No. 836,365. PATENTED NOV. 20, 1906.

C. J. COLEMAN.

STARTING MEANS FOR EXPLOSION ENGINES.

APPLICATION FILED MAR. 11, 1904.

2 SHEETS—SHEET 1

Fig. 1

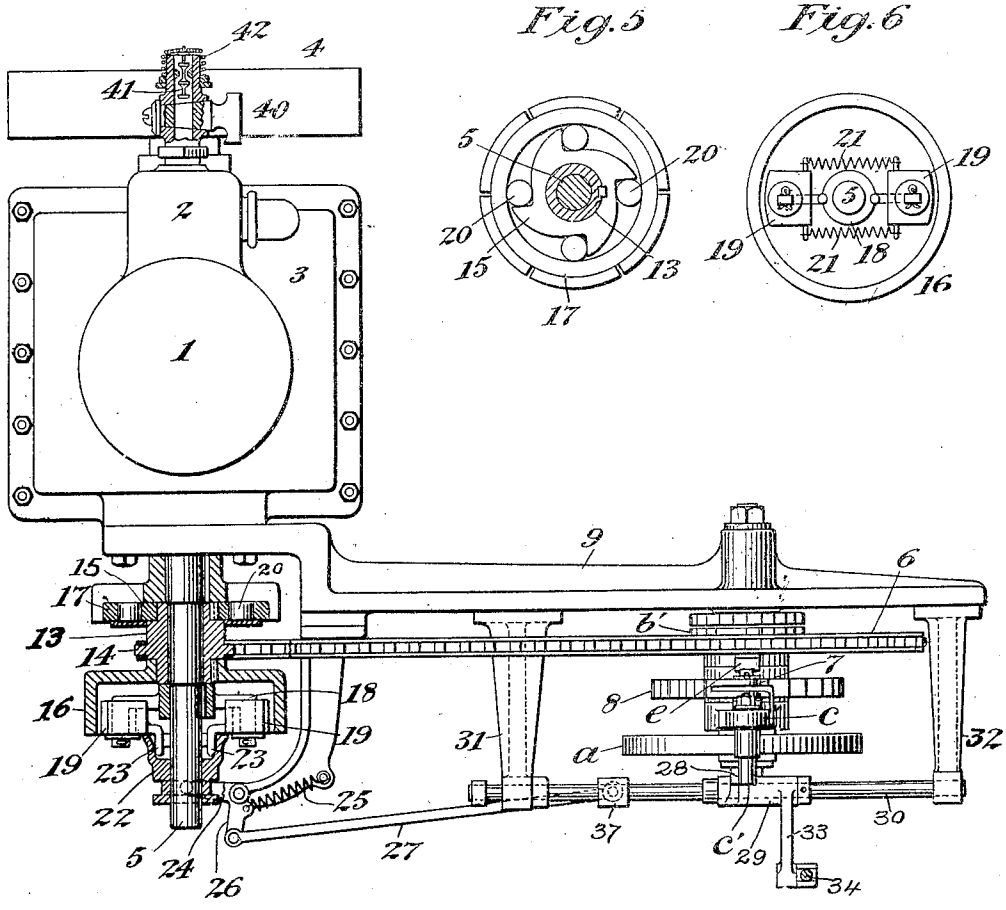


Fig. 5

Fig. 6

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2 SHEETS—SHEET 2.

Fig. 2

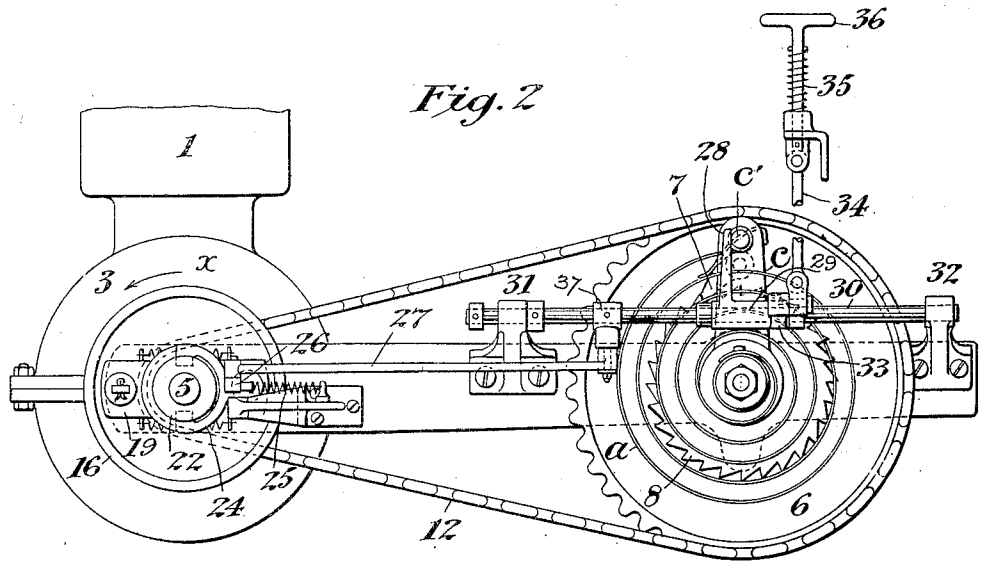


Fig. 3

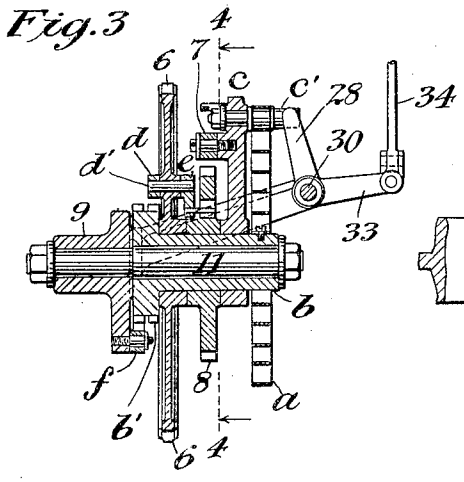
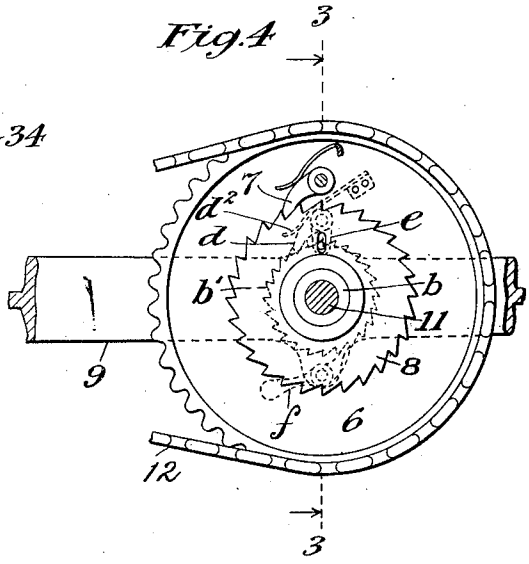


Fig. 4



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UNITED STATES PATENT OFFICE.

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

STARTING MEANS FOR EXPLOSION-ENGINES.

No. 836,365. Specification of Letters Patent. Patented Nov. 20, 1906.

Application filed March 11, 1904. Serial No. 197,642.

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 Starting Means for Explosion-Engines, of which the following is a specification, reference being had therein to the accompanying drawings, 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 includes a resilient or mechanically-retractive power-storing device, such as a spring or weight, means whereby it may be connected with the engine at the will of the operator to exert its power in starting the engine, and means whereby the engine is thereafter automatically connected with the retractive device to store power in the retractive device, such connection not being made, however, until the engine has attained a predetermined speed selected as suitable for the performance of the power-storing operation.

My invention also includes means for disconnecting the retractive device from the engine upon the completion of the power-storing operation, whereby the retractive device, with power stored therein suitable for the performance of another starting operation, remains a disconnected part until it is again called into operation at the will of the operator. Thus the engine is not called upon to perform the work of storing power in the retractive device until it has attained a sufficient speed to permit the performance of the power-storing operation without objectionable impairment of its other functions, and the retractive device is disconnected from the engine at all times, except when exerting its power in starting the engine or receiving power from the engine in the power-storing operation.

My invention also includes more specifically the utilization of a spring as the retractive power device.

My invention also includes numerous improvements in the construction and combination of parts generally applicable to power-starting means and specifically combined with power-starting devices such as above referred to and includes the combination, with power-starting means for an explosion-engine, of relief-controlling means for such engine.

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

Figure 1 is a plan view of an explosion-engine provided with starting means embodying my invention with the relief-controlling means shown in section. Fig. 2 is a front elevation of the lower portion of the same. Fig. 3 is a vertical section on the line 3 3, Fig. 4. Fig. 4 is a longitudinal vertical section on the line 4 4, Fig. 3. Fig. 5 is a detail elevation of the directional clutch. Fig. 6 is a detail elevation of the centrifugal clutch.

The retractive power device in the construction shown is a coiled or helical spring *a*, which is secured at its inner end to a winding-sleeve *b* and at its outer end to a pin *c'* on the power-arm *c*. The winding-sleeve *b* is loosely fitted to rotate on a stud projecting forward from an arm 9 of the starter-frame, and the power-arm *c* is loosely fitted to rotate on the winding-sleeve *b*. A power-pawl 7 is provided on the power-arm *c*, engaging with a power ratchet-wheel 8, which is also loosely fitted to rotate on the winding-sleeve *b*, and a winding ratchet-wheel *b'* is secured to or formed upon the rear end of the winding-sleeve and has two sets of teeth thereon, the teeth of the rear set being engaged by a counterweighted stop-pawl *f*, having a stationary pivot in the frame-arm 9 and the teeth of the front set being engaged by a winding-pawl *d*. This winding-pawl *d* is pivoted in a sprocket-wheel 6, loosely fitted to rotate on the winding-sleeve *b* between the winding ratchet-wheel *b'* and the power-ratchet wheel 8. The pivot-pin *d'* of the winding-pawl *d* extends forward through the sprocket-wheel 6 and has an arm *e* at its front end provided with a pin entering a radial slot in the power ratchet-wheel 8, so that when the power ratchet-wheel is actu-

ated by the power-spring it swings the arm *e* forward and lifts the winding-pawl *d* away from the winding ratchet-wheel *b'* and clear of engagement with the teeth of this ratchet *b'*, thus permitting the sprocket-wheel to be rotated by the power-spring *a*, with the inner end of the power-spring held stationary by the stop-pawl *f*. A light spring d^2 normally holds the winding-pawl *d* in engaging position and restores it to engaging position when the power actuation of the power ratchet-wheel is disconnected.

The sprocket-wheel 6 is connected by a chain 12 with a sprocket-pinion 14 on a sleeve 13, fitted to rotate freely on the main shaft 5 of the engine. This loose sleeve 13 carries a ratchet-wheel 15 of a directional clutch for connecting the sleeve to the engine-shaft to start or drive the engine and also carries a cup 16 of a centrifugal clutch also for connecting the sleeve and shaft to retract or wind the power-spring. The cup 17 of the directional clutch is secured upon the main shaft 5 and comprises a contact-ring tightly held in a split cup, but capable of slipping under extraordinary stress to prevent breakage. A spider 18, carrying the centrifugal clutch-dogs 19, is also secured upon such main shaft, the cup 17 of the directional clutch and the spider 18 of the centrifugal clutch being shown as keyed to the shaft and the ratchet-wheel 15 of the directional clutch and the cup 16 of the centrifugal clutch being shown as keyed to the sleeve 13.

The directional engaging means or clutch is of roller-grip construction, being provided with gripping-rollers 20, interposed between the ratchet and cup. The direction of rotation of the engine is indicated by the arrow *x*, Fig. 2. When the power-spring actuates the sprocket and sleeve to start the engine, this directional clutch automatically engages and the power of the spring is applied to the engine-shaft to drive the engine; but when the engine is self-actuated with greater power than that applied by the power-spring the directional clutch automatically disengages, and thus the clutch is effective only to apply the power-actuated movement of the starting means to the engine and automatically relieves the engine of any drag from the starting means at all other times.

The clutch-dogs 19 of the centrifugal clutch are normally held in disengaged positions by springs 21, these springs being of such strength as to prevent engagement of the clutch-dogs with the cup except under a speed of rotation of the engine approximating its maximum speed, so that the centrifugal clutch cannot become effective to connect the loose sleeve 13 to the engine-shaft except at the predetermined speed of rotation of the engine. When the centrifugal clutch is thus engaged, the sleeve 13 is actuated by the engine and actuates the sprocket-wheel to wind the power-spring, these parts constituting the centrifugal winding means. The centrifugal clutch is also automatically controlled, so that it will be disengaged when the power-spring has been wound to the predetermined maximum extent by means of a sliding sleeve 22, which is fitted loosely on the main shaft 5 and is provided with a dog-gripping cup engaging with annular arms 23, projecting from the clutch-dogs 19, this gripping-cup being partly conical, so as to have an oblique engagement with such arms when it is moved toward the dogs and being partly cylindrical to form a positive lock for such arms when the movement toward the dogs has been completed and being controlled by a pivoted yoke 24, entering an annular exterior groove of this cup-sleeve 22. The pivoted yoke 24 is controlled by a spring 25, tending to hold the gripping-cup out of operative position, and by a thrust-rod 27, both the spring and the thrust-rod engaging the angular arm 26 of the pivoted yoke.

The thrust-rod 27 coacts with the releasing mechanism of the power-spring *a*, this releasing mechanism including a lock-arm 28, normally engaging the pin *c'* of the power-arm *c* and extending upward from a sleeve 29, fitted to oscillate on a slide-rod 30, this slide-rod having a limited reciprocating movement in fixed brackets 31 32, extending forward from the arm 9 of the starter-frame. Another arm 33 extends forward from the sleeve 29 and has pivotally connected to it a hand-rod 34, which has a suitable handle 36 at its upper end and is depressed by the operator to swing the lock-arm 28 forward clear of the power-arm pin *c'* to release the starting mechanism. This hand-rod is controlled by a spring 35, which tends to hold it up and to hold the lock-arm 28 in engaging position, and the handle 36 at the upper end of the hand-rod is suitably located within reach of the operator.

The thrust-rod 27 is pivotally connected to a collar 37 on the slide-rod 30, and the sleeve 29 of the lock-arm 28 is held between collars on the slide-rod 30, so that the thrust of the power-spring *a*, exerted against the lock-arm 28, tends to move the slide-rod 30 toward the engine, and this thrust is resisted by the spring 25, connected to the clutch-yoke arm 26, and the strength of the spring 25 is so adjusted relative to the predetermined maximum power of the power-spring *a* that the dog-gripping cup 22 of the centrifugal clutch is actuated and moved into engaging position by the thrust of the power-spring *a* when the power-spring has been wound to this predetermined maximum extent, thereby withdrawing the dogs 19 of the centrifugal clutch from engagement with the cup 16 of this clutch and disengaging the clutch.

Relief-controlling means are provided for

the engine, such relief-controlling means comprising a relief-cock 40 (see Fig. 1) upon the valve-chest 3 of the engine and adapted to be manually operated; and automatic relief-controlling means upon an extension of the relief-cock casing. This automatic relief-controlling means comprises a double valve 41 and a controlling-spring 42. When the engine is to be started, the relief-cock 40 is opened. The controlling-spring holds the double valve normally in inner closed position, but yields sufficiently to the compression-pressure of the engine to hold the valve in intermediate position, so as to relieve compression during the starting operation, and yields to the explosion pressure and closes outward, thereby confining the gases of explosion and permitting their full utilization in driving the engine. Further, as the speed of the engine increases during the starting operation, the compression-pressure also increases, moving the valve farther outward and diminishing the relief effect as the speed and power of the engine increases. With a power-starting device there is a forward impulse at all times during the starting operation, while the action of the engine is frequently irregular, an occasional explosion giving the engine a rapid forward impulse and being followed by a failure or repeated failures to explode. Such a rapid forward impulse may momentarily actuate the engine more rapidly than the power-starter; but the power-starter is constantly following and fully utilizes every advantage. So, also, the engine may give a backward kick; but the power-starter resists and quickly overcomes any such opposition.

In the operation of the starting means the winding or power-starting connection with the engine, effected through the centrifugal clutch, is discontinued when the power-spring *a* has been wound to its predetermined maximum extent, and therefore the power-spring thus wound and locked by the lock-arm 28 is ready at any time to apply its power to start the engine. When the operator depresses the hand-rod 34, the lock-arm 28 is tilted forward clear of the power-arm pin *c'*, and the power-spring is thereby released and through the power-pawl 7 and ratchet 8 drives the sprocket-wheel 6, and the motion of the sprocket-wheel is imparted through the chain 12 to the loose sleeve 13, and the parts of the directional clutch 15 20 17 engage and drive the main shaft 5 of the engine. The operator holds the hand-rod 34 down until the engine is self-actuated, and the sprocket-wheel 6 may rotate as many times as is desirable for the complete performance of the starting operation up to the limit of the power of the power-spring *a*. The relief-controlling means coact with the power-starting means, as above explained. When the engine has been started and is fully self-actuated, the operator releases the hand-rod 34, the spring 35 lifts it and the lock-arm 28 to normal position, and the power-arm pin *c'* is brought to rest against the lock-arm 28. The tilting forward of the lock-arm 28 to release the power-spring also relieves the slide-rod 30 from the pressure of the power-spring and permits the spring 25 of the yoke 24 of the dog-gripping cup 22 to actuate the yoke 24 and connected parts, withdrawing the dog-gripping cup 22 from its engagement with the arms 23 of the dogs 19 of the centrifugal clutch, and thus releasing the dogs 19, so that they are free to perform their centrifugally-controlled operation. The engagement of the parts of the centrifugal clutch does not occur, however, until the predetermined speed of the engine for the performance of the power-storing or winding operation has been attained and is not continued unless such predetermined speed is capable of being maintained during such power-storing operation, so that the operation of winding the power-spring is not permitted to measurably impair the effectiveness of the engine. When the power-spring *a* has been wound to its predetermined maximum extent, the pressure of the power-spring against the lock-arm 28 overcomes the resistance of the yoke-spring 25, and the dog-gripping cup 22 performs its function of withdrawing and holding in the dogs of the centrifugal clutch, and the starting mechanism is wound and locked and ready to again start the engine.

It is obvious that various modifications may be made in the construction shown and above particularly described within the spirit and scope of my invention.

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

1. An engine-starter comprising a mechanical power-storing device, and means for connecting the power-storing device with an engine to start the engine and for automatically connecting the engine with the power-storing device, under the control of the speed of the engine, to store power in the power-storing device upon and not until the attainment of a predetermined speed of the engine sufficient for the power-storing operation.

2. An engine-starter comprising a mechanical power-storing device, driving means engageable only in one direction of movement for connecting the power-storing device with an engine to start the engine, automatic means under the control of the speed of the engine for connecting the engine with the power-storing device to store power in the power-storing device upon and not until the attainment of a predetermined speed of the engine sufficient for the power-storing operation, means for disconnecting the engine and power-storing device to discontinue the power-storing operation, and means controllable

by the operator for restraining the power-storing device to maintain the power-storing condition thereof and for releasing the power-storing device to perform the starting operation.

3. An engine-starter comprising a mechanical power-storing device, means for connecting the power-storing device with an engine to start the engine, and centrifugally-operated means for connecting the engine with the power-storing device to store power in the power-storing device upon the attainment of a predetermined speed of the engine.

4. An engine-starter comprising a mechanical power-storing device, means for connecting the power-storing device with an engine to start the engine, a centrifugal clutch for connecting the engine with the power-storing device to store power in the power-storing device upon the attainment of a predetermined speed of the engine, and automatic means for disengaging the centrifugal clutch to discontinue the power-storing operation.

5. An engine-starter comprising a mechanical power-storing device, engine-driving means engageable only in one direction of movement for connecting the power-storing device with an engine to start the engine, and centrifugally-operated means for connecting the engine with the power-storing device upon the attainment of a predetermined speed of the engine.

6. An engine-starter comprising a mechanical power-storing device, engine-driving means engageable only in one direction of movement for connecting the power-storing device with an engine to start the engine, a centrifugal clutch for connecting the engine with the power-storing device upon the attainment of a predetermined speed of the engine, and automatic means for disengaging the centrifugal clutch to discontinue the power-storing operation.

7. An engine-starter comprising a power-spring, engine-driving means engageable only in one direction of movement connected to one end of the spring, and a centrifugal clutch for connecting the engine with the other end of the spring to wind the spring upon the attainment of a predetermined speed of the engine.

8. An engine-starter comprising a power-spring, means for connecting the spring with the engine to start the engine, a centrifugal clutch for connecting the engine with the spring to store power in the spring upon the attainment of predetermined speed of the engine, and means controllable by the spring for disengaging the centrifugal clutch to discontinue the power-storing operation.

9. The combination, with an engine, of a power-spring, a rotatable power-arm controlled thereby, a lock-arm engaging the power-arm, a rotatable wheel and a rotatable part connected thereto, a clutch engageable only in one direction of movement for connecting such rotatable part to the engine and a centrifugal clutch also for connecting such rotatable part to the engine, means for connecting the power-arm and rotatable wheel to start the engine, and winding means for connecting the rotatable wheel and spring, substantially as set forth.

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

CLYDE J. COLEMAN.

Witnesses:
HENRY D. WILLIAMS,
HERBERT H. GIBBS.