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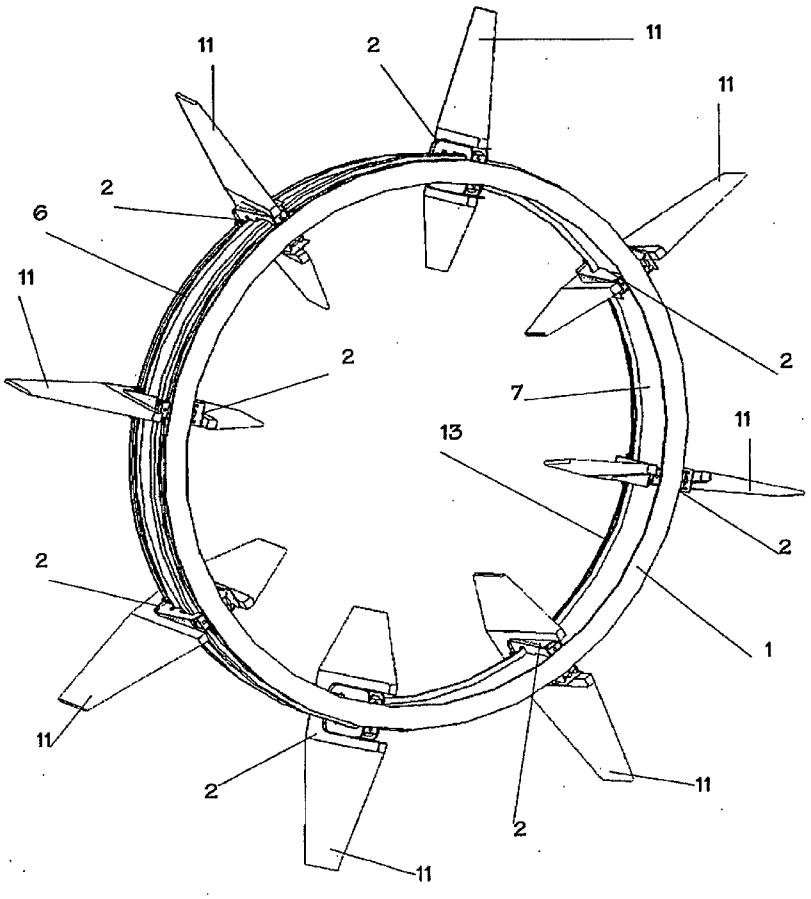
(54) Title: SYSTEM FOR GENERATING ELECTRICITY FROM FLUID CURRENTS



(57) Abstract: A system for generating electricity from fluid currents having one or more trolleys (2) that move along a closed-loop track (1) as a result of the action of fluid currents on one or more blades (11) attached to each trolley (2). Spacing between trolleys (2) is preferably maintained by a spacing ring (13) to which the trolleys (2) are attached. Optionally, one or more blades (11) may be attached to the spacing ring (13). The trolleys (2) are supported and guided either by wheels (4) or magnetic levitation (5). Electrical energy is preferably created by the movement of magnets (14) in an electrical ring (15) attached to the trolleys (2) with respect to a conductor (16) connected to the track (1).

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DESCRIPTION

SYSTEM FOR GENERATING ELECTRICITY FROM FLUID CURRENTS

TECHNICAL FIELD

[0001] This invention relates to a system for generating electrical energy from fluid currents, especially currents in water.

BACKGROUND ART

[0002] There are a variety of patents on different devices for generating electricity from ocean currents. These include the following: 4,313,059; 4,335,319; 4,383,182; 4,500,259; 4,850,190; 6,006,518; 6,109,863; 6,734,576; 6,781,253; 6,849,963; 6,856,036; 6,955,049; and 6,998,730.

[0003] Although intended to convert wind energy, the device of United States patent no. 4,756,666 employs sails attached to an "aerial cable railway." Similarly, patent no. 6,498,402 discloses parachutes connected to a continuous cable for converting wind energy to electrical energy. And patent no. 3,992,125 utilizes blades moving within a housing underwater in order to generate electrical power.

[0004] Furthermore, there are at least nine other patents and five patent applications dealing with the production of electricity from water currents. The patents are United States patent nos. 3,912,937; 4,224,527; 4,306,157; 5,440,176; 6,647,716; 6,806,586; 6,982,498; 6,995,479; and 7,011,501. The applications are contained in United States patent publication nos. 2002/0034437; 2002/0158472; 2003/0201645; 2005/0285404; and 2005/0285405.

[0005] Finally, there are four patents and one patent application dealing with a hydroelectric turbine blade having no central shaft. These are United States patent nos. 5,592,816; RE38,336; 6,648,589; and 6,729,840. The patent application is United States patent application no. 10/633,865, which has been published as United States patent application publication no. 2005/0031442. In the Hydroelectric Turbine of the patent application, magnets are used as bearings to maintain the alignment of the rotor blade. To generate electricity this Hydroelectric Turbine has " . . . magnets imbedded in the periphery of its blade and cores imbedded in its housing." Thus, the blade serves as a rotor of an electrical generator; and the housing functions as the stator of such a

generator. Consequently, though, the outer diameter of the blade must be less than the inner diameter of the stator.

[0006] Additionally, two patents, although not dealing with the production of electricity from ocean currents, do disclose underwater tracked systems. United States patent no. 3,943,644 describes a dredge which utilizes "a flexible combined guide train and conveying train assembly" to move buckets containing scraped sediments to a boat. And patent no. 4,422,799 discloses the use of a marine railway system to install submarine pipelines.

[0007] None of the preceding patents or applications, however, employ trolleys that are propelled by blades along a track to which the trolleys are mounted either through wheels or by magnetic levitation.

[0008] With regard simply to the general concept of magnetic levitation there are also a number of United States patents and patent publications.

[0009] The patents include United States patent nos. 5,511,488; 5,953,996; 6,357,359; 6,633,217; 6,664,880; and 6,899,036.

[0010] Exemplary patent publications are United States patent publication nos. 2003/0005851; 2003/0112105; 2003/0217668; 2004/0119358; 2004/0123766; 2005/0204948; and 2006/0016365.

[0011] Furthermore, an article which can be found at http://www.llnl.gov/str/Post.html asserts that a team at Lawrence Livermore National Laboratory headed by physicist Richard Post ". . . has successfully demonstrated the Inductrack concept . . . ." This is additional technology for magnetic levitation.

[0012] "Inductrack involves two main components: a special array of permanent, room-temperature magnets mounted on the vehicle and a track embedded with close-packed coils of insulated copper wire. The permanent magnets are arranged in configurations called Halbach arrays, named after Klaus Halbach, retired Lawrence Berkeley National Laboratory physicist. . . ."

[0013] The inventors did not locate a patent for the original Inductrack, itself; but the following United States patents appear to be variations of the basic concept: 6,629,503; 6,758,146; 6,827,022; and 6,983,701.

[0014] Still, the inventors are unaware of any patent or product which utilizes magnetic induction in a device to produce electricity from fluid currents.

[0015] Magnetic bearings are the subject of the following exemplary patents: United States patent nos. 5,177,387; 5,710,469; and 5,747,426.

[0016] Again, however, the use of magnetic bearings in a device to produce electricity from fluid currents is unknown to the inventors.

DISCLOSURE OF INVENTION

[0017] The System for Generating Electricity from Fluid Currents of the present invention employs one or more trolleys that are mounted, either through wheels or through magnetic levitation and magnetic bearings, to a closed-loop track.

[0018] Spacing between trolleys can be controlled with a computer, sensors, and brakes. Preferably, however, either a rigid beam is connected between adjacent trolleys or the trolleys are connected to a continuous annular structure having the same shape as the track. (Herein the term "spacing ring" shall be used as a generic term to cover both (a) such rigid beams connected between adjacent trolleys and (b) the continuous annular structure. With only one trolley in the System, the latter portion of the definition would, of course, be applicable.)

[0019] For propulsion, one or more blades are attached to each trolley. Optionally, one or more blades may also be attached to the spacing ring. The orientation of the blades with respect to the trolley or the spacing ring may be either fixed or adjustable. Current in the fluid within which the System is placed acts on the blades through any method that is known in the art for propelling a blade or sail. The fluid is preferably, but not necessarily water.

[0020] Generation of electricity is preferably the result of relative motion between magnets associated with (*i.e.*, attached to or imbedded—partially or completely—within) the trolley; the spacing ring; or, preferably, a ring designated the electrical ring, which is separate from the spacing ring (but still connected to the trolleys) and a conductor physically connected to the track in such a location that the conductor is at least sometimes within the magnetic field of the magnets associated with the trolley, the spacing ring, or the electrical ring. Alternatively, the locations of the conductor and the magnets can be reversed with one another.

[0021] If the track has a circular path, the spacing ring and the electrical ring merely need be circular. Should the track have a non-circular path, the spacing ring and

the electrical ring must each be hinged. In no embodiment, however, is the outer diameter of the blade limited by the inner diameter of the stator (the annular unit).

BRIEF DESCRIPTION OF DRAWINGS

[0022] FIG. 1 presents a perspective view of a preferred embodiment of the overall System for Generating Electricity from Fluid Currents.

[0023] FIG. 2 depicts, in an embodiment employing wheels, the relationship of such wheels to an embodiment of the track having a rectangular cross section.

[0024] FIG. 3 illustrates, in an embodiment employing wheels, the relationship of such wheels to an embodiment of the track having two rails with a circular cross section.

[0025] FIG. 4 depicts the embodiment of FIG. 2 utilizing magnetic levitation technology in lieu of all wheels.

[0026] FIG. 5 shows the embodiment of FIG. 2 utilizing magnetic levitation technology in lieu of some wheels.

[0027] FIG. 6 is a plan view showing a blade the position of which can be adjusted relative to the trolley to which the blade is attached.

[0028] FIG. 7 illustrates the embodiment of FIG. 3 with the addition of a brake.

[0029] FIG. 8 shows an exemplary embodiment of a rigid connecting beam between adjacent trolleys.

[0030] FIG. 9 shows multiple blades attached to each trolley.

[0031] FIG. 10 portrays a blade connected to the spacing ring to which trolleys are attached between each pair of adjacent trolleys.

[0032] FIG. 11 depicts coils imbedded within the annular unit and magnets imbedded within the electrical ring.

[0033] FIG. 12 shows magnets imbedded within the annular unit and coils imbedded within the electrical ring.

[0034] FIG. 13 shows a trolley rigidly connected to an electrical ring that is near an annular unit.

[0035] FIG. 14 portrays a trolley connected with one or more cables to an electrical ring that is near an annular unit.

[0036] FIG. 15 depicts a trolley that pushes against, but is not connected to, a stop attached to an electrical ring that is near an annular unit.

[0037] FIG. 16 illustrates a magnet connecting a trolley to an electrical ring that is near an annular unit.

[0038] FIG. 17 portrays the embodiment of FIG. 2 when the conductor is comprised of all or a portion of the ring so that sliding electrical connectors are necessary to transfer the electricity that is generated.

[0039] FIG. 18 is a perspective view of the overall System wherein a shaft-operated generator is employed.

[0040] FIG. 19 depicts traditional small electrical generators attached to some of the wheels in order to create electricity from the rotation of such wheels.

[0041] FIG. 20 illustrates a toothed ring attached to each trolley with such toothed ring driving one or more generators.

[0042] FIG. 21 portrays, located within a canal, the embodiment of FIG. 18 with the generator replaced by a hydraulic pump that sends pressurized fluid through a line to drive a remote generator.

[0043] FIG. 22 is a plan view of the System when the System is attached to the bed underlying a body of water and uses a slide for being raised and lowered.

[0044] FIG. 23 is a lateral view of the embodiment of FIG. 22 with the System in a lowered, operational position.

[0045] FIG. 24 is a lateral view of the embodiment of FIG. 22 with the System is a raised position.

[0046] FIG. 25A is a plan view of the System when the System is attached to the bed underlying a body of water and utilizes pivoting linkages for being raised and lowered.

[0047] FIG. 26 is a lateral view of the embodiment of FIG. 25 with the System in a lowered, operational position.

[0048] FIG. 27 is a lateral view of the embodiment of FIG. 25 with the System is a raised position.

[0049] FIG. 28 is a plan view of the System when the System is attached to a barge and uses a slide for being raised and lowered.

[0050] FIG. 29 is a lateral view of the embodiment of FIG. 28 with the System in a lowered, operational position.

[0051] FIG. 30 is a lateral view of the embodiment of FIG. 28 with the System is a raised position.

[0052] FIG. 31A is a plan view of the System when the System is attached to a barge and utilizes pivoting linkages for being raised and lowered.

[0053] FIG. 32 is a lateral view of the embodiment of FIG. 31 with the System in a lowered, operational position.

[0054] FIG. 33 is a lateral view of the embodiment of FIG. 31 with the System is a raised position.

[0055] FIG. 34 is a plan view of the System when the System is attached to a ship and uses a slide for being raised and lowered.

[0056] FIG. 35 is a lateral view of the embodiment of FIG. 34 with the System in a lowered, operational position.

[0057] FIG. 36 is a lateral view of the embodiment of FIG. 34 with the System is a raised position.

[0058] FIG. 37 is plan view of a System with an oval track supported by two columns, each of which columns is slidably mounted on a column fastened to the floor of a body of water.

[0059] FIG. 38 is a lateral view of the embodiment of FIG. 37 in a lowered, operational position.

[0060] FIG. 39 is a lateral view of the embodiment of FIG. 37 in a raised position.

[0061] FIG. 40 shows a single support column utilizing two horizontal beams to support two separate Systems.

MODES FOR CARRYING OUT THE INVENTION

[0062] The System for Generating Electricity from Fluid Currents of the present invention, an overall view of which is provided in FIG. 1, comprises a closed-loop track (1), one or more trolleys (2) having a blade (11) attached to each of such trolleys (2) and with such trolleys (2) moving along the track (1), a means for supporting each trolley (2) along the track (1), a means for keeping a desired spacing of the trolleys (2), and a means for converting the motion of each trolley (1) into electrical energy.

[0063] The track (1) may be comprised of a single rail (3) or multiple rails (3). The cross section of a rail (3) may be any open or closed shape but is preferably rectangular or circular.

[0064] Wheels (4), any well-known magnetic levitation technology (5), or a combination of both wheels (4) and magnetic levitation technology (5) constitute the

means for supporting and guiding each trolley (2) along the track (1). Herein the term "magnetic levitation technology" includes both magnetic bearings and traditional magnetic levitation.

[0065] FIG. 2 depicts, in an embodiment employing wheels (4), the relationship of such wheels to an embodiment of the track (1) consisting of a single rail (3) having a rectangular cross section. The track (1) preferably has a top (6), a bottom (7), and projecting edges (8) having a first side (9) as well as a second side (10); and, preferably, wheels (4) on each trolley (2) are simultaneously in contact with both the top (6) and bottom (7) of the track (1) as well as both sides (9), (10) of one of the projecting edges (8) of the track (1).

[0066] FIG. 3 illustrates, in an embodiment employing wheels (4), the relationship of such wheels (4) to an embodiment of the track (1) having two rails (3) with a circular cross section.

[0067] FIG. 4 depicts the embodiment of FIG. 2 utilizing magnetic levitation technology (5) in lieu of wheels (4). And FIG. 5 shows the embodiment of FIG. 2 utilizing magnetic levitation technology (5) in lieu of only some wheels (4).

[0068] The means for keeping a desired spacing can be any computerized system (not illustrated) known in the art of electrical generation or roller coasters, preferably involving a feedback process and utilizing any sensor known in the art of roller coasters together with either adjustment, as portrayed in FIG. 6, of one or more blades (11), which are—as discussed in the next paragraph—utilized for propulsion or the application of any type of brake (12) known in the art of roller coasters and illustrated in FIG 7. Preferably, however, either a rigid beam (13) is connected between adjacent trolleys (2), as illustrated in FIG. 8, or the trolleys (2) are connected to a continuous annular structure having the same shape as the track (1). (Herein the term "spacing ring" shall be used as a generic term to cover both (a) such rigid beams (13) connected between adjacent trolleys (2) and (b) the continuous annular structure. With only one trolley (2) in the System, the latter portion of the definition would, of course, be applicable.)

[0069] For propulsion, one or more blades (11) are, as shown FIGS 1, 3, 8 and 9, attached to each trolley (2). Optionally, one or more blades (11) may, as depicted in FIG. 10, also be attached to the spacing ring (13). The orientation of the blades (11) with respect to the trolley (2) or the spacing ring (13) may be either fixed or adjustable.

In the case of an adjustable blade (11), portrayed in FIG. 6, adjustment may occur mechanically when the trolley (2) is stopped or by computer or other remote control, using any technology that is well known in the art, at any time. Current in the fluid within which the System is placed acts on the blades (11) through any method that is known in the art for propelling a blade (11) or sail. The fluid is preferably, but not necessarily water.

[0070] Generation of electricity is preferably the result of relative motion between magnets (14) associated with (*i.e.*, attached to or imbedded—partially or completely—within) the trolley (2); the spacing ring (13); or, preferably, a ring (or portion of a ring) designated the electrical ring (15) (with such designation comprising both a complete ring and a portion of a ring), which is separate from the spacing ring (13) (but still connected to the trolleys (2)) and a conductor (16) physically connected to the track, as shown in FIG. 11, in such a location that the conductor (16) is at least sometimes within the magnetic field of the magnets (14) associated with the trolley (2), the spacing ring (13), or the electrical ring (15). (The conductor (16) can be an annular conductive unit or one or more coils (17) or linear conductive members attached to or imbedded—partially or completely—within an annular non-conductive unit. Herein the term "annular" denotes any linear shape having no end as well as any segment of such a linear shape.) Alternatively, the locations of the conductor (16) and the magnets (14) can be reversed with one another, as illustrated in FIG. 12. (If an electrical ring (15) or annular unit is so short that it will not interfere with the movement of a trolley (2) along the track (1), such electrical ring (15) or annular unit need not be a portion of a complete ring or a portion of the annular unit; in such a case, the electrical ring (15) or annular unit could even be straight.)

[0071] The connection of the electrical ring (15) to the trolleys (2) can be rigid, as depicted in FIG. 13, utilizing, *e.g.*, a welded or bolted bracket (100); the connection can be flexible, as shown in FIG. 14 using, *e.g.*, at least one cable (18) or piston; each trolley (2) can, as illustrated in FIG. 15, push against at least one stop (19) rigidly attached to the electrical ring (15); or the connection can, as portrayed in FIG. 16, employ one or more magnets (20). And when the conductor (16) is comprised of all or a portion of the electrical ring (15), specialized electrical connectors such as the sliding electrical connectors (21) portrayed in FIG. 17 are necessary to transfer the electricity that is generated.

[0072] Still further options for the generation of electricity by the System include connecting, *e.g.*, with spokes (101), as illustrated in FIG. 18, the spacing ring (13) or one or more trolleys (2) to a central shaft (22) which drives a traditional generator (23); when wheels (4) are employed, having a small generator (24) powered by one or more wheels (4), as shown in FIG. 19 (Of course, this option would require specialized electrical connectors such as those discussed above and shown in FIG. 17.); having, as portrayed in FIG. 20, a toothed wheel (25), preferably having substantially the same shape and size as the spacing ring (13), which is attached to each trolley (2) and drives one or more toothed projections (26) around the perimeter (27) of a drive shaft (28), each of which drive shafts (28) operates a traditional generator (23); and, as portrayed in FIG. 21 for a System located within a canal (29), replacing the traditional generator (23) in the first and third technologies of this sentence with a hydraulic pump (30) that sends pressurized fluid through one or more lines (31) to drive a remote traditional generator (23). (In FIGS. 21 through 40 the blades (11) have not been shown in order to enhance the clarity of the features being discussed in those figures.)

[0073] If the track (1) follows a circular path, the spacing ring (13) and the electrical ring (15) merely need be circular. Should the track have a non-circular path, the spacing ring (13) and the electrical ring (15) (at least when it is a complete ring) must each be hinged.

[0074] If placed in the ocean or another large body of water (32), the System can be attached, *e.g.*, with columns (102), to the bed (33) underlying the body of water (32), as depicted in FIGS. 22 through 27; to a floating object such as a barge (34), as portrayed in FIGS. 28 through 33; or to a powered ship (35), as illustrated in FIGS. 34 through 36. (In the case of the powered ship (35) the current driving the System would be that which is artificially generated by the movement of the ship through the water.) If placed in a river or other moving body of water, the System can be attached to the bed underlying the body of water; the System can be attached to a floating object, such as a barge; or the System can be attached to the shore, so long as only some or all of the portions of the system that need not be in contact with the flowing fluid, *i.e.*, in this case, the water, are outside the flow of the water.

[0075] Moreover, although the preferred orientation of the track (1) is within a substantially vertical plane, it can be operated in any orientation.

[0076] And a non-circular shape for the track (1) attached, *e.g.*, with columns (102), to the bed (33) of a body of water (32) is portrayed in FIGS. 37 through 39.

[0077] Since it is beneficial to be able to raise the System for maintenance or, sometimes, for movement of the barge (34) or ship (35), FIGS. 24, 30, and 36 shows the System raised through the use of a slide (36) whereas FIGS. 27 and 33 portray the System raised through the use of pivoting linkages (37).

[0078] Finally, the possibility of utilizing a single support column (38) and a single horizontal beam (39) or multiple (preferably, two) horizontal beams (39) to support multiple Systems is illustrated in FIG. 40.

[0079] As used herein, the term "substantially" indicates that one skilled in the art would consider the value modified by such terms to be within acceptable limits for the stated value. Also as used herein the term "preferable" or "preferably" means that a specified element or technique is more acceptable than another but not that such specified element or technique is a necessity.

INDUSTRIAL APPLICABILITY

The way in which the System for Generating Electricity from Fluid Currents is capable of exploitation in industry and the way in which the System for Generating Electricity from Fluid Currents can be made and used are obvious from the description and the nature of the Retractable Hose Extension for a Vacuum.

CLAIMS

We claim:

1. A system for generating electricity from fluid currents, which comprises:

a closed-loop track (1);

at least one trolley (2);

at least one blade (11) attached to each said trolley (2);

a means for supporting and guiding the movement along said track (1) of each said trolley (2);

a means for maintaining spacing of each of said trolleys (2); and

a means for converting motion of each said trolley (2) into electrical energy.

2. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for maintaining spacing of each of said trolleys (2) comprises a spacing ring (13).

3. The system for generating electricity from fluid currents as recited in claim 2, further comprising:

one or more blades (11) attached to said spacing ring (13).

4. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for supporting and guiding comprises wheels (4).

5. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

6. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

7. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

8. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

9. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

10. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

11. The system for generating electricity from fluid currents as recited in claim 4, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

12. The system for generating electricity from fluid currents as recited in claim 4, further comprising:

one or more blades (11) attached to said spacing ring (13).

13. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

14. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

15. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

16. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

17. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

18. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

19. The system for generating electricity from fluid currents as recited in claim 12, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

20. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for supporting and guiding comprises magnetic levitation technology (5).

21. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

22. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the

magnetic field of the magnets (14) contained in said annular non-conducting unit.

23. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

24. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

25. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

26. The system for generating electricity from fluid currents as recited in claim 20, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

27. The system for generating electricity from fluid currents as recited in claim 20, further comprising:

one or more blades (11) attached to said spacing ring (13).

28. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

29. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

30. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft(22).

31. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

32. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

33. The system for generating electricity from fluid currents as recited in claim 27, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

34. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for supporting and guiding comprises wheels (4) and magnetic levitation technology (5).

35. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

36. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

37. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

38. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

39. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

40. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

41. The system for generating electricity from fluid currents as recited in claim 34, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

42. The system for generating electricity from fluid currents as recited in claim 34, further comprising:

one or more blades (11) attached to said spacing ring (13).

43. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

44. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

45. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

46. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

47. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

48. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

49. The system for generating electricity from fluid currents as recited in claim 42, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

50. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

51. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

52. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

53. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

54. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

55. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

56. The system for generating electricity from fluid currents as recited in claim 2, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

57. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for supporting and guiding comprises wheels (4).

58. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

59. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

60. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

61. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

62. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

63. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

64. The system for generating electricity from fluid currents as recited in claim 57, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

65. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for supporting and guiding comprises magnetic levitation technology (5).

66. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

67. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

68. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

69. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

70. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

71. The system for generating electricity from fluid currents as recited in claim 65, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

72. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for supporting and guiding comprises wheels (4) and magnetic levitation technology (5).

73. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

74. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

75. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

76. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

77. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

78. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

79. The system for generating electricity from fluid currents as recited in claim 72, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

80. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises an electrical ring (15), said electrical ring (15) being attached to one or more of said trolleys (2) and said electrical ring (15) containing magnets (14); and

a conductor (16) connected to said track (1) in such a location that said conductor (16) is at least sometimes within the magnetic field of the magnets (14) contained in said electrical ring (15).

81. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises an annular non-conducting unit, said annular non-conducting unit being attached to said track (1) and said annular non-conducting unit containing magnets (14); and

an electrical ring (15) wherein said electrical ring (15) is a conductor in such a location that said electrical ring (15) is at least sometimes within the magnetic field of the magnets (14) contained in said annular non-conducting unit.

82. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2); and

a generator (23) driven by said central shaft (22).

83. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises at least one small generator (24) powered by at least one of said wheels (4).

84. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25); and

for each said drive shaft (28), a generator (23) operated by said drive shaft (28).

85. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises a central shaft (22);

spokes (101) attaching said central shaft (22) to at least one of said trolleys (2);

at least one line (31);

an hydraulic pump (30) driven by said central shaft (22) for pumping pressurized fluid through said at least one line (31); and

a generator (23) driven by the pumping of said hydraulic pump (30).

86. The system for generating electricity from fluid currents as recited in claim 1, wherein:

the means for converting comprises a toothed wheel (25) attached to each said trolley (2);

a drive shaft (28) having a perimeter (27) and one or more toothed projections (26) around such perimeter (27) such that said drive shaft (28) is driven by said toothed wheel (25);

at least one line (31) for each drive shaft (28);

for each said drive shaft (28), an hydraulic pump (30) operated by said drive shaft (28) for pumping pressurized fluid through said at least one line (31); and

for each said hydraulic pump (30), a generator (23) driven by the pumping of said hydraulic pump (30).

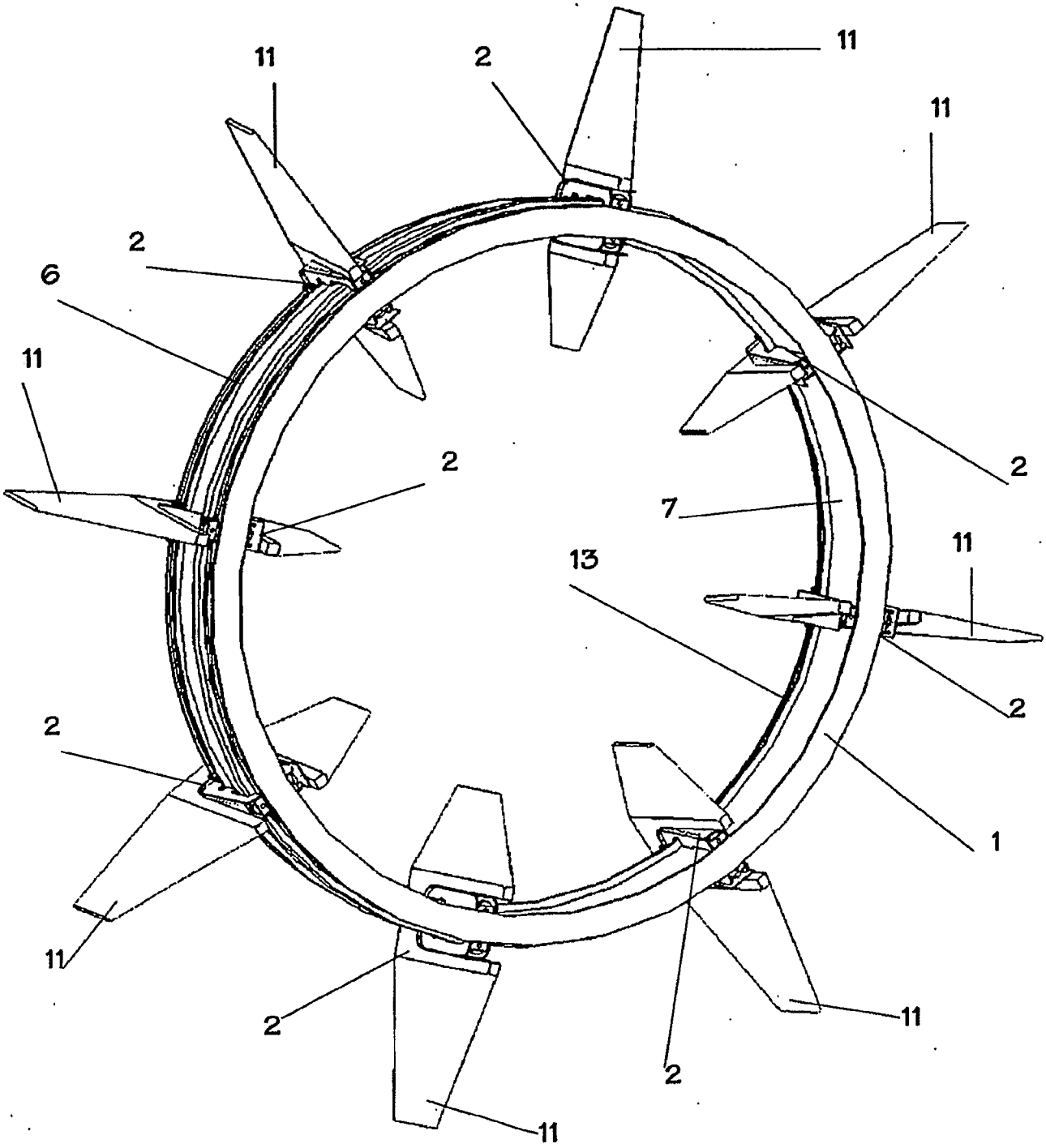

FIG. 1

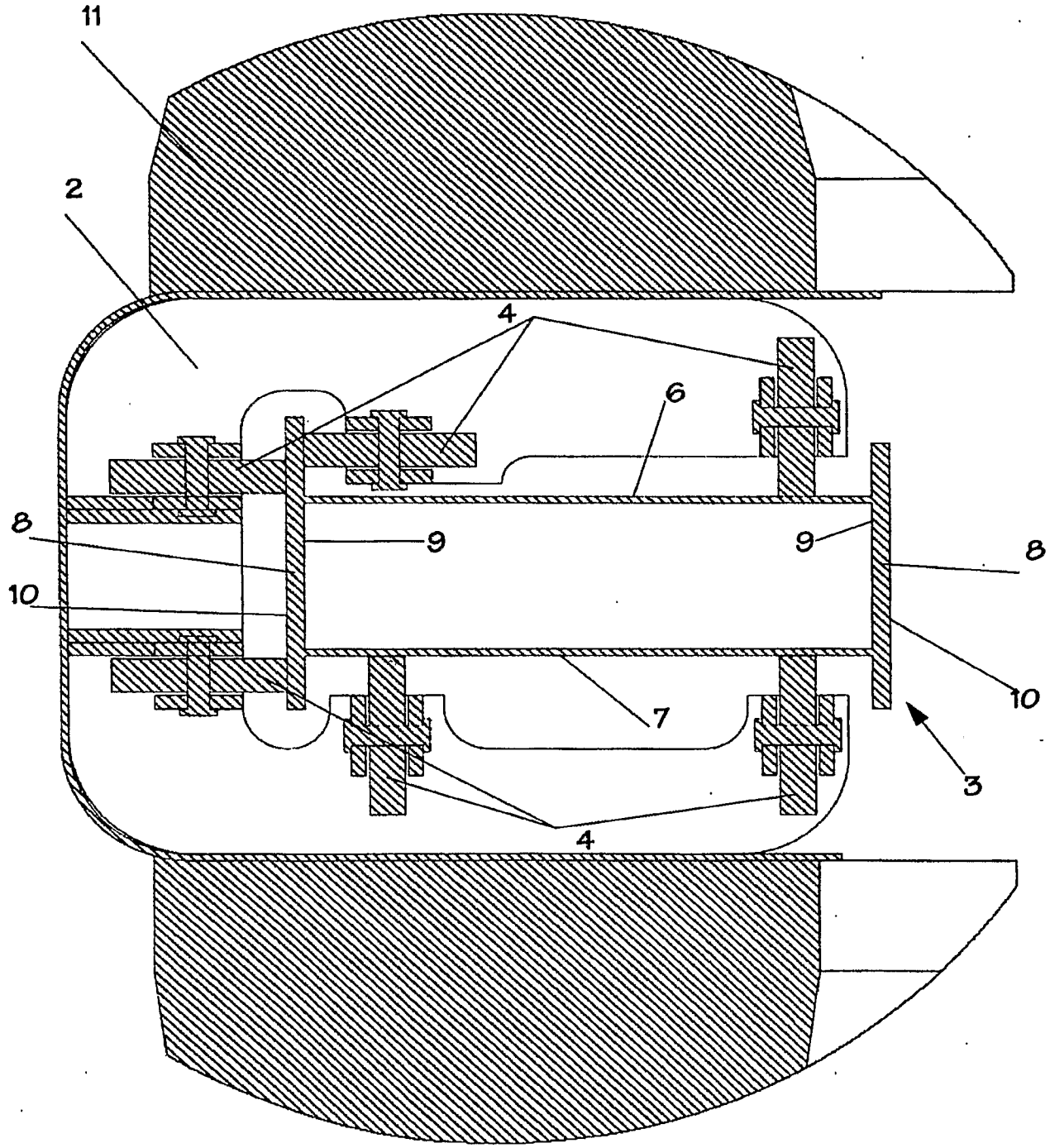

FIG. 2

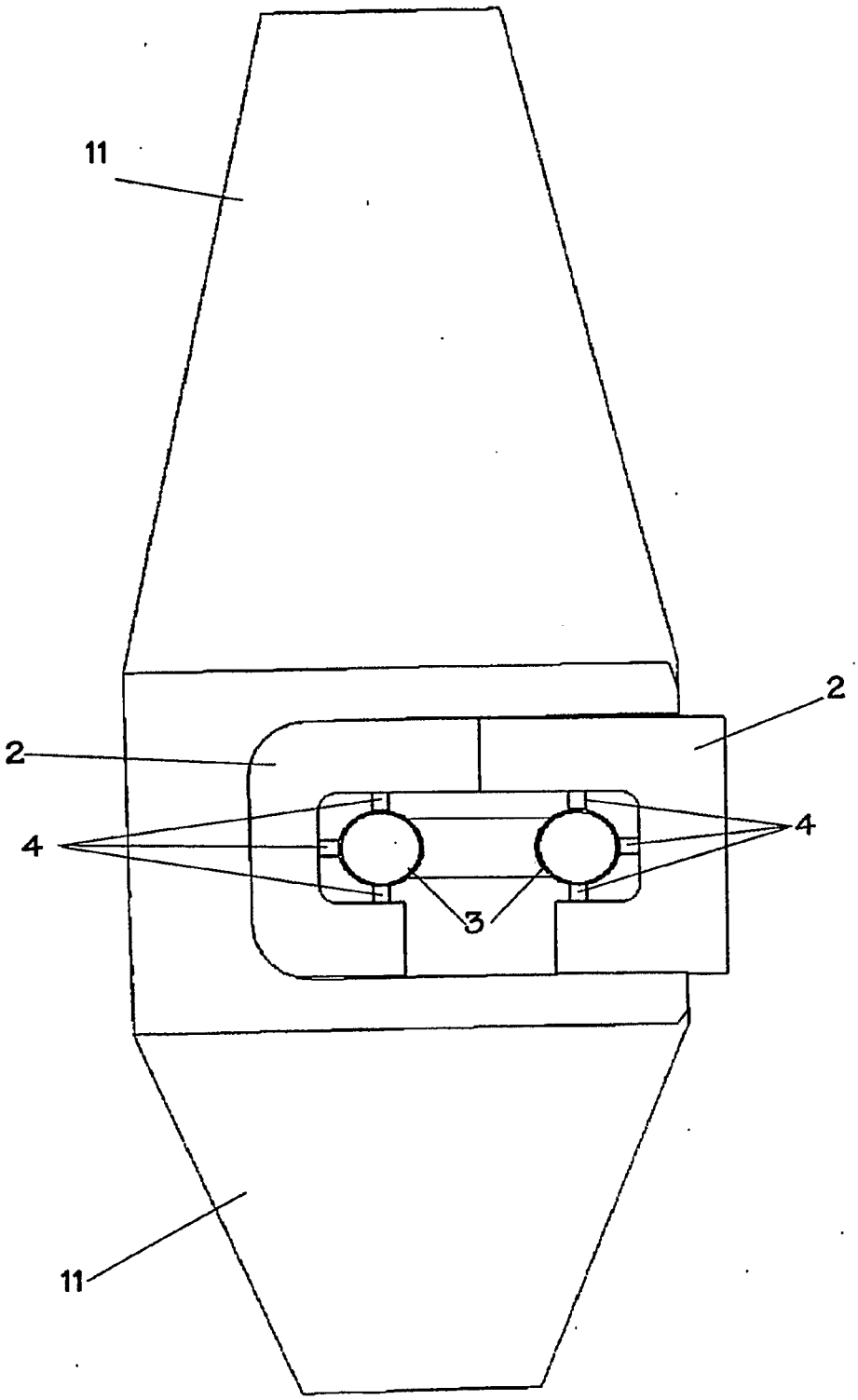

FIG. 3

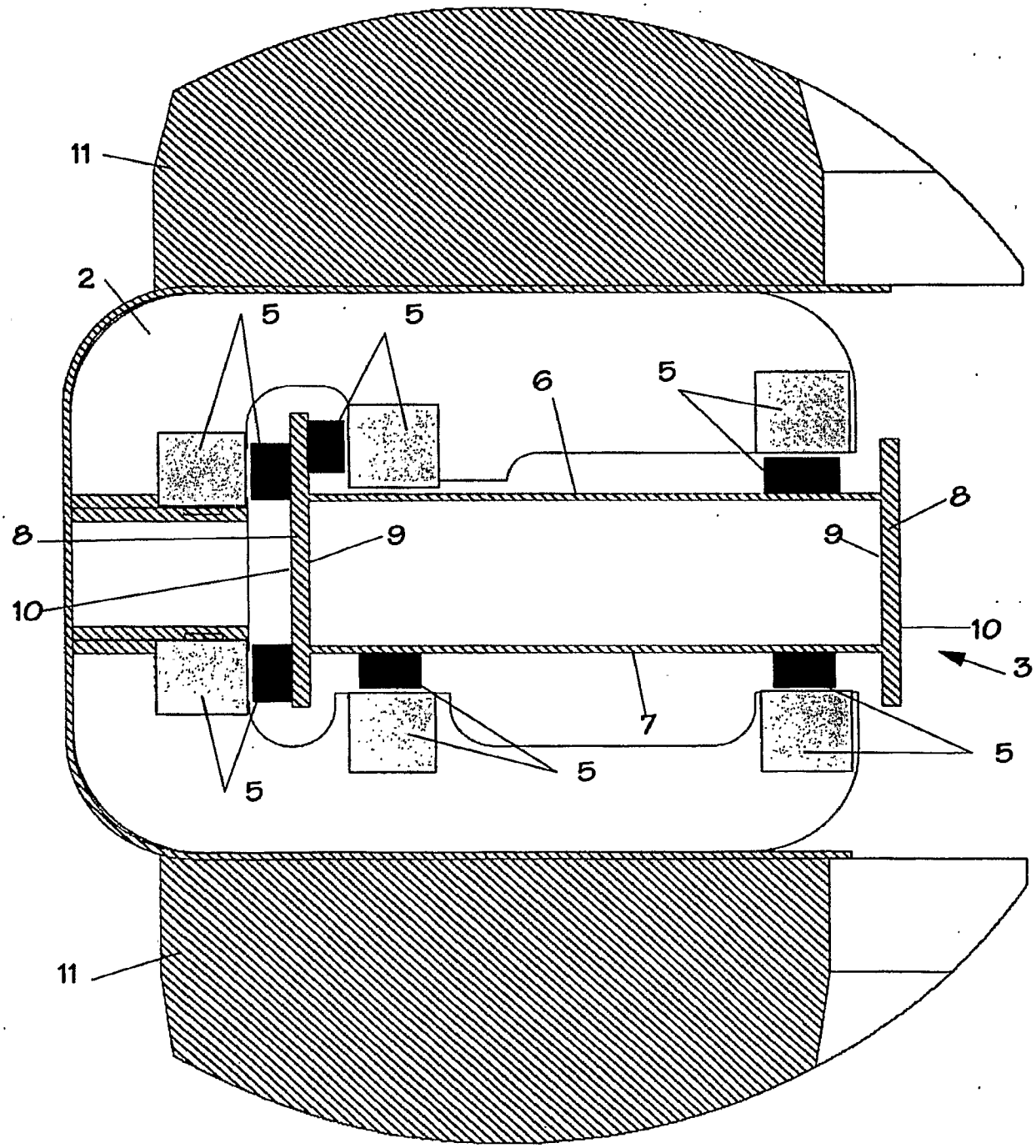

FIG. 4

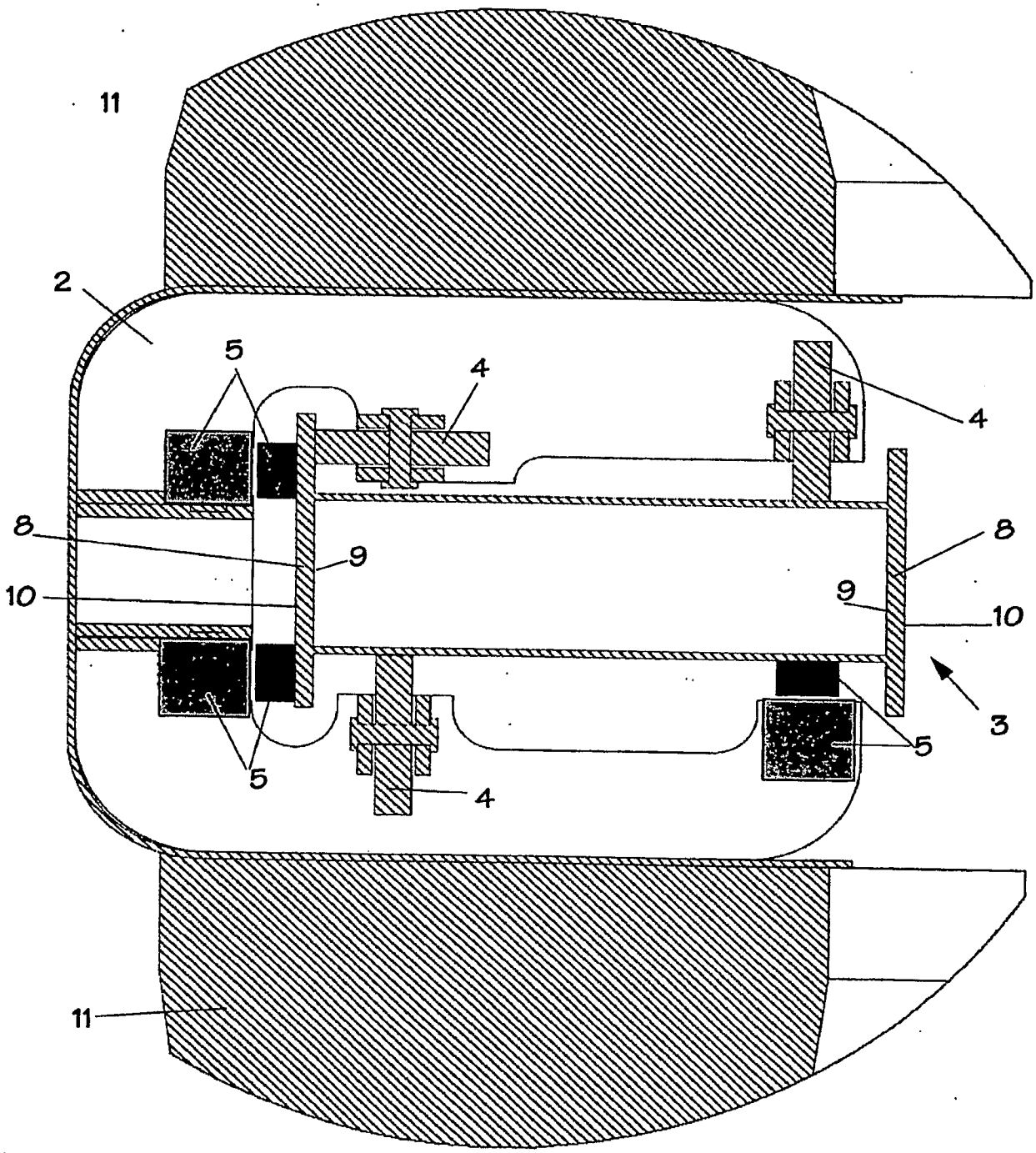

FIG. 5

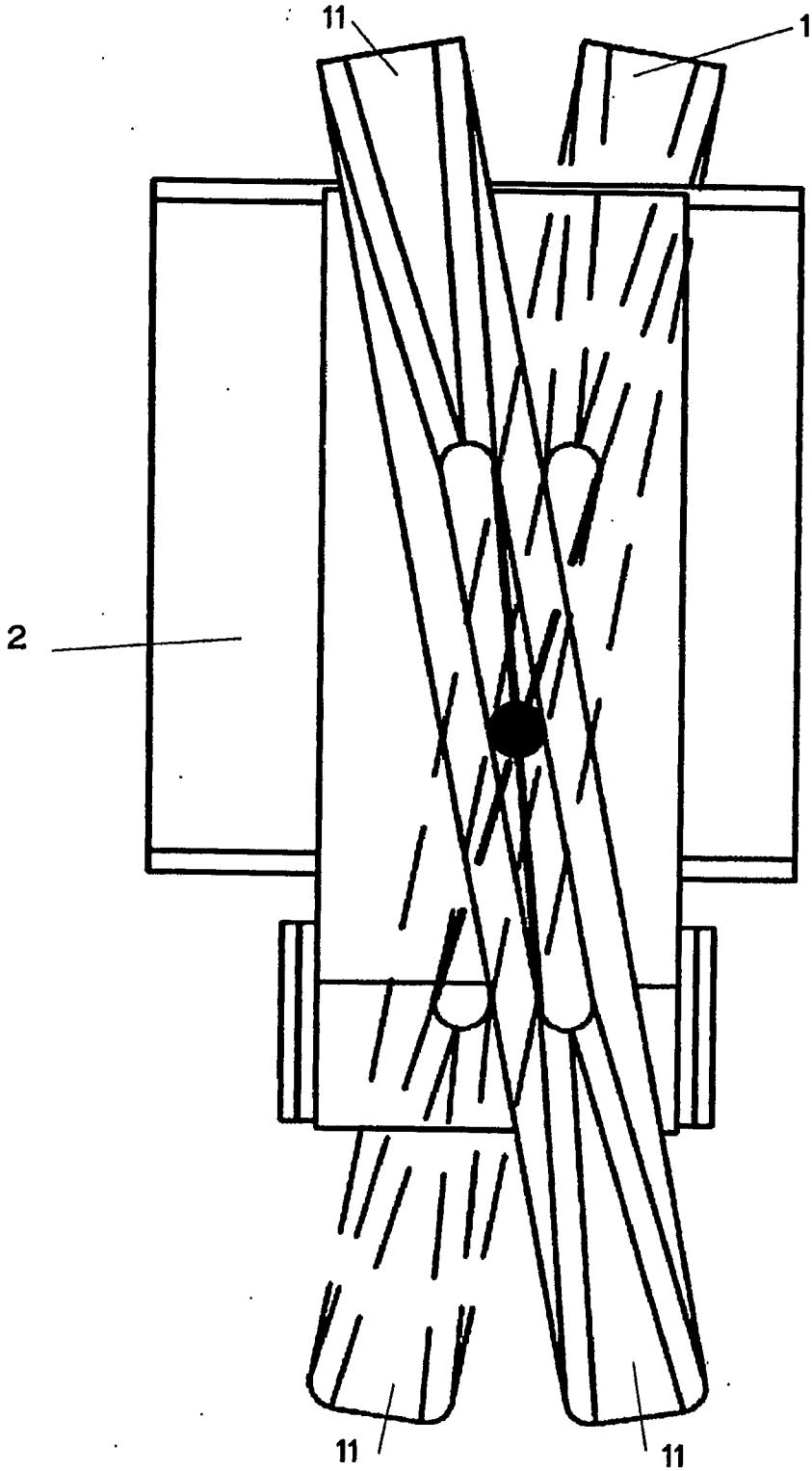

FIG. 6

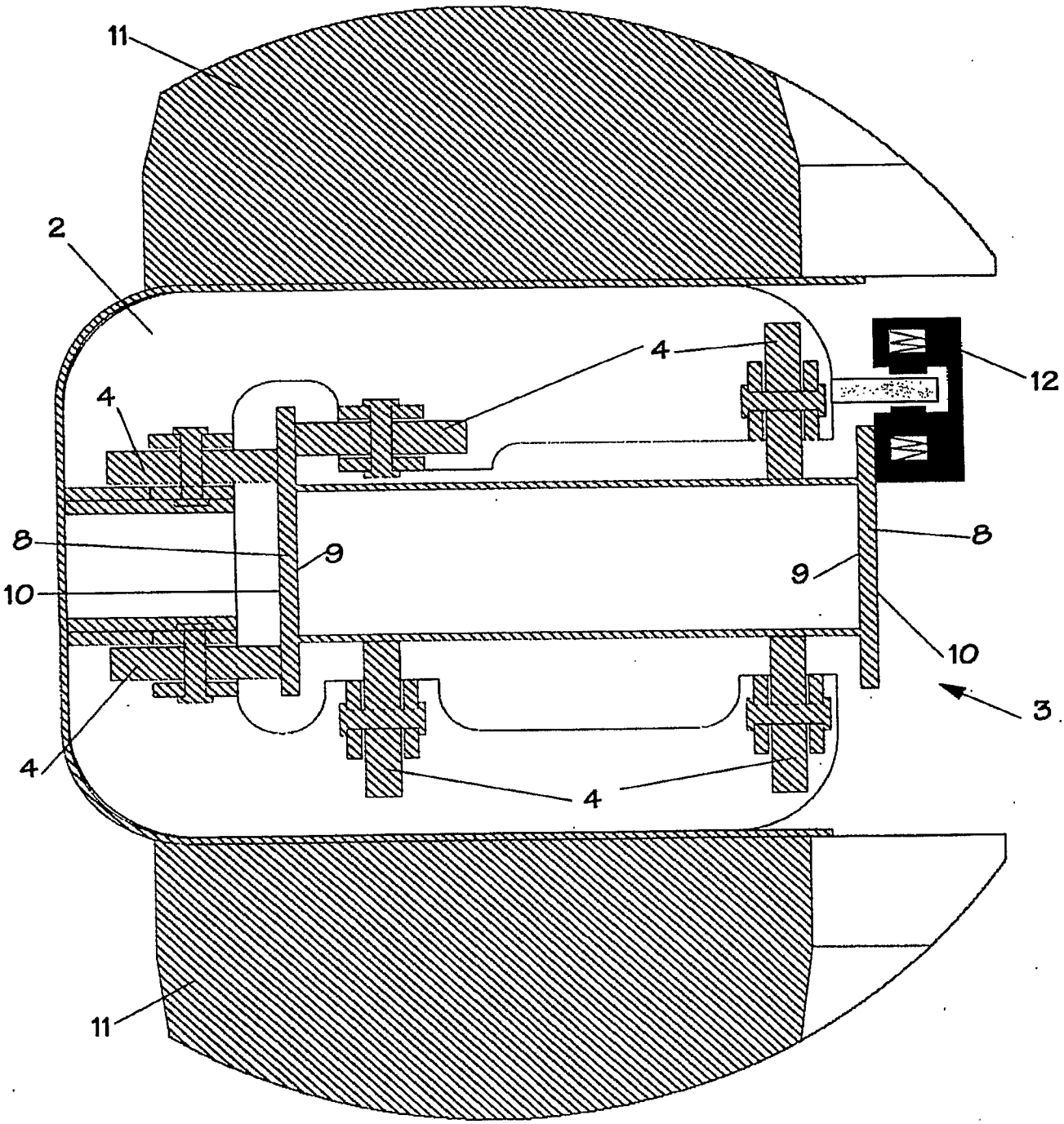

FIG. 7

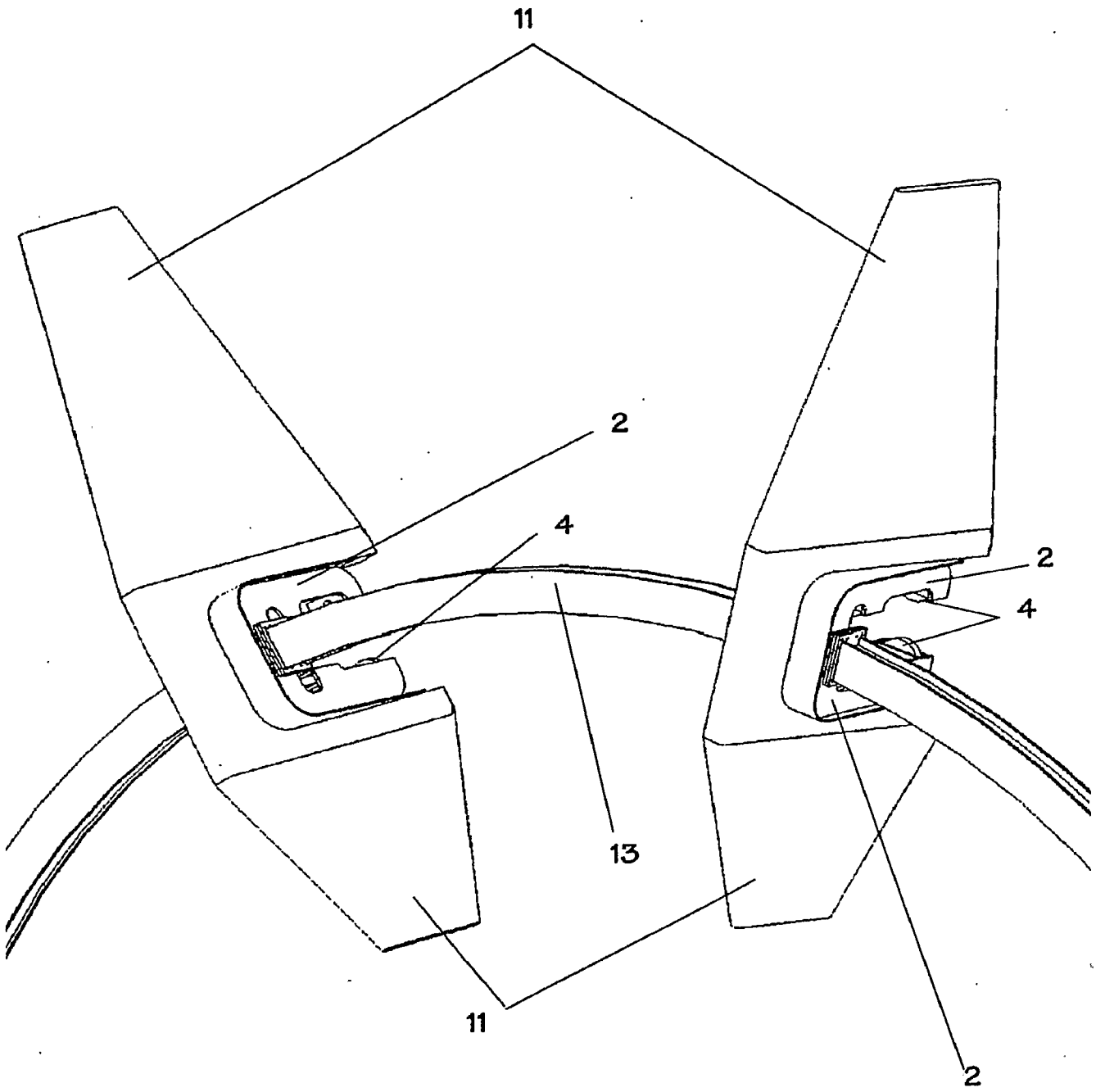

FIG. 8

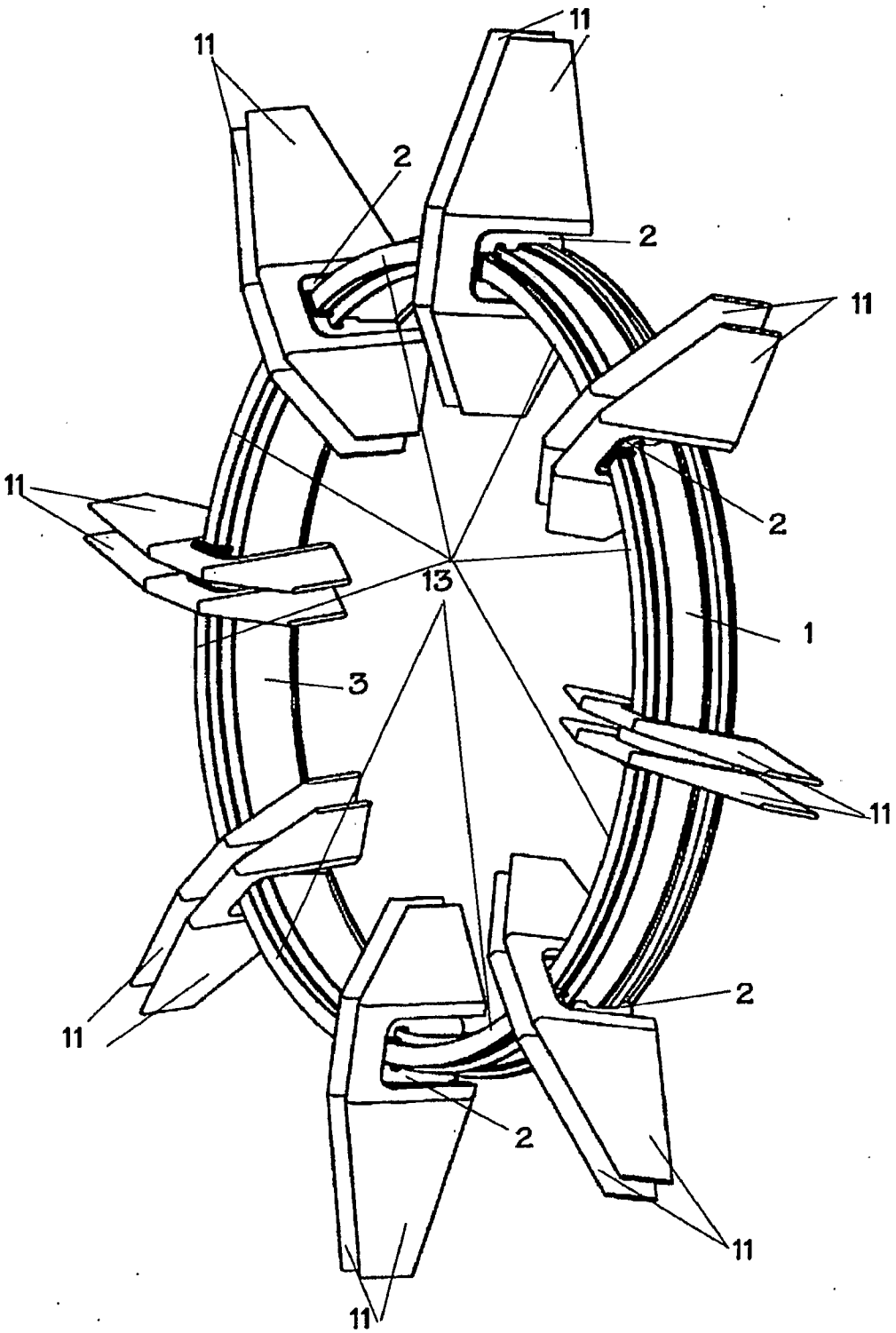

FIG. 9

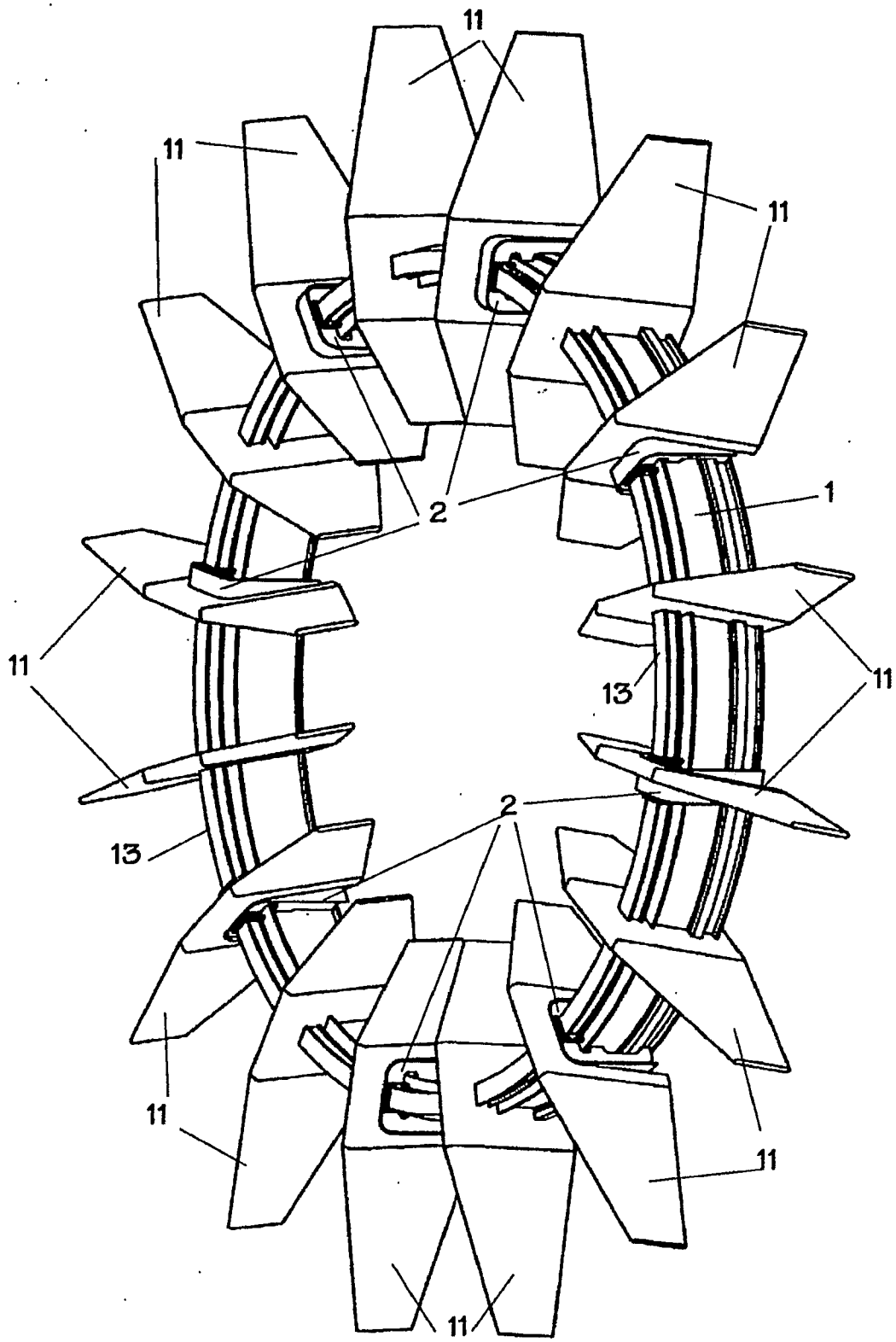

FIG. 10

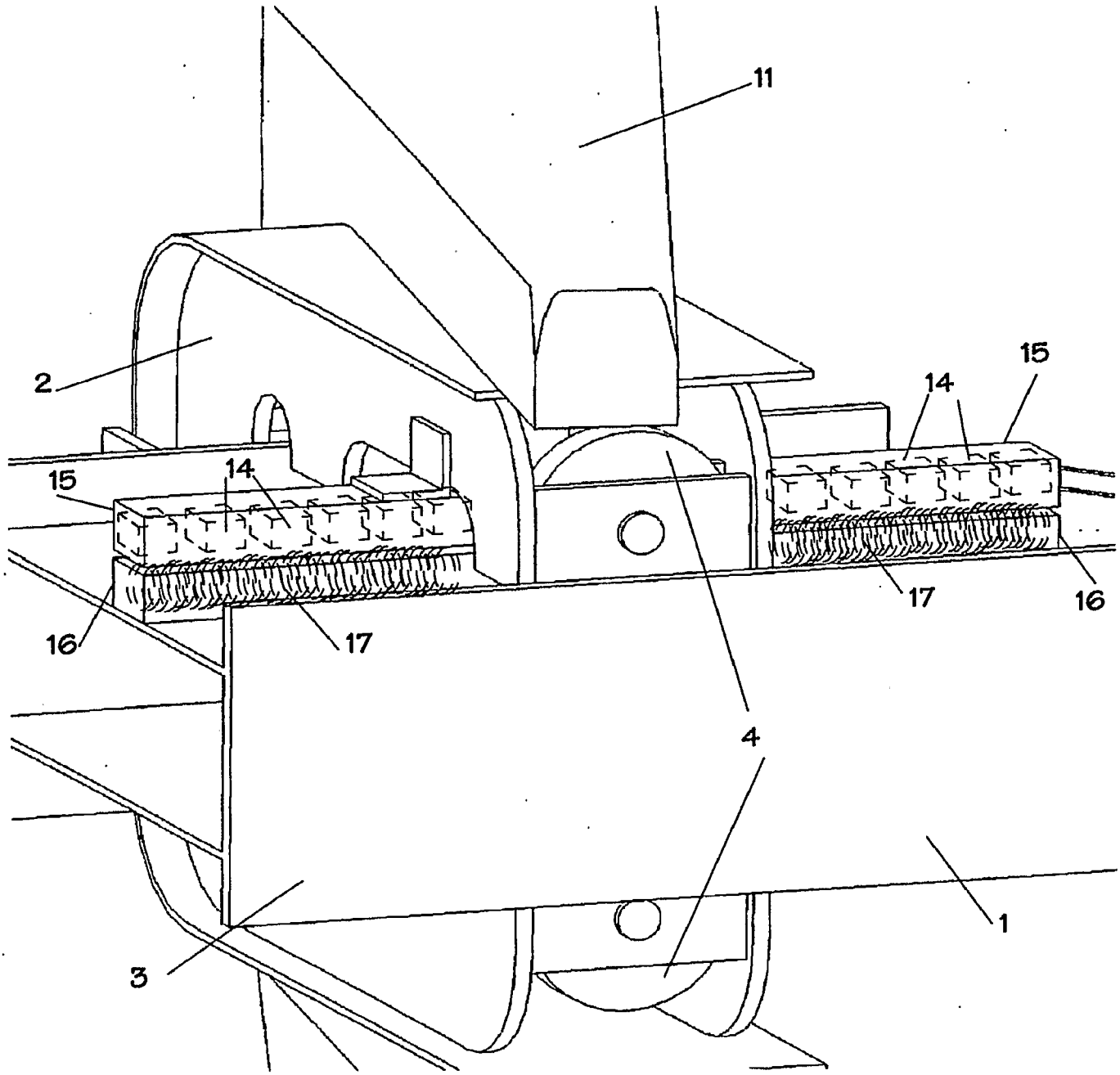

FIG. 11

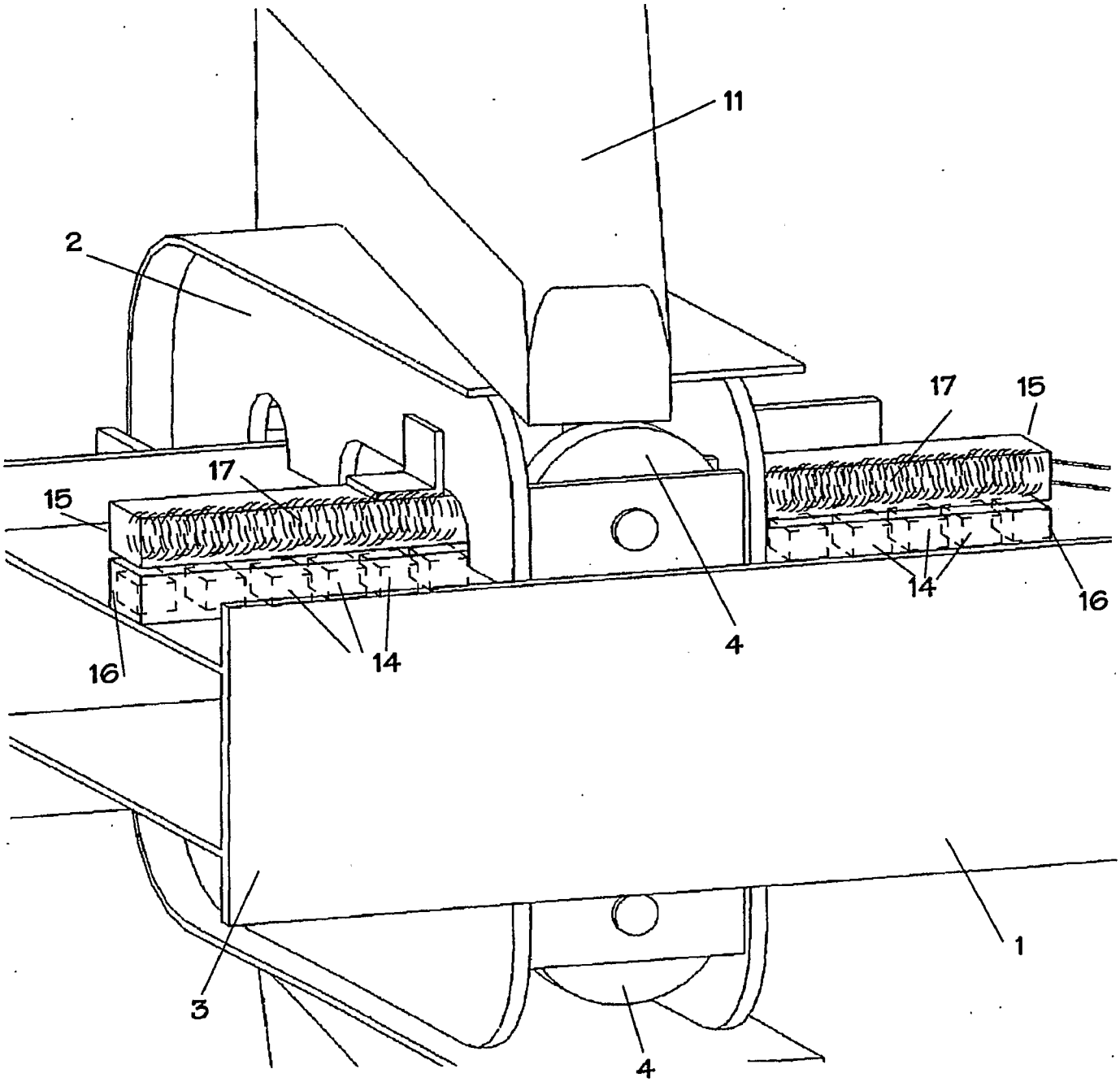

FIG. 12

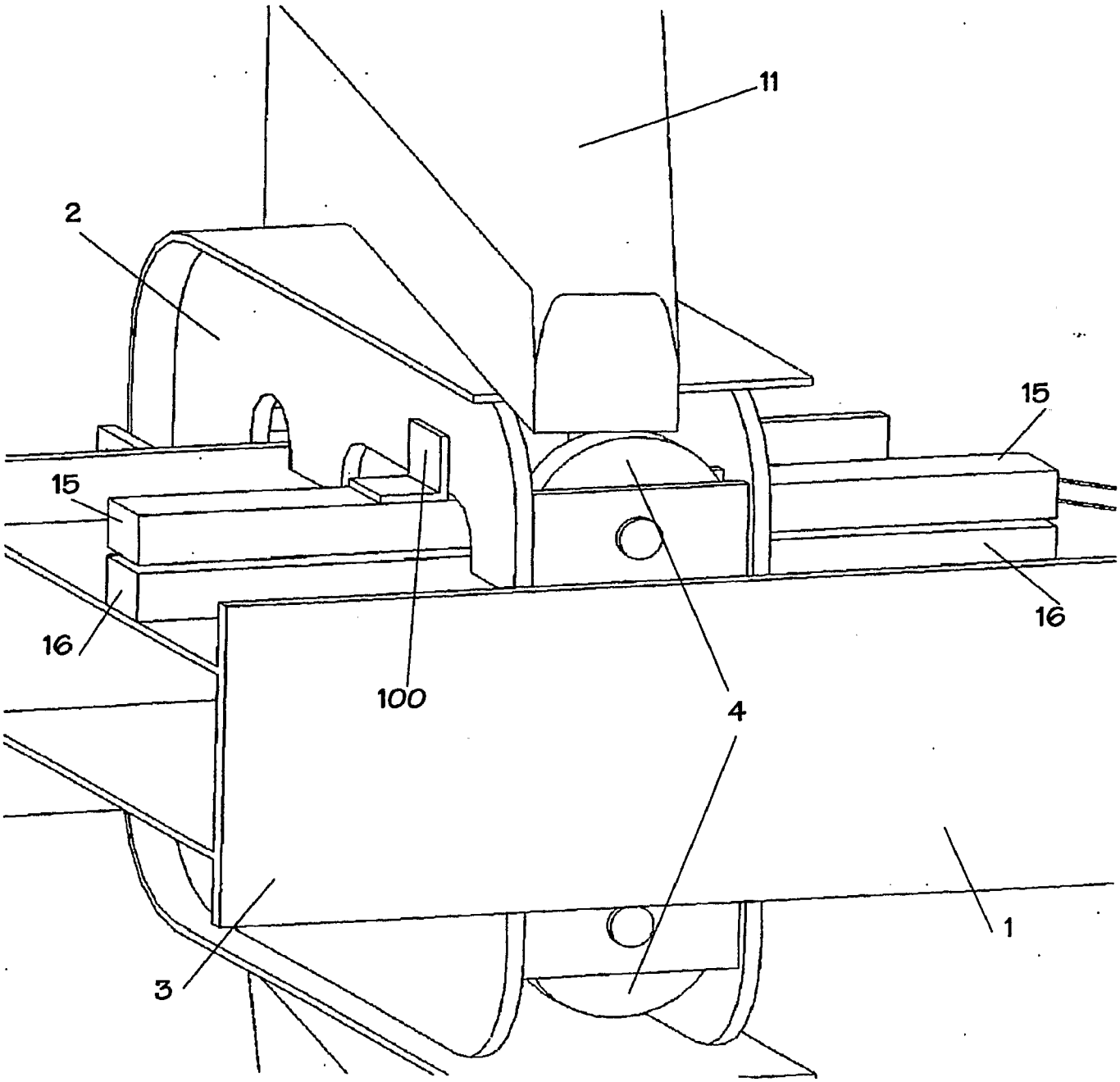

FIG. 13

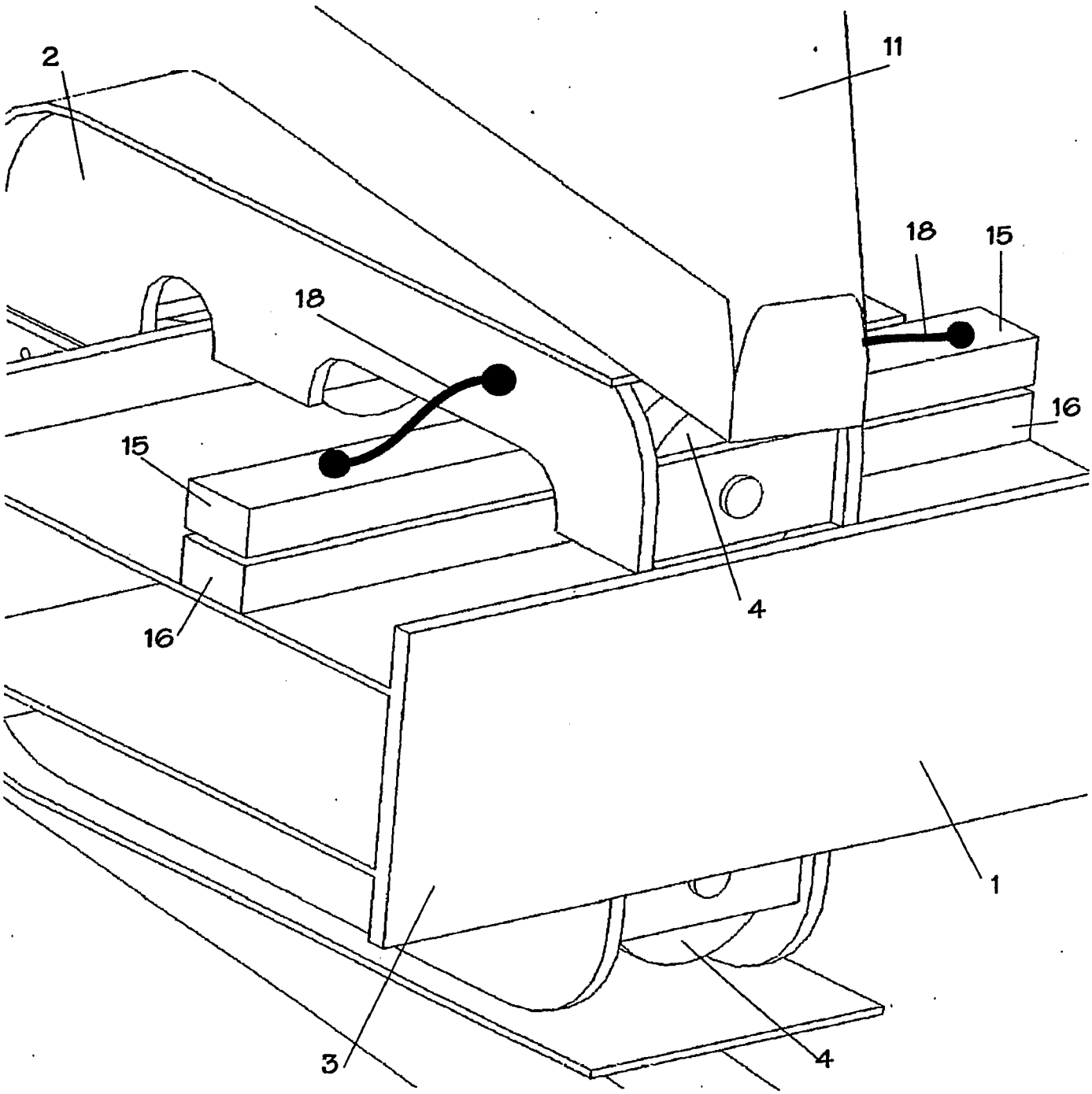

FIG. 14

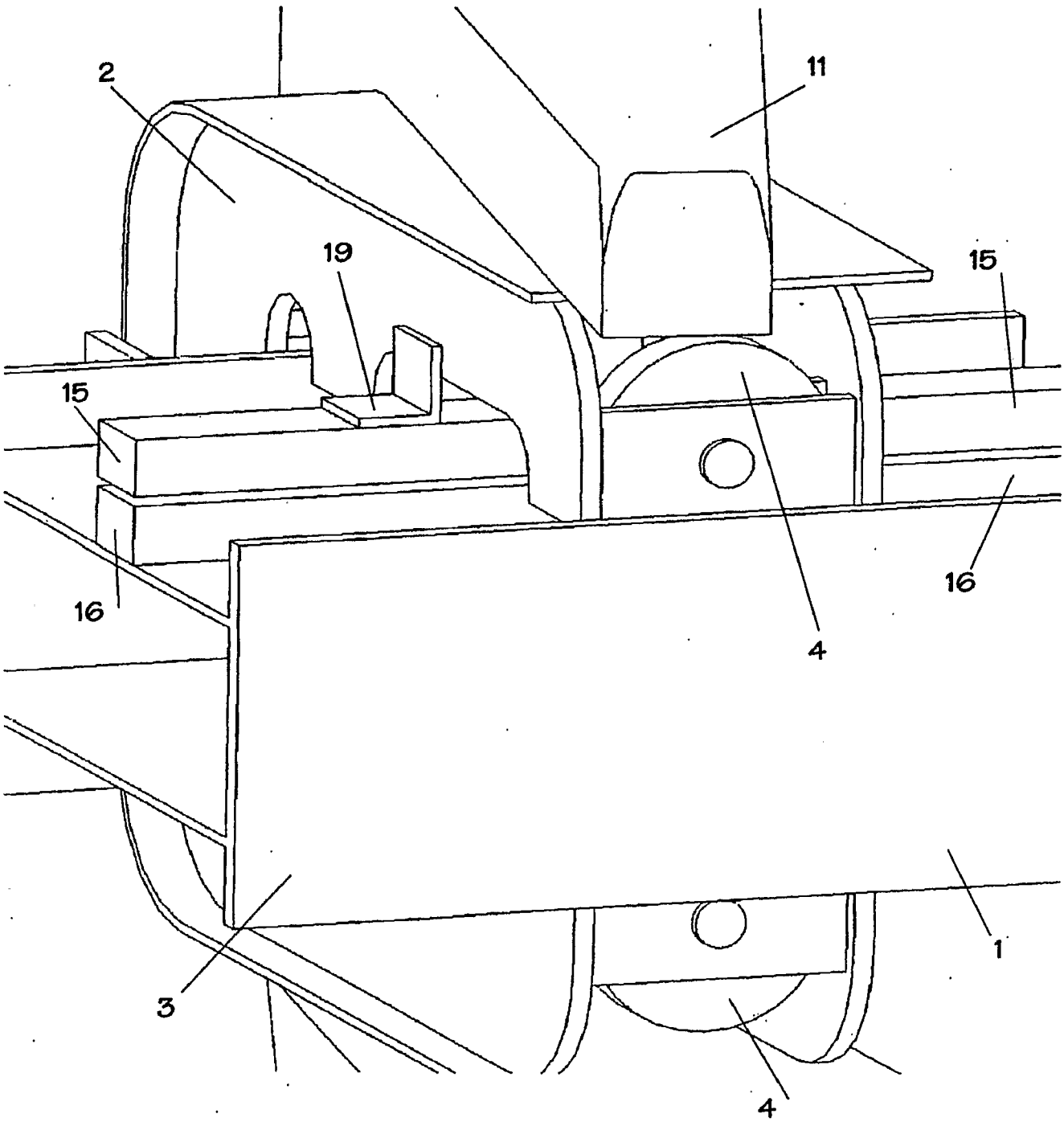

FIG. 15

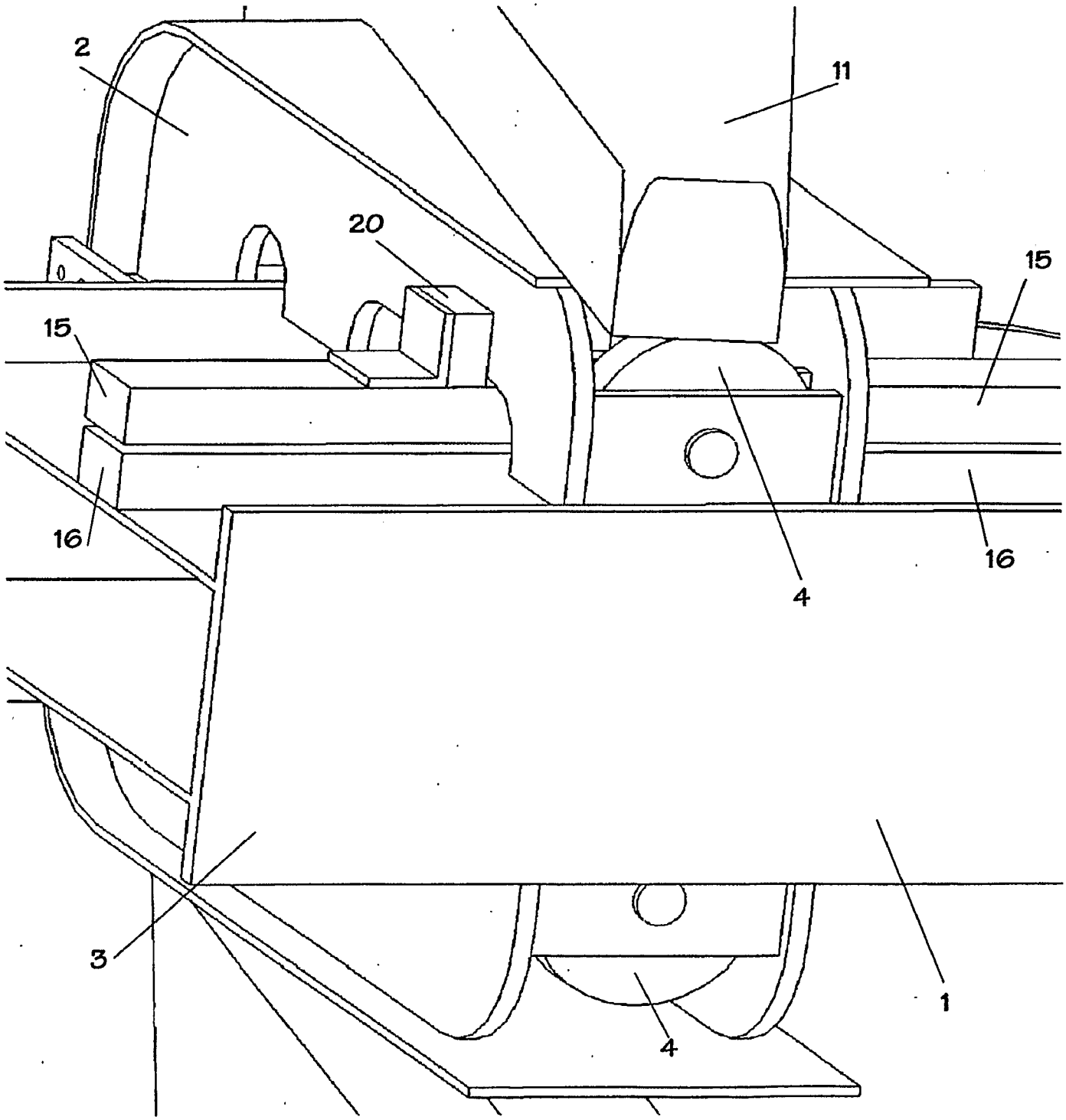

FIG. 16

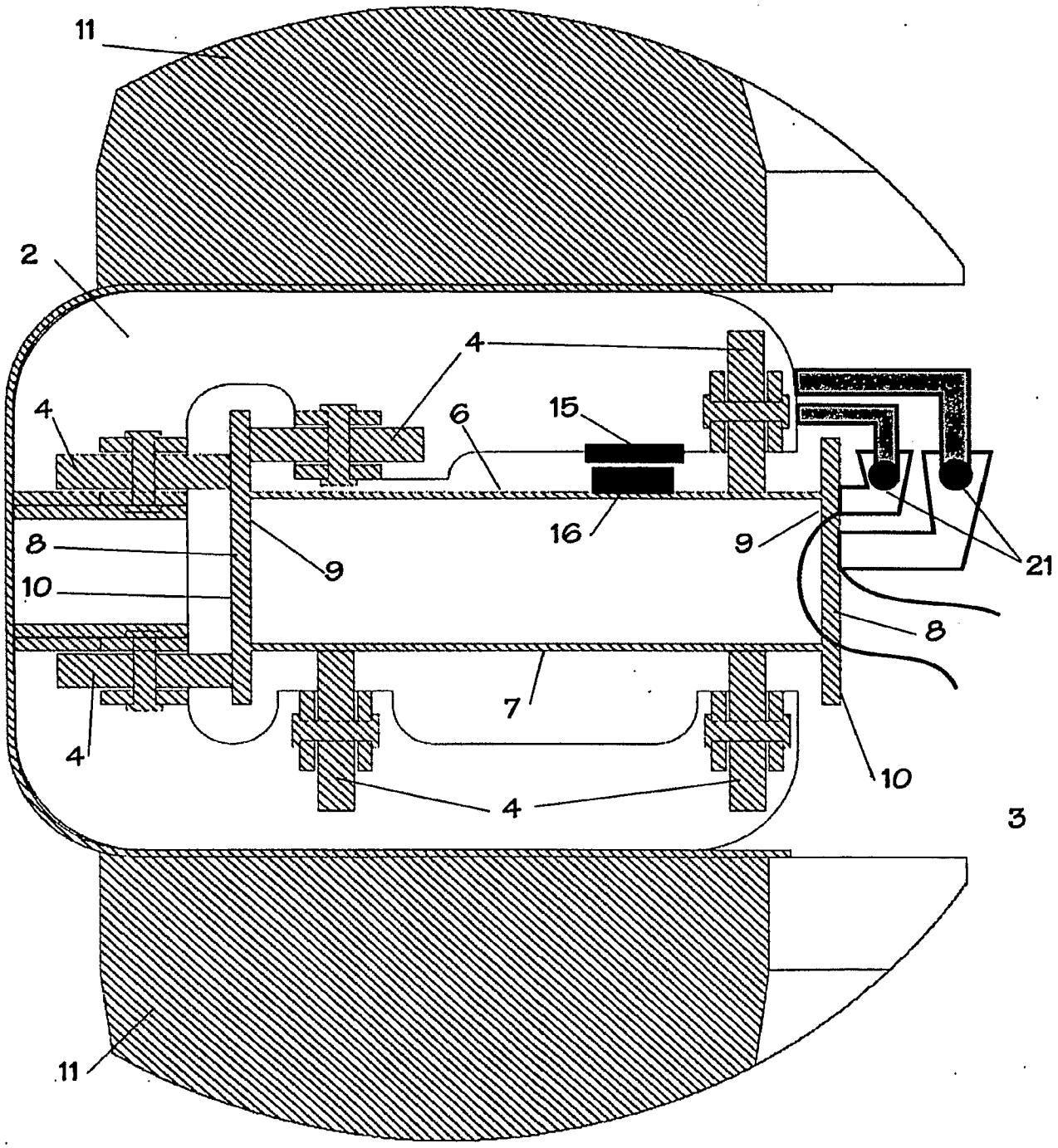

FIG. 17

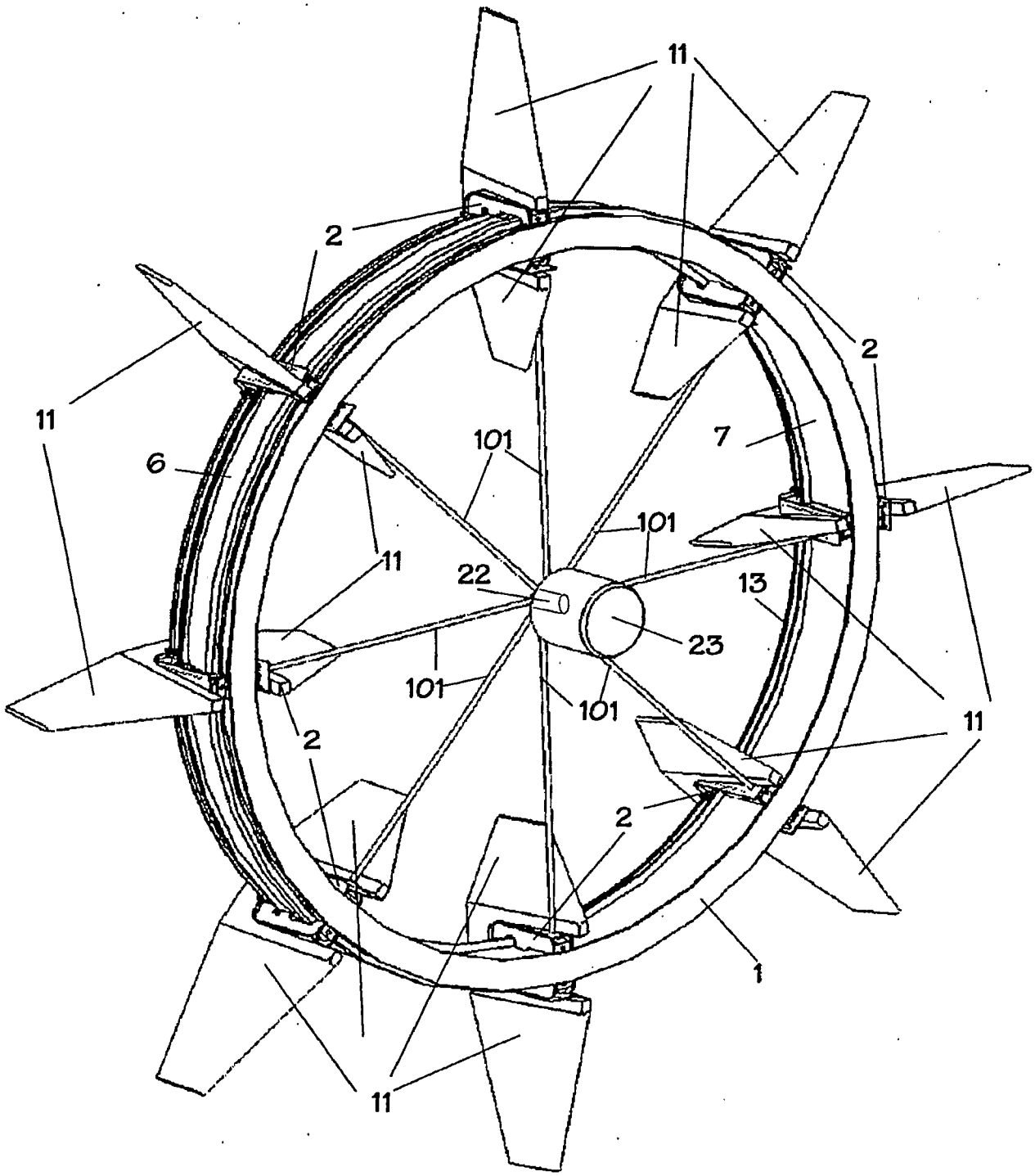

FIG. 18

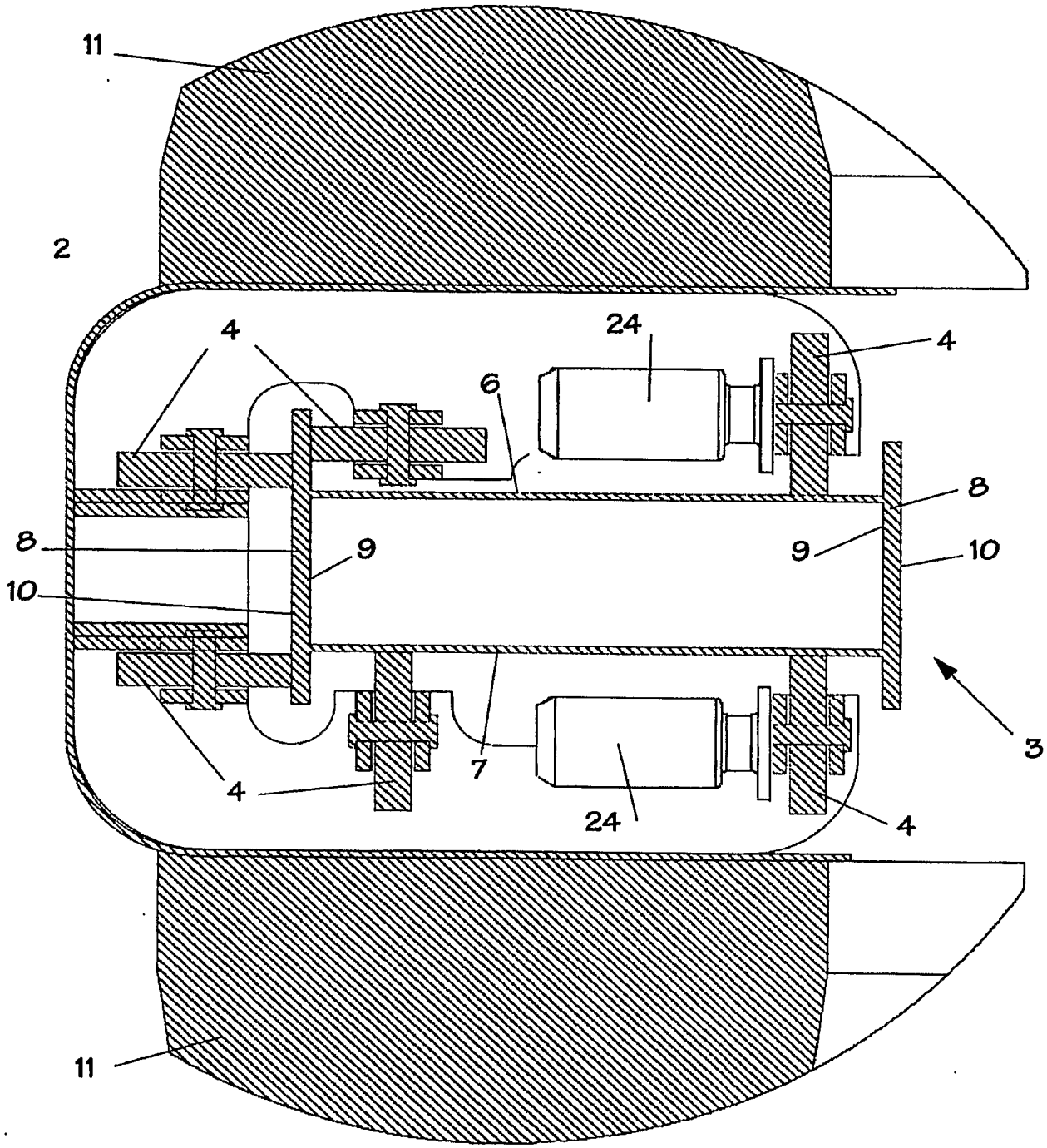

FIG. 19

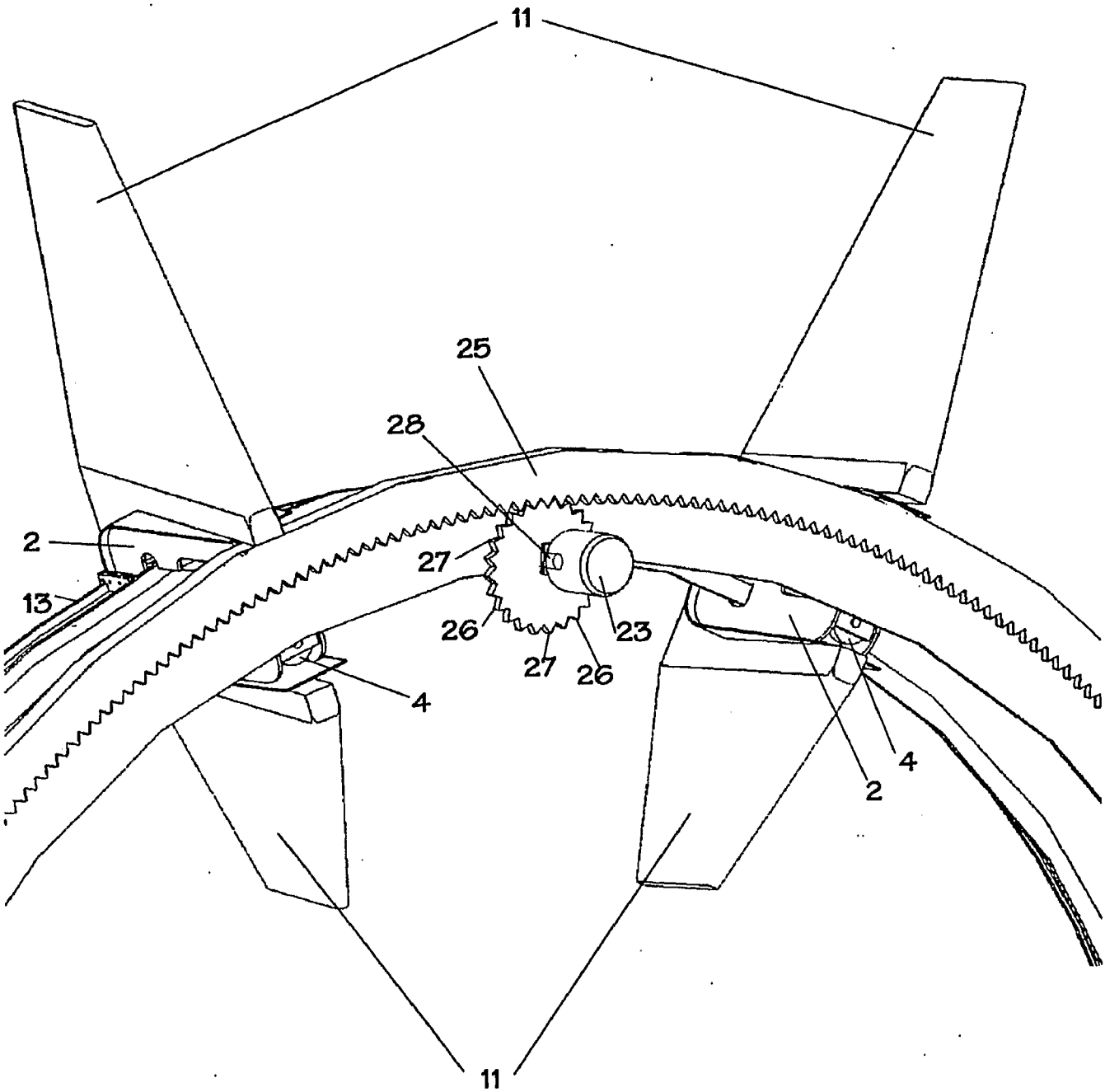

FIG. 20

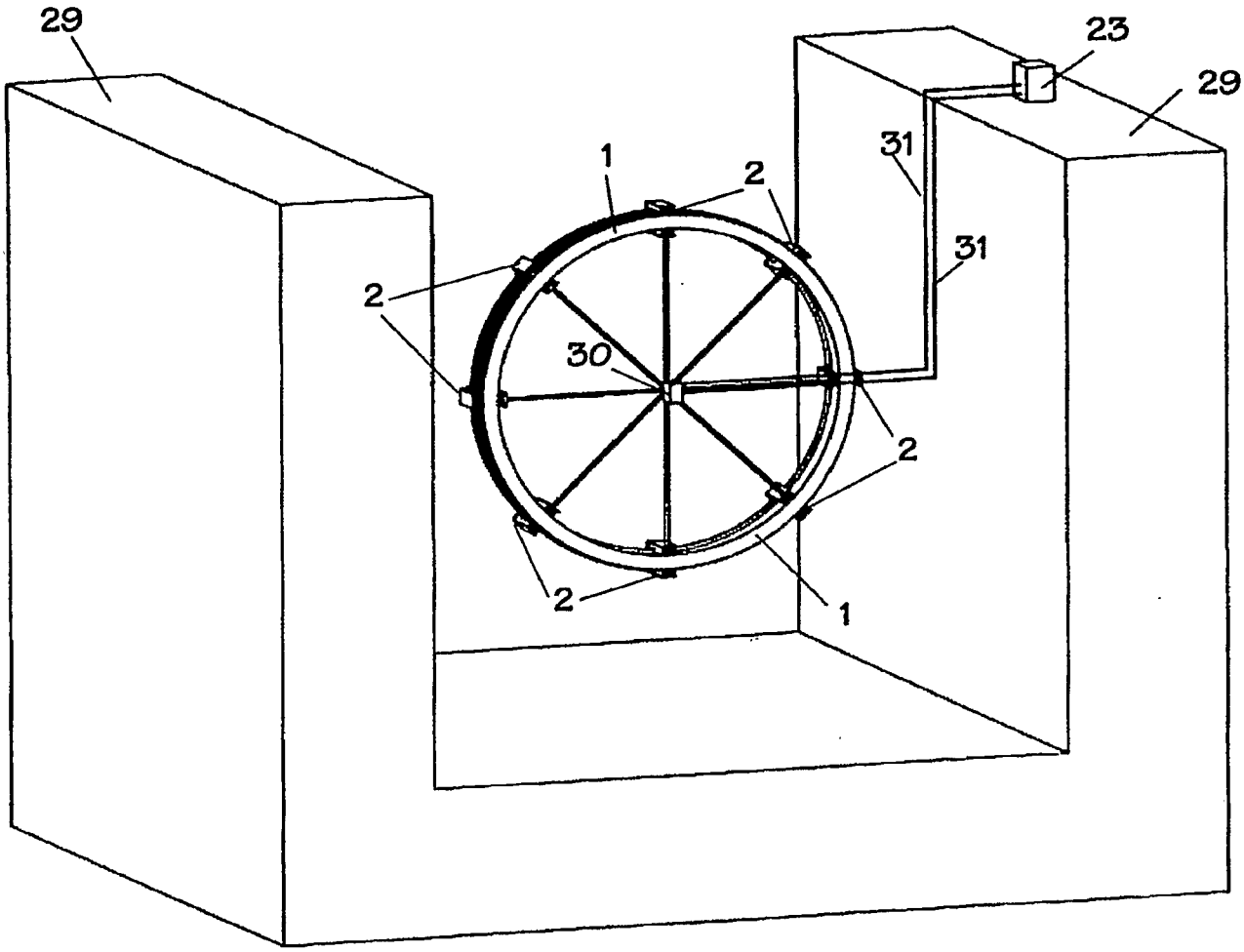

FIG. 21

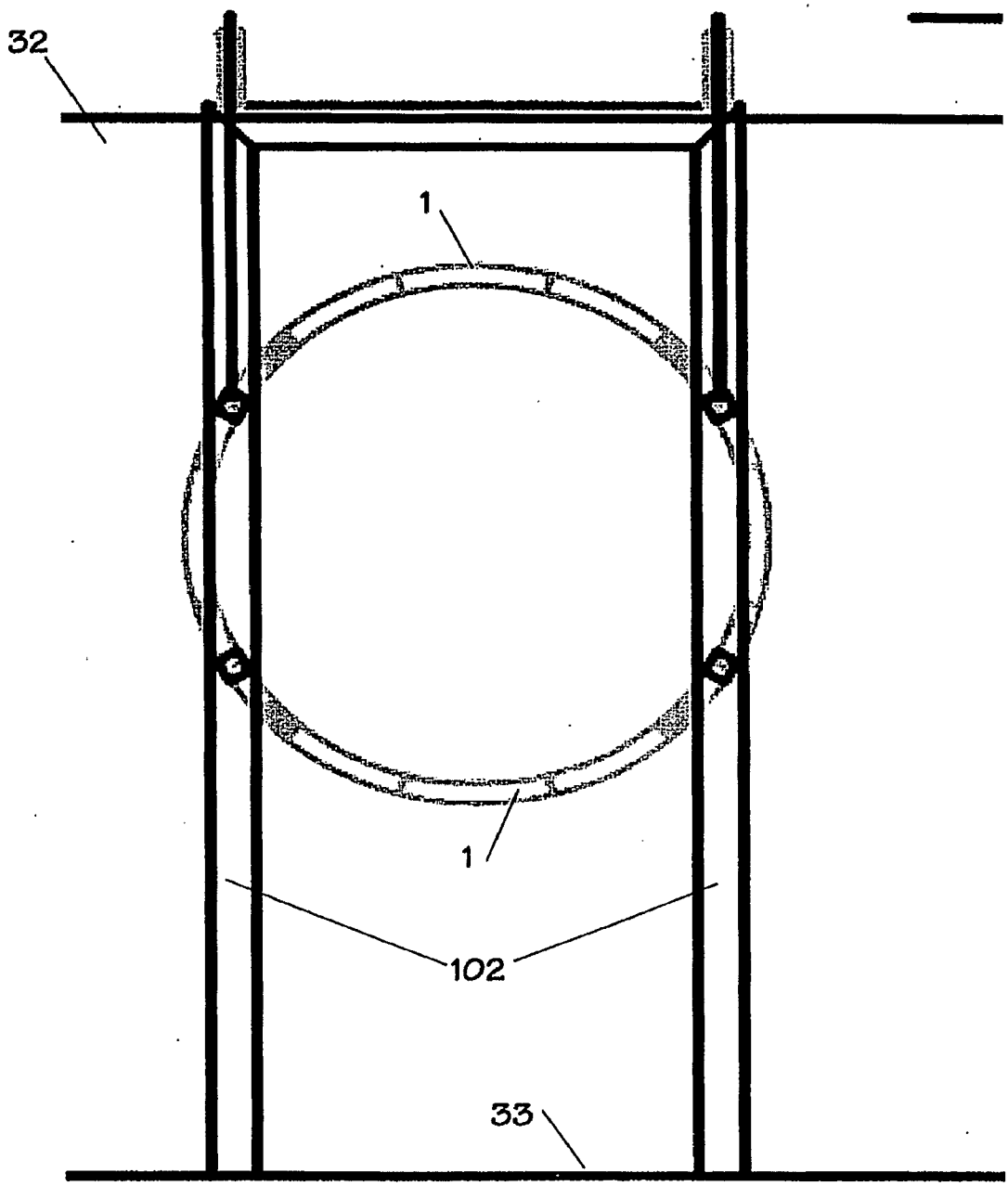

FIG. 22

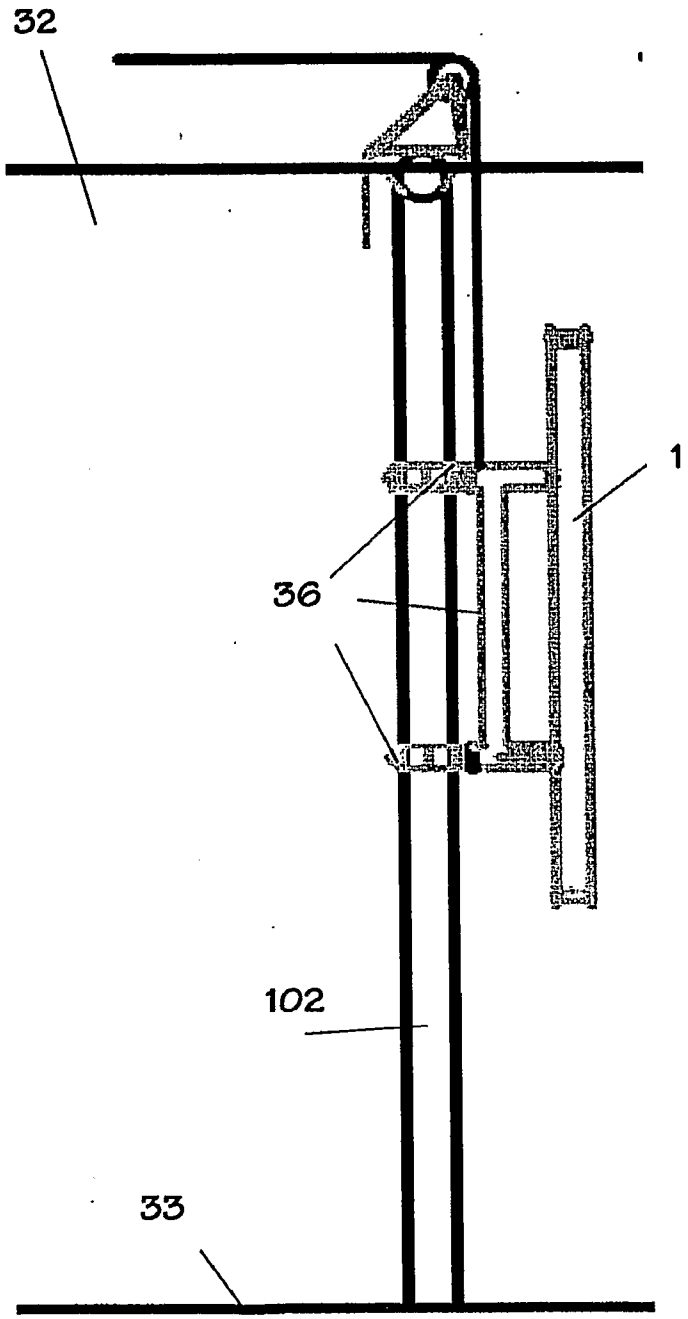

FIG. 23

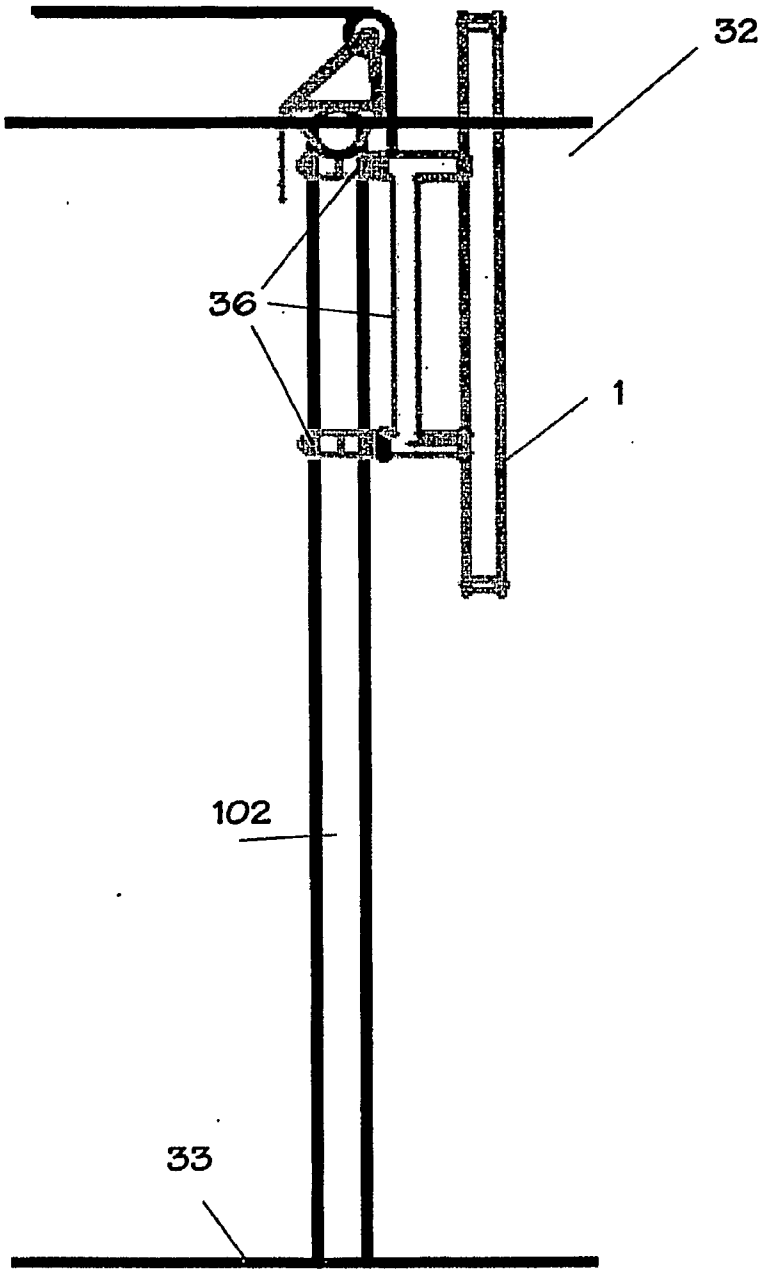

FIG. 24

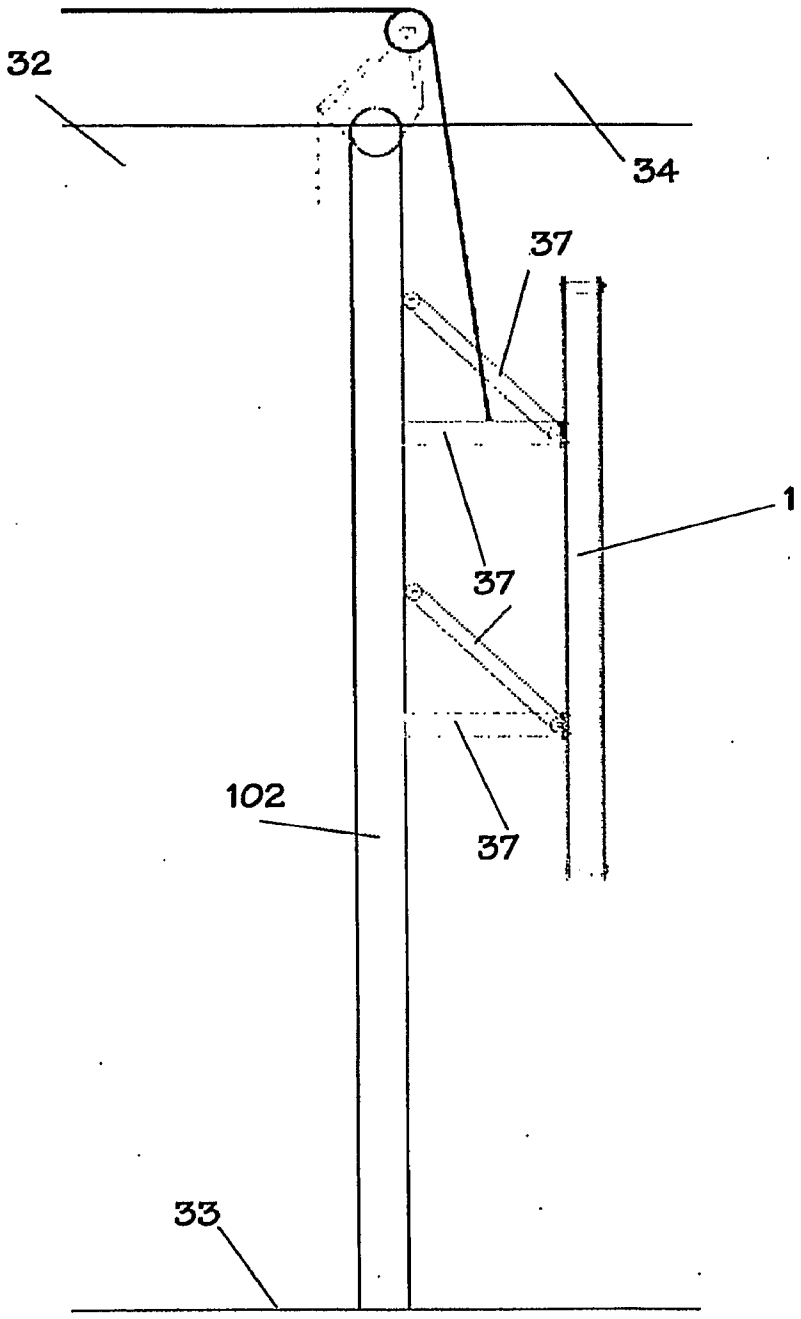

FIG. 25

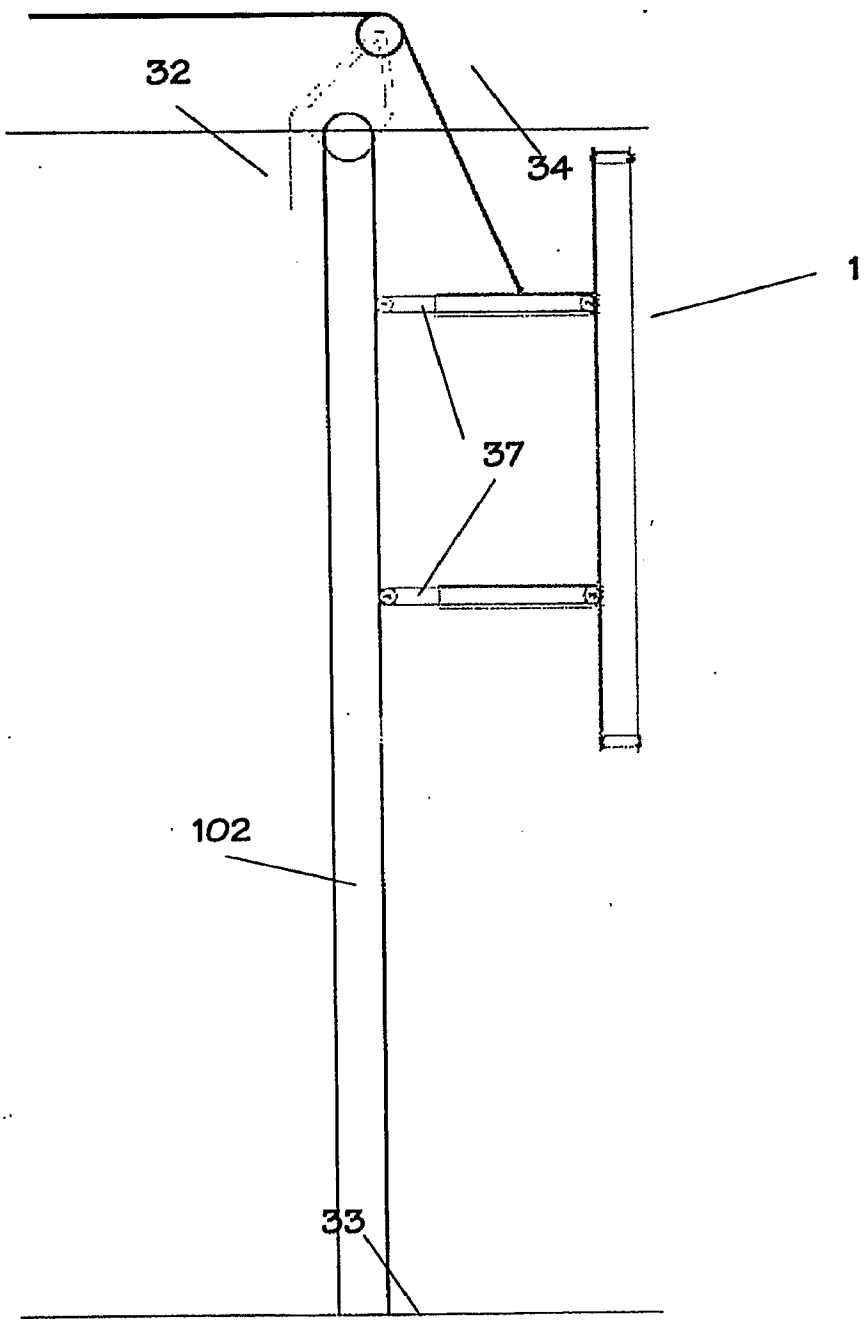

FIG. 26

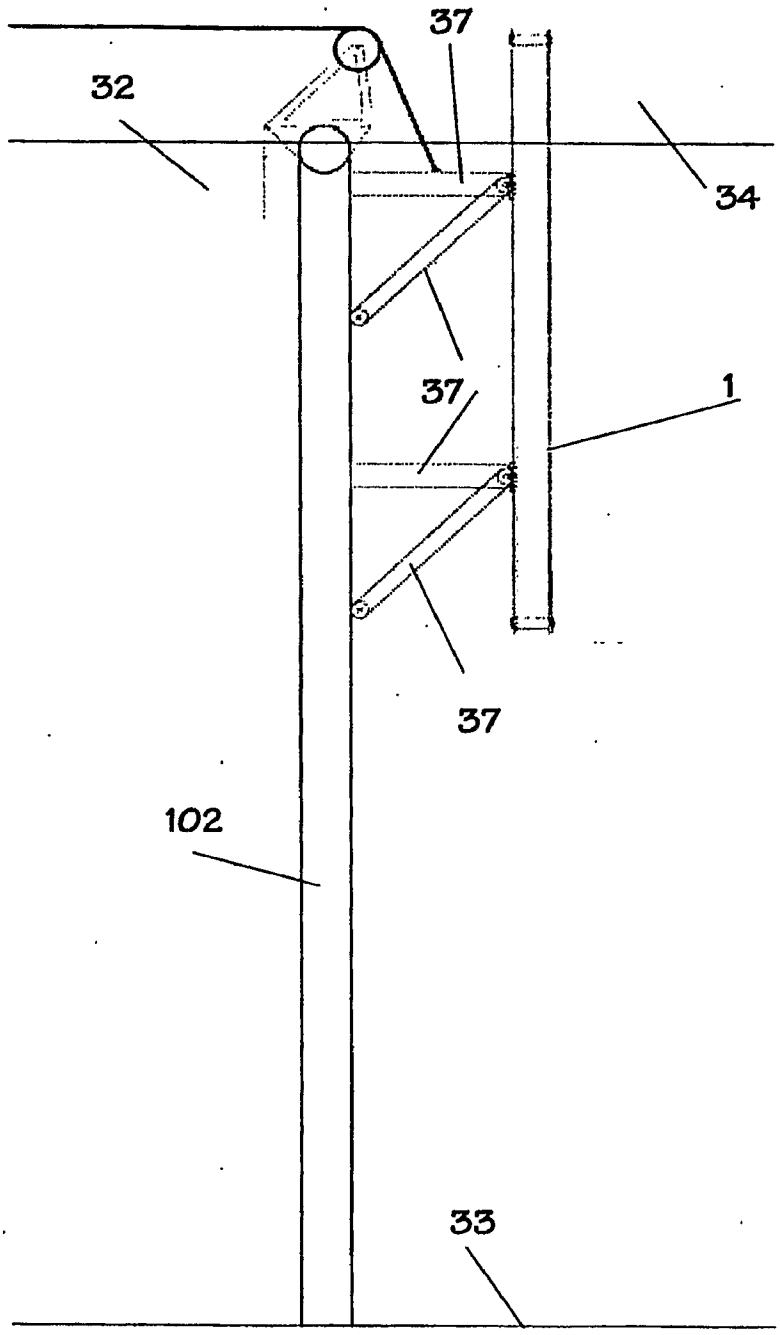

FIG. 27

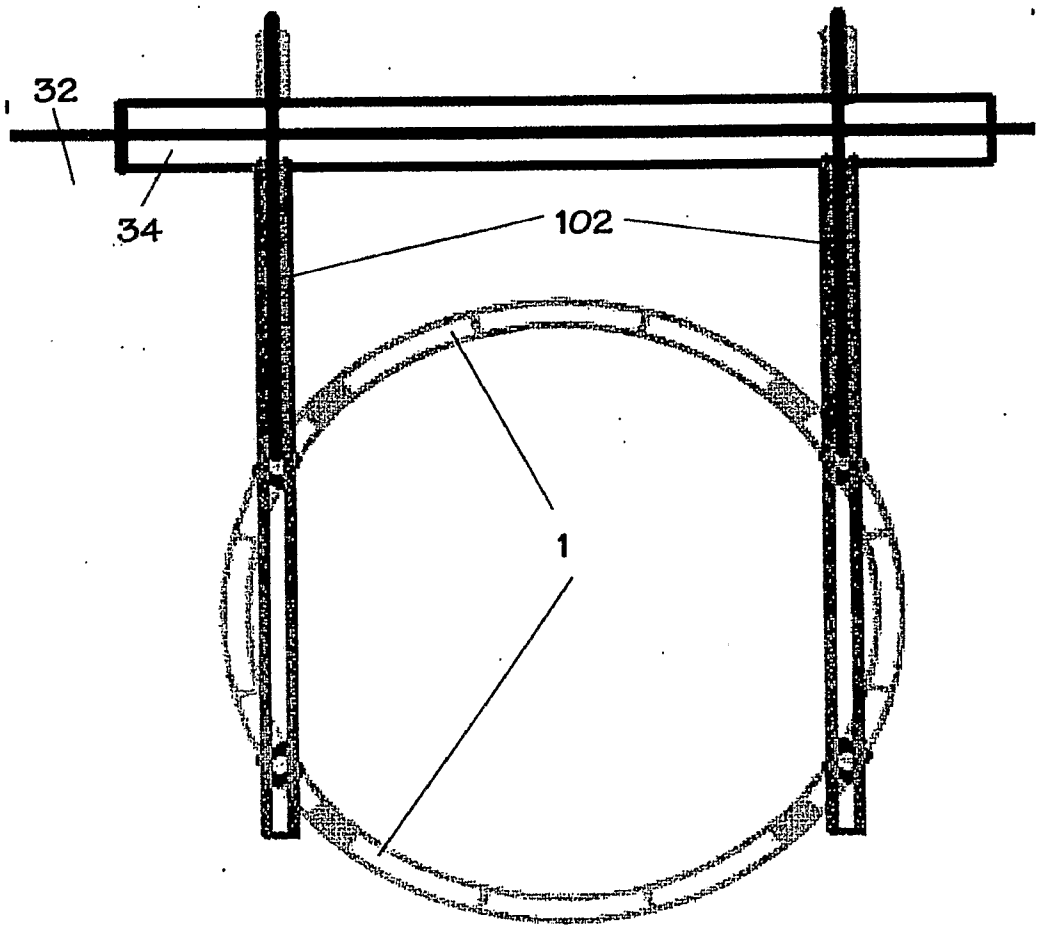

FIG. 28

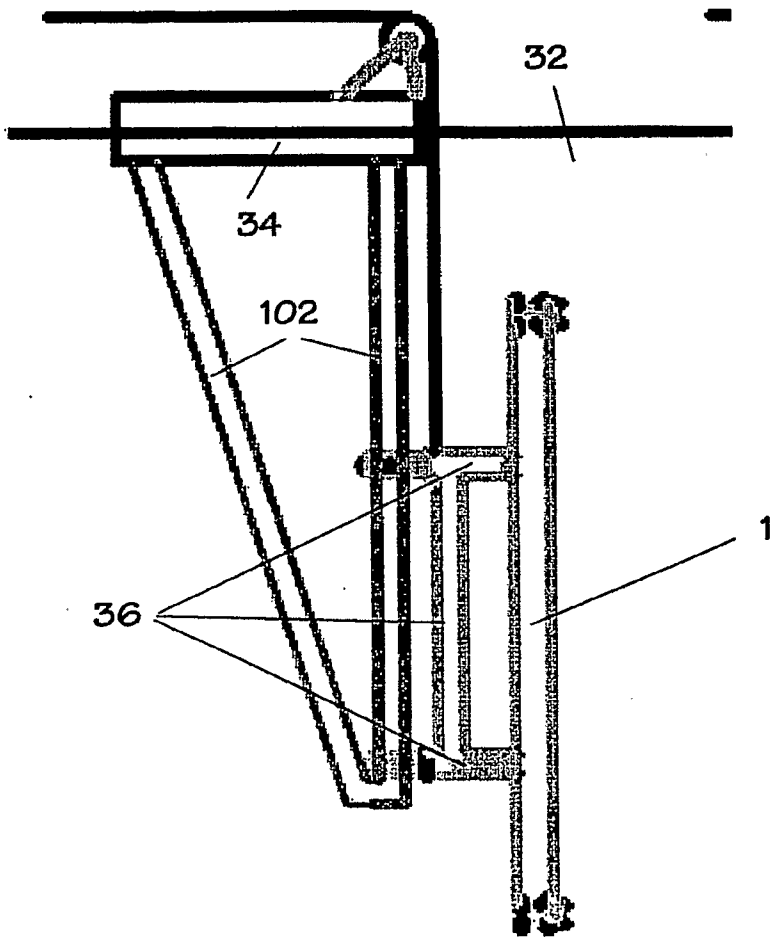

FIG. 29

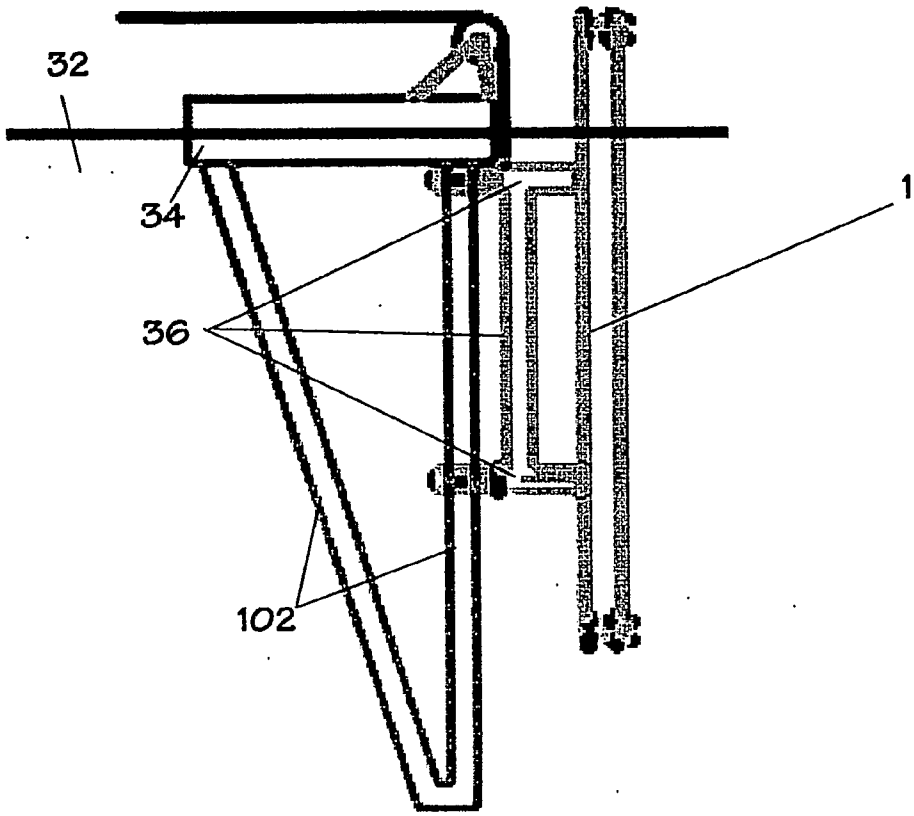

FIG. 30

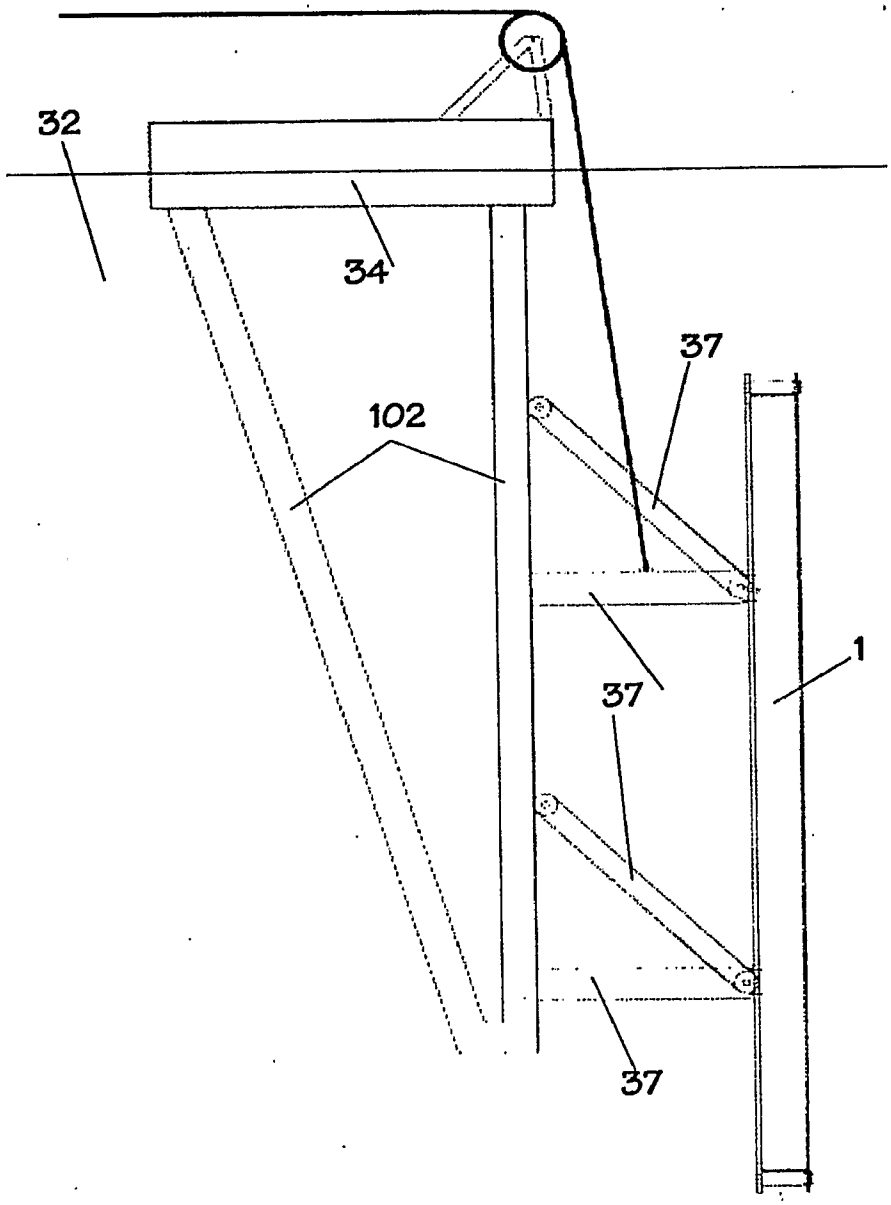

FIG. 31

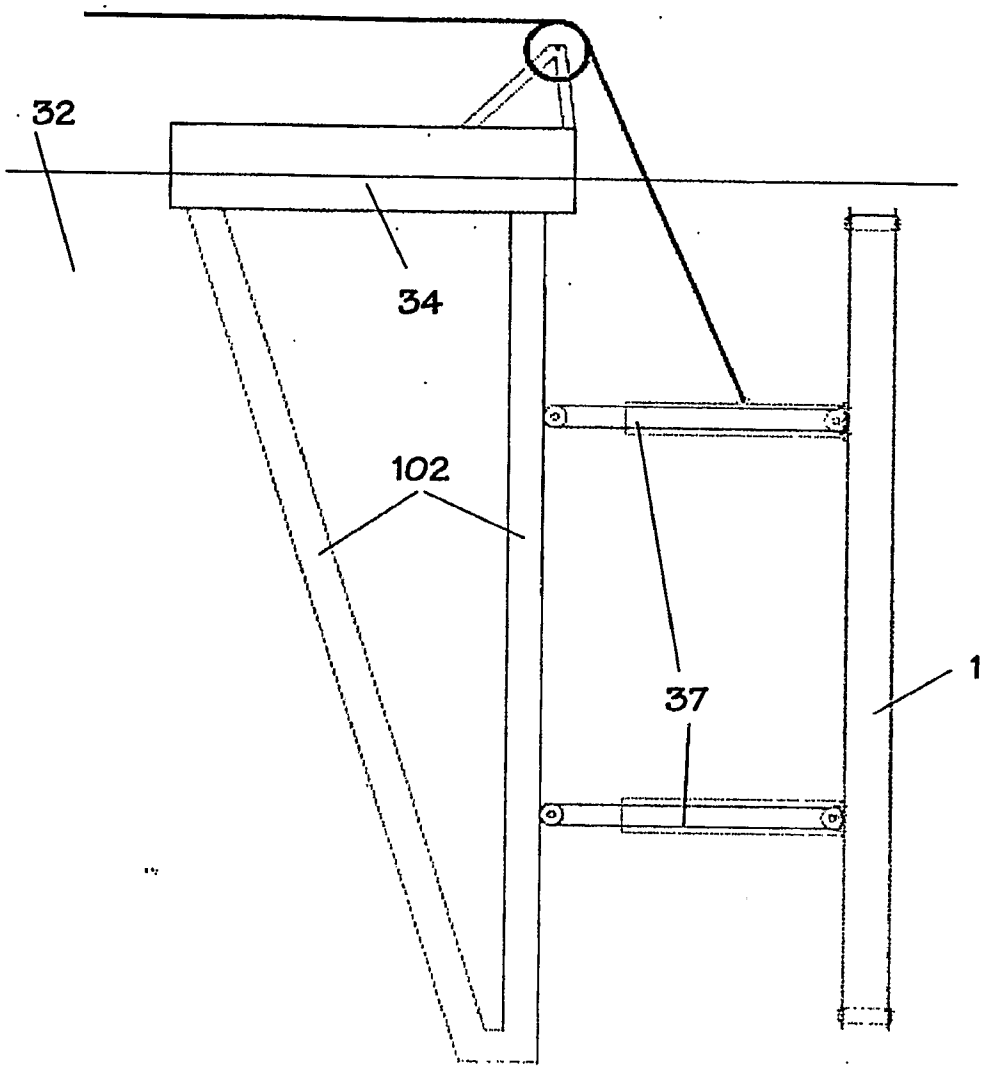

FIG. 32

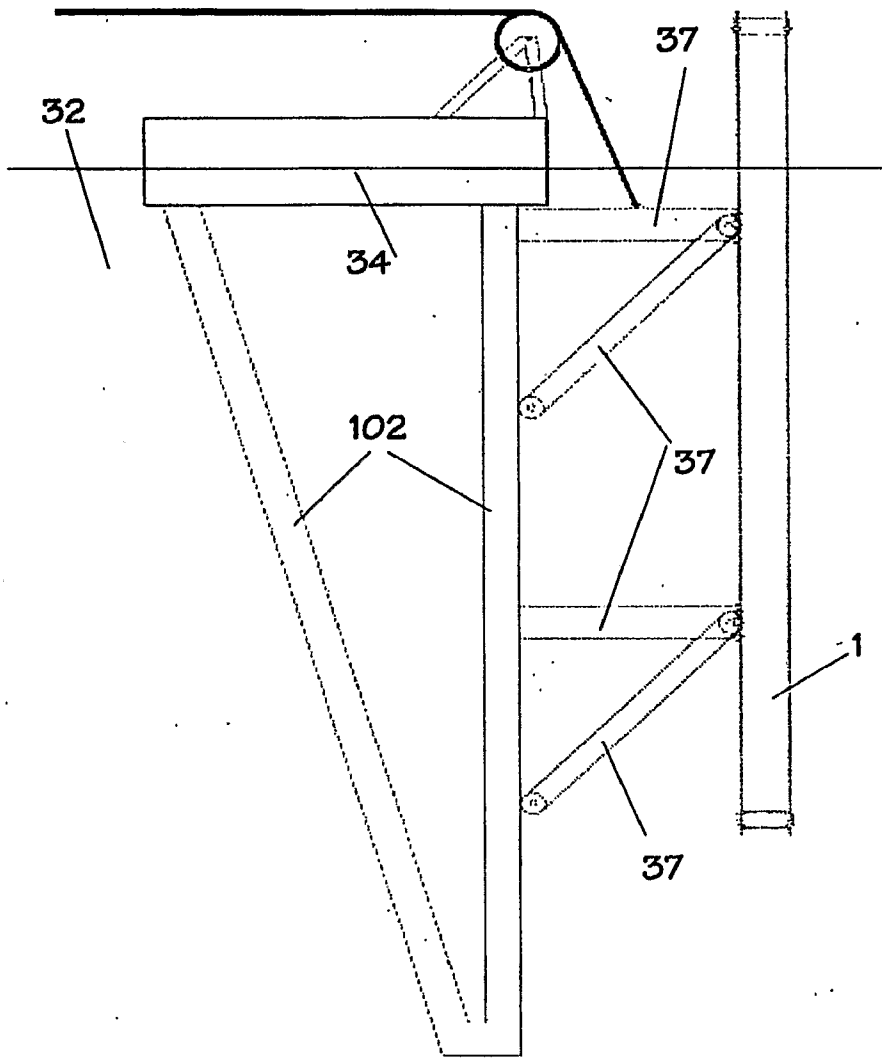

FIG. 33

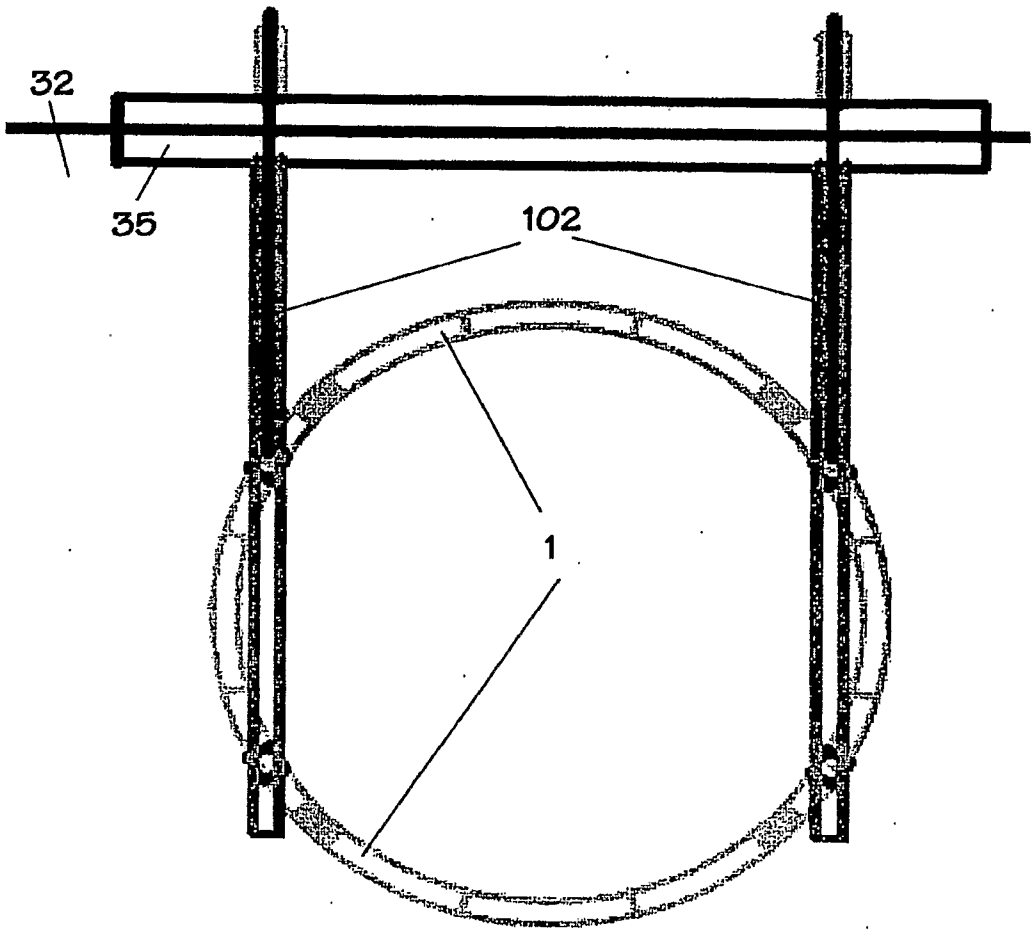

FIG. 34

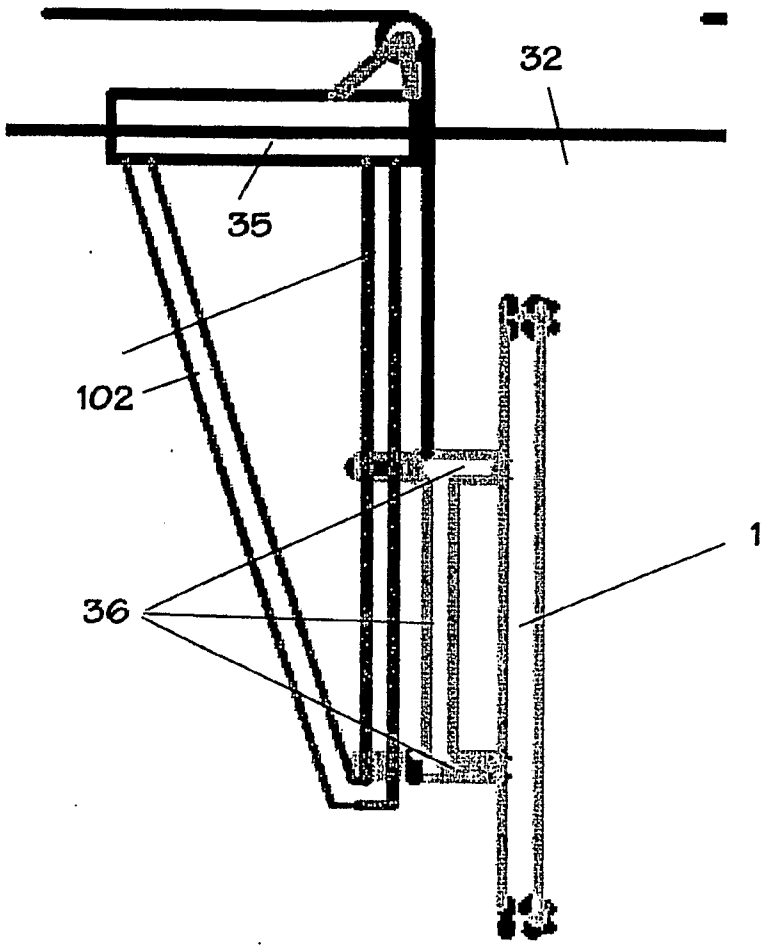

FIG. 35

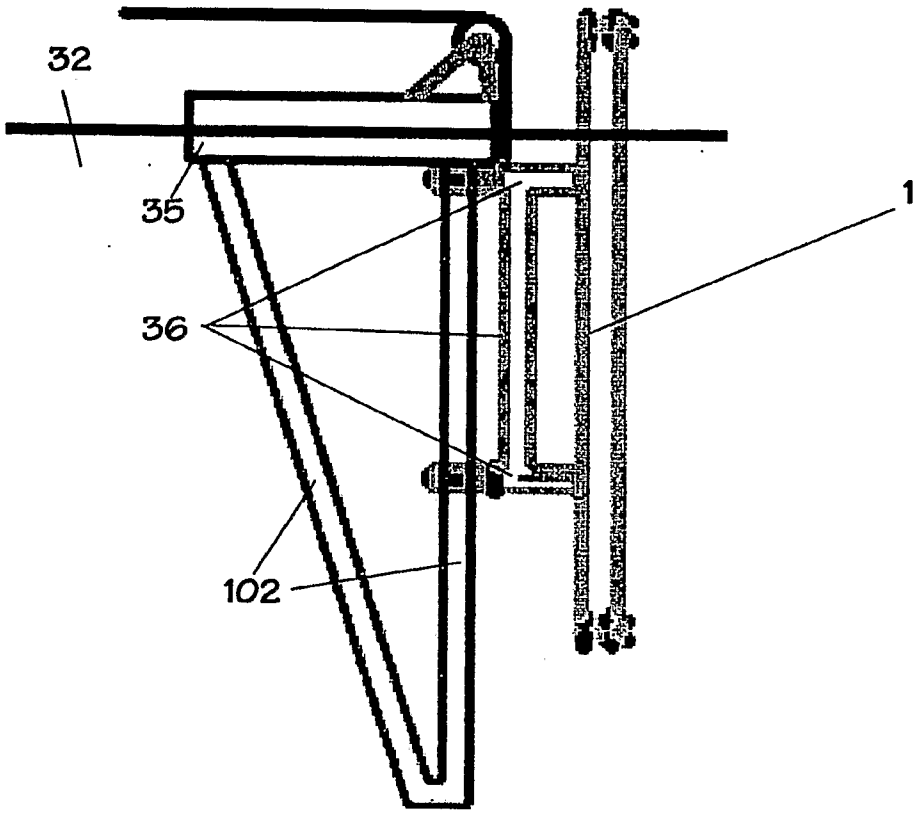

FIG. 36

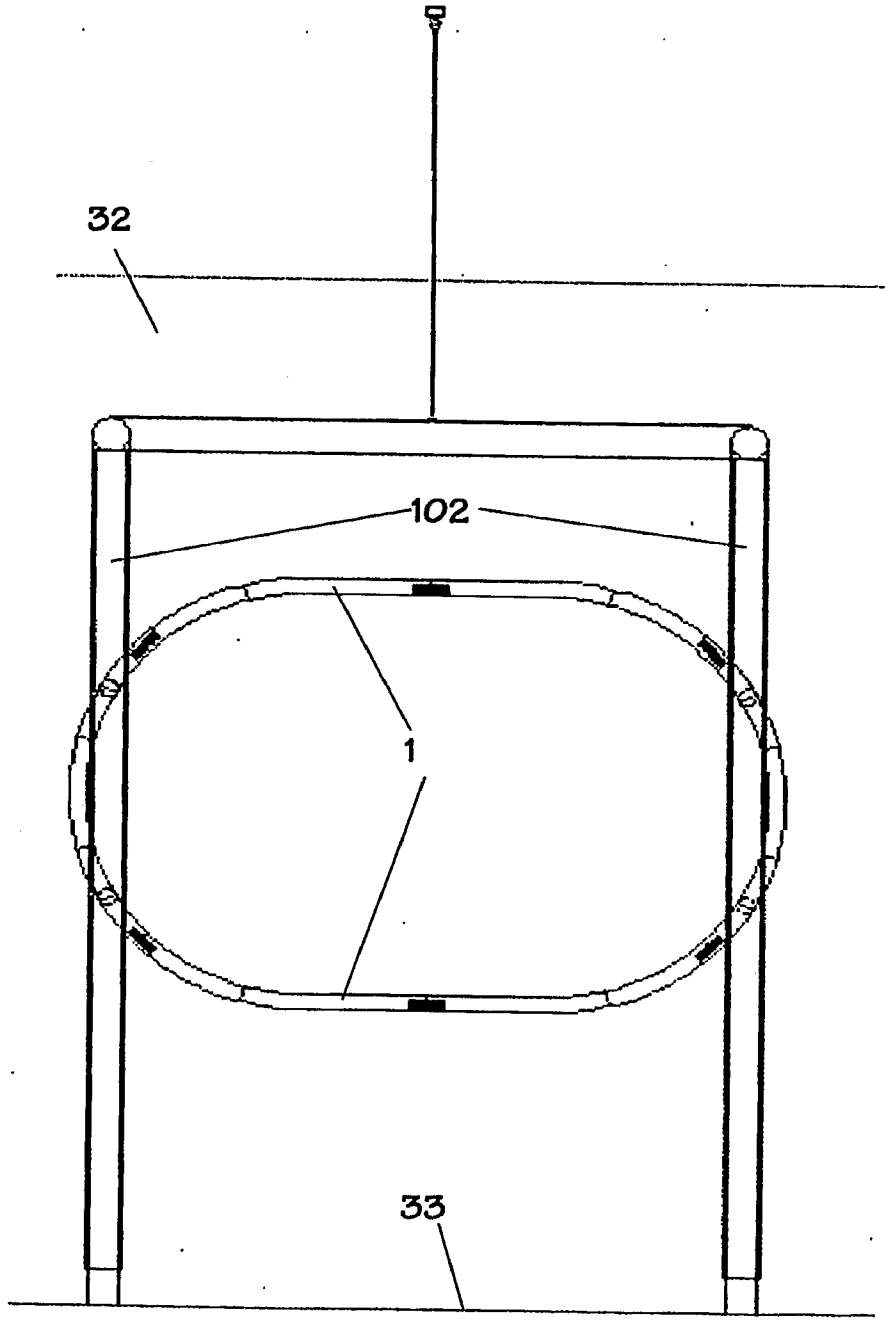

FIG. 37

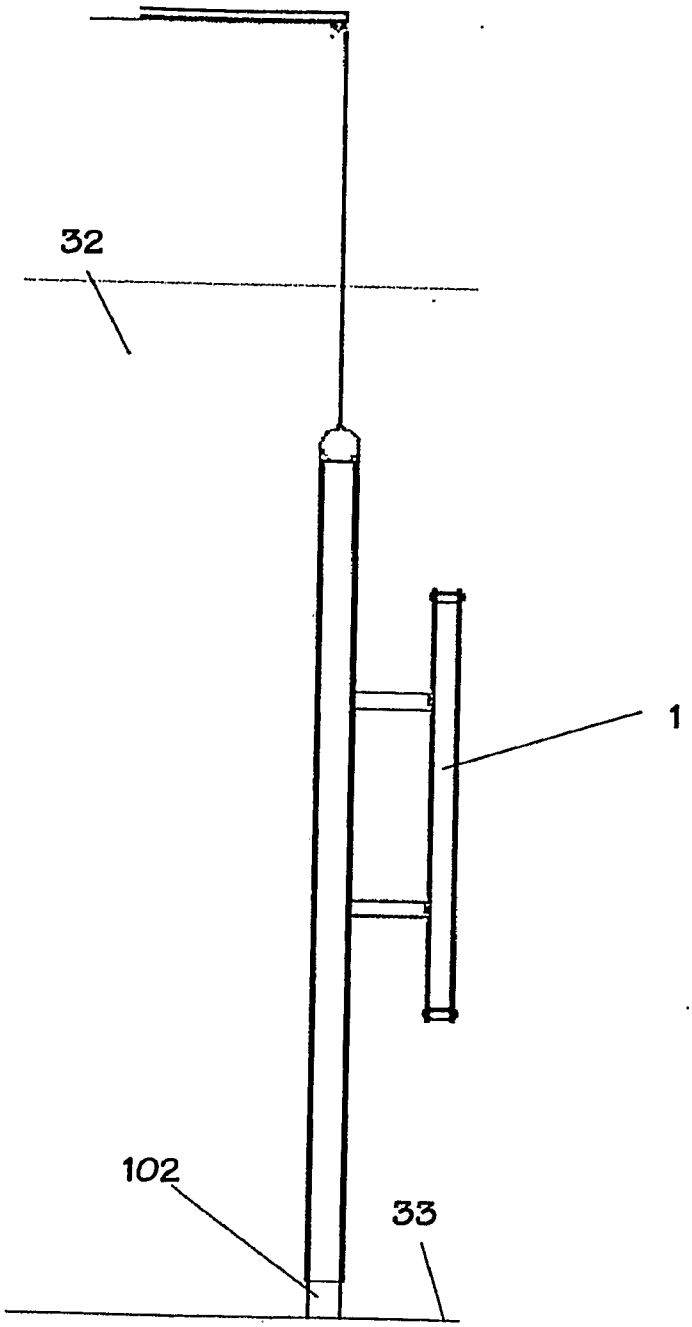

FIG. 38

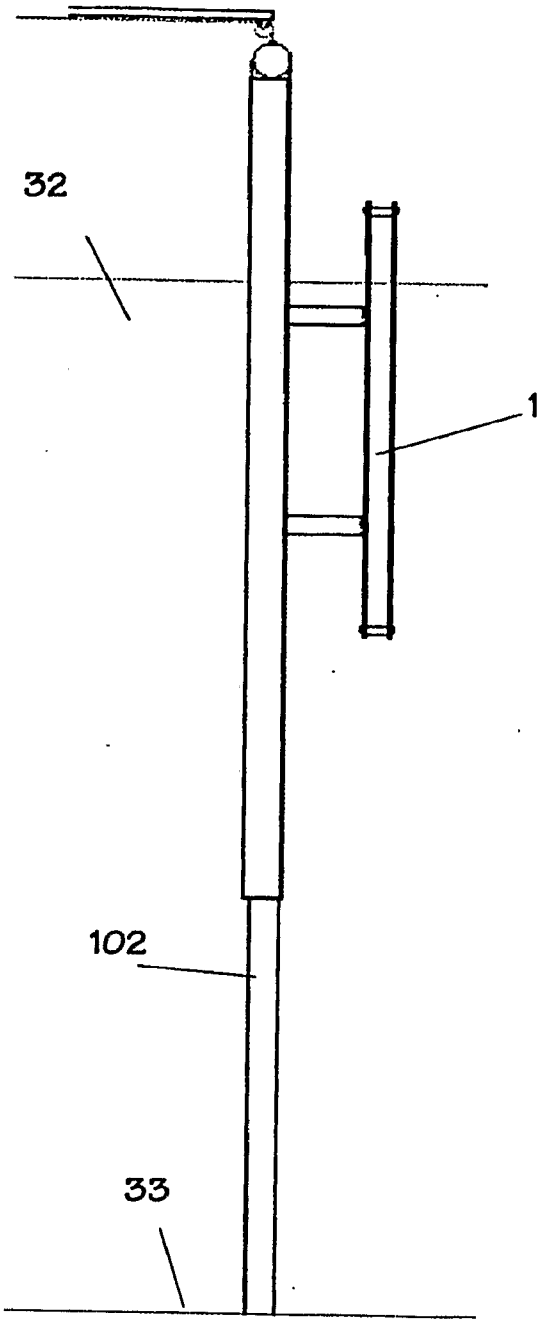

FIG. 39

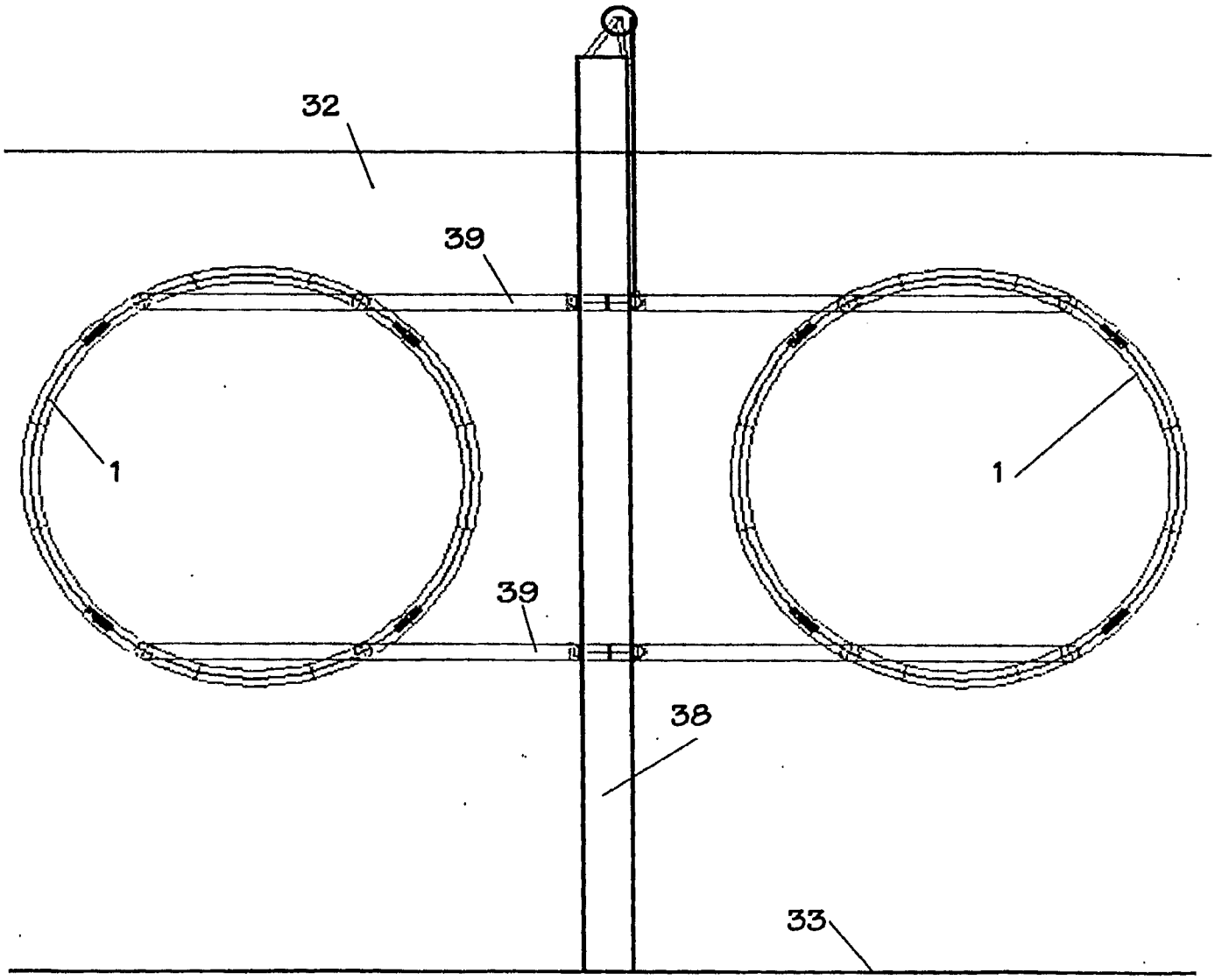

FIG. 40