July 14, 1953 E. BIRNSTIEL 2,645,214

TWO-CYCLE REAR PISTON COMPRESSION ENGINE

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Fig. 1

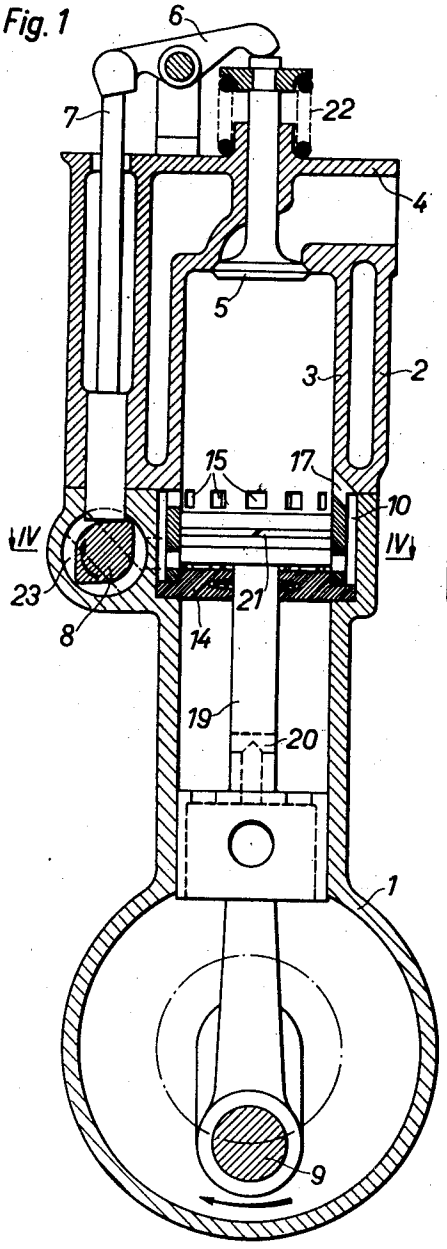
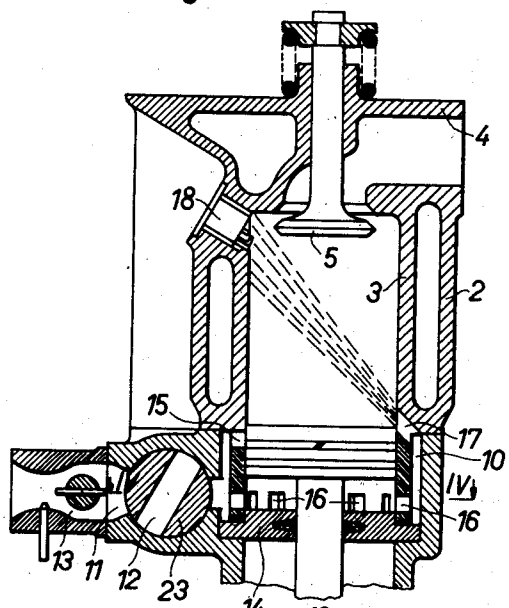


Fig. 2



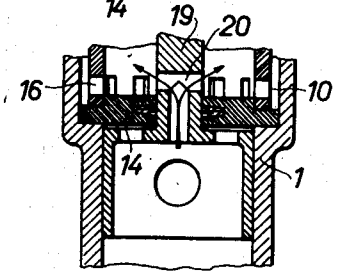
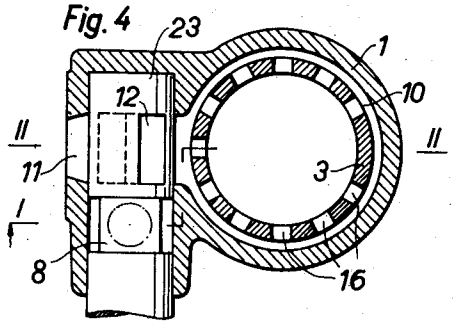


Fig. 3

Fig. 4



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TWO-CYCLE REAR PISTON COMPRESSION ENGINE

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3 Claims. (Cl. 123—74)

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The present invention relates to improvements in internal combustion engines in which the main piston serves as scavenging pump piston, as well as serving as the piston of the fuel mixture pump.

In some conventional two-cycle engines, the underside of the main piston cooperates with a portion of the crankcase for supplying fuel mixture and/or scavenging air; in other conventional two-cycle engines, a separate charging and scavenging pump is provided. Various difficulties have been experienced with such arrangements.

If the lower piston side is used in combination with the crankcase as charging pump, lubricating oil is admixed to the fuel mixture; this causes additional oil consumption, smoky and odorous exhaust, and fouling of the exhaust ports.

If a special charging pump is used, there is little advantage in a two-cycle engine over a four-cycle engine, and the compression conditions are unfavorable.

If the piston is used for controlling the inlet of the fuel mixture and the outlet of the combustion gases, the piston is subjected to undesirable temperature stresses, and its size is limited because larger pistons are likely to crack under the heat stresses.

Even if special control means are provided for discharging the combustion gases, the piston is heated excessively because it must perform twice as many operating cycles as that of a four-cycle engine running at the same number of revolutions per minute. With conventional systems for cooling the piston, the time available between two working strokes in a two-cycle engine is too short to maintain the temperature of a large piston within permissible limits. A piston which is too hot may cause spontaneous combustion and is likely to crack. To avoid this, the size of the piston, the rate of charging, and the compression ratio must be limited.

Removal of the combustion gases is unsatisfactory in the conventional two-cycle engines. The compression ratio is limited because of the admixture of lubricating oil to the fuel mixture, the ignition temperature of lubricating oil being lower than that of commercial gasoline. This is the reason why conventional two-cycle engines operate at lower means effective pressures than four-cycle engines.

Two-cycle engines of conventional design operate irregularly at low speed.

It is an object of the present invention to provide a two-cycle engine having outlet means for the combustion gases separate from the working piston, the engine overcoming the aforementioned

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difficulties by using the working piston as piston of the charging pump and by separating the piston chamber of the latter from the crankcase during substantially the whole stroke of the piston.

Further and other objects of the present invention will be hereinafter set forth in the accompanying specification and claims, and are shown in the drawings which, by way of illustration, show what I now consider to be a preferred embodiment of the invention.

In the drawing:

Fig. 1 is a diagrammatic, longitudinal sectional view of a two-cycle engine according to the invention, the section being taken along line I—II in Fig. 4;

Fig. 2 is a fractional, longitudinal sectional view of the engine shown in Fig. 1 and taken along line II—II in Fig. 4;

Fig. 3 is a diagrammatic, longitudinal sectional view of a portion of the engine illustrated in Figs. 1 and 2;

Fig. 4 is a diagrammatic, transverse sectional view of the engine according to Figs. 1, 2, and 3, the section being made along lines IV—IV in Figs. 1 and 2.

Like parts are designated by like numerals in all figures of the drawing.

Referring more particularly to Fig. 1, numeral 1 designates a crankcase surmounted by a cylinder block 2, comprising a cylinder 3 containing a power piston 21, and an exhaust 4. Flow of gases into the exhaust 4 is controlled by a disc valve 5 which is held closed by a spring 22 and actuated by a lever 6, the latter being operated by a rod 7 which is reciprocatingly moved by a cam 8 formed on a shaft 23 which is driven by the crankshaft 9 in the conventional manner and rotates at half the speed of the crankshaft. The lower portion of cylinder 3 is surrounded by an annular conduit or chamber 10 which communicates by means of a conduit 11 with a carbureter 13. Flow of combustible mixture through conduit 11 is controlled by a diametrical bore 12 in shaft 23 serving as a valve. The interior of cylinder 3 and chamber 10 are separated from the interior of crankcase 1 by a stuffing box member 14. The upper part of chamber 10 communicates with the interior of cylinder 3 through radial ports 15 and the lower part through auxiliary ports 16. There is an additional conduit 17 connecting chamber 10 with cylinder 3, which conduit is inclined and directed toward a spark plug 18 in the upper part of the cylinder. The lower part of piston rod 19 is provided with a T-shaped

conduit 20 through which the interior of crankcase 1 communicates with the interior of cylinder 3 when the power piston 21 is in its upper dead center position.

The engine according to the invention operates as follows:

If piston 21 moves upwards from its lower dead center position in which it is shown in Fig. 1 and valve 5 is closed and the space above piston 21 is filled with combustible mixture to be compressed, the piston will first close ports 15 and then conduit 17 and interrupt communication between chamber 10 and cylinder 3. While the upper side of piston 21 compresses the gas in cylinder 3, its underside creates a vacuum in the space below the piston, causing fresh combustible mixture to flow from carbureter 13 through bore 12, which is at that time in open position, into chamber 10 and through ports 15 and 16 into the space below piston 21. Member 14 seals that space against the crankcase 1. The so admitted fresh mixture cools the underside of the piston. When piston 21 arrives at its upper dead center position, the compressed mixture in the space above the piston is ignited in the conventional manner by means of spark plug 18. The expanding mixture forces the piston downwards. When the piston is in its upper dead center position, piston rod 19 is temporarily in such a position that the crankcase communicates for a short period through passage 20 with the space of cylinder 3 below the piston. Because of the relatively low pressure in that space, oil vapor will pass from the crankcase into cylinder 3 lubricating the interior wall of the cylinder. By suitably dimensioning and positioning passage 20, the amount of admitted lubricating oil may be controlled. At the following down-stroke of the piston, the gas mixture therebelow and in chamber 10 is compressed after bore 12 has been turned into the closed position shown in Fig. 2. Thereupon, the exhaust valve 5 is opened and the combustion gases leave the cylinder through exhaust conduit 4. Port 17 is opened at a pre-determined moment of the working stroke of piston 21, permitting a jet of compressed fresh fuel mixture to enter cylinder 3 in a direction toward spark plug 18, which jet cleans the latter and scavenges the cylinder. When piston 21 approaches its lower dead center position, ports 15 are opened, and the bulk of the pre-compressed fresh fuel mixture enters the cylinder space above the piston and cools the hot upper surface of the piston. When the space of cylinder 3 above piston 21 is sufficiently scavenged, cam 8 and lever 6 permit spring 22 to close valve 5. Fresh fuel mixture, which remains in the space below piston 21, is removed therefrom through auxiliary ports 16 when the piston arrives at its lower dead center position. After the movement of the piston is reversed, it closes ports 15 and subsequently conduit 17, whereupon the operation continues as described supra.

The engine according to the invention may be cooled by a liquid coolant or by air; for the latter purpose, the cylinder block would have to be provided with suitable cooling ribs in the conventional manner. Since the piston is efficiently cooled by the incoming fresh combustible mixture, satisfactory operation is possible with pistons which are larger than those of conventional engines. Because of the conduit 17, the spark plug is cleaned in each operating cycle, and the engine operates reliably at all speeds and loads. The engine according to the invention can be operated with light oil without admixture of lubricating oil, and its exhaust is smokeless. Due to the absence of lubricating oil, the fuel mixture can be more concentrated and compressed to a greater pressure, and more power can be produced and the fuel consumption per horsepower is less than in conventional two-cycle engines.

These advantages also prevail in comparison with a two-cycle engine having a separate charging pump, because no power is needed for operating such a pump and because the favorable compression, charging, and cooling conditions obtained with the engine according to the invention cannot be produced with conventional engines having a separately driven charging pump. Since the lubricating oil is not used for cooling the piston and does not come in contact with the hot cylinder wall in the engine according to the invention, its temperature remains low. This assures reliable operation of the engine and reduces oil consumption.

Because of the withdrawal of oil vapor from the crankcase, subatmospheric pressure is produced therein which prevents leakage of lubricating oil to the outside of the crankcase and keeps said outside clean.

By providing a conventional combustion chamber and a fuel injection pump, the engine according to the invention can be operated as a diesel engine.

While I believe the above described embodiment of my invention to be a preferred embodiment, I wish it to be understood that I do not desire to be limited to the exact details of design and construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

1. A two-cycle internal combustion engine comprising a cylinder, a power piston movable therein, a spark plug and exhaust control means connected with said cylinder substantially at one end thereof, a crankcase connected with the other end of said cylinder, means separating said cylinder from said crankcase, and pump means for forcing a fuel mixture into said cylinder; said pump means comprising a piston which is formed by said power piston, a pump chamber which is formed by said cylinder between said separating means and said power piston, a supplemental pump chamber communicating with said pump chamber and with said cylinder between said power piston and the cylinder end at which the exhaust control means are connected, and a fuel mixture conduit connecting said supplemental pump chamber and said cylinder and being inclined and directed toward said spark plug for directing a jet of fuel mixture thereto.

2. A two-cycle internal combustion engine comprising a cylinder, a power piston movable therein, exhaust control means connected with said cylinder substantially at one end thereof, a crankcase connected with the other end of said cylinder, pump means for pumping a fuel mixture into said cylinder and comprising a piston which is identical with said power piston, means separating the interior of said cylinder from that of said crankcase, a piston rod connected with said power piston and having a wrist pin end and extending through said separating means into said crankcase, and conduit means in the wrist pin end of said piston rod for connecting the interior of said crankcase with that of said cylinder below said power piston, when the latter

is in its upper dead center position, for conducting lubricating oil vapors from the crankcase into the cylinder.

3. A two-cycle internal combustion engine comprising a cylinder, a power piston movable therein, exhaust control means connected with said cylinder substantially at one end thereof, actuating means for said exhaust control means, a crankcase connected with the other end of said cylinder, pump means for pumping a fuel mixture into said cylinder and comprising a piston which is identical with said power piston, conduit means for conducting a fuel mixture to said pump means, and control means for controlling the flow of mixture through said conduit means, said last mentioned control means having a member in common with said exhaust control actuating means.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
322,477	Place	July 21, 1885
882,942	Gibbs	Mar. 24, 1908
920,989	Ostergren	May 11, 1909
966,972	Wiebe	Aug. 9, 1910
1,136,715	Pitts	Apr. 20, 1915
1,180,740	Reinhart	Apr. 25, 1916
1,259,391	Gildersleeve	Mar. 12, 1918
1,274,930	Brevard	Aug. 6, 1918
1,297,401	Ricardo	Mar. 18, 1919
1,366,448	Erickson	Jan. 25, 1921
2,376,233	Curtis	May 15, 1945

FOREIGN PATENTS

Number	Country	Date
543,641	France	June 8, 1922