D. B. GARDNER.

STARTER FOR EXPLOSION ENGINES IN SELF PROPELLED VEHICLES.

APPLICATION FILED DEC. 10, 1908.

982,946. Patented Jan. 31, 1911.

3 SHEETS—SHEET 1.

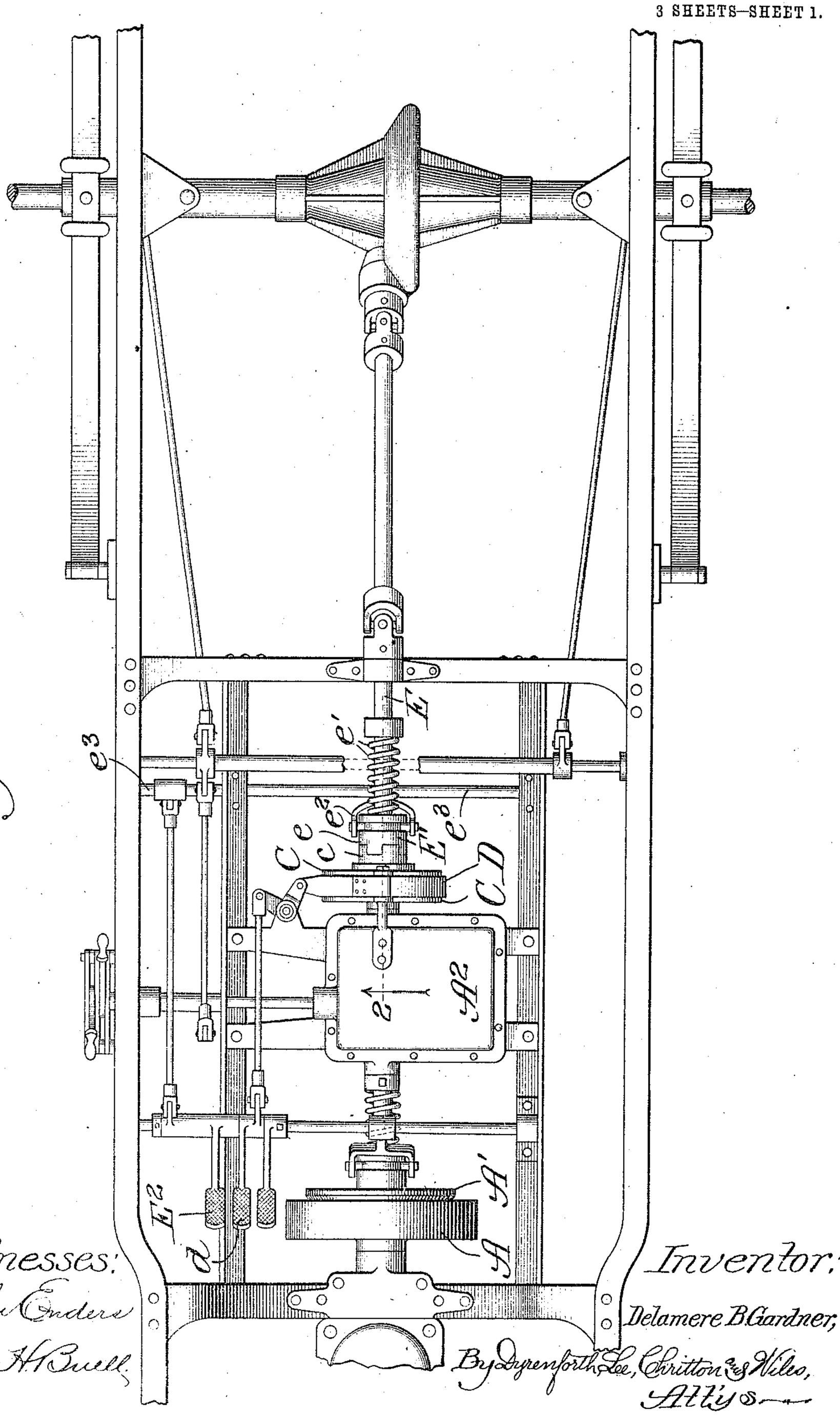

Fig. 1.

Witnesses:
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Chas. H. Buell.

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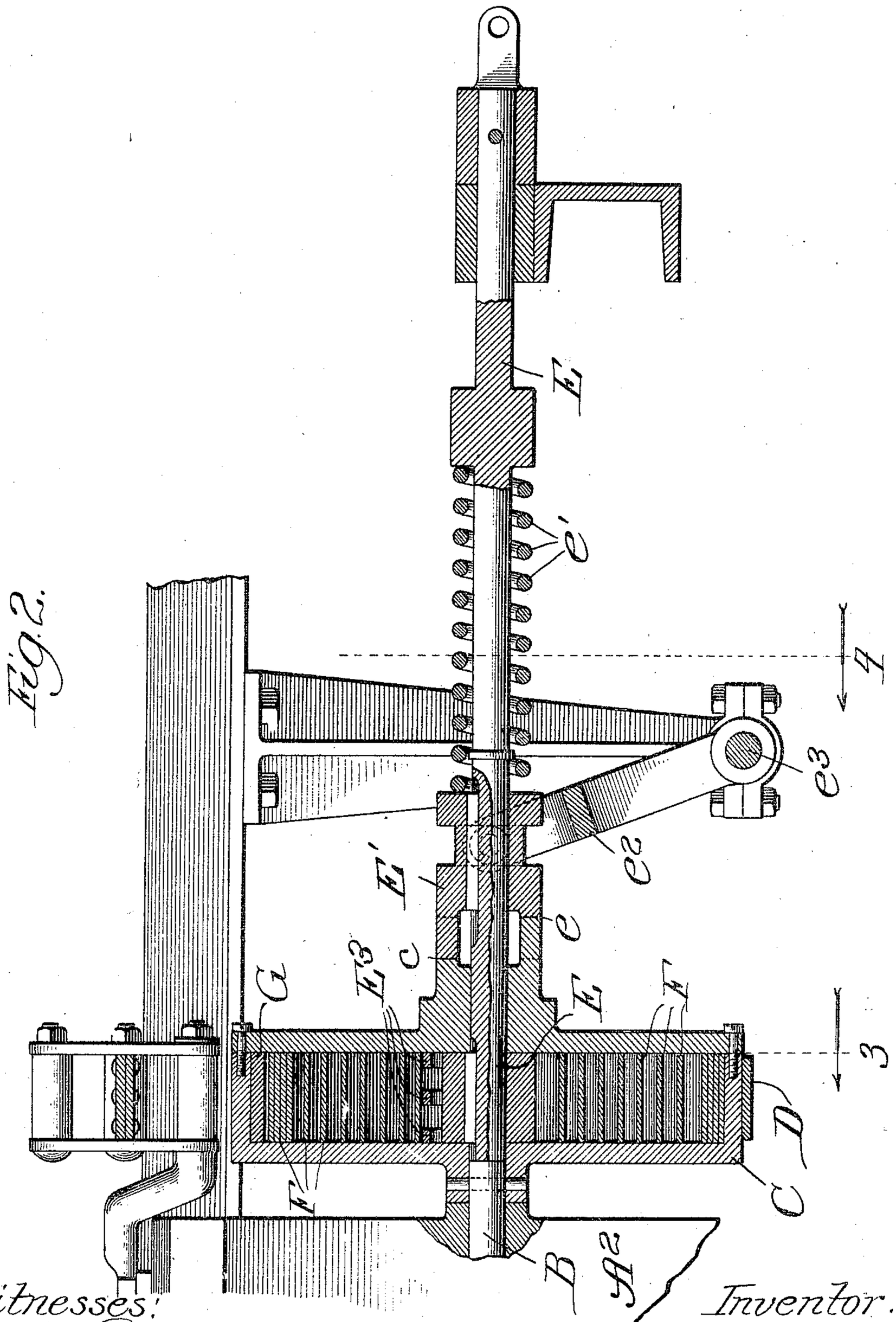
Fig. 2.



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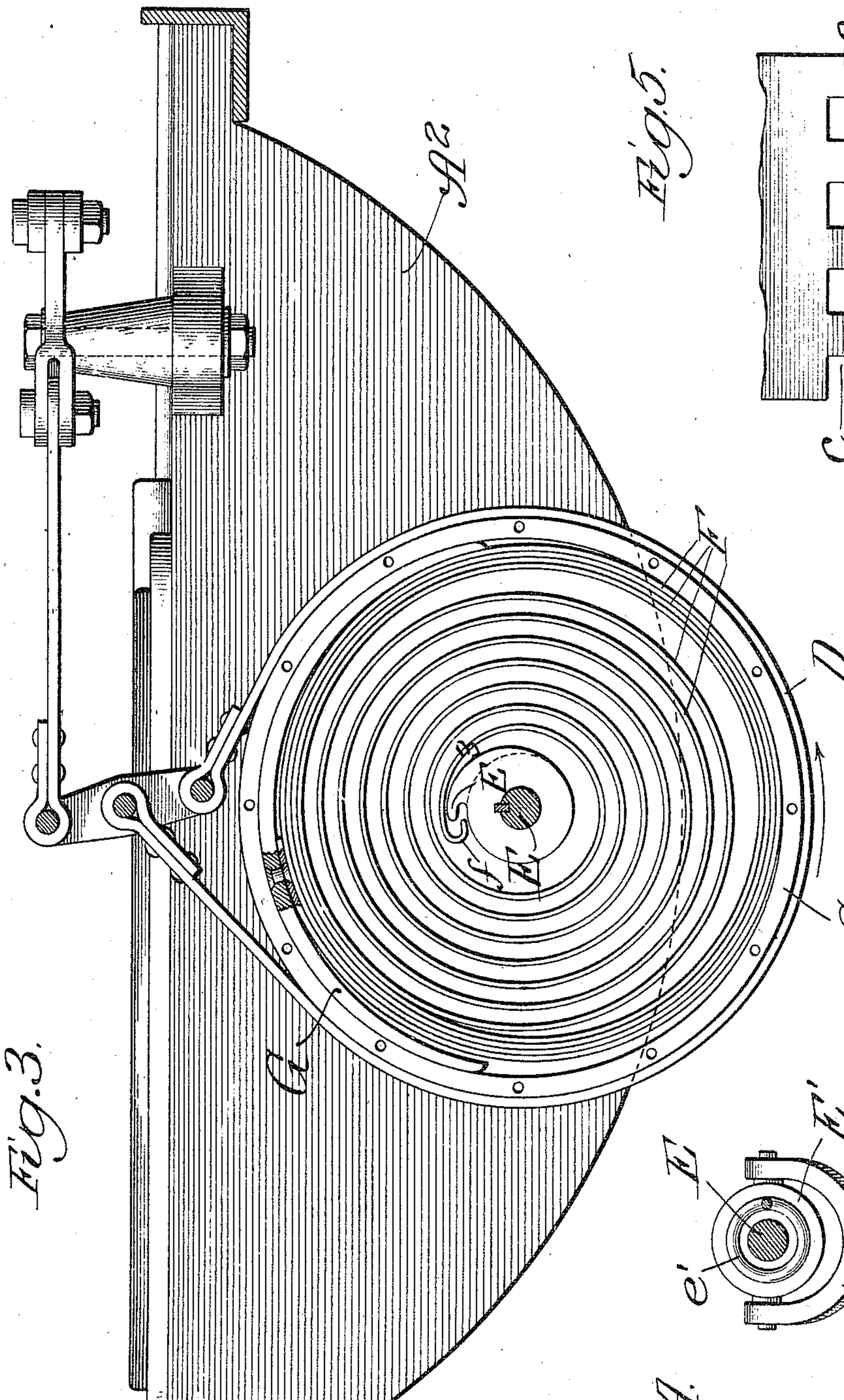

Fig. 3.

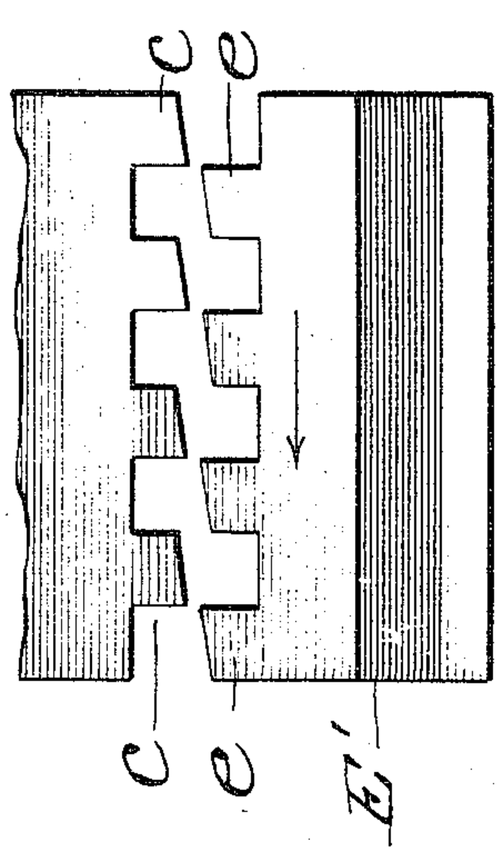

Fig. 4.

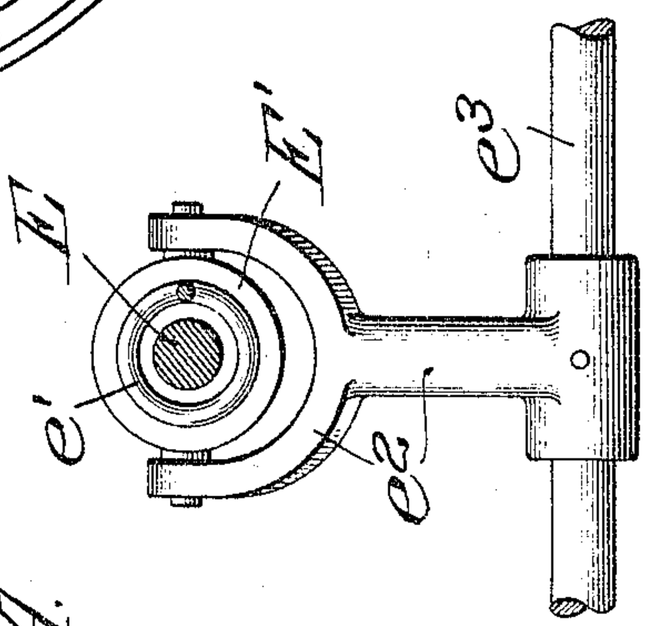

Fig. 4.

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UNITED STATES PATENT OFFICE.

DELAMERE B. GARDNER, OF CHICAGO, ILLINOIS.

STARTER FOR EXPLOSION-ENGINES IN SELF-PROPELLED VEHICLES.

982,946. Specification of Letters Patent. **Patented Jan. 31, 1911.**

Application filed December 10, 1908. Serial No. 466,803.

To all whom it may concern:

Be it known that I, DELAMERE B. GARDNER, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Starters for Explosion-Engines in Self-Propelled Vehicles, of which the following is a specification.

My invention relates to certain new and useful improvements in starters for explosion engines in self-propelled vehicles, and is fully described and explained in the specification and shown in the accompanying drawings, in which—

Figure 1 is a plan view of a chassis embodying my invention; Fig. 2 is a longitudinal vertical section in the line 2 of Fig. 1; Fig. 3 is a section in the line 3 of Fig. 2, looking in the direction of the arrow; Fig. 4 is a broken vertical transverse section in the line 4 of Fig. 2, looking in the direction of the arrow; Fig. 5 is a development, showing the arrangement of the clutch-piece.

Referring to the drawings, A is a fly-wheel connected in the usual way to the engine and B (Fig. 2) is a driving-shaft. Interposed between the driving-shaft B and the engine are the clutch A^1 and the gear-case A^2 both of usual form and adapted to operate and be controlled in the usual manner. Upon the shaft B is rigidly mounted a case C which serves the double purpose of containing certain of the operative portions of the starting-mechanism and of furnishing a cylindrical surface to act as a brake-drum. The case C is surrounded by a brake-band D which is of ordinary form and may be arranged as shown in Fig. 3. The operation of this brake-band is controlled by a foot-lever *d* in the usual manner. To the rear of the case or drum C is a driven-shaft E, which extends through said case to the front thereof and receives a bearing therein as seen in Fig. 2. The rear end of the shaft E is connected by universal joints and intermediate shafting of ordinary construction with the compensating-gear and therethrough with the driving wheels of the vehicle, all in ordinary manner. The shaft E is capable of connection, by means which will presently be described, with the case or drum C, and when so connected, it is obvious that the shaft B, case or drum C, shaft E and the shafting to the rear thereof will all move rigidly after the manner of the corresponding parts of a standard automobile, and the corresponding parts can all be operated in the same way as they would be in such a description.

The rear end of the case or drum C is provided with a boss, the rear surface of which is cut into clutch-teeth *c* which engage with corresponding clutch-teeth *e* upon a movable clutch-collar E^1 upon the driven-shaft E. The clutch-collar is normally pushed forward by means of a spring e^1, and it can be pushed backward through the medium of a fork e^2 on a rock-shaft e^3 connected in any common manner with the foot-pedal E^2 in such a way that downward or forward movement of the foot-pedal will so oscillate the rock-shaft e^3 as to disengage the clutch-collar E^1 from the boss upon the case C.

The construction of the clutch-teeth *c* and *e* is fully illustrated in Fig. 5, from which it will be noted that the teeth are correspondingly beveled and are also provided with parallel sides capable of mutual engagement.

In the device herein illustrated when the vehicle is in its normal forward movement, the shafts and drum will rotate in the directions shown by the arrows in Fig. 3, and thus the acute angles on the teeth *c* and the obtuse angles on the teeth *e* will be forward as shown by the arrows in Fig. 5. The purpose of this beveled arrangement of the teeth is to permit the clutch-collar, when once disengaged, to move forward relatively to the teeth on the drum or case C as long as there is a tendency to fairly rapid relative rotation, thus as long as the parts are in relative rapid movement, the teeth *e* will slip along over the teeth *c* even though the foot be removed from the pedal E^2. Backward relative rotation will be impossible for obvious reasons and the moment the relative movement in a forward direction between the two parts stops, the spring e^1 will force the clutch-collar home so as to prevent relative rotation in either direction.

The forward end of the driven-shaft E is provided with a hook E^3 adapted to engage with the end *f* of a spring F, coiled up within the case or drum C in such direction that rotation of the inner end of the spring with reference to the outer end in the same direction in which the shaft turns will wind up the spring. The hook E^3 is turned so as to engage with the hooked end of the spring for winding purposes, and is so shaped, that

it can readily slip past the end of the spring when turned in a reversed direction. The outer end of the spring may, if desired, be rigidly secured to the periphery of the drum C, but I prefer to leave the outer end of the spring loose within the drum and provided with a shoe G conforming in curvature to the inner surface of the drum, the spring being attached to the shoe centrally of its length. This construction is such that the spring may be wound up to a certain extent, its outer end being held fast by frictional engagement of the shoe with the inner surface of the drum, and when sufficient winding has been effected, the shoe will slip thus preventing any excessive strain on the spring and providing a smooth sliding movement which is valuable for purposes hereinafter described.

The apparatus described in detail is an improvement upon that shown in my Patent No. 896,375 granted August 18th, 1908, and its operation will be readily apparent. When the vehicle is to be stopped the brake is applied, and the pedal E^2 pushed to disengage the clutch on the shaft E from the casing or drum C. In practice it will probably be preferable to disengage the clutch before applying the brake but the two operations will be performed at substantially the same time or in rapid succession not particularly material. As soon as both operations have been performed the motion of the drum or case C will be retarded while the motion of the driven-shaft will continue at the speed of the vehicle, with the result that the spring will be wound up. It is unnecessary to hold the foot on the lever E^2 by reason of the fact that when the clutch has once been pushed out it will stay out on account of the beveled faces of the teeth until the spring is completely wound up and relative motion between the two parts substantially ceases when the clutch will go in. When the spring is completely wound up slippage will occur either between the outside end of the spring and the drum or case C or between the drum or case and the brake-band as the case may be, the vehicle thus being brought to a complete stop. As soon as the spring is wound up, the clutch will automatically go in, holding the spring in its wound condition. During the stopping operation the clutch E^1 may be thrown out at any desired time although it will be observed that any winding action will be entirely wasted between the time when the clutch E^1 is thrown out and the brake-band is applied.

The brake is handled in the usual way throughout the entire operation of the vehicle. When the machine has come to a stop it will usually be released, although if the machine were standing upon a hill it might be locked in braking position and released just at the moment of preparing to start the engine.

When it is desired to start the engine, the clutch A^1 is in and the clutch-roller E^1 is moved back by manipulating the pedal E^2. During this operation it is necessary that the pedal should be held down in order to prevent the meeting of the acute angles of the clutch-teeth. The potential energy stored in the spring will, when the spring is released, give rise to power which will be transmitted through its outer end to the drum, thence through the gear-case and clutch A^1 to the engine starting the same in the proper direction. As soon as the engine has begun to explode, the clutch A^1 can be thrown out if desired, or if it be not thrown out, the hooked end of the spring F will run over the rear of the hook E^3 permitting the engine to run free. The gears can then be shifted, and the car started in the usual manner. It is obvious that the clutch A^1 must be disengaged before shifting the gears.

My present device is preferable to the one described in my patent by reason of its greater simplicity of construction and operation and by reason of the further fact that the power is stored behind the gear-case. By reason of this fact it is possible to greatly multiply the number of turns transmitted to the engine in starting, for the gears can be set to transmit any desired ratio of speed to the engine depending upon the circumstances. In cold weather where a number of exceedingly rapid turns are necessary, the result can readily be accomplished.

It will be evident from an inspection of the construction illustrated and described that should it, for any reason, be desirable to wind up the spring without first getting the vehicle under way and stopping, this result can be accomplished by setting the transmission-gears in the reverse position, and then throwing in the main clutch. The driven-shaft will then be stationary, being held so by engagement of the vehicle-wheels with the roadway, and the driving-shaft will move in the reverse direction therefore winding up the spring. The clutch-collar E^1 would, of course, be operated in exactly the same manner as when the spring is wound up in the manner heretofore described. When the spring has been completely wound up in this manner, the clutch-collar will fall in automatically, and the vehicle will then either start to move backward or the main clutch will slip, depending upon whether the auxiliary-brake is applied to the wheels and on the amount of friction in the main-clutch. As soon as the clutch begins to slip or the vehicle to move backward, the clutch is disengaged, the gears shifted and the vehicle is in condition to move off in the usual way with the spring wound ready for another starting of the

motor. It will be noted that in this manner of manipulation the band-brake D is not a necessary element in the winding of the spring. While I consider the manner of manipulation first described as the preferable one, the method of winding by setting the transmission at reverse while the vehicle is stationary may be desirable under certain conditions and it is much more advantageous in those vehicles where there is no brake normally applied to the shaft, but where the two brakes are both on the wheels, one being usually a band-brake and the other an internal-expansion brake. In applying my starting apparatus to such vehicles, the provision of a third brake acting upon the shaft might lead to undue complexity which, however, can be entirely avoided by omitting the band-brake D entirely and restricting the mode of operation to that just described.

I realize that considerable variation is possible in the details of construction of my improved device, without departing from the spirit of my invention, and I do not intend therefore, to limit myself to the specific form herein shown and described.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination with a driving-shaft having operative connection with an internal combustion engine and a driven-shaft, of means adapted to connect said shafts and to disconnect the same, a spring adapted to absorb the momentum of the driven shaft and the parts carried thereby when said shafts are disconnected, means for connecting said spring with said driving-shaft to rotate the same for the purpose of starting the engine, and a ratchet-connection interposed between one end of said spring and one of said shafts whereby after the engine is started, it can run free without reversing the winding of the spring.

2. The combination with a driving-shaft having operative connection with an internal combustion engine and a driven shaft having connection with the running gear of the vehicle, of means adapted to connect said shafts and to disconnect the same, a spring having permanent engagement with the driving-shaft at one end and having a ratchet-connection with the driven-shaft at the other end and adapted to absorb the momentum of the driven-shaft and the parts carried thereby when said shafts are disconnected, said ratchet-connection serving to permit the driving-shaft to run faster than the driven-shaft when the shafts are disconnected and after the engine has been started.

3. The combination with an engine, a driving-shaft and an interposed gear-changing device, of a driven-shaft having releasable connection with the driving-shaft and means for absorbing the momentum of said driven-shaft and the parts connected therewith and storing the energy thereof while said shafts are disconnected and for transmitting such stored energy to the driving-shaft and thence through the gear-changing device to the engine for starting purposes.

4. The combination with a driving-shaft and means for applying a brake thereto, of a driven-shaft and means for engaging the same with the driving-shaft, a spring having at one end a connection with the driving-shaft, and ratchet means carried by the driven-shaft and adapted to engage the opposite end of the spring.

5. The combination with a driving-shaft, a driven-shaft and means for engaging the same, of a drum on the driving-shaft, a spring having frictional engagement therewith at one of its ends, and having at its opposite end means for engagement with the driven-shaft.

6. The combination with a driving-shaft, a drum mounted thereon, means for applying a brake to the outer surface of the drum, a spring wound within the drum, a driven-shaft, means for engaging the driven-shaft with the drum and means of connection between the driven-shaft and the opposite end of said spring.

7. The combination with a driving-shaft, a drum mounted thereon, means for applying a brake to the outer surface of said drum, a spring having frictional engagement at its outer end with the inner surface of said drum, a driven-shaft, means for engaging said driven-shaft with said drum and a hook on said driven-shaft adapted to engage the inner end of said spring.

8. The combination with a driving-shaft having connection with an internal combustion engine and a drum rigidly secured thereto, of means for applying a brake to the periphery of said drum, a spring wound within said drum and having connection at its outer end therewith, a driven-shaft, a clutch for connecting the same with the driving-shaft and means of connection between the inner end of said spring and said driven-shaft.

9. In an automobile, a driven-shaft connected to the propelling wheels of the vehicle, a driving-shaft having releasable connection therewith, a spring interposed between said driving and driven-shafts and adapted to be wound by relative movement between said shafts and when unwound to cause relative movement between the same, an internal combustion engine and a gear-changing device connecting the engine and driving-shaft, whereby by setting said gear-changing device in one position the spring will be wound by the action of the engine and by setting it in an opposite position the spring will turn the engine in a proper direction for starting, said gear-changing de-

vice serving also for the transmission of power in the usual way to the propelling wheels.

10. In an automobile, a driven-shaft connected to the propelling wheels of the vehicle, a driving-shaft having releasable connection therewith, a spring interposed between said driving and driven-shafts and constructed so as to be wound by relative forward rotation of the driven-shaft with reference to the driving-shaft and in unwinding when the driven-shaft is stationary to transmit forward rotation to the driving-shaft, an internal combustion engine and a gear-changing device connecting the engine and driving-shaft, whereby by setting the gear-changing device at reverse the spring will be wound by the action of the engine and by setting it in its normal position the spring will turn the engine in a proper direction for starting, said gear-changing device serving also for the transmission of power in the usual way to the propelling wheels.

11. The combination in an automobile, with an engine, a driving-shaft and an interposed gear-changing device, of a driven-shaft and means for engaging the same with the driving-shaft, a spring having at one end a connection with the driving-shaft, and ratchet means carried by the driven-shaft and adapted to engage the opposite end of the spring.

12. The combination with a driving-shaft and a driven shaft, of a spring having at one end connection with the driving-shaft and at the other end connection with the driven-shaft, and a clutch adapted to connect the driving and driven-shafts, said clutch being provided with teeth having parallel longitudinal faces and beveled transverse faces, the bevels running in opposite directions upon the two clutch-members, whereby when the clutch is once thrown out it will stay out until relative movement between the shafts ceases whereupon the clutch will automatically go in.

DELAMERE B. GARDNER.

In presence of—
CHAS. E. GAYLORD,
L. G. KIRKLAND.