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(54) TWO-STROKE INTERNAL COMBUSTION ENGINE

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(57) ABSTRACT

There is provided a loop-scavenged two-stroke internal combustion engine that is capable of effectively suppressing the short-circuiting of fresh charge (unburnt air-fuel mixture), while at the same time being capable of further improving scavenging efficiency, combustion efficiency, etc., as well as of improving the durability and output stability of a cylinder and a piston. One pair or a plurality of pairs of scavenging passages (**31**, **31** and **32**, **32**) that adopt a reverse scavenging system are so provided as to communicate a combustion actuating chamber (**15**) formed above a piston (**20**) with a crankchamber (**18**). At least one pair of the scavenging passages (**32**, **32**) comprises, in large part, passage portions with partitions (**32***k*, **32***k*). A cutout opening or through-hole that serves as a scavenging inlet (**32***a*, **32***a*), the upper portion or whole of which is of a substantially triangular shape that is narrower towards its upper side, is formed in a lower end portion of at least one of the partitions (**32***k*, **32***k*).

(A)

< Present invention >

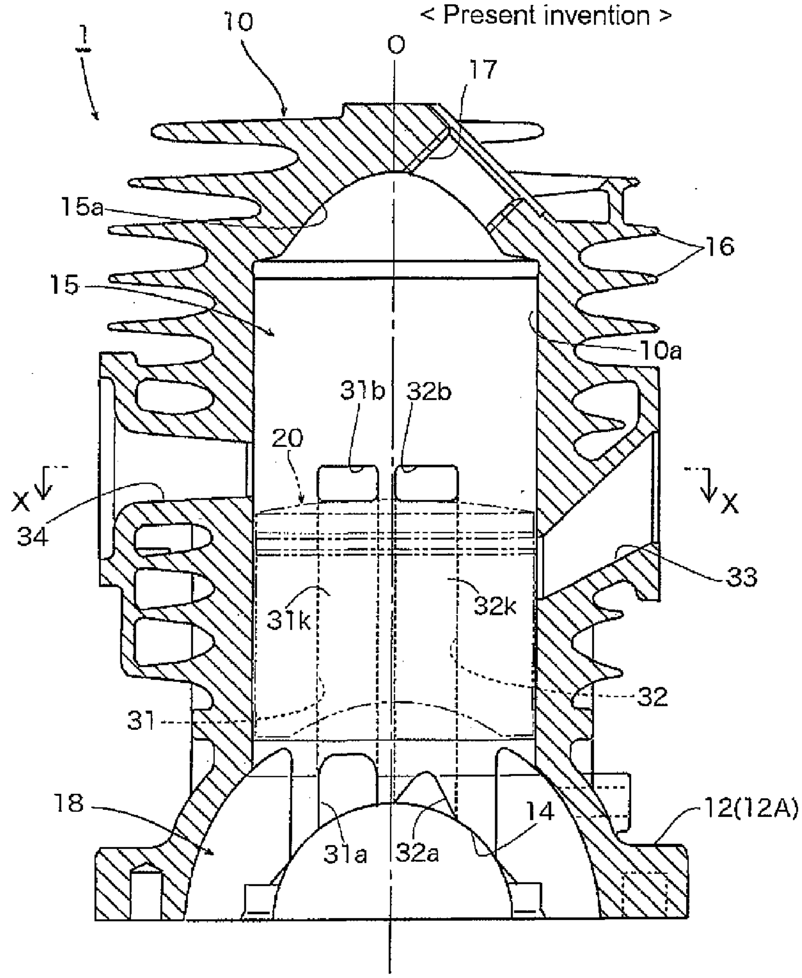


FIG. 1

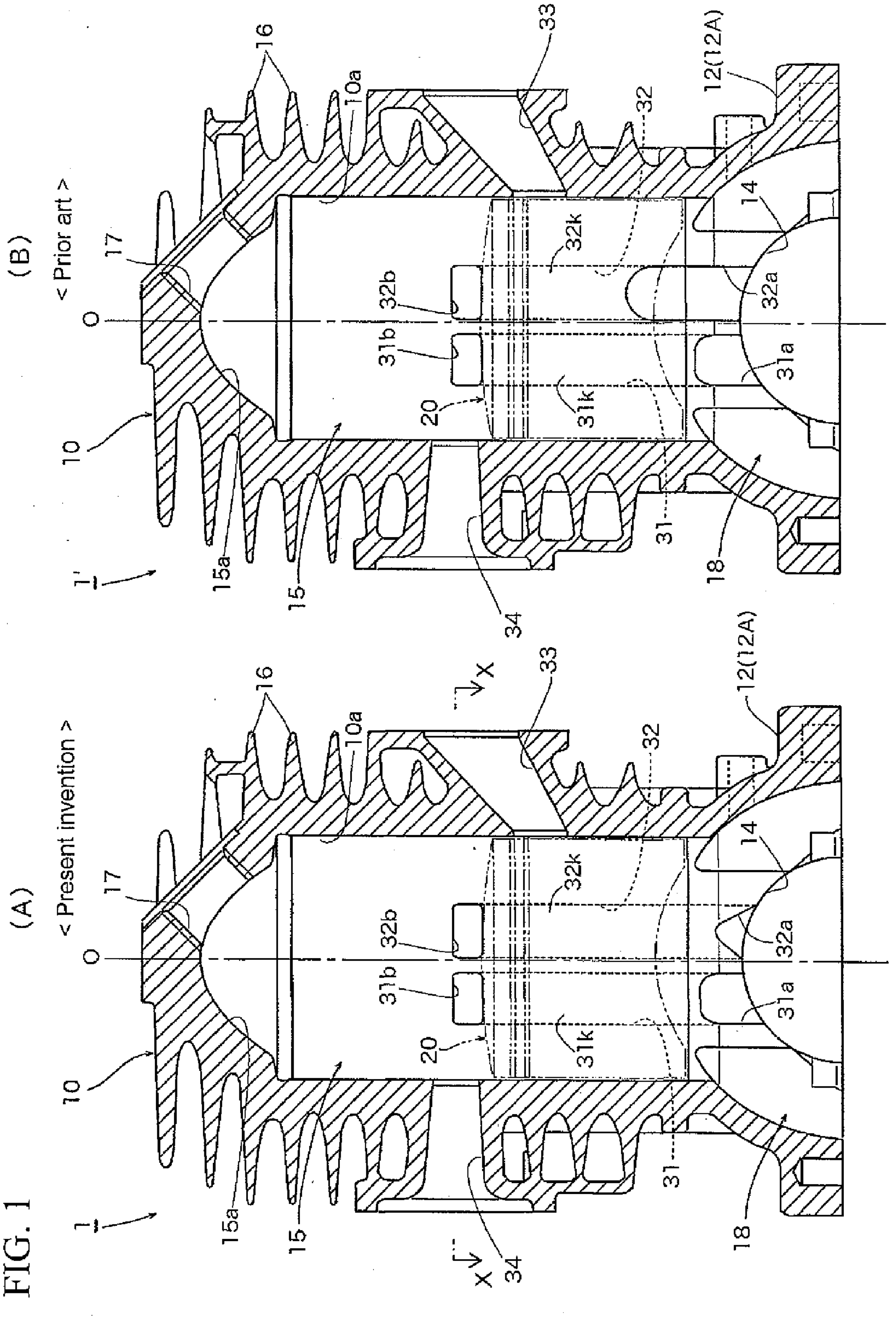

(A)
< Present invention >
(B)
< Prior art >
1
1'
10
10a
12(12A)
14
15
15a
16
17
18
20
31
31a
31b
31k
32
32a
32b
32k
33
34
O
X
X

FIG. 2

< Present invention (First embodiment) >

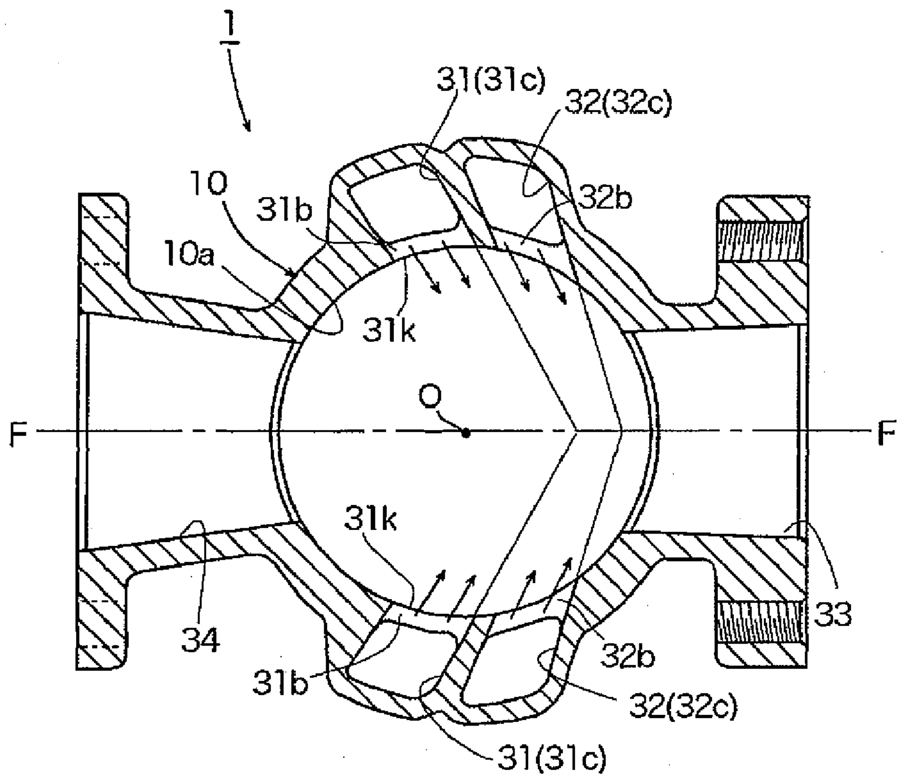


FIG. 3

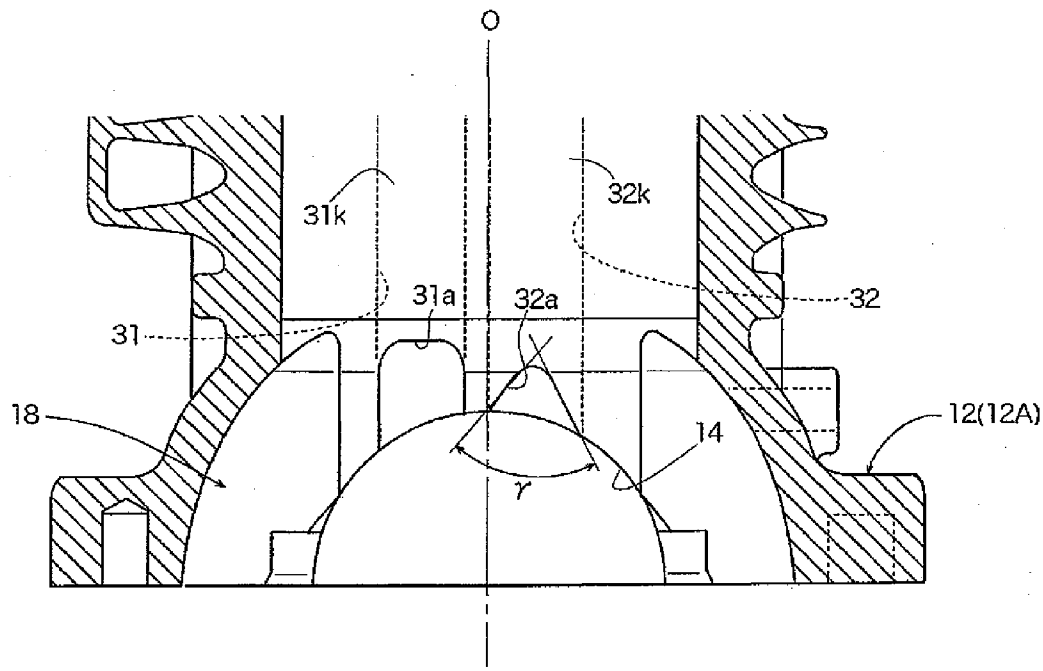


FIG. 4

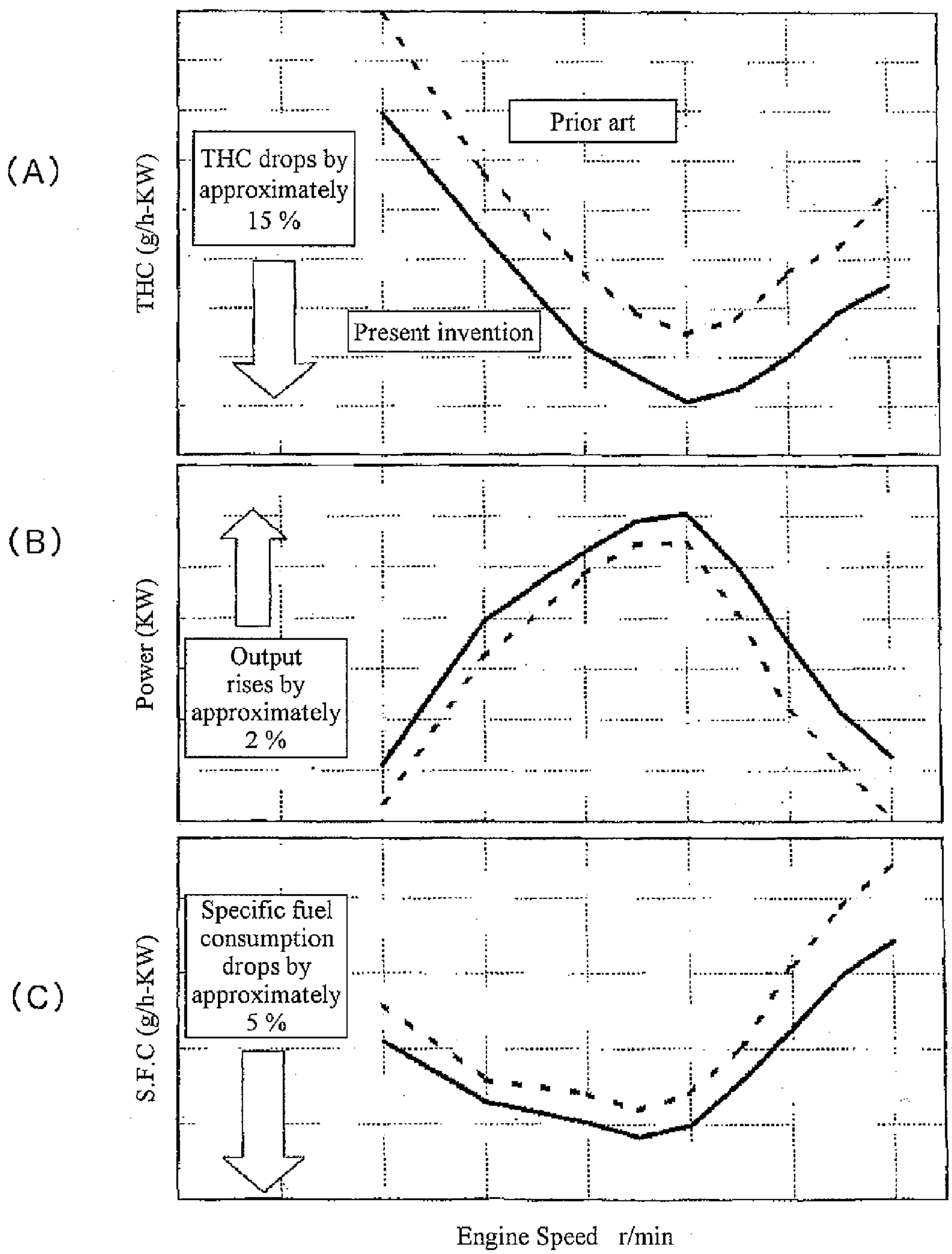

(A)
THC (g/h-KW)
THC drops by approximately 15 %
Prior art
Present invention
(B)
Power (KW)
Output rises by approximately 2 %
(C)
S.F.C (g/h-KW)
Specific fuel consumption drops by approximately 5 %
Engine Speed r/min

FIG. 5

< Present invention (Second embodiment) >

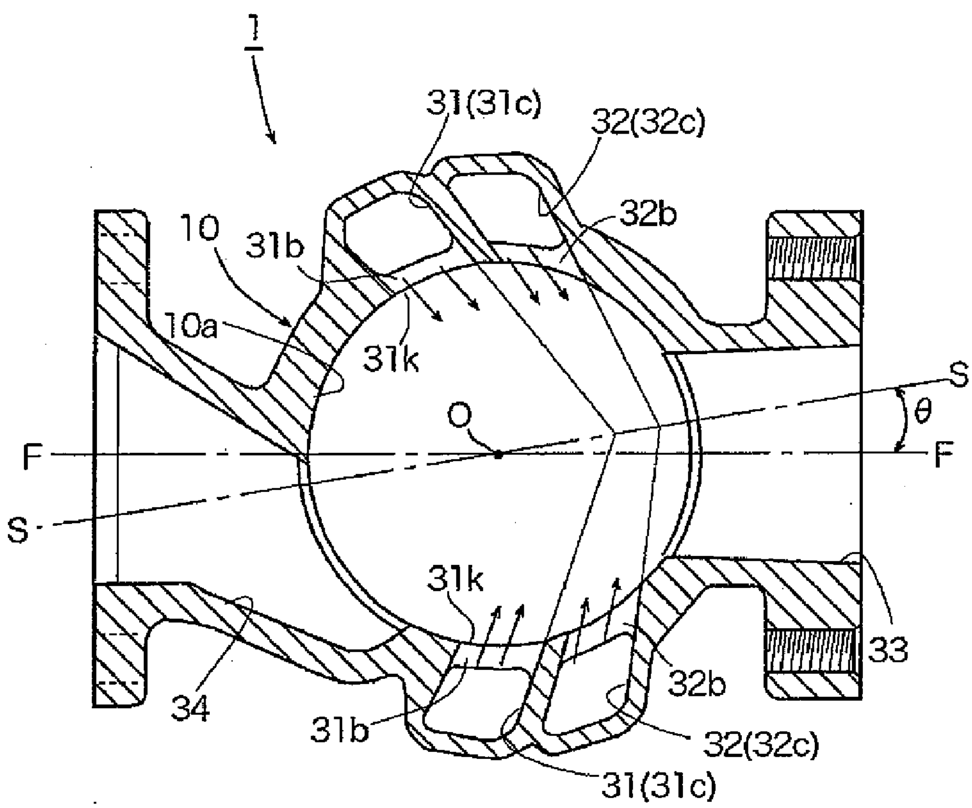


FIG. 6

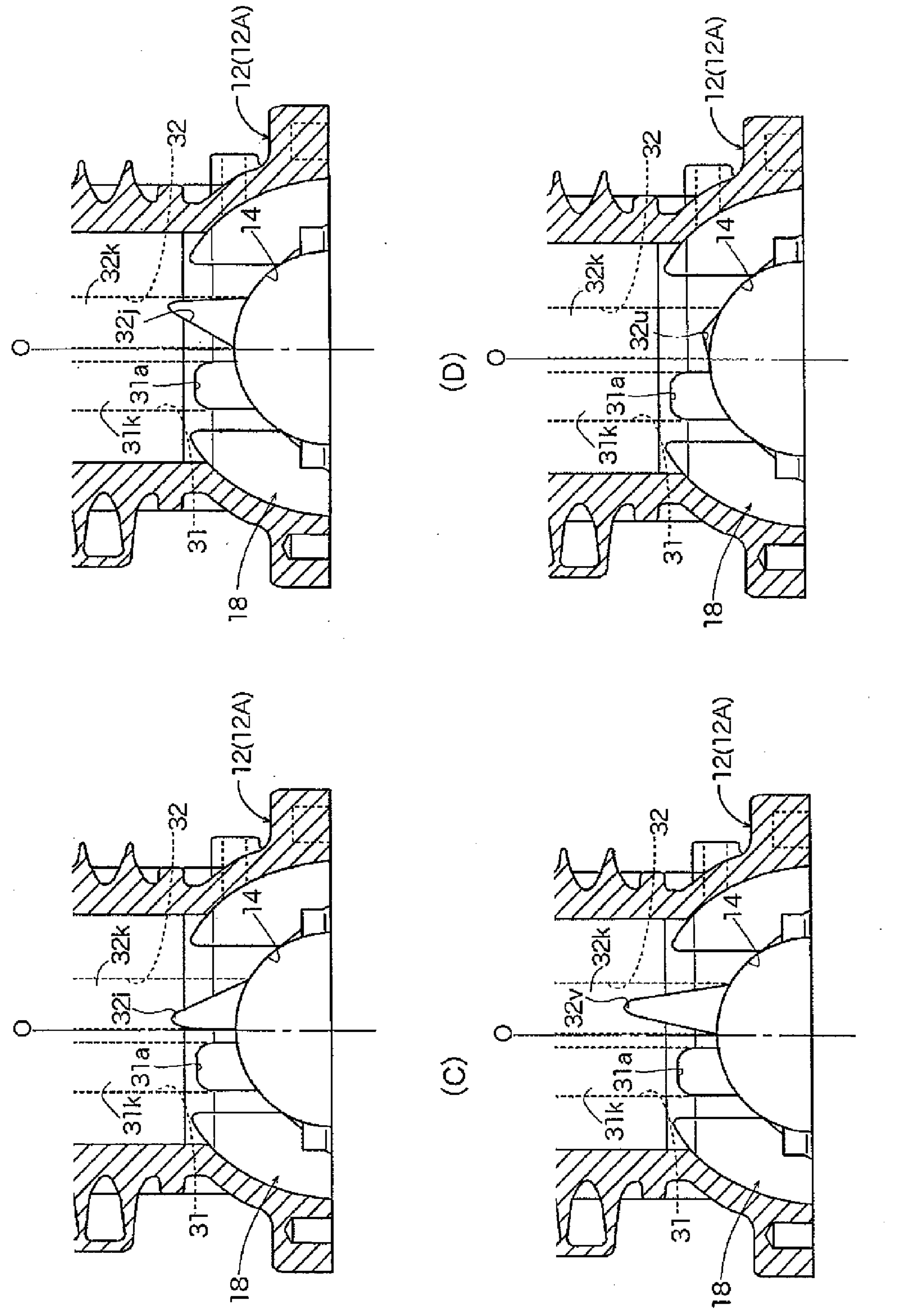
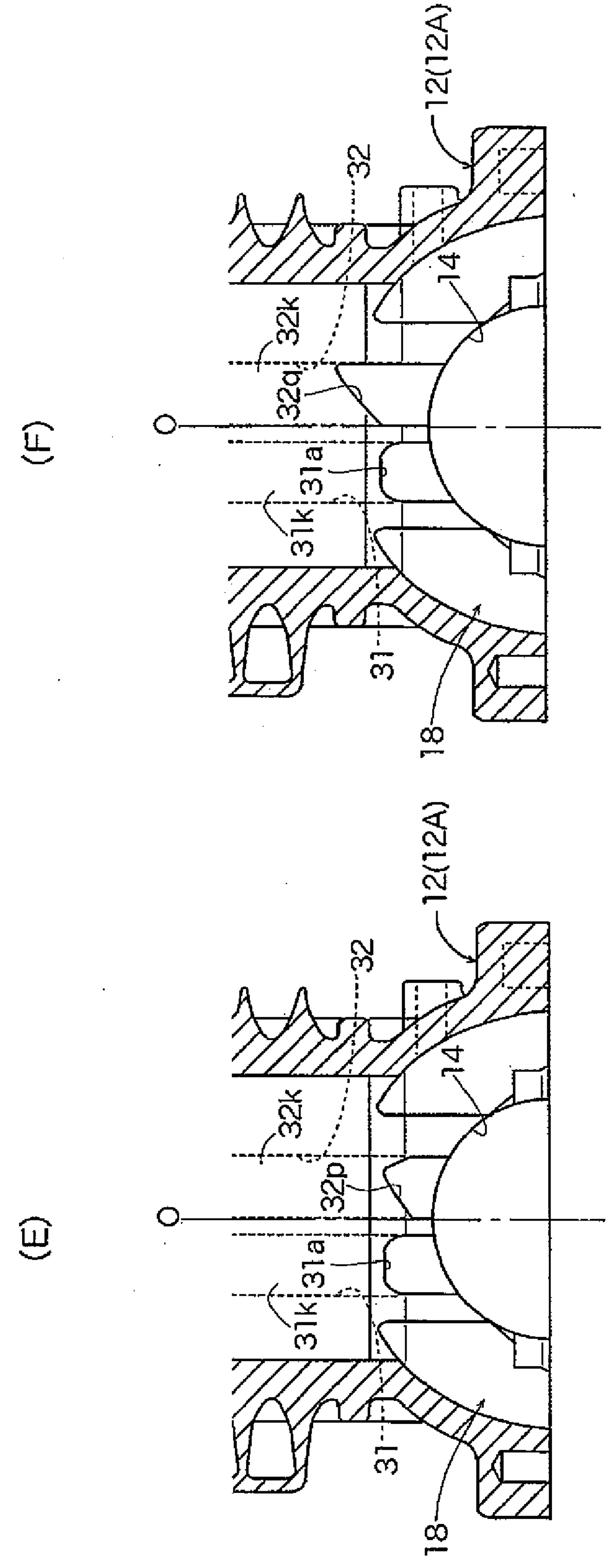


FIG. 7



TWO-STROKE INTERNAL COMBUSTION ENGINE

BACKGROUND INFORMATION

[0001] 1. Field of the Invention

[0002] The present invention relates to two-stroke internal combustion engines comprising one pair or a plurality of pairs of scavenging passages that adopt a reverse scavenging system, and more specifically to two-stroke internal combustion engines that are capable of suppressing the short-circuiting of fresh charge (unburnt air-fuel mixture), while at the same time also being capable of improving scavenging efficiency, combustion efficiency, and the like, as well as of improving the durability and output stability of the cylinder and the piston.

[0003] 2. Background Art

[0004] Ordinarily, in standard two-stroke gasoline engines conventionally used in portable powered work machines, such as lawn mowers, chainsaws, etc., a spark plug is disposed at a head portion of a cylinder. An intake port, a scavenging port, and an exhaust port that are opened/closed by a piston are formed in a barrel portion of the cylinder. There are no independent strokes dedicated to intake and exhaust alone. And one cycle of the engine is completed with two strokes of the piston.

[0005] More specifically, by an up-stroke of the piston, an air-fuel mixture is drawn into a crankchamber below the piston from the intake port, while the air-fuel mixture is pre-pressurized by a down-stroke of the piston and the pre-pressurized air-fuel mixture is blown out from the scavenging port into a combustion actuating chamber above the piston, thereby exhausting the combustion waste gas to the exhaust port. In other words, the scavenging of the combustion waste gas is performed utilizing the gas flow of the air-fuel mixture.

[0006] For this reason, an unburnt air-fuel mixture often becomes mixed in the combustion waste gas (exhaust gas), the amount of fresh charge (unburnt air-fuel mixture) that is exhausted into the atmosphere without being used for combustion, that is, the so-called short circuited amount, is large, and fuel economy is inferior as compared to four-stroke engines. Further, I-IC (unburnt components of the fuel), CO (incomplete combustion components of the fuel), etc., which are noxious components, are contained in the exhaust gas in large amounts. Therefore, while the machines may be small in size, environmental pollution still is a concern, and there are such issues as how to accommodate emission regulations as well as demands for improved fuel economy, which are bound to become even more stringent in the years to come.

[0007] In view of such issues, various improvements have hitherto been proposed with regard to the shape and structure of scavenging passages as can be seen in Patent Documents 1 and 2 cited below, for example.

[0008] In addition, with respect to a two-stroke internal combustion engine comprising one pair or a plurality of pairs of scavenging passages that adopt a reverse scavenging system (Schnuerle-scavenging system) in such a manner as to communicate a combustion actuating chamber formed above a piston with a crankchamber, the present applicant has also previously proposed the forming of, in a planar member (gasket) fitted between a cylinder, into which the piston is fitted and inserted, and the crankcase, throttling holes or throttling cutout openings of fixed opening areas that are smaller than the sectional areas of the scavenging passages in order to throttle the vicinity of inlets of the scavenging passages as disclosed in Patent Document 3 cited below.

[0009] According to this proposal, since the throttling holes are provided near the scavenging inlets, the pressure difference between the crankchamber and a point in the scavenging passages downstream of the throttling holes becomes greater as compared to a case where no throttling holes are provided, and the air-fuel mixture of the crankchamber bursts out from the throttling holes at once and flow downstream thereof. In other words, the pressure and flow speed of the scavenging gas are increased as compared to a case where the vicinity of the scavenging inlets of the scavenging passages is not throttled, and the scavenging gas that has passed through the throttling holes is blown out into the combustion actuating chamber from scavenging outlets while expanding rapidly and generating a predetermined turbulence.

[0010] Thus, the atomization of fuel is facilitated, scavenging efficiency (trapping efficiency) improves, while at the same time combustion efficiency also improves. Consequently, the desired output is obtained with less fuel, the noxious components within the exhaust gas, THC [=total amount of unburnt gas components such as HC (hydrocarbon) and the like] in particular, can be reduced effectively and, further, fuel economy improves as well.

[0011] On the other hand, as two-stroke internal combustion engines of this kind, there are known, as can be seen in Patent Documents 4 and 5 cited below, those in which scavenging passages comprise, in large part, passage portions with partitions (formed by portions of a cylinder bore wall surface portion), and in which communication portions, bypass grooves or the like are provided in or adjacent to the scavenging passages in order to place (a portion of) the fresh charge within the scavenging passages or the crankchamber in direct contact with an outer circumferential portion (skirt portion) of the piston.

[0012] By thus placing the cold fresh charge in direct contact with the outer circumferential portion of the piston, the piston is effectively cooled, along with which a rise in the temperature of the cylinder in contact therewith is suppressed as well. Deformation of and damage to the piston and the cylinder caused by heat become less likely to occur, and it is held that durability and the like are thus improved.

[0013] [Patent Document 1] JP Patent Publication (Kokai) No. 2008-274804 A

[0014] [Patent Document 2] JP Patent Publication (Kokai) No. 11-315722 A (1999)

[0015] [Patent Document 3] JP Patent No. 4082868

[0016] [Patent Document 4] JP Patent Publication (Kokai) No. 2000-34926 A

[0017] [Patent Document 3] JP Patent Publication (Kokai) No. 06-257504 A (1994)

SUMMARY

[0018] However, with the hitherto proposed techniques, it cannot be said that emission regulations and demands for improved fuel economy, which are bound to become even more stringent in the years to come, can be addressed to a sufficient extent, and the situation is such that there are strong demands for a new technique that is capable of suppressing the short-circuiting of fresh charge (unburnt air-fuel mixture) more than has been possible, while at the same time being capable of further improving scavenging efficiency, combustion efficiency, etc.

[0019] In addition, with respect to conventional techniques that cool the piston and suppress the rise in temperature of the cylinder by placing cold fresh charge in direct contact with the outer circumferential portion of the piston, such aspects as the following are not given sufficient consideration.

[0020] Specifically, with respect to such two-stroke internal combustion engines as those mentioned above, a greater amount of air-fuel mixture blown out from the scavenging passages into the combustion actuating chamber is preferable. Therefore, large opening areas had conventionally been set aside for scavenging inlets (cutout openings or through-holes) formed in lower end portions of the partitions. However, as the opening areas of the scavenging inlets become greater, the area of the cylinder bore wall surface that is the sliding surface for the piston decreases, and the area that supports and guides the piston becomes smaller. Thus, the stiffness (strength) of the cylinder drops, and there is a greater chance that the durability and output stability of the cylinder and the piston would be compromised.

[0021] The crown of the piston is exposed to high temperatures of 300° C. and above, and the side surface on the exhaust side is also similarly placed in a high-temperature state. In contrast, the intake side is cooled by fresh charge of approximately ambient temperature. Thus, the piston as a whole is placed under a significant temperature gradient.

[0022] In addition, with respect to the scavenging inlet portions, whereas the surface temperature of the partition portions is comparable to the combustion chamber temperature (250° C. to 300° C.) as they are formed integrally with the cylinder bore wall surface, the temperature of scavenging inlet portions in particular is considerably lower (50° C. to 100° C.) than that of the partition portions since the scavenging passages are filled with unburnt fuel-air mixture. The piston that slides within the cylinder thus must travel back and forth within a significant temperature gradient, such as that described above, that accompanies the presence/absence of partitions. Consequently, there is a greater chance that heat deformation resistance and durability would be compromised.

[0023] In addition, the piston slides within the cylinder while rocking to the left and right (because the upward and downward movement of the piston is converted into a rotational movement by a con rod and a crankshaft). Thus, if portions of the cylinder bore wall surface (i.e., left and right side surface portions) are wide-open as scavenging inlets, the area of the surface that supports the lateral movement of the piston becomes insufficient, the piston bearing capacity of the cylinder drops, and durability and output stability are compromised. In addition, the temperature gradient within the cylinder (particularly the horizontal section of the piston) becomes uneven, which may cause deformation by heat, accompanied by a drop in output. It may also cause biased contact of the piston relative to the cylinder, damage to the piston rings, and compromised durability of the piston itself as well.

[0024] The present invention is made in view of such circumstances, and an object thereof is to provide a loop-scavenged two-stroke internal combustion engine that is capable of effectively suppressing the short-circuiting of fresh charge, while at the same time being capable of further improving scavenging efficiency, combustion efficiency, etc, as well as of improving the durability and output stability of the cylinder and the piston.

[0025] In order to achieve the object above, a two-stroke internal combustion engine according to the present invention basically comprises one pair or a plurality of pairs of scavenging passages that adopt a reverse scavenging system in such a manner as to communicate a combustion actuating chamber, which is formed above a piston, with a crankchamber, wherein at least one pair of the scavenging passages comprises, in large part, passage portions with partitions, and a cutout opening or a through-hole, which serves as a scavenging inlet, the upper portion or the whole of which is substantially triangular where it becomes narrower towards the upper side, is formed in a lower end portion of at least one of the partitions.

[0026] In this case, in a preferred embodiment, the upper portion or the whole of at least one of the scavenging inlets is of a substantially triangular shape that widens at a substantially constant rate of change towards a lower end.

[0027] The scavenging inlet, the upper portion or the whole of which is of the substantially triangular shape, should preferably be such that its vertex angle is set at 130 degrees or less.

[0028] In yet another preferred embodiment, there are provided two pairs of the scavenging passages, and the scavenging inlet, the upper portion or the whole of which is of the substantially triangular shape, is formed in a lower end portion of at least one of the partitions of the scavenging passages located on the intake port side.

[0029] With a loop-scavenged two-stroke internal combustion engine according to the present invention, because (the upper portion or the whole of) the scavenging inlet formed in the lower end portion of the partition is of a substantially triangular shape that becomes narrower towards the upper side or, more preferably, is such that its opening width widens at a substantially constant rate of change towards the lower end, when the fresh charge that is compressed at the crankchamber flows into the scavenging passage through the scavenging inlet, the fresh charge is pushed in at a single focused point. Consequently, the flow speed of the scavenging flow increases and scavenging efficiency improves, thereby suppressing short-circuiting and reducing THC, while at the same time bringing about improvements in fuel economy and output.

[0030] In addition, because the scavenging inlet is of a substantially triangular shape, it becomes possible to reduce the opening area of the scavenging inlet as compared to a conventional device having a scavenging inlet of a substantially rectangular shape while securing an amount of air-fuel mixture that is necessary for the above-mentioned improvements in fuel economy and output. Thus, the area of the cylinder bore wall surface, which is the sliding surface for the piston, increases and, consequently, the stiffness (strength) of the cylinder increases, thereby making it possible to enhance the durability and output stability of the cylinder and the piston.

[0031] Further, because the scavenging inlet is of a substantially triangular shape, changes in the piston sliding area of the cylinder become more constant and gradual as compared to a conventional device having a substantially rectangular scavenging inlet, making it possible to avoid rapid changes in the piston bearing capacity of the cylinder. Consequently, deformation of and/or damage to the piston and the cylinder, as well as accompanying output drops and the like, become less likely, making it possible to further enhance the durability and output stability of the cylinder and the piston.

[0032] In addition, in relation to the temperature change accompanying the presence/absence of partitions, the rate of temperature change that the circumferential surface of the piston passing by the scavenging inlet portion is subjected to can be made substantially constant. Consequently, rapid temperature changes of the circumferential surface of the piston are prevented, thereby making it possible to improve the heat deformation resistance and durability of the piston.

[0033] Further, because the scavenging inlet is of a substantially triangular shape, thereby making the opening area smaller than its conventional counterpart, it becomes difficult for the highly viscous lubrication oil within the air-fuel mixture to enter the scavenging passages, and the separated lubrication oil thus accumulates within the crankcase. Consequently, such effects as a further improvement in seizure resistance, etc., are also achieved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] FIG. **1**(A) is a vertical sectional view showing the main portion of the first embodiment of a loop-scavenged two-stroke internal combustion engine according to the present invention (present invention), and FIG. **1**(B) is a vertical sectional view showing the main portion of an example of a conventional loop-scavenged two-stroke internal combustion engine (prior art).

[0035] FIG. **2** is a sectional view taken along and as viewed in the direction of arrows X-X in FIG. **1**(A).

[0036] FIG. **3** is an enlarged view of the scavenging inlet portion shown in FIG. **1**(A).

[0037] FIGS. **4**(A) through (C) show graphs indicating the results of comparative experiments between the first embodiment (present invention) and the conventional example (prior art), where FIGS. **4**(A), (B) and (C) respectively indicate THC emission, output (power) and specific fuel consumption (S.F.C.).

[0038] FIG. **5** is a sectional view of the second embodiment corresponding to the sectional view of the first embodiment shown in FIG. **2**.

[0039] FIGS. **6**(A) through (D) are enlarged partial vertical sectional views showing variations of the first and second embodiments.

[0040] FIGS. **7**(E) and (F) are enlarged partial vertical sectional views showing other variations of the first and second embodiments.

DESCRIPTION OF SYMBOLS

[0041] **1** Two-stroke internal combustion engine (first embodiment)

[0042] **2** Two-stroke internal combustion engine (second embodiment)

[0043] **10** Cylinder

[0044] **15** Combustion actuating chamber

[0045] **18** Crankchamber

[0046] **20** Piston

[0047] **31** First scavenging passage

[0048] **32** Second scavenging passage

[0049] **31***a*, **32***a* Scavenging inlet

[0050] **31***b*, **32***b* Scavenging outlet

[0051] **31***c*, **32***c* Guide wall surface

[0052] **33** Intake port

[0053] **34** Exhaust port

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0054] Embodiments of the present invention are described below with reference to the drawings.

[0055] FIG. **1**(A) is a vertical sectional view of an embodiment (first embodiment) of a loop-scavenged two-stroke internal combustion engine according to the present invention, and FIG. **1**(B) is a vertical sectional view of a conventional example of a loop-scavenged two-stroke internal combustion engine. FIG. **2** is a sectional view taken along and as viewed in the direction of arrows X-X in FIG. **1**(A). With respect to the engines of the first embodiment of the present invention and of the conventional example, corresponding parts or parts with like functions are designated with like reference numerals.

[0056] A description is provided below mainly with regard to portions that differ between an engine **1** of the first embodiment (present invention) and an engine **1'** of the conventional example (prior art).

[0057] The illustrated loop-scavenged two-stroke internal combustion engine **1** is a small air-cooled two-stroke gasoline engine of a four-port scavenging system used in portable powered equipment and the like, comprising a cylinder **10** in which a piston **20** is inserted and fitted, wherein an upper crankcase **12**A, which constitutes the upper half of a crankcase **12**, is integrally formed below the cylinder **10**. An unillustrated lower crankcase is fastened in a sealed state below the upper crankcase **12**A by means of, for example, four through bolts. The crankcase **12** defines a crankchamber **18** below the cylinder **10**, and rotatably supports, via a main bearing, a crankshaft that reciprocates the piston **20** via a con rod.

[0058] Plural cooling fins **16** are provided on an outer circumferential portion of the cylinder **10**. A squish dome shaped (hemispherical) combustion chamber portion **15***a* constituting a combustion actuating chamber **15** is provided at a head portion of the cylinder **10**. A mounting hole (internal thread portion) **17** by which a spark plug (not shown) is installed is formed in the combustion chamber portion **15***a*.

[0059] In addition, an exhaust port **34** is provided on one side of the barrel portion of the cylinder **10**, and an intake port **33** is provided on the other side of the barrel portion at a lower position than the exhaust port **34** (in FIG. **2**, the exhaust port **34** and the intake port **33** are shown as if they are located at the same height).

[0060] In addition, in the two-stroke internal combustion engine **1** of the present embodiment, a pair of first scavenging passages **31**, **31** located on the side of the exhaust port **34** and a pair of second scavenging passages **32**, **32** located on the opposite side to the exhaust port **34** (i.e., on the side of the intake port **33**), which adopt a reverse scavenging system (Schnuerle-scavenging system), are provided from the cylinder **10** to the upper crankcase **12**A. The first and second scavenging passages **31**, **31** and **32**, **32** are so provided as to be symmetrical about a central vertical section F-F that bisects the intake port **33** and the exhaust port **34**.

[0061] The first and second scavenging passages **31**, **31** and **32**, **32** are, in large part, passage portions with partitions **31***k*, **31***k* and **32***k*, **32***k*, respectively. Their lower ends open to a main bearing receiving face (half-cylindrical surface) **14** of the upper crankcase **12**A.

[0062] At lower end portions of the respective partitions **31***k*, **31***k* and **32***k*, **32***k* of the scavenging passages **31**, **31** and **32**, **32**, cutout openings **31***a*, **31***a*, and **32***a*, **32***a* of predetermined shapes (described later) and which serve as scavenging inlets are respectively formed.

[0063] In addition, rectangular first scavenging outlets **31***b*, **31***b* and second scavenging outlets **32***b*, **32***b* that open into the combustion actuating chamber **15** are respectively provided at the upper ends (downstream ends) of the first scavenging passages **31**, **31** and the second scavenging passages **32**, **32**. Here, the first scavenging outlets **31***b*, **31***b* and the second scavenging outlets **32***b*, **32***b* are provided at the same height, and their upper end height is made lower than the upper end of the exhaust port **34** by a predetermined amount. Thus, the first scavenging outlets **31***b*, **31***b* and the second scavenging outlets **32***b*, **32***b* are such that, when the piston **20** moves downward, both pairs open simultaneously following a slight delay from the exhaust port **34**.

[0064] In addition, in the present embodiment, the scavenging inlets (cutout openings) **32***a*, **32***a* formed in the lower end portions of the partitions **32***k*, **32***k* of the second scavenging passages **32**, **32** located on the side of the intake port **33** are of a substantially triangular shape that becomes narrower towards the upper side. More specifically, they are of a substantially triangular shape where, as shown enlarged in FIG. **3**, the left and right sides that form a vertex angle γ are substantially formed of straight lines except for the vicinity of the vertex (rounded corner portion from manufacturing), that is, a substantially triangular shape whose opening width widens at a substantially constant rate of change towards the lower end. The opening area and height of the scavenging inlets (cutout openings) **32***a*, **32***a* are made to be smaller and lower than the opening area and height of the substantially rectangular scavenging inlets (cutout openings) **31***a*, **31***a* formed in the first scavenging passages **31**, **31** located on the side of the exhaust port **34**.

[0065] The scavenging inlets (cutout openings) **32***a*, **32***a* of the substantially triangular shape have their vertex portions located at center portions thereof in their width direction, and the vertex angles γ thereof are set at 130 degrees or below.

[0066] The shapes of the respective cutout openings **31***a*, **31***a* and **32***a*, **32***a* of the first and second scavenging passages **31**, **31** and **32**, **32** of the conventional example (prior art) are substantially rectangular as in the cutout openings **31***a*, **31***a* of the first scavenging passages **31**, **31** in the present embodiment. The opening area and height of the scavenging inlets (cutout openings) **32***a*, **32***a* formed in the second scavenging passages **32**, **32** located on the side of the intake port **33** in the prior art are made to be larger and higher than the opening area and height of the scavenging inlets (cutout openings) **31***a*, **31***a* formed in the first scavenging passages **31**, **31** located on the side of the exhaust port **34**, and are such that they are generally open wider.

[0067] With the two-stroke internal combustion engine **1** of the present embodiment thus configured, as the pressure in the crankchamber **18** drops in the up-stroke of the piston **20**, an air-fuel mixture from an air-fuel mixture generating means, such as a carburetor or the like that is not shown in the drawings, is drawn into and captured in the crankchamber **18** from the intake port **33**.

[0068] As the air-fuel mixture within the combustion actuating chamber **15** above the piston **20** is then ignited to explode and combust, the piston **20** is pressed downward by the combustion gas. In this down-stroke of the piston **20**, the air-fuel mixture within the crankchamber **18** and the scavenging passages **31**, **31** and **32**, **32** is compressed by the piston **20**, while at the same time the exhaust port **34** is opened first, and as the piston **20** moves further downward, the respective scavenging outlets **31***b*, **31***b* and **32***b*, **32***b* at the downstream ends of the scavenging passages **31**, **31** and **32**, **32** are opened simultaneously. During this scavenging period in which the scavenging outlets **31***b*, **31***b* and **32***b*, **32***b* are opened, the air-fuel mixture compressed inside the crankchamber **18** is pushed into the scavenging passages **31**, **31** and **32**, **32** from the scavenging inlets **31***a*, **31***a* and **32***a*, **32***a*, while at the same time being drawn towards the combustion actuating chamber **15**, blown out towards the cylinder bore wall surface **10***a* on the opposite side to the exhaust port **34** (i.e., on the side of the intake port **33**) as scavenging flows from the scavenging outlets **31***b*, **31***b* and **32***b*, **32***b* at a predetermined horizontal scavenging angle, and made to collide with the wall surface and turn around, thereby pushing out the combustion waste gas to the exhaust port **34**.

[0069] Here, because in the loop-scavenged two-stroke internal combustion engine **1** of the present embodiment the scavenging inlets (cutout openings) **32***a*, **32***a* formed in the lower end portions of the partitions **32***k*, **32***k* of the second scavenging passages **32**, **32** are of the substantially triangular shape that becomes narrower towards the upper side, or more specifically of the substantially triangular shape whose opening width widens at a substantially constant rate of change towards the lower end, when the fresh charge that is compressed at the crankchamber **18** flows into the scavenging passages through the scavenging inlets **32***a*, **32***a*, the fresh charge is pushed in at a single focused point. Consequently, the flow speed of the scavenging flow increases and scavenging efficiency improves, thereby suppressing short-circuiting and reducing THC, while at the same time bringing about improvements in fuel economy, and output.

[0070] In addition, because the scavenging inlets **32***a*, **32***a* are of a substantially triangular shape and the opening areas of the scavenging inlets are made smaller than those of a conventional device having substantially rectangular scavenging inlets, the flow speed of the scavenging flow becomes even faster. Consequently, a further reduction in THC, and further improvements in fuel economy and output are achieved. Further, because the opening areas of the scavenging inlets are made small, the area of the cylinder bore wall surface, which is the sliding surface for the piston, increases, as a result of which the stiffness (strength) of the cylinder increases, making it possible to enhance the durability and output stability of the cylinder and the piston.

[0071] In fact, comparative experiments where the present embodiment (present invention) and the conventional example (prior art) were operated under the same conditions produced the results shown in FIGS. **4**(A) through (C). FIG. **4**(A) indicates THC emission, (B) output (power), and (C) specific fuel consumption (S.F.C.). From these results, it was confirmed that with the present invention, as compared to the prior art and across the entire operating revolution rate range (6,000 to 11,000 rpm), THC drops by approximately 15%, output rises by approximately 2%, and specific fuel consumption drops by approximately 5%.

[0072] Further, because the scavenging inlets **32***a*, **32***a* are of a substantially triangular shape, changes in the piston sliding area of the cylinder **10** become more constant and gradual as compared to a conventional device having substantially rectangular scavenging inlets, making it possible to avoid rapid changes in the piston bearing capacity of the cylinder **10**. Consequently, deformation of and/or damage to the piston **20** and the cylinder **10**, as well as accompanying output drops and the like, become less likely, making it possible to further enhance the durability and output stability of the cylinder **10** and the piston **20**.

[0073] Further, the rate of temperature change that the circumferential surface of the piston passing by the scavenging inlet portion is subjected to in relation to temperature changes accompanying the presence/absence of partitions becomes substantially constant. Consequently, rapid temperature changes of the circumferential surface of the piston are prevented, thereby making it possible to improve the heat deformation resistance and durability of the piston.

[0074] In addition, since the scavenging inlets **32***a*, **32***a* are of a substantially triangular shape and their opening areas are made small, it becomes difficult for the highly viscous lubrication oil within the air-fuel mixture to enter the scavenging passages, and the separated lubrication oil thus accumulates within the crankcase. Consequently, such effects as a further improvement in seizure resistance, etc., are achieved.

[0075] FIG. **5** shows a horizontal section of the second embodiment of a two-stroke internal combustion engine according to the present invention (corresponding to FIG. **2** which shows a horizontal section of the first embodiment). With respect to a two-stroke internal combustion engine **2** of the second embodiment, the scavenging passages **31**, **31** and **32**, **32** are so provided as to be symmetrical about an inclined vertical section S-S that is inclined, as viewed planarly, by a predetermined angle θ relative to a central vertical section F-F that bisects the intake port **33**. Further, the exhaust port **34** is so provided as to be eccentric relative to the central vertical section F-F as viewed planarly. In all other respects, it is configured in the same manner as the first embodiment.

[0076] With the two-stroke internal combustion engine **2** of the second embodiment thus configured, too, it has been confirmed that substantially similar working effects as those of the first embodiment are achieved.

[0077] It is noted that although in the embodiments above, the substantially triangular scavenging inlet (cutout opening) **32***a* is formed in both of the partitions **32***k*, **32***k* of the scavenging passages **32**, **32** located on the side of the intake port **33** among the two pairs of scavenging passages **31**, **31** and **32**, **32**, the substantially triangular scavenging inlet **32***a* may also be formed in only one of the partitions **32***k*, **32***k* instead.

[0078] In addition, with respect to the substantially triangular scavenging inlets **32***a*, **32***a*, besides the example where the vertex portions are located at the center portions in the width direction, they may instead have such shapes as those of scavenging inlets **32***i* and **32***j* shown in FIGS. **6**(A) and (B) where the vertex portions are skewed to one side in the width direction (i.e., the shape of a substantially right-angled triangle or a parallelogram including a substantially right-angled triangle). In addition, with respect to the opening height thereof, even in cases where they, in order to meet the demanded air-fuel mixture amount, open up to a position that is higher than the height of the scavenging inlet **31***a* on the exhaust port side as is the case with scavenging inlets **32***i*, **32***j* and **32***v* respectively shown in FIGS. **6**(A), (B) and (C), because the opening width widens at a constant rate of change towards the lower end, a throttling effect (an effect where fresh charge is pushed in at a single focused point) is achieved by virtue of the substantially triangular shape without compromising the heat deformation resistance of the cylinder and the piston.

[0079] Further, where it is possible to design the opening height of the scavenging inlet low as in scavenging inlet **32***u* shown in FIG. **6**(D), the throttling effect produced by virtue of the substantially triangular shape can be added while securing sufficient heat deformation resistance of the cylinder and the piston by way of the partitions. Here, in order to attain clear throttling effects, it is preferable that the vertex angle γ of the scavenging inlet be 130° or below.

[0080] In addition, while the scavenging inlets **32***a*, **32***i*, **32***j*, **32***v* and **32***u* mentioned above are defined as being such that their overall shapes are substantially triangular where they become narrower towards the upper side, they are by no means limited as such. The shape of the scavenging inlet may instead be such that, as in scavenging inlets **32***p* and **32***q* respectively shown in FIGS. **7**(E) and (F) for example, its upper portion is of a substantially triangular shape that becomes narrower towards the upper side (preferably with a vertex angle γ of 130° or below), and its lower portion is of a substantially rectangular shape; the overall shape thus substantially being a pentagon, a quadrilateral (trapezium), or the like. By thus having only the upper portion be of a substantially triangular shape, too, the above-mentioned throttling effect can still be attained, and the required air-fuel mixture amount and heat deformation resistance can be secured.

What is claimed is:

1. A two-stroke internal combustion engine comprising one pair or a plurality of pairs of scavenging passages that adopt a reverse scavenging system in such a manner as to communicate with a combustion actuating chamber formed above a piston with a crankchamber, wherein at least one pair of the scavenging passages comprises:
- in large part, passage portions with partitions; and
- a cutout opening or through-hole that serves as a scavenging inlet formed in a lower end portion of at least one of the partitions, the scavenging inlet including an upper portion or the whole of which is of a substantially triangular shape that is narrower towards its upper side.

2. The two-stroke internal combustion engine according to claim **1**, wherein the upper portion or the whole of at least one of the scavenging inlets is of a substantially triangular shape that widens at a substantially constant rate of change towards its lower end.

3. The two-stroke internal combustion engine according to claim **1**, wherein a vertex angle of the scavenging inlet is set at 130 degrees or below.

4. The two-stroke internal combustion engine according to claim **2**, wherein a vertex angle of the scavenging inlet is set at 130 degrees or below.

5. The two-stroke internal combustion engine according to claim **1**, comprising two pairs of the scavenging passages, wherein the scavenging inlet formed in the lower end portion of at least one of the partitions of the scavenging passages is located on the side of an intake port.

6. The two-stroke internal combustion engine according to claim **2**, comprising two pairs of the scavenging passages, wherein the scavenging inlet formed in the lower end portion of at least one of the partitions of the scavenging passages is located on the side of an intake port.

7. The two-stroke internal combustion engine according to claim **3**, comprising two pairs of the scavenging passages, wherein the scavenging inlet formed in the lower end portion of at least one of the partitions of the scavenging passages is located on the side of an intake port.

8. The two-stroke internal combustion engine according to claim **4**, comprising two pairs of the scavenging passages, wherein the scavenging inlet formed in the lower end portion of at least one of the partitions of the scavenging passages is located on the side of an intake port.

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