W. A. SHARPE.

ENGINE STARTER FOR AUTOMOBILES.

APPLICATION FILED OCT. 16, 1911.

1,046,030.

Patented Dec. 3, 1912.

2 SHEETS—SHEET 1.

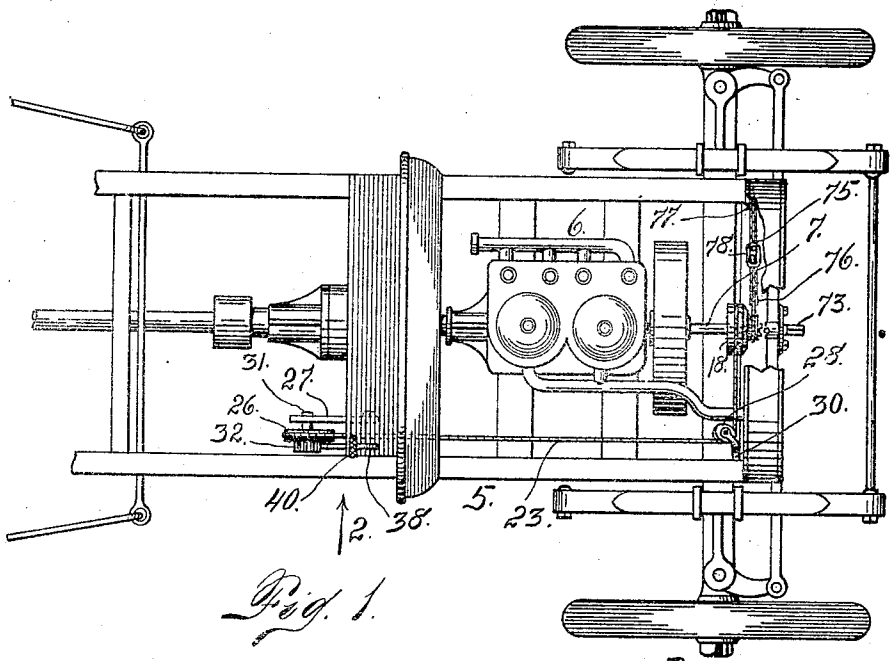

Fig. 1.

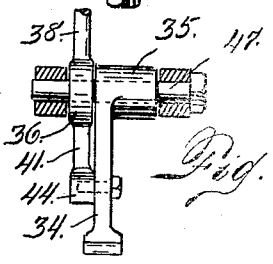

Fig. 10

Fig. 2.

Witnesses

Otto E. Hoddick.

C. H. Rossner.

Inventor

W. A. Sharpe

By A. J. O'Brien

Attorney

W. A. SHARPE.

ENGINE STARTER FOR AUTOMOBILES.

APPLICATION FILED OCT. 16, 1911.

1,046,030.

Patented Dec. 3, 1912.

2 SHEETS—SHEET 2.

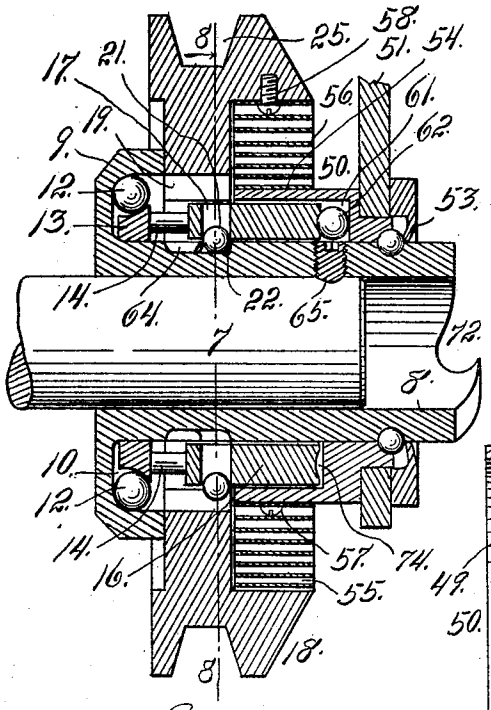

Fig. 3.

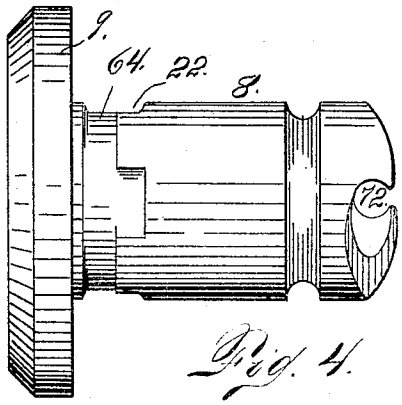

Fig. 4.

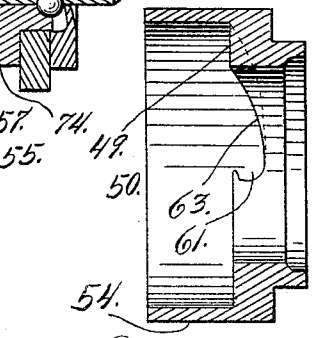

Fig. 6.

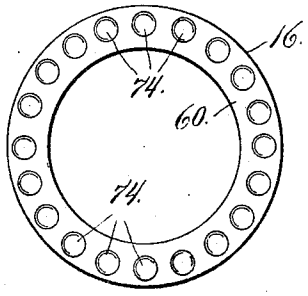

Fig. 7.

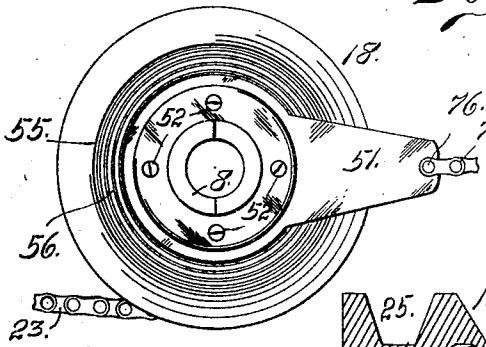

Fig. 5.

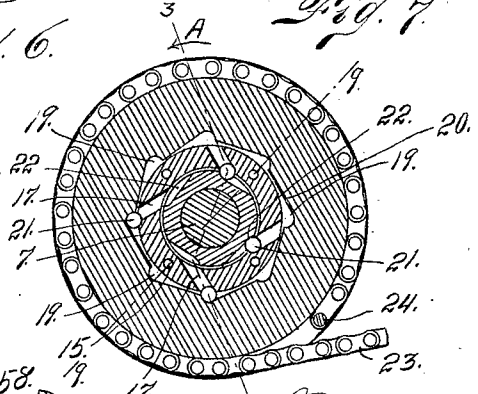

Fig. 8.

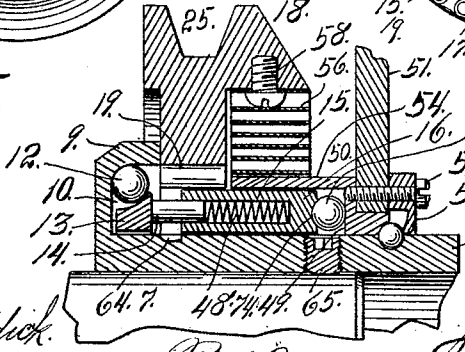

Fig. 9.

Witnesses

Otto E. Hoddick.

C. H. Roessner.

Inventor

W. A. Sharpe

By [illegible] Attorney

UNITED STATES PATENT OFFICE.

WILLIAM A. SHARPE, OF DENVER, COLORADO, ASSIGNOR TO THE S. & S. AUTO STARTER COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

ENGINE-STARTER FOR AUTOMOBILES.

1,046,030. Specification of Letters Patent. Patented Dec. 3, 1912.

Application filed October 16, 1911. Serial No. 654,988.

To all whom it may concern:

Be it known that I, WILLIAM A. SHARPE, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Engine-Starters for Automobiles; and I do 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, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in engine starters for automobiles, my object being to provide a device of this class which may be easily and quickly operated by the chauffeur from his position, without leaving his seat in the machine.

The starter is so constructed that it may be operated by the foot, thus leaving the hands of the chauffeur free for handling the steering-wheel. The device may, however, be operated to equal advantage by the hand of the chauffeur by simply changing the form of the actuating lever.

In my improved construction, provision is made for compensating for the reverse movement of the engine shaft, due to back-firing during the starting operation, the mechanism in this event being automatically regulated to allow the engine shaft to rotate freely without turning the operating wheel and its connections, which are mounted on the said shaft, or rather upon a sleeve secured to the shaft, the said sleeve and shaft rotating in harmony at all times. Provision is also made for a slight reverse movement of the engine shaft when the operating wheel is connected to rotate therewith, the same consisting of a spring interposed between an arm of the operating lever and the operating gear actuated by the lever, the said spring being sufficiently stiff to cause the lever and gear to normally move in unison. When, however, the reverse movement of the shaft occurs, and during the automatic adjustment to release the operating wheel from the engine shaft to permit the latter to turn independently thereof, the gear is permitted to move independently of the lever, the latter being in such position that it cannot respond to the reverse movement of the engine shaft. This limited movement, due to the interposed spring, as aforesaid, is sufficient to allow time for the aforesaid automatic operation, whereby the engine shaft becomes rotatably disconnected from the operating wheel or pulley.

Having briefly outlined my improved construction, I will proceed to describe the same in detail, reference being made to the accompanying drawing, in which is illustrated an embodiment thereof.

In this drawing:—Figure 1 is a top plan view of an automobile, showing my improved starting mechanism in position thereon. Fig. 2 is a fragmentary view of the machine illustrating the starting mechanism on a larger scale. This view is taken looking in the direction of arrow 2, Fig. 1. Fig. 3 is a section taken on the line 3—3 of Fig. 8. Fig. 4 is a detail view in elevation illustrating the sleeve adapted to be secured to the engine shaft, and upon which the operating wheel and other features coöperating therewith are mounted. Fig. 5 is an end view of the starting mechanism mounted on the engine shaft. Fig. 6 is a sectional detail view illustrating a stationary sleeve, adapted to coöperate with an actuating ball for shifting a movable member to release the operating wheel from the engine shaft during the reverse movement of the latter due to back-firing. Fig. 7 is an end elevation of the ring interposed between the operating wheel and the engine shaft for interlocking purposes. Fig. 8 is a section taken on line 8—8, Fig. 3. Fig. 9 is a detail section taken on line 9—9, Fig. 8. Fig. 10 is a fragmentary detail view looking in the direction of arrow 13, Fig. 2.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate the framework of an automobile, upon which is mounted an engine 6 having a shaft 7, to the outer exposed extremity of which is secured a sleeve 8 carrying at its inner extremity a relatively large disk 9, which is hollowed out, as shown at 10, to form a race

for bearing balls 12, which engage a cone member 13, carrying pins 14 extending parallel with the axis of the shaft and entering openings 15 formed in a ring 16 and provided with laterally-arranged openings 17 extending entirely through the ring. This ring is interposed between the bearing surface of a chain wheel 18 and the body of the sleeve 8 beyond the disk 9. The inner face of the wheel, adjacent the openings 17 of the ring, is provided with recesses 19, whose walls 20 slope gradually toward the center of motion, the said recesses being adapted to receive balls 21, when the mechanism is in position to allow the balls to roll downwardly by gravity from the openings 17 of the ring, whereby the chain wheel and the ring are locked to rotate in unison. These openings 17 also communicate at their inner extremities with ratchet recesses 22, formed in the sleeve 8, whereby one or more of the actuating balls 21 will always be in operative engagement with one of the recesses 22, which are so shaped with reference to the inner extremities of the openings 17 that the sleeve 8 and the ring are compelled to rotate in unison, when the ring is in its normal position. By virtue of this construction, it will be understood that, as the axis or center of motion is in a horizontal position, and, as there is a sufficient number of the openings 17 and the actuating balls 21 for the purpose, the chain wheel 18, the sleeve 8 and the interposed ring 9 will be normally interlocked to rotate in unison in the direction of the arrow in Fig. 8, this being the direction of the chain wheel's movement during the starting operation of the engine, a chain 23 being connected with a pin 24 fast on the periphery of the said wheel for the purpose, the wheel being grooved, as shown at 25, to maintain the chain in operative relation therewith. This chain leads from the chain wheel 18 to a wheel 26, suitably journaled on a support 27 attached to the framework 5 of the machine, an angle pulley 28 being interposed between the chain wheel and the said wheel 26, the angle pulley being mounted in a holder 29 having a swiveled connection with the machine, as shown at 30.

Fast on the spindle 31 of the wheel 26 is a pinion 32, meshing with the teeth 33 of a segmental gear 34, formed integral with a hub 35, interposed between the supporting member 27 and a hub 36, formed integral with an actuating lever 38, which projects upwardly through an opening 39 formed in the floor of the machine, its upper extremity carrying a foot-plate 40 for convenience of manipulation, said foot-plate being readily accessible to the chauffeur for this purpose. Also formed integral with the hub 36 is an arm 41, having an eye 42 at its outer extremity through which passes a curved stem 43, one extremity of which is secured, as shown at 44, to the segmental gear 34. To the opposite extremity of this stem is applied a nut 45, the stem being threaded for the purpose.

Interposed between the nut 45 and the eye 42 is a relatively stiff spiral spring 46, surrounding the said stem, which spring normally maintains the lever arm 41 in close contact with the lug 44, which forms a stop to prevent the further movement of the eye of the lever arm on the stem 42 in one direction.

It must be understood that the hub 36 of the lever 38 and its arm 41 is journaled on a spindle 47 independently of the hub 35 of the gear 34, permitting independent movement of the said parts on their spindle. Hence, in the regular operation of the starter, the lever 38 and the arm 41 move in unison with the segmental gear 34. When, however, the engine back fires and the engine shaft is moved in a direction the reverse of its normal direction, the action of the pinion 32, which would, in that event, move in the direction of the arrow adjacent the said pinion in Fig. 2, would be to move the gear in the direction indicated by the arrow adjacent the segmental gear in Fig. 2. But, under these circumstances, it may be assumed that the lever 38 is locked against movement, assuming that the said lever is in its rearward position indicated by full lines in Fig. 2; and, under these circumstances, it will become necessary for the segmental gear to move independently of the lever, and, in order to do so, the spiral spring 46 is compressed and its yielding capacity is sufficient to prevent injury to the parts of the mechanism until the chain wheel 18 is rotatably disconnected from the sleeve 8 and the engine shaft 7, permitting the latter to rotate independently of the chain wheel and its connections. The manner of disconnecting these parts will now be described.

Each opening 15 of the ring 16 carries a spiral spring 48, which, acting on the pins 14, normally forces the ring 16 toward a shoulder or face 49 on a collar 50, the said collar being connected with a stationary part 51 by means of screws 52, also passed through a bearing-ball-retaining ring 53. This collar has a sleeve 54 annularly arranged with reference to the engine shaft, and the sleeve 8, the sleeve 54 protruding into a chamber 55 formed in the chain wheel 18 and to which one extremity of a coiled spring 56 is secured, as shown at 57, the opposite extremity of said spring being secured to the chain wheel, as shown at 58. This collar 50 is cut away on the face or shoulder 49 adjacent the face 60 of the ring 16, forming a recess 61 of sufficient depth to receive a ball 62, the face of the collar leading from the deepest portion of the recess 61 to the normal face of the

shaft sufficiently to rotatably disconnect the wheel 18 from the engine shaft during the reverse movement of the latter, heretofore explained. These recesses 74 are important, since they prevent the slipping of the ball 62 on the face 60, whereby the shifting movement of the ring 16, necessary to rotatably disconnect the engine shaft from the engaging wheel 18, is accomplished more quickly than would be the case in the absence of the said recesses.

In order to secure the part 51 against rotary movement and make the same substantially stationary, and at the same time permit vibration without injury to the parts of the mechanism, I preferably secure a chain 75 to the outer extremity of the part 51,—see Figs. 1 and 5,—the opposite extremity of the chain being made fast to the framework of the vehicle, as shown at 77. Intermediate the extremities of the chain, I preferably locate a turn-buckle 78, or similar device, whereby the slack may be taken out of the chain and the latter rendered properly taut for the purpose. This construction is important, since, if an attempt is made to secure the part 51 to the frame in an absolutely rigid manner, the vibration incident to the use of the machine would very soon loosen the rigid structure, and, in time, the connecting part would become loose and therefore useless.

Attention is called to the fact that the securing chain 75 is located on the opposite side of the starter mechanism mounted on the engine shaft from the pull chain 23, the latter extending from the operating wheel 18 to the angle pulley 28 in a direction opposite that of the chain 75. In this manner, the strain on the engine shaft is virtually balanced during the operation of the starting mechanism.

It must be understood that my improved engine starting apparatus is equally applicable to all explosive engines, whether employed in connection with automobiles or in other relations.

Having thus described my invention, what I claim is:—

1. The combination with the engine shaft, of an operating wheel concentrically arranged thereon, means for actuating the said wheel in the forward direction to start the engine shaft, an interlocking connection between the said wheel and the shaft to cause the wheel, when moved in the forward direction, to rotate the shaft, the reverse movement of the shaft serving normally to operate the wheel, and means actuated by the reverse movement of the shaft for breaking the rotative relation between the shaft and wheel, said means comprising a ring having openings in register with ratchet recesses formed in the wheel and shaft, the said openings being open at both extremities, and balls located in the said recesses and arranged to interlock with the wheel on the lower side and with the engine shaft on the upper side, and an actuating ball interposed between the said ring and an adjacent stationary part recessed to a suitable depth to receive the ball and having an inclined face which crowds the ball away from the stationary member and shifts the said ring to disconnect the balls carried thereby from the ratchet recesses of the engine shaft, substantially as described.

2. The combination with an engine shaft, of an operating wheel mounted thereon, means for actuating the wheel, a ring interposed between the wheel and the engine shaft, the wheel and shaft having ratchet recesses, the ring having openings registering at their opposite extremities with the ratchet recesses of the wheel and an operating shaft, whereby, as the wheel is turned in one direction, the shaft is actuated, and, when the shaft is turned in the opposite direction, the wheel is actuated, and means actuated by the reverse movement of the engine shaft for shifting the said ring in a direction parallel with the axis of the shaft to disconnect the said balls from the ratchet recesses of the engine shaft to permit the engine shaft to move in the reverse direction, substantially as described.

3. In an engine starter, the combination with the engine shaft, an operating wheel annularly arranged thereon, means for rotating the wheel to impart the forward movement to the engine shaft, a ring interposed between the wheel and the engine shaft and having openings registering at their opposite extremities with ratchet recesses formed respectively in the engine shaft and the said wheel each of said openings containing a ball, whereby there is an interlocking connection at the beginning of the operation between the ring and the engine shaft on the upper side and between the ring and wheel on the lower side, the engine shaft having a circumferential groove formed thereon just beyond the ratchet recesses, and means actuated by the reverse movement of the engine shaft for shifting the said ring to move the said balls into the circumferential groove, whereby the rotative relation between the wheel and engine shaft is automatically broken, for the purpose set forth.

4. In an engine starter, the combination with the engine shaft, and an operating wheel concentrically arranged thereon, a ring interposed between the said wheel and the engine shaft and having openings registering at their opposite extremities with ratchet recesses formed respectively in the wheel and the engine shaft, balls located in the openings of the ring and adapted to enter the recesses of the engine shaft on the

collar being inclined, as shown at 63. Normally, or when the chain wheel is turned to start the engine shaft, or in the direction of the arrow A in Fig. 8, the ball 62 maintains its position in the deepest part 61 of the collar 50 and does not interfere with the normal position of the ring 16, which position is such that the balls 21 interlock with the ratchet recesses 19 and 22, whereby the movement of the chain wheel actuates the engine shaft to impart to the latter motion in the normal direction of its operation. However, when the engine shaft is reversed, or moved in a direction opposite the arrow A in Fig. 8, there would be a tendency to move the chain wheel 18 as well as the chain 23 in a corresponding direction, and this would result in breaking the mechanism, or some part thereof as soon as the chain had reached its limit of movement on the pulley 26. However, as soon as the reverse movement of the engine shaft and the sleeve 8 secured thereto starts, the ball 62 passes from the recess 61 of the collar 50, and, following the inclined face 63 of the said collar, gradually reaches the normal plane or face of the collar, and, as it approaches this plane, the ring 16 is forced toward the left, referring to Figs. 3 and 9, compressing the springs 48, and this movement of the ring carries with it the balls 21, which are moved out of the zone of the recesses 22 in the sleeve 8 and the recesses 19 of the chain wheel into a circumferential groove 64, which allows the sleeve 8 and the engine shaft to rotate freely, independently of the chain wheel 18, and the movement of the said chain wheel and its connections, necessary before the balls 21 are crowded into the groove 64, is compensated for by the yielding capacity of the spring 46, heretofore explained.

When the apparatus is in use, the sleeve 8 is secured to the engine shaft 7 by means of a set screw 65. When this is done, the said sleeve and engine shaft are an integral construction, so far as their operation is concerned, since they are compelled to rotate in unison. The sleeve 8, as distinguished from the engine shaft, is a matter of convenience in constructing the apparatus, whereby the sleeve and the operating parts of the mechanism mounted thereon may be formed complete independently of the engine shaft, and then applied thereto without making any change in the said shaft. It will be understood, however, that the engine shaft might be formed to conform in all respects to the exterior formation of the sleeve 8, and, in that event, the disk member 9 would be formed integral with the shaft. However, it is much more convenient to employ a sleeve 8, as an independent element, and then secure it to the engine shaft whenever necessary. It also makes it practicable to readily remove the mechanism from the engine shaft when, for any reason, it may be necessary or desirable to do so.

At the right of Figs. 1 and 2, I have illustrated the ordinary means for cranking the engine by hand, and the outer exposed extremity of the sleeve 8 is equipped to interlock with a pin 66 formed on the stem 67 of the crank, it being assumed, in this case, that the crank is left on the machine.

From the foregoing description, the use and operation of my improved engine starter will be readily understood. Assuming that the parts are assembled, as shown in Figs. 1 and 2, in order to crank the engine, it is only necessary to press the foot upon the foot-plate 40 of the lever 38, and move the same forwardly to the dotted line position in Fig. 2. This operation will turn the chain wheel 18 sufficiently to impart the starting movement to the shaft 7 through the instrumentality of the mechanism heretofore described. In the event that, during the starting operation, the engine should back fire, or an explosion should occur, which would serve to reverse the movement of the engine shaft, resulting in what is ordinarily termed a "kick," the spring 46 will permit the initial rearward movement without injury to any of the parts of the mechanism, and, by the time, or before, the yielding capacity of the spring 46 has become exhausted, the ball 62 will have traveled from the lowest point of the recess 61 of the collar 50 to the face 60 of said collar, whereby the ring 16 is moved in a direction parallel with the engine shaft far enough to throw the ratchet balls 21 out of engagement with the ratchet recesses 22 of the sleeve 8 and into the circumferential groove 64, allowing the engine shaft, together with the sleeve 8, to rotate independently of the starting mechanism. After each cranking operation of the mechanism, the wheels 18 and 26 and their connections are returned to their normal position by the recoil action of the coiled spring 56. From this, it will be understood that normally the chain 23 is wound on the wheel 18 to maintain the portion of the chain between the wheels 18 and 26 reasonably taut. During the cranking operation, the chain is unwound from the wheel 18 and wound on the wheel 26, but, as soon as the operating lever 38 is released, the spring 56 connected with the wheel 18, as aforesaid, reverses the movement of the chain and the parts connected thereby in the manner aforesaid.

The ring 16 has recesses 74 formed in its face 60, the said recesses engaging the ball 53 and causing it to travel in contact with the inclined cam face 63 of the recess 61 from the deepest part of the latter to the plane of the face 49 of the stationary collar 50, whereby the ring 16 is shifted longitudinally of the sleeve 8 and the engine

upper side and the recesses of the wheel on the lower side, whereby there is an interlocking connection between the wheel, ring and shaft, means yieldingly acting on the ring to thrust it in the direction of the axis of the shaft for maintaining its openings in position to allow the balls carried thereby to enter the ratchet recesses of the wheel and shaft, and means automatically acted on by the shaft during its reverse movement for thrusting the ring against the tension of the said yielding means, whereby the balls are carried beyond the zone of the ratchet recesses of the wheel and shaft to permit the shaft to rotate independently of the wheel during the back firing of the engine, substantially as described.

5. The combination with the engine shaft, of a wheel concentrically arranged thereon, means connected with the wheel for rotating the latter in a forward direction to start the engine, a ring interposed between the wheel and the engine shaft, the wheel and engine shaft having ratchet recesses, the said ring having openings extending therethrough in the zone of the ratchet recesses of the wheel and engine shaft, the said openings normally registering at their opposite extremities with the recesses of the wheel and shaft respectively, balls located in the said openings and arranged to pass by gravity therefrom into the recesses of the wheel and engine shaft according to their position, the engine shaft having a circumferential groove formed therein beyond the ratchet recesses of the shaft, a stationary member located adjacent the ring, the said member having a recess, which, at its deepest part, is equal to the diameter of the ball, the said recess having its wall inclined toward the adjacent face of the said ring, the said ball being in engagement with said face, whereby, as the shaft is rotated in the reverse direction and the ring actuated thereby, the ball will be caused to travel in contact with the inclined face of the said recess, within the stationary part, thus thrusting the ring in the direction of the axis of the shaft to carry the balls located in the openings thereof out of the zone of the ratchet recesses of the wheel and shaft, for the purpose set forth.

6. In an engine starter, the combination with the engine shaft, of a wheel concentrically arranged thereon, means connected with the wheel for rotating the latter to actuate the engine shaft, the said means containing a member adapted to yield when the engine shaft is moved in the reverse direction, an automatic interlocking connection between the wheel and engine shaft to cause the shaft to rotate in its normal direction when the wheel is moved in a corresponding direction, while the reverse movement of the shaft normally imparts a corresponding movement to the wheel, and means actuated by the reverse movement of the shaft for breaking the interlocking connection between the wheel and shaft to compensate for the back firing of the engine, substantially as described.

7. In an engine starting apparatus, the combination with the engine shaft, of an operating wheel concentrically arranged thereon, an interlocking connection between the wheel and the engine shaft, a flexible device connected with the periphery of the wheel, which is normally spring actuated to wind the flexible device thereon, a second wheel with which the opposite extremity of the flexible device is connected, a gear sector suitably journaled, an operative connection between the second wheel and the said gear, an operating lever journaled adjacent the said gear, the two parts, however, being capable of independent movement, a yielding connection between the said lever and the gear, whereby the movement of the lever also actuates the gear, the function of the yielding connection being to compensate for the initial reverse movement of the engine shaft due to back-firing, substantially as described.

8. In an engine starter, the combination with the engine shaft, of a relatively stationary support into which the outer extremity of the shaft protrudes, a flexible device secured to said support at one extremity, its opposite extremity being connected with an adjacent stationary part, the flexible device being made sufficiently taut for the purpose, an operating wheel concentrically arranged on the shaft adjacent said bearing or support, an interlocking connection between the said wheel and the engine shaft, and means for actuating the wheel, substantially as described.

9. In an engine starter, the combination with the engine shaft, of a bearing into which the extremity of the shaft protrudes, a flexible device connected with the bearing for securing the latter against rotation, an operating wheel mounted on the shaft adjacent the said bearing, a clutch ring interposed between the wheel and the shaft, means employed in connection with the ring for normally locking the wheel, ring and shaft to rotate in unison in either direction, the said bearing having a relatively deep recess located at one extremity of an inclined face formed on the bearing, and means adapted to enter the said recess and interposed between the bearing and the said ring, whereby, as the engine shaft is moved in the reverse direction, the ring will be shifted in the direction of the axis of the shaft to disconnect the latter from the operating wheel, substantially as described.

10. In an engine starter the combination with the engine shaft, of a relatively fixed

bearing into which the end of the shaft protrudes, an operating wheel mounted on the shaft adjacent the said bearing, a clutch ring interposed between the wheel and the shaft, means for normally locking the wheel, ring and shaft to rotate in unison in either direction, and means interposed between said bearing and ring for automatically unlocking said first named means upon the back-firing of the engine.

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

WILLIAM A. SHARPE.

Witnesses:

A. J. O'BRIEN,

A. EBERT O'BRIEN.