C. J. COLEMAN.

ENGINE STARTER.

APPLICATION FILED JULY 16, 1904.

1,011,582.

Patented Dec. 12, 1911.

3 SHEETS—SHEET 1

Fig. 1

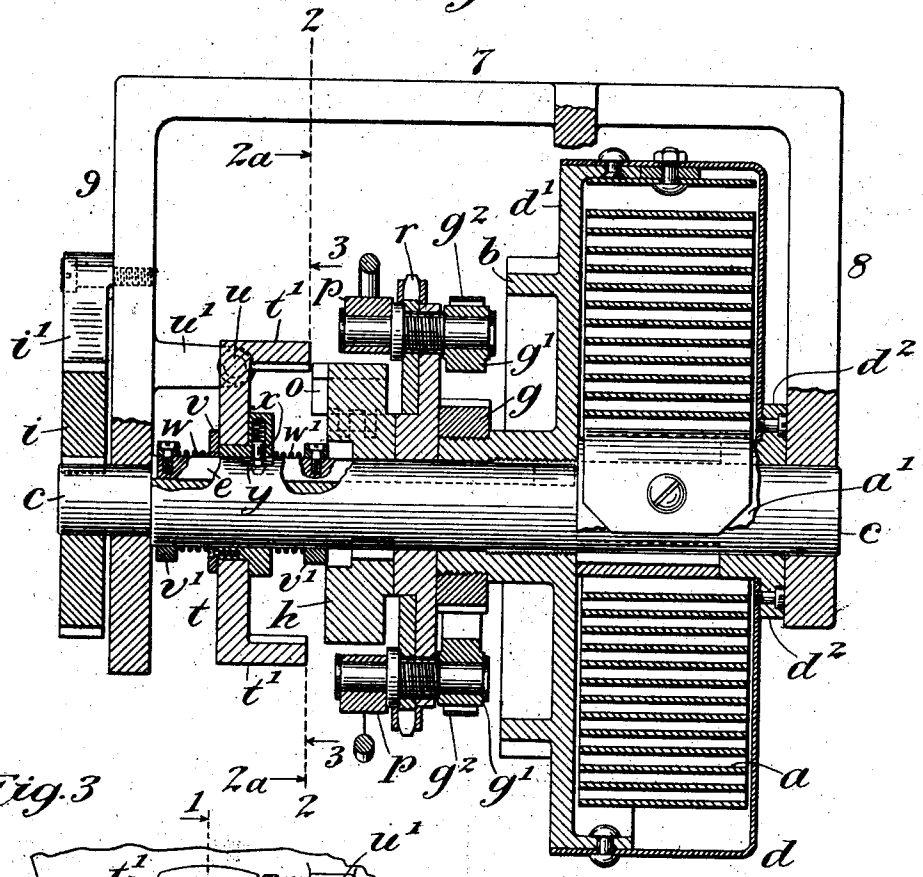


Fig. 3

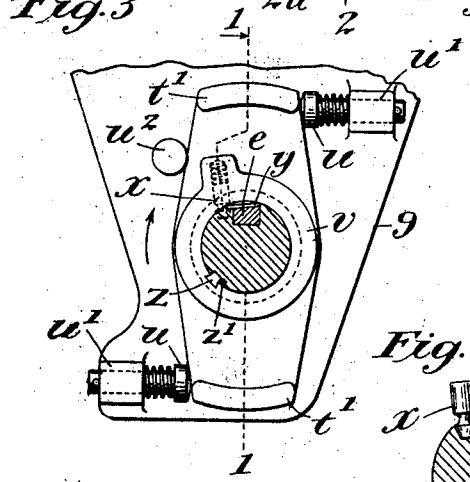


Fig. 4

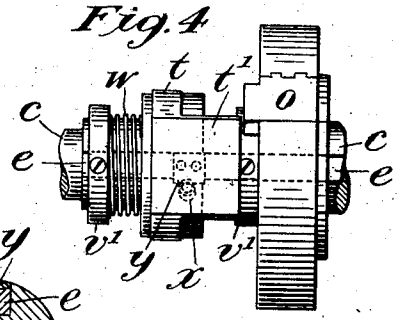
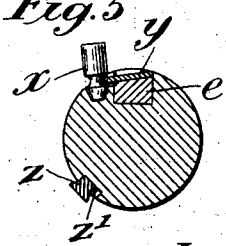


Fig. 5



Witnesses:

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3 SHEETS—SHEET 2.

Fig. 2

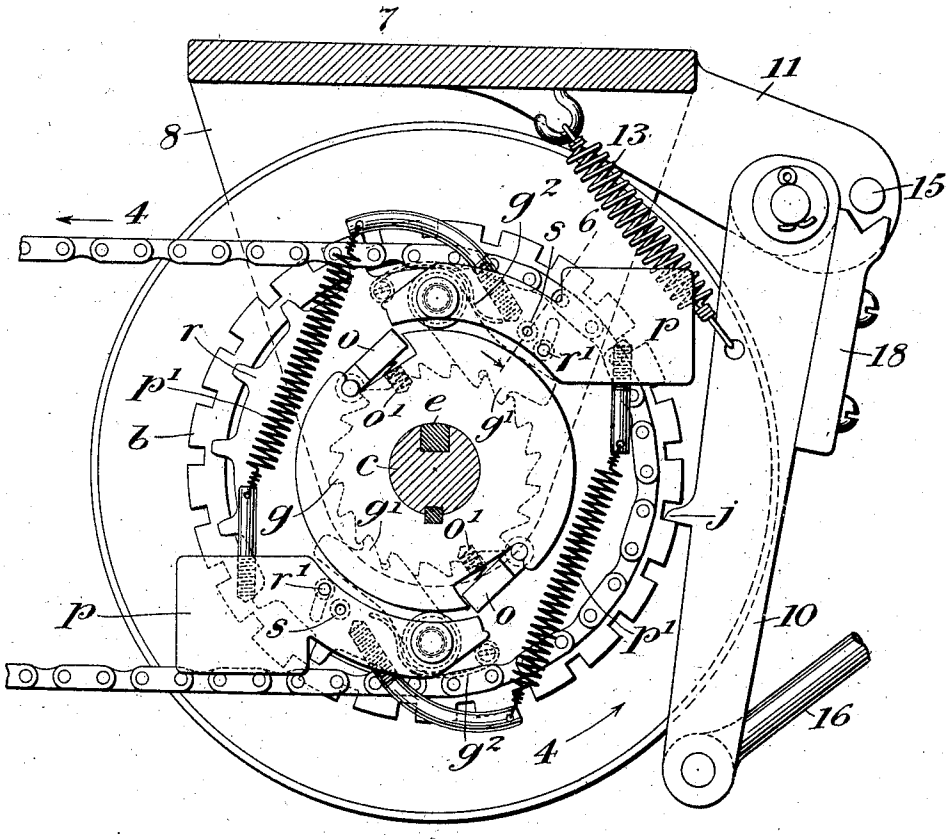
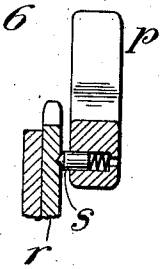


Fig. 6



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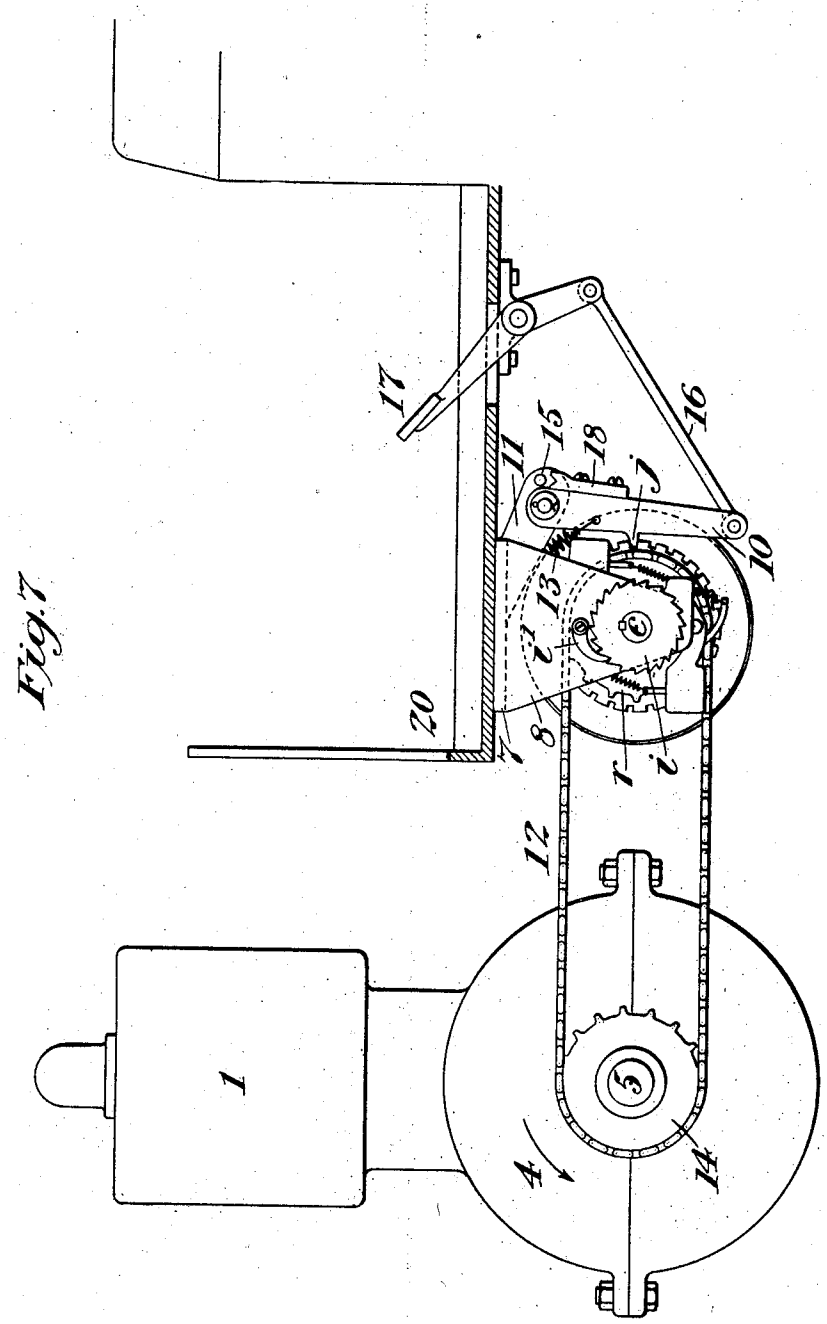
3 SHEETS—SHEET 3.

Fig. 7



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UNITED STATES PATENT OFFICE.

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

ENGINE-STARTER.

1,011,582. Specification of Letters Patent. Patented Dec. 12, 1911.

Application filed July 16, 1904. Serial No. 216,913.

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 in the following specification.

My invention particularly relates to engine starters characterized by the utilization of the power of the engine to store power in a retractive or power storing device by the self-actuation of the engine upon the attainment of a predetermined speed of the engine.

The present invention includes various improvements in the construction and combination of parts of such an engine-starter, such improvements being also generally applicable to power starting means.

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 a partly sectional elevation of the starter, the section through the clutch-dog releasing device at the left of this figure being indicated by the broken line 1—1, Fig. 3. Fig. 2 is a transverse vertical section of the same, taken on a plane indicated by the line 2—2, Fig. 1, looking to the right in Fig. 1, as indicated by the arrows 2 *a*. Fig. 3 is a transverse vertical sectional detail on the same plane, looking to the right as indicated by the arrows 3, 3. Fig. 4 is a detached plan view of the winding clutch-disk and clutch-dog releasing device. Fig. 5 is an enlarged detail cross-section of the same. Fig. 6 is a detail section, taken on a plane indicated by the line 6, in Fig. 2, showing the detent for one of the governor arms. Fig. 7 is a diagrammatic view of the starter and an explosion engine to which it is connected, and of portions of an automobile body.

The engine 1 illustrated in outline in Fig. 7 is an explosion engine of ordinary construction, which, by reason of the fact that it is non-starting or not self-starting, requires the application of a rotative force to its main shaft 5 to initiate the rotative movement thereof and to continue such movement until the engine is self-actuated. The direction of rotation of the engine is indicated by the arrows 4. The rotative force is shown as applied to the sprocket-wheel 14 fixed on the engine shaft 5 and driven during the starting operation by a chain 12 running over this sprocket-wheel and also running over the sprocket-wheel *r* of the starter, the last mentioned sprocket-wheel *r* being the engine-connected part of the starter.

The retractive power device of the starter is shown as a coiled or helical spring *a* secured at its inner end to a fixed sleeve *a'* on the shaft *c* of the starter and secured at its outer end to a drum *d*, this drum inclosing the spring and being carried at its rear end by a hub d^2 fitted to rotate on the starter shaft *c*. The drum has at its front end a head *d'*, the hub of which is partly internally threaded and bears at its unthreaded portion upon the starter shaft *c*, being fitted so as to rotate freely thereon. The starter shaft *c* is fitted to rotate in standards 8 and 9 of the starter frame, this frame also having an upper plate 7 which may be suitably secured to the automobile body as in the position shown in Fig. 7. The front head *d'* of the spring-drum has a forwardly projecting ring *b* with lock-teeth formed thereon and these lock-teeth are engaged by a tooth *j* of a lock-arm 10, this lock-arm being pivoted to a lug 11 of the frame and actuated by a rod 16 shown as connected to an actuating pedal 17, this pedal being conveniently located in the body 20 of the automobile, so that it may be readily actuated by the operator and depressed to unlock the spring drum and permit the starter spring to start the engine, and so that the pedal may be released to permit the helical spring 13, connected to the lock-arm 10 and the upper plate 7 of the starter, to return the

lock-arm 10 to locking position, thereby elevating the pedal. The lock-arm is limited in its unlocking movement by the engagement of a notched stop-piece 18 thereon with a stop-pin 15.

The hub of the front head d' of the spring-drum has fixed thereon a starting ratchet-wheel g. A winding clutch-disk h is fixed upon the starter shaft c, and the sprocket-wheel r, from which runs the chain 12 connecting the starter with the engine shaft, is fitted to rotate freely on the starter shaft c, and is located thereon between the starting ratchet-wheel g and the winding clutch-disk h.

The sprocket-wheel r carries starting-pawls, of which two g', g', are shown, these starting-pawls engaging the teeth of the starting ratchet-wheel g during the starting operation to transmit the rotation of the spring-drum to the sprocket-wheel r. When the engine is self-actuated these power-pawls are carried forward and are drawn outward by centrifugal force, overcoming their light springs g^2, g^2, and moving them clear of the power ratchet-wheel g, so that during the self-actuation of the engine they will be held by centrifugal force out of contact with the ratchet-wheel and will not rub over the teeth of the wheel, and the wear and noise which would otherwise result will thus be avoided. When, however, the engine slows down below a predetermined speed, the springs g^2 will move the pawls inward into contact with the teeth of the starting ratchet-wheel and they will be in position to engage the ratchet-wheel to impart thereto the thrust of the starting spring and will be held in contact therewith by their locking engagement until released and thrown outward by the self-actuation of the engine.

The parts above described perform the starting operation. This operation will now be described before describing the power-storing or winding mechanism and the operation whereby the spring is automatically wound so as to be ready to perform the starting operation.

The thrust of the starter-spring a, when the spring is wound, is exerted upon the spring-drum d in the direction in which the engine is to be rotated, and the lock-arm 10, by engagement of its tooth j with the lock-teeth b, prevents rotation of the spring-drum under the thrust of the starter-spring, thus securely holding the starter with its spring wound ready to start the engine. When the pedal 17 is depressed by the operator, the lock-arm 10 is moved to unlock the spring-drum and the thrust of the starter-spring is then exerted from the starting ratchet-wheel g through the starting-pawls g' to the sprocket-wheel r, sprocket-chain 12 and engine-shaft sprocket-wheel 14, to start the engine and continue the rotation thereof. When the engine becomes self-actuated with greater rotative speed than is applied to it by the starter-spring, the starting-pawls g' will be advanced as above described and moved outward by centrifugal force, so that their continued movement under the operation of the engine will be altogether clear of contact with the starting ratchet-wheel g. To prevent unwinding of the spring beyond its natural or normal set or shape, which would tend to wind it in an opposite direction and might break a spring of considerable strength, I provide a ratchet-wheel i fixed on the front end of the starter-shaft c and engaged by a back stop-pawl i' pivoted on the relatively stationary standard 9 of the starter frame, so as to lock the starter-shaft c against backward rotative movement but to freely permit forward rotative movement thereof. With this construction the starter-shaft will rotate freely forward when the strength of the spring is exhausted, thereby preventing appreciable reverse torsion on the starter-spring, by reason of the momentum of the moving parts, including the rotary spring-drum d and its adjuncts and also including the spring a itself. When the operator releases the pedal 17, the lock-arm 10 is restored by its spring 13 to normal position and the lock-tooth j engages and locks the spring-drum. Ordinarily the release of the pedal will occur before the exhaustion of the starter-spring, but should it be delayed beyond the point of exhaustion of the starter-spring, no injury could result to the mechanism by reason of the operation of the construction above described. The strength and capacity of the starter spring would usually be such as to allow an ample margin over the maximum work required to start the engine.

The winding clutch-disk h (fixed on the starter shaft c) is provided with clutch-dogs, of which two o, o, are shown. These clutch-dogs are normally held in their extreme outer positions, shown in Fig. 2, by light springs o' as well as by centrifugal force. Governor-arms are also provided carried by the sprocket-wheel r and pivotally mounted thereon, two of these arms p, p, being shown, each governor-arm having a weighted end and a toothed end and the governor-arms being connected by helical extensible springs p', p', tending to hold the arms in the positions shown in Fig. 2 with their toothed ends clear of the path of the clutch-dogs o, o. Centrifugal force will tend to move the weighted ends of the governor-arms outward and their toothed ends inward. For the purpose of restraining the movement of these governor-arms I provide spring-detents s therein which normally enter depressions in the face of

the sprocket-wheel r (see Fig. 6), affording a resistance superadded to that of the governor-springs p' and holding the governor-arms until a centrifugal force has developed which will move them quickly outward and will thereby cause a quick inward movement of their toothed ends and a positive engagement with the clutch-dogs o, o, of the winding clutch-disk h. This movement will not occur until a predetermined speed of the engine, usually its full speed, has been attained, so that the work of winding the starter-spring will not have to be performed by the engine until it is fully capable of performing such operation in addition to its ordinary work. The movement of the governor-arms is limited by ordinary fixed pins r' entering slots in the face of the sprocket-wheel r. When the winding clutch-disk h is actuated by the sprocket-wheel r, the starter-shaft c will be rotated and the rotative force applied at the one end of the spring will wind the spring or store power therein. As the spring is wound a slide-rod e, which is seated in a key-way in the starter-shaft c and is shaped at its rear end to engage the internal threads of the hub of the front head d' of the spring-drum d, will be moved rearward and as it approaches the end of its rearward movement will actuate mechanism which I will now describe for discontinuing the winding or power-storing operation.

The releasing plate t is mounted on a sleeve v on the starter-shaft c in front of the winding clutch-disk h and is provided with overhanging ends t', t', the inner arc-shaped faces of which are adapted, when the releasing plate is moved rearward, to engage forward projections on the clutch-dogs o (see Fig. 4) and thereby to move the clutch-dogs inward clear of the toothed ends of the governor-arms p. The releasing plate t is yieldingly held against part-rotative movement by spring-pins u, u, sliding in lugs u', u' (see Fig. 3), these lugs projecting rearward from the front standard 9. The spring-pins u press the releasing plate t against the stop-pin u^2. The releasing plate t and its sleeve v are free to rotate relatively to each other but are held together longitudinally by shoulders on the sleeve v. The sleeve v has a spline-and-groove connection with the starter-shaft c, the spline z having slight freedom of movement, rotatively, in its groove, under control of a spring z' in the groove and bearing against the spline z (see Fig. 5). This spline-and-groove connection permits the sleeve v to move longitudinally on the starter-shaft, but the sleeve is controlled in such longitudinal movement by helical springs w, w', which are located between the ends of the sleeve v and rings v', v', these rings being fitted loosely on the starter-shaft c and secured, as by set screws, to the slide-rod e so that they will move longitudinally with the slide-rod as the slide-rod is actuated by the winding or unwinding of the starter-spring a. A sleeve-positioning detent spring-pin x is carried by the sleeve v and has a grooved and taper-headed end entering a socket in the starter-shaft c, and a lock plate y is carried by the slide-rod e and engages in the groove of the spring detent-pin x so as to prevent the withdrawal of the detent-pin from its socket in the starter-shaft c until the slide-rod e has been drawn rearward very nearly to its extreme rearward position, thereby positively holding the releasing plate t in its forward or non-operative position and causing the front spring w, which constitutes resilient reactive actuating means for the clutch-releasing plate t, to be compressed until the plate y has moved clear of the detent-pin. When the plate y clears the detent-pin x, the detent-pin is quickly withdrawn and the releasing plate is projected quickly rearward by the spring w and engages the projections of the clutch-dogs o, the spring-pins u cushion the shock of such engagement, and the clutch-dogs are drawn inward clear of the path of the toothed ends of the governor-arms p and thus the winding operation is discontinued with the spring fully wound. The back-stop-pawl and ratchet i, i', retain the spring in its wound condition, and permit the relatively fixed starter frame to serve as an anchor or abutment to receive the starting thrust of the spring a in effecting the starting operation. During the unwinding movement of the starter-spring the slide-rod e is moved forward and the rear spring w' compressed. After a comparatively small unwinding movement the force stored in the rear spring w' moves the releasing plate t forward clear of the projections of the clutch-dogs, releasing the clutch-dogs so that they may assume their normal positions shown, ready to be engaged by the toothed ends of the governor-arms when the predetermined speed of the engine has been attained. As the sleeve v is moved forward so that the detent-pin x registers with its socket in the starter-shaft c, the detent-pin is forced by its spring into such socket, the slight play of the spline z and the control of the spline-spring z' permitting the sleeve v to yield rotatively sufficiently for the tapering end of the detent-pin to pass the lock-plate y, but when the groove of the detent-pin has become engaged by the lock-plate y, the detent-pin cannot again be withdrawn from its socket until the lock-plate y has been moved rearward clear of the detent-pin.

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, driving means for connecting the power-storing device with an engine to start the engine including a centrifugal clutch for connecting the engine with the power-storing device to store power in the power-storing device, clutch-releasing means controlled by the power-storing device, actuating means tending to move the clutch-releasing means into operative position during the power-storing movement of the power-storing device, and a lock opposing such actuating means and holding the clutch-releasing means at non-operative position until a predetermined point is reached in the power-storing operation.

2. An engine-starter comprising a power-storing device, driving means for connecting the power-storing device with an engine to start the engine and means including a centrifugal clutch for connecting the engine with the power-storing device to store power in the power-storing device, clutch-releasing means, reactive actuating-means for the clutch-releasing means arranged to be gradually put under stress by the power-storing movement of the power-storing device, and a locking device for restraining such stressed reactive means, the locking device being controlled by the power-storing device so as to be unlocked at a predetermined point in the power-storing movement thereof.

3. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start an engine, a centrifugal clutch for connecting the engine-connected member with the power-storing device to store power therein, clutch releasing means, resilient actuating means for the clutch-releasing means arranged to be gradually put under tension by the power-storing movement of the power-storing device, and a locking device for holding the clutch-releasing means at non-operative position in opposition to the tension of the resilient actuating means until a predetermined point is reached in the power-storing movement of the power-storing device.

4. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start an engine, a centrifugal clutch for connecting the engine-connected member with the power-storing device to store power therein, a slide-rod actuated by the power-storing device, clutch-releasing means for the centrifugal clutch, yieldable reactive actuating means connecting the clutch-releasing means with the slide-rod, for transmitting clutch-releasing energy from the slide-rod to the clutch-releasing means, and means for restraining the operation of such reactive energy-transmitting means until a predetermined point is reached in the movement of the slide-rod.

5. An engine-starter comprising a power-storing device, means for connecting the power-storing device with an engine to start the engine and means including a centrifugal clutch for connecting the engine with the power-storing device to store power therein, a releasing plate for such clutch movable into operative position, a part controlled by the movement of the power-storing device for moving such releasing plate, and a spring interposed between such plate and part through which movement is transmitted from said part to the plate.

6. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start the engine, a centrifugal clutch for connecting the engine-connected member with the power-storing device to store power therein, a releasing plate for such clutch movable into operative position, a slide-rod actuated by the power-storing device, and a spring resiliently connecting the releasing plate and slide-rod during the movement of the releasing plate into or out of operative position.

7. An engine-starter comprising a power-storing device, means for connecting the power-storing device with an engine to start the engine and means including a centrifugal clutch for connecting the engine with the power-storing device to store power therein, a releasing plate for such clutch movable into operative position, a part controlled by the movement of the power-storing device for moving such releasing plate, yielding means for connecting such plate and part, and a detent for restraining the movement of such plate, such detent having a locking engagement to a predetermined point in the movement of such part.

8. An engine-starter comprising a power-storing device, a power-transmitting member connected thereto, a member rotatably connected with the engine, means for connecting the power-transmitting member with the engine-connected member to start an engine, a centrifugal clutch for connecting the engine-connected member with the power-storing device to store power therein, a slide-rod actuated by the power-transmitting member, a releasing plate for such clutch, yielding means for connecting such plate and slide-rod, and a detent for restraining the movement of such plate, such detent having a locking engagement to a predetermined point in the movement of the slide-rod.

9. An engine-starter comprising a power-

storing device, a member rotatably connected with the engine, means for connecting the power-storing device with the engine-connected member to start the engine by the power-storing device, a centrifugal arm carried by the engine-connected member, a rotating clutch-dog carrier connected to the power-storing device, a clutch-dog carried thereby and normally located in position to co-act with the centrifugal arm upon the attainment of a predetermined speed of the engine-connected member, a movable releasing plate engageable with the clutch-dog to move the clutch-dog out of such co-active position, a movable part actuated by the movement of the power-storing device, and retractive yielding means for connecting such plate and part.

10. An engine-starter comprising a power-storing device, a member rotatably connected with the engine, means for connecting the power-storing device with the engine-connected member to start the engine, a centrifugal-arm carried by the engine-connected member, a rotating clutch-dog carrier connected to the power-storing device, a clutch-dog carried thereby and normally located in position to co-act with the centrifugal-arm upon the attainment of a predetermined speed of the engine-connected member, a movable releasing plate engageable with the clutch-dog to move it out of such co-active position, a movable part actuated by the movement of the power-storing device, retractive yielding means for connecting such plate and part, and a detent for restraining the movement of such plate.

11. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start the engine, a centrifugal-arm carried by the engine-connected member, a rotating clutch-dog carrier connected to the power-storing device, a clutch-dog carried thereby and normally located in position to co-act with the centrifugal-arm upon the attainment of a predetermined speed of the engine-connected member, a movable releasing plate engageable with the clutch-dog to move the clutch-dog out of such co-active position, a movable part actuated by the movement of the power-storing device, yielding means for connecting such plate and part, and a detent for restraining the movement of such plate, such detent having a locking engagement to a predetermined point in the movement of such part.

12. An engine-starter comprising a starter-spring, a drum connected to one end of the spring, a ratchet on the drum, a shaft connected to the other end of the spring, a member rotatively connected with the engine and fitted to rotate on the shaft, a pawl carried by such part and engaging the ratchet on the drum, a centrifugal-arm carried by the engine-connected member, and means co-operative with such arm carried by the shaft.

13. An engine-starter comprising a starter-spring, a drum connected to one end of the spring, a ratchet on the drum, a shaft connected to the other end of the spring, a clutch-disk on the shaft and a clutch-dog carried thereby, a member rotatively connected with the engine and fitted to rotate on the shaft between the drum and clutch-disk, a pawl carried by such part in position to engage the ratchet on the drum, and a centrifugal-arm also carried by such part in position to engage the clutch-dog.

14. An engine-starter comprising a power-storing device, driving means for connecting the power-storing device with an engine to start the engine including a clutch for connecting the engine with the power-storing device to store power in the power-storing device, clutch-releasing means controlled by the power-storing device, actuating means tending to move the clutch-releasing means into operative position during the power-storing movement of the power-storing device, and a lock opposing such actuating means and holding the clutch-releasing means at non-operative position until a predetermined point is reached in the power-storing operation.

15. An engine-starter comprising a power-storing device, driving means for connecting the power-storing device with an engine to start the engine, connecting means for connecting the engine with the power-storing device to store power in the power-storing device, disconnecting means for disconnecting the connecting means to discontinue the power-storing operation, reactive actuating means for the disconnecting means arranged to be gradually put under stress by the power-storing movement of the power-storing device, and locking mechanism for restraining the operation of such stressed reactive means, the locking mechanism being controlled by the power-storing device so as to be unlocked at a predetermined point in the power-storing operation.

16. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start an engine, a clutch for connecting the engine-connected member with the power-storing device to store power therein, clutch releasing means, resilient actuating means for the clutch-releasing means arranged to be gradually put under tension by the power-storing movement of the power-storing device, and a locking device for holding the clutch-releasing means at non-operative position in oppo-

sition to the tension of the resilient actuating means until a predetermined point is reached in the power-storing movement of the power-storing device.

17. An engine-starter comprising a power-storing device, a member rotatively connected with the engine, means for connecting the power-storing device with the engine-connected member to start an engine, a clutch for connecting the engine-connected member with the power-storing device to store power therein, a slide-rod actuated by the power-storing device, clutch-releasing means for said clutch, yieldable reactive actuating means connecting the clutch-releasing means with the slide-rod, a positioning detent for the clutch-releasing means, and a lock for holding the detent at engaging position, such lock being unlocked by the slide-rod at a predetermined point in the movement thereof during the power-storing operation.

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

CLYDE J. COLEMAN.

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