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INTERNAL COMBUSTION ENGINE

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Fig. 1.

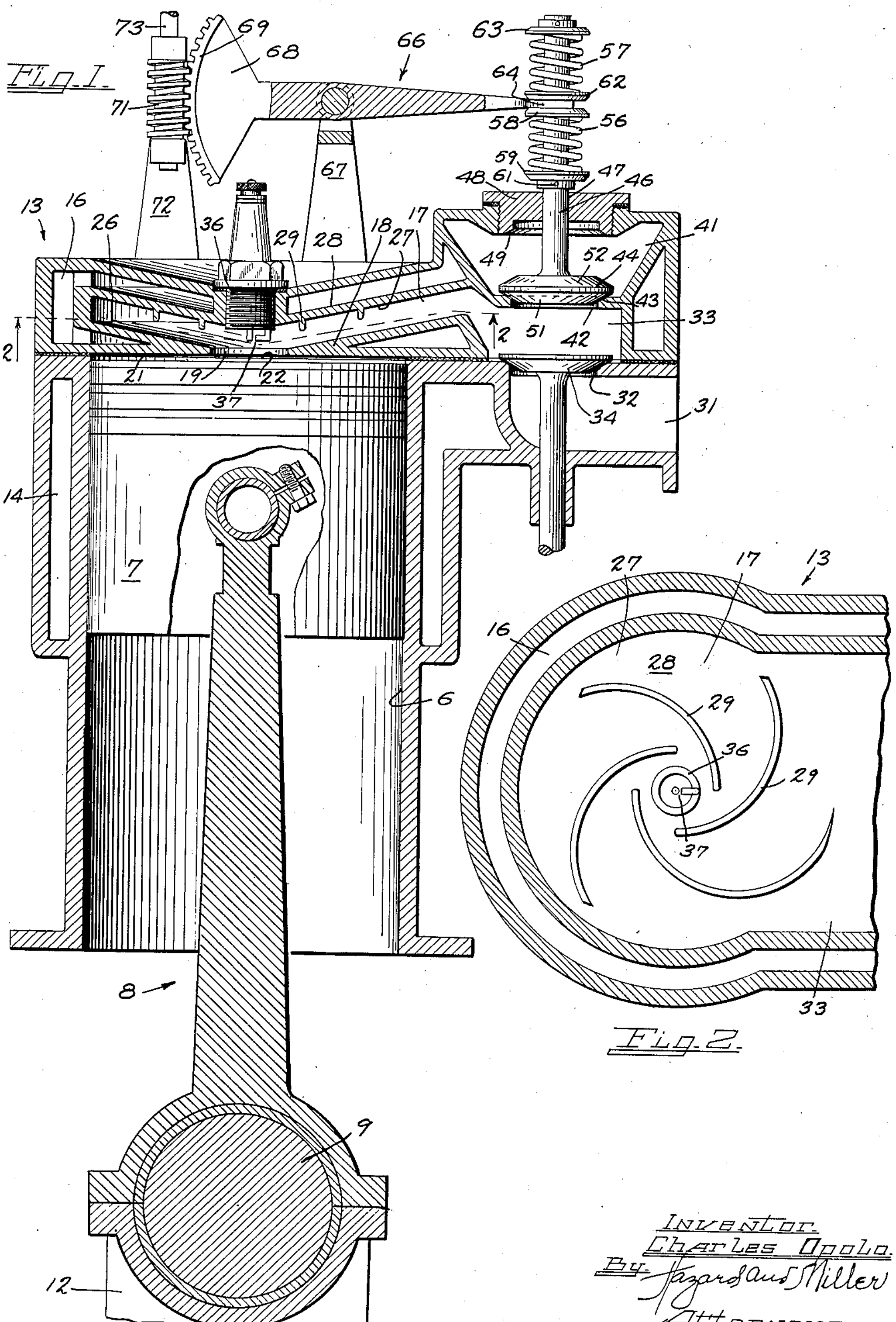

Fig. 2.

Inventor.
Charles Opolo.
By Hazard and Miller
Attorneys.

UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Charles Opolo, Culver City, Calif.

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5 Claims. (Cl. 123—48)

This invention relates to internal combustion engines and has for an object the provision of a novel design of combustion and compression chamber for engines of this general class.

A more detailed object in this connection is to provide an improved type of combustion chamber communicating with the cylinder through a relatively restricted orifice so that the pressure generated within the combustion chamber when the fuel is ignited will be imposed upon the piston relatively slowly, building up upon the piston gradually until maximum pressure upon the piston is attained. This relieves the piston and its associated engine parts of the shock of detonation.

Another object is to provide means for altering the compression ratio of the engine, this portion of the device being capable of being actuated while the engine is in operation.

The invention possesses other objects and advantageous features, some of which, with those enumerated, will be set forth in the following description of the invention's particular embodiment which is illustrated in the drawing accompanying and forming a part of the specification.

Referring to the drawing:

Fig. 1 is a transverse vertical sectional view taken through a cylinder of an engine embodying the principles of the present invention.

Fig. 2 is a horizontal sectional view taken upon the line 2—2 of Fig. 1, with the direction of view as indicated. A portion of this figure is broken away to reduce its size.

The present invention seeks to provide an internal combustion engine of such design that higher efficiency of operation and smoother running is obtained. This is accomplished by providing means for overcoming the shock of the detonation which takes place as a result of the substantially instantaneous combustion of the explosive gases fed to the combustion chamber. It is desirable that combustion in the engine cylinder commence while the crank arm is at or even slightly in advance of top dead center, the result being that in the conventional internal combustion engine the greatest force is exerted against the top of the piston when the associated crank arm is in the least advantageous position to transmit the energy exerted in a linear direction against the piston into rotary motion of the crank shaft. This invention overcomes this disadvantage of the conventional type of engine by providing means for cushioning the impact, this being accomplished by requiring the gaseous products of combustion to flow into the cylinder of the engine through a relatively restricted orifice whereby pressure is permitted to build up against the piston relatively slowly, hence maximum pressure will not be exerted against the piston until the associated crank arm is moved far enough beyond top dead center to be in a more advantageous position to transmit energy from the connecting rod to the crank shaft. Toward this same end resilient means are interposed within the connecting rod, and in addition means are provided for varying the compression ratio of the engine during the operation thereof.

Specifically describing a prefered embodiment of my invention, an internal combustion engine cylinder is indicated at 6; this cylinder has a piston 7 reciprocable therein which is connected by a connecting rod 8 to the crank pin 9 carried by a crank arm 12 of the crank shaft (not shown). The upper end of the cylinder 6 is closed by a head 13, and preferably both the cylinder 6 and the head 13 are provided with water jackets 14 and 16, respectively.

A combustion chamber 17 is provided within the head 13 and this combustion chamber is separated from the cylinder 6 by a horizontal partition 18 having a relatively restricted orifice 19 therethrough, this orifice being disposed co-axially with respect to the cylinder 6 and combustion chamber 17. Preferably the under surface 21 of the partition 18 is horizontal, i. e., extends in a plane perpendicular to the axis of the cylinder 6, and the parts are so proportioned that when the piston 7 is at its upper extreme of motion its upper end 22 is disposed closely adjacent the under surface 21 of the partition 18. This results in permitting the gases rushing through the orifice 19 to act against only a relatively small area upon the top 22 of the piston 7 while the piston is at the upper extreme of its motion, thereby minimizing the force exerted by the piston 7 and through the connecting rod 8 against the crank pin 9 when the crank arm 12 is at top dead center. However, as soon as the crank arm 12 moves beyond top dead center the piston 7 moves away from the partition 21, whereupon gases rushing through the orifice 19 will be permitted to act upon the entire area of the top 22 of the piston 7, thus increasing the total force exerted by the gases at a given pressure against the piston.

Owing to the restricted nature of the orifice 19, gases rushing from the combustion chamber 17 into the cylinder 6 will be impeded so that even after the piston 7 has moved away from the partition 21 pressure will be permitted to build up against the piston gradually, the result being that the maximum pressure of the gases against the piston will not be exerted until the crank arm 12 has moved a considerable distance beyond top dead center.

In order to guide the gaseous products of combustion through the orifice 19 I prefer that the combustion chamber 17 be of substantially inverted conical configuration, hence the upper surface 26 of the partition 18 is dished slightly, the central portion having the orifice 19 being slightly lower than the peripheral edge of the upper surface 26 of the partition. The under surface 27 of the top 28 of the combustion chamber 17 is similarly formed and preferably is provided with a plurality of spiral beads 29 which serve to guide gases moving toward the orifice 19 in spiral paths. These beads 29 serve to impart turbulence not only to the gaseous products of combustion but also to the carbureted fuel before combustion, thereby tending to provide a more nearly homogeneous mixture of vaporized fuel and air, with a consequent increase in the rapidity and completeness of combustion when ignition takes place.

Fuel is supplied to the combustion chamber 17 through an inlet passage 31 which communicates through an inlet port 32 with a passageway 33 which leads laterally from above the port 32 into the combustion chamber 17. The port 32 is controlled by an inlet valve 34 of suitable design. Fuel mixture thus supplied to the combustion chamber 17 is ignited at the proper time during the cycle of the engine by means of a spark plug 36, the points 37 of which are disposed within the combustion chamber 17 and preferably immediately above the orifice 19.

The exhaust valve is positioned and operates parallel to the inlet valve 34 and has an outlet passage separated from and parallel to the inlet passage 31. These elements are directly in line with the inlet valve 34 and inlet passage 31 illustrated in Fig. 1 and hence do not show on such figure. The passage 33 thus communicates both with the inlet and exhaust valves and the inlet and exhaust passages.

Means are provided for altering the compression ratio of the cylinder. For this purpose an auxiliary compression chamber 41 is formed in the head 13 and communicates by a port 42 with the combustion chamber 17, the port 42 preferably being disposed immediately above the inlet port 32. A valve seat 43 encircles the port 42 and has associated therewith a double faced valve 44, the stem 46 of which extends through a hole 47 in a removable valve guide 48. A second valve seat 49 is concentric with the hole 47 in the valve guide 48 and the valve 44 is so arranged that when it is in lowermost position, as illustrated on Fig. 1, its lower face 51 is adapted to engage the valve seat 43 to close the port 42, whereas in its upper position the upper face 52 of the valve 44 is adapted to engage the seat 49 and prevent the escape of gases through the hole 47 within which the stem 46 is slidable.

The upper end of the stem 46 extends far enough beyond the guide 48 to receive a pair of compression springs 56 and 57. The lower spring 56 is under compression between a washer 58, which is slidable upon the stem 46, and a second washer 59, which is secured to the stem 46 as by a pin 61, the upper spring 57 being similarly confined between a slidable washer 62 and a fixed washer 63. The bifurcated end 64 of a lever 66 is engaged between the two slidable washers 58 and 62. This lever is pivotally mounted, as by a bracket 67 rigid with the head 13, and its other end 68 is provided with a segment gear 69 engaged by a vertically disposed worm gear 71. This worm gear is journalled in a suitable bracket 72 and is adapted to be rotated, preferably manually, as by means of a shaft 73, so as to raise or lower the end 68 of the lever 66 and thus swing it on the axis of its pivotal mounting. In this manner the washers 58 and 62 may be raised or lowered, this motion being imparted through the springs 56 and 27 to the valve stem 46, so as to move the valve 44 optionally onto the seat 43 or the seat 49. When the valve 44 is in elevated position the auxiliary chamber 41 is in communication through the port 42 with the combustion chamber 17. Preferably the valve is maintained in this position when the engine is operating slowly under load, or when idling. However, when the engine is operating at higher speeds the valve 44 should be lowered to the seat 43, thereby disconnecting the auxiliary chamber 41 from the combustion chamber 17 and requiring that the gases compressed within the cylinder 6 and the combustion chamber 17 be confined to a smaller space and thereby increasing the compression ratio of the cylinder. However, in the event of detonation, the sudden great increase in pressure will cause the valve 44 to be lifted slightly from the seat 43, this being permitted because of the resilient interconnection between the stem 46 and the shifting lever 66. This feature serves to relieve the pressure of detonation after which the valve 44 will be returned to its seat 43 by the spring 57.

It is to be understood that the details of the invention as herein disclosed are subject to alteration within the scope of the appended claims.

I claim:

1. In an internal combustion engine having a cylinder with a closed head, said head having a combustion chamber defined by lower and upper, conical shaped walls adjacent to and remote from the closed end of the cylinder respectively and spaced apart the height of the combustion chamber, the closed head being provided with an orifice axially centered as to the cylinder and in the apex of the combustion chamber whereby exploded fuel may have a direct conical flow in the combustion chamber and through the orifice to the cylinder.

2. In an internal combustion engine having a cylinder, a closed head, said head having a combustion chamber with an under and an upper surface forming cones with their apices towards the cylinder and thus defining a conical combustion chamber, a partition having a central orifice in the axial center of the cylinder terminating the under surface, the said under and upper surfaces adapted to develop a flow of exploded fuel following the path of the cone and discharging at the apex through the orifice into the cylinder.

3. In an internal combustion engine having a cylinder, a cylinder head having a partition at right angles to the axis of the cylinder, said head having a conical combustion chamber defined by a conical under surface of the head adjacent the cylinder and a conical upper surface remote from the cylinder, the said surfaces being spaced apart the height of the combustion chamber, said surfaces having their apices directed towards the cylinder, the said partition having an orifice centrally positioned on the axis of the cylinder, said orifice having a small axial measurement and defining the apex portion of

the under surface, and a spark plug in the head extending through the upper surface, and in axial alignment with the said orifice.

4. In an internal combustion engine having a cylinder, means forming a combustion chamber and an auxiliary compression chamber with a first valve seat between the said chambers, there being a passageway connecting the said chambers, a valve guide having a hole and having a second seat surrounding said hole, a valve having a stem slidable in the said hole, the valve being adapted to engage either of said seats, and means for moving the valve to exert a resilient closing pressure between the valve and both of the seats.

5. In an internal combustion engine, a cylinder head having a partition with a central orifice therein and a wall member spaced apart from the said partition and forming a combustion chamber therewith, means forming a passageway communicating at one side of the chamber, a structure forming an auxiliary compression chamber having a first valve seat, a valve in the auxiliary compression chamber having a stem and forming a closure at the valve seat to the passageway, the head having a hole with the stem slidable therethrough, and means for reciprocating said stem including a resilient pressure means for closing the valve against the first seat by a resilient pressure.

CHARLES OPOLO.