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(54) **Washing machine**

(57) The invention relates to a washing machine (1) comprising: a tub (2), a draining unit (17) fluidly connected to the tub (2) for draining fluid from the tub (2), and a valve (7) arranged between the tub (2) and the draining unit, wherein the valve (7) comprises a valve body (8), a

valve seat and a movable closure element (14) adapted to be releasably engaged with the valve seat to close or open the valve (7), in particular to close or open a valve aperture (13). According to the invention the valve seat comprises a gasket (16) having at least two lips (12a, 12b).

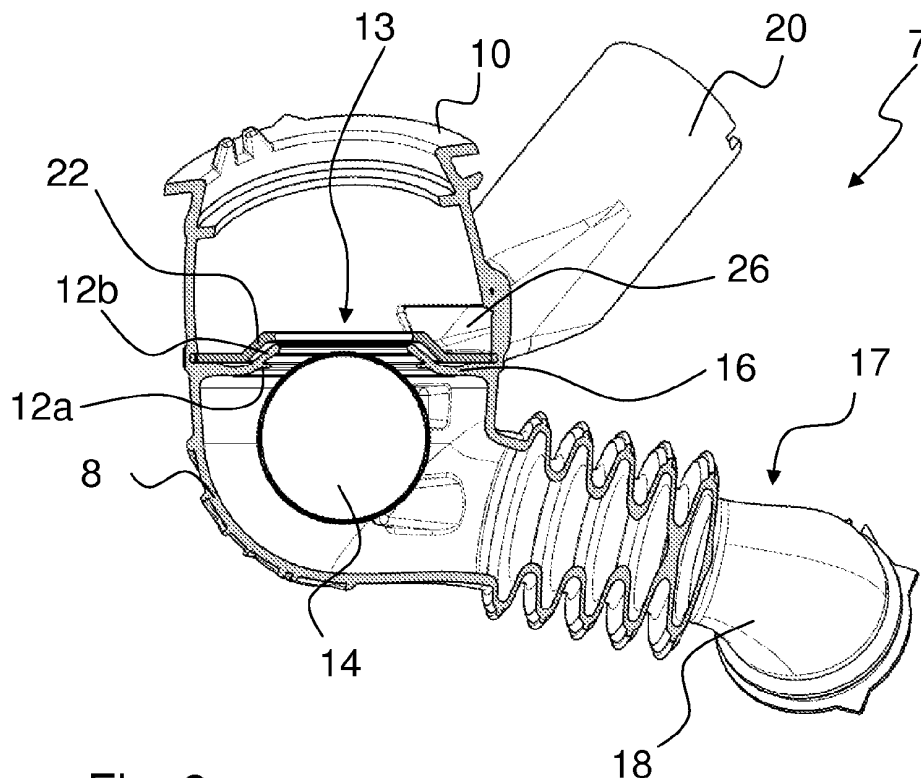


Fig. 2a

Description

[0001] The invention relates to a washing machine having a valve. The expression "washing machine" in this context also comprises a washing machine having dryer function.

[0002] US 3,770,001 B discloses a check valve assembly for a washing machine. A ball valve is arranged between a lower portion of the tub and a draining unit of the washing machine. A valve seat is formed by a pliable resilient seat member with a lip which interacts with an upper tubular member formed of resilient material. When the ball of the valve engages with the lip of the seat member, the tubular member defines a backup seat for engagement with the inwardly extending lip of the seat member to ensure a high pressure seal against backflow of fluid into the tub.

[0003] It is an object of the invention to provide a washing machine comprising an improved valve.

[0004] The invention is defined in claim 1. Particular embodiments are set out in the dependent claims.

[0005] In the following, when reference is made to "water", the term "water" may denote water as such, washing water, washing liquid, washing liquor or the like. Also in the following, when reference is made to "washing machine", the term "washing machine" may denote a front-loading type or a top-loading type washing machine, both having or not having a dryer function.

[0006] According to claim 1, a washing machine comprises a tub, a draining unit fluidly connected to the tub for draining fluid from the tub, and a valve arranged between the tub and the draining unit. The valve comprises a valve body, a valve seat and a movable closure element adapted to be releasably engaged with the valve seat to close or open the valve. For example the valve is adapted to shut off or seal the tub interior from the draining unit during a heating phase in a washing cycle of the washing machine, such that water in the draining unit is not heated. Alternatively or additionally the valve is closed when feeding fresh water into the tub, such that used or dirty water from the draining unit does not reenter the tub during a washing or rinsing phase. advantageously, the valve seat comprises a gasket having at least two lips. I.e. the valve seat is formed by a gasket having at least two sealing lips. Thus only one gasket is preferably provided with the at least two lips, i.e. the gasket is a one-piece construction. In comparison to the valve of US 3,770,001 B, the assembly time for the present valve is reduced due to reduced number of individual parts.

[0007] Preferably at least one lip of the gasket is rigid, stiff, inelastic or inflexible. In other words, at least one lip of the gasket is substantially not deformed when the movable closure element engages or is engaged with the valve seat or the at least one lip. Alternatively or additionally one of the lips (the lip that is first contacted by the movable closure element in the valve closing sequence) is more resilient than the other lip or lips. Thus the at least one rigid and/or less resilient lip provides a

stop element or a stop/end position for the movable closure element. This arrangement prevents that the closure element passes the valve seat or that the closure element enters the valve aperture too far and gets stuck in the valve aperture. This is particularly advantageous when during a washing cycle the closure element is pressed or pushed into the valve seat, e.g. due to pressure (differences) between tub and draining unit. For example when a ball of a ball valve is pushed into its seat or a swing of a swing check valve. Consequently maintenance for the valve is reduced or the valve is maintenance-free.

[0008] According to a preferred embodiment, at least one lip of the gasket is resilient. In other words, at least one lip of the gasket is deformable or is deformed when the movable closure element engages or is engaged with the valve seat. When the valve is closed, the resilient lip abuts or lies against the closure element. In particular the resiliency of at least one lip provides that the lip is deformed or bent such that it abuts tightly or closely against the closure element. Such resiliency is advantageous for example when the surface of the closure element is not perfectly smooth or is not perfectly clean, e.g. due to detergent deposited on the closure element. Further, the at least one resilient lip provides that the valve seat is flexible and can adapt itself to the shape of the closure element. In other words, the shape and surface of the closure element does not have to be exactly matched to the sealing contour of valve seat (in the force-free state) as the resilient lip compensates for possible irregularities or dimensional deviations of the shape or surface of the closure element. For example it is not required for a ball of a ball valve to be a perfect sphere to provide in any angular or rotated position a perfect seal with the valve seat. As less requirements are made with respect to the shape or surface of the closure element, e.g. a ball, the production of the closure element is less time-consuming and less expensive, while at the same time the at least one resilient lip provides an improved water tightness of the valve.

[0009] Preferably at least a portion or a border or rim area of the gasket is resilient, in particular at least a portion of the gasket adjacent to the valve body is resilient. In other words, the gasket is basically formed as a diaphragm or plate with the valve aperture or valve seat arranged therein. A border area or rim of the gasket is attached to the valve housing and supports the portion of the gasket adjacent to the valve seat or aperture, i.e. supports the at least two lips. Thus when a closure element abuts against the valve seat, the border of the gasket gives in to the pressure and is (slightly) deformed (additionally to an optional resilient lip). Thereby the gasket provides additional resiliency or elasticity for the valve, in particular for the valve seat, to hold the closure element, which provides an improved water tightness of the valve.

[0010] According to an embodiment the at least two lips are arranged in a staggered or stepped way. Thereby

the valve aperture or valve seat is adapted to a shape or form of the movable closure element, e.g. a ball, such that a close contact of the at least two lips with the movable closure element is provided. For example, when considering a spherical closure element like a ball, a diameter or cross-section of the valve aperture is successively or stepwise increased as seen from the tub side. In other words, when seen from downstream the valve seat, the diameter or cross section of the valve aperture is successively decreased. Thus the shape of the aperture is matched to the shape of the closure element to provide an improved water tightness.

[0011] Preferably the valve, valve seat or gasket comprises at least two sealing planes or sealing lines or contours. When the valve is closed, the movable closure element is engaged with or contacts each of the at least two lips. Preferably the sealing contours or lines of the lips are spaced apart from each other. For example the contours or lines are spaced by a gap. This means that preferably the lips are spaced from each other by a gap between the lips along a path of closure movement of the moveable closure element.

[0012] Preferably the valve body and the valve seat are integrally formed, i.e. they are formed in one-piece. Thus the valve body and the gasket with the at least two lips are formed in one piece, which reduces the number of elements to be assembled substantially and thus reduces the assembly time for the valve. In addition, the fact that the valve body and the gasket with at least two lips are preferably formed in one piece increases the, watertightness of the assembly. In case of different resiliency of the two or at least two of the lips, a two-component injection cast or injection mold can be used in which at least two mold components having different resiliency characteristics are used for the at least two lips. Alternatively or additionally, at least two of the lips have different material thickness and provide different mechanical elasticity in this manner.

[0013] According to an advantageous embodiment, the valve comprises at least one stop element arranged upstream and/or downstream the valve seat. The stop element provides a predetermined end or stop position for the closure element which is defined by the position of the stop element. E.g. the upstream stop element prevents that the movable closure element passes the valve aperture or allows the moveable closure element to enter the valve aperture only up to the predetermined end position, such that the closure element does not become stuck in the valve aperture or valve seat. Preferably at least one of the lips is the upstream stop element or provides an end stop position for the closure element.

[0014] In an advantageous embodiment the valve body is formed by the sump container or a portion thereof or by a portion of a draining suction duct connecting the tub to a draining pump. Thus the number of elements for providing the valve is reduced as compared to a valve having a separate body.

[0015] Preferably the valve is closed and opened in

dependency of a water level and/or a pressure difference between the tub and the valve body. Thus the valve may be adapted to be self-actuated in dependency of a water level, advantageously by a closure element which is floating in or on the water. E.g. the closure element floats on the water that fills the draining unit or a sump and is eventually pressed towards the valve seat by the rising water level, i.e. by buoyant force, and seals thereby a valve opening in the valve seat. Thereby the tub is shut off from the draining unit, wherein a simple and robust valve is provided which is maintenance-free or substantially maintenance-free. Alternatively the movable closure element is for example spring-loaded to keep it shut, wherein e.g. the suction force during a draining cycle opens the valve. E.g. the valve is a check valve, in particular a ball check valve, a lift check valve or a swing check valve.

[0016] Preferably the movable closure element has a spherical or substantially spherical shape, such that it engages with the valve seat in any (rotated) position. This is advantageous when the closure element is freely floating within the sump or draining unit. For example the diameter of the movable closure element may be between 1.2 to 1.7 times the diameter of the valve aperture, preferably between 1.3 to 1.5 times, more preferably at least 1.4 times the diameter of the valve aperture. Alternatively the closure element is formed by a hinged flap, e.g. like in a swing check valve, which is closed by buoyant force and water pressure.

[0017] According to an advantageous embodiment of the invention, a recirculation circuit is fluidly connected to a lower portion of the tub for recirculating fluid from the lower portion of the tub into the tub. For example an inlet to the recirculation circuit is positioned downstream the valve seat. Alternatively or additionally the valve body may have further ports for fluid connection, for example an opening in fluid connection to a duct which itself is connected for example to a pressure sensor for detecting the water level in the tub. Thus the valve body acts as a manifold for fluidly connecting a plurality of elements and functional components of the washing machine.

[0018] For the embodiments of the washing machine each isolated feature of the claims or description can be added or any arbitrary combination of isolated or individual features can be added to or provided in the claims.

[0019] Reference is made in detail to preferred embodiments of the invention, examples of which are illustrated in the accompanying figures, which show:

- 50 Fig. 1 a perspective view of a part of an exemplary internal structure of a washing machine comprising a ball valve according to a first embodiment,
- 55 Figs. 2a, 2b a perspective, partially cross-sectional side view of the ball valve of Fig. 1 in an opened and a closed position, and

Figs. 3a, 3b a perspective, partially cross-sectional side view of a ball valve according to a second embodiment in an opened and closed position.

[0020] Fig. 1 depicts a part of an exemplary internal structure of a top-loading washing machine 1 in a perspective view (for more clarity, the housing of the washing machine has not been represented). A drum 4 is rotatably or rotatable supported in a tub 2, wherein the inside of the drum 4 is accessible via an opening in the tub 2 and a lid 6 in the drum 4. A valve 7, preferably a valve body 8 thereof, is attached or connected to a lower portion of the tub 2, preferably via a flange portion 10. A draining unit 17 of the washing machine 1 advantageously comprises a draining suction pipe 18, a draining pump (not shown) and a drain filter housing 24 upstream the draining pump. The draining suction pipe 18 is located downstream the valve 7 and advantageously leads to the drain filter housing 24 of the draining unit 17. The draining pump is advantageously arranged downstream the valve 7 and the drain filter housing 24, and is adapted to pump water out of the tub 2 during a draining phase of a washing cycle. Preferably, a duct 20 is attached to the valve 7 and is connected to or leads to a pressure control (e.g. a pressostat; not shown) for detecting the water level in the tub 2 of the washing machine 1.

[0021] Fig. 2a shows a perspective, partially cross-sectional side view of the valve 7 of Fig. 1 in an opened position. The valve 7 advantageously comprises a gasket 16 having two lips 12a, 12b which form the valve seat of the valve 7.

[0022] Advantageously the lips 12a and 12b and the gasket 16 are made in a single-piece construction (i.e. they are made in a single body).

[0023] The gasket 16 is advantageously attached to the lower rim of an extension of the tub 2 which extends at the bottom of the tub 2. The valve body 8, receiving a closure element 14, e.g. a valve ball, is preferably attached to the tub extension at the gasket 16. The valve body 8 may advantageously also be considered as forming part of the draining unit 17, preferably being a portion of the draining suction pipe 18, wherein the body 8 and pipe 18 may be preferably integrally formed as one piece. The draining suction pipe 18 has preferably a section formed as a bellow, which serves for dampening vibrations of the tub 2 from being transferred to the draining pump. Preferably, but not necessarily, an opening 26 in the valve body 8 fluidly connects the interior of the valve body 8 to the duct 20. As outlined above, the duct 20 is advantageously connected to a pressure control for detecting the water level in the tub 2.

[0024] The closure element 14 (e.g. a ball) is a movable closure element adapted to engage with the two lips 12a, 12b to close the valve 7, in particular to close the valve aperture 13. The closure element 14 is preferably made of floatable material, e.g. plastic, and floats on the water while rising and descending in dependency of the water

level in the valve body 8. When the water level rises, the closure element 14 is raised towards the valve seat until the closure element surface closes the aperture 13 at the valve seat (Fig. 2b). In the depicted embodiment the draining suction pipe 18 is advantageously pipe-shaped and forms (at least part of) the sump and the valve body 8 connected to the lowest point of the tub 2. However in other embodiments the draining suction pipe 18 may have different shapes, at least in the region directly below the opening to the tub 2. Both lips 12a, 12b extend into the valve body 8 or towards the aperture 13. Further, the lower lip 12a is advantageously more flexible or less rigid than the upper lip 12b; preferably, the lower lip 12a is resilient or elastic, while the upper lip 12b is rigid or inflexible.

[0025] The valve 7 preferably further comprises a stop element 22 to prevent the closure element 14 to pass the aperture 13 or to provide an end position for the closure element 14.

[0026] When the closure element 14 moves, preferably vertically or substantially vertically, towards the aperture 13 or valve seat, the closure element first contacts the lower more resilient lip 12a. The lip 12a is deformed to closely abut or lie against the surface of the closure element 14. When the water level further rises, the closure element 14 abuts against the upper rigid lip 12b as depicted in Fig. 2b which prevents that the closure element 14 is pushed or pressed further up or into the aperture 13. Thus the second lip 12b prevents that the closure element 14 gets stuck in the valve seat or gasket 16. In case the closure element 14 is pushed with higher pressure force against the valve seat, i.e. against the lips 12a, 12b, the stop element 22 provides (if present) that the closure element 14 does not become stuck in the aperture 13.

[0027] Fig. 3a shows a perspective, partially cross-sectional side view of a ball valve 7' according to a second embodiment in an opened position. Elements or features which functionally and/or structurally correspond to the first embodiment are denoted with the same reference numerals. In addition to the features described above, the second embodiment of the valve 7' advantageously comprises an inlet 28 of a recirculation circuit (not shown), which is attached to the valve body 8' downstream the valve seat or gasket 16. The recirculation circuit is adapted to recirculate water from a lower portion of the tub 2 back into the tub 2 and onto laundry in the tub 2 / drum 4. Thus the amount of water required to thoroughly wet laundry within the drum 4 is reduced. Further, the valve may advantageously comprise a filter element 30 arranged upstream the recirculation inlet 28 to prevent foreign objects to enter the recirculation circuit.

[0028] As described above with respect to Figs. 2a and 2b the closure element 14 engages with the valve seat, i.e. with the lips 12a, 12b of the gasket 16, e.g. due to a rising water level in the draining unit 17 or valve body 8'. Thus the valve 7' is closed as depicted in Fig. 3b. When the recirculation pump (not shown) and/or the draining

pump is operated during a washing operation, the ball is at least partially opened, such that water from the tub is recirculated back into the tub 2 or is transported to the outside of the washing machine via the draining unit 17. Alternatively the inlet of the recirculation circuit is arranged upstream the valve seat, e.g. the recirculation inlet is connected to the tub 2.

Claims

1. Washing machine (1) comprising:

a tub (2),
a draining unit (17) fluidly connected to the tub (2) for draining fluid from the tub (2), and
a valve (7, 7') arranged between the tub (2) and the draining unit (17),
wherein the valve (7, 7') comprises a valve body (8, 8'), a valve seat and a movable closure element (14) adapted to be releasably engaged with the valve seat to close or open the valve (7, 7')

characterized in that

the valve seat comprises a gasket (16) having at least two lips (12a, 12b).

2. Washing machine according to claim 1, wherein said lips (12a, 12b) and said gasket (16) are made in a single-piece construction.

3. Washing machine according to claim 1 or 2, wherein the lip that is first contacted by said movable closure element (14) in the valve closing sequence is more resilient than the other lip.

4. Washing machine according to one or more of the previous claims, wherein at least one lip (12b) is rigid and/or at least one lip (12b) is substantially not deformed when the movable closure element (14) engages or is engaged with the valve seat.

5. Washing machine according to one or more of the previous claims, wherein at least one lip (12a) is resilient and/or at least one lip (12a) is deformable or is deformed when the movable closure element (14) engages or is engaged with the valve seat.

6. Washing machine according to one or more of the previous claims, wherein the valve seat comprises at least two sealing planes or sealing lines of closure and/or the movable closure element (14) is adapted to simultaneously engage with or abut against the at least two lips (12a, 12b) to close the valve.

7. Washing machine according to any of the previous claims, wherein at least a portion of a border area of

the gasket (16) is resilient, in particular a portion of the gasket (16) adjacent to the valve body (8, 8').

8. Washing machine according to any of the previous claims, wherein the at least two lips (12a, 12b) are arranged in a staggered or stepped way and/or wherein a diameter or cross-section of the valve aperture is successively or stepwise increased or decreased as seen from the tub side.

9. Washing machine according to any of the previous claims, wherein the valve body (8, 8') and the gasket (16) are integrally formed.

10. Washing machine according to any of the previous claims, wherein the valve (7, 7') comprises at least one stop element (22) arranged upstream and/or downstream the valve seat to provide a stop position or end position for the movable closure element (14).

11. Washing machine according to any of the previous claims, wherein the valve body (8, 8') is or forms a sump container, a portion of a sump container and/or a portion of a draining duct.

12. Washing machine according to any of the previous claims, wherein the valve (7, 7') is closed and opened in dependency of a water level and/or a pressure difference between the tub (2) and the valve body (8, 8').

13. Washing machine according to any of the previous claims, wherein the movable closure element (14) comprises a spherical or substantially spherical shape and wherein the diameter of the movable closure element is between 1.2 to 1.7 times the diameter of the valve aperture, preferably between 1.3 to 1.5 times, more preferably at least 1.4 times the diameter of the valve aperture.

14. Washing machine according to any of the previous claims, wherein the valve body (8, 8') comprises an opening (26) fluidly connecting the inner volume of the valve body (8, 8') and/or inner volume of the tub (2) to a pressure sensor, wherein the opening is arranged above or below the valve seat.

15. Washing machine according to any of the previous claims, comprising a recirculation circuit fluidly connected to a lower portion of the tub (2) for fluid recirculation from the lower portion of the tub into the tub, wherein an inlet (28) of the recirculation circuit is positioned downstream or upstream the valve seat.

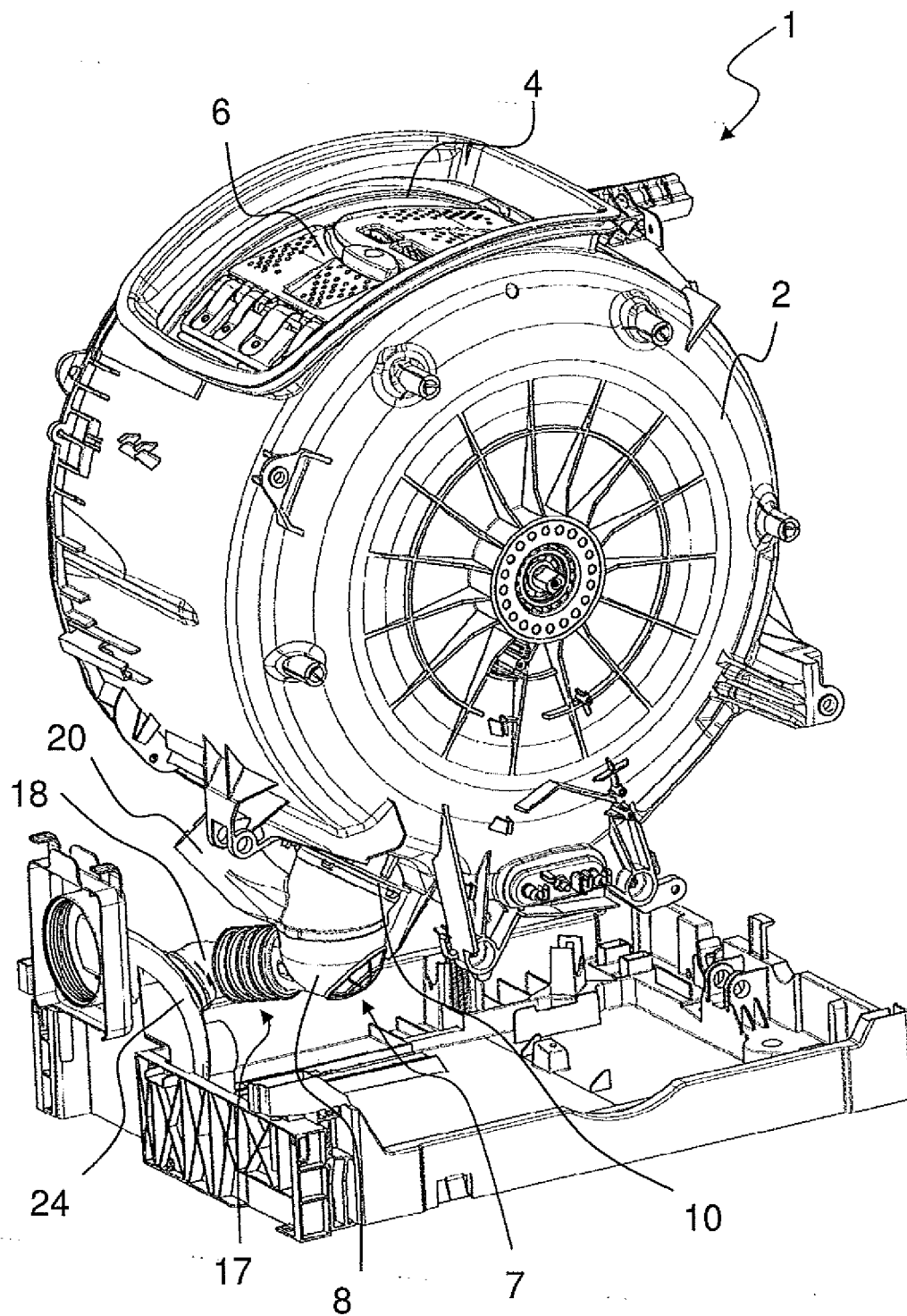


Fig. 1

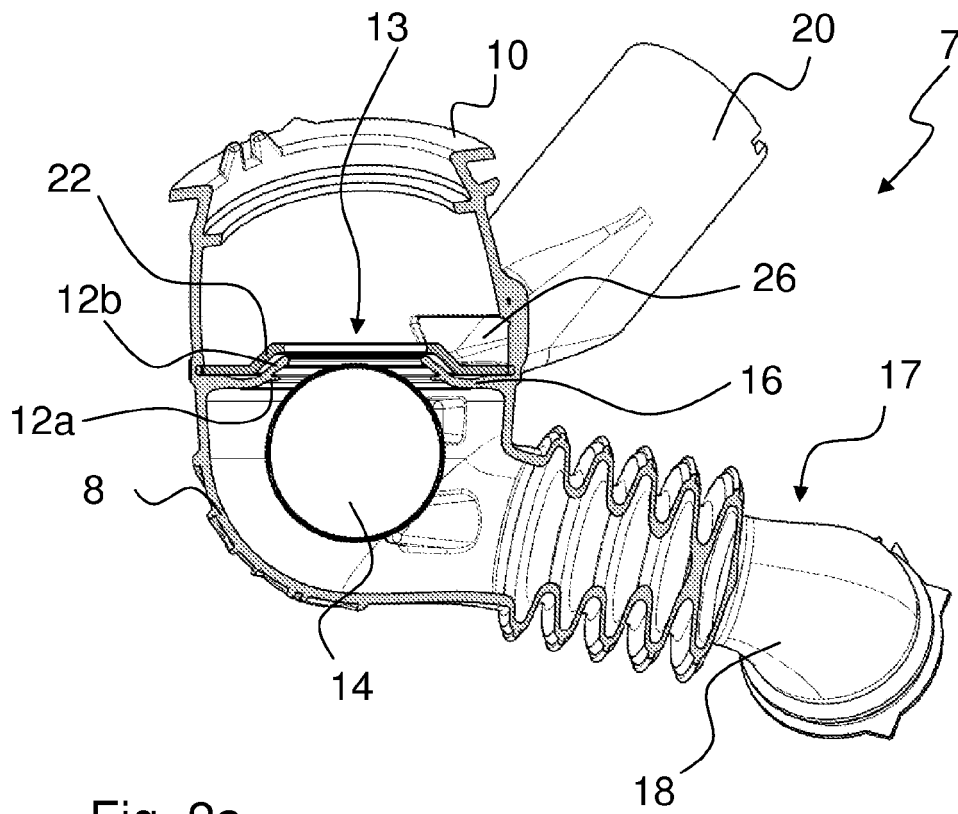


Fig. 2a

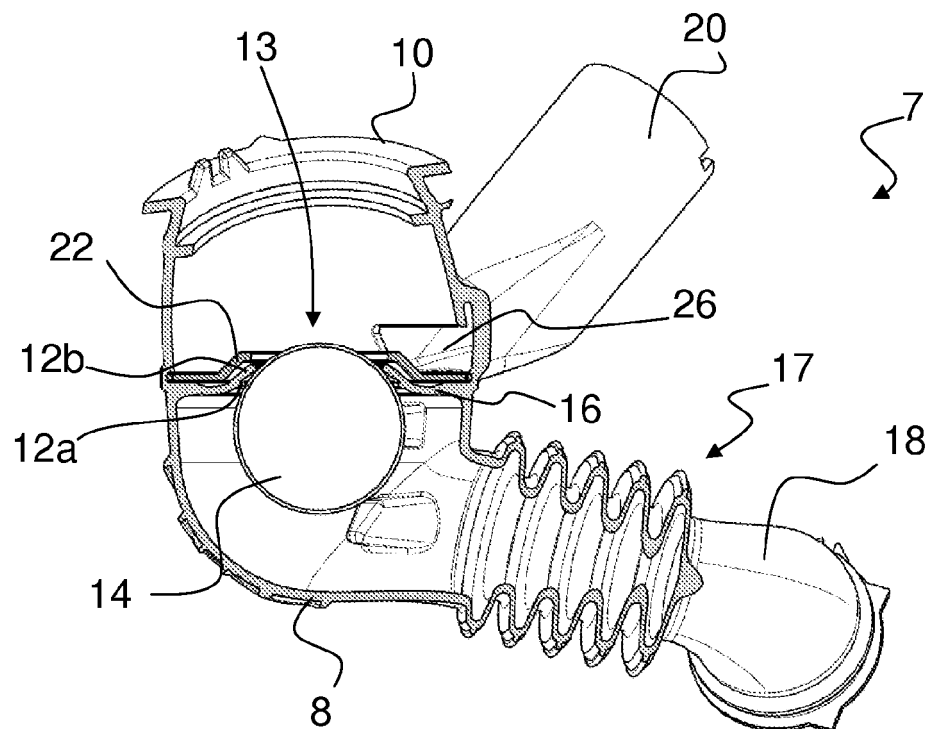


Fig. 2b

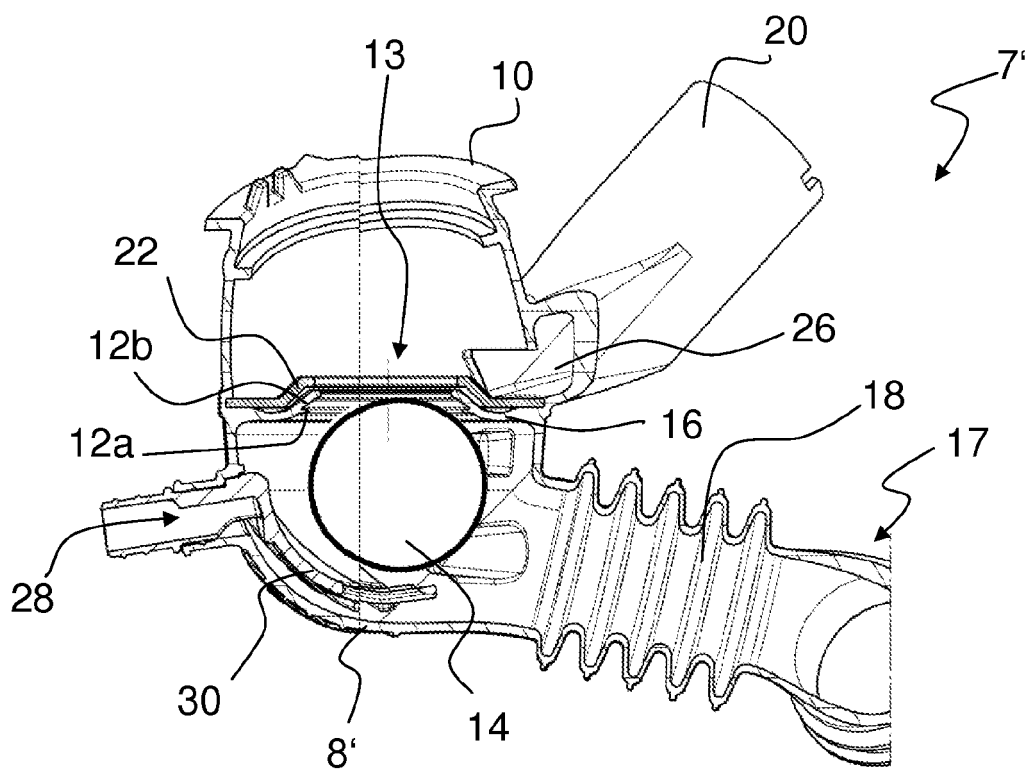


Fig. 3a

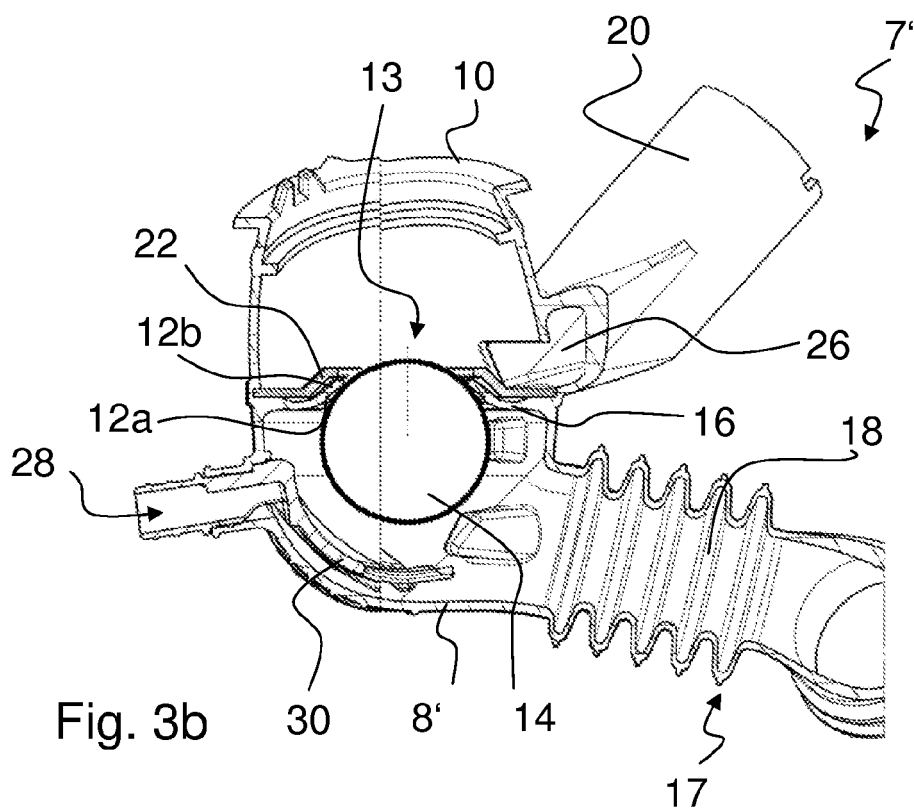


Fig. 3b



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 2060

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 27 May 2011	Examiner Kising, Axel
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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27-05-2011

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