Oct. 20, 1925. 1,557,710

W. LENNON

INTERNAL COMBUSTION ENGINE

Filed Oct. 9. 1924

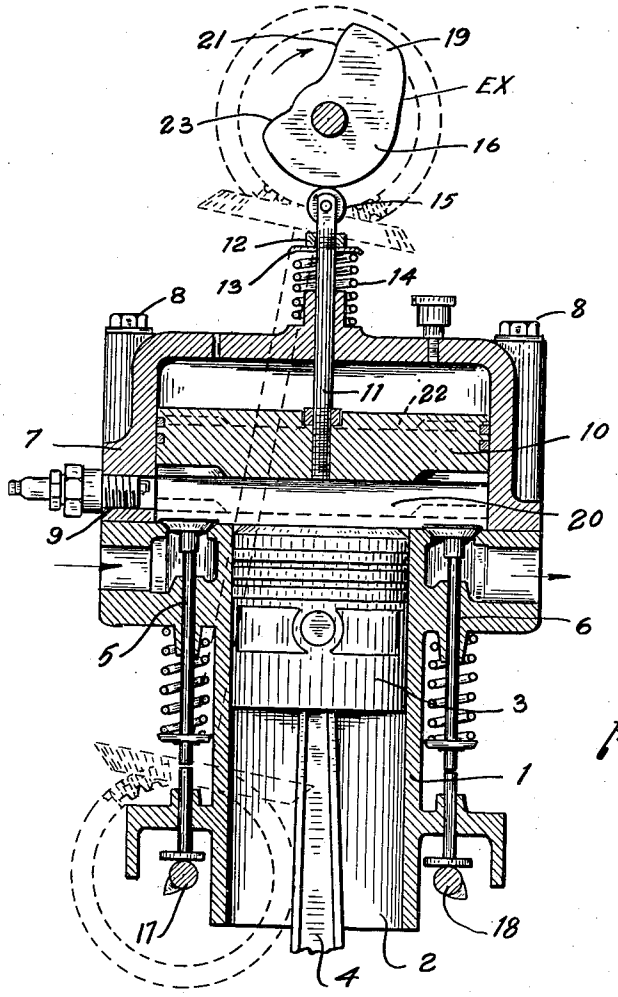

Fig. 1.

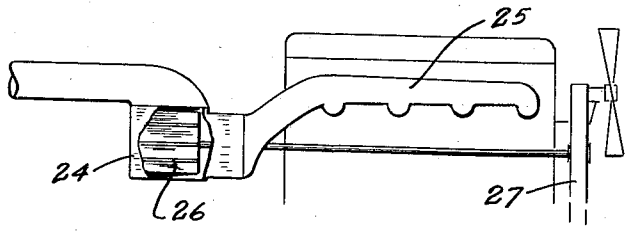

Fig. 2.

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INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, WILLIAM LENNON, a citizen of the United States, residing at Manitou, county of El Paso, and State of Colorado, have invented certain new and useful Improvements in Internal-Combustion Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings and to the characters of reference marked thereon, which form a part of this specification.

This invention relates to improvements in the construction of internal combustion engines and has reference more particularly to the provision of means for effecting more complete scavenging of the combustion chamber after each explosion and of obtaining a supercharge of fuel.

It is well known that internal combustion engines as usually constructed do not completely exhaust the burned gases after each charge. This is due to the fact that all engines must have a clearance space whose volume in proportion to the piston displacement provides the desired initial compression of the charge. This clearance space, is, of course, never fully cleared of exhaust gases which therefore become mixed with the charge of fuel that is taken in on the intake stroke. It is very evident that the inert products of combustion which are thus added to the new charge merely serve to dilute the latter and render it less efficient per unit volume.

It is one object of the invention to so construct an internal combustion engine that the volume of the clearance space decreases during the exhaust stroke so that very little, if any, of the inert gaseous products of combustion will remain.

Owing to the fact that the fuel mixture is usually sucked into the cylinder and that it has to pass through valve openings that are so small that wire drawing takes place, it is obvious that the gases in the cylinder at the end of the intake stroke are at a pressure below atmosphere, wherefore the quantity of fuel is far below what it would be if the charge at the end of the intake stroke were at atmosphere pressure of more.

It is another object of this invention to produce an engine in which the fuel will be taken into the engine in a greater amount than would be the case if the action of the piston alone were depended upon for the purpose and thereby producing what may be termed a "supercharge." By this means the power of the engine can be greatly increased.

The complete removal of the products of combustion will, of itself, greatly increase the power of the engine and so will the "supercharging." If the engine is provided with means that accomplish both of these functions, it is evident that a greater benefit will accrue than if either were used alone.

In order to obtain the desired scavenging effect, and the supercharging action, I provide an auxiliary piston which forms a portion of the wall surface of the clearance space and which is controlled by cams or other means in such a manner that it will be moved at predetermined times during the engine cycle thereby varying the volume of the combustion chamber. The movements of the auxiliary piston are such that during the exhaust stroke of the regular piston, the auxiliary piston moves in a direction in which it causes the volume of the clearance space at the end of the exhaust stroke to become very small. During the intake stroke of the engine piston the auxiliary piston moves in the opposite direction whereby the volume of the combustion chamber is increased beyond normal. This permits a larger amount of fuel to enter than would otherwise be the case. At the beginning of the compression stroke, the auxiliary piston moves back to an intermediate position where it remains until some time during the exhaust stroke when it starts moving, and begins the cycle above described.

In order better and more clearly to describe my invention and the means employed by me in carrying it out, I shall have reference to the accompanying drawing in which—

Fig. 1 is a vertical transverse section of an engine constructed in accordance with my invention, and

Fig. 2 is a diagrammatic showing of a modified form of my invention.

Numeral 1 designates the cylinder block of an engine and may contain one or more cylindrical chambers 2, for the reception of pistons 3 of ordinary construction. To each piston there is operatively secured one end

of a connecting rod 4, whose other end is connected in the usual manner with a crank shaft which has not been shown.

In the particular type of engine used for the purpose of illustration, the intake and exhaust valves are located on opposite sides of the cylinder. I want it understood, however, that the specific form of construction of the engine is immaterial and that the showing on the drawing is illustrative only. For the purpose of this description, the valve 5 represents the intake valve, and valve 6 the exhaust valve. The cylinder head 7 is secured to the block by means of bolts 8 and has a spark plug opening 9 for each cylinder. The cylinder head is provided with a short cylindrical opening within which is reciprocably mounted a piston 10. A piston rod 11 is threadedly secured to the piston and extends through a suitable opening in the cylinder head. The upper end of the rod 11 is threaded for the reception of a nut 12, which engages a dished washer 3 against which the upper end of the spring 14 abuts. The spring 14 is of sufficient strength to move the piston 10 upwardly so as to always keep the roller 15 against the surface of the cam 16. The space between the adjacent surfaces of the piston 3 and 10 is the clearance space of the engine. If the piston 10 remained stationary, the engine would operate exactly like any other engine of the four cycle type. The intake and the exhaust valves are operated by cam shafts 17 and 18 in the usual way. The parts are shown in the position which they occupy at the end of the compression or the beginning of the power stroke.

Let us assume that the parts are in the position shown and that the charge is ignited. The pistons 3 will be moved downwardly by the pressure of the gases, and finally reaches the point at which the exhaust valve opens, which as a rule, occurs a short time before the piston reaches the end of its stroke. During the power stroke, the cam 16 has rotated clockwise until the point Ex. is in contact with the roller 15. From this point the cam surface moves outwardly from the center until it reaches the accurate position 19. As the piston 3 moves upwardly on the exhaust stroke, the cam 16 moves the piston 10 downwardly to the dotted line position indicated by the numeral 20, in which position it will be held until after the piston 3 begins the intake stroke at which point the cam 16 will be in such a position that the roller 15 is about to begin contacting with the incline 21. During the intake stroke the piston 10 moves upwardly until its lower surface reaches the dotted line 22. This movement on the part of the piston 10 enlarges the combustion chamber with the results that a greater volume of fuel is taken in. After the intake stroke is finished and at the beginning of the compression stroke, the cam surface 22 cooperates with the roller 15 and moves the piston 10 down to the position shown in full lines in which position it remains during the remainder of the compression stroke and the power stroke after which the cycle just described will be repeated.

It is apparent that moving the piston 10 downwardly during the exhaust stroke decreases the volume of the clearance space and thereby effects more thorough scavenging of the engine. It is possible to so adjust the parts that the volume of the clearance space is reduced to almost nothing at the end of the exhaust stroke. By having the piston 10 move upwardly during the intake stroke, a greater volume of fuel is taken in which produces a "supercharge" and by having the auxiliary piston move downwardly at the beginning of the compression stroke the clearance space is reduced to normal and the initial pressure increased above what it would have been if there had been no "supercharge".

In Fig. 2, I have shown how a similar effect may be obtained by providing a suction pump 224 in the exhaust manifold 25. This pump has been indicated as a centrifugal pump having a rotating fan 26 which may be driven from the fan belt. By this expedient a partial vacuum is produced in the exhaust manifold, which assists in removing the exhaust gases and if made sufficiently strong, may also produce a partial vacuum in the combustion chamber which causes the fuel mixture to enter more readily at the beginning of the intake stroke whereby a supercharge is obtained.

I am aware that the results aimed at by me may be attained by different means than those illustrated, which are simply intended to illustrate one practical embodiment. This disclosure should therefore be considered as illustrative only and not in a limited sense.

Having now described my invention, what I claim as new is:

1. An internal combustion engine of the four cycle type provided with means for intermittently varying the volume of the clearance space to values over and under normal, said means comprising an auxiliary piston, said piston being stationary during the greater part of the compression and power stroke, means for moving the piston so as to decrease the clearance space during the exhaust stroke whereby thorough scavenging is obtained and means for moving the auxiliary piston so as to increase the volume of the clearance space above normal during the intake stroke whereby a supercharge of fuel is taken in, said means being also adapted to move the piston back to normal position during the first part of the compression stroke.

2. In an internal engine of the four cycle type, in combination, a cylinder block having a cylindrical chamber, two pistons (one main and one auxiliary) movably mounted in said chamber, said pistons determining by their position the volume of the combustion chamber, the main pistons having a movement whose rate is a sine function and the auxiliary piston being intermittently movable, means operatively associated with the main piston for moving the auxiliary piston so as to enlarge or decrease the volume of the clearance space, said means moving the auxiliary piston towards the main piston during the exhaust stroke whereby the clearance space is decreased in volume and thorough scavenging effected, said means moving the auxiliary piston away from the main piston during the intake stroke so as to increase the clearance space above normal whereby a supercharge of gas is obtained, said means also moving the auxiliary piston back to normal position during the first part of the compression stroke.

In testimony whereof, I affix my signature.

WILLIAM LENNON.