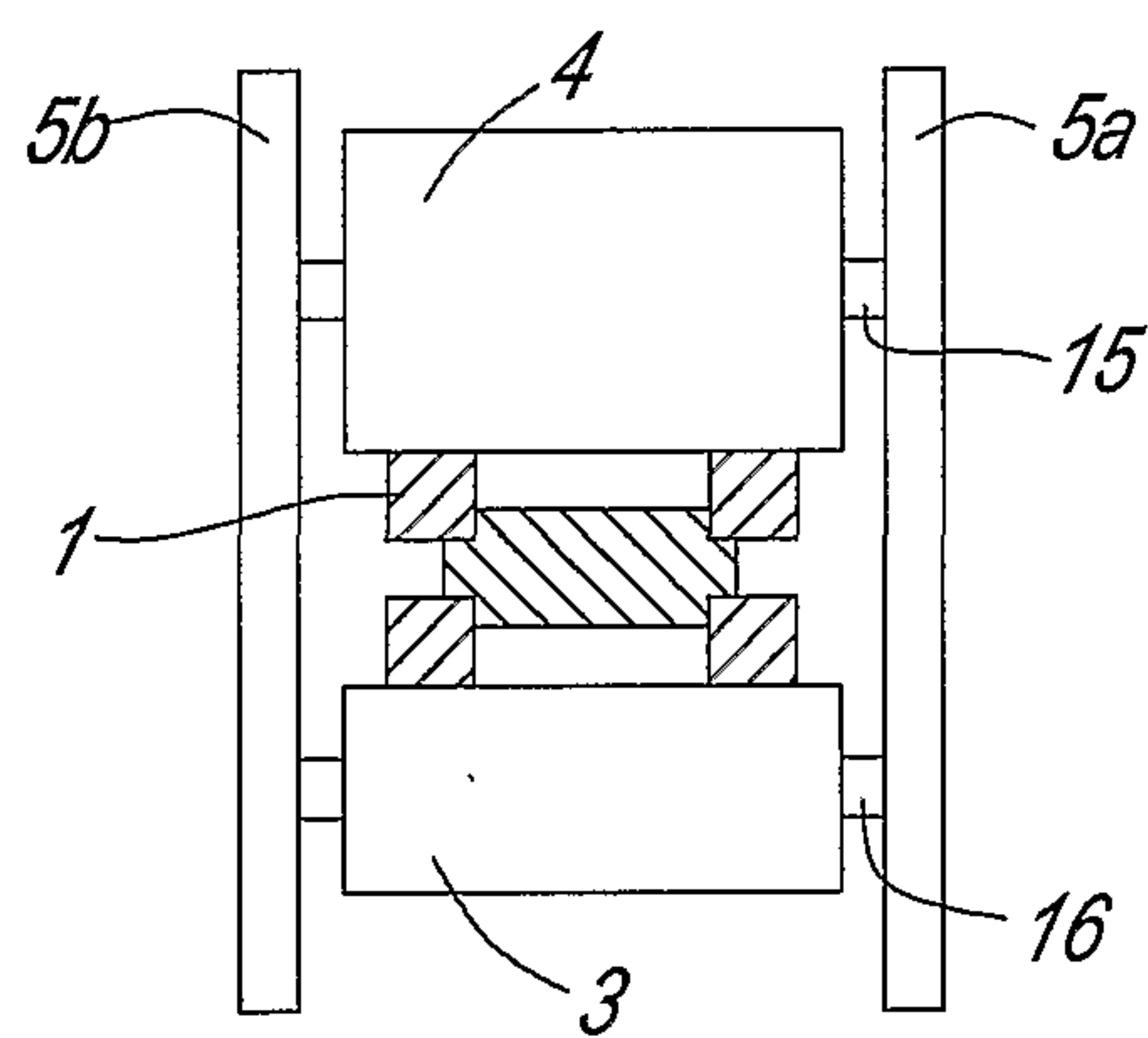
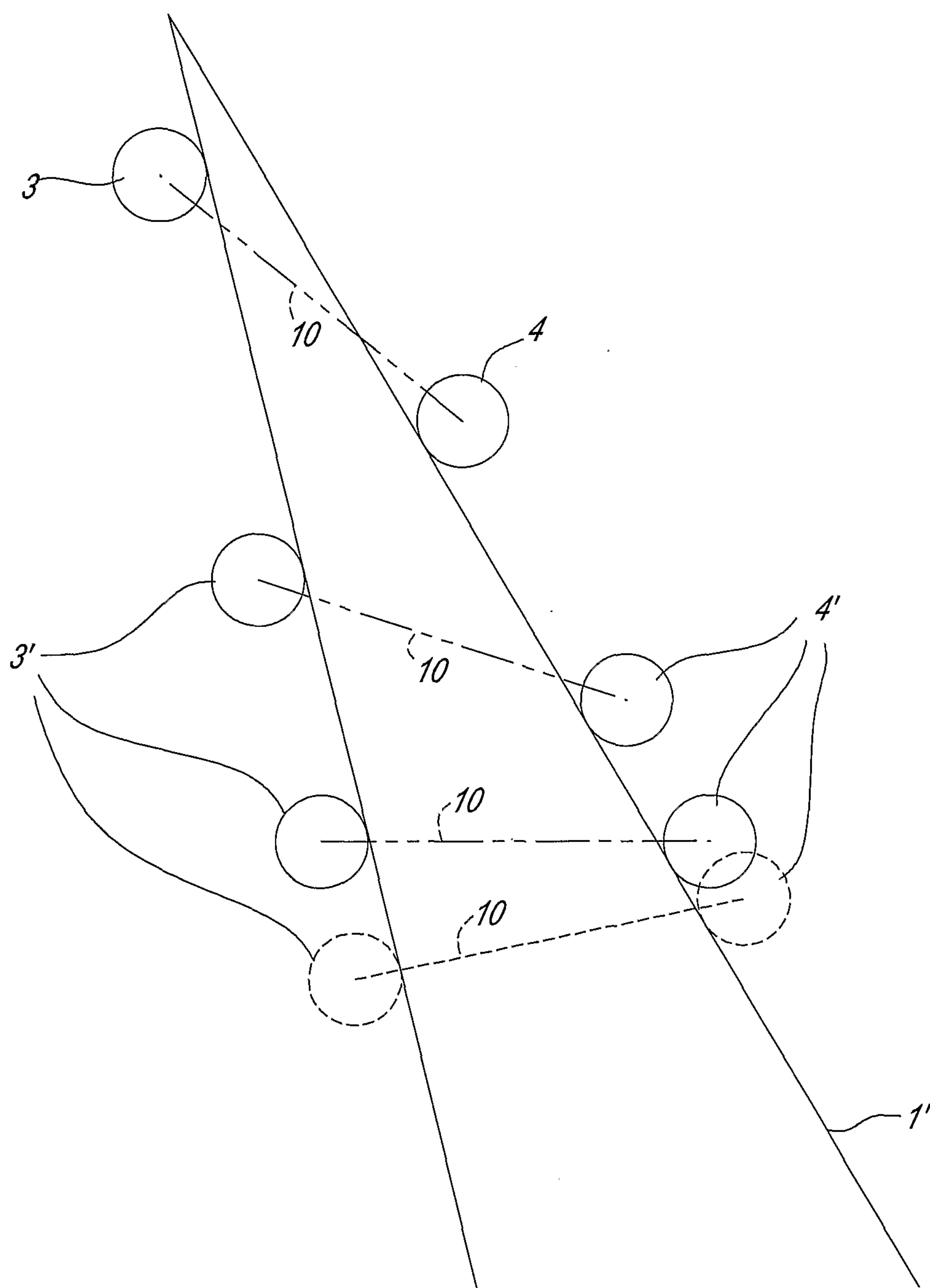


FIG. 6C

**FIG. 7**

