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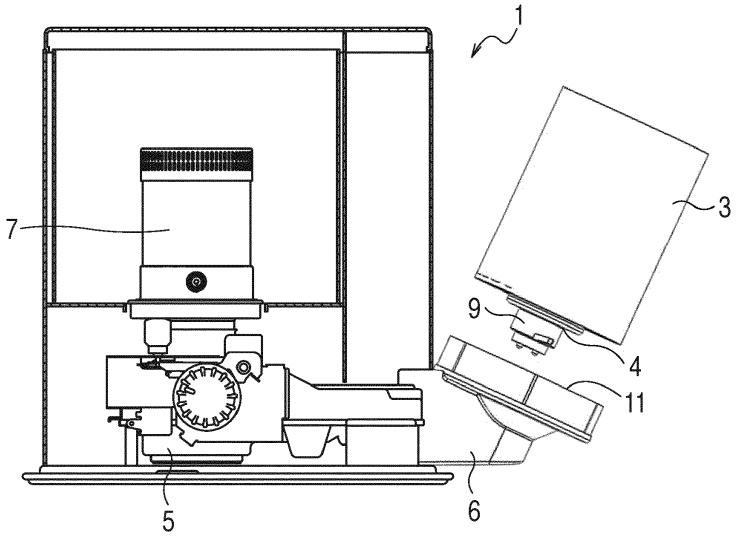
(54) **LIQUID FUEL BURNER**

(57) Provided herein is a liquid fuel burner that does not allow a liquid fuel tank and a cartridge tank to be opened by a simple operation. The liquid fuel burner includes a cartridge tank (3) that has a first valve assembly (9) and a liquid fuel tank (5) that has a second valve assembly (11). A first valve body (15) of the first valve assembly (9) is retained so as to be linearly movable along an imaginary centerline (IL) as defined to extend in a direction in which a first valve seat body (13) and a second valve seat body (39) are fitted with each other. A motion conversion mechanism is provided between the first valve seat body (13) and the first valve body (15), and is configured such that, when the first valve seat body (13) is rotated by a prescribed angle in one direction around the centerline IL after the first valve seat body 13 and the second valve seat body 39 are fitted with each other, the first valve body 15 moves in a direction in which a first valve component (17) is moved apart from a first valve seat portion (21) so as to allow the first valve body (15) to press the second valve body (41) in a direction in which a second valve component (43) is moved apart from a second valve seat portion (57).

Fig.1



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Description

[0001] The present invention relates to a liquid fuel burner that burns a liquid fuel fed from a liquid fuel tank using a burner.

[0002] Some of the conventional or existing liquid fuel burners have a fuel leakage prevention mechanism configured to prevent a liquid fuel in a liquid fuel tank from leaking out when the liquid fuel burner falls over. In the liquid fuel burner illustrated in Fig. 1 of JP 09-269118 A, for example, a projection 3a is provided on a movable plate 8, and when a cartridge tank 4 is mounted to a fuel feed port, a valve 5 of the cartridge tank 4 is pushed up by the projection 3a and the movable plate 8 is pushed down to form a flow path for a liquid fuel from the cartridge tank 4 to a liquid fuel tank 2. When the cartridge tank 4 is detached, the valve 5 is closed, and the movable plate 8 is pushed up by a spring member 9 to close an opening 7a, which blocks the flow path for the liquid fuel. Thus, even if the liquid fuel burner falls over in a situation where the cartridge tank 4 is removed from the fuel feed port or mounted to the fuel feed port, or if the cartridge tank 4 which has been mounted to the fuel feed port is detached from the fuel feed port, the opening 7a is closed by the movable plate 8 to prevent the liquid fuel from leaking out of the liquid fuel tank 2 and/or the cartridge tank 4.

[0003] In the liquid fuel burner described in JP 09-269118 A, the movable plate 8 is pushed down by the weight of the cartridge tank 4 and the liquid fuel contained in the cartridge tank 4. Therefore, when the liquid fuel is consumed and the cartridge tank 4 becomes lighter, the force to push down the movable plate 8 becomes weaker. Consequently, the cartridge tank 4 may be pushed up by the projection 3a, which makes the cartridge tank 4 unstably be mounted to the fuel feed port.

[0004] In case the liquid fuel burner falls over with the cartridge tank 4 being mounted to the fuel feed port, the flow path for the liquid fuel may not appropriately be blocked if the cartridge tank 4 is detached from the fuel feed port and the opening 7a is not closed, which may lead to leakage of the liquid fuel.

[0005] Further, the liquid fuel burner described in JP 09-269118 A has another technical problem. Even when the cartridge tank 4 is not mounted to the fuel feed port, the opening 7a may be easily opened if the projection 3a is pushed down with a finger or the like by mistake. Likewise, the valve 5 may be easily opened with a finger or the like.

[0006] The present invention aims to provide a liquid fuel burner in which a cartridge tank is securely fixed to a fuel feed port so that a liquid fuel will not leak out even in the case where the liquid fuel burner falls over with the cartridge tank being mounted to the fuel feed port.

[0007] The present invention also aims to provide a liquid fuel burner in which a liquid fuel tank and a cartridge tank cannot be opened by a simple operation in a situation where the cartridge tank being detached from a fuel feed port.

[0008] A liquid fuel burner of the present invention includes a cartridge tank, a liquid fuel tank, and a burner assembly. The cartridge tank has a fuel discharge port and includes a first valve assembly provided with a first valve mechanism disposed at the fuel discharge port. The liquid fuel tank has a fuel feed port and includes a second valve assembly provided with a second valve mechanism disposed at the fuel feed port. The burner assembly is operable to burn a liquid fuel fed from the liquid fuel tank. The first valve assembly includes a first valve seat body, a first valve body, and a first energizing member. The first valve seat body includes a first valve seat portion and is mounted to the fuel discharge port. The first valve body is provided with a first valve component configured to cooperatively act with the first valve seat portion. The first energizing member is capable of generating a pressing force to act to press the first valve component onto the first valve seat portion when the first energizing member is released. The second valve assembly includes a second valve seat body, a second valve body, and a second energizing member. The second valve seat body includes a second valve seat portion and is mounted to the fuel feed port. The second valve body is provided with a second valve component configured to cooperatively act with the second valve seat portion. The second energizing member is capable of generating a pressing force to act to press the second valve component onto the second valve seat portion when the second energizing member is released. When the first valve seat body of the first valve assembly is engaged with the second valve seat body of the second valve assembly, the first and second valve components of the first and second valve assemblies are respectively located apart from the first and second valve seat portions and the first and second energizing members of the first and second valve assemblies are in an energized state. When the first valve seat body of the first valve assembly is disengaged from the second valve seat body of the second valve assembly, the first energizing member is released to bring the first valve component into contact with the first valve seat portion and the second energizing member is released to bring the second valve component into contact with the second valve seat portion.

[0009] In the liquid fuel burner according to the present invention, the first valve body of the first valve assembly is retained so as to be linearly movable along an imaginary centerline as defined to extend in a direction in which the first and second valve seat bodies of the first and second valve assemblies are fitted with each other. A motion conversion mechanism is provided between the first valve seat body and the first valve body, and is configured such that, when the first valve seat body is rotated by a prescribed angle in one direction around the centerline after the first valve seat body and the second valve seat body are fitted with each other, the first valve body moves in a direction in which the first valve component is moved apart from the first valve seat portion so as to allow the first valve body to press the second valve body

in a direction in which the second valve component is moved apart from the second valve seat portion. The motion conversion mechanism is configured so as to allow the first energizing member of the first valve assembly to be released when the first and second valve seat bodies of the first and second valve assemblies are disengaged from each other.

[0010] With this configuration, according to the present invention, the first and second valve assemblies will not be opened unless the first valve seat body is rotated by the prescribed angle in one direction with the first valve seat body and the second valve seat body being engaged with each other. Therefore, the valve assembly of either of the liquid fuel tank and the valve assembly of the cartridge tank will not be opened if the liquid fuel burner falls over. Thus, according to the present invention, the liquid fuel will not leak out of the liquid fuel tank and/or the cartridge tank if the liquid fuel burner falls over.

[0011] An engagement structure may be provided between the first valve seat body of the first valve assembly and the second valve seat body of the second valve assembly and be configured not to act to engage the first and second valve seat bodies of the first and second valve assemblies with each other when the first and second valve seat bodies are merely fitted with each other, but to act to engage the first and second valve seat bodies of the first and second valve assemblies with each other when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction. By providing such an engagement structure, the first valve seat body and the second valve seat body are engaged with each other by the engagement structure when rotating the first valve seat body, which makes it easier to rotate the first valve seat body. In addition, the first valve seat body and the second valve seat body are engaged with each other when the first and second valve assemblies are open. Thus, the cartridge tank will not be detached even if the liquid fuel burner falls over with the cartridge tank being mounted to the fuel feed port. This prevents the liquid fuel from leaking out.

[0012] The configuration for implementing the motion conversion mechanism may be determined as desired. For example, a guiding portion may be provided at an inner wall portion of the first valve seat body of the first valve assembly and a guided portion may be provided on an outer wall portion of the first valve body of the first valve assembly so as to be guided by the guiding portion. An engaged portion may be provided at the second valve seat body of the second valve assembly and an engaging portion may be provided at the first valve body of the first valve assembly so as to be engaged with the engaged portion. Then, the first and second valve seat bodies may be configured such that the engaging portion comes into engagement with the engaged portion when the first and second valve seat bodies are engaged with each other. The guided portion may be guided by the guiding portion to move the first valve body of the first valve assembly in a direction in which the first valve component of the first valve assembly is moved apart from the first valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction with the engaging portion being engaged with the engaged portion. In this way, the motion conversion mechanism can be implemented with a simple configuration, and is easily operable.

[0013] More particularly, the engaging portion may be at least one protrusion protruding from an end portion of the first valve body of the first valve assembly in parallel with the imaginary centerline in a direction away from the cartridge tank. The engaged portion may be provided at the second valve seat portion of the second valve assembly, and have a thickness dimension which is smaller than a length dimension of the at least one protrusion and have at least one through hole formed therein to allow the at least one protrusion to be inserted thereinto. The at least one protrusion may not press the second valve body of the second valve assembly when the first and second valve seat bodies are merely fitted with each other, but the at least one protrusion may press the second valve body of the second valve assembly so as to move the second valve component of the second valve assembly apart from the second valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction to move the first valve body of the first valve assembly in a direction in which the first valve component of the first valve assembly is moved apart from the first valve seat portion. With this configuration, the second valve body can be moved by pressing the second valve body using the at least one protrusion which is the engaging portion provided on the first valve body. Therefore, the structure of the first and second valve assemblies can be simplified. In addition, the first and second valve assemblies cannot be opened by a simple method, such as by pressing the projection with a finger or the like, with the cartridge tank being detached from the fuel feed port.

[0014] In the motion conversion mechanism, a guiding portion may be provided at an inner wall portion of the first valve seat body of the first valve assembly and a guided portion may be provided on an outer wall portion of the first valve body of the first valve assembly so as to be guided by the guiding portion. An engaged portion may be provided at the first valve body of the first valve assembly and an engaging portion may be provided at the second valve body of the second valve assembly so as to be engaged with the engaged portion. Then, the first and second valve seat bodies may be configured such that the engaging portion comes into engagement with the engaged portion when the first and second valve seat bodies are engaged with each other. The guided portion may be guided by the guiding portion to move the first valve body of the first valve assembly in a direction in which the first valve component of the first valve assembly is moved apart from the first valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction

with the engaging portion being engaged with the engaged portion.

[0015] More particularly, the engaging portion may be at least one protrusion protruding from an end portion of the second valve body of the second valve assembly in parallel with the imaginary centerline in a direction away from the liquid fuel tank. The engaged portion may be at least one bottomed recess provided at the first valve body of the first valve assembly, and at least one through hole may be formed in the second valve seat body of the second valve assembly to allow the at least one protrusion to pass therethrough. A bottom of the at least one bottomed recess of the first valve assembly may not press the at least one protrusion when the first and second valve seat bodies are merely fitted with each other, but the bottom of the at least one bottomed recess may press the at least one protrusion so as to move the second valve component of the second valve assembly apart from the second valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction to move the first valve body of the first valve assembly in a direction in which the first valve component of the first valve assembly is moved apart from the first valve seat portion. With this configuration, the first valve body has no protrusions, and hence has no hooky portions. Therefore, a user is not likely to open the first valve assembly by rotating the first valve body with a finger by mistake. Although the second valve assembly can still be opened by pressing the at least one protrusion, the liquid fuel will not leak out unless the at least one protrusion is pressed with the fuel feed port facing downward.

[0016] In the configuration described above, the first valve body which is included in the first valve assembly is configured to make a linear motion when the first valve seat body is rotated by the prescribed angle in one direction. Conversely, however, the second valve body which is included in the second valve assembly may be configured to make a linear motion when the first valve seat body is rotated by the prescribed angle in one direction. For this purpose, the second valve assembly may include the second valve body retained so as to be linearly movable along the imaginary centerline as defined to extend in a direction in which the first valve seat body and the second valve seat body are fitted with each other, and a motion conversion mechanism may be provided between the second valve seat body and the second valve body, and be configured such that, when the first valve seat body is rotated by the prescribed angle in one direction around the centerline after the first valve seat body and the second valve seat body are fitted with each other, the second valve body moves in a direction in which the second valve component is moved apart from the second valve seat portion so as to allow the second valve body to press the first valve body in a direction in which the first valve component is moved apart from the first valve seat portion. The motion conversion mechanism may be configured so as to allow the second energizing member of the second valve assembly to be released when the first and second valve seat bodies of the first and second valve assemblies are disengaged from each other. Also in this case, the first and second valve assemblies will not be opened unless the first valve seat body is rotated by the prescribed angle in one direction with the first valve seat body and the second valve seat body being engaged with each other. Therefore, the valve assembly of either of the liquid fuel tank and the cartridge tank will not be opened if the liquid fuel burner falls over. Thus, the liquid fuel will not leak out of the liquid fuel tank and/or the cartridge tank if the liquid fuel burner falls over.

[0017] Also in this example, an engagement structure may be provided between the first valve seat body of the first valve assembly and the second valve seat body of the second valve assembly and be configured not to act to engage the first and second valve seat bodies of the first and second valve assemblies with each other when the first and second valve seat bodies are merely fitted with each other, but to act to engage the first and second valve seat bodies of the first and second valve assemblies with each other when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction.

[0018] The configuration for implementing the motion conversion mechanism may also be determined as desired, and the motion conversion mechanism may be configured in the similar manner as in the example described above. For example, a guiding portion may be provided at an inner wall portion of the second valve seat body of the second valve assembly and a guided portion may be provided on an outer wall portion of the second valve body of the second valve assembly so as to be guided by the guiding portion. An engaged portion may be provided at the first valve seat body of the first valve assembly and an engaging portion may be provided at the second valve body of the second valve assembly so as to be engaged with the engaged portion. Then, the first and second valve seat bodies may be configured such that the engaging portion comes into engagement with the engaged portion when the first and second valve seat bodies are engaged with each other. The guided portion may be guided by the guiding portion to move the second valve body of the second valve assembly in a direction in which the second valve component of the second valve assembly is moved apart from the second valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction with the engaging portion being engaged with the engaged portion. In this way, the motion conversion mechanism can be implemented with a simple configuration, and is easily operable.

[0019] More particularly, the engaging portion may be at least one protrusion protruding from an end portion of the second valve body of the second valve assembly in parallel with the imaginary centerline in a direction away from the liquid fuel tank. The engaged portion may be

provided at the first valve seat portion of the first valve assembly, and have a thickness dimension which is smaller than a length dimension of the at least one protrusion and have at least one through hole formed therein to allow the at least one protrusion to be inserted thereinto. The at least one protrusion may not press the first valve body of the first valve assembly when the first and second valve seat bodies are merely fitted with each other, but the at least one protrusion may press the first valve body of the first valve assembly so as to move the first valve component of the first valve assembly apart from the first valve seat portion when the first valve seat body of the first valve assembly is rotated by the prescribed angle in the one direction to move the second valve body of the second valve assembly in a direction in which the second valve component of the second valve assembly is moved apart from the second valve seat portion. With this configuration, similarly, the first valve body can be moved by pressing the first valve body using the at least one protrusion which is the engaging portion provided at the second valve body. Therefore, the structure of the first and second valve assemblies can be simplified. In addition, the first and second valve assemblies cannot be opened by a simple method, such as by pressing the projection with a finger or the like, with the cartridge tank being detached from the fuel feed port.

[0020] The cartridge tank is assumed to be made of a metal. However, the cartridge tank may be made of any material, and may be made of a resin, for example.

[0021] In the drawings:

Fig. 1 illustrates a cartridge tank, a liquid fuel tank, a fuel tank coupling portion, and a burner assembly that constitute a liquid fuel burner according to an embodiment of the present invention.

Fig. 2 is an exploded perspective view of a first valve assembly.

Fig. 3A is a plan view of the first valve assembly, Fig. 3B is a sectional view taken along line B-B of Fig. 3A, and Fig. 3C is a sectional view taken along line C-C of Fig. 3A.

Fig. 4 is an exploded perspective view of a second valve assembly.

Fig. 5A is a plan view of the second valve assembly, and Fig. 5B is a sectional view taken along line B-B of Fig. 5A.

Fig. 6 illustrates that the cartridge tank is inserted into the fuel tank coupling portion.

Fig. 7 illustrates that the cartridge tank is rotated with the cartridge tank being inserted into the fuel tank coupling portion.

Fig. 8 illustrates that the cartridge tank has been rotated to be fixed to the fuel tank coupling portion.

Fig. 9 is an exploded perspective view of a first valve assembly that constitutes a liquid fuel burner according to a second embodiment of the present invention.

Fig. 10 is an exploded perspective view of a second valve assembly that constitutes the liquid fuel burner according to the second embodiment of the present invention.

[0022] Embodiments of a liquid fuel burner according to the present invention will be described in detail below with reference to the accompanying drawings.

<First Embodiment>

[Overall Configuration]

[0023] Fig. 1 illustrates the pre-assembled positional relationship of a cartridge tank 3, a liquid fuel tank 5, a fuel tank coupling portion 6, and a burner assembly 7 employed in a liquid fuel burner 1 according to an embodiment of the present invention. In Fig. 1, the body of the liquid fuel burner 1 is illustrated as partially cut away so that the liquid fuel tank 5 and the burner assembly 7 can be seen. In the embodiment, the cartridge tank 3 is filled with a liquid fuel (e.g. kerosene), and the liquid fuel is fed to the liquid fuel tank 5 by mounting the cartridge tank 3 to a fuel feed port 8 of the liquid fuel tank 5 provided in the fuel tank coupling portion 6. The liquid fuel fed to the liquid fuel tank 5 is burned by the burner assembly 7 and consumed. A first valve assembly 9 is provided at a fuel discharge port 4 of the cartridge tank 3. A second valve assembly 11 is provided at the fuel feed port 8 of the liquid fuel tank 5.

[First Valve Assembly]

[0024] Fig. 2 is an exploded perspective view of the first valve assembly 9 provided at the fuel discharge port 4 of the cartridge tank 3. Fig. 3A is a plan view of the first valve assembly 9, Fig. 3B is a sectional view taken along line B-B of Fig. 3A, and Fig. 3C is a sectional view taken along line C-C of Fig. 3A. As illustrated in the figures, the first valve assembly 9 is constituted by combining a first valve seat body 13, a first valve body 15, a first valve component 17 formed of an O-ring, and a first energizing member 19 shaped in a coil spring.

[0025] The first valve seat body 13 is attached to the fuel discharge port 4 of the cartridge tank 3, and is constituted in a cylindrical shape to communicate between the cartridge tank 3 and the outside. A first valve seat portion 21 is formed at a portion of the first valve seat body 13 that contacts the first valve component 17. A first shaft portion 25 extends at the center portion of the first valve seat body 13, and is supported by a shaft support portion 23 integrally constituted with the inner wall of the first valve seat body 13. The first shaft portion 25 extends along an imaginary centerline IL as defined to extend in a direction in which the first valve seat body 13 and a second valve seat body 39, which will be discussed later, are fitted with each other. The first energizing member 19 shaped in a coil spring is engaged with the first shaft portion 25 so that one end 19A of the first energizing member 19 abuts against the shaft support portion 23.

Guiding portions 27 are formed on the inner wall of the first valve seat body 13. Guided portions 37 provided on the first valve body 15, which will be discussed later, are configured to be guided by the guiding portions 27. A pair of engaging portions 29 are formed on the outer wall of the first valve seat body 13 at positions opposite to each other in the radial direction of the first valve seat body 13. The pair of engaging portions 29 are engaged with the second valve seat body 39, which will be discussed later, to constitute an engagement structure. The pair of engaging portions 29 are grooves that open outward in the radial direction, and constitute paths for a pair of engaged portions 59 to pass through.

[0026] The first valve body 15 cooperatively acts with the first valve seat portion 21 of the first valve seat body 13. The first valve body 15 includes a first valve component fixing portion 31, a pair of first energizing member engaging portions 33, and a pair of protrusions 35. The first valve component 17 is fixed to the periphery of the first valve component fixing portion 31. The pair of first energizing member engaging portions 33 extend within the first valve seat body 13, and are engaged with the first energizing member 19. The pair of protrusions 35 are engaging portions that extend in parallel with the centerline IL from an end portion of the first valve body 15 in a direction away from the cartridge tank 3. Bent portions 33A are formed at end portions of the pair of first energizing member engaging portions 33 on the cartridge tank 3 side. The bent portions 33A abut against the other end 19B of the first energizing member 19 so that the first energizing member 19 is retained at a predetermined position and the first valve body 15 is retained with respect to the first valve seat body 13. Consequently, the first valve body 15 is energized by the first energizing member 19, and the first energizing member 19 generates a pressing force to act to press the first valve component 17 onto the first valve seat portion 21 when the first energizing member 19 is released. The guided portions 37 are provided on the side surfaces of the pair of first energizing member engaging portions 33 so as to be guided by the guiding portions 27. The pair of protrusions 35 are engaged with an engaged portion 51, which will be discussed later, provided on the second valve seat body 39.

[0027] When the first valve seat body 13 is rotated by a prescribed angle in one direction by the guiding portions 27 and the guided portions 37, the guided portions 37 are guided by the guiding portions 27 to move the first valve body 15 (linearly) in a direction in which the first valve component 17 is moved apart from the first valve seat portion 21.

[0028] The first valve component 17 is fixed to the first valve component fixing portion 31 of the first valve body 15 and contacts the first valve seat portion 21 of the first valve seat body 13 to work as a valve between the first valve seat body 13 and the first valve body 15.

[Second Valve Assembly]

[0029] Fig. 4 is an exploded perspective view of the second valve assembly 11 provided at the fuel feed port 8 of the liquid fuel tank 5 disposed at the fuel tank coupling portion 6. Fig. 5A is a plan view of the second valve assembly 11, and Fig. 5B is a sectional view taken along line B-B of Fig. 5A.

[0030] The second valve assembly 11 is constituted by combining the fuel tank coupling portion 6, the second valve seat body 39, a second valve body 41, a second valve component 43 formed of an O-ring, and a second energizing member 45 shaped in a coil spring.

[0031] The fuel tank coupling portion 6 is provided with the fuel feed port 8 at the center portion thereof to receive members such as the second valve seat body 39. A shaft insertion portion 49 formed in a tubular shape is provided at the center of the fuel tank coupling portion 6 to extend along the centerline IL discussed earlier. The second valve body 41 and the second energizing member 45 are fitted into the shaft insertion portion 49.

[0032] The second valve seat body 39 is attached to the fuel feed port 8, and is configured to be engaged with the first valve seat body 13. The engaged portion 51 is provided at the center portion of the second valve seat body 39 to be engaged with the pair of protrusions 35 of the first valve body 15. A pair of through holes 53 for insertion of the protrusions 35 and a fuel passage hole 55 for passage of the liquid fuel are formed in the engaged portion 51. The engaged portion 51 is configured to have a thickness dimension which is smaller than the length dimension of the protrusions 35. A second valve seat portion 57 is formed on the liquid fuel tank 5 side of the engaged portion 51 so as to contact the second valve component 43. The pair of engaged portions 59 in a projecting shape are formed on the inner wall of the second valve seat body 39 to be engaged with the pair of engaging portions 29 of the first valve seat body 13.

[0033] The second valve body 41 cooperatively acts with the second valve seat portion 57 of the second valve seat body 39. The second valve body 41 includes a second valve component fixing portion 61 and a second shaft portion 63. The second valve component 43 is fixed to the periphery of the second valve component fixing portion 61. The second shaft portion 63 is inserted into the shaft insertion portion 49 provided in the fuel tank coupling portion 6 and supported therein, and extends along the centerline IL. The second shaft portion 63 is inserted into the shaft insertion portion 49 with the second energizing member 45 being engaged on the shaft insertion portion 49 to surround the periphery of the shaft insertion portion 49. One end 45A of the second energizing member 45 abuts against the fuel tank coupling portion 6, and the other end 45B of the second energizing member 45 abuts against the second valve body 41. Consequently, the second valve body 41 is energized by the second energizing member 45, and the second energizing member 45 generates a pressing force to act to press the

second valve component 43 onto the second valve seat portion 57 when the second energizing member 45 is released.

[0034] The second valve component 43 is fixed to the second valve component fixing portion 61 of the second valve body 41 and contacts the second valve seat portion 57 of the second valve seat body 39 to work as a valve between the second valve seat body 39 and the second valve body 41.

[Supply of Fuel to Liquid Fuel Tank]

[0035] Fig. 6 illustrates that the cartridge tank 3 is inserted into the fuel tank coupling portion 6. Fig. 7 illustrates that the cartridge tank 3 is rotated with the cartridge tank 3 being inserted into the fuel tank coupling portion 6. Fig. 8 illustrates that the cartridge tank 3 has been rotated to be fixed to the fuel tank coupling portion 6.

[0036] When feeding the liquid fuel to the liquid fuel tank 5, first, as illustrated in Fig. 6, the cartridge tank 3 is inserted into the fuel tank coupling portion 6 to fit the first valve seat body 13 and the second valve seat body 39 with each other. When fitting the members with each other, the members are aligned with each other such that the pair of protrusions 35 of the first valve body 15 are inserted into the pair of through holes 53 formed in the engaged portion 51 of the second valve seat body 39 and the pair of engaging portions 29 of the first valve seat body 13 are engaged with the pair of engaged portions 59 of the second valve seat body 39. In this state, the protrusions 35 are in contact with the second valve body 41.

[0037] Next, in this state, as illustrated in Fig. 7, the cartridge tank 3 is rotated by the prescribed angle with respect to the fuel tank coupling portion 6. When the cartridge tank 3 is rotated, the first valve body 15 is not rotated because the pair of protrusions 35 are engaged with the pair of through holes 53, but the first valve seat body 13 is rotated. Then, the guided portions 37 are guided by the guiding portions 27, and the first valve component 17 is moved apart from the first valve seat portion 21 and the first energizing member 19 is brought into the energized state. Consequently, the protrusions 35 press the second valve body 41, and at the same time, the second valve component 43 is moved apart from the second valve seat portion 57 and the second energizing member 45 is brought into the energized state. In this way, in the embodiment, a motion conversion mechanism is configured to convert a rotational motion to rotate the first valve seat body 13 fixed to the cartridge tank 3 into a linear motion of the first valve body 15 and the second valve body 41.

[0038] Rotation of the cartridge tank 3 is stopped when the pair of engaged portions 59 are inserted into the pair of engaging portions 29 and moved to the end points thereof. When the cartridge tank 3 cannot be rotated any further, the state of Fig. 8 is established. In the state of Fig. 8, the first valve component 17 is located at the farthest position from the first valve seat portion 21, and similarly, the second valve component 43 is located at the farthest position from the second valve seat portion 57. The first energizing member 19 and the second energizing member 45 are in the energized state in which the first energizing member 19 and the second energizing member 45 are compressed. In this state (also during rotation of the cartridge tank 3), the first valve assembly 9 and the second valve assembly 11 are opened to communicate the cartridge tank 3 and the liquid fuel tank 5 with each other. Thus, a flow path for the liquid fuel is formed to allow the liquid fuel in the cartridge tank 3 to pass through the first and second valve assemblies and reach the liquid fuel tank 5.

[0039] When removing the cartridge tank 3, the cartridge tank 3 is rotated in a direction opposite to the direction in which the cartridge tank 3 is rotated for mounting to the burner. Then, the motion conversion mechanism releases the first energizing member 19 to bring the first valve component 17 into contact with the first valve seat portion 21, and releases the second energizing member 45 to bring the second valve component 43 into contact with the second valve seat portion 57. Consequently, the first valve assembly 9 and the second valve assembly 11 are closed to block the supply of fuel from the cartridge tank 3 to the liquid fuel tank 5.

[0040] In the embodiment described above, the first valve body 15 which constitutes the first valve assembly 9 is configured to make a linear motion when the first valve seat body 13 is rotated by the prescribed angle in one direction. Conversely, however, the second valve body 41 which constitutes the second valve assembly 11 may be configured to make a linear motion when the first valve seat body 13 is rotated by the prescribed angle in one direction. For this purpose, specifically, the second valve assembly 11 may include the second valve body 41 that is retained so as to be linearly movable along the imaginary centerline IL as defined to extend in a direction in which the first valve seat body 13 and the second valve seat body 39 are fitted with each other, and a motion conversion mechanism may be provided between the second valve seat body 39 and the second valve body 41, and be configured such that, when the first valve seat body 13 is rotated by the prescribed angle in one direction around the centerline IL after the first valve seat body 13 and the second valve seat body 39 has been fitted with each other, the second valve body 41 moves in a direction in which the second valve component 43 is moved apart from the second valve seat portion 57 so as to allow the second valve body 41 to press the first valve body 15 in a direction in which the first valve component 17 is moved apart from the first valve seat portion 21.

<Second Embodiment>

[0041] Figs. 9 and 10 each illustrate a liquid fuel burner according to a second embodiment. Fig. 9 is an exploded perspective view of a first valve assembly 109 that con-

stitutes the liquid fuel burner according to the second embodiment. Fig. 10 is an exploded perspective view of a second valve assembly 111 that constitutes the liquid fuel burner according to the second embodiment. In the second embodiment, members that are the same as those in the first embodiment are denoted by reference numerals obtained by adding 100 to the reference numerals affixed to their counterparts in Figs. 1 to 5 and the descriptions thereof are omitted.

[0042] In the second embodiment, a second valve body 141 is provided with a pair of protrusions 135, and a pair of through holes 165 are formed in the center portion of a second valve seat body 139. The pair of protrusions 135 pass through the through holes 165. Correspondingly, a pair of bottomed recesses 153 are formed in a first valve body 115 to be engaged with the pair of protrusions 135 so that the first valve body 115 serves as an engaged portion. When the first valve seat body 113 and the second valve seat body 139 are merely fitted with each other, the bottom portions of the pair of recesses 153 do not press the pair of protrusions 135. When a first valve seat body 113 is rotated by a prescribed angle in one direction so that the first valve body 115 is moved in a direction in which a first valve component 117 is moved apart from a first valve seat portion 121, the bottom portions of the pair of recesses 153 press the pair of protrusions 135 so that a second valve component 143 is moved apart from a second valve seat portion 157.

[0043] With this configuration, the first valve body 115 has no protrusions, and hence has no hooky portions. Therefore, a user is unlikely to open the first valve assembly 109 by rotating the first valve body 115 with a finger by mistake. Although the second valve assembly 111 can still be opened by pressing the protrusions 135, the liquid fuel will not leak out unless the protrusions 135 are pressed with a fuel feed port 108 facing downward.

[0044] While embodiments of the present invention have been specifically described above, the present invention is not limited to such embodiments, and it is a matter of course that changes, modifications, or variations may be made within the scope of the technical concept of the present invention.

[0045] According to the present invention, it is possible to obtain a liquid fuel burner in which a cartridge tank is securely fixed to a fuel feed port so that a liquid fuel will not leak out even in the case where the liquid fuel burner falls over with the cartridge tank being mounted to the fuel feed port. It is also possible to obtain a liquid fuel burner in which a liquid fuel tank and a cartridge tank cannot be opened by a simple operation in a situation where the cartridge tank is detached from a fuel feed port.

Claims

1. A liquid fuel burner comprising:

a cartridge tank (3, 103) having a fuel discharge port (4, 104) and including a first valve assembly (9, 109) disposed at the fuel discharge port (4, 104);

a liquid fuel tank (5, 105) having a fuel feed port (8, 108) and including a second valve assembly (11, 111) disposed at the fuel feed port (8, 108); and

a burner assembly (7, 107) operable to burn a liquid fuel fed from the liquid fuel tank (5, 105), **characterized in that**:

the first valve assembly (9, 109) includes:

a valve seat body (13, 113) including a valve seat portion (21, 121) and mounted to the fuel discharge port (4, 104);
a valve body (15, 115) provided with a valve component (17, 117) configured to cooperatively act with the valve seat portion (21, 121); and
an energizing member (19, 119) capable of generating a pressing force to act to press the valve component (17, 117) onto the valve seat portion (21, 121) when the energizing member (19, 119) is released;

the second valve assembly (11, 111) includes:

a valve seat body (39, 139) including a valve seat portion (57, 157) and mounted to the fuel feed port (8, 108);
a valve body (41, 141) provided with a valve component (43, 143) configured to cooperatively act with the valve seat portion (57, 157); and
an energizing member (45, 145) capable of generating a pressing force to act to press the valve component (43, 143) onto the valve seat portion (57, 157) when the energizing member (45,145) is released;

when the valve seat body (13, 113) of the first valve assembly (9, 109) is engaged with the valve seat body (39, 139) of the second valve assembly (11, 111), the respective valve components (17, 43, 117, 143) of the first and second valve assemblies (9, 109, 11, 111) are located apart from the corresponding valve seat portions (21, 57, 121, 157) and the respective energizing members (19, 45, 119, 145) of the first and second valve assemblies (9, 109, 11, 111) are in an energized state;

when the valve seat body (13, 113) of the first valve assembly (9, 109) is disengaged from the valve seat body (39, 139) of the second valve

assembly (11, 111), the respective energizing members (19, 45, 119, 145) of the first and second valve assemblies (9, 109, 11, 111) are released to bring the respective valve components (17, 43, 117, 143) of the first and second valve assemblies (9, 109, 11, 111) come into contact with the valve seat portions (21, 57, 121, 157); the valve body (15, 115 or 41, 141) of one valve assembly (9, 109 or 11, 111) of the first and second valve assemblies (9, 109, 11, 111) is retained so as to be linearly movable along an imaginary centerline (IL) as defined to extend in a direction in which the valve seat bodies (13, 39, 113, 139) of the first and second valve assemblies (9, 109, 11, 111) are engaged with each other;
a motion conversion mechanism (27, 35, 37, 51, 127, 135, 137, 153) operable to convert a rotational motion into a linear motion and vice versa is configured between the valve seat body (13, 113 or 39, 139) of the one valve assembly (9, 109, or 11, 111) and the corresponding valve body (15, 115 or 41, 141) of the one valve assembly (9, 109, or 11, 111); and
the motion conversion mechanism is configured such that:

when the cartridge tank (3, 103) is rotated by a prescribed angle in one direction around the imaginary centerline (IL) of the one valve assembly (9, 109 or 11, 111) after the valve seat bodies (13, 39, 113, 139) of the first and second valve assemblies (9, 109, 11, 111) are fitted with each other, the valve seat body (13, 113 or 39, 139) of the one valve assembly (9, 109 or 11, 111) is rotated by the prescribed angle in the one direction, and then the valve body (15, 115 or 41, 141) of the one valve assembly (9, 109 or 11, 111) moves in a direction in which the valve component (17, 117 or 43, 143) of the one valve assembly (9, 109 or 11, 111) is moved apart from the corresponding valve seat portion (21, 121 or 57, 157) so as to allow the valve body (15, 115 or 41, 141) of the one valve assembly (9, 109 or 11, 111) to press the valve body (15, 115 or 41, 141) of the other valve assembly (9, 109 or 11, 111) of the first and second valve assemblies (9, 109, 11, 111) in a direction in which the valve component (17, 117 or 43, 143) of the other valve assembly (9, 109 or 11, 111) is moved apart from the corresponding valve seat portion (21, 121 or 57, 157) ; and when the valve seat bodies (13, 39, 113, 139) of the first and second valve assemblies (9, 109, 11, 111) are disengaged from each other, the energizing member (19, 119 or 45, 145) of the one valve assembly (9, 109 or 11, 111) is released.

2. The liquid fuel burner according to claim 1, wherein:

an engagement structure (29, 59, 129, 159) is provided between the valve seat body (13, 113) of the first valve assembly (9, 109) and the valve seat body (39, 139) of the second valve assembly (11, 111) and is configured not to act to engage the valve seat bodies (13, 39, 113, 139) of the first and second valve assemblies (9, 109, 11, 111) with each other when the valve seat bodies (13, 39, 113, 139) are merely fitted with each other, but to act to engage the valve seat bodies (13, 39, 113, 139) of the first and second valve assemblies (9, 109, 11, 111) with each other when the valve seat body (13, 113 or 39, 139) of the one valve assembly (9, 109 or 11, 111) is rotated by the prescribed angle in the one direction.

3. The liquid fuel burner according to claim 1 or 2, wherein:

a guiding portion (27) is provided at an inner wall portion of the valve seat body (13) of the one valve assembly (9);
a guided portion (37) is provided on an outer wall portion of the valve body (15) of the one valve assembly (9) so as to be guided by the guiding portion (27);
an engaged portion (51) is provided at the valve seat body (39) of the other valve assembly (11);
an engaging portion (35) is provided at the valve body (15) of the one valve assembly (9) so as to be engaged with the engaged portion (51);
the valve seat bodies (13, 39) are configured such that the engaging portion (35) comes into engagement with the engaged portion (51) when the valve seat bodies (13, 39) are engaged with each other; and
the guided portion (37) is guided by the guiding portion (27) to move the valve body (15) of the one valve assembly (9) in a direction in which the valve component (17) of the one valve assembly (9) is moved apart from the corresponding valve seat portion (21) when the valve seat body (13) of the one valve assembly (9) is rotated by the prescribed angle in the one direction with the engaging portion (35) being engaged with the engaged portion (51) .

4. The liquid fuel burner according to claim 3, wherein:

the engaging portion (35) is at least one protrusion (35) protruding from an end portion of the

valve body (15) of the one valve assembly (9) in parallel with the imaginary centerline (IL) in a direction away from the cartridge tank (3);
the engaged portion (51) is provided at the valve seat portion (57) of the other valve assembly (11), and has a thickness dimension which is smaller than a length dimension of the at least one protrusion (35) and has at least one through hole (53) formed therein to allow the at least one protrusion (35) to be inserted thereinto; and
the at least one protrusion (35) does not press the valve body (41) of the other valve assembly (11) when the valve seat bodies (13, 39) are merely fitted with each other, but the at least one protrusion (35) presses the valve body (41) of the other valve assembly (11) so as to move the valve component (43) of the other valve assembly (11) apart from the corresponding valve seat portion (57) when the valve seat body (13) of the one valve assembly (9) is rotated by the prescribed angle in the one direction to move the valve body (15) of the one valve assembly (9) in a direction in which the valve component (17) of the one valve assembly (9) is moved apart from the corresponding valve seat portion (21).

5. The liquid fuel burner according to claim 1 or 2, wherein:

a guiding portion (127) is provided at an inner wall portion of the valve seat body (113) of the one valve assembly (109);
a guided portion (137) is provided on an outer wall portion of the valve body (115) of the one valve assembly (109) so as to be guided by the guiding portion (127);
an engaged portion (153) is provided at the valve body (115) of the one valve assembly (109);
an engaging portion (135) is provided at the valve body (141) of the other valve assembly (111) so as to be engaged with the engaged portion (153);
the valve seat bodies (113, 139) are configured such that the engaging portion (135) comes into engagement with the engaged portion (153) when the valve seat bodies (113, 139) are engaged with each other; and
the guided portion (137) is guided by the guiding portion (127) to move the valve body (115) of the one valve assembly (109) in a direction in which the valve component (117) of the one valve assembly (109) is moved apart from the corresponding valve seat portion (121) when the valve seat body (113) of the one valve assembly (109) is rotated by the prescribed angle in the one direction with the engaging portion (135) being engaged with the engaged portion (153).

6. The liquid fuel burner according to claim 5, wherein:

the engaging portion (135) is at least one protrusion (135) protruding from an end portion of the valve body (141) of the other valve assembly (111) in parallel with the imaginary centerline (IL) in a direction away from the liquid fuel tank (105);
the engaged portion (153) is at least one bottomed recess (153) provided at the valve body (115) of the one valve assembly (109) ;
at least one through hole (165) is formed in the valve seat body (139) of the other valve assembly (111) to allow the at least one protrusion (135) to pass therethrough; and
a bottom of the at least one bottomed recess (153) of the one valve assembly (109) does not press the at least one protrusion (135) when the valve seat bodies (113, 139) are merely fitted with each other, but the bottom of the at least one bottomed recess (153) presses the at least one protrusion (135) so as to move the valve component (143) of the other valve assembly (111) apart from the corresponding valve seat portion (157) when the valve seat body (113) of the one valve assembly (109) is rotated by the prescribed angle in the one direction to move the valve body (115) of the one valve assembly (109) in a direction in which the valve component (117) of the one valve assembly (109) is moved apart from the corresponding valve seat portion (121).

7. The liquid fuel burner according to any one of claims 1 to 6, wherein:

the one valve assembly of the first and second valve assemblies is the first valve assembly (9, 109); and
the other valve assembly of the first and second valve assemblies is the second valve assembly (11, 111).

8. The liquid fuel burner according to any one of claims 1 to 6, wherein:

the one valve assembly of the first and second valve assemblies is the second valve assembly (11, 111); and
the other valve assembly of the first and second valve assemblies is the first valve assembly (9, 109).

9. The liquid fuel burner according to any one of claims 1 to 8, wherein the cartridge tank (3, 103) is made of a metal.

10. The liquid fuel burner according to any one of claims

1 to 8, wherein the cartridge tank (3, 103) is made of a resin.

Fig.1

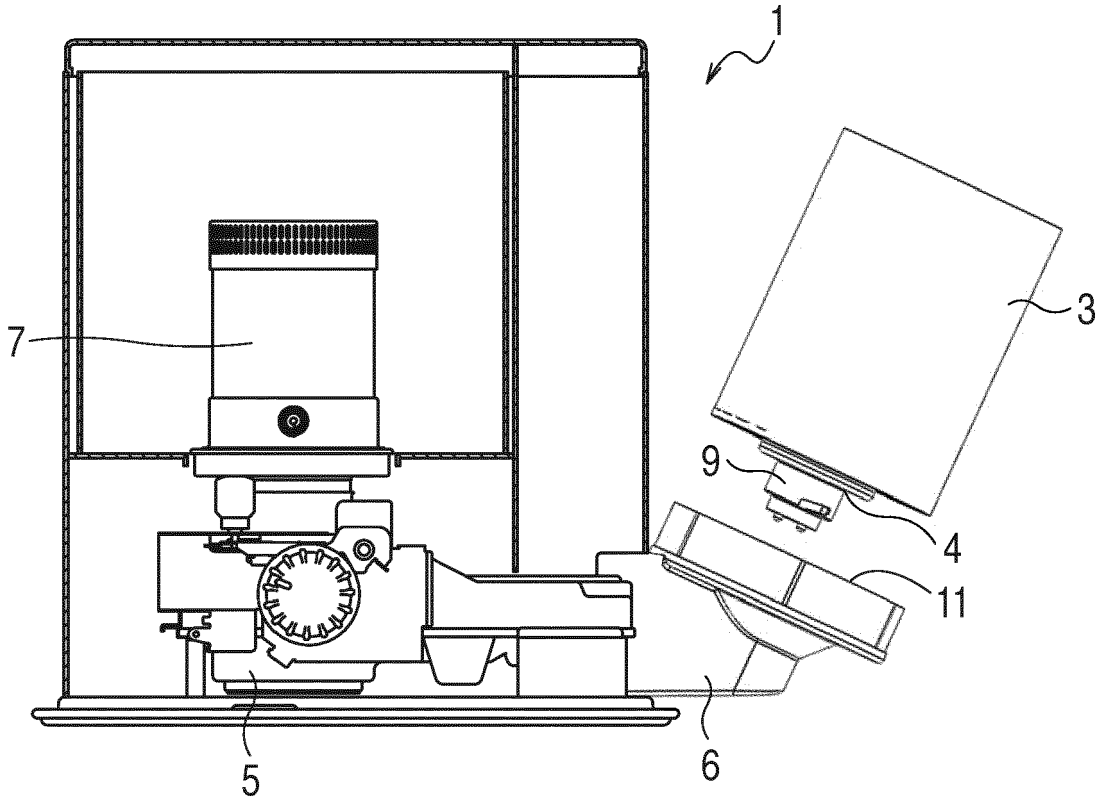


Fig.2

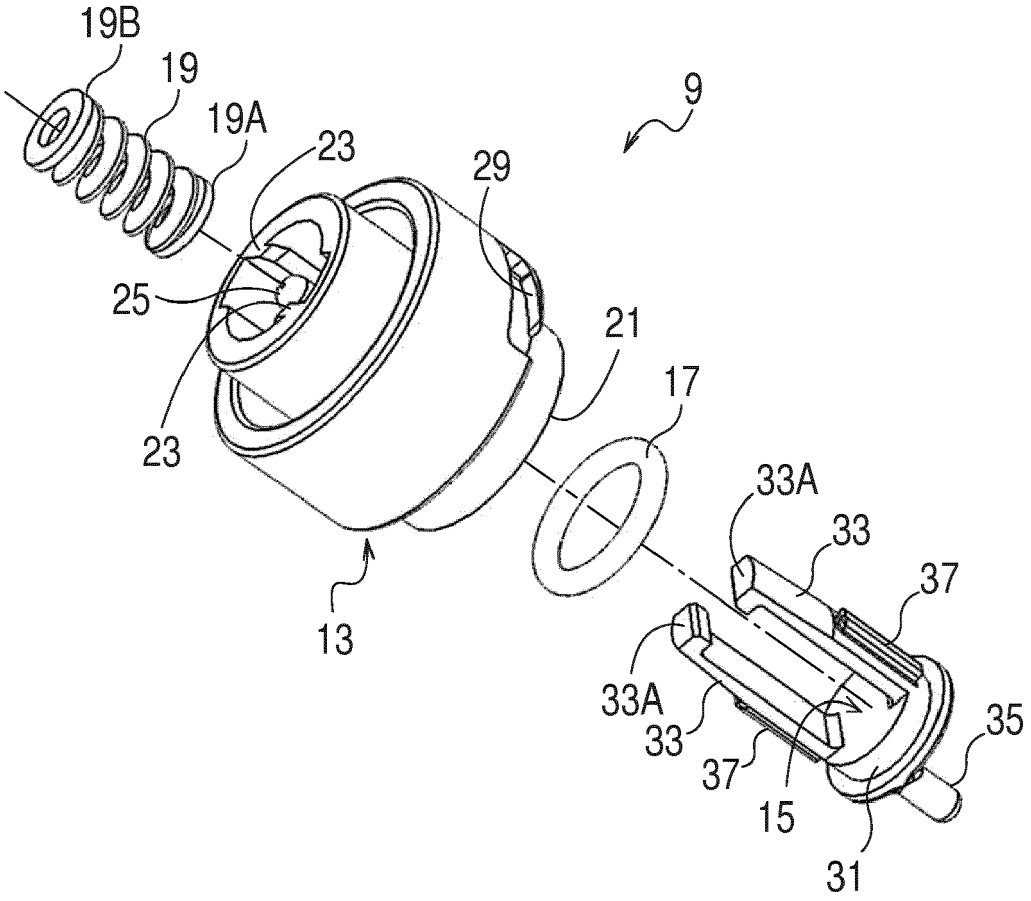


Fig.3A

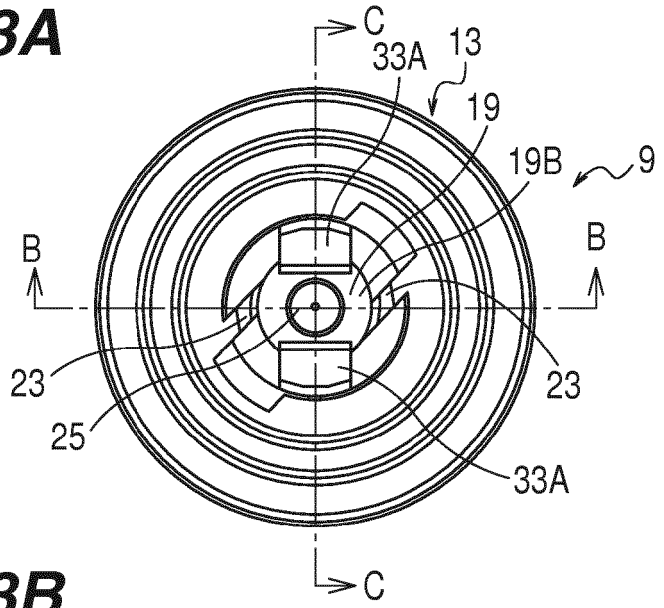


Fig.3B

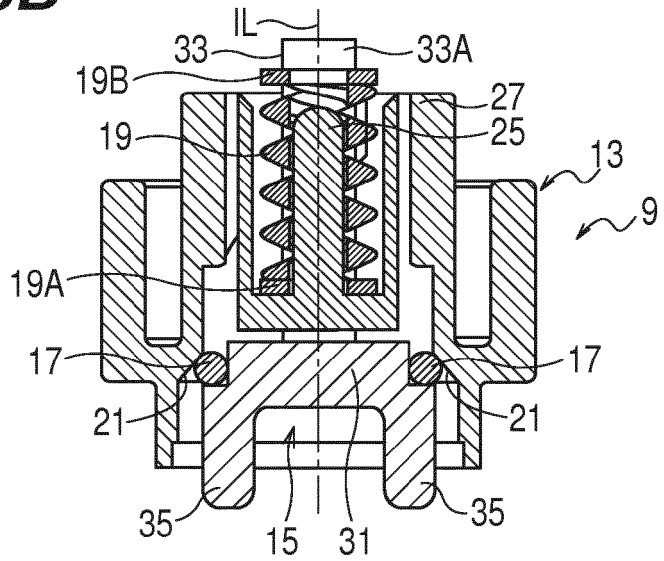


Fig.3C

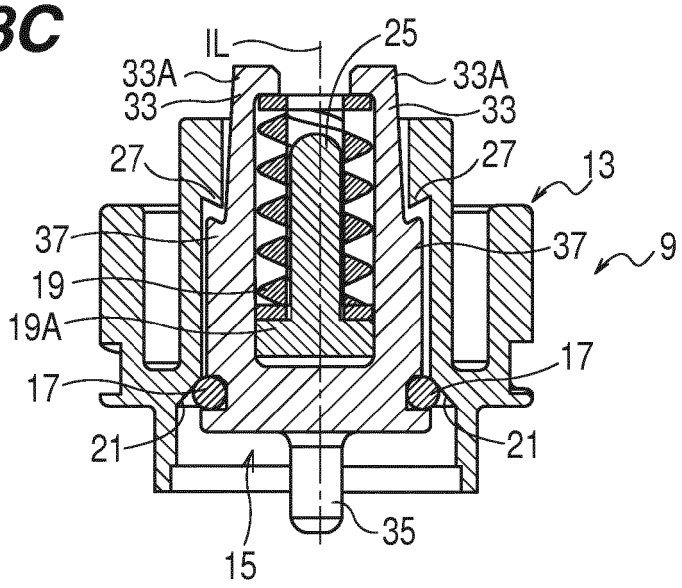


Fig.4

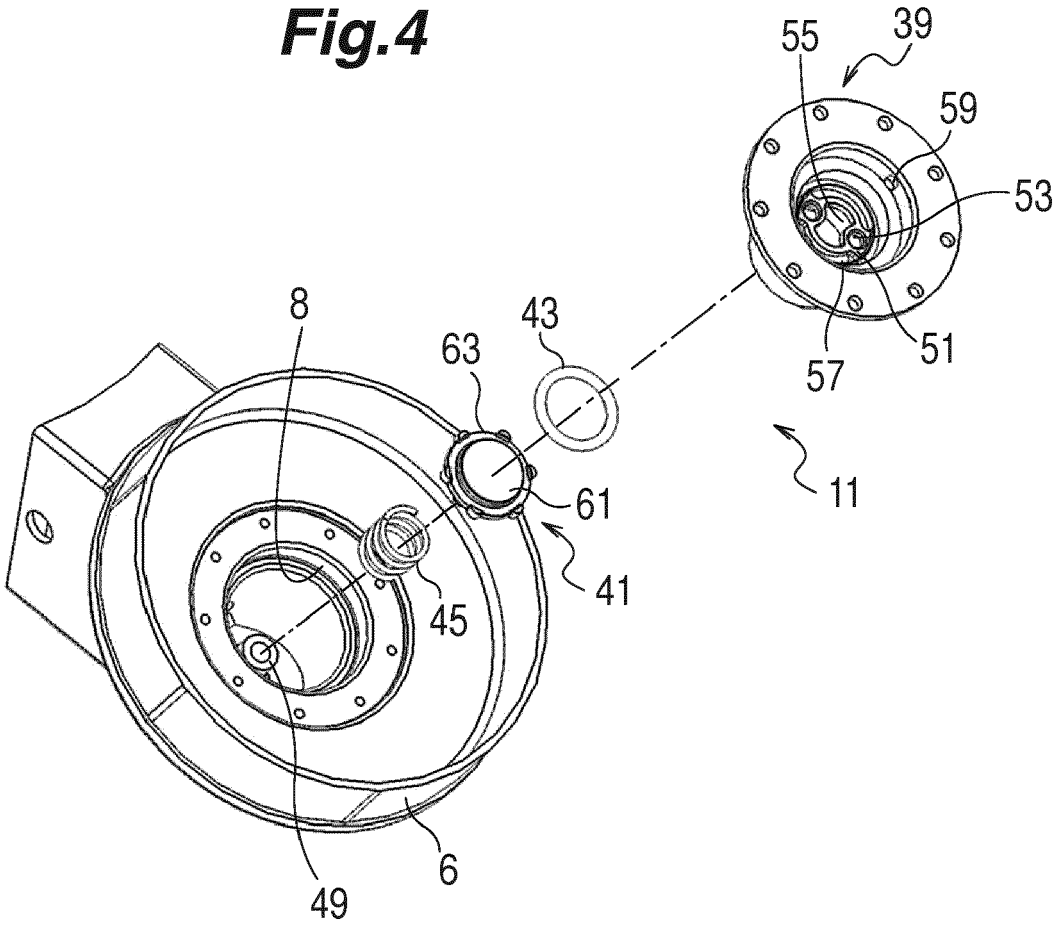
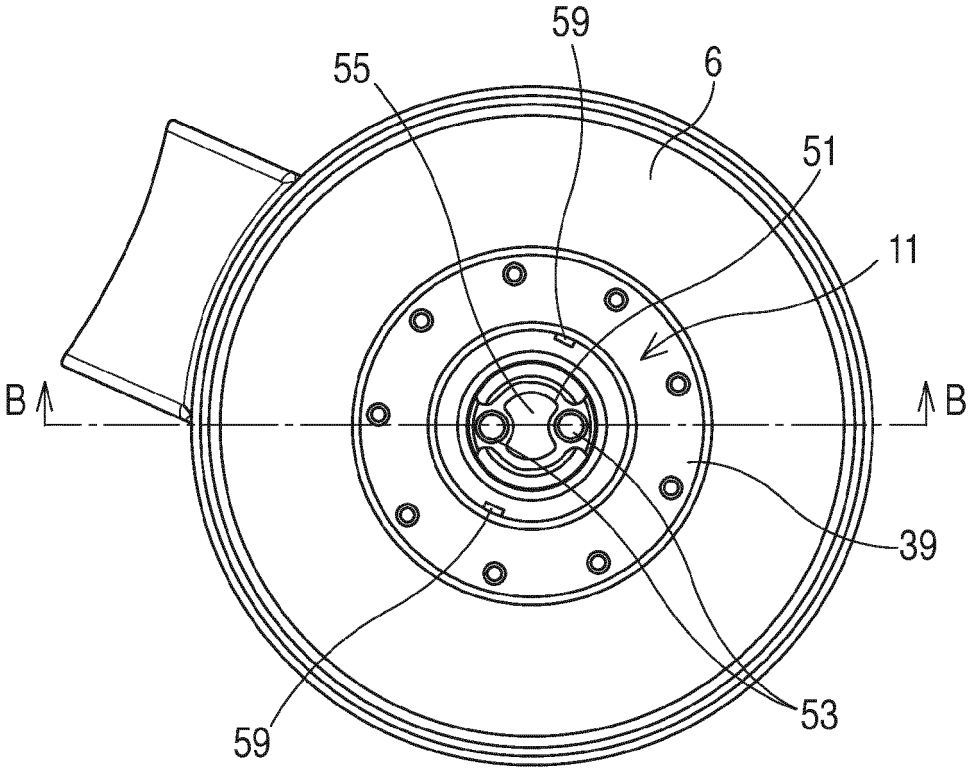


Fig.5A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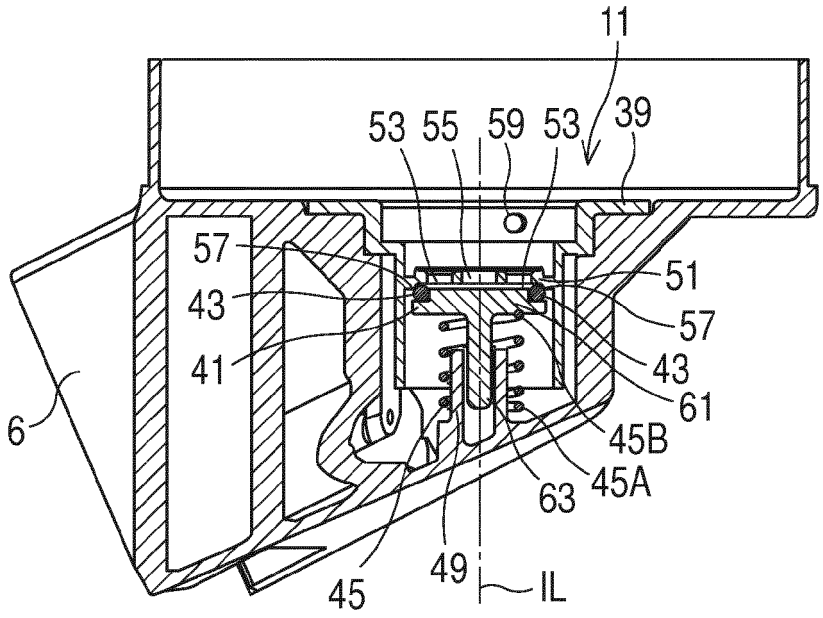
55
6
51
11
B
B
39
59
53

Fig.5B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45A
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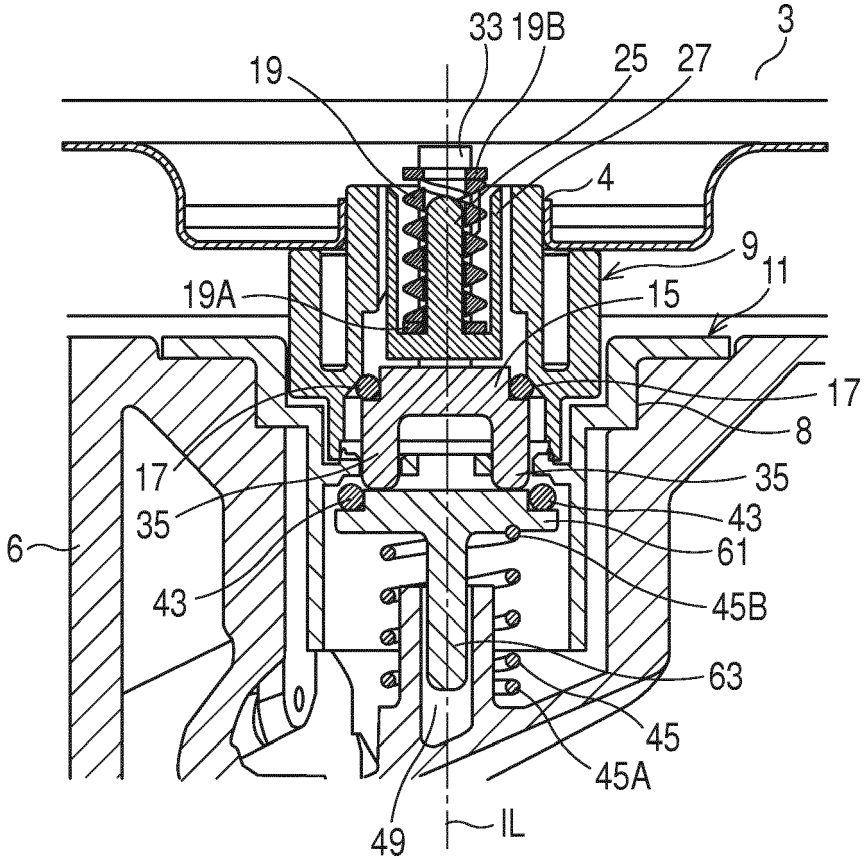
IL

Fig.6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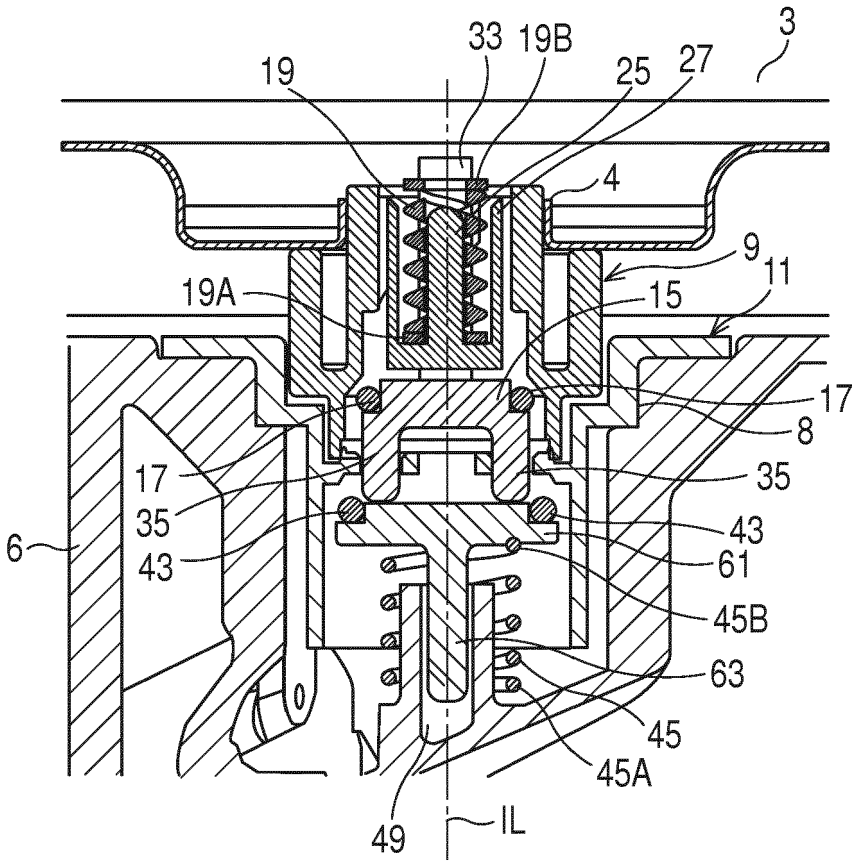
IL

Fig.7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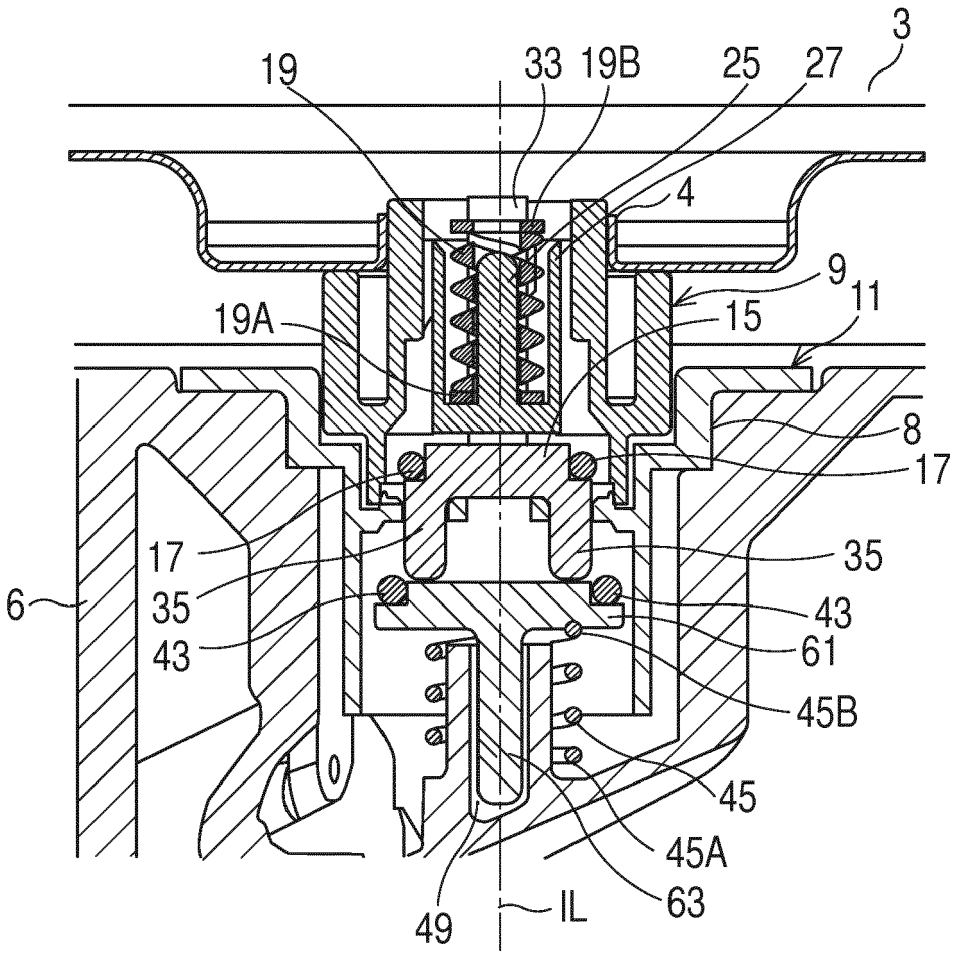
IL

Fig.8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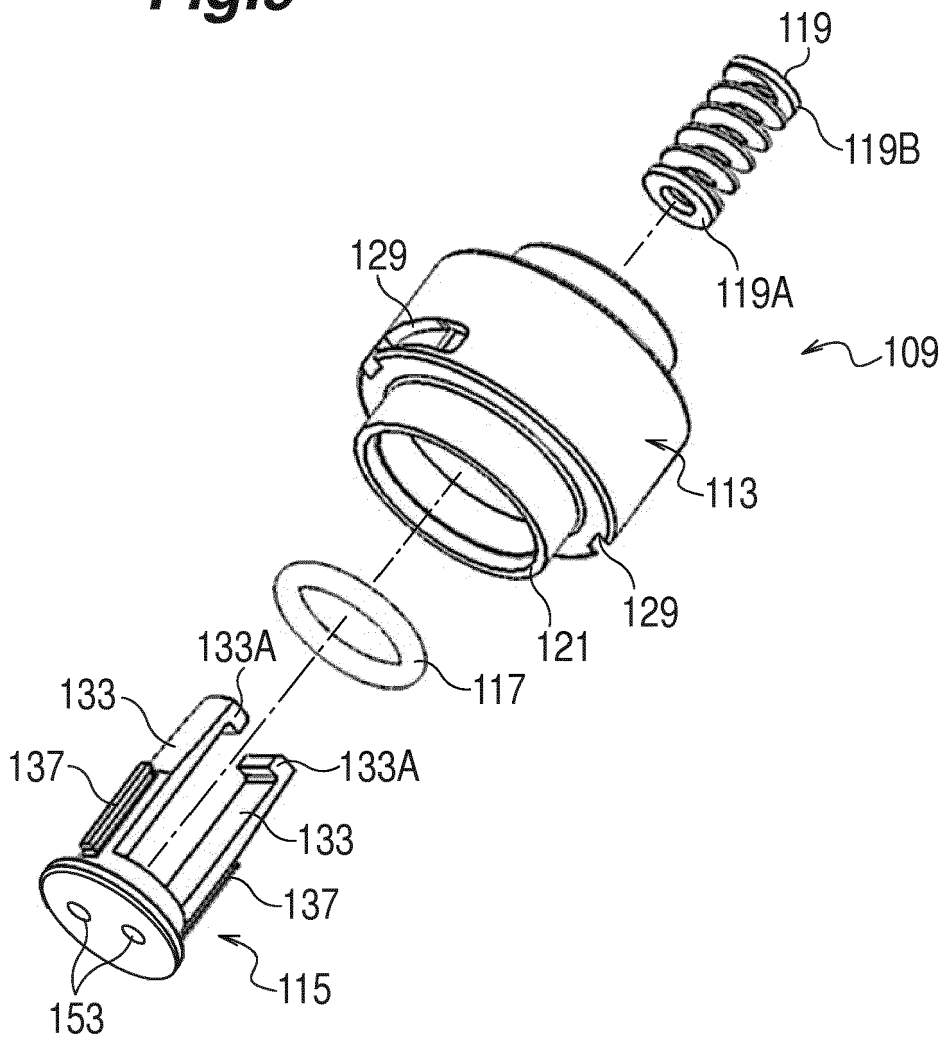
49
IL

Fig.9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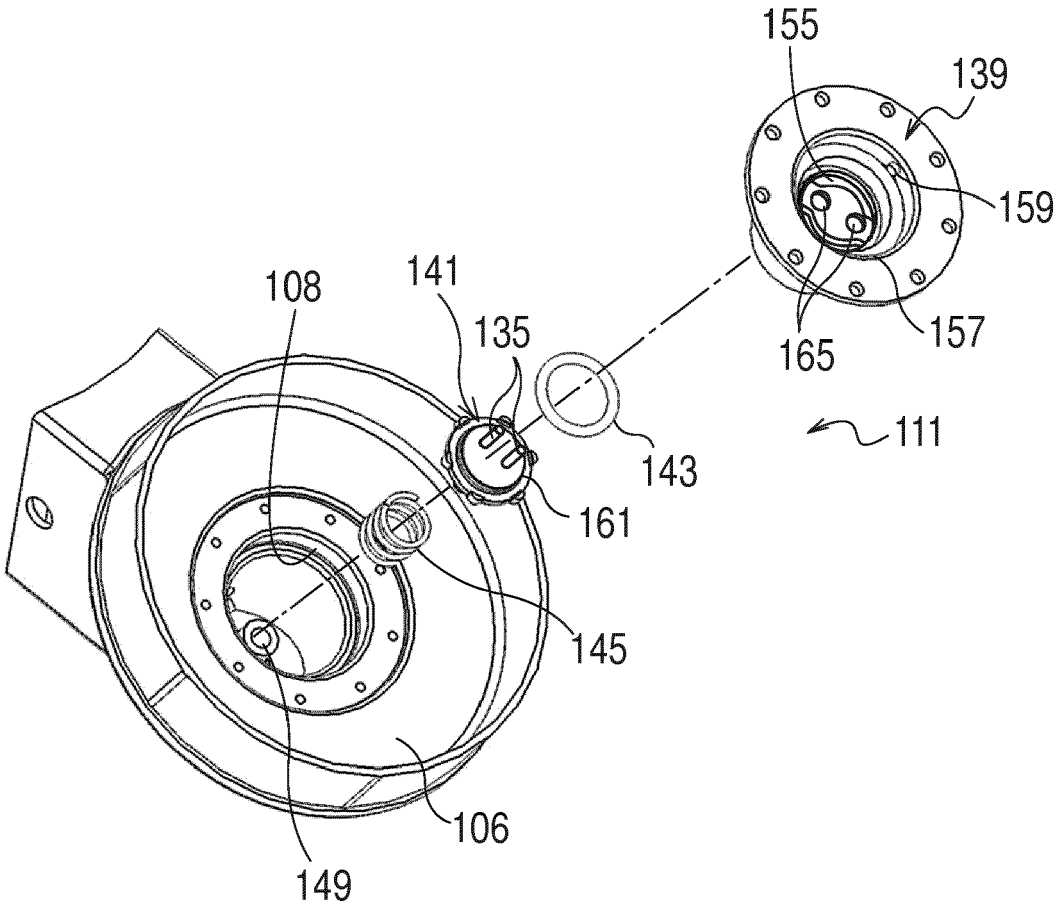
153

Fig.10



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EUROPEAN SEARCH REPORT

Application Number
EP 17 15 8501

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A,D	JP H09 269118 A (TOYOTOMI KOGYO CO LTD) 14 October 1997 (1997-10-14) * paragraph [0008] - paragraph [0022]; figures 1-3 *	1	INV. F23K5/14
A	JP 2001 012727 A (HITACHI HOME TEC LTD) 19 January 2001 (2001-01-19) * paragraph [0002] - paragraph [0026]; figures 1-3 *	1	
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TECHNICAL FIELDS SEARCHED (IPC)

F23K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	23 June 2017	Theis, Gilbert

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23-06-2017

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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