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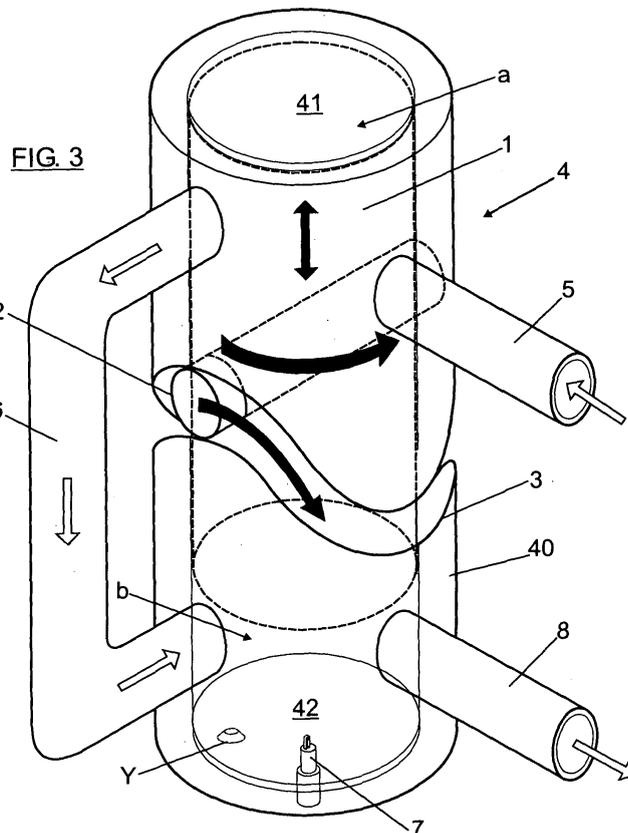
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(54) **Reciprocating rotary internal combustion engine**

(57) The invention relates to a reciprocating rotary internal combustion engine having: a stator (4) having a cylindrical inner cavity (a, b) having a side wall (40); an inner piston (1) configured to be driven in the inner cavity (a, b) by a combustion of the fuel and combustion agent mixture; the stator (4) has a guide (3) worked in the side face (40) to generate a rotary movement in the inner piston (1) during the reciprocating movement of the inner piston (1); the inner piston (1) has a bushing (2) perpendicular to the side face (40), the bushing (2) defining two diametrically opposite protrusions configured to run along the guide (3) during the reciprocating movement of the inner piston (1) and generate the rotary movement in the inner piston (1) during the reciprocating movement.

ton (1) during the reciprocating movement of the inner piston (1); the inner piston (1) has a bushing (2) perpendicular to the side face (40), the bushing (2) defining two diametrically opposite protrusions configured to run along the guide (3) during the reciprocating movement of the inner piston (1) and generate the rotary movement in the inner piston (1) during the reciprocating movement.



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**Description**Field of the Invention

**[0001]** The invention is comprised in the technical field dedicated to internal combustion heat engines, more specifically those called explosion or spark ignition engines (SIE) and combustion ignition engines (CIE).

Background of the Invention

**[0002]** In the automotive field and in the other fields, the most used heat engines are conventional or reciprocating type engines with cylinders and pistons, both gasoline explosion or spark ignition engines (SIE), and diesel oil, diesel or combustion ignition engines (CIE).

**[0003]** In these engines, the rectilinear reciprocating movement of the pistons is converted into a circular or rotating movement by means of the connecting rods and the crankshaft.

Description of the Invention

**[0004]** aspect of the invention relates to a reciprocating rotary internal combustion engine having:

a stator having a cylindrical inner cavity having a side wall, a first base and a second base;

an inner piston configured to be driven in the inner cavity along a stroke comprised between the first base and the second base by a combustion of a fuel and combustion agent mixture;

**characterized in that:**

the stator comprises a guide worked in the side face to generate a rotary movement in the inner piston during the reciprocating movement of the inner piston;

the inner piston comprises a bushing perpendicular to the side face, the bushing defining two diametrically opposite protrusions configured to run along the guide during the reciprocating movement of the inner piston and generate the rotary movement in the inner piston during the reciprocating movement.

**[0005]** The stator can further comprise:

an intake duct connected to a compression chamber to drive:

a combustion agent when it is a direct injection (di) engine;

a fuel and combustion agent mixture when it is an indirect injection (ii) engine; to the compression chamber;

an exhaust duct connected to a combustion chamber to drive waste from a combustion from the combustion chamber.

**[0006]** The stator can also comprise

an injector in the combustion chamber to inject a fuel under pressure into the combustion chamber when it is a direct injection (di) engine.

stator can additionally comprise:

an injector in the intake duct to inject a fuel into the intake duct when it is an indirect injection (ii) engine.

**[0007]** Depending on the type of engine, the stator can comprise:

a spark plug in the combustion chamber to cause the combustion of the mixture when it is a spark ignition engine (SIE)..

the stator further comprises:

a transport duct connected to the compression chamber and to the combustion chamber to drive:

a compressed combustion agent when it is a direct injection (di) engine;

a compressed fuel and combustion agent mixture when it is an indirect injection (ii) mixture;

from the compression chamber to the combustion chamber.

the inner piston further comprises:

a rod located on a central longitudinal axis of the piston and stator configured to receive the rotary movement generated by the inner piston;

the stator further comprises:

an intake valve configured to open/close an inlet port where the intake duct is connected to the compression chamber;

an exhaust valve configured to open/close an outlet port where the exhaust duct is connected to the combustion chamber;

a cam connected to the rod in order to rotate, dragged by the rod, the cam comprising a profile configured to make contact with a rear portion of the intake and exhaust valves and to push the intake and exhaust valves between open and closed positions.

Brief Description of the Drawings

**[0008]** A series of drawings is very briefly described below which aid in better understanding the invention and are expressly related to an embodiment of said in-

vention shown as a non-limiting example thereof.

Figures 1A, 1B, 1C, 1D and 1E show a sequence of a 4-stroke engine with two opposite cylinders.

Figure 2 shows a 4-stroke engine.

Figure 3 shows a 2-stroke engine.

#### Description of a Preferred Embodiment of the Invention

**[0009]** embodiment of the invention relates to a reciprocating rotary internal combustion engine having:

a stator (4) having a cylindrical inner cavity (a, b) having a side wall (40), a first base (41) and a second base (42);

an inner piston (1) configured to be driven in the inner cavity (a, b) along a stroke comprised between the first base (41) and the second base (42) by a combustion of a fuel and combustion agent mixture;

#### **characterized in that:**

the stator (4) comprises a guide (3) worked in the side face (40) to generate a rotary movement in the inner piston (1) during the reciprocating movement of the inner piston (1);

the inner piston (1) comprises a bushing (2) perpendicular to the side face (40), the bushing (2) defining two diametrically opposite protrusions configured to run along the guide (3) during the reciprocating movement of the inner piston (1) and generate the rotary movement in the inner piston (1) during the reciprocating movement.

**[0010]** The stator (4) further comprises:

an intake duct (5) connected to a compression chamber (a) to drive:

a combustion agent when it is a direct injection (di) engine;

a fuel and combustion agent mixture when it is an indirect injection (ii) engine; to the compression chamber (a);

an exhaust duct (8) connected to a combustion chamber (b) to drive waste from a combustion from the combustion chamber (b).

**[0011]** The stator (4) also comprises:

an injector (Y) in the combustion chamber (b) to inject a fuel under pressure into the combustion chamber (b) when it is a direct injection (di) engine.

**[0012]** The stator (4) additionally comprises:

an injector (Y) in the intake duct (5) to inject a fuel

into the intake duct (5) when it is an indirect injection (ii) engine.

**[0013]** Depending on the type of engine, the stator (4) further comprises:

a spark plug (7) in the combustion chamber (b) to cause the combustion of the mixture when it is a spark ignition engine (SIE).

the stator (4) further comprises:

a transport duct (6) connected to the compression chamber (a) and to the combustion chamber (b) to drive:

a compressed combustion agent when it is a direct injection (di) engine;

a compressed fuel and combustion agent mixture when it is an indirect injection (ii) engine; from the compression chamber (a) to the combustion chamber (b).

the inner piston (1) further comprises:

a rod (10) located in a central longitudinal axis of the pistons (1) and stator (4) configured to receive the rotary movement generated by the inner piston (1);

the stator (4) further comprises:

an intake valve (50) configured to open/close an inlet port where the intake duct (5) is connected to the compression chamber (a);

an exhaust valve (80) configured to open/close an outlet port where the exhaust duct (8) is connected to the combustion chamber (b);

a cam (B) connected to the rod (10) in order to rotate, dragged by the rod (10), the cam (B) comprising a profile configured to make contact with a rear portion of the intake (50) and exhaust (80) valves and to push the intake (50) and exhaust (80) valves between open and closed positions.

**[0014]** In the 2-stroke variant, which is more effective due to lower consumption and less parts in friction and smaller mass shifts, the rotary piston no longer needs a camshaft or connecting rods and has its own internal lubrication - it is not included in the fuel.

**[0015]** The fuel and combustion agent mixture (5) enters the upper part of the chamber (a) through an inlet or intake hole, where it is compressed by the upper face of the piston (1), expelled through an outlet hole through the duct (6) and an inlet hole towards the lower chamber (b), where a heater (7) and the compression of the lower face of the piston (1) make it explode; the piston (1) has reached this position by rotating, guided by the bushing

(2) moving through the groove-guide (3). This explosions expels the combustion gases through an outlet hole and exhaust manifold and moves the lower face of the pistons (1) forwards, whereby the cycle starts again absorbing new fuel (5).

**[0016]** This assembly of pistons, bushing, guide and chambers is covered by an outer cylinder or sleeve (4), with 2 opposite inner guides for the bushing (2) and the lubricant-refrigerant. This sleeve (4) has a gear at its outer part to drive a belt-pulley, a chain or another gear sleeve - as a simple transmission element or as part of another piston; it furthermore protects the assembly. Elements that decrease the power, give mechanical problems or are excessively heated are thus avoided.

**[0017]** As in the 4-stroke version, there may be a second rotary piston in line to compensate horizontal or vertical compensations - it can be placed as desired or as is most suitable depending on the existing transmission or on the space- in the vehicle; it can also be placed in parallel with opposite rotation.

## Claims

1. A reciprocating rotary internal combustion engine having:

a stator (4) having a cylindrical inner cavity (a, b) having a side wall (40), a first base (41) and a second base (42);

an inner piston (1) configured to be driven in the inner cavity (a, b) along a stroke comprised between the first base (41) and the second base (42) by a combustion of a fuel and combustion agent mixture;

### characterized in that:

the stator (4) comprises a guide (3) worked in the side face lateral (40) to generate a rotary movement in the inner piston (1) during the reciprocating movement of the inner piston (1); the inner piston (1) comprises a bushing (2) perpendicular to the side face (40), the bushing (2) defining two diametrically opposite protrusions configured to run along the guide (3) during the reciprocating movement of the inner piston (1) and generate the rotary movement in the inner piston (1) during the reciprocating movement.

2. The engine of claim of 1, wherein the stator (4) further comprises:

an intake duct (5) connected to a compression chamber (a) to drive:

a combustion agent when it is a direct injection (di) engine;

a fuel and combustion agent mixture when it is an indirect injection (ii) engine; to the compression chamber (a);

5 an exhaust duct (8) connected to a combustion chamber (b) to drive waste from a combustion from the combustion chamber (b).

3. The engine of any of claims 1-2, wherein the stator (4) further comprises:

10 an injector (Y) in the combustion chamber (b) to inject a fuel under pressure into the combustion chamber (b) when it is a direct injection (di) engine.

4. The engine of any of claims 1-2, wherein the stator (4) further comprises:

20 an injector (Y) in the intake duct (5) to inject a fuel into the intake duct (5) when it is an indirect injection (ii) engine.

5. The engine of any of claims 1-4, wherein the stator (4) further comprises:

25 a spark plug (7) in the combustion chamber (b) to cause the combustion of the mixture when it is a spark ignition engine (SIE).

6. The engine of any of claims 1-5, wherein the stator (4) further comprises:

30 a transport duct (6) connected to the compression chamber (a) and to the combustion chamber (b) to drive:

a compressed combustion agent when it is a direct injection (di) engine;

a compressed fuel and combustion agent mixture when it is an indirect injection (ii) engine;

from the compression chamber (a) to the combustion chamber (b).

7. The engine of any of claims 2-5, wherein:

the inner piston (1) further comprises:

50 a rod (10) located in a central longitudinal axis of the pistons (1) and stator (4) configured to receive the rotary movement generated by the inner piston (1);

55 the stator (4) further comprises:

an intake valve (50) configured to open/close an inlet port where the intake duct (5)

is connected to the compression chamber

(a);

an exhaust valve (80) configured to open/  
close an outlet port where the exhaust duct  
(8) is connected to the combustion chamber

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(b);

a cam (B) connected to the rod (10) in order  
to rotate, dragged by the rod (10), the cam  
(B) comprising a profile configured to make  
contact with a rear portion of the intake (50)  
and exhaust (80) valves and to push the in-  
take (50) and exhaust (80) valves between  
open and closed positions.

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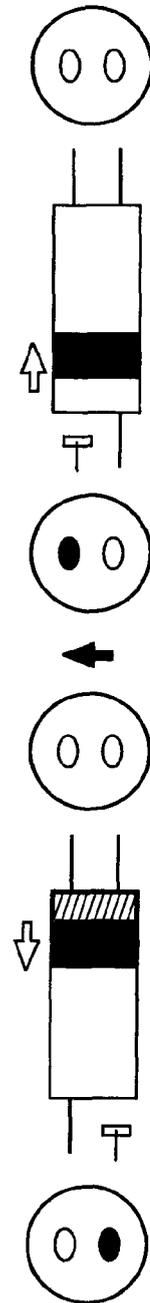
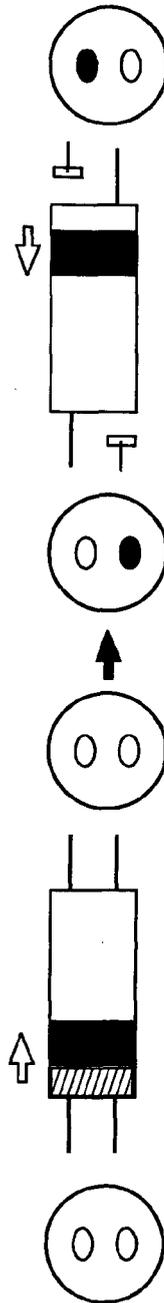
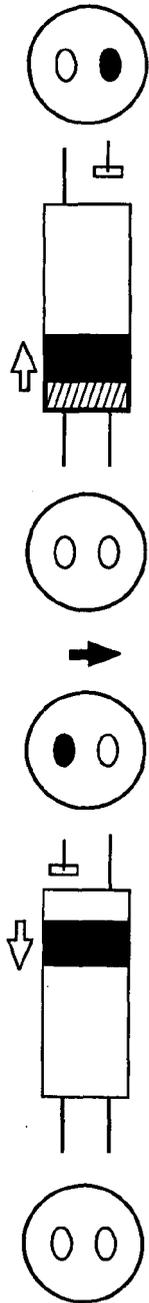
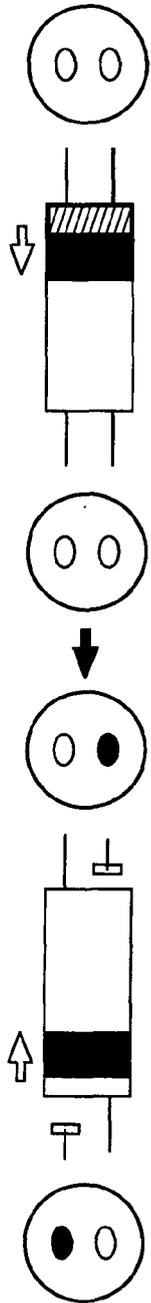
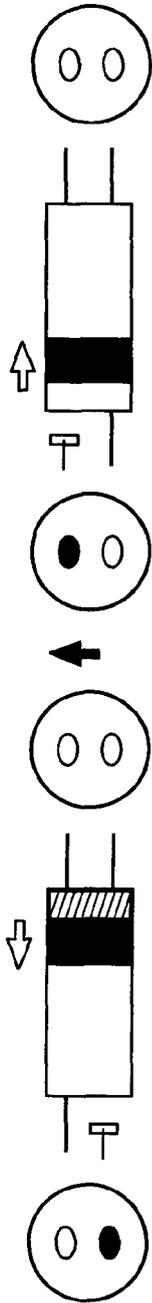
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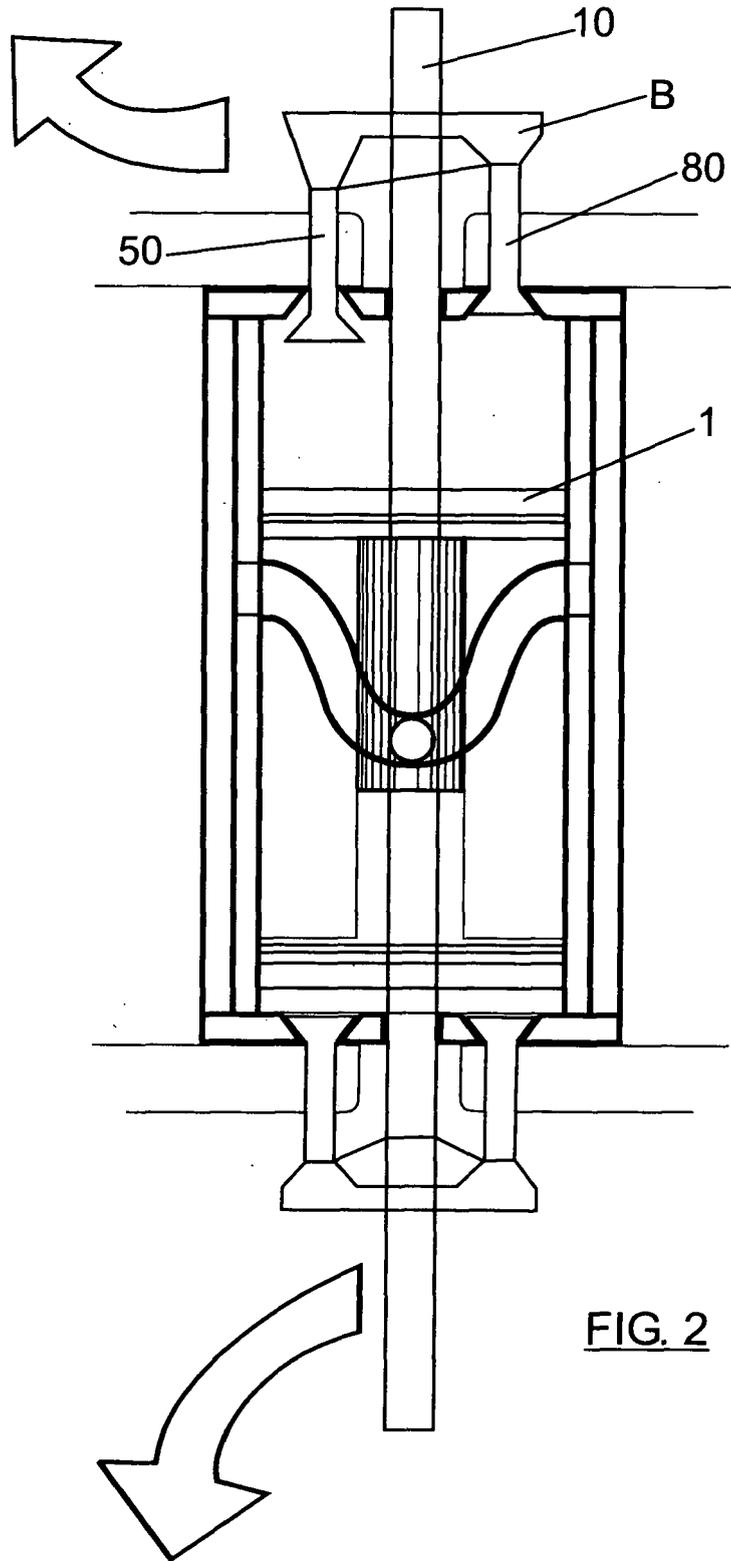
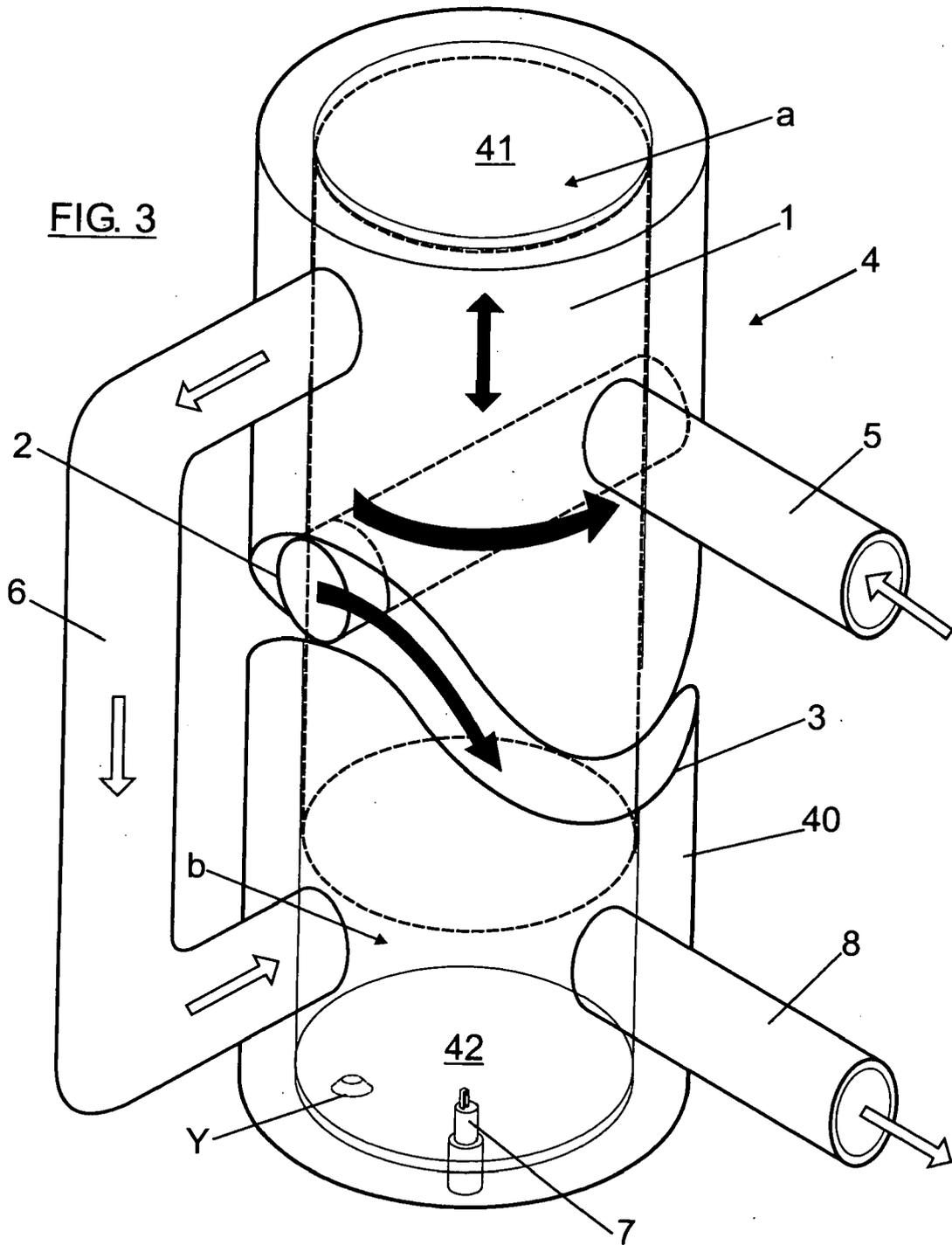


FIG. 2





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Place of search The Hague		Date of completion of the search 15 July 2008	Examiner Matray, J
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			



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