



US010875599B2

(12) **United States Patent**
Kipnis

(10) **Patent No.:** **US 10,875,599 B2**

(45) **Date of Patent:** ***Dec. 29, 2020**

(54) **VEHICLE WITH WEIGHT-BASED DRIVE MECHANISM**

(71) Applicant: **Michael Kipnis**, Wheeling, IL (US)

(72) Inventor: **Michael Kipnis**, Wheeling, IL (US)

(73) Assignee: **Cyclazoom, LLC**, Evanston, IL (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 176 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/072,211**

(22) PCT Filed: **Jan. 30, 2017**

(86) PCT No.: **PCT/US2017/015596**

§ 371 (c)(1),

(2) Date: **Jul. 24, 2018**

(87) PCT Pub. No.: **WO2017/132658**

PCT Pub. Date: **Aug. 3, 2017**

(65) **Prior Publication Data**

US 2019/0031280 A1 Jan. 31, 2019

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/412,962, filed on Jan. 23, 2017, now Pat. No. 10,167,046.

(Continued)

(51) **Int. Cl.**

B62M 1/32 (2013.01)

B62K 3/00 (2006.01)

(Continued)

(52) **U.S. Cl.**

CPC **B62M 1/32** (2013.01); **B62K 3/005** (2013.01); **B62M 1/28** (2013.01); **B62M 1/30** (2013.01); **B62M 6/00** (2013.01); **B62M 23/00** (2013.01)

(58) **Field of Classification Search**

CPC . B62M 1/32; B62M 1/28; B62M 1/30; B62M 6/00; B62M 23/00; B62K 3/005

See application file for complete search history.

(56)

References Cited

U.S. PATENT DOCUMENTS

608,674 A 8/1898 Harshner
2,141,967 A 12/1938 Ball, Jr.

(Continued)

FOREIGN PATENT DOCUMENTS

CN 2799373 Y 7/2006
CN 102361789 A 2/2012

(Continued)

OTHER PUBLICATIONS

Search Report and Written Opinion for International Application No. PCT/US17/015596 dated May 26, 2017.

(Continued)

Primary Examiner — Tony H Winner

Assistant Examiner — Marlon A Arce

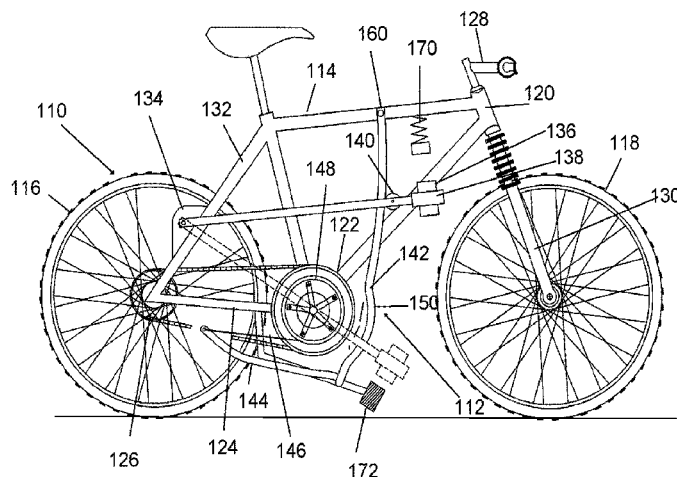
(74) *Attorney, Agent, or Firm* — Brian Roffe

(57)

ABSTRACT

Vehicle (110) including a frame (114), a seat mounted to the frame (114), wheels (116, 118) rotatably mounted on the frame (114), and drive mechanisms (112) for causing rotation of one wheel (116). Each drive mechanism (112) includes an arm (132) pivotally attached to the frame (114) at one end, a weight (136) and attached pedal (138) at an opposite end of the arm (132), and a guide member (142) including a bump (150) and that moves in conjunction with movement of the weight (136). The guide member (142) has a first end region at which it is pivotally attached to the frame (114) and a second, opposite end region which is free. A roller (140) attached to the arm (132) moves along the guide member (142) during pivotal movement of the arm (132) to cause pivoting of the guide member (142) as the roller (140)

(Continued)



engages with the bump (150). An energy transfer system (148) converts pivotal movement of the guide member (142) into motive power to rotate the wheel (116).

20 Claims, 10 Drawing Sheets

Related U.S. Application Data

(60) Provisional application No. 62/288,611, filed on Jan. 29, 2016.

(51) **Int. Cl.**
B62M 6/00 (2010.01)
B62M 1/28 (2013.01)
B62M 1/30 (2013.01)
B62M 23/00 (2006.01)

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,039,790 A 6/1962 Trott
 3,873,128 A 3/1975 Dunder et al.
 3,888,334 A 6/1975 Mack
 3,954,282 A 5/1976 Hege
 4,026,571 A 5/1977 Vereyken
 4,077,648 A 3/1978 Seul
 4,134,481 A 1/1979 Calderazzo
 4,456,276 A 6/1984 Bortolin
 4,574,649 A 3/1986 Seul
 4,666,173 A 5/1987 Graham
 4,700,962 A 10/1987 Salmon
 4,772,252 A 9/1988 Bona
 4,846,488 A 7/1989 Szadkowski
 4,878,684 A 11/1989 Lemle
 5,035,678 A 7/1991 Hageman
 5,272,928 A 12/1993 Young
 5,290,054 A 3/1994 Po
 5,527,246 A 6/1996 Rodgers
 5,732,963 A 3/1998 White
 5,915,710 A 6/1999 Miller
 5,979,922 A 11/1999 Becker et al.
 6,000,707 A 12/1999 Miller
 6,007,083 A 12/1999 Currie
 6,173,981 B1 1/2001 Coleman
 6,209,900 B1 4/2001 Yoshizawa
 6,237,928 B1 5/2001 Islas
 6,340,067 B1 1/2002 Fujiwara et al.

6,412,802 B1 7/2002 Kugel et al.
 6,730,003 B1 5/2004 Phillips
 6,827,362 B2 12/2004 Smith et al.
 7,048,290 B2 5/2006 Paquette
 7,326,137 B2 2/2008 van der Linde
 7,497,453 B2 3/2009 Fan
 7,559,264 B2 7/2009 Qian
 7,753,387 B2 7/2010 Wei
 8,157,281 B2 4/2012 Wang
 8,215,654 B1 7/2012 Leser
 8,689,957 B2 4/2014 Christini et al.
 8,857,839 B2* 10/2014 Scolari B62K 3/002
 280/244
 8,955,861 B1 2/2015 Rasiah
 8,967,022 B2 3/2015 Beard
 8,979,107 B2 3/2015 Lin
 9,688,349 B2 6/2017 Thompson
 9,815,519 B2* 11/2017 Zhou B62M 1/36
 9,850,992 B2 12/2017 Valle
 10,457,348 B2 10/2019 Voss
 2002/0053779 A1 5/2002 Fujiwara et al.
 2002/0074788 A1 6/2002 Fujiwara et al.
 2003/0193160 A1 10/2003 Mehmet
 2007/0228687 A1 10/2007 Parker
 2011/0049830 A1 3/2011 Hung
 2011/0057411 A1 3/2011 Scolari et al.
 2011/0115190 A1 5/2011 McIsaac
 2011/0266768 A1 11/2011 Kohlheb et al.
 2014/0210179 A1 7/2014 Sprague
 2014/0367940 A1 12/2014 Lin
 2015/0076787 A1 3/2015 Kipnis
 2017/0217536 A1 8/2017 Kipnis

FOREIGN PATENT DOCUMENTS

WO 2006002577 A1 1/2006
 WO 2006059003 A1 6/2006
 WO WO 2010084363 A1* 7/2010
 WO 2014021702 A 2/2014
 WO 2017132658 A1 8/2017

OTHER PUBLICATIONS

Partial Supplementary European Search Eeport for EP 17745075.6 dated Oct. 31, 2019.
 Extended European Search Report for EP 17745075.6 dated Feb. 10, 2020.
 Office Action for Chinese patent application No. 201780008408.5 dated Dec. 31, 2019.

* cited by examiner

FIG. 1

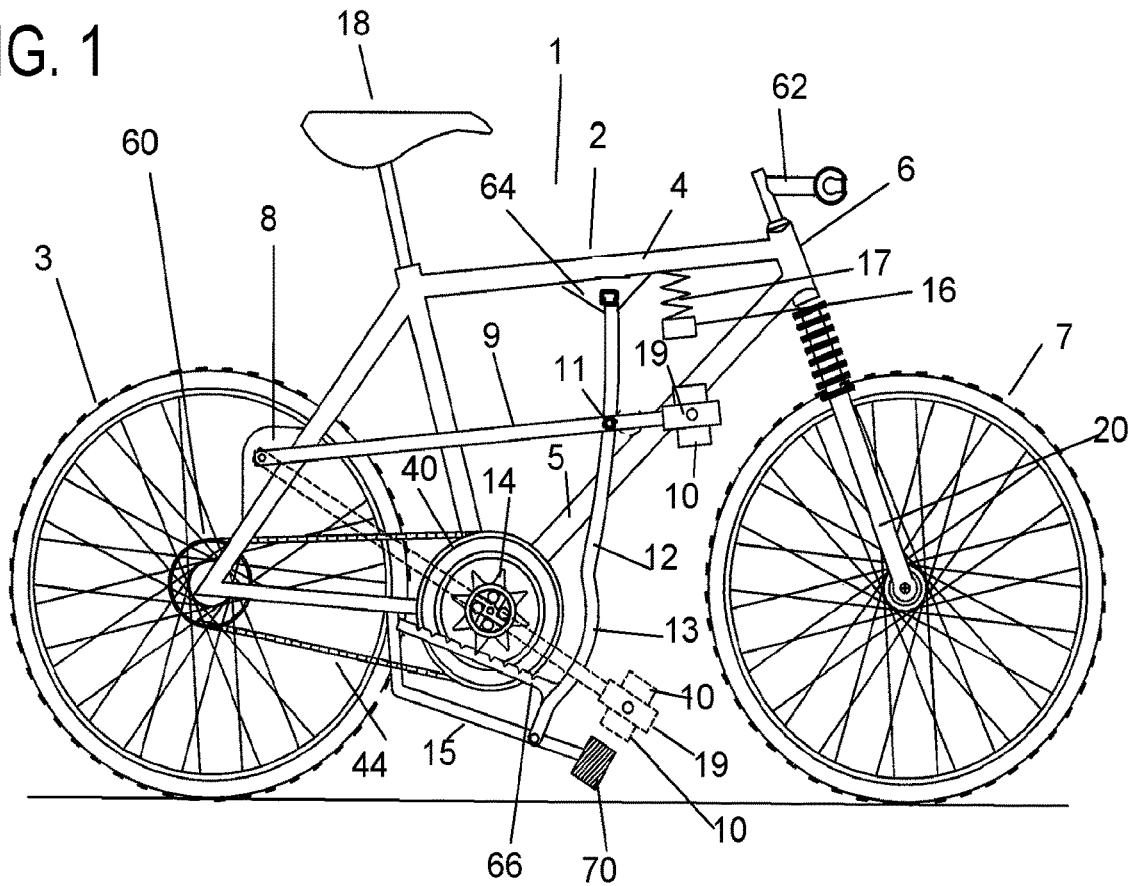
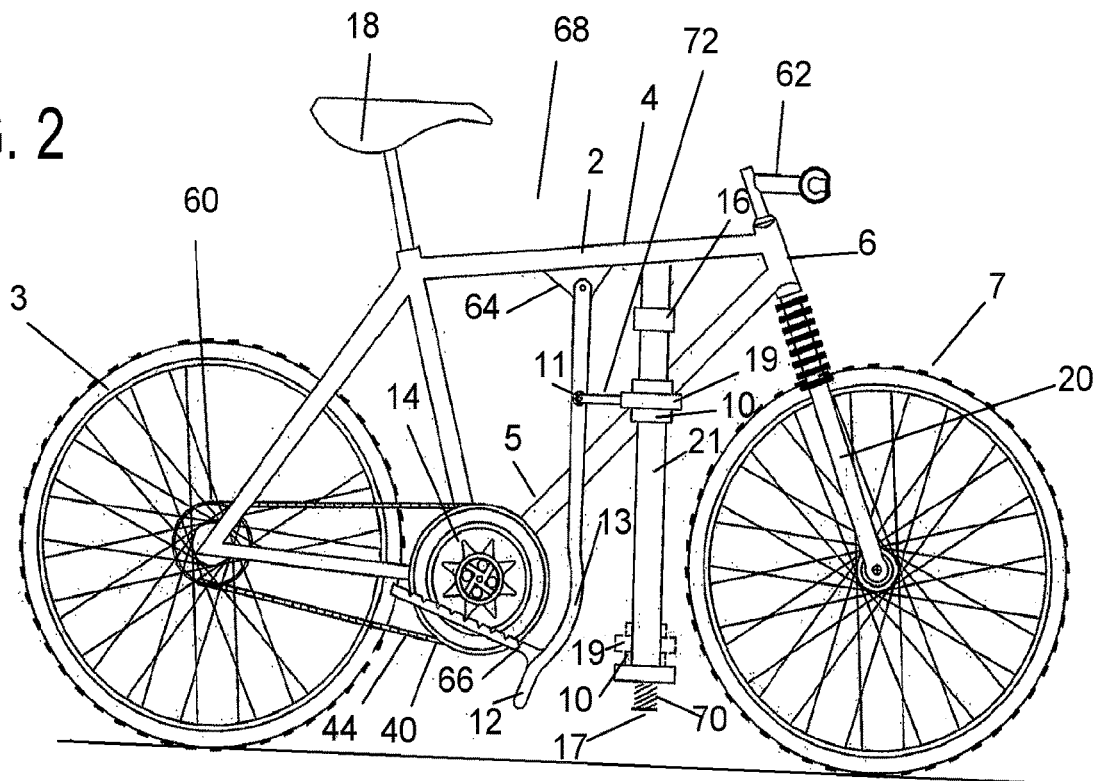


FIG. 2



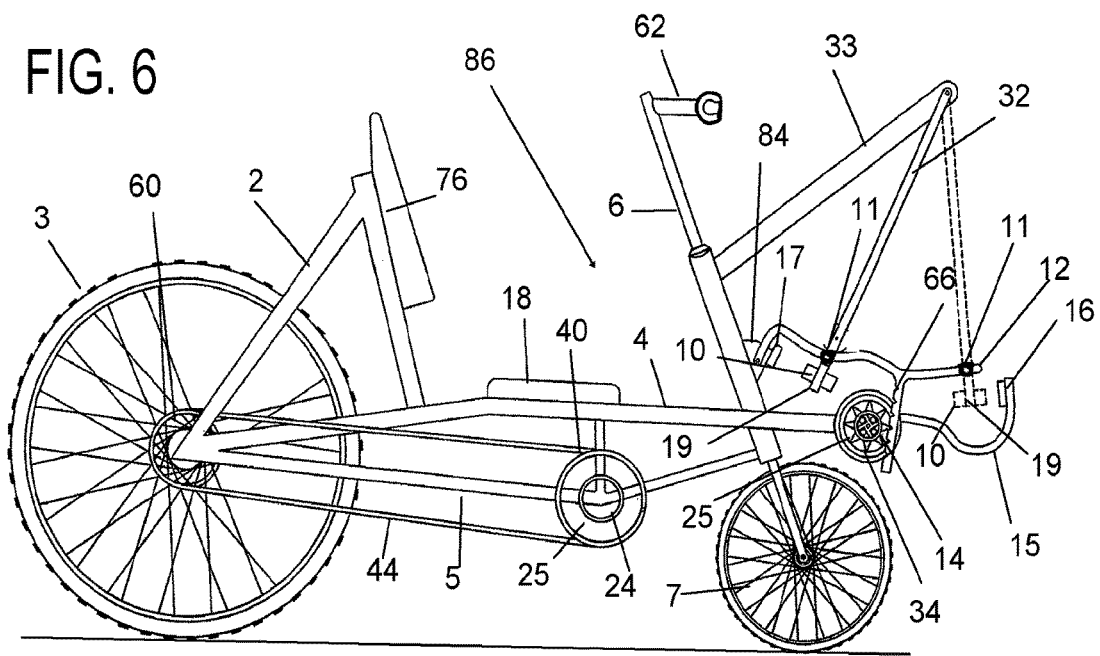
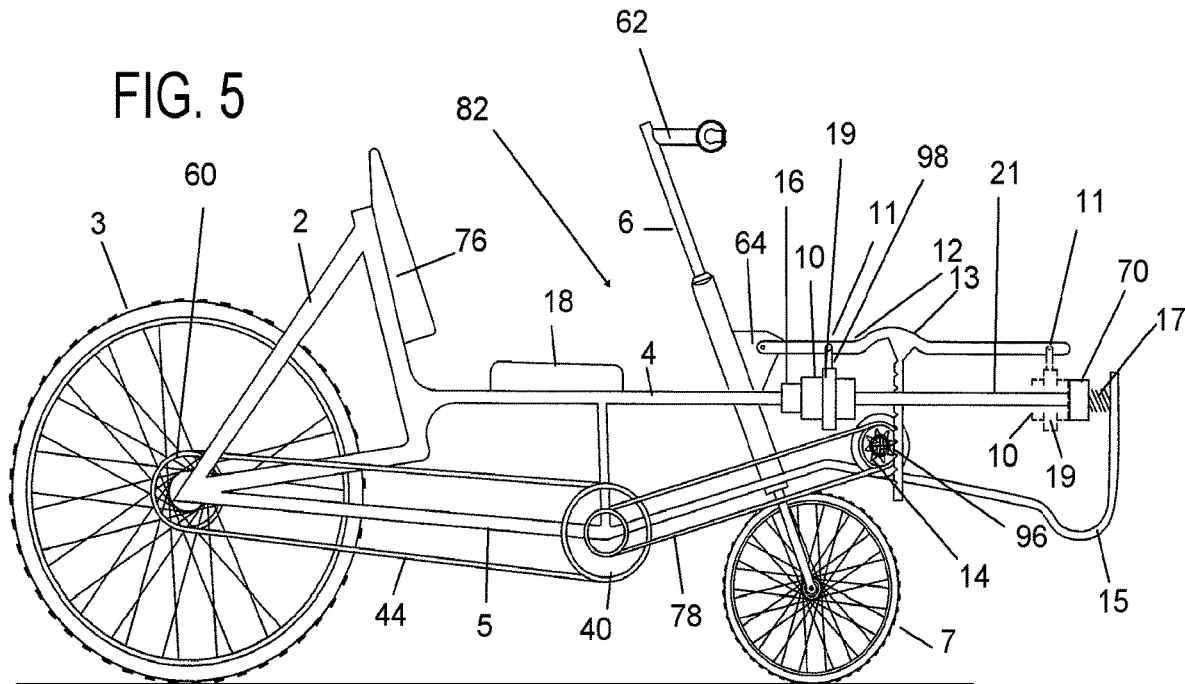


FIG. 7

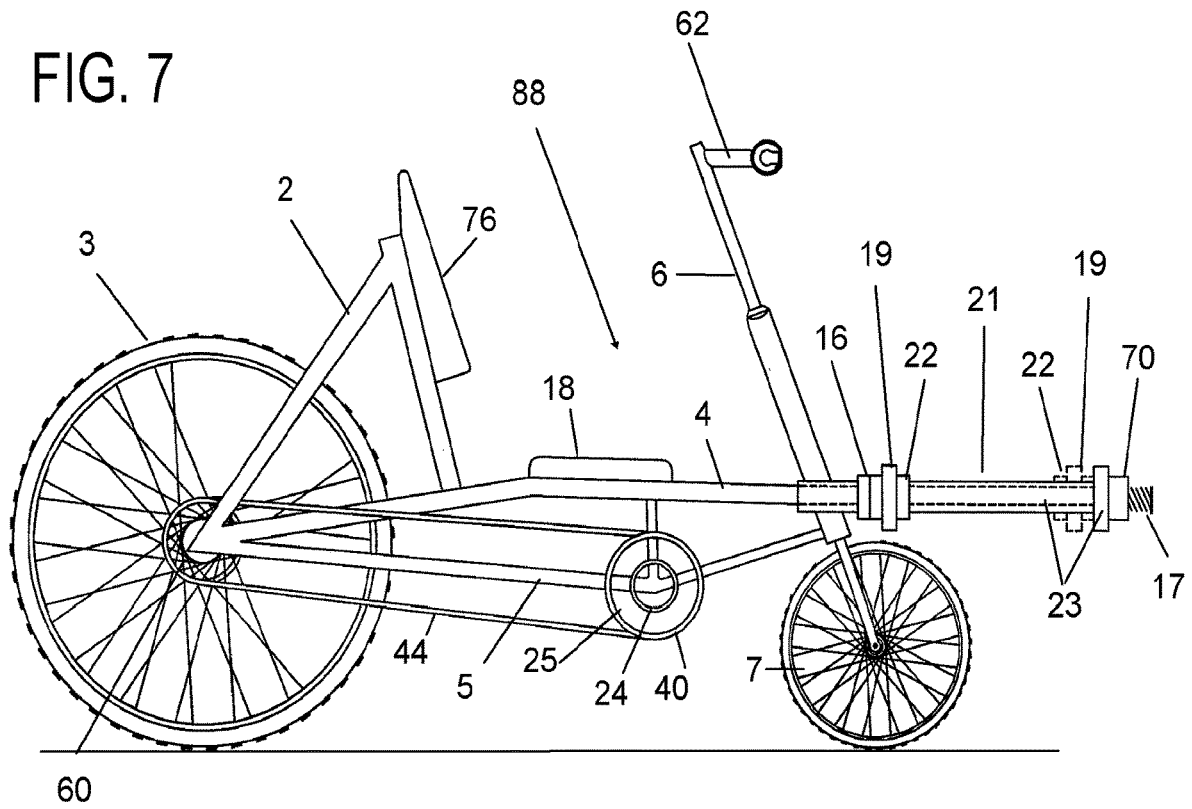


FIG. 8

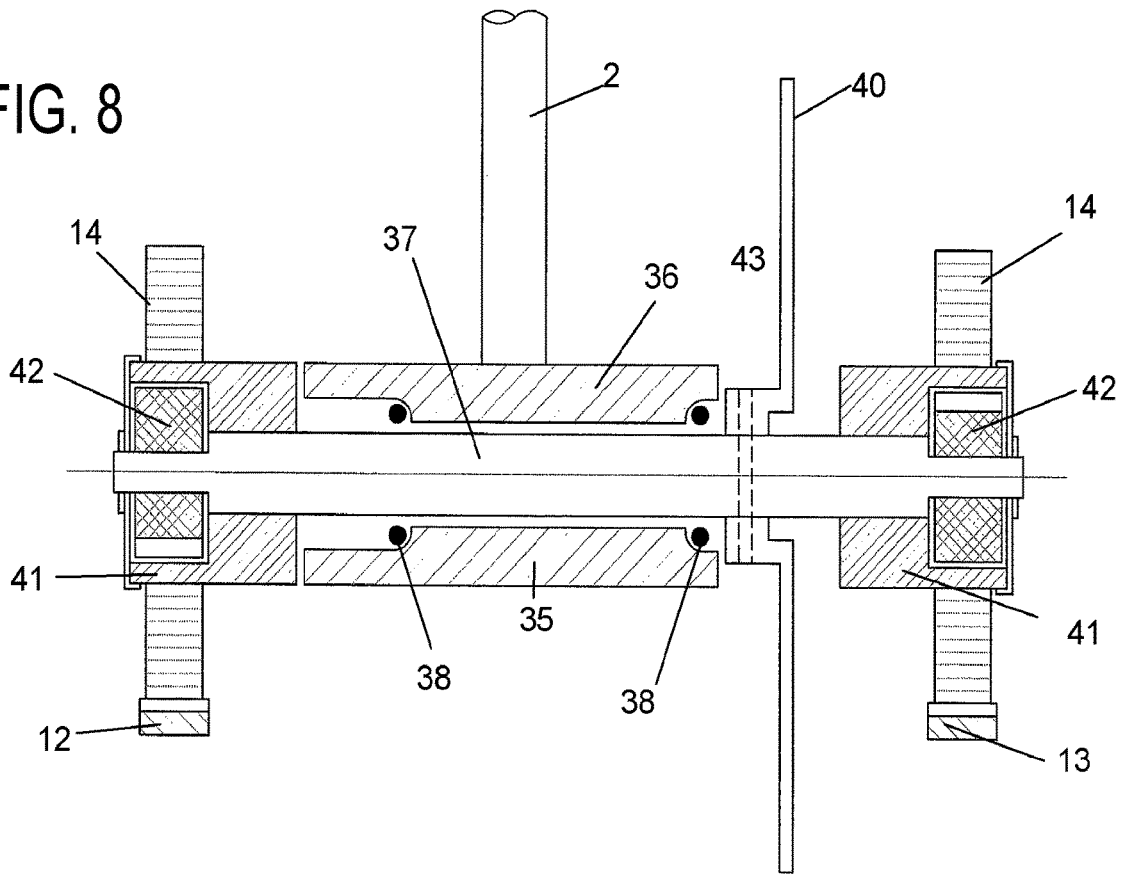


FIG. 9

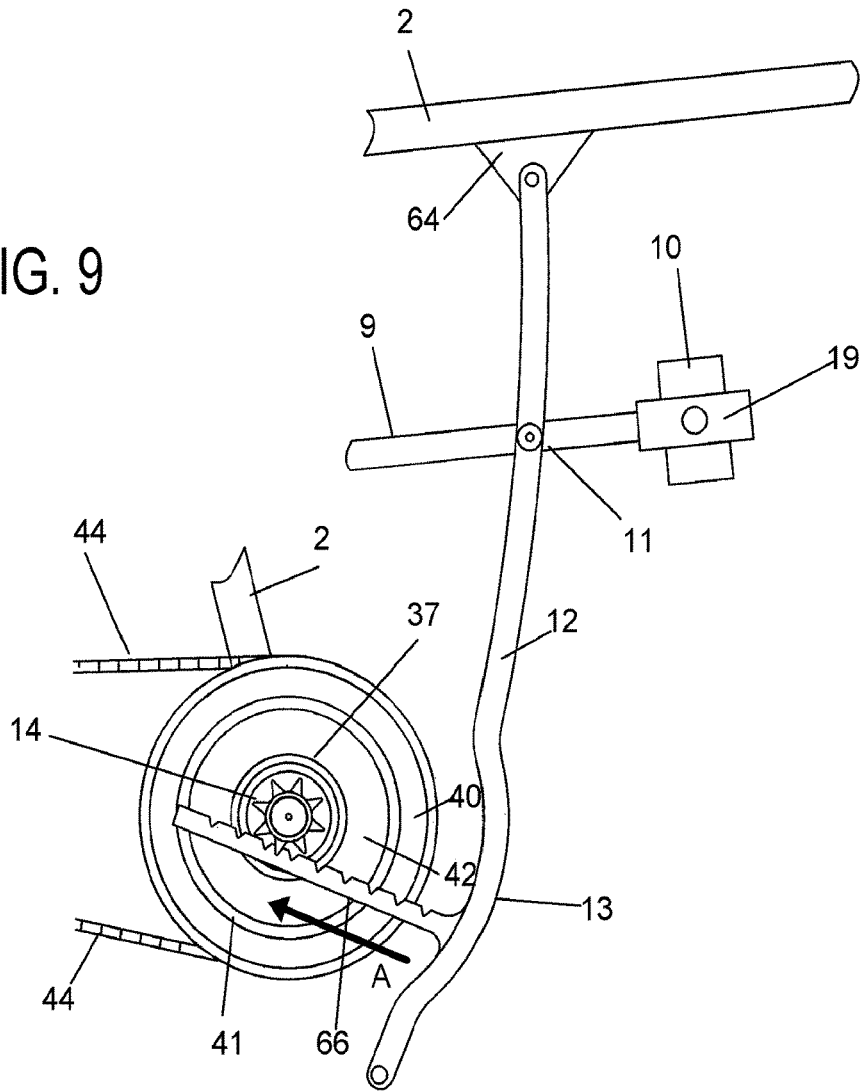


FIG. 10

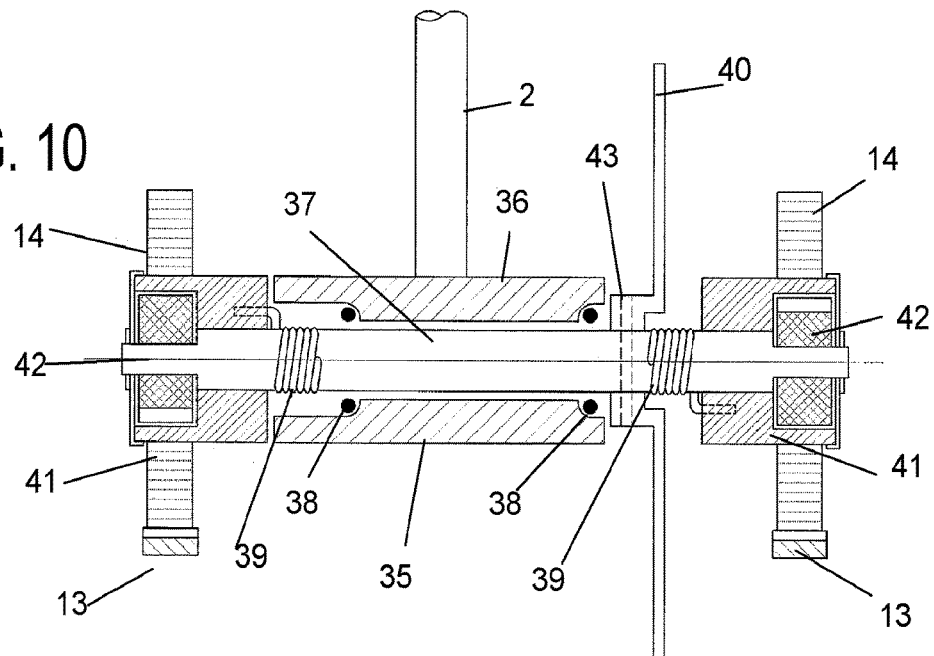


FIG. 11

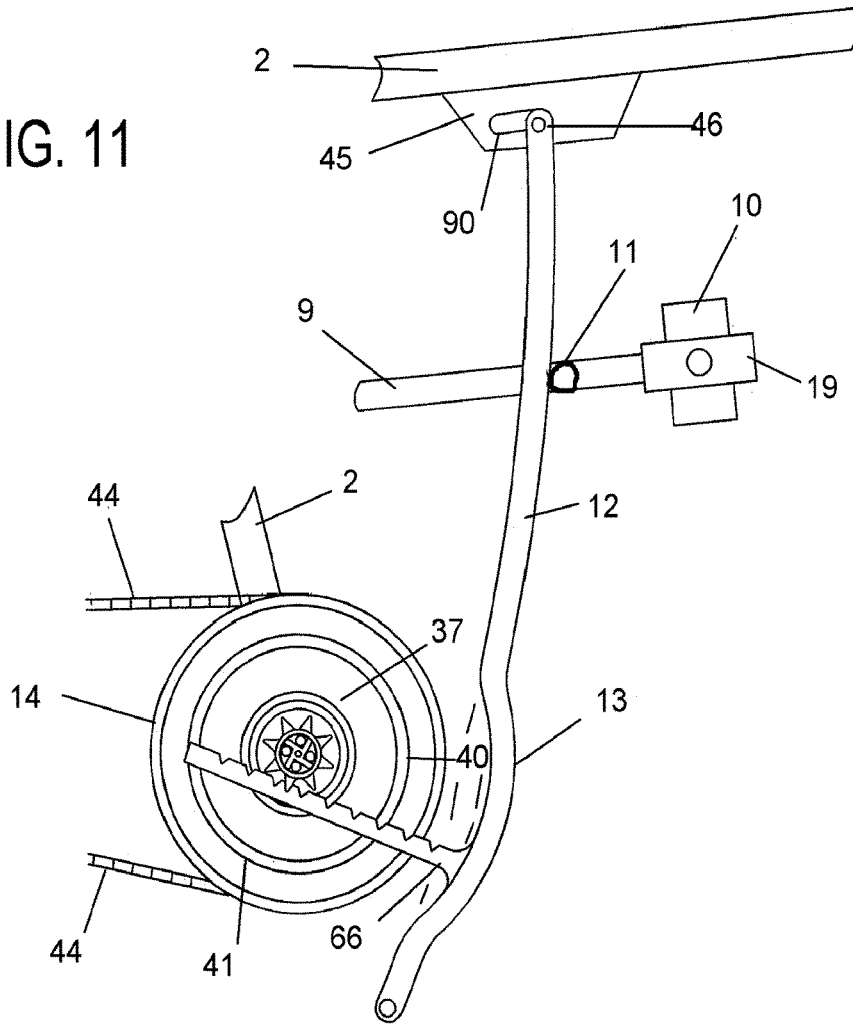


FIG. 12

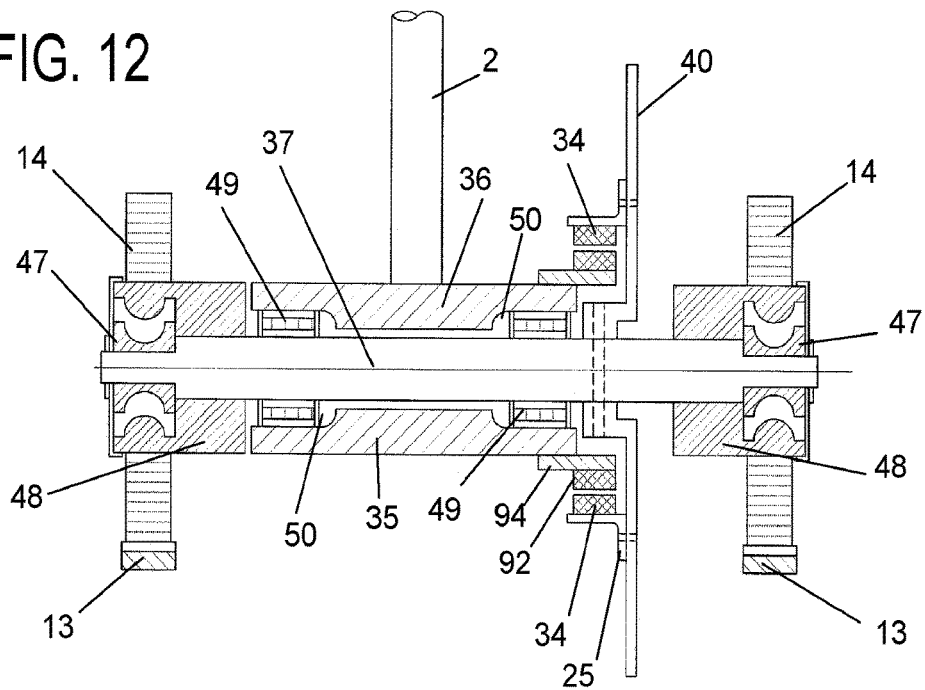


FIG. 13

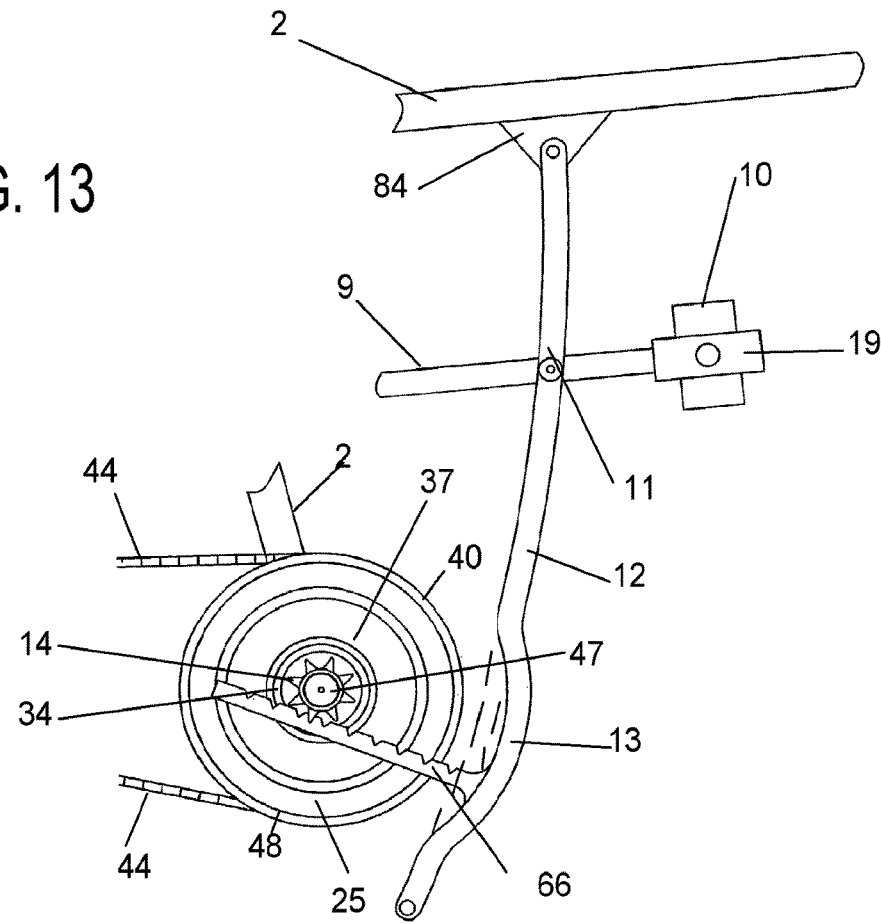


FIG. 14

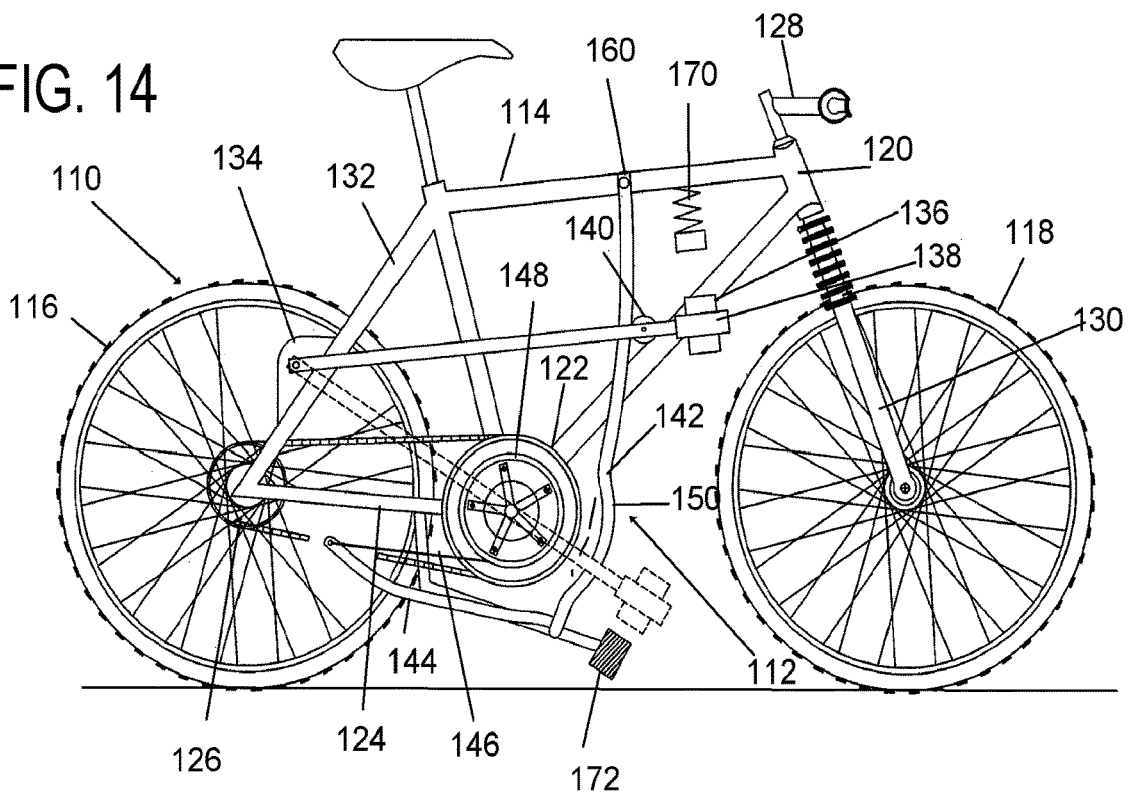


FIG. 15

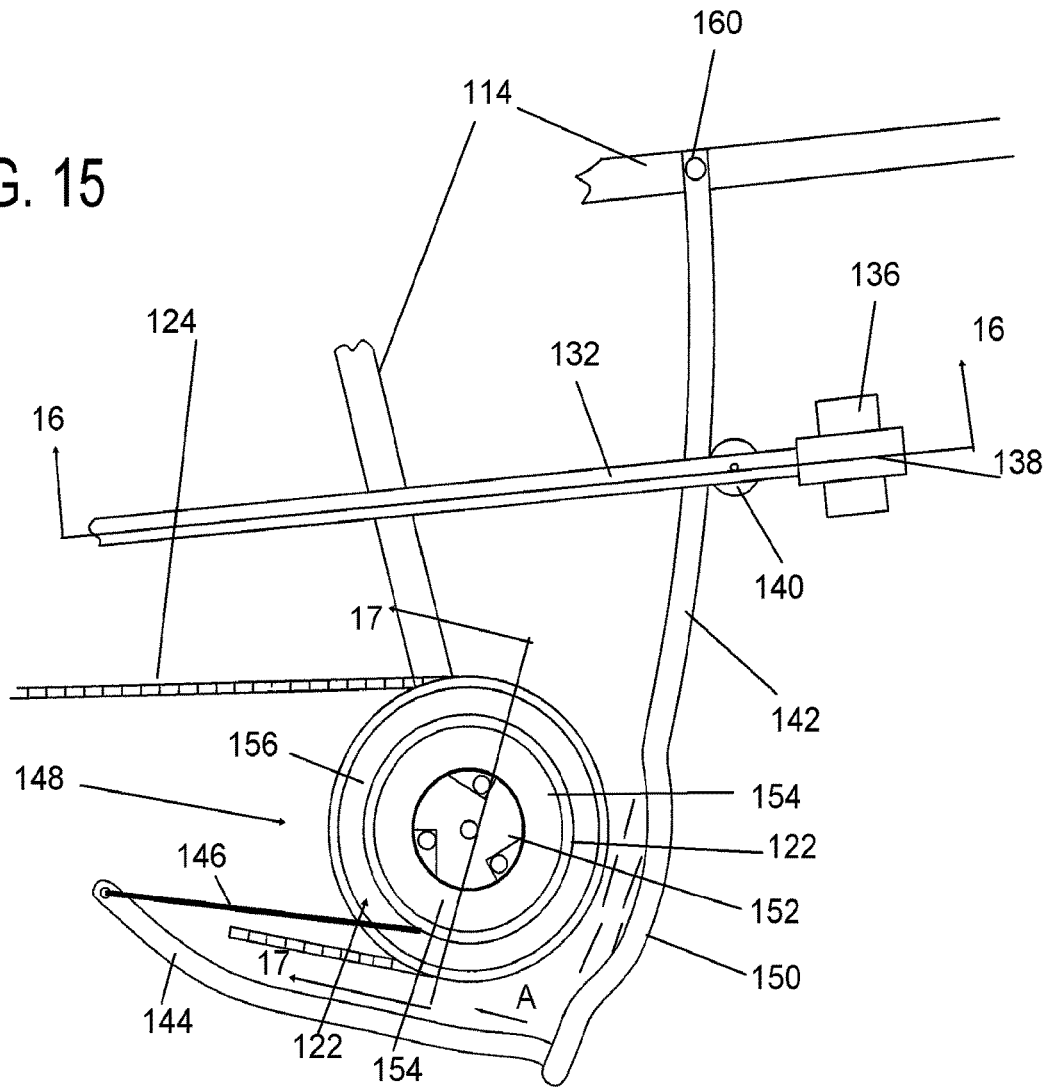


FIG. 19

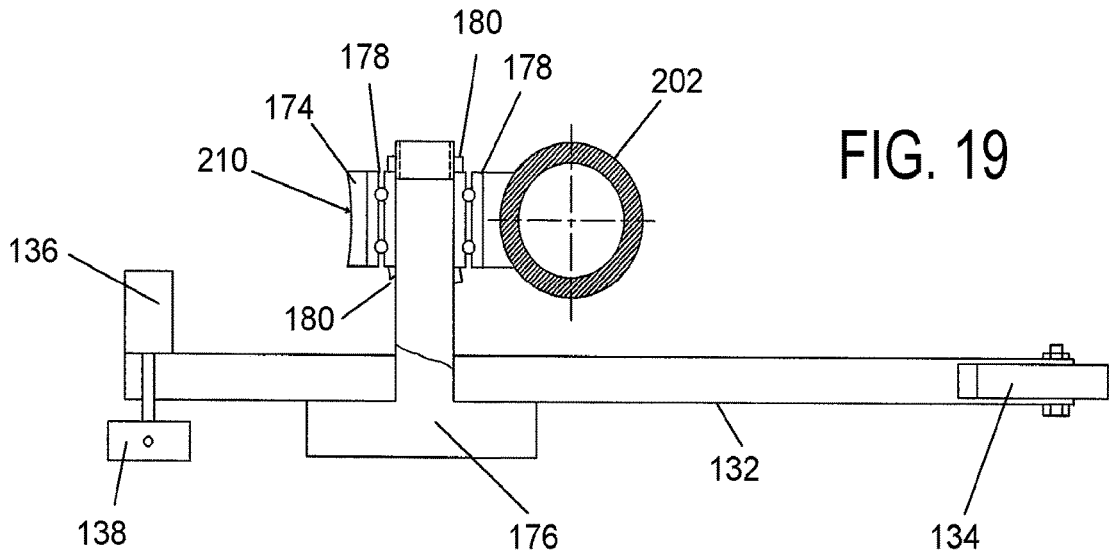


FIG. 16

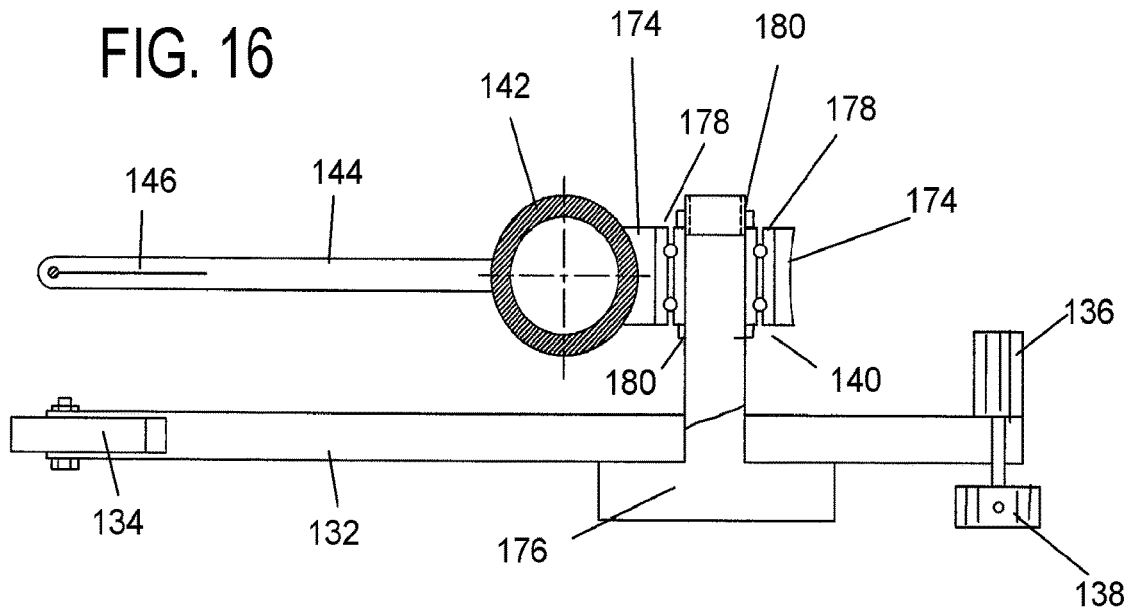


FIG. 17

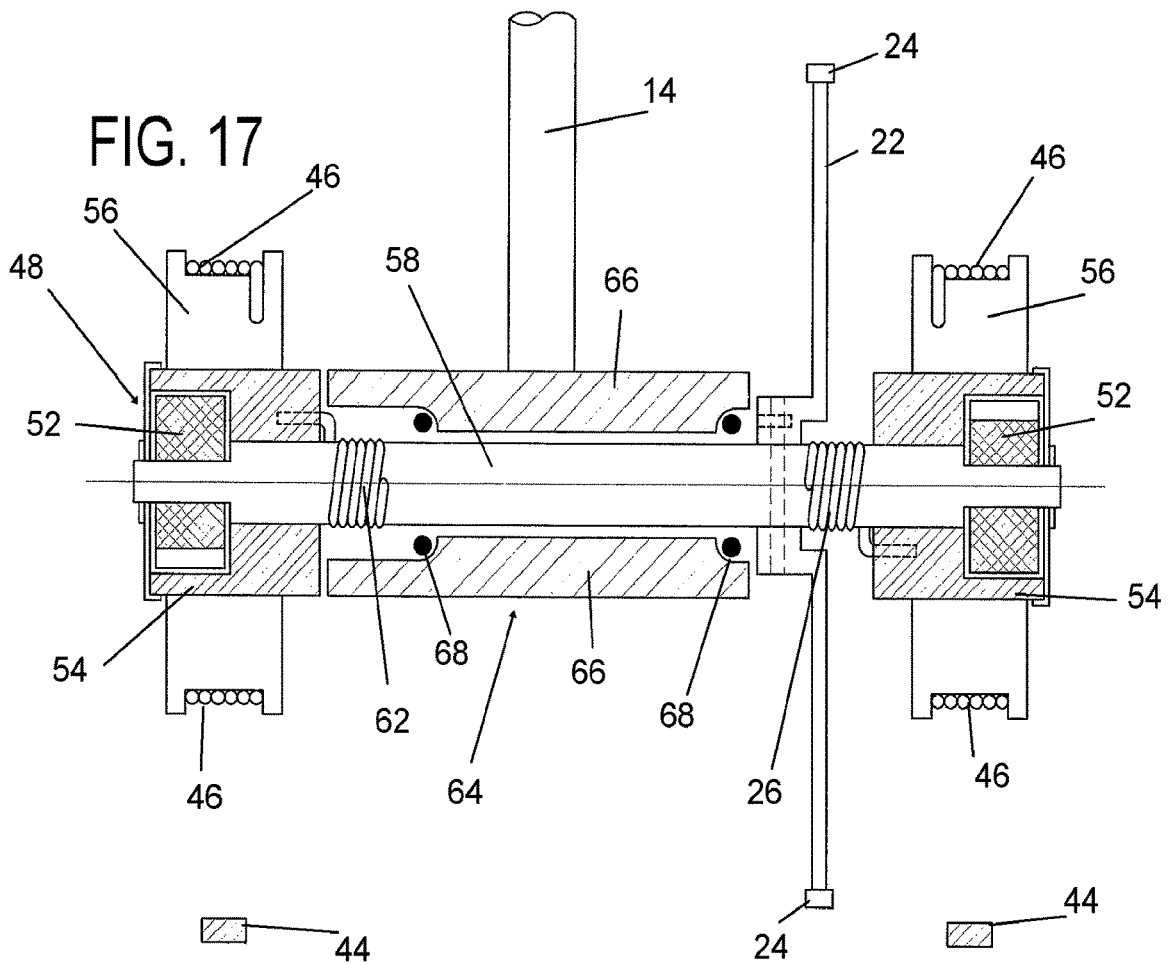
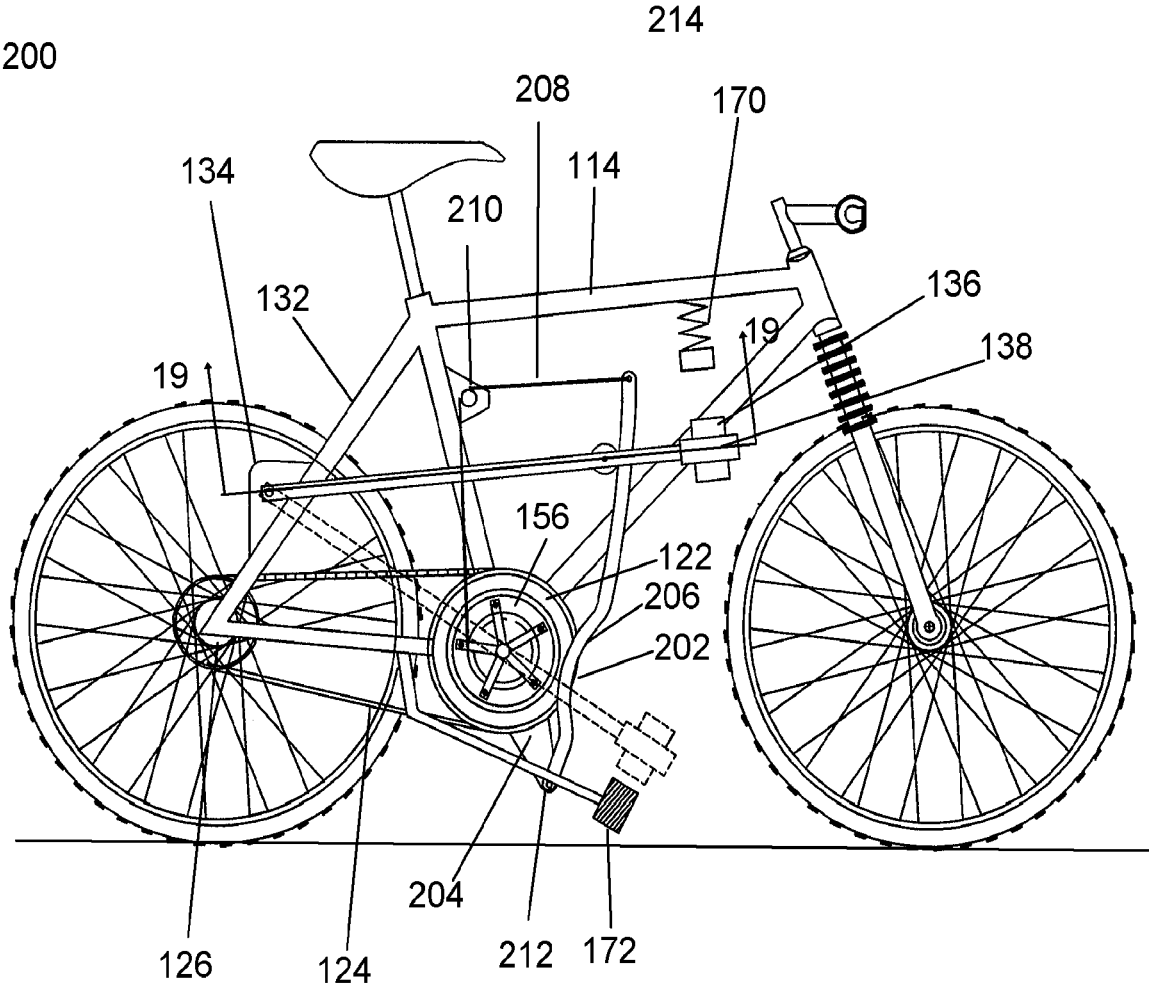


FIG. 18



VEHICLE WITH WEIGHT-BASED DRIVE MECHANISM

TECHNICAL FIELD

This invention relates to human-powered vehicles such as bicycles, tricycles and other multi-wheel variants and specifically to such human-powered vehicles propelled by a reciprocating thrust motion of the operator using a double bump drive hammer powered mechanism connected by a power-gear to a double overrunning clutch transmission with optional returning springs. The human-powered vehicle is propelled using pedals/hammers positioned in between wheels or approximately above and on either side of the front wheel.

BACKGROUND OF INVENTION

Recumbent human-powered vehicles, such as bicycles and tricycles and human-powered vehicles with linear drivers, are known in the prior art. Some examples of such vehicles are found in U.S. Pat. Nos. 4,574,649; 4,846,488; 4,878,684; 5,272,928; 5,290,054; 5,732,963; 5,915,710; 5,979,922; 6,173,981; and 7,048,290; and WO 2006002577.

DISCLOSURE OF INVENTION

A vehicle includes a frame, a seat mounted to the frame, wheels rotatably mounted on the frame, and at least one drive mechanism for causing rotation of one of the wheels. Each drive mechanism includes an arm pivotally attached at first end region to the frame, a weight arranged on the arm at an opposite, second end region, a pedal attached to the weight and configured such that a user of the vehicle can move the pedal and thus the weight and cause pivoting of the arm, and a guide member including a bump and that moves in conjunction with movement of the weight. The guide member has a first end region at which the guide member is pivotally attached to the frame and a second, opposite end region which is free. A roller attached to the arm moves along the guide member during pivotal movement of the arm to cause pivoting of the guide member as the roller engages with the bump of the guide member. An energy transfer system converts pivotal movement of the guide member into motive power to rotate the wheel.

DESCRIPTION OF DRAWINGS

The invention, together with further advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings, wherein like reference numerals identify like elements, and wherein:

FIG. 1 is a side view of an embodiment of upright seated position of the present invention incorporating hammer handle pedals/hammers weights attached to it.

FIG. 2 is a side view of an embodiment of the present invention, incorporating vertical slider for pedals/hammers weights.

FIG. 3 is a side view of an embodiment of the present invention, incorporating vertical sliders for pedals/hammer weights which contain electrical generation elements which produces electrical power to move the vehicle and returning pedals/hammers weights-electrical springs.

FIG. 4 is a side view of an embodiment of the transmission of the present invention, recumbent human power

vehicle with slider/hammer handle associated with slider bracket attached to the steering column.

FIG. 5 is a side view of an embodiment of the present invention, recumbent human-powered vehicle with horizontal sliders attached to the frame.

FIG. 6 is a side view of an embodiment of the present invention, incorporating vertical sliders and gears, and for pedals/hammers weights, the gears associated with the generator produces electrical power to move the vehicle.

FIG. 7 is a side view of an embodiment of the present invention incorporating horizontal sliders which contain electrical generation elements which produce electrical power to move the vehicle and returning pedals/hammers weights-electrical springs.

FIG. 8 is a cross-sectional view of a particular embodiment of the transmission of the present invention utilizing sliders and gears.

FIG. 9 is a side view of a particular embodiment of the transmission and electrical hammer powered drive mechanism of the present invention utilizing bumps and overrunning clutches.

FIG. 10 is a cross-sectional view of a particular embodiment of the transmission of the present invention utilizing spiral torsion returning springs.

FIG. 11 is a side view of a particular embodiment of the transmission of the present invention utilizing movable leading slider gear axle and therefore changeable bump height.

FIG. 12 is a cross-sectional view of particular embodiment of the transmission of the present invention utilizing hydraulic overrunning latches, hydraulic self-pressure bearings, electrical generator, and flywheel.

FIG. 13 is a side view of a particular embodiment of the transmission and inertial hammer powered drive mechanism of the present invention utilizing hydraulic overrunning latches, hydraulic self-pressure bearings, electrical generators, and flywheels.

FIG. 14 is a side view of another embodiment of a bicycle of the present invention.

FIG. 15 is an enlarged side view of the transmission mechanism of the bicycle shown in FIG. 14:

FIG. 16 is a cross-sectional view taken along the line 16-16 in FIG. 15;

FIG. 17 is a cross-sectional view taken along the line 17-17 in FIG. 15;

FIG. 18 is a side view of another embodiment of a bicycle of the present invention; and

FIG. 19 is a cross-sectional view taken along the line 19-19 in FIG. 18.

BEST MODE FOR CARRYING OUT INVENTION

Referring to FIGS. 1-13, a bicycle 1 has a double-stroke inertial hammer-powered gear drive mechanism 10, 12, 13, 14 integral with a bicycle frame 2. The bicycle 1 has many of the standard components found in typical bicycles, such as a rear wheel 3, top tube 4, low tube 5, steering column 6, front wheel 7, main drive sprocket 40, main drive chain 44, rear wheel drive sprocket 60, adjustable handlebar 62, and a front fork 20. Bicycle 1 may include alternative or other components known to be used on bicycles as long as they do not interfere with the motive system to be disclosed.

The hammer-powered gear drive mechanism of the bicycle 1 includes leading adjustable sliders and gears 12, bumps 13, and is engaged with follower left and right gears 14. This arrangement is shown on the right side of the

bicycle 1 in FIG. 1, with a leading slider and gear 12, a bump 13 and right side gear 14 shown, but the same combination of components, i.e., a leading slider and gear 12, a bump 13 and the left side gear 14, are present on the left side of the bicycle 1. The description will generally discuss one combination of these components, it being understood that the opposite side of the frame 2 includes the same components.

Each leading slider and gear 12 serves as a guide member that moves in conjunction with movement of an inertial hammer weight 10. Movement of this guide member is converted by the energy transfer system coupled thereto into motive power to rotate the rear wheel 3 only when the weight 10 moves in a direction from a first position (an upper position shown in solid lines in FIG. 1) to a second position (a lower position shown in dotted lines in FIG. 1), i.e., downward in the configuration shown in FIG. 1 and not when the weight 10 moves in the opposite direction from the second position to the first position (upward). Various forms of this guide member and energy transfer system are possible.

Leading slider and gear 12 is joined by a roller 11 with the hammer handle 9 and the inertial hammer weight 10, combined with a pedal 19. Weight 10 is fixed to the hammer handle 9 and the pedal 19 is fixed to the weight 10, although it could alternatively or additionally be fixed to the hammer handle 9.

Roller 11 is fixed to the hammer handle 9 but can rotate in this fixed position (rotatably mounted to the hammer handle 9) and is positioned in connection with the leading slider and gear 12 to be guided in its reciprocating up and down sliding movement by the leading slider and gear 12. As the hammer handle 9 pivots relative to its pivot point on a bracket 8 fixed to the frame 2, the radial distance of the roller 11 from the pivot point on the bracket 8 does not change, but rather, the leading slider and gear 12 pivots about its pivot point on another bracket 64 fixed to the frame 2. Bracket 8 is fixed to a part of the frame 2 leading to the axle of the rear wheel 3. Bracket 64 is fixed to the top tube 4 of the frame 2.

Hammer handle 9 and leading slider and gear 12 are joined with or connected to the frame 2 by the brackets 8, 64, one bracket 8 supporting the fixed end of the hammer handle 9 and the other bracket 64 supporting the upper end of the leading slider and gear 12. Bracket 64 can support the leading slider and gear 12 on both sides of the bicycle 1, or two brackets 64 can be provided, whereas a separate bracket 8 is usually required on each side of the bicycle 1 to support a respective hammer handle 9. With such fixing of the pedal 19, weight 10 and hammer handle 9 to one another and the hammer handle 9 to the bracket 8, downward movement of the pedal 19, caused by force exerted by the rider of the bicycle 1, causes downward movement of the weight 10 and pivotal downward movement of the hammer handle 9 relative to the pivot point defined on the bracket 8. Upward movement of the pedal 19 causes upward movement of the weight 10 and pivotal upward movement of the hammer handle 9 relative to the pivot point defined on the bracket 8.

Inertial hammer weight 10 along with the driver's own body weight creates a pendulum-type oscillation movement of the hammer handle 9 resulting in guided movement of the roller 11 along the leading slider and gear 12. Springs 15, 16, 17, 70 provide movement control of the inertial weight 10, resisting shocks and creating an additional reciprocating force. By passing bump 13, the roller 11 creates a high power movement of leading slider and gear 12 and rotating following gear 14. Springs 16 and 17 are positioned on the underside of the top tube 4 to first limit the upward move-

ment of the weight 10 and second to provide a reciprocating force if the weight 10 should come into contact with the lowermost spring 16 in its upward stroke. With respect to the downward stroke, springs 15 and 70 are positioned to first limit the downward movement of the weight 10 (shown in dotted lines in FIG. 1) and second to provide a reciprocating force if the weight 10 should come into contact with the spring 70 in its downward stroke. Spring 15 may be fixed to the frame 2. With the springs 16, 70 in fixed positions, the weight 10 has a defined path of movement, effected by the rider moving the pedals 19.

Bump 13 is formed by providing the leading slider and gear 12 with a deviation radially outward of its radius of curvature, or a deviation from a straight path. Preferably, the bump 13 is curved to provide for easy passage of the roller 11 therethrough. The dotted lines along the leading slider and gear 12 represent the path of the roller 11. However, each leading slider and gear 12 is not configured to correspond to this path and enable the roller 11 to move in this path, but rather have the bump 13. The bump 13 thereby causes the leading slider and gear 12 to pivot rearward about the pivot point defined on the bracket 64 as the roller 11 passes through the bump 13. This pivotal rearward movement causes rearward movement of a ratchet portion 66 of the leading slider and gear 12 which is engaged with a gear 14 of the drive mechanism, thereby causing rotation of the gear 14.

Ratchet portion 66 extends from the bump 13, and since the leading slider and gear 12 is generally in a vertical orientation, the ratchet portion 66 extends in a generally horizontal orientation. The length and construction of the ratchet portion 66 of the leading slider and gear 12 is determined relative to the extent of its rearward movement and the size and shape of the teeth on the gear 14. Other variables relating to the construction of and coupling between the ratchet portion 66 of the leading slider and gear 12 and the gear 14 to enable a maximal portion of the force of the downward stroke applied by the rider to the pedals 19 to be converted into rotation of the gear 14 are readily determinable by one skilled in the art to which this invention pertains in view of the disclosure herein.

Gears 14, one on each side for the frame 2, transmit power to the single main drive sprocket wheel 40 by overrunning clutches having outer and inner rings 41 and 42 (see FIGS. 8-11) or outer and inner rings 47 and 48 (see FIGS. 12 and 13). As the gear 14 rotates, the main drive sprocket wheel 40 rotates causing the main drive chain 44 threaded over it to move and the rear wheel drive sprocket 60, over which the main drive chain is threaded, to rotate thereby causing rotation of the rear wheel 3 to which the rear wheel drive sprocket 60 is connected.

FIG. 2 shows an embodiment of a bicycle 68 similar to the bicycle 1 shown in FIG. 1 with the exception that each hammer handle 9 is replaced by a directional slider 21 attached to the top tube 4, i.e., there is a directional slider 21 on each side of the frame 2 of the bicycle 68. The directional slider 21 may be fixed to the frame 2 and, as illustrated, is substantially vertical, although the angle between the main axis of the directional slider 21 and the top tube 4 of the frame 2 may vary or be variable depending on, for example, rider preference.

Weight 10 is connected to the directional slider 21 to enable it to slide up and down along the directional slider 21, an upper position of the weight 10 being shown in solid lines and a lowermost position of the weight along the directional slider 21 being shown in dotted lines. Pedal 19 is attached to the weight 10 for movement along with the weight 10, and

5

a bracket or connector 72 joins the pedal 19 to the leading slider and gear 12 via a roller 11. Thus, the roller 11 is rotatably connected to the connector 72 and moves up and down dependent on the up and down movement of the pedal 19, and connected weight 10.

Spring 16 situated at the top of the directional slider 21 limits upward movement of the weight 10 along the directional slider 21 and provides a reciprocating force if the weight 10 should come into contact with the spring 16 in its upward stroke. Spring 70 situated at the bottom of the directional slider 21 limits downward movement of the weight 10 along the directional slider 21 and provides a reciprocating force if the weight 10 should come into contact with the spring 70 in its downward stroke. Spring 17 is optionally positioned below the lowermost spring 70. There may be any number of upper and lower springs at the end regions of the directional slider 21.

In FIG. 2, the roller 11 moves downward as the rider forces the pedal 19 downward causing the weight 10 to move downward along the directional slider 21. The roller 11 also moves downward in a straight path and when it reaches the bump 13 in the leading slider and gear 12, it cases the leading slider and gear 12 to pivot rearward about the pivot point on the bracket 64, and the ratchet portion 66 of the leading slider and gear 12 to move rearward while in contact with the gear 14. As the gear 14 rotates, the main drive sprocket wheel 40 rotates causing the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3. Ratchet portion 66 extends from a portion of the leading slider and gear 12 below the bump 13. Comparing FIGS. 1 and 2, it can be seen that the ratchet portion 66 can extend from either the bump 13 itself or another part of the leading slider and gear 12.

FIG. 3 shows an embodiment wherein the rider's control of the pedals 19 causes generation of electricity which powers an electrical motor 24 that turns the rear wheel 3. An energy generating system is thus provided. A directional slider 21 is provided, as in the embodiment of FIG. 2, but an electrical coil assembly 22 is connected to each pedal 19 and another electrical coil assembly 23 is integrated into the directional slider 21 on each side of the bicycle 2, and thus serves as a stationary static electrical generator coil assembly. These electrical coil assemblies 22, 23 form the energy generating system that converts sliding movement of the weight (considered the combination of the pedal 19 and the electrical coil assembly 22) along the directional slider 21 into rotational force to rotate a flywheel. 25.

Movement of the electrical coil assembly 22 relative to the stationary electrical coil assembly 23 on each directional slider 21 causes generation of electricity which is conveyed through wires on the bicycle 1 to a common electrical motor 24. Motor 24 may be housed in a housing attached to the frame 2. Motor 24 is electrically coupled to a flywheel 25 that causes rotation of the main drive sprocket wheel 40 in turn, causing the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3. There may be two motors and flywheels, one for each energy generating system, or a single motor and single flywheel that are powered by both energy generating systems.

In use, the rider sitting on seat 18 puts their feet on the pedals 19, one on each side of the frame 2, and then moves their feet up and down, causing vertical, linear movement of the electrical coil assembly 22 along the directional slider 21 and relative to the stationary electrical coil assembly 23. The uppermost position of the electrical coil assembly 22 is shown in solid lines while the lowermost position is shown

6

in dotted lines. This relative movement of the coil assemblies 22, 23 generates electricity, in a manner known to those skilled in the art. The electrical coil assembly 23 may be integrated into a reciprocating electrical spring. It is possible for the rider to move only one of their feet up and down, and when moving both of their feet up and down, they can move their feet simultaneously in down stroke and up stroke, or alternatively in down and up stroke, i.e., one going down and the other going up.

As in FIG. 2, spring 16 situated at the top of the directional slider 21 limits upward movement of the electrical coil assembly 22 along the directional slider 21 and provides a reciprocating force if the electrical coil assembly 22 should come into contact with the spring 16 in its upward stroke. An optional spring 74 is above spring 16 and aids the function of spring 16. Spring 17 situated at the bottom of the directional slider 21 limits downward movement of the electrical coil assembly 22 along the directional slider 21 and provides a reciprocating force if the electrical coil assembly 22 should come into contact with the spring 17 in its downward stroke. Another spring 15 is connected to the spring 17 and is attached to the frame 2. Electrical wires between the electrical coil assemblies 22, 23 may pass through spring 15, or other parts of the frame 2.

Springs 15, 16, 17, 74 may be reciprocating electrical springs that generate electrical power and returning force at the same time. In this case, the springs 15, 16, 17, 74 are also connected by wires to the motor 24 and provide electrical energy to the motor 24. Electrical springs that generate electricity when contacted by a moving object are known.

FIG. 4 shows a bicycle 80 similar to that shown in FIG. 1 but the frame 2 is configured to allow the rider to sit on the seat 18 and rest their back on a backrest 76. Also, the hammer handle 32 is pivotally connected to a pedal slider bracket 33 attached to the frame 2 and specifically to the steering column 6. The weight 10 is attached to a swinging hammer handle 32, e.g., in the same manner that the weight 10 is attached to the hammer handle 9, and the pedal 19 is attached to the weight 10 or hammer handle 32. By pivotally mounting the hammer handle 32 at its upper end to the pedal slider bracket 33, a pivot point for the hammer handle 32 is defined on the pedal slider bracket 33 and the hammer handle 32 swings in a pendulum-type motion between a rearwardmost position shown in solid lines and a forwardmost position shown in dotted lines. Ratchet portion 66 of the leading slider and gear 12 extends from the bump 13, and since the leading slider and gear 12 is generally in a horizontal orientation, the ratchet portion 66 extends in a generally vertical orientation.

The rider puts their feet onto the pedals 19, one on each side of the frame 2 of the bicycle 80, and then pushes the pedal 19, with the connected weight 10, forward causing the hammer handle 32 to swing forward. This swinging movement causes the roller 11 to move along the leading slider and gear 12. As the roller 11 rolls over the bump 13 in the leading slider and gear 12, the ratchet portion 66 of the leading slider and gear 12 is moved downward while in contact with the gear 14 causing rotation of the gear 14,

Rotation of gear 14 causes movement of a secondary drive chain 78 only when the hammer handle 32 swings forward and not when the hammer handle 32 swings rearward. This is achieved by an overrunning clutch 96 integrated with the gear 14, as in the embodiments of FIGS. 1 and 2. Thus, the secondary drive chain 78 does not move unless the inner ring of the overrunning clutch 96 is engaged with the outer ring of the overrunning clutch 96, which occurs only when the ratchet portion 66 of the leading slider

and gear 12 moves downward and the gear 14 rotates clockwise, but not when the leading slider and gear 12 moves upward and the gear 14 rotates counterclockwise. Movement of the secondary drive chain 78 causes the main drive sprocket wheel 40 to rotate which in turn, causes the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3.

FIG. 5 shows a bicycle 82 similar to that shown in FIG. 2 wherein a directional slider 21 is attached to the frame 2, one on each side of the frame 1. Each directional slider 21 is attached by a bracket 84 to a front part of the frame 2, specifically the steering column 6, to project forward from the frame 2 to position the pedals 19 in a position in which the rider seated on seat 18 and leaning back on backrest 76 can contact the pedals 19.

As in FIG. 2, weight 10 slides along the directional slider 21, and the pedal 19 is attached to the weight 10. Springs 15, 16, 17, 70 provide for controlled movement of the weight 10 and can also generate force upon contact by weight 10. Each leading slider and gear 12 is positioned in a substantially horizontal orientation with the ratchet portion 66 in a substantially vertical orientation. Each roller 11 is coupled to the pedal 19 by a connector or bracket 98 and is able to move forward and rearward at a fixed (vertical) distance from the respective directional slider 21, and as the roller 11 passes through the bump 13, a downward force is exerted on the ratchet portion 66 of the leading slider and gear 12 causing rotation of the gear 14 in contact with the ratchet portion 66.

Rotation of gear 14 causes movement of a secondary drive chain 78 only when the weight 10 slides forward and not when the weight 10 slides rearward. This is achieved by an overrunning clutch 96 integrated with the gear 14, as in the embodiments of FIGS. 1 and 2. Movement of the secondary drive chain 78 causes the main drive sprocket wheel 40 to rotate which in turn, causes the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3.

In this embodiment and the embodiments with a secondary drive chain, e.g., FIG. 4, the roller 11 of each drive mechanism passes through the bump 13 in both strokes, i.e., the forward stroke and the rearward stroke or the up stroke and the down stroke. During the forward or down stroke, the ratchet portion 66 of the leading slider and gear 12 is moved downward or rearward. During the rearward or up stroke, the ratchet portion 66 of the leading slider and gear 12 is moved upward or forward to return it to the initial position. This upward or forward movement does not result in movement of the secondary drive chain 78 in view of the use of the overrunning clutches described below. Thus, the drive mechanism is configured to provide unidirectional movement of the secondary drive chain 78 so that it moves only in one direction during the forward or down stroke of each pedal 19, and not during the reverse rearward or up stroke of each pedal 19.

FIG. 6 shows an embodiment similar to that shown in FIG. 4, but wherein the rider's control of the pedals 19 causes generation of electricity which powers an electrical motor 24 that turns the rear wheel 3. An electrical generator 34 is connected to the gear 14 of each drive mechanism on the sides of the frame 2 of the bicycle 86. As in FIG. 4, the ratchet portion 66 of the leading slider and gear 12 is moved downward, while in contact with the gear 14, upon forward pushing force exerted by the rider on the pedals 19 causing rotation of the gear 14. There are two gears 14 and thus two electrical generators 34.

In use, the rider on seat 18 puts their feet on pedals 19, one on each side of the frame 2, and moves their feet forward and backward, causing swinging of the hammer handle 32 and thus downward and upward movement of the ratchet portion 66 of the leading slider and gear 12 as the roller 11 passes through the bump 13. The forwardmost position of the hammer handle 32 is shown in dotted lines while the rearwardmost position is shown in solid lines. The downward movement causes rotation of the gear 14, but not the upward movement in view of the construction of the gear 14, described below.

Rotation of the gear 14 causes generation of electricity which is conveyed through wires on the bicycle 86, e.g., partly through the top tube 4, to a common electrical motor 24. The manner in which rotation of a component can generate electricity is known to those skilled in the electrical energy generation field. Motor 24 is electrically coupled to a flywheel 25 that causes rotation of the main drive sprocket wheel 40 in turn, causing the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3.

As in FIG. 4, springs 15, 16, 17 limit the swinging movement of the hammer handle 32. If springs 15, 16, 17 are reciprocating electrical springs, they can also generate electrical power and return force when impacted by the weight 10, with this electrical power being conveyed through wires. Thus, springs 15, 16, 17 are also connected by wires to the motor 24 and provide electrical energy to the motor 24. Electrical springs that generate electricity when contacted by a moving object are known.

FIG. 7 shows an embodiment, similar to FIG. 3, wherein the rider's control of the pedals 19 causes generation of electricity which powers an electrical motor 24 that turns the rear wheel 3. The electrical coil assembly 22 is connected to each pedal 19 and another electrical coil assembly 23 is integrated into the directional slider 21 on each side of the bicycle 88, and thus serves as a stationary static electrical generator coil assembly. Movement of the electrical coil assembly 22 relative to the stationary electrical coil assembly 23 on each directional slider 21 causes generation of electricity which is conveyed through wires on the bicycle 88 to a common electrical motor 24. Motor 24 is electrically coupled to a flywheel 25 that causes rotation of the main drive sprocket wheel 40 in turn, causing the main drive chain 44 to move and the rear wheel drive sprocket 60 to rotate thereby causing rotation of the rear wheel 3.

In use, the rider on seat 18 with the back potentially against backrest 76 and puts their feet on pedals 19, one on each side of the frame 2 of the bicycle 88, and then moves their feet forward and backward, causing linear movement of the electrical coil assembly 22 along the directional slider 21 and relative to the stationary electrical coil assembly 23. The rearmost position of the electrical coil assembly 22 is shown in solid lines while the forwardmost position is shown in dotted lines. This relative movement of coil assemblies generates electricity, in a manner known to those skilled in the art. The electrical coil assembly 23 may be integrated into a reciprocating electrical spring. It is possible for the rider to move only one of their feet forward and backward, and when moving both of their feet forward and backward, they can move their feet simultaneously in a forward stroke and a rearward stroke, or alternatively in forward and rearward strokes, i.e., one going forward and the other going rearward.

Spring 70 situated at the rear of the directional slider 21 limits rearward movement of the electrical coil assembly 22 along the directional slider 21 and provides a reciprocating

force if the electrical coil assembly 22 should come into contact with the spring 70 in its rearward stroke. Similarly, a spring 16 situated at the front of the directional slider 21 limits forward movement of the electrical coil assembly 22 along the directional slider 21 and provides a reciprocating force if the electrical coil assembly 22 should come into contact with the spring 16 in its forward stroke. Another spring 17 is optionally connected to the spring 70. Electrical wires between the electrical coil assemblies 22, 23 may pass through spring 16, or other parts of the frame 2.

Springs 16, 17, 70 may be reciprocating electrical springs that generate electrical power and returning force at the same time, as mentioned elsewhere herein. Thus, the springs 16, 17, 70 are also connected by wires to the motor 24 and provide electrical energy to the motor 24.

FIGS. 8-11 show the clutch mechanism that allows the rotation of gear 14 in only one direction to cause movement of the main drive chain 40 which may be considered part of the energy transfer systems. For this explanation, the motive stroke will be that stroke that causes the movement of the main drive chain 40 while the return stroke is that stroke that causes return of the weight 10 to a position ready for another motive stroke. In the motive stroke, an outer ring 41 is in engagement with an inner ring 42, while in the return stroke, the outer ring 41 is not in engagement with the inner ring 42, respectively. Also, FIG. 8 clearly shows that there are two drive mechanisms, one on each side of the frame 2.

The gear 14 of the drive mechanism on each side of the frame 2 is shown. Each gear 14 has an opening in which at least a part of the outer ring 41 and at least a part of the inner ring 42 are situated (see also FIG. 1). The inner ring 42 is housed in a cavity in the outer ring 42. The outer ring 41 extends inward toward the frame 2 which the inner ring 42 is mostly housed in a space defined by the outer ring 41. The single main drive sprocket 40 is between a transmission bracket 36 fixed to the frame 2, and the inner ring 41 on one side of the transmission bracket 36. The main drive sprocket 40 is fixed to a transmission axle 37.

The clutch mechanism includes a transmission main chain axis drive 35 having the transmission axle 37 located in the transmission bracket 36 and bearings 38 or possibly hydraulic self-pressure bearings 49 between the inner surface of the transmission bracket 36 and the outer surface of the transmission axle 37 to enable rotation of transmission axle 37 relative to the transmission bracket 35 (see also FIG. 12). To return follower gears 14 in a working position after a motive stroke in which the inner and outer rings 41, 42 rotate counterclockwise in the direction of the arrows in FIG. 9, the outer ring 41 (or 48) is configured to be placed into an idle condition on the return stroke cycle.

A spiral torsion returning spring 39, see FIG. 10, or leading slider and gear 12 rotates the overrunning clutch outer ring 41 or a hydraulic overrunning clutch outer ring 48 in the opposite direction. Then, to perform another motive stroke, the outer rings 41 (or 48) re-engage with the inner ring 42 (or 49) to perform a power stroke cycle and transmit rotational force to transmission axle 37 via the inner ring 42 (or 49), then to the main drive sprocket wheel 40 connected thereto and then to the main drive chain 44 running over the main drive sprocket wheel 40.

FIG. 9 shows the direction of rotation of the outer ring 41 that causes rotation of the inner ring 42 in the same rotational direction, i.e., engagement of the inner ring 42 with the outer ring 41. Outer ring 41 is rotated upon the rearward movement of the ratchet portion 66 of the leading slider and gear 12 (in the direction of arrow A) as the roller 11 passes downward through the bump 13. The dotted lines represent

the movement of the roller 11, which movement forces the rearward movement of the ratchet portion 66 of the leading slider and gear 12

FIG. 10 shows the torsion spiral returning spring 39 provided to return the overrunning clutch outer ring 41. A torsional spiral returning spring 39 may be situated at each end of the transmission axle 37 proximate the outer rings 41. The torsional spiral returning spring 39 is particularly useful when the leading slider and gear 12 does not return by itself to its initial, motive stroke-ready position. One embodiment wherein such return is not automatic is shown in FIG. 11.

FIG. 11 is a side view of an embodiment of the transmission wherein the pivot point of the leading slider and gear 12 is adjustable. To this end, the pivot point is defined by an axle 46 and instead of bracket 64, a flange 45 with a longitudinal slide slot or aperture 90 is provided. The axle 46 is dimensioned to slide in the aperture 90 while being retained therein. With the configuration, the height of the bump 13 is variable. The axle 46 and/or the aperture 90 can be constructed to provide for defined positions of the axle 46 in the aperture 90 to avoid movement of the axle 46 after setting by the rider and during use. Since the axle 46 can move in the aperture 90, there is no automatic return of the leading slider and gear 12 and thus the torsional spiral returning spring 39 on the transmission axle 37 are used to rotate the outer gear 41 and gear 14 back to their initial positions in which they will be ready for a motive stroke.

FIG. 12 shows a hydraulic overrunning clutch inner ring 47 and outer ring 48 which are connected with follower gear 14. The inner ring 47 is connected to the transmission axle 37 which is rotatably mounted on the frame 2 by hydraulic self-pressure bearings 49 to enable rotation of transmission axle 37 relative to the transmission bracket 36 attached to the frame 2. The transmission main chain axis drive 35 contains the electrical generator 34 connected to a flywheel 25 integrated with the main drive sprocket wheel 40. Hydraulic self-pressure bearing seals 50 seal the hydraulic self-pressure bearings 49.

During the motive stroke, rotation of the gear 14 causes rotation of the overrunning clutch outer ring 48 and the overrunning clutch outer ring 47 engaged therewith, which in turn causes rotation of the transmission axle 37. Rotation of the transmission axle 37 causes rotation of the main drive sprocket wheel 40 connected to the transmission axle 37. Rotation of the main drive sprocket wheel 40 causes rotation of the flywheel 26 and generator 34 thereon relative to a stationary coil 92 mounted on a flange 94 connected to the bracket 35. Relative rotation of the generator 34 to the coil 92 generates electricity in the generator 34 which is directed to the motor 24 (not shown in FIG. 12).

FIG. 13 is a side view of an embodiment of the transmission and inertial hammer powered drive mechanism of the present invention utilizing hydraulic overrunning latches (where are the latches), hydraulic self-pressure bearings 49, electrical generators 34, and flywheels 25 as described with reference to FIG. 12.

In any of the embodiments described above, the left and right power stroke cycles are independent from one another. Because of this independent action, the rider can use both legs simultaneously when necessary to provide more power to the vehicle, such as, for example, when accelerating, riding uphill or carrying larger loads (e.g., passengers in a rickshaw-like configuration). Likewise, the rider may alternate between left and right leg motion such as used in a typical upright or recumbent bicycle. Finally, the vehicle of this invention may be propelled with the use of either the right or left leg in a single-stroke action,

11

FIGS. 14-17 shows a bicycle 110 in accordance with the invention that has a double-stroke inertial hammer-powered gear drive mechanism 112 integral with a bicycle frame 114 (the same titled or identified parts may have the same features as parts described above even though represented with different reference numbers). The bicycle 110 has many standard components found in typical bicycles, such as a rear wheel 116, front wheel 118, steering column 120, main drive sprocket 122 (also referred to as the main drive sprocket plate), main drive chain 124, rear wheel drive sprocket 126, adjustable handlebar 128, and a front fork 130. Bicycle 110 may include alternative or other components known to be used on bicycles as long as they do not interfere with the mechanism 112.

Mechanism 112, of which there is one on each side of the bicycle assuming the bicycle is made for use with both left and right feet of the rider, includes a rigid arm 132, pivotally attached at one end region to a plate 134 attached to the frame 114, a weight 136 attached to the opposite end region of the arm 132, a pedal 138 attached to either the weight 136 or the end region of the arm 132 at which the weight 136 is attached, and a roller 140 rotatably mounted to the arm 132 rearward of the weight 136 and pedal 138. Weight 136 may be connected to the same axle as pedal 138, and the weight 136 situated on an opposite side of the arm 132 from the pedal 138 (see FIG. 16). The pedal 138 may include a strap or basket to better facilitate movement of the pedal 138 in the manner described below. This component constitutes the actuating part of the mechanism 112.

Mechanism 112 also includes a force transmission part which includes a rigid bar 142 pivotally attached at one end region to the frame 114 (for example, defining a pivot axis via a pivot pin 160), and having a rearwardly oriented extension 144 at or proximate to the opposite end region. Bar 142 may be, but is not required to be, hollow as shown, and is also referred as a guide member herein. A link 146 is connected at one end region to the free end of the extension 144 and at an opposite end region to a part of a clutch mechanism 148. Link 146 is a power link or chain and may be a vinyl-coated metal cord, a metal chain or other similar components.

An important feature of the invention is that the bar 142 includes a discernible bump 150. Bump 150 is an example of a deviation radially outward of a radius of curvature that the bar 140 generally follows (represented by the dotted lines in FIG. 14). The dotted lines in FIG. 14, however, represent the permitted path of the bar 140 arising from the fixed length between the roller 140 and the pivot point at which the arm 132 is attached to the frame 114. Bump 150 thereby causes the bar 142 to pivot rearward about the pivot point defined on the frame 114 as the roller 140 passes over the forward surface of the bump 150. This pivotal rearward movement causes rearward movement of extension 144, the effect of which is described below.

An energy transfer system that converts pivotal movement of the guide member (bar 142) into motive power to rotate the rear wheel 116 includes clutch mechanism 148 which is an overrunning clutch, the general design of which is known to those skilled in the transmission field. Generally, an overrunning clutch has outer and inner rings 152 and 154 (see FIG. 17). Rings 152, 154 are alternatively considered or termed races or gears, or other comparable terminology used by those in the transmission field. A drum 156 is connected to the outer ring 154. The link 146 is connected to the drum 156. Outer and inner rings 152, 154 are configured such that when outer ring 154 rotates in one direction (clockwise in the configuration shown in FIG. 14), the inner ring 152 is

12

engaged with the outer ring 154 and rotates as well in the same direction. However, when outer ring 154 rotates in the opposite direction (counterclockwise in the configuration shown in FIG. 14), the inner ring 152 is disengaged with the outer ring 154 and does not rotate.

Rotation of the inner ring 152 is transmitted to the rear wheel 116 via a main drive sprocket plate 122 which is fixed to a transmission axle 158 to which the inner ring 152 is fixed (see FIG. 17), a drive chain 124 that passes around the outer periphery of the main drive sprocket plate 122 (shown in FIG. 14 but not FIG. 17).

Clockwise rotation of the outer ring 154 is caused by pulling of the link 146, which causes the drum 156 to rotate clockwise and thus the outer ring 154 to rotate clockwise in view of its fixing to the drum 156 (see FIG. 17).

Biasing members, such as spiral torsional springs 162, are provided to cause the counterclockwise rotation of the outer ring 154 (FIG. 17).

Additional features of the clutch mechanism 148 includes a transmission main chain axis drive 164 having the transmission axle 158 located in the transmission bracket 166 and bearings 168 between an inner surface of the transmission bracket 166 and an outer surface of the transmission axle 158 to enable rotation of transmission axle 158 relative to the transmission bracket 166.

Additional features of the bicycle 110 include a set of movement limiters 170, 172, one attached to the frame 114 in a position to limit the upward movement of the arm 132 by preventing upward movement of the weight, and the other attached to the frame 114 in a position below the bar 140 to limit the downward movement of the arm 132. Each movement limiter 170, 172 may include a spring to aid the movement of the arm in the return direction.

Roller 140 and bar 142 can interact with one another in a variety of different ways with the purpose being to allow the roller 140 to roll along the bar 142. As shown in FIG. 16, the roller 140 is situated forward of the bar 142 and includes a roller pad 174 that contacts the outer surface of the bar 142 and is support on a pin or axle 176 by a bearing 178. Axle 176 is a sturdy axle which is fixed to the arm 132. As shown, the fixing structure is a flange 180 that extends through an aperture in the arm 132. Other fixing structures, e.g., a weld, adhesive, bolt, and the like, may be used in the invention. The bearing 178 is fixed on the axle 176 by supports 180. The contour of the pad 174 and the complementary contour of the bar 142 can be different from that shown in FIG. 16. The pad 174 may have a convex outer surface whereas the bar 142 is provided with a concave surface along that side which will be in contact with the pad 174.

In operation, from the state shown in FIG. 14, the rider sits on the seat and puts their feet on the pedals 138. The rider pushes one or both pedals 138 downward. As the pedal 138 moves downward, the arm 132 pivots about its pivot axis on the plate 134 and the roller 140 slides along the bar 142. Until the roller 140 reaches the bump 150, it is in a condition in which it is free-fall and is acquiring energy. That is, it is converting potential energy into kinetic energy, and the magnitude of the change in energy is increased by the presence of the weight 136.

When the roller 140 contacts the bump 150, the bar 142 is pushed rearward, pivoted counterclockwise about the pivot point at which the bar 142 is attached to the frame 114. This rearward pushing causes the extension 144 to move rearward pulling the link 146. By pulling the link 146, the outer ring 154 is rotated clockwise, and in view of the engagement of the inner ring 152 with the outer ring 154, the inner ring 152 is rotated clockwise. This causes the main

drive sprocket plate **122** to rotate clockwise, and the drive chain **124** that passes around the outer periphery of the main drive sprocket plate **122** to move and cause rotation of the rear wheel **116**.

Once the roller **140** passes by the bump **150**, it releases energy and the weight **136** or pedal **138** contacts the movement limiter **172** at the end of the downward movement. During this time, the spring returns the link **146** to the starting position. However, the inner ring **152** is not engaged with the outer ring **154**, so the counterclockwise rotation of the outer ring **154** is not transmitted to the inner ring **152**.

When the rider moves the pedal **138** upward, over the bump **150** from the bottom, the same effect occurs causing another transference of motive energy to the rear wheel **116**. The upward movement of the arm **132** is limited by movement limiter **170**.

The rider can therefore propel themselves forward using only one foot, using both feet in the same synced movement (downward at the same time and upward at the same time), or stagger movement (left foot down while right foot up, and vice versa). The rider has extreme versatility in use of the bicycle to move.

FIGS. **18** and **19** show another embodiment of the invention designated **200** with a similar drive mechanism **112** but the manner in which the drive mechanism **112** is actuated is different. Bicycle **200** includes a bar **202** is attached at a lower pivot point **212** to an extension **204** from the frame **114**. Bar **202** has a bump **206** oriented in the rearward direction, so that the roller **140** is positioned rearward of the bar **202**, and may be, but is not required to be, hollow as shown. Orientation of the bump **206** in a rearward direction means that the bump **206** projects from a virtual radius of curvature of the bar **202** rearward, or toward the center of the virtual radius of curvature.

A link **208** is attached at one end region to the upper end region **214** of the bar **202**, passes around a roller **210** attached to the frame **114** and then attaches to the drum **156**. Roller **210** is situated rearward of the bar **202**. Link **208** has characteristics similar to link **146**. Otherwise, the bicycle **200** has the same features as bicycle **110** and the same reference elements are used to designate the same components.

Operation of bicycle **200** differs from the operation of bicycle **110** in that as the pedal **138** moves downward, the arm **132** pivots about its pivot axis on the plate **134** and the roller **140** slides along a rearward surface of the bar **202**. Until the roller **140** reaches the bump **206**, it is in a condition in which it is free-fall and is acquiring energy. That is, it is converting potential energy into kinetic energy, and the magnitude of the change in energy is increased by the presence of the weight **136** attached to each pedal **138**.

When the roller **140** contacts the bump **206**, the bar **202** is pushed forward, pivoted clockwise about the pivot point at which the lower end region of the bar **202** is attached to the frame extension **204**. This forward pushing causes the upper end region of the bar **202** to move forward pulling the link **208**. By pulling the link **208**, the outer ring **154** is rotated clockwise, and in view of the engagement of the inner ring **152** with the outer ring **154**, the inner ring **152** is rotated clockwise. This causes the main drive sprocket plate **122** to rotate clockwise, and the drive chain **124** that passes around the outer periphery of the main drive sprocket plate **122** to move and cause rotation of the rear wheel **116**.

Once the roller **140** passes by the bump **206**, it releases energy and the weight **136** or pedal **138** contacts the movement limiter **172** at the end of the downward movement. During this time, the spring returns the link **206** to the

starting position. However, the inner ring **152** is not engaged with the outer ring **154**, so the counterclockwise rotation of the outer ring **154** is not transmitted to the inner ring **152**.

When the rider moves the pedal **138** upward, over the bump **206** from the bottom, the same effect occurs causing another transference of motive energy to the rear wheel **116**. The upward movement of the arm **132** is limited by movement limiter **170**.

In the embodiments described above, the left and right power stroke cycles are independent from one another. Because of this independent action, the rider can use both legs simultaneously when necessary to provide more power to the vehicle, such as, for example, when accelerating, riding uphill or carrying larger loads (e.g., passengers in a rickshaw-like configuration). Likewise, the rider may alternate between left and right leg motion such as used in a typical upright or recumbent bicycle. Finally, the vehicle of this invention may be propelled with the use of either the right or left leg in a single-stroke action.

The drive mechanism **112** described above in the bicycle **10** shown in FIGS. **1-4**, or the variant shown in FIGS. **5** and **6** can be incorporated into any type of wheeled vehicle, including a recumbent bicycle, a tricycle, etc. Different configurations of a bicycle into which drive mechanism **12** may be incorporated are disclosed in U.S. provisional patent application Ser. No. 62/288,611 filed Jan. 29, 2016, incorporated by reference herein. Also, the drive mechanism **112** may be configured to generate electricity as the inner ring **152** rotates which is stored in a battery on the bicycle **110**, **200** and then used to rotate the rear wheel **116**, in a similar manner as disclosed in the '611 application. The battery is charged whenever the inner ring **152** rotates. This electrical power is controlled by the rider or a mechanical speed regulator to provide for linear movement of the bicycle **110**, **200** in a manner known to those skilled in the art in view of the disclosure herein.

In some embodiments, the rotation of the outer ring **154** may be used by a generator on the bicycle **110**, **200** to generate electricity which is either directly used to power a motor associated with one or more of the wheels of the bicycle to provide motive power to the bicycle and/or is stored in a battery for later use. Use of a generator powered by pedal motion is disclosed in the '611 provisional application and can be applied to any of the embodiments disclosed herein.

It is possible to construct the weight/pedal assembly so that it is moved in a linear manner and the linear motion of this assembly interacting with a guide member having a bump to cause the energy transfer system to transfer energy to the rear wheel **116**. Application of linear motion instead of pivotal motion is disclosed in the '611 provisional application and can be applied to any of the embodiments disclosed herein.

While particular embodiments of the invention have been shown and described, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention in its broader aspects, and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of the invention.

The invention claimed is:

1. A vehicle, comprising:
 - a frame;
 - a seat mounted to said frame;
 - a wheel rotatably mounted on said frame; and
 - at least one drive mechanism for causing rotation of said wheel;

15

each of said at least one drive mechanism comprising:
 an arm attached at a first end region to said frame;
 a weight arranged on said arm at an opposite, second
 end region;
 a pedal attached to said weight, said pedal being
 configured such that a user of the vehicle when
 present in said seat can move said pedal and thus said
 weight and said arm;
 an elongate bar including a bump and that moves in
 conjunction with movement of said weight, said bar
 having a first end region at which said bar is pivotally
 attached to said frame and a second, opposite end
 region;
 a roller attached to said arm and movable along said bar
 during movement of said arm to cause pivoting of
 said bar as said roller engages with said bump of said
 bar; and
 an energy transfer system that converts pivotal movement
 of said bar into motive power to rotate said wheel.

2. The vehicle of claim 1, wherein said frame includes a
 downward oriented extension, said first end region of said
 bar being pivotally attached to said extension such that said
 second end region of said bar is above said first end region,
 said bump being oriented in a rearward direction such that
 said roller is positioned rearward of said bar, wherein said
 energy transfer system comprises:

an overrunning clutch mechanism having an outer ring
 and an inner ring configured such that rotation of said
 outer ring in a first direction causes rotation of said
 inner ring while rotation of said outer ring in a second,
 opposite direction does not cause rotation of said inner
 ring;

a drive chain passing around an axle of said wheel, said
 inner ring being motively coupled to said drive chain
 such that rotation of said inner ring causes movement
 of said drive chain and results in rotation of said wheel;
 and

an elongate link coupled at a first end region to said
 second end region of said bar and coupled at a second,
 opposite end region to said outer ring, pivotal move-
 ment of said bar causing pulling of said link and
 rotation of said outer ring in the first direction.

3. The vehicle of claim 2, further comprising an additional
 roller attached to said frame and over which said link passes
 between coupling to said bar and said outer ring, said energy
 transfer system further comprising a drum fixed to said outer
 ring, said second end region of said link being connected to
 said drum.

4. The vehicle of claim 2, wherein said roller is attached
 to said arm between said first and second end regions and
 moves in front of said overrunning clutch mechanism.

5. The vehicle of claim 2, further comprising an additional
 roller attached to said frame and over which said link passes
 between coupling to said bar and said outer ring.

6. The vehicle of claim 2, wherein said energy transfer
 system further comprises a drum fixed to said outer ring,
 said second end region of said link being connected to said
 drum.

7. The vehicle of claim 1, wherein said at least one drive
 mechanism comprises a pair of drive mechanisms, one
 arranged on each of a left side and a right side of the vehicle
 which are on opposite lateral sides of said frame, further
 comprising an axle extending through said arm at said
 second end region, said pedal and said weight being con-
 nected to said axle and positioned on opposite lateral sides
 of said arm.

16

8. The vehicle of claim 1, wherein said energy transfer
 system includes an overrunning clutch mechanism having an
 outer ring and an inner ring configured such that rotation of
 said outer ring in a first direction causes rotation of said
 inner ring while rotation of said outer ring in a second,
 opposite direction does not cause rotation of said inner ring,
 a drive chain passing around an axle of said wheel, said inner
 ring being motively coupled to said drive chain such that
 rotation of said inner ring causes movement of said drive
 chain and results in rotation of said wheel, and an elongate
 link coupled at a first end region to said second end region
 of said bar and coupled at a second, opposite end region to
 said outer ring, pivotal movement of said bar causing pulling
 of said link and rotation of said outer ring in the first
 direction.

9. The vehicle of claim 8, where said energy transfer
 system further comprises a drum fixed to said outer ring to
 which said second end region of said link is connected, a
 transmission axle to which said inner ring is fixed, and a
 main drive sprocket plate fixed to said transmission axle,
 said drive chain passing around an outer periphery of said
 main drive sprocket plate, and wherein each of said at least
 one drive mechanism further comprises at least one biasing
 member that biases said outer ring to rotate in the second
 direction, said at least one biasing member being arranged in
 connection with said transmission axle.

10. The vehicle of claim 1, wherein said roller comprises
 a roller pad contacting an outer surface of said bar and a
 bearing, the vehicle further comprising a pin fixed to said
 arm and around which said bearing is arranged, said roller
 pad having an outer surface complementary to an outer
 surface of said bar.

11. The vehicle of claim 1, wherein said pedal is movable
 in opposite directions in a non-circular, arcuate path between
 end positions.

12. The vehicle of claim 1, wherein said pedal is movable
 in opposite directions along a straight path.

13. The vehicle of claim 1, wherein said first end region
 of said bar is an upper end region and said second end region
 of said bar is a lower end region below said upper end
 region, said bump being between said upper and lower end
 regions, said roller passing over said bump in its downward
 movement from said upper end region to said lower end
 region and also passing over said bump in its upward
 movement from said lower end region to said upper end
 region.

14. The vehicle of claim 1, wherein said bump is between
 said first and second end regions of said bar.

15. A vehicle, comprising:

a frame;
 a seat mounted to said frame;
 a wheel rotatably mounted on said frame; and
 at least one drive mechanism for causing rotation of said
 wheel;

each of said at least one drive mechanism comprising:
 an arm attached at a first end region to said frame;
 a weight arranged on said arm at an opposite, second
 end region;
 a pedal attached to said weight, said pedal being
 configured such that a user of the vehicle when
 present in said seat can move said pedal and thus said
 weight and said arm;
 a guide member including a bump and that moves in
 conjunction with movement of said weight, said
 guide member having a first end region at which said
 guide member is pivotally attached to said frame and
 a second, opposite end region;

a roller attached to said arm and movable along said guide member during movement of said arm to cause pivoting of said guide member as said roller engages with said bump of said guide member; and
 an energy transfer system that converts pivotal movement of said guide member into motive power to rotate said wheel,
 wherein said arm is elongate and said first end region of said arm is attached to said frame at a location rearward of said guide member, and
 wherein said second end region of said arm, said weight and said pedal are at a location in front of said guide member such that said arm extends to both sides of said guide member.

16. A vehicle, comprising:
 a frame;
 a seat mounted to said frame;
 a wheel rotatably mounted on said frame; and
 at least one drive mechanism for causing rotation of said wheel;
 each of said at least one drive mechanism comprising:
 an arm attached at a first end region to said frame;
 a weight arranged on said arm at an opposite, second end region;
 a pedal attached to said weight, said pedal being configured such that a user of the vehicle when present in said seat can move said pedal and thus said weight and said arm;
 a guide member including a bump and that moves in conjunction with movement of said weight, said guide member having a first end region at which said guide member is pivotally attached to said frame and a second, opposite end region;
 a roller attached to said arm and movable along said guide member during movement of said arm to cause pivoting of said guide member as said roller engages with said bump of said guide member; and
 an energy transfer system that converts pivotal movement of said guide member into motive power to rotate said wheel,
 wherein said arm is elongate and said arm is attached to said frame at a location in front of said seat, and
 wherein said second end region of said arm, said weight and said pedal are at a location below said first end region of said arm and in front of said seat such that said arm, said weight, said pedal, said guide member and said roller are in front of said seat.

17. The vehicle of claim 1, wherein said frame includes a downward oriented extension, said first end region of said bar being pivotally attached to said extension such that said second end region of said bar is above said first end region, said bump being oriented in a rearward direction such that said roller is positioned rearward of said bar.

18. The vehicle of claim 1, wherein said at least one drive mechanism comprises a pair of drive mechanisms, one arranged on each of a left side and a right side of the vehicle which are on opposite lateral sides of said frame.

19. The vehicle of claim 1, wherein said energy transfer system comprises an overrunning clutch mechanism having an outer ring and an inner ring configured such that rotation of said outer ring in a first direction causes rotation of said

inner ring while rotation of said outer ring in a second, opposite direction does not cause rotation of said inner ring, and an elongate link coupled at a first end region to said second end region of said bar and coupled at a second, opposite end region to said outer ring, pivotal movement of said bar causing pulling of said link and rotation of said outer ring in the first direction.

20. A vehicle, comprising:
 a frame;
 a pedal slider bracket connected to said frame and projecting forward from a front of said frame;
 a seat arranged on said frame;
 a backrest arranged on said frame, said frame being configured to enable a rider to sit on said seat and rest their back on said backrest whereby the vehicle is a recumbent bicycle;
 a wheel rotatably mounted on said frame;
 a weight mounted to said frame for movement between first and second positions;
 a pedal attached to said weight, said pedal being configured such that a user of the vehicle when present in said seat can move said pedal and thus said weight;
 a guide member that moves in conjunction with movement of said weight and includes a bump and a ratchet portion;
 an energy transfer system coupled to said guide member and that converts movement of said guide member into motive power to rotate said wheel only when said weight moves in a direction from said first position to said second position and not when said weight moves in a direction from said second position to said first position, said energy transfer system comprising a hammer handle having an upper end region connected to said pedal slider bracket and an opposite, lower free end region, said weight being arranged at the opposite, lower free end region such that said weight swings between said first and second positions; and
 a roller that couples said hammer handle to said guide member to enable said guide member to move in conjunction with swinging movement of said weight between said first and second positions,
 said energy transfer system comprising:
 a gear engaging with said ratchet portion,
 a main drive chain connected to said wheel,
 a main drive sprocket wheel that rotates said main drive chain and thus said wheel,
 an overrunning clutch having an outer ring and an inner ring that selectively connects to said outer ring only when said weight moves from said first position to said second position and not when said weight moves from said second position to said first position, and
 a secondary drive chain connected to said main drive sprocket wheel and moved upon rotation of said inner ring,
 said overrunning clutch being configured to connect said outer ring to said inner ring only when said gear rotates in one direction and not when said gear rotates in an opposite direction such that rotation of said gear causes rotation of said secondary drive chain leading to rotation of said main drive sprocket wheel and said wheel.