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(71) Applicant: **Winterthur Gas & Diesel Ltd.**
8401 Winterthur (CH)

(72) Inventor: **Affolter, Samuel**
8248 Uhwiesen (CH)

(74) Representative: **Hepp Wenger Ryffel AG**
Friedtalweg 5
9500 Wil (CH)

(54) **SEALING RING, CYLINDER FOR A COMBUSTION ENGINE, COMBUSTION ENGINE, METHOD FOR PRODUCING A CYLINDER AND USE OF A SEALING RING**

(57) A sealing ring (1), in particular anti-polishing ring, for use in a cylinder of a combustion engine, preferably of a large two-stroke ship engine has an inner diameter D, a length L and a width W. Length L is dimensioned such that in an built-in situation in a cylinder the sealing ring (1) extends beyond the cylinder liner (2) of the cylinder.

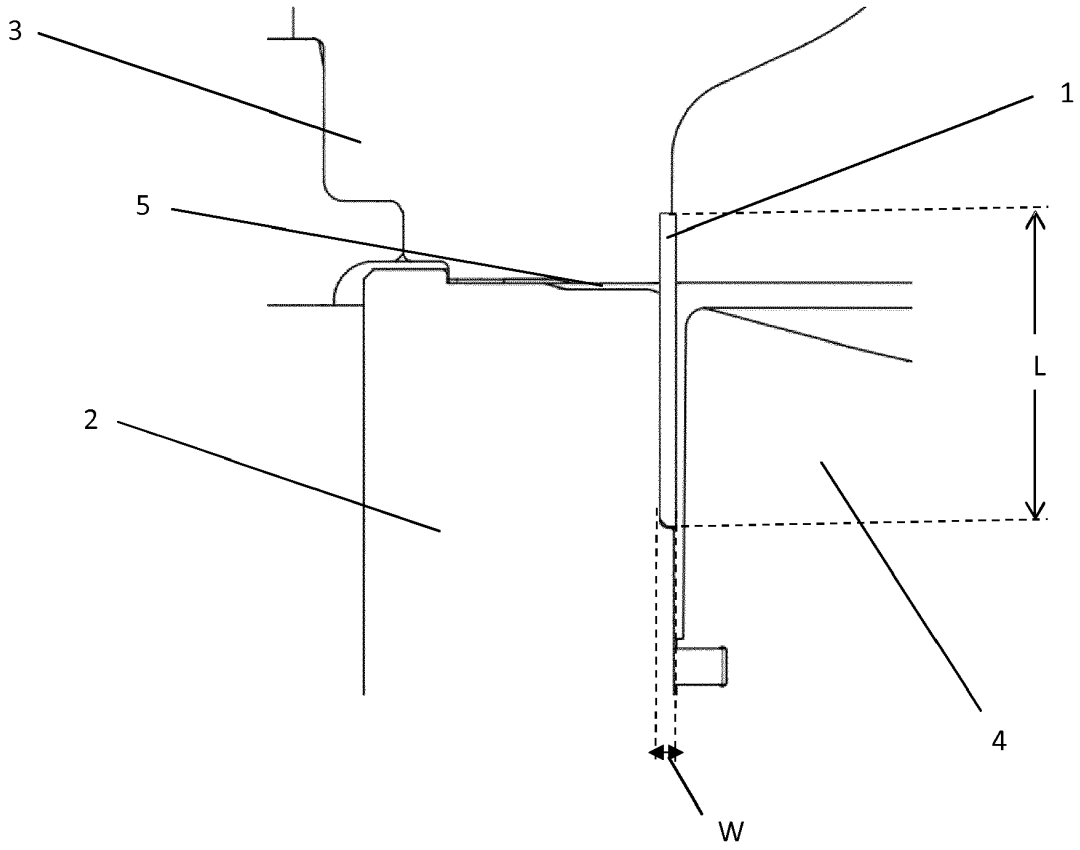

Fig. 1

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Description

[0001] The present invention is directed to a sealing ring for use in a cylinder of a combustion engine, a cylinder for a combustion engine, a combustion engine, a method for producing a cylinder for a combustion engine and the use of a sealing ring according to the preamble of the independent claims.

[0002] It is known to position an anti-polishing ring on the top part of a cylinder liner to remove deposits accumulating on the top land of a piston. Those anti-polishing rings are mainly used in diesel engines in which heavy fuel oil and/or gas or other fuels are used as a fuel or at least as a fuel option for the engine. Those anti-polishing rings are for example known from EP 2 535 540, EP 0 684 411 and EP 1 061 294.

[0003] Especially in multi fuel and/or dual fuel and or pure gaseous fuel engines ignited gas can enter the gap between cylinder cover and cylinder liner leading to significant heat input into the components.

[0004] It is therefore an object of the present invention to overcome the disadvantages of the prior art and in particular create a cylinder for a gaseous fuel engine which is durable and leads to optimized fuel consumption.

[0005] The object is achieved by a sealing ring, in particular an anti-polishing ring, for use in a cylinder of a combustion engine, preferably of a large two-stroke, cross-head ship engine. A sealing ring has an inner diameter D, a length L and a width W. The length L is dimensioned such that in a built-in situation in a cylinder the sealing ring extends beyond the cylinder liner of the cylinder.

[0006] Such a sealing ring enables the sealing of the gap between cylinder liner and cylinder cover and thus leads to essentially no gas or ignited gas or other fuel or ignited fuel entering the gap, thereby less or no heat is introduced into those components and additionally fuel efficiency is increased.

[0007] The engine can be a dual fuel engine. The sealing ring can additionally be an anti-polishing ring, and thereby removing any deposits accumulating on the top land of the piston. For this purpose the anti-polishing ring has a slightly smaller inner diameter than the corresponding cylinder liner.

[0008] The sealing ring can comprise at least two segments along the length L, wherein at least one segment has different elasticity behavior than at least one of the other segments.

[0009] This way the mechanical stresses on the sealing ring caused by relative movement between cylinder liner and cylinder cover can be reduced.

[0010] The sealing ring can comprise at least two, preferably three, different width W along its length L.

[0011] This way the width can be adapted to the needs in the certain position of the sealing ring. Especially in regions where more elastic behavior of the sealing ring is needed, for example in the area of the gap between cylinder liner and cylinder cover, the width can be reduced.

[0012] The sealing ring can comprise three different widths W, wherein a first width W_1 at a first end is larger than a second width W_2 at a second end and both widths W_1 and W_2 are larger than a third width W_3, which is located between the first width W_1 and the second width W_2.

[0013] Hence, the sealing ring is more elastic in the region W3, where more elasticity might be desired. This could lead to less stresses in the parts and therefore a longer durability of the whole cylinder.

[0014] The sealing ring can be made from metal, in particular forged steel.

[0015] The object is further accomplished by a cylinder for a combustion engine, in particular a two-stroke, cross head engine, more particularly a diesel engine, preferably a multi-fuel or dual-fuel engine, comprising a cylinder liner and a cylinder cover. The cylinder cover is arranged on the cylinder liner, wherein a sealing ring, in particular an anti-polishing ring, in particular a sealing ring as previously described, is arranged on a cylinder liner. The sealing ring extends beyond the cylinder liner into the cylinder cover.

[0016] Such a cylinder with a sealing ring does not allow for gas or other fuel to enter the gap between cover and liner and therefore the heat input into the components is reduced. Additionally this leads to a reduced fuel consumption.

[0017] The sealing ring can extend at least 10%, preferably at least 20%, of its length L beyond the cylinder liner.

[0018] This leads to a reliable sealing of the gap between cylinder cover and cylinder liner.

[0019] A sealing ring can extend at most 60%, preferably at most 50%, more preferably at most 40% of the length L of the sealing ring beyond the cylinder liner.

[0020] This leads to a reliable sealing of the gap between cylinder liner and cylinder cover and additionally to a reliable fit between sealing ring and cylinder cover without increasing the height of the cylinder cover.

[0021] A second width W_2 of the sealing ring in an area of the cylinder cover can be smaller than a first width W_1 in an area of the cylinder liner.

[0022] This leads to a more elastic sealing ring in the area of the cylinder cover and thus to less stresses in the parts.

[0023] A third width W_3 of a sealing ring can be smaller in an area between cylinder liner and cylinder cover than a first width W1 in an area of the cylinder liner and preferably than a second width W2 in an area of the cylinder cover.

[0024] This leads to the most elastic part of the sealing ring being in the area of the gap and therefore an adaptable sealing in case of relative movements between cylinder cover and cylinder liner.

[0025] The widths can each comprise a segment of a third of the length of the sealing ring. Additionally, it is

possible to adjust each length segment of each width to the need of each cylinder, e.g. the width W_3 can extend along a shorter segment than widths W_2 and/or W1.

[0026] In case the sealing ring does not comprise just one width, the transition between the different widths can be steep, or smooth such that no sharp transitions are present which would cause local stress concentrations.

[0027] The object is additionally achieved by a combustion engine, preferably a two-stroke, cross-head engine in particular a multi-fuel or dual-fuel engine, more preferably a diesel engine, comprising a cylinder as previously described.

[0028] Such a combustion engine is more durable, has a lower fuel consumption and is less service intense.

[0029] The object is further achieved by a method for producing a cylinder, in particular a cylinder for a combustion engine, preferably a two-stroke, cross-head combustion engine of a large ship, more preferably a diesel engine, in particular a multi-fuel or dual-fuel engine, more preferably a cylinder as previously described, comprising the steps of

- Installing a sealing ring, in particular an anti-polishing ring, on the inside of a cylinder liner, such that a sealing ring extends beyond the cylinder liner;

- Installing a cylinder cover onto the cylinder liner such that the sealing ring extends into the cylinder cover.

[0030] This way the sealing ring seals the gap between cylinder liner and cylinder cover and leads to a more durable cylinder and lower fuel consumption.

[0031] The object is additionally achieved by the use of a sealing ring, in particular anti-polishing ring, for sealing the gap between cylinder liner and cylinder cover of a cylinder of a combustion engine, in particular an engine for a large ship, preferably a two-stroke, cross-head engine, more preferably a diesel engine, most preferably a multi-fuel or dual-fuel diesel engine for ships.

[0032] The fuels used for such an engine can be heavy fuel oil and/or diesel and/or gas and/or alcohol or a derivative thereof and/or a mixture of the fuels mentioned in particular comprising water.

[0033] The invention is further described by means of embodiments in the following figures. It shows

Figure 1: A first embodiment of a sealing ring in a sectional view;

Figure 2: a second embodiment of a sealing ring in a sectional view;

Figure 3: a third embodiment of a sealing ring in a sectional view;

Figure 4: a sealing ring in top view;

Figure 5: a sectional view of a sealing ring.

[0034] Figure 1 shows a first embodiment of sealing ring 1 in a sectional view. The view is a cutout from a cylinder and shows a cylinder liner 2 and a cylinder cover 3. Between cylinder liner 2 and cylinder cover 3 a gap 5 is arranged. Inside the cylinder a piston 4 is shown below its top position. The sealing ring 1 extends beyond the cylinder liner 2 into cylinder cover 3. This way the gap 5 is covered and sealed by sealing ring 1. Additionally, the inner diameter of the sealing ring 1 is slightly smaller than the inner diameter of the cylinder liner 2, such that it is possible to use the sealing ring 1 simultaneously as an anti-polishing ring. The sealing ring 1 has a length L which is dimensioned such that the sealing ring covers gap 5 and extends beyond cylinder liner 2 into cylinder cover 3. The sealing ring further has one width W along its entire length. The sealing ring is made from metal, in particular forged steel.

[0035] The length of the sealing ring 1 is in a range between 40 mm and 200 mm, depending on the cylinder used. The width W of the sealing ring 1 is in a range of 8 mm to 30 mm depending on the cylinder used.

[0036] Figure 2 shows an alternative of a sealing ring 1 in a sectional view. The sealing ring 1 covers the gap 5 between cylinder liner 2 and cylinder cover 3. The piston 4 is in its top position above the sealing ring 1. The sealing ring 1 additionally has an anti-polishing function. Compared to the sealing ring 1 shown in figure 1, this sealing ring is wider and shorter, which makes the ring easier to produce.

[0037] Figure 3 shows an alternative embodiment of a sealing ring 1 as shown in figure 2. The sealing ring 1 has the same widths in the area of the cylinder cover 3 and the cylinder liner 2. In the area of the gap 5 the widths W of the sealing ring 1 is reduced. This leads to the sealing ring 1 being more elastic in the area and less forces to be introduced into the parts. Furthermore, the reduction in widths W of the sealing ring 1 is steady which leads to a better stress distribution.

[0038] Figure 4 shows a sealing ring 1 in a top view. The sealing ring 1 has an inner diameter D, which in case of the sealing ring having an anti-polishing function is slightly smaller than the inner diameter of the cylinder liner (not shown).

[0039] Figure 5 shows a sealing ring 1 having three different widths W. The area of the sealing ring being arranged in the cylinder liner 2 (not shown) is the broadest width W_1. The area being arranged in the cylinder cover 3 (not shown) is smaller than W_1 and denoted as W_2. The smallest width W_3 is located in the area of the gap 5 (not shown).

Claims

1. Sealing ring (1), in particular anti-polishing ring, for use in a cylinder of a combustion engine, preferably of a large two-stroke ship engine, the sealing ring (1) having an inner diameter D, a length L and a width

W **characterized in that** the length L is dimensioned such that in an built-in situation in a cylinder the sealing ring (1) extends beyond the cylinder liner (2) of the cylinder.

2. Sealing ring (1) according to claim 1 **characterized in that** the sealing ring (1) comprises at least two segments along the length L, wherein at least one segment has a different elasticity behavior than at least one of the other segments.

3. Sealing ring (1) according to any one of the preceding claims, **characterized in that** the sealing ring (1) comprises at least two, preferably three, different width W along its length L.

4. Sealing ring (1) according to claim 3, **characterized in that** the sealing ring (1) comprises three different width W, wherein a first width W_1 at a first end is larger than a second width W_2 at a second end and both widths W_1 and W_2 are larger than a third width W_3, which is located between the first width W1 and the second width W_2.

5. Cylinder for a combustion engine comprising a cylinder liner (2) and a cylinder cover (3), wherein the cylinder cover (3) is arranged on the cylinder liner (2), wherein a sealing ring (1), in particular an anti-polishing ring, in particular a sealing ring (1) according to any one of claims 1 to 4, is arranged on the cylinder liner (2), **characterized in that** the sealing ring (1) extends beyond the cylinder liner (2) into the cylinder cover (3).

6. Cylinder according to claim 5, **characterized in that** the sealing ring (1) extends at least 10%, preferably at least 20%, of its length L beyond the cylinder liner (2).

7. Cylinder according to any one of claims 5 or 6, **characterized in that** the sealing ring (1) extends at most 60%, preferably at most 50%, more preferably at most 40 %, of the length of the sealing ring (1) beyond the cylinder liner (2).

8. Cylinder liner according to any one of claims 5 to 7, **characterized in that** a second width W_2 of the sealing ring (1) in an area of the cylinder cover (3) is smaller than a first width W_1 in an area of the cylinder liner (2).

9. Cylinder according to any one of claims 5 to 8, **characterized in that** a third width W_3 of the sealing ring (1) is smaller in an area between cylinder liner (2) and cylinder cover (3) than a first width W_1 in an area of the cylinder liner (2) and preferably than a second width W_2 in an area of the cylinder cover (3).

10. Combustion engine, preferably a two-stroke, cross-head engine, comprising a cylinder according to any one of claims 5 to 9.

11. Method for producing a cylinder, in particular a cylinder for a combustion engine, preferably a two-stroke, cross head combustion engine of a ship, more preferably a cylinder according to any one of claims 5 to 9, comprising the steps of

- installing a sealing ring (1), in particular an anti-polishing ring, on the inside of a cylinder liner (2), such that the sealing ring (1) extends beyond the cylinder liner (2);
- installing a cylinder cover(3) onto the cylinder liner (2) such that the sealing ring (1) extends into the cylinder cover (3).

12. Use of a sealing ring (1), in particular anti-polishing ring, for sealing the gap between cylinder liner (2) and cylinder cover (3) of a cylinder of a combustions engine, in particular an engine for a large ship, preferably a two-stroke cross-headengine, more preferably a diesel engine, most preferably a multi-fuel or dual-fuel diesel engine for ships.

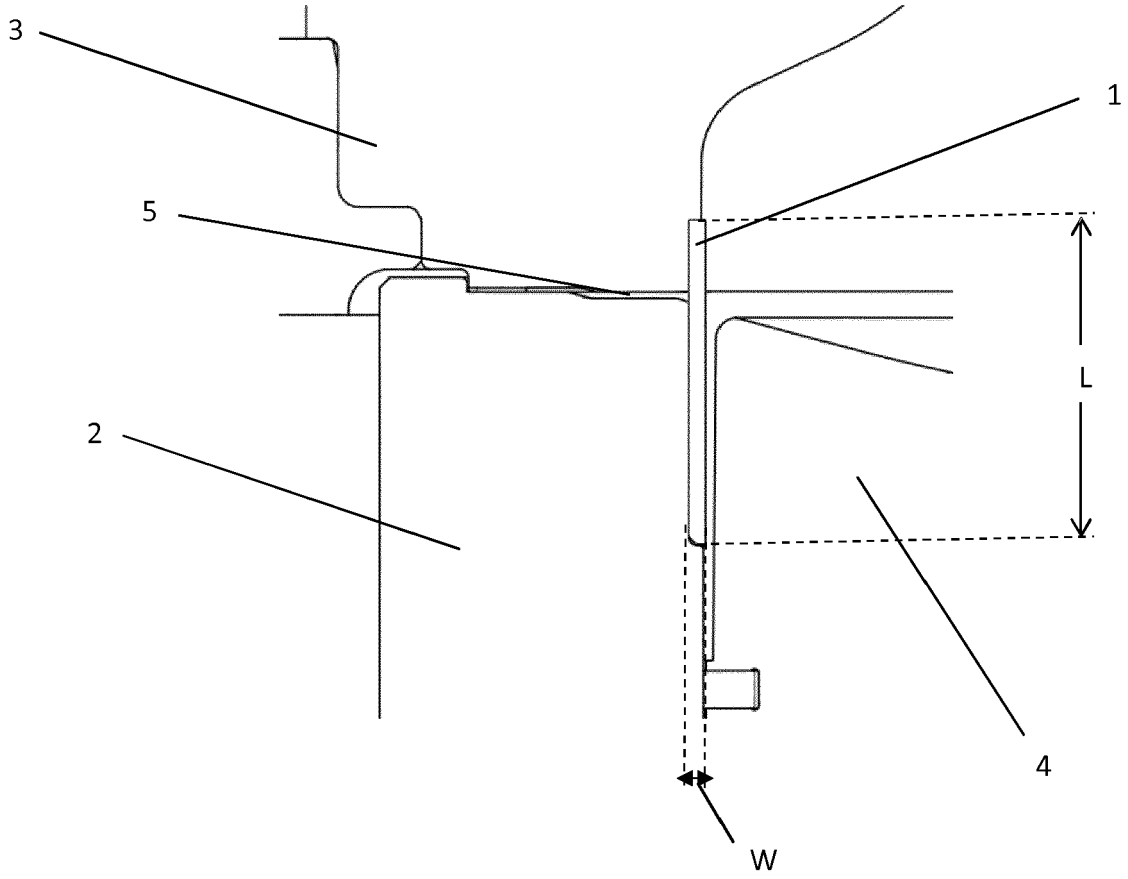

Fig. 1

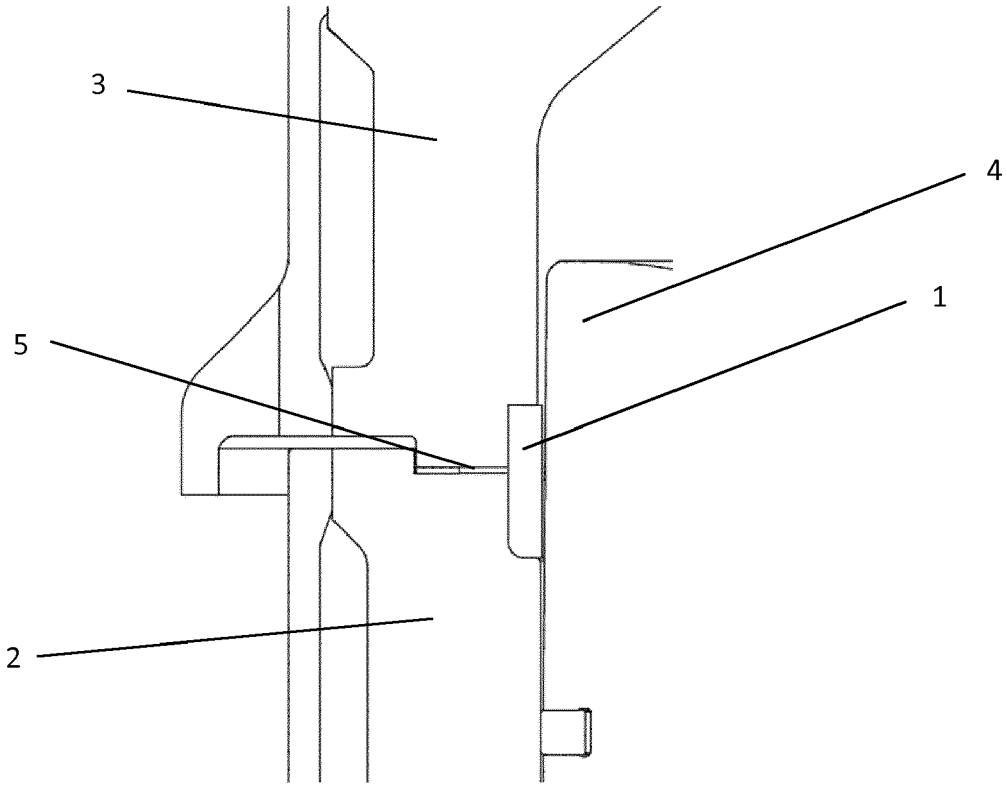

Fig. 2

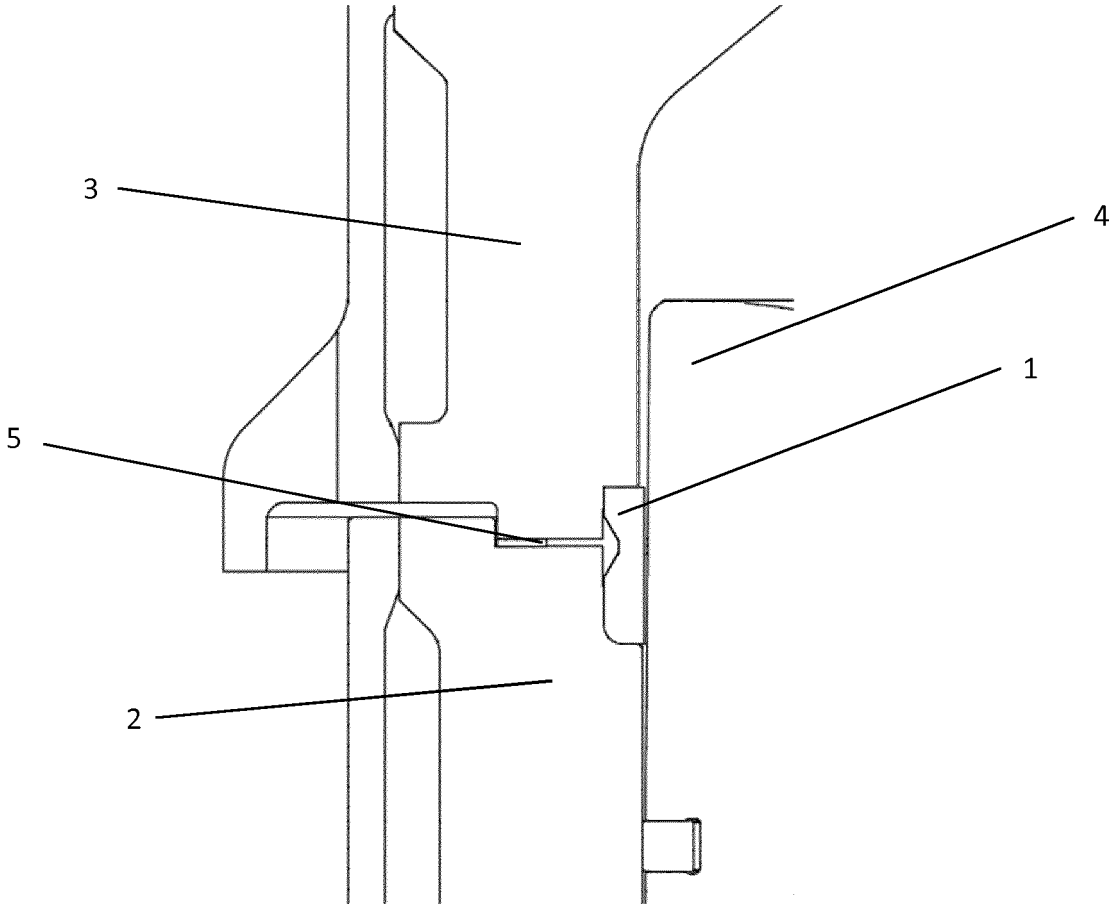

Fig. 3

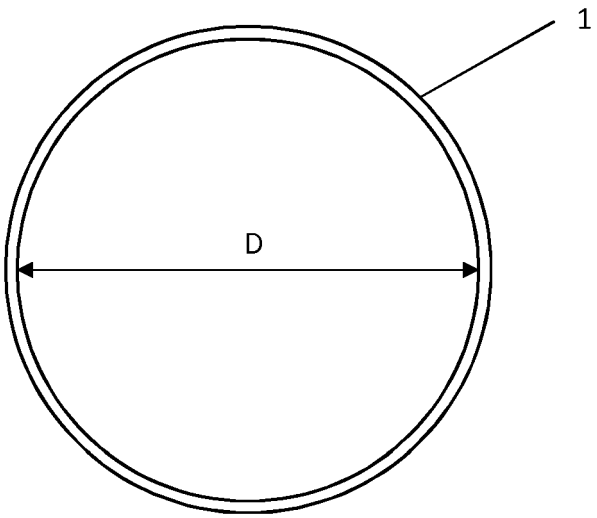

Fig. 4

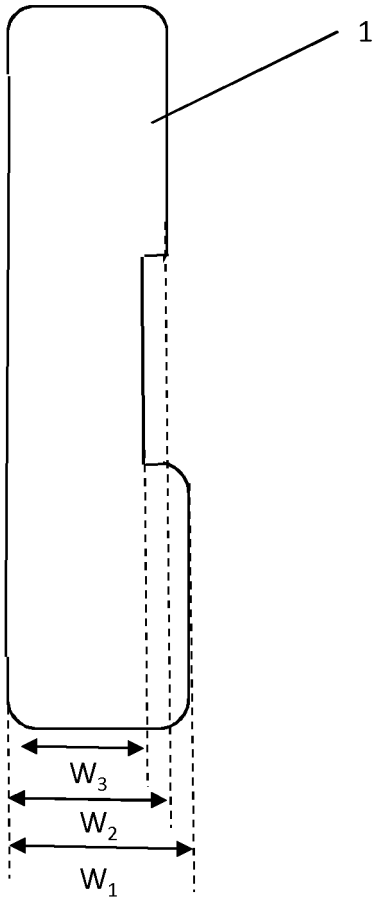

Fig. 5

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Application Number
EP 18 16 1648

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	20 September 2018	Matray, J

CATEGORY OF CITED DOCUMENTS

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