No. 858,625. PATENTED JULY 2, 1907.

# E. A. REEVES.

## SPRING MOTOR.

APPLICATION FILED MAY 18, 1903. RENEWED JAN. 9, 1907.

3 SHEETS—SHEET 1.

Fig. 1.

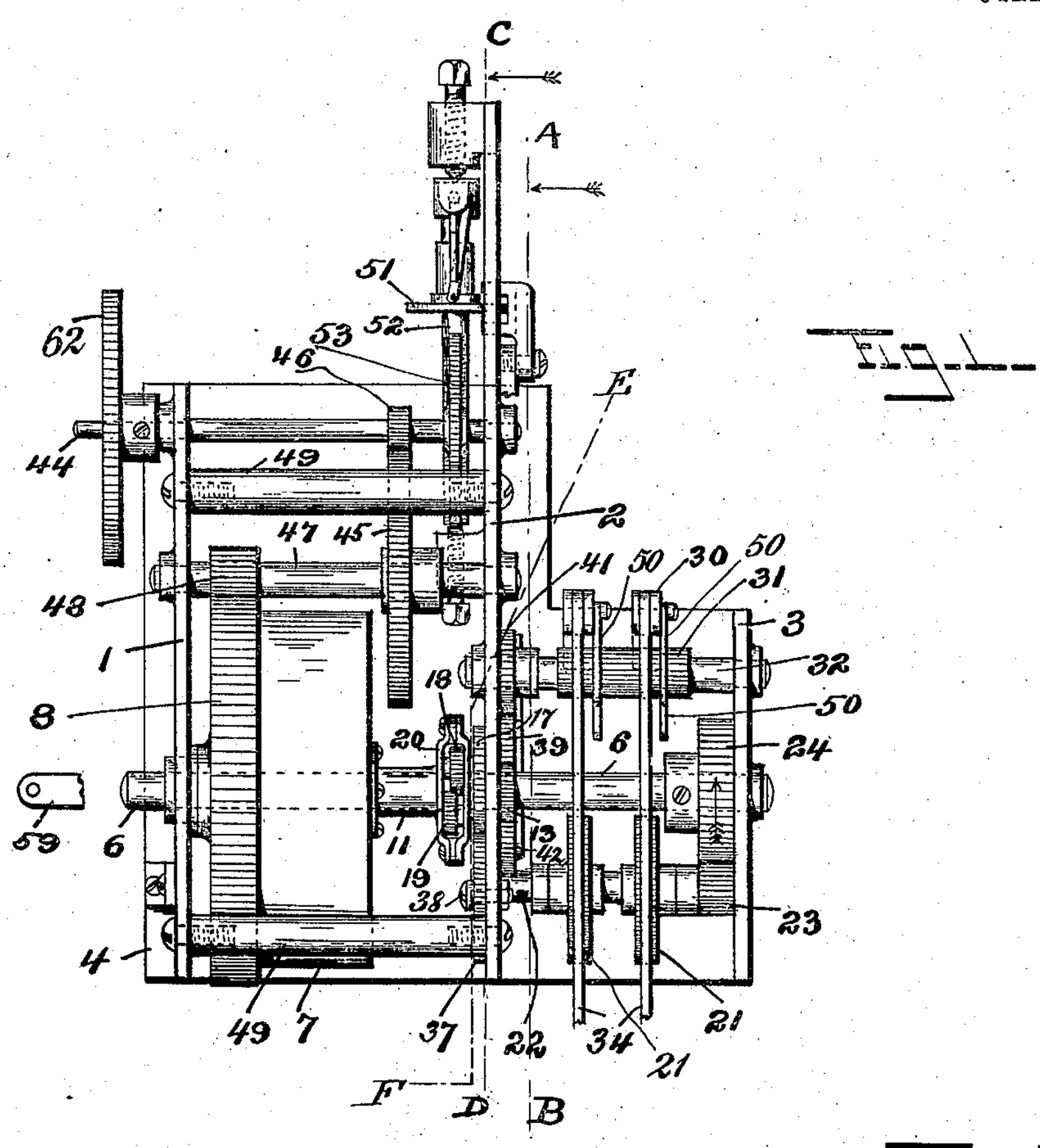



Fig. 2.

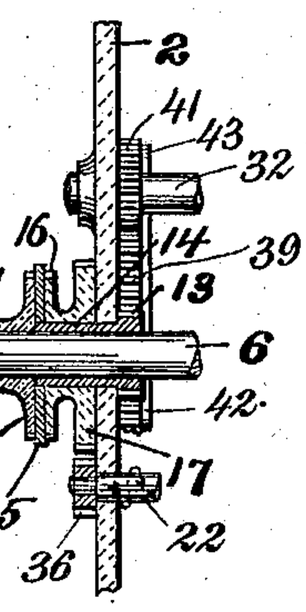
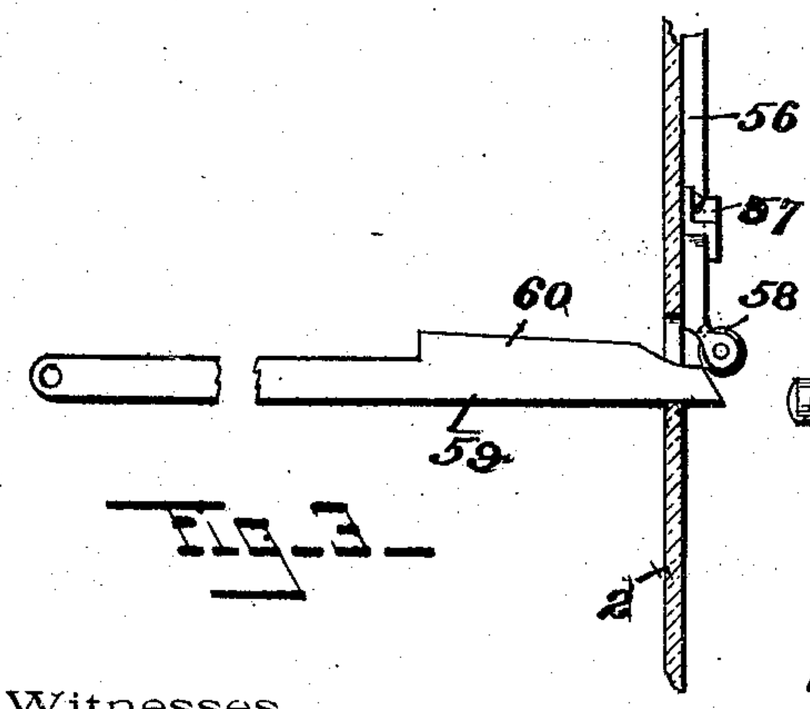



Fig. 3.

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No. 858,625. PATENTED JULY 2, 1907.

E. A. REEVES.

SPRING MOTOR.

APPLICATION FILED MAY 19, 1903. RENEWED JAN. 9, 1907.

3 SHEETS—SHEET 2.

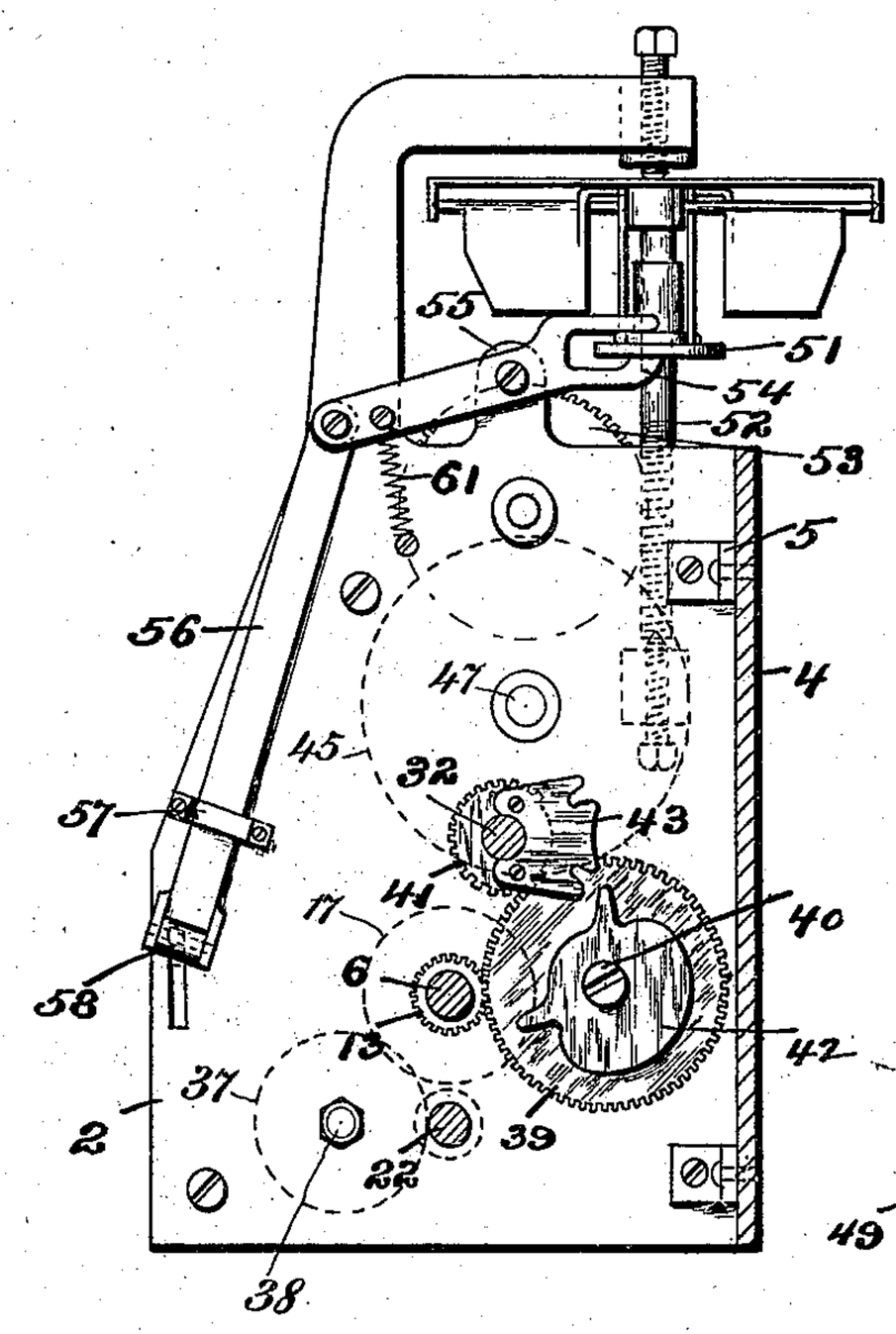


Fig. 4.

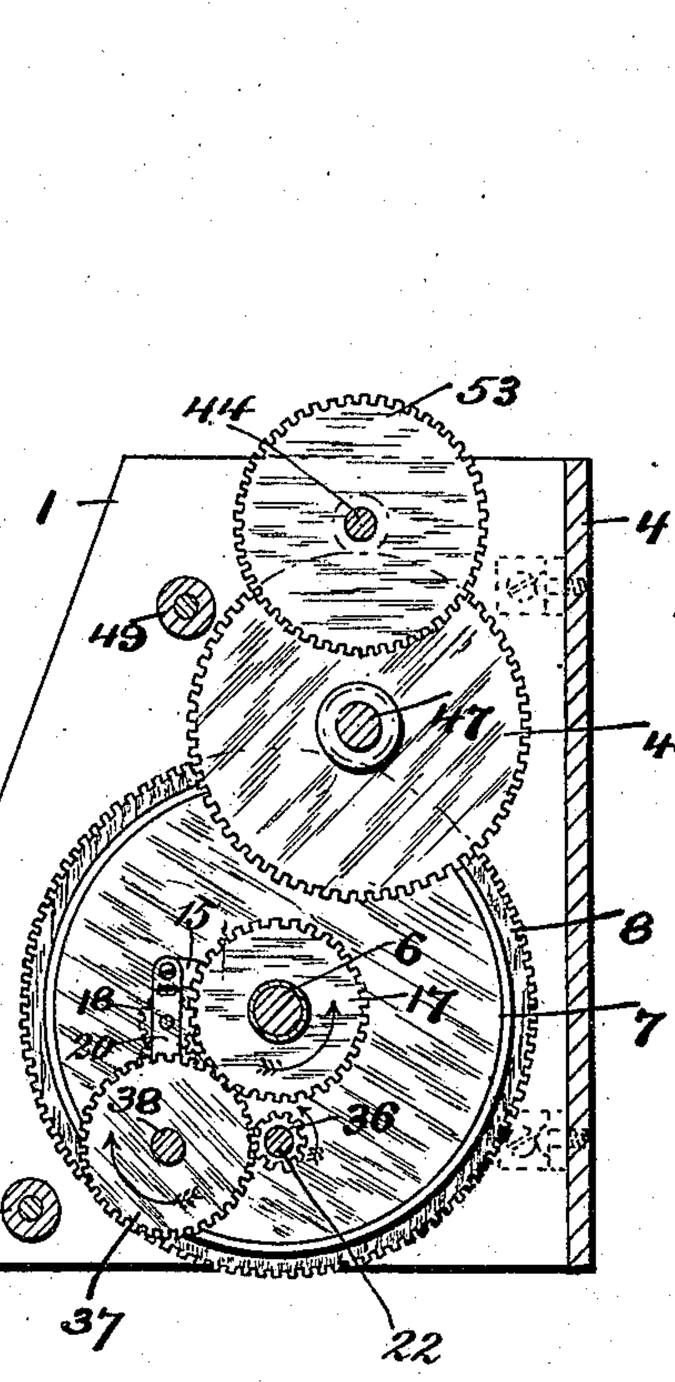


Fig. 5.

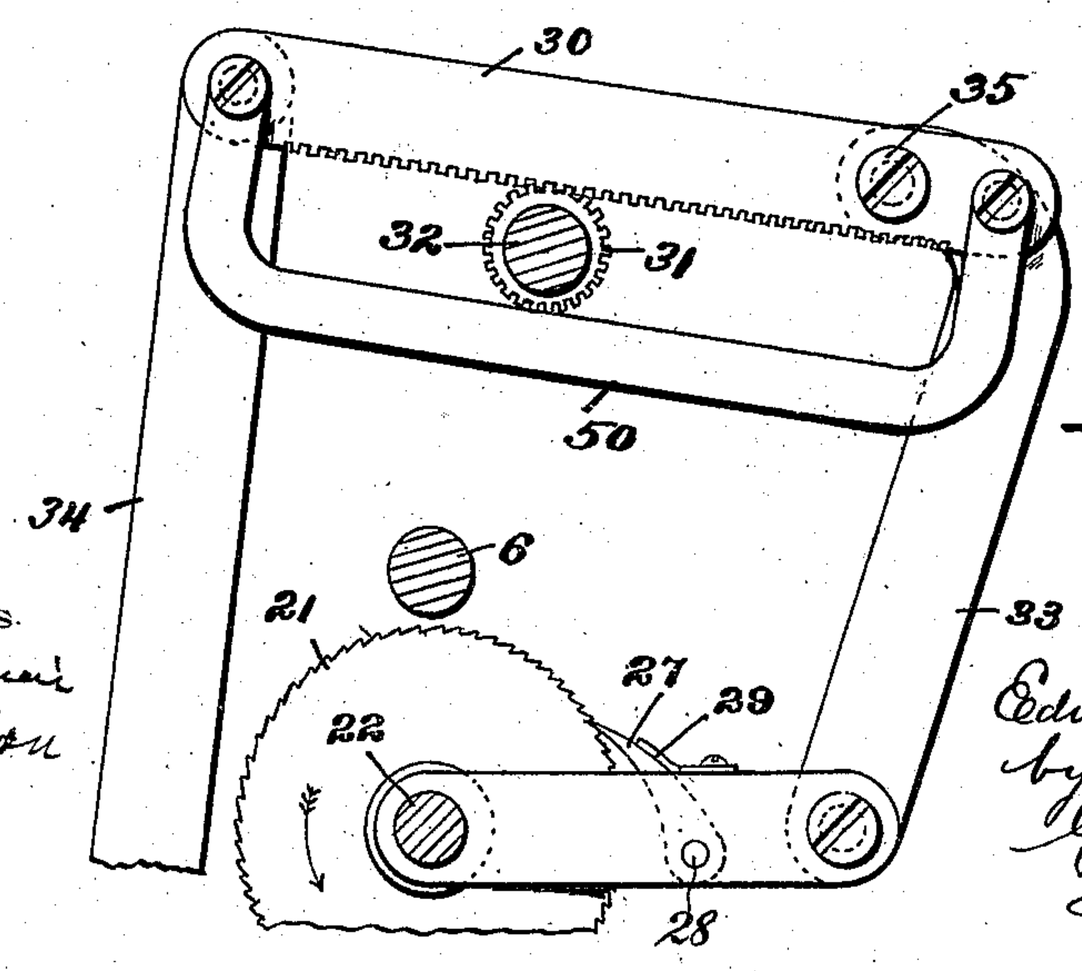


Fig. 6.

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No. 858,625. PATENTED JULY 2, 1907.

# E. A. REEVES.

## SPRING MOTOR.

APPLICATION FILED MAY 19, 1903. RENEWED JAN. 9, 1907.

3 SHEETS—SHEET 3.

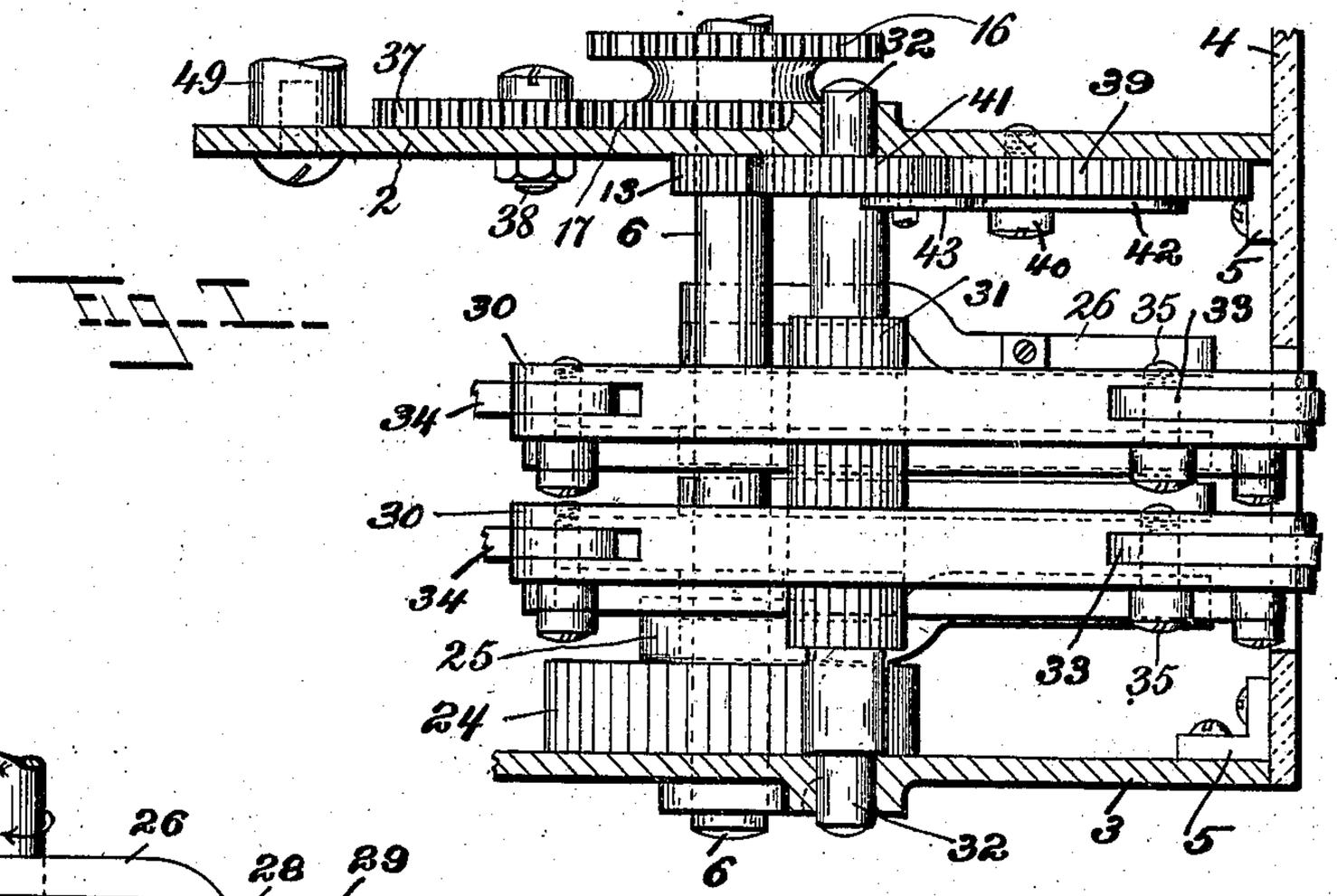


Fig. 1.

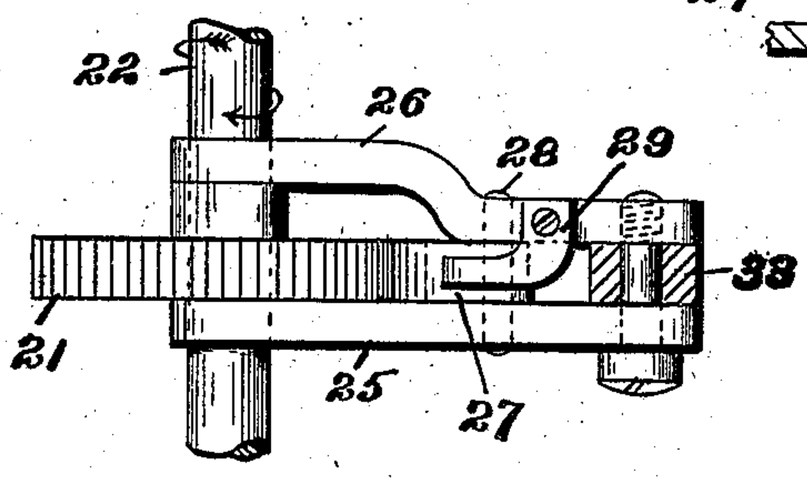


Fig. 2.

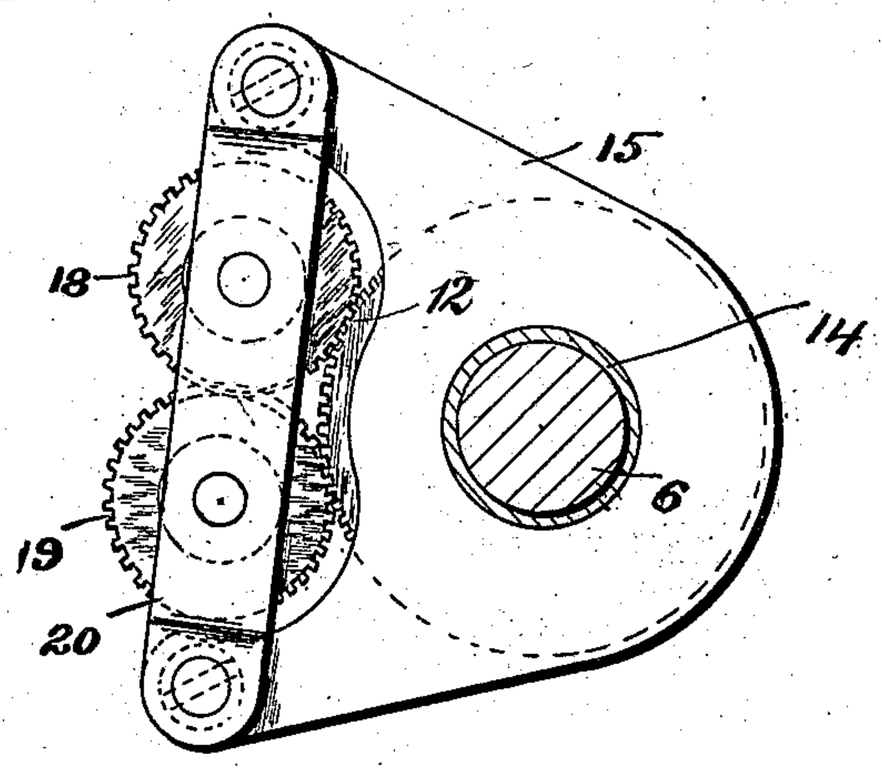


Fig. 3.

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# UNITED STATES PATENT OFFICE.

EDWIN A. REEVES, OF BRIDGEPORT, CONNECTICUT.

## SPRING-MOTOR.

No. 858,625. Specification of Letters Patent. Patented July 2, 1907.

Application filed May 19, 1903. Renewed January 9, 1907. Serial No. 351,565.

*To all whom it may concern:*

Be it known that I, EDWIN A. REEVES, a citizen of the United States, residing at Bridgeport, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Spring-Motors, of which the following is a specification, reference being had therein to the accompanying drawings.

My invention relates to new and useful improvements in spring motors, and refers more especially to that type of motor which is used to drive automatic piano playing devices.

Referring to the drawings, in which like numerals of reference designate like parts in the several figures; Figure 1 is a front elevation of my improved spring motor; Fig. 2 is a transverse sectional view of the spring drum and its adjacent mechanism; Fig. 3 is a fragmentary detail view of the cam lever; Fig. 4 is a sectional elevation of the parts taken upon line A—B of Fig. 1 looking in the direction of the arrow; Fig. 5 is a sectional elevation of the parts taken upon line C—D of Fig. 1 also looking in the direction of the arrow; Fig. 6 is an enlarged detail view of the ratchet and its operating mechanism; Fig. 7 is an enlarged plan view, partly in section, of the ratchet operating mechanism; Fig. 8 is a plan view of the ratchet disk, pawl and pawl carrier; and Fig. 9 is an enlarged side elevation of the epicyclic train, the sectional parts being taken upon line E—F of Fig. 1.

In the practice of my invention I provide the parallel plates 1, 2 and 3 and the back plate 4, which is secured thereto, preferably by the angle plates 5. The plates 2 and 3 are rigidly secured by the rods 49. The spring shaft 6 is journaled in plates 1, 2 and 3 and has a spring drum 7 thereon. Integral with said drum is the gear 8 and contained therein is a spring 10 that is secured at its inner end to said shaft and at its outer end to the drum. The open side of the drum 7 is closed by a plate 9 to which is fixed the journal 11 having a transmitting gear 12 integral therewith. Mounted within the plate 2 on the shaft 6 is a pinion 13, to the hub 14 of which is fixed a plate 15 having plates 20 secured thereto and between which is rotatably mounted the intermeshing pinions 18 and 19. Rotatable upon said hub 14 between the plates 2 and 15 is the winding gear 16 and gear 17 which are preferably made integral with each other (Figs. 2 and 7). The gears 12 and 16 are of the same diameter and pitch. The pinion 18 meshes into the gear 16 and pinion 19 and the pinion 19 into pinion 18 and gear 12. The gears 12 and 16 and pinions 18 and 19 combine to make an epicyclic train, the pinions 18 and 19 being rotatable about their own axis between the plates 20 and move with the plate 15 in a rotary path concentric to the axis of shaft 6.

Journaled in the plates 2 and 3 is the shaft 22 having a pinion 23 fixed thereon which meshes into a gear 24 fixed on the shaft 6. Also fixed on the shaft 22 are the ratchet disks 21 upon either side of which are the plates 25 and 26 carrying the pawls 27 upon the pins 28, which are held in engagement with the ratchet teeth by the spring fingers 29. The levers 30 are provided with teeth upon their underside which engage the teeth in the pinion 31, preferably integral with the shaft 32, and the guides 50 prevent accidental disengagement of said teeth. The levers 30 are connected with the plates 25 and 26 by the links 33, that are secured to said levers by the screws 35, and with the pedal mechanism by the links 34. A pinion 36 secured on shaft 22 drives the gear 17 through an idler gear 37 rotatable upon a stud 38. The gear 39 mounted upon a stud 40 meshes into a pinion 41 fixed on the shaft 32. Some of the teeth in the pinion 41 are cut away as shown by dotted lines in Fig. 4. Attached to gear 39 is a plate 42 having a concentric portion $42^a$, and two teeth projecting radially therefrom which are designed to mesh into the notches in a plate 43 fixed to the pinion 41 and having a recess $43^a$ in its periphery of the same radius as the concentric portion $42^a$.

The character or details of the mechanism for connecting this motor with the piano playing mechanism is not material to my invention and is therefore not shown or described. It may be driven either by connection with a gear upon said piano playing mechanism, with a gear 62 upon the shaft 44, or by a sprocket chain connected with a sprocket gear substituted for the said gear 62. The shaft 44 is driven by gear 8, pinion 48, shaft 47, gear 45 and pinion 46.

The speed of my spring motor is determined by a governor, the wings of which are directly connected with a disk 51 slidable upon a worm shaft 52 that is driven by the worm gear 53 upon the shaft 44. The position of the disk 51 upon the shaft 52 is varied through the friction lever 54 pivotally connected with a fixed lug 55 and having connection with a slide 56 held in the straps 57 and having an idler roll 58 thereon. This slide 56 is moved lengthwise and the lever 54 is oscillated through the lever 59 having a cam 60 upon its forward end movable in the path of the idler roll 58. The lever 59 is connected with the piano playing mechanism by any desired means and by shifting the same so that the cam 60 actuates the idler roll 58 the slide 56 is given an endwise movement, the lever 54 is oscillated and the disk 51 moved upon the shaft 52 so as to move the governor wings into a position that will offer the least resistance to the rotation thereof, thereby permitting the mechanism to be operated at its fastest possible speed. By a reverse movement of the lever 59 the speed is decreased. The spring 61 which connects the lever 54 with the plate 2 normally holds said lever 54 in a position wherein it has the greatest amount of friction upon the disk 51 and holds all of the parts in their rest position.

In operation the actuation of the pedal mechanism

imparts a rocking movement to the lever 30 upon its fulcrum, the pinion 31, and through the links 33, pawls 27 and ratchet disks 21, a rotary movement is imparted to the shaft 22, and through the pinion 23 and gear 24 to the shaft 6, which winds the coil spring 10 within the drum 7. The rotation of the shaft 22 also imparts a rotary movement to the gear 17 through the idler gear 37 in a direction opposite to that of the shaft 6. The unwinding of the spring 10 rotates the spring drum 7 and the gear 12 which is connected therewith in the same direction as the shaft 6. The gear 16, it will be noted, is rotated through the mechanism that winds the spring and the gear 12 by the unwinding of the same spring and both rotating in opposite directions. Pinions 18 and 19 are rotated about their own axis by either the gear 12 or 16 whichever is rotating the faster and through the plate 15 they move in a circular path about the axis of the shaft 6 in the same direction as that of the gear (12 or 16) which is imparting rotation to the pinions 18 and 19. The pinion 13 being fixed to the plate 15 rotates therewith, and through the gear 39 and pinion 41 imparts a rotary movement to the shaft 32 and pinion 31. The rotation of the pinion 31 shifts the position of the levers 30 thereon and by reason thereof controls the amount and speed of the spring winding. When the center of the pinion 31 is below the center of the screw 35 no movement is imparted to the pawl and the pedal mechanism will operate without winding the spring. The reverse is also true, *i. e.*, the farther away the center of the pinion 31 is from the screw 35 the longer the stroke of the pawl and hence a greater rotary movement is imparted to the spring shaft 6. If the spring is being wound faster than the same is running down the gear 16 will rotate faster than the gear 12 and hence rotate the shaft 32 and the epicyclic train will rotate in the direction of said gear 16 and through the plate 15 and intermediate connections the shaft 32 will be rotated and shift the levers 30 so that the center of the pinion 31 will be moved toward the center of the screw 35 thus reducing the stroke of the pawl and the winding of the spring. If, however, the spring is unwinding faster than it is being wound the gear 12 will rotate faster than the gear 16 and the epicyclic train will rotate in the direction of said gear 12, and the shaft 32 caused to rotate in the direction opposite to that when rotated with the gear 16 and shifts the levers 30 so that the axis of the pinion 31 is farther away from the center of the screws 35, thereby increasing the throw and imparting a longer movement to the pawl and a greater winding movement to the spring. When the speed of winding and unwinding is the same the gears 12 and 16 will rotate at the same speed and no movement is imparted to the epicyclic train and hence the pinion 31 remains stationary.

The action of the controlling mechanism is entirely automatic and governed through positively actuated gears, the stroke of the links 34 which connect the pedal mechanism being always substantially the same, but the movement of the pawl mechanism being variable. The winding of the spring may be accomplished independently of the movement of the drum which can remain stationary and the spring wound tight, at which time the center of the pinion 31 is below the screws 35 and no further movement is imparted to the spring shaft and continued movement of the pedals becomes lost motion.

In order that the tension of the spring 10 may be uniform it is desirable that the maximum throw of the levers be attained during the unwinding of the first few coils of the spring and that no increased throw be had during the unwinding of the other coils of said spring. This object is accomplished by the coöperation of the plates 42 and 43. During the unwinding of the first few coils of the spring the action of the gears 39 and pinion 41 shifts the levers 30 to a position wherein they have the maximum throw, at which time one of the teeth upon the plate 42 engages one of the notches in the plate 43 and rotating the pinion 41 and that portion of the periphery of the pinion 41 having no teeth therein is in contact with the periphery of the gear 39. When the teeth are so disengaged no further rotary movement is imparted to the shaft 32 and the pinion 31 connected therewith and the levers 30 are held in a permanent position. As the gear 39 has a continual rotary movement, whenever the pinion 13 is rotating, the said gear 39 continues to rotate and with it the plate 42 which through the engagement of the tooth thereon with the notch in the plate 43 shifts said plate so that the concaved portion $43^a$ thereon is in contact with the concentric portion $42^a$ of the plate 42. When these plates 42 and 43 are so engaged the shaft 32 is held against rotary movement in either direction, but the gear 39 and plate 42 can continue its rotary movement, the concentric portion $42^a$ of said plate 42 sliding through the concaved portion $43^a$ of the plate 43.

In the drawings the mechanism is illustrated as applied to a spring in which the lever 30 assumes its maximum throw during the unwinding of substantially the first two coils thereof, but it is apparent that the mechanism may be used as well with various other ratios of unwinding.

There has been illustrated but one way through which the levers may be shifted upon their fulcrum, *i. e.*, through the epicyclic train, but there are many ways by which this result may be obtained aside from said epicyclic mechanism, and therefore I do not limit myself to said specific means for accomplishing this result.

There are many minor changes and alterations that can be made within my invention aside from those herein shown and suggested, and I would therefore have it understood that I do not limit myself to the exact construction herein shown and described, but claim all that falls fairly within the spirit and scope of my invention.

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

1. In a spring motor, the combination with the spring; of a lever; a fulcrum for said lever; and mechanism connecting said spring with said fulcrum for changing the position of contact of said lever and fulcrum during the winding and unwinding of said spring.

2. In a spring motor, the combination with a lever; of a fulcrum for said lever; and means for moving one of said parts in relation to the other while said parts are in operation, whereby the point of contact with each other may be changed.

3. In a spring motor, the combination with the spring; of a lever; a fulcrum for said lever having a toothed engagement therewith; and means for actuating said fulcrum, whereby its point of contact with said lever may be changed.

4. In a spring motor, the combination with the spring; of a lever; a fulcrum for said lever; a winding mechanism; a ratchet disk forming part of said winding mechanism; a pawl; a connection between said lever and pawl; and means operated by the movement of said spring for shifting said lever upon its fulcrum.

5. In combination with a spring; of a lever having an operative connection with said spring; a fulcrum for said lever having a positive engagement therewith; and means for rotating said fulcrum during the action of said spring, whereby said lever is moved endwise thereon.

6. In a spring motor, the combination with a spring; of a lever; a fulcrum for said lever having a positive engagement therewith; and an epicyclic train for varying the relative position of said lever and fulcrum.

7. In a spring motor, the combination with a spring; of a lever; a fulcrum for said lever; a winding mechanism having a gear forming part thereof; another gear rotated by the unwinding of said spring in a direction opposite to said first mentioned gear; and means operated by said gears for shifting the relative position of said lever and fulcrum.

8. In a spring motor, the combination with a shaft; of a spring fixed thereto; a drum surrounding said spring, connected therewith and rotated thereby; two gears, one of which is driven with said shaft and the other with said drum; a lever; and means connected with said gears for shifting the position of said lever.

9. In a spring motor, the combination with a shaft; of a spring fixed thereto; a drum surrounding said spring, connected therewith and rotated thereby; two gears, one of which is driven with said shaft and the other with said drum; an epicyclic train having engagement with said gears; a lever; and an intermediate mechanism between said epicyclic train and said lever for shifting the position thereof.

10. In a spring motor, the combination with a shaft; of a spring fixed thereto; a drum surrounding said spring, connected therewith and rotated thereby; two gears, one of which is driven with said shaft and the other with the said drum; an epicyclic train having engagement with said gears; a lever; a fulcrum for said lever having a positive engagement therewith; and means operated by said gears for rotating said fulcrum upon its axis.

11. The combination with the ratchet disk; of the fulcrum pinion; a lever having a toothed engagement with said pinion; a pawl carrier; a pawl connected therewith and engaging said ratchet disk; a connection between said lever and carrier; and means for rotating said fulcrum pinion.

12. The combination with the shaft 6; of the spring 10 fixed thereto; drum 7 surrounding said spring; gear 12 rotating with said drum; gear 16 rotating with said shaft; a rotatably mounted plate 15; pinions 18 and 19 rotatably connected therewith; levers 30; pinion 31; and gear mechanism connecting said rotatable plate with said pinion 31.

13. The combination with the shaft 6; of the spring 10 fixed thereto; drum 7 surrounding said spring; gear 12 rotating with said drum; gear 16 rotating with said shaft; a rotatably mounted plate 15; pinions 18 and 19 rotatably connected therewith; levers 30; pinion 31; mechanism connecting said rotatable plate with said pinion 31; and plates 42 and 43 connected with said gear for limiting the rotation of said pinion 31.

14. The combination with a motor; of a winding mechanism; a controller for controlling the extent of movement of said winding mechanism; and operative connections between said motor and controller.

15. The combination with a motor; of a variable winding mechanism therefor; means for varying the speed of the winding; and means connecting the said varying means with the motor for operation thereby.

16. The combination with a motor having a transmitting gear and a winding gear; of a winding mechanism geared to the winding gear; and controlling mechanism for controlling the extent of the movement of the said winding mechanism operatively connected to the transmitting and winding gears of the motor; substantially as described.

17. The combination with a motor having a transmitting gear and a winding gear; of a rotary shaft geared to the winding gear; mechanism for rotating the shaft; a controlling mechanism therefor; and means for actuating the controlling mechanism from the motor transmitting and winding gears; substantially as described.

18. The combination with a motor having a transmitting gear and a winding gear; of a rotary shaft geared to the winding gear; mechanism for rotating the shaft; a controlling mechanism therefor; gearing connecting the motor transmitting gear with the said controlling mechanism; and gearing connecting the motor winding gear with the said controlling mechanism; substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

EDWIN A. REEVES.

Witnesses:

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FLORENCE H. MONK.