(No Model.) 2 Sheets—Sheet 1.

M. J. McDONALD.

SPRING MOTOR FOR VELOCIPEDES.

No. 567,037. Patented Sept. 1, 1896.

Fig. 1,

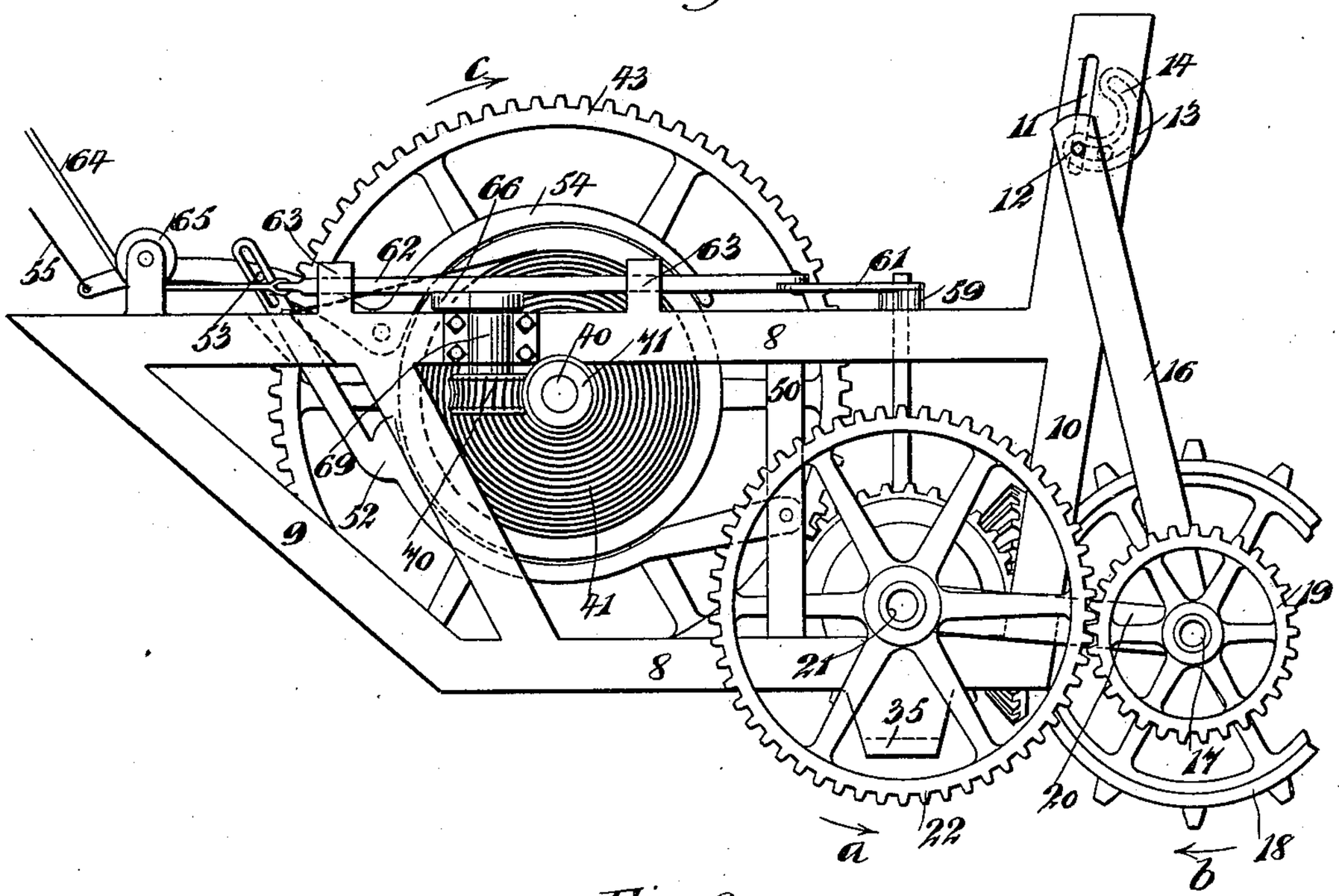
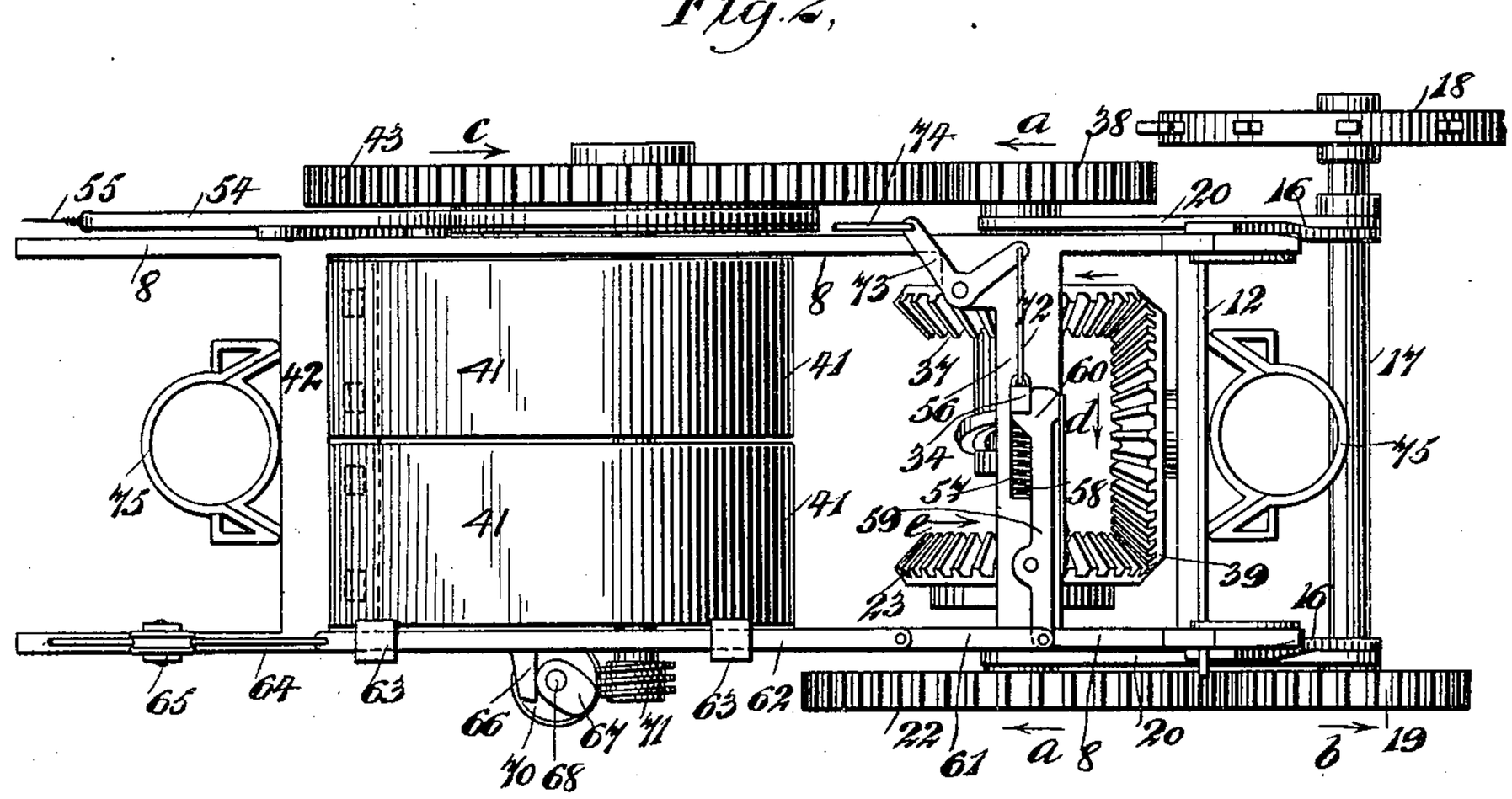


Fig. 2,



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(No Model.) 2 Sheets—Sheet 2.

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Fig. 3,

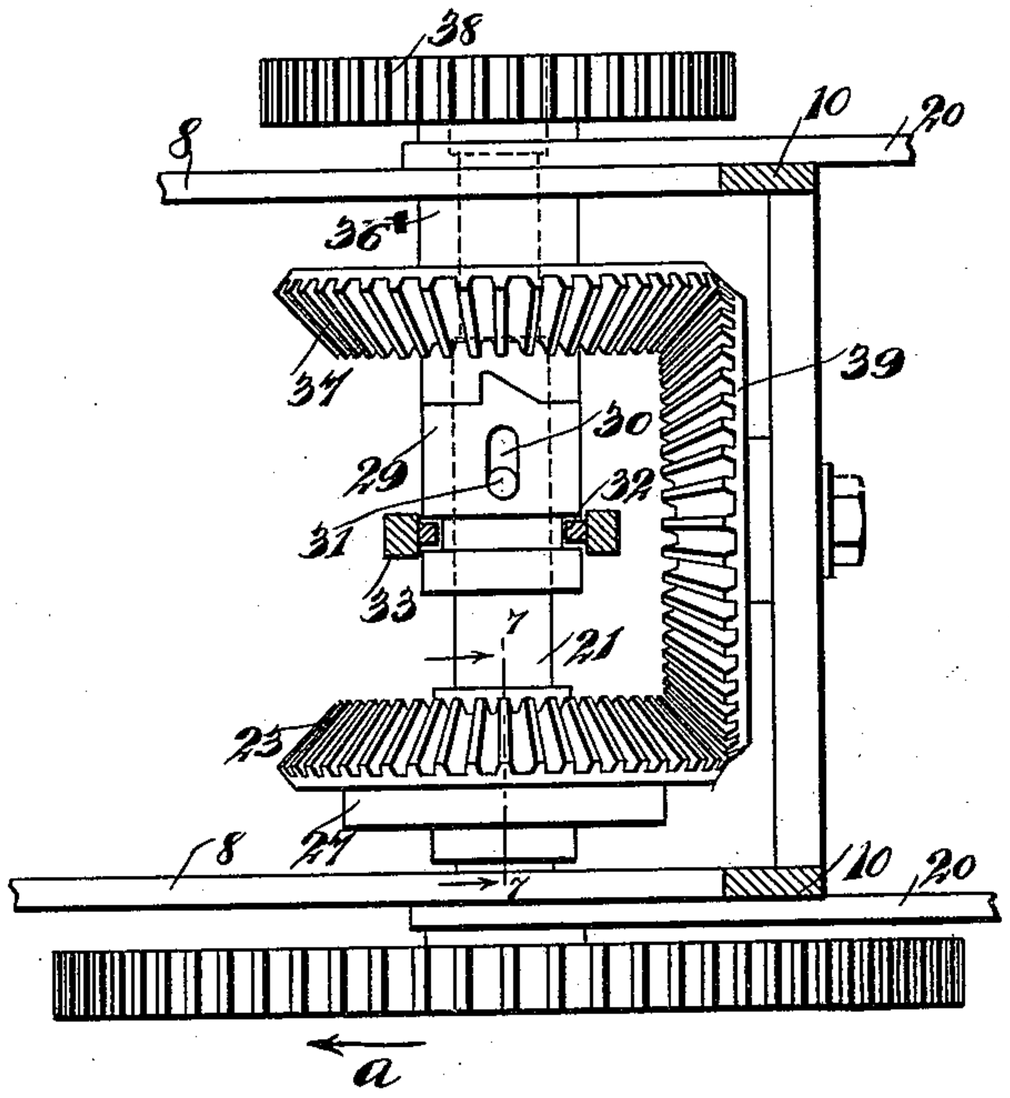

Fig. 4,

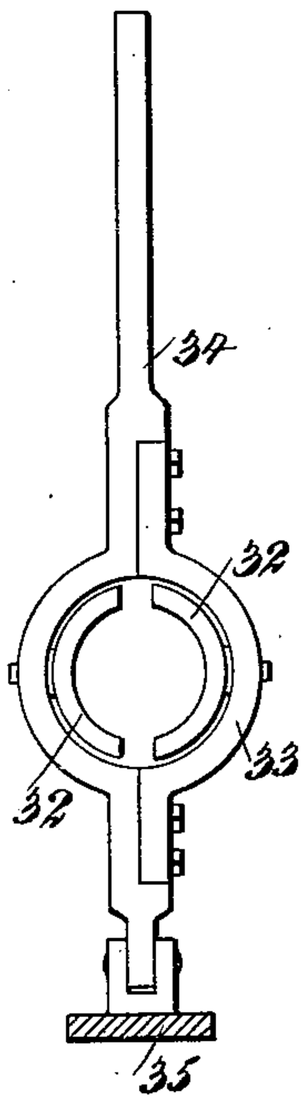

Fig. 5.

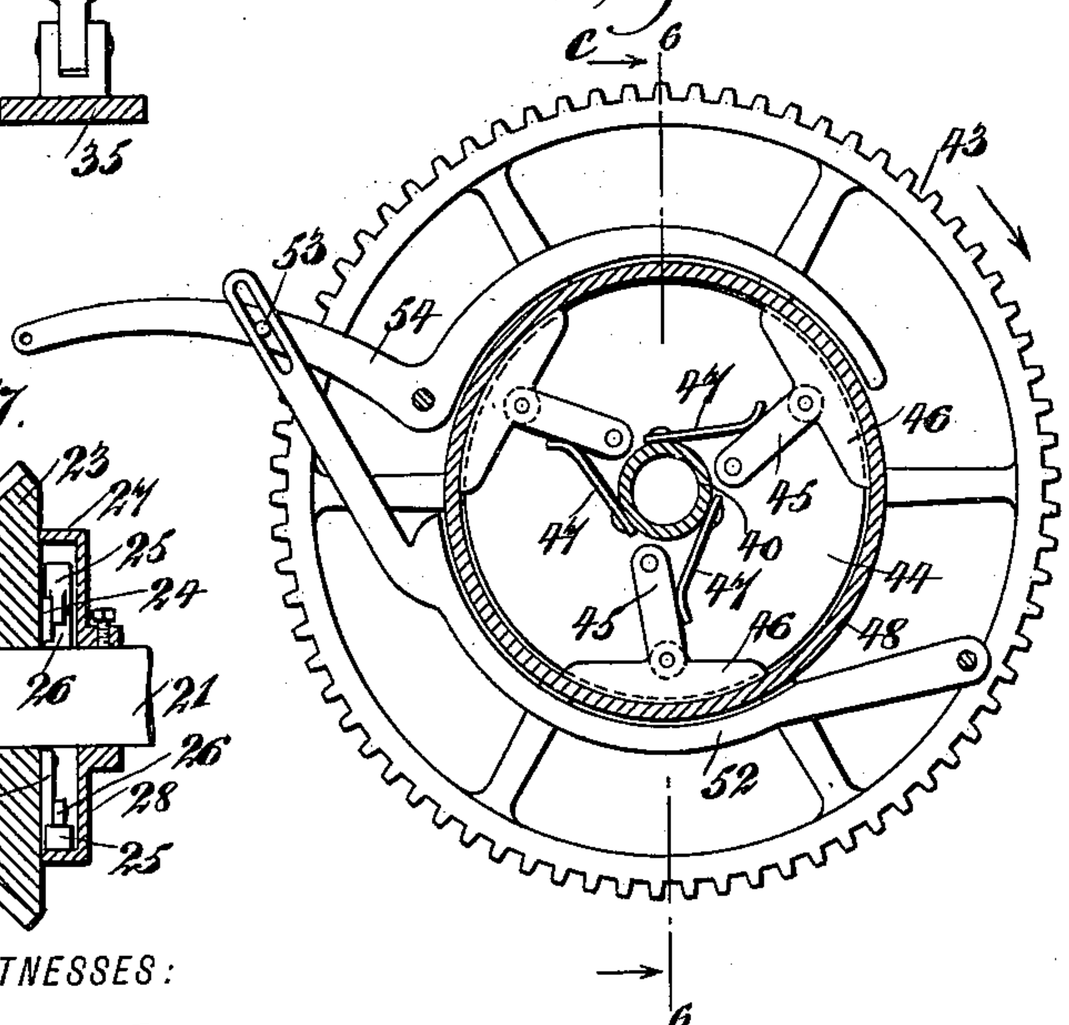

Fig. 6,

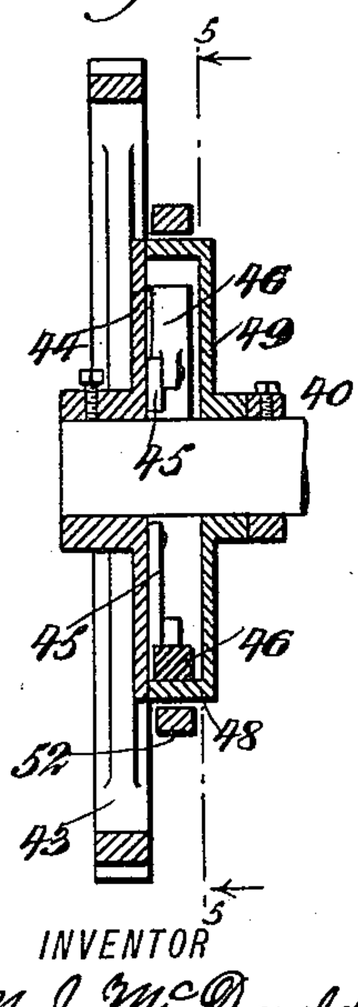

Fig. 7.

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UNITED STATES PATENT OFFICE.

MARTIN J. McDONALD, OF TRENTON, NEW JERSEY.

SPRING-MOTOR FOR VELOCIPEDES.

SPECIFICATION forming part of Letters Patent No. 567,037, dated September 1, 1896.

Application filed February 21, 1896. Serial No. 580,276. (No model.)

To all whom it may concern:

Be it known that I, MARTIN J. McDONALD, of Trenton, in the county of Mercer and State of New Jersey, have invented a new and Improved Spring-Motor for Velocipedes, of which the following is a full, clear, and exact description.

The object of this invention is to provide a superior apparatus for accumulating the surplus power attending the operation of a velocipede in descending a grade, so that this power may be stored and effectively applied in the subsequent propulsion of the velocipede. These ends I attain by means of a spring which is adapted to receive and to give the power referred to and which is associated with gearing and clutch mechanism capable of operation to change the direction of movement to and from the springs, so that when it is desired to wind the springs the gears may be adjusted to carry movement to the springs and when it is desired to unwind them the gears may be adjusted to carry movement from the springs.

The invention consists in certain peculiar features of construction and combinations of parts, which will be fully described hereinafter, and finally embodied in the claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a view in elevation of the left-hand side of the invention. Fig. 2 is a plan view thereof. Fig. 3 is a sectional plan of a portion of the machine. Fig. 4 is an elevation of a shifting-lever which I employ. Fig. 5 is a sectional view on the line 5 5 of Fig. 6. Fig. 6 is a sectional view on the line 6 6 of Fig. 5, and Fig. 7 is a sectional view on the line 7 7 of Fig. 3.

In carrying out my invention I provide a frame consisting of parallel side bars 8, connected at their front ends by upwardly and outwardly inclined bars 9 and at their rear end by approximately vertical bars 10, which are extended upwardly above the upper bars 8 and the extensions formed with slots 11, in which a shaft 12 is revolubly mounted, the shaft being capable of moving in the slot and having fixed to a point near each end a plate 13, in which an arc-shaped slot 14 is formed, the slots respectively receiving pins 15, fixed to the respective extensions of the bars 10. With this construction when the shaft 12 is rocked in its bearings the plate 13 will swing, and owing to the arc-shaped disposition of the slot 14 the shaft 12 will be raised in the slot 11. Fixed to each end of the shaft 12 is an arm 16, the said arms extending downwardly and rearwardly beyond the frame and having at their lower ends bearings in which a shaft 17 is revolubly mounted, said shaft carrying at its right-hand end a fixed sprocket-wheel 18, adapted to mesh with the sprocket-chain of the velocipede and at its left-hand end a fixed spur-gear 19.

Each bearing at the lower ends of the arms 16 has a plate 20 loosely connected thereto, and these plates extend forwardly and approximately horizontally to a shaft 21, journaled in the lower bars 8 of the frame. The plates 20 are loosely connected to the shaft 21, and by these means the shaft 17 and the gears carried thereby may be raised or lowered, so that the sprocket-wheel 18 will engage or disengage with the sprocket-chain.

The shaft 21 has fixed thereto a gear 22, which meshes with the pinion 19, and which, during the operation of the machine, revolves continuously in the direction of the arrow *a*, the gear 19 also revolving continuously in the direction of the arrow *b*. Loosely mounted on the shaft 21 is a bevel-gear 23, which has (see Fig. 7) links 24 pivotally connected to it, said links carrying pivotally-attached shoes 25, and being provided with springs 26, by which the shoes are pressed against a flange 27 of the disk 28, said disk being fixed to the shaft 21. By these means the gear 23 is free to move on the shaft 21 in one direction, and when the gear 23 revolves in the opposite direction the arms 24 and their shoes 25 will cause the gear to be fixed to the disk 28 and consequently to the shaft 21. The device is of the same class as that shown in Fig. 5, to be hereinafter described. Slidable longitudinally on the shaft 21 is a sleeve 29, having at each side a slot 30, respectively receiving pins 31, by which the sleeve is allowed a limited longitudinal movement on the shaft 21. The sleeve 29 is provided with an annular groove receiving the shoes 32, pivotally mounted in a yoke 33,

formed on a lever 34, said lever being pivotally mounted on a bar 35, extending transversely from one side of the frame to the other and at the lower portion thereof.

The right-hand end of the sleeve 29 is formed with clutch-teeth adapted to engage corresponding recesses formed on the left-hand end of a hollow shaft or sleeve 36, which is rotatably mounted on the shaft 21, and also loosely mounted in the right-hand side of the frame 8. Fixed to the left-hand or inner end of the shaft 36 is a bevel-gear 37, and the right-hand extremity of the shaft 36 carries a fixed pinion-gear 38. The shaft 21 is reduced in size within the sleeve or shaft 36, as shown by dotted lines in Fig. 3, so that the friction between these parts may be correspondingly reduced. Loosely mounted on a stub-shaft carried in the rear of the frame is a bevel-gear 39, which continually meshes with the gears 23 and 37 and serves to transmit movement from one gear to the other.

Revolubly mounted in boxes and carried on the under sides of the upper bars 8 of the frame and at approximately the middle of said bars is a shaft 40, on which the helical springs 41 are wound, said springs each having one end fixed to the shaft and having the remaining ends fixed to a cross-bar 42 of the frame, as shown in Fig. 2.

Fixed to the right-hand end of the shaft 40 is a spur-gear 43, which meshes with the pinion 38 on the shaft 36, and which serves to transmit to or from the shaft 40 movements respectively attending the winding or unwinding of the springs 41. A plate 44 (see Fig. 5) is fixedly carried by the gear 43 and has links 45 pivotally connected thereto, said links having at their free ends pivoted shoes 46, and being pressed by springs 47, fixed to the shaft 40. The shoes 46 are adapted to engage a flange 48, carried on a disk 49, which is loose on the shaft 40. When the shaft 40 revolves in one direction, the shoes 46 will slide idly along the inner surface of the flange 48; but when the shaft revolves in the opposite direction the disposition of the shoes 46 and links 45 is such that the shoes will be clamped against the fiange aud the disk 49 will be caused to revolve with the shaft 40 and the spur-gear 43.

Pivotally connected to a vertically-extending bar 50 (shown in Fig. 1) is a brake-lever 52, which has a curved shoe portion engaging the under side of the flange 48 of the disk 49 and which has an upwardly-extended and longitudinally-slotted free end receiving a pin 53, carried on a second brake-lever 54, fulcrumed to the left-hand upper side bar 8 of the frame, as best shown in Fig. 1. The rear end of the brake-lever 54 is formed as a shoe to engage the upper side of the flange 48 of the disk 49, and the forward end of the lever is connected to a flexible connection 55, by which operating movement may be applied to the brake-lever 54. It will be seen that the gravity of the levers 52 and 54 will keep the shoes thereof out of engagement with the flange 48, and it will also be seen that upon drawing on the connection 55 the shoes of the brake-levers 52 and 54 will be engaged with the flange 48 and said flange held fixed thereto. The disposition of the links 45 is such that as the shaft 40 revolves under the influence of the unwinding of the springs 41 the shoes 46 will be made to engage the flange 48 and the disk 49 will be fixed to the shaft 40; but when the shaft 40 revolves under the influence of movement which will wind the springs 41 the disposition of the links 45 is such that the shoes 46 will slide loosely along the inner side of the flange 48. By these means the shaft 40 may be held from revolution, which will permit the unwinding of the spring 41, and the shaft is allowed to have this revolution as the operator desires by releasing the brake-levers 52 and 54, and also by these means the shaft 40 may, as far as the operation of the links 45 and disk 49 is concerned, freely revolve to apply movement which will wind the springs 41.

Extending horizontally across the upper portion of the frame and near the rear part thereof is a cross-bar 56, in which is formed a transversely-elongated slot 57, receiving the upper and free end of the lever 34, said lever being drawn to the left-hand portion of the slot by a retractile spring 58. Fulcrumed on the cross-bar 56 is a lever 59, which is formed with a shoulder 60, adapted to engage the lever 34 and hold the same at the right-hand end of the slot 57 and against the tendency of the spring 58.

Connected to the left-hand end of the lever 59 is a link 61, to which a longitudinally-sliding bar 62 is connected, the bar having bearings 63 and being attached at its front end to a flexible connection 64, passing over a pulley 65 and extending to a point within easy reach of the operator.

Projecting from the left-hand end of the bar 62 is a toe 66, adapted to be engaged by a cam 67, carried on a vertically-extending shaft 68, having a bearing 69, carried by the left-hand upper side bar 8 of the frame. The lower end of the shaft 68 has a worm-wheel 70 fixed to it, and this worm-wheel meshes with a worm 71, fixed on the left-hand end of the shaft 40, so that as the shaft 40 revolves movement will be imparted to the shaft 68 and the cam 67 engaged with the toe 66 to slide the bar 62. The disposition of these parts is such that when the shaft 40 has received movement sufficient to completely wind the springs 41 the cam 67 will have been turned so as to force the bar 62 forwardly and cause the shoulder 60 to disengage the lever 34 and allow the spring 58 to draw the lever leftward so as to disengage the sleeve 29 with the hollow shaft 36 and dis-

connect the parts which, by their connection, fix the shaft 36 to the shaft 21 and thus automatically stop the winding of the springs 41.

Connected to the lever 34 is a link 72, which is connected to a bell-crank 73, fulcrumed at the right-hand side of the frame and having a connection 74 attached thereto, so that the levers 34 may be returned to the position shown in Fig. 2 after the lever 59 has been rocked to permit the lever to move from said position.

The frame is provided with clips 75, by which it may be attached to the frame of the bicycle in connection with which the device is used.

In using my invention when it is desired to wind the springs 41 from movement derived from the sprocket-chain of the vehicle in connection with which the invention is used the sprocket-wheel 18, continuously revolving in the direction of the arrows *b*, will transmit movement to the gear 22 in the direction of the arrows *a*, causing the shaft 21 to revolve in a similar direction. The lever 34 should now be operated to move the sleeve 29 to engage with the hollow shaft 36, whereupon the gear 38 will also revolve in the same direction and transmit movement to the gear 43 and shaft 40 in the direction of the arrows *c*. The disposition of the springs 41 should be such that they will be wound by the movement of the shaft 40 in this direction.

Should it be desired at any time to stop the winding of the springs 41, the connection 64 may be drawn on to rock the lever 59 and release the lever 34, whereupon the sleeve 29 will disengage the hollow shaft 36. If the winding operation is permitted to continue until the springs have been completely wound, the cam 67, actuated by the worm-wheel 70 and drum 71, will automatically slide the bar 62 to rock the lever 59 and permit the spring 58 to move the lever 34 leftward, also resulting in the disengagement of the sleeve 29 and hollow shaft 36.

During the winding of the shaft 40 the brake-levers 52 and 54 should have been applied to the flange 48, so as to prevent any retrograde movement of the shaft 40, and when it is desired that the springs 41 unwind, so that power may be applied from the same as distinguished from to the springs, the brake-levers should be released from the flange, so that the shaft will be free to revolve in a direction opposite to that indicated by the arrows *c*. When this operation is desired, it is necessary that the sleeve 29 be disengaged with the hollow shaft 36, and if this condition is not present the connection 64 should be drawn on to swing the lever 59, so that the lever 34 may move leftward. The hollow shaft 36 will now revolve independently of the shaft 21 and in a direction opposite to that indicated by the arrows *a*, transmitting to the gear 39 movement opposite to the movement indicated by the arrow *d* in Fig. 2 and causing the gear 23 to revolve in a direction opposite to that of the arrow *e*, also in Fig. 2. The disposition of the links 24 is such that when the gear 23 revolves in this direction it will be fixed to the shaft 21, which will cause the shaft to revolve in the direction of the arrow *a*, and the gear 22 will transmit movement to the shaft 17 in the direction of the arrow *b*, such being the direction in which the shafts 21 and 17 continually revolve.

The arrows *d* and *e* indicate the direction in which the gears 39 and 23 respectively revolve during the revolution of the shaft 36 to wind the springs 41, it being understood that these gears 39 and 23 are idle when the springs 41 are being wound. The unwinding of the springs 41 is stopped by the application of the brake-levers 52 and 54.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination with a frame, of a shaft, a spring actuating said shaft, a gear fixed to the shaft, a second shaft, a gear carried by the second shaft and capable of revolving freely thereon in one direction only, a hollow shaft embracing the second shaft, two gears fixed to the hollow shaft, a clutch on the second shaft for fixing the hollow shaft to the second shaft, and an idle-gear for connecting the gear on the second shaft with one of the gears on the hollow shaft, the remaining gear of the hollow shaft being meshed with the gear on the spring-shaft, substantially as described.

2. The combination with a frame, of a mounted spring, a hollow shaft geared therewith, a second shaft, means for fixedly connecting the second shaft with the hollow shaft, a gear carried by the solid shaft and capable of moving freely on the same in one direction, and an idle-gear connecting the hollow shaft and the gear on the second shaft, substantially as described.

3. The combination with a frame, of a shaft, a spring actuating the shaft, a second shaft, a hollow shaft receiving the second shaft, gearing connecting the hollow shaft with the spring-shaft, a gear fixed to the hollow shaft, an idle-gear meshing with the gear on the hollow shaft, a gear capable of loose movement on the second shaft in one direction and meshed with the idle-gear, a clutch capable of fixing the hollow shaft to the second shaft, a lever connected to the clutch, a spring pressing the lever, a second lever having a shoulder adapted to engage the first lever, a sliding bar connected to the second lever, a cam engaging the sliding bar, a worm-wheel in fixed connection with the cam, and a worm driven by the spring-shaft, substantially as described.

4. The combination with a frame, of a spring mounted therein, a hollow shaft geared with the spring, a gear-wheel fixed on the hol-

low shaft, an idle gear-wheel with which the gear-wheel on the hollow shaft meshes, a second shaft, a gear-wheel carried by the second shaft and capable of revolving freely on the same in one direction only, the gear-wheel of the second shaft being meshed with the idle gear-wheel, and a clutch capable of connecting the solid and the second shafts, substantially as described.

5. The combination with a frame, of a spring mounted therein, a hollow shaft geared with the spring, a gear fixed on the hollow shaft, an idle-gear meshing with the gear on the hollow shaft, a second shaft, a gear carried thereby and capable of revolving freely in one direction only, the gear on the second shaft being meshed with the idle-gear, a clutch capable of connecting the second shaft with the hollow shaft, and means controlled by the spring for automatically actuating the clutch, substantially as described.

6. The combination with a frame, of a spring mounted therein, a worm driven by the spring, a worm-wheel coöperating with the worm, a cam moving with the worm-wheel, a sliding rod which the cam actuates, a lever connected to the sliding rod, a clutch controlled by the lever, and two sets of gearing controlled by the clutch, substantially as described.

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