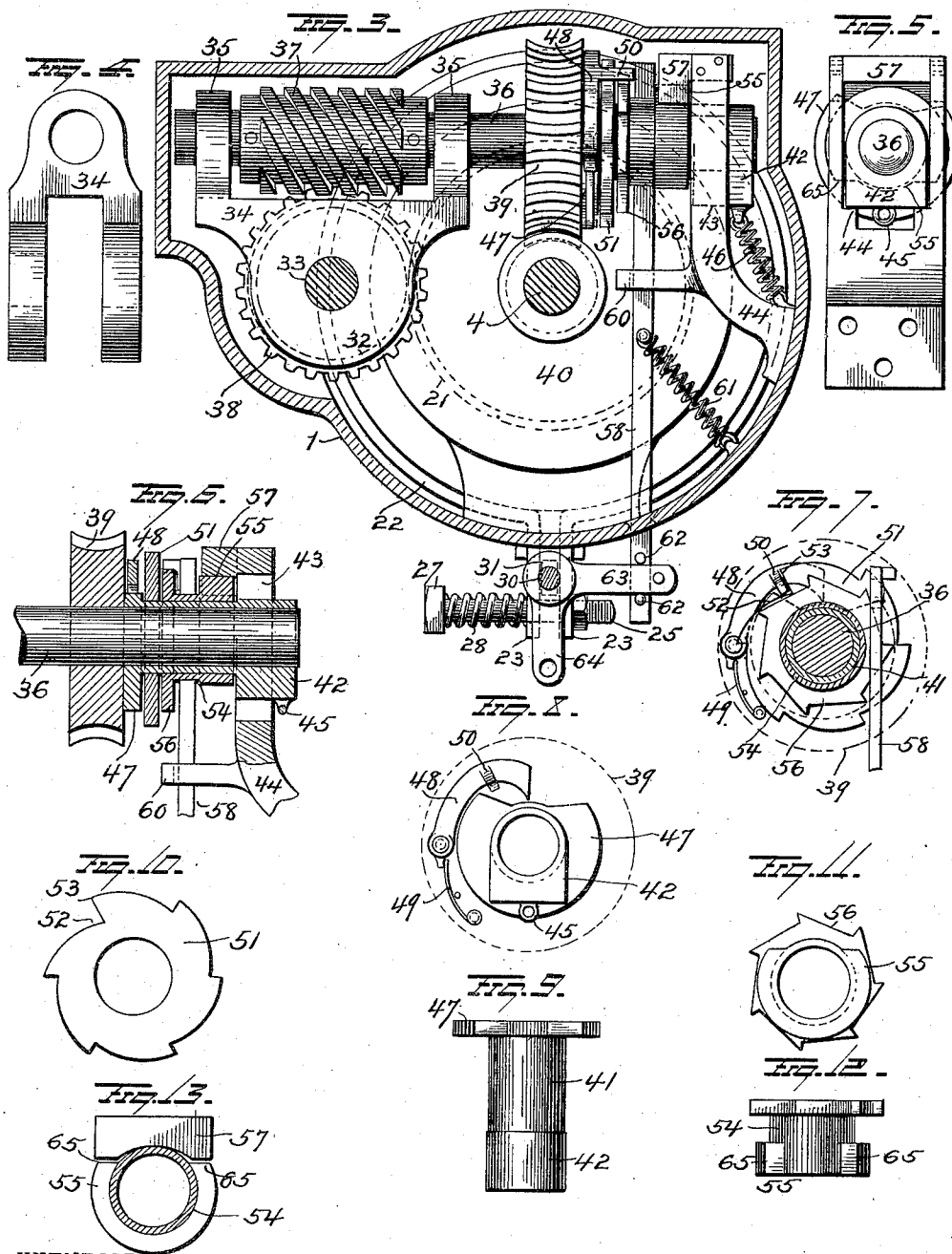


1,030,799.

3 SHEETS-SHEET 2.



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 STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.
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3 SHEETS-SHEET 3.

Fig. 4.

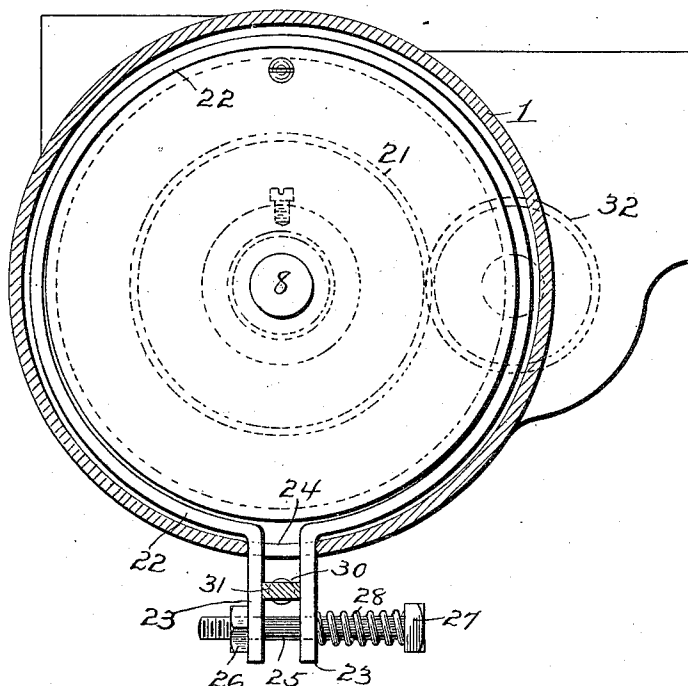
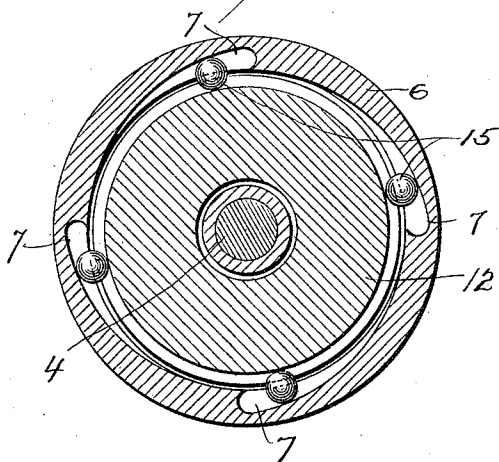


Fig. 5.



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STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

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Specification of Letters Patent.

Patented June 25, 1912.

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To all whom it may concern:

Be it known that we, JOHN L. BARKER, of Racine, in the county of Racine and State of Wisconsin, and FREDERIC A. BARKER, of Toledo, in the county of Lucas and State of Ohio, have invented certain new and useful Improvements in Starting Mechanism for Internal-Combustion Engines; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in starting mechanism for internal combustion engines and is particularly adaptable for use with automobile engines,—one object of the invention being to so construct a starting mechanism that the engine can be started with the use of a spring motor and the spring of the motor rewound by the operation of the engine without the necessity for the use of any reversing devices.

A further object is to so construct a spring motor and operating mechanism of devices of the character specified, that the driven devices for starting the engine can be connected with one end of the motor spring and the rewinding mechanism connected with the other end of the motor spring, so that the various mechanisms will always rotate in the same direction.

A further object is to so construct spring actuated starting mechanism for internal combustion engines, that when said mechanism is released motion will be imparted to the engine shaft for starting purposes and so that when the engine shall have been started the spring of the motor will be rewound and the rewinding mechanism then automatically thrown out of action.

A further object is to construct the mechanism in such manner that the propelling spring of the motor shall be utilized to supply power for throwing the rewinding mechanism out of action when the spring shall have been rewound.

With these and other objects in view, the invention consists in certain novel features of construction and combinations of parts as hereinafter set forth and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in longitudinal section. Fig. 2 is

a plan view with the casing shown in section. Fig. 3 is a view in section on the line *x x* of Fig. 1. Fig. 4 is a detail view of the yoke 34. Fig. 5 is a detail view showing the bracket 44 and certain parts having bearing therein. Fig. 6 is a sectional view showing the ratchet devices. Fig. 7 is a face view with parts in section of the ratchet devices. Figs. 8, 9, 10, 11, 12 and 13 are views showing the details of the ratchet devices and some of the related parts. Fig. 14 is a view partly in section showing the brake devices, and Fig. 15 is a sectional view of the clutch devices between the motor shaft and the shaft whereby motion is imparted to the engine shaft.

1 represents a casing provided at its ends with hubs or enlargements 2—3 to form bearings for certain shafts of the mechanism. This casing, with its contained mechanism, is secured to a cross-member of the automobile frame just under the radiator and is fixed in such position by means of any suitable securing devices.

A shaft 4 has a bearing in the hub or enlargement of the casing and this shaft is intended to be connected in any suitable manner with the shaft of the engine not shown. The inner end of the shaft 4 terminates approximately midway between the ends of the casing and has secured thereto, the hub of a disk 5, the latter being provided at its periphery with a lateral annular flange 6 having in its inner face a plurality of cam grooves 7,—said disk 5 and its peripheral grooved flange constituting one member of a clutch as will be more fully hereinafter explained. A shaft 8 has a bearing near one end in the hub or enlargement 2 of the casing and the free end of this shaft is made with an angular head 9 to receive a tool. This head 9 is housed within a recess 10 made in the hub or enlargement 2. The inner end of the shaft 8 has secured thereto, a hub 11 provided with a wheel 12 disposed in proximity to the disk 5 and surrounded by the annular flange 6 of said disk. The hub 11 is located within an opening formed in a standard 13 fixed within the casing and between said hub and the wall of the opening in said standard, anti-friction balls 14 are disposed. The wheel 12 constitutes a member of the clutch hereinbefore referred to and the remaining

member of said clutch consists of a plurality of balls 15 disposed between the flange 6 and the periphery of the wheel 12,— said balls being located in a groove 15 in the periphery of the disk and in the cam grooves 7 of the flange 6. This clutch device for connecting the shafts 8 and 4 is clearly shown in Fig. 15 and is also shown in section in Fig. 1. By having the balls 15 carried by the member 6 which always rotates with the engine shaft, the balls will be held out of engagement with the grooved member 12, thereby rendering the clutch noiseless.

The shaft 8 may be conveniently termed the motor shaft and it has secured thereto a drum 16, within which a driving or motor spring 17 is located. The outer end of this spring is secured to the peripheral portion of the drum by means of a suitable bolt 18 and the inner end of said spring is secured by means of a fastening device 19 to the hub 20 of a gear wheel 21,—said hub 20 entering the drum 16 and loosely surrounding the hub of the latter.

The unwinding of the motor spring is normally prevented by means of a brake band 22 which surrounds the motor drum 16,— said brake band being provided at its ends with arms 23 which project through an opening 24 in the casing and these arms are perforated for the passage of a bolt 25. One end of the bolt 25 is threaded for the reception of a nut 26 which bears against the outer face of one of the arms 23 and the other end of said bolt which projects some distance laterally from the other arm 23 of the brake band, is provided with a head 27, between which and the adjacent arm 23, a spring 28 is disposed and operates to cause the brake band to tightly embrace the motor drum and prevent the latter from turning. Brackets 29 are secured to the casing 1 and serve as bearings for a shaft 30 provided with an enlarged or flattened portion 31 disposed between the arms 23 of the brake band. It is apparent that when the shaft 30 is rotated by means of any suitable manually operated devices not shown, the engagement of respective sides of the enlarged portion 31 with the respective arms 23 of the brake band, said arms will be moved away from each other to the position shown in Fig. 14 and the brake band will thus be opened to release the motor. It is equally apparent that when the shaft 30 is rotated in a direction to cause the flattened portion 31 to assume the position shown in dotted lines in Fig. 3, the spring 28 will operate to cause the brake band to firmly grasp the motor drum and hold the same.

The gear wheel 21 (which is loosely mounted on the motor shaft 8) meshes with a gear 32 on a shaft 33. The shaft 33 supports a yoke 34, in the arms 35 of which, a

shaft 36 is mounted and to this shaft a worm 37 is secured and meshes with a worm wheel 38 on the shaft 33. The shaft 36 also carries a worm wheel 39 adapted to mesh with a worm 40 secured to the shaft 4.

A sleeve 41 is located on the shaft 36 and one end of this sleeve is made with an angular enlargement 42 disposed in an angular opening 43 in a standard 44 secured to the casing 1,—said angular opening 43 being of such size as to permit vertical movement of the sleeve 41 and the shaft 36 on which it is mounted and said enlargement 42 of the sleeve 41 may, at certain times, rest upon shoulders 44 at the lower end of the opening 43. A loop or eye 45 is secured to the enlargement 42 and to this loop or eye, one end of a spring 46 is attached, the other end of said spring being connected with the casing 1 and serving to normally tend to pull the sleeve 41 and the shaft 36 on which it is mounted, downwardly to assist in causing the worm wheel 39 to mesh with the worm 40. The sleeve 41 extends to the worm wheel 39 where it is provided with a cam 47. A pawl 48 is attached to one side of the worm wheel 39 and is normally pressed in a direction toward the cam 47 by means of a spring 49. The pawl 48 is provided with a laterally projecting finger 50 for a purpose which will presently be explained. A ratchet wheel 51 is mounted on the sleeve 41 adjacent to the cam 47 and this ratchet wheel is provided with a predetermined number of teeth. In the present instance I have shown this ratchet as having six teeth, the recess 52 which forms the tooth 53 being made deeper than the recesses which form the remaining teeth of said ratchet 51. A sleeve 54 is revolubly mounted upon the sleeve 41 and provided at one end with a cam 55,— the other end of said sleeve 54 being provided with a ratchet wheel 56 which, in the present instance is made with seven teeth. During the rotation of the shaft 36 and the worm wheel 39 thereon, motion will be imparted, step by step to the ratchet wheel 51 by the finger 50 and when said finger drops into the deep recess 52 of the ratchet 51, it will be in position to engage a tooth of the ratchet 56 to turn the sleeve 54 and cause the cam 55 thereon to cooperate with an arm or shoulder 57 at the upper end of the standard 44.

A rod 58 passes upwardly through a suitable opening in the casing 1 and this rod is adapted to project beyond the shaft 36 so that a spring pressed dog 59 at the upper end of said rod can be brought into operative relation with the ratchet 56. Rod 58 is vertically movable and is guided by an arm 60 on the bracket 44. A spring 61 attached to the casing and to rod 58 tends to normally pull said rod downwardly. Below the casing 1, the rod 58 is provided with pins

62 between which an arm 63 secured to the shaft 30 projects. The shaft 30 is also provided with an arm 64 with which any suitable manually operated means may be connected for the purpose of turning said shaft to open the brake band 22 and operate the rod 58.

Let it be assumed that the engine is at rest and the spring 17 is unwound. The operator will release the brake band by the operation of the shaft 30 and then, with a suitable wrench applied to the head 9 on the shaft 8, turn said shaft backwardly and thus cause the winding of the spring. During such winding, the inner end of the spring will be held practically stationary because the engagement of the worm wheel 38 with the worm 37 will prevent motion from being transmitted by the gears 21 and 32 to the shaft 33. After the spring shall have been wound, its tendency will be to transmit motion through the gears 21 and 32 to the shaft 33 but as such transmission of motion is prevented by the engagement of the worm wheel 38 with the worm 37 and as the yoke 34 is mounted on the same shaft which carries the worm wheel 38, such tendency of the spring to transmit motion through the gearing just described will cause the yoke 34 to be rocked and the worm wheel 39 carried by the shaft 36 which is mounted in said yoke to be raised out of mesh with the worm 40. Let it now be assumed that the spring 17 has been wound and that it is being held in such wound condition by the brake band 22, and also that the worm wheel 39 is in raised position out of mesh with the worm 40 as above described. The mechanism is now ready to be operated for starting the engine. To accomplish this the operator will turn the shaft 30 by means of the manually operated devices connected with the arm 64 and thus cause the opening of the brake band to release the spring drum. The shaft 8 will now be propelled by the action of the spring 16 and the clutch devices 6, 7, 12 and 15 will cause said shaft 8 to be operatively connected with the shaft 4, by means of which latter motion is imparted to the engine shaft for starting the engine. At the time that the shaft 30 was turned to release the spring motor device, the rod 58 was moved upwardly so that its dog 59 would be in position to engage a tooth of the ratchet 56. The engine having now been started, the operator will again turn shaft 30 and permit the brake band to grasp the spring drum 16. When the shaft 30 is thus operated, the rod 58 will be caused to descend (being assisted in such movement by the spring 61) and the dog 59 at the upper end of said rod will engage the ratchet 56 and move it one tooth. This will cause the sleeve 54 to be turned and

the shoulder 65 of the cam 55 to engage the arm or shoulder 57 on the bracket 44 and force the shaft 36 downwardly and the worm wheel 39 into mesh with the worm 40. As soon as the engine shall have been started and the shaft 4 is being rotated by the engine the clutch devices connecting this shaft with the shaft 8 will operate automatically to unlock the connection between these shafts. The shaft 4 is now being rotated by the engine and is transmitting motion by means of the worm gearing 40 and 39 to the shaft 36. This motion of the shaft 36 is imparted to the shaft 33 by the worm gearing 37—38 and from said shaft 38 motion is imparted by the gear 32 to the gear 21 with which latter the inner end of the spring 17 is connected as clearly shown in Fig. 1 and thus the motor will be rewound from the inside while the drum 16 is being held by the brake band. During the rotation of the worm wheel 39, the pawl 48 will be so moved by the action of the cam 47 so as to cause the finger 50 to engage a tooth of the ratchet 51 during each complete rotation of the worm wheel 39. When the ratchet 51 shall have been rotated to an extent sufficient to bring the deep recess 52 thereof under the finger 50 of the pawl 48, said pawl will be permitted to descend sufficiently to bring said finger 50 in position to engage a tooth of the ratchet 56. These operations will continue until the ratchet 56 shall have been rotated sufficiently to bring the flattened portion of the cam 55 under the arm or shoulder 57 on the bracket 44. By this time the spring 17 of the motor will have been rewound and as the resistance to the upward movement of the shaft 36 has been removed by the disposition of the flattened portion of the cam 55 under the arm or shoulder 57, the yoke 34 will be caused to be rocked by the force of the spring 17 in the manner hereinbefore explained and the shaft 36 to be raised to elevate the worm wheel 39 out of mesh with the worm 40. It is evident that after the initial winding by hand, the mechanism will thereafter automatically rewind the spring after the engine shall have been started.

Having fully described our invention what we claim as new and desire to secure by Letters-Patent, is,—

1. In starting mechanism, the combination with a shaft, a drum secured thereto, a gear loose on the shaft, a spring secured at its outer end to said drum and at its inner end to said gear, an engine shaft and clutch devices for connecting said first-mentioned shaft with and disconnecting it from the engine shaft, of means for controlling the operation of said drum to propel the shaft to which it is secured, mechanism operable by the engine to impart motion to

said gear to rewind the motor spring, and automatically operating devices for throwing said mechanism out of action.

2. In starting mechanism, the combination with a shaft, a drum secured thereto, a gear loose on the shaft, a spring secured at its outer end to said drum and at its inner end to said gear, means for controlling the rotation of the drum, an engine shaft, and clutch devices for connecting said first-mentioned shaft with and releasing it from the engine shaft, of gearing operable by the engine for imparting motion to said first mentioned gear to rewind the spring, means permitting said gearing to be normally inoperative, means for moving the gearing into operative relation, and means operating automatically to move said gearing out of operative relation.

3. In starting mechanism, the combination with two shafts, mountings therefor, a spring motor secured to one of said shafts, a gear mounted on the same shaft and connected with one end of the spring of the motor, means for controlling the operation of the motor, and clutch devices connecting said shafts, of a shaft carrying a gear meshing with said first mentioned gear, a yoke mounted on the last mentioned shaft, a worm wheel also on said last mentioned shaft, a shaft mounted in said yoke and carrying a worm meshing with the said worm wheel, gearing operable by the engine for driving said last mentioned shaft, and means for moving said gearing into mesh and permitting it to be moved out of mesh when the said yoke is rocked by the action of the spring of the motor.

4. In starting mechanism, the combination with two shafts, mountings therefor, clutch devices connecting said shafts, one of said shafts constituting a continuation of an engine shaft, and a motor drum secured to the other shaft, of a spring secured at its outer end to said motor drum, a gear loose on the same shaft and having the inner end of the spring secured thereto, a worm on the engine shaft extension, a shaft parallel with said first mentioned shafts, a yoke mounted thereon, a worm wheel also mounted thereon, a shaft mounted in the yoke and carrying a worm meshing with said last mentioned worm wheel, a worm wheel on the shaft mounted in the yoke and adapted to mesh with the worm on the engine shaft extension, and a gear secured to the shaft carrying the first mentioned worm wheel and meshing with the gear to which the inner end of the spring is secured.

5. In starting mechanism, the combination with an engine shaft extension, a motor shaft, and clutch devices connecting said shafts, of a drum secured to the motor shaft, a gear loose on the motor shaft, a spring secured at its outer end to said drum and at

its inner end to said gear, a shaft at an angle to the motor shaft extension, gearing between this shaft and the motor shaft extension, means permitting disengagement of said gears, cam devices for throwing said gearing into mesh and gearing between the gear to which the inner end of the spring is secured, and the shaft which is disposed at an angle to the engine shaft extension.

6. In starting mechanism, the combination with a motor shaft, an engine shaft extension, a spring motor connected with said motor shaft, and clutch devices connecting said shafts, of a gear secured to one end of the spring of the motor, a counter shaft, a gear secured to the counter shaft and meshing with the gear to which the motor spring is secured, a yoke on said counter shaft, a superimposed shaft mounted in said yoke, worm gearing between the superimposed shaft and the counter shaft, worm gearing between the superimposed shaft and the engine shaft extension, means permitting vertical movement of said superimposed shaft to disengage said last mentioned gearing, and cam devices for moving said gearing into mesh.

7. In starting mechanism, the combination with a motor shaft, a driven shaft, and clutch devices connecting said shafts, of a spring motor connected with the motor shaft, a gear connected with the spring of said motor, a counter shaft, a gear on the counter shaft meshing with the gear to which the motor spring is secured, a rocking yoke mounted on the counter shaft, a shaft mounted in said yoke, worm gearing between said last mentioned shaft and the driven shaft, worm gearing between the same shaft and the counter shaft, and cam devices operable by the rotation of the shaft mounted in the yoke for rocking the yoke and moving the gear on said shaft into mesh with the gear on the driven shaft.

8. In starting mechanism, the combination with a spring motor, a driven shaft, and clutch devices connecting the motor with the driven shaft, of a gear connected with the spring of the motor, a rocking member, a shaft mounted therein, gearing between said shaft and the driven shaft, permanently meshed gearing between the same shaft and the gear to which the motor spring is secured, a non-rotatable sleeve mounted on said shaft and provided with a cam, a pawl rotatable with said shaft and coöperating with said cam, said pawl having a finger, a ratchet mounted on said sleeve and having one notch deeper than the others, a smaller ratchet also mounted on said sleeve, both of said ratchets being operable by the finger on the pawl, a cam movable with said smaller ratchet, a fixed member with which the last mentioned cam coöperates to cause the rocking of the shaft, and manually operable

means for moving the smaller ratchet wheel one tooth.

9. In starting mechanism, the combination with two shafts, mountings therefor, a
5 spring motor secured to one of said shafts, a gear mounted on the same shaft and connected with one end of the spring of the motor, means for controlling the operation of the motor, and clutch devices connecting
10 said shafts, of a shaft carrying a gear meshing with said first-mentioned gear, a worm wheel on said last-mentioned gear, a worm wheel on said last-mentioned shaft, a shaft mounted adjacent to said last mentioned
15 shaft and carrying a worm meshing with said worm wheel, gearing operable by the engine for driving the shaft carrying the

worm, means for moving said worm toward and into mesh with the worm wheel, and means for moving the worm away from and
20 out of mesh with said worm wheel.

In testimony whereof, we have signed this specification in the presence of two subscribing witnesses.

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."