

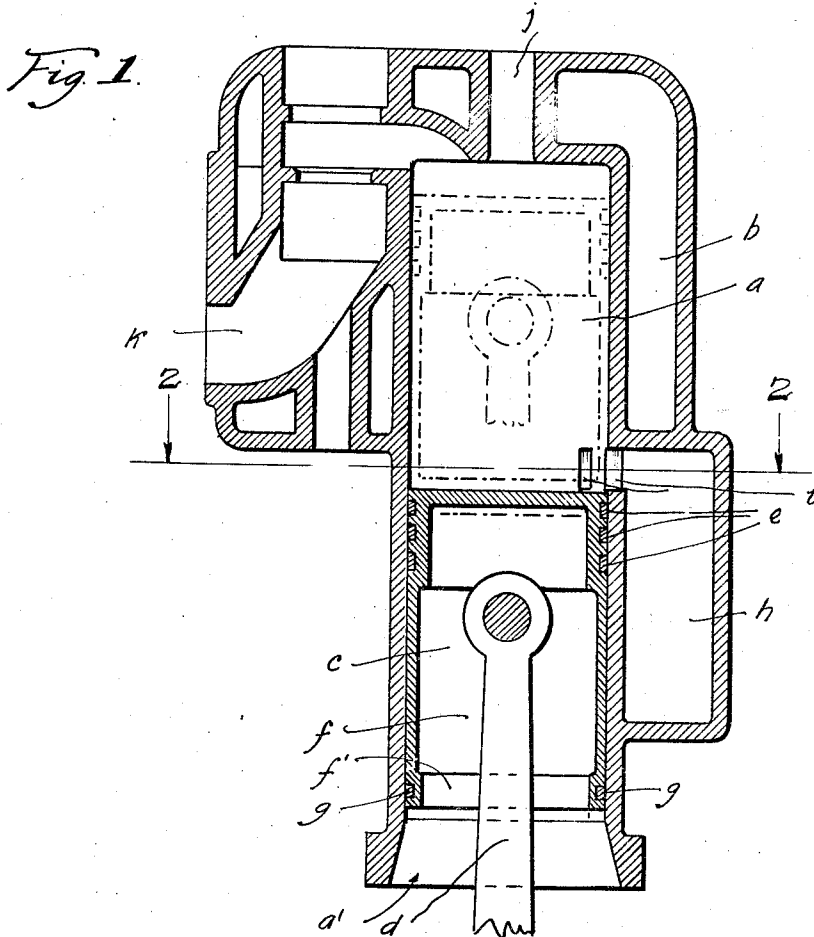
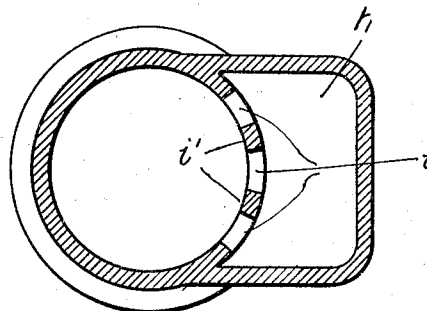
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INTERNAL COMBUSTION ENGINE

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UNITED STATES PATENT OFFICE.

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INTERNAL-COMBUSTION ENGINE.

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To all whom it may concern:

Be it known that I, ELBERT VAUGHAN, a citizen of the United States, and a resident of Portland, county of Multnomah, and State of Oregon, have invented a new and useful Improvement in Internal-Combustion Engines, of which the following is a specification.

My invention relates to internal combustion engines and more especially to four-cycled engines.

In engines of this type as generally constructed, with their inlet and outlet ports in the head of the cylinder, the piston on its suction stroke does not draw a sufficient charge of combustible mixture into the cylinder to completely fill the vacuum caused by the displacement of the piston. Hence when the piston passes the point of reciprocation and starts its compression stroke it does not act against a cylinder-full of combustible mixture at atmospheric pressure and therefore a maximum amount of compression relatively to piston displacement is not obtained.

The object of my invention is to provide an internal combustion engine with means for assuring the maximum compression of the piston at the time of the firing without varying the proportions of said mixture, and without increasing the charge of combustible mixture.

I attain my object by combining with the cylinder, an auxiliary chamber having a port which communicates only with the cylinder, at a point slightly above the lowest point of reciprocation of the piston. This chamber becomes filled with the products of combustion on the power stroke of the piston, which is entrapped by the piston on its exhausting stroke and which is released by the uncovering of the communicating port by the succeeding suction stroke of the piston. Hence the products of combustion which are entrapped in said auxiliary chamber when released by the opening of said port, during the suction stroke of the piston will be projected into the cylinder and commingle with the combustible mixture drawn into the latter and tend to relieve any vacuum therein; and then upon the ensuing compression stroke of the piston a maximum compression of the combustible mixture is assured.

Preferably the walls of said auxiliary chamber are made of substantial thickness

and enclose a space directly about and extending alongside of the cylinder.

The details of construction of these and other features are illustrated in the accompanying drawings, in which:

Fig. 1 is a diagrammatic longitudinal section thru the cylinder embodying my invention; and

Fig. 2 is a section taken on the line 2—2 of Fig. 1, thru the auxiliary pocket and its communicating ports.

My invention is adaptable for use in an internal combustion engine, preferably of the four-cycled type. The four strokes of an engine of this type in succession are, suction, compression, power and exhaust, which complete each cycle.

Internal combustion engines are made with a cylinder *a* which is usually cooled by a water jacket *b*. A piston *c* reciprocates in the cylinder and is connected to the driven means by a connection rod *d*. The piston is made with a plurality of piston rings *e* near its head which serve to prevent the intense pressure of the explosion within the cylinder from leaking by the piston.

The piston is made with an elongated skirt *f* which has an enlarged portion *f'* at the bottom. This enlarged portion is grooved and an auxiliary piston ring *g* is inserted therein. The auxiliary chamber *h*, which I combine with the cylinder, is arranged alongside of the cylinder and communicates only with the cylinder by a port *i*. In the accompanying drawings, I have shown two guiding pieces *i'* which serve to prevent the piston from catching on the edge of the port. The piston ring *g* at the bottom of the skirt of the piston *c* is arranged so that it will always be between the port *i* and the bottom of the cylinder and thus prevent gases entrapped in the auxiliary chamber *h* from escaping out from the bottom *a'* of the cylinder. As shown, the auxiliary chamber has no connection except thru the port *i* and thus is merely a pocket in which gases from the cylinder may be entrapped. The cylinder is provided with an opening *j* in the head in which a spark plug may be positioned and passage ways as *k* are arranged to permit the inlet and outlet of the charge of combustion mixture to and from the cylinder.

At the beginning of the suction stroke of the engine the piston is at its uppermost

point in the cylinder as shown in dotted lines in Fig. 1. It is then forced downward in the cylinder and as it moves downward it creates a region of diminished pressure in the cylinder directly above the head. This causes the combustible mixture to be drawn into the cylinder so as to equalize the pressure therein and the atmosphere without. It continues to flow into the cylinder as the piston moves downward. It can readily be seen that as the engine speeds up this downward movement of the piston will not draw in a charge of combustible mixture sufficient to equalize the pressure in the cylinder and atmospheric pressure without, and therefore as the piston passes the lower point of reciprocation as shown in full lines in Fig. 1 it will not have drawn into the cylinder a full charge of combustible mixture. Thus when it moves upward it will not act against a cylinder full of fuel charge and thus the compression in the cylinder will not reach the maximum. As the compression attained in the engine is a deciding factor in the efficient combustion of this mixture it is desirable that the cylinder be filled completely. The introduction of an auxiliary charge of combustible mixture or of fresh air will cause the proportions of the mixture to be varied. In a throttling type motor this is objectionable because it is difficult to regulate the speed of the engine due to this change. I have discovered that if gases are introduced to the cylinder which have been thoroly burned and contain no combustible matter, they will merely serve as so much mass but will not combine with the fuel charge. Thus, for example, if the cylinder were filled half full of the combustible mixture and the other half of the products of complete combustion, the resulting value of the fuel charge would not be increased except in so far as the compressing of the mixture would increase the pressure at which the charge was fired.

In my invention I have introduced this gas by providing an auxiliary pocket *h* and thus when the piston is forced downward due to the firing of the compressed combustible mixture the intense pressure created by this combustion will force this piston downwardly until it passes the port *i*. The expansion of the gases will then have completed substantially all of their work and the pressure within the cylinder will force part of the products of combustion into the auxiliary chamber *h*. The exhaust port is then opened and the piston moves upwardly and forces the gases out thru the auxiliary port. The piston in moving upward, however, covers the port *i* and traps a certain percentage of the gas in this chamber, under pressure. The gas entrapped can not escape because the piston is provided with a piston ring at the lower portion of its skirt and

also has a number of piston rings in the head of the piston. The first stroke of the succeeding cycle will cause a fresh fuel charge to be drawn in and as the piston moves downwardly it will uncover the port *i* and permit the products of combustion under pressure to escape into the cylinder. This will equalize the partial vacuum created therein and thus as the piston moves upward it acts against a cylinder full of a mixture of fuel charge and burned gases and thus the compression is raised without varying the proportion of hydrocarbon and oxygen in the mixture. The size of the auxiliary chamber is determined by the size of the cylinder and is arranged so that the chamber will contain a sufficient amount of gas so as to equalize the partial vacuum created by the piston on its suction stroke.

I claim:

1. An internal combustion engine of the character described, comprising a cylinder and a piston reciprocating therein, an auxiliary chamber for receiving part of the heated gaseous products of combustion, said chamber having a valveless port which communicates with said cylinder only, such port being so located as to be covered and uncovered by the piston at the end of its working stroke, whereby heated spent gas is trapped during the exhaust stroke and reintroduced upon the succeeding intake stroke to heat and add mass to the fuel mixture.
2. An internal combustion engine of the character described, comprising a cylinder and a piston reciprocating therein, an auxiliary chamber for receiving part of the gaseous products of combustion, said chamber having a valveless port which communicates with said cylinder only, such port being so located as to be uncovered when the piston is at the end of its working stroke, the walls of said cylinder encompassing said auxiliary chamber, to maintain the same in a heated condition.
3. An internal combustion engine of the character described, comprising a cylinder open at one end and a piston reciprocating therein, an auxiliary chamber for receiving part of the gaseous products of combustion, said chamber having a valveless port which communicates with said cylinder only, such port being so located as to be uncovered when the piston is at the end of its working stroke, said piston provided with a skirt portion having a sealing medium thereon, said sealing medium being arranged to lie between said port and the open end of said cylinder, whereby the gases entrapped in said auxiliary pocket are prevented from passing by said piston.
4. An internal combustion engine of the character described, comprising a cylinder and a piston reciprocating therein, an auxiliary chamber for receiving part of

the gaseous products of combustion, said chamber having a valveless port which communicates with said cylinder only, such port being so located as to be uncovered when the piston is at the end of its working stroke, the walls of said cylinder encompassing said auxiliary chamber to maintain the walls thereof in a heated condition, said piston provided with a piston ring and a skirt portion, whereby the gases entrapped in said auxiliary pocket are prevented from passing by said piston. 10

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