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1,533,387

A. E. CHAPMAN

SUSTAINED EXPLOSION GAS ENGINE

Filed Nov. 5, 1923

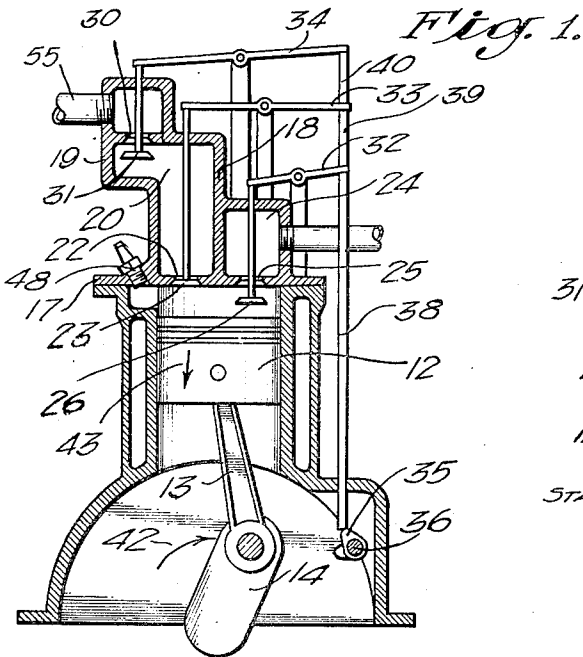
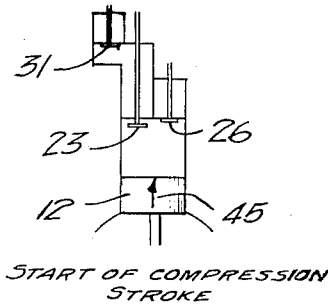
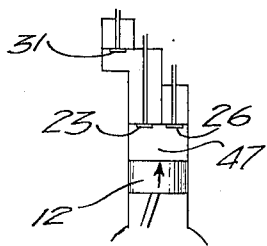


Fig. 2.



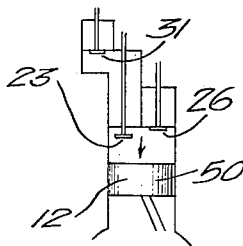
START OF COMPRESSION STROKE

Fig. 3.



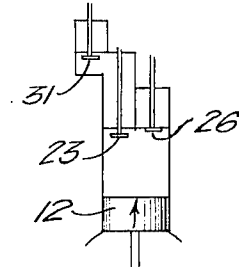
MIDDLE OF COMPRESSION STROKE

Fig. 4.



MIDDLE OF POWER STROKE

Fig. 5.



BEGINNING OF EXHAUST STROKE

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SUSTAINED EXPLOSION GAS ENGINE.

Application filed November 5, 1923. Serial No. 672,849.

To all whom it may concern:

Be it known that I, ALONZO E. CHAPMAN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles, State of California, have invented a new and useful Sustained Explosion Gas Engine, of which the following is a specification.

This invention relates to combustion engines of the type having cylinders in which gaseous fuel is combusted and the expanding thereof employed for the purpose of reciprocating pistons in the cylinders.

It is an object of the invention to provide an internal combustion engine having means for the compression of only a small portion of the combustion gases to the pressure necessary for ready ignition, and allowing the use of a leaner mixture by the use of more air in same, and relieving the load of compression in self or hand starting.

It is a further object of the invention to provide a combustion engine in which the entire fuel charge is compressed to an intermediate pressure and a small portion thereof is then compressed to ignition pressure, thus consuming less of the fly wheel torque in compression of the fuel charge. The invention employs a cylinder in which a piston operates. At the upper end of the cylinder, a secondary chamber is provided which communicates with the cylinder through a valve. During the initial portion of the compression stroke of the piston, the valve communicating between the cylinder and the secondary chamber is open so that a portion of the fuel charge is compressed therein. Just before the piston reaches the upper end of its stroke, the intercommunicating valve closes, thus causing the fuel mixture remaining in the cylinder to be compressed to a high pressure, at which pressure it will readily ignite. Immediately following the piston advance downwardly under pressure of the explosion therein, the intercommunicating valve opens and the fuel therein ignites and in expanding exerts a pressure on the piston during the power stroke. This feature of only compressing a small portion of the gases to the point where it is readily ignited allows the use of an excess of air in

the gas mixture, giving a more expansive and resultant longer power impulse upon the piston during a greater portion of the power stroke than is now accomplished, thus enabling the use of poor fuel mixtures and the running of the engine at a slower speed, or as an alternative, enables production of greater power at the customary speeds.

The especial advantages of the invention and further objects thereof will be made evident hereinafter.

Referring to the drawings which are for illustrative purposes only:

Fig. 1 is a sectional view of a combustion engine employing the features of my invention, the piston thereof being disposed at the beginning of the intake stroke.

Figs. 2, 3, 4 and 5 are diagrammatic views illustrating the disposal of valves in various positions of the piston.

As designated in the separate views in the section shown in Fig. 1 of the drawing, 11 indicates a cylinder in which a piston 12 reciprocates, this piston being associated through the connecting rod 13 with a crank 14. The head plate 17, which is bolted on the top of the cylinder 11, provides walls 18 and 19 which enclose a secondary chamber 20 which communicates with the upper portion of the cylinder 11 through a valve opening 22 controlled by a valve member 23. A fuel inlet 24 is provided which communicates with the cylinder through a valve opening 25 controlled by a poppet valve 26. In the upper end of the secondary chamber 20, there is situated an exhaust opening 30, equipped with an exhaust valve member 31. These valve members 23, 26 and 31 are actuated by rocker arms 32, 33 and 34 lifted by cams 35 disposed on the cam shaft 36, through thrust rods 38, 39 and 40 which are arranged in consecutive order.

In Fig. 1, the crank 14 is represented as swinging in the direction of the arrow 42 and the piston 12 is moving downwardly as indicated by the arrow 43 through a suction or fuel intake stroke. At this time, the valve members 26 and 31 are in open position, whereas the valve 23 is closed, thus drawing a charge of fuel into the cylinder

11 as the piston advances downwardly from the position in which it is shown in Fig. 1 to the position shown in Fig. 2. When the piston 12 reaches the bottom of the suction stroke and is ready to advance upwardly as indicated by the arrow 45, Fig. 2, the intake valve 26 and the exhaust valve 31 are closed and the intercommunicating valve 23 opened, by the action of the cams 35. As the piston moves upwardly during the compression stroke, a portion of the fuel gas therein is compressed into the secondary chamber 20, but at an intermediate point possibly at the center of the upward stroke or slightly thereabove, Fig. 3, the intercommunicating valve 23 closes and the gas remaining in the upper portion 47 of the cylinder 11 is compressed to a high pressure and ignited by a spark plug 48 which may be suitably located in a position communicating with the upper end of the cylinder.

The piston is then forced downwardly by the expansive action of the ignited fuel and in travelling downwardly through its power stroke passes through an intermediate position such as indicated at 50, Fig. 4. When the piston is in this position, immediately following the explosion of the highly compressed gases the intercommunicating valve 23 opens, thus allowing the compressed fuel mixture in the secondary chamber 20 to ignite with the result that the pressure thereof is exerted against the piston 12 during the latter part of the power stroke, or in other words during the travel of the piston downwardly from the position in which it is shown in Fig. 4. When the piston reaches the bottom of the power stroke as indicated in Fig. 5, the exhaust valve 31 is opened so that the explosive gases will be expelled into the exhaust pipe 55 through the secondary chamber 20 and the exhaust opening 30, the valves 23 and 31 remaining open until the piston reaches the beginning of the intake stroke, Fig. 1.

I claim as my invention:

1. In an engine, the combination of: a cylinder; a piston operating in said cylinder; walls forming a secondary chamber arranged for communication with said cylinder; and valve means providing communication between said secondary chamber and said cylinder during the compression stroke of said piston, said valve means to be provided for the closing such communication during the latter part of the compression stroke of said piston so that only a portion of the gases will be brought to a pressure necessary for ignition.

2. In an engine; the combination of: a cylinder; a piston operating in said cylinder; walls forming a secondary chamber at head of said cylinder and arranged for communication with the upper end or head of said cylinder;

said secondary chamber arranged with communication with outer air controlled by an exhaust valve, with valve to control communication between said cylinder and said secondary chamber, both these valves to remain open during the exhaust stroke allowing the consumed gases to pass out through said secondary chamber to the open air, and valve means to close the communication between said cylinder and said secondary chamber during the suction stroke in order to prevent the mixing of pure gases with the consumed gases remaining in said secondary chamber.

3. In an engine, the combination of: a cylinder; a piston operating in said cylinder; walls forming a secondary chamber at head or upper end of said cylinder; valve means of control of communication between said cylinder and said secondary chamber; valve means of exhausting the consumed gases from said secondary chamber and from said cylinder through said secondary chamber to the open air, such valve means to close the communication between said cylinder and said secondary chamber during the suction stroke, and such exhaust valve means to open air from said secondary chamber to remain open until the beginning of the compression stroke to further reduce the amount of consumed gases remaining in said secondary chamber for the purpose of obtaining more perfect ignition in the following power stroke.

4. In an engine, the combination of a cylinder; a piston operating in said cylinder; walls forming a secondary chamber arranged for communication with said cylinder, said chamber being arranged for communication with said cylinder during the compression stroke of said piston so that a portion of the combustible mixture will be received therein, and means of closing said secondary chamber so that the remainder of the combustible mixture remaining in said cylinder may be brought to a pressure necessary for ready ignition, and arranged for communication with said cylinder intermediate the power stroke of said piston so that the combustible mixture in said secondary chamber will be ignited and the expansive force thereof exerted against said piston during said power stroke.

5. In an engine, the combination of a cylinder; a piston operating in said cylinder; walls forming a secondary chamber arranged for valve controlled communication with said cylinder during the compression stroke of said piston so that a portion of the combustible mixture will be received therein, and valve means of closing said secondary chamber so that the remainder of the combustible mixture in said cylinder may be brought to a pressure necessary for ready

ignition and arranged for communication with said cylinder immediately following the ignition of the gases in said cylinder and the start of the power stroke of said piston so that the combustible mixture in said secondary chamber will be ignited and the expansive force thereof exerted against said piston during said power stroke; and an exhaust valve for said secondary chamber; and means for holding said valve means and said exhaust valve open during the exhaust stroke of said piston. 10

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 30th day of October, 1923.

ALONZO E. CHAPMAN.