J. L. ADAMS, JR.

STARTING MECHANISM.

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1,210,028. Patented Dec. 26, 1916.

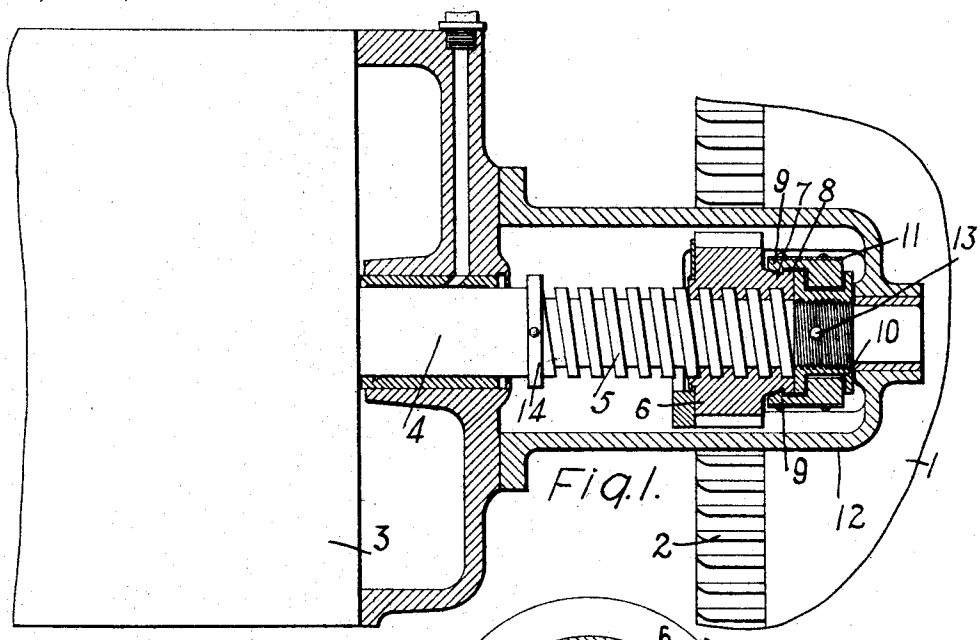


Fig. 1.

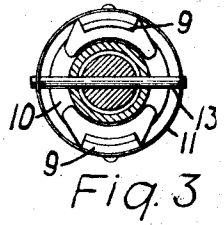


Fig. 3

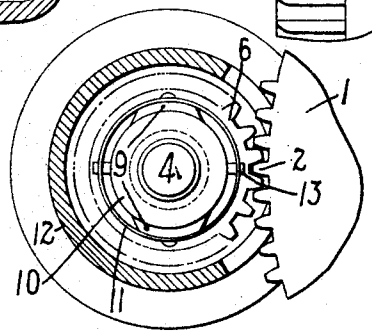


Fig. 2.

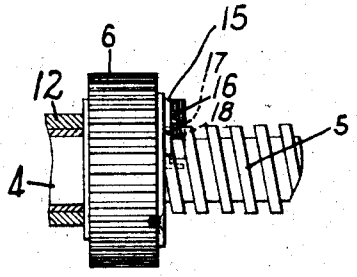


Fig. 4.

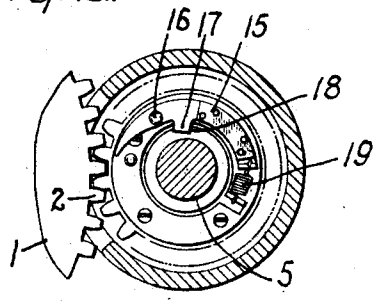


Fig. 5.

WITNESSES:

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STARTING MECHANISM.

1,210,028. Specification of Letters Patent. Patented Dec. 26, 1916.

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To all whom it may concern:

Be it known that I, JAMES L. ADAMS, Jr., a citizen of the United States, and a resident of Wilkinsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Starting Mechanisms, of which the following is a specification.

My invention relates to starting mechanisms for internal combustion engines and it has particular reference to such mechanisms as embody screw-threaded shafts for controlling the operative connections of starting motors to engine shafts.

My invention has for its object to provide a simple and efficient arrangement whereby the operative connection of a starting motor to the shaft of an internal combustion engine may be controlled automatically in accordance with the engine speed.

It has been found, in practice, that starting mechanisms of the same general character as that of my invention possess the defect of alternately connecting and disconnecting the motor from the engine shaft because of fluctuations in engine speed as the engine is respectively rotated toward and away from the points of highest compression in the engine cylinders. This condition obtains especially in connection with electric starting motors that are adapted to operate at high speed through reduction-gear mechanisms for cranking the engine. In such cases, the energy stored in approaching the compression points is so great that the increase in speed of the usual engine fly wheel after passing these points cannot be followed quickly enough by the starting motor to prevent their mechanical disconnection, because of the high speed ratio at which the latter is arranged to operate.

According to the present invention, I provide an arrangement for locking the motor pinion to its actuating shaft when it is fully meshed with the fly wheel gear or other gear wheel operatively connected to the engine shaft. The locking mechanism is automatically released when the engine starts under its own power and drives the pinion at a predetermined speed which is above that occurring during the operation of cranking.

The details of my invention will be described in connection with the accompanying drawings in which—

Figure 1 is a side view, partially in elevation and partially in section, of a portion of an engine fly wheel with my invention applied thereto. Fig. 2 is a sectional view of the mechanism of Fig. 1. Fig. 3 is an end view of the collar member. Fig. 4 is a view, similar to Fig. 1, of a modification, parts being broken away. Fig. 5 is a view, in transverse section, of the mechanism of Fig. 4.

Referring particularly to Figs. 1 and 2, an engine fly wheel 1, only a portion of which is shown, is provided with gear teeth 2. An electric motor 3, which may be mounted on any suitable stationary part (not shown) adjacent to the fly wheel, is provided with an armature shaft 4 having a screw-threaded portion 5. An eccentrically weighted pinion 6 is provided with coacting screw threads and is adapted to be actuated by the shaft 5 into and out of mesh with the gear teeth 2. The ends of the gear teeth 2 and the teeth of the pinion 6 may be beveled or inclined in order to facilitate their meshing. The pinion is provided with an integral grooved collar 7 having shoulder portions 8 to be engaged by a pair of clips or latches 9 and are loosely carried by a collar member 10 on the shaft 4 and are connected by an annular spring 11. The shaft 4 has an outer bearing in a housing 12 which incloses the shaft 4 and its connected parts. A pin 13, which extends through the shaft 4 and through suitable openings in the spring 11, insures that equal outward movements of each of the clips 9 will occur. Normally, the pinion 6 occupies a position at the extreme left of the screw-threaded portion 5 adjacent to a collar member 14. To start the engine, power is supplied to the motor 3 through any suitable connections (not shown). The shaft 4 then rotates in a clockwise direction, as viewed from the right. Because of the rapid acceleration of the motor shaft, and the inertia of the pinion 6, the former overruns the

latter, and the pinion is actuated to the right along the shaft into mesh with the fly-wheel gear teeth.

When the pinion is in engagement with the collar 10, which operates as a stop member, the clips 9 engage the collar member 7 of the pinion, and the various parts occupy the respective positions illustrated in Fig. 1. The fly wheel 1 is then rotated by the motor to start the engine. During the cranking operation, the motor operates the fly wheel at varying speeds because of the variation in load as the motor approaches or passes beyond the compression points of the engine. Ordinarily, the sudden increases in speed of the fly wheel, as it passes the successive compression points of the engine, would operate to actuate the pinion out of mesh with the gear teeth 2 because of the inability of the motor to accelerate at a sufficiently high rate to compensate for the temporarily increased speed of the fly wheel. In the present case, however, the clips 9 operate to maintain the pinion in its illustrated position so as to cause the fly wheel to drive the motor while the speed of the former is increasing. The result is to cause the fly wheel to be retarded by the force required to accelerate the motor. The engine is thus started by the motor without any possibility of the pinion being disconnected from the fly wheel during the operation. When the engine starts under its own power, the pinion 6 and the shaft 4 will be rotated at a rapidly increasing speed. When the speed reaches a predetermined rate, for which the weights of the clips 9 have been adjusted, the latter will be actuated outwardly by centrifugal force to release the collar member 7. The pinion 6 will then be driven at a higher rate of speed than the shaft 4 and will be actuated along the shaft 4 to the left, as shown, and out of mesh with the fly-wheel gear teeth 2. The motor circuit may then be opened by the operator to permit the motor to come to rest.

Reference may now be had to Figs. 4 and 5, in which a modification is illustrated, like numerals being employed to designate corresponding parts. In this form of my invention, the pinion 6 is provided with a weighted arm 15 having a pivotal support at 16. The arm is provided with a projecting pawl or lug 17 which projects into a recess 18 in the shaft 5 when the pinion is fully in mesh with the fly wheel. A spring 19 yieldingly retains the arm 15 in its inner position to effect the entrance of the lug 17 into the coacting recess 18 when they are in register.

It may be assumed that the pinion 6 has been actuated to the left, Fig. 3, into mesh with the fly-wheel gear teeth 2, in the manner above described in connection with Figs. 1 and 2. The lug 17 then occupies the recess 18, and the pinion 6 is thereby locked to the shaft 5 so that relative rotation of these parts is positively prevented. This connection is maintained during the cranking of the engine, and the varying speeds of the fly wheel can not operate to shift the pinion 12 out of engagement.

When the engine starts under its own power, the weighted arm 15 will be actuated outwardly by centrifugal force to withdraw the lug 17 from the recess 18. The pinion 6 will then overrun the shaft 5 and will be actuated to the right to its inoperative position.

It will be noted that I provide a simple and effective means for preventing the disconnection of the motor pinion from the fly-wheel gear during the operation of cranking. The mechanism for locking the pinion to the screw threaded shaft is automatically released at a predetermined speed which is higher than that occurring during the cranking operation. The predetermined speed will be so arranged, however, at such a value that the connections will be broken before the motor is driven at an excessively high rate.

Many modifications may occur to those skilled in the art to which my invention appertains. It is understood, however, that such changes as fall within the scope of the appended claims may be made without departing from the spirit of my invention.

I claim as my invention:

1. In a starting mechanism, the combination with two coacting gear wheels, and means for automatically actuating one gear wheel into and out of mesh with the other, of speed-controlled means for locking said gear wheels in operative position.

2. In a starting mechanism, the combination with an engine shaft, a starting motor, and means for operatively connecting the motor to said shaft, of means for locking said connecting means in operative position while the engine rotates below a predetermined speed.

3. In a starting mechanism, the combination with two coacting gear wheels, and means comprising a screw-threaded shaft for effecting the meshing and demeshing of said gear wheels, of automatic means for preventing movement of one of said gear wheels relatively to said shaft, under predetermined conditions.

4. In a starting mechanism, the combination with a gear wheel, a pinion coacting therewith, and means for actuating said pinion into and out of mesh with said gear wheel according as the pinion constitutes the driving or the driven member, of means for automatically locking said pinion in its operative position.

5. In a starting mechanism, the combi-

nation with an engine, a gear wheel operatively connected thereto, a pinion, and a motor having a screw-threaded shaft for actuating said pinion into and out of mesh with said gear wheel, of centrifugally actuated means for locking said pinion in its operative position.

6. In a starting mechanism, the combination with an engine, a gear wheel operatively connected thereto, a pinion, and a motor having a screw-threaded shaft for actuating said pinion into and out of mesh with said gear wheel, of speed-responsive means for locking said pinion in its operative position.

7. In a starting mechanism, the combination with a starting motor, two coacting gear wheels, and means for automatically actuating one gear wheel into mesh with the other upon the initial operation of said motor, of centrifugally controlled means for releasing said gear wheels from their operative positions.

In tesimony whereof I have hereunto subscribed my name this 8th day of April, 1915.

JAMES L. ADAMS, JR.

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