A. R. HENDRIX.

GAS ENGINE.

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996,643.

Patented July 4, 1911.

Fig. 1.

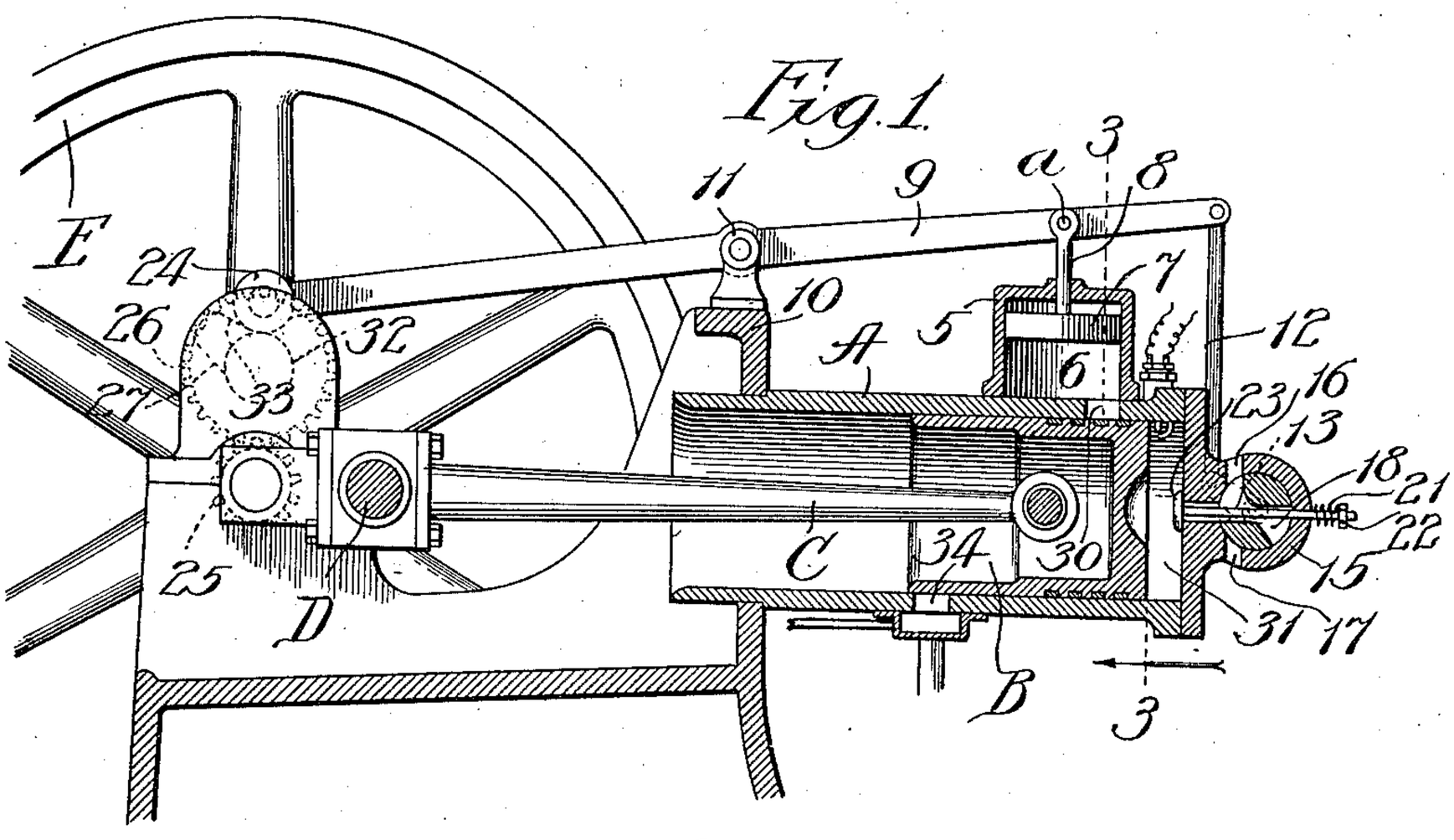


Fig. 2.

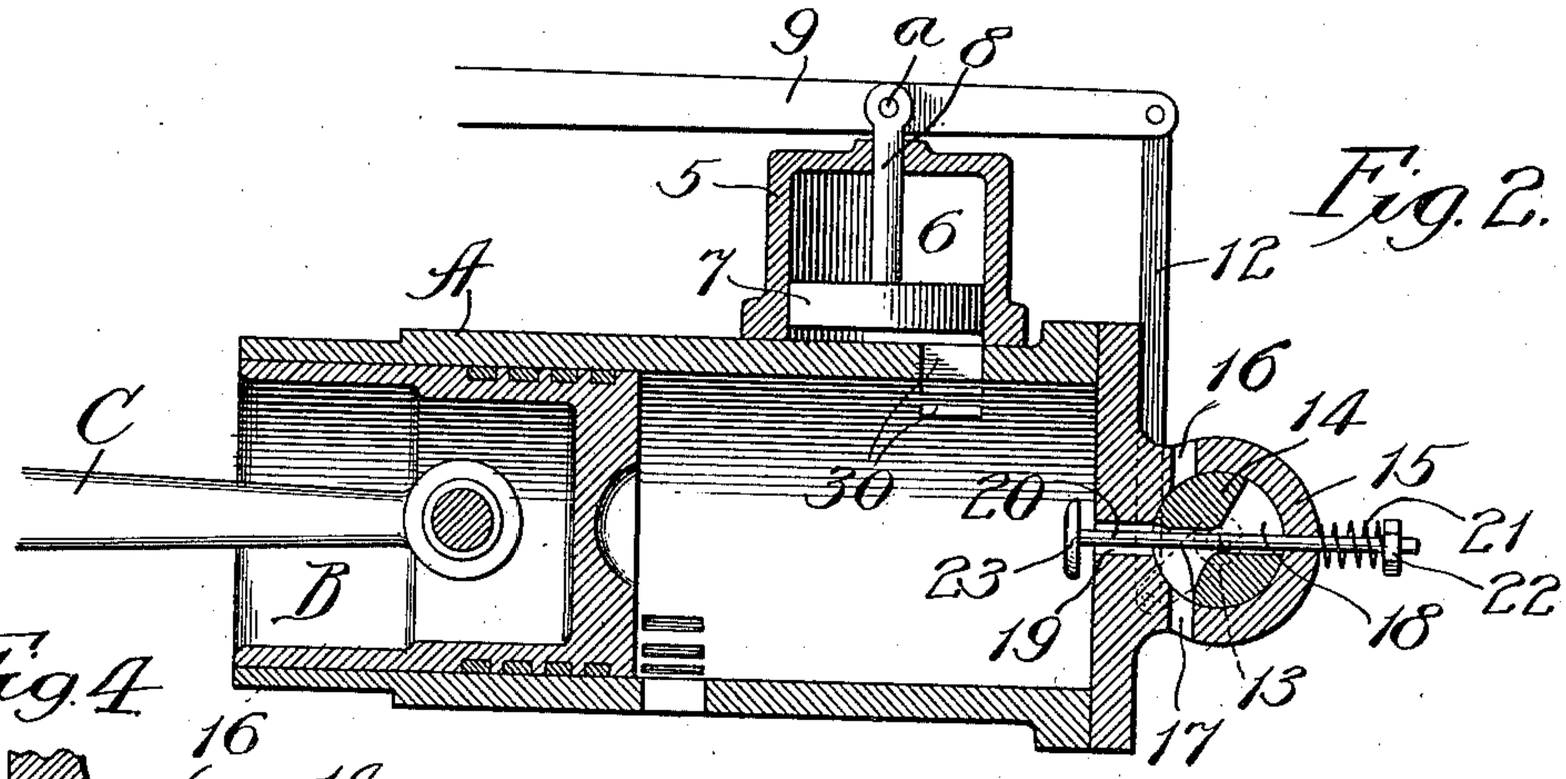


Fig. 4

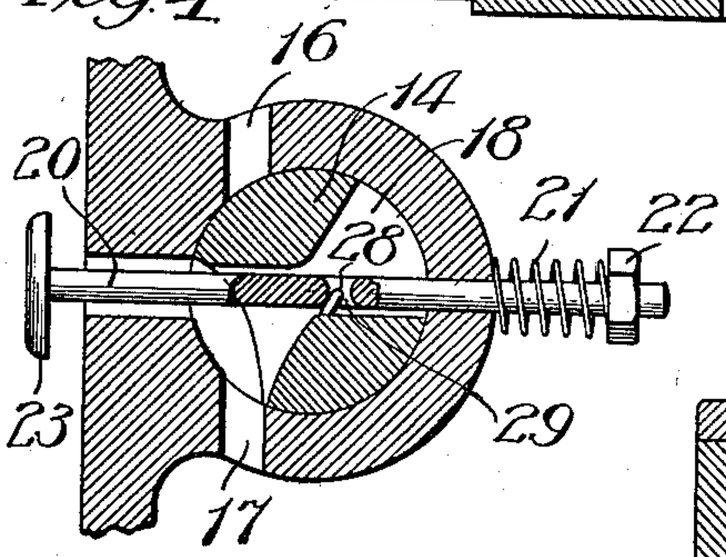
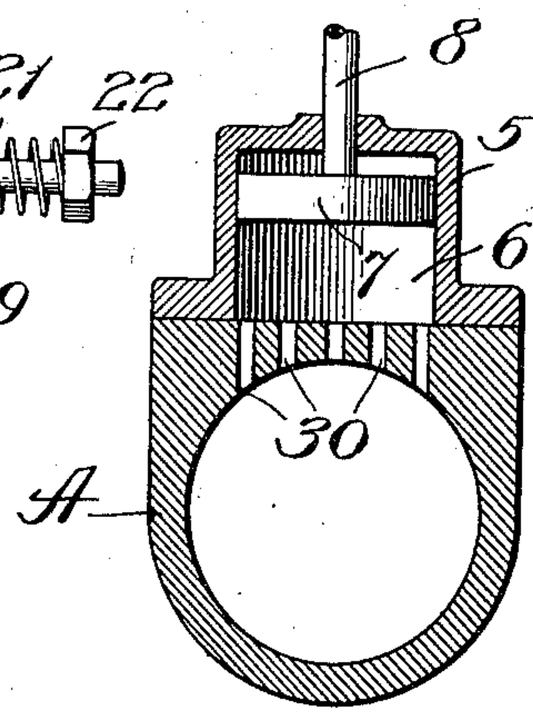


Fig. 3.



Witnesses:
John Enders.
Chas. H. Bull.

Inventor:
Adam R. Hendrix.
By L. B. Copeland.
Atty.

COLUMBIA PLANOGRAPH CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ADAM R. HENDRIX, OF CHICAGO, ILLINOIS.

GAS-ENGINE.

996,643. Specification of Letters Patent. Patented July 4, 1911.

Application filed May 19, 1909. Serial No. 497,030.

To all whom it may concern:

Be it known that I, ADAM R. HENDRIX, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Gas-Engines, of which the following is a specification.

This invention relates to explosive engines generally, but more especially of the four cycle type; and has for its principal object to greatly increase the duty efficiency without proportionately increasing the consumption of fuel.

This improvement is well adapted to be used in connection with the general class of gas and vapor engines in which the propulsive force is the usual gaseous admixture of liquid, fuel and air or similar explosive agent.

Figure 1 is a central longitudinal section of an explosive engine embodying the improved features. Fig. 2 is a similar view showing the piston and other working elements in their relative opposite position from that shown in Fig. 1. Fig. 3 is a vertical transverse section on line 3, Fig. 1. Fig. 4 is a detached sectional view, showing the valves controlling the admission and exhaust ports.

A may represent the engine cylinder, B, the piston, C, the piston-rod, having the usual operative connection with the crank-shaft D, on which the fly-wheel E, is mounted. In this improvement the cylinder is provided with a dome 5, inclosing an auxiliary fuel-chamber 6 in which is located a piston 7 secured to the inner end of a piston-rod 8. This rod extends out through the dome 5 and is pivoted to a rocking-lever 9, as at *a*. This lever is supported from the frame part 10 and is provided near its longitudinal center with a rocking bearing 11. The outer end of lever 9 is pivotally connected to the upper end of a link 12, the lower end of which is pivoted to an arm 13 mounted on one end of an oscillating valve 14 as indicated by dotted lines in Figs. 1 and 2. This oscillating valve is inclosed in a casing 15 formed on the outer closed end of the engine cylinder. The casing is provided with an inlet port 16 and an exhaust port 17, and the valve 14 with a port opening 18 extending therethrough. An aperture 19 in the head end of the cylinder forms a communicating passage through which the explosive charge enters and the spent gases are expelled in alternate operation.

A valve-stem 20 extends through the aperture 19 and the valve 14 and out through the casing 15 and has a spring 21 coiled thereon which is retained in place by a compression tension nut 22. A disk-valve 23 is mounted on the inner end of the valve-stem 20 and is located on the inside of the cylinder and positioned to automatically open and close the passage 19 at the proper time in practical working.

A roller 24 is pivoted to the inner end of the rocking lever 9, as shown in Fig. 1. A pinion 25 is mounted on the crank-shaft and is in driving engagement with a gear-wheel 26, provided with a suitable journal bearing. A cam 27 forms a part of gear wheel 26 and is in line with roller 24 which has a rolling or frictional contact therewith.

The valve 14 is provided with a pin 28 (Fig. 4) fixed in the wall of the port opening 18, which is adapted to engage a slot 29 formed in the valve-stem 20. When the valve 14 is turned to the position shown in Figs. 2 and 4, the intake port 16 is closed and the exhaust side opened to the atmosphere. In this movement of the valve 14, the pin 28 engages the wall of the slot 29 in the valve-stem 20 and imparts an inward endwise movement thereto and moves the valve 23 away from its seated position and uncovers the passage through the cylinder-head so that the spent gases may escape into the exhaust passage. When the valve 14 is turned in the opposite direction to open the inlet port and close the exhaust side, the valve-stem 20 will be moved outwardly and the disk-valve seated in its closing position by the tension of the spring on the end of the valve-stem, the piston being at the inner end of its stroke at this time, as shown in Fig. 1. By way of description this will be called the idle or charging stroke, the different parts being in the relative position shown. When the piston starts back, from the position shown in Fig. 1, the disk valve is opened by the suction of the same for the admission of the next explosive charge. On the return stroke, the charge is compressed and a portion of the same forced into the auxiliary chamber 6 through ports 30, opening thereinto from the cylinder. It will be

understood that during the charging cycle, the piston 7, in chamber 6, will remain stationary, as will be hereinafter explained. The engine-piston will cover the ports 30 before it reaches the end of its stroke, thus dividing the explosive charge into two parts, which will be termed the initial and auxiliary charges to be exploded in succession. The initial or primary charge being exploded in the clearance space 31 between the piston and cylinder head, and the auxiliary or secondary charge exploded after the piston has uncovered ports 30 and the charge in the auxiliary chamber is forced back into the cylinder. The auxiliary chamber will be so positioned that the explosive charge stored therein will be returned to the cylinder and exploded when the engine crank-arm is on the up movement from the dead point, and at the time when the additional propulsive force can be utilized to the best advantage. This dual operation of having a plurality of explosions in regular order of succession in the same stroke has the effect of greatly increasing the power and working efficiency of the engine. The auxiliary piston 7 not only acts to compress and force the second charge back into the cylinder, but also prevents the spent gases from entering the auxiliary chamber during the period of the exhaust stroke, as piston 7 will remain in its innermost closing position during that time, as shown in Fig. 2. It will be understood that during the charging cycle, or idle stroke, the piston 7 will remain in its outermost position, as shown in Fig. 1. This is effected by means of the differentiating gear and cam on the crank. The gear 26 being of a greater diameter than its driving pinion 25, or approximately two to one. During the charging cycle the roller 24 is in contact with the low part 32 of the cam 27 so that the position of the lever 9, to which piston 7 is connected, is not changed during that period of time. On the next cycle when the initial charge has been exploded and the engine piston has moved back far enough to uncover the ports 30, the roller 24 will come in contact with the high part 33 of the cam, raising that end of the lever 9 and depressing the opposite end, which will have the effect of moving the piston 7 inward and forcing the auxiliary charge into the cylinder where it is exploded at the proper time. This same movement of lever 9 will turn the oscillating valve 14 to close the inlet-port 16 and open the exhaust-port 17 as shown in Fig. 2. This movement of valve 14 will also have the effect of imparting an inner endwise movement to the valve-stem 20 and hold the valve 23 open for the exhaust stroke, as shown in Figs. 2 and 3.

No means for supplying the liquid or gaseous fuel is shown, but which may be done in any or the usual manner.

Having thus described my invention, what I claim is:—

1. In an explosive engine, the combination with a cylinder, of means for supplying fuel direct to said cylinder, an auxiliary fuel chamber connected to said cylinder between the respective ends thereof and adapted to receive fuel from said cylinder, and means in the chamber for compressing a charge therein.

2. In an explosive engine, the combination with a cylinder, means for supplying fuel direct to said cylinder, an auxiliary fuel chamber connected to said cylinder at a point removed from the initial explosive chamber, said chambers being momentarily divided from each other by the piston, and means in the auxiliary chamber for compressing a charge therein.

3. In an explosive engine, the combination with a cylinder, of means for supplying fuel direct to said cylinder, an auxiliary fuel chamber opening into said cylinder in which a portion of the explosive charge is stored during the compression cycle, means in the chamber for compressing a charge therein, and means for retaining the auxiliary charge in said chamber until after the initial explosion has taken place and then delivering said auxiliary charge to the cylinder.

4. In an explosive engine, a cylinder having ports in one side thereof, an auxiliary chamber into which said ports open and through which a portion of each explosive charge is forced into said chamber, and means operating in the chamber for returning said charge at predetermined intervals to be exploded in the cylinder subsequent to the firing of the initial charge.

5. In an explosive engine, a cylinder having fuel ports opening directly into the cylinder, an auxiliary fuel chamber adapted to receive a portion of each incoming charge and communicating with the cylinder through said ports which are closed by the engine piston until after the initial explosion and means for compressing the charge in the auxiliary chamber while the ports are closed.

6. In an explosive-engine, a cylinder having fuel ports opening directly into the cylinder in the side wall thereof, an auxiliary chamber receiving a portion of each incoming charge through said ports, and means located in said chamber for expelling said charge at the proper time to be exploded subsequent to a prior explosion.

7. In an explosive engine, a cylinder, an auxiliary fuel chamber opening into said cylinder and adapted to receive and temporarily retain a portion of each incoming explosive charge, a piston located in said chamber, and the operative connection for periodically actuating said piston in return-

ing the fractional charge to the cylinder at the proper time.

8. In an explosive-engine, a cylinder provided with port openings in one side thereof, a reciprocating power piston, and an auxiliary fuel-chamber, said ports establishing communication between said cylinder and chamber and so positioned as to be closed by said piston in each revolution of the crank-shaft and means for compressing the charge in the auxiliary chamber while the ports are closed.

9. In an explosive engine, a cylinder, a dome mounted thereon and inclosing an auxiliary fuel chamber opening into the cylinder, said chamber being charged from said cylinder, and means for returning said charge to the cylinder and closing said chamber against the entrance of the spent gases.

10. In an explosive-engine, a cylinder, means for supplying fuel direct to said cylinder, an auxiliary fuel chamber opening into said cylinder, a piston located in said chamber, a rocking lever connected with said piston, and means for actuating said lever at predetermined intervals.

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

ADAM R. HENDRIX.

Witnesses:
J. H. STANTON,
M. J. KIRKLAND.