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The Director

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Therefore, this United States

Patent

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Katherine Kelly Vidal



DIRECTOR OF THE UNITED STATES PATENT AND TRADEMARK OFFICE

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If the application for this patent was filed on or after June 8, 1995, the term of this patent begins on the date on which this patent issues and ends twenty years from the filing date of the application or, if the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121, 365(c), or 386(c), twenty years from the filing date of the earliest such application (“the twenty-year term”), subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b), and any extension as provided by 35 U.S.C. 154(b) or 156 or any disclaimer under 35 U.S.C. 253.

If this application was filed prior to June 8, 1995, the term of this patent begins on the date on which this patent issues and ends on the later of seventeen years from the date of the grant of this patent or the twenty-year term set forth above for patents resulting from applications filed on or after June 8, 1995, subject to the payment of maintenance fees as provided by 35 U.S.C. 41(b) and any extension as provided by 35 U.S.C. 156 or any disclaimer under 35 U.S.C. 253.



US011718365B2

(12) **United States Patent**
Kipnis

(10) **Patent No.:** **US 11,718,365 B2**

(45) **Date of Patent:** **Aug. 8, 2023**

(54) **VEHICLE WITH PEDALS MOVABLE ALONG SLIDERS**

(56) **References Cited**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 379 days.

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)

(21) Appl. No.: **17/133,888**

(22) Filed: **Dec. 24, 2020**

(65) **Prior Publication Data**

US 2021/0171152 A1 Jun. 10, 2021

Related U.S. Application Data

(60) Division of application No. 16/072,211, filed as application No. PCT/US2017/015596 on Jan. 30, (Continued)

(51) **Int. Cl.**
B62M 1/24 (2013.01)
B62M 1/28 (2013.01)
(Continued)

(52) **U.S. Cl.**
CPC **B62M 1/24** (2013.01); **B62M 1/28** (2013.01); **B62M 1/30** (2013.01); **B62M 1/32** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC . B62M 1/24; B62M 1/28; B62M 1/30; B62M 1/32; B62M 6/00; B62M 9/02;
(Continued)

OTHER PUBLICATIONS

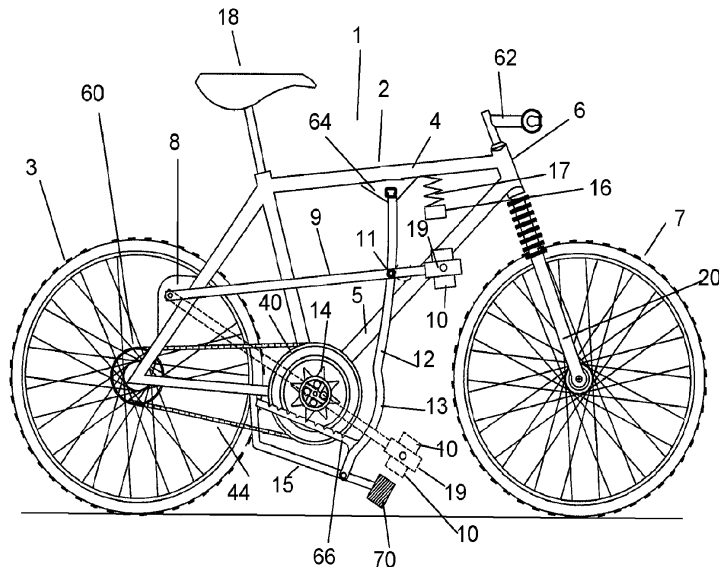
Search Report and Written Opinion for International Application No. PCT/US17/015596 dated May 26, 2017.
(Continued)

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(57) **ABSTRACT**

Vehicle includes a frame, a seat arranged on the frame, a wheel rotatably mounted on the frame, an elongate directional slider, a pedal on the directional slider that slides between first and second positions, a main drive chain connected to the first wheel, a main drive sprocket that rotates the main drive chain and thus the first wheel, a flywheel that rotates the main drive sprocket, and an energy generating system that converts sliding of the pedal on the directional slider into rotational force to rotate the flywheel. The energy generating system may include a first electrical coil assembly connected to the pedal, a second electrical coil assembly in connection with the directional slider and that cooperates with the first electrical coil assembly to cause generation of electricity, and an electrical motor that is powered by the generated electricity and is coupled to the flywheel to rotate the flywheel.

20 Claims, 11 Drawing Sheets



Related U.S. Application Data

2017, now Pat. No. 10,875,599, and a continuation-in-part of application No. 15/412,962, filed on Jan. 23, 2017, now Pat. No. 10,167,046.

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

(51) **Int. Cl.**

B62M 1/30 (2013.01)
B62M 1/32 (2013.01)
B62M 6/00 (2010.01)
B62M 23/00 (2006.01)
B62M 9/02 (2006.01)
B62K 3/00 (2006.01)
B62M 6/55 (2010.01)
B62M 6/90 (2010.01)

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

CPC **B62M 6/00** (2013.01); **B62M 9/02** (2013.01); **B62M 23/00** (2013.01); **B62K 3/005** (2013.01); **B62M 6/55** (2013.01); **B62M 6/90** (2013.01)

(58) **Field of Classification Search**

CPC B62M 23/00; B62M 6/55; B62M 6/90; B62K 3/005

See application file for complete search history.

(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 Seol
 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
 5,035,417 A * 7/1991 Ross A63B 22/0605
 74/48
 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.
 6,699,161 B1 * 3/2004 Speas B62M 9/00
 482/61
 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
 7,946,963 B1 * 5/2011 Schreiner A63B 23/03575
 280/223
 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 et al.
 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 et al.
 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
 2007/0085297 A1 * 4/2007 Eugene Cruft B62M 1/24
 280/252
 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
 2016/0046351 A1 * 2/2016 Thomas A63B 21/227
 482/57
 2016/0159435 A1 * 6/2016 Yehuda B62M 9/00
 180/220
 2016/0310786 A1 * 10/2016 Prosnitz B62M 1/26
 2017/0217536 A1 8/2017 Kipnis
 2017/0368409 A1 * 12/2017 Felker B62K 21/125

FOREIGN PATENT DOCUMENTS

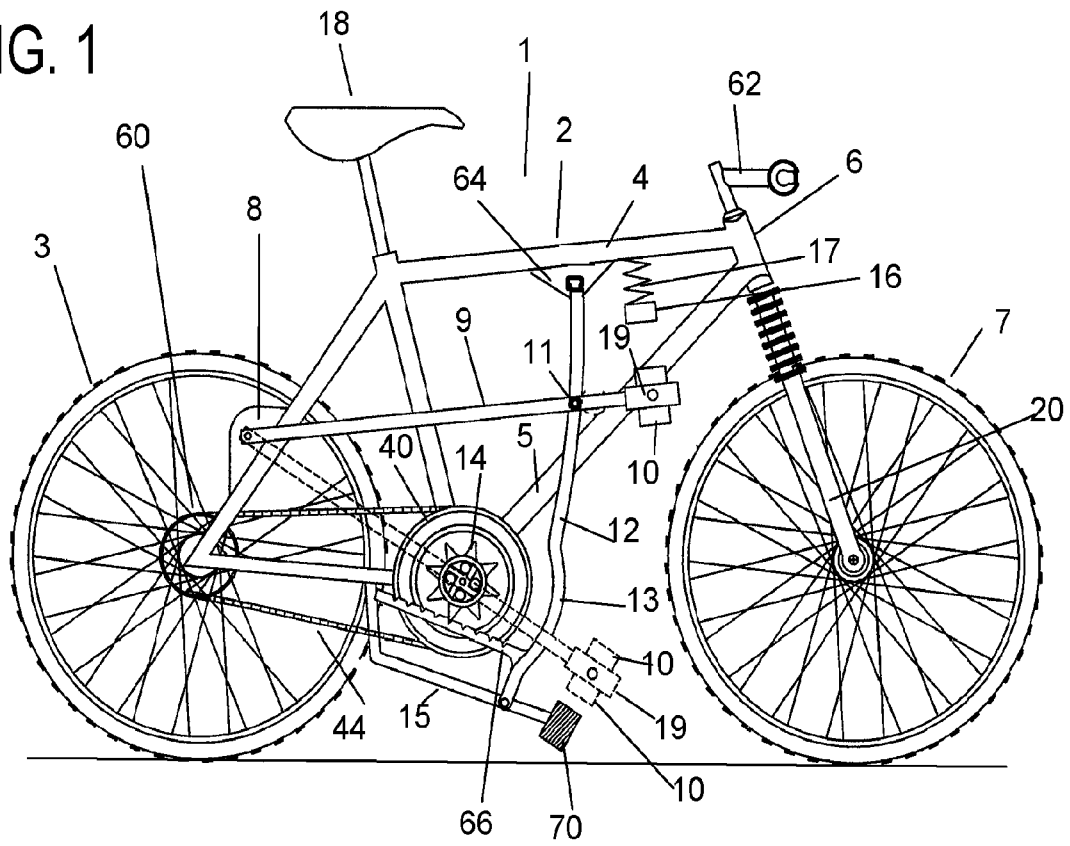
WO 2006002577 A1 1/2006
 WO 2006059003 A1 6/2006
 WO 2010084363 A1 7/2010
 WO 2014021702 A 2/2014
 WO 2017132658 A1 8/2017

OTHER PUBLICATIONS

Partial Supplementary European Search Report 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



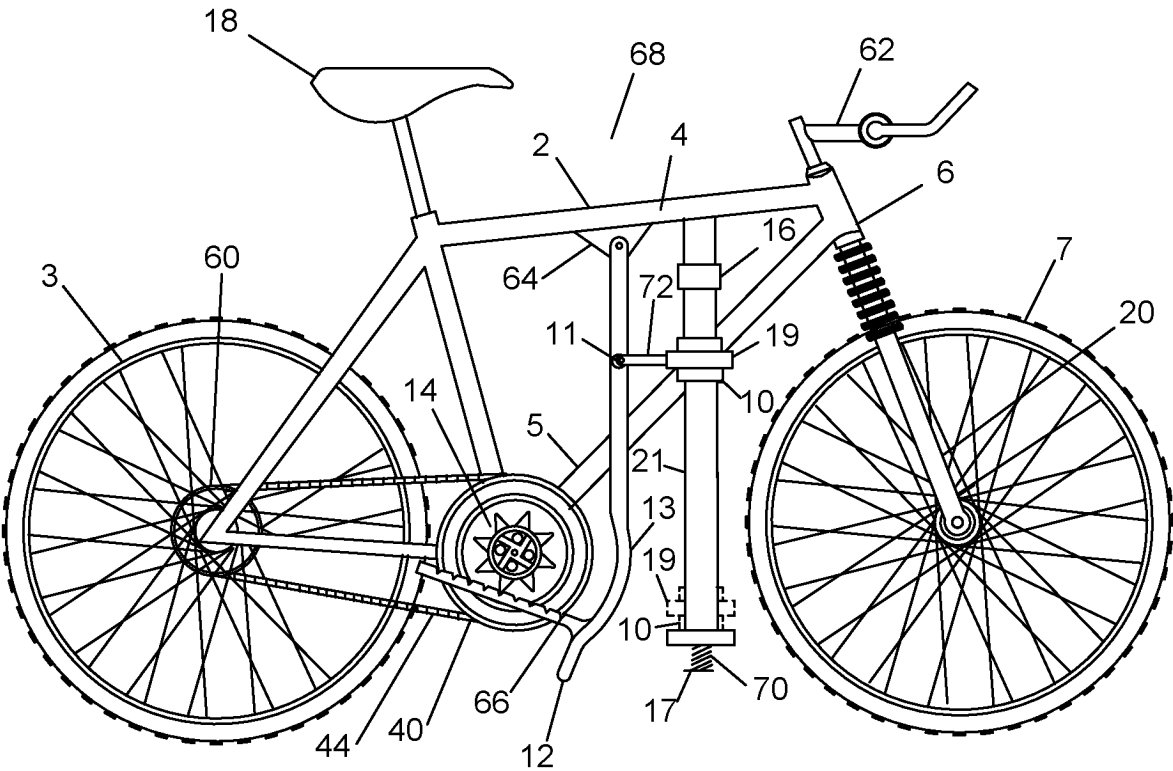


FIG. 2

FIG. 3

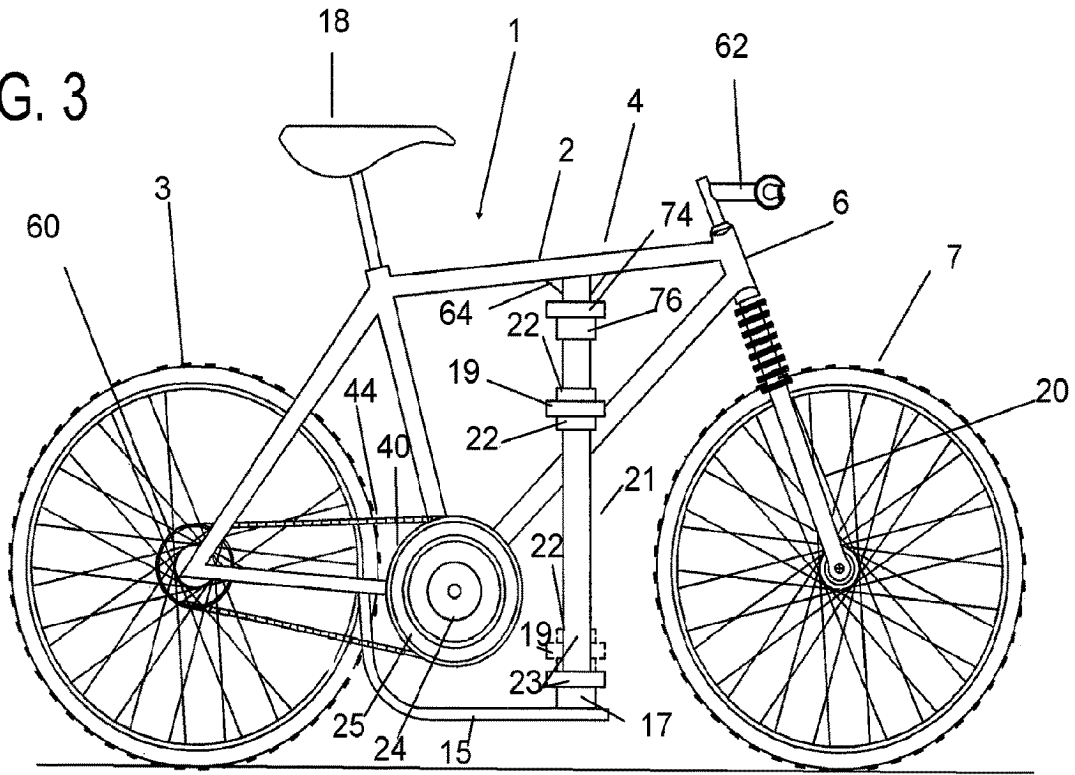
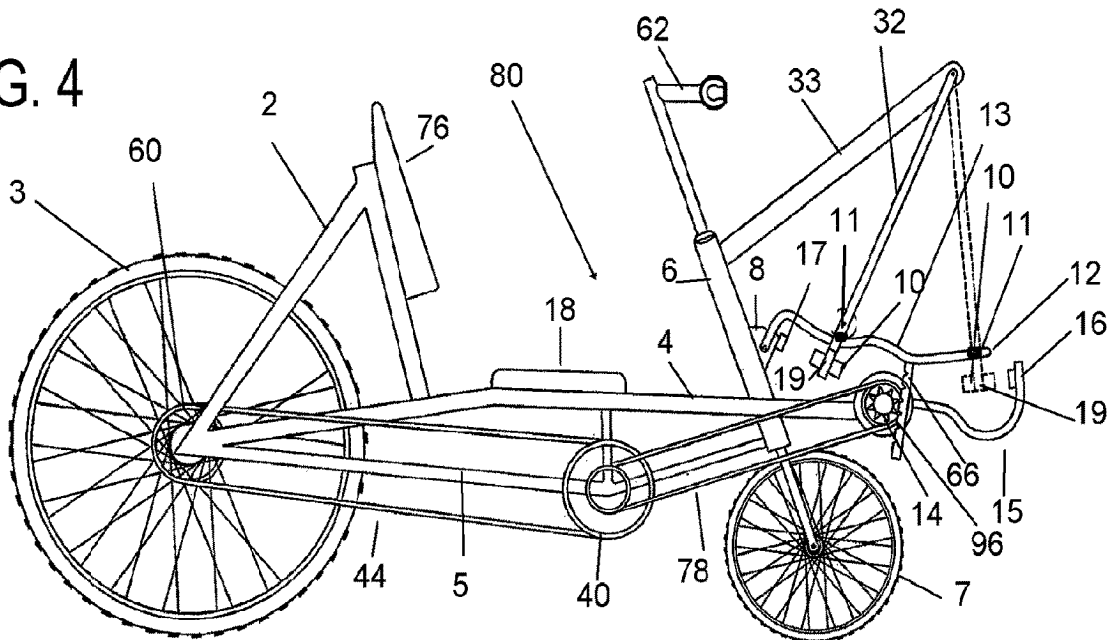


FIG. 4



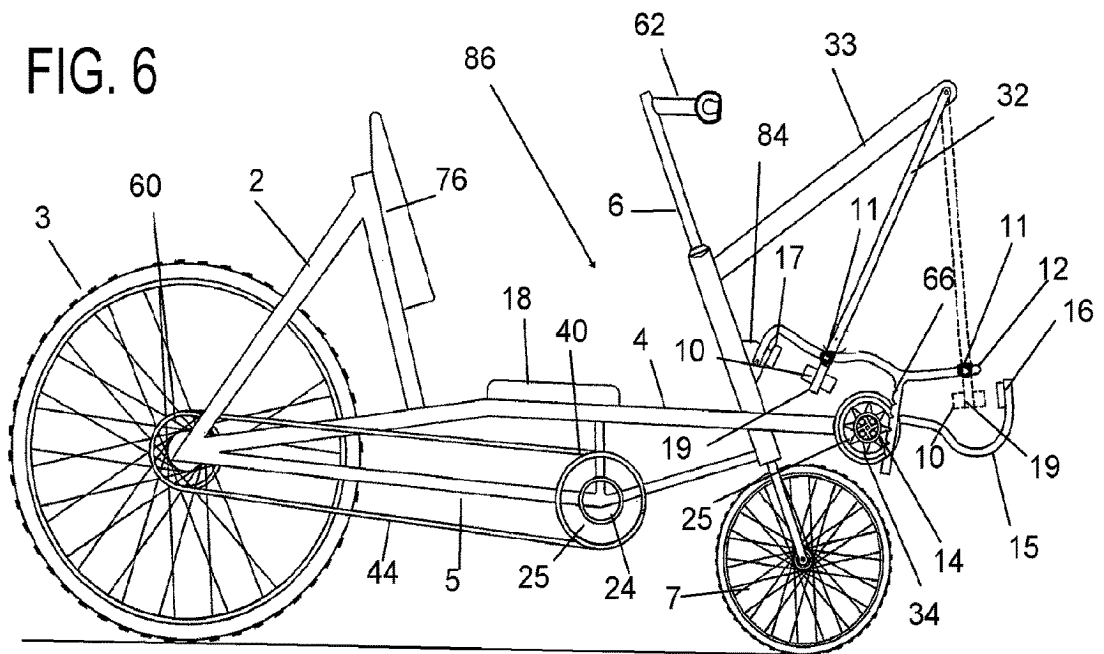
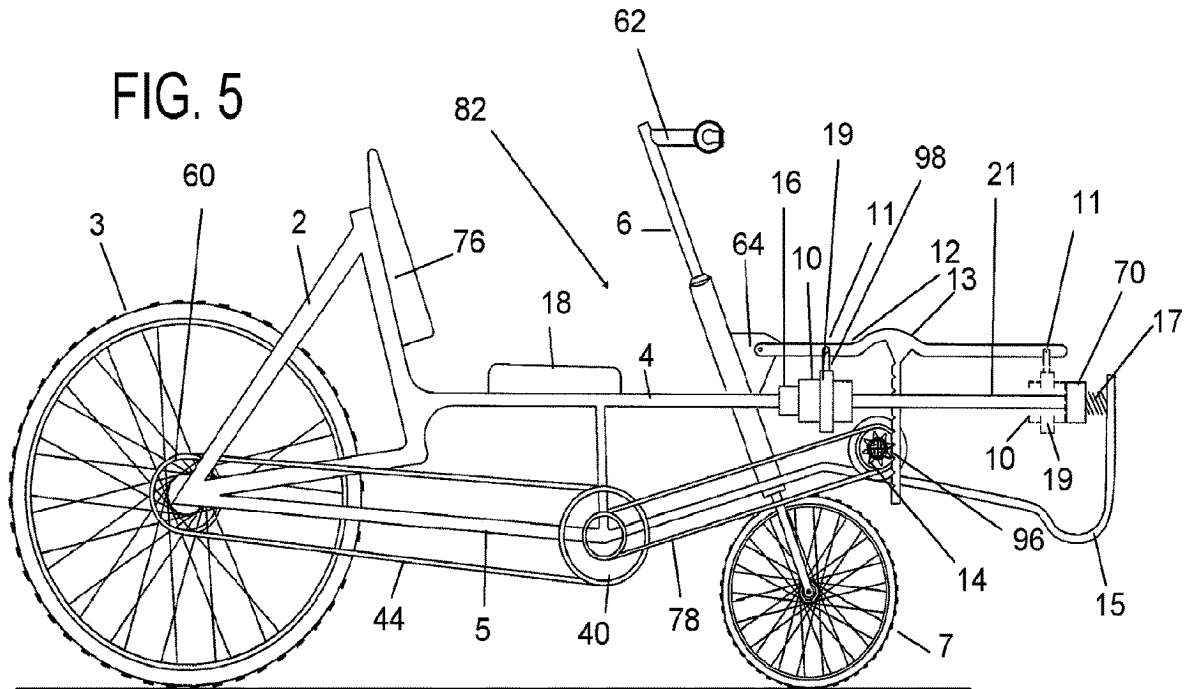


FIG. 7

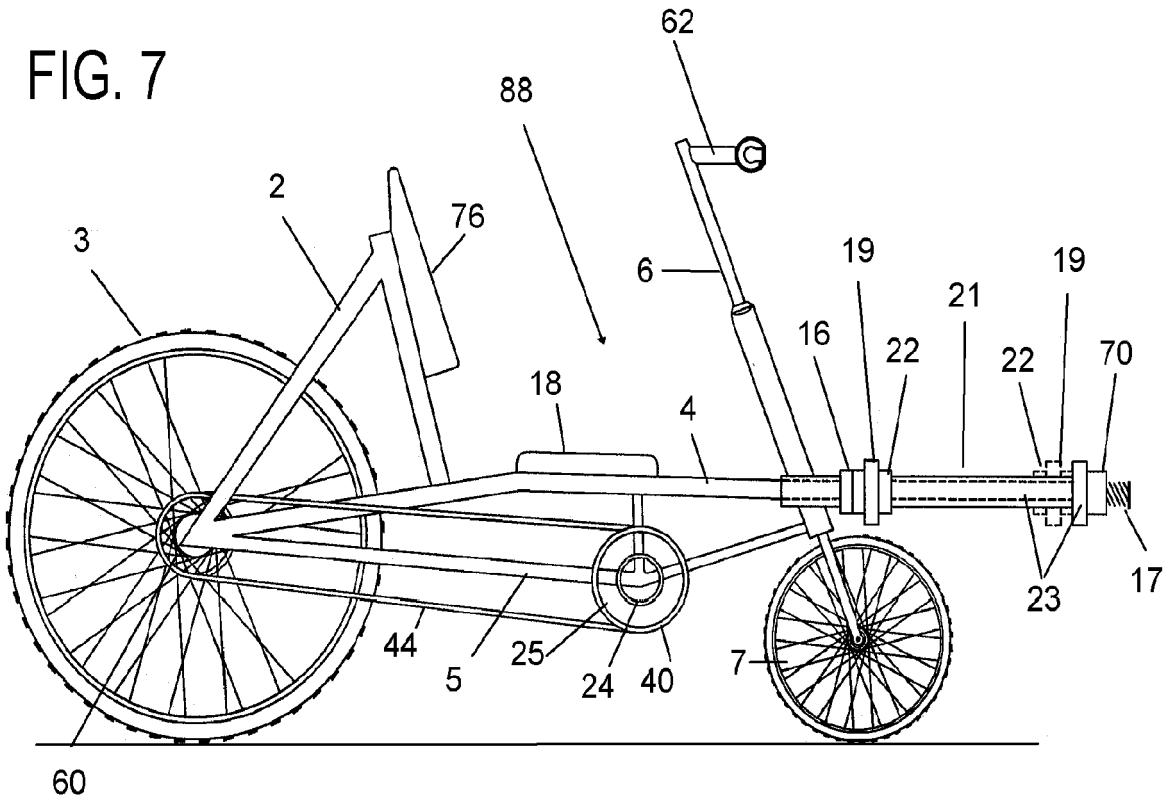


FIG. 8

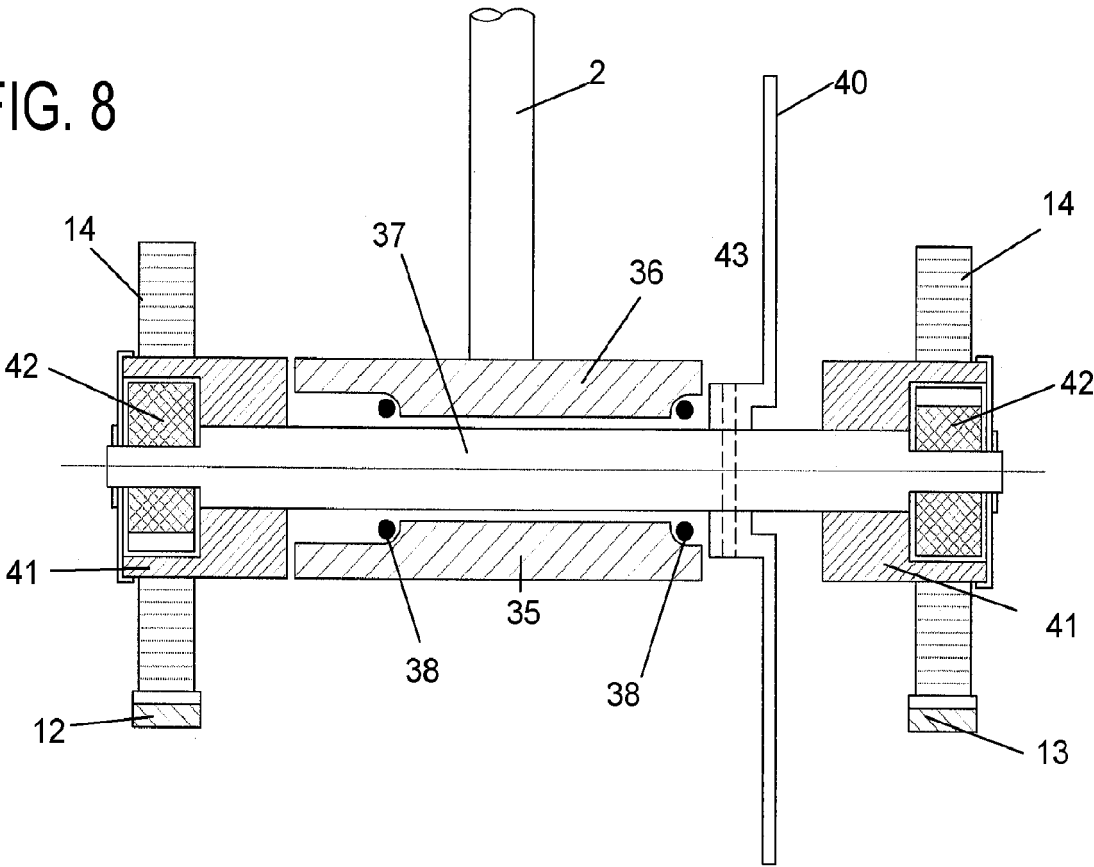


FIG. 9

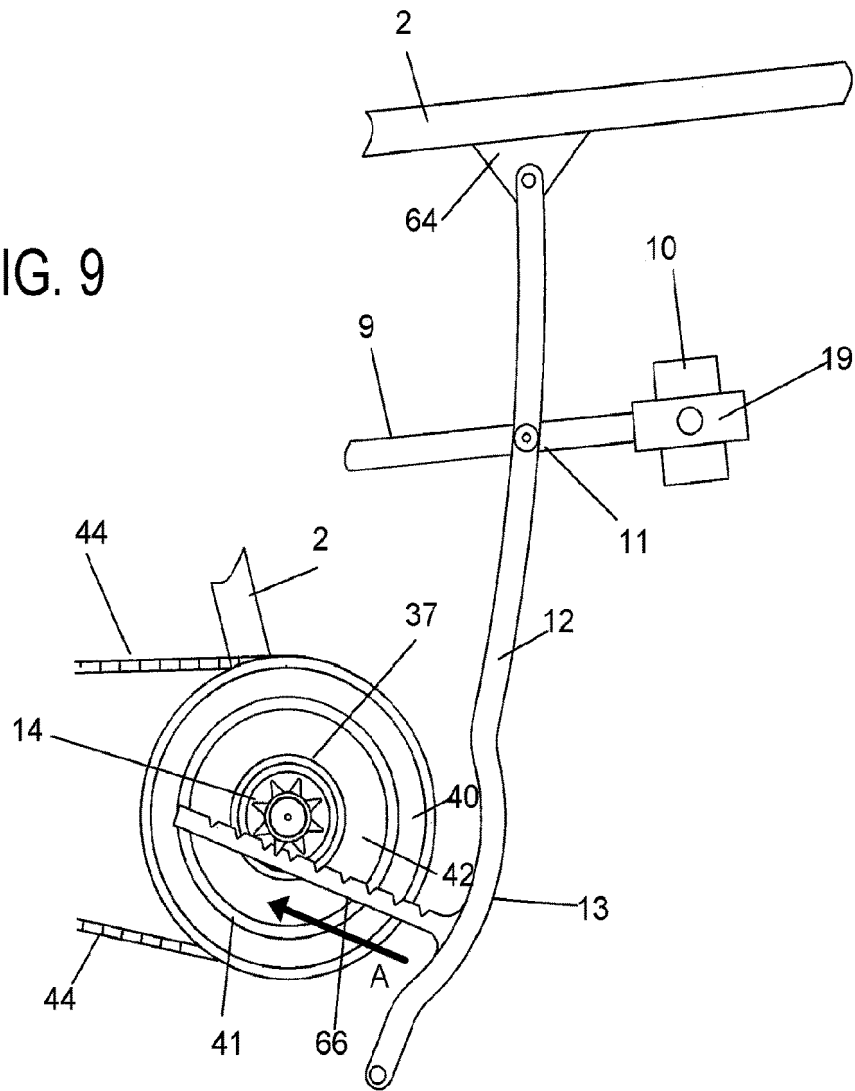


FIG. 10

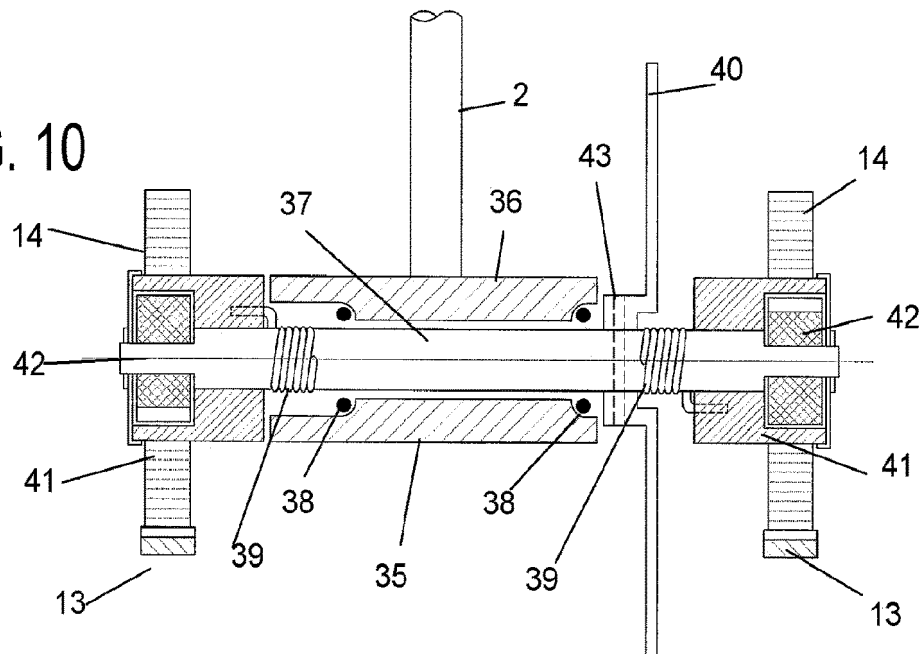


FIG. 11

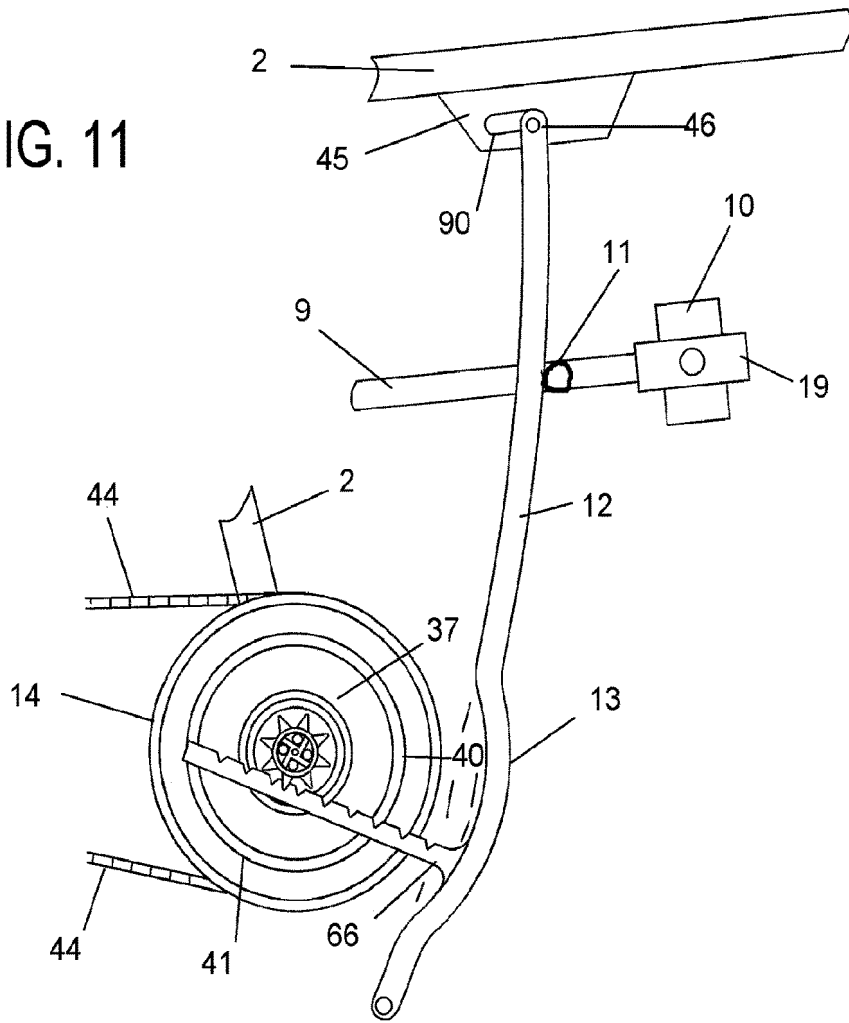


FIG. 12

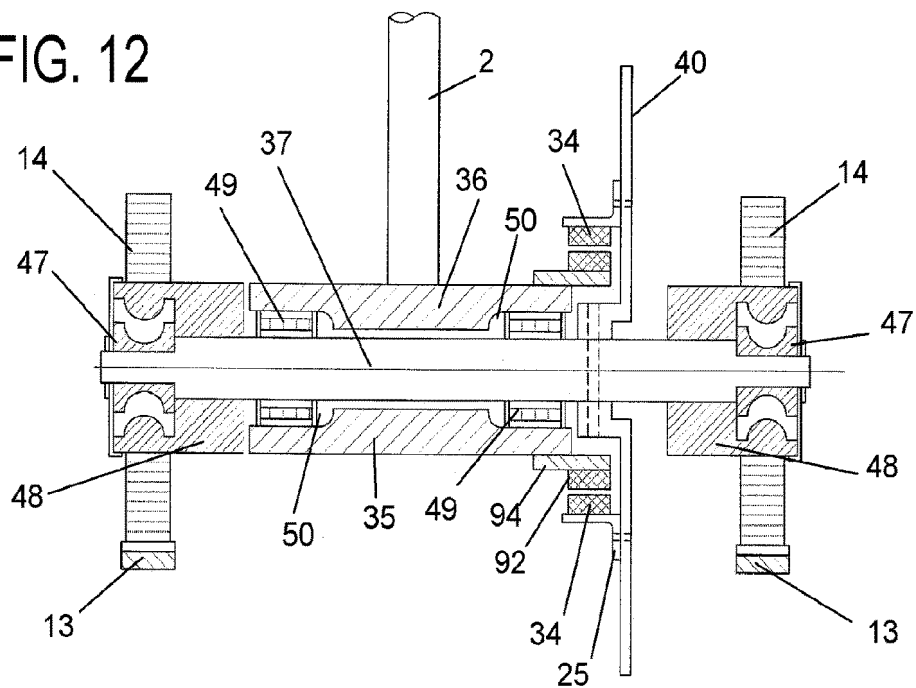


FIG. 13

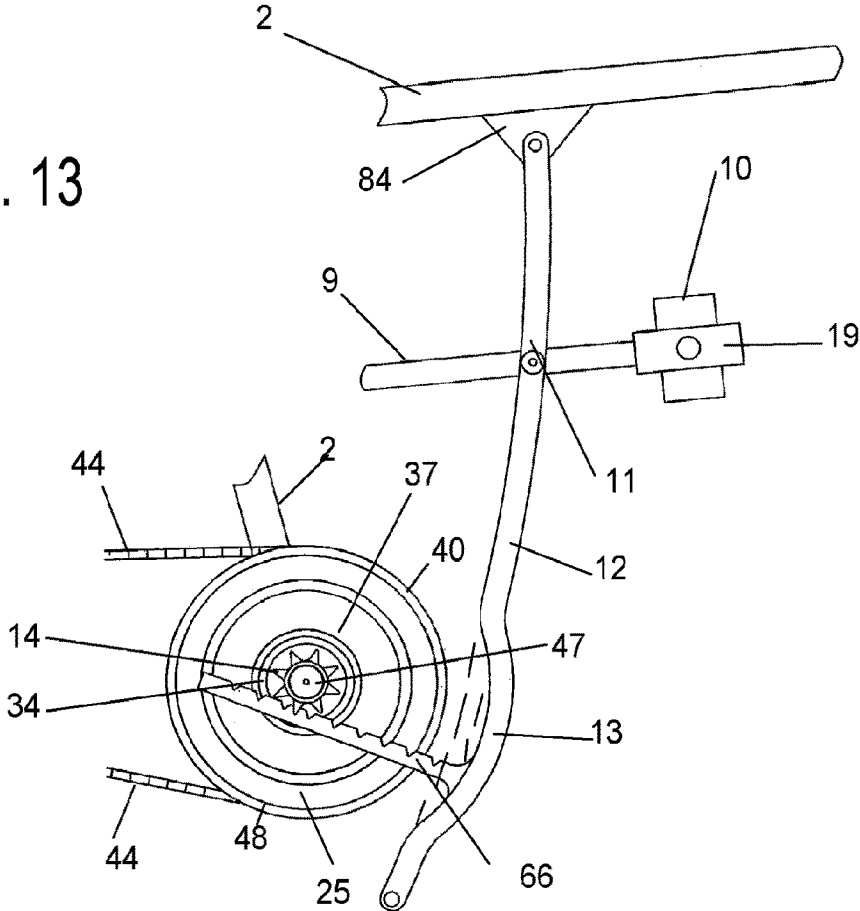


FIG. 14

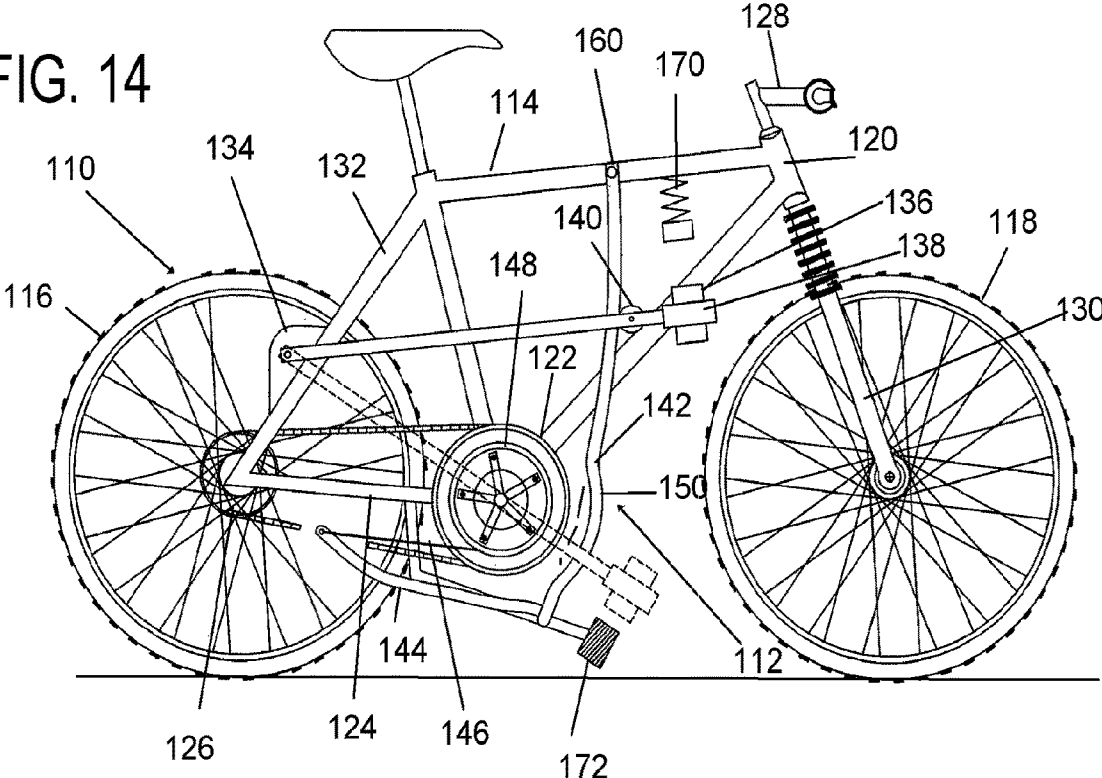


FIG. 15

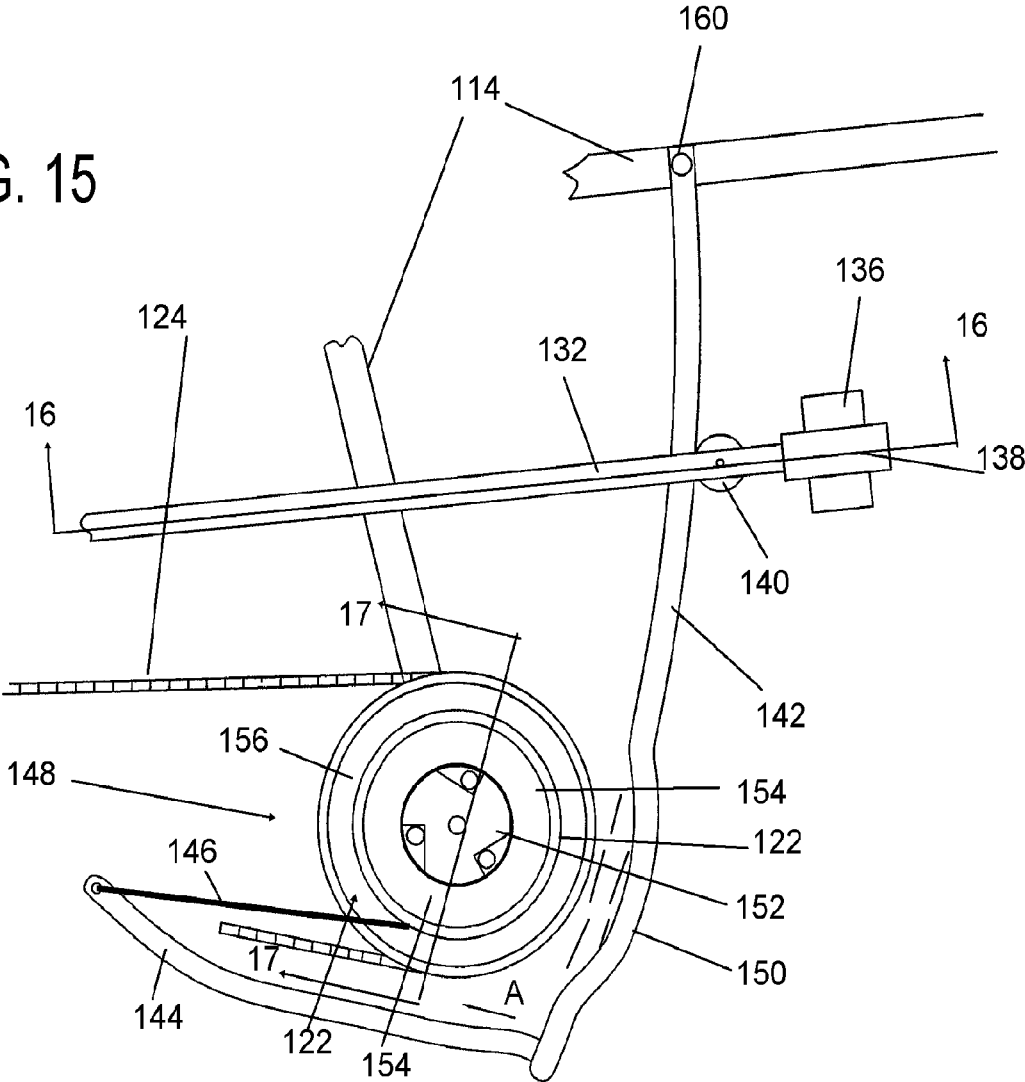


FIG. 19

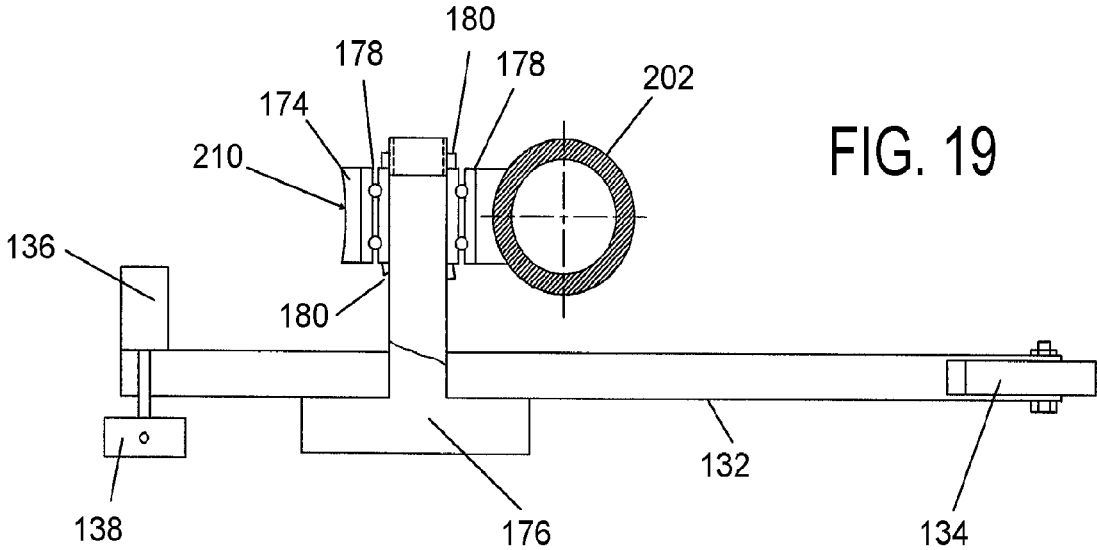


FIG. 16

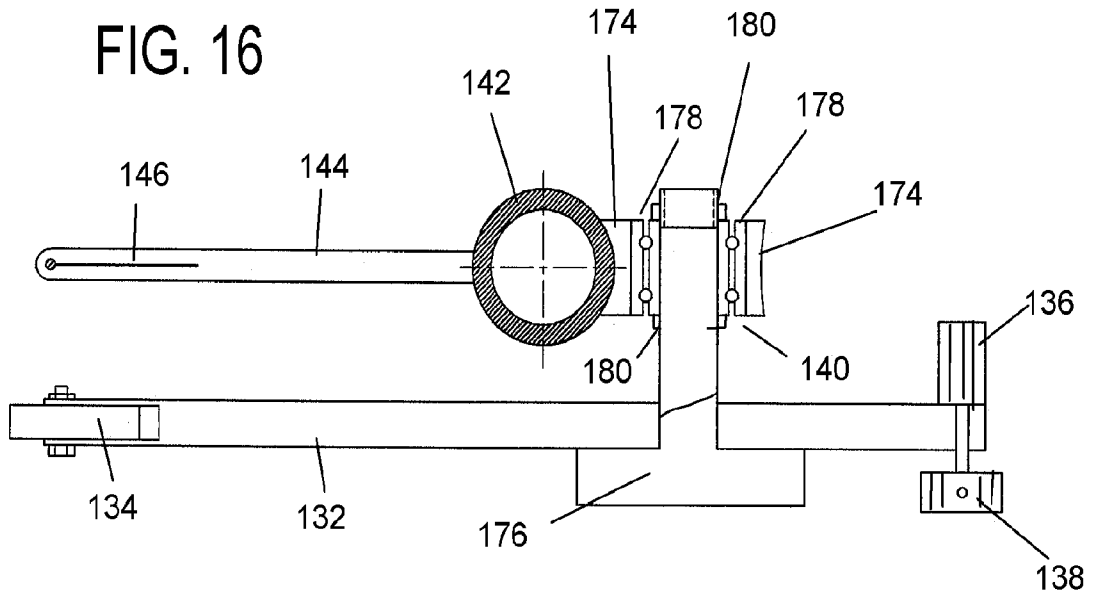


FIG. 17

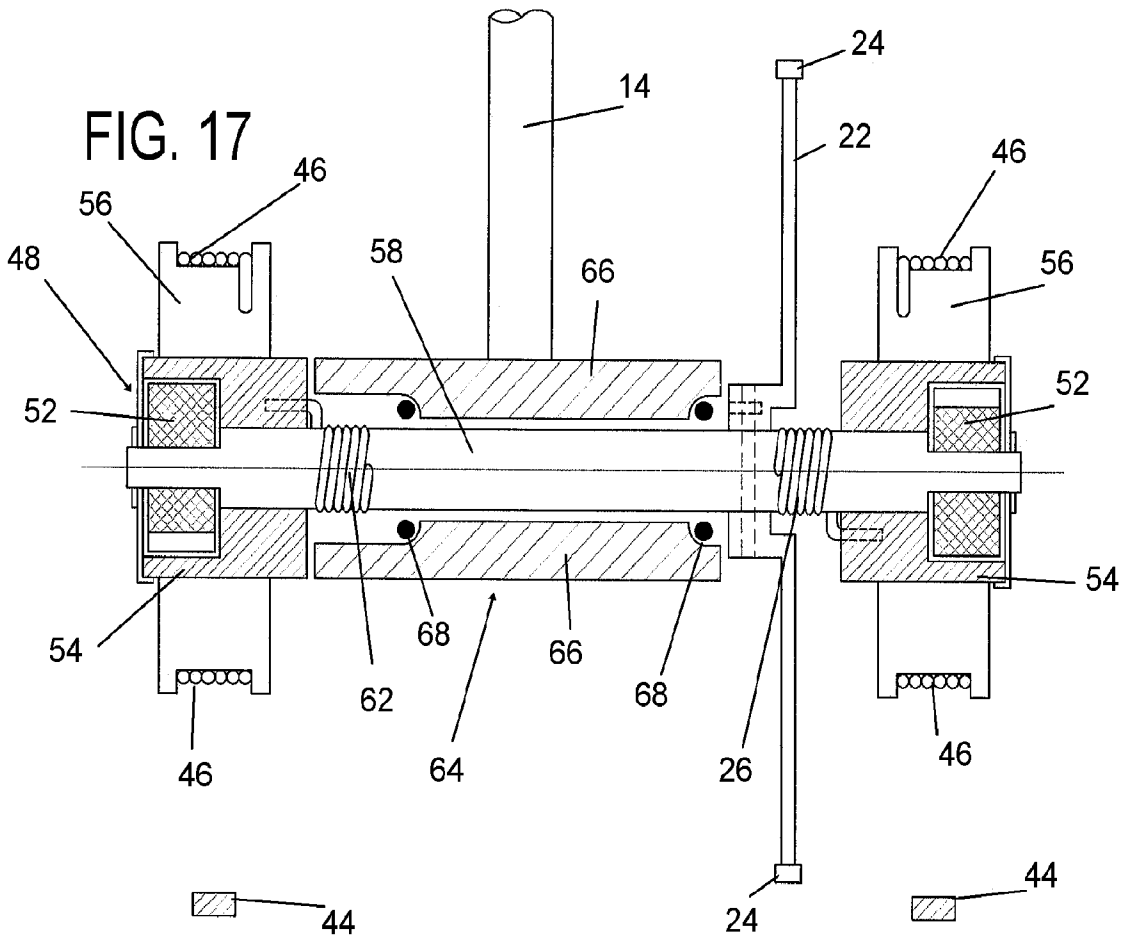
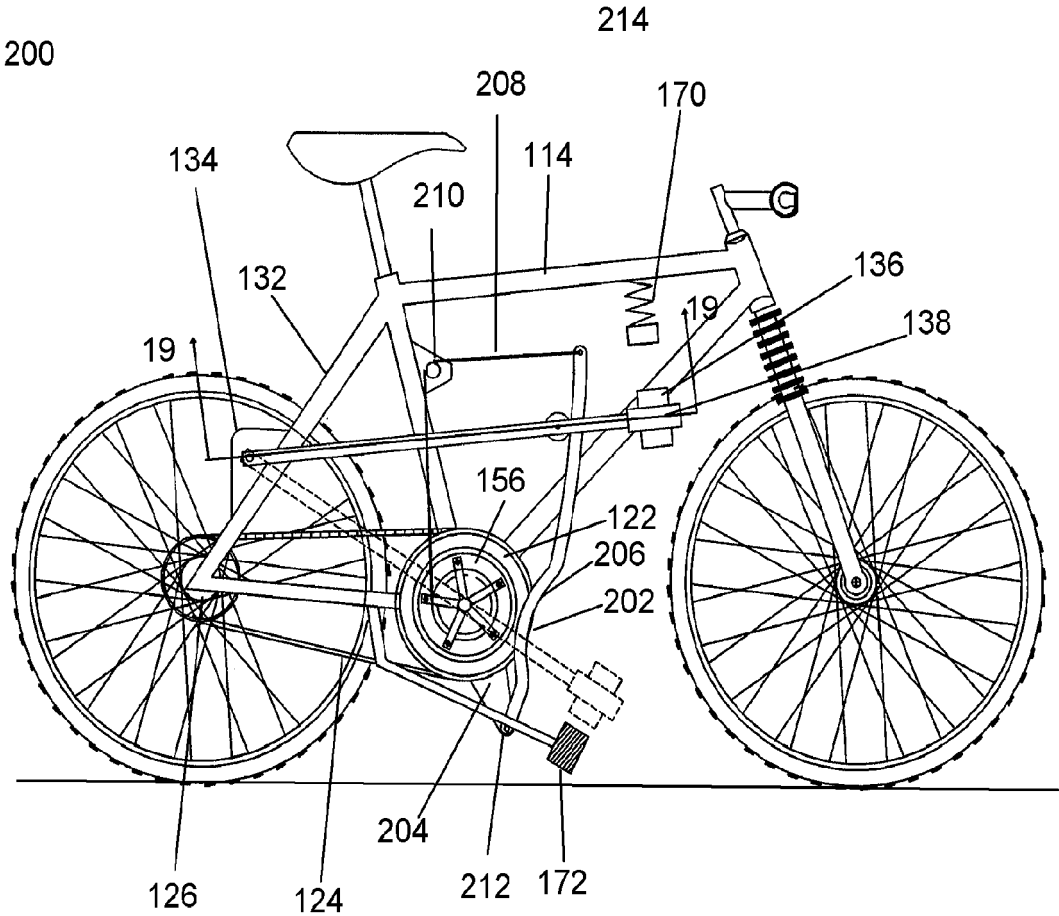


FIG. 18



1

VEHICLE WITH PEDALS MOVABLE ALONG SLIDERS

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a divisional of U.S. patent application Ser. No. 16/072,211 filed Jul. 24, 2018, now U.S. Pat. No. 10,875,599, which is a National Stage of International Application No. PCT/US17/15596 filed Jan. 30, 2017 which claims priority of U.S. provisional patent application Ser. No. 62/288,611 filed Jan. 29, 2016, and U.S. patent application Ser. No. 15/412,962 filed Jan. 23, 2017, now U.S. Pat. No. 10,167,046, all of which are incorporated by reference herein.

FIELD OF THE INVENTION

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 overruning 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 THE 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.

SUMMARY OF THE INVENTION

A vehicle in accordance with the invention includes a frame, a seat arranged on the frame, a wheel rotatably mounted on the frame, an elongate directional slider, a pedal on the directional slider that slides between first and second positions, a main drive chain connected to the first wheel, a main drive sprocket that rotates the main drive chain and thus the first wheel, a flywheel that rotates the main drive sprocket, and an energy generating system that converts sliding of the pedal on the directional slider into rotational force to rotate the flywheel.

The energy generating system may include a first electrical coil assembly connected to the pedal, a second electrical coil assembly in connection with the directional slider and that cooperates with the first electrical coil assembly to cause generation of electricity, and an electrical motor that is powered by the generated electricity and is coupled to the flywheel to rotate the flywheel. Wires may be used to convey electricity to the motor, which is as such, or otherwise, electrically coupled to the flywheel.

An additional directional slider may be provided on an opposite side of the frame from a side on which the directional slider is situated, and an additional pedal provided on the additional directional slider that slides between first and second positions. The energy generating system converts sliding of the additional pedal on the additional directional slider into rotational force to rotate the flywheel. In this case, the energy generating system includes a first

2

electrical coil assembly connected to the pedal, a second electrical coil assembly in connection with the directional slider and that cooperates with the first electrical coil assembly to cause generation of electricity, a third electrical coil assembly connected to the additional pedal, a fourth electrical coil assembly in connection with the additional directional slider and that cooperates with the third electrical coil assembly to cause generation of electricity, and an electrical motor that is powered by the generated electricity and is coupled to the flywheel to rotate the flywheel. Movement of the pedal on the directional slider is independent of movement of the additional pedal on the additional directional slider.

The directional slider may be vertically oriented on the frame such that the pedal is movable in a vertical, linear movement. In this case, the vehicle optionally includes a spring at a top of the directional slider in an upward path of the pedal to limit upward movement of the pedal on the directional slider and/or a spring at a bottom of the directional slider in a downward path of the pedal to limit downward movement of the pedal on the directional slider. Each spring or both springs may be a reciprocating electrical spring that generates electrical power and returns force at the same time, the spring being part of the energy generating system. An additional spring may be provided at the bottom of the directional slider below the spring and which is attached to the frame.

The vehicle may include an additional wheel in front of the wheel such that the additional wheel is a front wheel of the vehicle and the wheel is a rear wheel of the vehicle. The directional slider is situated between the front and rear wheels. A seat is provided rearward of the directional slider and a handlebar in front of the directional slider.

In another embodiment, the directional slider is horizontally oriented on the frame such that the pedal is movable in a horizontal, linear movement. The vehicle may include an additional wheel in front of the wheel such that the additional wheel is a front wheel of the vehicle and the wheel is a rear wheel of the vehicle. In this case, the directional slider is preferably situated at least partly over the front wheel. A seat is rearward of the directional slider and a handlebar in front of the directional slider, with the seat including a backrest. Optionally, a first spring is at a front of the directional slider in a forward path of the pedal to limit forward movement of the pedal on the directional slider, and a second spring is at a rear of the directional slider in a rearward path of the pedal to limit rearward movement of the pedal on the directional slider.

BRIEF DESCRIPTION OF THE 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.

3

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.

DETAILED DESCRIPTION OF THE 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,

4

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 jointed 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

5

following gear 14. Springs 16 and 17 are positioned on the underside of the top tube 4 to first limit the upward movement 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

6

slider 21 being shown in dotted lines. Pedal 19 is attached to the weight 10 for movement along with the weight 10, and 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 causes 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 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 **76** 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 **76** and aids the function of spring **76**. 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, 17, 74, 76** may be reciprocating electrical springs that generate electrical power and returning force at the same time. In this case, the springs **15, 17, 74, 76** 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

11

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

12

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,

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

13

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 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

14

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.

15

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;

16

- a seat on said frame;
- a wheel rotatably mounted on said frame;
- an elongate directional slider;
- a pedal on said directional slider that slides between first and second positions;
- a main drive chain connected to said first wheel;
- a main drive sprocket that rotates said main drive chain and thus said first wheel;
- a flywheel that rotates said main drive sprocket; and
- an energy generating system that converts sliding of said pedal on said directional slider into rotational force to rotate said flywheel,

said energy generating system comprising:

- a first electrical coil assembly in connection with said pedal;
- a second electrical coil assembly in connection with said directional slider and that cooperates with said first electrical coil assembly to cause generation of electricity; and
- an electrical motor that is powered by the generated electricity and is coupled to said flywheel to rotate said flywheel.

2. The vehicle of claim 1, wherein said energy generating system further comprises wires to convey the generated electricity to said electrical motor.

3. The vehicle of claim 1, wherein said electrical motor is electrically coupled to said flywheel.

4. The vehicle of claim 1, further comprising:

- an additional directional slider on an opposite side of said frame from a side on which said directional slider is situated, said additional directional slider having one end region connected to said frame and an opposite, free end region; and
- an additional pedal on said additional directional slider that slides between first and second positions,
- said energy generating system converting sliding of said additional pedal on said additional directional slider into rotational force to rotate said flywheel.

5. The vehicle of claim 4, wherein said energy generating system further comprises:

- a third electrical coil assembly in connection with said additional pedal; and
- a fourth electrical coil assembly in connection with said additional directional slider and that cooperates with said third electrical coil assembly to cause generation of electricity.

6. The vehicle of claim 4, wherein movement of said pedal on said directional slider is independent of movement of said additional pedal on said additional directional slider.

7. The vehicle of claim 1, wherein said directional slider is vertically oriented on said frame such that said pedal is movable in a vertical, linear movement.

8. The vehicle of claim 1, wherein said directional slider has opposite ends, further comprising at least one spring at a top at least one of the opposite ends of said directional slider in a path of said pedal to limit movement of said pedal on said directional slider.

9. The vehicle of claim 8, wherein said at least one spring includes a reciprocating electrical spring that generates electrical power and returns force at the same time, said at least one spring being part of said energy generating system.

10. The vehicle of claim 8, wherein said directional slider is at least partly vertically oriented on said frame such that said pedal is movable in an at least partly vertical, linear movement, said at least one spring comprising one spring situated at a bottom one of the opposite ends of said directional slider in a downward path of said pedal to limit

17

downward movement of said pedal on said directional slider, and an additional spring at the bottom of said directional slider below said one spring and which is attached to said frame.

11. The vehicle of claim 1, further comprising an additional wheel in front of said wheel such that said additional wheel is a front wheel of the vehicle and said wheel is a rear wheel of the vehicle, said directional slider being situated between said rear wheel and said front wheel.

12. The vehicle of claim 11, further comprising a seat rearward of said directional slider and a handlebar in front of said directional slider.

13. The vehicle of claim 1, wherein said directional slider is horizontally oriented on said frame such that said pedal is movable in a horizontal, linear movement.

14. The vehicle of claim 13, further comprising an additional wheel in front of said wheel such that said additional wheel is a front wheel of the vehicle and said wheel is a rear wheel of the vehicle, said directional slider being situated at least partly over said front wheel or between said rear wheel and said front wheel.

15. The vehicle of claim 14, further comprising:
a seat rearward of said directional slider and a handlebar in front of said directional slider, said seat including a backrest;
a first spring at a front of said directional slider in a forward path of said pedal to limit forward movement of said pedal on said directional slider; and
a second spring at a rear of said directional slider in a rearward path of said pedal to limit rearward movement of said pedal on said directional slider.

16. A vehicle, comprising:
a frame having a top tube;
a seat on said frame;
a wheel rotatably mounted on said frame;
an elongate directional slider;
a pedal on said directional slider that slides between first and second positions;
a main drive chain connected to said first wheel;
a main drive sprocket that rotates said main drive chain and thus said first wheel;
a flywheel that rotates said main drive sprocket; and
an energy generating system that converts sliding of said pedal on said directional slider into rotational force to rotate said flywheel,

18

said directional slider being attached to said top tube of said frame such that said directional slider is vertically oriented and said pedal on said directional slider is movable vertically.

17. A vehicle, comprising:
a frame;
a seat on said frame;
a wheel rotatably mounted on said frame;
an elongate directional slider having opposite ends;
a pedal on said directional slider that slides between first and second positions;
at least one spring at at least one of the opposite ends of said directional slider in a path of said pedal to limit movement of said pedal on said directional slider;
a main drive chain connected to said first wheel;
a main drive sprocket that rotates said main drive chain and thus said first wheel;
a flywheel that rotates said main drive sprocket; and
an energy generating system that converts sliding of said pedal on said directional slider into rotational force to rotate said flywheel.

18. The vehicle of claim 17, wherein said directional slider is partly vertically oriented on said frame such that the opposite ends of said directional slider are top and bottom ends, said at least one spring includes a top spring at a region of the top end of said directional slider in an upward path of said pedal to limit upward movement of said pedal on said directional slider and a bottom spring at a region of the bottom end of said directional slider in a downward path of said pedal to limit downward movement of said pedal on said directional slider.

19. The vehicle of claim 17, wherein said at least one spring includes a reciprocating electrical spring that generates electrical power and returns force at the same time, said at least one spring being part of said energy generating system.

20. The vehicle of claim 17, wherein said directional slider is horizontally oriented on said frame such that said pedal is movable in a horizontal, linear movement and the opposite ends of said directional slider are front and rear ends, said at least one spring including a first spring at a region of the front end of said directional slider in a forward path of said pedal to limit forward movement of said pedal on said directional slider, and a second spring at a region of the rear end of said directional slider in a rearward path of said pedal to limit rearward movement of said pedal on said directional slider.

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