F. W. TEVES.

STARTING MECHANISM FOR INTERNAL COMBUSTION ENGINES.

APPLICATION FILED NOV. 8, 1907.

914,615. Patented Mar. 9, 1909.

Fig. 1.

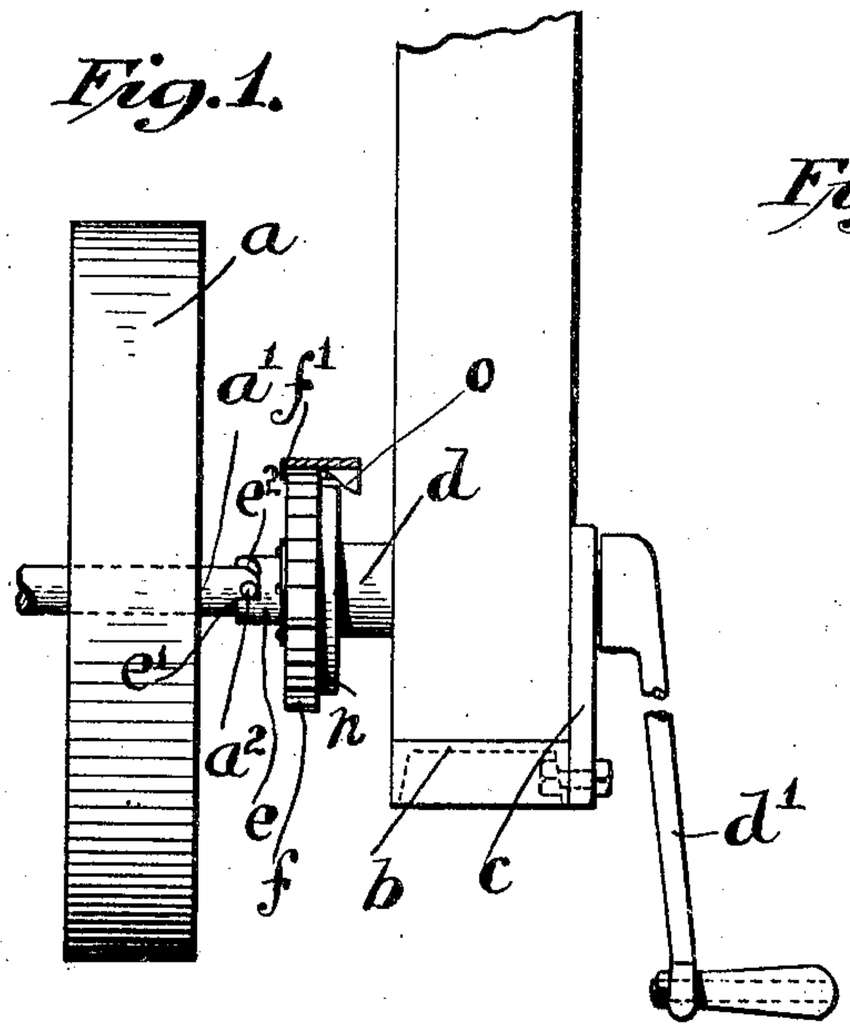


Fig. 2.

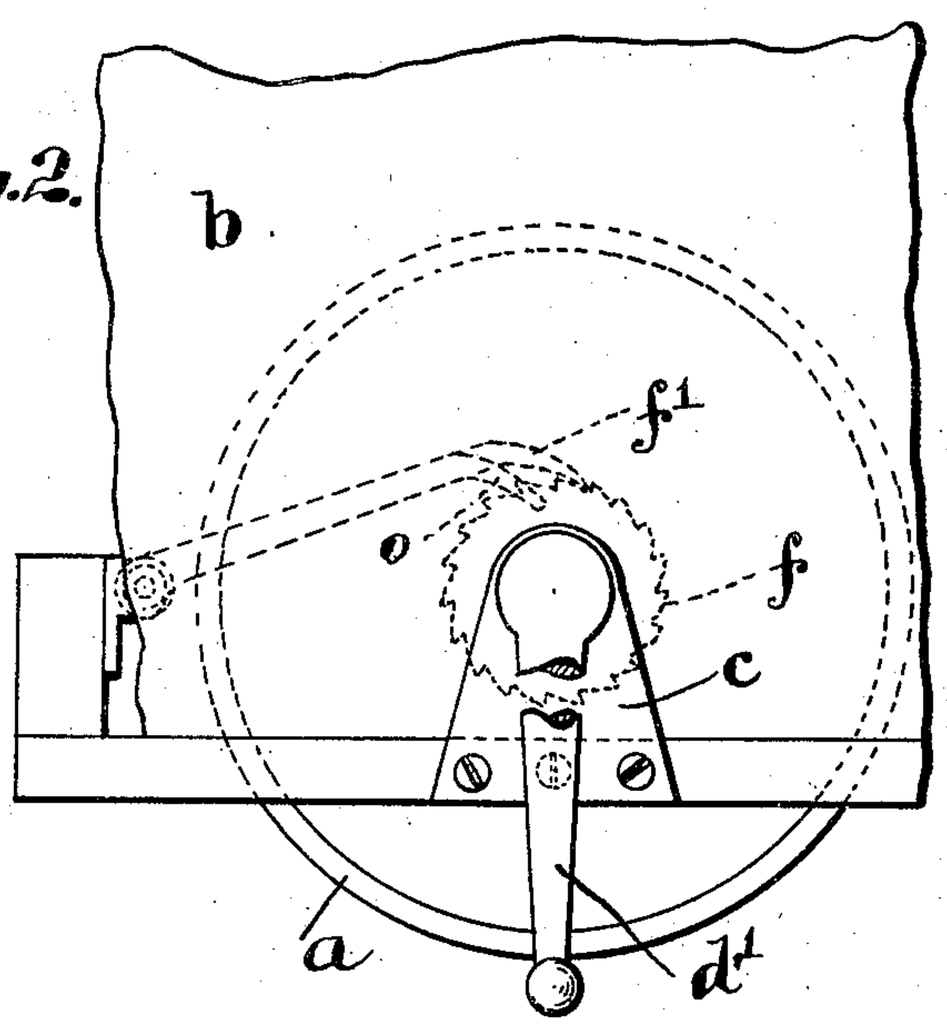


Fig. 3.

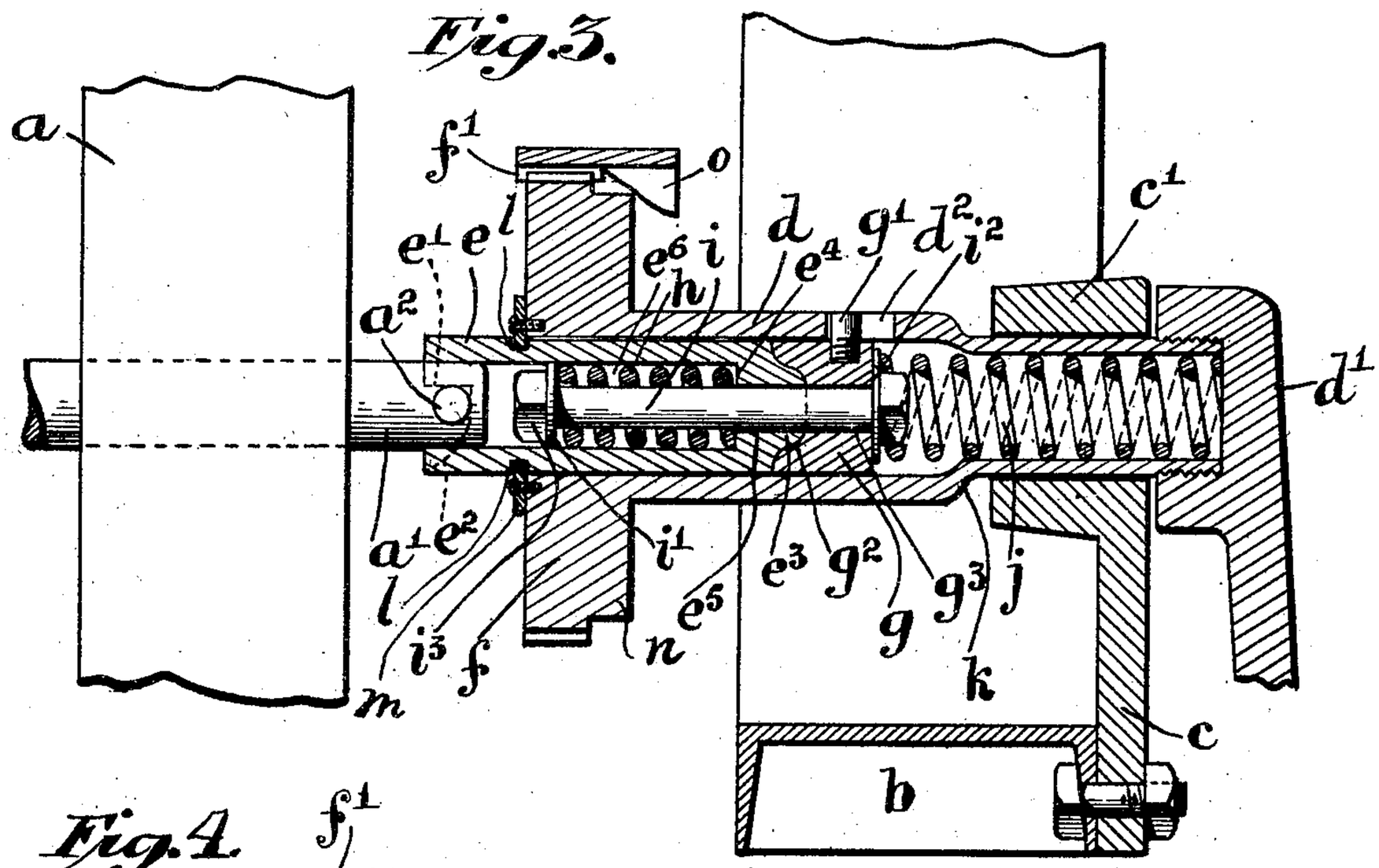
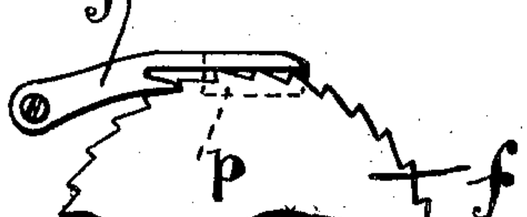


Fig. 4.



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UNITED STATES PATENT OFFICE.

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STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES.

No. 914,615. Specification of Letters Patent. Patented March 9, 1909.

Application filed November 8, 1907. Serial No. 401,192.

To all whom it may concern.

Be it known that I, FREDERICK W. TEVES, a citizen of the United States, residing in the borough of Brooklyn, in the city of New York, county of Kings, and State of New York, have invented certain new and useful Improvements in Starting Mechanisms for Internal-Combustion Engines, of which the following is a specification, reference being had therein to the accompanying drawings, which form a part thereof.

My invention relates to a starting mechanism for internal combustion engines, and more particularly to a type thereof embodying a rotary coupling and a crank actuating same.

In devices of this character now in common use it is a common practice to employ a self releasing impact coupling between the engine crank shaft and the starting crank shaft, a construction which in case the charge or charges under full or partial compression, are not properly ignited, results in a quick return of the starting crank with the engine shaft, endangering the person endeavoring to start the engine. In connection with automobile engines this return action is known as the "kick" of the starting crank, and badly injured arms frequently result from this source.

The main object of the invention is to provide a starting mechanism wherein the engine crank shaft coupling is free to turn in one direction with the starting crank, and equally free to turn in the opposite direction independently of said starting crank, thus preventing a return movement of said starting crank, or "kick" thereof, in case the engine charge is not ignited.

A further object is to provide a starting mechanism wherein, when the starting crank shaft coupling is disconnected from the engine crank shaft, it may be turned to any desired position to secure a proper purchase to place a charge of gas under compression in the engine.

A still further object is to provide a starting mechanism embodying therein a starting crank and shaft and means whereby said shaft may be permitted to turn in one direction, a coupling member adapted to engage an engine crank shaft, a coupling member carried by said starting crank and shaft adapted to coöperate with said engine shaft coupling members and means automatically locking said coupling members together while permitting them to be automatically uncoupled in case of a return movement, or "kick" of the engine shaft.

A still further object is to provide a starting mechanism employing a coupling mechanism of the character above referred to, wherein the various parts will be so compactly arranged as to not only be capable of being applied to automobiles or in other relations when but little clearance is afforded, but to have the various parts so positioned and supported as to insure reliability in the operation of the device, such being essential as the nature of the device is an emergency appliance.

A still further object of the invention is to provide a device wherein all parts will be moved with the engine shaft coupling, as the engine starts, thus permitting such movement to be utilized to release the locking mechanism for the starting crank shaft.

A still further object is to provide in a starting mechanism of this character a rotary engine crank shaft coupling member, a non-rotary coupling member adapted to be forced into engagement with the rotary member by a spring, and a spindle connection between said members whereby they are held in substantial alinement at all times and said rotary member is permitted to turn to release itself from the non-rotary member.

A still further object is to provide in a device of this character means automatically coupling the rotary and the non-rotary members together which will be such as to permit the starting shaft to transmit sufficient power to place the charge or charges of gas under compression, while being capable of instantly and automatically disengaging said members in case of the return or "kick" of the engine. And a still further object is to provide a neat compact starting mechanism having the characteristics above referred to which will be simple in its design and reliable and durable in use.

The invention consists in the novel features of construction and combination of parts as are hereinafter set forth and described, and more particularly pointed out in the claims hereto appended.

Referring to the drawings: Figure 1 is a side elevation of a starting mechanism for internal combustion engines embodying my invention; Fig. 2 is a front elevation thereof;

Fig. 3 is a longitudinal section of said mechanism; and Fig. 4 is a view of a modification of the locking mechanism for the starting shaft.

Like characters refer to like parts throughout the several views.

In the embodiment of my invention shown in the drawings, I have illustrated the invention as being applied to an automobile, such being the greatest field of utility for the device. In said drawings, *a* indicates the fly wheel of an internal combustion engine, not shown, and *a'* the protruding end of the crank shaft which is utilized to crank the engine to place the initial charge of gas under compression for ignition. This said end *a'* carries one member of an impact coupling as the pins a^2. This is a common and well known construction and is shown merely to illustrate one form of coupling between the engine and the starting mechanism. *b* indicates the radiator housing and its supports.

Mounted on the supports for the radiator, or on any other desired or convenient member, is a frame *c*, on which is a boss *c'* adapted to act as a bearing for the starting shaft *d* of the starting mechanism. In the form of the invention shown, this boss *c'* supports said shaft *d* in axial alinement with the shaft end *a'*.

Any suitable means may be used for rotating the shaft *d*, a crank handle *d'* being preferred on account of its simplicity, and of its being the customary agency for cranking purposes. The handle *d'* is shown as being screwed onto the shaft *d* but its manner of attachment is immaterial to the invention.

The shaft *d* actuates a coupling member *e* adapted to coöperate with the coupling member a^2 on the engine shaft. To permit said member to turn said engine shaft with it, and to permit said engine shaft to turn independently thereof when the charge is ignited and disconnect the coupling pins a^2 therefrom, the end of said member *e* is formed with two shoulders as *e'* and face cams e^2 rising therefrom in the direction of rotation of the engine. This also is a well known expedient now generally adopted in automobile practice. This arrangement, it will be observed, forms an impact coupling which is automatically released if the engine charge is properly ignited; but in case the charge is not ignited such a coupling alone will cause the engine shaft to rotate the member *e* and the means turning same, with it, as the gases expand when pressure from the starting mechanism is relieved. To obviate the difficulty which results in the so called "kick" of the starting crank, I positively lock the shaft *d* against such a return movement, and so construct and arrange the device that said member *e* is capable of such return movement.

The locking mechanism for the shaft *d* above referred to must be such as to permit the free rotation of said shaft in one direction, while locking it against all movement in the reverse direction. Preferably I accomplish this result by providing the shaft *d* with a ratchet wheel *f* rotatable therewith, and mounting a pawl *f'* spring pressed or not, as desired, in such relation to said wheel *f* as to engage same when the coupling members a^2—*e* are connected, and thus limit the direction of rotation of the shaft *d* to that necessary to turn the engine shaft *a'*.

The shaft *d* carries means whereby the coupling member *e* is connected thereto when said shaft is so rotated, and disconnected therefrom, in case said member *e* turns with the shaft *a'* in the opposite direction. To simplify the design of the starting mechanism, to insure reliability of action; to minimize wear; and to make the mechanism compact, I make the shaft *d* hollow, and make the member *e* cylindrical and seat it and the means coupling it to the shaft *d*, within said shaft. Hence the member *e* is rotatable within said shaft, while the means coupling it to the said shaft are held stationary relative to said shaft. Said means are also rotatable with said shaft so as to permit power to be transmitted therefrom to the member *e*, and have such movement as to permit the automatic disconnection of the member *e* therefrom in a manner to be hereinafter described.

The coupling means above referred to comprise a reciprocating cylindrical block *g* mounted in the shaft *d* which block is provided with a stud *g'* moving in an elongated way d^2 formed in said shaft *d*. Said block has at diametrically opposite points of the face thereof a recess g^2 the rear side of which at least, is pitched backward to present a cam surface adapted to aid in accomplishing the disconnection of the members *e g*. Said block has an opening as g^3, extending axially therethrough.

The coupling member *e* has similarly shaped lugs e^3 adapted to interlock with the recesses g^2, and an opening e^4 passing axially therethrough and alined with the opening g^3 which opening e^4 at its outer end is enlarged to form a spring seat e^5 and chamber e^6 within said member *e*. Seated within said chamber and acting against the seat is a spiral spring *h* which spring is placed under such compression by a bolt *i* passing therethrough and through the openings g^3 e^4, as to normally cause the lugs e^3 to interlock with the recesses g^2 at each half revolution of the block *g*. Suitable washers *i'* i^2 are provided to form a seat for the spring *h* and engage the block *g*, and the nut i^3 is placed on the end of the bolt *i* so as to permit ready access thereto to permit the adjustment of the compression of said spring. It will thus be seen that the member *e* is free to rotate within the shaft *d*

and about the bolt *i* independently of the block *g* which is held against such rotation, to accomplish the connection or disconnection of the interlocking parts carried by said members, whether under or against the tension of said spring. The reciprocating movement of the block *g* is necessary to permit the disengagement of the lugs e^3 from the recesses g^2. To permit the use of a supplemental spring *j* if such becomes necessary to reinforce the spring *i* in case it is not strong enough to hold the members e^3 g^2 interlocked against the strains necessarily transmitted therethrough to place the charge of gas in the engine under compression, the outer end of the shaft *d* is also made hollow, the spring *j* acting against the block *g* or washer i^2 and the crank handle *d'*.

The foregoing mechanism relates solely to the features of the device relating to the starting and "kick" of the engine. It is desirable, however, to provide an automatic release for the pawl *f'*, as it is necessary at times to turn the shaft *d*, to position the handle *d'* so as to secure the desired purchase to start the engine. To simplify the structure of the device, and its mode of operation, I make such release automatic, and actuate it through the movement of the coupling member *e* in disengaging the shaft end *a'*, thus causing the pawl and ratchet to be disengaged at all times when it is necessary to crank the engine. To provide an automatic release for this purpose, I provide clearance on the shaft *d* at *k* adjacent to the boss *c'* so as to permit the shaft *d* and all parts appurtenant thereto to have such axial movement as will permit the disengagement of the shoulders *e'* and pins a^2 and I also form a channel *l* in the coupling member *e* adapted to receive a face plate *m* carried by the ratchet wheel *f*. This arrangement insures the movement of the shaft *d* and appurtenant parts, with the member *e* although if desired, the spring *j* may be relied upon to transmit such movement and thereafter restore the various parts to normal. I also provide a rim *n* to the wheel *f* extending to a point adjacent to the periphery thereof, which rim is adapted to engage a cam *o* carried by the pawl *f'*, to raise said cam as the shaft *d* is forced outwardly, or to permit it to drop to place, as the shaft is forced inwardly.

In Fig. 4, I have shown a modification of this construction, which may be used when the ratchet wheel *f* is set on the shaft *d* adjacent to the plate *c*, and the pawl is mounted on said plate. In this form, the pawl carries an overhung cam *p* which rests upon a plurality of the teeth of the ratchet, thus causing said ratchet to act directly on the cam, and dispensing with the rim *n*. This form of the invention, is as to its mode of operation, identical with the other form shown, being merely a variation of mechanical details to adapt the invention to different conditions of use.

The operation of the herein described starting mechanism for internal combustion engines is substantially as follows: The various parts of the mechanism proper are normally so positioned relative to each other that the coupling members *e g* are connected, the spring *i* alone or in conjunction with the spring *j* causing such relation. While the member *e* is uncoupled from the shaft *a'*, the pawl *o* or *p* will ride upon the rim *n* or the ratchet *f*, thus disengaging said pawl from said ratchet, and permitting the free rotation of the shaft *d* in either direction. When it is desired to "crank" the engine, the crank *d'* is turned to bring it to the desired position, and forced inwardly, the shaft *d* moving axially in the boss *c'* until the coupling member *e* passes about the shaft *a'* and the shoulders *e'* thereon are brought so as to engage the pins a^2. This movement causes the ratchet *f* and its rim *n* to have such movement as to permit the pawl *f'* to drop upon the ratchet *f* thus limiting the movement of the ratchet and the shaft *d* to the direction necessary to start the engine. This causes all the parts to assume the positions shown in Fig. 3. The crank *d'* is then turned, thus turning the shaft *d*, which movement is transmitted to the block *g* through the stud *g'* thereon. The tension of the spring *h* is sufficient to resist the tendency of the cam e^3 to ride out of the recess g^2, being greater than any power which may be applied to the crank *d'* by the operator. If the charge placed under compression in this manner is not properly ignited, the gases under compression will expand and tend to cause the crank *d'* to "kick" back through the same chain of mechanisms through which power is applied to the shaft *a'*. The engagement of the pawl *f'* with the ratchet wheel *f* will, however, act positively to prevent any movement of the said pawl the shaft *d* and the block *g*, thus causing the entire power of the expanding gases to be applied to the coupling members *e g* against the shoulder *e'* thereon. This power will be sufficiently great to cause the cams e^3 to act against the pitched walls of the recesses g^2 in a manner to force the entire block *g* backward against the tension of the springs *h j*, or *h* alone when the spring *j* is not used, the stud *g'* moving into the way d^2 to an extent to permit the coupling members *e g* to be automatically disconnected. When so disconnected, the coupling member *e* is free to rotate within the shaft *d* and about the bolt *i*. Thus for the purpose of more clearly establishing the relative operation of the parts *e g* it will be observed that when said parts are coupled, they are rotatable together; that the latter is adapted to be held stationary relative to the former, and that

the former is rotatable with the latter, and also independently thereof. If the engine shaft should return more than a half rotation, the members *e g* would automatically couple and uncouple again, it being impossible under any conditions to turn the shaft *d* while the coupling member *e* is engaged with the shaft *a'*.

The bolt *i* not only serves to cause the spring *h* to cause the members *e g* to act as described, but aids to keep these parts in such alinement as to insure their reliability in action. If the charge in the engine be properly ignited, the shaft *a'* continues to rotate in the same direction, thus causing the pins a^2 to force the entire starting mechanism backwardly through their action upon the cams e^2 on the coupling member *e*. This backward movement of the coupling member *e* transmits a direct axial movement to the shaft *d* and all of its appurtenants through the plate *m*, which movement causes the rim *n* or the ratchet *f* itself in the form shown in Fig. 4, to engage the cam *o* or *p*, and raise the pawl *f'* out of engagement with said ratchet. The clearance at *k* permits the reciprocation of the shaft *d*.

It will be observed that the arrangement of the coupling members *e g* and the spring *i* is such as to cause said members to be automatically coupled whenever the cams e^3 are brought into alinement with the recesses g^2, thus insuring the proper and automatic positioning of the parts in order to permit the engine to be cranked.

It is not my intention to limit the invention to the precise details of construction shown in the accompanying drawings, the manner of associating the essential elements being largely dependent upon the design, or location of the engine, or of the automobile to which it is attached. It is merely necessary that the means permitting rotation of the crank shaft in one direction and locking it against movement in the reverse direction, be positioned on said shaft in a relation which will be most convenient.

Having described the invention, what I claim as new and desire to have protected by Letters Patent is:—

1. In a starting mechanism for internal combustion engines, the combination of a shaft, means whereby said shaft may be turned, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a coupling member adapted to rotate the engine crank shaft, a coupling member rotatable with said first mentioned shaft and adapted to be coupled to said first mentioned coupling member, means whereby said coupling members may be connected to transmit motion from said first mentioned shaft and disconnected to permit said first mentioned coupling member to rotate independently of said first mentioned shaft, and means whereby, when said first mentioned coupling member is disengaged from the engine shaft, said locking mechanism will be inoperative.

2. In a starting mechanism for internal combustion engines, the combination of a shaft, means whereby said shaft may be turned, and moved axially, a coupling member adapted to rotate the engine crank shaft, a coupling member rotatable with said first mentioned coupling member, means whereby said coupling members may be connected to transmit motion from said first mentioned shaft and disconnected to permit said first mentioned coupling member to rotate independently of said first mentioned shaft, interlocking members carried by said first mentioned shaft and a relatively stationary part, and means carried by one of said members whereby the axial movement of said shaft to couple said first mentioned coupling member to the engine starting shaft will lock said members, and axial movement in the opposite direction will release said members, whereby said first mentioned shaft is permitted to turn in one direction only when coupled to the engine starting shaft, and locked against movement in the opposite direction, and is permitted to turn in both directions, when said first mentioned shaft is not so coupled.

3. In a starting mechanism for internal combustion engines, the combination of a starting shaft, means whereby same may be rotated, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a coupling member mounted on said shaft having an axial opening therethrough enlarged at the forward end to form a spring seat and chamber, forward and rear coupling means thereon, a coupling member adapted to engage said rear coupling means carried by, rotatable with, and having an axial movement independently of, said starting shaft and having an axial opening therethrough alined with the opening in said first mentioned member, a tie rod or bolt passing through said openings and engaging said last mentioned coupling member, and a spring under compression in said chamber and between said spring seat and the end of said tie rod or bolt, whereby said coupling members are normally connected, but may be automatically disconnected against the tension of said spring.

4. In a starting mechanism for internal combustion engines, the combination of a starting shaft, means whereby same may be rotated, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a coupling member mounted on said shaft having an axial opening therethrough enlarged at the forward end to form a spring

seat and chamber, forward and rear coupling means thereon, a coupling member adapted to engage said rear coupling means carried by, rotatable with, and having an axial opening therethrough alined with the opening in said first mentioned member, a tie rod or bolt passing through said openings and engaging said last mentioned coupling member, having a screw threaded end, a take up nut on said threads, and a spring under compression in said chamber and between said spring seat and said take up nut, whereby said coupling members are normally connected but may be automatically disconnected against the tension of said spring and the tension of said spring may be regulated.

5. In a starting mechanism for internal combustion engines, the combination of a starting shaft having an axial opening therein, means whereby said shaft may be rotated, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a reciprocating coupling member having an axial opening therethrough, mounted in said opening and rotatable with said shaft, a second coupling member rotatably mounted in said opening, having an axial opening therethrough enlarged at its forward end to form a spring seat and chamber, interlocking cams carried by the adjoining ends of said coupling members, a tie rod or bolt passing through said openings and engaging said reciprocating member, and a spring under compression in said chamber, and between said spring seat and the end of said tie rod or bolt, whereby said cams are normally interlocked, but may be automatically disconnected against the tension of said spring.

6. In a starting mechanism for internal combustion engines, the combination of a starting shaft having an axial opening therein, means whereby said shaft may be rotated, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a reciprocating coupling member having an axial opening therethrough, mounted in said opening and rotatable with said shaft, a second coupling member rotatably mounted in said opening, having an axial opening therethrough enlarged at its forward end to form a spring seat and chamber, interlocking cams carried by the adjoining ends of said coupling members, a tie rod or bolt passing through said openings and engaging said reciprocating member, a spring under compression in said chamber, and between said spring seat and the end of said tie rod or bolt whereby said cams are normally interlocked but may be automatically disconnected against the tension of said spring, and a supplemental spring in said first mentioned opening acting against said reciprocating coupling member.

7. In a starting mechanism for internal combustion engines, the combination of a starting shaft having an axial opening and a way therein, means whereby said shaft may be rotated, a locking mechanism whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a coupling member mounted in said opening, a stud on said member movable in said way, said member having an axial opening therethrough, a second coupling member rotatably mounted in said opening having an axial opening therethrough enlarged at its forward end to form a spring seat and chamber, interlocking cams carried by the adjoining ends of said coupling members, a tie rod or bolt passing through said opening and engaging said first mentioned coupling member, and a spring under compression in said chamber, and between said spring seat and the end of said tie rod or bolt, whereby said cams are normally interlocked but may be automatically disconnected through the reciprocation of said first mentioned coupling member against the tension of said spring.

8. In a starting mechanism for internal combustion engines, the combination of a starting shaft having an axial opening therein means whereby said shaft may be rotated, a ratchet wheel carried by said shaft, a pawl mounted adjacent to and adapted to engage said ratchet wheel, whereby said shaft is permitted to turn in one direction but is locked against movement in the other direction, a reciprocating coupling member having an axial opening therethrough, mounted in said opening and rotatable with said shaft, a second coupling member rotatably mounted in said opening, having an axial opening therethrough enlarged at its forward end to form a spring seat and chamber, interlocking cams carried by the adjoining ends of said coupling members, a tie rod or bolt passing through said openings and engaging said reciprocating member, and a spring under compression in said chamber, and between said spring seat and the end of said tie rod or bolt, whereby said cams are normally interlocked but may be automatically disconnected against the tension of said spring.

9. In a starting mechanism for internal combustion engines, the combination of a starting shaft, means whereby said shaft may be rotated, a ratchet wheel carried by said shaft, a pawl mounted adjacent to, and adapted to engage, said ratchet wheel, whereby said shaft is free to turn in one direction and may be locked against movement in the other direction, a rim on said ratchet wheel, a cam carried by said pawl adapted to be engaged by said rim, a bearing for said shaft whereby it may be moved axially, a coupling member rotatably mounted in said shaft, means whereby said

coupling member is caused to move axially with said shaft, said member having on the forward face thereof one member of an impact coupling having disengaging cam surfaces thereon, adapted to engage the engine shaft whereby when the engine starts said coupling member will be disengaged from said engine shaft and reciprocate said starting shaft so as to raise said pawl from said ratchet, a reciprocating coupling member rotatable with said starting shaft and adapted to be coupled to said first mentioned coupling member, and means whereby said coupling members may be automatically connected to transmit motion from said first mentioned shaft and be automatically disconnected to permit said first mentioned coupling member to be rotated independently of said starting shaft.

In witness whereof, I have hereunto affixed my signature this 6th day of November, 1907, in the presence of two witnesses.

FREDERICK W. TEVES.

Witnesses:

GEORGE MCCAY,

F. T. WENTWORTH.