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(54) MECHANICAL TRANSMISSION

(76) Inventor: **Laird B. Gogins**, Salt Lake City, UT (US)

Correspondence Address:
MORRISS O'BRYANT COMPAGNI, P.C.
136 SOUTH MAIN STREET
SUITE 700
SALT LAKE CITY, UT 84101 (US)

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(60) Provisional application No. 60/238,888, filed on Oct. 10, 2000.

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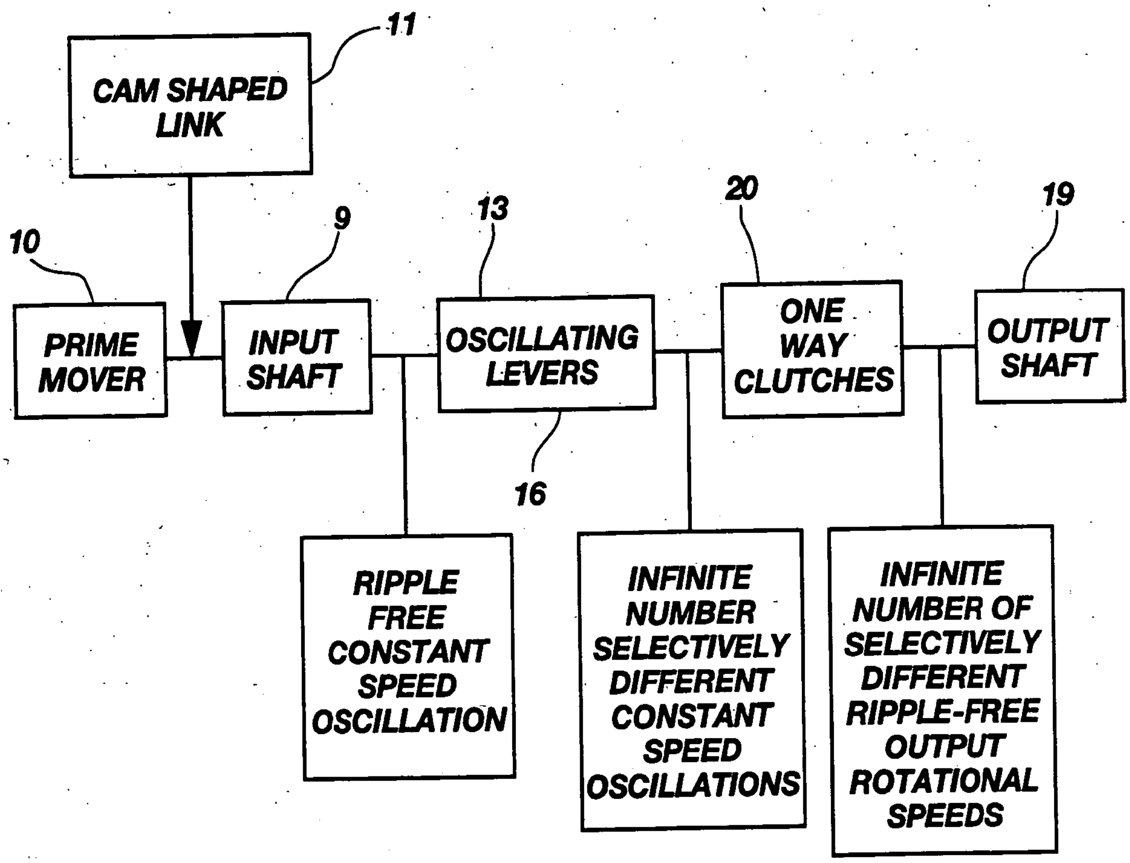
(57) ABSTRACT

A constant power mechanical transmission with seamless, ripple free, infinitely variable torque multiplying outputs comprises an input shaft and an output shaft. The input shaft is coupled to a pair of oscillating levers whereby rotation of the input shaft causes oscillation of the oscillating levers in opposite directions. The oscillating levers are linked to the output shaft with one-way clutches in order to cause rotation of the shaft upon movement of the oscillating levers. The rotational speed of the output shaft can be infinitely varied by changing the throw of the oscillating levers.



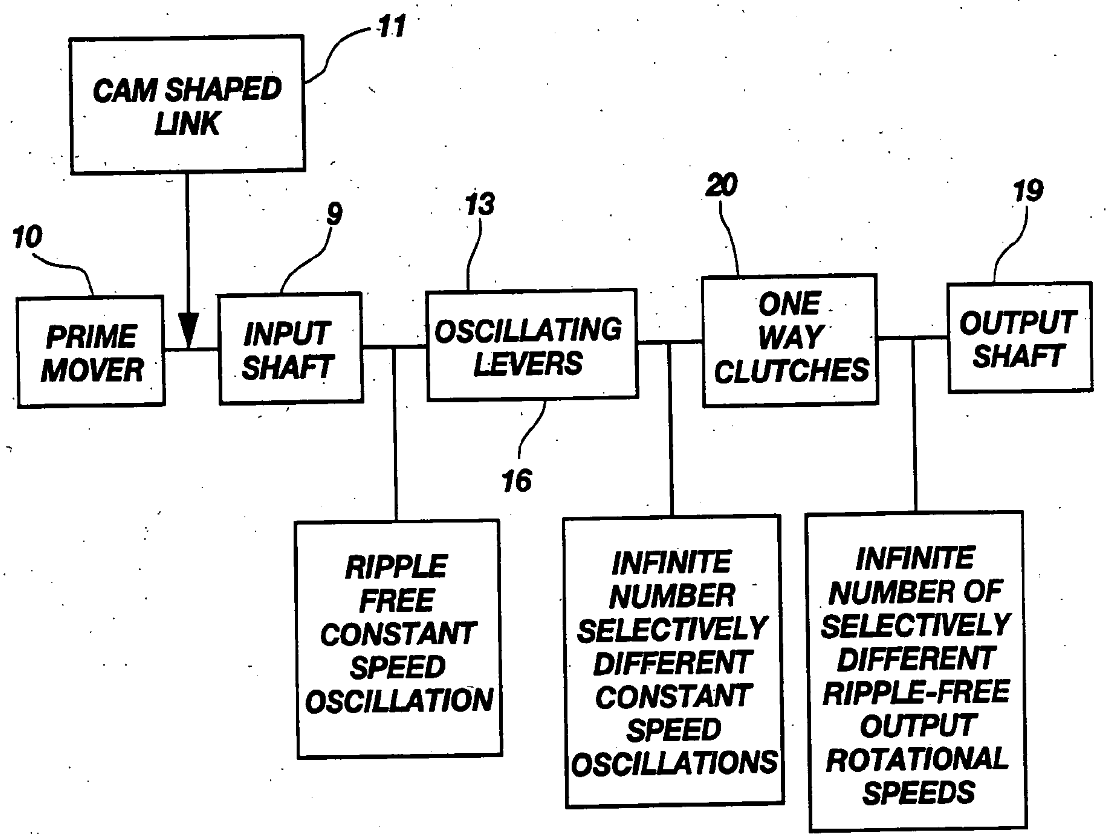

11
CAM SHAPED LINK
10
PRIME MOVER
9
INPUT SHAFT
13
OSCILLATING LEVERS
16
20
ONE WAY CLUTCHES
19
OUTPUT SHAFT
RIPPLE FREE CONSTANT SPEED OSCILLATION
INFINITE NUMBER SELECTIVELY DIFFERENT CONSTANT SPEED OSCILLATIONS
INFINITE NUMBER OF SELECTIVELY DIFFERENT RIPPLE-FREE OUTPUT ROTATIONAL SPEEDS

Fig. 1

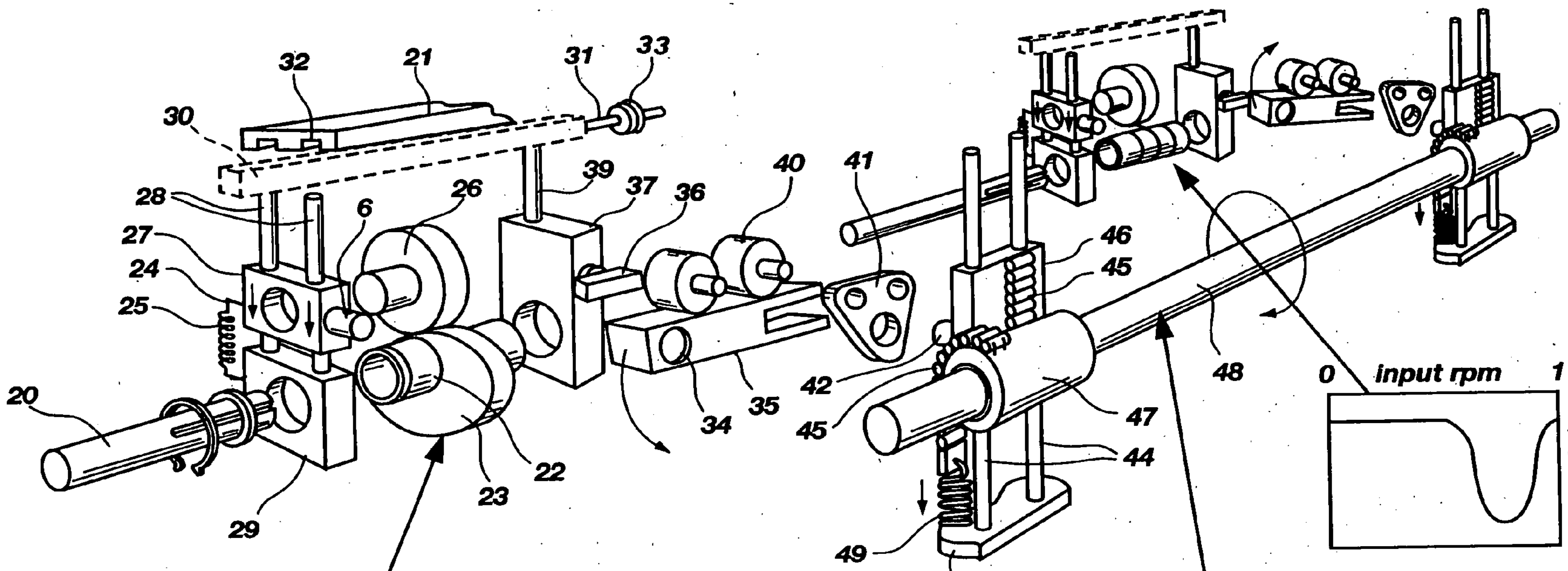


Fig. 2

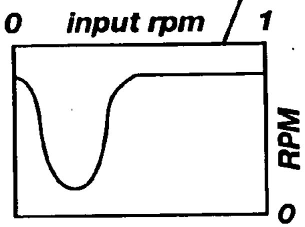


Fig. 3

Fig. 4

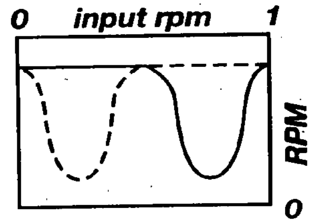


Fig. 5

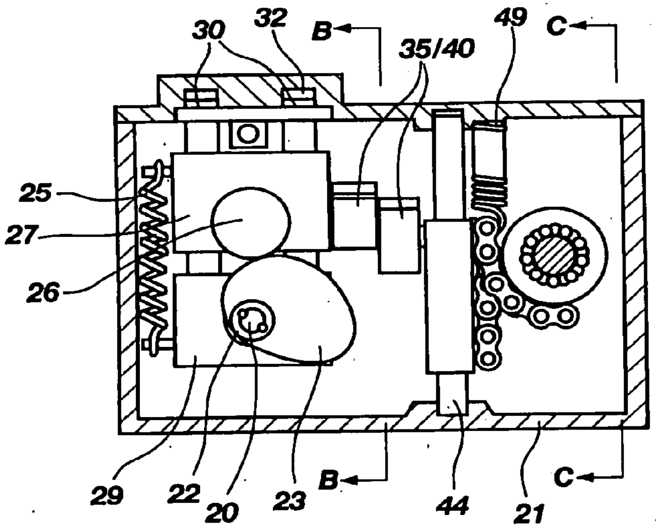


Fig. 6A

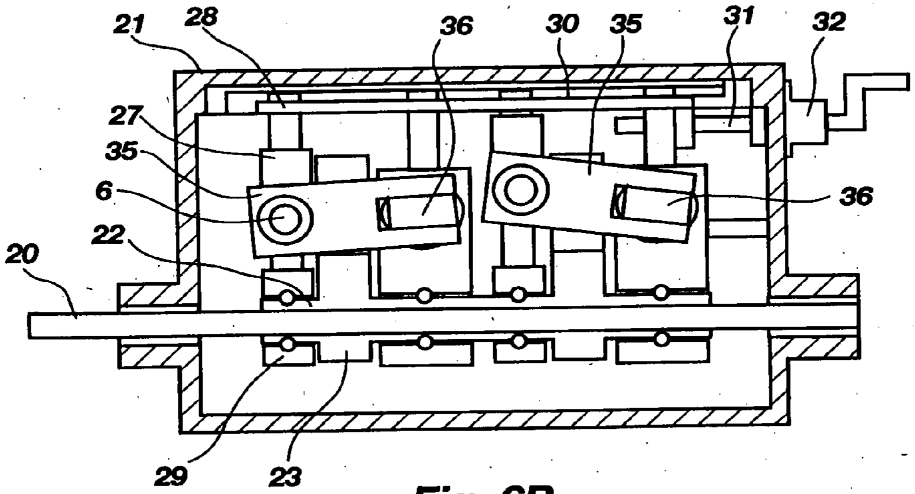


Fig. 6B

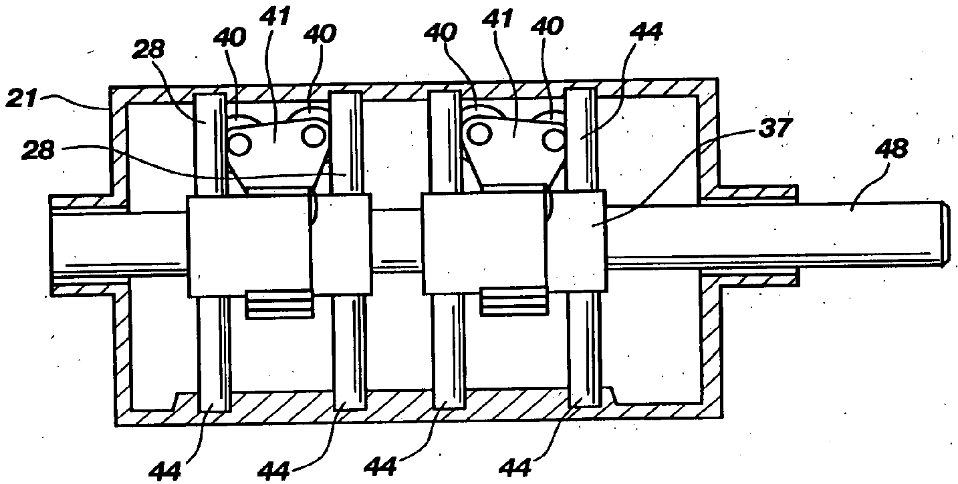


Fig. 6C

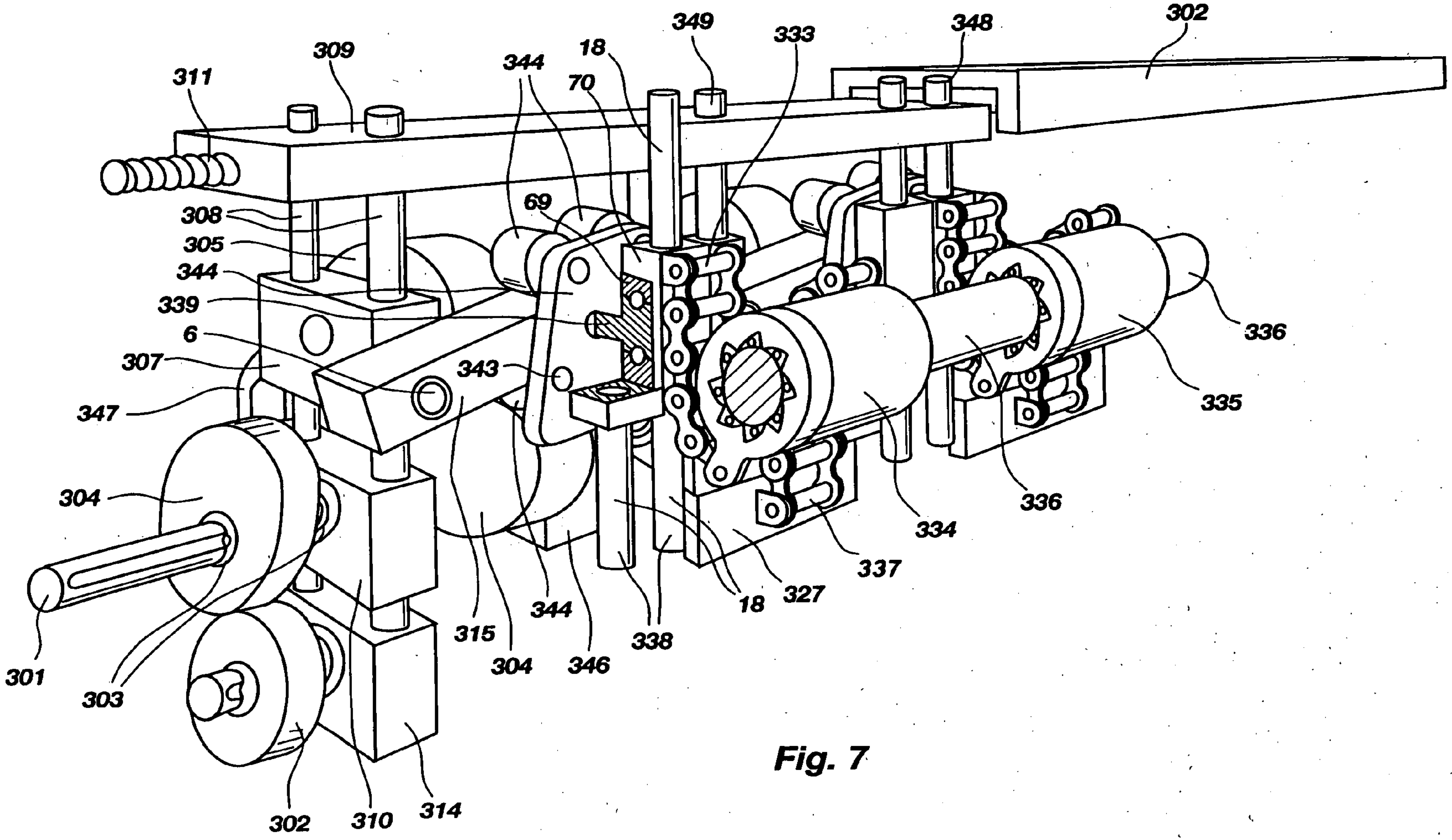


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Fig. 7

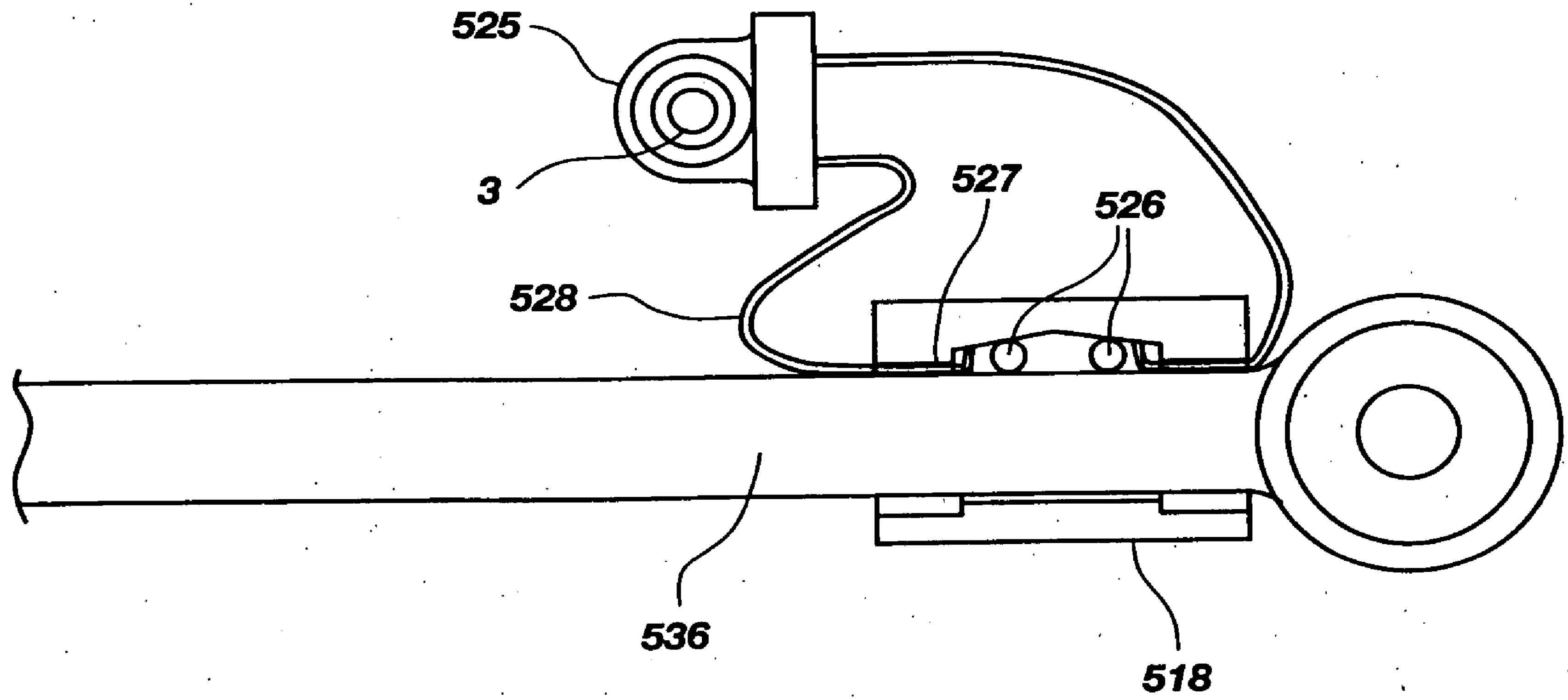


Fig. 8

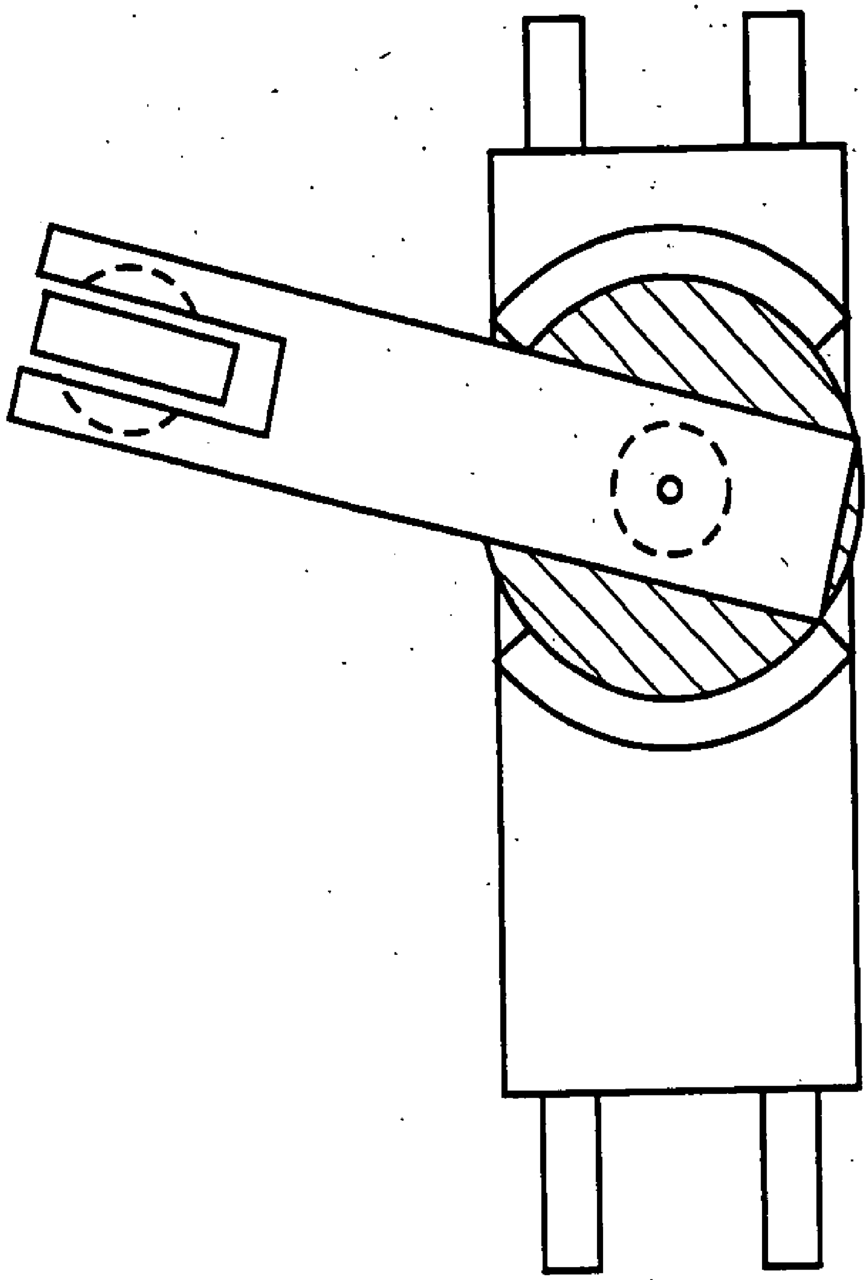


Fig. 9

(PRIOR ART)

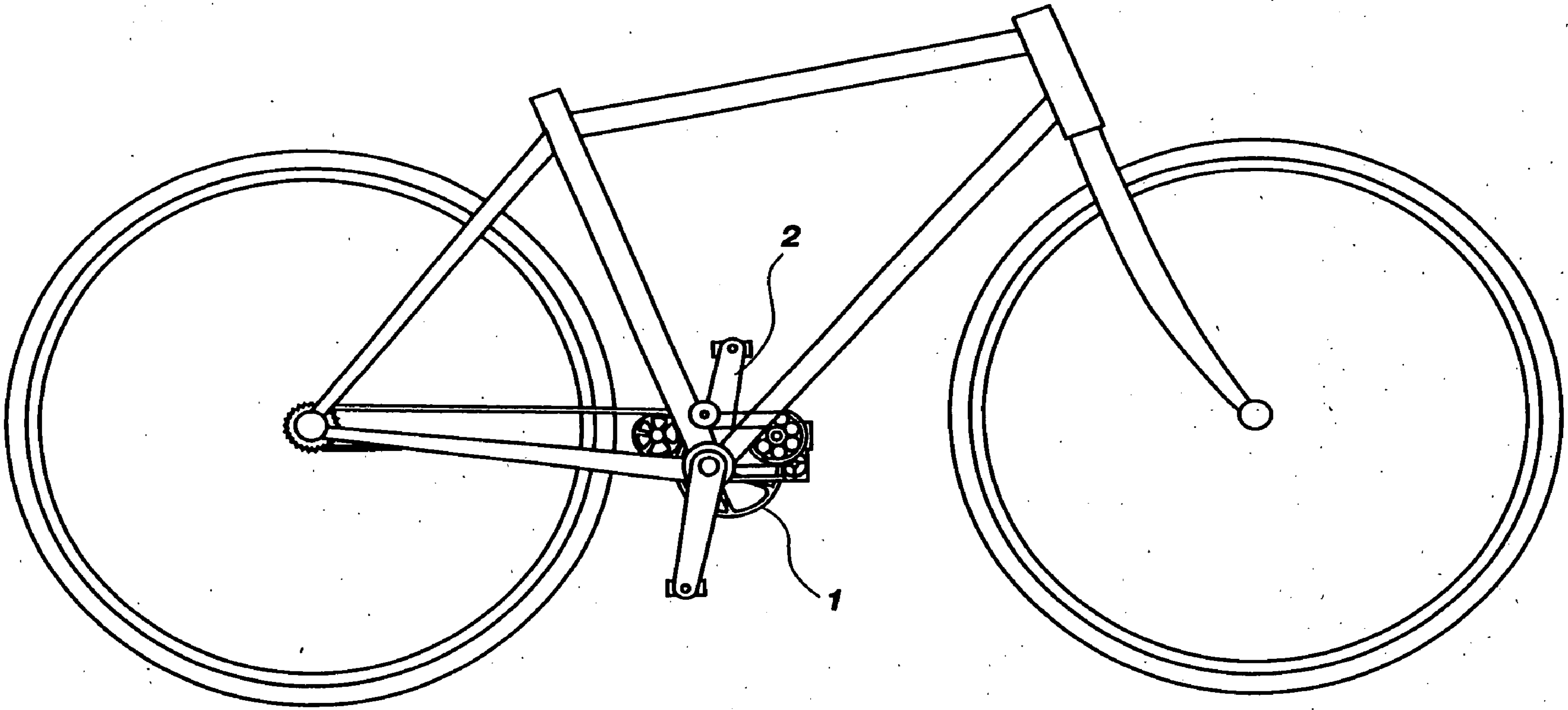


Fig. 10

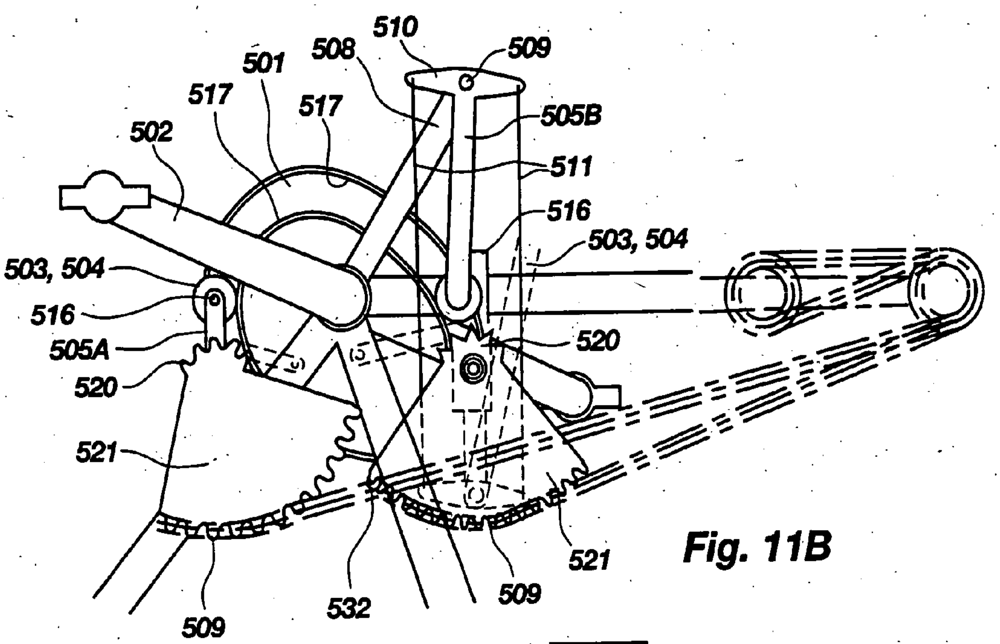


Fig. 11B

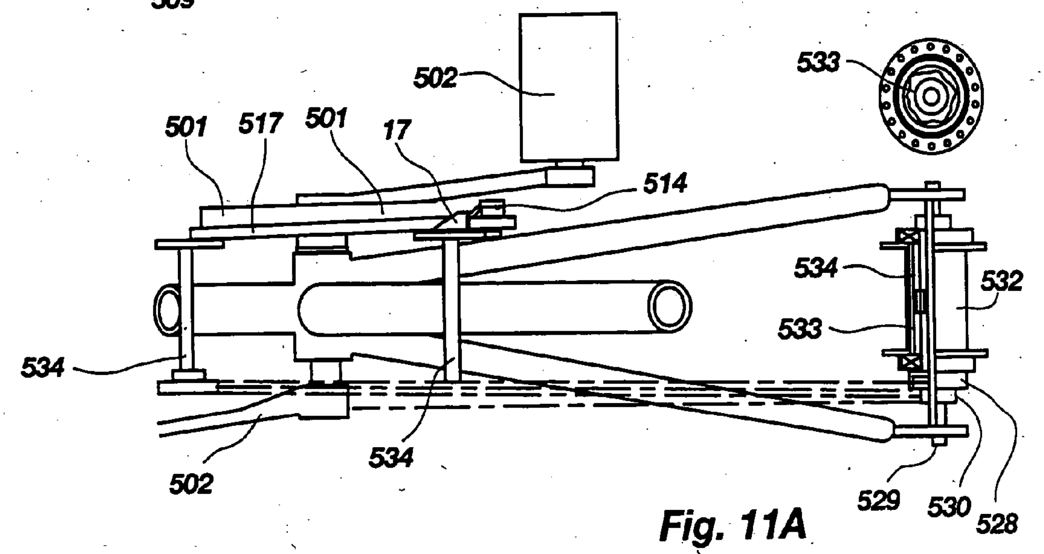


Fig. 11A

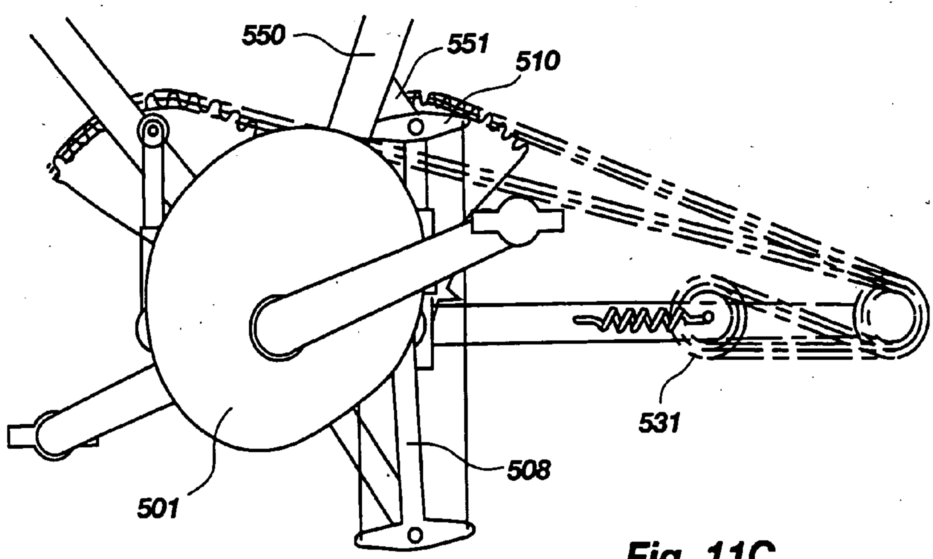


Fig. 11C

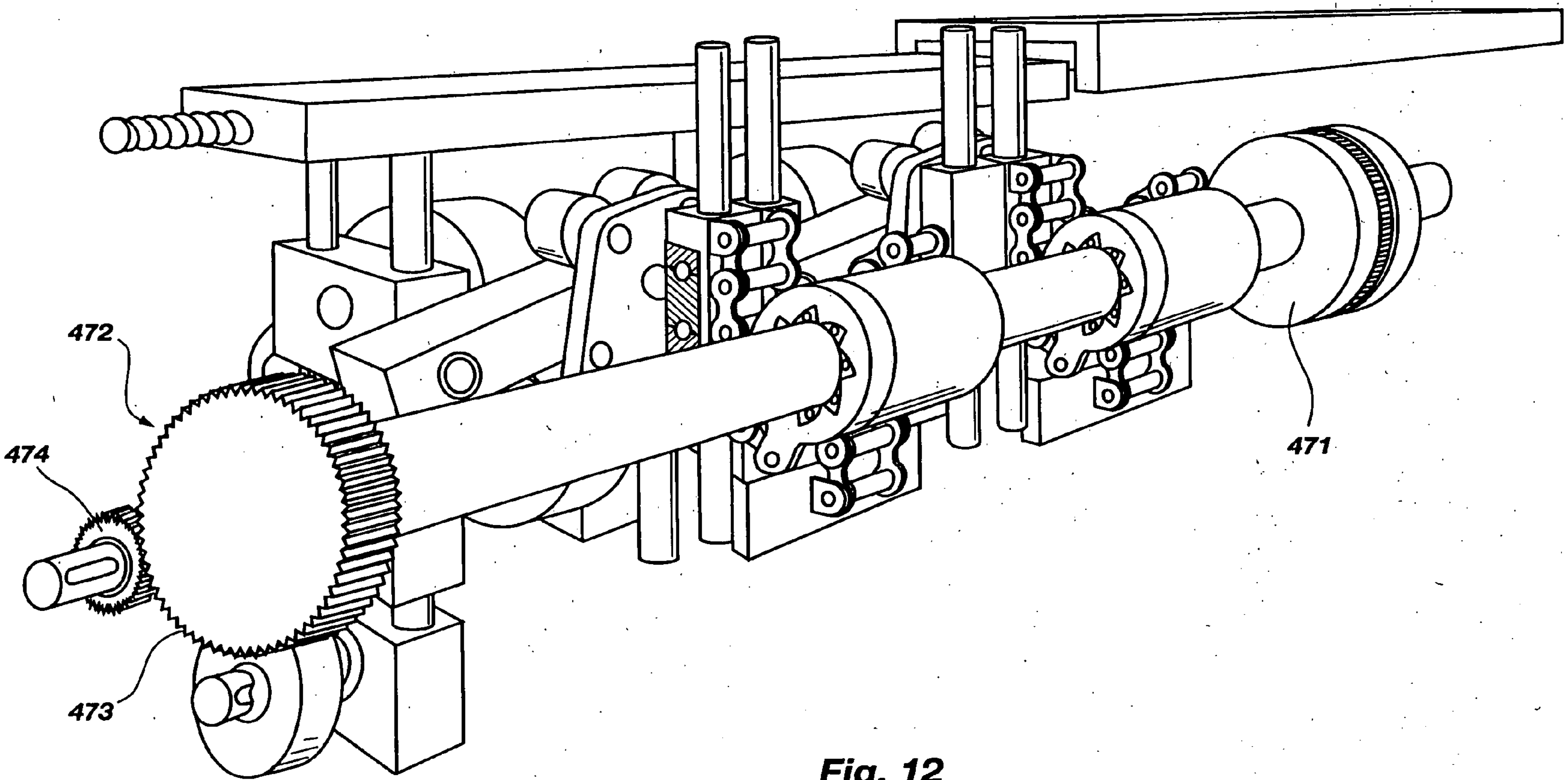
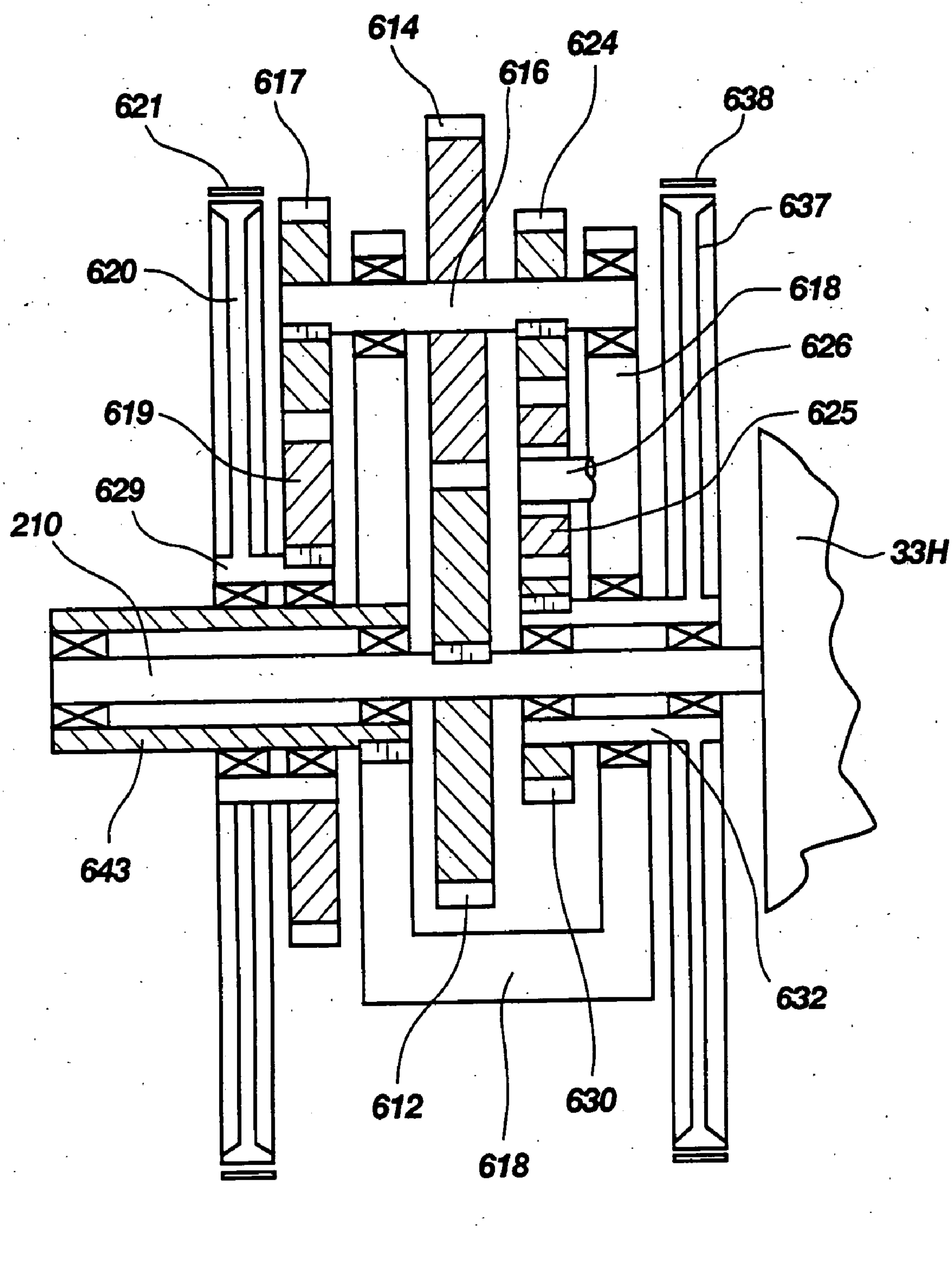


Fig. 12


614
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629
210
33H
643
632
612
630
618

Fig. 13

MECHANICAL TRANSMISSION

[0001] This patent application claims priority to U.S. Provisional Patent Application Ser. No. 60/238,888 filed on Oct. 10, 2000.

BACKGROUND OF THE INVENTION

[0002] 1. Technical Field

[0003] This invention relates to mechanical apparatus for changing the speed and torque of the output shaft of a prime mover relative to its input shaft. More specifically, this invention is directed to an apparatus for providing up to an infinite number of seamless, ripple free changes of speed and torque from a power source such as a gas or diesel engine, an electric motor, a jet engine, a steam engine, the crank of a bicycle, or the like.

[0004] 2. Background Art

[0005] Historically, significant efforts have been directed to the provision of transmission assemblies adapted for changing the speed and torque of a power source. Many of these assemblies have involved the use of ratchet drives, eccentrically-oriented cam assemblies, and variable length lever arms. Representative of past efforts in this regard are the structures disclosed in the following issued patents: U.S. Pat. Nos. 629,389; 3,803,931; 4,630,830; 4,487,085; 6,068,570; 4,936,155.

[0006] For example, U.S. Pat. No. 629,389 discloses a bicycle in which it is stated, "The gear may be changed by substituting larger or smaller pulleys." Thus, one would have to get off the bike, take out his tool kit, take-off the pulleys and attach new and different pulleys to change gear ratios. Furthermore, U.S. Pat. No. 629,389 is a one speed transmission.

[0007] U.S. Pat. No. 4,936,155 discloses a transmission to provide constant power, speed changing and torque multiplication. The invention utilizes "a variable throw cam and cam follower system to provide ripple free output speeds and wide ranging torques." The cam follower wheel makes point contact with said cam. With this configuration, the cam follower of the present transmission makes line contact with the cam, thus limiting torque and power capacity.

[0008] U.S. Pat. No. 3,803,931 discloses "a variable speed transmission device comprises an output shaft rotated from a first eccentric member through unidirectional couplings", thus rippled output speeds.

[0009] In U.S. Pat. No. 4,487,085, "The cam is tapered from one end to the other to permit the gear ratio of the transmission to be varied in infinite increments by adjusting the position of the cam relative to the followers." Power must pass the power through a tiny point of contact greatly limiting the power capacity of the transmission.

[0010] In U.S. Pat. No. 4,630,839, "A bicycle having pivoted level pedal system (1, 2, 45) and lever arm length or gear ratio (speed) change devices (3, 4, 5, 6)" is disclosed.

[0011] The device of U.S. Pat. No. 4,630,839 does not provide any means for removing ripple and, therefore, cannot provide seamless, ripple free outputs.

[0012] U.S. Pat. No. 6,068,570 utilizes eccentrics 14 and 25 which it refers to as cams. The eccentrics 14 and 25 cannot provide ripple free outputs. Furthermore, the transmission of U.S. Pat. No. 6,068,570 does not provide means to produce an infinite number of output speeds.

[0013] Thus, it would be advantageous to provide an infinitely variable torque multiplying, substantially constant power mechanical transmission that produces ripple free outputs, requires fewer components to assemble, is easier to manufacture, is adaptable to any prime mover providing ease of shifting, allows power shifting under load, can provide compression braking and can handle substantially more power and torque than prior art transmissions.

SUMMARY OF THE INVENTION

[0014] The instant invention includes an input shaft journaled in a restraining support or housing, one or more oscillators, two or more output levers driven by one or more oscillators. The output levers are coupled to one-way clutches on the output shaft. The throw on the output levers is by selection and infinitely variable in order to change the rotational speed of the output shaft.

[0015] In one embodiment the oscillators, levers and their respective fulcrum blocks may be rotatably coupled on a concentric shaft slidably splined on the input shaft for axial displacement relative to the fixed location of power take-offs.

[0016] In another embodiment the output slides are moveable and the oscillators are not axially moveable.

[0017] In all embodiments the movement of the power take-off members may be self powered and self locking.

[0018] Various oscillator configurations are contemplated, related but not limited to a slidable member on slide guides, wherein oscillators are adapted for back and forth linear displacement of a member along the length of those guides.

[0019] In other embodiments an oscillator may be a cam wherein a single cam will drive two levers.

[0020] In yet further embodiments two drive cams, 180° apart, may drive the two power levers.

[0021] In another configuration, each cam drives its power lever while another cam is configured to keep the drive cam follower wheel in contact with the drive cam at all times.

[0022] In yet another configuration a spring is used to keep a cam or eccentric follower wheel in contact with the cam.

[0023] In another configuration a pair of rollers journaled on the power take-off ride on the lever while a spring holds the lever in contact with these rollers.

[0024] In another arrangement rack gears on the output slide drive a pinion gears integral with overrunning clutches journaled on the output shaft.

[0025] In some embodiments a single cam drives two cam followers 180° apart kept in contact with the cam by spring forces.

[0026] Likewise, the single cam may have an inner and an outer race, with one biasing cam follower wheel riding on the outer face and another cam follower wheel riding on the inner race with two cam follower wheels journaled on each independent axle.

[0027] The instant invention may be adapted to include structures for selectively applying vector longitudinal force generated by transmission power levers directly on the cam/follower assemblies thereby power shifting the assemblies along the length of a shaft on which they are mechanically associated.

[0028] In some embodiments the instant invention may include a control slide, constrained in a groove or along guide rails attached to the transmission housing, and integral with cam follower (oscillator) slide guides and fulcrum blocks connecting rods.

[0029] In some embodiments the control slide is contoured with grooves having oppositively oriented inclined planes wherein rollers biased in cages against the oppositely angled inclined planes in the grooves function as opposed linear one-way clutches to lock the control slide to the housing or to selectively bias the rollers by moving the cage one way or the other wherein the lever forces generated within the transmission may move the control slide one way or the other, thus providing power shifting and automatic clamping.

[0030] In another embodiment the one-way clutch cavities, rollers and cages may be in the power take-offs and automatically hold the power take-offs in selected positions or allow them to be moved by interior lever forces in one direction or the other on power levers.

[0031] Screw or hydraulic positioners or the like may be used to move or to hold the control slide.

[0032] One end of the cam driven lever provides zero output speed and maximum output torque. The other end of the lever, which may extend beyond the cam drive connection, provides the maximum output speed and a smaller output torque. Thus, the instant invention is an infinitely variable constant power transmission.

[0033] In another embodiment, by not including a moveable control slide, the transmission may be used as a low cost, power dense, one or two fixed speed reducer.

[0034] In yet another embodiment cam shaped links, sans cam followers, effectively remove ripple free selected output.

DESCRIPTION OF THE DRAWINGS

[0035] These and other advantages of the present invention are best understood through reference to the drawing, of which:

[0036] **FIG. 1** is a schematic block diagram representing the basic components and their function in accordance with the principles of the present invention.

[0037] **FIG. 2** is an exploded perspective of a first embodiment of a transmission with two spring biased cams in linear array in accordance with the present invention.

[0038] **FIG. 3** is a graphical representation of speeds delivered from first cam to an output shaft of a transmission in accordance with the principles of the present invention.

[0039] **FIG. 4** is a graphical representation of the speeds delivered from a second cam to an output shaft in accordance with the principles of the present invention.

[0040] **FIG. 5** is a graphical representation of how the speed from a first cam combines on the output shaft with the speed from a second cam to provide a wide selection of selected, totally ripple free, seamless output speeds of a transmission in accordance with the principles of the present transmission.

[0041] **FIGS. 6A, 6B** and **6C** are end, right side and left side views, respectively, of the transmission of **FIG. 2**.

[0042] **FIG. 7** is a perspective view of a second embodiment, a self biasing transmission in accordance with the principles of the present invention.

[0043] **FIGS. 8A and 8B** are sectional views of power shift assemblies A and B.

[0044] **FIG. 9** is a view of a power take-off that is equivalent to the roller type power take-off in accordance with the principles of the present invention.

[0045] **FIG. 10** is a side view of a bicycle of the present invention installed as a bicycle transmission.

[0046] **FIGS. 11A, 11B** and **11C** are left side, top and right side views of a third embodiment of a transmission in accordance with the present invention used as a bicycle transmission.

[0047] **FIG. 12** is a perspective drawing of the transmission of **FIG. 7** as a vehicle transmission.

[0048] **FIG. 13** is a cross-sectional side view of a planetary gear set providing selected forward, reverse, neutral and park when connected to the transmissions of this invention.

DESCRIPTION OF THE INVENTION

[0049] **FIG. 1** is a schematic block diagram representing the basic components and their function of a transmission in accordance with the principles of the present invention comprising an input shaft **9** coupling a prime mover **10**, such as electric motor, the crank of a bicycle, a motor vehicle, an internal combustion or such as a jet engine, a steam engine, or a wind turbine propeller, to an oscillator, which may be a self biasing cam **11** or cam shaped link in line contact with its cam follower **12**. Line contact between cam and cam follower deliver well over 100 times the torque, or power, than by follower wheels with rounded rims used with variable throw cams. Biased oscillators **12** are coupled to levers **13** in line contact, or equivalent, with power take-offs **14** slidably and selectively clamped on the levers **13**: control means that power shift the position of the power take-off **14** and automatically lock it in a selected place on lever **13**. Power take-offs **14** are coupled to slides **15**, a rack gear **16** or equivalent pinned at one end to housing and in mesh with a pinion **17** integral with one-way clutches **20** on output shaft **19**. Cams, or cam shaped links, are designed to drive at ripple free, seamless speeds the output shaft which may turn the output at an infinite number of selected infinitesimally different speeds from zero rpm to a design maximum top speed. This is a torque multiplying constant power mechanical transmission. The lower the output speed, the greater the output torque.

[0050] A second embodiment (see **FIG. 2**) is comprised of an input shaft **20** rotatable in a housing **21**, a concentric cam shaft **22** slidably splined on input shaft **20**, and two or more cams **23** fixed to cam shaft **22** said cams are contoured to provide periods of constant linear speed to cam followers **24** biased against cams **23** by a spring **25**. A first cam 180° from a second cam. Two or more cam followers, comprised of follower wheels **26** rotatable on a stub shaft **6** extending from slide **27** that rides up and down just like an elevator in an elevator shaft. Guides **28** extending from blocks **29** held from rotating on rotating cam shafts **22** by guides **28** in grooves **33**. Control slide **30** fixed to guides **28** receives screw **31** the shank of which extends through housing **21** via bearing **32** that restricts back and forth motion of screw **31** while allowing screw **31** to rotate. The ends of guides **28** extend from control slide **30** into grooves **32** in housing **21**.

[0051] Stub shafts **6** extending from followers **24** are held by bearings **34** in levers **35** connected to fulcrums **36** extending from and rotatable in blocks **37**. Cam shaft **22** is rotatable in blocks **37**. Guides **39** fixed to control slide **30**. Guides **39** extend from control slide **30** and ride in grooves **32** in housing **24**.

[0052] Cam **23**, follower slides **24** and fulcrum blocks **37** remain in fixed axial locations because they are so restrained by control slide **30**.

[0053] The shafts of rollers **40** riding on levers **35** are press fit into links **41**. Shaft **42** also press fits in link **41** extends from a bearings press fit into slide **46**. Slide **46** is slidable on guides **44** fixed to housing **21**.

[0054] Tension members **45** are fixed at their upper ends to slides **46** and at their other ends to one-way clutches **47** journaled on output shaft **48**. Springs **49** fastened at their one end to tension members **45** are fixed at their other end to housing **21**. Said tension member arrangement could be replaced by rack and pinion gearing.

[0055] In operation: Input shaft **20** rotates. It rotates cam shaft **22** and cams **23** causing cam followers **24** to reciprocate at a constant linear speed relative to the input speed during 180° of input shaft **20** rotation. First one follower **24**, see **FIG. 3**, moves at that constant speed, then the other follower **24**, see **FIG. 4**, moves at that same constant speed as the first follower pulled by spring **25** rewinds. Together, see **FIG. 5**, they provide a seamless, ripple free output from a cam and cam follower that are always in line, or equivalent, contact one with the other.

[0056] Power levers **35** rotatable on and driven by followers **24** move up and down around fulcrum pivots **36**. Power take-off wheels **40** always in line contact or equivalent with levers **35** cause link **41** to rotate back and forth on slides **46**. Slides **46** move up and down on vertical guides **44** fixed in housing **21**, just like an elevator goes up and down in its shaft. First one is driven at a fixed speed, and then the other is driven at the same, ripple-free, seamless speed.

[0057] Since the cam assembly, including fulcrums **36** is slidably splined on the input shaft, it can be slidably displaced relative to housing **21**. Thus, when fulcrums pivots **36** are in line with the centers of links **41**, those links will not move up and down. When cam assemblies are moved away from fulcrums **36**, links **27** begin to move at a constant speed up and down. The farther the cam assembly is moved, by control screw **31**, the faster slides **46** move.

[0058] An infinite number of speeds are available.

[0059] Slides **46**, fixed to one end of tension members **45** are, at their other end, fixed to over-running clutches **47** journaled on the output shaft **48**. The faster slides **17** move, the faster output shaft **48** turns. Another tension member fixed to said over-running clutches connects with a spring **49** fixed to housing **21**. That force also keeps power take-off wheels **40** on levers **35**.

[0060] First one cam drives the output shaft, and then the other cam drives that output shaft at the same selected ripple-free, seamless output speeds.

[0061] **FIG. 7** shows the transmission of the invention in yet another embodiment where input shaft **301** rotatable in housing **302** is slidable in, but keyed to rotate with concentric shaft **303** rotatable in two guide blocks **310** as well as in two fulcrum blocks **346**. Two drive cams **304** fixed to concentric shaft **303** drive two cylindrical cam follower wheels **305** rotatable on shafts extending one each from two cam follower slides **307** riding on guide rods **308** extending from guide blocks **310**. Two cams **304**, fixed to concentric shaft **303**, in line contact with cam follower **307**, are contoured to drive cam followers at a seamless constant speed during the first 180° of each input shaft rotation. The second cam **304** keyed 180° away from the first described cam **304**, and in line contact with its cam follower wheel **305** drives its carrier **307** at the same seamless constant speed during the next 180° of input shaft rotation.

[0062] Two biasing cams **311** keyed to concentric shaft **303** and in line contact with two cam follower wheels **312** journaled on cam follower **314** slidably or ball splined on the same guides **308** as driving cam followers **304**. Biasing cams **304** are contoured to always keep driving cam follower wheels **305** in contact with cams **304**. Biasing cam followers **314** are fixed to driving cam followers **307** by connector **347**. So that followers **314** are one with followers **307**.

[0063] Stub shafts extending from followers **307** are rotatable in levers **315** pivotally pinned on fulcrum block **346**. The upper and lower surfaces of levers **315** are parallel. At least two rollers **344** roll on the upper surface, at least one roller **344** rides on the lower surface of each lever **315**. Roller shafts **343** are pinned to a connecting plate of power take-off **341**. Center lines of shafts **339** fixed to connecting plates of power take-off **344** intersect the center lines of levers **315**. Shafts **339** are rotatable in output slides **327** which ride on guides **338** fixed in and to housing **302**. Tension members **333** pinned to output slides **327** wrap around and are pinned to one-way clutches **334** and **335** journaled on the transmission output shaft **336**. Tension members **337** pinned to the opposite ends of output slides **327** wrap around output clutches **334, 335** and are pinned, at their other ends to those clutches. Said tension members could be replaced with rack gears in mesh with pinions on clutches **334, 335**.

[0064] Control slide **309** is slidable in groove **348** in housing **302**. Cam follower slides **308** and fulcrum block rods **349** extending from fulcrum block are fixed to control slide **309**. Screw **3** threaded into control block **309** at its one end, its shank extending through housing **302** is rotatable, and restrained against axial motion, in housing **302**. Said shank extends outside of housing. A crank, or wheel, or other mode may be used to rotate screw **3** to move the control slide to change output speed. The axial location of cam, followers and fulcrum relative to each other are fixed by control block **309** and will not change as the array is moved by said controls.

[0065] Screw **349** can be replaced by a self powered shift means comprised of linear opposed one-way clutches, as described in **FIG. 8**.

[0066] In operation, the input shaft **301** turns the concentric shaft **303** and the cams **304** fixed thereon one 180° from the other. Rotating cams **304** take turn driving followers **314** at a constant speed. While the first follower rewinds the second follower is driven by the second cam at that same constant speed. Together they provide a seamless, ripple free output from a cam and cam follower that are always in line contact, one with the other. Biasing cams **311** keep drive cam follower wheels **305** in line contact with drive cam **304** at all times. No springs are needed. Line contacts or equivalent, see **FIG. 14**, deliver well over 100 times the torque force of point contact from rounded rim follower wheels.

[0067] Power levers **315** rotatable on cam followers **307** oscillate up and down on fulcrum block **346**. Power rollers **344** rotatable on a power take-off **341**, two or more on the top surface of the lever and one or more on the bottom surface of the lever. Power take-offs **341** are journaled in output slides **327** riding on guide rods **308** fixed to housing **302**. Said slides are coupled to over running clutches **334** and **335** on the output shaft by rack and pinion gearing or by tension members drive described above.

[0068] Move concentric shaft **303** assembly **350** relative to the power take-offs **340** to change transmission ratios. When the fulcrums **346** are in line with power take-offs the output speed is zero and the output torque is very large. The farther the lever is displaced from the power take-offs, the faster the output shaft turns.

[0069] Simply turn screw **311** threaded in the control **309** slide to change speeds. Or the said screw **303** can be replaced by coupling said slide via opposing one-way clutches which share the same roller cage. This latter method, see **FIG. 8**, moves its opposing one-way clutches effortlessly and automatically locks it in selected locations on control slide **309**. When no control force is applied, the opposing one-way clutches are automatically locked in selected positions.

[0070] **FIG. 12** is a perspective drawing of the transmission for an automobile wherein the transmission of **FIG. 7** is shown feeding a planetary gear set **471** designed to provide a choice of forward or reverse drive as well as park or a free neutral. Compression drive means **472** are also shown.

[0071] Variable speed output shaft **210** of **FIG. 7** driven by one-way clutches of the transmission of **FIG. 7** planetary gear set **411**, wherein gear **612** fixed to shaft **210** meshes with gear **614**, fixed to jack shaft **616**. Jack shaft **616** rotatable in carrier **618** fixed to output shaft **643**. Pinion **617** fixed to jack shaft **616** meshing with gear **619**, fixed to concentric shaft **629**. Brake drum **620** fixed to shaft **629** engages brake band **621**, controlled by the transmission operator. Pinion **624** fixed to jack shaft **616** and in mesh with idler gear **625**, rotatable on stub shaft **626**, extending from and integral with carrier **618**. Idler **625** in mesh with gear **630**, keyed to shaft **629**, fixed to brake drum **637**. Brake drum **637** is engageable with brake band **638**.

[0072] In operation, brake bands **621** and **638** are free from drums **620** and **637**, and the transmission is in neutral. Tightening band **621** holds gear **619** still. Input gear **612** on shaft **210** is in mesh with gear **614**, which is fixed to jack shaft **616** and which rotates gear **617**, which then rolls around held gear **619** causing carrier **618** to rotate output shaft **643** in a reverse direction.

[0073] Releasing break band **621** and tightening brake band **638** stopping brake drum **637** causes jack shaft **616** to rotate carrier **618**, fixed to output shaft **643** in a forward direction. When both brake bands **621** and **638** are tightened, the transmission is in park.

[0074] Compression braking means are comprised of gear **473** coupled by a one-way clutch to output shaft **336**, of the transmission of **FIG. 8**. Gear **473** is in mesh with gear **474** fixed to the engine shaft, which is the transmission input shaft. When gear **474** is driven faster than engine speed by gear **472** we have compression braking.

[0075] In yet another configuration, a bicycle type transmission that is self biasing, infinitely variable, torque multiplying and that never needs to move a chain from one sprocket to another to change speed rotors is disclosed. **FIG. 10** shows an illustration of the transmission in a bicycle. **FIG. 11A** is a top view of the transmission. **FIG. 11B** is a left hand view and **FIG. 11C** is a right hand view where a self biasing cam **501** driven by pedals **502** drives cam followers **505**A and **505**B pinned to bike frame **50**. Cam follower wheels **504** ride on the inner race of cam **501**. Cam **501** is designed to produce a ripple free, constant speed rotation of follower **505**A during the first 180° of pedal rotation and the same ripple free, constant rotation of follower **505**B in reverse during the next 180° of pedal rotation.

[0076] Biasing cam follower wheel **514** in contact cams outer race **517** is designed to keep follower wheels **504** on cam **501**. Follower wheels **514** are independently journaled on shaft **516** fixed to and extending from followers **505**A and **505**B. Cam follower **505**A fixed to transfer shaft **509** journaled in tab welded to bicycle frame **50** is fixed at its other end to beam lever **518**. Bicycle frame extension **508** has walking beam extensions **510** connected by rods or cable **511** to a similar walking beam extensions **510** rotatably fixed to transfer shaft on one end rotatable in tabs **511** extending from bike frame **50** at its other send. Said walking beam is integral with beam **518**. Power take-offs **519** slidable splined on beam **518** has shafts **509** extending therefrom that journal cluster sprockets **521** comprised of a small sprocket fixed to a larger segment sprocket **521**.

[0077] Power take-offs **519** with opposed linear overrunning-clutches, see **FIG. 8**, comprised of rollers **523** in cage **524** biased against inclined planes of cavities **525** in power take-offs **519** slidable on beams **518**. Control cable **526** fixed to one end of cage **524** extends to twist grip, or control lever, on the handle bars of the bike. Another control cable **526** is fixed to the other end of cage **524** and at its other end to the same twist grip or lever. Move the twist grip or lever one way and the power take-off, impelled by interior transmission forces, moves that way. Move the twist grip, or lever, the other way and the power take-off moves the other way.

[0078] Short segments of chain are pinned to bike frame **50**. Their other end is fixed to and wraps around small sprockets **520**, fixed to larger sprocket **521** segments. Roller chain **522** fixed to front sprocket segment **521** extends to rear sprocket **528** journaled on rear axle **529** fixed to bike frame **50** and then to lightly spring loaded idler **531** on rear fork of frame **50** and then back to and around sprocket **528** journaled on axle **529** and then back to the other larger sprocket segment **521** where it is pinned.

[0079] The hub **532** of the bicycle's rear wheel is journaled on rear axle **529**. That hub is the outer race of roller clutches with wedge shaped cavities **533** and **534**. Rollers **30** in cages **31** are biased against the inclined plan of the wedge shaped cavity.

[0080] In operation, when the pedal is pushed down the cam rotates. When the cam rotates cam follower **505**A oscillate. Cluster sprockets **521** journaled on power take-offs **519** are selectively positioned on beams **518**. Cluster sprockets **521** turned by chains fixed to bike frame **50** on their one end and to the smaller sprocket of cluster sprocket **521** on its other end turn larger sprocket segment **521** coupled by chain **22** to rotate rear wheel sprocket **528**. A walking beam cam follower **505**B pinned to bike frame **50** coupled to a walking beam lever **552** oscillates in reverse. Cluster sprockets **521** selectively positioned on beam **552** is coupled by chain **22** to the other rear wheel sprocket. Both rear wheel sprockets are fixed to inner races of one-way clutches in rear wheel hub. First one rear wheel sprocket drives the rear wheel, and then the other rear wheel sprocket drives the rear wheel. The speed of the rear wheel depends on the selected position of the power take-offs on oscillating beams **522**. Power shifting is effortless. When the twist grip is turned one way, roller **523** is held away from inclined plane of cavity **525** and internal transmission forces can push the power take-off in that direction. The other roller **523** remains biased to the inclined plane in its cavity **525** to keep power take-off from moving in the opposite direction. When the twist grip is turned the other way clutch roller **523** is held away from the opposite inclined plan in its cavity **525** allowing interior transmission forces to then move the power take-off in the opposite direction. When the twist grip is held still, rollers **523** are biased against both inclined planes and the power take-off is held fast to beam levers.

[0081] The walking beams could be replaced with idler sprockets.

1-65. (cancelled)

66. A transmission, comprising:

an input member;

an output member;

at least two cam followers;

at least two camming devices coupled to and rotatable by said input member, said at least two camming devices each contoured to provide substantially constant linear speed to said output member when the linear motion of the at least two cam followers is summed;

at least two levers each coupled to at least one of said at least two cam followers in a manner that causes said at least two levers to oscillate upon movement of said at least two cam followers, said at least two levers oscillating out of phase; and

at least one clutching mechanism coupled between said at least two levers and said output member, where oscillation of said at least two levers drives said clutching mechanism causing substantially ripple free rotational movement of said output member.

67. The transmission of claim 66, wherein said at least two cam followers are in line contact with said at least two camming devices.

68. The transmission of claim 66, wherein said camming device comprises a cam shaft having at least one drive cam thereon, each of said at least two cam followers coupled to said at least one drive cam and to one of said at least two levers, such that movement of said at least two cam followers relative to said cam shaft causes oscillation of said at least two levers.

69. The transmission of claim 68, further comprising biasing means associated with said at least two cam followers for biasing said at least two cam followers into line contact with said at least one drive cam.

70. The transmission of claim 66, wherein said at least two levers comprise a first lever and a second lever that oscillate in opposing directions upon rotation of said input member.

71. The transmission of claim 66, further comprising at least one selectively positionable power take-off coupled to said at least two levers, wherein adjustment of said at least one power take-off relative to said at least two levers changes the fulcrum of each of said at least two levers resulting in a change in the rotational speed of said output member.

72. The transmission of claim 71, further comprising a control mechanism coupled to said power take-off, said control mechanism being controllable by a user to selectively alter the rotational speed of the output member.

73. The transmission of claim 68, wherein said cam shaft comprises a concentric shaft slidably splined on said input member and wherein said at least two cam followers and said at least two levers are selectively movable with said cam shaft.

74. The transmission of claim 69, wherein movement of said cam shaft, at least two cam followers and said at least two levers relative to a longitudinal axis of said input shaft changes the rotational speed of the output shaft.

75. The transmission of claim 66, wherein said clutching device comprises a pair of one-way clutches.

76. A transmission, comprising:

an input shaft;

a pair of cams coupled to said input shaft;

a pair of cam followers, each in line contact with one of said pair of cams;

at least two oscillating members, each pivotable about a fulcrum and each coupled to one of said pair of cam followers such that rotation of said input shaft causes at least partial out of phase oscillation of said at least two oscillating members;

at least two clutching devices each coupled to at least one of said at least two oscillating members; and

an output shaft coupled to said at least two clutching devices, said output shaft being driven by oscillation of said at least two oscillating members which in turn drive said at least two clutching devices to rotate said output shaft in a substantially ripple free manner.

77. The transmission of claim 76, wherein rotation of said input shaft causes rotation of said pair of cams.

78. The transmission of claim 76, further comprising biasing means associated with said at least two cam followers for biasing said at least two cam followers into contact with said pair of cams.

79. The transmission of claim 76, wherein said at least two oscillating members comprise a first lever and a second lever that oscillate in opposing directions upon rotation of said input shaft.

80. The transmission of claim 76, further comprising a first selectively positionable power take-off coupled to said first lever and a second selectively positionable power take-off coupled to said second lever, wherein adjustment of said first and second power take-offs relative to said first and second levers causes a proportional change in the rotational speed of said output shaft.

81. The transmission of claim 80, further comprising a control mechanism coupled to said first and second power take-offs, said control mechanism being controllable by a user to selectively alter the rotational output of the output shaft.

82. The transmission of claim 76, wherein said pair of cams are coupled to a cam shaft, said cam shaft being slidably splined on said input shaft and wherein said pair of cam followers and said at least two oscillating members are selectively movable with said cam shaft.

83. The transmission of claim 82, wherein movement of said cam shaft, pair of cam followers and said at least two oscillating members relative to a longitudinal axis of said input shaft changes the rotational speed of the output shaft.

84. A transmission, comprising:

an input shaft;

an output shaft;

at least two oscillators, each configured to provide select constant output speed of said output shaft driven by said input shaft;

at least two oscillator followers, each coupled to one of said at least two oscillators and moveable thereby;

at least two levers, each coupled to one of said at least two oscillator followers for movement thereby, each of said at least two levers being pivotable about a fulcrum and each of said at least two levers oscillating out of phase; and

means for coupling said at least two levers to said output shaft to rotate said output shaft at substantially constant rotational speed upon movement of said at least two levers.

85. The transmission of claim 84, further comprising at least two slide members, each coupled to one of said at least two levers for movement of said at least two slide members along with the movement of said at least two levers, said at least two slide members driving said output shaft in a substantially ripple free manner.

86. The transmission of claim 85, wherein translation of said at least two levers relative to said slide members varies a rate of rotation of said output shaft relative to said input shaft, said rate of rotation being constant for a given position of said at least two levers relative to said slide members.

87. The transmission of claim 84, wherein said at least two oscillating members comprise a cam shaft having a pair of drive cams thereon and wherein said at least two oscillator followers comprises at least two cam followers in line contact with said at least two drive cams and each coupled to one of said at least two levers, such that movement of said at least two cam followers relative to said cam shaft causes corresponding oscillation of said at least two levers.

88. The transmission of claim 87, further comprising biasing means associated with each of said at least two cam followers for biasing said at least two cam followers into contact with its respective said at least two drive cams.

89. The transmission of claim 84, wherein said at least two levers comprises a first lever and a second lever that oscillate in opposing directions upon rotation of said input shaft.

90. The transmission of claim 84, further comprising at least two selectively positionable power take-offs, each coupled to one of said at least two levers, wherein adjustment of said at least two power take-offs relative to said at least two levers causes a proportional change in the rotational speed of said output shaft.

91. The transmission of claim 90, further including a control mechanism coupled to said at least two power take-offs, said control mechanism being controllable by a user to selectively alter the rotational output of the output shaft.

92. The transmission of claim 87, wherein said cam shaft comprises a concentric shaft slidably splined on said input shaft and wherein said at least two cam followers and said at least two levers are selectively movable with said cam shaft.

93. The transmission of claim 92, wherein movement of said cam shaft, said at least two cam followers and said at least two levers relative to a longitudinal axis of said input shaft changes the rotational speed of the output shaft.

94. The transmission of claim 84, wherein said input shaft is coupled to the engine of an automobile.

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