F. C. PRIESTLY.

ENGINE STARTER.

APPLICATION FILED DEC. 2, 1909.

977,043.

Patented Nov. 29, 1910.

2 SHEETS—SHEET 1.

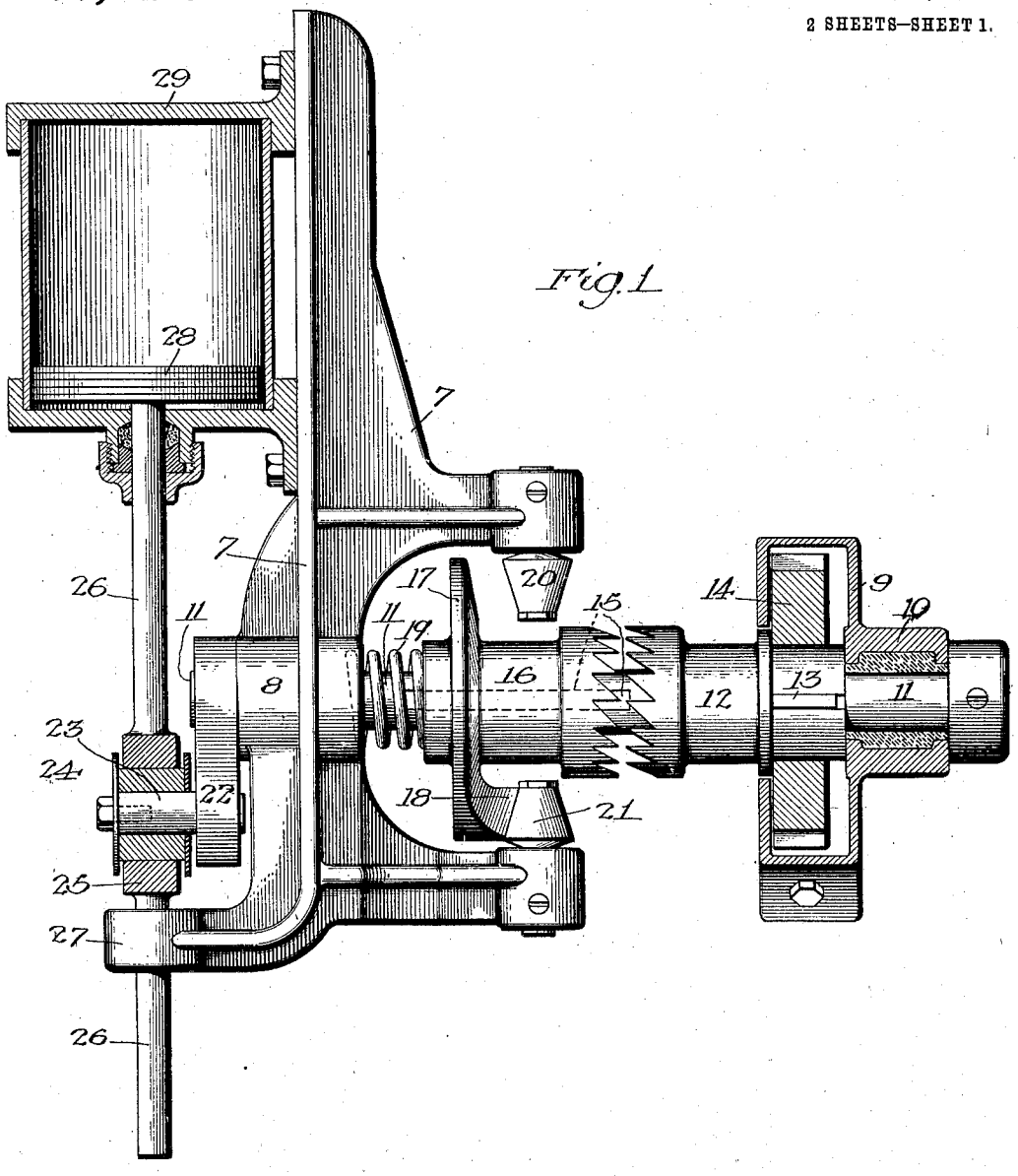

Fig. 1

Witnesses:
Lulu S. Stites.
Louis W. Gratz.

Inventor:
Frank C. Priestly.
by Townsend Sawyer & Hackley
attys.

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2 SHEETS—SHEET 2.

Fig. 2.

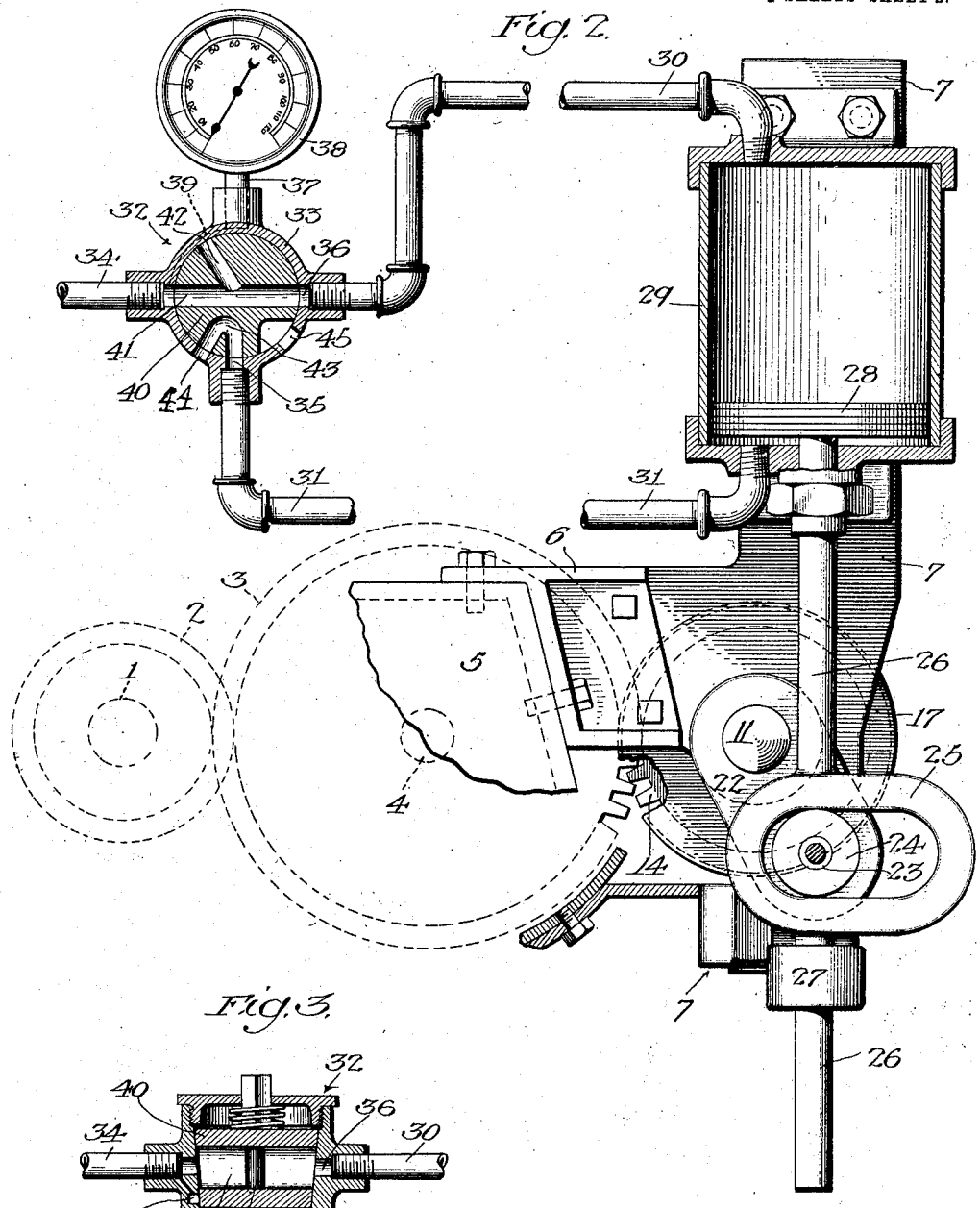

Fig. 3.

Witnesses:
Leto S. Alter.
Louis W. Gratz.

Inventor:
Frank C. Priestly
by Pennell & Southackley
Attys.

UNITED STATES PATENT OFFICE.

FRANK C. PRIESTLY, OF LOS ANGELES, CALIFORNIA.

ENGINE-STARTER.

977,043. Specification of Letters Patent. Patented Nov. 29, 1910.

Application filed December 2, 1909. Serial No. 531,097.

To all whom it may concern:

Be it known that I, FRANK C. PRIESTLY, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented a new and useful Engine-Starter, of which the following is a specification.

This invention relates to an engine starter which is operated by compressed air and which is particularly adapted for starting automobile engines.

The main objects of the invention are to provide a device of this character which is of simple construction, effective in operation and durable in use.

In carrying out the invention I employ a pneumatically operated piston which acts to impart a turning movement to a ratchet member which co-acts with another ratchet member on the shaft to be turned, which shaft may be either the engine shaft or another shaft geared therewith, and a further object is to provide novel means for disconnecting the two ratchet members when the piston has operated its length of stroke and imparted a turning movement of less than half a circle to the first ratchet member, whereby the piston may then take a reverse movement and enable a reëngagement of the ratchet before commencing another stroke.

So far as I am aware, it is novel to employ a reciprocating piston which operates a ratchet member by one or more impulses to impart rotation to the element to be driven and to produce absolute disengagement of the ratchet from the element to be driven at the termination of each impulse, so that immediately after the impulse which is imparted to it the driven element is allowed perfect freedom to be operated under the engine power without the slightest hindrance from the starting ratchet.

A further object is to produce absolute disengagement of the starting ratchet upon the termination of the recovery stroke of the ratchet, so that in the event of a premature explosion in the cylinder acting to drive the piston of the engine down before the crank had passed a dead center, the sudden reverse movement of which would thereby be communicated to the starting ratchet does not do any damage on account of the release of the starting ratchet at the termination of its rear movement or recovery stroke. Thus, a premature explosion would only result in moving back the starting ratchet through its recovery stroke.

In starting internal combustion engines generally only a quarter or less turn of the crank is required to start the engines of four cylinders and in the present invention by causing the piston to operate through the ratchet in the manner stated, it is possible to start the engine with the least expenditure of air used for operating the piston. As compared with imparting a continuous rotating motion to the element to be driven by means of the pneumatically operated piston, such as has heretofore been attempted, the present invention results in a considerable economy in amount of air employed, in addition to the advantages of relieving the starting device from shock of premature explosions, as above explained.

Another object is to so construct the device that it may be applied to engines already in use without any appreciable reconstruction, the device being designed to be bolted to the engine casing and to apply the turning power through the medium of a gear to the regular cam shaft of the engine and through the latter drive the crank shaft.

Other objects and advantages of the invention will be brought out in the accompanying description.

Referring to the drawings: Figure 1 is a side elevation of the invention showing the cylinder in cross section and part of the gear housing in section. Fig. 2 is a front elevation of the invention with the cylinder in section and the valve in section. Fig. 3 is a longitudinal section through the valve.

1 designates the crank shaft of the engine which carries the gear 2 meshing with a gear 3 on the cam shaft 4, the gear 3 being twice the size of the gear 2 in accordance with the usual practice, whereby the cam shaft 4 is driven one-half as fast as the crank shaft 1.

5 designates part of the engine casing to which is bolted a bracket 6 which forms a part of the attachment comprised in the present invention. A frame 7 is carried by the bracket 6 and is provided with a journal 8. A gear housing 9 is also bolted to the engine frame 5 and is provided with a journal 10. Mounted in the journals 8 and 10 is a shaft 11, on which a driven ratchet member 12 is loosely mounted, relative rotation between ratchet member 12 and shaft 11 being permitted. Fixed on the ratchet mem-

ber 12 by means of a key 13 is a gear 14 which meshes with the cam shaft gear 3.

Slidable on the shaft 11 and being caused to rotate therewith by a feather 15 is a driving ratchet member 16 which is formed with a beveled flange 17 having a cam 18. A coil spring 19 acts to force the ratchet member 16 into engagement with ratchet member 12, but the ratchet member 16 is positively prevented from engaging with the ratchet member 12 when in either one of two angular positions, each angular position being that occupied by the cam 18 when at either end of its stroke, the shaft 11 being a rocked shaft and the flange 17 and cam 18 therefore partaking of a turning movement through only a part of a circle. At either end of the stroke, the cam 18 comes in contact with a conical roller 20 or 21, the former being at the end of the return stroke of the cam and the roller 21 being at the end of the forward stroke of the cam. Thus, as the cam 18 rides over the roller 20 during the latter part of the return stroke, it results in shifting the ratchet member 16 to the left, thereby disengaging it from the ratchet member 12 and during the latter part of the forward movement of the ratchet member 16, the cam 18 rides over the roller 21 and acts to shift the ratchet member 16 to the left out of engagement with the ratchet member 12. During the intervening portion of its stroke, as the cam moves away from either roller 20 or 21, the spring 19 presses the ratchet member 16 into engagement with ratchet member 12. Thus, during the forward stroke of the ratchet member 16 it imparts a like turning movement to the ratchet member 12 and gear 14, while during the return stroke of the ratchet member 16 its teeth click idly over the teeth of the ratchet member 12, the latter not being turned during this retraction stroke.

A crank 22 is fixed on the end of shaft 11 and has a crank pin 23, on which is a roller 24 which engages in a slotted yoke 25 arranged at an intermediate point in a piston rod 26, the lower part of the piston rod 26 sliding in a bracket 27 and the upper end carrying a piston 28 which operates a cylinder 29 secured to the frame 7. A pipe 30 communicates with the upper part of the cylinder 29 and a pipe 31 communicates with the lower part of the cylinder 29. A suitable valve 32 is employed for conducting compressed air through either of the pipes 30 or 31 to propel the piston 28. The throw of the crank 22 is greater than the stroke of the piston 28, so that when the piston 28 is at either end of its stroke it positively arrests the yoke 25 and thus prevents the crank 22 from turning through a complete half circle, which is further prevented by the yoke 25 being offset, as clearly shown in Fig. 2, so that the crank arm 22 can not stand on a dead center at either end of its stroke, but stands at a considerable distance from a dead center, so that the pressure from the yoke 25 against the roller 24 will readily start movement of the crank and its shaft 11.

The valve 32 comprises a casing 33 having an inlet 34 and a port 35 communicating with pipe 31 and a port 36 communicating with the pipe 30. The casing 33 also has a pipe 37 leading to a pressure gage 38 which is in constant communication through a passage 39, indicated by dotted lines in Fig. 2, with the inlet 34, so that the pressure from the inlet 34 is always indicated by the gage 38. Within the casing 33 is a valve 40 having a diametrical passage 41, a lateral passage 42 and a branched passage 43.

When the valve is in the position shown in Fig. 2, air from the inlet pipe 34 passes through the passage 41 through the pipe 30 into the upper end of cylinder 29 and moves down the piston 28, thereby imparting forward turning movement to the shaft 11 and ratchet mechanism, as before described; air below the piston 28 passing out through pipe 31 through port 35 into branched passage 43 and thence to atmosphere through exhaust port 44. By turning the valve into its other position, as the passage 42 moves across the inlet pipe 34, a sufficient amount of air enters to pass from the passage 42 into the passage 41, thence through the port 35 into pipe 31 below the piston and raises the piston to the top of the cylinder, air from above the piston passing out through pipe 30 into branched passage 43 and exhausting through port 45. Continued movement of the valve carries the passage 42 completely across the mouth of the inlet pipe 34 and at the completion of the movement the passage 42 lies against a blank part of the valve casing 33, and a blank part of the valve plug 40 lies across the mouth of the inlet pipe 34, thereby effectually preventing any leakage of air from the inlet pipe 34 and keeping the mechanism free from the entry of any compressed air until it is again desired to operate it.

It should be understood that the valve 32 will be located on the dashboard or some other convenient point of the automobile, so that it may readily be operated by the chauffeur. The pressure gage 38 should also be located at a convenient point for easy inspection.

What I claim is:

1. An engine starter comprising a shaft, a driven ratchet on the shaft, a driving ratchet on the shaft, a cylinder, a piston therein, a piston rod on the piston, a crank on said shaft, a connection between said crank and piston rod, means for moving said ratchet members out of contact with each other when the driving ratchet is in a certain angular position, and valve means

for admitting a compressed fluid to or exhaust the same from either side of said piston.

2. An engine starter comprising a shaft, a driven ratchet on the shaft, a driving ratchet on the shaft, a cylinder, a piston therein, a piston rod on the piston, a crank on said shaft, a connection between said crank and piston rod, means for disconnecting said ratchet members when the driving ratchet is in a certain angular position in its forward stroke and for disconnecting said ratchets when the driving ratchet is in a certain angular position in its retraction stroke, and valve means for admitting a compressed fluid to or exhaust the same from either side of said piston.

3. A shaft, a driven ratchet loose thereon, a gear on the driven ratchet adapted to mesh with a gear on the cam shaft or crank shaft of the motor, a driving ratchet splined on the first named shaft, a spring normally holding said ratchets in engagement, a cam on one ratchet, an abutment onto which said cam rides to shift the driving ratchet out of engagement with the driven ratchet, a crank on the first named shaft, a cylinder, a piston therein, a piston rod on the piston, a yoke on the piston rod, a pin on the crank projecting into said yoke, and valve means for admitting a compressed fluid to or exhaust the same from either side of said piston.

4. A frame, a shaft journaled at one end therein, a journal for the other end of said shaft, a gear housing formed with the latter journal, a driven ratchet loose on said shaft, a gear fixed on the driven ratchet within said gear housing, a driving ratchet splined on said shaft, a spring for normally holding the driving ratchet in engagement with the driven ratchet, a cam on the driving ratchet, rollers at each end of the stroke of said cam for causing said cam to move said driving ratchet out of engagement with the driven ratchet, a cylinder, a piston therein, a yoke connected with the piston, a crank on said shaft connected with said yoke, and valve means for admitting a compressed fluid to or exhaust the same from either side of said piston.

5. A frame, a shaft journaled therein, a driven ratchet loose on said shaft, a gear fixed on the driven ratchet, a driving ratchet splined on said shaft, a spring between the driving ratchet and the frame, a beveled flange on the driving ratchet, a cam on said flange, a pair of beveled rollers mounted on said frame, a cam on said flange adapted to ride upon either of said rollers and move the driving ratchet out of engagement with the driven ratchet, a crank on said shaft, a pin on the crank, a roller on the crank pin, a cylinder on the frame, a piston in the cylinder, a piston rod extending from the piston, a bracket on the frame through which the lower end of said piston rod slides, a yoke formed in said piston rod, the roller on the crank pin operating in said yoke, and valve means for admitting a compressed fluid to or exhaust the same from either side of said piston.

6. A frame, a shaft journaled therein, a driven ratchet loose on said shaft, a gear fixed on the driven ratchet, a driving ratchet splined on said shaft, a spring between the driving ratchet and the frame, a flange on the driving ratchet, a cam on said flange, a pair of rollers mounted on said frame, a cam on said flange adapted to ride upon either of said rollers and move the driving ratchet out of engagement with the driven ratchet, a crank on said shaft, a pin on the crank, a roller on the crank pin, a cylinder on the frame, a piston in the cylinder, a piston rod extending from the piston, a bracket on the frame through which the lower end of said piston rod slides, a yoke formed in said piston rod, the roller on the crank pin operating in said yoke, valve means for admitting a compressed fluid to or exhaust the same from either side of said piston, said piston having a length of stroke less than the natural throw of said crank, whereby said crank is restricted to a throw of less than half a circle, said yoke being offset.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 23d day of November, 1909.

FRANK C. PRIESTLY.

In presence of—
G. T. HACKLEY,
FRANK L. A. GRAHAM.