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(54) Title: TWO-STROKE INTERNAL COMBUSTION ENGINE

(57) Abstract: According to an embodiment, a two-stroke internal combustion engine 100 is disclosed. The engine 100 may include a cylinder 102 and a piston 104. The piston 104 may axially reciprocate within the cylinder 102. The piston 104 may draw an air during an up-stroke and may compress an air-fuel mixture during a down-stroke. The engine 100 may include an inlet valve 106 provided on a bottom part of the cylinder 102 that allows air into the cylinder 102. The engine 100 may further include an exhaust port 108 provided on a cylindrical wall, in proximity to a top part of the cylinder 102 that discharges the exhaust gas out of the cylinder 102. A fuel injector 110 mounted in proximity to the bottom part of the cylinder 102 may be configured to inject fuel 112 into the cylinder 102 when the piston 104 covers the exhaust port 108 during the down-stroke.

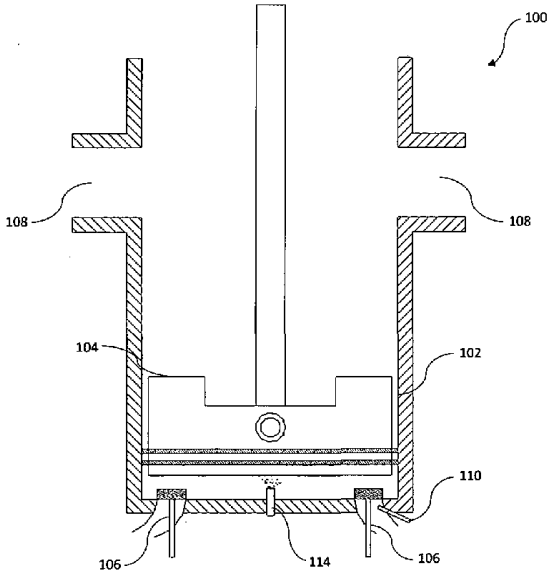

Figure 1

ABSTRACT

Two-stroke internal combustion engine

According to an embodiment, a two-stroke internal combustion engine 100 is disclosed. The engine 100 may include a cylinder 102 and a piston 104. The piston 104 may axially reciprocate within the cylinder 102. The piston 104 may draw an air during an up-stroke and may compress an air-fuel mixture during a down-stroke. The engine 100 may include an inlet valve 106 provided on a bottom part of the cylinder 102 that allows air into the cylinder 102. The engine 100 may further include an exhaust port 108 provided on a cylindrical wall, in proximity to a top part of the cylinder 102 that discharges the exhaust gas out of the cylinder 102. A fuel injector 110 mounted in proximity to the bottom part of the cylinder 102 may be configured to inject fuel 112 into the cylinder 102 when the piston 104 covers the exhaust port 108 during the down-stroke.

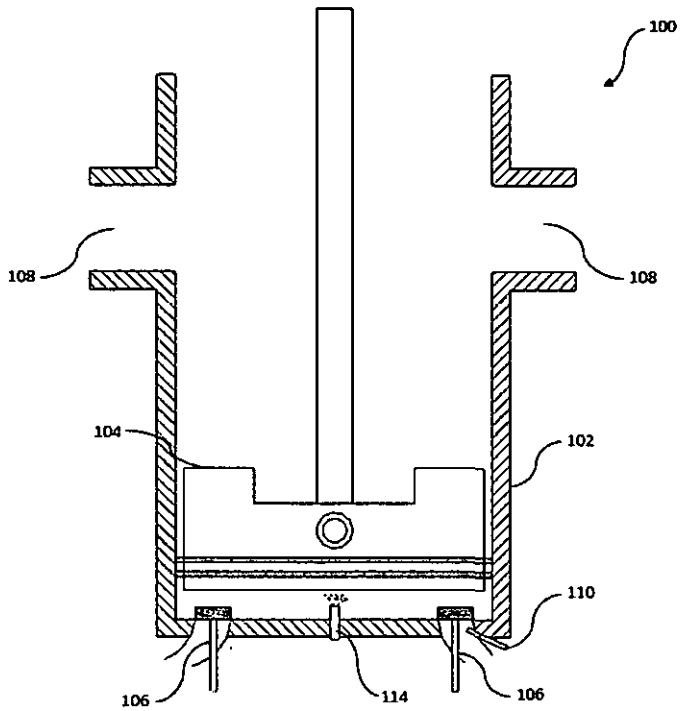

Figure 1

We claim:

1. A two-stroke internal combustion engine 100 comprising:

a cylinder 102;

a piston 104, axially reciprocating within the cylinder 102, wherein the piston 104 draws an air into the cylinder 102 during an up-stroke and compresses an air-fuel mixture in the cylinder 102 during a down-stroke;

at least one inlet valve 106 on a bottom part of the cylinder 102 to allow air without fuel into the cylinder 102;

at least one exhaust port 108 on a cylindrical wall of the cylinder 102 in proximity to a top part of the cylinder 102 to discharge an exhaust gas out of the cylinder 102; and

a fuel injector 110 mounted in proximity to the bottom part of the cylinder 104, the fuel injector 110 being configured to inject fuel 112 into the cylinder 102, wherein the fuel 112 is injected when the piston 104 covers the exhaust port 108 during the down-stroke.

2. The two-stroke internal combustion engine 100 as claimed in claim 1, wherein the two-stroke internal combustion engine 100 further includes a spark plug 114 to ignite the air-fuel mixture in the cylinder 102.

3. The two-stroke internal combustion engine 100 as claimed in claim 1, wherein the exhaust port 108 is opened and closed by the piston 102.

4. The two-stroke internal combustion engine 100 as claimed in claim 1, wherein the up-stroke is an expansion stroke and the down-stroke is a compression stroke.

5. The two-stroke internal combustion engine 100 as claimed in claim 1, wherein the piston 104 moves along gravity during the compression stroke and against gravity during the expansion stroke.

6. The two-stroke internal combustion engine 100 as claimed in claim 1, wherein the fuel injector 110 sprays fuel 112 in a direction against the gravity.

Dated this 27th day of September 2017,

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FIELD OF INVENTION

The invention generally relates to internal combustion engines and more particularly to two-stroke internal combustion engines.

BACKGROUND

A two-stroke engine is an internal combustion engine that completes a power cycle with only two strokes of a piston. The two-stroke internal combustion engine, in the process of producing power, takes in a fresh air fuel charge and exhausts the burned gases. This process of exhausting the burned gases from a cylinder and filling the cylinder with the fresh air fuel charge for the next cycle is referred to as scavenging.

In a conventional two-stroke internal combustion engine, the inner surface of the cylinder is furnished with an exhaust port and a set of inlet ports. The opening and closing of the exhaust port and the inlet ports is controlled by a reciprocating piston. On the completion of a power stroke, the burnt gases in the cylinder is exhausted out of the cylinder via the exhaust port and the fresh air fuel charge enters into the cylinder via the inlet ports.

The scavenging in the two-stroke internal combustion engines is characterized mainly by two problems: short-circuiting and mixing. In short circuiting, the fresh air fuel charge combines with the exhaust gases and nearly 35% of fresh air fuel charge is lost through the exhaust port. In mixing, a small amount of residual gas remains trapped without being expelled from the cylinder. This residual gas mixes with the fresh air fuel charge which leads to incomplete combustion and emission of significant amount of particulate matter, un-burnt hydrocarbons,

carbon mono-oxide, Nitrous oxides etc. Therefore, the conventional two stroke internal combustion engines are known to pollute the atmosphere and their future will be limited due to excessive pollution.

Hence there is a need for an improved two-stroke internal combustion engine.

SUMMARY OF THE INVENTION

According to an exemplary embodiment of the invention, a two-stroke internal combustion engine is disclosed. The two-stroke internal combustion engine may include a cylinder and a piston. The piston may axially reciprocate within the cylinder. The movement of the piston may be such that the piston may draw air into the cylinder during an up-stroke and may compress an air-fuel mixture in the cylinder during a down-stroke. The two-stroke internal combustion engine may further include at least one inlet valve provided on a bottom part of the cylinder. The inlet valve may allow air without fuel to flow into the cylinder. The two-stroke internal combustion engine may further include at least one exhaust port. The exhaust port may be provided on a cylindrical wall, in proximity to a top part of the cylinder. The exhaust port may discharge an exhaust gas out of the cylinder. A fuel injector may be mounted in proximity to the bottom part of the cylinder. The fuel injector may be configured to inject fuel into the cylinder. The fuel injection may be triggered only when the piston covers the exhaust port during the down-stroke.

BRIEF DESCRIPTION OF DRAWINGS

Other objects, features, and advantages of the invention will be apparent from the following description when read with reference to the accompanying drawings. In the drawings, wherein like reference numerals denote corresponding parts throughout the several views:

Figure 1 illustrates a sectional front view of a two-stroke internal combustion engine at the end of a compression stroke according to an exemplary embodiment of the invention;

Figure 2 illustrates the sectional front view of the two-stroke internal combustion engine at near-end of expansion stroke according to an exemplary embodiment of the invention;

Figure 3 illustrates the sectional front view of the two-stroke internal combustion engine at the end of expansion stroke according to an exemplary embodiment of the invention; and

Figure 4 illustrates the sectional front view of the two-stroke internal combustion engine at the start of compression stroke according to an exemplary embodiment of the invention.

DETAILED DESCRIPTION OF DRAWINGS

The following description with reference to the accompanying drawings is provided to assist in a comprehensive understanding of exemplary embodiments. It includes various specific details to assist in that understanding but these are to be regarded as merely exemplary. Accordingly, those of ordinary skill in the art will recognize that various changes and

modifications of the embodiments described herein can be made without departing from the scope and spirit of the invention. In addition, descriptions of well-known functions and constructions are omitted for clarity and conciseness.

Figure 1-4 illustrates a front sectional view of a two-stroke internal combustion engine 100 at different stages according to an exemplary embodiment of the invention. The two-stroke internal combustion engine 100 may be connected to a crankcase (not shown in figure) via screws. The two-stroke internal combustion engine 100 may be employed in a mechanical device such as a motorcycle, a car, a racing vehicle, a jet ski, a dirt bike, a chain saw etc. for imparting energy to operate the mechanical device. The two-stroke internal combustion engine 100 may include a cylinder 102. In some embodiments, the two-stroke internal combustion engine 100 may include two or more cylinders 102 arranged adjacent to each other. The cylinder 102 may be constructed from materials or combination of materials that may include, but are not limited to, one or more of metal, alloy, and any other suitable material known in the art. The cylinder 102 may have a top part, a bottom part and a cylindrical wall. The two-stroke internal combustion engine may further include a piston 104. The piston 104 may be arranged within the cylinder 102. The piston 104 may be a piston head connected to a crankshaft by means of a connecting rod and a crank pin. In the following, the terms 'piston' may be used to refer 'piston head' without restricting the invention in any way. The piston head may have one or more piston rings fitted around the piston head in machined grooves. The piston 104 may be arranged within the cylinder 102 in such a manner that the piston 104 may axially reciprocate within the cylinder 102. The reciprocation of the piston 104 may be adjusted between a Top Dead Centre (TDC) position and a Bottom Dead Centre (BDC) position. This axial movement of the piston 104 within the cylinder 102 may draw an air into the cylinder 102 during an up-stroke and may compress an air-fuel mixture in the cylinder 102 during a down-stroke. It must

be noted that the up-stroke in the two-stroke internal combustion engine 100 is an expansion stroke and the down-stroke in the two-stroke internal combustion engine 100 is a compression stroke. The cylinder 102 and the piston 104 arrangement in the two-stroke internal combustion engine 100 may be such that the piston 104 may move along gravity during the compression stroke and moves against gravity during the expansion stroke. In other words, the piston 104 may move downwards during the compression stroke and may move upwards during the expansion stroke.

The two-stroke internal combustion engine 100 may further include at least one inlet valve 106 provided on the bottom part of the cylinder 102. The bottom part of the cylinder 102 may be the bottom surface of the cylinder 102. According to an embodiment, the inlet valve 106 may be an air valve. It will be apparent to a person skilled in the art that the inlet valve 106 may be a valve that allows air into the cylinder 102 when the pressure within the cylinder 102 becomes less than the pressure outside the cylinder 102. The inlet valve 106 may be configured to allow air into the cylinder 102 during the upstroke of the piston 104. According to an embodiment, the two-stroke internal combustion engine 100 may include only one inlet valve 106. According to another embodiment, the two-stroke internal combustion engine 100 may include two or more inlet valves 106. The number of inlet valves 106 may depend on parameters such as, but not limited to, dimensions of each of the inlet valves 106, efficiency of the engine 100, volume of the cylinder 102 etc. By way of an example, the two-stroke internal combustion engine 100 may have only one inlet valve 106 with a large opening or may have two inlet valves 106 with smaller openings. The inlet valve 106 of the two-stroke internal combustion engine 100 may be connected to a fresh air source. It should be noted that the inlet valve 106 may only allow the air into the cylinder 102.

The two-stroke internal combustion engine 100 may further include at least one exhaust port 108 provided on the cylindrical wall of the cylinder 102 in proximity to the top part of the cylinder 102. The exhaust port 108 may be an opening provided on the surface of the cylinder 102 that may be opened and closed by the movement of the piston 104. According to an embodiment, the two-stroke internal combustion engine 100 may include only one exhaust port 108. According to another embodiment, the two-stroke internal combustion engine 100 may include two or more exhaust ports 108. The number of exhaust ports 108 may depend on parameters such as, but not limited to, dimensions of each of the exhaust ports 108, efficiency of the engine 100, volume of the cylinder 102 etc. By way of an example, the two-stroke internal combustion engine 100 may have only one exhaust port 108 with a large opening or may have two or more exhaust ports 108 with smaller openings. The exhaust port 108 in the two-stroke internal combustion engine 100 may discharge an exhaust gas out of the cylinder 102.

The two-stroke internal combustion engine 100 may further include a fuel injector 110. The fuel injector 110 may be mounted in proximity to the bottom part of the cylinder 102. The fuel injector 110 may be mounted in such a manner that a spray tip of the fuel injector 110 may be directed substantially upwards within the cylinder 102. The fuel injector 110 may inject fuel 112 into the cylinder 102. According to an embodiment, thc fuel 112 injected from the fuel injector 110 may be a petrol or a gasoline. According to another embodiment, the fuel 112 injected from the fuel injector 110may be diesel. The fuel injector 102 may be configured in such a way that the fuel 112 injection may be triggered only when the piston 104 covers the exhaust port 108 during the down stroke. The fuel injector 110 may further be mounted in such a way that the fuel 112 may be sprayed into the cylinder 102 in a direction against the gravity.

The spraying of fuel 112 against the gravity may enable the fuel to achieve a greater distribution within the cylinder 102 thereby producing a better air-fuel mixture.

According to an embodiment, the two-stroke internal combustion engine 100 may include a spark plug 114. The spark plug 114 may ignite the air-fuel mixture in the cylinder 102 during the down-stroke of the piston 104. According to an embodiment, the spark plug 114 may be used in a two-stroke internal combustion petrol engine 100 or a two-stroke internal combustion diesel engine 100 to ignite the air-fuel mixture. According to another embodiment, the air-fuel mixture in the two-stroke internal combustion diesel engine 100 may ignite itself due to the rise in pressure and temperature of the air-fuel mixture in the cylinder 102 without the need of the spark plug 114.

Figure 1 illustrates a sectional front view of the two-stroke internal combustion engine 100 at the end of the compression stroke according to an exemplary embodiment of the invention. At this stage, the piston 104 may be in proximity to the bottom part of the cylinder 102. As the piston 104 moves to the BDC, the air-fuel mixture within the cylinder 102 gets compressed. According to an embodiment, at this stage the spark plug 114 may ignite the air-fuel mixture for petrol or diesel engines. According to another embodiment, the air-fuel mixture may get ignite itself due to the high pressure and temperature of the compressed air fuel mixture in diesel engines. The combustion of air-fuel mixture within the cylinder 102 may produce power initiating the expansion stroke.

Figure 2 illustrates the sectional front view of the two-stroke internal combustion engine 100 at near-end of the expansion stroke according to an exemplary embodiment of the invention. In the expansion stroke, the piston 104 may move from the BDC to the TDC. As the piston 104

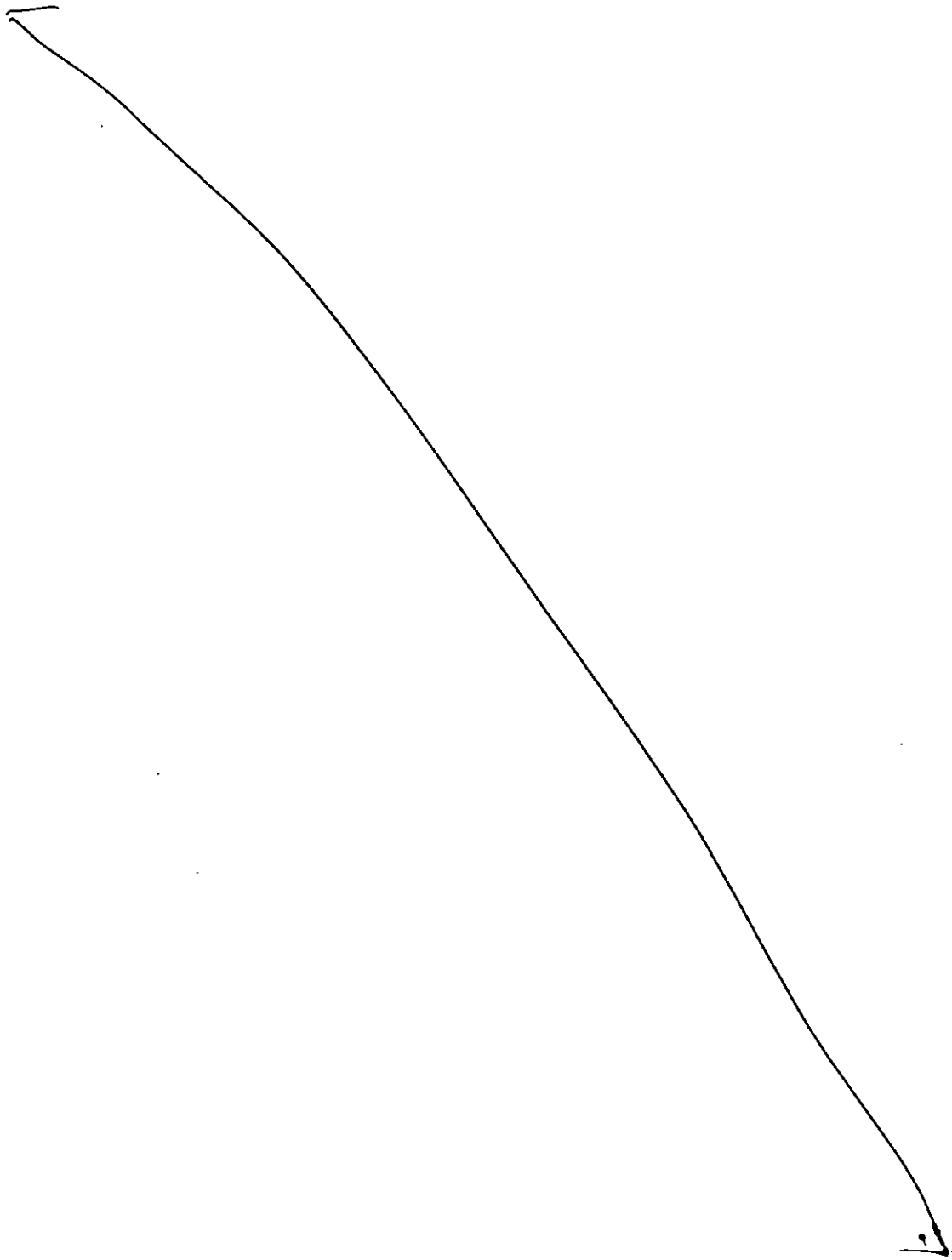
move to the TDC, the piston 104 may uncover the exhaust port 108 provided on the cylindrical wall in proximity to the top part of the cylinder 104. The exhaust gas formed by the combustion of the air-fuel mixture within the cylinder 102 may be at high pressure and so, may move out of the cylinder 102 as the exhaust port 108 opens.

Figure 3 illustrates the sectional front view of a two-stroke internal combustion engine 100 at the end of the expansion stroke according to an exemplary embodiment of the invention. The piston 104 may move to TDC position by the end of the expansion stroke. When the piston 104 reaches the TDC position, the pressure inside the cylinder 102 may drop below the pressure at inlet. The pressure drop within the cylinder 102 is followed by opening of the inlet valves 106. The opening of inlet valves 106 may allow the air for the next cycle into the cylinder 102 and the air may push the remaining exhaust gases out of the cylinder 102 through the exhaust port 108.

Figure 4 illustrates the sectional front view of a two-stroke internal combustion engine 100 at the start of the compression stroke according to an exemplary embodiment of the invention. The piston 104 may move from the TDC of the cylinder 102 to the BDC for the compression stroke. As the piston 104 moves to the BDC, the piston 104 may cover the exhaust port 108 and the inlet valve 106 may close due to pressure. At this stage, the fuel injector 110 may inject fuel 112 on the air within the cylinder to form the air-fuel mixture.

It is understood that the above description is intended to be illustrative, and not restrictive. It is intended to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined in the appended claims. Many other embodiments will be apparent to those of skill in the art upon reviewing the above description.

The scope of the invention should, therefore, be determined with reference to the appended claims, along with the full scope of equivalents to which such claims are entitled. In the appended claims, the terms "including" and "in which" are used as the plain-English equivalents of the respective terms "comprising" and "wherein," respectively.



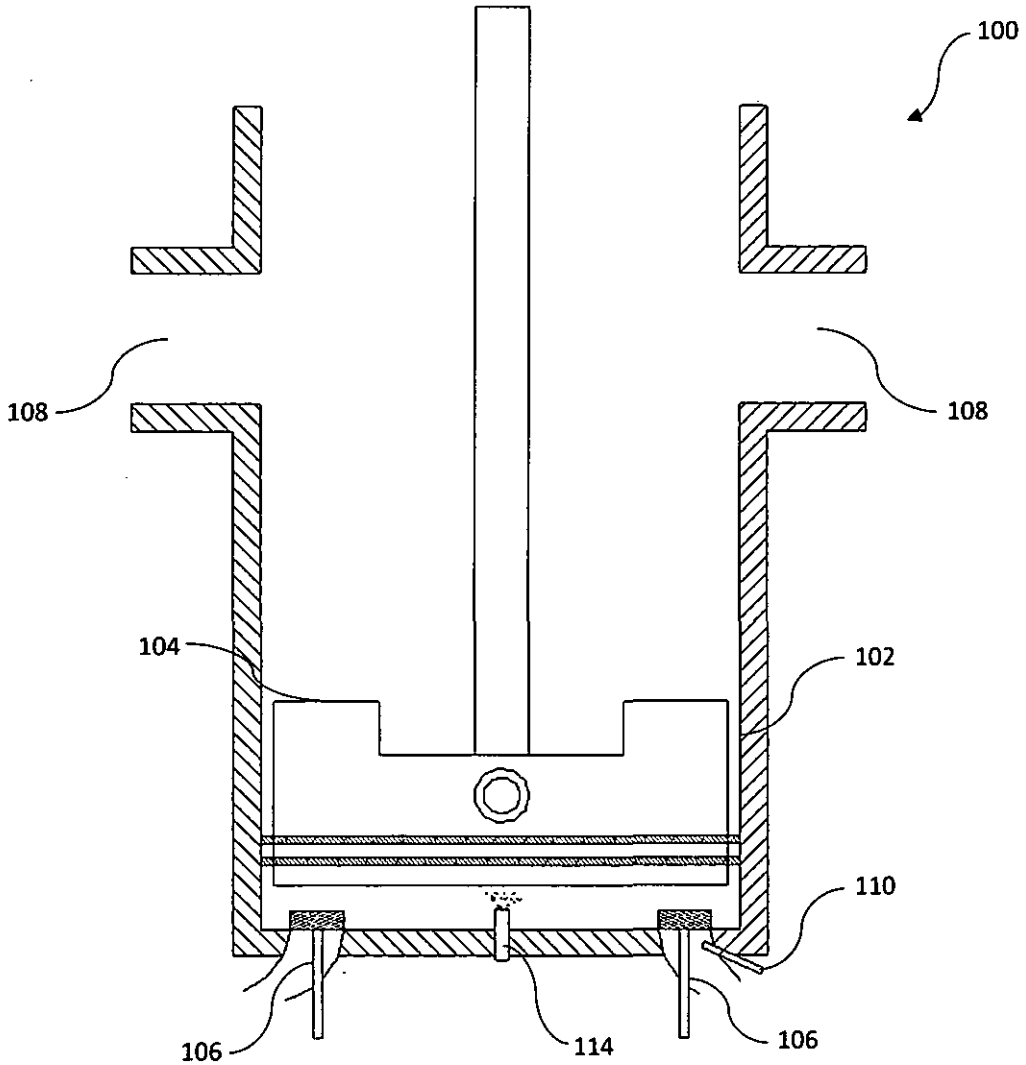


Figure 1

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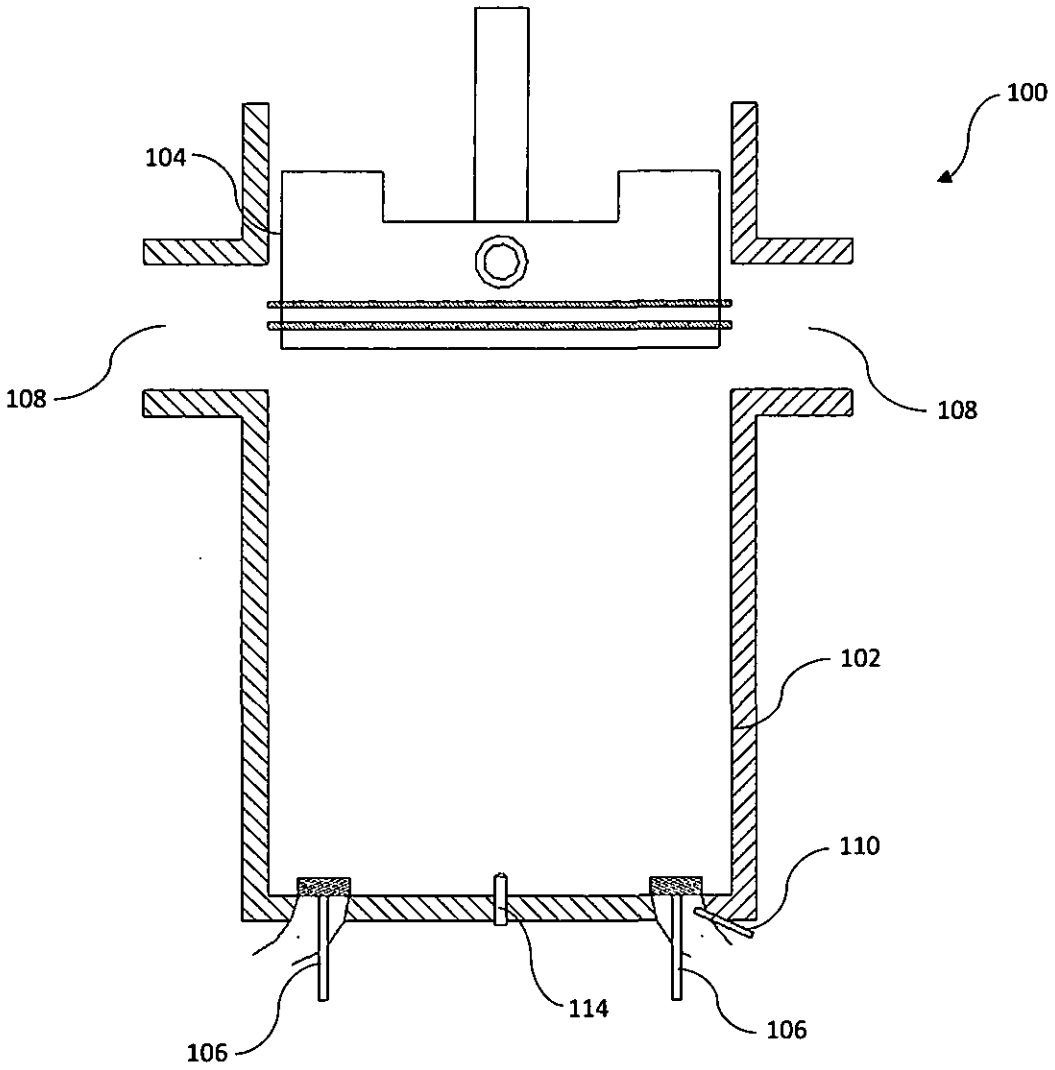

Figure 2

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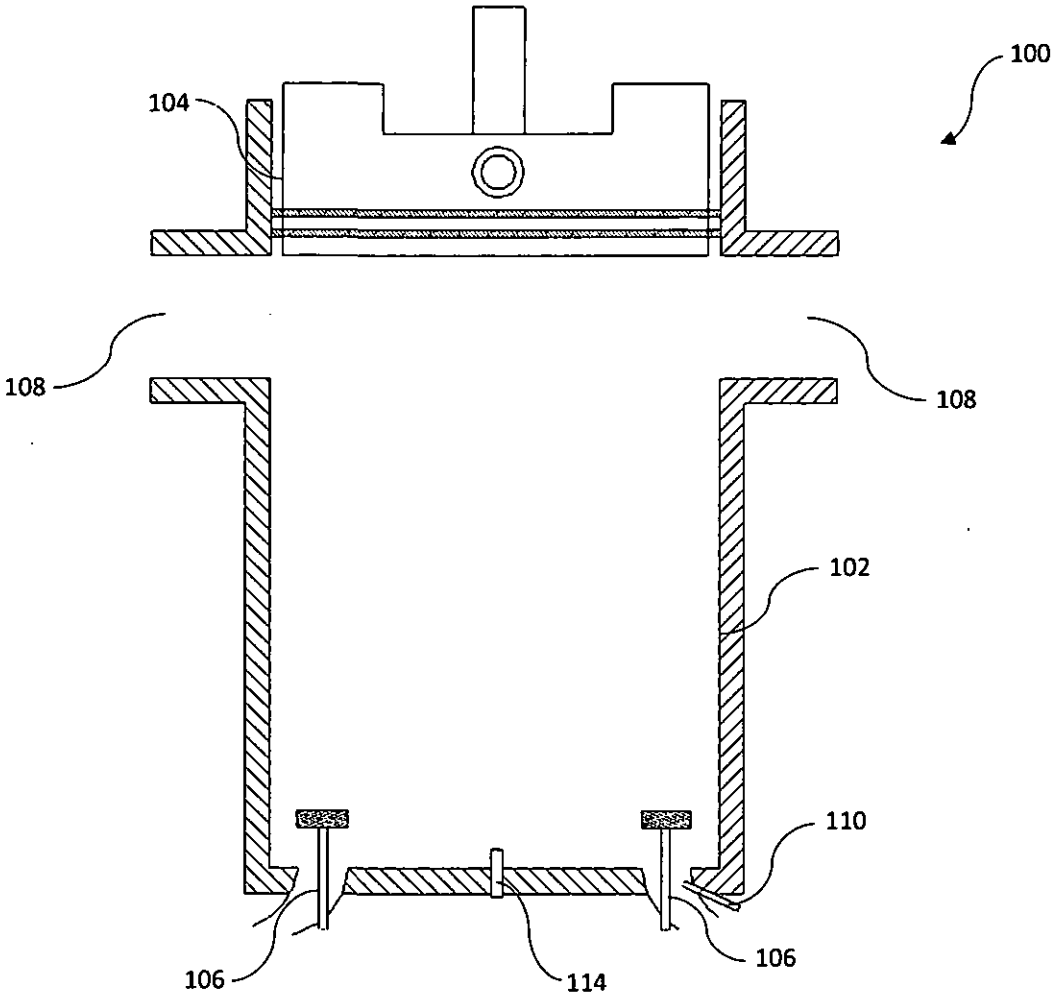

Figure 3

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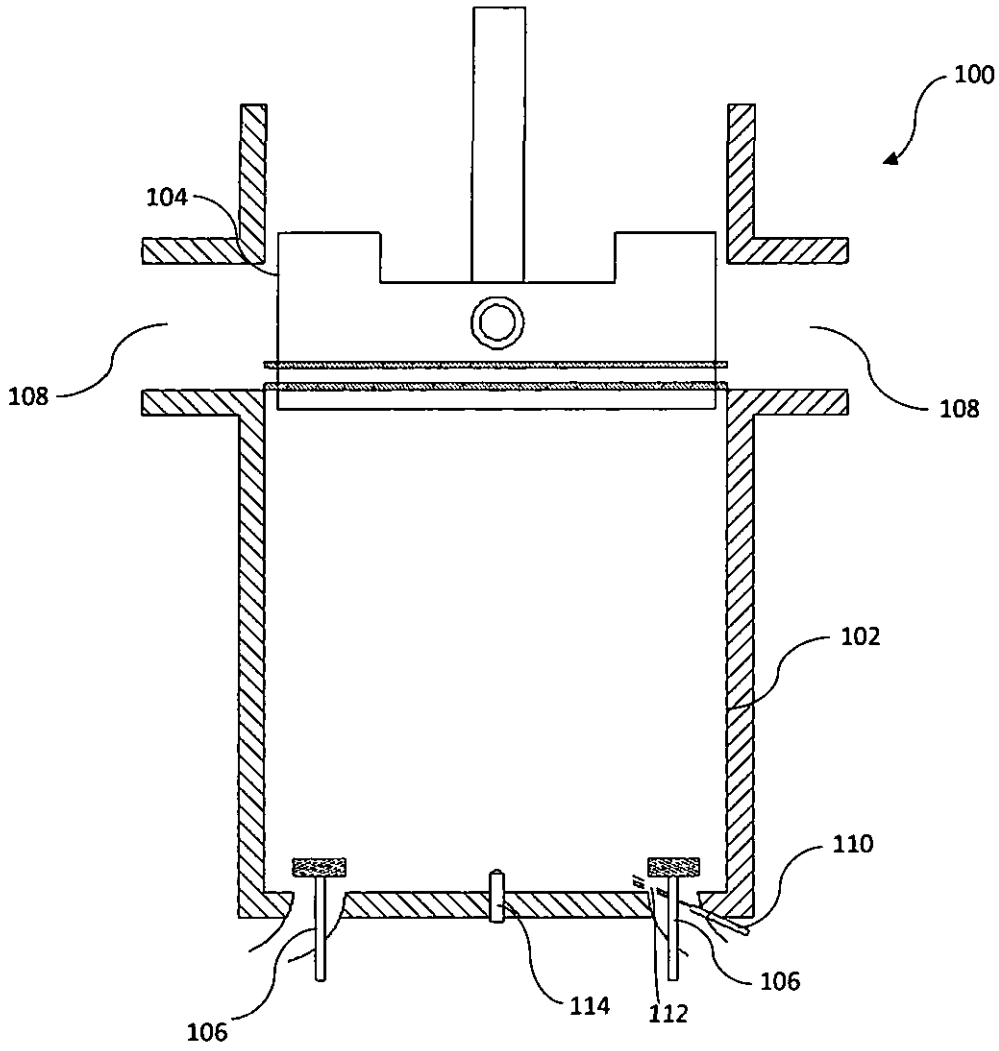

Figure 4

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