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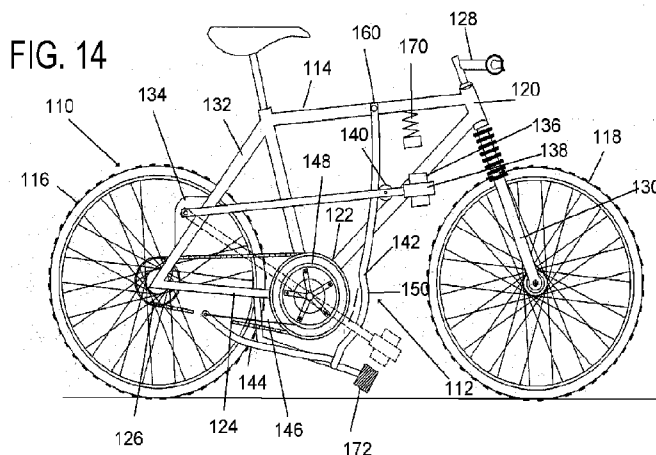
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(54) Title: VEHICLE WITH MOVABLE WEIGHT-BASED DRIVE MECHANISM



(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) 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).



VEHICLE WITH MOVABLE 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.

10 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.

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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.

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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:

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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.

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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.
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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.
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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.
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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.
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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.
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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:
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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.
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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 show 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 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 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 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.

5 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
10 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
15 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
20 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
25 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
30 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.

35 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.

5 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
10 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
15 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.

20 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
25 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
30 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
35 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,

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, 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 142 generally follows (represented by the dotted lines in FIG. 14). The dotted lines in FIG. 14, however, represent the permitted path of the bar 142 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
5 alternatively considered or termed races or gears, or other comparable terminology used by those in the transmission field. A dram 156 is connected to the outer ring 154. The link 146 is connected to the dram 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
10 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
15 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 dram 156 to rotate clockwise and thus the outer ring 154 to rotate clockwise in view of its fixing to the dram 156 (see FIG. 17).

Biasing members, such as spiral torsional springs 162, are provided to cause the
20 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
25 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
30 purpose being to allow the roller 140 to roll along the bar 142. As shown in FIG. 16, the roller 40 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
35 132. 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
5 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
10 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
15 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
20 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
25 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.
30 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
35 around a roller 210 attached to the frame 114 and then attaches to the dram 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
5 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
10 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
15 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
20 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
25 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.
30 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
35 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.

5 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.

10 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.

15 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.

CLAIMS

1. A vehicle, comprising:

a frame;

a seat mounted to said frame;

5 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 pivotally attached at first end region to said frame;

a weight arranged on said arm at an opposite, second end region;

10 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 cause pivoting of 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
15 attached to said frame and a second, opposite end region which is free;

a roller attached to said arm and movable along said guide member during pivotal movement of said arm to cause pivoting of said guide member as said roller engages with said bump of said guide member; and

20 an energy transfer system that converts pivotal movement of said guide member 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 guide member being pivotally attached to said extension such that said second end region of said guide member is above said first end region, said bump being oriented in a
25 rearward direction such that said roller is positioned rearward of said guide member, 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;

30 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

35 an elongate link coupled at a first end region to said second end region of said guide member and coupled at a second, opposite end region to said outer ring, pivotal movement of said guide member causing pulling of said link and rotation of said outer ring in said first direction.

3. The vehicle of claim 2, further comprising a roller attached to said frame and over

which said link passes between coupling to said guide member 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.

5 4. 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 bicycle 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 connected to said axle and positioned on opposite lateral sides of said arm.

10

5. 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 guide member and coupled at a second, opposite end region to said outer ring, pivotal movement of said guide member causing pulling of said link and rotation of said outer ring in said first direction.

20

6. The vehicle of claim 5, 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.

25

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

30

8. A vehicle, comprising:
35 a frame;
 a seat arranged on said frame;
 a wheel rotatably mounted on said frame;

a directional slider having one end region connected to said frame and an opposite, free end region;

a pedal mounted on said directional slider for sliding movement between first and second positions;

5 a main drive chain connected to said first wheel;

a main drive sprocket wheel 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 the sliding movement of said pedal along said directional slider into rotational force to rotate said flywheel.

10

9. The vehicle of claim 8, wherein said energy generating system comprises a first electrical coil assembly attached to said pedal and a second electrical coil assembly attached to said directional slider such that movement of said first electrical coil assembly and said pedal relative to said second electrical coil assembly causes electrical power to be generated, said energy generating system further comprising a motor that receives the generated electrical power and rotates said flywheel, and wherein said directional slider is attached to a top tube of said frame such that said directional slider is vertically oriented and said pedal connected to said directional slider is movable vertically, further comprising at least one upper return spring assembly arranged on said frame and in an upward path of said pedal to limit upward movement of said pedal and at least one lower return spring assembly arranged on said frame and in a downward path of said pedal to limit downward movement of said pedal,

15

20

10. A vehicle, comprising:

a frame;

25

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;

30

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;

35

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
5 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:

10 a gear engaging with said ratchet portion,

a main drive chain connected to said first wheel.

a main drive sprocket wheel that rotates said main drive chain and thus said first wheel,

an overrunning clutch having an outer ring and an inner ring that selectively connects to said outer ring only when said weight moves in a direction from said first position to said second position
15 and not when said weight moves in a direction 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
20 that rotation of said gear causes rotation of said secondary drive chain leading to rotation of said main drive sprocket wheel and said first wheel.

FIG. 9

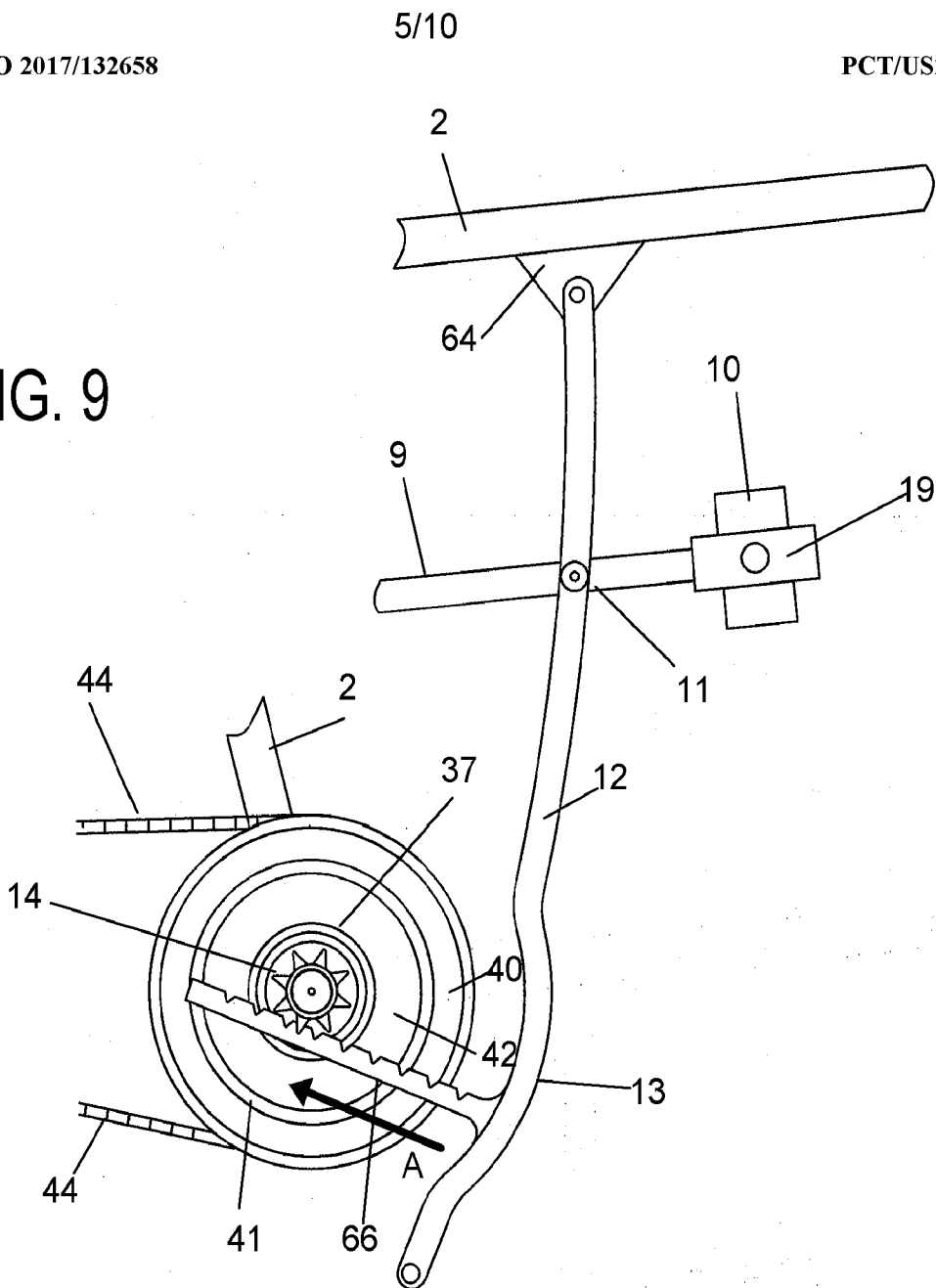


FIG. 10

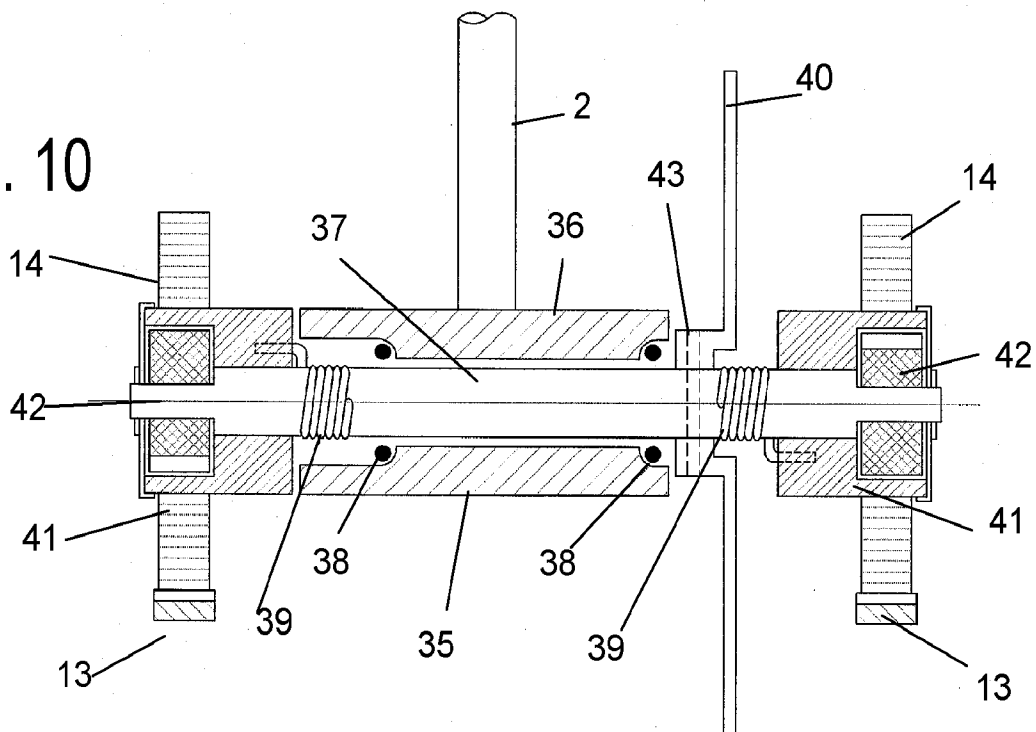


FIG. 11

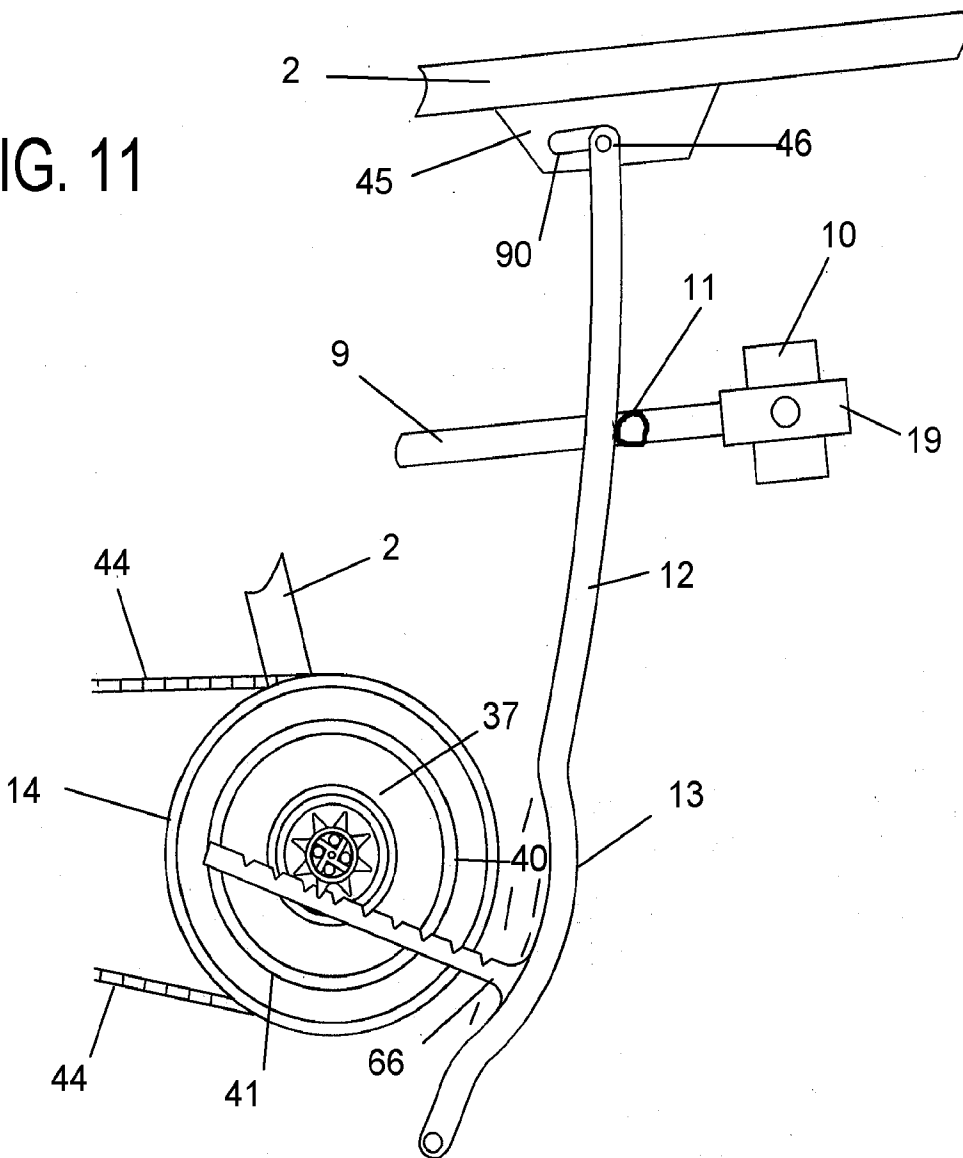


FIG. 12

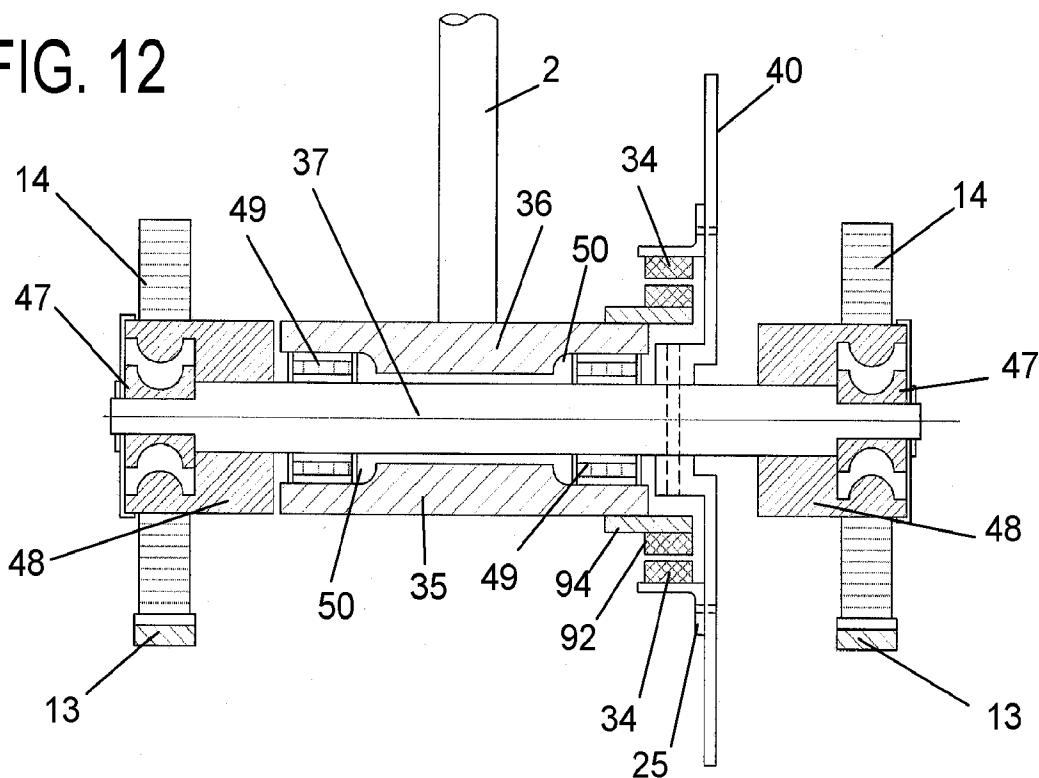


FIG. 13

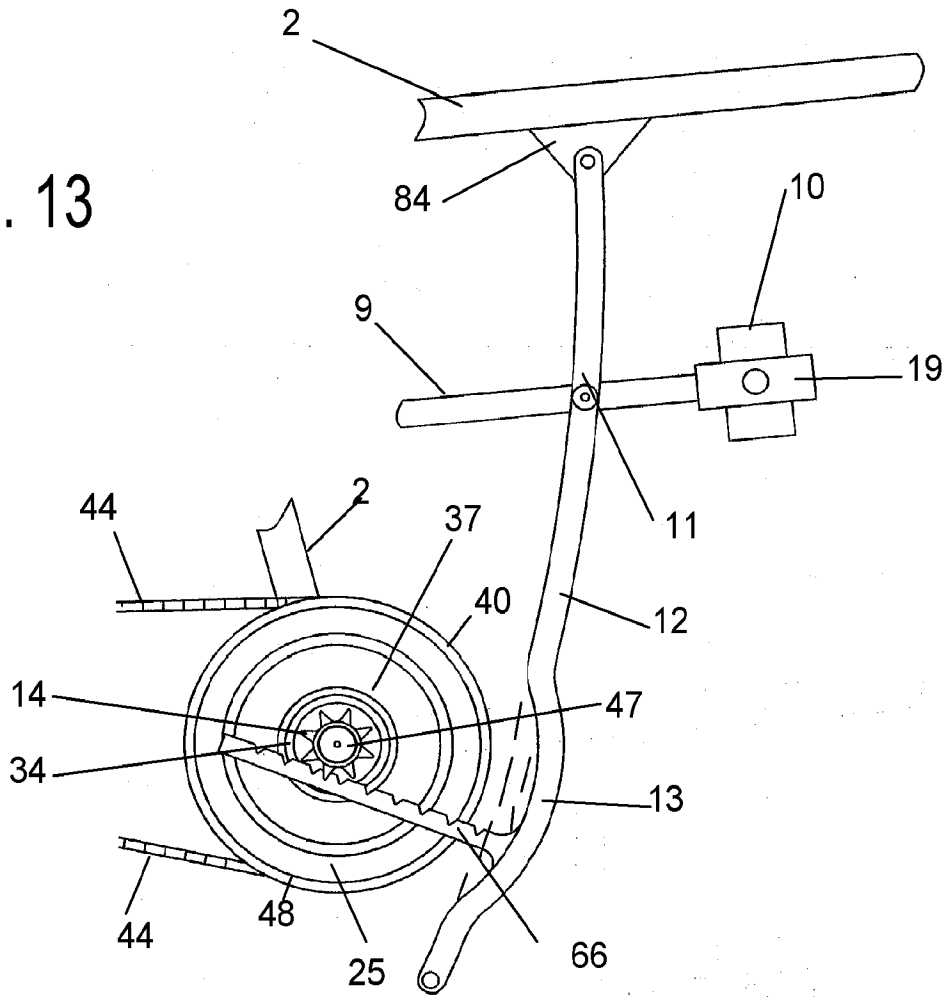


FIG. 14

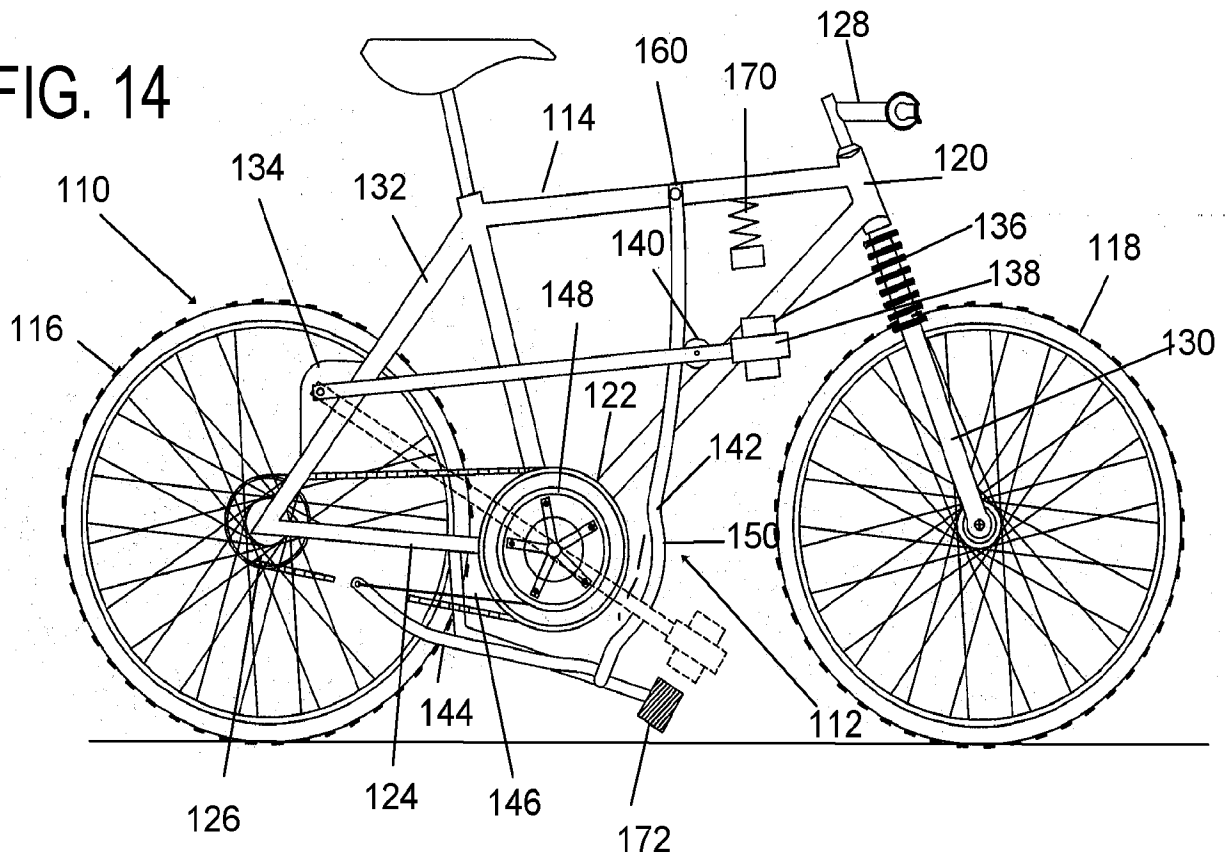


FIG. 15

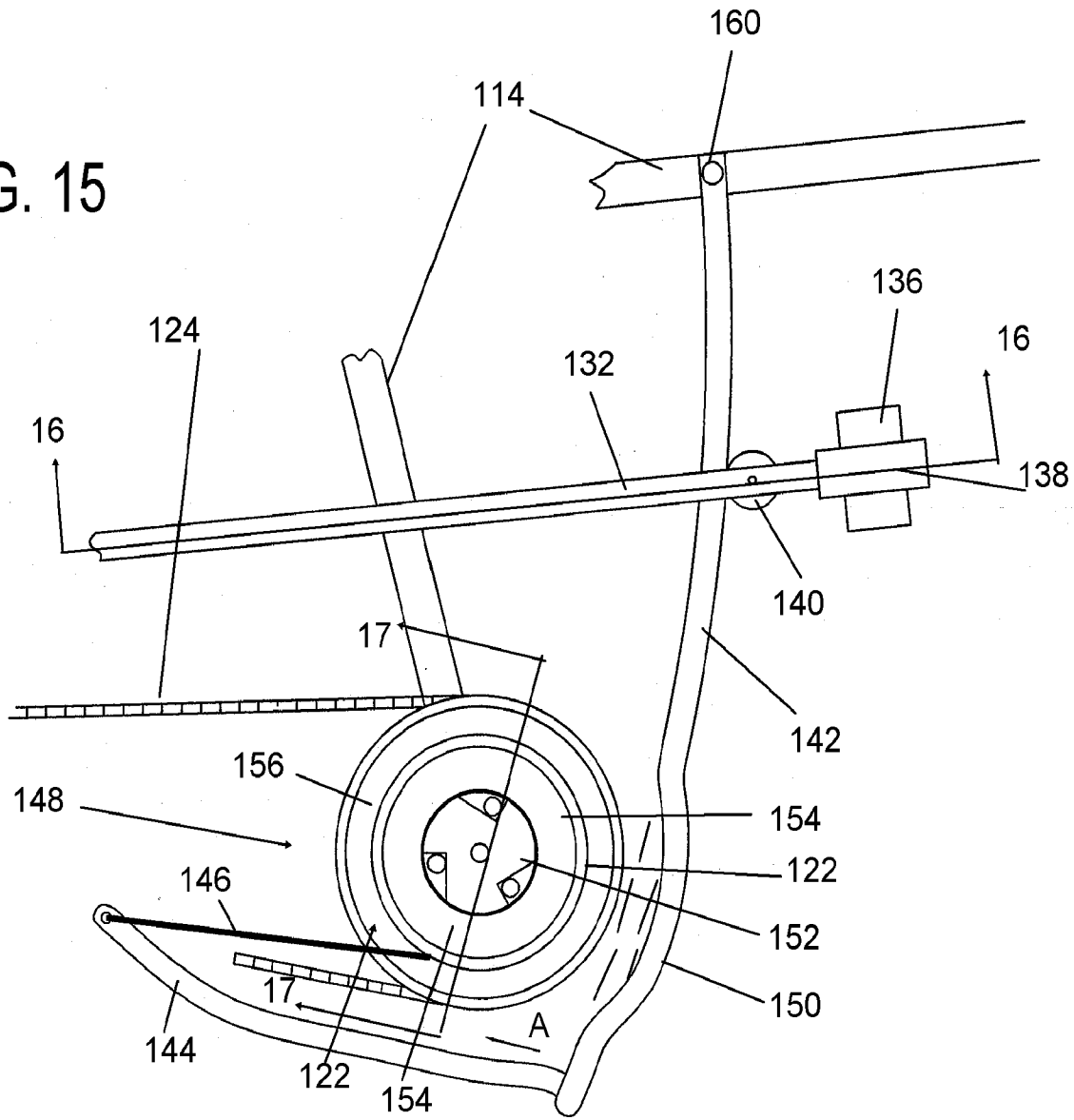


FIG. 19

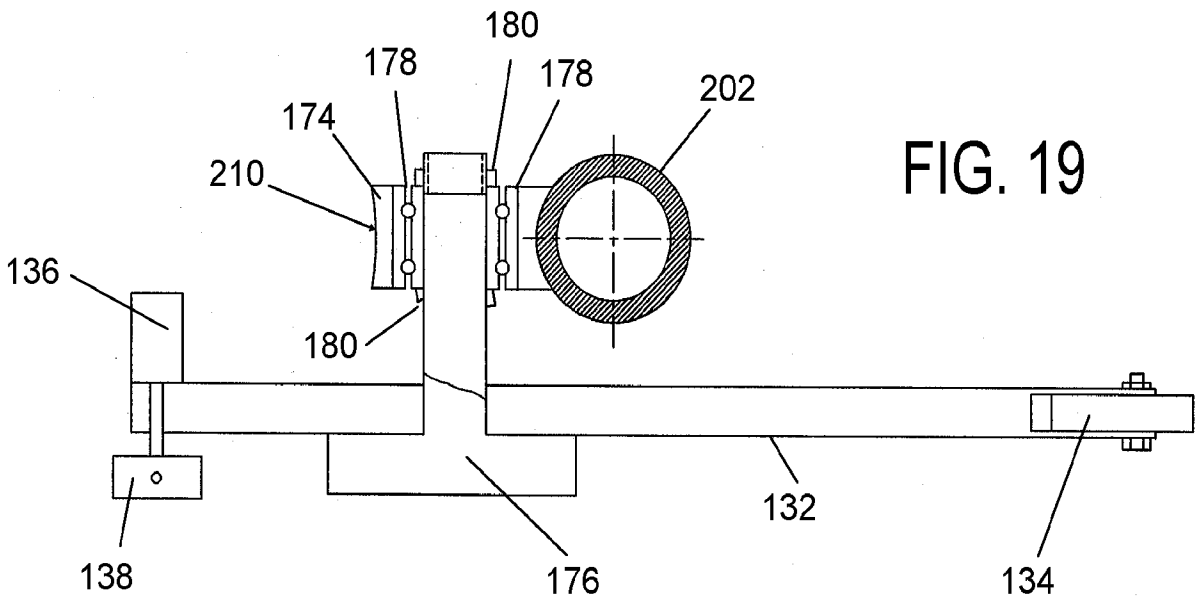


FIG. 16

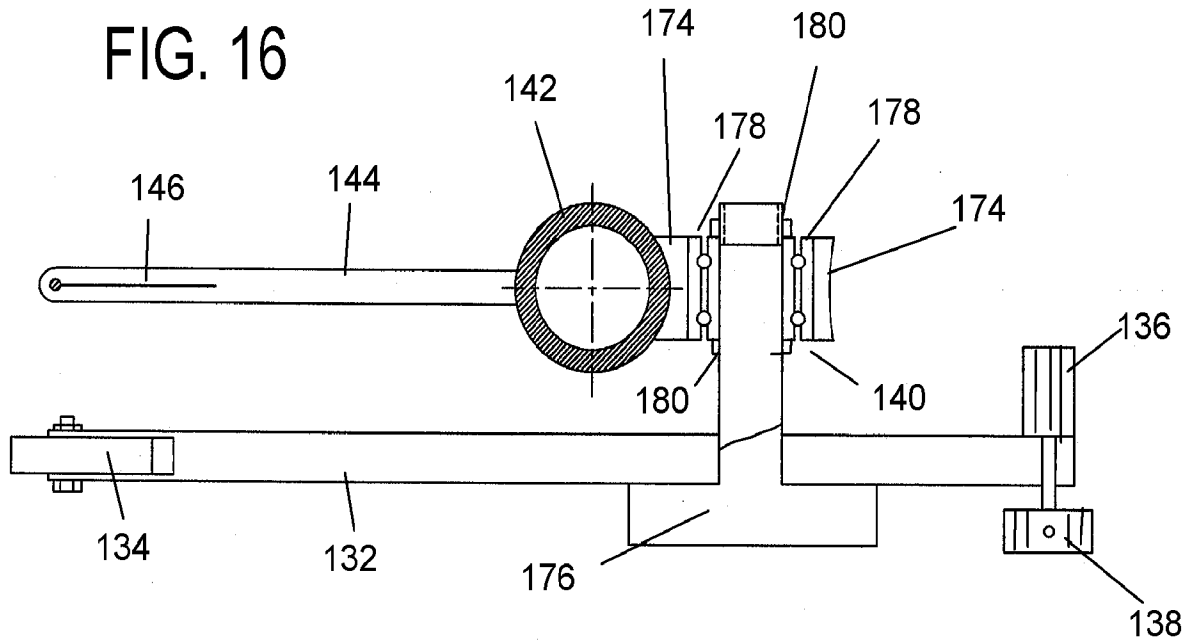


FIG. 17

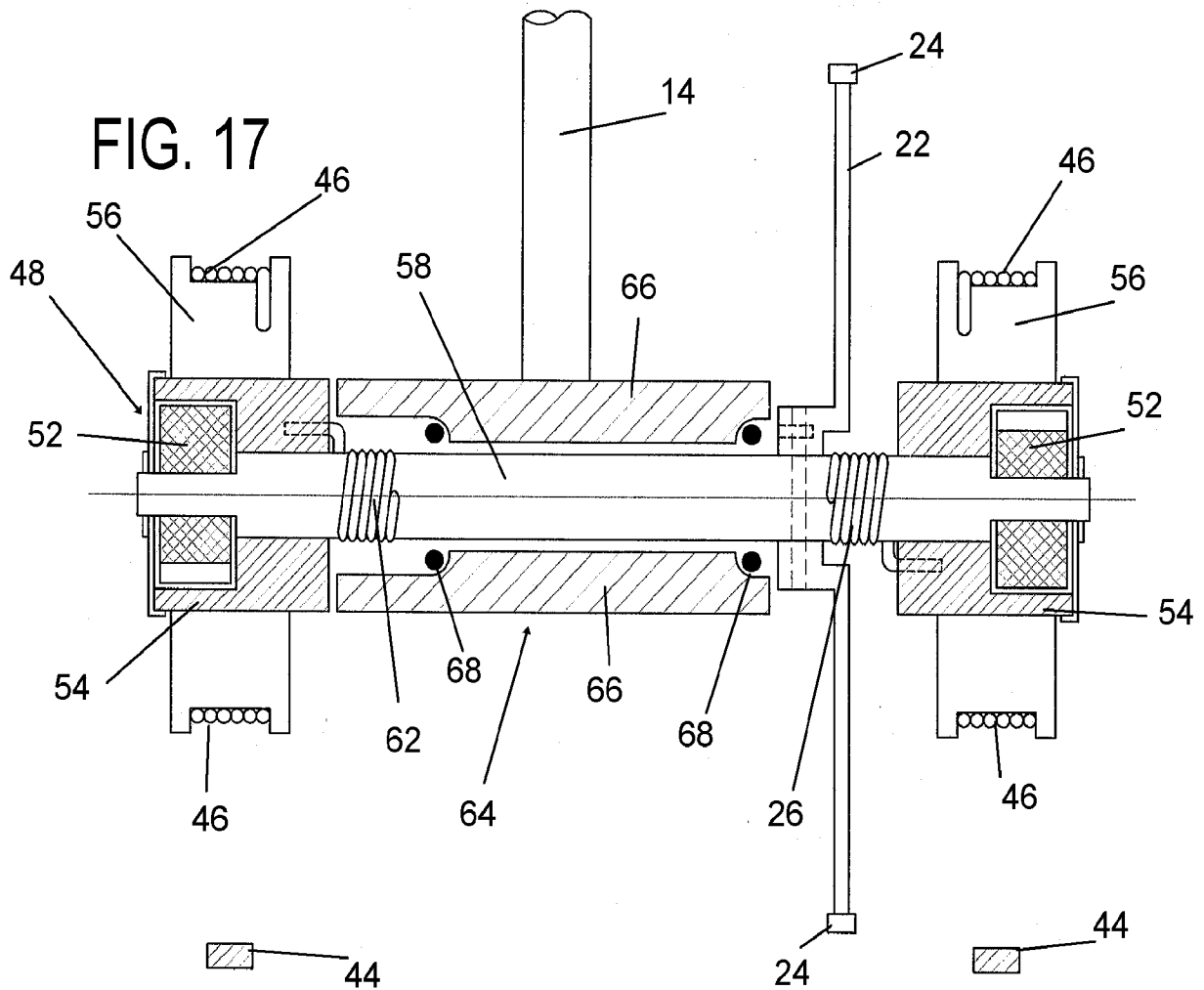
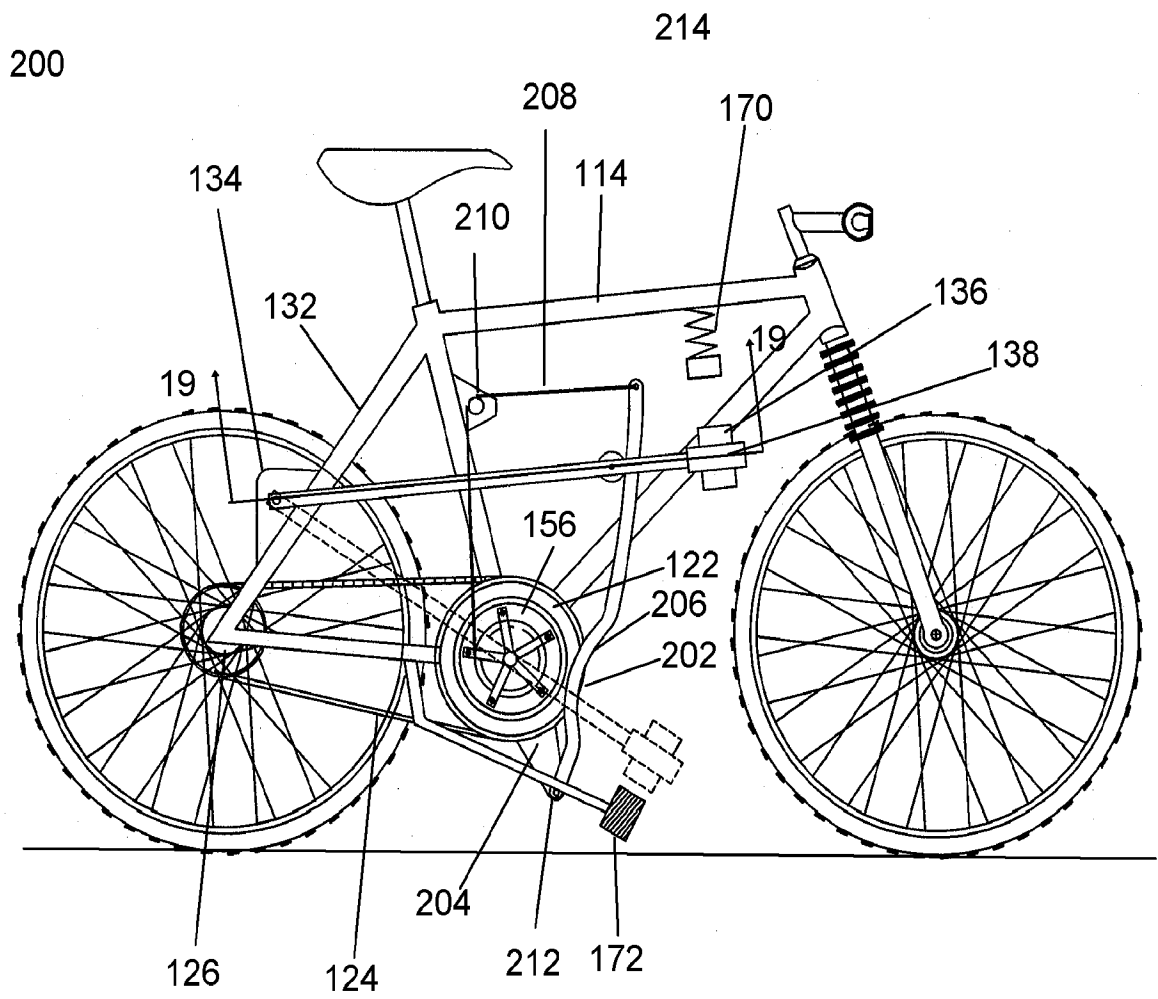


FIG. 18



INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/015596

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B62M 1/24; B62K 3/00; B62M 1/26; B62M 1/28; B62M 1/32 (2017.01)

CPC - B62M 1/24; B62K 3/005; B62M 1/26; B62M 1/28; B62M 1/32 (2017.02)

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

See Search History document

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

USPC - 74/137; 74/142; 74/594.1; 192/28; 192/64; 280/251; 280/253; 280/255; 280/258; 280/301 (keyword delimited)

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

See Search History document

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4,574,649 A (SEOL) 11 March 1986 (11.03.1986) entire document	1-7, 10
A	US 8,955,861 B1 (RASIAH) 17 February 2015 (17.02.2015) entire document	1-7, 10
A	US 2015/0076787 A1 (KIPNIS) 19 March 2015 (19.03.2015) entire document	1-7, 10
A	US 2003/0193160 A1 (MEHMET) 16 October 2003 (16.10.2003) entire document	1-7, 10
A	US 5,035,678 A (HAGEMAN) 30 July 1991 (30.07.1991) entire document	1-7, 10

 Further documents are listed in the continuation of Box C.

 See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

24 April 2017

Date of mailing of the international search report

26 MAY 2017

Name and mailing address of the ISA/US

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Authorized officer

Blaine R. Copenheaver

PCT Helpdesk: 571-272-4300
PCT OSP: 571-272-7774

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US2017/015596

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

See Extra Sheet(s)

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:
1-7, 10

- Remark on Protest**
- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
 - The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
 - No protest accompanied the payment of additional search fees.

Continued from Box No. III Observations where unity of invention is lacking

This application contains the following inventions or groups of inventions which are not so linked as to form a single general inventive concept under PCT Rule 13.1. In order for all inventions to be examined, the appropriate additional examination fees need to be paid.

Group I, claims 1-7, 10 are drawn to a vehicle comprising a weight.

Group II, claims 8, 9 are drawn to a vehicle comprising a flywheel.

The inventions listed in Groups I-II do not relate to a single general inventive concept under PCT Rule 13.1, because under PCT Rule 13.2 they lack the same or corresponding special technical features for the following reasons:

The special technical features of Group I, a vehicle comprising an arm/hammer handle pivotally attached at a first end region to a frame, a weight arranged on said arm/hammer handle 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 cause pivoting of said arm/hammer handle, a guide member including a bump and that moves in conjunction with movement of said weight, and a roller, are not present in Group II; and, the special technical features of Group II, a vehicle comprising a directional slider having one end region connected to said frame and an opposite, free end region, a flywheel that rotates said main drive sprocket, and an energy generating system that converts the sliding movement of said pedal along said directional slider into rotational force to rotate said flywheel, are not present in Group I.

Groups I and II share the technical features of a vehicle comprising a frame, a seat arranged on said frame, a wheel rotatably mounted on said frame, a pedal, a main drive chain connected to said first wheel, a main drive sprocket wheel that rotates said main drive chain and thus said first wheel, and an energy system.

However, these shared technical features do not represent a contribution over the prior art. Specifically, US 5,035,678 A to Hageman teaches of a vehicle (Abstract regarding bicycle) comprising a frame (frame 1, Fig. 1), a seat (unnumbered seat, Fig. 1) arranged on said frame, a wheel (drive wheel 2, Fig. 1) rotatably mounted on said frame, a pedal (pedal 7, Fig. 1), a main drive chain (drive chain 4, Fig. 1) connected to said first wheel, a main drive sprocket wheel (sprocket wheel 20, Fig. 2) that rotates said main drive chain and thus said first wheel (Col. 3, Lns. 6-10 regarding rear drive wheel 2 mounted to the frame at wheel hub 3 and driven in a typical fashion by drive chain 4. In turn, the drive chain is driven by sprocket wheel 20), and an energy system (Col. 4, Lns. 50-52 regarding spring 9 expands, releasing the stored energy; Abstract regarding energy-storing bicycle sprocket drive system).

Since none of the special technical features of the Groups I-II inventions are found in more than one of the inventions, unity is lacking.