

(No Model.)

2 Sheets—Sheet 1.

M. J. McDONALD.
POWER ACCUMULATOR.

No. 569,049.

Patented Oct. 6, 1896.

Fig. 1.

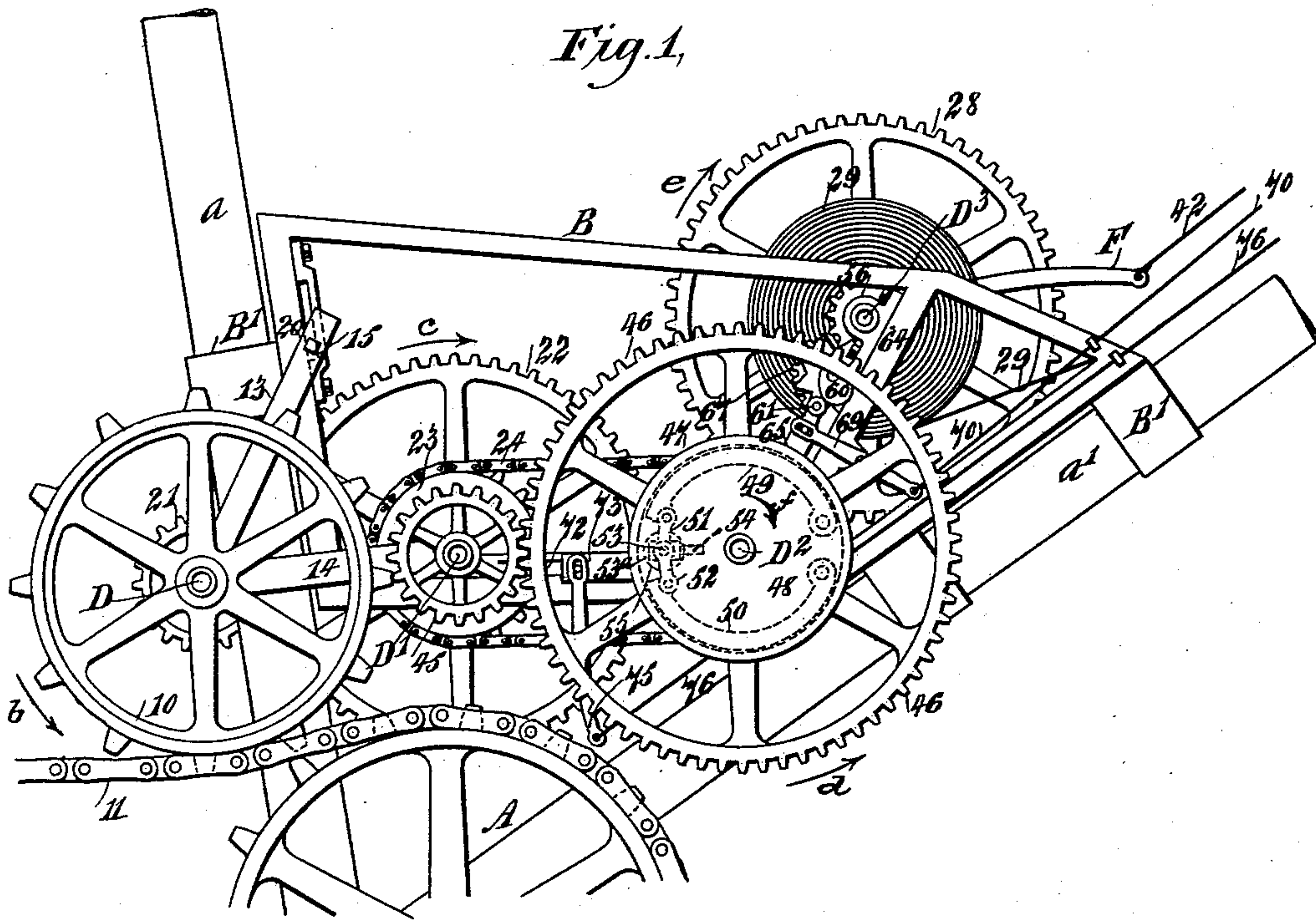
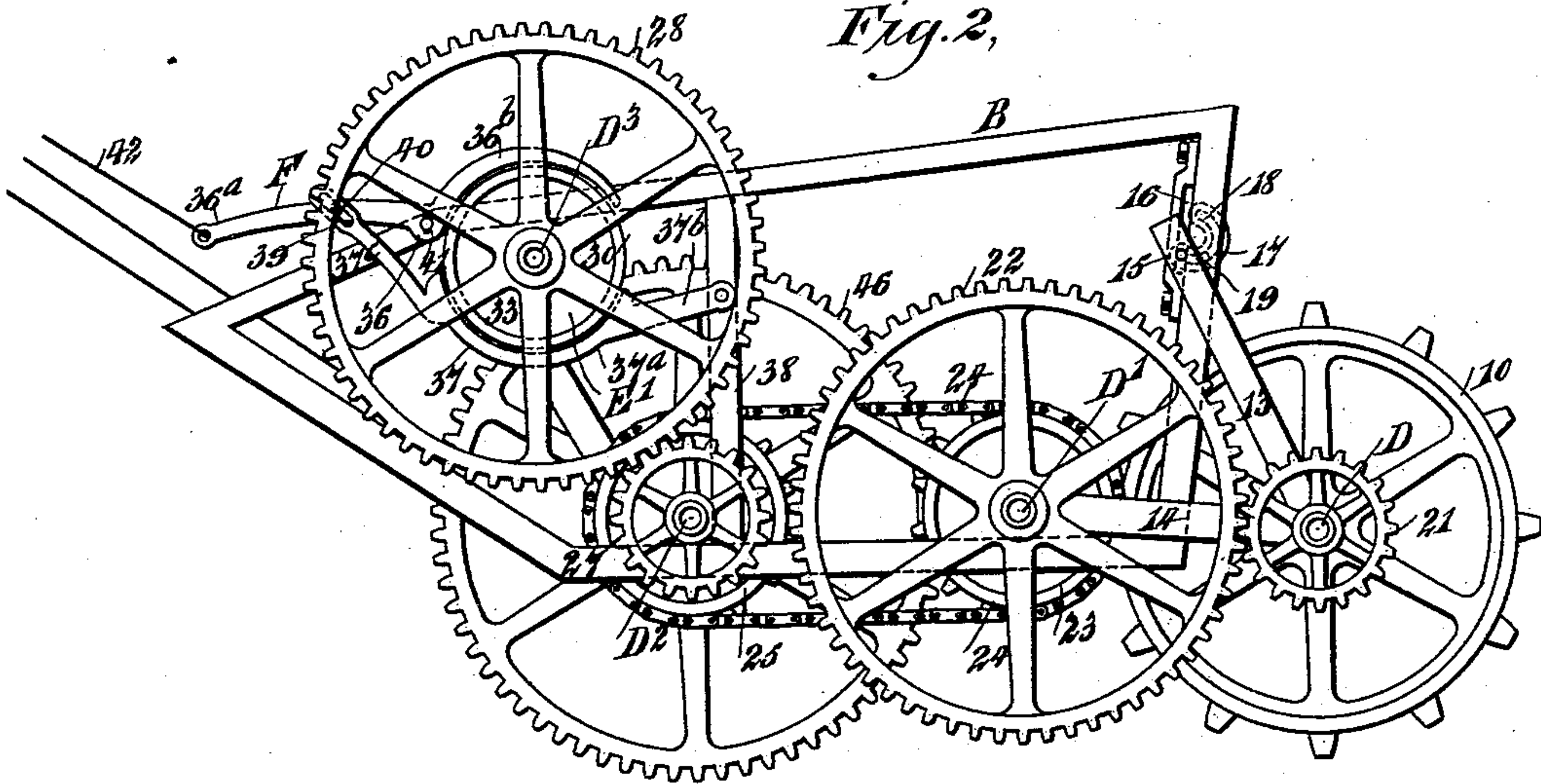


Fig. 2.



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(No Model.)

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Fig. 3.

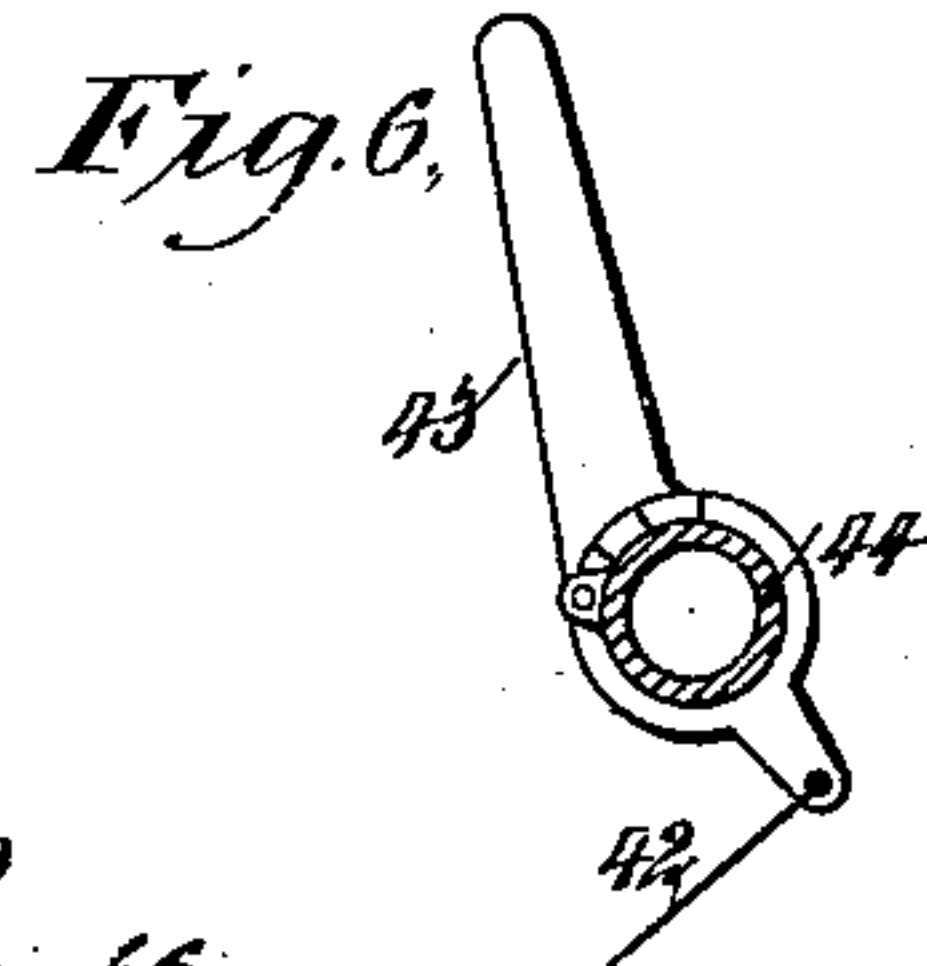
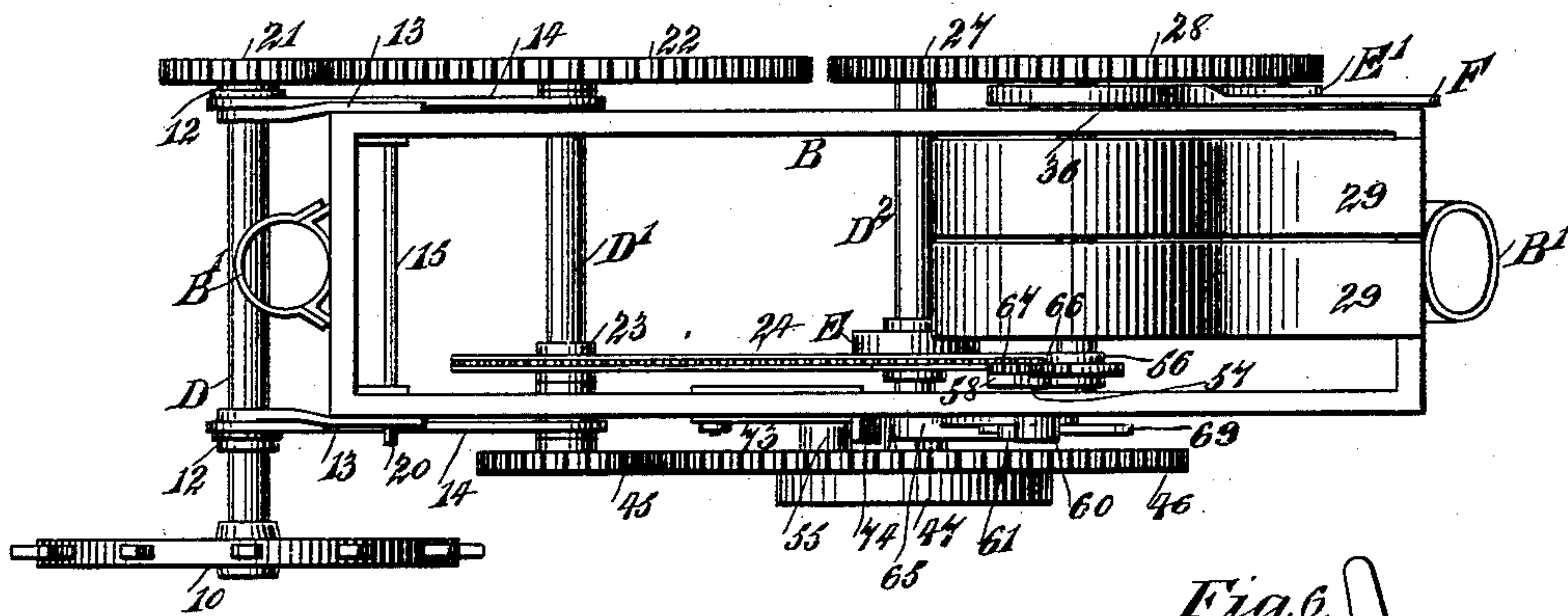


Fig. 7.

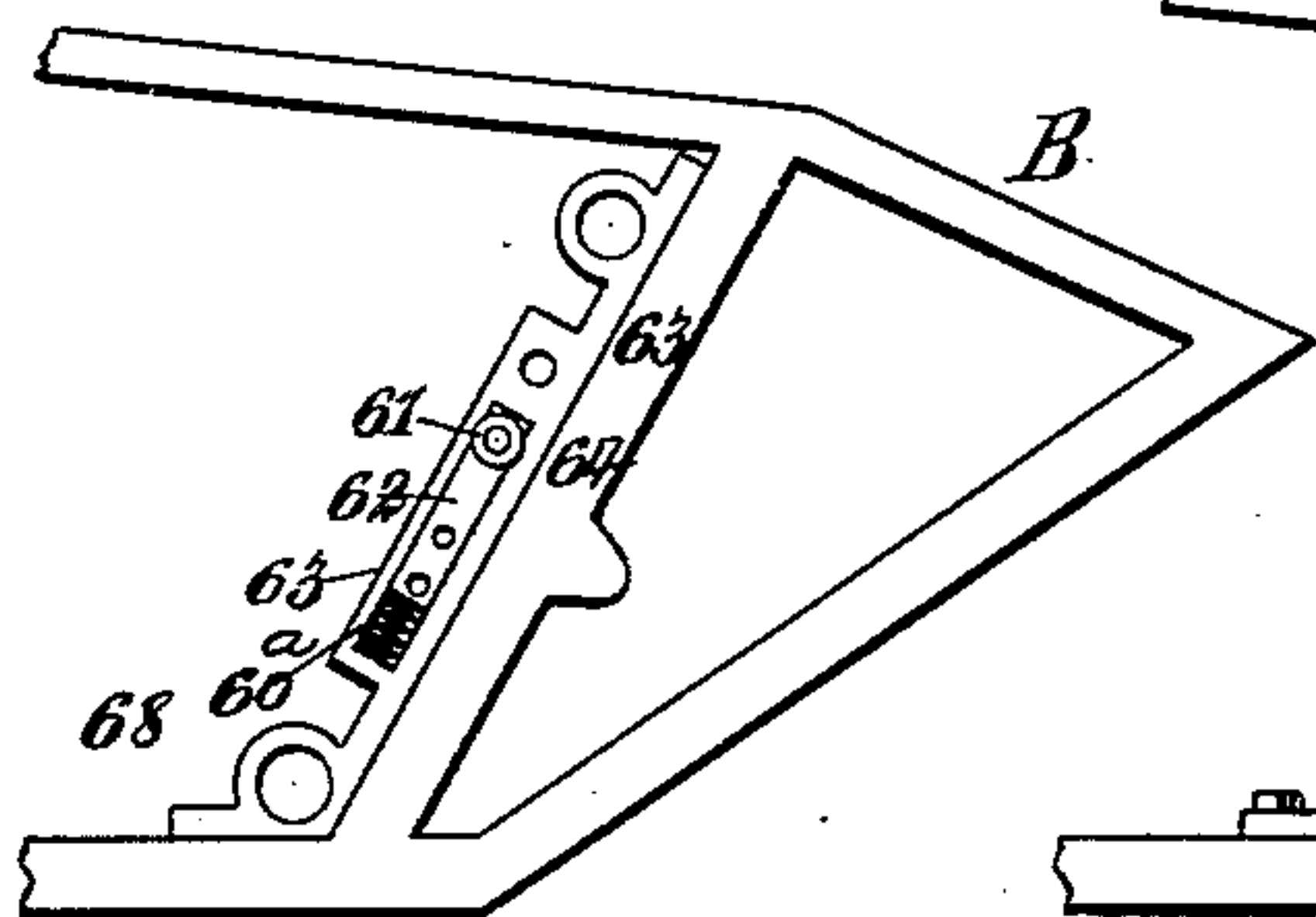


Fig. 4.

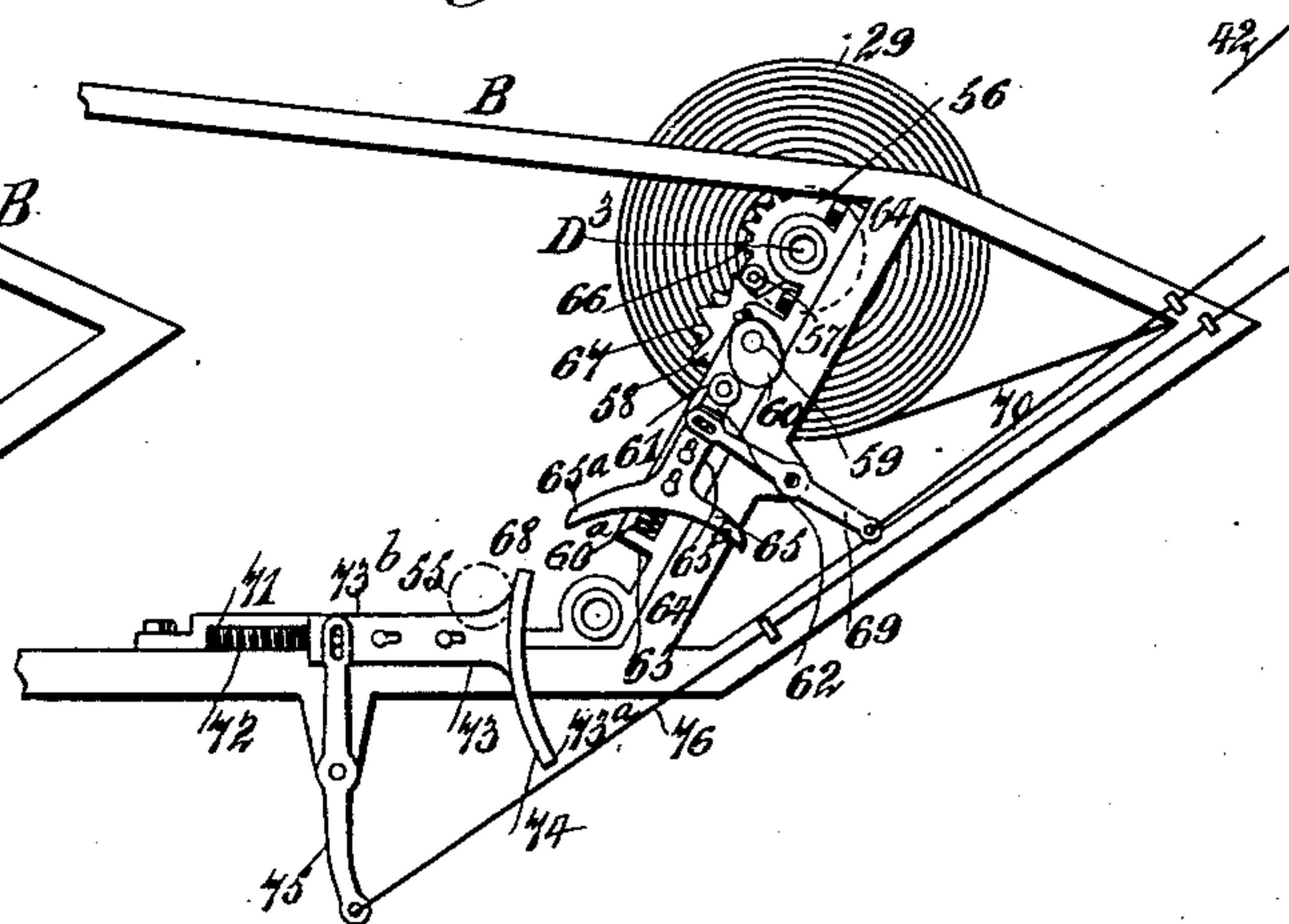
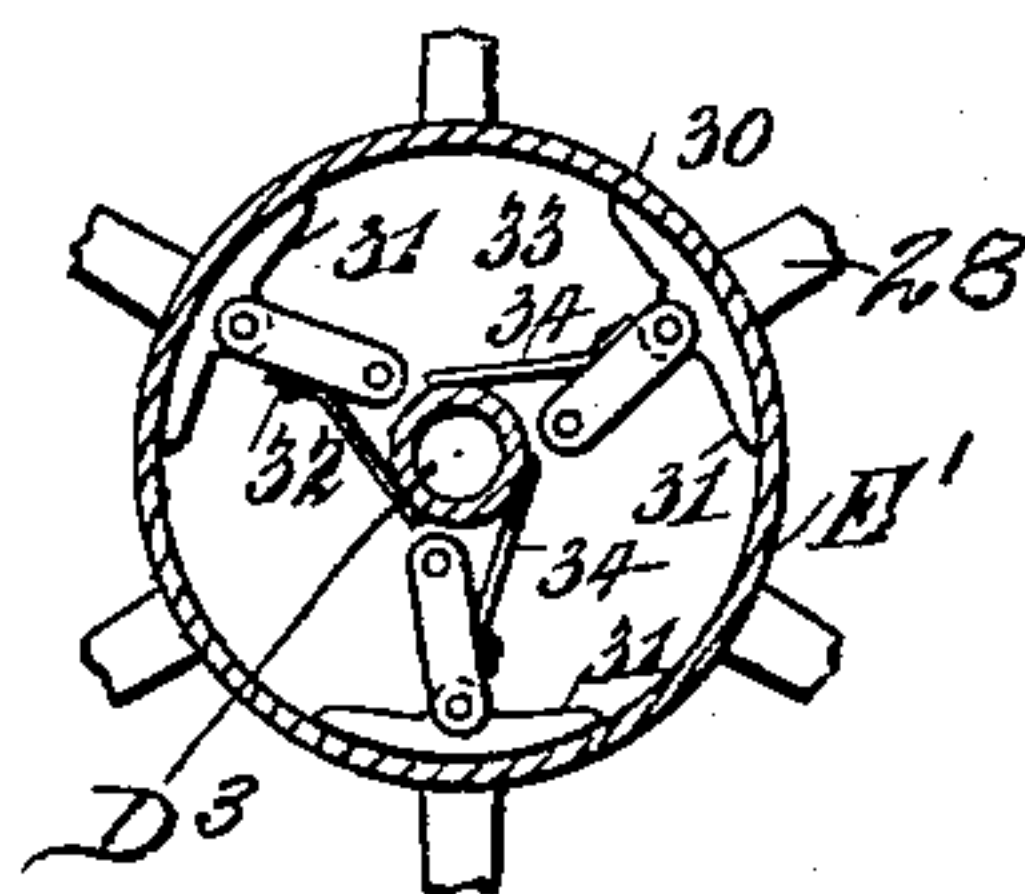


Fig. 5.



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UNITED STATES PATENT OFFICE.

MARTIN J. McDONALD, OF TRENTON, NEW JERSEY.

POWER-ACCUMULATOR.

SPECIFICATION forming part of Letters Patent No. 569,049, dated October 6, 1896.

Application filed November 15, 1895. Serial No. 569,058. (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 useful Improvement in Power-Accumulators, of which the following is a full, clear, and exact description.

The object of this invention is to provide a superior apparatus by which the useless power attending the momentum of the vehicle in descending grades may be stored and subsequently applied to the propulsion of the vehicle. I attain this end by mechanism which comprises a spring, means interconnecting the spring and a moving part of the vehicle and by which means power may be applied to and from the spring and from and to the moving part of the vehicle, and means for controlling and regulating the connecting means, all of which will be fully described hereinafter.

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

The apparatus is particularly adapted for use in connection with velocipedes, and in the accompanying drawings this connection is shown, which drawings form a part of this specification, and in which similar characters of reference indicate corresponding parts in all of the figures.

Referring to the drawings, Figure 1 is a side elevation of the invention. Fig. 2 is a similar view taken from the opposite side. Fig. 3 is a plan view. Fig. 4 is a fragmentary elevation particularly illustrating the means for controlling the winding of the spring. Fig. 5 is an elevation illustrating one of the clutches employed in my invention, one of the clutch members being shown in section. Fig. 6 is a detail view illustrating one of the operating-levers; and Fig. 7 is a view of a fragment of the frame, the said fragment of the frame being shown stripped of parts which in practice it carries.

The frame B of the apparatus may be of any form, but the form shown in the drawings is best adapted for use in connection with a bicycle-frame A, comprising a vertical center brace *a* and a forwardly-extending main brace *a'*. The frame B is provided with

clips B', by which it is secured to the said braces of the bicycle-frame.

A shaft D, having a sprocket-wheel 10 arranged to mesh with a sprocket-chain 11, driven by the pedal-axle of the bicycle, is revolubly mounted in sleeves 12, which form its bearings, and the sleeves 12 are respectively carried in the lower ends of the arms 13, said arms projecting upwardly and forwardly to the upper portion of the frame B and being connected by a transverse shaft 15, which slides vertically in guides 16, carried by the rear vertical portion of the frame B.

Fixed to the shaft 15 and respectively adjacent to the guides 16 are two arc-shaped plates 17, each of which is formed with a similarly-shaped slot 18, the slots respectively receiving studs 19, projected inwardly from the inner sides of the frame B, as best shown in Fig. 2. The right-hand end of the shaft 15 is squared or otherwise formed for the reception of a tool by which the shaft may be manually rotated; and the rotation of the shaft results in a swinging of the plate 17, whereby the arms 13, and consequently the shaft D, are raised or lowered according to the movement of the shaft 15. Also fixed to the sleeves or bearings 12 are two rods 14, which extend approximately horizontally and at each side of the frame B and carry at their forward ends bearings in which a shaft D' is revolubly mounted. This shaft D' is located just above the lower portion of the frame B and by means of the arms 14 is kept at the proper relation to the shaft D, the latter shaft having a pinion 21 fixed thereon and meshing with a spur-gear 22, fixed on the shaft D', to permit at all times the proper engagement of said gears being the purpose of the arms 13 and 14. The purpose of adjusting the shaft D and its sprocket 10 is to engage and disengage said sprocket with the chain 11, so that the device may be adjusted for operation or may be thrown out of operative adjustment by raising the shaft D.

Fixed on the shaft D' is a sprocket-wheel 23, with which a chain 24 operates, the said chain extending forwardly and passing over a sprocket-wheel 25, carried loosely on a shaft D², journaled in and at the forward portion of the frame B. Fixed to the right-hand end of the shaft D' is a pinion-gear 45, said gear

meshing with a sprocket-gear 46, loosely carried on the right-hand end of the shaft D^2 .

The sprocket-wheel 25 is provided with a clutch E, by which it may be made to revolve with the shaft D^2 when said shaft moves in one direction, the sprocket-wheel 25 being incapable of revolving with the shaft D^2 when it moves in an opposite direction. The clutch E will be described hereinafter.

Fixed on the gear 46 is a circular plate having therein a radial slot 54. (Shown by dotted lines in Fig. 1.) Pivoted to this plate are two arc-shaped clutch members 49 and 50, the free ends of which are adjacent to each other and respectively arranged on each side of the slot 54. Pivotally connected to the free ends of the respective clutch members 49 and 50 are the links 51 and 52, which are connected to a spindle 53, the same carrying a slide 53^a and being projected through the slot 54 to the left-hand side of the gear 46 and carrying a small roller 55 at said left-hand side. The spindle 53 and the slide 53^a, together with the attached parts, are movable radially in the slot 54, and the links 51 and 52 form a toggle by which the clutch members 49 and 50 may be held in an outward position or may be permitted to move inwardly simultaneously with and consequently upon the inward movement of the spindle 53 and the slide 53^a.

Fixed on the shaft D^2 and adjacent to the outer side of the gear 46, so as to cover the clutch members 49 and 50, is a disk 48, the periphery of which has an inwardly-extending and concentric flange 47, forming with the disk 48 a clutch-casing which embraces the members 49 and 50, said members being adapted to bear against the inner periphery of the flange 47, so as to lock with the disk 48 and thereby fix the gear 46 on the shaft D^2 . The mechanism actuating this clutch will be described hereinafter.

Revolubly mounted in bearings carried by the upper forward portion of the frame B is a shaft D^3 , which carries two helical springs 29, the springs each having one end fixed to the shaft D^3 and the remaining ends to the frame B, as best shown in Fig. 3. Fixed to the left-hand extremity of the shaft D^3 is a spur-wheel 28, which meshes with a pinion 27, fixed on the shaft D^2 . A brake mechanism is provided for the shaft D^3 and will now be described. (See Fig. 5.) Fixed on the gear-wheel 28 is a plate 33, and this plate has pivotally connected to it three arms 32, actuated by springs 34, and having shoes 31, respectively, pivoted at their free ends. A disk 30 is loosely mounted on the shaft and alongside of the gear 28, the disk having an outwardly-extended flange embracing the arms 32 and against the inner side of which the shoes 31 bear. The disk 30 by these means may be fixed to the gear 28, and consequently to the shaft D^3 ; and the arrangement of the parts is such that as the gear-wheel 28 revolves with the shaft D^2 , under

the influence of the unwinding of the springs 29, the disk 30 and its flange will tend to move with the shaft, the pawls positively engaging the flange through the medium of the shoes 31. When, however, the shaft D^3 and the gear 28 revolve under the influence of movement which winds the springs 29, the arms 32 and their shoes 31 will not effect a positive connection between the disk 30 and the gear 28. The purpose of this construction is to provide a brake which may be continually applied and which will hold the springs 29 from unwinding, but which at the same time will not prevent such revolution of the shaft that may effect a winding of the springs 29.

The brake proper, F, engages the flange of the disk 30, and consists, as best shown in Fig. 2, of a lever 37, fulcrumed to a middle brace 38 of the frame B and having a rear portion 37^b and a curved shoe portion 37^a, the latter bearing against the flange of the disk 30 and being extended at its free end to form a member 37^c, formed with a slot 39, receiving the antifriction-roller 40, carried on the forward extremity 36^a of the second brake member 36, the same being fulcrumed on a pin 41, carried by the forward portion of the frame B and having a rearwardly-projected shoe portion 36^b engaging the flange of the disk 30.

Connected to the forward portion 36^a of the member 36 is a wire or other flexible connection 42, the same being adapted to extend to the forward upper portion of the bicycle-frame and connected to the short arm of a lever 43, (see Fig. 6,) said lever being fulcrumed on a sleeve 44, carried by the bicycle-frame. This lever may be of any approved construction. It will thus be seen that upon the tightening of the brake members 36 and 37 the disk 30 will be locked with the same, and it will also be seen that the shaft D^3 will be then prevented from revolving to permit the unwinding of the springs 29, so that such unwinding can only take place upon the relaxation of the brake F.

The before-referred-to clutch E is constructed similarly to the clutch E', and its purpose is to fix the sprocket-wheel 25 on the shaft D^2 when the shaft D^2 is revolving under the influence of the unwinding of the springs 29, for the sprocket-chain 24 only transmits power from the springs 29, and when the springs 29 are being wound the sprocket-wheel 25 runs idly on the shaft D^2 .

At the clutch E' the disk 30, and that against which the shoes 31 bear, is loose on the shaft D^3 , but at the clutch E the disk thereof, which is a counterpart of the disk 30, is fixed to the shaft D^2 , and the sprocket-wheel is loose on the shaft, the sprocket-wheel carrying devices similar to the arms 32 and shoes 31 of the clutch E'.

I will now describe the mechanism by which the winding of the springs 29 is automatically stopped upon the completion of said operation or by which it may be stopped at the

desire of the operator. A disk 56 is fixed on the shaft D^3 and carries an antifriction-roller 57, adapted to cooperate with a star-wheel 58, the number of the teeth of which is equal to the number of revolutions of the shaft D^3 necessary to the complete winding of the springs 29, so that as the shaft D^3 revolves in the winding operation of the shaft it will impart a step-by-step movement to the star-wheel 58, which will give the spindle 59, on which said wheel is mounted, a complete revolution for each winding of the springs 29. Fixed on the spindle 59 is a cam 60, adapted to engage with an antifriction-roller 61, carried on a slide 62, movable in a guideway 63, formed at the forward portion of the frame B, and pressed upward by means of an expansive spring 60^a, carried in the guideway. Moving with the slide 62 is a shifting arm 65, which comprises an arc-shaped shoe 65^a, formed with a broad bearing-face eccentric to the shaft D^2 , and a shank 65^b, adjustably secured on the slide 62.

Fulcrumed on the frame B is a lever 69, having pivotal and sliding connection with the shank 65^b of the shifting arm 65 and having a flexible connection 70 attached to its outer end. This connection 70 extends to a suitable lever similar in location and function to the lever 43. The parts above described, exclusive of the lever 69 and the connection 70, are so timed that when the winding of the springs 29 is complete the cam 60 will have been moved to press the slide 62, and consequently the shifting arm 65, downward slightly below the position shown in Fig. 4, which operation will disconnect the mechanism which transmits to the shaft D^3 movement for winding the springs 29, as will be fully described hereinafter. This operation may also be effected by manipulating the lever 69 through the medium of the connection 70.

To make sure the operation of the devices for moving downwardly the shifting arm 65, I provide a supplemental step-by-step moving device comprising a disk 66, fixed to the shaft D^3 and having a segment of teeth which mesh with a similar segment formed on the disk 67, fixed to the spindle 59. These parts are so timed that they will, upon the completion of the winding of the springs 29, move the cam 60, so that the shifting arm 65 will be moved downward. It will be understood that these disks 66 and 67 operate concurrently with the operation of the star-wheel 58 and the disk 56.

In order to connect the gearing which transmits the movement for winding the springs 29, I provide a shifting arm 73, comprising a shoe 73^a and a shank 73^b, which shank is connected to a slide movable in a guideway 71 and pressed by an expansive spring 72. The shoe 73^a is formed with a flange 74, projecting outwardly therefrom and also eccentric to the shaft D^2 . A lever 75 is fulcrumed on the frame B and connected with the shank 73^a,

as best shown in Fig. 4, the lever 75 being provided with a connection 76, extending to a third lever, which also is similar to the lever 43 and by means of which and the connection 76 the shifting arm 73 is manually operated.

The clutch members 49 and 50 and their attendant parts have been before described, and the roller 55, which is connected to the spindle 53, in turn connected to the slide 53^a and links 51 and 52, is adapted to engage with the shoes of the shifting arms 65 and 73 and to be moved in or out, according to the arm which it engages. As the roller 55 revolves with the wheel 46, if the shifting arm 65 is moved to a downward position the roller will engage the lower periphery of the shoe 65^a of said arm, and owing to the eccentric disposition of said shoe the roller will be moved inwardly, so as to move the links 51 and 52 in a similar direction and release the pressure with which the sections 49 and 50 bear against the flange 47. When, however, the wheel continues to move so as to move the roller 55 into engagement with the rear side of the flange 74, as shown by dotted lines in Fig. 4, the eccentric position of said flange will draw the roller 55 outward and move the slide 53^a, and consequently the links 51 and 52, in a similar direction, applying the shoes 49 and 50 against the flange 47. It is thus apparent that upon the completion of the winding of the springs 29 the clutch members 49 and 50 will be automatically disengaged with the flange 47 and the wheel 46 rendered loose upon the shaft D^2 , and also that when desired the operator may draw on the connections 70 and produce this effect by manual operation. Also it will be seen that upon the proper movement of the shifting arm 73 by the hand of the operator the flange 74 will be disposed in the manner necessary to effect a forcible engagement between the members 49 and 50 and the disk 48.

Having thus described the construction and organization of my invention, I will proceed to explain the use thereof. Assuming that the parts are in the positions shown in Fig. 1 and that it is desired to apply to the chain 11 the power of the wound springs 29, the brake F should be released and (if the automatic disconnecting mechanism of the clutch-arms 49 and 50 had not been automatically operated to disconnect the clutch) the connection 70 should be manually operated to effect this disconnection, whereupon the shaft D^3 will revolve, imparting to the shaft D^2 a movement in the direction of the arrow f , which will be transferred, through the medium of the sprocket-wheels 23 and 25 and the chain 24, to the shaft D' , causing said shaft to revolve in the direction of the arrow c , it being understood that the sprocket-wheel 25 revolves with the shaft D^2 only when said shaft moves under the influence of the unwinding of the springs 29, and that when the shaft D^3 moves to wind the springs 29 the

sprocket-wheel 25 runs idly on the shaft D². From the shaft D' the movement above explained is transmitted to the shaft D in the direction of the arrow *b*, and from the shaft D this movement is applied to the sprocket-chain 11. The unwinding of the springs 29 may be stopped at any time by an application of the brake F.

To wind the springs 29, assuming that they have been unwound, the connection 76 should be operated to force the clutch-arms 49 and 50 into engagement with the flange 47, whereupon the revolution of the shafts D and D', respectively, in the direction of the arrows *b* and *c* will be transmitted to the shaft D³ through the medium of the gears 45 and 46, the sprocket-wheel 25, as above explained, running idly on the shaft D². From the shaft D³ this winding movement is transmitted to the shaft D³ through the medium of gears 27 and 28 and the springs 29 wound. The winding may be manually stopped at any time by the operations of the connection 70 and is automatically stopped by the mechanism shown in the upper portion of Fig. 4 upon the completion of the winding operation.

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

1. The combination, with a driving mechanism, a power-accumulator shaft, springs secured to the said shaft, being coiled around the same and attached to a fixed support, a power-transmitting gearing adapted for engagement with the driving mechanism, a clutch-controlled gear carried by the accumulator-shaft and in winding connection with the transmitting-gear, a brake controlling the said clutch, and a second clutch connection between the accumulator-shaft and the transmitting-gear, the latter connection operating to convey the power of the springs to the transmitting-gearing and a third clutch connection whereby the springs may be wound up by the winding mechanism as and for the purpose specified.

2. The combination, with a driving mechanism, a power-accumulating shaft and a support for the same, springs attached to and coiled around the said accumulator-shaft, being secured also to the fixed support, and a transmitting-gearing located between the driving mechanism and power-transmitting shaft and adapted for engagement with the former, of a winding mechanism for the said accumulator-shaft, the same consisting of a gear fixed to the said shaft a clutch loosely mounted on the said shaft and connected with the said gear, a brake adapted to hold the clutch stationary, and a connection between the said gear and the transmitting-gearing, the brake being so arranged with reference to the clutch that when the brake is released from engagement with the clutch the springs will act to turn the shaft and convey their power to the transmitting-gearing, as and for the purpose specified.

3. The combination, with a driving mechanism, a power-accumulator shaft, a support for the same, springs attached to and coiled around the said shaft, being also secured to a fixed support, and transmitting-gearing adapted for engagement with the driving mechanism and located between it and the power-accumulator shaft, of a gear-wheel secured on the accumulator-shaft, a clutch loosely mounted on the said shaft and comprising a shell, pawls in engagement with the inner peripheral portion of the shell, and spring-controlled arms pivoted to the said pawls and pivotally attached to the said gear, a connection between the said clutch-controlled gear and the transmitting-gearing, substantially as described, a brake comprising two jaws, pivoted at opposite ends to supports, the jaws being adapted to clamp respectively opposite portions of the shell of the clutch, and a lever for controlling the said brake, as and for the purpose specified.

4. The combination, with a driving mechanism, a power-accumulator shaft, a support for the same, springs coiled around the said shaft, being attached thereto and to a fixed support, a line-shaft having a positive gear connection at one of its ends with the accumulator-shaft, and a clutch-controlled connection with the transmitting-gear, of a gear loosely mounted on the said line-shaft and in driving connection with the transmitting-gearing, a shell attached to the said shaft, segmental pawls pivotally connected to the gear and adapted for engagement with opposite points on the said shell, the free ends of the pawls being provided with pivotally-connected links having sliding movement in the opening in the gear, a friction-wheel carried by the connecting pivot-pin of the said links, and a trip-arm terminating in a shoe, adapted for engagement with the said friction-wheel to force the same inward, releasing the pawls from the clutch and thereby causing the gear to turn loosely on the said shaft to cease winding the said springs, as and for the purpose set forth.

5. The combination, with a driving mechanism, a power-accumulator shaft, a support for the same, springs coiled around the said shaft, being attached thereto and to a fixed support, a line-shaft having a positive gear connection at one of its ends with the accumulator-shaft, and a clutch-controlled connection with the transmitting-gearing, of a gear loosely mounted on the said line-shaft and in driving connection with the transmitting-gearing, a shell attached to the said shaft, segmental pawls pivotally connected to the gear and adapted for engagement with the opposite points on the said shell, the free ends of the pawls being provided with pivotally-connected links having sliding movement in an opening in the gear, a friction-wheel carried by the connecting pivot-pin of the said links, and a trip-arm terminating in a shoe, adapted for engagement with the said friction-wheel to force the same inward, releasing the pawls from the

clutch and thereby causing the gear to turn loosely on the said shaft to cease winding the said springs, and a trip mechanism operated from the power-accumulator shaft and operating on the said trip-arm to force the latter to an engagement with the aforesaid friction-wheel, thereby automatically stopping the winding of the springs, substantially as described.

6. The combination, with a support, transmitting-gearing journaled in the said support and adapted for engagement with a power mechanism, a power-accumulator shaft journaled in the support, springs attached to the said shaft, and coiled around the same, being also secured to the said support, a line-shaft intermediate of the accumulator-shaft and power-transmitting gearing, the said shaft being geared at one end to the power-accumulator shaft in a substantially positive manner, of a gear-wheel loosely mounted on the opposite end of the line-shaft, having driving connection with the transmitting-gears, a clutch secured to the said shaft near the said gear, comprising a shell, segmental pawls pivoted at one of their ends to the gearing, having engagement with the inner peripheral surface of the clutch-shell, links pivotally connected, and connected to the free ends of the pawls, the connecting-pin of the said links being passed through an opening in the said gear and provided at its inner end with a friction-roller, a trip-arm having sliding movement on the frame, and provided with a semicircular shoe adapted for engagement with the said roller, a disk attached to the accumulator-shaft, provided with an extension from its periphery, a star-wheel engaged by the said extension, and a cam operated by the said star-wheel to move the shifting arm in a direction to engage with the friction-wheel of the clutch, thereby releasing the gear controlled by the clutch from engagement with the line-shaft and causing the winding action of the accumulator-shaft to cease, as and for the purpose specified.

7. The combination, with a frame, transmitting-gearing journaled in the said frame and adapted for engagement with a driving mechanism, a power-accumulator shaft, springs coiled around the said shaft, being secured thereto and to a fixed support, a clutch-controlled connection between one end of the power-accumulator shaft and the transmitting-gear, an intermediate line-shaft constituting a portion of the said gearing, a gear-wheel loosely mounted upon the opposite side of the said shaft, a clutch controlling the said gear and comprising a shell secured to the shaft, pawls engaging with the periphery of the said shell, being pivoted at one of their ends to the gear, their opposite ends being connected by links, the connecting pivot-pin whereof is passed through an opening in the wheel and provided at its inner end with a friction-roller, a trip-slide terminating in a

flanged shoe, adapted to operate in the frame and to receive upon the outer surface of its flange the aforesaid friction-roller, applying the pawls to the shell of the clutch, and a lever for operating the said slide, as and for the purpose set forth.

8. The combination with a frame, of a spring-motor, a set of gearing for transmitting winding movement to said motor, an additional set of gearing capable of receiving movement from the motor, two clutches respectively capable of connecting and disconnecting the two sets of gearing, and means controlled by the motor by which one of said clutches may be automatically disconnected upon the completion of the winding of the motor, substantially as described.

9. The combination with a frame, of a spring-motor, a shaft driven by said motor, a gear-wheel loose on the shaft, a clutch capable of connecting said gear-wheel with the shaft when the shaft revolves in one direction, a second gear-wheel also loose on the shaft, a second clutch capable of connecting the second gear with the shaft, and a shifting arm controlled by the motor and capable of operating the second clutch, substantially as described.

10. The combination with a frame, of a spring-motor, means for transmitting winding movement to the motor, a clutch controlling said means, and means automatically controlled by the motor for operating the clutch, substantially as described.

11. The combination with a frame, of a spring-motor, means for transmitting winding movement to the motor, a clutch controlling said means, a shifting arm capable of operating the clutch and step-by-step movement transmitting mechanism interposed between the shifting arm and the motor whereby the shifting arm is automatically operated, substantially as described.

12. The combination with a frame, of a spring-motor, means for winding the motor, a rotary clutch controlling said means, the said clutch having a radially-movable operating-wheel, two shifting arms eccentric to the axis of the clutch and respectively capable of moving the operating-wheel toward or from said axis, and means for operating the shifting arms, substantially as described.

13. In a clutch, the combination with a shaft, of a wheel loose on said shaft, a clutch member fixed to the shaft, a clutch-arm carried by the wheel, a radially-movable slide with which the arm is connected, and means for moving the slide, substantially as described.

14. In a clutch, the combination with a shaft, of a wheel loose on the shaft, two clutch-arms carried by the wheel, a slide having a toggle connection with the clutch-arm, a clutch member fixed to the shaft and with which the clutch-arms engage, and a mounted shifting arm having a curved shoe eccentric

to the axis of the wheel, the arm being movable to engage and disengage the shoe with the slide, substantially as described.

15. In a clutch, the combination with a shaft, of a wheel loose on the shaft, two clutch-arms fixed to the wheel, a slide radially movable on the wheel, a toggle-link connecting each arm with the slide, and an operated shifting arm eccentrically disposed to the axis of the wheel, substantially as described.

16. The combination, with a frame, of a spring-motor, movement-transmitting mechanism connected with the motor, a clutch controlling said mechanism, means for operating the clutch, and a step-by-step movement-transmitting mechanism interposed between the motor and the clutch-operating means, substantially as described.

17. The combination with a frame, of a spring-motor, movement-transmitting mechanism connected with said motor, a clutch controlling said movement-transmitting mechanism, a disk moving in unison with the motor and having a projection thereon, a star-wheel with which the projection periodically engages, a shifting arm cooperating with the clutch, and means operating with the star-wheel for moving the shifting arm, substantially as described.

18. The combination with a frame, of a spring-motor, movement-transmitting mechanism in connection with the motor, a clutch controlling said mechanism, a shifting arm, a disk moving with the motor and having a projection thereon, a star-wheel periodically engaged by the projection, and a cam revolving with the star-wheel and engaging the shifting arm, substantially as described.

19. The combination of two sets of mounted gearing, a shaft continually geared with one set and capable of being geared with the remaining set, a pivotally-mounted arm carrying the shaft and means for locking the arm at varying adjustments, substantially as described.

20. The combination with a frame, of mechanism carried thereon, a shaft geared with the mechanism, means for mounting said shaft to move in an arc, an arm connected to the shaft, a shaft rotatable in the arm, and a plate having a curved slot fixed on the shaft, the said slot receiving a part rigid with the frame, substantially as described.

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