L. C. VAN RIPER.

STARTING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED MAY 28, 1912.

1,104,087.

Patented July 21, 1914.

2 SHEETS—SHEET 1.

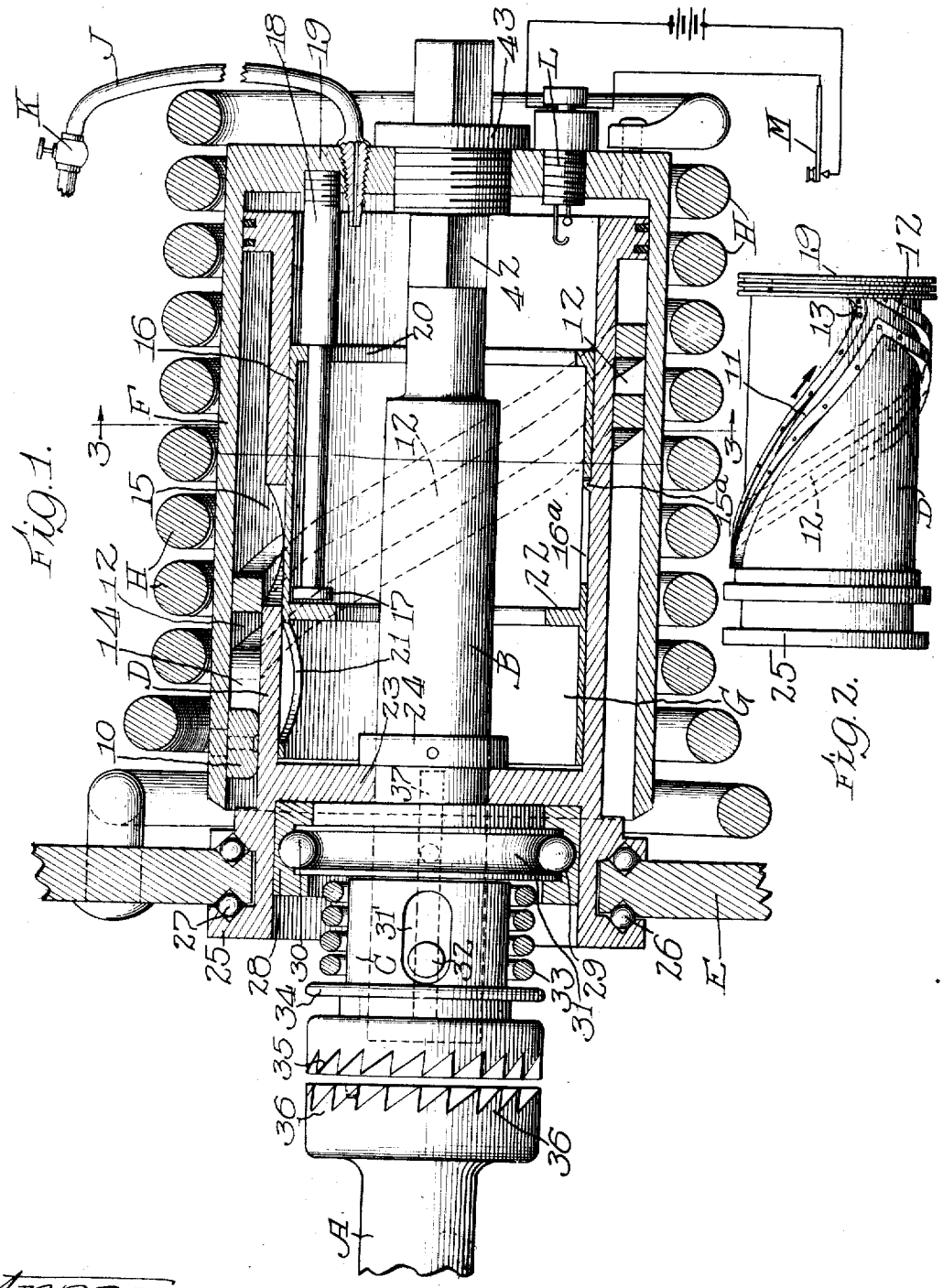


FIG. 1.

FIG. 2.

Witnesses:
G. C. Bonarus Jr.
R. Bauerle.

Inventor:
Lewis C. Van Riper
by Barnett & Truman
Attys.

L. C. VAN RIPER.

STARTING DEVICE FOR EXPLOSIVE ENGINES.

APPLICATION FILED MAY 26, 1912.

1,104,087.

Patented July 21, 1914.

2 SHEETS—SHEET 2.

Fig. 3.

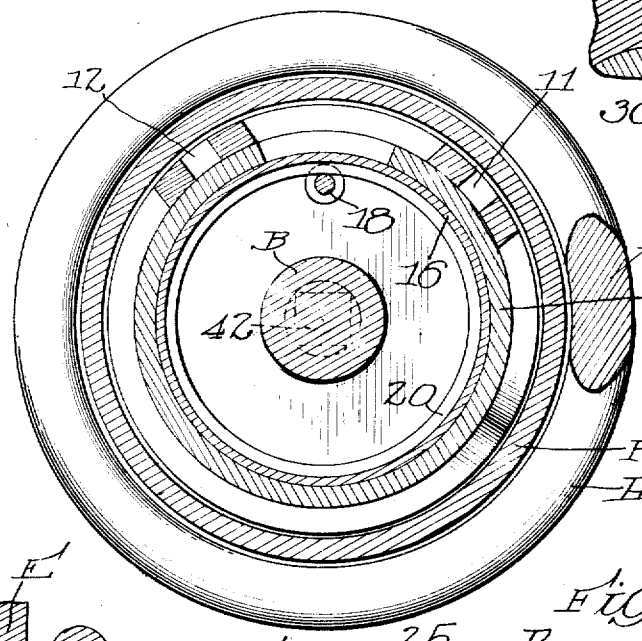


Fig. 4.

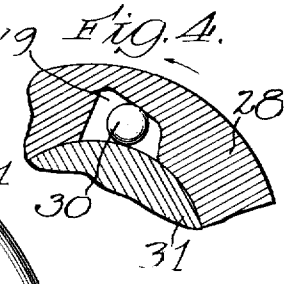


Fig. 5.

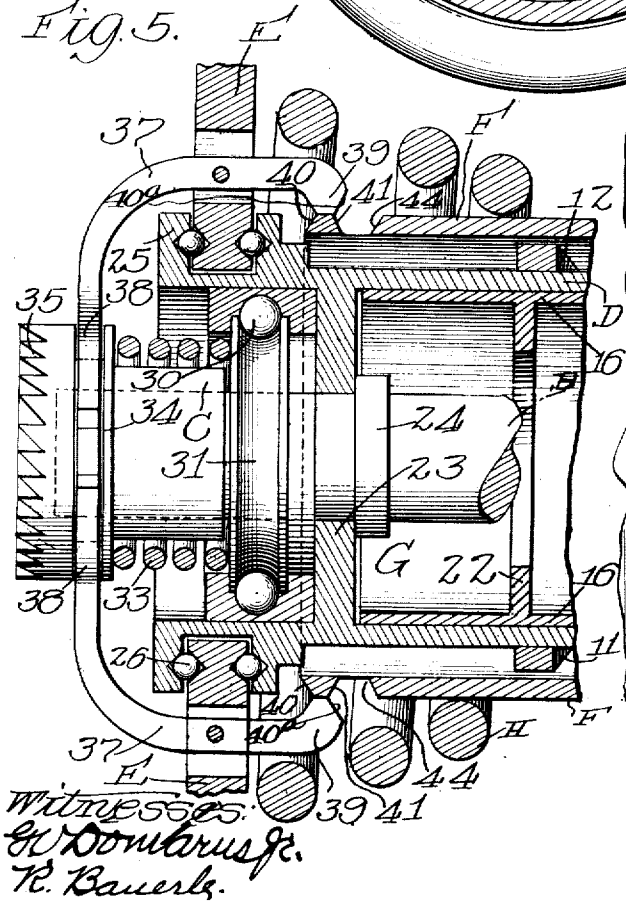
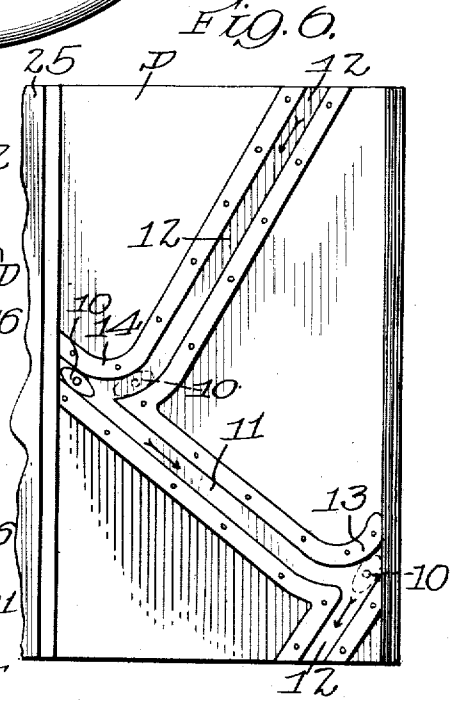


Fig. 6.



Witnesses:
G. W. Dombaru Jr.
R. Bauerle.

Inventor:
Lewis C. Van Riper
by Barrett & Brown
Attys.

UNITED STATES PATENT OFFICE.

LEWIS C. VAN RIPER, OF NEW YORK, N. Y.

STARTING DEVICE FOR EXPLOSIVE-ENGINES.

1,104,087. Specification of Letters Patent. Patented July 21, 1914.

Application filed May 28, 1912. Serial No. 700,283.

To all whom it may concern:

Be it known that I, LEWIS C. VAN RIPER, a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Starting Devices for Explosive-Engines, of which the following is a specification.

My invention relates to starting mechanism suitable for starting explosive engines, and has for its object to provide a starting device which will be certain and reliable in its action, which will not produce any undesirable jar upon the engine or associated mechanisms, and which is capable of repeated operations without delays or any manual readjustment of the parts in case the engine, for any reason, does not respond to the first starting impulse.

A further object of the invention is to provide a starting device operated preferably but not necessarily by the explosion of the gas capable of exerting sufficient explosive force for the work required without compression in which a separate motor is used operating upon the engine shaft, or some other rotatable element connected with the engine, instead of employing the device heretofore tried and found objectionable, of introducing the gas into one or more of the cylinders of the engine.

A further object of the invention is to provide a starting device adapted to operate upon a cranking shaft and connected with said shaft in such manner that the engine may be cranked in the ordinary way if need be, for example, if the supply of gas or gas-producing material used in the starter become exhausted.

The invention has for a further object to provide a novel and improved strating device consisting of the mechanisms and combinations of mechanisms shown in the drawings and to be hereinafter described and claimed.

The invention is illustrated, in a preferred embodiment, in the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional view of the apparatus; Fig. 2, a side elevation, on a smaller scale, of what has been termed the "cylinder element"; Fig. 3, a cross sectional view taken on line 3—3 of Fig. 1, looking in the direction of the arrows; Fig. 4, a detail sectional view illustrating the construction of one of the clutches; Fig. 5, a fragmentary sectional view to illustrate particularly the construction of another clutch and certain associated parts, and Fig. 6, a developed view of the cylinder element.

Like characters of reference designate like parts in the several figures of the drawings.

Referring to the drawings, A designates the engine shaft or other shaft to which the initial rotary impulse is to be imparted.

B designates what may be termed the starter shaft which carries the clutch member C adapted to couple shafts A and B together.

D designates a cylinder element which is rotatably mounted on the stationary support or bracket E, and F a piston element which telescopes over the cylinder element D, these two elements providing together a closed chamber G in which the explosion takes place.

H is a spring secured at one end to the stationary bracket E and at the other end to the piston element F. Any suitable means may be employed for introducing the explosive into chamber G and igniting the same. I have shown a flexible tube J for introducing an explosive gas through the head of the piston into the explosive chamber, the tube being provided with a valve K.

L designates a spark plug of ordinary construction, the circuit of which is closed by the maker and breaker M. The cylinder element D is coupled to the starter shaft B by any suitable form of clutch which will cause these parts to be engaged when the cylinder D receives the rotary starting impulse but which will allow shaft B to run free from the cylinder as soon as the engine is started. Mechanism is interposed between the piston element F and the cylinder element D which converts the linear movement of the former, caused by the explosion in chamber G, into rotary movement in the latter. The explosion takes place against the tension of spring H so that the danger of injury to the parts by the shock of the explosion is avoided. Preferably the piston and cylinder are so related that as the spring H carries the piston back to its initial position it continues in the same direction the rotary movement of the cylinder initiated by the outward movement of the piston.

The mechanisms and devices for accom-

plishing the above stated results will now be described in detail. The cylindrical portion of the piston element F has pivoted on its inner surface a cam follower 10 which is adapted to run in the cam slots 11 and 12 formed on the outer surface of the cylinder D. The cam slots 11 and 12 intersect at each end. When the explosion takes place the follower 10 moves along the cam slot 11 in the direction of the arrow (Fig. 6) which engagement rotates the cylinder. The outer end of the slot 11 has a curve or switch 13 which causes the follower 10 to be turned on its pivot and alined with slot 12. The contraction of the spring H draws the follower through the slot 12 in the direction of the arrows (Fig. 6) which continues the rotation of the cylinder in the same direction. The inner end of slot 12 has the switch 14 which alines the follower 10 with slot 11 in readiness for a new starting operation.

The burnt gas exhausts from the explosion chamber G in the following manner: The cylinder D has a port 15 which is covered by the slide valve 16 until the piston F approaches its outmost position. Then the disk 17 on the end of a rod 18 secured in the head 19 of a piston F, engages with the ring 20 formed on the slide valve 16 and moves the slide until a port 21 registers with the port 15 in the cylinder. The slide remains in the same position until the disk 17, on the return movement of the piston, engages with a ring 22 on the inner end of the slide and forces the slide back to its initial position. Preferably the slide 16 rotates with the cylinder and to insure this the slide is formed with a longitudinal slot 16^a and the cylinder with a pin 15^a.

I preferably employ a clutch for coupling the rotating cylinder D to the starter shaft B which clutch is constructed on the principle of the familiar coaster brake. The head 23 of the cylinder D bears against a collar 24 on the starter shaft B. On the head of the cylinder is a circular flange 25 which has a rotatable bearing in the support E. Preferably ball bearings 26 are employed to reduce friction. Within, and secured to the flanged portion 25 of the cylinder, is a ring 28 formed with the tapered recesses 29 (Fig. 4) to receive the balls 30, which latter bear against the disk 31 secured to the shaft B. When a rotary movement is given to the cylinder D and to the ring 28 in the direction shown by the arrow in Fig. 4, the shaft is clutched to the cylinder. As soon, however, as power is applied to the shaft, that is, when the engine starts up, it carries the balls into the enlarged ends of recesses 29 and the shaft runs free from the cylinder.

The shaft B is coupled with and uncoupled from the engine shaft A preferably by automatic mechanism constructed as follows: The clutch member C is formed with slots 31′ through which extend pins 32 on shaft B. A spiral spring 33 bears against the boss 34 with a pressure which carries the teeth 35 on the movable clutch member C into engagement with the teeth 36 on shaft A when the member C is free to move. Normally the member C is restrained and held out of engagement with the engine shaft A by means of the levers 37 which are pivoted in the stationary support E, one end 38 of each lever bearing against the boss 34, and the other end 39 on the extreme end of piston F. As soon as the explosion takes place the piston F is moved out of engagement with the ends 39 of the levers and the spring 33 operates to clutch shaft B to the engine shaft A. The end of the piston F is formed with a cam surface 40 which comes against the cam faces 40^a on the levers 37 when the piston is returned to its initial position, causing the levers 37 to be rocked and the engagement between shafts A and B destroyed.

In order that the engine may be cranked in the ordinary manner, in case, for example, the supply of the explosive gas should be exhausted, I have devised the following described arrangements: The starting shaft B has a squared end 42 which normally bears against a plug 43 in the end of the piston head 19, this engagement being such as to hold the piston a trifle away from the flanged portion 25 of the cylinder D. If it is found necessary to crank the machine by hand the plug 43 is removed and this allows the spring H to force the piston F in a direction toward the support E and the ends 39 of levers 37 into slots 44 in the piston F permitting the spring 33 to force the clutch member C into engagement with shaft A. A crank can then be inserted into the opening in the head 19 of the piston and engaged with the squared end 42 of the starting shaft B.

The operation of the device will be apparent from the above description. To resume, when the expansible or explosive gas, preferably acetylene gas, is introduced into the explosion or compression chamber G through the tube J and the charge ignited by means of the spark plug L, the piston member F will be forced outwardly, that is, to the right in Fig. 1, and the follower 10, by engagement with the cam slot 11 on the cylinder D, will rotate the cylinder. The cylinder when rotated in this direction is coupled, by means of the coaster brake clutch described, to the starting shaft B. As soon as the piston F has moved from its normal position the movable clutch member C on the starting shaft B is forced by means of its spring 33 into engagement with the clutch teeth on the shaft A. Therefore a starting impulse is given to shaft A. This

rotational impulse is continued in the same direction by the engagement of the follower 10 with the return cam slot 12 on the cylinder D as the piston is moved back to its initial position by tension of the spring H. The return of the piston uncouples the starter shaft B from shaft A, but in case the engine should get a start before this uncoupling is effected, no damage will be done because of the interposition of the coaster brake clutch between the cylinder and starting shaft B. The waste gases exhaust through ports 21, 15, which are brought into and out of register automatically by the movement of the piston F.

The spring H serves not only to return the piston element to its original position but also cushions the same against the explosion which produces its out-stroke. In the preferred arrangement of the spring shown the outward movement of the piston element is exerted against the torsional stress of the spring as well as its compressive force so that there will be a slight turning of the piston element as it moves outwardly which, however, causes no loss of power as there will necessarily be a reverse rotational movement of the same amplitude on the return of the piston element to its original position. The torsional stress of the spring against the piston element therefore cushions the element as well as the longitudinal stress.

While I have described my invention in a certain preferred embodiment, it will be readily understood that modifications might be made without departure from the invention. Hence I do not wish to limit myself to the particulars described and claimed except so far as the same are made limitations specifically in certain claims herein. For instance, in place of using an explosive charge in the cylinder it may be operated by compressed air or by some mechanical or manual means. The means for introducing the gas into the explosion chamber G and the means for producing the igniting spark are shown diagrammatically. Any suitable mechanism, and there are several such mechanisms now available, may be used for accomplishing these operations.

My invention has had for a specific purpose to provide a starting mechanism for the gasolene engine of an automobile and as automobiles frequently carry a supply of acetylene gas for lighting purposes, the particular embodiment of the invention herein shown and described provides for the use of acetylene gas to give, when ignited and exploded, the outward impulse to what has been termed the piston element. It will be readily understood, however, that any other suitable explosive or expansible fluid might be used for this purpose. In fact, in its broader aspect my invention is not limited to the movement of the longitudinally moving element by the agency of the expansibility of a fluid or gas as other means for producing the forward or outward movement of this initially moved element of the mechanism could be readily devised.

I do not claim herein the explosive engine which forms a part of the starting mechanism disclosed in this application; the engine, as such, being the subject matter of a divisional application filed Apr. 28, 1913 Serial No. 764,078.

I claim:

1. The combination with an engine shaft, of starting mechanism for the same comprising a rotatable cylinder element, a longitudinally movable piston element, which elements together provide an explosion chamber, means for introducing an explosive into said explosion chamber, means for igniting the same, one element being formed with a cam slot and the other being provided with a follower which moves in said cam slot whereby the longitudinal movement of the piston element imparts a rotating movement to the cylinder element, a spring against the tension of which the explosion takes place, and means operated by the longitudinal movement of the piston element for connecting and disconnecting the cylinder element to said engine shaft.

2. The combination with an engine shaft having a clutch member, of a starting shaft, a clutch member which is movable on said starting shaft, a rotatable cylinder element, a longitudinally movable piston element, which elements form together an explosion chamber, means for introducing an explosive into said chamber, means for igniting the same, a spring against the tension of which the explosion takes place, one of said elements being formed with a cam slot and the other with a follower which moves in said cam slot, and means actuated by the movement of one of said elements for causing said movable clutch member to be engaged with and disconnected from the clutch member on the engine shaft.

3. In starting mechanism the combination with a rotatable cylinder element, of a longitudinally movable piston element, which elements together provide an explosion chamber, means for introducing an explosive into said explosion chamber, means for igniting the same, one element being formed with communicating cam slots angularly arranged one to another and the other being provided with a follower which moves in said cam slots whereby the longitudinal movements of the piston element in opposite directions imparts a rotating movement in one direction to the cylinder element, a starting shaft, and means for coupling the cylinder element to said starting shaft, one end of said starting shaft having a suitable

cross sectional configuration for a crank, substantially as described.

4. In starting mechanism the combination with a rotatable cylinder element, of a longitudinally movable piston element, which elements together provide an explosion chamber, and means for introducing an explosive into said explosion chamber and igniting the same, one element being formed with a cam slot and the other being provided with a follower which moves in said cam slot whereby the longitudinal movement of the piston element imparts a rotating movement to the cylinder element, a starting shaft arranged within said explosion chamber, the extremity of which is suitably formed to be engaged by a crank, the head of the piston being formed with a removable part by means of which access may be had to the starting shaft, and means for engaging the starting shaft with said cylinder element and for disengaging the same when power is applied to said shaft.

5. The combination with the shaft of an engine provided with a clutch member, of starting mechanism comprising a starting shaft, a clutch member longitudinally movable on said starting shaft, a rotatable cylinder, a cylindrical piston which telescopes over said cylinder, the piston and cylinder providing together an explosion chamber, means for introducing an explosive into said chamber, means for igniting the same, a spring secured to said piston element so as to be put under tension by the outward movement of the piston when the explosion takes place, a clutch between the cylinder and said starting shaft, intersecting spiral camways formed on said cylinder, a follower on the piston adapted to move in said camways, a spring which tends to force the movable clutch member on the starting shaft into engagement with the clutch on the engine shaft, a lever, one end of which bears against the movable clutch member and the other upon the piston so as to hold said clutch members separate when the piston is in its inner position but permit them to engage when the piston is moved outwardly, a removable plug in the head of the piston which bears against the starting shaft so as to hold the piston a trifle away from its inmost position, the outer end of said starting shaft being suitably formed for a crank, and the piston being formed with a slot adapted to receive the engaging end of said lever when the piston moves to its inmost position upon the removal of said plug, substantially as described.

6. The combination with an engine shaft, of starting mechanism for the same comprising a rotatable element, a longitudinally movable element, means for imparting movement in one direction to the longitudinally movable element, a spring which moves said longitudinally movable element in the opposite direction, one of said elements being formed with a camway and the other with a follower whereby the reciprocating longitudinal movements of one of said elements impart rotational movement in one direction to the other of said elements, and means operated by the movement of one of said elements for connecting and disconnecting the rotatable element to said engine shaft.

7. The combination with an engine shaft, of starting mechanism for the same comprising a rotatable cylinder element, a longitudinally movable piston element, which elements together provide an explosion chamber, means for introducing an explosive into said explosion chamber, means for igniting same, one element being formed of a cam slot and the other being provided with a follower which moves in said cam slot whereby the longitudinal movement of the piston element imparts a rotating movement to the cylinder element, a spring against the tension of which the explosion takes place, and means operated by the movement of one of said elements for connecting and disconnecting the cylinder element to said engine shaft.

8. The combination with an engine shaft, of starting mechanism for the same comprising a rotatable element, a longitudinally movable element, one of said elements being formed with a camway and the other with a follower whereby reciprocating movements of said longitudinal element impart rotational movement in one direction to said rotatable element, means operated by the movement of one of said elements for connecting and disconnecting the rotatable element to said engine shaft, said starting mechanism being constructed so as to provide an explosion chamber back of said longitudinally movable element, means for introducing an explosive fluid into said chamber, means for igniting the same so as to produce an explosion which gives the longitudinally movable element its out-stroke, and resilient means which returns the longitudinally movable element to its original position and cushions the same on the out-stroke.

9. The combination with an engine shaft, of starting mechanism for the same comprising a stationary member, a rotatable element, a longitudinally movable element, one of said elements being formed with a camway and the other with a follower whereby the reciprocating longitudinal movements of one of said elements impart rotational movement in one direction to said rotatable element, a spring having one end attached to said stationary member and the other end to the longitudinally movable element to return the latter element to its normal position and to cushion the shock of one element against the other, and means operated by the move-

ment of one of said elements for connecting and disconnecting the rotatable element to said engine shaft.

10. The combination with an engine shaft, of starting mechanism for the same comprising a stationary member, a rotatable element, a longitudinally movable element, one of said elements being formed with a camway and the other with a follower whereby the reciprocating longitudinal movements of one of said elements impart rotational movement in one direction to said rotatable element, a coiled spring around said longitudinally movable element attached at one end thereto and at the other to said stationary member to return said longitudinally movable element to its normal position and to cushion the shock of one of said elements against the other, and means operated by the movement of one of said elements for connecting and disconnecting the rotatable element to said engine shaft.

LEWIS C. VAN RIPER.

Witnesses:
L. A. FALKENBERG,
G. Y. SKINNER.

ment of one of said elements for connecting and disconnecting the rotatable element to said engine shaft.

10. The combination with an engine shaft, of starting mechanism for the same comprising a stationary member, a rotatable element, a longitudinally movable element, one of said elements being formed with a camway and the other with a follower whereby the reciprocating longitudinal movements of one of said elements impart rotational movement in one direction to said rotatable element, a coiled spring around said longitudinally movable element attached at one end thereto and at the other to said stationary member to return said longitudinally movable element to its normal position and to cushion the shock of one of said elements against the other, and means operated by the movement of one of said elements for connecting and disconnecting the rotatable element to said engine shaft.

LEWIS C. VAN RIPER.

Witnesses:
L. A. FALKENBERG,
G. Y. SKINNER.

Corrections in Letters Patent No. 1,104,087.

It is hereby certified that in Letters Patent No. 1,104,087, granted July 21, 1914, upon the application of Lewis C. Van Riper, of New York, N. Y., for an improvement in "Starting Devices for Explosive-Engines," errors appear in the printed specification requiring correction as follows: Page 1, line 41, for the word "strating" read *starting;* page 4, line 8, strike out the word "and" and insert a comma and the words *means for;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of August, A. D., 1914.

[SEAL.]

J. T. NEWTON,
Acting Commissioner of Patents.

Corrections In Letters Patent No. 1,104,087.

It is hereby certified that in Letters Patent No. 1,104,087, granted July 21, 1914, upon the application of Lewis C. Van Riper, of New York, N. Y., for an improvement in "Starting Devices for Explosive-Engines," errors appear in the printed specification requiring correction as follows: Page 1, line 41, for the word "strating" read *starting;* page 4, line 8, strike out the word "and" and insert a comma and the words *means for;* and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of August, A. D., 1914.

[SEAL.]

J. T. NEWTON,

Acting Commissioner of Patents.