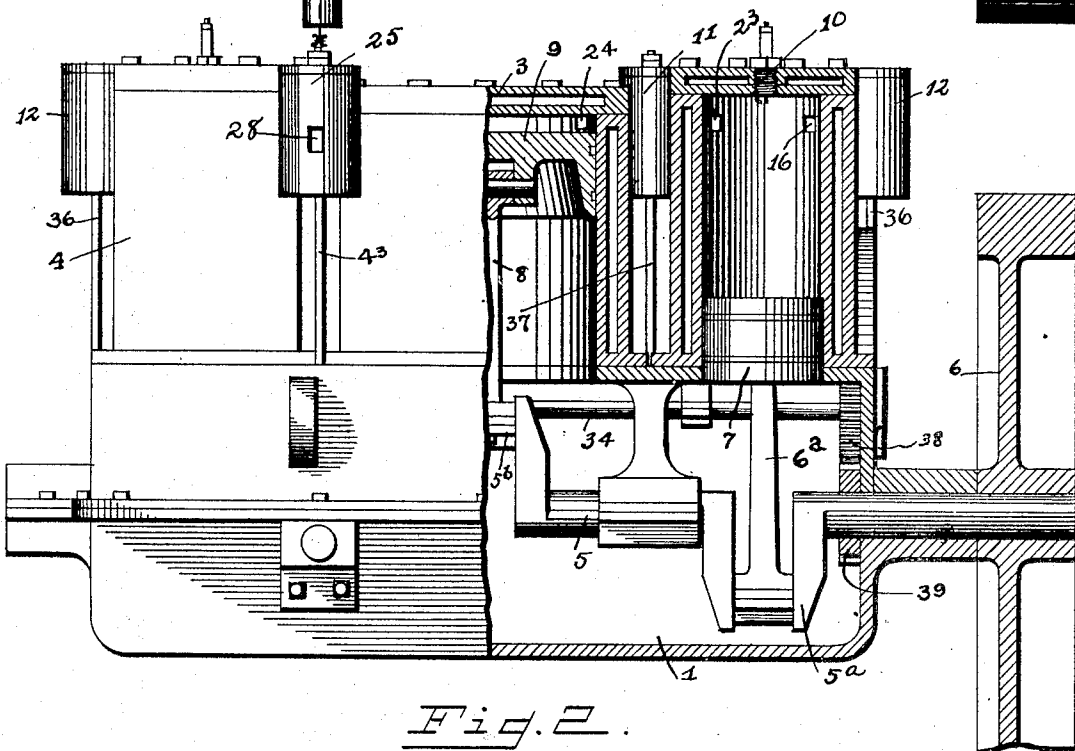
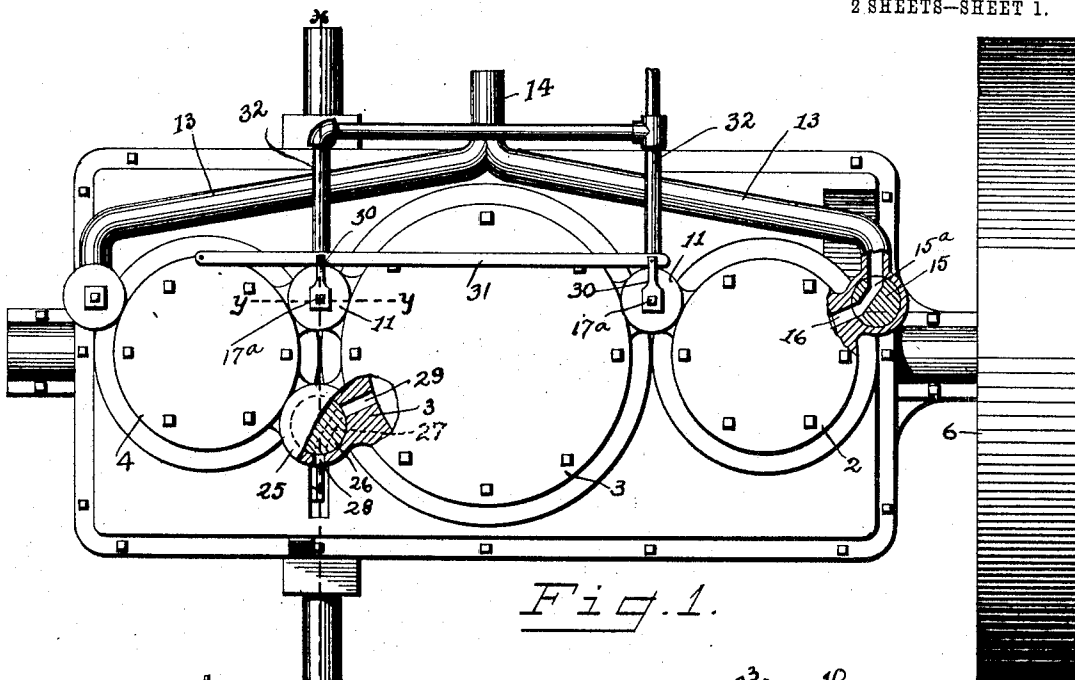


L. C. BURTON.
COMPOUND GASOLENE ENGINE.
APPLICATION FILED DEC. 11, 1908.

935,740.

Patented Oct. 5, 1909.

2 SHEETS—SHEET 1.



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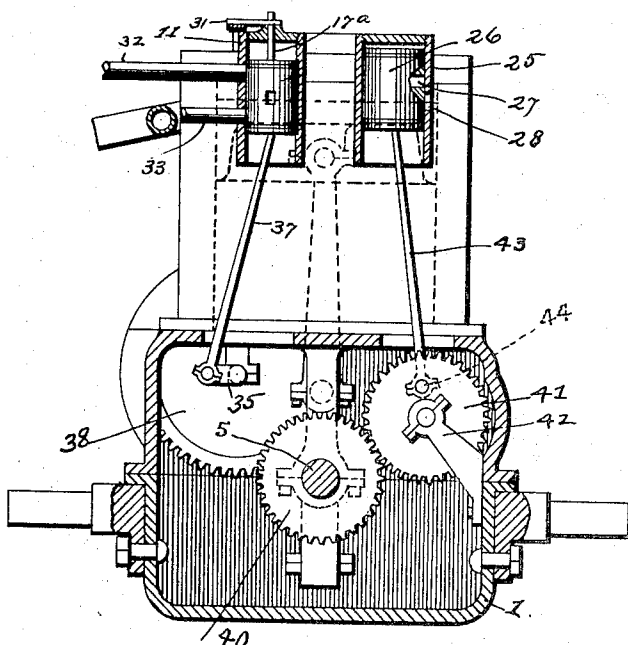


Fig. 3.

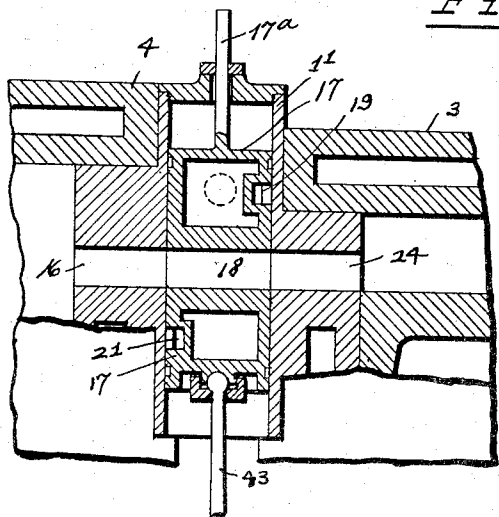


Fig. 4.

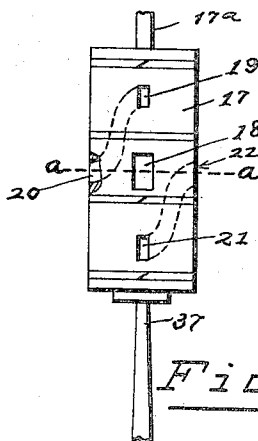


Fig. 5.

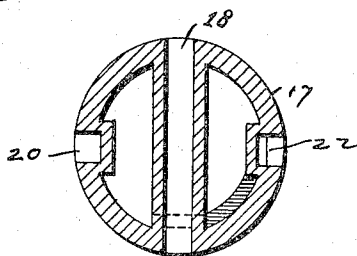


Fig. 6.

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UNITED STATES PATENT OFFICE.

LAWRENCE C. BURTON, OF COLUMBUS, OHIO, ASSIGNOR OF ONE-HALF TO JOHN SHRUM,
OF COLUMBUS, OHIO.

COMPOUND GASOLENE-ENGINE.

935,740.

Specification of Letters Patent.

Patented Oct. 5, 1909.

Application filed December 11, 1908. Serial No. 466,971.

To all whom it may concern:

Be it known that I, LAWRENCE C. BURTON, a citizen of the United States, residing at Columbus, in the county of Franklin and State of Ohio, have invented certain new and useful Improvements in Compound Gasolene-Engines, of which the following is a specification.

My invention relates to the improvement of compound gas or gasolene engines, and the objects of my invention are to provide an improved construction of engine of this class wherein improved valve mechanism is provided for directing the exhaust of products of combustion from the high pressure cylinders to the low pressure cylinder and exhausting the same therefrom; to provide improved means for imparting the initial or starting movement to the engine and to produce other improvements, the details of construction of which will be more fully pointed out hereinafter. These objects I accomplish in the manner illustrated in the accompanying drawings, in which:

Figure 1 is a plan view of my improved engine, Fig. 2 is a partial front elevation and partial vertical section of my improved engine, Fig. 3 is a transverse section on line *x-x* of Fig. 1, Fig. 4 is an enlarged vertical section on line *y-y* of Fig. 1, Fig. 5 is a side elevation of one of the exhaust controlling valves, and, Fig. 6 is an enlarged transverse section on line *a-a* of Fig. 5.

Similar numerals refer to similar parts throughout the several views.

1 represents a horizontally disposed crank case, from which rise hollow walled cylinders 2, 3 and 4, the central cylinder 3 being of greater dimensions than the cylinders 2 and 4 and being hereafter referred to as the low pressure cylinder. Suitably journaled in the crank casing is the crank shaft 5 carrying on an end extension thereof, on the outer side of said crank case, a fly wheel 6. With the two outer cranks 5^a are connected the upwardly extending piston rods 6^a of pistons 7 which are slidably fitted within the outer or high pressure cylinders 2 and 4. With the central crank 5^b of the shaft 5 is connected the lower end of a piston rod 8 of a piston 9, which is adapted to fit and slide within the central low pressure cylinder 3.

In the head or upper end of each of the cylinders 2 and 4, I provide a threaded opening which is adapted to receive a spark plug,

such as is shown at 10, the ignition points of which project within the upper end of the cylinder. Between the adjacent walls of the cylinder 2 and cylinder 3 and between the walls of the cylinder 4 and the cylinder 3, I provide vertical fixed valve casings 11. On the outer side of each of the cylinders 2 and 4, I provide vertical cylindrical valve casings 12. Each of the valve casings 12 has leading into one side thereof, an arm 13 of a charge intake pipe 14. In each of the cylinders 11, I provide a vertically movable valve body 15, one of which is shown in Fig. 1 of the drawing, and each of said valve bodies has formed therethrough a port or passage 15^a which when the valve is properly turned, as one of its ends brought into communication with the pipe arm 13 and its remaining end into communication with a port 16 in the upper portion of the adjoining cylinder wall 2 or 4.

Within each of the casings 11, I provide a vertically reciprocating valve 17 which is of piston form and which is provided with a central horizontal passage 18 which extends diametrically therethrough. Each of said valves 17 is also provided with a passage 19, the entrance to which is in the upper portion of the valve above one end of the passage 18 and the outlet of which is as indicated at 20 in Figs. 5 and 6 of the drawing, at a point on the periphery of the valve at the center of the height of the latter and at right angles with the point of entrance to said port or passage. A similar port or passage which is indicated at 21, leads into the lower portion of each of said valves 17 below the entrance to the central passage 18 and has its outlet at a point opposite the outlet 20, which point is indicated at 22. In the upper portion of each of the cylinders 2 and 4, I provide a port 23 which leads through the wall of the cylinder and has its outlet at a point in the rotary path of the upper entrance to the port or passage 19. The central port 18 of each of the valves 17 is adapted to communicate with a passage or port 24 which leads through the valve casing 11 to the upper portion of the low pressure cylinder 3, one of the ports 24 being shown in Fig. 1 of the drawing.

Between the forward portions of the cylinders 3 and 4, I provide a vertical cylindrical exhaust valve casing 25 in which is contained a vertically reciprocating exhaust

valve 26 (see Figs. 1 and 3). This exhaust valve has running diagonally therethrough a passage 27 and at the center of the height of the casing 25 is formed an outlet port 28 which is adapted to be brought into communication with said valve passage 27 when the valve is moved to a certain position in its casing and when in this position, said passage 27 is also in communication with a port 29 which leads through the wall of the low pressure cylinder 3. Each of the valves 17 has a central upward extension in the form of a stem 17^a, which stem leads through an opening in the top of the valve casing. The upper end portions of these stems are squared and with each of said squared stem ends is connected one end of a rearwardly extending arm 30, the outer ends of said arms being pivotally connected with a horizontally disposed bar 31.

32 represent two pipes which lead respectively into the casings 11 of the valves 17, these pipes running from a source of compressed air. I also provide each of the valve casings 11 in its lower portion with an exhaust outlet pipe 33.

Journalled horizontally in the upper portion of the crank casing, is a supplemental crank shaft 34 and with the cranks of this shaft, one of which is indicated at 35 in Fig. 3, are connected the lower ends of vertical valve rods 36 of the valves 15 and similar valve rods 37 of the valves 17. In one end of the casing 1, the shaft 34 carries a gear wheel 38 which meshes with a pinion 39 carried on the crank shaft and shown in Fig. 2. Toward the opposite end of the case 1, the crank shaft 5 carries a gear wheel 40, the teeth of which mesh with those of a gear wheel 41 which is journaled in a bracket arm 42 which projects from the side of the case 1.

43 represents a valve rod which connects the lower end of the exhaust valve 26 with the gear wheel 41. The connection of the rod 43 and the valve 26, is, as shown in Fig. 4 of the drawing, in the nature of a jointed connection and preferably consists in forming the upper end of the rod 43 with a rounded termination which loosely engages a socket in the lower end of the valve. The lower end of the rod 43 is eccentrically connected with the wheel 41, being pivoted to a pin 44 which projects from said wheel.

In order to illustrate the operation of my improved engine, we will assume that the pistons 7 are, as shown, in the lower ends of their cylinders; that the piston 9 is in the upper end of the intermediate or low pressure cylinder and that the valves 17, 26 and 15 are in the positions indicated in the drawings. In order to impart the initial or starting movement to my improved engine, the bar 31 may be moved horizontally, thereby rotating the valves 17 until the upper ports

19 are in communication with the compressed air inlet pipes 32 and the openings 22 of said passages 19 are in communication with the ports 24 of the lower pressure cylinder. The charge of compressed air thus admitted into the upper end of the larger cylinder 3, results in forcing the piston 9 thereof downward, which through the movement of the crank shaft, causes an upward movement of the pistons 7. One of the cylinders 11 being previously provided with a charge of mixed gas and air from the pipes 13 and through the ports 15^a and 16 and a spark being generated between the ignition points of the spark plug, it is obvious that the charge thus compressed in one of the cylinders 11 by the upward movement of the piston thereof, will be fired, with the result that both of the pistons 7 will be again driven downward and the piston 8 forced upward, the air above said piston being driven out through the exhaust port 29, thence through the passage 27 of the exhaust valve 26 and through the port 28 in the casing 25, the said exhaust valve having during the operation described and by the movement of the gear wheel 41 been moved downward until its passage 27 is in communication with the port 29 and outlet 28. In the first upward movements of the pistons 7, it will be understood that the air contained in the cylinders 11, will be forced outward through the passages 23 and 21 and outlet pipes 33, the vertical movement of the valves imparted by their rods being such as to bring said passages and ports into communication. The engine thus being started, the bar 31 is moved horizontally to rotate the valves 17 to their normal positions and when in such positions, it will be understood that at each alternate upward movement of each of the pistons 7, the exhaust or burned gases will be forced through the passages 23 thence through the valve openings 18 and ports 24 into the low pressure cylinder 3, the products of combustion thus discharged into said low pressure cylinder operating to force the piston thereof downward. In the succeeding upward movement of the piston 9 of the low pressure cylinder, it is obvious that the products of combustion contained in the cylinder will be forced outward through the port 29, valve passage 27 and casing outlet 28. Owing to the relative sizes and arrangement of the gears 38, 39, 40 and 41 and the connections heretofore described between the valve 26 and the wheel 41 and between the valves 17 and 15 with the supplemental crank shaft 34, the vertically movable valves are brought into communication or moved out of communication with the ports and passages heretofore described at proper intervals. From this operation, it will be seen that the necessity of employing a muffler is obviated, inasmuch as the products of com-

bustion are exhausted into a low pressure cylinder where said products are utilized to contribute power to the engine. It is also obvious that such operation will result not only in attaining increased power from a given amount of fuel by the utilization of the exhaust products, but that a comparatively noiseless engine is produced.

What I claim, is:

- 10 In a compound gasoline engine, the combination with a pair of high pressure cylinders having ports for the entrance of a charge of gasoline and air, and means for automatically controlling said ports, of vertically movable incased valves between the
15 high and low pressure cylinders, each of said valves having a central port there-through, and ports leading from the upper

and lower portions of the valves to opposite sides of the center thereof, pipes leading from a source of compressed air through the casings of said valves, means for rotating said valves to bring their upper ports into communication with said air pipes, and means for automatically moving said valves vertically in their casings to bring the main valve ports into or out of communication with ports of the low pressure and high pressure cylinders.

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

LAWRENCE C. BURTON.

Witnesses:

A. L. PHELPS,
C. C. SHEPHERD.