No. 887,067. PATENTED MAY 12, 1908.

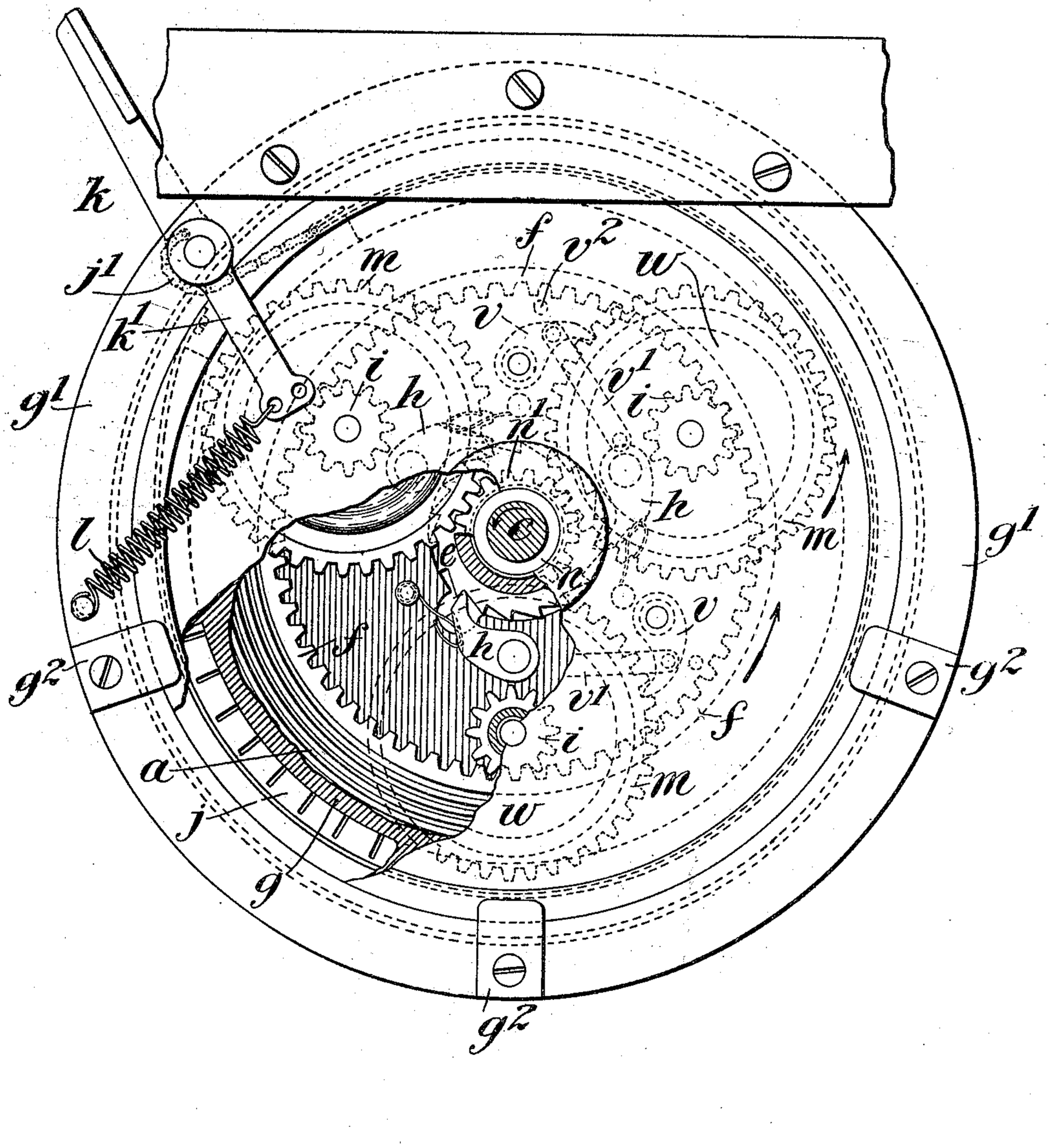
C. J. COLEMAN.

ENGINE STARTER.

APPLICATION FILED AUG. 19, 1905.

3 SHEETS—SHEET 1.

Fig. 1



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3 SHEETS—SHEET 2.

Fig. 2

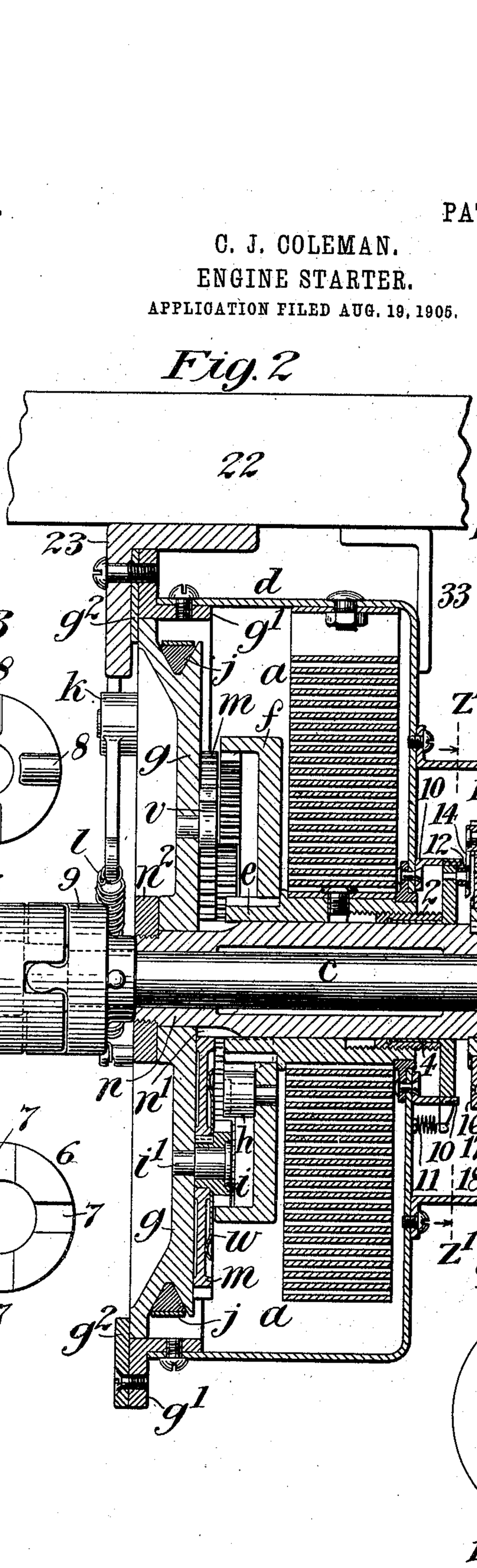


Fig. 3

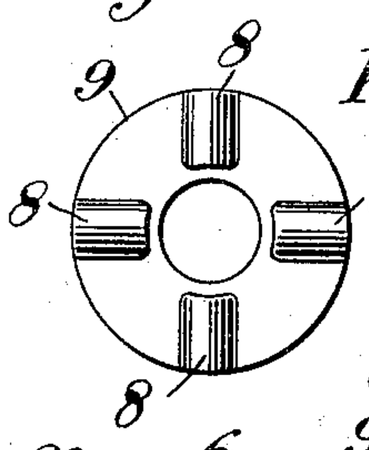


Fig. 4

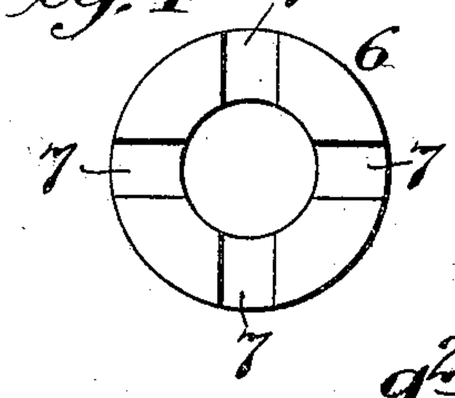
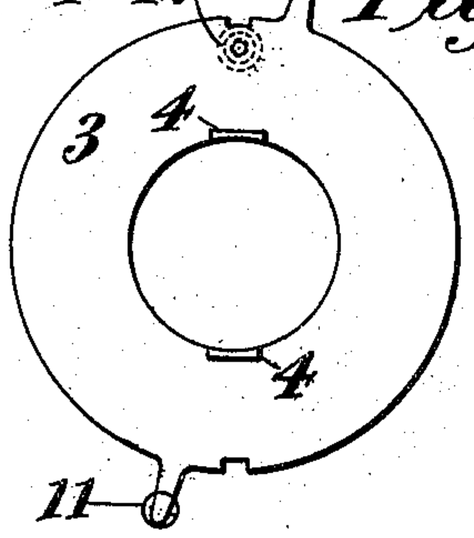


Fig. 6

Fig. 5



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3 SHEETS—SHEET 3.

Fig. 8

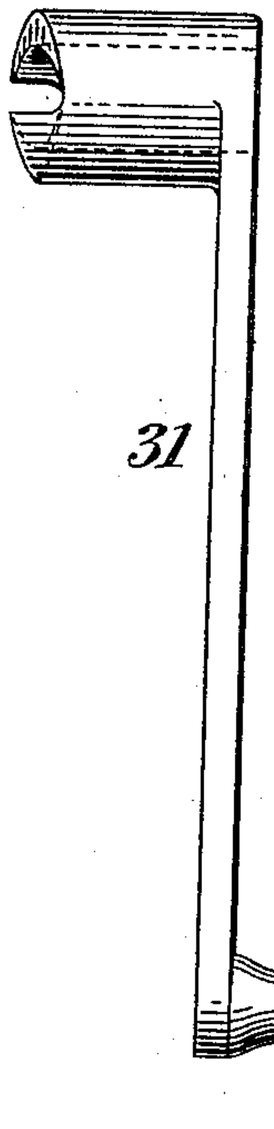


Fig. 9

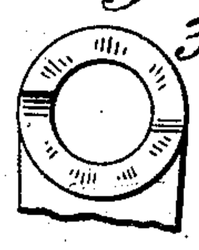


Fig. 10

Fig. 7

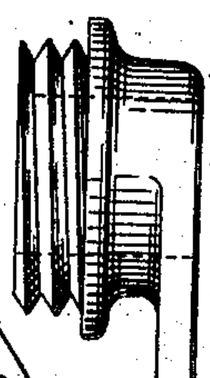


Fig. 13

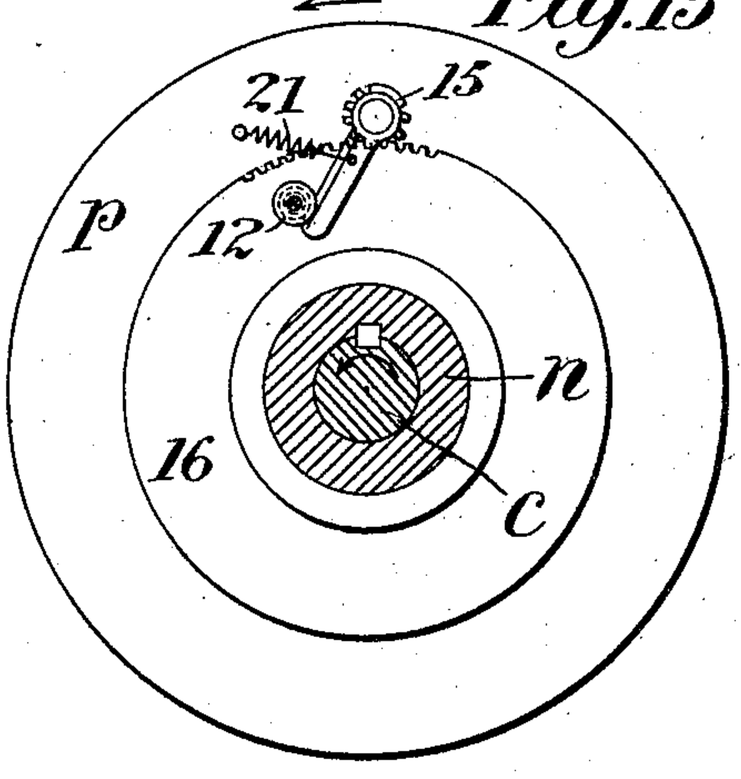


Fig. 11

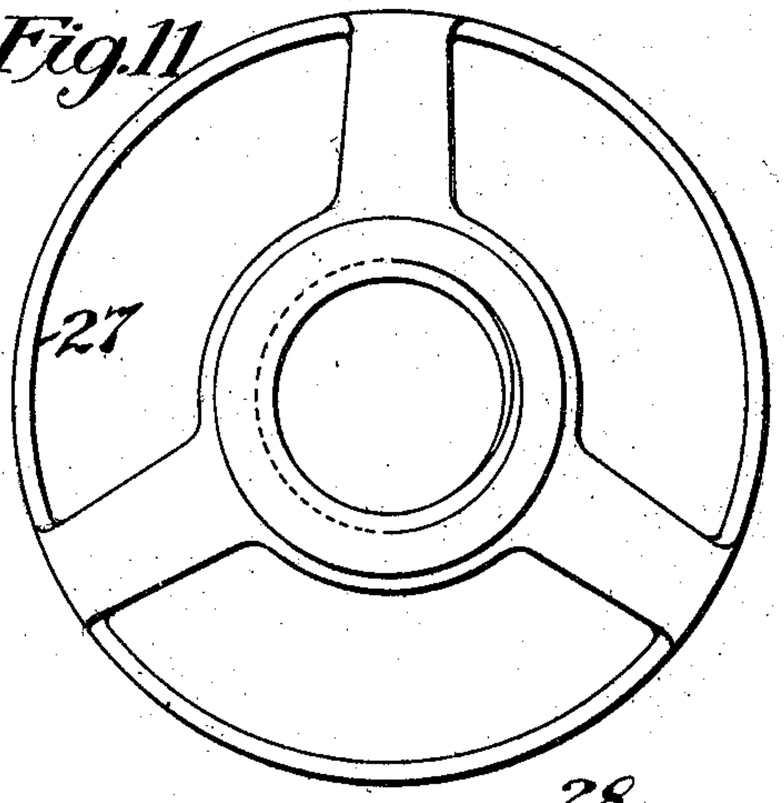
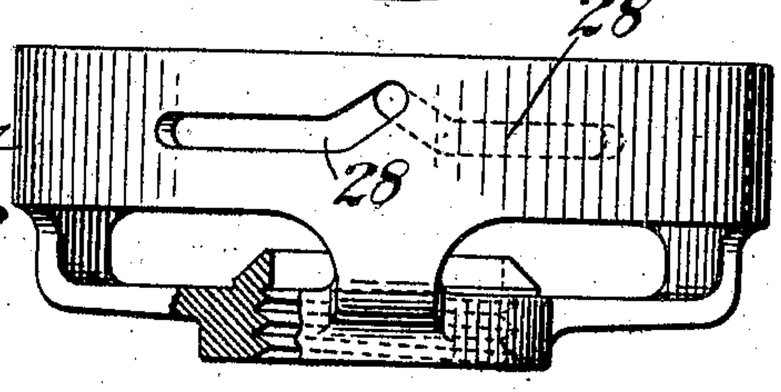


Fig. 12



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Atty.

UNITED STATES PATENT OFFICE.

CLYDE J. COLEMAN, OF ROCKAWAY, NEW JERSEY, ASSIGNOR TO CONRAD HUBERT, OF NEW YORK, N. Y.

ENGINE-STARTER.

No. 887,067. Specification of Letters Patent. Patented May 12, 1908.

Application filed August 19, 1905. Serial No. 274,819.

To all whom it may concern:

Be it known that I, CLYDE J. COLEMAN, a citizen of the United States, residing at Rockaway, in the county of Morris and State of New Jersey, have invented certain new and useful Improvements in Engine-Starters, of which the following is a specification, reference being had therein to the accompanying drawing, forming a part thereof.

My invention relates to starting means for engines not self-starting, such as explosion engines, and means embodying my invention are particularly adapted for use on engines of automobiles by reason of the frequent necessity in the use of automobiles for the performance of the starting operation.

My invention has for its objects simplicity of construction, durability, reliability in operation, and the realization of other advantages which will appear from the following specification.

My invention relates more particularly to engine-starting devices wherein a power-storing device supplies the spring or other power to start the engine, and the power of the engine is thereafter utilized to re-store power in the power-storing device.

My invention includes improved means for effecting the connection of the power-storing device and the engine including a centrifugal engaging device for the power-storing operation and improved means for automatically releasing the centrifugal engaging device upon the completion of this operation.

My invention also includes means for manually effecting the storage of power in the power-storing device, and includes various improvements in the construction, arrangement and combination of parts, the several improvements included in my present invention being largely applicable to power-storing means in general, although shown specifically as combined with a retractive power-storing device, in the form of a spring.

I will now describe the construction embodying my invention illustrated in the accompanying drawings and will thereafter point out my invention in claims.

Figure 1 is an inner end elevation of the starter, partly in section. Fig. 2 is a longitudinal central vertical section of the same. Figs. 3 and 4 are face views of the two parts of the clutch for connecting the starter-shaft and engine-shaft. Fig. 5 is a detail of the non-rotative disk for actuating the releasing device. Fig. 6 is a horizontal sectional detail of the wedge-part and releasing device. Fig. 7 is a side elevation of the winding crank. Fig. 8 is a side elevation of the starting crank. Fig. 9 is a part end elevation of the same. Fig. 10 is a transverse section of the outer portion of the starter taken on a plane indicated by the line *z*—*z*, Fig. 2. Fig. 11 is an inner end elevation of the winding sleeve detached. Fig. 12 is a plan view of the same. Fig. 13 is a transverse vertical section taken on the line *z'*—*z'*, Fig. 2, and showing, detached, the wedge-carrying part and means for actuating it.

The engine in connection with which the starter is to be used is not shown in the drawings otherwise than by the illustration in Fig. 2 of the end of its shaft 5, this shaft being coupled to the starter shaft *c* by a coupling or clutch device shown as a cup 6 on the engine shaft, having recesses 7 to receive projections 8 from the disk 9 on the starter shaft *c*. The two parts of the clutch are separately illustrated in Figs. 3 and 4.

The direction of rotation of the engine is indicated by the arrow *x* in Fig. 2. The rotative force to start the engine originates at the retractive power device or coiled spring *a*, which is secured at its outer end to a stationary drum *d* and at its inner end to an outer sleeve *e* fitted to rotate upon an inner sleeve *n* which is fitted to rotate upon the starter shaft *c*, this outer sleeve *e* having ratchet teeth formed at its inner end and carrying a cup-shaped rotative part or internal gear *f* fitted to rotate loosely thereon and connected thereto by a plurality of spring pawls *h*, of which three are shown (see Fig. 1), engaging the ratchet teeth on the sleeve *e* when the sleeve is rotated by the power spring *a* in the direction of rotation of the engine-shaft *c*, which is the direction of rotation of the power spring in its starting or power-applying operation. The function of this pawl and ratchet connection is to prevent the momentum of the parts from carrying the spring beyond its unwound condition in the event of the complete unwinding of the spring.

Planet pinions *i*, of which three are shown, are fitted to rotate on studs *i'* projecting

from a brake-disk *g*, this brake-disk bearing loosely at its inner periphery upon the inner sleeve *n* and against an end nut or collar n^2 screwed thereon, and having an outer flange the outer periphery of which is fitted to rotate in a bearing formed by the stationary ring *g'* and against end-thrust removable ledges g^2 on the stationary ring. A brake-band *j* enters a V-shaped peripheral groove in the brake-disk *g* and very nearly encircles the brake-disk, and is secured at one end to the stationary ring *g'* and is connected at its other end by a chain *j'* to a pivoted pedal *k* so that pressure upon this pedal will cause the brake-band to be released, the pedal having a lower arm *k'* controlled by a helical spring *l* so that the spring acts to tighten the brake-band upon the brake-disk *g*. Thus ordinarily the brake is applied and the brake-disk *e* is held from rotation, but at the will of the operator the brake may be released and the brake-disk permitted to rotate under the actuation of the power spring. The lower arm *k'* has an eye to which may be connected an actuating rod or chain or other device permitting the brake to be released, pedally or manually, from any suitable point.

The planet pinions *i*, which are, as aforesaid, fitted to rotate on studs projecting from the brake-disk *g*, have fixedly secured upon them planet-gear-wheels *m*, which mesh with gear-teeth *n'* formed upon the inner sleeve *n*. A cup or internal ratchet *p* is fixedly secured upon the outer end of this inner sleeve *n*. This cup *p* carries two sets of ratchet-teeth, the teeth *q* of the inner set, comprising a considerable number of teeth, being engaged with their pawls during the power-applying or starting operation, and the teeth *r* of the outer set, shown as comprising two teeth, being engaged during the winding operation, the ratchet-teeth of the two sets being arranged to engage in opposite directions of rotation. Both sets of pawls are carried by the disk *t*, which is fixedly secured upon the starter-shaft *c*. The power-pawls *s* are pivoted thereon and weighted so that the weights will be thrown outward and the pawls moved inward out of engaging positions when the shaft is rotating at something approaching its normal speed and the grip between the pawls and the teeth engaged thereby is loosened by the forward movement of the engine. They are also controlled by light springs *s'*, which throw them into engaging positions when the starter-shaft and connected engine-shaft are at rest. These pawls are centrifugally operated therefore only for the purpose of throwing them out of engagement. The other pawls *u*, employed in the winding operation, are centrifugally operated for the purpose of throwing them into engagement and will be hereinafter described.

The thrust of the power spring *a*, when wound, is exerted upon the outer sleeve *e*, in the direction of rotation of the engine-shaft and starter-shaft, and is therefore imparted from such outer sleeve *e* through the pawls *h* to the internal gear *f* and from the internal gear *f* to the planet-pinions *i* and planet-wheels *m*. Lock-pawls *v* are provided, engaging the teeth of the planet gear-wheels *m* and are controlled by spring friction disks *w* which are fitted upon the hubs of the planet pinions *i* and bear against the faces of the planet gear-wheels *m* and are connected to the lock-pawls *v* by connecting rods *v'*. These friction disks *w* act, under the unwinding effort of the main spring, to pull the lock pawls *v* into engagement with the teeth of the planet-gear-wheels *m* and thereby to lock the planet-gear-wheels and planet-pinions from rotation on their axes and therefore to lock them and the other connected parts above referred to from forward movement under the power of the mainspring so long as the brake-disk *g* is held stationary by the application of the brake-band *j*. When, however, the brake-band *j* is loosened, at the will of the operator, and thereby the brake-disk is permitted to rotate, the brake-disk and the planet-pinions and planet-wheels carried thereby and locked from rotation thereon by the pawls *v* will be rotated as a whole and their rotative movement will be imparted to the inner sleeve *n* at the gear-teeth *n'*, and the rotation of this sleeve will be imparted to the starter-shaft *c* by means of the ratchet-teeth *q* and starting-pawls *s*, and the power of the spring will be applied to rotate the engine-shaft and thus to start the engine. When the pedal *k* is released and the brake-band *j* applied to the brake-disk *g*, this application of power to the engine will be discontinued. Should the pedal be not released until the power spring is unwound, which would not however usually occur or be required, the forward rotative movement of the engine-shaft would not be in any manner nor under any circumstances impeded, as the construction above described permits the engine-shaft at all times to rotate without imparting rotation by means of the starting-pawls *s* to the inner sleeve *n*. Further, the momentum of the parts above described could not strain or tend to reversely wind the spring by reason of the pawl and ratchet connection between the outer sleeve *e* and the internal gear *f*. Usually, however, the engine will have been started before the power of the spring has been exhausted and the operator will release the pedal and the brake will be applied and thereby the grip of the starting-pawls *s* upon the ratchet-teeth *q* will be loosened and centrifugal force will throw the starting-pawls *s* inward out of contact with the ratchet-teeth and they will remain thus out of engagement and out of contact so long as the engine

is rotated by its own power and will not be returned to engaging position until the engine slows down in approaching its condition of rest.

It will be noted that by reason of the locking of the planet gearing, the outer sleeve *e*, the inner sleeve *n* and the starter-shaft and engine-shaft will be actuated all at the same speed of rotation, and under these conditions the power of the spring will be applied at a maximum in the starting operation. In contrast with this arrangement, the winding will be performed with the engine-shaft, starter-shaft, and inner sleeve rotating at a higher rate of speed than the outer sleeve, so that a minimum effort of the engine will be required to wind the power spring. The winding operation is not performed until the engine has attained a predetermined speed selected as suitable for such operation, so that the power of the engine will not be drawn upon to wind the spring until such power is ample to perform the winding operation without material interference with the ordinary work of the engine.

The connection between the engine and power-spring for the winding operation is effected between the cup *p* on the inner sleeve *n* and the disk *t* on the starter-shaft *c*, by means of the centrifugal power-storing or winding pawls *u*, engaging with the ratchet-teeth *r*. These centrifugal pawls *u*, of which two are shown, are fitted in recesses in the outer face of the disk *t* so that they may swing outward at their front ends, turning in half-round sockets at their rear ends. They are normally held in inner position by spring detents *y*, consisting of spring-pressed pins protruding slightly from the centrifugal pawls into depressions in the adjacent faces of the disk and which act to restrain the centrifugal pawls until a sufficient centrifugal force has been developed to throw them quickly outward into engaging positions. When the engine has attained the sufficient speed selected for the winding operation, these centrifugal pawls are thrown out into engagement with the ratchet-teeth *r* and the winding operation is initiated. The inner sleeve *n* is rotated and its gear-teeth *n'* impart rotation to the planet-wheels *m* and the friction disks *w* carried thereby, moving the lock-pawls *v* outward and out of engaging position. These lock-pawls are moved outward into contact with their back-stops v^2 and thereby the motion of the friction-disks *w* is arrested, but the continued motion of the planet-wheels is retarded only by the frictional slip of the friction-disks. The rotation of the planet-wheels is now upon their own axes, the brake-disk *g* being held from rotation by the brake-band *j*, and the planet-pinions *i* impart motion to the internal gear *f* in a direction opposite to that in which it was rotated during the starting operation and this movement is transmitted by the pawls *h* to the outer sleeve *e* and the spring is wound at a very smuch slower speed than that of the engine-shaft.

The winding or power-storing operation is discontinued automatically by the spring or retractive device at a predetermined point of winding or power storing, in the construction shown, just before the spring has been fully wound, and this discontinuance of the winding operation is effected by disengaging the centrifugal pawls *u*. To effect this operation, I provide an externally threaded sleeve 2 engaging with an internal thread on the outer or spring-carrying sleeve *e* and a non-rotative disk 3, having projecting fingers or keys 4 entering the threaded sleeve 2, so that it will prevent rotation of the threaded sleeve, and itself held from rotation by stationary arms 10 entering notches in its outer periphery. This non-rotative disk is separately shown in Fig. 5. By reason of the fact that the threaded sleeve 2 is non-rotative, it is caused to traverse longitudinally as the power-spring unwinds or is wound, and during the winding movement it is moved outward away from the spring and toward the cup *p*. The disk 3 is pushed outward during this movement and is at all times yieldingly held against the threaded sleeve 2 by helical springs 11. As shown, the sleeve and disk have very nearly reached the outer limit of their movement and the winding operation is about to be discontinued. A roller 12 is mounted upon the outer face of the disk 3 and in the position shown has just come into engagement with an arm 14 on a pinion 15 fitted to oscillate upon a pin projecting from the cup *p* (see Fig. 13). The rotation of the cup *p* and the outward movement of the disk 3 bring these two parts into engagement and then the further rotative movement of the cup *p* causes the arm 14 and pinion 15 to be partly rotated and causes a partial rotation, in much smaller degree, of a disk 16, fitted to oscillate and move longitudinally upon the hub of the cup *p*, thereby causing wedge-thrust-pieces 17, carried by the disk 16 and entering recesses in the cup *p* having counterpart inclined faces, to be thrust forward against a releasing plate 18, this releasing plate having projecting cone-pointed pins 19 which slide in cylindrical perforations in the disk *t* and enter cone-shaped recesses in the centrifugal pawls *u*, and by this forward thrusting movement force the centrifugal pawls *u* inward out of engagement with the ratchet-teeth *r*, thereby disconnecting the shaft and the power-spring, and discontinuing the wind-

ing or power-storing operation. The power-spring, being then released, will at once reverse the direction of rotation of the planet-wheels and cause the lock-pawls *v* to be moved into engaging position so as to lock the power-spring against unwinding so long as the brake-band *j* is applied to the brake-disk *g*.

The releasing-plate 18 which carries the cone-pointed pins 19 will at all times rotate with the shaft and so long as the wedge-thrust-pieces 17 are advanced will rotate in contact therewith and be held thereby in position to hold the centrifugal pawls *u* out of engagement. A helical spring 20 between this releasing plate 18 and the disk *t* presses the releasing plate 18 against the wedge-thrust-pieces 17 and causes it to be retracted out of releasing position when these wedge-thrust-pieces are withdrawn. The oscillating arm 14 is retracted by a spring 21 but continues to hold the disk 16 and wedge-thrust-pieces 17 in releasing position so long as the mainspring is fully wound, and the oscillating arm 14 is not retracted until the beginning of a starting operation, and although the retraction of the oscillating arm 14 which then occurs, results in the withdrawal of the releasing plate 18, the comparatively slow speed of the starting operation will not develop sufficient centrifugal force to effect the engagement of the centrifugal winding or power-storing engaging means or clutch above described, and the centrifugal winding arms *u* will be held out of engagement by their detents *y* until the attainment of the predetermined speed of the engine selected as sufficient for the winding or power-storing operation, and upon the attainment of this speed, whenever the spring is not fully wound, the centrifugal winding arms *u* will engage with their ratchet-teeth *r* to effect a winding of the spring to its maximum power-storing capacity.

The framing is such as to house and protect the working parts, and as shown is suspended from a beam 22, which may be a part of the body or frame of an automobile. An angle-beam 23, suitably secured to the beam 22, has secured to it the ring *g'*, which, as aforesaid, provides a bearing for the outer periphery of the brake-disk *g*. The spring drum *d* is secured to the ring g^2 and is supported at its outer end by the bracket 33 and has a bearing for the front end of the spring-carrying sleeve *e*. A smaller drum 24 is secured to the drum *d* and has an opening at its outer end closed by a pivoted door 25.

For the purpose of initially winding the spring and of rewinding it in the unusual event of so short an operation of the engine that the spring has not been wound by the engine, I provide a winding crank 26, externally threaded to enter a threaded boss on a winding sleeve 27, this winding sleeve having cam-grooves 28 engaging pins 29 on the cup *p* so that the rotative effort of the crank will first cause the winding sleeve to be moved longitudinally inward, thereby causing a frusto-conical projection 30 thereon to engage and move outward the inner weighted ends of the starting-pawls *s* so as to move the starting-pawls out of engagement and disconnect the cup *p* from the shaft. The further rotative effort of the winding crank 26 will bring the ends of the cam-grooves 28 against the pins 29 and then the winding sleeve 27 and the cup *p* will rotate together and the spring will be wound in the manner already described. This winding or power-storing crank is separately shown in Fig. 7. I also provide for starting the engine by a crank in the event of breakage of the starter, the starting crank 31 being of usual construction and adapted to fit over the protruding end of the starter-shaft *c* and to engage with pins 32 thereon. This starter crank is separately shown in Figs. 8 and 9.

It will be noted that the brake-disk *g* is in effect a locking part or lock-wheel, in that it locks the power-spring or power-storing device in wound-up or maximum power-storing condition, and that the brake-band *j* which controls the brake-disk or lock-wheel *g* is the locking device therefor. It will also be noted that the inner sleeve *n* and the cup *p* carried thereby together constitute a part which is connected with the spring or power-storing device and is utilized both in the starting operation and in the winding or power-storing operation, and is actuated by the power-storing device in the starting operation and by the engine in the winding or power-storing operation; and that the starter-shaft *c* is in effect merely an extension of the engine-shaft 5, while the disk *t* thereon may be referred to separately or taken therewith, as an engine-connected part. It will also be noted that the engagement of the starting and storing part and the engine-connected part is effected by uni-directional engaging means, the starting-pawls *s* being engageable only to transmit power from the starting and storing part to the engine-connected part and the winding or power-storing pawls *u* being engageable only to transmit power from the engine-connected part to the starting and storing part.

The arrangement of the lock-wheel and gearing at one side of the power spring and of the engaging means for the starting and storing operations and the releasing means at the other side thereof is peculiarly advantageous in that it assembles together the parts requiring nice adjustment and thorough lubrication and permits these latter parts to be inclosed in a separate portion of the casing which may be removed without disturbance of the power spring and gearing.

It is obvious that various modifications

may be made in the construction shown and above particularly described within the principle and scope of my invention.

What I claim and desire to secure by Letters Patent is:—

1. An engine-starter comprising a power-storing device, a ratchet member connected thereto, and a rotary pawl carrier connected with the engine, the ratchet member having two oppositely-facing ratchet-teeth and the pawl carrier having a centrifugal starting pawl coöperative with one ratchet-tooth and movable by centrifugal force out of engagement therewith and a centrifugal power-storing pawl coöperative with the oppositely facing ratchet-tooth and movable by centrifugal force into engagement therewith.

2. An engine-starter comprising a power-storing device, a ratchet member connected thereto and a rotary pawl carrier connected with the engine, the ratchet member having two oppositely-facing ratchet-teeth and the pawl carrier having a centrifugal starting pawl coöperative with one ratchet-tooth and movable by centrifugal force out of engagement therewith and a centrifugal power-storing pawl coöperative with the oppositely-facing ratchet-tooth and movable by centrifugal force into engagement therewith, and a detent for restraining the engaging movement of the power storing pawl until the development of a predetermined centrifugal force.

3. An engine-starter comprising a power-storing device, a ratchet member connected thereto, and a rotary pawl carrier connected with the engine, the ratchet member having two oppositely facing ratchet-teeth and the pawl carrier having a centrifugal starting pawl coöperative with one ratchet-tooth and movable by centrifugal force out of engagement therewith and a centrifugal power-storing pawl coöperative with the oppositely facing ratchet-tooth and movable by centrifugal force into engagement therewith, and releasing means for the power-storing pawl controlled by the power-storing device.

4. An engine-starter comprising a power-storing device, a ratchet member connected thereto and a rotary pawl carrier connected with the engine, the ratchet member having two oppositely-facing ratchet-teeth and the engine-connected part having a centrifugal starting pawl coöperative with one ratchet-tooth and movable by centrifugal force out of engagement therewith and a centrifugal power-storing pawl coöperative with the oppositely-facing ratchet-tooth and movable by centrifugal force into engagement therewith, yielding means for moving the starting pawl into engagement, a detent for restraining the engaging movement of the storing pawl until the development of a predetermined centrifugal force, and releasing means for the storing pawl controlled by the power-storing device.

5. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part and movable by centrifugal force into engagement with the power-transmitting member, a wedge-part having an inclined engagement with the power-transmitting member, means controlled by the power-storing device for partly rotating the wedge-part relatively to the power-transmitting member, and releasing means for the centrifugal engaging device operated by the resultant lateral movement of the wedge-part.

6. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a rotating pawl carrier connected with the engine, a centrifugal pawl carried by the pawl carrier and movable by centrifugal force into engagement with the power-transmitting member, a wedge-part having an inclined engagement with the power-transmitting member, means controlled by the power-storing device for partly rotating the wedge-part, and releasing means for the centrifugal pawl, such releasing means being carried by and rotatable with the pawl carrier and rotating in contact with the wedge-part.

7. An engine-starter comprising a power-storing device, a power transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part and movable by centrifugal force into engagement with the power-transmitting member, a releasing pin having an inclined face and coöperative with the centrifugal engaging device, and means controlled by the power-storing device for thrusting the releasing pin into releasing position.

8. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part, releasing means for the centrifugal engaging device, a threaded sleeve controlling the releasing means, and a threaded part controlled by the power-storing device and cooperative with the threaded sleeve.

9. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part and movable by centrifugal force into engagement with the power-transmitting member, a wedge-part having an inclined engagement with the power-transmitting member, a non-rotative part movable by the

power-storing device into operative position and coöperative with the wedge-part, and releasing means for the centrifugal engaging device controlled by the wedge-part.

10. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part and movable by centrifugal force into engagement with the power transmitting member, a wedge-part having an inclined engagement with the power-transmitting member, a non-rotative part movable by the power-storing device into operative position, an oscillating arm and pinion carried by the power transmitting member, the arm being coöperative with the non-rotative part and the pinion actuating the wedge-part, and releasing means for the centrifugal engaging device controlled by the wedge-part.

11. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part and movable by centrifugal force into engagement with the power transmitting member, a wedge-part having an inclined engagement with the power-transmitting member, a non-rotative part movable by the power-storing device into operating position and coöperative with the wedge-part, and a releasing pin having an inclined face and coöperative with the centrifugal engaging device and controlled by the wedge-part.

12. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part, a threaded non-rotative sleeve, a threaded part controlled by the power-storing device and coöperative with the threaded sleeve, a wedge-part having an inclined engagement with the power-transmitting member and coöperative with the non-rotative sleeve to be partly rotated thereby, and releasing means for the centrifugal engaging device controlled by the wedge-part.

13. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part, a threaded non-rotative sleeve, a threaded part controlled by the power-storing device and coöperative with the threaded sleeve, a wedge-part having an inclined engagement with the power-transmitting member, an oscillating arm and pinion carried by the power-transmitting member, the arm being coöperative with the non-rotative sleeve and the pinion actuating the wadge-part, and releasing means for the centrifugal engaging device controlled by the wedge-part.

14. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part rotatively connected with the engine, a centrifugal engaging device carried by the engine-connected part, a threaded non-rotative sleeve, a threaded part controlled by the power-storing device and coöperative with the threaded sleeve, a wedge-part having an inclined engagement with the power-transmitting member, an oscillating arm and pinion carried by the power-transmitting member, the arm being coöperative with the non-rotative sleeve and the pinion actuating the wedge-part, and a releasing pin having an inclined face and cooperative with the centrifugal engaging device and controlled by the wedge-part.

15. An engine-starter comprising a power-storing device, a power-transmitting member, a lock-wheel and means for locking it, gearing connecting the power-storing device and the power-transmitting member and comprising a gear carried by the lock-wheel, a part operatively connected with the engine, and means connecting the engine-connected part and the power-transmitting member including centrifugal engaging means to effect the power-storing operation and releasing means for the centrifugal engaging means, and also including unidirectional engaging means to effect the starting operation, the lock-wheel and gearing being located at one side of the power-storing device and the engaging and releasing means being located at the other side of the power-storing device.

16. An engine-starter comprising a power-spring, a starting and winding sleeve connected therewith, a lock-wheel and locking means controlling the same, gearing connecting the power-spring and the starting and winding sleeve and comprising a gear carried by the lock-wheel and concentric with the starting and winding sleeve, a part operatively connected with the engine, and means connecting the engine-connected part and starting and winding sleeve including centrifugal engaging means to effect the winding operation and releasing means for the centrifugal engaging means, and also including uni-directional engaging means to effect the starting operation, the lock-wheel and gearing being located at one side of the power-spring and the engaging and releasing means being located at the other side of the power-spring.

17. An engine-starter comprising a power-spring, a lock-wheel and locking means controlling the same, an internal gear connected to the power-spring, a planetary gear on the lock-wheel, means for locking the planetary gear against rotation on its axis in the direction of the thrust thereon of the starting ef-

fort of the spring, a power-transmitting member concentric with the lock-wheel and having teeth engaging with the planetary gear, a part rotatively connected with the engine, and means for connecting the power-transmitting member therewith to transmit power thereto from the spring for the starting operation and to transmit power from the engine-connected part to the spring for the winding operation.

18. An engine-starter comprising a power-spring, a lock-wheel and locking means controlling the same, an internal gear connected to the power-spring, a planetary gear on the lock-wheel, a part frictionally engaging the planetary gear and a lock-pawl connected to such part so that the frictional part will actuate the pawl to lock the planetary gear against rotation on its axis in the direction of the thrust thereon of the starting effort of the spring, a power-transmitting member concentric with the lock-wheel and having teeth engaging with the planetary gear, a part rotatively connected with the engine, and means for connecting the power-transmitting member therewith to transmit power thereto from the spring for the starting operation and to transmit power from the engine-connected part to the spring for the winding operation.

19. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part operatively connected with the engine, means for connecting the power-transmitting member and the engine-connected part, and manually operable means operative first to disconnect the power transmitting member and the engine-connected part and then to apply power to restore the power-storing device.

20. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part operatively connected with the engine, means for connecting the power-transmitting member and the engine-connected part, and a crank-receiving member connected to the power-transmitting member and initially movable with relation thereto to disconnect the power-transmitting member and the engine-connected part and thereafter movable with the power-transmitting member to actuate the same.

21. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a part operatively connected with the engine, means for connecting the power-transmitting member and the engine-connected part, and a crank-receiving sleeve movably connected with the power-transmitting member by a pin and a cam-groove and having a disconnecting projection thereon, so that the initial operation of the crank will cause the sleeve to be moved relatively to the power-transmitting member and the projection thereon will disconnect the power-transmitting member and the engine-connected part and the further movement of the crank will cause the actuation of the power-transmitting member.

22. An engine-starter comprising a shaft connected with the engine, a sleeve concentric with the shaft, a spring surrounding the sleeve, means for connecting the sleeve with the spring at one side of the spring, and means for connecting the sleeve with the shaft at the other side of the spring.

23. An engine-starter comprising a shaft connected with the engine, a sleeve concentric with the shaft, a power-storing device, gearing connecting one end of the sleeve with the power-storing device to re-store it with power, and means for connecting the other end of the sleeve with the shaft to actuate the sleeve.

24. An engine-starter comprising a shaft connected with the engine, a sleeve concentric with the shaft, a spring surrounding the sleeve, means for connecting the spring on one side thereof with the shaft to start the engine and with the adjacent portion of the sleeve to rewind the spring, and means for connecting the shaft with the sleeve at the other side of the spring to actuate the sleeve and rewind the spring.

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

CLYDE J. COLEMAN.

Witnesses:
HENRY D. WILLIAMS,
BERNARD POWEN.