C. J. FARRAR.

EXPLOSIVE ENGINE.

APPLICATION FILED MAY 10, 1907.

919,842.

Patented Apr. 27, 1909.

2 SHEETS—SHEET 1.

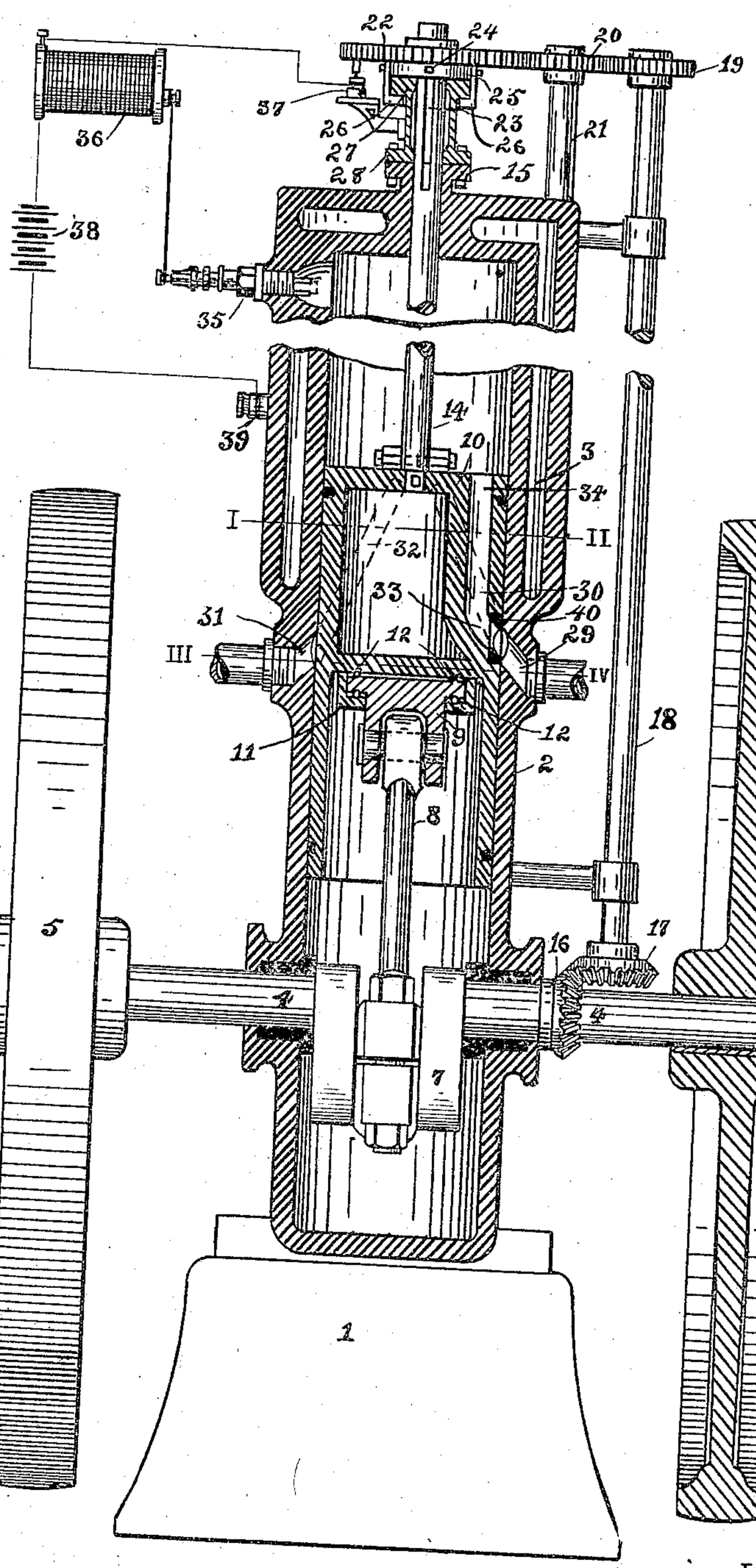

Fig. 1.

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2 SHEETS—SHEET 2.

FIG. 2.

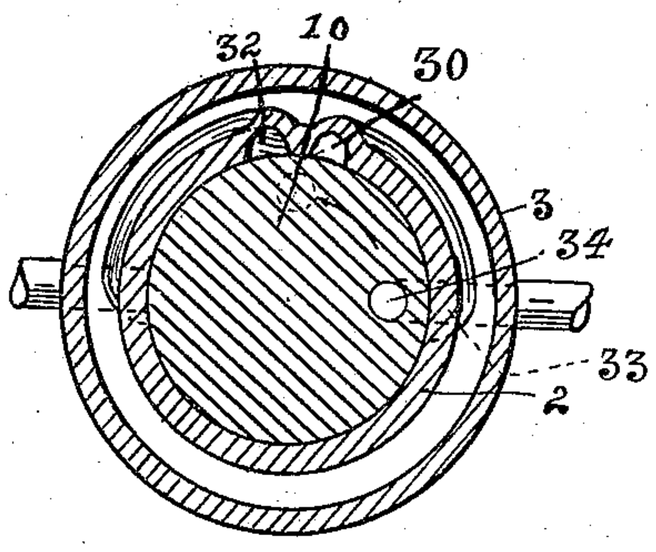


FIG. 3.

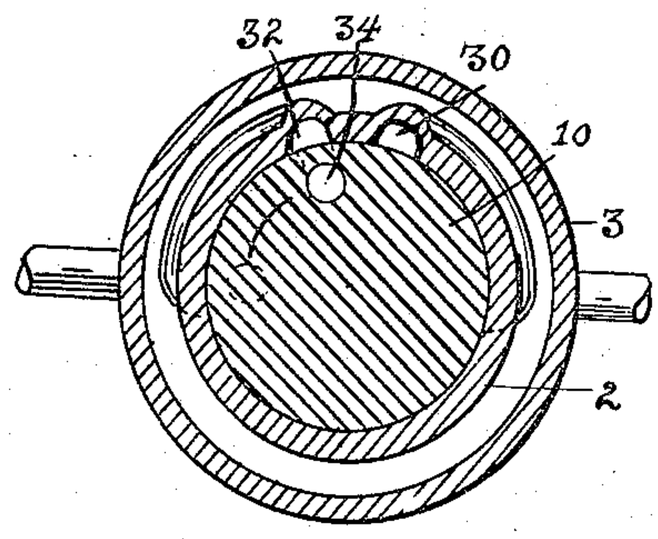


FIG. 4.

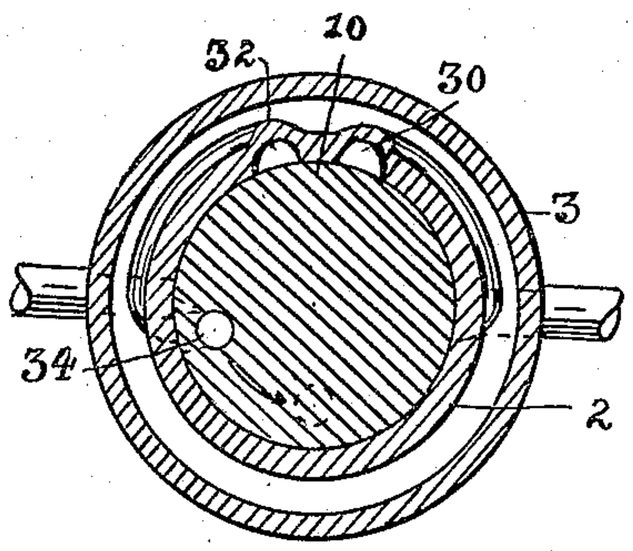


FIG. 5.

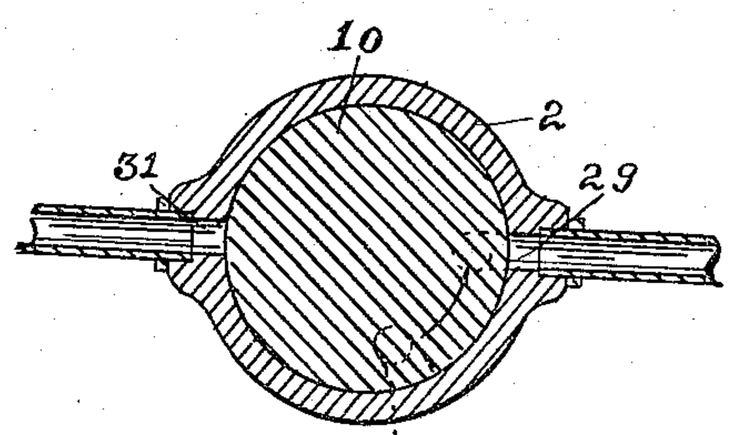
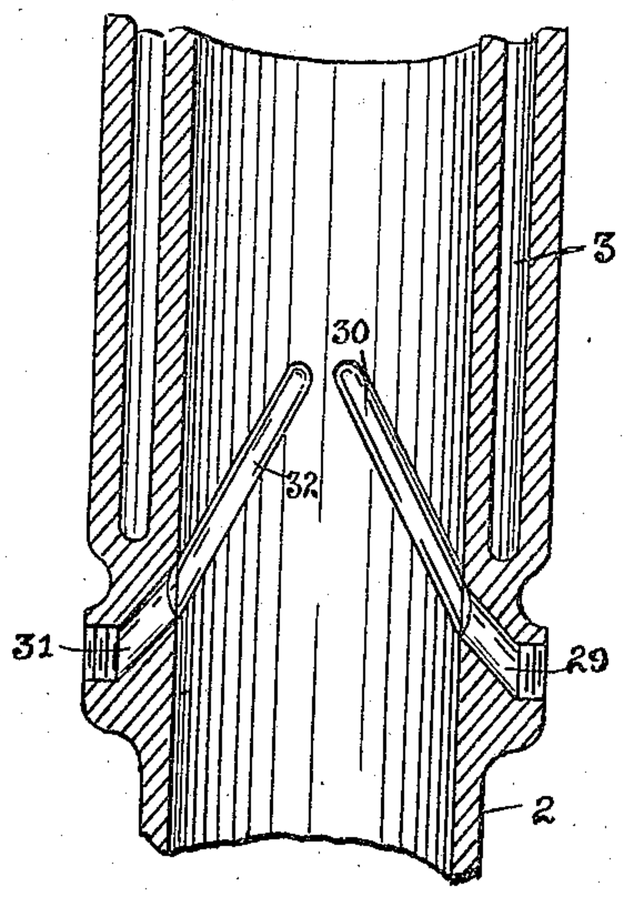


FIG. 6.



WITNESSES:

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UNITED STATES PATENT OFFICE.

CHARLES J. FARRAR, OF CRAFTON, PENNSYLVANIA.

EXPLOSIVE-ENGINE.

No. 919,842. Specification of Letters Patent. Patented April 27, 1909.

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To all whom it may concern:

Be it known that I, CHARLES J. FARRAR, a citizen of the United States, and residing in the borough of Crafton, in the county of Allegheny and State of Pennsylvania, have invented or discovered new and useful Improvements in Explosive-Engines, of which the following is a specification.

My invention consists in certain new and useful improvements in explosive engines and is particularly applicable to the type of engines known as "four cycle." More particularly, I provide means for doing away with the complicated and delicate valve mechanism now required in that class of engines and substitute therefor open ports. To attain these ends I provide gas inlet and outlet passages in the wall of the cylinder casting which intermittently register with a port in the piston communicating with the interior of the cylinder. To obtain such intermittent registration, I impart a rotary movement to the piston in addition to its reciprocation.

For the sake of illustration, I have shown a single cylinder engine, but it will be readily understood that any number of cylinders desired may be provided.

In the accompanying drawings, Figure 1 is a vertical section of a single cylinder engine fitted with my invention, the cylinder, piston, band pulley and one of the fly wheels being shown in section; Figs. 2, 3 and 4 are horizontal sections along the line I—II in Fig. 1, illustrating, respectively, the piston at the beginning of the exhaust, suction and compression strokes; Fig. 5 is a similar section along the line III—IV in Fig. 1, illustrating the piston and the beginning of the explosion stroke, and Fig. 6 is a broken section of the cylinder similar to Fig. 1, the piston being omitted to show the ports and channels in the cylinder casting.

The following is a detailed description of the embodiment of the invention illustrated in the drawings.

1 is the bed plate of the engine and 2 the cylinder casting preferably provided with an integral water jacket 3.

4 is the main shaft, 5—5 the fly wheels and 6 the band pulley.

7 is the crank to which is pivotally attached the connecting rod 8 attached at its other end to head 9 which is pivotally attached to the piston 10 by means of flanged collar 11 attached to the piston by any convenient means, not shown. I prefer to interpose ball bearings, 12—12, or other antifriction devices, between said head 9 and the collar 11 and piston 10 so that the piston may be rotated, as hereinafter described, without interference from the connecting rod 8.

14 is a shaft rigidly attached to piston 10 and extending up through the cylinder head 15 where it is provided with a suitable stuffing box, not shown, to prevent leakage of gas from the cylinder.

16 is a beveled gear rigidly mounted on main shaft 4 and meshing with a second beveled gear 17 rigidly mounted on the end of shaft 18 which may be suitably journaled from the cylinder casting. The other end of said shaft 18 is provided with a second gear wheel 19 rigidly attached thereto and meshing with an idle gear 20 mounted on shaft 21 extending from the cylinder casting.

22 is a gear wheel slidably mounted on the exposed end of shaft 14 which shaft is provided with a spline 23 which is engaged by key 24 carried by hub 25 of gear 22, thus causing the gear to rotate said shaft, and preventing the lateral displacement of the gear when the shaft 14 reciprocates with the piston.

26—26 are straps attached to hub 25 of gear 22 and engaging the shoulder 27 on extension collar 28 attached to cylinder casting 2, and surrounding the shaft 14. It is evident that, by means of the gears and shafting above described, the piston 10 will be continuously rotated from main shaft 4 while at the same time reciprocating. The gears are so proportioned that the piston completes a rotation for every two revolutions of the main shaft.

29 is a port leading through the wall of the cylinder casting 2 and so located as to be at all times covered by the body of the piston 10. Said port connects at its exterior with the exhaust and at its interior with a channel or groove 30 formed in the bore of the cylinder and leading upward at an angle in the direction of rotation of the piston through somewhat less than ninety degrees of the periphery of the bore, and to an elevation somewhat greater than the limit of travel of the lower end of the piston.

31 is a second port through the cylinder casting, somewhat less, preferably, than one hundred and eighty degrees from the port 29 in the direction of piston rotation and on

substantially a horizontal line with port 29. At the exterior of the casting, said port 31 connects with the carbureter or other fuel supply and at the inner end of said port with a channel or groove 32, similar to channel 30 and extending upwardly at an equal elevation and at a reverse angle to said channel 30 through somewhat less than ninety degrees to an elevation substantially equal to that of channel 30.

33 is a port in the wall of piston 10 and communicating with vertical passage 34 in said piston wall opening into the interior of the cylinder. It is evident that, if the piston completes a full rotation once in every four strokes of the same, in the stroke illustrated in Figs. 1 and 2, the port 33 in the piston will at first register with port 29 and thereafter during the following quadrant of rotation will continuously register with channel 30 in the cylinder bore while the piston ascends until said port 33 rises above said channel, and when said piston descends during the next stroke, the said port 33 will be maintained in registration with the channel 32 until it registers with port 31. On the third stroke, as illustrated in Fig. 4, the rotation of the piston will have thrown port 33 to the "blind" side of the cylinder bore containing neither ports nor channels, and likewise in the fourth stroke as illustrated in Fig. 5.

35 is the sparking plug of any convenient design, extending into the cylinder bore adjacent to the head thereof and connected in the usual manner with the secondary of the induction coil 36, the primary of which is wired to the circuit breaker 37 operated once in every revolution by the gear 22.

38 is the battery and 39 the ground.

The operation of my engine as above illustrated is as follows:—In the position shown in Figs. 1 and 2, the piston is supposed to have just completed the explosion stroke and to be at the beginning of the exhaust stroke. The port 33 registers with port 29 thus forming an open passage from the interior of the cylinder to the exhaust. As the piston rises on the stroke, it is gradually rotated through a quarter turn or quadrant, thus maintaining the registration of port 33 with channel 30 whereby an open passage from the interior of the cylinder to the exhaust is formed, until, as the piston nears the completion of the stroke, the port 33 rises above the upper end of channel 30. It is evident that the compression caused by the rise of the piston in the cylinder will expel through the open passage above described all the products of combustion remaining from the last explosion stroke. As the piston descends on the next stroke, as shown in Fig. 3, it is gradually rotated through a second quadrant bringing and maintaining port 33 in registration with channel 32 until it reaches and registers with port 31, thus maintaining during said stroke an open passage between the interior of the cylinder and the carbureter or other fuel supply, thus sucking into the cylinder during this stroke a fresh charge of fuel. As the piston starts on the next stroke the port 33 passes to the blind side of the cylinder bore, as shown in Fig. 4, thus sealing said port against the escape of gas from the interior of the cylinder and thus compressing, as the piston rises, the charge sucked in during the preceding stroke. As the piston starts to descend on the fourth and last stroke of the cycle, the port 33 is still sealed by the blind side of the cylinder bore, as shown in Fig. 5. As the piston begins to descend, the gear 22 operates the circuit breaker 37 causing the plug 35 to spark and ignite the charge compressed in the cylinder. An explosion constituting the power stroke follows. During this stroke the port 33 being sealed, the full force of the explosion is exerted on the piston. At the completion of the above described stroke, the piston is in in the position shown in Figs. 2 and 3 and ready to begin the exhaust stroke. I prefer to provide port 33 in the face of the piston 10 with a packing ring or gasket 40, of suitable material, set into the face of the piston to prevent the leaking of gas through passage 34 and port 33 into the cylinder bore while the port 33 is traversing the blind quadrants. It is thus evident that the cylinder is charged and exhausted on the proper strokes without the use of valve mechanism.

Although I have illustrated the application of my invention to a four cycle engine, it is evident that the principles thereof may be applied to any type of explosive engine having a reciprocating piston.

Although for the sake of clearness I have described the mechanism shown in the drawings with great minuteness, I do not wish to limit myself thereby but claim broadly:—

1. In an explosive engine, a cylinder, a fuel inlet passage in said cylinder, an exhaust passage for the products of combustion in said cylinder adapted to be intermittently opened and closed by the motion of the engine piston, a piston adapted to be both reciprocated and rotated within said cylinder, an inlet passage in said piston adapted to be intermittently brought into communication with said inlet passage in said cylinder by the movement of said piston, a reciprocating connecting rod extending into the rear end of said cylinder and having a swivel connection with said piston, a shaft rigidly connected to said piston and extending through the front end of said cylinder and means for imparting rotation to said shaft from said engine, for the purposes described.

2. In an explosive engine, a cylinder, a fuel inlet passage in said cylinder, an exhaust passage for the products of combustion in

said cylinder adapted to be intermittently opened and closed by the motion of the engine piston, a piston adapted to be both reciprocated and rotated within said cylinder, an inlet passage in said piston adapted to be intermittently brought into communication with said inlet passage in said cylinder by the movement of said piston, a reciprocating connecting rod extending into the rear end of said cylinder and having a swivel connection with said piston, a shaft rigidly connected to said piston and extending through the front end of said cylinder, a second shaft in rotatable connection with the crank shaft of the engine and operative connection between said shafts, for the purposes described.

3. In an explosive engine, a cylinder, a fuel inlet passage in said cylinder, an exhaust passage for the products of combustion in said cylinder adapted to be intermittently opened and closed by the motion of the engine piston, channels in the bore of said cylinder communicating, respectively, with said inlet and exhaust passages, a piston adapted to be both reciprocated and rotated within said cylinder, an inlet passage in said piston communicating with the interior of said cylinder and adapted to be intermittently brought into communication with said inlet passage in said cylinder and its communicating channel by the movement of said piston, a connecting rod extending into the rear end of said cylinder and having a swivel connection with said piston to reciprocate the rod, a shaft rigidly attached to said piston and extending through the front end of said cylinder and means whereby said shaft is rotated by the engine.

4. In an explosive engine, a cylinder, a fuel inlet passage in said cylinder, an exhaust passage for the products of combustion in said cylinder adapted to be intermittently opened and closed by the motion of the engine piston, channels in the bore of said cylinder communicating, respectively, with said inlet and exhaust passages, a piston adapted to be both reciprocated and rotated within said cylinder, an inlet passage in said piston communicating with the interior of said cylinder and adapted to be intermittently brought into communication with said inlet passage in said cylinder and its communicating channel by the movement of said piston, a connecting rod extending into the rear of said cylinder and having a swivel connection with said piston to reciprocate the rod, a shaft rigidly attached to a piston and extending through the front end of said cylinder, a second shaft rotated by the engine and operative means whereby rotation is communicated to said first shaft from said second shaft, for the purposes described.

5. In an explosive engine, a cylinder, a fuel passage in said cylinder, an exhaust passage for the products of combustion in said cylinder adapted to be intermittently opened and closed by the motion of the engine piston, channels in the bore of said cylinder communicating, respectively, with said inlet and exhaust passages, a piston adapted to be both reciprocated and rotated with said cylinder, an inlet passage in said piston communicating with the interior of said cylinder and adapted to be intermittently brought into communication with said inlet passage in said cylinder and its communicating channel by the movement of said piston, a connecting rod pivoted to the crank shaft of the engine, extending into the rear of said cylinder and having a swivel connection with said piston to reciprocate the rod, a shaft rigidly attached to said piston and extending through the front end of said cylinder, a second shaft parallel with said first shaft and receiving rotation from the crank shaft of the engine and gears interposed between said shafts whereby said first shaft and the piston attached thereto are rotated, for the purposes described.

Signed at Pittsburg, Penna., this 9th day of May, 1907.

CHARLES J. FARRAR.

Witnesses:
J. H. PRICE,
M. MURRAY.