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(54) **Title:** UNIDIRECTIONAL GEAR DRIVE

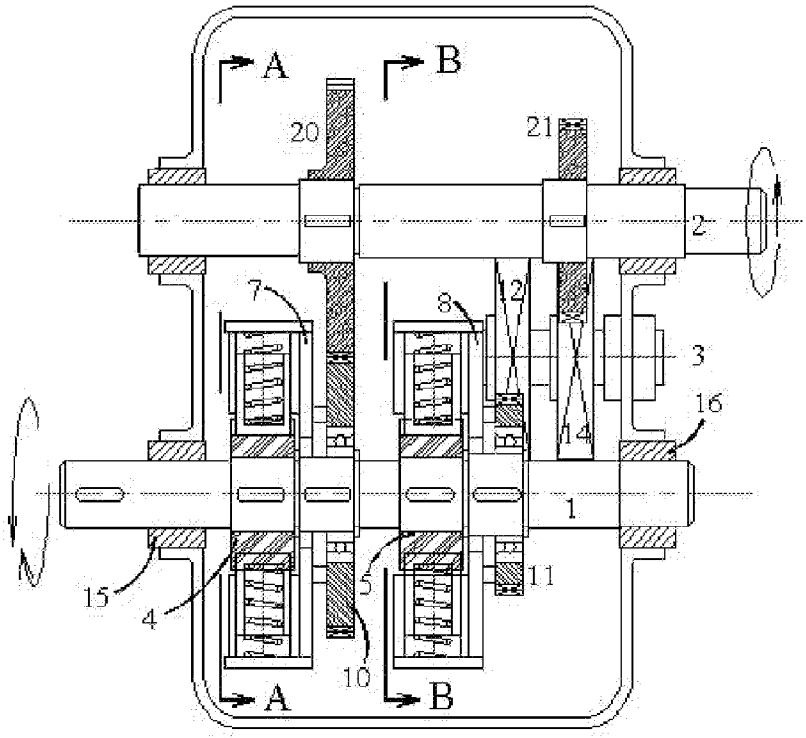

FIGURE - 1

(57) **Abstract:** A mechanical assembly applicable to convert bidirectional motion of an input shaft into unidirectional motion of an output shaft comprising input shaft, intermediate shaft and output shaft, wherein two sets of gearing arranged one after the other, in combination with ratchet and pawl mechanisms driven in opposite directions, with two opposing ratchet wheels fitted to input shaft, each accompanied by a gearwheel driven on bearings on the same shaft with protruded flanges integral to aforesaid gear wheel, carrying spring loaded pawls on flanges to engage with accompanied ratchet wheel. The output shaft is coupled to input shaft by aforesaid gearings, in which 1st gear fitted on input shaft meshes directly with 1st gearwheel fitted on output shaft to turns in clockwise direction only while 2nd gear fitted to input shaft couple the output shaft, by means of intermediate gear arrangement to reserve its direction. This sort of gear arrangement is suitable for wave power generation, internal combustion engine and many industrial applications as a separate gearing unit to convert oscillations in to rotation.

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Unidirectional Gear Drive

Classification

The present invention relates to gear arrangements converting bidirectional motion of a shaft in to unidirectional motion of another shaft applicable in power generation and in power transmission.

Background Art

In Industry and in power generation, there are numerous applications require oscillatory motion to be turned to unidirectional motion. At present this duty is performed using various mechanisms for a specific requirement of particular equipment, capable of utilizing only one directional swings, or using two devices capable of converting clockwise and counter clock wise swings separately and brought finally in to the output shaft along different paths.

The aforesaid first kind can seize swings in one direction only and the second type is using additional gearing paths. Such a device is not applicable as an exclusive unidirectional gear drive available a variety of applications.

Therefore still there is a need of a unidirectional gear drive applicable as a unique apparatus applicable in variety of applications, for the purpose of turning swings of a shaft in to continues uni-directional rotation of an output shaft.

An object of this invention is to provide an apparatus and method capable of converting bidirectional motive power available in a source to harness as unidirectional motion which will be available as useful power to consumer.

Another object of this device is to introduce a unique device capable of converting oscillatory motion of a shaft in to unidirectional motion, applicable for variety of applications.

Disclosure of the invention

According to the invention there is provided a mechanical assembly comprising two sets of gearing arranged one after the other in combination with ratchet and pawl mechanisms driven in opposite directions accompanied by three shafts namely input shaft, intermediate shaft and output shaft. The input shaft is fitted with two opposing ratchet wheels axially at fixed a distance while each of aforesaid ratchet wheels is followed by a gearwheel driven on bearings on the same shaft. Protruded flanges, connected to aforesaid each gear wheels, are carrying spring loaded pawls sliding in guides along radial direction to the axis of the input shaft.

Therefore in operation, bidirectional movements cause the pawl key to engage the slots in ratchet wheel until it disengage and ride on the periphery of the ratchet surface and drops to the next slot. As long as the pawl catches in the teeth, the ratchet wheel carries flange and gear wheel connected with pawl, turning about its axis. When the input shaft turns the other way, the pawl disengages the slot in ratchet wheel and slides over the ratchet surface to drop in the next recess.

The output shaft is coupled to input shaft, by the aforesaid two consecutively arranged gearings, in which 1st gear fitted on input shaft meshes directly with the 1st gearwheel fitted on output shaft which turns in clockwise direction only, while 2nd gear fitted to input shaft couple the output shaft, by means of counter gear arrangement to reserve its direction by means of intermediate shaft. So that, in operation, oscillations performed in the manner of rotary movement either clockwise or counterclockwise on input shaft will result continues unidirectional rotary motion on output shaft.

This apparatus is having variety of applications in power generation and in power transmission as described below:

Application of the invention in wave power generation:

The renewable energy sources such as ocean waves are associated with periodic rising & falling of energy level.

When a floating body fitted with a straight rod that can slide along fixed guides is floated over the surface of the ocean waves, the floating body is reciprocating along with the attached rod due to the action of periodic rise and fall of ocean waves. Towards the other end of the rod a rack of gears is attached and meshing with the pinion gear wheel fitted to the input shaft of the uni-directional gear drive. Due to reciprocation action resulting on rack of gears, pinion wheel fitted to input shaft of the unidirectional gear drive is oscillating thereby turning oscillations into continues rotary motion.

Generally the rotary motion resulted on the out put shaft due to wave power would be at a lesser revolutionary speed. Preferably, this speed is increased to run at a faster R.P.M. to generate power, using additional gear arrangement before it is converted to electrical energy, by electromagnetic induction.

This system is advantageously accompanied by underwater structure facing an inclined surface towards floating device to boost the hydro dynamic forces upwards.

Preferably the depth from the sea level to this structure, made adjustable, depending on tidal conditions.

Application of the invention in wave power generation:

Another example of power generation is application of swings of a shaft that can turn in to oscillations. When gasses pressure due to internal combustion process is imposed periodically on an extended arm of the input shaft of the unidirectional gear drive the aforesaid arm is oscillating due to power strokes. Such oscillations are converted to unidirectional rotary motion using the introduced apparatus. In case of the swings to be controlled within a definite angle of swings, two stoppers are placed on either ends of the swings of aforesaid extended arm travels, so that the oscillations are restricted within a definite angle of rotation. In such arrangements the combustion pressure force is exerted at the beginning of each stroke, provided that there is no power release towards the end of stroke from source.

Various other examples of application of this device are associated with manually operated mechanical equipments such as water pumps, loads shifting and handling equipments etc, where human power released in forward and backward directions. In such instances the human power is fed though a rack and pinion mechanism to the unidirectional gear drive to acquire continues rotation to improve the productivity of such equipments.

Further, this type of uni-directional gear is applicable to generate useful electrical power instead of applying frictional resistance during controlled power release in break systems in machinery and automotives.

Also, unidirectional gear drive is applicable with human powered electrical generators. Human power generated in swings by pedal power, hands or body movements will be supplied to input of unidirectional gear drive to generate useful mechanical power or electricity. Such generators can be practically used to charge batteries, and advantageously integral with an inverter.

Plurality of this device may be connected to a single power takeoff shaft to obtain higher mechanical power. In the same way electricity generated by each device can be combined parallel or in series to generate higher electrical power.

Brief Description of the Drawings

These features and advantages of the present invention as well as others will be fully

understood when the following description is read in light of the accompanying drawings, in which:

Fig. 1 is the typical sectional view of unidirectional gear assembly

Fig. 2 is the Details of Clockwise assembly at input shaft

Fig. 3 is the Details of Counterclockwise assembly at input shaft

Fig. 4 is a General view of a wave power generator installed on offshore flat form

Fig. 5 is a sectional view at D-D of the ocean wave power generator shown in Figure.4

Fig. 6 is the details of assembly of unidirectional gear of each power generating unit

Fig. 7 is an arrangement of the working vessel of internal combustion engine applicable with unidirectional gear

Description of preferred Embodiments

Embodiment 1

Referring to Figure 1, ratchet wheels 4 & 5 are keyed to input shaft 1 which is oscillating in operation, to engage pawls (5) in clockwise direction and counter clockwise direction respectively. The input shaft (1) is secured on bearings 15 and 16, on housing. Each ratchet wheel is accompanied by a gear wheel 10 and 11 running on bearing on the same input shaft. The two gear wheels 10 and 11 are fitted with protruded flanged 7 and 8, carrying spring loaded prismatic pawls (6) that engage slots on ratchet wheels. So that the pawls are driven by ratchet wheels along with the accompanied flange and gearwheel

running on bearings on the same input shaft. The gear wheel 10 running on bearing is meshing with gear wheel 20 secured on out put shaft 2.

The gear wheels 12 and 14 are secured to intermediate shaft to mesh continuously with the gear wheel 11 running on bearing on input shaft and gear 21 fitted to output shaft, thereby reversing the motion imparted on gear wheel 11. This way the oscillatory motion on input shaft in either direction are independently taken up and are brought onto a single output shaft (2) resulting unidirectional rotary motion on output shaft. The pawls are set forth to move along the radial direction of the axis of shaft 1. Advantageously such gearing prevents unintentional rotation of pawl housing over the oscillating shaft, as well.

Plurality of such devices may be connected to a single power takeoff shaft to obtain higher power. Similarly this type of device is applicable in power transmission as well.

Embodiment 2

Unidirectional gear drive is applicable in harnessing wave power with a floating buoyant, in ocean incorporating a offshore marine platform 37, that may be installed at sea, comprises a structural columns (35) anchored to the sea bed. The floating buoyant 33 is a water tight vessel moored with straight rods 36 that can slide along fixed guides 32,

33 and floated over the surface of the ocean waves. Due to rise and fall of ocean waves the floating body along with attached rod is sliding up and down along fixed guides. Towards the other end of the rod connecting the floating body, rack of gears 31 is attached in order to mesh with the pinion 32, attached to the unidirectional gear drive (30).

Therefore unidirectional gear (30) is driven by the rocking motion of floating buoyant (33), caused by the waves.

The platforms of the wave power generating assembly, is accompanied by underwater structure caisson 34. facing an inclined surface towards the wave front preferably containing watertight chambers. It is capable of reflecting the hydro dynamic forces of waves upwards to the floating device 33. Depth to the caisson from sea level is adjustable depending on the tidal levels using the mechanical attachment 38.

Resulting continues rotary motion generated by unidirectional gear due to rocking motion of the floating body over the ocean waves is generally at a lesser revolutionary speed. To convert to consumable electrical power, resolution speed of this output is preferably increased using additional gearing before it is converted to electricity using electricity generator

Also this structure and its arrangement help defense against coastal erosion due to absorption of wave power by the wave power generator.

Embodiment 3

Another example of power generation using swings on a shaft that can turn in to oscillations is application in internal combustion process. When gasses pressure due to internal combustion process is imposed periodically on an extended arm of the input shaft of the unidirectional gear drive the aforesaid arm is oscillating due to power strokes. Such oscillations are converted to unidirectional rotary motion using the introduced apparatus. In case of the swings to be controlled within a definite angle of swings, two stoppers are placed on either ends of the swings that the arm travel, so that the oscillations are restricted within a definite angle of rotation. In such arrangements the combustion pressure pulses force is exerted at the beginning of each stroke, provided that there is no power release towards the end of stroke from source.

Figure 7, an example of power generation using swings is shown in Figure 7. The figure is a sectional view of the working vessel of an internal combustion engine applicable along with the unidirectional gear drive. The working vessel functions as the oscillations generator to generate swings on oscillating shaft 50, which id the extended input shaft of the unidirectional gear drive.

Combustion cycle take place in the working vessel (5) and impart swings on oscillation shaft (50). Principle elements of this thermal power generator are working vessel 51, working head (52) and the flap (53).

The working vessel constitute of a semicircular segment having cylindrical profile. Inside the housing an oscillating flap performs the action of the mobile piston. The flap is movable slidably with respect to walls of the housing, thereby defining two working chambers in centrally divided housing. The housing and working head encased by water jacket 56.

The engine head provide seals between two working chambers 54 and 55. Intake ports & exhaust ports are operated by valves from overhead cam shafts. Two sets of intake ports and exhaust ports are positioned one behind the other to facilitate each working chamber. Oscillations generated, due to combustion cycle with this arrangement is conveyed to the input shaft of the unidirectional gear drive coupled to the oscillating shaft. Oscillations conveyed by the oscillating shaft are converted to continues rotation by the unidirectional gear. The angle of swings of the oscillating shaft is limited by stoppers fitted at two ends of swings of an arm rigidly fitted to the oscillating shaft. Therefore power in continues rotary manner is available at power take off shaft

While only certain preferred embodiments of the invention have been disclosed in details herein, it will be readily apparent to those who skilled in the art that various changes in form and arrangement of parts may be made to suit the requirements without departing from the scope and spirit if the invention.

Claims

That which is claimed is:

a mechanical assembly applicable to convert bidirectional motion of a shaft in to unidirectional motion of an output shaft comprising

means forming for two sets of gearing arranged one after the other,

means for three shafts namely input shaft, intermediate shaft and output shaft, supported on bearings,

means for aforesaid input shaft to be fitted with two opposing ratchet wheels axially one after the other at definite intervals

means to introduce two gear wheels running on bearings on input shaft to accompany each ratchet wheel

means for protruded flanges extending from afore said gearwheels to seize spring loaded pawls engaging the accompanied ratchet wheel

means to engage spring loaded prismatic pawls on aforesaid ratchet wheels

means to drive aforesaid gear wheel with the accompanied pawls when it engage with the slots in ratchet wheel and drive on the driven direction

means for gearing to couple the first gearing on input shaft directly with the first gear on out put shaft while the second gear on input shaft with the second gear on out put shaft by an intermediate shaft to reverse its direction

so that in operation bidirectional motion imparted on input shaft results unidirectional motion on output shaft.

2. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 characterized by pawls engaging the slots on ratchet wheels in radial direction.

3. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 characterized by the prismatic pawls engaging the slots on ratchet wheels in radial direction.

4. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 where a gear mechanism applicable in harnessing wave power with a floating bob, causing reciprocal movement and thereby oscillatory motion on a rack and pinion connected to the input shaft of the introduced apparatus.

5. A mechanical assembly applicable to convert oscillations generated by internal combustion process in to continues rotary motion of a shaft as claimed in claims 1, 2, 3.

6. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 4, where a caisson is secured underneath the floating blob inclined its top surface toward the float.

7. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 6, where a caisson is made adjustable depending on tidal level of the ocean.

8. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 6, where the complete assembly is built for defense against coastal erosion.

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5. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 2 where a gear mechanism applicable in harnessing wave power with a floating bob, causing reciprocal movement and thereby oscillatory motion on a rack and pinion connected to the input shaft of an apparatus.

6. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 3 where a gear mechanism applicable in harnessing wave power with a floating bob, causing reciprocal movement and thereby oscillatory motion on a rack and pinion connected to the input shaft of an apparatus.

7. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

8. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 2 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power as claimed.

9. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 3 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power

10. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 4 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

11. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power as claimed.

12. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 2 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

13. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 3 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

14. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 4 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

15. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

16. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 2 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

17. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 3 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

18. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 4 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

19. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 1 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

20. A mechanical assembly applicable to convert bidirectional motion of an input shaft in to unidirectional motion of an output shaft as claimed in claim 2 where a Plurality of gear mechanisms connected to a single power takeoff shaft to obtain higher power.

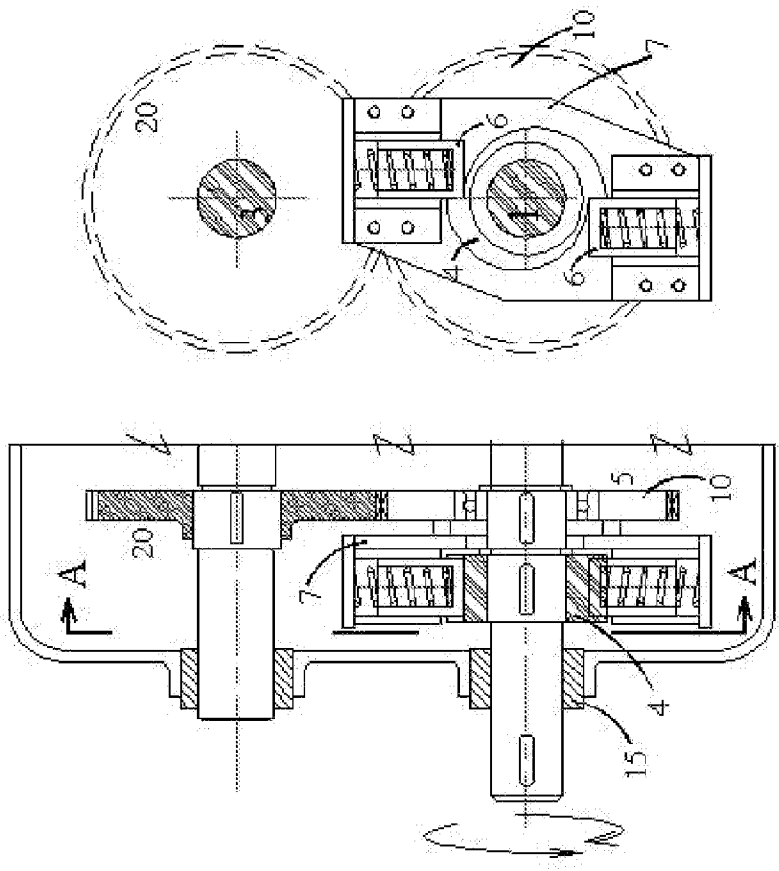

FIGURE - 2

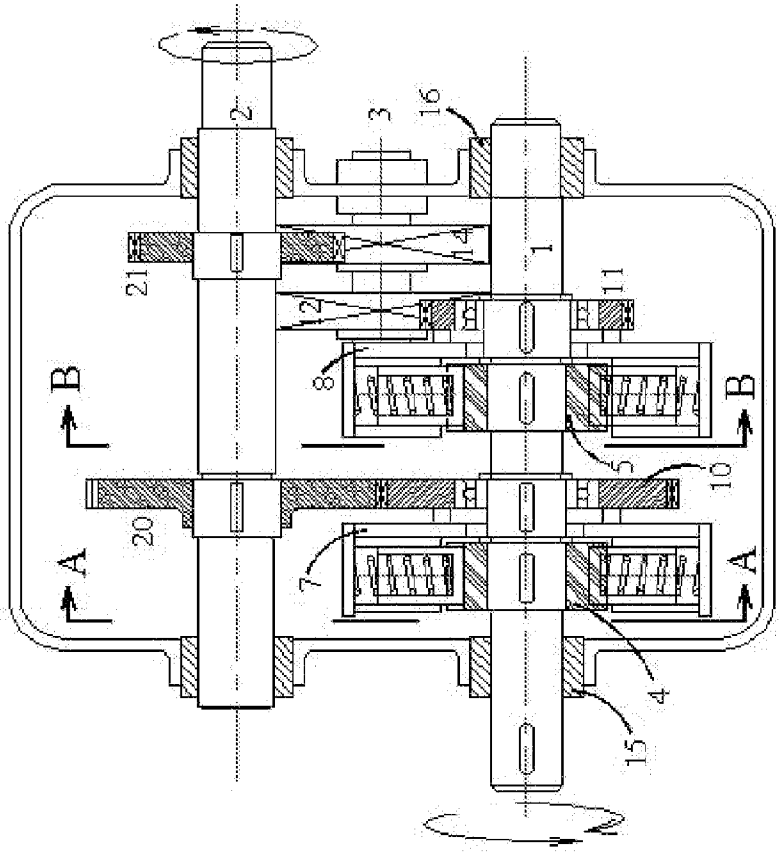

FIGURE - 1

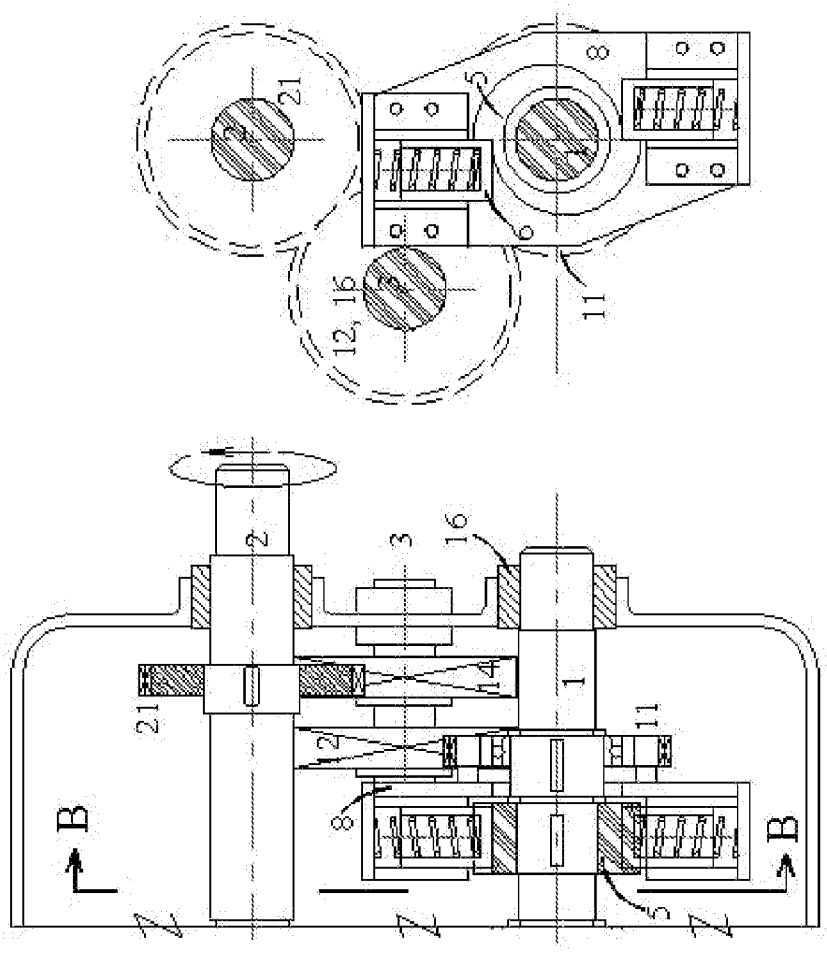

FIGURE - 3

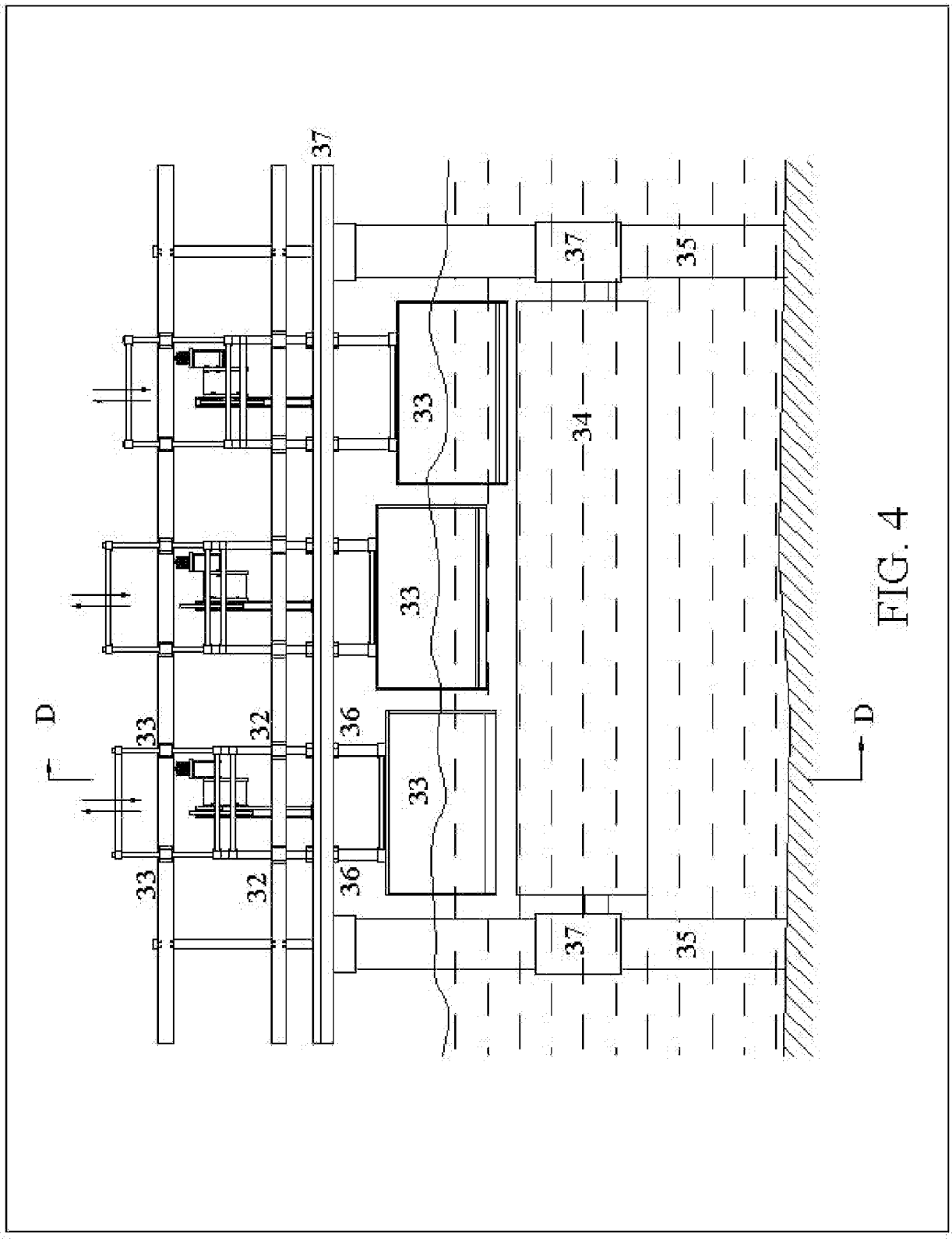

FIG. 4

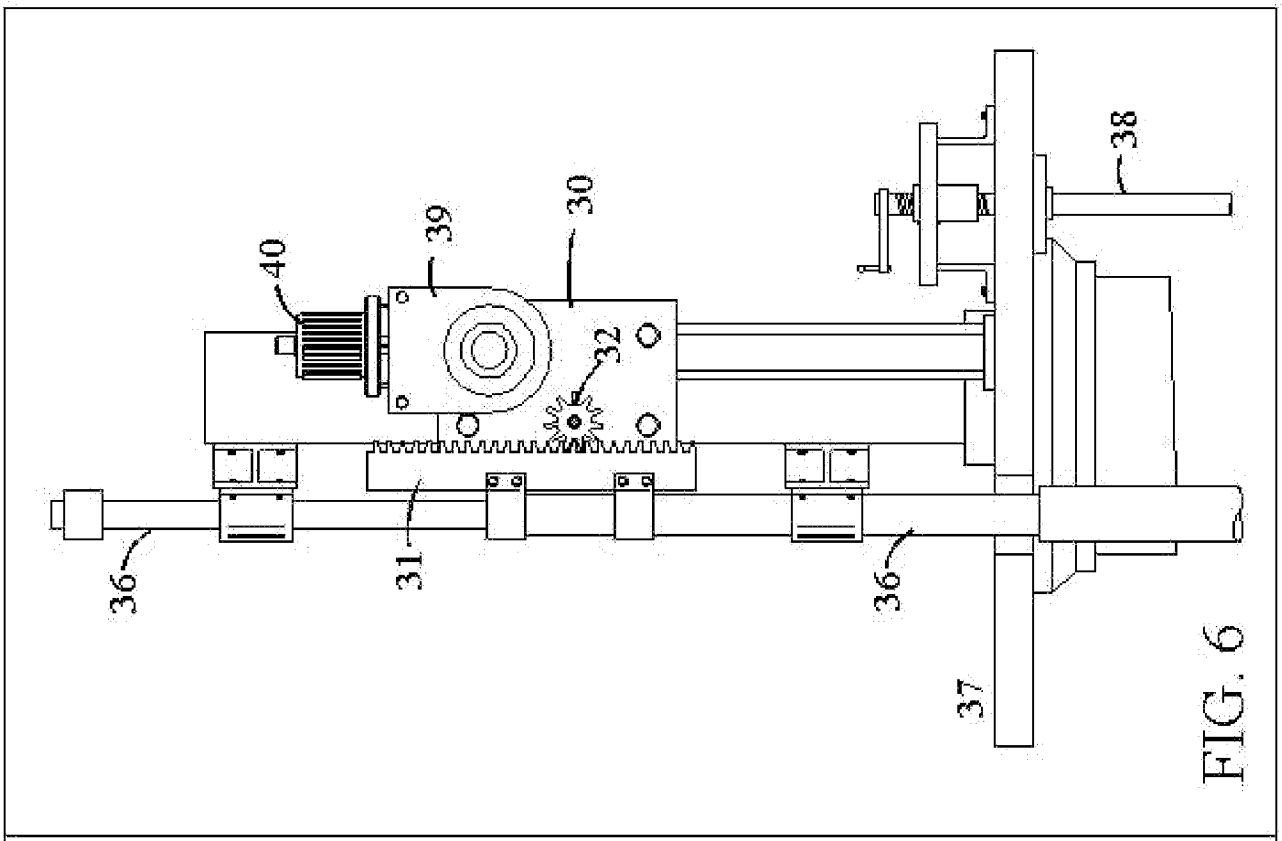

FIG. 6

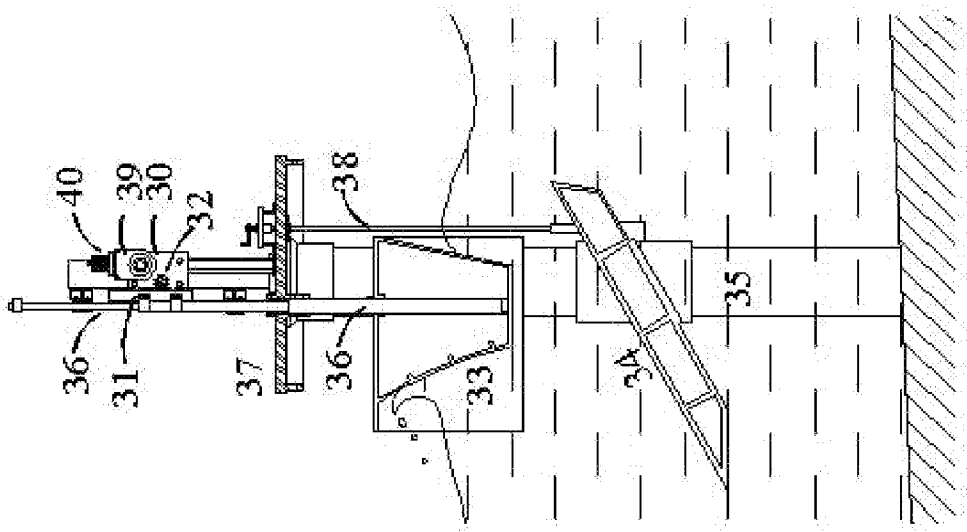

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FIG. 5

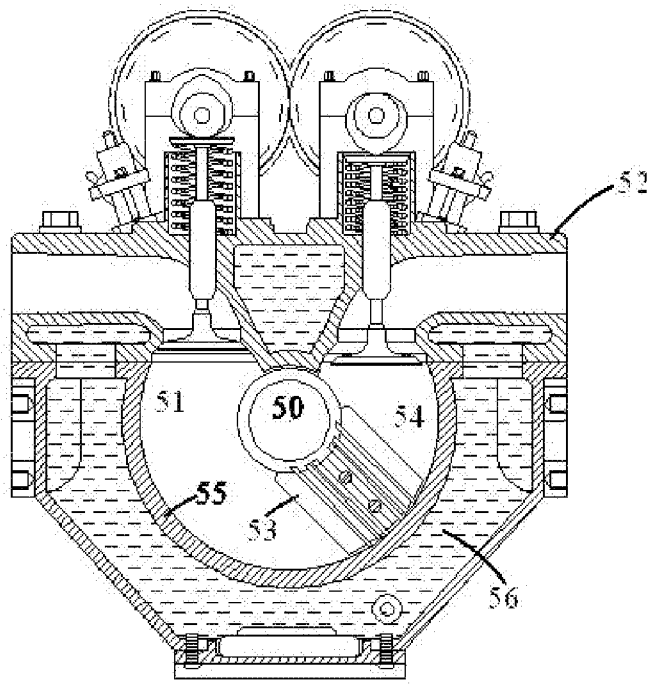

FIGURE. 7 TYPICAL CROSS SECTION