Sept. 22, 1953 J. C. APPLETON 2,653,065

PISTON

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Fig. 1

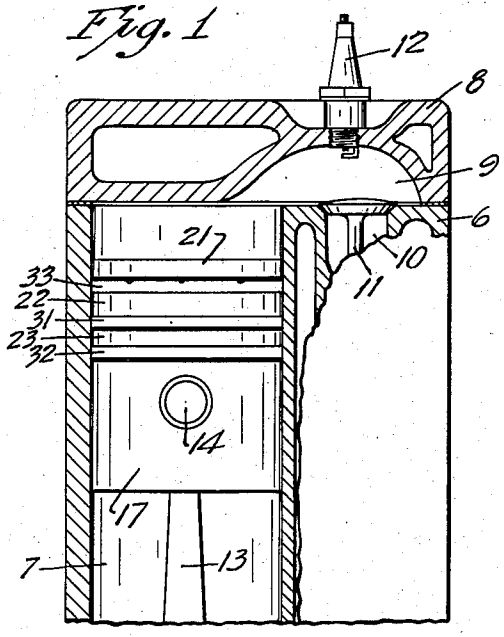


Fig. 2

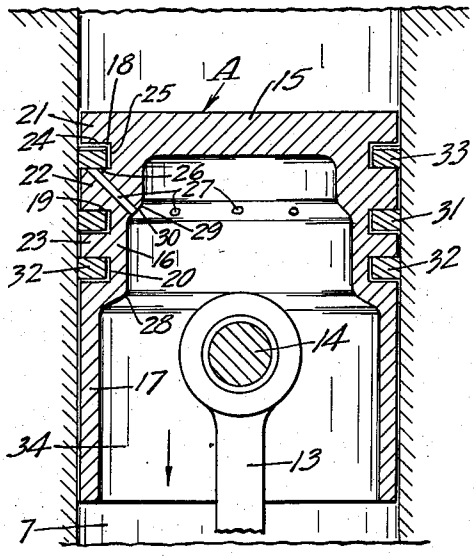


Fig. 3

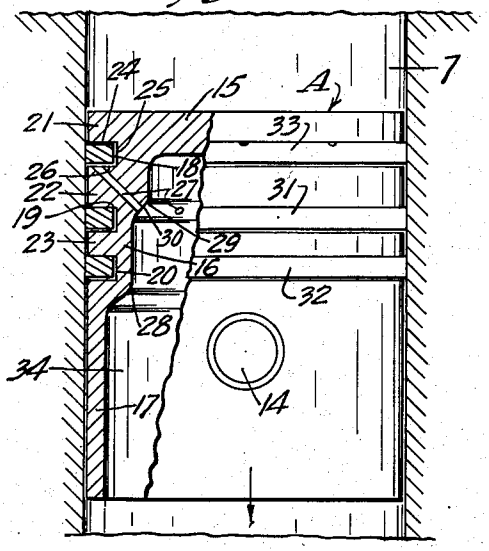


Fig. 4

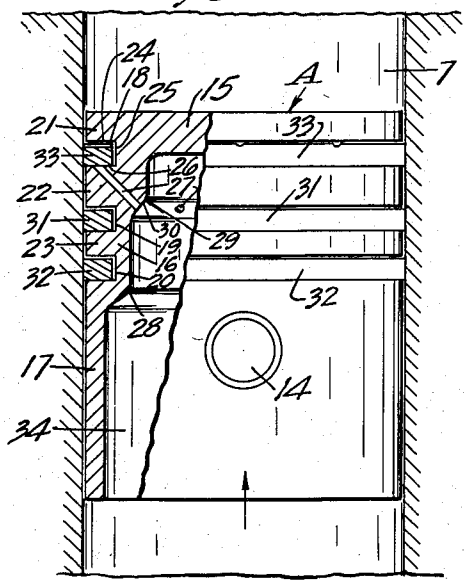
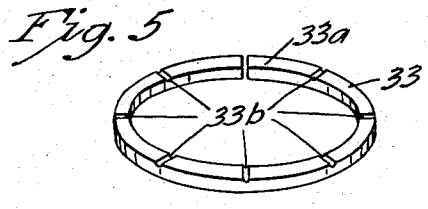


Fig. 5



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PISTON

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3 Claims. (Cl. 309—7)

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This invention relates to pistons for four cycle internal combustion engines.

It is one of the objects of the invention to provide a novel and improved piston so constructed as to permit of proper lubrication of the cylinder wall and which at the same time will not permit pumping of oil past the uppermost ring of the piston during the intake stroke of the piston.

With the ordinary piston used in a four cycle internal combustion engine, if during the intake stroke the throttle after being pushed way down is suddenly released so as to cut off a supply of fuel to the cylinder before the intake stroke has proceeded very far, the vacuum pressure in the head of the cylinder will be very high and under ordinary circumstances this vacuum pressure may be high enough to cause oil to be drawn up above the head of the piston around the upper ring resulting in what is commonly referred to as "oil pumping" and "the burning of oil" and "excessive formation of carbon during the explosion stroke."

It is a more specific object of the invention to provide a piston construction so made as to partially relieve excessive vacuum pressures in the cylinder head during the intake stroke to prevent oil pumping by permitting the travel of gases from the interior of the piston around the uppermost ring carried by the piston to the head of the piston.

For some time automotive engineers have been attempting to very greatly increase the explosive forces in the cylinder of an internal combustion engine during the power stroke without at the same time increasing the vacuum pressure in the head of the cylinder during the intake stroke which would tend to cause oil pumping.

It is another object of the invention to provide a piston so constructed that the maximum vacuum pressure in the head of the cylinder during the intake stroke can be regulated, thereby permitting the power of the explosion stroke to be greatly increased without producing oil pumping.

The objects and advantages of the invention will more fully appear from the following description made in connection with the accompanying drawing wherein like reference characters refer to the same or similar parts throughout the different views, and in which:

Fig. 1 is a view in vertical section showing a portion of a four cycle internal combustion engine provided with a piston embodying the present invention, the piston being shown in side elevation;

Fig. 2 is a vertical section in enlarged scale through the piston and portions of the cylinder

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walls showing the parts of the piston as they will appear during the power portion of the explosion stroke of the engine;

Fig. 3 is a generally similar view showing the parts as they will appear during the intake stroke and the explosion stroke after the power of the explosion stroke has been spent;

Fig. 4 is a generally similar view showing the parts as they will appear during the compression and exhaust strokes;

In Figs. 1, 2, and 3 the clearance for up and down movement of the rings in the various ring grooves of the piston is greatly exaggerated for the purpose of illustrating the relative positioning of the different rings in the grooves during the different strokes or portions thereof of the piston; and

Fig. 5 is a perspective view illustrating the upper piston ring as shown in the other views of the drawing.

Referring to the drawings, there is there shown portions of a four cycle internal combustion engine including the engine block 6 having a cylinder 7 formed therein, the block being closed at its top by the usual cylinder head 8 and this head having a passage 9 running from the fuel intake passage 10 controlled by the intake valve 11 to the head of the cylinder 7. One of the spark plugs 12 is also shown, as is one of the connecting rods 13 of the engine and one of the pins 14 for attachment of the connecting rod to a piston.

In accordance with the present invention, there is provided a piston of special construction, this piston being designated generally by the letter A. The said piston, as is usual, includes a head 15 and a hollow cylindrical wall 16 terminating in a skirt 17. The piston, accordingly, forms in the usual manner an internal chamber 34 which is open at the bottom of the piston. In the peripheral surface of the wall of the piston there is cut an upper ring groove 18, an intermediate ring groove 19 and a lower ring groove 20, and the exterior portions of the wall of the piston between the several grooves and between the upper groove and the top of the piston form an upper land 21, an intermediate land 22, and a lower land 23. For ready reference the lower surface of the upper land 21 and, accordingly, the upper wall of the upper ring groove 18 is designated 24, while the vertical wall between the upper land 21 and the lower land 22 forming the bottom of the groove 18 is designated by the numeral 25. The upper wall of the intermediate land 22, i. e., the next-to-the-uppermost land of the piston, is designated by the numeral 26.

The spacing between the upper groove 18 and

the intermediate groove 19 is slightly greater than is found in most pistons, and this is for the special purpose of the boring of a number of diagonal passages 27 through the wall of the piston and for the insertion through the uppermost groove 25 of bits for this purpose in line with the passages to be formed. These passages 27 extend through from the surface 26 to the chamber 18, the upper ends of the passages being located intermediate the inner and outer portions of the surface 26. The wall of the piston A is stepped at 28 and again at 29 so that the wall is considerably thicker above the skirt 17 in order to be thick enough to take the various ring grooves. The upper step 29 is made to give adequate strength to the piston for connection of the head 15 to the wall thereof. Between the stepped portion 28 and the stepped portion 29 of the piston the piston is provided with a truncated conical internal surface surface 30 which extends generally normal to the various passages 27 at the point where the passages terminate at the interior side of the piston and the inner ends of these passages are formed on this surface, and the purpose of making the said surface substantially normal to the passages 27 is to prevent the breakage of drills during the formation of the passages 27 while preserving the accuracy of the bore. The piston pin 14 which carries the connecting rod 13 is connected to the skirt 17 of the piston in the usual manner.

Fitted within the two lower grooves 19 and 20 of the piston in the usual manner are ordinary piston rings 31 and 32 of any standard construction, these rings having the usual very slight clearances within the grooves 19 and 20 for very limited up and down movement in these grooves.

Fitted within the uppermost ring groove 18 is a split piston ring 33 of special construction. This ring 33 as is best illustrated in Fig. 5 has a top surface 33*a* equipped with a plurality of shallow radially extending channels 33*b* cut therein. The ring itself is fitted into the upper groove 18 so as to have a clearance for up and down movement in this groove which is between .0015 and .003 inch. Such clearance is quite essential to the present construction in order to permit the lower surface of the upper ring 33 to have a cooperative valve action with the upper openings in the passages 27 at the point where these openings are formed in the surface 26. Of course, the ring 33 is a compression ring and there is thus always formed between the inner surface of this ring and the surface 25 of the piston a short vertical passage.

Considering first the intake stroke of the piston A in the cylinder, as the piston moves downwardly in the cylinder in the direction of the arrow shown in Fig. 3, the three rings 33, 31, and 32 tend to drag relative to the piston A, and, hence, the upper surfaces of the three rings will ride against the under surfaces of the three lands 21, 22, and 23 as illustrated in Fig. 3.

A very important function is accomplished by the present piston during the intake stroke. As high vacuum is created in the head of the cylinder above the upper ring 33, excessive vacuum may be relieved by the passage of gases from the chamber 18 of the piston upwardly through the passages 27, which are now uncovered, around between the inner side of the upper ring 33 and the surface 25 of the piston and through the channels 33*b* formed at the top of the upper ring 33. These gases will carry with them oil vapor from the crank case to lubricate the top surface 33*a* of the top ring 33 and the under surface 24 of top land 21. By accurately gauging the depth to which the channels 33*b* are cut and providing the requisite number of these channels and providing passages 27 of the proper number and size, it is possible to regulate the maximum negative pressure to which the head of the cylinder is subjected during the intake stroke before this pressure is relieved by the passages described from the chamber of the piston to the head of the cylinder. This permits exceedingly high explosive pressures to be developed in the cylinder during the explosion stroke and yet prevents excessive vacuum during the suction stroke and, of course, eliminates what is commonly known as oil pumping. In other words, the present construction is adapted for use in very high compression motors without producing oil pumping.

During the compression stroke of the piston the parts will appear as shown in Fig. 4, the piston moving in the direction indicated by the arrow on that view. As the piston moves upwardly to compress the gases in the cylinder all three rings, 33, 31 and 32 will bear against the lower surfaces of the grooves 18, 19 and 20, respectively, and, accordingly, the under surface of the upper ring 33 will seal against the surface 26, thereby closing the upper ends of the passages 27 to prevent the gases being compressed to run through the passages 27 into the chamber 34 of the piston.

During the power portion of the explosion stroke of the piston the parts will appear as shown in Fig. 2, the piston, of course, moving in a downward direction as indicated by the arrow on that view. The pressure developed during the power portion of the explosion stroke in the head of the cylinder is sufficient to force the upper ring 33 into contact with the surface 26 of the piston, thereby sealing the passages 27 and preventing blowing of the compressed explosive gases through the passages 27 into the chamber 34 of the piston and thence into the crank case. The two lower rings 31 and 32 dragging relative to the piston A have their upper surfaces in contact with the lower surfaces of the respective lands 22 and 23 as indicated in Fig. 2 during the power portion of the explosive stroke and during the entire stroke, for that matter. During the latter portion of the explosion stroke after the explosive forces have been largely spent relatively light pressure is applied against the upper surface of the upper ring 33 and the upper surface of the upper ring will move into contact with the surface 24 of the piston as is shown in Fig. 3.

During the exhaust stroke of the piston the parts will again assume the position as shown in Fig. 4. At this time the upper ring 33 will seal the passages 30 so as to prevent exhaust gases from escaping into the chamber 34 of the piston and thence into the crank case.

The peculiar action to prevent oil pumping of the engine is accomplished only when the passages 27 run from the upper ring groove 18 and when the upper ring provided has the limited clearance for slight up and down movement in the upper ring groove. The relief of suction pressure in the head of the cylinder is accomplished only when the upper ring is provided with the channels 33*b* or equivalent means.

It will be seen that a highly effective piston has been provided for use in four cycle internal combustion engines.

It will, of course, be understood that various

changes may be made in the form, details, arrangement, and proportions of the various parts without departure from the scope of the present invention, which, generally stated, consists in the matter shown, and described, and set forth in the appended claims.

What I claim is:

1. A piston for four cycle internal combustion engines, said piston having an internal bottom opening chamber, a plurality of spaced ring grooves cut in the peripheral wall thereof and lands formed between said ring grooves and above the uppermost ring groove, said piston having a plurality of passages running only from the top surface of the next-to-the-uppermost land intermediate the periphery of said land and the bottom of the uppermost groove into the chamber of the piston, rings fitting within said ring grooves, the uppermost ring having a limited vertical play within the uppermost groove and the lower surface of the uppermost ring cooperating as a valve with the upper ends of said passages at the top surface of the next-to-the-uppermost land to seal said passages during the power portion of the explosion stroke of the engine and during the compression and exhaust strokes, the said uppermost ring during the intake stroke and the spent portion of the explosion stroke moving away from the top surface of the next to the uppermost land, and means cooperatively associated with the uppermost ring and the uppermost land to afford communication between the cylinder above the piston and the upper ends of said passages when said uppermost ring is shifted into extreme upper position within its groove thereby preventing the pumping of oil into the head of the cylinder above the piston.

2. The structure defined in claim 1, said passages being inclined and forming straight passages through said uppermost groove to the internal side of said piston.

3. A piston for four cycle internal combustion engines, said piston having an internal bottom opening chamber, a plurality of spaced ring grooves cut in the peripheral wall thereof and lands formed between said ring grooves and above the uppermost ring groove, said piston having a plurality of passages running only from the top surface of the next-to-the-uppermost land intermediate the periphery of said land and bottom of the uppermost groove into the chamber of the piston, rings fitting within said ring grooves, the uppermost ring having a limited vertical play within the uppermost groove and the upper surface of the uppermost ring having a plurality of shallow cross channels therein, the lower surface of the uppermost ring cooperating as a valve with the ends of said passages at the top surface of said next-to-the-uppermost land to seal said passages during the power portion of the explosion stroke of the engine and during the compression and exhaust strokes, said uppermost ring during the intake stroke and the spent portion of the explosion stroke moving away from the top surface of the next-to-the-uppermost land, said cross channels cooperating with the bottom portion of the uppermost groove and said passages to form continuous passages around the uppermost ring into the chamber in said piston to relieve high suction pressure at the head of the cylinder during the intake stroke.

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