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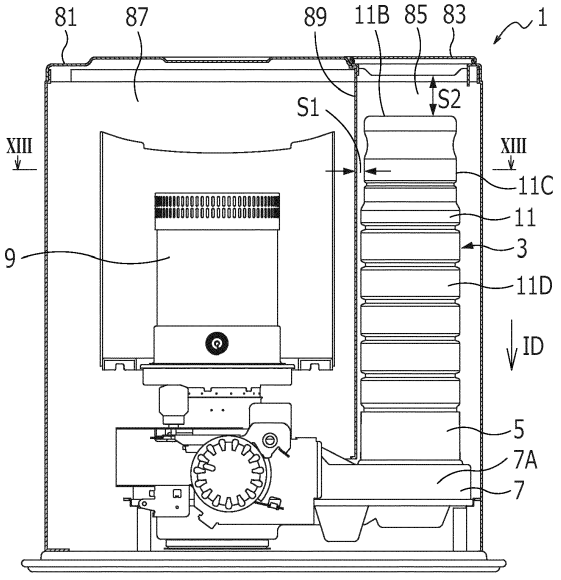
(54) LIQUID FUEL BURNER AND COUPLING STRUCTURE FOR LIQUID FUEL CARTRIDGE

(57) Provided herein is a liquid fuel burner that can utilize a liquid fuel cartridge pre-filled with liquid fuel. The liquid fuel burner includes a liquid fuel cartridge 3, an attachment 5, a liquid fuel tank 7, and a burner assembly 9. A plurality of engagement projecting portions are provided on an inner wall surface of a recessed portion of the attachment 5. A plurality of groove portions are formed in an outer wall surface of a valve seat structure of the liquid fuel cartridge 3, and protruding portions are respectively provided in the groove portions. The inner circumferential surface of each groove portion and the outer circumferential surface of each protruding portion are shaped such that the engagement projecting portions are guided respectively between a first opposed portions of the inner surfaces of the groove portions and a second opposed portions of the outer surfaces of the protruding portions. When the valve seat structure is inserted into the recessed portion and a pushing-down force is applied, each engagement projecting portion reaches between the first and second opposed portions. In this state, releasing the pushing-down force causes the open/close energizing element to press the protruding portions onto the engagement projecting portions, thereby fixedly mounting the liquid fuel cartridge in the liquid fuel burner.

FIG.1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a liquid fuel burner that burns liquid fuel fed from a liquid fuel tank using a burner, and to a coupling structure for a liquid fuel cartridge.

BACKGROUND ART

[0002] In a conventional liquid fuel burner, commercially available liquid fuel is poured into a metallic cartridge tank. Then, the liquid fuel is fed from the cartridge tank to a liquid fuel tank, and the liquid fuel is burnt with a burner.

[0003] To save the troublesome labor of pouring the liquid fuel into the cartridge tank, it has been taken into consideration to use a disposable cartridge pre-filled with liquid fuel.

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0004] Various types of liquid fuel burners are commercially available. If a liquid fuel cartridge cannot be used in the commercially available liquid fuel burners, popularization of the liquid fuel cartridge pre-filled with liquid fuel cannot be expected.

[0005] An aim of the present invention is to provide a liquid fuel burner that can use a liquid fuel cartridge pre-filled with liquid fuel.

[0006] Another aim of the present invention is to provide a liquid fuel burner to which a liquid fuel cartridge is easily mountable and from which the liquid fuel cartridge is not easily detached when vibration and/or impact is imposed on the liquid fuel burner.

[0007] A further aim of the present invention is to provide a coupling structure for a liquid fuel cartridge that allows a liquid fuel cartridge to be used in various types of liquid fuel burners.

SOLUTION TO PROBLEM

[0008] In an aspect of the present invention, a liquid fuel burner is provided. The liquid fuel burner of the present invention comprises a liquid fuel cartridge, a liquid fuel tank, an attachment, and a burner assembly.

[0009] The liquid fuel cartridge includes a cartridge body having a fuel discharge port and a valve assembly mounted to the fuel discharge port. The valve assembly includes a valve seat structure including a valve seat, a valve element including a valve member co-operative with the valve seat, and an open/close energizing element capable of generating a pressing force to act to press the valve member onto the valve seat.

[0010] The liquid fuel tank has a fuel feed port.

[0011] The attachment is mounted to the fuel feed port, and includes a recessed portion to be fitted with the valve seat structure and a pushup pin disposed inside the recessed portion and configured to push up the valve element with the valve seat structure being fitted in the recessed portion. The fuel discharge holes are formed in the recessed portion to allow a liquid fuel, which has been discharged from the liquid fuel cartridge into the recessed portion, to pass therethrough.

[0012] The burner assembly is operable to burn the liquid fuel fed from the liquid fuel tank.

[0013] A plurality of engagement projecting portions are provided on an inner wall portion of the recessed portion and arranged at a predetermined pitch in a circumferential direction of the inner wall portion so as to project inwardly of the recessed portion. A plurality of groove portions are formed in an outer wall portion of the valve seat structure and arranged at the predetermined pitch in a circumferential direction of the valve seat structure so as to be opened in an inserting direction in which the valve element is inserted into the recessed portion and an orthogonal direction orthogonal to the inserting direction. A plurality of protruding portions are disposed on the outer wall portion of the valve seat structure so as to be located respectively in the groove portions to protrude in the orthogonal direction.

[0014] An inner circumferential surface of each of the groove portions and an outer circumferential surface of each of the protruding portions are shaped such that in a process in which the valve seat structure is inserted into the recessed portion, the engagement projecting portions are respectively guided into the groove portions along the inner circumferential surfaces of the groove portions or the outer circumferential surfaces of the protruding portions, and that when the valve seat structure is further inserted into the recessed portion, the engagement projecting portions are respectively guided such that each of the engagement projecting portions is situated between a first opposed portion of the inner circumferential surface of the groove portion and a second opposed portion of the outer circumferential surface of the protruding portion, the first and second opposed portions being opposed to each other in the inserting direction.

[0015] An energizing means is provided in the attachment, and is configured to be energized in a process in which the valve member is pushed up away from the valve seat by the pushup pin when a pushing-down force is applied to the liquid fuel cartridge to move the liquid fuel cartridge toward the attachment, and are configured to be released to press the protruding portions onto the engagement projecting portions when the pushing-down force applied to the liquid fuel cartridge is released.

[0016] With the above-mentioned configuration, a liquid fuel cartridge can be placed in a liquid fuel burner to which the attachment is mountable. In addition, the liquid fuel cartridge is easily mountable to the attachment, and the liquid fuel cartridge is not easily detached from the attachment when vibration and/or impact is imposed on

the liquid fuel burner.

[0017] The pushup energizing element may be disposed inside the recessed portion of the attachment and be energized by the valve seat structure when the valve seat structure is inserted into the recessed portion. In this configuration, the energizing means is constituted from the open/close energizing element and the pushup energizing element.

[0018] Alternatively, the open/close energizing element of the liquid fuel cartridge may also work as the energizing means.

[0019] An outline of the inner circumferential surface of each of the groove portions may be shaped as viewed from an outside in the orthogonal direction such that a dimension of the outline as measured in the circumferential direction becomes smaller toward the first opposed portion of the inner circumferential surface of the groove portion. An outline of the outer circumferential surface of each of the protruding portions may be shaped such that a dimension of the outline as measured in the circumferential direction becomes larger toward the second opposed portion of the outer circumferential surface of the protruding portion.

[0020] As viewed in the inserting direction, a leading portion of a wall portion located between two adjacent groove portions and a leading portion of each protruding portion, and each engagement projecting portion may be shaped such that the engagement projecting portion slides into the groove portion when the engagement projecting portion abuts onto the leading portion of the wall portion or the leading portion of the protruding portion.

[0021] The leading portion of the wall portion and the leading portion of each protruding portion may be shaped such that the dimension as measured in the circumferential direction gradually becomes smaller in the inserting direction. As viewed in a pull-out direction in which the valve element is pulled out from the recessed portion, a leading portion of each engagement projecting portion may be shaped such that the dimension as measured in the circumferential direction gradually becomes smaller in the pull-out direction.

[0022] An end surface of each protruding portion that is located in the pull-out direction may be larger than an end surface of the protruding portion that is located in the inserting direction and may be constituted from a curved surface curved to be convex in the inserting direction.

[0023] The predetermined pitch may be 360°/N where N may be an integer of 2 to 6. For example, N is 4.

[0024] In another aspect of the present invention, a coupling structure for a liquid fuel cartridge is provided.

[0025] The coupling structure for the present invention allows a liquid fuel cartridge to be used in an existing or conventional liquid fuel burner.

[0026] The coupling structure for a liquid fuel cartridge of the present invention is configured to detachably couple a liquid fuel cartridge to a liquid fuel tank. Here, the liquid fuel cartridge includes a cartridge body having a fuel discharge port, and a valve assembly mounted to the fuel discharge port of the cartridge body. The valve assembly includes a valve seat structure including a valve seat, a valve element including a valve member co-operative with the valve seat, and an open/close energizing element capable of generating a pressing force to press the valve member onto the valve seat when the open/close energizing element is not energized. The liquid fuel tank has a fuel feed port for the liquid fuel burner. The coupling structure of the present invention is mounted to the fuel feed port of the liquid fuel tank of the liquid fuel burner. The coupling structure includes an attachment. The attachment includes a recessed portion to be fitted with the valve seat structure, and a pushup pin disposed inside the recessed portion and configured to push up the valve element with the valve seat structure being fitted in the recessed portion. The attachment has fuel discharge holes formed in the recessed portion to allow a liquid fuel, which has been discharged from the liquid fuel cartridge into the recessed portion, to pass therethrough. A plurality of engagement projecting portions are provided on an inner wall portion of the recessed portion and arranged at a predetermined pitch in a circumferential direction of the inner wall portion so as to project inwardly of the recessed portion. A plurality of groove portions are formed in an outer wall portion of the valve seat structure and arranged at the predetermined pitch in a circumferential direction of the valve seat structure so as to be opened in an inserting direction in which the valve element is inserted into the recessed portion and an orthogonal direction orthogonal to the inserting direction. A plurality of protruding portions are disposed on the outer wall portion of the valve seat structure so as to be located respectively in the groove portions to protrude in the orthogonal direction. An inner circumferential surface of each of the groove portions and an outer circumferential surface of each of the protruding portions are shaped such that in a process in which the valve seat structure is inserted into the recessed portion, the engagement projecting portions are respectively guided into the groove portions along the inner circumferential surfaces of the groove portions or the outer circumferential surfaces of the protruding portions; and when the valve seat structure is further inserted into the recessed portion, the engagement projecting portions are respectively guided such that each of the engagement projecting portions is situated between a first opposed portion of the inner circumferential surface of the groove portion and a second opposed portion of the outer circumferential surface of the protruding portion, the first and second opposed portions being opposed to each other in the inserting direction. The attachment includes an energizing means to be energized in a process in which the valve member is pushed up away from the valve seat by the pushup pin when a pushing-down force is applied to the liquid fuel cartridge to move toward the attachment, and to be released to press the protruding portions onto the engagement projecting portions when the pushing-down

force applied to the liquid fuel cartridge is released.

BRIEF DESCRIPTION OF DRAWINGS

[0027]

FIG. 1 illustrates a liquid fuel burner, a part (a front part) of which is cut away, according to an embodiment of the present invention.

FIG. 2 generically illustrates a liquid fuel cartridge mounted with a cap, assuming that the cartridge is for sale; and FIGs. 2A, 2B, 2C, and 2D are a top plan view, a front elevation view, a cross sectional view as taken along line C-C of FIG. 2B, and a cross sectional view as taken along line D-D of FIG. 2A, respectively.

FIG. 3 is a perspective view of a valve assembly.

FIG. 4 is a perspective view of the valve assembly as disassembled.

FIGs. 5A, 5B, and 5C illustrate a valve assembly, and are a top plan view, a cross sectional view as taken along line B-B of FIG. 5A, and a cross sectional as taken along line C-C of FIG. 5A, respectively.

FIG. 6 is a perspective view of a cap to be mounted on the liquid fuel cartridge.

FIG. 7 is a perspective view of an attachment.

FIG. 8 is a perspective view of the attachment as disassembled.

FIGs. 9A and 9B illustrate that the liquid fuel cartridge is brought into engagement with the attachment at a point of time in an engagement process.

FIGs.10A and 10B illustrate that the liquid fuel cartridge is brought into engagement with the attachment at another point of time in an engagement process.

FIGs. 11A and 11B illustrate that the liquid fuel cartridge is brought into engagement with the attachment at a further point of time in an engagement process.

FIGs. 12A and 12B illustrate that the liquid fuel cartridge is brought into engagement with the attachment at a still further point of time in an engagement process.

FIG. 13 illustrates an end surface of the liquid fuel burner as cross sectioned along line XIII-XIII of FIG. 1.

DESCRIPTION OF EMBODIMENT

[0028] Now, an embodiment of the present invention will be described below in detail with reference to the accompanying drawings.

[Overall Configuration]

[0029] FIG. 1 illustrates a liquid fuel burner of an embodiment of the present invention, a part (a front part) of which is cut away. As illustrated in FIG. 1, a liquid fuel burner 1 includes a liquid fuel cartridge 3, an attachment 5, a liquid fuel tank 7 having a fuel feed port 7A, and a burner assembly 9.

[0030] The burner assembly 9 is operable to burn the liquid fuel (generally, kerosene oil) fed from the liquid fuel tank 7. In this embodiment, the burner assembly 9 is provided with a wick-type burner having a burning capacity of 2200W.

[0031] In this embodiment, the configuration of the burner is the same as that of a commercially available liquid fuel burner, except the liquid fuel cartridge 3 and the attachment 5. Using the attachment 5 allows the liquid fuel cartridge 3 to be mounted to various types of commercially available liquid fuel burners.

[0032] In this embodiment, an inserting direction ID of the liquid fuel cartridge 3 is defined as a vertically downward direction on the paper of FIG. 1 as indicated with an arrow in FIG. 1. The inserting direction ID is used as a reference when identifying various directions in other figures.

[Liquid Fuel Cartridge]

[0033] Referring to FIGs. 2 to 5, the liquid fuel cartridge 3 will be described below.

[0034] Specifically, FIGs. 2A, 2B, 2C, and 2D are a top plan view, a front elevation view, a cross sectional view as taken along line C-C of FIG. 2B, and a vertical cross sectional view as taken along line D-D of FIG. 2A, respectively, each illustrating the liquid fuel cartridge mounted with a cap. The liquid fuel cartridge 3 is filled with liquid fuel (e.g. kerosene oil). The liquid fuel cartridge 3 filled with the liquid fuel is put on sale and sold to the consumer. The liquid fuel cartridge 3 includes a cartridge body 11 made of a resin and having a fuel discharge port 11A, and a valve assembly 13 to be mounted to the fuel discharge port 11A of the cartridge body 11. The valve assembly 13 is mounted with a cap 15. The cartridge body 11 includes a bottom portion 11B, a main body portion 11C continuous with the bottom portion 11B, and a central portion 11D continuous with the main body portion 11C. In the main body portion 11C, a plurality of finger hook recesses 11E are continuously formed to be outwardly opened so as to be engaged with a plurality of fingers of a worker or a person who replaces the liquid fuel cartridge with another one. A hook may be formed unitarily with an outer surface of the bottom portion 11B to be engaged with one or more fingers of the worker.

[0035] FIG. 3 through FIGs. 5A to 5C illustrate the valve assembly 13 that is detached from the cartridge body 11. FIG. 3 is a perspective view of the valve assembly 13. FIG. 4 is a perspective view of the disassembled valve assembly 13. FIGs. 5A, 5B, and 5C are a top plan view, a cross sectional view as taken along line B-B of FIG. 5A, and a cross sectional as taken along line C-C of FIG. 5A, respectively. The valve assembly 13 includes a valve seat structure 17 made of a resin, a valve element 19 made of a resin, an open/close energizing element 21

formed of a metallic coil spring, and a pressing member 23 made of a resin. The material for the open/close energizing element 21 is not limited to metals, but may be made of a resin.

[0036] The valve seat structure 17 includes a bottom wall portion 25 having a through hole 29 formed in a central portion thereof to allow the liquid fuel to pass therethrough, and a peripheral wall portion 27 extending upright from an outer periphery of the bottom wall portion 25. An annular flange portion 28 is unitarily formed with an end portion of the peripheral wall portion 27 that is located opposite to the bottom wall portion 25. An annular valve seat 31 is formed around the through hole 29 formed in the bottom wall portion 25.

[0037] In an outer wall portion 33 of the peripheral wall portion 27 of the valve seat structure 17, four groove portions 35 are formed, and four protruding portions 37 are respectively formed in the four groove portions 35. The groove portions 35 are opened in the inserting direction ID and are also opened outwardly in an orthogonal direction orthogonal to the inserting direction ID. As viewed from an outside in the orthogonal direction, an outline of an inner circumferential surface 35a of each of the groove portions 35 is triangularly shaped such that the triangular outline has a base on the side of the bottom wall portion 25 and a dimension of the outline as measured in the circumferential direction becomes smaller toward an apex of the triangle. In this embodiment, the apex constitutes a first opposed portion 35A of the inner circumferential surface 35a of each groove portion 35.

[0038] An outline of an outer circumferential surface 37a of each of the protruding portions 37 is shaped such that the outline has an apex (a leading end) 37A in an opening of the groove portion 35 opened in the inserting direction ID, and a dimension of the outline as measured in the circumferential direction becomes larger in a direction opposite to the inserting direction ID and then becomes smaller in a direction opposite to the inserting direction ID. In this embodiment, an end surface of the protruding portion 37 that is located in a direction opposite to the inserting direction ID constitutes a second opposed portion 37B of the outer circumferential surface 37a of the protruding portion 37. The end surface of each protruding portion 37 that constitutes the second opposed portion 37B is slightly curved to be convex in the inserting direction ID. In terms of positional relationship, the first opposed portion 35A and the second opposed portion 37B are opposed to each other in the inserting direction ID. Specifically, the inner circumferential surfaces 35a of the groove portions 35 and the outer circumferential surfaces 37a of the protruding portions 37 are shaped such that in a process in which the valve seat structure 17 is inserted into a recessed portion 67 of the attachment 5 which will be described later in detail, engagement projecting portions 73 of the attachment 5 are respectively guided into the groove portions 35 along the inner circumferential surfaces 35a of the groove portions 35 or the outer circumferential surfaces 37a of the protruding portions 37, and that when the valve seat structure 17 is further inserted into the recessed portion 67, the engagement projecting portions 73 are respectively guided such that each of the engagement projecting portions 73 is situated between the first opposed portion 35A of the inner circumferential surface 35a of the groove portion 35 and the second opposed portion 37B of the outer circumferential surface 37a of the protruding portion 37, the first and second opposed portions 35A and 37B being opposed to each other in the inserting direction ID.

[0039] As illustrated in FIG. 5A, four groove portions 35 and four protruding portions 37 are each arranged at a predetermined pitch in the circumferential direction. In this embodiment, a pitch P that is an angular interval between two apexes (35A) of the adjacent groove portions 35, a pitch P between two apexes of the adjacent protruding portions 37 are 360°/4 = 90°.

[0040] The leading portion 36A, which is located in the inserting direction ID, of a wall portion 36 located between two adjacent groove portions 35 and the leading portion 37A of each protruding portion 37, which is located in the inserting direction ID, are shaped such that the respective dimensions as measured in the circumferential direction gradually become smaller in the inserting direction. A pitch that is an angular interval between the leading portion 36A of the wall portion 36 and the leading portion 37A of the protruding portion 37 that are adjacent to each other is 360 ° /8 = 45 ° . On the surface of the wall portion 36 located in two adjacent groove portions 35 and the surfaces of the four protruding portions 37, partial male screw portions 36B and 37C are formed to be screwed with the cap 15.

[0041] As illustrated in FIGs. 3 and 5A, two cap engaging portions 38 are formed in the vicinity of the flange portion 28 of the outer wall portion 33 of the valve seat structure 17 so as to be engaged with the cap 15. The two cap engaging portions 38 are disposed 180° apart from each other in the circumferential direction. The cap engaging portions 38 each include an inclined portion 38A that gradually becomes more distant from the outer wall portion 33 in the orthogonal direction along the circumference and a flat portion 38B continuous with the inclined portion 38A.

[0042] The valve seat structure 17 is formed by injection molding. The parting line PL of a mold to be used in injection molding passes through the leading portion 36A of the wall portion 36 as illustrated in FIG. 3. A plurality of thinned portions 33A are formed to prevent sinks.

[0043] As illustrated in FIGs. 4, 5B, and 5C, a pressing member engaged portion 34A to be fixedly engaged with the pressing member 23 and a cartridge body engaged portion 34B to be engaged with the fuel discharge port 11A of the cartridge body 11 are formed inside the peripheral wall portion 27 (specifically, an inner wall portion 34) of the valve seat structure 17.

[0044] The valve element 19 includes a valve body portion 39, a valve member 41 disposed at a location opposed to the valve seat 31 and co-operative with the valve

seat 31, a plurality of protrusions 43 (in this embodiment, eight protrusions) formed in an outer wall of the valve body portion 39, and an axial portion 45 extending from a central portion of the valve body portion 39 in the inserting direction ID. The liquid fuel passes through a valley portion 44 defined between two adjacent protrusions 43.

[0045] The open/close energizing element 21 passes through the axial portion 45, with one end 21A of the open/close energizing element 21 abutting on the valve body portion 39 and the other end 21B abutting on the pressing member 23. The open/close energizing element 21 is operable to generate a pressing force that acts to press the valve member 41 onto the valve seat 31 when the open/close energizing element 21 is released.

[0046] As illustrated in FIG. 4, the pressing member 23 includes an open/close energizing element receiving portion 47 that receives the open/close energizing element 21, an annular valve seat structure engaging portion 49 formed around an open/close energizing element receiving portion 47, an axial through hole 51 formed on an apex of the open/close energizing receiving portion 47, through which the axial portion 45 passes, and a fuel passage 53 formed around the open/close energizing element receiving portion 47 to allow the liquid fuel to pass therethrough. The valve seat structure engaging portion 49 is engaged with the pressing member engaged portion 34A formed in the inner wall portion of the valve seat structure 17 [see FIG. 5C] and then comes into fixed engagement with the valve seat structure 17. The other end 21B abuts on the periphery of the axial through hole 51.

[Cap]

[0047] FIG. 6 is a perspective view of the cap 15, as viewed from below the cap 15, to be mounted to the valve assembly illustrated in FIGs. 3, 4, and 5A to 5C. A female screw portion 55 to be screwed with the partial male portions 36B and 37C illustrated in FIG. 3, and two engaged portions 57 to be engaged with a cap engaging portion 38 illustrated in FIG. 5A are formed in an inner peripheral surface of the cap 15. The two engaged portions 57 are disposed 180° apart in the circumferential direction. The engaged portions 57 each include an inclined surface 57A that gradually becomes more distant radially inward from the inner peripheral surface of the cap 15 along the circumference in a direction opposite to a turning direction for mounting the cap 15, and a flat surface 57B extending from the terminal position of the inclined surface 57A, radially toward the inner peripheral surface.

[0048] Two index portions 59 that indicate a finger pressing position are formed in an outer peripheral surface of the cap 15. The two index portions 59 are shifted from the two engaged portions 57 by 90 ° in the circumferential direction. The two index portions 59 are disposed apart from each other by 180° in the circumferential direction.

[0049] The cap 15 is fitted with the valve assembly 13 and the cap 15 is turned until the cap engaging portion 38 abuts on the engaged portions 57 with the partial male screw portions 36B and 37C being screwed into the female screw portion 55. Then, the cap 15 is further turned with respect to the valve assembly 13. The engaged portions 57 climb on the inclined surfaces 38A of the cap engaging portions 38, slide on the flat surfaces 38B, and finally climb over the cap engaging portions 38. Thus, the liquid fuel cartridge will not be detached by turning the cap 15 in an opposite direction to the direction for tightening the liquid fuel cartridge since the engaged portions 57 are engaged with the cap engaging portions 38. Thus, this works as a so-called child safety lock that prevents a child from inadvertently opening the liquid fuel cartridge 3 [see FIGS. 2C and 2D]. To open the liquid fuel cartridge 3, the child safety lock should be released by tightly gripping the cap 15 with fingers at the two index portions 59 to deform the cap 15, thereby widening the distance between the engaged portions 57, and while maintaining this state, turning the cap 15 with respect to the valve assembly 13 in the opposite direction to the direction for closing the cap. This causes the engaged portions 57 to climb over the cap engaging portions 38, thereby releasing the child safely lock.

[Attachment]

[0050] FIG. 7 is a perspective view of the attachment. FIG. 8 is a perspective view of the disassembled attachment. The attachment 5 is mounted to the fuel feed port 7A of the liquid fuel tank 7. The attachment 5 includes an attachment body portion 61, a pushup energizing element 63, and a partition plate 65. The attachment body portion 61 includes a recessed portion 67 to be engaged with the valve seat structure 17, a pushup pin 69 provided in the recessed portion 67 and configured to push up the valve element 19 with the valve seat structure 17 being fitted in the recessed portion 67, and four fuel discharge holes 71 formed in the recessed portion 67 and configured to allow the liquid fuel, which has been discharged from the liquid fuel cartridge into the recessed portion 67, to pass therethrough.

[0051] A plurality of engagement projecting portions 73 are provided on an inner wall portion of the recessed portion 67 to project inwardly of the recessed portion 67 and arranged at a predetermined pitch in the circumferential direction of the recess portion 67. In this embodiment, there are four engagement projecting portions 73. The pitch that is an angular interval between two adjacent engagement projecting portions 73 is 360°/4 = 90° . The engagement projecting portions 73 are each shaped such that a dimension, as measured in the circumferential direction, of a leading portion 73A extending in a pull-out direction opposite to the inserting direction ID gradually becomes smaller in the pull-out direction.

[0052] The pushup energizing element 63 is provided around the pushup pin 69. The partition plate 65 is an

annular member having a through hole 75 formed in a central portion thereof, and is supported by the pushup energizing element 63. When the pushup energizing element 63 is released, the partition plate 65 is supported by the pushup energizing element 63 and the four engagement projecting portions 73, and is configured not to be positioned above the four engagement projecting portions 73. When engaging the liquid fuel cartridge with the attachment 5, the bottom wall portion 25 of the valve seat structure 17 of the valve assembly 13 abuts on the partition plate 65. To reduce an area where the bottom wall portion 25 contacts the partition plate 65, four projections 77 are formed on the surface of the partition plate 65.

[Engagement of Liquid Fuel Cartridge]

[0053] FIGs. 9A and 9B to Figs. 12A and 12B illustrate that the liquid fuel cartridge is to be engaged with the attachment. In these figures, FIGs. 9A, 10A, 11A, and 12A are cross sectional views of the liquid fuel cartridge 3 and the attachment 5. In correspondence with FIGs. 9A, 10A, 11A, and 12A, FIGs. 9B, 10B, 11B, and 12B schematically illustrate the engagement process of the groove portions 35 and protruding portions 37 formed in the outer wall portion 33 of the valve seat structure 17 with the engagement projecting portions 73 provided on the inner wall portion of the attachment 5.

[0054] To engage the liquid fuel cartridge 3 with the attachment 5, the side where the valve assembly 13 of the liquid fuel cartridge 3 is located is caused to face the recessed portion 67 of the attachment 5 and then the liquid fuel cartridge 3 is inserted into the recessed portion 67 of the attachment5 [see FIGs. 9A and 9B] . In this state, the engagement projecting portions 73 are positioned outside the groove portions 35 as illustrated in FIG. 9B. While softly applying a pushing-down force to the liquid fuel cartridge 3 in the inserting direction ID, the liquid fuel cartridge 3 is turned (regardless of the turning direction) around an imaginary centerline IL of the axial portion 45 of the valve element 19. Then, the engagement projecting portions 73 are guided along the inner circumferential surfaces 35a of the groove portions 35 or the outer circumferential surfaces 37a of the protruding portions 37 into the groove portions 35 [see FIGs. 10A and 10B] since the leading portions 36A and 37A, and the leading portions 73A of the engagement projecting portions 73 each have a small contact area. From this point, the liquid fuel cartridge 3 is further pressed in the inserting direction ID. The engagement projecting portions 73 are guided along the inner circumferential surfaces 35a of the groove portions 35 and reach the first opposed surface portion 35A [see FIGs. 11A and 11B] . In FIGs. 11A and 11B, the open/close energizing element 21 is energized since the valve element 19 is pushed up by the pushup pin 69, and the pushup energizing element 63 is energized since the valve seat structure 17 pushes down the partition plate 65. Namely, the open/close energizing element 21 and the pushup energizing element 63 cooperatively work as the energizing means. At this point, releasing the pressing force to press the liquid fuel cartridge 3 in the inserting direction ID releases the open/close energizing element 21 and pushup energizing element 63 to cause the liquid fuel cartridge 3 to move in the pull-out direction. The engagement projecting portions 73, however, abut on the second opposed portions 37B of the protruding portions 37 before the open/close energizing element 21 and pushup energizing element 63 are fully released, and the engagement of the liquid fuel cartridge 3 and the attachment 5 is completed [see FIGs. 12A and 12B]. In FIGs. 12A and 12B, the pushup pin 69 still pushes up the valve element 19, thereby causing the liquid fuel to flow out of the fuel discharge port 11A and flow in order through the fuel passage 53 of the pressing member 23 and the through hole 29 of the valve seat structure 17 and out to the attachment 5. The liquid fuel further passes through the fuel discharge port 71 of the attachment 5 and reaches the liquid fuel tank 7.

[0055] To detach the liquid fuel cartridge 3 from the attachment 5, while applying the pushing-down force to the liquid fuel cartridge 3, the liquid fuel cartridge 3 is turned to cause the engagement projecting portions 73 to be guided along the inner circumferential surfaces 35a of the groove portions 35 and slide out to release the engagement [the disengagement process follows FIGs. 12A and 12B, FIGs. 11A and 11B, FIGs. 10A and 10B, and FIGs. 9A and 9B in this order].

[Shape and Dimension of Liquid Fuel Cartridge]

[0056] The liquid fuel burner 1 includes a frame structure 81 and a lid 83 as illustrated in FIG. 1. The frame structure 81 includes a cartridge chamber 85 to receive the liquid fuel cartridge 3 and a burner assembly chamber 87 to receive the burner assembly 9. A heat insulating plate 89 is provided between the cartridge chamber 85 and the burner assembly chamber 87. The frame structure 81 and the heat insulating plate 89 are made of a metal plate. The lid 83 blocks an upper opening of the cartridge chamber 85 and is opposed to a bottom portion 11B of the cartridge body 11 with the liquid fuel cartridge 3 being received in the cartridge chamber 85.

[0057] Heat from the burner assembly 9 scatters around the burner assembly 9. A top plate of the frame structure 81 and a portion of the heat insulating plate 89 in the vicinity of the top plate are heated to a fairly or quite high temperature by heat scattering upward, and in turn the heat from the heated top plate and the heated portion of the heat insulating plate 89 heats the cartridge main portion 11C of the cartridge body 11. In this embodiment, the temperature of the cartridge main portion 11C of the cartridge body 11 is designed to be lower than the temperature of starting thermal deformation while increasing the volume of the cartridge body 11 by devising the dimension and shape of the cartridge body 11. Namely, as illustrated in FIG. 1 and FIGs. 2A to 2D, the outside di-

mension of the cartridge main portion 11C is designed to be smaller than the outside dimension of a central portion 11D of the cartridge body 11, and a gap S1 is provided between the heat insulating plate 89 and the cartridge main portion 11C. Further, a heat insulating space S2 is provided between the cartridge body 11 and the bottom portion 11B.

[0058] Referring to FIGs. 1 and 13, specific dimensions of the cartridge body 11 of the embodiment are described below. FIG. 13 illustrates an end surface of the liquid fuel burner as cross sectioned along line XIII-XIII of FIG. 1, and shows only necessary part of the cartridge body 11, the frame structure 81, and the heat insulating plate 89. The outside dimension of the central portion 11D of the cartridge body 11 is set to 86 mm, and that of the cartridge main portion 11C is set to 80 mm. The thickness of the gap S1 is set to 6.64 mm and that of the heat insulating space S2 is set to 50.7 mm. With these settings, the temperature of the cartridge main portion 11C and that of the bottom portion 11B will not be higher than 50°C at room temperature of 25°C at the time that the burner assembly with a burning capacity of 2200W burns the liquid fuel.

[0059] The embodiment of the present invention is specifically described above, but the present invention is not limited to this embodiment. Variations, modifications, and changes are possible within the scope of technical ideas of the present invention. In the embodiment described above, the pushup energizing element 63 is provided in the recessed portion 67 of the attachment 5, and is cooperative with the open/close energizing element 21 to work as the energizing means. The pushup energizing element is optionally provided. In other words, the open/close energizing element 21 may also work as the energizing means without providing the pushup energizing element 63.

INDUSTRIAL APPLICABILITY

[0060] According to the present invention, there is provided a liquid fuel burner that can utilize a liquid fuel cartridge pre-filled with liquid fuel, that allows the liquid fuel cartridge to be easily mounted, and that prevents the liquid fuel cartridge from being easily detached when vibration or impact is added to the liquid fuel burner. Further, there is provided a coupling structure for a liquid fuel cartridge that allows the liquid fuel cartridge to be used in various types of liquid fuel burners.

Claims

1. A liquid fuel burner comprising:

a liquid fuel cartridge (3) including:

a cartridge body (11) having a fuel discharge port (11A); and
a valve assembly (13) mounted to the fuel discharge port (11A) and including a valve seat structure (17) including a valve seat (31), a valve element (19) including a valve member (41) co-operative with the valve seat (31), and an open/close energizing element (21) capable of generating a pressing force to act to press the valve member (41) onto the valve seat (31);

a liquid fuel tank (7) having a fuel feed port (7A);
an attachment (5) mounted to the fuel feed port (7A), and including a recessed portion (67) to be fitted with the valve seat structure (17) and a pushup pin (69) disposed inside the recessed portion (67) and configured to push up the valve element (19) with the valve seat structure (17) being fitted in the recessed portion (67), the attachment(5) having fuel discharge holes (71) formed in the recessed portion (67) to allow a liquid fuel, which has been discharged from the liquid fuel cartridge (3) into the recessed portion (67), to pass therethrough; and
a burner assembly (9) operable to burn the liquid fuel fed from the liquid fuel tank (7), **characterized in that**:

a plurality of engagement projecting portions (73) are provided on an inner wall portion of the recessed portion (67) and arranged at a predetermined pitch in a circumferential direction of the inner wall portion so as to project inwardly of the recessed portion (67);
a plurality of groove portions (35) are formed on an outer wall portion of the valve seat structure (17) and arranged at the predetermined pitch in a circumferential direction of the valve seat structure (17) so as to be opened in an inserting direction (ID) in which the valve element (19) is inserted into the recessed portion (67) and an orthogonal direction orthogonal to the inserting direction (ID);
a plurality of protruding portions (37) are disposed on the outer wall portion of the valve seat structure (17) so as to be located respectively in the groove portions (35) to protrude in the orthogonal direction;
an inner circumferential surface of each of the groove portions (35) and an outer circumferential surface of each of the protruding portions (37) are shaped such that in a process in which the valve seat structure (17) is inserted into the recessed portion (67), the engagement projecting portions (73) are respectively guided into the groove portions (35) along the inner circumferential surfaces of the groove portions (35) or the

outer circumferential surfaces of the protruding portions (37); and when the valve seat structure (17) is further inserted into the recessed portion (67), the engagement projecting portions (73) are respectively guided such that each of the engagement projecting portions (73) is situated between a first opposed portion (35A) of the inner circumferential surface of the groove portion (35) and a second opposed portion (37B) of the outer circumferential surface of the protruding portion (37), the first and second opposed portions (35A, 37B) being opposed to each other in the inserting direction (ID); and

an energizing means (21, or 21 and 63) is provided in the attachment, and is configured to be energized in a process in which the valve member (41) is pushed up away from the valve seat (31) by the pushup pin (69) when a pushing-down force is applied to the liquid fuel cartridge (3) to move the liquid fuel cartridge (3) toward the attachment (5), and configured to be released to press the protruding portions (37) onto the engagement projecting portions (73) when the pushing-down force applied to the liquid fuel cartridge (3) is released.

2. The liquid fuel burner according to claim 1, wherein a pushup energizing element (63) is provided inside the recessed portion (67) of the attachment (5) and is energized by the valve seat structure (17) when the valve seat structure (17) is inserted into the recessed portion (67); and

the energizing means is constituted from the open/close energizing element (21) and the pushup energizing element (63).

3. The liquid fuel burner according to claim 1, wherein the open/close energizing element (21) of the liquid fuel cartridge (3) works also as the energizing means.

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

an outline of the inner circumferential surface of each of the groove portions (35) is shaped, as viewed from an outside in the orthogonal direction, such that a dimension of the outline as measured in the circumferential direction becomes smaller toward the first opposed portion (35A) of the inner circumferential surface of the groove portion (35); and

an outline of the outer circumferential surface of each of the protruding portions (37) is shaped such that a dimension of the outline as measured in the circumferential direction becomes larger toward the second opposed portion (37B) of the outer circumferential surface of the protruding portion (37).

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

as viewed in the inserting direction (ID), a leading portion of a wall portion located between two adjacent groove portions (35) and a leading portion of each protruding portion (37), and each engagement projecting portion (73) are shaped such that the engagement projecting portion (73) slides into the groove portion (35) when the engagement projecting portion (73) abuts onto the leading portion of the wall portion or the leading portion of the protruding portion (37).

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

the leading portion of the wall portion and the leading portion of each protruding portion (37) are shaped such that the dimension as measured in the circumferential direction gradually becomes smaller in the inserting direction (ID); and

as viewed in a pull-out direction in which the valve element (19) is pulled out from the recessed portion (67), a leading portion of each engagement projecting portion (73) is shaped such that the dimension as measured in the circumferential direction gradually becomes smaller in the pull-out direction.

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

an end surface of each protruding portion (37) as located in the pull-out direction is larger than an end surface of the protruding portion as located in the inserting direction, and is constituted from a curved surface curved to be convex in the inserting direction (ID).

8. The liquid fuel burner according to claim 1, wherein the predetermined pitch is 360°/N where N is an integer of 2 to 6.

9. The liquid fuel burner according to claim 8, wherein N is 4.

10. A coupling structure for a liquid fuel cartridge configured to detachably couple a liquid fuel cartridge (3) to a liquid fuel tank (7) of a liquid fuel burner; the liquid fuel tank (7) having a fuel feed port (7A) for the liquid fuel burner; the liquid fuel cartridge (3) comprising a cartridge body (11) having a fuel discharge port (11A), and a valve assembly (13) mounted to the fuel discharge port (11A) of the cartridge body (11); the valve assembly including a valve seat struc-

ture (17) including a valve seat (31), a valve element (19) including a valve member (41) co-operative with the valve seat (31), and an open/close energizing element (21) capable of generating a pressing force to press the valve member (41) onto the valve seat (31) when the open/close energizing element (21) is not energized, **characterized in that**:

the coupling structure for a liquid fuel cartridge comprises an attachment (5), wherein:

the attachment (5) is mounted to the fuel feed port (7A), and includes a recessed portion (67) to be fitted with the valve seat structure (17) and a pushup pin (69) disposed inside the recessed portion (67) and configured to push up the valve element (19) with the valve seat structure (17) being fitted in the recessed portion (67), the attachment(5) having fuel discharge holes (71) formed in the recessed portion (67) to allow a liquid fuel, which has been discharged from the liquid fuel cartridge (3) into the recessed portion (67), to pass therethrough;
a plurality of engagement projecting portions (73) are provided on an inner wall portion of the recessed portion (67) and arranged at a predetermined pitch in a circumferential direction of the inner wall portion so as to project inwardly of the recessed portion (67);
a plurality of groove portions (35) are formed in an outer wall portion of the valve seat structure (17) and arranged at the predetermined pitch in a circumferential direction of the valve seat structure (17) so as to be opened in an inserting direction (ID) in which the valve element (19) is inserted into the recessed portion (67) and an orthogonal direction orthogonal to the inserting direction (ID);
a plurality of protruding portions (37) are disposed on the outer wall portion of the valve seat structure (17) so as to be positioned respectively in the groove portions (35) to protrude in the orthogonal direction; and
an energizing means (21, or 21 and 63) is provided so as to be energized in a process in which the valve member (41) is pushed up away from the valve seat (31) by the pushup pin (69) when a pushing-down force is applied to the liquid fuel cartridge (3) to move the liquid fuel cartridge (3) toward the attachment (5), and so as to be released to press the protruding portions (37) onto the engagement projecting portions (73) when the pushing-down force applied to the liquid fuel cartridge (3) is released; and

an inner circumferential surface of each of the groove portions (35) and an outer circumferential surface of each of the protruding portions (37) are shaped such that in a process in which the valve seat structure (17) is inserted into the recessed portion (67), the engagement projecting portions (73) are respectively guided into the groove portions (35) along the inner circumferential surfaces of the groove portions (35) or the outer circumferential surfaces of the protruding portions (37); and when the valve seat structure (17) is further inserted into the recessed portion (67), the engagement projecting portions (73) are respectively guided such that each of the engagement projecting portions (73) is situated between a first opposed portion (35A) of the inner circumferential surface of the groove portion (35) and a second opposed portion (37B) of the outer circumferential surface of the protruding portion (37), the first and second opposed portions (35A, 37B) being opposed to each other in the inserting direction (ID).

FIG.1

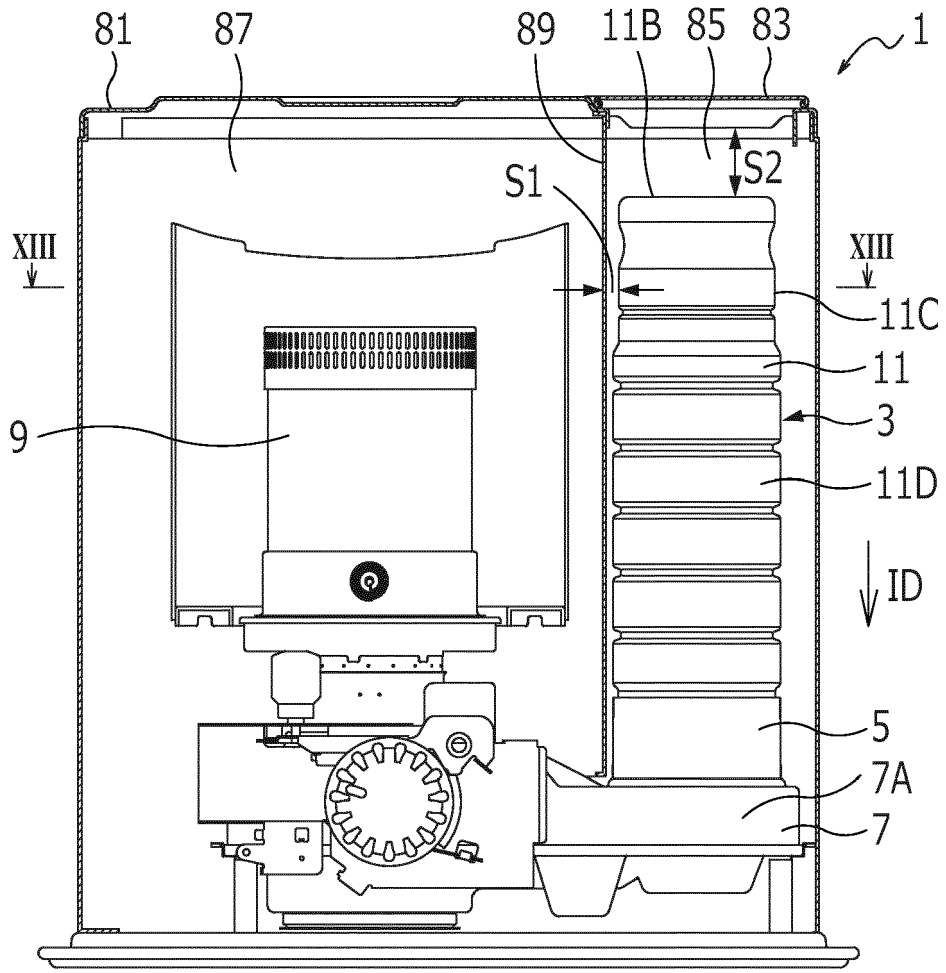


FIG.2A

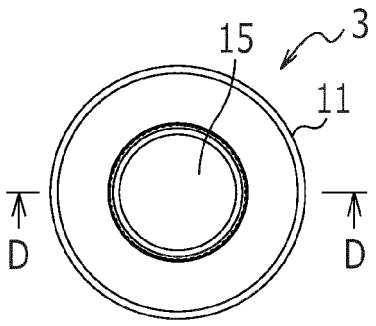


FIG.2C

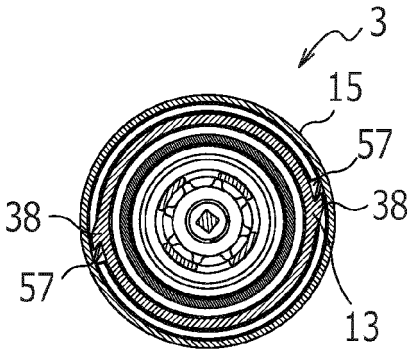


FIG.2B

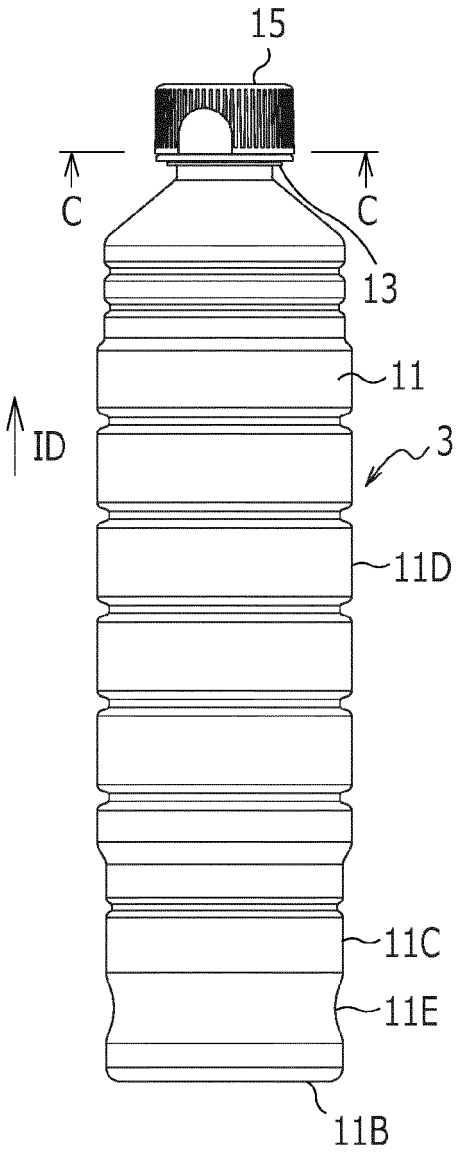


FIG.2D

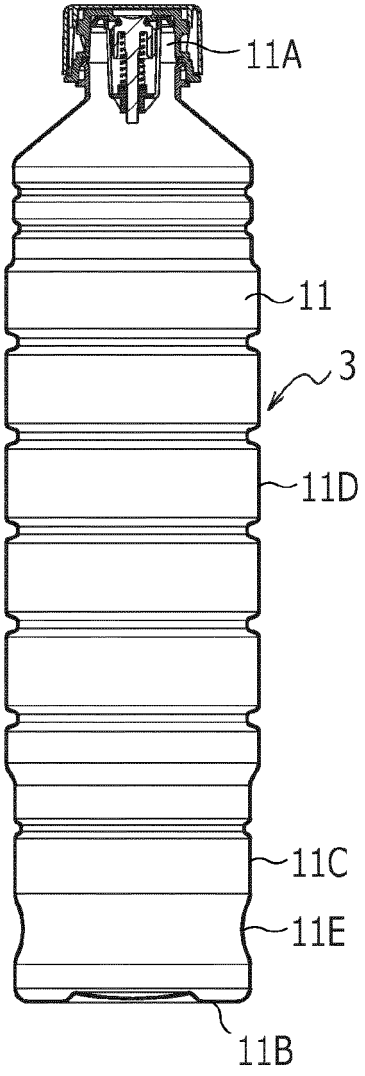
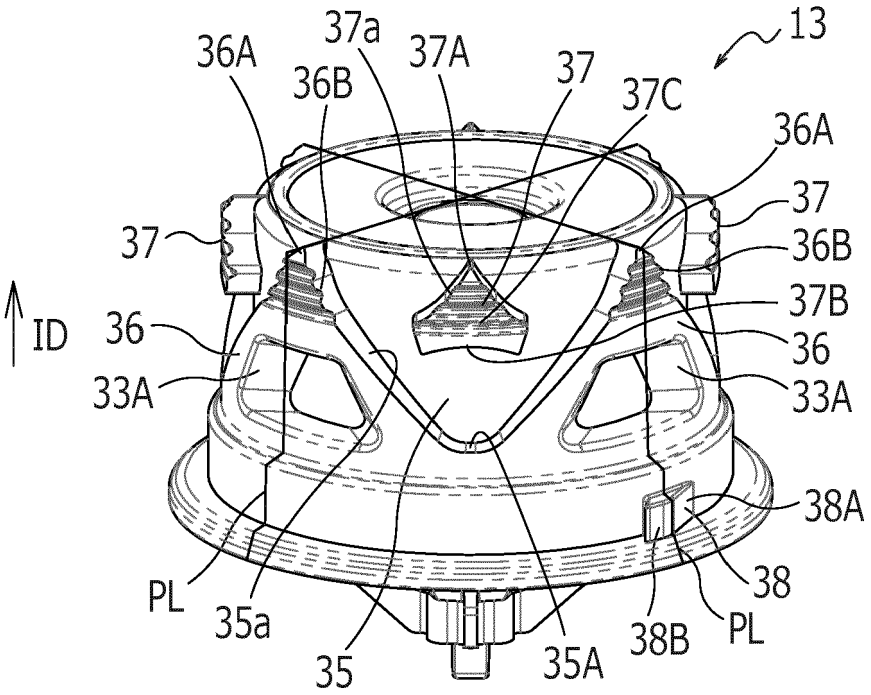


FIG.3


13
36A
37a
37A
37
37C
36B
36A
37
37
36B
37B
ID
36
36
33A
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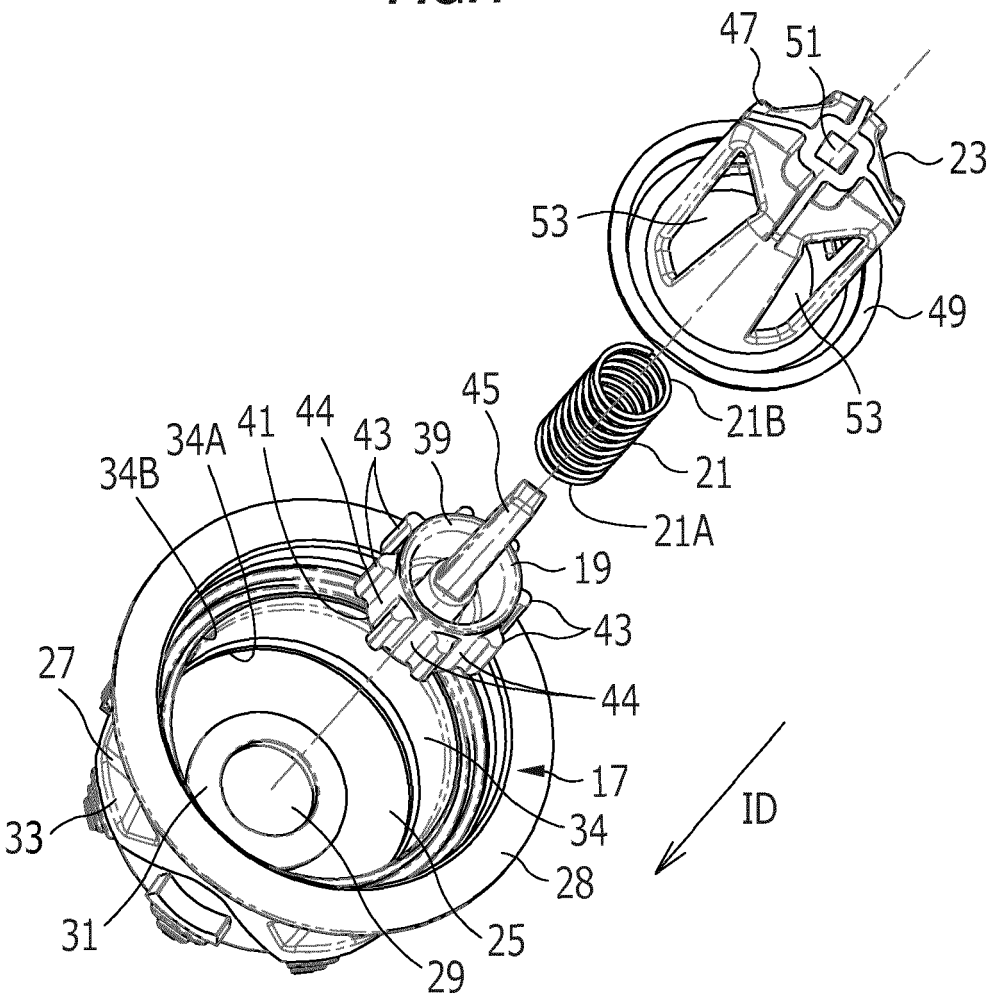
38A
38
PL
35a
35
35A
38B
PL

FIG.4


47
51
23
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49
53
21B
45
21
21A
19
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17
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25
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34B
34A
41
44
43
39
ID

FIG.5A

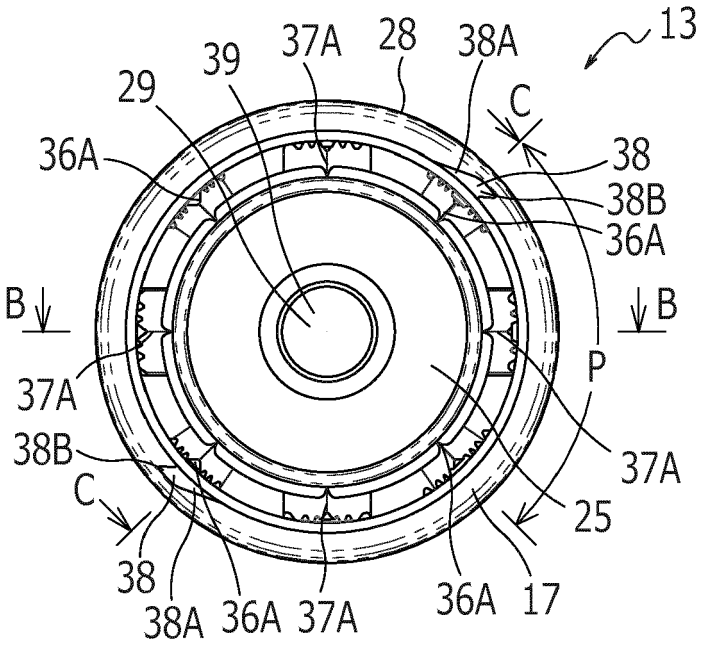


FIG.5B

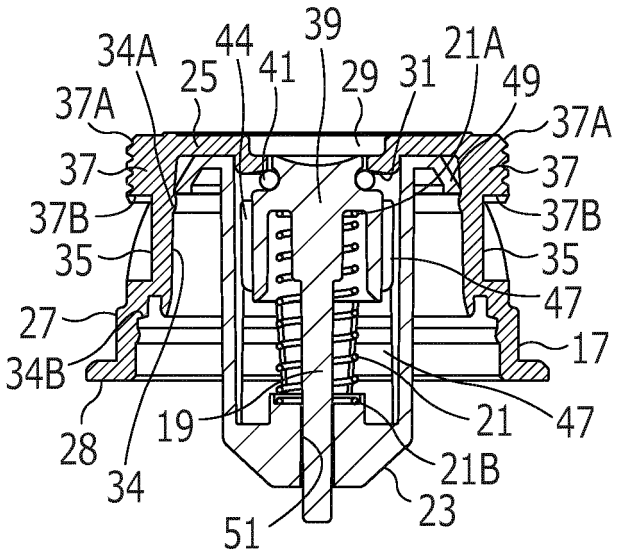


FIG.5C

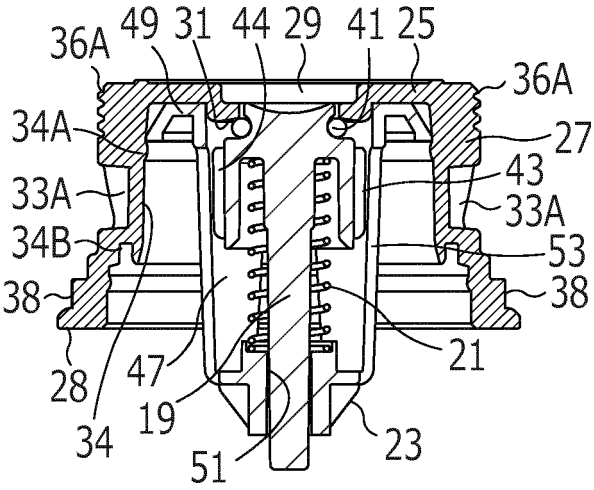


FIG.6

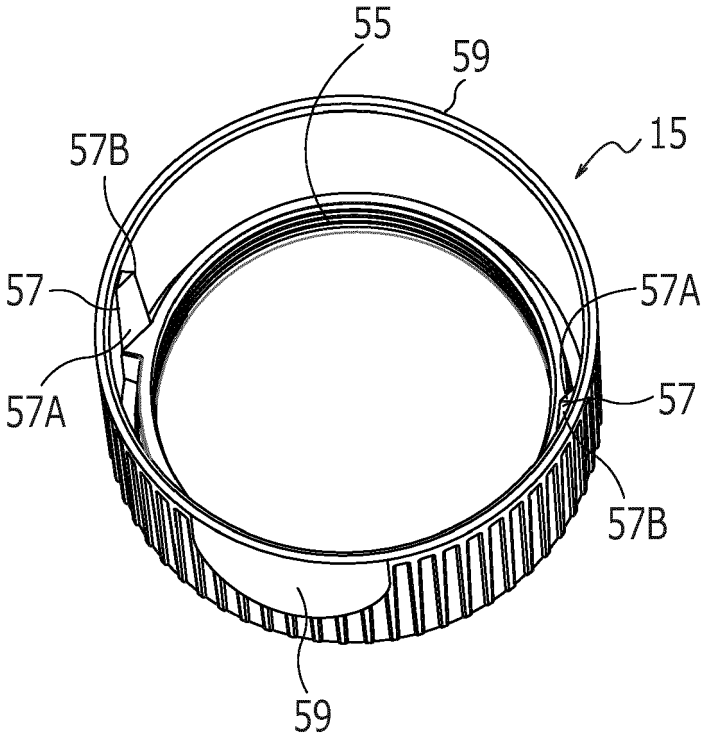


FIG.7

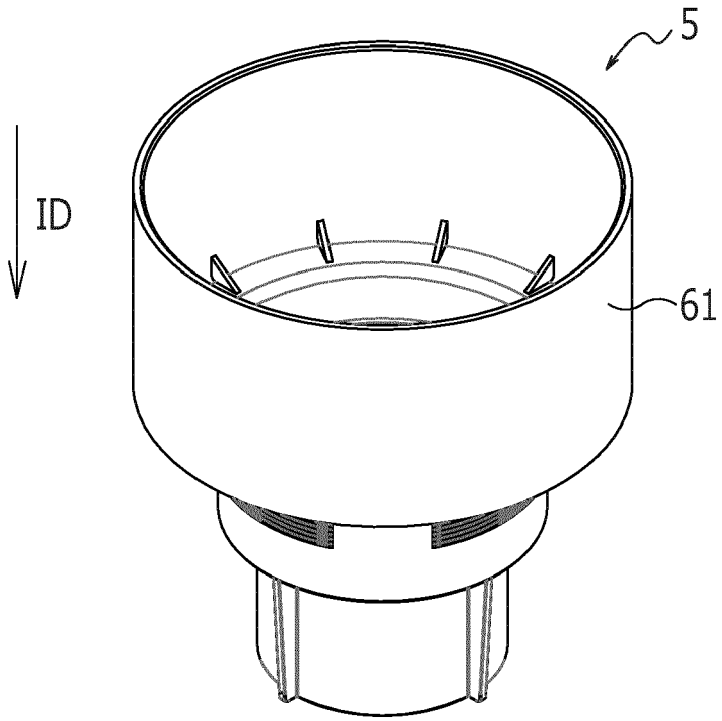


FIG.8

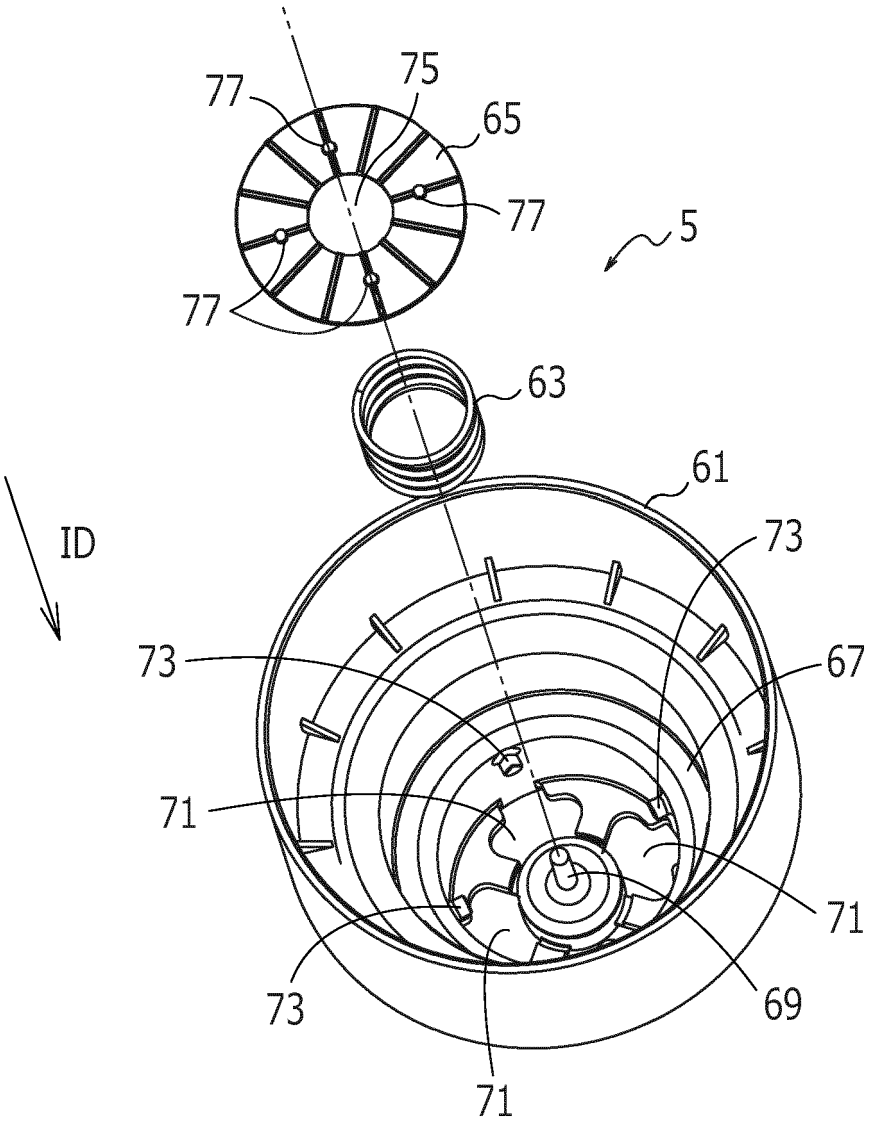
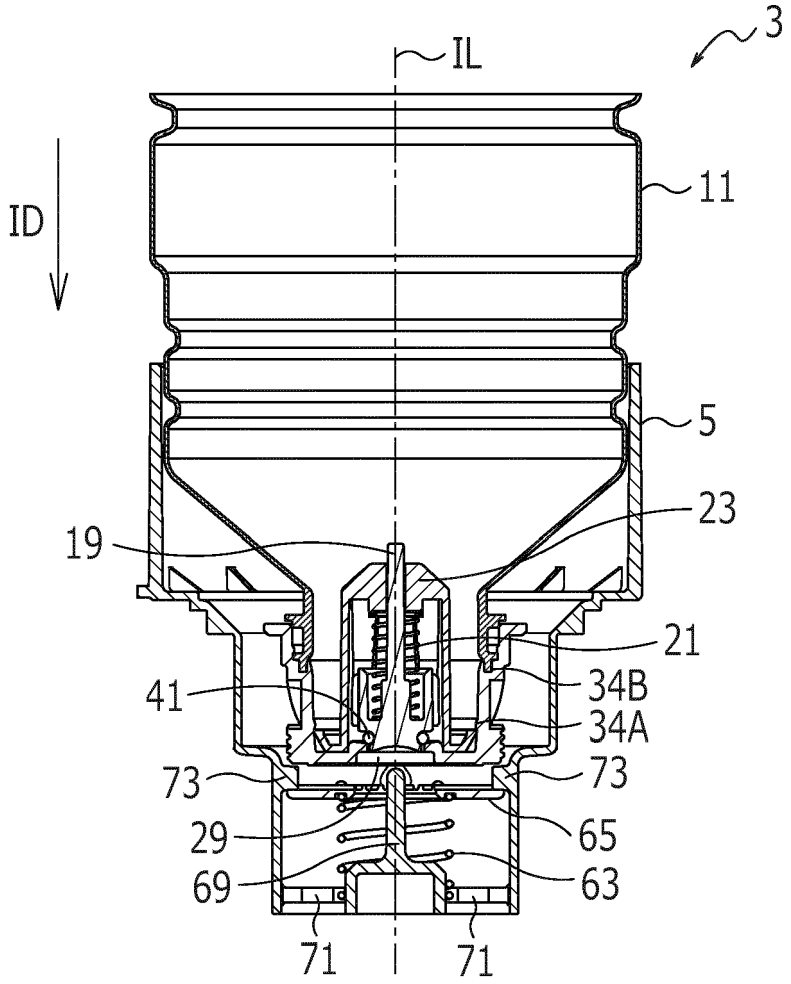


FIG.9A


3
IL
ID
11
5
23
19
21
41
34B
34A
73
73
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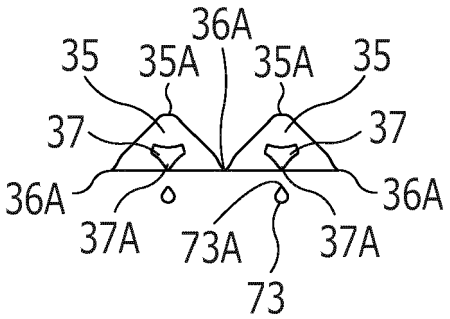
69
63
71
71

FIG.9B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37
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36A
37A
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37A
73

FIG.10A

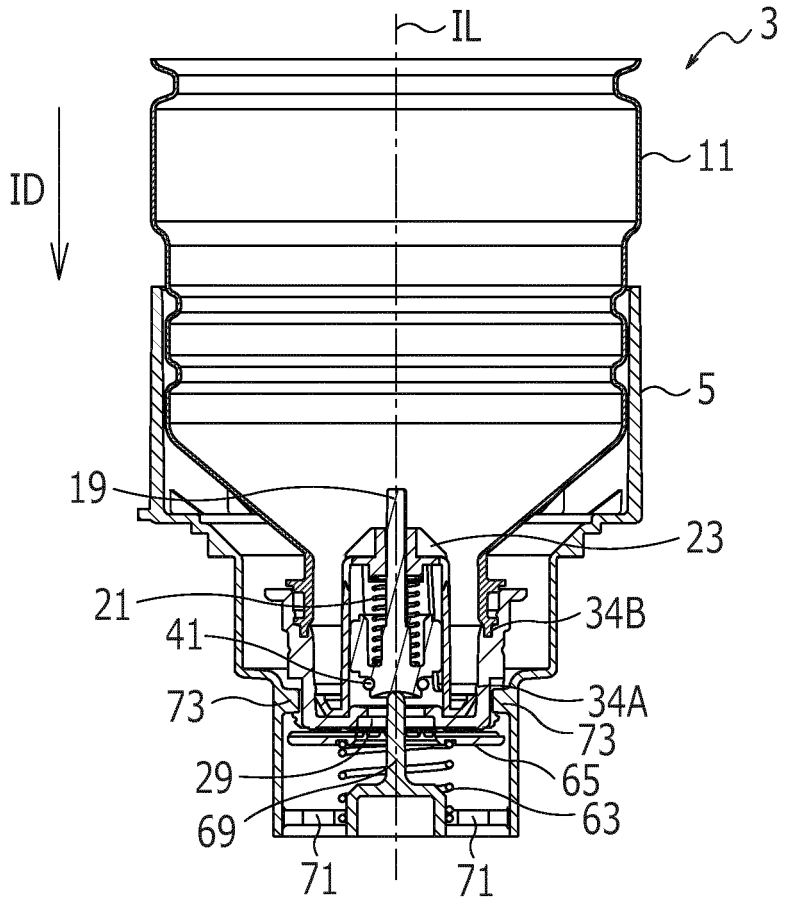


FIG.10B

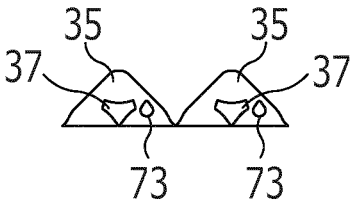


FIG.11A

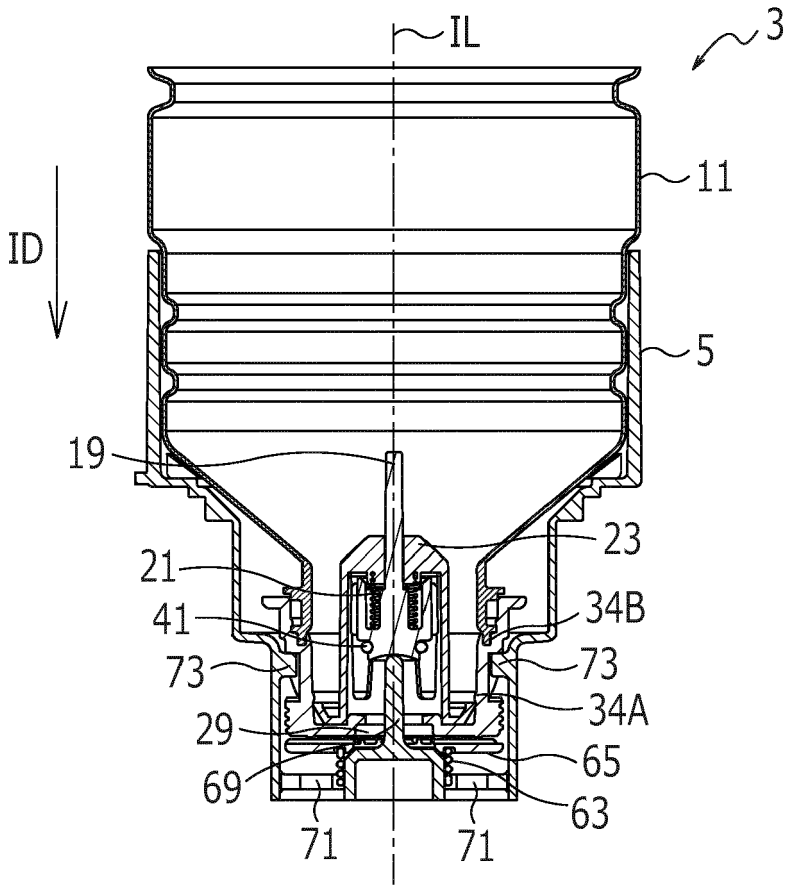


FIG.11B

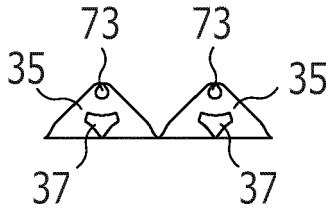


FIG.12A

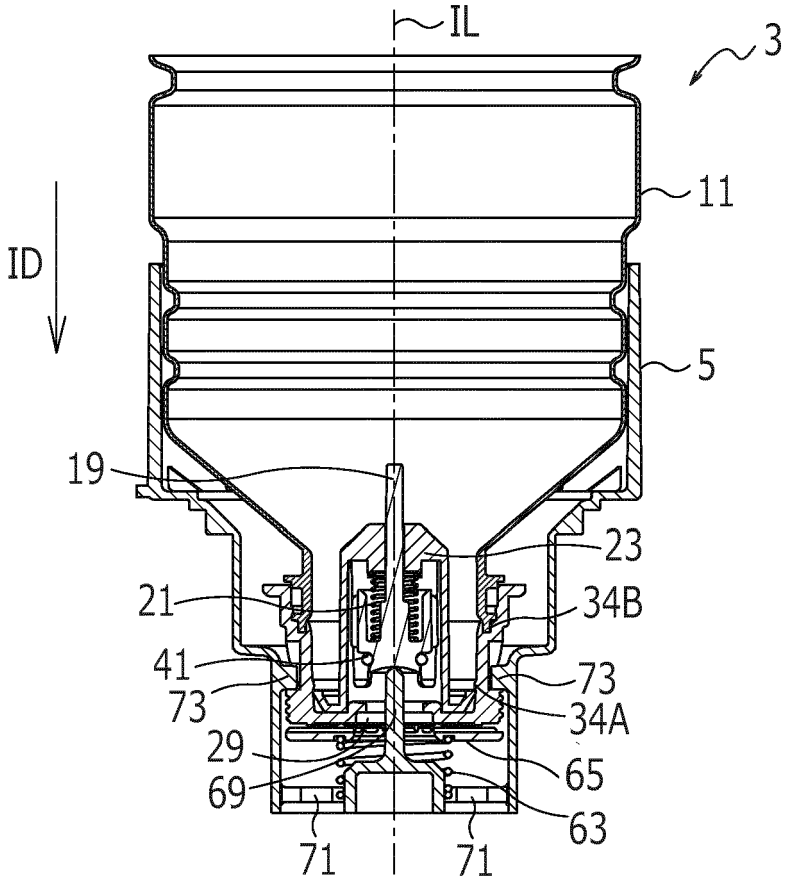


FIG.12B

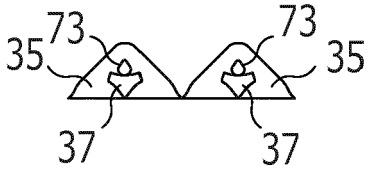
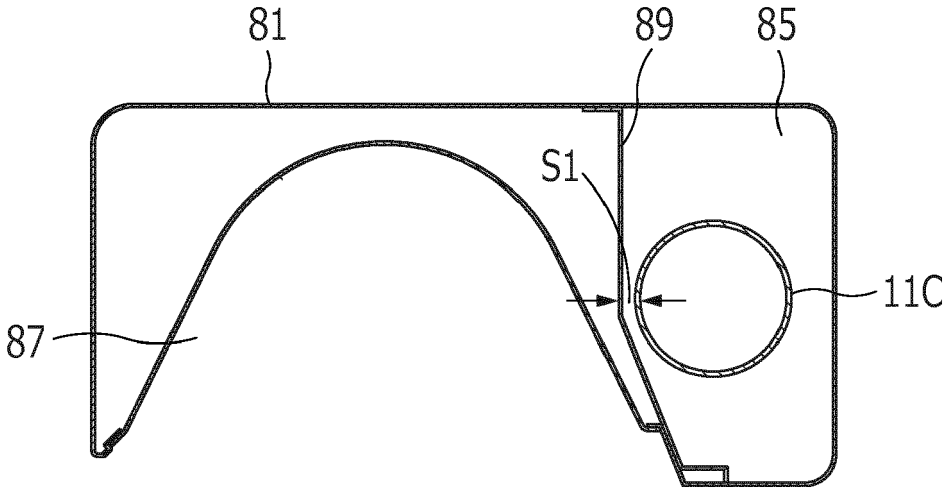


FIG.13



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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 4198

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	JP 2001 147010 A (DAINICHI CO LTD) 29 May 2001 (2001-05-29) * abstract; figure 1 *	1-10	INV. F23K5/14 F16L37/28
A	JP H09 269118 A (TOYOTOMI KOGYO CO LTD) 14 October 1997 (1997-10-14) * abstract; figure 1 *	1-10	
A	JP S64 63708 A (MATSUSHITA ELECTRIC IND CO LTD) 9 March 1989 (1989-03-09) * abstract; figure 1 *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)
F23K
F16L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	25 June 2018	Coli, Enrico

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 4198

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25-06-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2001147010 A	29-05-2001	NONE	
JP H09269118 A	14-10-1997	NONE	
JP S6463708 A	09-03-1989	JP H0752007 B2	05-06-1995
		JP S6463708 A	09-03-1989

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