Nov. 27, 1923. 1,475,440

W. J. LARSON

INTERNAL COMBUSTION ENGINE

Filed May 9, 1921 2 Sheets-Sheet 1

Fig. 1

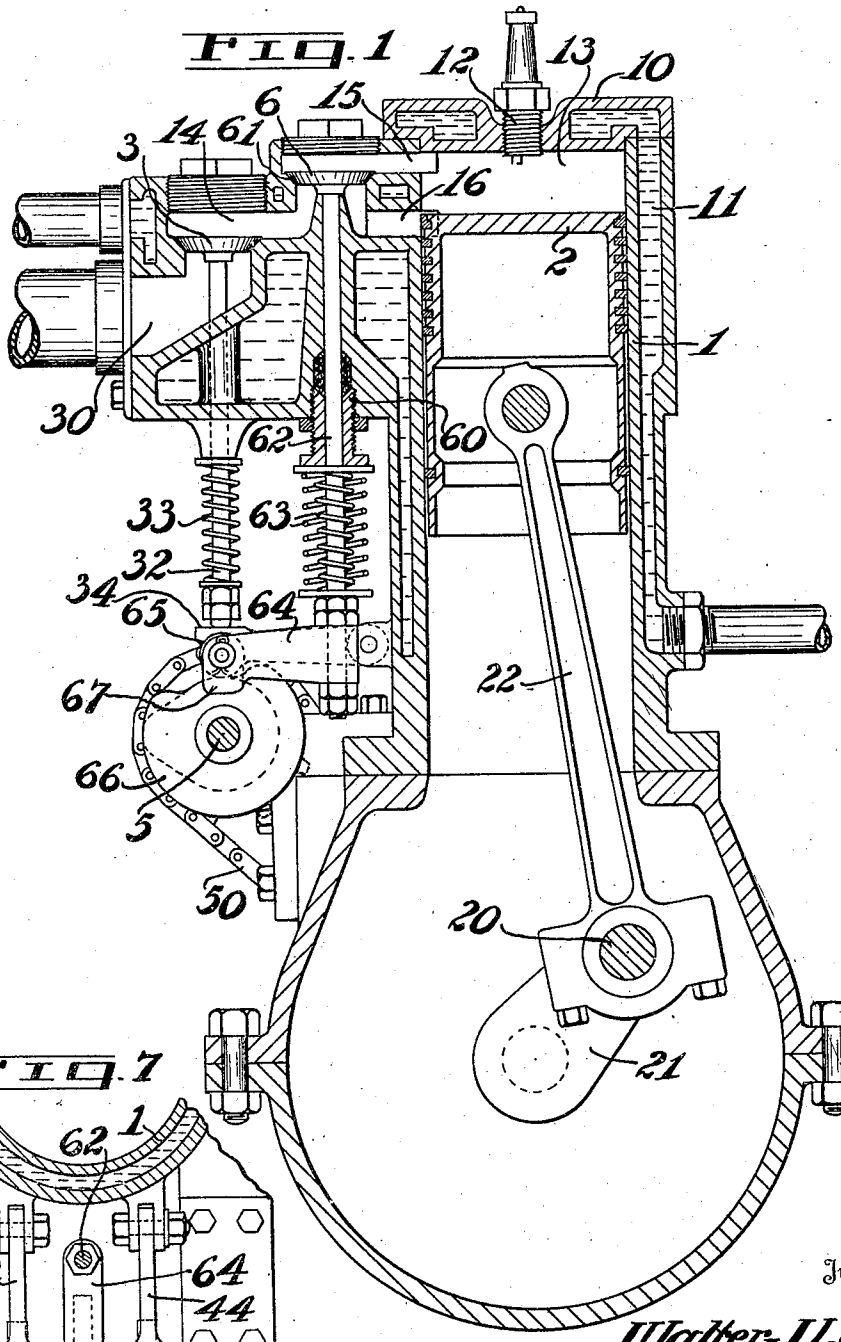

Fig. 7

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Fig. 2

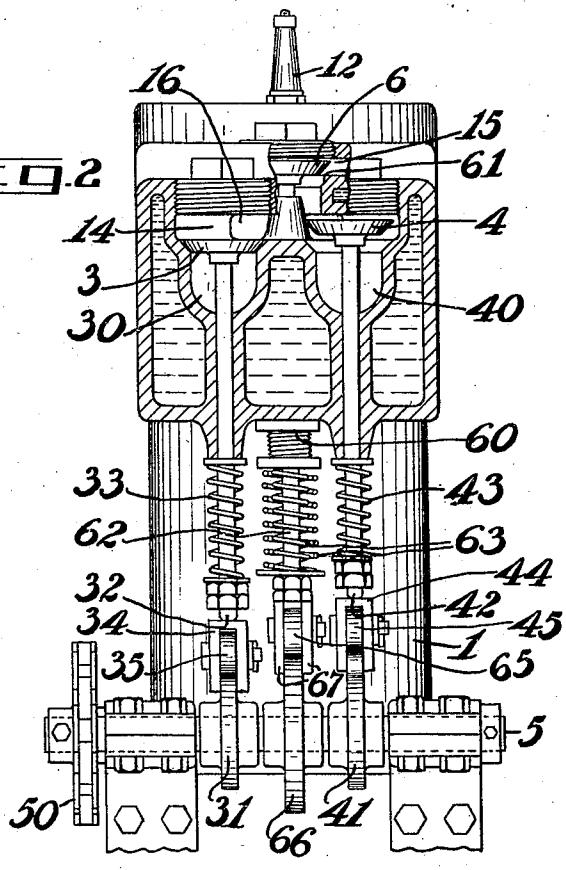


Fig. 3

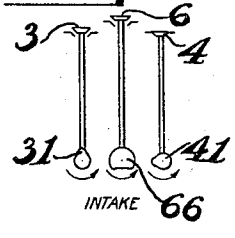


Fig. 4

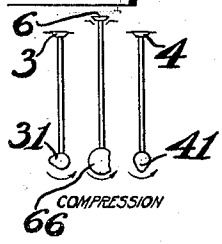


Fig. 5

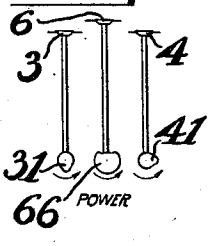
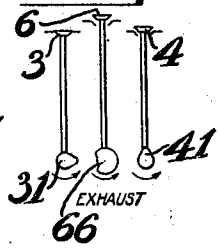


Fig. 6



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Patented Nov. 27, 1923. 1,475,440

UNITED STATES PATENT OFFICE.

WALTER J. LARSON, OF WRANGELL, TERRITORY OF ALASKA, ASSIGNOR OF ONE-FOURTH TO FRANK E. GINGRASS AND ONE-FOURTH TO HERBERT E. HARVIE, OF WRANGELL, TERRITORY OF ALASKA.

INTERNAL-COMBUSTION ENGINE.

Application filed May 9, 1921. Serial No. 468,050.

To all whom it may concern:

Be it known that I, WALTER J. LARSON, a citizen of the United States of America, and resident of the city of Wrangell, Territory of Alaska, have invented certain new and useful Improvements in Internal-Combustion Engines, of which the following is a specification.

My invention comprises improvements in internal combustion engines whereby a second explosion may be caused in the combustion chamber following the first or primary explosion and after the piston has begun its advance upon the power stroke.

The object of my invention is to provide means whereby such a secondary explosion may be caused, to deliver an additional power impulse to the crank shaft after the shaft has advanced well past dead-center, in this manner increasing the average effect and decreasing the initial effect of the impulse upon the crank shaft.

Another object of my invention is to provide in connection with an engine cylinder and piston, an arrangement of pockets and passages connecting with the cylinder, and valves for controlling the same, to effect the desired result.

My invention comprises those novel parts and combinations thereof which are shown in the accompanying drawings, described in the specification, and particularly defined by the claims terminating the same.

In the accompanying drawings I have shown my invention in the form which is now preferred by me.

Figure 1 is an axial section through an engine cylinder and piston and the valve casing.

Figure 2 is a side elevation of an engine, the valve casing being shown in section.

Figures 3, 4, 5, and 6 are diagrammatic illustrations of the relative positions of the valves at the different stages of operation of the engine.

Fig. 7 is a plan view of the valve operating means.

In order to produce a primary and a secondary explosion following the first power stroke of the piston, by my present invention I provide means whereby a portion of the charge admitted to the cylinder may be segregated so that at the time of the primary explosion it is not in communication with the combustion chamber, but is placed in communication therewith as the piston advances on its power stroke. A second explosion results from the communication of the segregated combustible charge with the heated gases caused by the primary explosion. This imparts an additional impulse to the crank shaft. The timing of the secondary explosion may be arranged to occur when the crank shaft has advanced a considerable number of degrees past top dead-center. The effect of this secondary explosion is in this way considerably increased by the increased leverage upon the crank shaft.

The cylinder 1, which has the usual head 10, the water jackets 11, and the spark plug 12 positioned in the upper clearance space 13 which forms the primary combustion chamber, has the piston 2 movable therein in the usual manner. The piston is connected to the crank pin 20 of the crank shaft 21 by the usual connecting rod 22. Such features as these may be varied in any manner found suitable or desirable. I also provide a cam shaft 5 which is driven from the crank shaft at half the latter's speed in any usual manner, as by a chain 50.

In a water cooled valve casing, which is shown as forming a part of the cylinder 1, are provided an inlet valve 3 and an exhaust valve 4 controlling the admission from and exhaust into the inlet passages 30 and exhaust passages 40, respectively. Cams 31 and 41 upon the cam shaft 5, engaging rollers 35 and 45, carried by pivoted arms 34 and 44, upon which arms the lower end of the valve stems 32 and 42, respectively, bear, control the opening of the respective valves. The valves are held seated by the usual springs 33 and 43. The valves 3 and 4 communicate with a pocket 14, which is at one side of the combustion chamber of the cylinder 1 and which communicates therewith ordinarily through a port 15 which is positioned at the top of the cylinder and which communicates with the clearance space 13 therein.

Between the pocket 14 and the port 15 I provide a valve 6. This valve is adapted to seat at 61 to close off the pocket 14 from the port 15 and consequently from the combustion chamber through this port 15. The pocket 14, however, communicates with the

combustion chamber of the cylinder by a second port 16. This port 16 is shown as axially spaced from the clearance space 13 and when the piston 2 is at the top of its stroke the port 16 is closed thereby. Instead of the piston 2 serving as a valve to close the port 16, I might provide a separate valve, although the piston itself acts as a valve which is automatically timed properly, in conjunction with the port 16 which is axially spaced from the port 15. If the two ports were not axially spaced, another valve might be required.

The valve 6 referred to above is held seated by springs 63 and its stem 62 extends through a packing gland 60. An arm 64, secured to the lower end of the valve stem 62, carries a cam roller 65 in its outer end. This roller 65 engages a cam 66 upon the cam shaft 5. Ears 67 extending upon opposite sides of the cam 66 from the arms 64 serve to prevent lateral displacement of the roller 65 from the cam.

The relative positions of the valves 3, 4, and 6 are shown in Figures 3, 4, 5, and 6. At the start of a cycle, as shown in Figure 3, cams 31 and 66 have raised the intake valve 3 and the auxiliary valve 6. The exhaust valve 4 is closed. As the piston moves downward upon the intake stroke, a gaseous charge is supplied through the port 30, past the valve 3, through the pocket 14, past the valve seat 61 and the valve 6, and through the port 15 into the clearance space 13. As the piston 2 continues downward the port 16 is uncovered and the charge is supplied through both ports 15 and 16. As compression commences the intake valve 3 is closed, although the valve 6 preferably remains open. This position is shown in Figure 4. As the piston reaches the top of its compression stroke valve 6 is closed and intake valve 3 and exhaust valve 4 remain closed. An amount of compressed gas is retained in the pocket 14 under the same amount of compression practically as obtains in the cylinder, although by closing valve 6 before the end of the compression stroke the compression in pocket 14 is lessened. By making the clearance 13 very slight the charge may be compressed to the proper degree even though a part of the compressed gas is permitted to expand into the pocket 14.

At the top of the compression stroke the port 16 is closed off by the piston 2 and all of the valves are seated. At this time explosion occurs in the cylinder 1 and the piston 2 starts downward on the power stroke. As the port 16 is uncovered by the movement of the piston the compressed combustible charge in the pocket 14 comes in contact with the highly heated gases caused by the explosion in the cylinder. The result is that the gases in the chamber 14 are exploded, and the additional power impulse thus created is added to the downward impulse of the piston. Figure 1 illustrates parts in positions assumed at the time of the secondary explosion. The piston continues downward until ready to begin the exhaust stroke when the valve 4 opens and the valve 6 also opens before the piston again covers the port 16. This position is shown in Figure 6

By properly spacing the ports 16 axially of the cylinder 1, the secondary explosion may be timed to occur when the crank shaft 21 has advanced a considerable number of degrees past top dead-center. This position of the crank shaft is attained before the piston 2 has advanced any considerable distance from the top of the cylinder. The secondary impulse therefore acts upon a greatly increased lever arm at the crank shaft and its effect is therefore increased by the amount of the increased lever arm. The engine is thus made to operate more smoothly, by reason both of lessening the first violent impulse, when the crank shaft is at or near top dead-center, and by adding to the impulse when the crank arm has advanced considerably.

What I claim as my invention is:

1. A cylinder for internal combustion engines having a pocket communicating therewith by one port leading to the clearance space and by a second port axially spaced from the first towards the opposite end of the cylinder, and having intake and exhaust ports communicating with said pocket and a valve seat in said first port between the pocket and the clearance space.

2. In an internal combustion engine, the combination with a cylinder having a pocket communicating therewith by one port leading to the clearance space and by a second port axially spaced from the first towards the opposite end of the cylinder, and having valved intake and exhaust ports communicating with said pocket, of a valve seating in said first port between the pocket and the clearance space, and a piston movable in the cylinder to close said second port during the primary explosion and to open said port thereafter.

3. In an internal combustion engine, the combination with a cylinder and a piston movable therein, said cylinder having a pocket communicating therewith by two ports, one leading to the clearance space, and the other being axially spaced from the first to be closed by said piston at the top of its stroke, of valve mechanism controlling admission to and exhaust from said pocket comprising an intake and an exhaust valve opening into said pocket, and an auxiliary valve adapted to close said first port immediately preceding the time of the primary explosion.

4. In an internal combustion engine, the combination with a cylinder having a pocket communicating therewith by one port leading to the clearance space and by a second port axially spaced from the first towards the opposite end of the cylinder, and having intake and exhaust ports communicating with said pocket, of an intake and an exhaust valve controlling their respective ports and when seated lying in a common plane, a valve seating in said first-mentioned port in a plane parallel to the plane of the exhaust and intake valves, and opening away from said latter valves, and a piston movable in the cylinder to close said second port during the primary explosion and to open it thereafter.

5. In an internal combustion engine, the combination with a cylinder having a pocket communicating therewith by two axially-spaced ports, one leading to the clearance space, and the second being in alinement with the pocket and leading to the cylinder below the clearance space, said pocket having intake and exhaust ports communicating therewith, of an intake and an exhaust valve controlling their respective ports, a valve seating in said first port, and a piston movable in the cylinder to close said second port during the primary explosion and to open it thereafter.

6. In an internal combustion engine, the combination with a cylinder having a pocket communicating therewith by two axially spaced ports, the first port leading to the clearance space and the second spaced therefrom towards the opposite end of the cylinder, and having valved intake and exhaust ports communicating with said pocket, of a valve and seat therefor controlling communication through said first port, communication between said pocket and cylinder through the second port being always direct and freely open, and a piston movable in the cylinder to close said second port at the time of primary explosion and to open it thereafter.

Signed at Wrangell, Territory of Alaska, this 27th day of April, 1921.

WALTER J. LARSON.