(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 452 732 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.09.2004 Bulletin 2004/36

(51) Int Cl.[7]: **F03B 17/04**

(21) Application number: **03004535.5**

(22) Date of filing: **28.02.2003**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IT LI LU MC NL PT SE SI SK TR
Designated Extension States:
AL LT LV MK RO

(71) Applicant: **Huang, Chien-Hua**
Sanchung City, Taipei (CN)

(72) Inventor: **Huang, Chien-Hua**
Sanchung City, Taipei (CN)

(74) Representative: **Viering, Hans-Martin, Dipl.-Ing.**
Patent- und Rechtsanwälte
Viering, Jentschura & Partner,
Steindorfstrasse 6
80538 München (DE)

(54) **Hydraulic buoyant force engine**

(57) Disclosed herein is a hydraulic buoyant force engine whose essential component is a plurality of floats (1) engaged to two transmission chains (6,7) of two sprocket and chain combination units each disposed at either side of the floats. The float (1) is wrapped with a canvas (14) supported by several rib units (13). When the float (1) is expanded by air its buoyancy overcomes its own weight, floats up and drives the chains (6,7) to move up. When the float comes up to a gear (8) above it, a gear (17) will mate an annular gear rack (8) to act as an internal spur gear unit so as to retract the rib units (13) thereby squeezing the float (1) to discharge the contained air. The shrunk float sinks into the water together with the two chains.

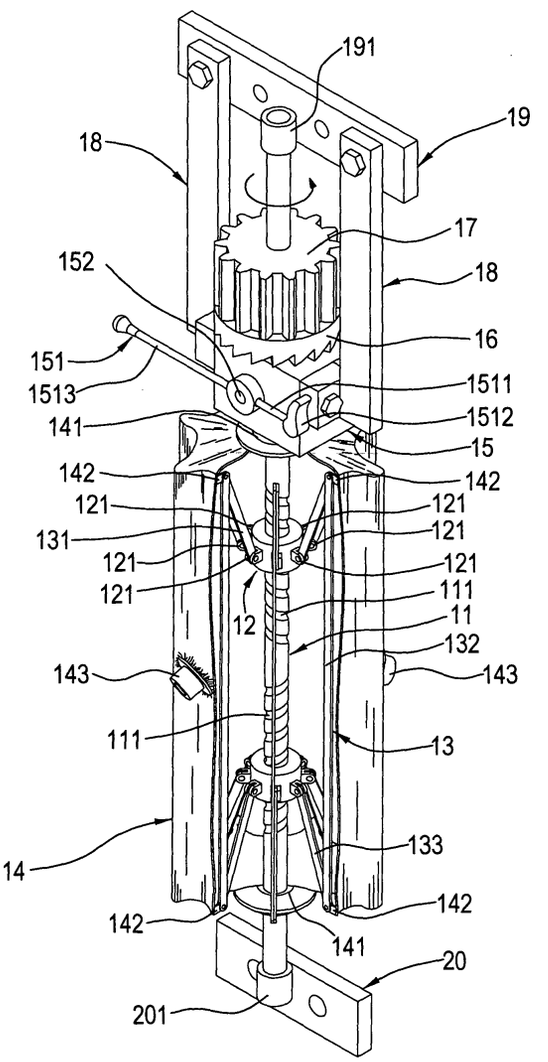


FIG.2 A

EP 1 452 732 A1

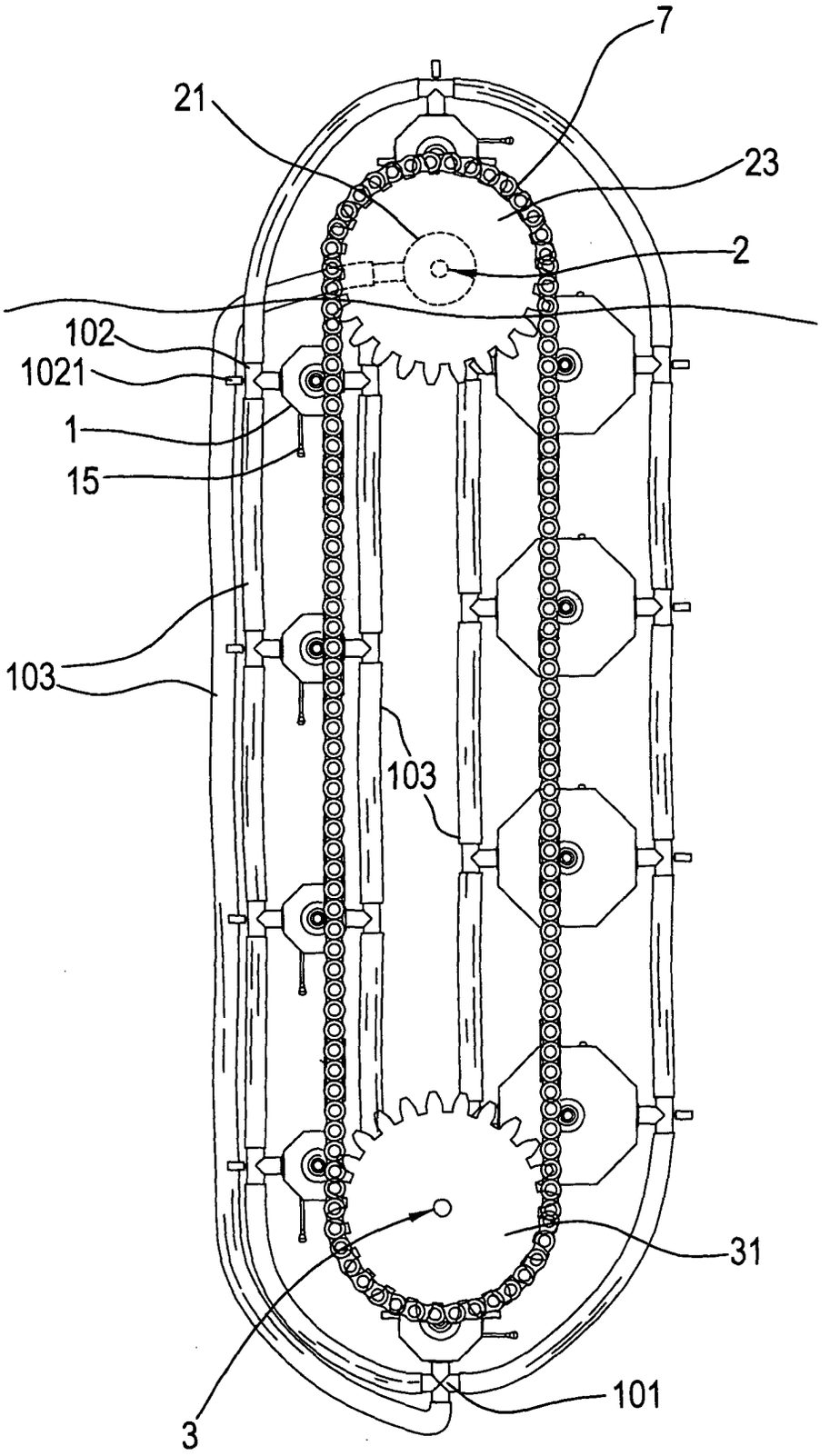


FIG.6

Description

BACKGROUND OF THE INVENTION

1. Field of the invention

[0001] The present invention relates to hydraulic buoyant force engine, in particular, to a machine which is capable of operating to generate power exclusively driven by buoyancy.

2. Description of the Prior Art

[0002] The conventional power generation can usually be classified into two categories, e,g. power generation by means of force of nature, such as hydraulic power and wind power, the other one is power generation consuming natural resources, such as neuclear power and steam power.

[0003] However, there are some disadvantages inherent to the aforesaid modes of power generation.

[0004] 1.Reliability of force of nature can not be expected up to 100%, abrupt variation of annual rainfall and frequency of typhoon cause the production of water power, and wind power can not be eagily controlled.

[0005] 2.The production and maintenance cost for a neuclear or a steam power plant is usually quite expensive, and the rapid fading of natural resources in addition to loosing ecological balance applies a brake force to unlimited and unvironment unconscious exploitation of natural reforces that causes further development of neuclear power and steam power impossible.

[0006] It is what the reason the inventor has endeavored for years by continuous research and experimentation attempting to find out an ingeniously unlimited and clean environment conscious power generating technique, and finally has come out with the hydraulic buoyant force engine of the present invention.

SUMMARY OF THE INVENTION

[0007] It is an object of the present invention to provide a hydraulic buoyant force engine which can generate mechanical power without consuming any other resurces.

[0008] It is another object of the present invention to provide a hydraulic buoyant force engine which can be fabricated with a low production cost and operate with hydraulic buoyant force only without need for other expensive natural resources.

[0009] To achieve the above objects, the hydraulic buoyant force engine of the present invention comprises a plurality of canvas enclosed floats each provided with an air inlet and an air outlet float up and sink down in a water tank along a central transmission bar by expanding and shrinking alternatively in accordance with the action absorbing the air into the float and releasing the air out of the float by means of an air guide unit connected to the float and emerged out of the water surface. The machenical power produced by motion of the floats is transmitted to an output shaft trough two sprocket and chain units each provided at one side of the floats so as to produce a continuous and restless mechanical power. The expansion and shrinkage of the float are performed by joint action of precisely designed gear mechanism and pivoted lever together with its actuation rod. Meanwhile, the water tank may be configurated in a L shaped polyhedron, or a regular polyhedron.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] For fuller understanding of the nature and objects of the invention, reference should be made to the following detailed description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a three dimensional view of the float which is an essential component of the present invention;
Fig. 2A and 2B are sectional views showing the float are in expanded and shrunk states respectively;
Fig. 3A to 3D are the drawings illustrating the function of the pivoted block on a stationary base;
Fig. 4 is a schematic view showing the transmission mechanism of the present invention;
Fig. 5 is a perspective view showing the internal structure of the hydraulic buoyant force engine of the present invention;
Fig. 6 is the side view of Fig. 5;
Figs. 7A and 7B are schematic views showing an embodiment of the present invention;
Figs. 8A and 8B are cross sectional view of the air guide unit according to the present invention;
Fig. 9 is a schematic view in another embodiment of the present invention; and
Fig. 10 is a schematic view in further embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0011] Referring to Figs. 1, 2A and 2B simultaneously, in which a float 1, the essential component of the present invention, and its expansion and shrinking states are illustrated. The component structure of the float 1 includes:

transmission bar 11 erecting and piercing through the center of the float 1 and having two sections of screw threads 111 spiraled in opposite direction with respect to each other formed on the upper and lower portions respectively thereof;
two ball bearing blocks 12 sleeved onto the upper and lower threaded portions 111 of the transmission bar 11 and having a plurality of drilled holes 121 formed in equal spacing around their outer surfaces thereof;

a rib unit 13 composed of a first, a second, and a third ribs 131, 132, 133 each having a via hole formed at both ends, wherein the via holes at one end of ribs 131 and 133 are jointed with the corresponding drilled holes 121 of both bearing blocks 121, while the via holes at the other end of the ribs 131 and 133 are jointed with the corresponding via holes formed at both ends of the second rib 132;

a canvas 14 wrapping the entire rib unit 13 and having a fixed axle 141 engaged with the canvas 14 at upper and lower ends thereof by high frequency bonding for achieving water tight effect and keeping flexibility of the canvas 14, wherein the canvas 14 is enclosed over the transmission bar 11, furthermore, several holding rings 142 made of similar material as that of the canvas 13 and bonded to the canvas 14 by high frequency bonding are provided in order to tie the end position of each rib, besides, an air inlet/outlet 143 is respectively formed at each side of the canvas 14 opposite to each other, wherein the fixed axle 141 is provided with a ball bearing; and

a stationary base 15 conjoined with the canvas fixed axle 141 and being sleeved over the transmission bar 11 for firmly holding the canvas 14, wherein at its side thereof is a cylindrically shaped pivoted block 151 turnable around a pivoted axle 152 on the base 15, the block 151 has an engaging arm 1511 etended out from one side, the arm 1511 has a hook 1512 at its front end, and a pushing rod 1513 extended from the other side thereof, and a recess 1514 is formed inside of the pivoted block 151, and a lever is extended from the pivoted block 151.

[0012] The action of the pivoted block 151 are described in Figs. 3A-3D. A tunnel like through hole 153 is opened in the base at a properly offset position beneath the pivoted axle 152, at the end of the through hole 153 near the pivot axle 152, a clogging portion 1531 is formed, while the other end is formed into a threaded portion 1532. Further, a ball 154 is placed in the clogging portion 1531, and a coil spring 155 is set in the through hole 153 with its one end forcibly pressing the ball 154, while the other end thereof is engaged with the threaded portion 152 by screw combination. As shown in figs. 3A-3D, when the pivoted block 151 has not yet actuated by a external force, the recess 1514 is engaged with the ball 154, when the pivoted block 151 is actuated by an external force, the ball 154 is exerted a downward force so as to leave away from the recess 1514. In case the pivoted block 151 is displaced a certain angle, the recess 1514 now comes down to trap another ball 156 so as to assist the pivoted block 151 to operate effectively.

[0013] A bevel gear 16 encircles one end of the transmission bar 11 at the stationary base (15) side, and a gear wheel 17 is provided on it.

[0014] Two stand 18 are engaged with a first joint plate 19 by screws, and the other end of each stand 18 is bolted with the stationary base 15 by means of a protruded block.

[0015] A first joint plate 19 formed above the gear wheel 17 is provided with an end support 191 at its inner side center portion thereof, and two tapped holes are formed on the joint plate 19 each at one side of the end support 191 for engaging with the two stands 18. A second joint plate 20 formed under the float 20 also has an end support 201 at is center portion, and are provided with two tapped holes each at one side of the end support 201 to be engaged with staples of a transmission chain (to be described later on). The two end supports 191, 201 are for supporting the transmission bar 11.

[0016] As soon as the gear wheel 17 above the float 1 is driven to rotate clockwise, both bearing blocks 12 are moved relatively close to each other such that the three ribs 131, 132, 133 are retracted inwards thereby the canvas 14 is shrunk (see Fig. 2A). On the other hand, when the gear wheel 17 is driven to rotate counterclockwise, both bearing blocks 12 are moved away form each other such the three ribs 131, 132, 133 stretch outwards thereby causing the canvas 14 expanded (see Fig. 2B). In this version, the float 1 floats up or sinks down in the water.

[0017] For understanding the structure of the transmission mechanism of the present invention, reference should be made to Fig. 4. The transmission mechanism includes:

an output shaft 2 having an air guide unit 21 sleeved onto a proper middle position of the output shaft 2, wherein the front end thereof is formed into an air outlet 211, while an air inlet 212 is formed at its side, a first and a second sprockets 22, 23 are each coupled with one end of the output shaft 2 respectively, wherein the air guide unit 21 is provided with a ball bearing:

two transmission shafts 3, 4 each coupled with a third and a fourth sprockets 31 and 41 respectively, wherein the first sprocket 22 is coupled with the fourth sprocket 41 by a first transmission chain 6, while the second sprocket 23 is coupled with the third sprocket 31 by a second transmission chain 7, further, the fourth sprocket 41 is coupled with a driving gear 42 nearby by means for the transmission shaft 4, a fixing plate 43 with two posts 44 tightened on its upper portion is engaged with the driving gear 42 with screws, and both posts 44 are fastened to the wall of the water tank 9 to be described latter, a clear space 5 is formed between the two transmission shafts 3, 4, wherein the axle of the driving gear 42 is provided with a ball bearing, at least one staple 61, (71) is provided for the first and the second sprockets 6, 7, respectively, the staple 61(71) has a screw hole 611(711); a semi-circular annular gear 8 to be coupled

with the pinion gear 17 for driving the same so as to serve as an internal gear unit, wherein working of the pinion gear 17 causes the two bearing blocks 12 to move towards each other thereby making the float 1 shrink and loose buoyancy by discharging the inner air, and the float 1 sinks following the motion of the first and the second sprockets 6, 7.

[0018] Fig. 5 is a perspective view showing the internal structure of the present invention. The first joint plate 19 is engaged with the staple 61 of the first transmission chain 6 by screw combining its tapped hole with the tapped hole 611 of the staple 61, or by welding thereof such that the first joint plate 19 at one end of the float 1 is firmly engaged with the first transmission chain 6; similarly the second joint plate 20 is engaged with the staple 71 of the second transmission chain 7 by screw combining its tapped hole with the tapped hole 711 of the staple 71, or by welding thereof such that the second joint plate 20 at the opposite end of the float 1 is firmly engaged with the second transmission chain 7. By doing so , the float 1 is settled between the two chains 6 an 7 so as to move together with them at a track defined by the two chains 6 and 7.

[0019] Fig. 6 is the side view of Fig. 5, and further refer to Figs. 7A and 7B, several floats 1 can be connected between the first and the second chains 6, 7, in order to make all the floats 1 be communicated with each other, a four-way tube 101 can be provided to an air inlet/outlet 143 installed at the outer side of one of the floats 1, and a three-way tube 102 can be provide at the inner side thereof, and the three-way tubes 102 are provide to both inner/outer air inlet/outlet 143 for rest of the floats 1. Furthermore, a hose 103 is used to interconnect each air inlet/outlet 143 of the floats 1. Finally, external air is introduced into the floats 1 via air guide unit 21 by connecting the output end of the hose 103 with the air guide unit 21. Meanwhile, in order to prevent twisting of the hose 103 during operation of the present invention, the hose 103 laid under the first and the second chains 6, 7 is set at the clear spacing 5 reserved between the two transmission shafts 3, 4, and a V shaped supporter 1021 is provided at one side of the three-way tube 102 (see Fig. 7B) installed on the air inlet/outlet 143 at outer side of the float 1 so as to trap the hose 103 thereat, and cause the float 1 along with its four-way tube 101 to locate thereby preventing the twisting of the hose 103 during movement of the float 1.

[0020] An embodiment of the present invention is illustrated in Fig. 7A.

[0021] A L shaped water tank 9 constructed according to Torricelli's law is provided, a first electromagnetic valve 91 is installed at the right upper side of the water thank 9, while a second electromagnetic valve 92 is installed at the left lower side thereof. Water is supplied into the water tank 9 from the second electromagnetic valve 92. At this moment the first electromagnetic valve 91 is at closed state so that water can not overflow therefrom. The state of closing the valve 91 and opening the valve 92 is maintained until the water level reaches a height below the output shaft 2. Then the valve 92 is closed, and the valve 91 is opened. At this state, water does not flow out from the valve 92 according to Torricelli's law, and the pressure inside the water tank 9 is reduced so that the floats can move along smoothly. Meanwhile, the output shaft 2 and transmission shafts 3, 4 are fixed in the water tank 9, and a transmission gear wheel 24 is coupled to the output shaft 2 at one end extended out of the water tank 9 so as to output power. A ball bearing block 911 and an annular rubber collar 912 is applied to the tank wall at inner and outer side respectively from where the output shaft 2 goes out so as to prevent air leakage. The other end of the output shaft 2 and the fixed ends of both transmission shafts 3, 4 are all set at the wall surface of the water tank 4, and the annular rubber collar 912 is made of a friction resist and heat withstanding material.

[0022] In another embodiment shown in Fig. 9, a miniature water tank 93 is equipped abut on the outer wall of the water tank 9 and is similarly pierced through by the output shaft 2. The wall of the water tank 9 where the output shaft 2 pierced through is provided with the ball bearing 911 and the annular rubber collar 912, whereas for the miniature tank 93, only an annular rubber collar 913 is provided. With this structure, the first and the second transmission chains 6, 7 are set in the tank 9 and the air guide unit 21 on the output shaft 2 is emerged above the water level so as to let the air in. Meanwhile, a first actuating rod 94 is provided at the rear upper inner wall of the tank 9, and a second actuating rod 95 is provided on the bottom of the tank 9 nearby the first chain 6. The two actuating rods 94, 95 are essentially for actuating the lever of the pivoted block 151 so as to cause the float 1 shrink or expand. When the float 1 is under the water level, the lever of the pivoted block 151 is apart from the surface of the bevel gear 16, before the float 1 approaches the driving gear wheel 41 of the transmission shaft 4 the second actuating rod 95 will tap the lever 151 in advance such that the lever 151 swings to the left and is blocked on the surface of the bevel gear 16. On the other hand, the pinion 17 is in mesh with the driving gear 42 and rotates. Meanwhile, by reason that the pivoted block 151 has an inlaid tension spring provided at its blocking terminal 1512 of the blocking rod 1511 (see Fig. 3C), the blocking terminal 1512 can not strongly trammel the bevel gear 16, but can only pressing it lightly. At this moment the two bearing blocks 12 of the float 1 is displaced gradually outward and extended so as to introduce external air into the float 1 via the air guide unit 21 thereby the float 1 is expanded. As soon as the buoyancy of the float 1 has overcome its own weight and floats up, the first and the second chains 6, 7 are driven to move along and drive the other floats conjoined with the first and the second transmission chains 6, 7, and the output shaft 2 together

with the transmission shaft 3, 4. As soon as the float 1 approaches the annular gear 8, the first actuating rod 94 taps the lever of the pivoted block 151 in advance so that the lever swings to the left and leaves away from the surface of the bevel gear 16 and the gear wheel 17 comes to, in mesh with the annular gear 8 and rotates. Then, the two bearing blocks 12 of the float 1 are gradually displaced inwards and the float 1 is shrunk to discharge the contained air into the other float which is gradually expanding. The float 1 which entirely lost its air sinks down in the water by its own weight and by driving force of the first and the second chains 6, 7. Each float repeats expansion and shrinkage restlessly so as to cause the first and the second chains 6, 7 also continuously to drive the output shaft 2 thereby a continuous mechanical power output can be obtained.

[0023] Incidentally, the water tank 10 may be constructed poly hedrical as shown in Fig. 10.

[0024] Returning to Figs. 8A and 8B which show the cross sectional view of the air guide unit 21, an annular flange 213 is provided between the air outlet 211 and air inlet 212, and a check damper 214 is rockingly hinged abut on the annular flange 213 with a pivot axle 215. During the expanding and shrinking operation of the float, the required air may be absorbed from the air inlet 212 whereas the check damper 214 works to prohibit counter flow of air in the float.

[0025] It emerges from the above description that the hydraulic buoyanct force engine of the present invention has several noteworthy merits namely:

1. The mechanical power is obtained from the buoyant force only without need for help of other cources.
2.No sophisiticated structure is involved in the present invention which helps to reduce the production cost.

[0026] Other embodiment of the present invention will become obvious to those skilled in the art in light of above disclosure. It is of course also understood that the scope of the present invention is not to be determined by the foregoing description, but only by the following claims.

Claims

1. A hydraulic buoyant force engine comprising:

a float capable of shrinking and expanding, wherein said float is provided with more than one air inlet/outlet, a transmission bar is piercing through the center portion thereof with its both ends emerged out of said float, and engaged with a joint plate at each side, a fixed axle for a canvas enclosing said float is fixed at each float end, one of said fixed axle is engaged with a stationary base and a bevel gear accompanying a gear wheel at is side is installed at one side of said stationary base, said joint plate is conjoined to said stationary base by two stands:

a water tank equipped with two electromagnetic valves each of them being set at its upper and lower sides for storing water, wherein an annular gear is provided near the top portion of said water tank, a first and a second actuating rods are each provided at the upper rear side and the inner bottom of said water tank respectively;

an output shaft equipped with an air guide unit on it, wherein one end of said air guide unit is an air outlet, while an air inlet is formed at its side thereof, a first and a second sprockets are each respectively coupled with its one end, one end of said output shaft is extended out of the wall of said water tank, and a transmission gear is fitted to this end;

two transmission shafts each coupled with a third and a fourth sprockets respectively, wherein the first and the fourth sprockets, and the second and the third sprockets are aligned with each other, one end of said fourth sprocket is coupled with a driving gear by mean of said transmission shaft, a fixing plate is provided in the manner engaging its lower portion with said driving gear, while its upper portion is fastened to the wall of the water tank, and a clear space is formed between said two transmission shafts; and

a first and a second transmission chains each provided with several staples, wherein said first transmission chain is in mesh with said first and said fourth sprockets, while said second transmission chain is in mesh with said second and said third sprockets;

with this structure, said joint plates at two sides of said float are engaged with said staples provided on said first and said second transmission chains so as to settle said float between said two transmission chains, and connect said air inlet/outlet for each float in cascade with a hose, and one of the output terminal of said hose is connected with the air outlet of said air guide unit, when said float sinks nearby said driving gear for said transmission shaft, the float is in a shrunk state, said gear wheel located above will be mated with said driving gear to rotate so as to expand said float, as soon as the buoyancy of said float becomes larger than its own weight, it floats up so as to drive said first and said second chains, the float, conjoined with the first and third, the second and fourth sprockets, said output shaft, and two transmission shafts, besides, when said float approaches said annular gear, the gear above

said float is mated with said annular gear and rotate so that said float shrinks thereby discharging its air to other float which is going to expand, said shrunk float lost its inner air entirely sinks down by its own weight along with the rotation of said first and said second chains, in this manner, each float repeats expansion and shrinkage action restlessly so as to cause said first and said second chains also continuously drive said output shaft therefore a continuous mechanical power output is obtained.

2. The hydraulic buoyant force engine of claim 1, wherein said float is composed of said transmission bar, several rib units, and said canvas, wherein said canvas is used to enclose said rib units so as to achieve a water tight effect and cause said float to expand or shrink.

3. The hydraulic buoyant force engine of claims 1 to 2, wherein two ball bearing blocks are sleeved onto said transmission bar, and several said rib units are engaged therebetween, when both bearing blocks are moved relatively close together to each other, said rib units are retracted inwards thereby said canvas shrank, on the other hand, when both bearing blocks are moved away from each other, said rib units are extended outwards thereby causing said canvas to expand.

4. The hydraulic buoyancy force engine of claim 1, wherein in order to avoid twisting of said hose during operation of said engine, a clear -space is always provided between said two transmission shafts and is able to revolve together with the motion of said float.

5. The hydraulic buoyancy force engine of claim 1, wherein a four-way tube is provided to an air inlet/outlet installed at the outer side of one of said floats, and a three-way tube is provided at the inner side thereof, and said three-way tubes are provided to both outer and inner sides of the air inlet/outlet for rest of said floats, said hose is used to interconnect each air inlet/outlet of said floats, finally, outside air is introduced into said floats 1 via air guide unit by connecting the output end of said hose with said air guide unit.

6. The hydraulic buoyant force engine of claim 1, wherein a pivoted lever is provided at the side of said stationary base to act to press on said bevel surface of said expanded float so as to set said float in expanded state without back turning or shrinking.

7. The hydraulic buoyant force engine of claim 6, wherein a first and a second actuating rods are used to actuate said pivoted lever of said float.

8. The hydraulic buoyant force engine of claim 1, wherein an annular flange is provided between the air outlet and air inlet of said air guide unit, and a check damper is rockingly hinged abut on said annular flange with a pivot axle.

9. The hydraulic buoyancy force engine of claim 8, wherein expansion speed of said float is accelerated by introducing outside air form said air guide unit.

10. The hydraulic buoyancy force engine of claim 8, wherein said air guide unit is emerged out of the water level for inputting air.

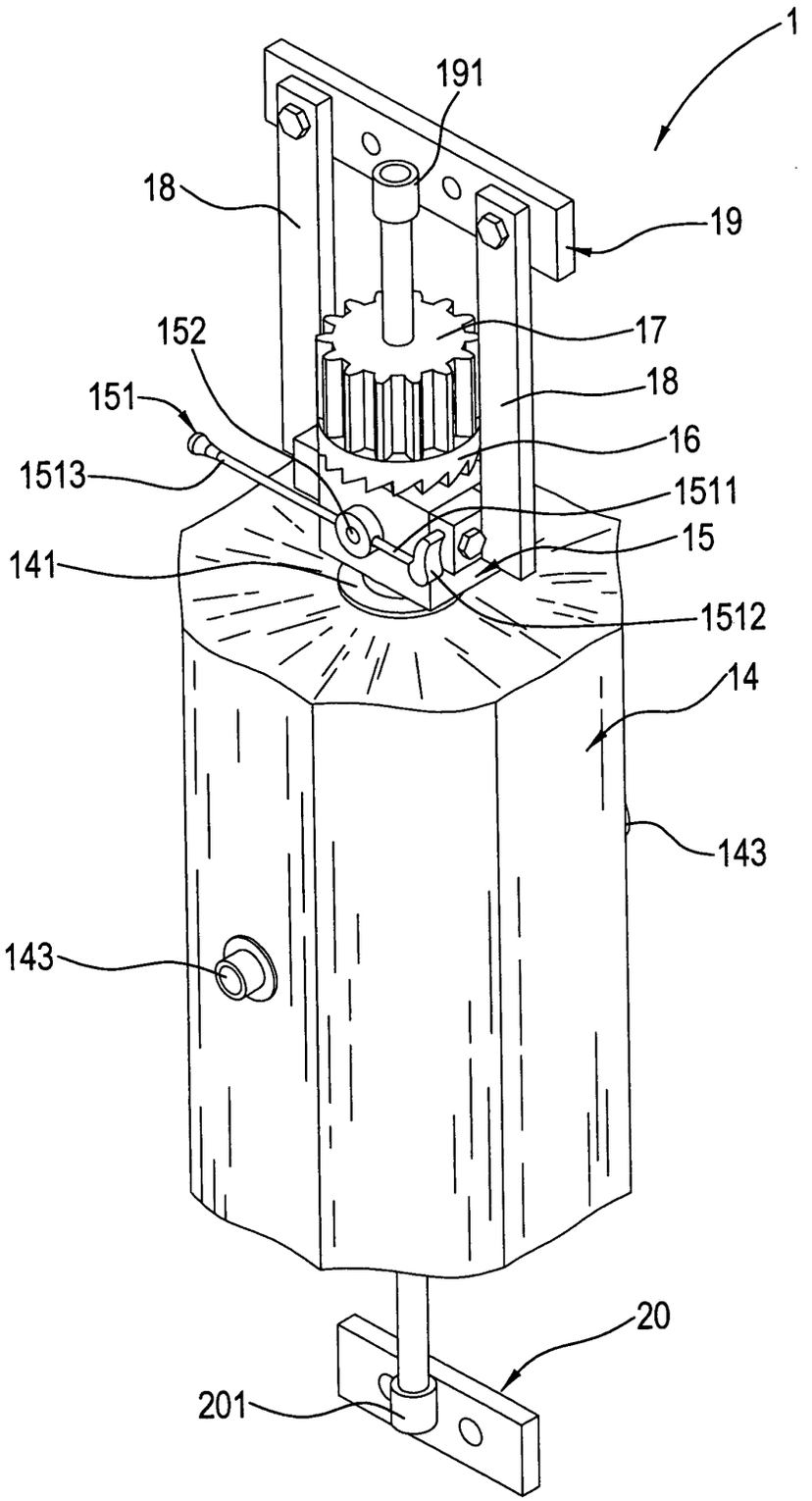

1
191
18
19
152
17
151
18
16
1513
1511
15
141
1512
14
143
143
20
201

FIG. 1

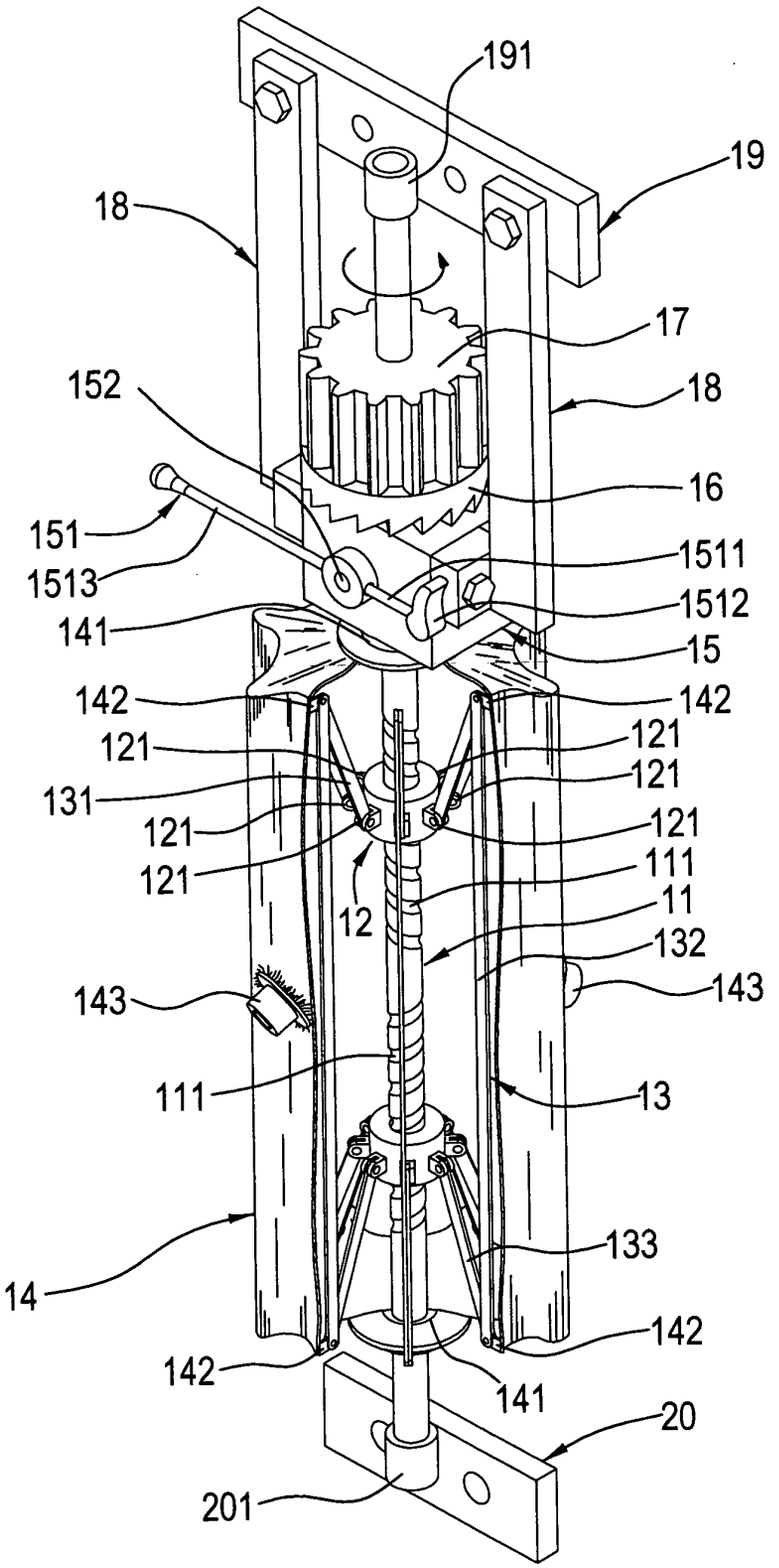

191
19
18
17
152
18
16
151
1511
1513
1512
141
15
142
142
121
121
121
131
121
121
121
111
12
11
132
143
143
111
13
14
133
142
142
141
20
201

FIG.2 A

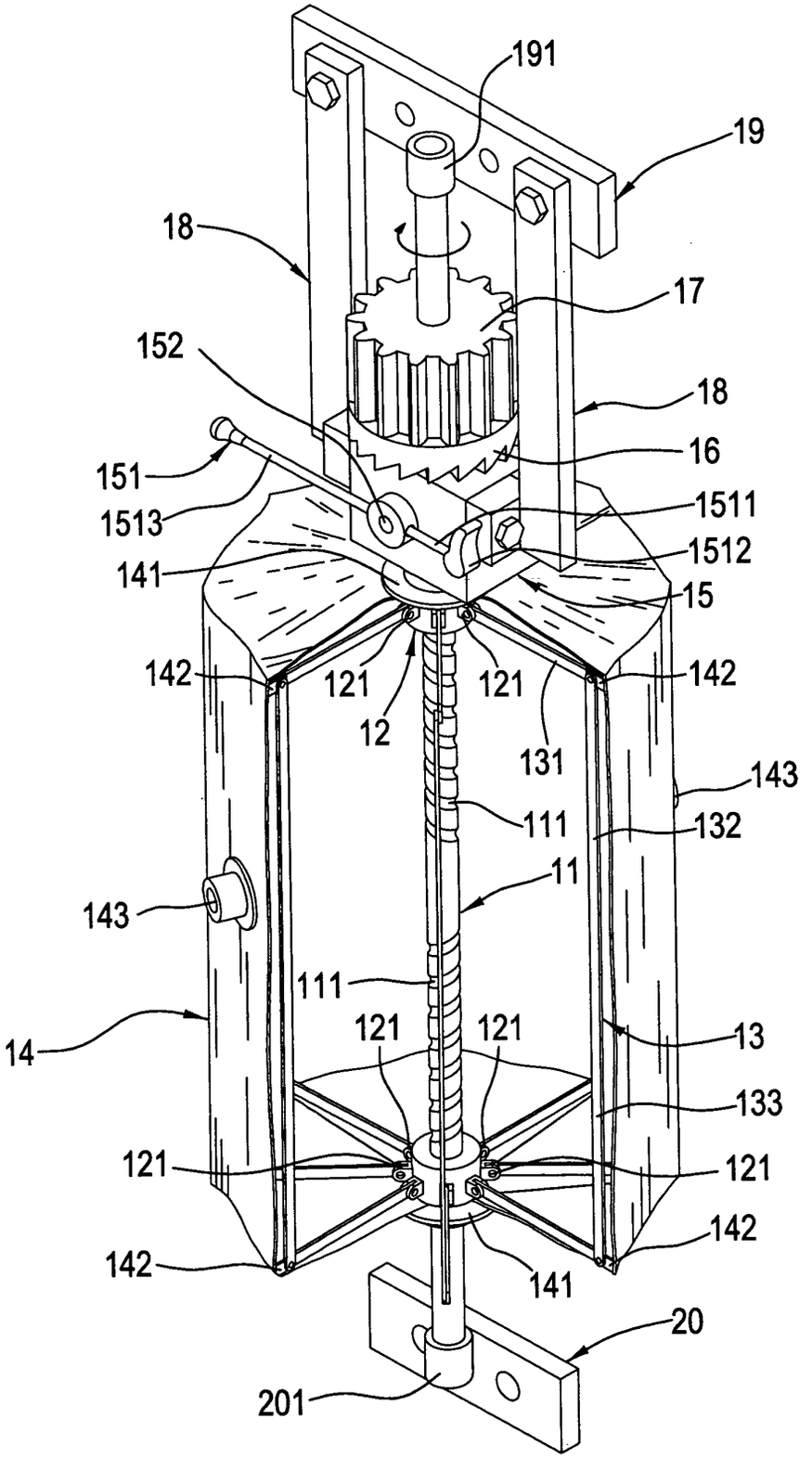

191
19
18
17
152
18
16
151
1513
1511
1512
141
15
142
121
121
142
12
131
143
111
132
11
143
111
121
121
13
14
133
121
121
142
142
141
20
201

FIG. 2 B

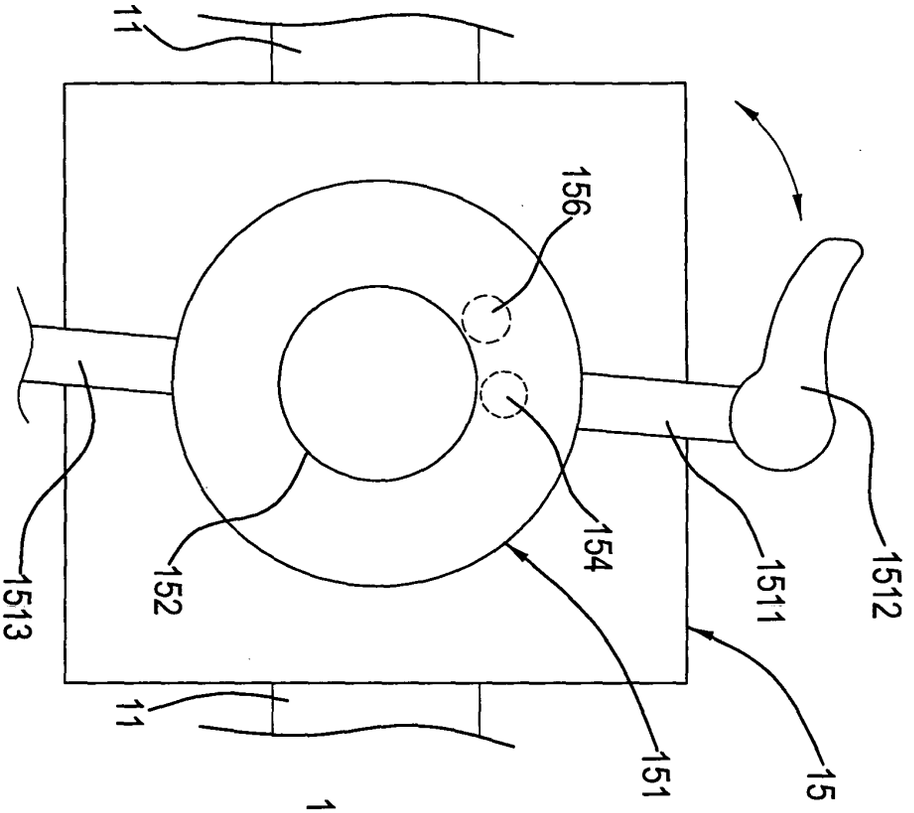

11
156
154
1512
1511
1513
152
151
15
11

FIG.3 A

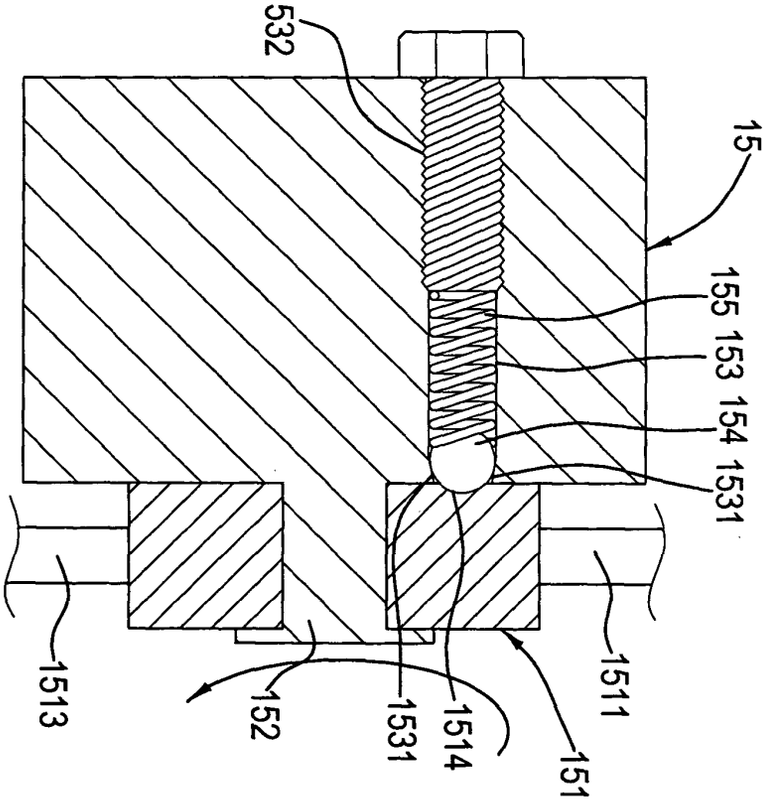

1532
15
155
153
154
1531
1513
152
1531
1514
151
1511

FIG.3 B

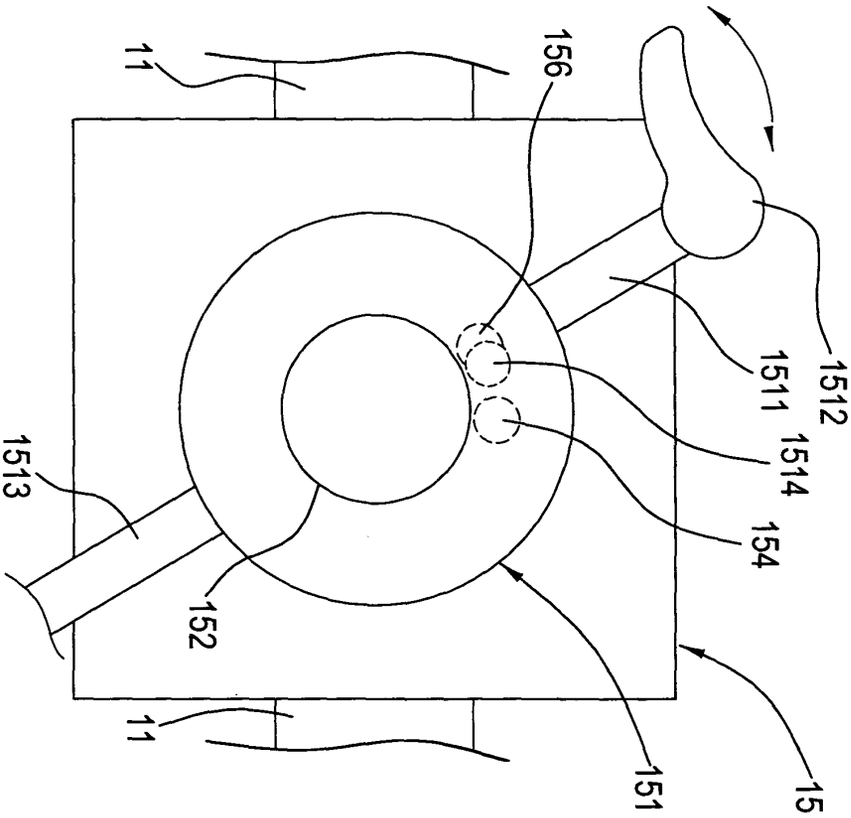

11
156
1512
1511
1514
154
1513
152
11
151
15

FIG.3 C

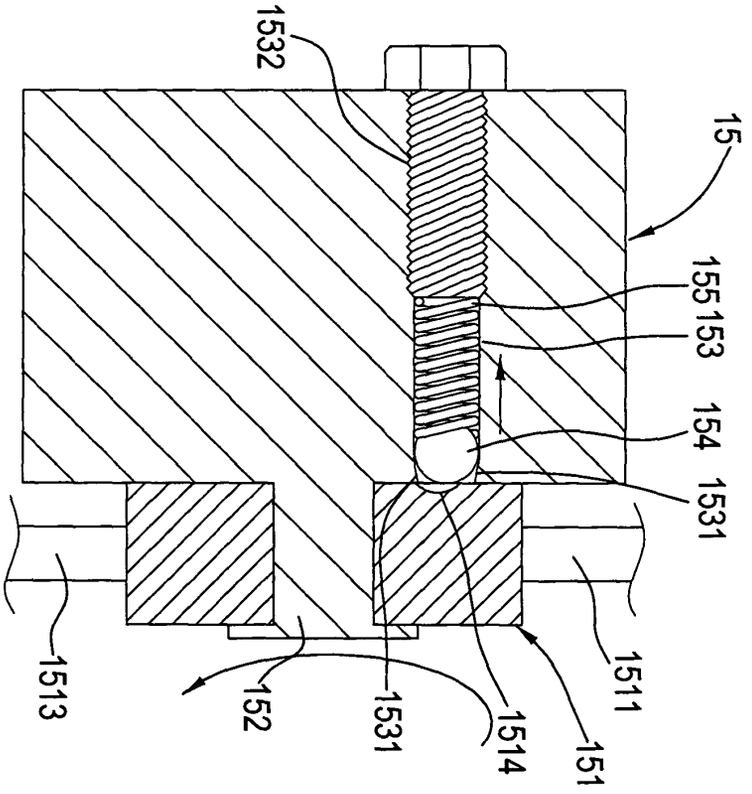

1532
15
155
153
154
1531
1513
152
1531
1514
151
1511

FIG.3 D

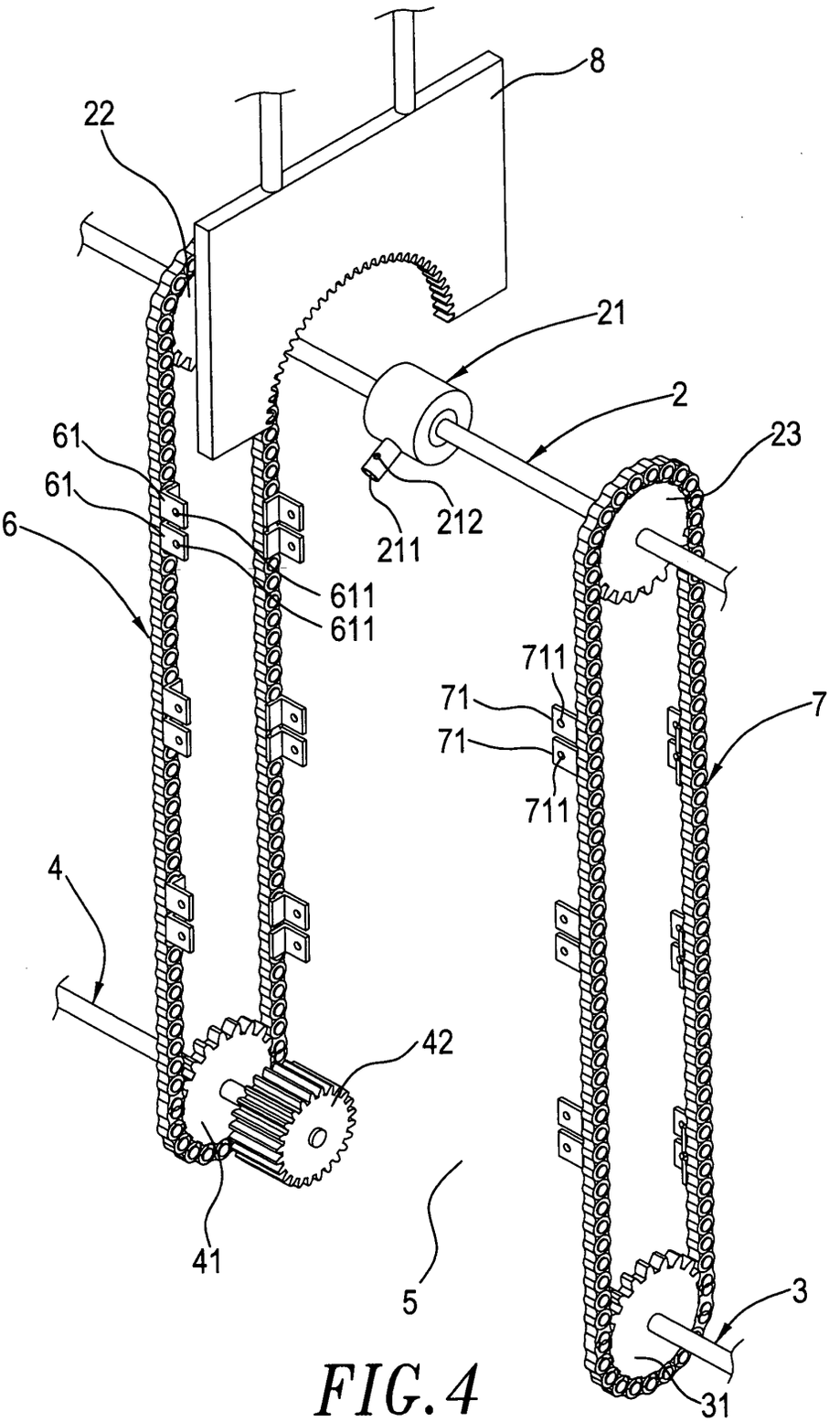


FIG.4

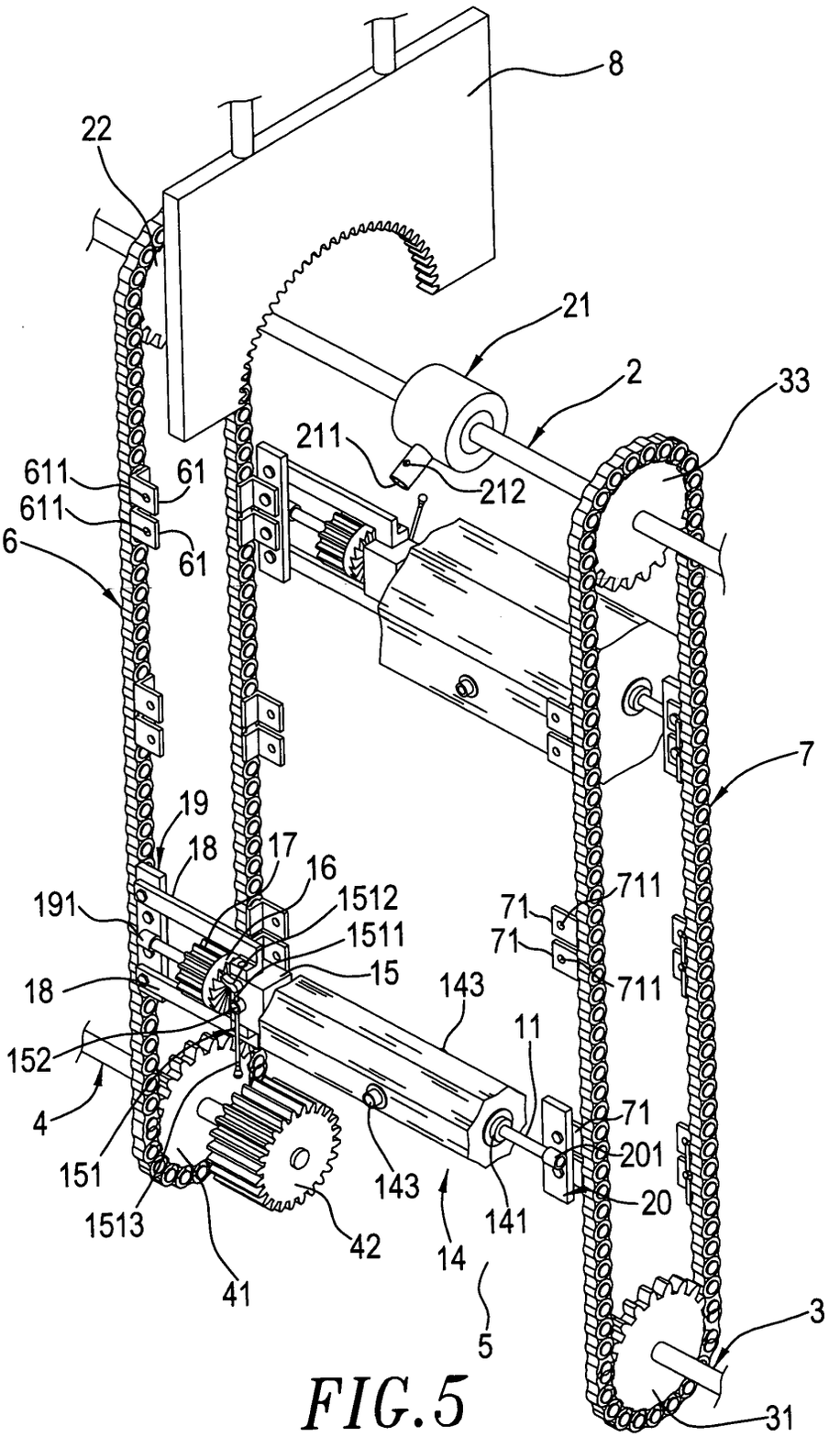

8
22
21
2
33
211
212
611
61
611
61
6
7
19
18
17
16
1512
1511
15
191
18
152
4
151
1513
41
42
143
11
71
711
71
71
711
201
20
141
14
5
3
31

FIG.5

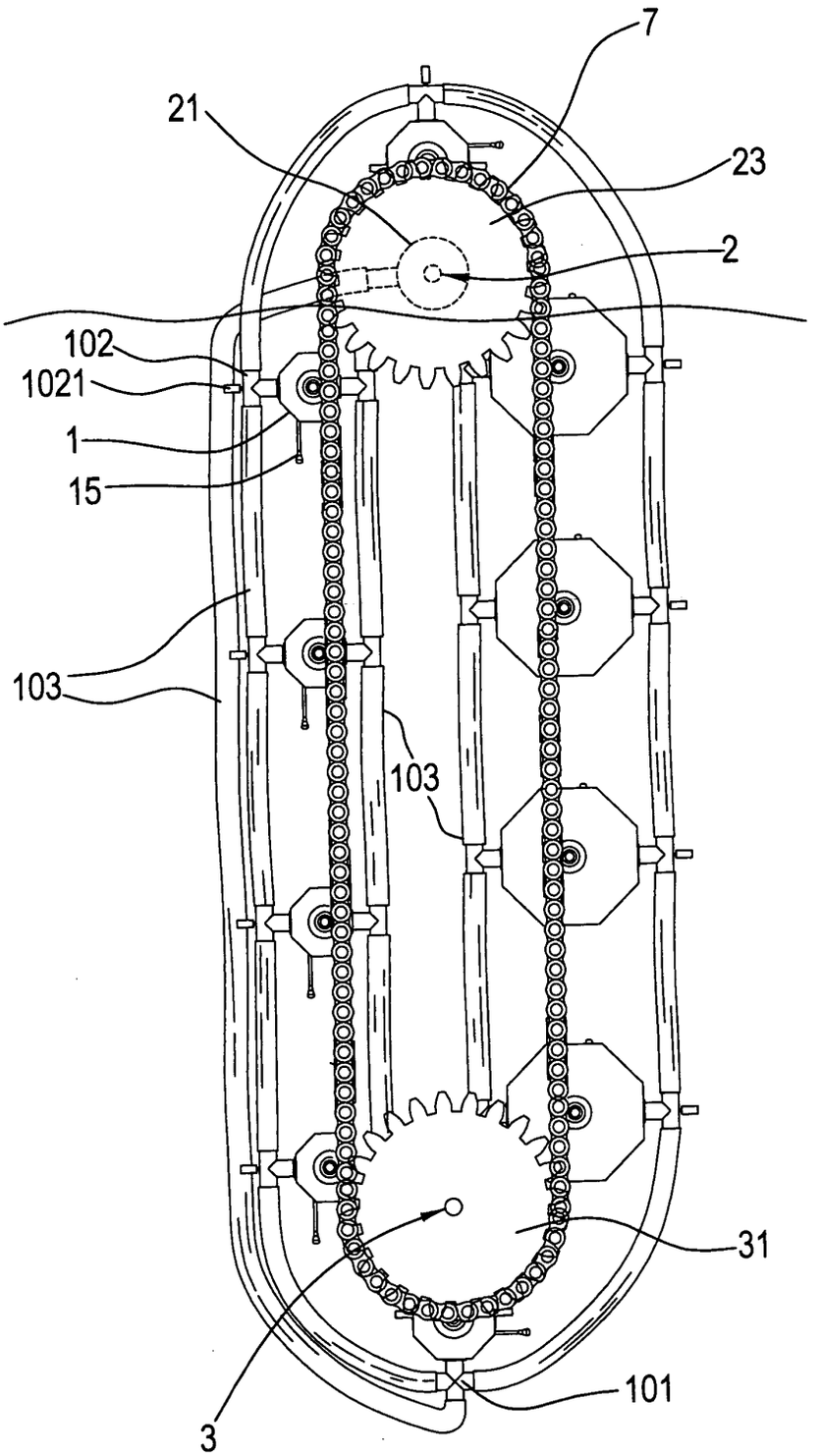


FIG.6

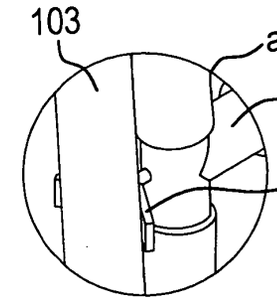

103
a
102
1021

FIG.7B

9
91
22
6
8
94
21
2
7
23
911
61
611
61
611
212
92
19
16
103
711
71
191
15
71
711
14
912
24
17
20
152
201
a
141
151
103
44
44
101
43
4
152
42
1
3
41
95
5
31

FIG.7A

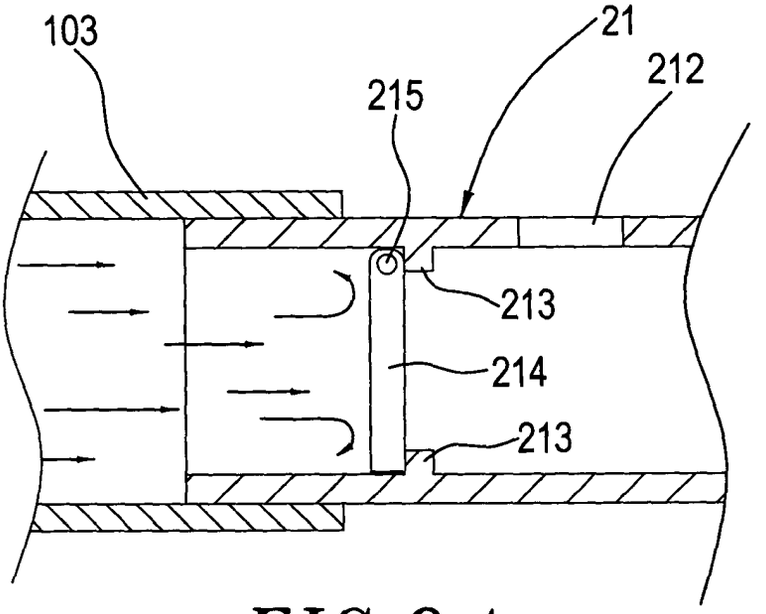


FIG. 8 A

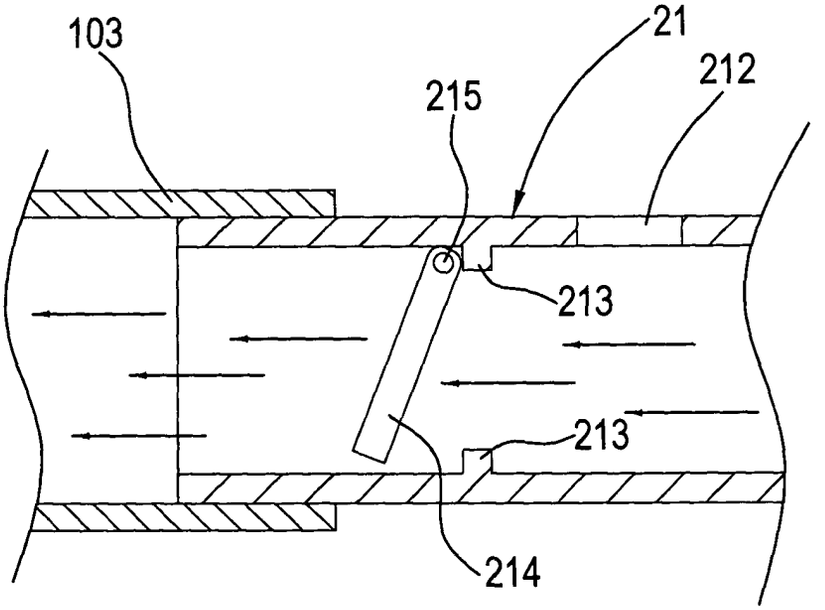


FIG. 8 B

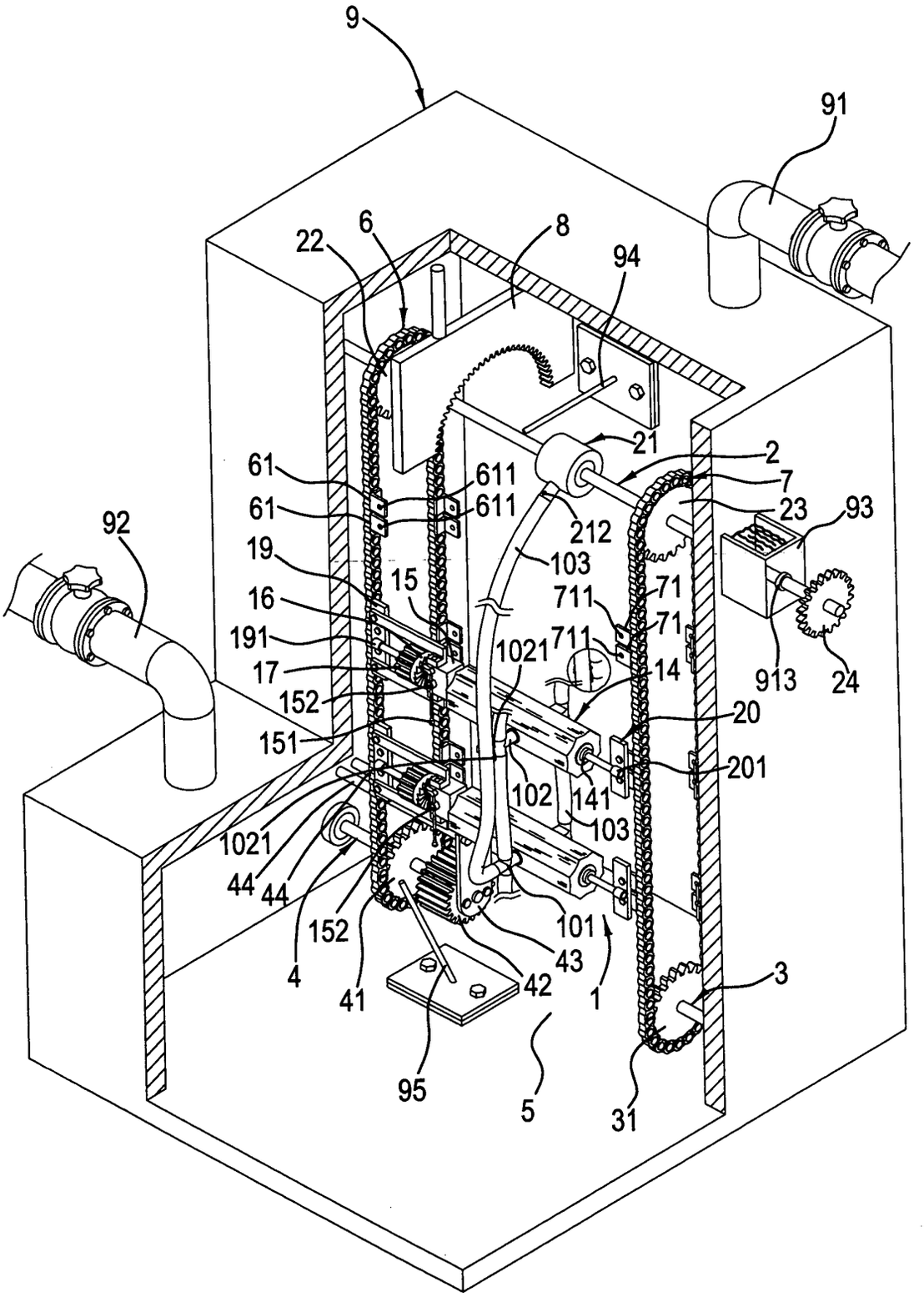

9
91
22
6
8
94
21
2
7
23
93
92
61
611
61
611
212
103
19
15
711
71
16
711
71
191
1021
711
14
913
24
17
152
20
151
201
102
141
103
1021
44
44
152
101
43
4
41
42
1
3
95
5
31

FIG.9

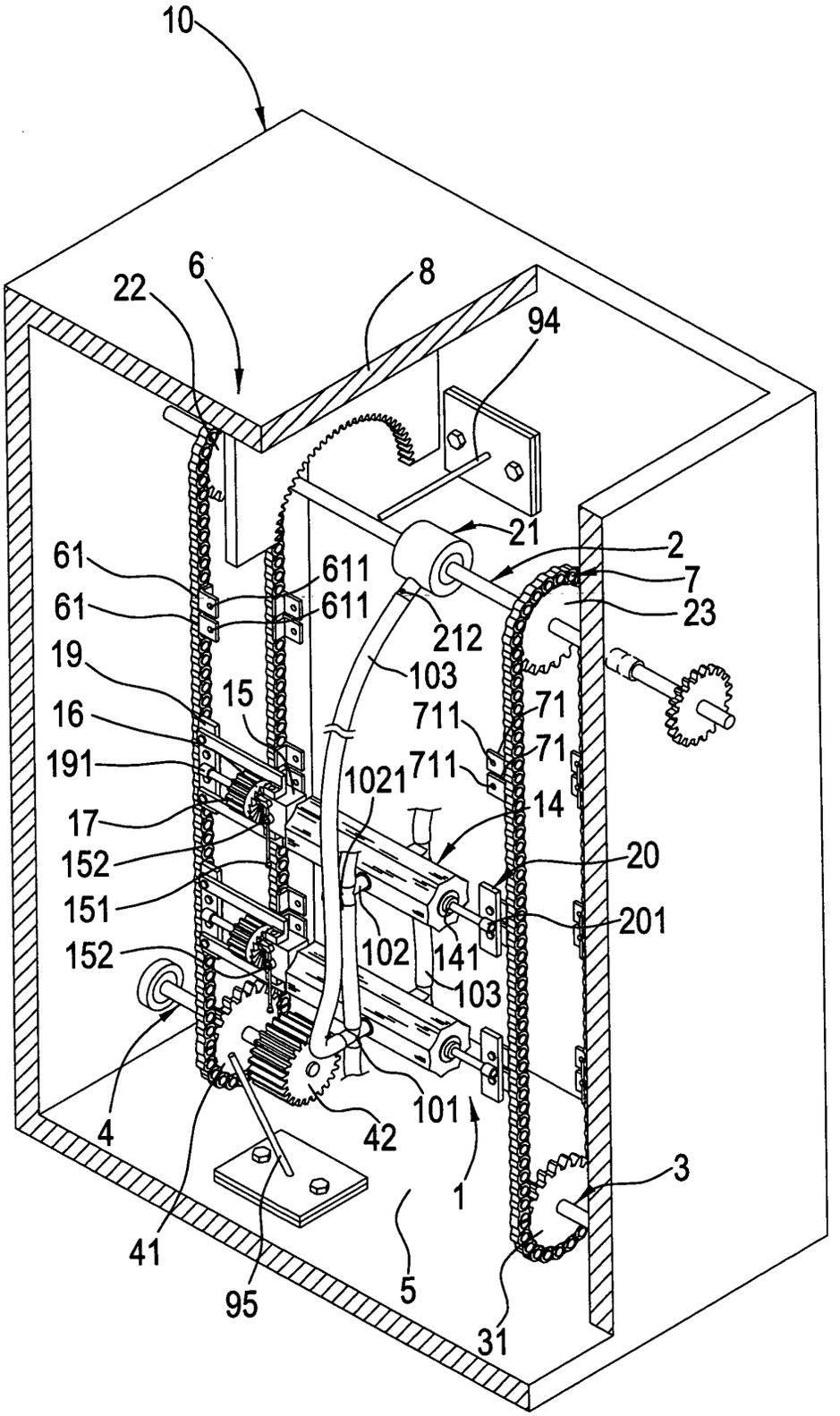

10
22
6
8
94
21
2
7
23
61
611
61
611
212
19
103
15
16
711
71
191
711
71
1021
17
14
152
20
151
201
152
102
141
103
101
4
42
3
1
41
5
95
31

FIG. 10

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 03 00 4535

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	EP 0 452 601 A (FABRY ALEXANDRE) 23 October 1991 (1991-10-23) * page 3, line 9 - line 30 * * figures * ---	1-10	F03B17/04
A	FR 2 260 001 A (GOMILA CHARLES) 29 August 1975 (1975-08-29) * page 1, line 10 - line 36 * * figures * ---	1-10	
A	GB 2 326 916 A (WHAN GHEM SHENG) 6 January 1999 (1999-01-06) * page 3, line 23 - page 4, line 26 * * abstract; figures * ---	1-10	
A	ORD-HUME A W J G: "PERPETUAL MOTION" , PERPETUAL MOTION. HISTORY OF AN OBSESSION, NEW YORK, ST. MARTIN'S PRESS, US, PAGE(S) 100-103 XP002067445 * page 101, paragraph FIG62 * * page 102, paragraph FIG63 * * page 103, paragraph FIG65 * -----	1-10	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

F03B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 July 2003	O'Shea, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 03 00 4535

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

16-07-2003

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0452601 A	23-10-1991	MC 2198 A	05-10-1992
		EP 0452601 A1	23-10-1991
		MC 215 E	05-10-1992
FR 2260001 A	29-08-1975	FR 2260001 A1	29-08-1975
GB 2326916 A	06-01-1999	AU 3995097 A	14-01-1999
		BR 9706243 A	08-06-1999
		CA 2225582 A1	01-01-1999
		JP 11037035 A	09-02-1999
		TR 9800176 A2	21-02-2000
		ZA 9711553 A	01-07-1998

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82