

C. M. LEE.
STARTING DEVICE FOR EXPLOSIVE ENGINES.
APPLICATION FILED DEC. 26, 1911.

1,044,546.

Patented Nov. 19, 1912.

2 SHEETS-SHEET 1.

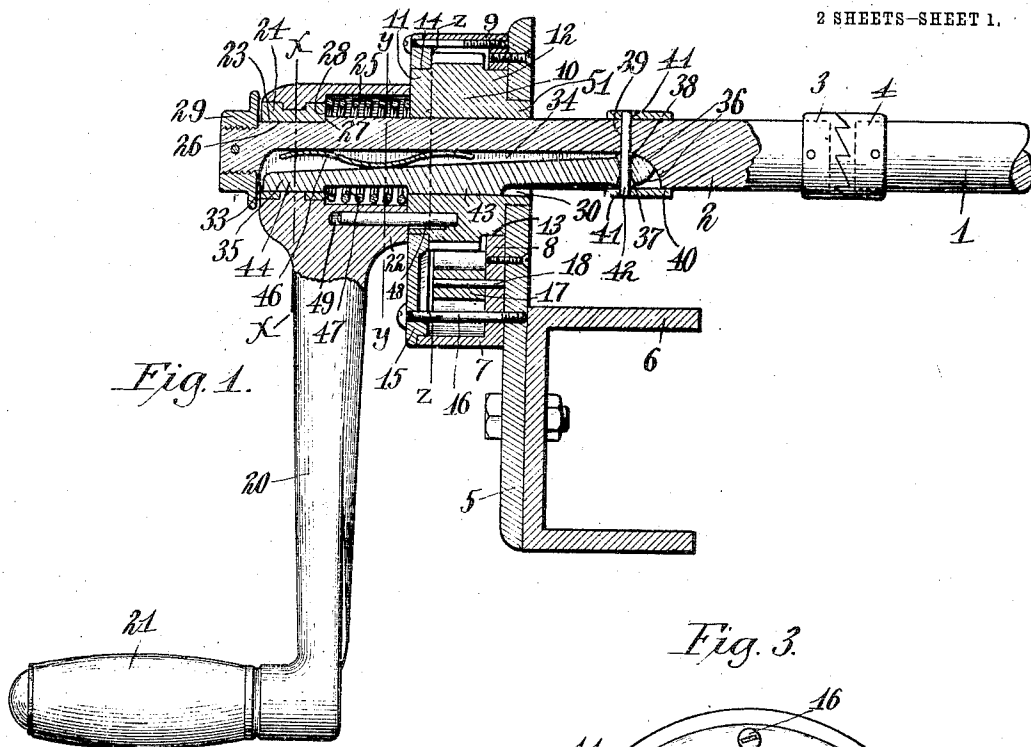


Fig. 1.

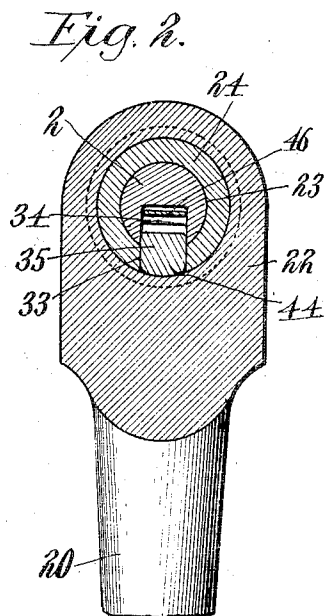


Fig. 2.

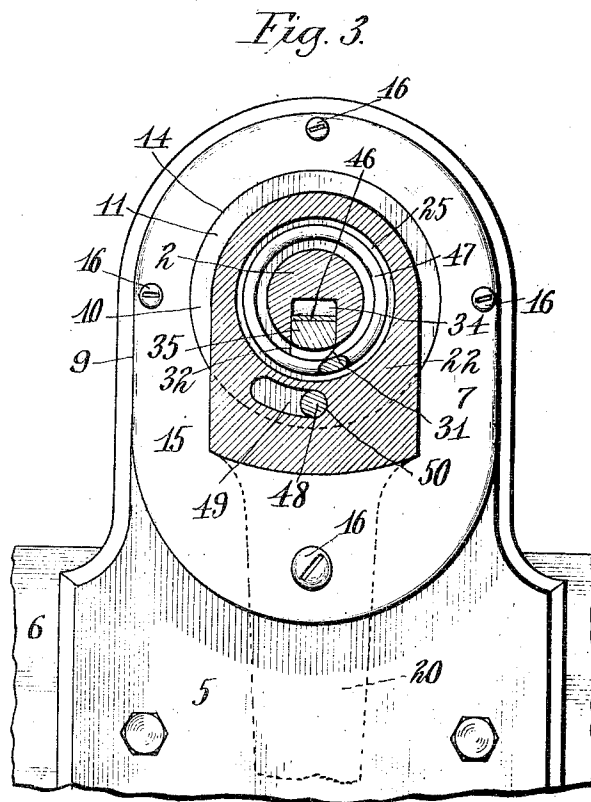


Fig. 3.

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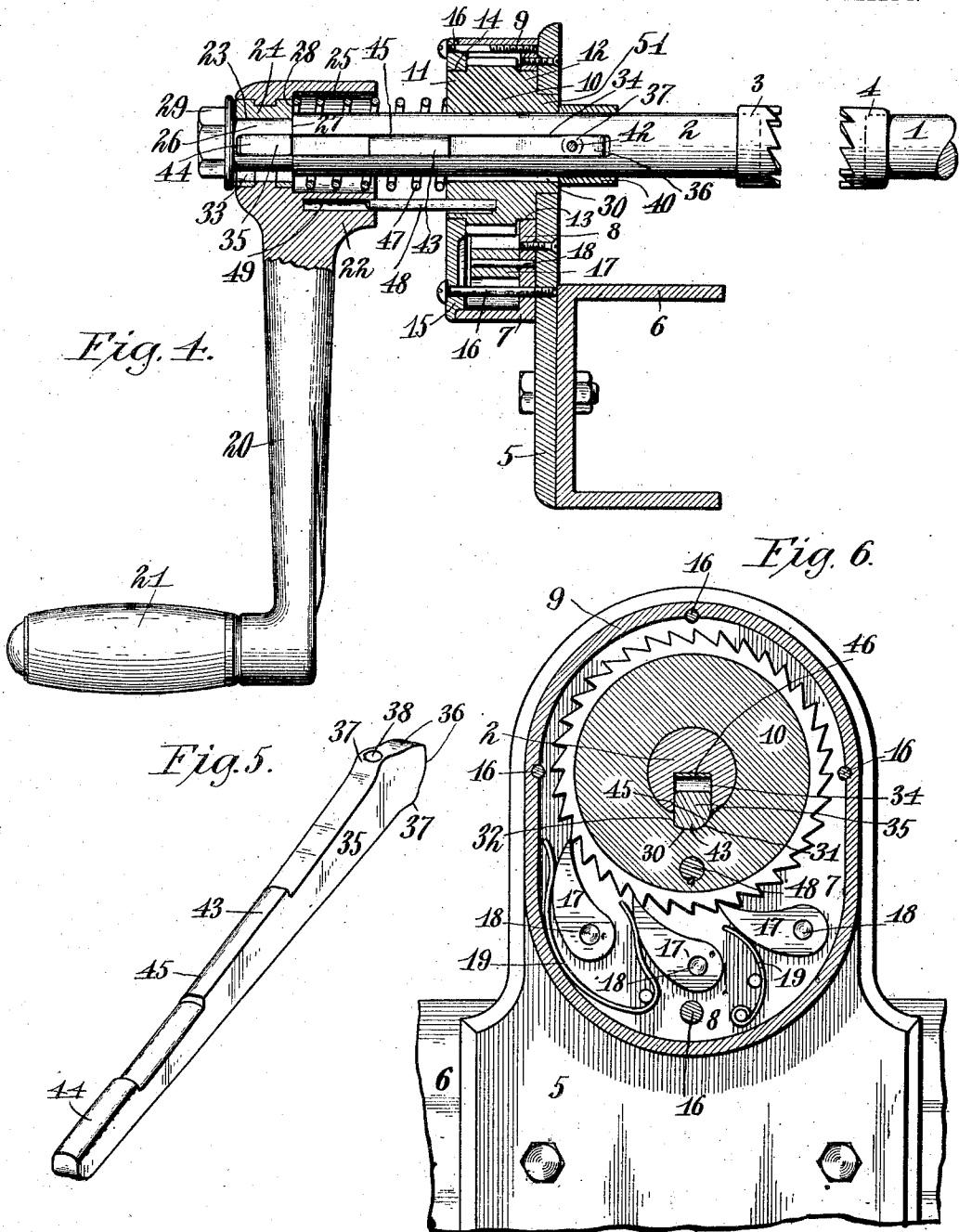
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2 SHEETS—SHEET 2.



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UNITED STATES PATENT OFFICE.

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STARTING DEVICE FOR EXPLOSIVE-ENGINES.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, CHARLES M. LEE, a citizen of the United States, residing at Buffalo, in the county of Erie 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 devices for internal combustion engines and more particularly to that class of starting devices which include a crank handle or other operating element adapted, upon actuation, to cause rotation of the engine crank-shaft and thereby reciprocate the engine piston or pistons for the purpose of drawing into the cylinder or cylinders and compressing therein the combustible mixture to effect the initial explosion and start the operation of the engine.

In explosive engines, for one cause or another, a reverse action of the crank-shaft sometimes occurs when the initial explosion takes place, which causes a sudden and severe backward force to be exerted against the forward movement exerted by the operator on the crank, which sudden forcible reverse action is apt to cause injury to the operator.

With a view of eliminating this evil, my invention has for its object the provision of simple, inexpensive and positively-acting safety-mechanism to be preferably used in connection with the present form of starting-crank and wherein provision is made to effectually and automatically relieve the crank from the reverse action of the crank-shaft in the event of a "back-fire" occurring in the engine.

While in the drawings I have shown my invention applied to a separate cranking or starting shaft adapted to be connected with the engine crank-shaft for turning the same to start the engine, such an arrangement is merely representative of one of the many forms capable of use for making connection with the crank-shaft and it is therefore plain that the use of other forms or constructions of operating handles or elements may be resorted to without departing from the spirit of the invention.

My invention consists in the novel features of construction, and in the arrangement and combination of parts to be hereinafter de-

scribed and particularly pointed out in the subjoined claims.

In the accompanying drawings illustrating my invention by way of example,—Figure 1 is a longitudinal sectional elevation of my improved starting device in, what I now consider, the preferred embodiment, the crank handle being in position to start the engine. Fig. 2 is an enlarged cross section taken on line $x-x$, Fig. 1. Fig. 3 is an enlarged cross section taken on line $y-y$, Fig. 1. Fig. 4 is a section similar to Fig. 1 with the starting-shaft unlocked from the crank handle. Fig. 5 is an enlarged detached perspective view of the lock-key. Fig. 6 is an enlarged cross section taken on line $z-z$, Fig. 1.

Referring now to the drawings in detail by reference numerals, 1 designates the engine crank-shaft or it may represent a shaft from which motion may be imparted to the crank-shaft, and 2 represents the starting-shaft, both having clutch members 3, 4, at adjacent ends which are adapted to co-act when starting the engine. A support 5 in the form of a bracket is secured to the chassis 6 of an automobile or other structure, depending of course on the type of engine with which it is to be used or to the use the engine is to be put to. To the support 5 a casing 7 is secured, which casing, in the particular form illustrated, is oval in formation and has a rear wall 8 lying in contact with said support and an endless side confining wall 9. A ratchet-wheel 10 is confined in said casing and has hub-portions 11, 12 on opposite sides thereof which fit, respectively, into openings 13, 14 formed in the rear wall 8 and cover 15 of the casing and it also has an axial boss 51 which extends into the support 5. The cover 15 fits onto the casing 7 and is secured thereto by means of screws 16. The rear wall 8, the cover 15 and the support 5, therefore serve as bearings for the ratchet-wheel into the bore of which the starting-shaft 2 fits, said starting-shaft therefore is supported indirectly in the support 5 and it also extends a considerable distance in front and in rear of the same.

Within the casing 7 are confined a series of dogs 17 which are pivotally secured to the rear wall thereof, as at 18, and are spring-pressed against the teeth of the ratchet-wheel; trigger or other suitable

springs 19 being provided for this purpose. In the drawings I have shown three spring-pressed dogs so arranged relative to the teeth of the ratchet-wheel that if said wheel is turned a distance equaling one-third the length or pitch of one tooth, assurance is had that it will be firmly held against retrograde movement. This may, however, be otherwise arranged and the number of dogs to be used could be in accordance with the desires of the constructor.

In the embodiment of my invention shown I have employed a crank-handle 20 as the operating element. This handle is provided with a suitable hand-grasp 21 at its outer end and with an enlargement or head 22 at its inner end, said head having a shaft-bore 23 provided advisedly with a babbitt or other suitable lining 24, and with a socket 25 in rear of said bore. The starting-shaft 2 has a slight reduction 26 near its outer end which fits into the babbitt lined bore 23 and the shoulder 27 of the shaft thus formed bears against a shoulder 28 formed at the meeting of said bore with said socket. The extremity of said starting-shaft is further reduced in diameter and on it is threaded a nut 29, thus holding the crank-handle in fixed relation lengthwise of the shaft. The ratchet-wheel 10 has a key-way 30 with one side beveled or inclined, as at 31, and its other abrupt, as at 32, and the crank-handle is also provided with a key-way 33, which differs, however, from the key-way 30 in that it has both sides abrupt and is therefore a standard key-way. The starting-shaft 2 has a longitudinal key slot 34 formed therein which extends preferably from its threaded extremity to a point beyond the support or bracket 5. In this key-slot is arranged a lock-key 35 which has free movement therein and at its inner end is oppositely tapered, as at 36, and provided on opposite edges near said end with protruding bearing points 37. Through said lock-key in line with said bearing points is a pin hole 38 and in the starting-shaft near the rear end of its key-slot is a pin hole 39 with which the pin hole 38 is alined. Surrounding the starting-shaft at this point is a stop-sleeve 40 which limits the outward movement of the starting-shaft when it comes in contact with the support 5. Said sleeve is provided at diametrically opposite points with pin holes 41, which register with the pin holes 38 and 39. Passing through these registering pin holes is a pin 42 which serves a double purpose: namely, that of a pivot for the lock-key 35 and as a means of fastening the stop-sleeve in place. It will be noted that the pin hole 38 in the lock-key is flared toward opposite ends, thus providing the necessary play to permit the lock-key to swing thereon, said key being thus allowed to move into or out of its key slot.

By providing the lock-key with the oppositely protruding bearing-points 37, which bear, respectively, against the inner wall of the key slot and the inner surface of the top-sleeve 40, and by oppositely tapering the rear end of said key, the latter has freedom in action and friction is reduced to the minimum.

The lock-key is provided on its outer edge with two protruding parts or lugs 43, 44, corresponding in length or approximately so to the key-ways 30, 33, respectively, with which they are adapted to co-act. Excepting said lugs, the lock-key is at all times wholly confined within the key-slot 34 so that it offers no obstruction at any time or under any conditions to the free turning of the shaft. The lug 43 which is adapted to co-act with the key-way 30 in the ratchet-wheel is beveled at one side, as at 45, to correspond with the beveled wall 31 of said seat, and for a purpose to be made clear hereafter.

Within the key-slot 34 between its inner wall and the lock-key 35 is a spring 46, which at all times exerts its force to swing said key outward on its pivot pin, and when the key-way 33 in the crank-handle and the key-way 30 in the ratchet-wheel are in line with said key, the latter is forced into them by said spring. Surrounding the starting-shaft is an expansion spring 47 which, when the crank-handle is in normal position shown in Fig. 4, has one end fitting into the socket 25 of said crank-handle and bearing against the shoulder 28 therein and its other end bearing against the outer hub-portion 11 of the ratchet-wheel. Said spring serves to keep the starting-shaft out of engagement with the engine shaft or the shaft connected with the engine, as the case may be, so that the engine may operate without imparting motion to the starting-shaft. Fastened into the ratchet-wheel 10 and projecting outward therefrom is a retainer pin 48 which fits into a comparatively deep segmentally-shaped pocket 49 formed in the head or enlargement of the crank-handle from its inner side. The purpose of said retainer pin is to allow the crank-handle slight retrograde movement independent of the ratchet-wheel during a back-fire, such movement being sufficient only to allow the beveled side 45 of the lock-key to ride up the co-acting beveled face 31 of the key-way 30 in the ratchet-wheel to compel the lock-key to be moved inward and thus be withdrawn from the key-seat 33 in the crank-handle. This slight reverse movement of the crank-handle is hardly perceptible to the operator who may be exerting force against the handle in a forward direction, as the releasing of the key from the handle is almost instantaneous. The said segmental pocket 49 and retainer pin 48 also assure proper engage-

ment of the lock-key with its key-ways in the ratchet-wheel 10 and crank-handle 20 since in the attempt to turn the crank-handle to the right when starting the engine, the retainer pin is brought in contact with the right hand end 50 of said pocket and causes the ratchet-wheel to turn with the crank-handle and when the parts are in this position the key-ways in the ratchet-wheel and crank-handle are in line and when brought to the position the lock-key may be in (which may stop at any point after a "back-fire" depending on the momentum with which the starting-shaft is turned), the said key will enter said key-ways and consequently cause the starting-shaft to turn, which when forced inward against the action of the expansion spring 47 will bring its clutch member 3 in engagement with the clutch member 4 of the engine shaft and cause the same to turn.

The operation of the device is as follows:—The operating crank-handle may be in the position shown in Fig. 1 with the lock-key 35 entered into the key-ways of said handle and ratchet-wheel, or in a position in which the lock-key is out of engagement with said key-ways. When the parts are in the positions last-mentioned, the retainer pin may be at the left hand end of the segmental pocket 49 or in an intermediate position therein and when said pin is in either of the two last-mentioned positions, the turning of the crank-handle to the right will bring the right hand end of the segmental pocket 49 against said retainer pin, at which time the key-way in the crank-handle is brought in line with the key-way of the ratchet-wheel, after which said crank-handle and ratchet-wheel are turned together so that when their key-ways are brought opposite the lock-key, the latter will be forced thereinto to lock the starting-shaft to said ratchet-wheel and crank-handle. During this action the operator forces the crank-handle inward against the action of the expansion spring 47 and carries the starting-shaft inward so that its clutch member 3 engages that of the engine-shaft. During this turning movement of the crank-handle and the inward movement of the starting-shaft, the inner lug 43 on the lock-key is moved in the transverse plane of the key-way 30 in the ratchet-wheel so that when said lock-key is forced outward it may enter said key-way. Now, upon continuing the rotary movement of the crank-handle the starting-shaft is rotated with it and as the clutch-member of the said starting-shaft is in engagement with the clutch-member of the engine-shaft, the latter is caused to rotate as well, thus imparting the reciprocating movement to the pistons of the engine for the purpose of causing ignition of the explosive mixture within the engine

and automatic operation of the latter. The ratchet-wheel 10 is caused to rotate with the starting-shaft and crank-handle and the dogs 17 snap over the respective teeth of the same so as to allow free rotation of said ratchet-wheel; but if, by reason of a premature explosion or for any other reason, "back-firing" takes place in the engine so as to cause a sudden and forcible reverse movement of the engine shaft, which movement is imparted to the starting-shaft, the ratchet-wheel is held against reverse movement by one of said dogs, thus causing the lock-key to be forced inward and disengaging said shaft from the crank-handle so that it may rotate independent of the latter. No perceptible rearward movement is therefore imparted to the crank-handle, and by reason of this the operator is protected against injury.

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

1. A starting-device comprising a rotatably mounted shaft, a ratchet-wheel on said shaft held against retrograde movement, an operating element also on said shaft adapted to rotate the same in one direction, a locking device on said shaft adapted to engage said ratchet-wheel and operating element and arranged to be disconnected therefrom upon reverse movement of said shaft.

2. A starting-device comprising a rotatably mounted shaft having a longitudinal key-slot, a ratchet-wheel on said shaft held against retrograde movement, an operating element also on said shaft, said ratchet-wheel and operating element having key-ways, and a lock-key fitting into the key-slot of said shaft and movable inwardly and outwardly, said lock-key being adapted for engagement with said key-ways when manually rotating said shaft in one direction and being arranged to become disengaged from said key-ways upon reverse movement of said shaft.

3. A starting-device comprising a rotatably mounted shaft having a longitudinal slot therein, a lock-key arranged in said slot and spring-pressed outwardly, a ratchet-wheel on said shaft having a key-way and being held against retrograde movement, and an operating element on said shaft having a key-way, said lock-key being forced into said key-ways to cause rotation of said shaft in one direction when actuating said operating element and being arranged to recede into said key-slot when said shaft is rotated in a reverse direction.

4. A starting-device comprising a rotatably mounted shaft having a longitudinal key-slot therein, a lock-key in said key-slot, a spring also in said key-slot behind said lock-key acting to force the latter outward, a ratchet-wheel on said shaft held against lengthwise movement thereon and having a

key-way therein, means to prevent retrograde movement of said ratchet-wheel a crank-handle also on said shaft and having a key-way therein, and an expansion-spring surrounding said shaft and bearing with one end against said ratchet-wheel and with its other end against said crank-handle, said crank-handle being also held against lengthwise movement on said shaft and said lock-key being adapted to engage said key-ways to allow said shaft to be rotated manually in one direction and to become disengaged from said key-ways when said shaft is forcibly rotated in the opposite direction.

5. A starting-device comprising a rotatably mounted shaft having a longitudinal key-slot therein, a lock-key arranged in said slot, a spring serving to force said key outward, a ratchet-wheel on said shaft allowing the latter to move lengthwise therein and having a key-way adapted to receive said lock-key, means to prevent retrograde movement of said ratchet-wheel, a retainer pin extending outwardly from said ratchet-wheel, a crank-handle on said shaft held against movement thereon lengthwise and having a key-way also adapted to receive said lock-key and a segmental pocket adapted to receive said retainer pin, said segmental pocket being of sufficient depth to allow said crank-handle and said shaft to be forced inwardly, and a spring resisting inward movement of said shaft and crank-handle, said lock-key and key-ways being formed to permit said key to be automatically disengaged from said key-ways on forcible reverse movement of said shaft.

6. The combination of an engine shaft, a starting shaft, and means for connecting said shafts and arranged to cause them to turn together in one direction, said starting-shaft being mounted for lengthwise and for rotatable movement; an operating element for rotating said starting shaft in one direction, radially movable means on said starting-shaft for locking said operating element thereto, and a ratchet-wheel on said shaft held against retrograde movement and also adapted to be engaged by said radially movable means, said radially movable means being disengaged from said operating element and said ratchet-wheel upon forcible reverse movement of said starting-shaft, and means to hold said ratchet-wheel against retrograde movement.

7. The combination of an engine shaft, a starting-shaft manually rotatable in one direction, a ratchet-wheel on said starting-shaft held against retrograde movement, a crank-handle also on said starting-shaft, and a radially movable lock-key on said starting-shaft adapted to engage said ratchet-wheel, a lock-device to cause said ratchet-wheel and starting-shaft to be moved by said crank-handle in one direction and to

cause disengagement of said starting shaft from said ratchet-wheel and crank-handle when said starting-shaft is rotated in an opposite direction.

8. A starting-device comprising a rotatably mounted shaft having a key-slot arranged lengthwise therein, a lock-key movable radially in said slot and having two lugs on its outer edge, one of said lugs being beveled at one side, a ratchet-wheel on said shaft having a key-way beveled on one side and adapted for co-action with said beveled lug, means to prevent retrograde movement of said ratchet-wheel, a crank-handle on said shaft having a key-way adapted to receive the other lug of said lock-key to cause the crank-handle and ratchet-wheel to be rotated in one direction upon turning said crank-handle, said beveled lug and said beveled key-way serving to cause disengagement of said crank-handle from said shaft when the latter is rotated in an opposite direction.

9. The combination of an engine shaft, a starting-shaft having a longitudinal key-slot therein, means connecting said shafts and constructed to cause them to turn together in one direction, a lock-key in said key-slot, a ratchet-wheel on said starting-shaft allowing the same to move lengthwise therein and having a key-way adapted to receive said lock-key, said ratchet-wheel being held against retrograde movement and also against movement lengthwise on said starting-shaft, a crank-handle held to said starting-shaft against lengthwise movement thereon and having a key-way adapted to receive said lock-key, said lock-key and key-ways being constructed to cause rotation of said starting-shaft and said ratchet-wheel upon turning said crank-handle in one direction and to cause disengagement of said lock-key from said key-ways upon reverse rotation of said starting-shaft.

10. A starting-device comprising a bracket, a casing on said bracket, a shaft rotatably mounted and lengthwise movable through said bracket and having a longitudinal key-slot therein, a ratchet-wheel in said casing through which said shaft is passed and having a key-way therein, means within said casing to prevent retrograde movement of said ratchet-wheel, a crank-handle secured to said shaft in a manner to prevent lengthwise movement thereon and having a key-way therein, retaining means between said ratchet-wheel and crank-handle allowing said handle limited independent movement and compelling said ratchet-wheel to be moved with said crank-handle in one direction when the key-ways in both are aligned, a spring resisting lengthwise movement of said shaft, and a lock-key in said key-slot adapted to enter said key-ways to cause rotation of said shaft and ratchet-wheel when turn-

ing said crank-handle in one direction and to release said crank-handle and said ratchet-wheel from said shaft when the latter is forcibly rotated in an opposite direction.

11. A starting-device comprising a rotatable shaft having a longitudinal key-slot, a lock-key in said slot, a sleeve surrounding said shaft, a pin passing through said sleeve, said shaft and said lock-key whereby said key is pivotally held within said slot, a spring in rear of said key tending to force the same outward, a ratchet-wheel on said shaft held against retrograde movement and having a key-way adapted to be engaged by said lock-key, and a crank-handle on said shaft having a key way adapted to be engaged by said lock-key, said crank-handle being held against lengthwise movement of said shaft, and said lock-key and the

key-way in said ratchet-wheel being constructed to cause disengagement of said key from said key-ways when said shaft is forcibly rotated in a reverse direction.

12. In a starting device, a shaft having a longitudinal key-way, a lock-key in said slot having one end tapered and having two protruding parts near said end and a pin hole extending therethrough in line with said protruding parts, a sleeve surrounding said shaft, and a pin passing through said sleeve, said shaft and the pin hole of said lock-key.

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

CHARLES M. LEE.

Witnesses:

EMIL NEUHART,
ELIZABETH HEINTZ.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."