March 29, 1932. W. S. STEWART 1,851,530

INTERNAL COMBUSTION ENGINE

Original Filed Oct. 2, 1929 3 Sheets-Sheet 1

Fig. 1.

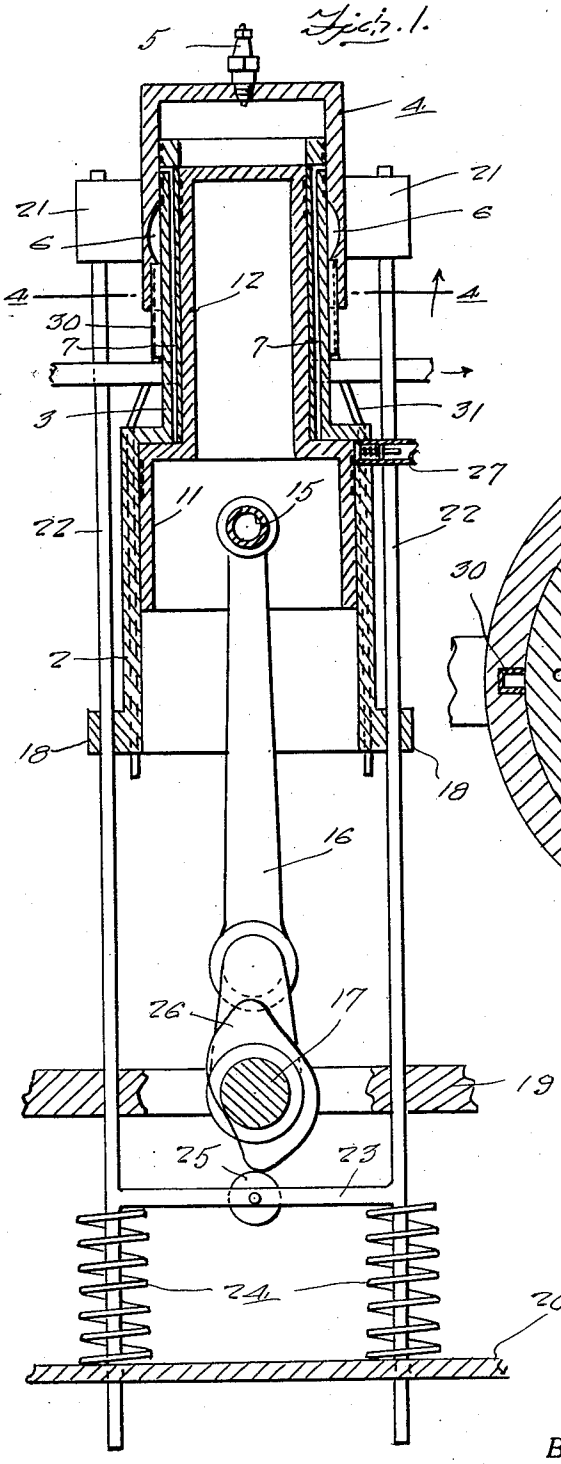

Fig. 4.

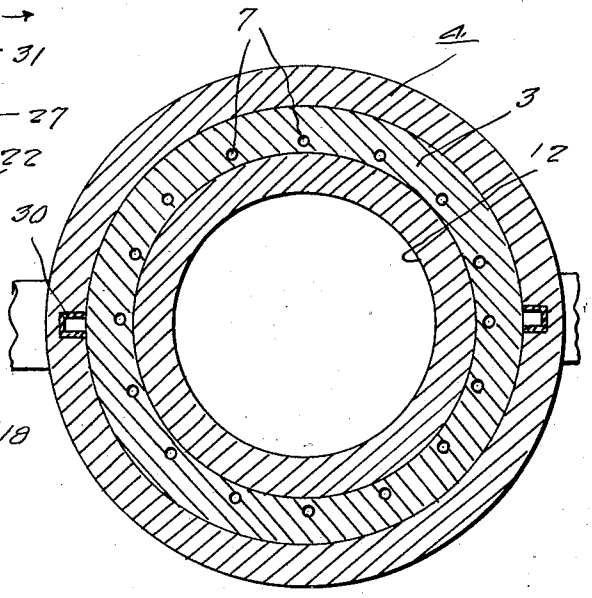

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Fig. 2.

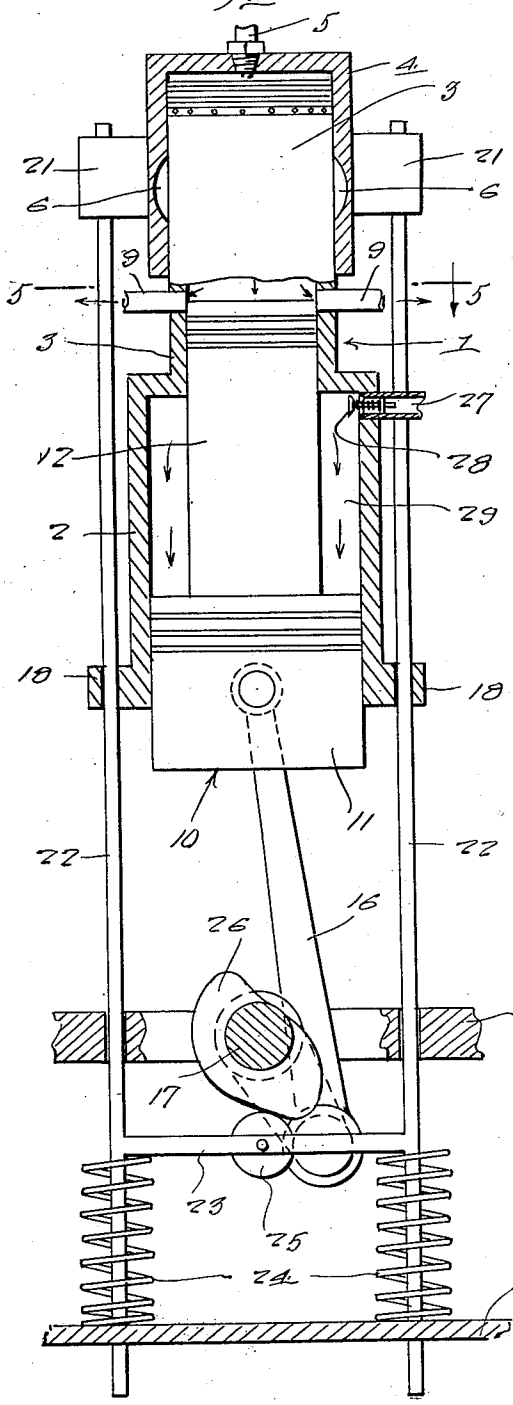
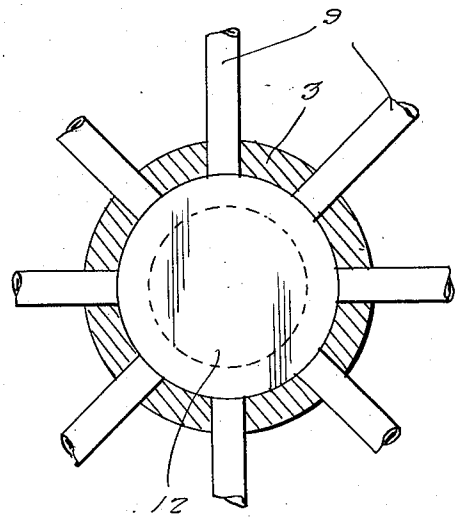


Fig. 5.



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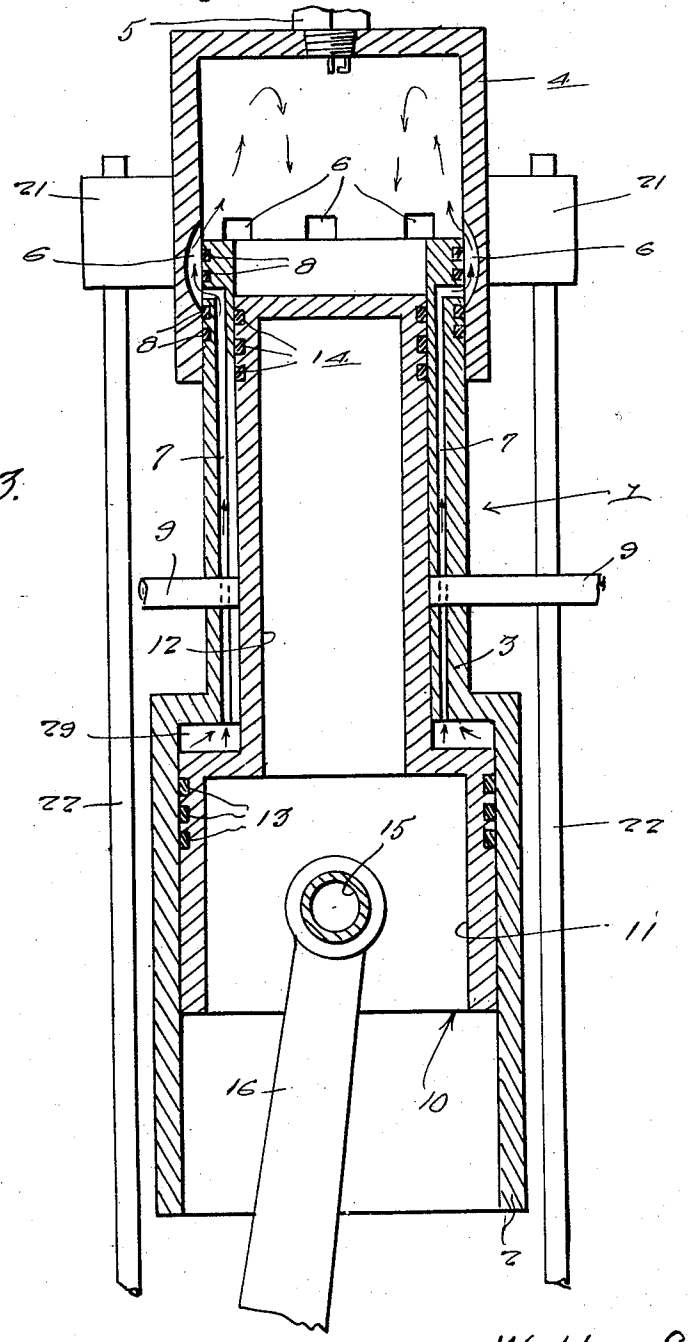

Fig. 3.

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UNITED STATES PATENT OFFICE

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INTERNAL COMBUSTION ENGINE

Application filed October 2, 1929, Serial No. 396,762. Renewed September 4, 1931.

This invention relates to internal combustion engines, and more particularly to devices of this character of the two-cycle type, but it is to be understood that an engine embodying the principles of this invention may be constructed for four-cycle or six-cycle operation.

An important object of the invention is to provide, in a manner as hereinafter set forth, an engine of the aforementioned character wherein the exhaust and intake operations are caused when the piston is in distinctly different positions in the cylinder, thus eliminating the danger of pre-ignition which often occurs in conventional two-cycle engines due to the incoming gas contacting with the hot exhaust gases which have not completely left the cylinder.

Another important object of the invention is to provide an engine of the aforementioned character wherein a vertically reciprocating cylinder head is utilized for the purpose of compressing the explosive charge and wherein said reciprocating head constitutes the major portion of the combustion chamber.

Other objects of the invention are to provide an internal combustion engine of the aforementioned character which will be simple in construction, strong, durable, efficient in its use, and which may be manufactured at low cost.

Other objects and advantages of the invention will become apparent from a study of the following specification, taken in connection with the accompanying drawings wherein like characters of references designate corresponding parts throughout the several views, and wherein:—

Figure 1 is a vertical sectional view showing the position of the piston and the reciprocating head as well as all of the moving parts of the engine at the time the explosion takes place in the combustion chamber.

Fig. 2 is a vertical sectional view showing the relative positions of the parts when the exhaust operation is taking place and when the incoming gases have been drawn into the lower chamber of the cylinder.

Fig. 3 is a vertical sectional view showing the relative position of the parts when the fresh charge is entering the combustion chamber.

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 1.

Fig. 5 is a horizontal section taken approximately on the line 5—5 of Fig. 2.

Referring to the drawings in detail, the reference character 1 designates generally the cylinder of the engine and comprises a lower portion or section 2 and an upper section 3 or less diameter than said section 2. The upper portion of the section 3 is adapted for telescopic distortion in a vertically reciprocating head 4 in the closed upper end of which is a spark plug 5. Adjacent its lower end and on its inner periphery, the reciprocating head 4 is provided with a series of circumferentially spaced segmental recesses or grooves 6.

The walls of the section 3 of the cylinder, are provided with circumferentially spaced ducts 7 which communicate at their lower ends with the interior of the section 2 and are turned outwardly at right angles adjacent the top of said section 3 and are adapted to be brought into communication with the grooves or recesses 6 of the reciprocating head 4.

Packing rings 8 are mounted on the upper end portions of the section 3 on opposite sides of the adjacent terminals of the ducts 7 for engagement with the inner walls of the reciprocating head 4 for sealing the joint therebetween. Adjacent its lower end of section 3 is provided with a plurality of radially extending exhaust conduits 9 which pass between the ducts 7 and communicate with the interior of said section.

A piston designated generally by the reference character 10 is mounted for reciprocation in the cylinder 1 and comprises a main or base section 11 mounted for reciprocation in the section 2 of the cylinder and an upper section or extension 12 of less diameter than the section 11 and adapted for reciprocation in the section 3 of the cylinder 1.

The section 11 is provided with sealing rings 13 adjacent its upper end and the section 12 is provided with sealing rings 14 ad-

jacent its upper end. The section 11 of the piston, is provided with a wrist pin 15 which is provided for connecting the connecting rod 16 thereto and, as usual, the lower end of the connecting rod 16 is coupled to a crank shaft 17.

The lower end of the cylinder 1 is adapted to be coupled to a crank case, not shown, and is provided with an annular flange 18. The crank case of the engine is to have mounted therein a pair of vertically spaced bars 19 and 20, the purpose of which will be presently set forth. On diametrically opposite sides, the reciprocating head 4 is provided with outwardly extending lugs or arms 21 having vertical bores extending therethru for the reception of the upper end of a pair of elongated lift rods 22 which are secured rigidly in the arms 21 in any suitable manner. The lift rods 22 extend slidingly through openings in the flange 18, bar 19 and bar 20 in the crank case and terminate a distance below said bar 20.

The bar 19 is of a configuration to avoid contact with the crank shaft 17. A cross rod 23 connects the lift rods 22 intermediate the bars 19 and 20 and expansible coiled springs 24 encircle said lift rods and impinge the rods 23 and the lower guide rod 20. A roller 25 is mounted on the coupling rod 23 beneath the crank shaft 17. Rigidly mounted on said crank shaft 17 is a cam 26 of a suitable configuration with which the roller 25 is maintained in constant engagement through the medium of the spring 24, as will be obvious.

An intake conduit 27 communicates with the interior of the section 2 of the cylinder at its upper end through the medium of the intake valve 28, which is actuated in any suitable manner. The cylinders, piston, and reciprocating head receive their lubrication by the splash system from the crank case and the oil works its way up between the sections 2 and 3 of the cylinder and the sections 11 and 12 of the piston, and in so doing, it passes through the chamber 29 which is warmed by said section 2 of the cylinder and 11 of the piston. Owing to the greater size of the section 11 and its closer proximity to the crank case, more oil will enter the chamber 29 than will work upwardly between the piston section 12 and the cylinder section 3, and this oil enters the ducts 7 and discharges into the recesses or grooves 6 in a manner to lubricate the side walls of said reciprocating head and the adjacent outer walls and rings on the section 3.

For taking care of an excess of lubricating oil in the recesses 6, a plurality of elongated substantially U-shaped conduits 30 communicate at their upper ends with the lower ends of said recesses and extending a distance therebelow where they connect with conductor plates 31 extending downwardly through the wall of the cylinder section 2 and communicating with the interior of the crank case.

The inner side of the members 30 engage the peripheral walls of the section 3 and are closed thereby. In the operation of the engine, the piston 10 is moved to the position shown in Fig. 2 of the drawings, the intake valve 28 opens and a charge of fuel is drawn into the chamber 29. In this position, the upper end of the section 12 of the piston is below the exhaust ports 9 and the exhaust gases are thus free to pass from the combustion chamber and the upper portion of the section 12.

As the piston goes down in the cylinder the cam 26 forces the lift rods 22 downwardly against the tension of the spring 24, through the medium of the roller 25 and cross rod 23 for the purpose of accelerating the exhaustion of the gases and at the moment when the exhaust ports 9 are uncovered, the highest position or point on the cam 26 engages the roller 25 and the reciprocating cylinder head is brought rapidly down to a position closely adjacent the upper end of the cylinder for the purpose of ejecting practically all of the exhaust gases, therefrom.

When the piston starts on its upstroke, the cam 26 has rotated to a position which permits the spring 24 to raise the head 4 through the medium of the lift rods 22 and the fuel charge which has entered the chamber 29 is compressed in said chamber and the ducts 7 until the heads 4 reaches the position shown in Fig. 3 of the drawings, when the segmental grooves or channels 6 establish communication between the upper ends of said ducts 7 and the interior of the head.

At this time, another comparatively high place on the cam 26 engages the roller 25 and the head 4 is brought rapidly downwardly to compress the charge therein. As soon as the head 4 reaches the limit of this compression stroke, the charge is exploded through the medium of the spark plug 5 and the piston is driven downwardly on the power stroke in the usual manner. As soon as the piston reaches the uppermost point of the compression stroke, a slightly lower place on the cam 26 engages the roller 25 and permits a very slight upward movement of the head 4 at the time the explosion takes place, to eliminate what is commonly known as "knocking" or "compression knocks".

It is understood, of course, that the intake valve 28 closes as soon as the piston starts the upstroke.

It is believed that the many advantages of an engine constructed in accordance with this invention will be readily understood, and although the preferred embodiment of the invention is as illustrated and described, it is to be understood that changes in the details of construction may be had, which

will fall within the scope of the invention as claimed.

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

1. An engine of the character described comprising a cylinder having upper and lower sections, said lower section being of greater diameter than the upper section, a piston having upper and lower sections mounted for reciprocation in the corresponding sections of the cylinder, a reciprocating compression head enclosing the upper end of the upper section and communicating with the interior thereof, a valve for supplying fuel to the interior of the lower section of the cylinder, the upper section of the cylinder being provided with a plurality of passages extending from an upper peripheral portion to the lower end thereof and communicating with the lower portion of the cylinder for the reception of fuel therefrom, the compression head being provided with longitudinally extending recesses in the inner wall thereof adapted for registry with the passages upon reciprocation of said head in a manner to establish communication between said passages and the interior of the compression head, said passages and the recesses constituting means for conducting the fuel from the lower cylinder section to the interior of the compression head, and means for rapidly lowering the compression head on the cylinder when the piston is substantially in its uppermost position in a manner to compress the fuel charge therein.

2. An engine of the character described comprising a cylinder having a lower section, and means for supplying fuel thereinto, an upper section on said lower section of smaller diameter than said lower section, a piston comprising a lower section mounted for reciprocation in the corresponding section of the cylinder and an upper section for reciprocation in the upper section of the cylinder, a vertically reciprocating compression head slidably mounted on the upper portion of the upper cylinder section, said compression head and the upper cylinder section being provided with passages adapted to be peroidically brought into communication with each other in a manner to establish communication between the lower cylinder section and the interior of the compression head for conducting the fuel charge from said lower section into said head, said upper cylinder section being further provided, adjacent its lower end, with exhaust ports adapted to be closed by the adjacent piston sections, a crank shaft operatively connected to the piston, a cam mounted on said crank shaft, and means engageable with the cam and connected to the compression head for lowering same on the cylinder while the piston is in substantially its uppermost position for compressing the fuel charge therein.

3. An internal combustion engine of the character described comprising a cylinder, having a lower section provided with a fuel supply means, a piston having a section mounted for reciprocation in the lower section of the cylinder, said cylinder being further provided with an upper section of less diameter than the lower section, an upper section on the piston of less diameter than the lower section, and mounted for reciprocation in the corresponding cylinder section, a reciprocating compression head mounted for longitudinal sliding movement on the upper cylinder section, said compression head and cylinder section being provided with a series of circumferentially spaced coacting passages adapted to be periodically brought into communication with each other by the reciprocation of the compression head in a manner to establish communication between the interior of said head and the interior of the lower cylinder section, said upper cylinder section being further provided with radially extending exhaust passages adapted to be closed by the adjacent cylinder section, the crank shaft operatively connected to the piston, a cam mounted on said crank shaft, arms extending laterally from the compression head, vertical lift rods anchored in said arms and extending downwardly on opposite sides of the crank shaft, expansible coiled springs associated with said rods in a manner to urge the compression head upwardly on the cylinder, and means carried by said rod engageable with the cam for shifting the compression head downwardly on the cylinder through the medium of said lift rods and against the tension of the coiled springs for compressing the fuel charge in said head when the piston is substantially in its uppermost position in the cylinder.

In testimony whereof I affix my signature.

WALTER SCOTT STEWART.