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(54) **Household laundry washing and drying machine**

(57) Laundry washing and drying machine (1) comprising: an outer casing (2); a hollow washing tub (3) suspended in floating manner inside said casing (2); a hot air duct (7) attached onto said washing tub (3) and com-

prising a tubular body (12) structured for being crossed by an airflow. The hot air duct (7) is provided with at least one elastic protrusion/projection (23b) protruding from the tubular body (12) in such a way to locally protect the tubular body (12) from the bumps.

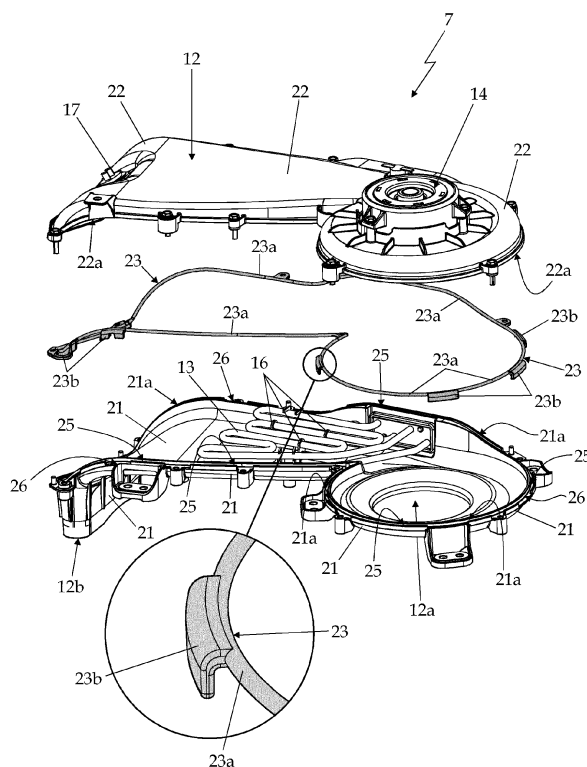


Fig. 3

Description

[0001] The present invention relates to a household laundry washing and drying machine.

[0002] As is known, today's front-loading laundry washing and drying machines generally comprise: a substantially parallelepiped-shaped outer boxlike casing structured for resting on the floor; a substantially bell-shaped washing tub which is generally suspended in floating manner inside the casing via a number of coil springs and shock-absorbers, with the front opening/mouth directly facing a laundry loading/unloading pass-through opening provided in the front wall of the casing; a substantially cylindrical elastically-deformable bellows which connects in watertight manner the front mouth/opening of the bell-shaped washing tub to the laundry loading/unloading opening on front wall of the casing; and a porthole door which is hinged to the front wall of the casing to rotate to and from a closing position in which the door rests on the front face of the casing to close the laundry loading/unloading on the front wall and substantially watertight seal the washing tub.

[0003] The front-loading laundry washing and drying machines of the above type furthermore comprise: a substantially bell-shaped, cylindrical revolving drum which is structured for housing the laundry to be washed and/or dried, and is housed in axially rotating manner inside the washing tub for rotating about its longitudinal reference axis; an electric motor assembly which is located outside of the washing tub, and is structured for driving into rotation the revolving drum about its longitudinal reference axis inside the washing tub; and a, preferably closed-circuit, air duct assembly which is structured to circulate inside the washing tub a stream of hot air having a low moisture content, and which flows through the revolving drum and over the laundry inside the drum to dry the laundry.

[0004] The air duct assembly is structured for gradually drawing air from the washing tub; cooling down the air arriving from the washing tub so to extract and retain the surplus moisture in the air; heating the dehumidified air to a predetermined temperature, normally higher than the temperature of the air arriving from the washing tub; and feeding the heated, dehumidified air back into the washing tub, where it flows over the laundry stored inside the revolving drum to rapidly dry the laundry.

[0005] In several models of known front-loading laundry washing and drying machines, the cooling down and dehumidification of the air drawn from the washing tub is performed inside a cold-water condenser which is attached/ integrated to/on the back of the washing tub, obviously inside the boxlike casing, and which uses the cold tap water of the water mains as refrigerant.

[0006] In some known front-loading laundry washing and drying machines the heating up of the dehumidified air coming out of the cold-water condenser is performed inside an hot air duct which is rigidly attached to the top of the washing tub so as to have a first end in direct

communication with the cold-water condenser and a second end in direct communication with the washing tub close to the front mouth of the latter, and which internally houses the electric centrifugal fan that circulates the air across the washing tub and the resistor that heats up the dehumidified air directed back into the washing tub.

[0007] For example WO2010/100114 discloses a hot air duct of the type referred above.

[0008] Since in above described known washing and drying machines the washing tub (and therefore the hot air duct rigidly attached to the latter) is suspended in floating manner inside the boxlike casing, and it shakes/jerks very hardly inside the casing, in particular at the beginning of the spinning phase of the washing cycle, there is the risk that the hot air duct violently bumps (collides, impacts) against the hard walls of the casing, which may damage both the hot air duct and the casing. In order to partially solve this problem, some known washing and drying machines are provided with several shock-absorbing pads conveniently attached on the lateral walls of the casing to prevent the hot air duct from violently bumping against the hard walls of the casing.

[0009] However the assembly of these pads to the casing is cumbersome and moreover they are quite costly. Moreover it is not certain that the hot air duct collides exactly in correspondence of the pads, and therefore, in order to increase the probability that during the shaking of the tub the hot air duct bumps (collides, impacts) against a pad, and not directly on the casing, the number of shock-absorbing pads has to be quite high, and their positioning as to be very precise, which increases the production costs of the washing and drying machine.

[0010] Aim of the present invention is to ensure that the hot air duct of a washing and drying machine is not damaged because of the shaking of the tub to which the hot air duct is attached, without increasing the complexity and the production costs of the machine.

[0011] Another object of the present inventions is simplifying and speeding up the assembly of the washing and drying machine.

[0012] Applicant has found that by using a an hot air duct comprising a tubular body structured for being crossed by an airflow, and provided with at least one elastic protrusion/projection protruding from the tubular body in such a way to locally protect the latter from the bumps, it is possibly to protect the hot air duct from the bumps, in particular against the casing of the machine, in an easy but effective way, and without increasing the complexity and the production costs of the machine.

[0013] In particular, being the elastic protrusion/projection provided directly on the tubular body, the latter is effectively protected from bumps (or shocks), without the need of providing shock-absorbing pads attached on the lateral walls of the casing.

[0014] In particular, the above-mentioned aim and objects, as well as others that will become better apparent hereinafter, are achieved by a laundry washing and drying machine comprising: an outer casing; a hollow wash-

ing tub suspended in floating manner inside the casing; a hot air duct attached onto the washing tub and comprising a tubular body structured for being crossed by an airflow, and an air-heating device. The hot air duct is provided with at least one elastic protrusion/projection protruding from the tubular body in such a way to locally protect the tubular body from the bumps (or shocks).

[0015] Preferably, the tubular body comprises at least two hemi-shells, reciprocally coupled to compose/form the tubular body, and an intermediate sealing gasket interposed between the at least two hemi-shells to seal the hemi-shells one another; the intermediate sealing gasket comprises a main body interposed between the two or more hemi-shells when the hemi-shells are coupled one another. The intermediate sealing gasket comprises the at least one elastic protrusion/projection protruding from the main body and from the tubular body in such a way to locally protect the tubular body from the bumps.

[0016] Preferably the main body of the intermediate sealing gasket is made of an elastomeric material.

[0017] Advantageously at least one protrusion/projection of the intermediate sealing gasket is made of the same material of the main body.

[0018] Preferably the peripheral edge of at least one of the hemi-shells is provided with a longitudinal groove or seat, and the main body of the sealing gasket is shaped/dimensioned so as to be at least partly recessed into the longitudinal groove or seat. In this embodiment the groove or seat is preferably provided, in correspondence of one or more of the protrusion/projections, with a slot through which the respective protrusion/projections can protrude externally from the groove or seat, and therefore from the tubular body.

[0019] Advantageously the protrusion/projection of the intermediate sealing gasket is substantially L-shaped so as to bend sideways, when out of the tubular body, and extends locally substantially tangent or close to the outer surface of the tubular body, so as to form a corresponding outer shock-absorbing pad onto the outer surface of tubular body.

[0020] In an advantageous embodiment the main body of the intermediate sealing gasket is substantially annular in shape.

[0021] In another advantageous embodiment the main body of the intermediate sealing gasket is open in shape.

[0022] In an advantageous embodiment a plurality of protrusions/projections is spaced along the main body.

[0023] In another advantageous embodiment, the at least one protrusion/projection is over-molded on the external surface of the tubular body.

[0024] Preferably at least one protrusion/projection is arranged in such a way that it is positioned between the tubular body and the outer casing, so as to locally protect the tubular body from the bumps against the outer casing, and vice versa.

[0025] A non-limiting embodiment of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view, with parts removed for clarity, of a front-loading laundry washing and drying machine in accordance with the teachings of the present invention;
- Figure 2 is an enlarged perspective view, with parts removed for clarity, of the hot air duct of the laundry washing and drying machine of Figure 1; whereas
- Figure 3 is a partly exploded perspective view, with parts removed for clarity, of the hot air duct of Figure 2.

[0026] It is underlined that in the enclosed figures there is illustrated a front-loading washing and drying machine; however it is clear that the present invention can be applied as well to a top-loading washing and drying machine.

[0027] With reference to Figure 1, reference number 1 indicates as a whole a laundry washing and drying machine 1 that comprises:

- a preferably, though not necessarily, substantially parallelepiped-shaped outer boxlike casing 2 which is preferably structured for resting on the floor;
- a preferably, though not necessarily, substantially cylindrical, bell-shaped, hollow washing tub 3 which is suspended in floating manner inside the casing 2 with its front opening or mouth directly facing a laundry loading/unloading pass-through opening provided in the front wall 2a of the boxlike casing 2; and
- a substantially cylindrical, bell-shaped revolving drum (not shown) which is structured for housing the laundry to be washed, and is housed in axially rotating manner inside the washing tub 3 so as to be able to freely rotate about its longitudinal reference axis (L in figure 1).

[0028] In the example shown, washing tub 3 is advantageously suspended in floating manner inside casing 2 via a suspension system preferably comprising a number of coil springs (not shown) and vibration dampers (not shown); and the front opening/mouth of washing tub 3 is preferably connected in watertight manner to the laundry loading/unloading opening on front wall 2a via a substantially cylindrical, elastically-deformable bellows (not shown).

[0029] The revolving drum is preferably arranged inside washing tub 3 so that the drum front opening is directly faced/aligned to the laundry loading/unloading opening on front wall 2a, and so that the rotation axis of the drum is preferably locally substantially coincident with the substantially horizontally-oriented, longitudinal reference axis L of washing tub 3.

[0030] With reference to Figure 1, the front-loading laundry washing and drying machine 1 preferably furthermore comprises:

- a porthole door 4 which is preferably hinged to the front wall 2a of casing 2 to rotate about a preferably,

though non necessarily, vertically-oriented reference axis to and from a closing position in which the peripheral border of the porthole door 4 rests completely on front wall 2a for closing the laundry loading/unloading opening and watertight sealing the washing tub 3;

- an electric motor assembly (not shown) which is structured for driving into rotation the revolving drum about its longitudinal reference axis L inside the washing tub 3; and
- a water and detergent supplying assembly (not shown) which is structured for selectively feeding into the washing tub 3, according to the selected washing cycle, a given amount of detergent, softener and/or other washing agent suitably mixed with the fresh water arriving from the water mains, or simply a given amount of fresh water arriving from the water mains.

[0031] The laundry washing machine 1 is provided with a, preferably closed-circuit, air duct assembly 5 which is structured to circulate inside the washing tub 3 a stream of hot air having a low moisture content, and which flows through the revolving drum and over the laundry located inside the drum to rapidly dry the laundry.

[0032] The air duct assembly 5 is structured for:

gradually drawing air from washing tub 3;
cooling down the air arriving from washing tub 3 so to extract and retain the surplus moisture in the air;
heating the dehumidified air to a predetermined temperature preferably higher than that of the air arriving from washing tub 3;
feeding the heated, dehumidified air back into the washing tub 3, where it flows over the laundry stored inside the revolving drum to rapidly dry the laundry.

[0033] With reference to Figures 1, 2 and 3, the air duct assembly 5 is housed inside the boxlike casing 2 and advantageously comprises:

- an air cooling device 6 which is preferably attached to the back of washing tub 3, is fluidly connected to washing tub 3 preferably on the bottom of the latter, and is structured to cool down the air arriving from washing tub 3 so to extract the surplus moisture in the air drawn from washing tub 3; and
- an air heating device 7 which is rigidly attached to the washing tub 3, is fluidly connected to both the washing tub 3 and the air cooling device 6 to allow the dehumidified air to flow from the air cooling device 6 to the washing tub 3, and is structured to heat up the dehumidified air arriving from the air cooling device 6 before this air returns back into washing tub 3.

[0034] In the example shown, the air cooling device 6 preferably comprises a cold-water condenser which is

attached/integrated to/on the back of washing tub 3, and which uses a rain/shower of cold water arriving from the water mains to cool down the moist air that arrives from washing tub 3 and flows upwards on the back of washing tub 3 up to the top of the latter.

[0035] With reference to Figures 1, 2 and 3, the air heating device 7 advantageously comprises a hot air duct 7 which is rigidly attached preferably to the top of washing tub 3, and preferably comprises one or more of the following components:

- a tubular outer body 12 which is structured for being firmly fixed to washing tub 3, preferably on the top of the latter, preferably with a first opening or mouth 12a fluidly connected to, i.e. in direct communication with, the air cooling device 6, and preferably with a second opening or mouth 12b fluidly connected to, i.e. in direct communication with, the inside of the bellows (not shown) connecting the washing tub 3 to the laundry loading/unloading opening on front wall 2a of casing 2, or directly with the inside of washing tub 3, preferably close to the front opening of washing tub 3;
- an air-heating device 13, for example a resistor, which is housed inside tubular body 12, and is structured to heat up, when electrically powered, the air that flows across tubular body 12;
- an electric centrifugal fan 14 or other air-pumping device which is preferably housed inside tubular body 12, preferably upstream of air-heating device 13, and is structured to circulate across tubular body 12 an airflow that subsequently flows across the washing tub 3 and the air cooling device 6 for finally returning back to tubular body 12.

[0036] In the example shown, the air-heating device 13 is preferably rigidly fixed in a suspended manner to a mid section of tubular body 12 via a metal supporting bracket 16 which in turn rests, and is rigidly fixed to, the inner surface of tubular body 12.

[0037] Centrifugal fan 14, is preferably recessed on a portion of tubular body 12 suitably shaped to form the outer volute or impeller housing of centrifugal fan 14.

[0038] Preferably, though not necessarily, the hot air duct 7 furthermore comprises one or more temperature sensors 17 which are located inside, or faced to the inside of, tubular body 12 and are structured for measuring the temperature of the air flowing inside tubular body 12, preferably close to the second opening or mouth 12b of the tubular body 12.

[0039] With reference to Figures 2 and 3, tubular body 12 preferably, but not necessarily, comprises at least two complementary hemi-shells 21 and 22 having their peripheral edges 21a and 22a structured for being reciprocally coupled to compose/form the tubular body 12, and an intermediate sealing gasket 23 which is structured for being interposed between the peripheral edges 21a and 22a of hemi-shells 21 and 22 to seal in substantially air-

tight manner the hemi-shells 21 and 22 to one another.

[0040] At least one of the hemi-shells 21, 22 is furthermore preferably structured for being rigidly fixed to the washing tub 3.

[0041] The intermediate sealing gasket 23 comprises a flexible main body 23a, preferably substantially cable-shaped, which is made of an elastomeric material and is bended/profiled so as to match with the shape of the peripheral edges 21a and 22a of hemi-shells 21 and 22, so to be interposed between and compressed by the peripheral edges 21a, 22a of the two hemi-shells 21 and 22 when the hemi-shells 21 and 22 are coupled to one another. In the example shown, the cross-section of the cable-shaped main body 23a is preferably substantially circular in shape.

[0042] Advantageously the main body 23a of the sealing gasket 23 can be closed (i.e. having a closed/annular perimeter or profile), as in the embodiment illustrated in enclosed figures, such that it forms a sealing ring; in another embodiment, not illustrated, the main body 23a of the sealing gasket 23 can be open (i.e. having an open perimeter or profile).

[0043] With reference to Figures 2 and 3, the intermediate sealing gasket 23 is furthermore provided with one or more elastic protrusions (or projections) 23b which are conveniently spaced along the main body 23a, and each of which is made of an elastic material and protrudes from the main body 23a so as to jut out of the tubular body 12.

[0044] In another advantageous embodiment, not illustrated, one or more elastic protrusions (or projections) may be fixed to the tubular body 12 in other possible ways, for example they may be over-molded (over-injected) on the external surface of the tubular body 12, so as to locally protect the tubular body 12 from the bumps (collisions, impacts); in this advantageous embodiment the tubular body 12 may comprise the above described hemi shells and gasket (with or without further elastic protrusions or projections projecting from the gasket), or not (i.e. the tubular body may have a different structure).

[0045] In the example shown, each protrusion (or projection) is preferably, though not necessarily, made of the same elastomeric material of the cable-shaped main body 23a.

[0046] Advantageously the one or more protrusions/projections 23b are arranged in such a way that they are positioned between the tubular body 12 and the outer casing 2, so as to locally protect the tubular body 12 from the bumps (collisions, impacts) against the outer casing 2 (and clearly also to locally protect the outer casing 2 from the bumps of the tubular body 12).

[0047] With reference to Figure 3, in the example shown, the peripheral edge 21a, 22a of at least one of the two hemi-shells 21 and 22 (both hemi-shells in the example shown) is furthermore preferably provided with a longitudinal groove (or seat) 25, and the cable-shaped main body 23a of gasket 23 is preferably shaped/dimensioned so as to be at least partly recessed inside the

longitudinal groove/seat 25 and preferably also compressed/ deformed so as to substantially fill up the longitudinal groove/seat 25.

[0048] Advantageously in this embodiment each protrusion (or projections) 23b, is shaped to protrude from the cable-shaped main body 23a so as to come out of the longitudinal groove 25 and then jut out of the outer surface of tubular body 12, to form a corresponding outer shock-absorbing protrusion 23b of tubular body 12. In this case the groove or seat 25 is preferably provided, in correspondence of one or more of the protrusion/projections 23b, with a slot 26 through which the protrusion/projections 23b can protrude externally from the groove or seat, and therefore from the tubular body 12. In this case the protrusions /or projections 23b and the corresponding slots 26 provided in the groove/seat may serve, during the assembly of the hot air duct 7, as centering elements for the correct reciprocal positioning of the sealing element and of the tubular body 12, thus also greatly simplifying the assembly of the air duct assembly 5.

[0049] In addition to the above, with reference to Figures 2 and 3, in the example shown the tubular body 12 is preferably composed by a substantially basin-shaped, lower hemi-shell 21 which is structured for being rigidly fixed to the top of the washing tub 3 preferably via a number of anchoring screws 18, and by a substantially lid-shaped, upper hemi-shell 22 which is shaped/dimensioned to rest in abutment on the annular upper rim 21a of hemi-shell 21 to completely close the basin-shaped lower hemi-shell 21.

[0050] The basin-shaped lower hemi-shell 21 is furthermore preferably provided with two coupling collars/manifolds which protrude downwards from the bottom of the hemi-shell 21 and are shaped/dimensioned to fit/couple in substantially airtight manner respectively with the air escape mouth of the air cooling device 6 and with an auxiliary pass-through opening provided either on the cylindrical bellows connecting washing tub 3 to the laundry loading/unloading opening on front wall 2a, or directly on the body of washing tub 3.

[0051] Preferably the substantially basin-shaped, lower hemi-shell 21 is furthermore shaped/dimensioned so to directly house the air-heating device 13, and the metal supporting bracket 16 that supports air-heating device 13 is preferably rigidly fixed to the bottom of the hemi-shell 21, preferably between the two coupling collars/manifolds that protrude downwards from the bottom of hemi-shell 21.

[0052] The substantially lid-shaped, upper hemi-shell 22, is preferably, though not necessarily, structured/shaped to directly support the temperature sensors 17 preferably aligned immediately above the coupling collar/manifold that connects the hemi-shell 21 directly or indirectly to the inside of washing tub 3.

[0053] A first portion of the outer volute of centrifugal fan 14 is furthermore preferably, though not necessarily, provided directly on the substantially basin-shaped, lower hemi-shell 21 locally substantially coaxial to the cou-

pling collar/manifold structured to be fitted/coupled to the air escape mouth of the air cooling device 6, whereas a second complementary portion of the outer volute of centrifugal fan 14 is provided on the lid-shaped upper hemi-shell 22, so that the complete outer volute of centrifugal fan 14 is composed when the upper and lower hemi-shells 21 and 22 are coupled to one another.

[0054] In the example shown, both upper and lower hemi-shells 21 and 22 are preferably made of a metal (preferably aluminum).

[0055] With reference to Figure 3, in the example shown the cable-shaped main body 23a of sealing gasket 23 is preferably substantially annular in shape (i.e. it is a sealing ring); preferably the main body 23a of the sealing gasket 23 is so shaped and arranged to exactly match with the annular upper rim 21a of the lower hemi-shell 21.

[0056] One or more of the protrusions (or projections) 23b of sealing gasket 23 are furthermore preferably substantially L-shaped so as to bend (or curve) sideways, when out of tubular body 12, and extends locally substantially tangent or close to the outer surface of tubular body 12 to form corresponding outer shock-absorbing pads 23b onto the outer surface of tubular body 12.

[0057] In the examples shown, the intermediate sealing gasket 23 is preferably made of an elastomeric plastic material and is made in one piece via an injection molding process.

[0058] General operation of the front-loading laundry washing and drying machine 1 is clearly inferable from the above description, with no further explanation required.

[0059] The advantages connected to the particular structure of the hot air duct according to invention are large in number.

[0060] First of all, being integrally provided with several shock-absorbing protrusions/projections onto the outer surface of tubular body, the hot air duct is effectively protected from the bumps due to the shaking of the tub to which the hot air duct is attached, without increasing the complexity and the production costs of the machine.

[0061] Moreover a plenty of shock-absorbing pads conveniently attached on the lateral walls of the boxlike casing is no more necessary, which greatly simplifying the assembly of the front-loading laundry washing and drying machine.

[0062] Clearly, changes may be made to either the laundry washing and drying machine as described herein without, however, departing from the scope of the present invention.

[0063] In a less sophisticated embodiment of the hot air duct 7, the cable-shaped main body 23a of the intermediate sealing gasket 23 may be bended so as to match with the shape of only a limited section of the peripheral edges 21a, 22a of the hemi-shells 21 and 22, and the one or more protrusions (or projections) 23b protrude from the main body 23a so as to jut out of the longitudinal slit delimited, on the outer surface of tubular body 12, by this limited section of the peripheral edges 21a and 22a of

the two hemi-shells 21 and 22.

Claims

1. Laundry washing and drying machine (1) comprising:

- an outer casing (2),
- a hollow washing tub (3) suspended in floating manner inside said casing (2),
- a hot air duct (7) attached onto said washing tub (3) and comprising a tubular body (12) structured for being crossed by an airflow,

characterized in that

said hot air duct (7) is provided with at least one elastic protrusion/projection (23b) protruding from said tubular body (12) in such a way to locally protect said tubular body (12) from the bumps.

2. Laundry washing and drying machine (1), according to claim 1, wherein said tubular body (12) comprises at least two hemi-shells (21, 22) reciprocally coupled to compose/form said tubular body (12), and an intermediate sealing gasket (23) interposed between said at least two hemi-shells (21, 22) to seal said hemi-shells (21, 22) one another, said intermediate sealing gasket (23) comprising a main body (23a) interposed between said two or more hemi-shells (21, 22) when said hemi-shells (21, 22) are coupled one another, said intermediate sealing gasket (23) comprising said at least one elastic protrusion/projection (23b) protruding from the main body (23a) and from said tubular body (12) in such a way to locally protect said tubular body (12) from the bumps.

3. Laundry washing and drying machine according to Claim 2, wherein the main body (23a) of the intermediate sealing gasket (23) is made of an elastomeric material.

4. Laundry washing and drying machine according to Claim 2 or 3, wherein said at least one protrusion/projection (23b) of the intermediate sealing gasket (23) is made of the same material of the main body (23a).

5. Laundry washing and drying machine according to one or more of claims 2 to 4, wherein the peripheral edge (21a, 22a) of at least one of said hemi-shells (21, 22) is provided with a longitudinal groove or seat (25), and the main body (23a) of the sealing gasket (23) is shaped/dimensioned so as to be at least partly recessed into said longitudinal groove or seat.

6. Laundry washing and drying machine according to claim 5, wherein said groove or seat (25) is provided,

in correspondence of one or more of said protrusion/projections (23b), with a slot (26) through which the respective protrusion/projections (23b) protrude externally from said groove or seat (25), and therefore from said tubular body (12).

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7. Laundry washing and drying machine according to one or more of claims 2 to 6, wherein the protrusion/projection (23b) of the intermediate sealing gasket (23) is substantially L-shaped so as to bend sideways, when out of the tubular body (12), and extends locally substantially tangent or close to the outer surface of the tubular body (12), so as to form a corresponding outer shock-absorbing pad (23b) onto the outer surface of tubular body (12). 10
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8. Laundry washing and drying machine according to one or more of claims 2 to 7, wherein the main body (23a) of the intermediate sealing gasket (23) is substantially annular in shape. 20
9. Laundry washing and drying machine according to one or more of claims 2 to 7, wherein the main body (23a) of the intermediate sealing gasket (23) is open in shape. 25
10. Laundry washing and drying machine according to one or more of claims 2 to 9, wherein a plurality of said protrusions/projections (23b) is spaced along said main body (23a). 30
11. Laundry washing and drying machine according to claim 1, wherein said at least one protrusion/projection (23b) is over-molded on the external surface of said tubular body (12). 35
12. Laundry washing and drying machine according to any one of the preceding claims, wherein said at least one protrusion/projection (23b) is arranged in such a way that it is positioned between said tubular body (12) and said outer casing (2), so as to locally protect said tubular body (12) from the bumps against said outer casing (2), and vice versa. 40

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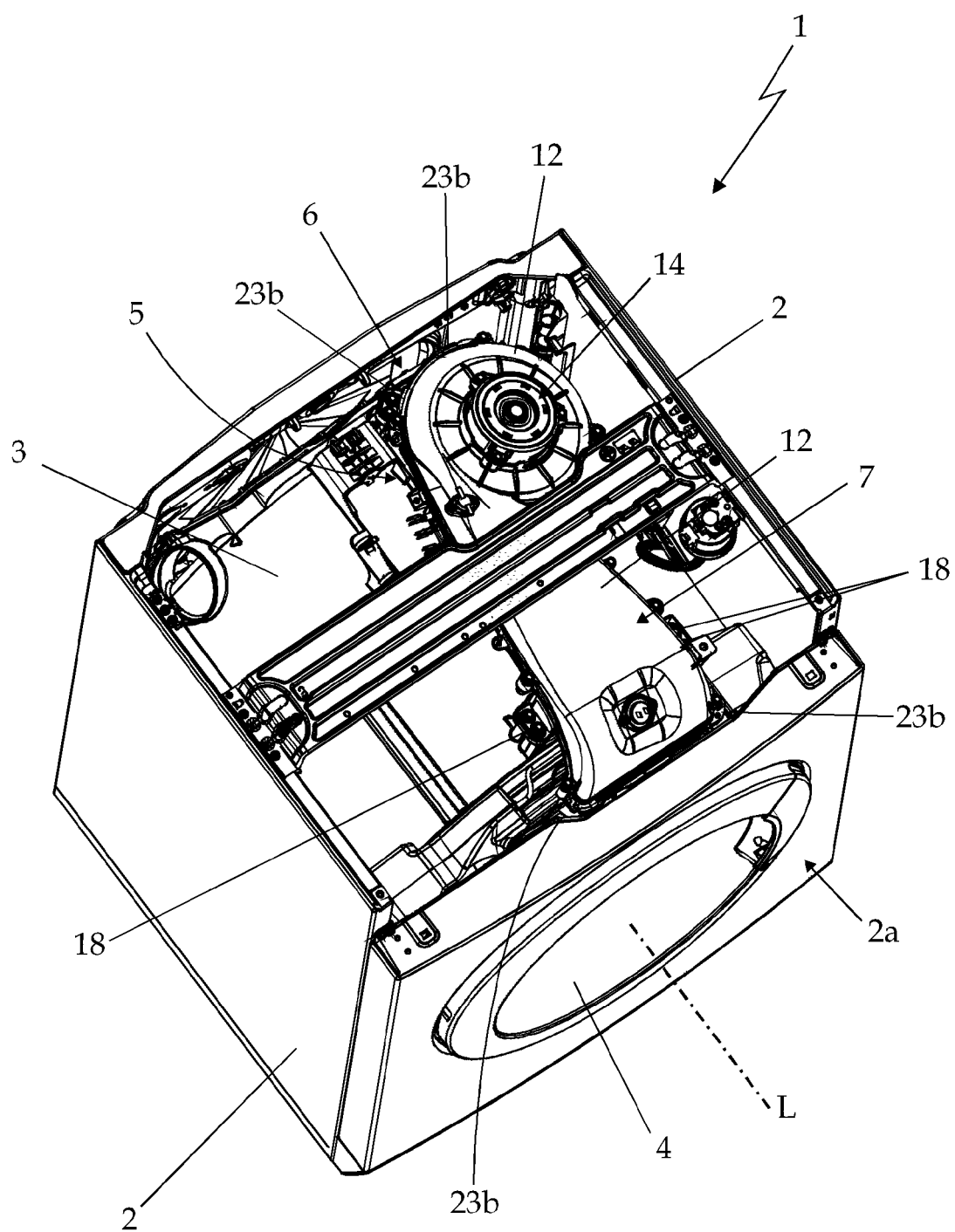


Fig. 1

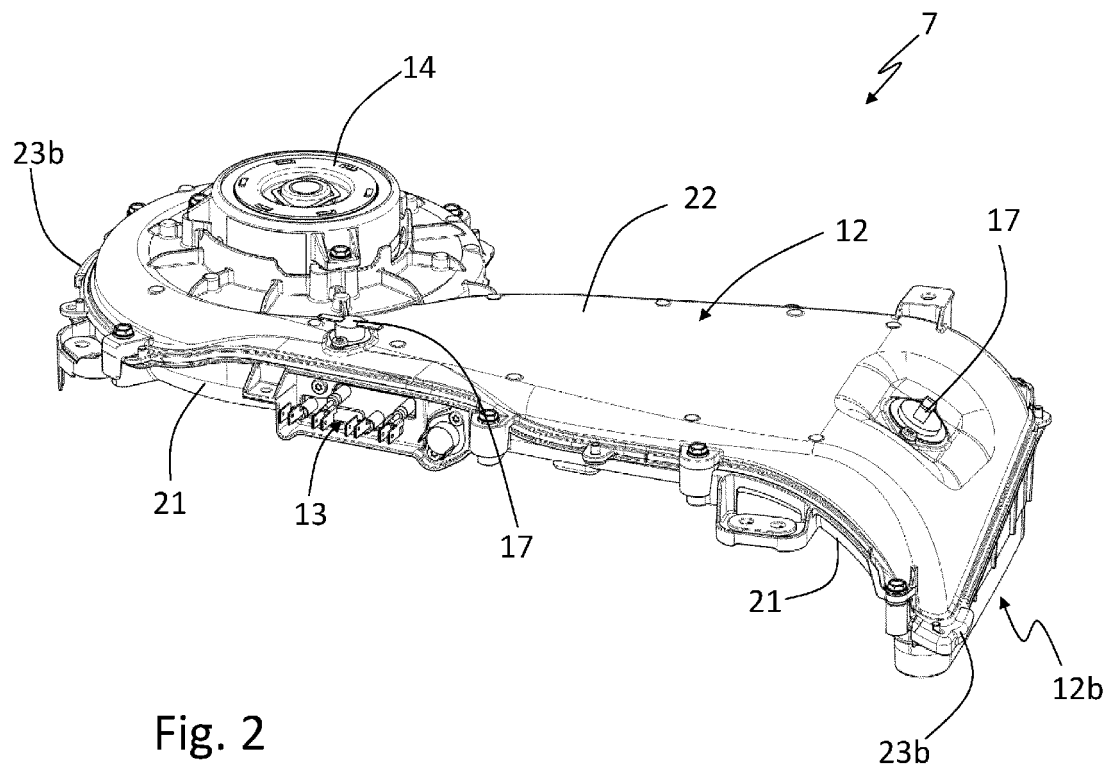


Fig. 2

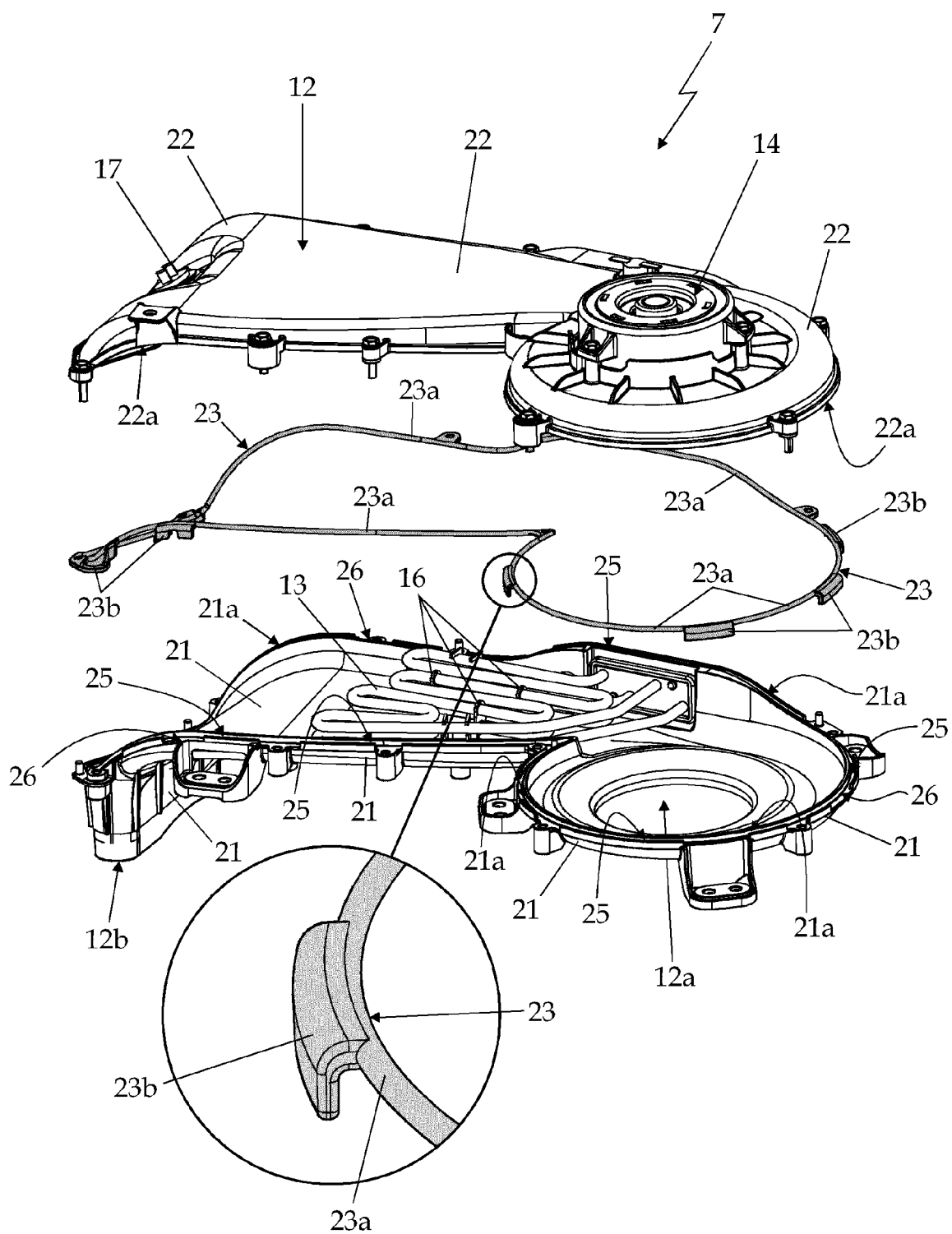


Fig. 3



EUROPEAN SEARCH REPORT

Application Number
EP 11 19 3953

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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A	WO 2007/021134 A2 (LG ELECTRONICS INC [KR]; KIM MYOUNG-DEOK [KR]; KANG DONG-WOO [KR]; SHI) 22 February 2007 (2007-02-22) * paragraph [0055] - paragraph [0058]; figures 2,3 *	1-12	
A	US 2010/058815 A1 (LIM JAE YOEN [KR] ET AL) 11 March 2010 (2010-03-11) * paragraph [0037] - paragraph [0052]; figure 2 *	1-12	TECHNICAL FIELDS SEARCHED (IPC) D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 30 April 2012	Examiner Hannam, Martin
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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EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 19 3953

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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