

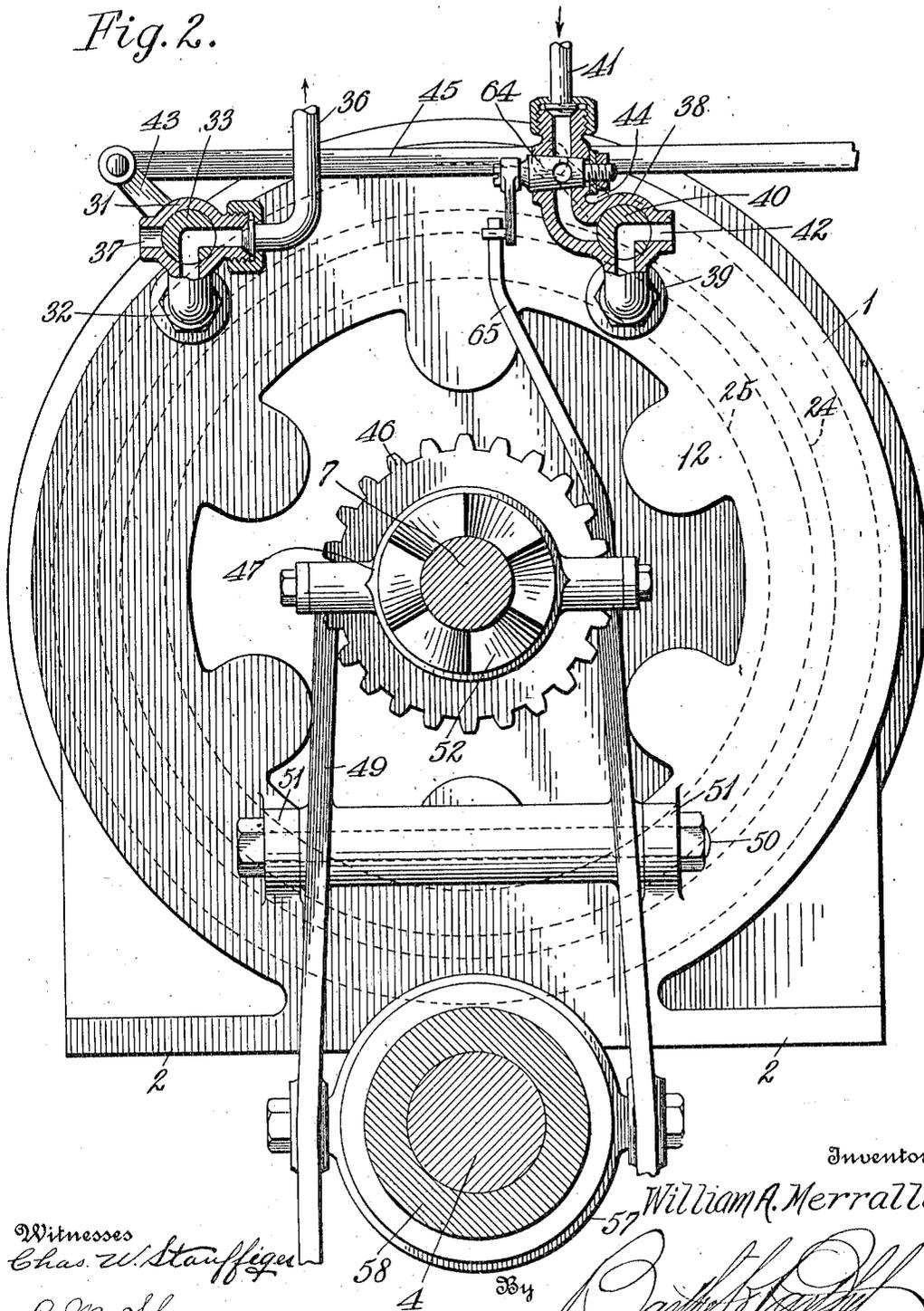
W. A. MERRALLS.
 ENGINE STARTER.
 APPLICATION FILED SEPT. 9, 1912.

1,107,687.

Patented Aug. 18, 1914.

3 SHEETS-SHEET 2.

Fig. 2.



Witnesses
 Chas. W. Stauffer
 R. M. Shannon

Inventor
 William A. Merralls,
Charles H. [Signature]
 Attorneys

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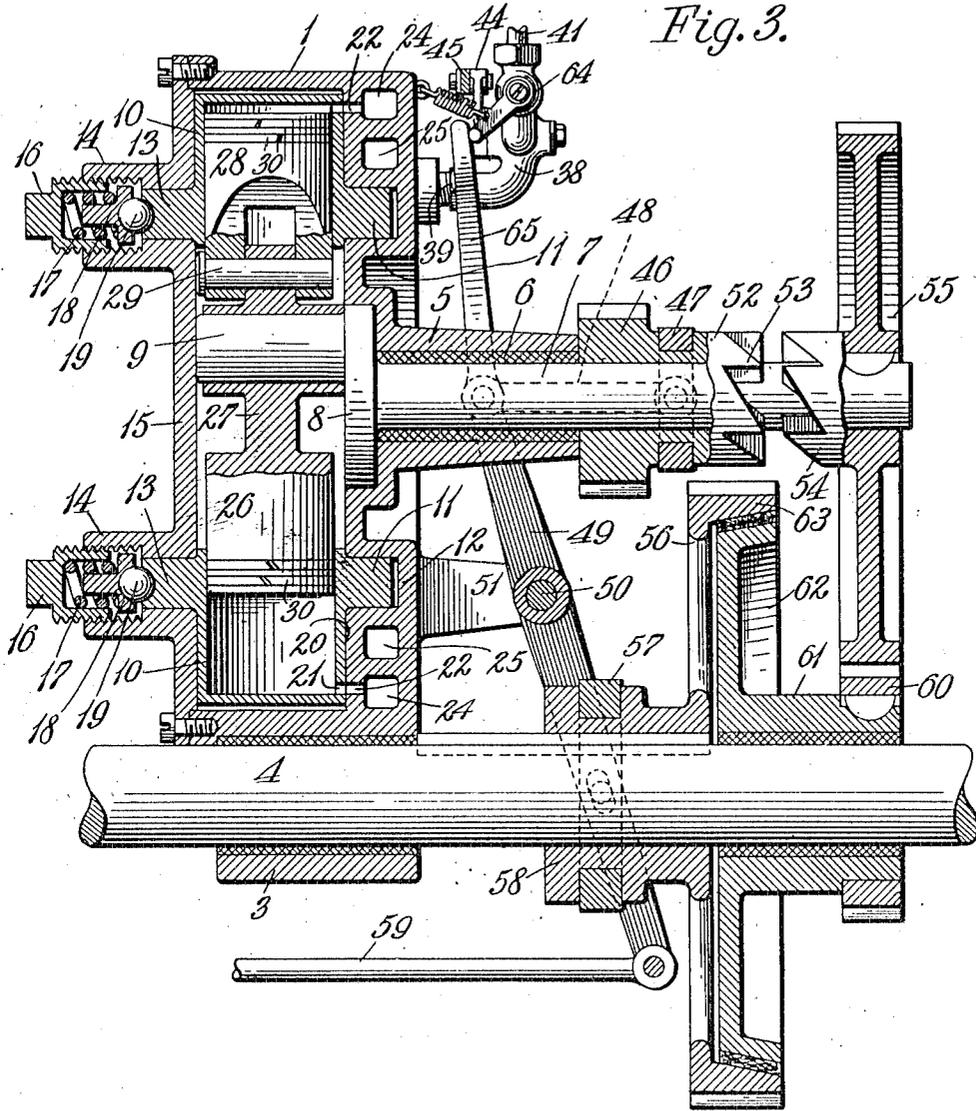


Fig. 3.

Inventor

William A. Merralls,

Witnesses

Chas. W. Stauffiger

A. M. Shannon.

By

Barthelme
 Attorneys

UNITED STATES PATENT OFFICE.

WILLIAM A. MERRALLS, OF DETROIT, MICHIGAN.

ENGINE-STARTER.

1,107,687.

Specification of Letters Patent.

Patented Aug. 18, 1914.

Application filed September 9, 1912. Serial No. 719,356.

To all whom it may concern:

Be it known that I, WILLIAM A. MERRALLS, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Engine-Starters, of which the following is a specification, reference being had therein to the accompanying drawings.

In the operation of internal combustion motors it is desirable in applying starters thereto, that the motor be mechanically rotated and thereby made to compress and explode its normal fuel charge, so as to avoid undue strain and shock to the parts, such being the result of the priming or fuel injecting starters. It is also necessary in applying starting devices to internal combustion motors that they be so arranged as to be positive in action regardless of the position of the engine, so as to overcome any "dead center". It is also advantageous that the starter be compact, simple and be readily applied to any type of motor.

This invention relates to a starter for explosive engines that is mechanical in action, that is simple and positive in operation and that may be converted, if desired, into means for charging or storing the starter propelling medium.

In general terms the invention comprises a rotor adapted to be driven by fluid under pressure or when mechanically turned, to compress fluid, together with means for automatically disconnecting the rotor under certain conditions of service from the driven or driving member. In form the rotor consists of a plurality of symmetrically disposed oscillatory cylinders with pistons reciprocating therein and operating on a common crank shaft, the method of connection being such as to avoid any dead center and to increase the torque imparted to the crank shaft by the piston.

The invention consists in the matters hereinafter set forth and pointed out in the appended claims.

In the drawings, Figure 1 is a view in end elevation with a front plate removed and parts shown in section, of a starter that embodies features of the invention together with a motor shaft to which it may be coupled; Fig. 2 is a view, partially in elevation and partially in section, of the other end of the starter; and Fig. 3 is a view in section

through the starter on or about line III—III of Fig. 1.

Referring to the drawings an external casing of appropriate design to combine strength with lightness has lugs 2 or brackets by which it may be attached to the support or base of a motor, and preferably includes a bearing boss 3 in which the shaft 4 to be driven may be journaled. A bearing sleeve 5 on one end face of the casing is concentric with the cylindrical chamber of the latter and affords support, through an appropriate bearing sleeve 6 or the like, to a main shaft 7. A wrist plate 8 on the inner end of the shaft carries a wrist pin 9 eccentric to the latter in the casing chamber. A series of oscillatory cylinders 10 are each journaled on oppositely disposed studs. One, 11, of these engages a bearing socket in the end wall 12 of the casing adjacent the bearing sleeve 5. The other stud 13 is journaled in a chambered lug 14 of a plate 15 that is removably secured to the casing 1 as the outer wall thereof. A friction end thrust bearing yieldingly forces each cylinder toward the wall 12. Preferably this is in the form of a cap 16 screwthreaded into the boss 14 to compress a spring 17 against a thrust plate 18 that forces a bearing ball 19 against the end of a stud 13, the thrust plate and stud being appropriately hollowed to form seats for the ball. Each cylinder has a bearing face indicated at 20 with port 21 therethrough which may be brought into register by oscillation of the cylinder with an inlet opening 22 in the wall 12 and an exhaust or outlet aperture 23. The inlet openings 22 are in communication with a common duct or passage 24 formed in the end wall 12 of the casing and an exhaust passage 25 is likewise in communication with each one of the exhaust ports 23. One of the cylinders 10 is provided with a plunger piston 26 that is termed a master piston and is rigidly secured to or made integral with a disk 27 that is journaled on the wrist pin 9. The other cylinders have plunger pistons 28 which are articulated to the disk 27 by pivot pins 29. Each piston is provided with a suitable packing ring as indicated at 30. A three-way cock 31 mounted in a nipple 32 of the end wall 12 is in communication with the passage 24 and has a closure 33, which when oscillated may bring the passage into com-

5 munication either with a pipe 36 adapted to lead to an air tank, or with an outlet 37 opening to air. Similarly a three-way cock 38 in a nipple 39 of the end wall 12 is in communication with the passage 25 and has
 10 a closure 40 whereby this passage may be thrown into communication either with a pipe 41 leading to the same air tank as the pipe 36, or to an opening 42 to air. A rock arm 43 that operates the closure 33 and a similar member 44 that turns the closure 40 may be coupled by a link 45 so that when the latter is at one end of its throw one of the valves and communicating passage is open to the tank, while the other valve and companion passage is open to the air.

15 A clutch pinion 46 is rotatably and reciprocally secured on the main shaft 7 with a yoke 47 and means for shifting it, which may conveniently consist of a double-arm link 48 pivoted to the extremities of an H-lever 49 that swings on a pivot pin 50 secured in lugs 51 on the casing wall 12. A hub 52 of the pinion 46 has ratchet shaped teeth or projections indicated at 53 by which it may be made to mesh with the correspondingly toothed hub 54 of a gear 55 made fast to the shaft 7. A sliding gear 56 is non-rotatably and reciprocally mounted on the shaft 4 to be driven so as to be thrown into mesh with the pinion 46. This may conveniently be accomplished by coupling a yoke 57 that is journaled in a groove of a hub 58 of the gear 56 to the lever 49 so that movement of the latter in one direction as by a rod 59 or the like, slides the pinion 46 into engagement with the gear 56 and at the same time throws the hubs 52 and 54 into locking engagement.

40 A pinion 60 is keyed or otherwise made fast to the sleeve 61 of a friction disk 62 that is journaled on the shaft 4 and is arranged to engage with the correspondingly beveled rim face 63 of the pulley 56 when the latter is moved to the position shown in Fig. 3 completely clear of the pinion 46, while the hubs 52 and 54 are disconnected.

50 The mechanism is mounted in proper operative relation to the motor shaft or other part to be turned and is connected through its pipes with a compressed air tank. While the gear 56 is disconnected both from the pinion 46 and from the friction drum 62 the motor may be started by hand and the gear 56 then thrown into engagement with the friction drum 62. At the same time the closures 33 and 40 are so shifted by the member 45 that the rotation of the shaft 7 and consequent reciprocation, in succession of the pistons 28 draws air from the outlet of one of the valves and forces it through the other valve into the air tank. When sufficient pressure is in the tank the gear 56 is thrown out of engagement with the drum 62. Thereafter when it is desired to start

the motor the position of the closures 33 and 40 is reversed and at the same time the pinion 46 slid into engagement with the gear 56 with its hub 52 interlocking with the hub 53. The compressed air causes the pistons to reciprocate in succession, thereby imparting a practically continuous torque to the shaft 7 which is communicated through the gear 56 to the shaft 4. When the motor which normally drives the shaft 4 "picks up" and exceeds the speed with which it is driven by the starter, the camming action of the beveled faces of the ratchet teeth on the hub 54 cause the pinion 46 to slide out of engagement with the gear 56 and leave the starter in position for further use.

One of the passages 24 or 25 may be omitted if it is desired to use the starter merely as a motor and not as a compressor, in which instance the gear 55 and friction drum 62 may be omitted, a suitable ring with ratchet teeth being fixed with the shaft 7 to take the place of the hub 54. The form herein shown is preferable, however. The pinion 46 and gear 56 constitute a starter driving mechanism while the gear 55, pinion 60, drum 62 and engaging member 56 may be said to constitute the compressor driving mechanism if the starter be provided with the extra passage and valve for operating as a compressor.

As a further convenient feature of control a suitable self-closing shut off cock 64 is placed in the pipe line 41 which is used when the device is operated as a starter. Suitable connections indicated at 65 operate to hold this cock open whenever the pinion 46 is approaching complete mesh or engagement with the gear 56.

One advantage of the mechanism is its compactness and its simplicity as the operating pistons and cylinders may work in oil or other lubricant if desired and have but few parts. Another feature is the elimination of any "dead center" effect owing to the angular relation of the pistons and the fact that the master piston acts as a lever fulcrumed on the studs of its companion cylinder that is oscillated by the transverse thrusts of the other pistons. Another advantage is the automatic release of the starter when the motor has picked up so that the latter is not loaded by the starting mechanism when in full operation. The fact that the starter may be operated as a compressor when the motor is running makes the starter particularly effective and useful on automobiles where it is difficult to maintain a very large storage tank. As the parts of the mechanism are few it is easy to assemble and adjust the same and when once in operation the apparatus is not liable to displacement or injury.

Any form of coupling or connecting means may be used to drive the rotatable

member or shaft from the crank shaft, whereby the former may be turned at equal speed or in any desired ratio to the speed of the crank shaft so long as it comes within the limits of good machine-shop practice and is suitable for the purpose within the range of operation of the starting mechanism as a whole.

Obviously, changes in the details of construction may be made without departing from the spirit of my invention and I do not care to limit myself to any particular form or arrangement of parts.

What I claim is:—

1. In an engine starter, a casing, a crank shaft journaled therein, cylinders oscillatory in the casing provided each with a port adapted to open alternately into an inlet and an exhaust passage of the casing, pistons in the cylinders operatively connected to the crank shaft, a pinion rotatable and reciprocable on the crank shaft, means adapted to lock the pinion with the shaft and to release the pinion from turning with the shaft when the pinion rotates faster than the shaft, a rotatable member, a gear on the latter adapted to mesh

with the pinion, and means adapted to throw the pinion into mesh with the gear and into engagement with the shaft.

2. In a starter for an explosive engine, a casing having an inlet and an exhaust passage, valves each controlling a passage, a crank shaft journaled in the casing, cylinders oscillatory in the casing around the crank shaft each with a port adapted to open into the passage alternately, pistons reciprocatory in the cylinders operatively connected to the crank shaft to rotate the latter and oscillate the cylinders, a rotatable member, means for operatively connecting the member and crank shaft adapted to automatically disconnect the shaft and member when the speed of the latter exceeds the speed of the former, and means for operating the inlet and exhaust valves adapted to close one and open the other when the member is disconnected from the crank shaft.

In testimony whereof I affix my signature in presence of two witnesses.

WILLIAM A. MERRALLS.

Witnesses:

CLEMENT R. STICKNEY,
Q. M. SHANNON.