G. S. THOMPSON & R. NETTER.

ENGINE STARTING APPARATUS FOR AUTOMOBILES.

APPLICATION FILED OCT. 11, 1910.

987,930. **Patented Mar. 28, 1911.**

3 SHEETS—SHEET 1.

Fig. 1.

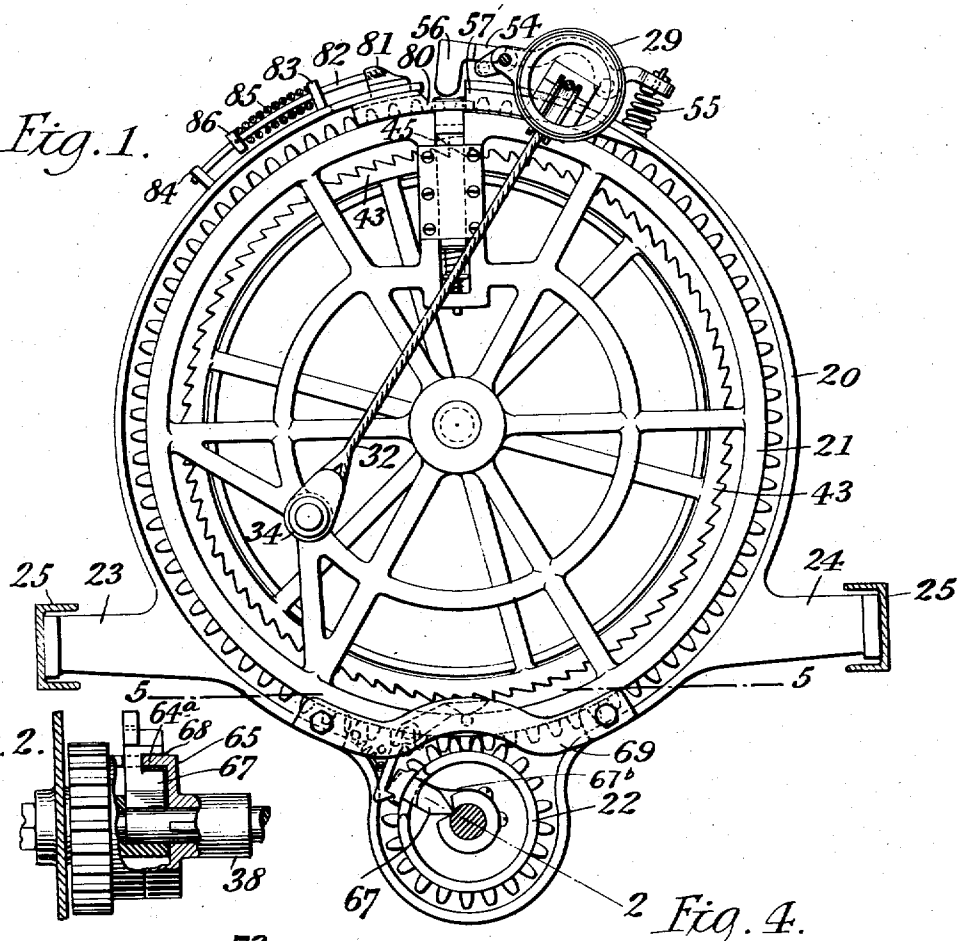
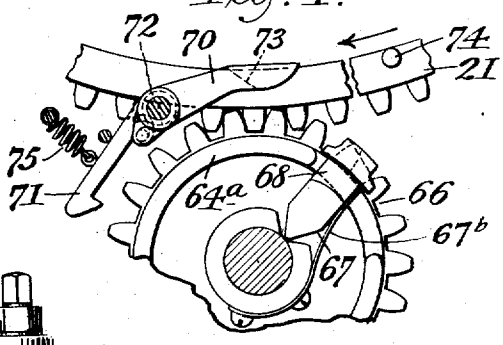


Fig. 2.

Fig. 4.



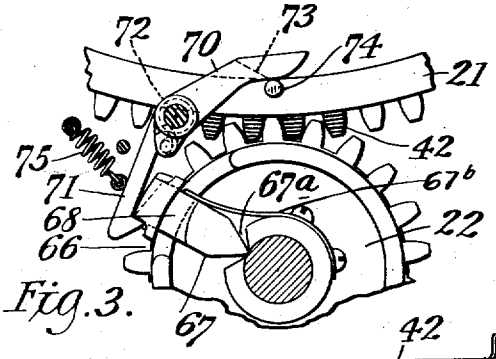


Fig. 3.

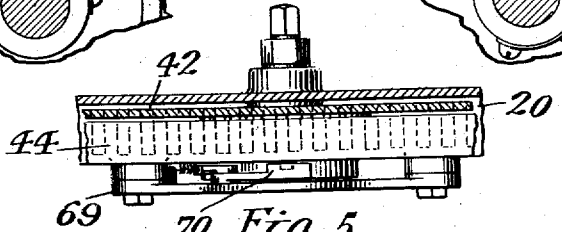


Fig. 5.

Witnesses:
A. R. Appleman.
W. W. Hawkins

Inventors
G. S. Thompson and
R. Netter.
By their Attorneys
Kerr, Page, Cooper & Haywood

G. S. THOMPSON & R. NETTER.

ENGINE STARTING APPARATUS FOR AUTOMOBILES.

APPLICATION FILED OCT. 11, 1910.

987,930. Patented Mar. 28, 1911.

3 SHEETS—SHEET 2.

Fig. 6.

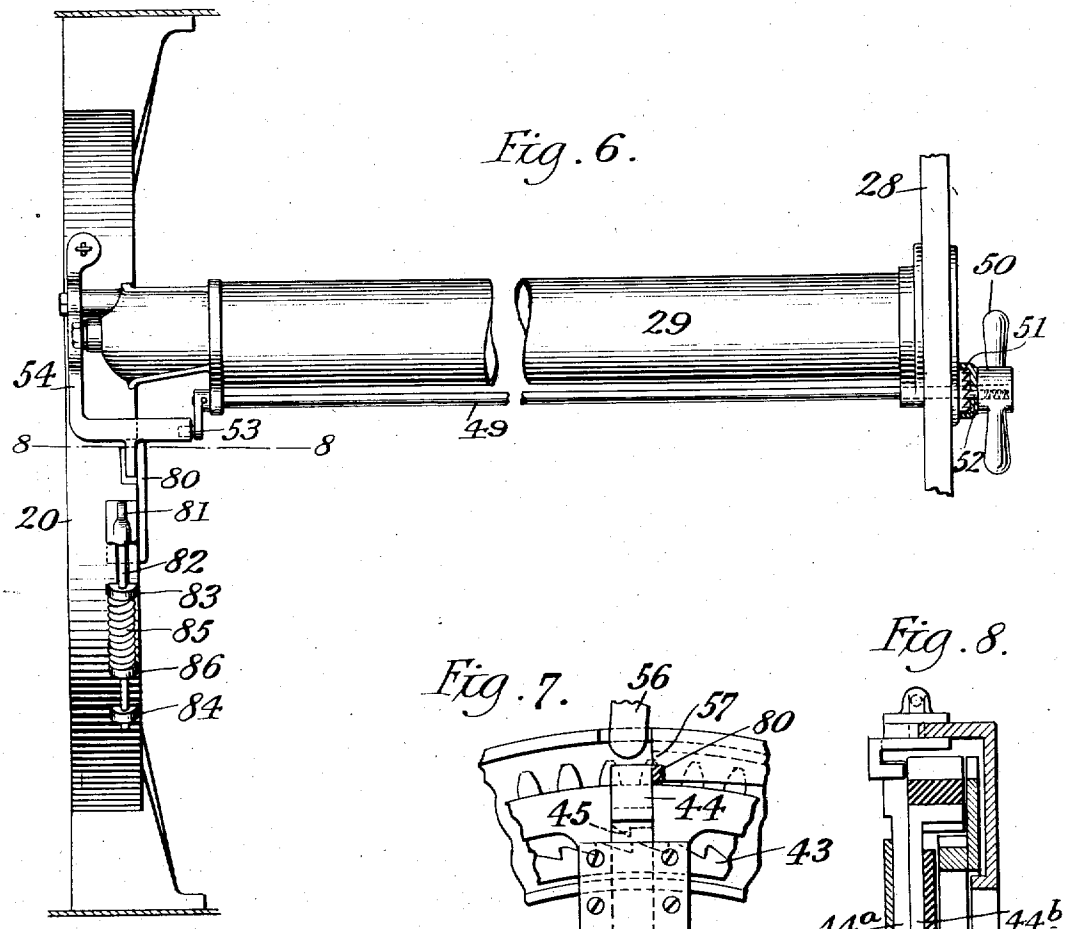
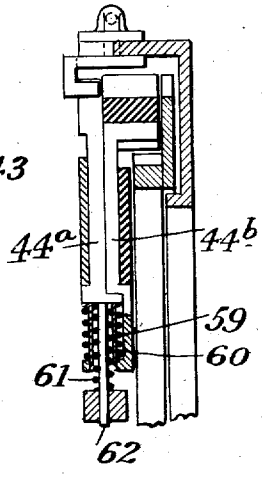


Fig. 7.

Fig. 8.



Witnesses:
A. R. Appleman
Wm. H. Hamilton

Inventors and
G. S. Thompson
R. Netter.
By their Attorneys
Kerr, Page, Cooper & Hayward

G. S. THOMPSON & R. NETTER.

ENGINE STARTING APPARATUS FOR AUTOMOBILES.

APPLICATION FILED OCT. 11, 1910.

987,930. Patented Mar. 28, 1911.

3 SHEETS—SHEET 3.

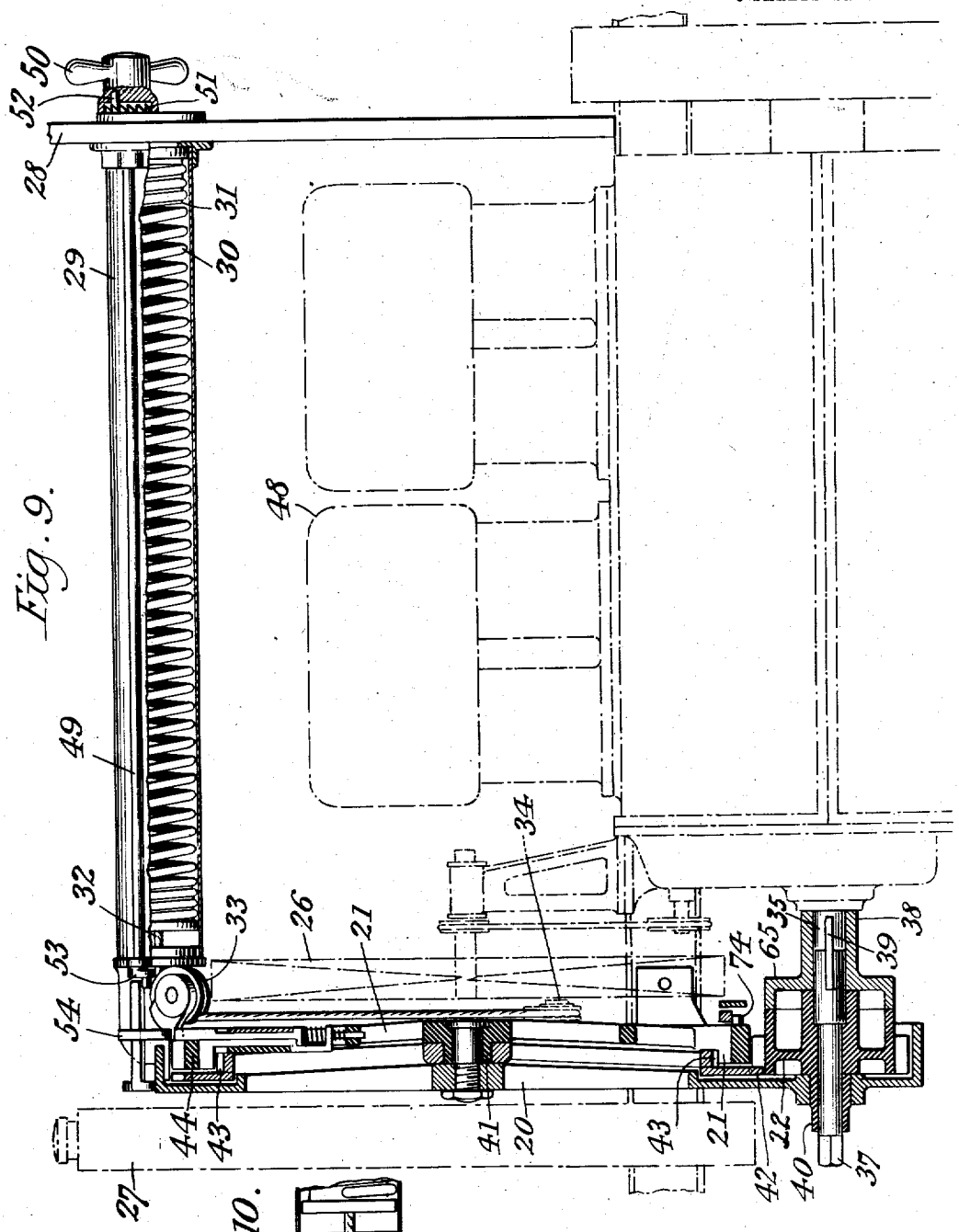


Fig. 9.

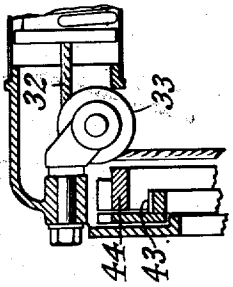


Fig. 10.

Witnesses:
A. V. Appleman
Wm. H. Hauskins

Inventors
G. S. Thompson and
R. Netter,
By their Attorneys
Kerr, Page, Cooper & Hayward

UNITED STATES PATENT OFFICE.

GEORGE S. THOMPSON, OF HOPKINTON, MASSACHUSETTS, AND RAPHAEL NETTER, OF NEW YORK, N. Y., ASSIGNORS, BY DIRECT AND MESNE ASSIGNMENTS, OF SEVEN TWENTY-FOURTHS TO FRED I. ELDRIDGE AND ONE-THIRD TO WILLIAM M. KINGSLEY, BOTH OF NEW YORK, N. Y., AND FIVE TWENTY-FOURTHS TO WILLIAM A. FULLER, OF CLINTON, MASSACHUSETTS.

ENGINE-STARTING APPARATUS FOR AUTOMOBILES.

987,930. Specification of Letters Patent. **Patented Mar. 28, 1911.**

Application filed October 11, 1910. Serial No. 586,433.

To all whom it may concern:

Be it known that we, GEORGE S. THOMPSON, a citizen of the United States, residing at Hopkinton, in the county of Middlesex and State of Massachusetts, and RAPHAËL NETTER, a citizen of the French Republic, residing at New York, in the county and State of New York, have invented certain new and useful Improvements in Engine-Starting Apparatus for Automobiles, of which the following is a full, clear, and exact description.

In the use of automobiles propelled by internal combustion motors the necessity of "cranking" the engine to start the same is at times a considerable inconvenience, and various schemes have accordingly been proposed for obviating the difficulty.

Our present invention is designed to provide improved means for the purpose, employing mechanism actuated by power derived from a previous operation of the engine, and to this and other ends the invention consists in the novel features of construction and combinations of elements hereinafter described.

In carrying out the invention in the preferred manner the engine shaft is provided with a pinion, adapted to mesh with a gear wheel which is suitably connected with a power spring so as to be rotated thereby, thus rotating the pinion. Between the pinion and the engine shaft is a suitable clutch by which the pinion and shaft may be coupled together, so that the rotation of the pinion by the spring-actuated gear will cause the shaft to be revolved, thus starting the engine. Succeeding revolutions of the shaft, now actuated by the engine, continue the rotation of the pinion, which, being in mesh with the gear rotates the latter and winds up or stores power in the spring. As the gear completes its revolution a bolt, carried by the gear, comes into engagement with a suitable stop, thereby arresting the gear with the spring wound up. This locking bolt has associated with it suitable manually operated releasing mechanism by which the driver of the car can disengage the bolt from the stop whenever he desires to start the engine. The embodiment thus briefly outlined is illustrated in the accompanying drawings, and referring now thereto,

Figure 1 is a rear elevation of the apparatus, with the side members of the chassis in cross section. Fig. 2 is a detail view of the pinion, and associated parts, by which the energy of the starting spring is applied to the engine shaft, said view being partly in section on line 2 of Fig. 1. Figs. 3 and 4 are detail rear views of the parts illustrated in Fig. 2, with additional elements, showing such parts and elements in different operative positions; one of said elements being the spring-driven gear wheel to which the starting spring is connected and which is adapted to actuate the pinion on the engine shaft. Fig. 5 is a sectional plan view, on line 5—5 of Fig. 1, of the parts and elements illustrated in Figs. 3 and 4. Fig. 6 is a plan view of the complete apparatus as mounted on an automobile, the engine and other parts being omitted. Fig. 7 is a detail rear view of the locking mechanism for releasably holding the starting gear against the tension of its actuating spring. Fig. 8 is a detail sectional view of the locking mechanism shown in Fig. 7, showing also the buffer mechanism employed to take up the shock produced by the starting spring as the point of attachment thereof to the starting gear passes the dead center during the operation of winding up or extending the spring to store power therein; the view being taken substantially on line 8—8 of Fig. 7. Fig. 9 is a view of the complete apparatus in longitudinal vertical section, showing also, in broken lines, the engine, radiator, and fan for cooling the latter. Fig. 10 is a detail sectional view showing the swiveled pulley over which runs the cord or cable connecting the starting spring with the starting gear.

The various parts of the apparatus are conveniently mounted in a cast frame 20, conforming in contour to the gear 21, and pinion 22, as shown in Fig. 1, and having near its bottom two arms 23, 24, by which it is securely attached to the side members 25 of the chassis, at a point between the fan

26 and radiator 27, which are shown in broken lines in Fig. 9. At its top the supporting frame is firmly connected to the dashboard 28 by a hollow cylinder 29, which also serves the purpose of inclosing the contractile coil starting spring 30. At the dashboard end the spring is attached to a fixed stud 31, and at its front end the spring is attached to one end of a cable or cord 32 running over a pulley 33 swiveled in the frame 20; said cable being connected by its other end to a crank pin 34 on the gear 21, as shown in Fig. 1. The length of this cable is such that with the gear in the position of Figs. 1 and 9 that is, with the crank pin on the opposite side of the center of the gear, the starting spring 30 will be extended.

On the engine shaft 35, in position to mesh with and be driven by the gear 20, is a pinion 22. This pinion may be mounted directly on the engine shaft if the latter is long enough to accommodate it; but if the shaft is too short, it may be lengthened by means of a short stem or piece of shafting 37, connected to and in line with the shaft by a sleeve 38 to which the parts embraced are fastened by a key 39. The end of the stem or shaft extends through the supporting frame, and is squared, as shown, to permit cranking in the ordinary way if desired. The hub 40 of the pinion 22 also extends forwardly, as shown, to permit being engaged by a suitable crank or wrench when it is desired to wind up the starting spring by hand, as will be readily understood. Assuming that the pinion 22 is fixedly connected to the sleeve 38, and is in mesh with the gear 21, it will be seen that if the expanded spring 30 be allowed to contract the shaft will be revolved, thereby "cranking" the engine.

The gear 21 has loosely mounted on its hub 41, another gear 42, of the same size, the two being thus movable independently of each other. They are, however, so intimately connected, both in physical relationship and in function, that they may be conveniently referred to as a compound gear, 21—42. The front portion, 42, is always in mesh with the pinion 22, but the rear portion, 21, is mutilated, having a sufficient number of teeth omitted to cause it to be disengaged from the pinion, as indicated in Figs. 3 and 9. On the gear 42 is a ratchet 43, of less diameter than the gear, and on the gear 21 is a radially slidable bolt 44 having a forwardly extending portion lying over the ratchet and having on its inner face one or more teeth 45, Fig. 7. It will therefore be seen that if the bolt be shifted inwardly, bringing its teeth into engagement with the ratchet 43, the two gears 21 and 42 will become in effect one, and will both be in mesh with the pinion as soon as the mutilated portion of gear 21 has moved far enough to bring its first tooth into action. This compound-gear construction is preferred for this reason: If a single mutilated gear be employed it will, of course be stopped with its mutilated portion over the pinion 36; but when this pinion comes to rest, as by stopping the engine for example, it might not stop with its teeth in such position as to be properly engaged by the teeth of the driving gear when the same is rotated by the powerful starting spring. On the contrary, the position of the gears may be such as to cause their teeth to jam when they come together, with possible breakage. In the construction illustrated, however, the gears 21 and 42 will be locked together by the ratchet and bolt before the teeth of the first named gear can engage those on the engine pinion; and the proportions, and the relative positions, of the ratchet and bolt on their respective gears, are such that the two cannot lock together except when the teeth on the two gears are in exact register. It will therefore be seen that the pinion 22 and gear 21 must come into mesh accurately.

Extending longitudinally above the engine, shown in broken lines at 48, Fig. 9, is a rod 49, rotatably mounted in the heads of the cylinder or casing 29, and projecting through the dashboard, where it carries a handle 50. The face of the handle hub is recessed, as shown, to fit over a fixed ratchet 51, and carries a spring-pressed pin or pawl 52 to engage said ratchet and so prevent movement of the handle hub and the rod 49 except in one direction,—in the present instance clockwise as viewed from the driver's seat behind the dashboard. At its forward end the releasing rod 49 is provided with a short crank or arm 53, see Fig. 6 also, lying under a rearwardly turned extension of a hammer or lever 54 pivoted on top of the frame 20 and connected to a spring 55 to hold said extension yieldingly in an elevated position. Immediately above the bolt 44 the hammer has a downwardly projecting lug or boss 56, the bolt, as will be seen in Figs. 1 and 7, bearing against a stop 57 on the frame 20 and thereby acting to hold the gear 21 in the position shown in Fig. 1, with the starting-spring 30 expanded. If now the spring-releasing handle 50 be turned by the operator the trigger or finger 53 will first raise the free end of the hammer 54, compressing the hammer-actuating spring 55; and as the said finger continues to move it eventually passes from under the hammer-extension, permitting the actuating spring to throw the hammer down against the locking bolt and throwing the latter smartly downward. As the bolt moves down its tooth 45 engages the adjacent tooth on the ratchet, thus locking the gears 21—42 together with their teeth in register, as before

described. Both being now free to turn the spring 30 revolves them rapidly and they in turn rotate the pinion 22. It is of course desirable that when the bolt is depressed one of the teeth on the ratchet be in position for engagement by the bolt tooth, for if the ratchet should not be so positioned the bolt tooth would merely strike the top of a ratchet tooth and the gears not be registered in time to prevent injury to the teeth of the mutilated gear or the pinion. To avoid such contingency the bolt is made in two parts, 44^a, 44^b, as shown in Fig. 8, overlapping at their inner ends and connected thereat by a coil spring 59 encircling a guide barrel 60 which is fixed to the bolt-section 44^b and is slidable therewith relatively to the other section. The bolt as a whole is urged upwardly, or outwardly with respect to the gear on which it is mounted, by a coil spring 61 encircling the stem 62 inside the guide barrel. Suppose now that the bolt tooth, when the bolt is thrown down by the actuating hammer, should strike the top of one of the ratchet teeth: the part 44^b, which carries the tooth, will be arrested, but the part 44^a is free to continue its movement and will do so, thereby compressing the spring 59 and storing power therein, the part 44^a being held depressed by the underside of the stop 57. In the meantime the gear 21, on which the bolt is mounted, is turning, and carries the bolt forward; and as the bolt-section 44^b is urged downwardly by the spring 59 its tooth 45 is quickly seated against the ratchet tooth, bringing the teeth of the two gears into register before the mutilated gear engages the pinion 22.

If for any reason it should be necessary or desirable to crank the engine or wind up the starting spring by hand, it should be possible to do so, in the one case without wasting strength on the starting spring, and in the other case without wasting strength by turning the engine shaft too. For these reasons the pinion 22 is loose on the shaft, as previously stated, but becomes rigidly connected therewith when revolved by the gear 21—42 under the power of the starting spring. For such purpose the pinion rim (which is extended rearwardly into abutting engagement with a flange on the disk 65 at the end of the sleeve 38, to afford additional strength) has in its rear edge a deep notch or slot 66, Figs. 1, 2, 3, and 4, to accommodate a radial locking pin 67, which has in its rear face a notch 68 to fit the flange on said disk 65. The bottom of the notch is rounded, as shown in Figs. 3 and 4, and the inner end of the pin is pointed, extending through an opening 67^a in the pinion hub into contact with the engine shaft. The clutch-pin 67 is steadied by a light blade spring 67^b on the pinion hub. On the cross member 69, which is fixed to the frame 20, is a flexible pawl composed of two parts, 70, 71, yieldingly connected by a spring 72 so that the two parts may swing together but are capable of angular separation under sufficient force. The free end of part 70 has a forwardly extending lip, the inclined edge of which is shown at 73 in dotted lines, and the other end of the pawl 70—71 is adapted to engage the projecting end of the locking pin 67. On the gear 21 is a stud 74, against which the said pawl-lip may be caused to bear by a contractile coil spring 75 connected to the part 71, as will be readily seen in Fig. 4. Suppose, now, that the gear 21—42 is being revolved by the cranking spring 30, and the pinion 22 rotating counter-clockwise as viewed in Fig. 3: the outer end of the locking pin 67 being held by the pawl 71 and the inner end of the pin being engaged by the engine shaft, which so far is still at rest, the advancing edge of the notch 66 tends to turn the pin counter-clockwise on its pointed end as a fulcrum, thereby causing the sharper edge of the bottom of notch 68 to bind on the underside of the flange 64^a and the opposite end-edge of the top of said notch to bind on the top or outside of the pinion rim. The pinion rim and the flange, which latter is integral with the sleeve 38, are thus rigidly connected together and the engine shaft begins to turn. At the same time the pawl 71 is cammed away from the locking pin by the beveled engaging face of the latter this disengagement being facilitated by the stud 74 passing from under the lip of the pawl 70. Thereafter the pawl 71 is held out of the path of the pin 67 by the spring 75. By the time the crank pin 74 reaches the upper dead center the engine will have been started and the pinion will thereafter be revolved by the engine, continuing the rotation of the gear 21—42, which, after the crank pin passes the dead center, extends the actuating spring 30. As the gear approaches its initial position the stud 74 comes under the pawl 70, raising the same and throwing the pawl 71 again into engagement with the locking or clutch pin 67, thereby unclutching the latter from the pinion rim and flange 64^a, and leaving the engine shaft free to turn independently of the pinion. At this time the bolt 44 encounters the stop 57 and brings the gear 21 to rest, the gear 42 continuing to turn until its mutilated portion comes to the initial position, leaving it free from the pinion. If the engine should not be started by the time the crank pin 34 passes the upper dead center it will be necessary either to crank the engine by hand or to "wind up" the spring 30 by hand. In the latter case the pinion is rotated in the reverse direction, by a suitable tool applied to the forwardly projecting pinion hub as previously described, so as to rotate the gear 21—42 with-

out turning the engine shaft. In this operation the clutch pin of course releases the parts which it had engaged, and as the pin reaches the pawl 71 it cams the latter upwardly until the same is passed. At the same time the bolt 44, cammed down by the inclined underside of the stop 57, (see Fig. 7), snaps up behind the stop and holds the gear in its initial position. When, while the spring 30 is being extended by the engine, the crank pin 34 passes the lower dead center, the spring begins to contract, and would bring the bolt 44 up against the stop 57 with a sharp blow. For the purpose of cushioning or easing such blow the following buffer devices are provided. On the underside of the frame 20 is a sliding hook 80, embracing the bolt 44 and having a lug 81 extending up through a slot in the frame 20. This lug is attached to a rod 82, slidably mounted in fixed guides 83, 84, and urged in the leftward direction (as viewed in Fig. 1) by a coil spring 85, bearing against the guide 83 and a collar 86 on said rod. Now as the bolt approaches the stop 57 it will first strike the hook 80, compressing the spring 85 and thereby taking up a considerable portion of the energy of the spring 30 and allowing the bolt to come up with less force against the stop 57. The engaging end of the hook is then seated in a notch cut in the stop 57, so that as the latter is closed by the bolt when the latter is thrown in to release the gear 21 the hook will be retracted by the spring 85 into position to reëngage the bolt as the latter again approached the stop.

The operation may now be briefly summarized as follows: When the driver desires to start the engine he turns the releasing handle 50 clockwise, thereby actuating the hammer 54, which throws the bolt 44 downwardly out of engagement with the stop 57. The contraction of the spring 30 immediately starts the gear 21—42, the two parts being locked together by the ratchet 43 and bolt-tooth 45, and the pinion 22 begins to rotate, actuating the clutch member 67 and causing it to clutch the pinion rim and flange 64^a together. The engine shaft is thus rotated, and the engine is started. The rotation of the pinion by the engine carries the crank pin 34 past the upper dead center and expands the spring 30 again; and as the stud 74 comes under the pawl 70 the other portion of the pawl is carried into the path of the clutch pin and disengages the same from the pinion rim and flange 64^a. At the same time the bolt 44, having engaged the hook 80 and compressed the spring 85, comes up against the stop 57 and arrests the gear, leaving the parts in their initial positions, ready for another operation.

The construction herein specifically illustrated is the preferred form of the invention, and is thoroughly successful in operation, but it is to be understood that the invention is capable of embodiment in other forms without departure from its proper spirit and scope as defined by the appended claims.

We claim:

1. In a starting apparatus for explosive engines, the combination of an engine shaft, of a pinion associated therewith, a spring actuated gear for rotating the pinion to automatically start the engine, said spring adapted to be extended by continued rotation of the gear by the engine, means associated with the pinion for manually storing energy in the spring, and another means independent of the aforesaid means for starting the engine manually.

2. In a starting apparatus for explosive engines, the combination of an engine shaft, of a pinion loosely associated therewith, a spring actuated gear for rotating the pinion in one direction, means connected to said pinion for clutching the shaft when rotated by the said spring actuated gear, means associated with the pinion for disengaging the clutch, and manual means for rotating the said pinion in an opposite direction after the clutch has been disengaged for storing energy in the spring.

3. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with the shaft to rotate the same, a gear adapted to mesh with the pinion but out of mesh therewith when in its initial position, a second gear constantly in mesh with the pinion, and rotatable independently of the first named gear, and means for locking said gears together with their teeth in register.

4. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion loosely associated therewith, a gear constantly in mesh with the pinion, a gear concentric with the first named gear and capable of independent movement, means connected to the second named gear for rotating the same, and means for locking the said gears together with their teeth in register.

5. In a starting apparatus for explosive engines, the combination with a gear, means connected therewith to actuate the same, a spring pressed bolt carried by the gear, a stop in the path of the bolt to hold the gear stationary against the actuating means, means arranged to strike the bolt and advance the same out of engagement with said stop, and means for operatively connecting the gear with the engine.

6. In a starting apparatus for explosive engines, the combination with a supporting frame adapted to be mounted in front of the engine, a gear journaled in the frame,

a pulley supported by the frame at the top thereof, a casing extending rearwardly from the pulley and adapted for attachment to the dashboard of the vehicle, a spring in the casing, a cord connected to the spring and extending over the pulley into operative connection with the gear, and means for operatively connecting the gear with the engine.

7. In a starting apparatus for explosive engines, the combination with a gear, a spring connected with the gear to rotate the same and adapted to be extended by continued rotation of the gear by the engine, a releasable means carried by the gear, means in the path of the aforesaid means to arrest the same and the gear after the spring has been extended, yielding means for opposing the tension of said spring as the bolt approaches the arresting means, and means operatively connecting the gear with the engine.

8. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with and normally loose upon the shaft to rotate the same, means for establishing a rigid connection between the pinion and the engine shaft, a gear for rotating the pinion, a spring connected with the gear to rotate the same in one direction and adapted to be extended by continued rotation of the gear by the engine, and manual means for rotating the gear in the opposite direction and adapted to extend said spring.

9. In a starting apparatus for explosive engines, the combination of an engine shaft, a pinion on the shaft to rotate the same, a gear constantly in mesh with the pinion, a spring actuated gear initially out of mesh with the pinion, releasable mechanism for holding the spring-actuated gear stationary against the tension of its actuating spring, and means, operable upon release of the spring-actuated gear, to lock the said gears together.

10. In a starting apparatus, the combination of an engine shaft, a pinion loosely mounted thereon, a gear arranged to rotate the pinion, expansible and contractible means associated with the gear to actuate the same, mechanism adapted to connect the pinion and the shaft and enabling the pinion to rotate the shaft to start the engine and to be rotated by the shaft to store energy in the gear actuating means, and releasable means for arresting the gear.

11. In a starting apparatus for explosive engines, the combination of an engine shaft, a pinion on the shaft to rotate the same, a gear constantly in mesh with the pinion, means for rotating the gear, a spring connected with said gear rotating means to actuate the same, releasable mechanism for holding said gear rotating means stationary against the tension of the actuating spring, and means operable upon release of the gear rotating means, for locking said gear and its rotating means together.

12. In a starting apparatus for explosive engines, the combination of an engine shaft, a pinion loosely mounted thereon, means for clutching the pinion and engine shaft together, a spring actuated gear adapted to rotate the pinion, and the pinion in turn adapted to complete the rotation of the gear, manually releasable means for arresting the gear, and means for unclutching the pinion and engine shaft.

13. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with the shaft to rotate the same, a mutilated gear adapted to mesh with the pinion but out of mesh therewith when in its initial position, a spring connected with the mutilated gear to actuate same, a gear constantly in mesh with the pinion and rotatable independently of the mutilated gear, a locking bolt carried by the mutilated gear, a stop in the path of the bolt, manual means for releasing the bolt from said stop, and means actuated by the locking bolt for locking the said gears together with their teeth in register.

14. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion loosely associated therewith, a gear constantly in mesh with the pinion, a mutilated gear concentric with the first named and capable of independent movement, a spring connected with the mutilated gear to rotate the same, manually releasable mechanism for holding the mutilated gear stationary against the tension of its actuating spring, means actuated by said mechanism for locking the said gears together with their teeth in register, and clutching means, actuated by movement of the pinion, for connecting the pinion rigidly to the shaft.

15. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with the shaft to rotate the same a pair of concentric gears capable of independent movement, one being constantly in mesh with the pinion and the other having a mutilated portion whereby it may be disengaged from the pinion, a spring connected with the mutilated gear to rotate the same, a ratchet carried by the other gear, a locking bolt carried by the mutilated gear, a stop in the path of said bolt, manually operated means for releasing the bolt from said stop, and means carried by the bolt to engage said ratchet and lock the gears together with their teeth in register when the bolt is released from its stop.

16. In a starting apparatus for explosive engines, the combination with a starting gear, of a spring connected with the gear to

actuate the same, a spring-pressed bolt carried by the gear, a stop in the path of the bolt to hold the gear stationary against the tension of its actuating spring, a spring-actuated hammer arranged to strike the bolt and advance the same out of engagement with said stop, and manual means for releasing the hammer.

17. In a starting apparatus for explosive engines, the combination of a supporting frame adapted to be mounted at one end of the engine, a starting gear journaled in the supporting frame, a locking bolt carried by the gear, a stop on the frame and in the path of said bolt, a pulley swiveled at one side of the frame, a cable connected to the gear on the opposite side of the center and passing over the pulley, a spring connected with the cable beyond the pulley, and manual means for releasing the bolt from said stop.

18. In a starting apparatus for explosive engines, the combination with a supporting frame adapted to be mounted in front of the engine, a gear journaled in the frame, a pulley supported by the frame at the top thereof, a casing extending rearwardly from the pulley and adapted for attachment to the dashboard of the vehicle, a spring in the casing, a cord connected to the spring and extending over the pulley into connection with the gear on the opposite side of the center of the same, and manually releasable means for holding the gear stationary against the tension of said spring.

19. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with the shaft to rotate the same, a gear for rotating the pinion, a spring connected with the gear to rotate the same and adapted to be extended by continued rotation of the gear by the engine, a manually releasable bolt carried by the gear, a stop in the path of the bolt to arrest the same and the gear after the spring has been extended, and yielding means for opposing the tension of the said spring as the bolt approaches the stop.

In testimony whereof we affix our signatures hereto, each in the presence of two subscribing witnesses.

GEORGE S. THOMPSON.

RAPHAËL NETTER.

Witnesses to the signature of George S. Thompson:

DOROTHY H. SHEAN,

FRANK E. MANN.

Witnesses to the signature of Raphaël Netter:

S. S. DUNHAM,

FRED I. ELDRIDGE.

Correction in Letters Patent No. 987,930.

It is hereby certified that Letters Patent No. 987,930, granted March 28, 1911, upon the application of George S. Thompson, of Hopkinton, Massachusetts, and Raphaël Netter, of New York, N. Y., for an improvement in "Engine-Starting Apparatus for Automobiles," were erroneously issued to the inventors, said Thompson and Netter, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller as assignees, whereas said Letters Patent should have been issued to the *first-mentioned inventor, George S. Thompson, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller, assignees*, they being owners of the entire interest as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of April, A. D., 1911.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.

actuate the same, a spring-pressed bolt carried by the gear, a stop in the path of the bolt to hold the gear stationary against the tension of its actuating spring, a spring-actuated hammer arranged to strike the bolt and advance the same out of engagement with said stop, and manual means for releasing the hammer.

17. In a starting apparatus for explosive engines, the combination of a supporting frame adapted to be mounted at one end of the engine, a starting gear journaled in the supporting frame, a locking bolt carried by the gear, a stop on the frame and in the path of said bolt, a pulley swiveled at one side of the frame, a cable connected to the gear on the opposite side of the center and passing over the pulley, a spring connected with the cable beyond the pulley, and manual means for releasing the bolt from said stop.

18. In a starting apparatus for explosive engines, the combination with a supporting frame adapted to be mounted in front of the engine, a gear journaled in the frame, a pulley supported by the frame at the top thereof, a casing extending rearwardly from the pulley and adapted for attachment to the dashboard of the vehicle, a spring in the casing, a cord connected to the spring and extending over the pulley into connection with the gear on the opposite side of the center of the same, and manually releasable means for holding the gear stationary against the tension of said spring.

19. In a starting apparatus for explosive engines, the combination with the engine shaft, of a pinion associated with the shaft to rotate the same, a gear for rotating the pinion, a spring connected with the gear to rotate the same and adapted to be extended by continued rotation of the gear by the engine, a manually releasable bolt carried by the gear, a stop in the path of the bolt to arrest the same and the gear after the spring has been extended, and yielding means for opposing the tension of the said spring as the bolt approaches the stop.

In testimony whereof we affix our signatures hereto, each in the presence of two subscribing witnesses.

GEORGE S. THOMPSON.

RAPHAËL NETTER.

Witnesses to the signature of George S. Thompson:

DOROTHY H. SHEAN,

FRANK E. MANN.

Witnesses to the signature of Raphaël Netter:

S. S. DUNHAM,

FRED I. ELDRIDGE.

Correction in Letters Patent No. 987,930.

It is hereby certified that Letters Patent No. 987,930, granted March 28, 1911, upon the application of George S. Thompson, of Hopkinton, Massachusetts, and Raphaël Netter, of New York, N. Y., for an improvement in "Engine-Starting Apparatus for Automobiles," were erroneously issued to the inventors, said Thompson and Netter, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller as assignees, whereas said Letters Patent should have been issued to the *first-mentioned inventor, George S. Thompson, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller, assignees*, they being owners of the entire interest as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of April, A. D., 1911.

[SEAL.]

C. C. BILLINGS,

Acting Commissioner of Patents.

Correction in Letters Patent No. 987,930.

It is hereby certified that Letters Patent No. 987,930, granted March 28, 1911, upon the application of George S. Thompson, of Hopkinton, Massachusetts, and Raphaël Netter, of New York, N. Y., for an improvement in "Engine-Starting Apparatus for Automobiles," were erroneously issued to the inventors, said Thompson and Netter, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller as assignees, whereas said Letters Patent should have been issued to the *first-mentioned inventor, George S. Thompson, and Fred I. Eldridge, William M. Kingsley, and William A. Fuller, assignees,* they being owners of the entire interest as shown by the record of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 25th day of April, A. D., 1911.

[SEAL.]

C. C. BILLINGS,
Acting Commissioner of Patents.