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(54) **Laundry machine with an improved bellows**

Waschmaschine mit einem verbesserten Balg

Machine à laver avec soufflet amélioré

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Description**TECHNICAL FIELD**

[0001] The present invention relates to a laundry machine.

[0002] The present invention may be used to particular advantage in a laundry washing machine, to which the following description refers purely by way of example.

BACKGROUND ART

[0003] A standard laundry washing machine comprises a casing resting on a floor on a number of feet. The casing supports a cylindrical tub enclosing a revolving perforated drum, which rotates about a rotation axis, and front access to which is closed by a door hinged to the casing. A back end of the tub is closed by a back wall, and a front end of the tub, opposite the back end, is open to define a door opening, and is connected to a circular fixed frame of the hinged door by an annular elastic watertight bellows. More specifically, a back end of the bellows is connected rigidly (e.g. interference fitted) to the front end of the tub, and a front end of the bellows, opposite the back end, is connected rigidly (e.g. interference fitted) to the circular fixed frame of the hinged door.

[0004] The bellows comprises a vertical annular lip (so-called "bellows nose"), which closes the annular gap between the front end of the tub and the front end of the drum to prevent the laundry being washed from slipping accidentally between the tub and the drum. This is a particularly dangerous situation, on account of any laundry items slipping accidentally between the tub and drum being located between a fixed part (the tub and bellows) and a rotating part (the drum), and so subject to tearing or wear by friction. Moreover, in some cases, rotation of the drum may be slowed (braked) or even stopped, thus resulting in mechanical and electric stress of the entire rotating part of the washing machine.

[0005] In currently marketed washing machines, the inner edge of the vertical annular lip has substantially the same diameter as, and is located opposite and separated slightly from, the open front end of the drum. It is important to note that the vertical annular lip of the bellows must be a given distance from the drum to allow for manufacturing tolerances, and to prevent the drum - which, only being supported at the rear, tilts slightly downwards when loaded - from sliding on the vertical annular lip of the bellows.

[0006] In response to market demand, currently marketed washing machines are characterized by a continual increase in rated capacity, i.e. the maximum amount of laundry (normally measured in kg) that the drum can hold. As a result, more and more often, when the drum is fully loaded, part of the laundry falls out of the drum by gravity and weighs on the bottom portion of the bellows, thus flexing the bellows so that the vertical annular lip rotates forwards (i.e. towards the door), thus widening the gap

between the inner edge of the vertical annular lip and the front end of the drum, and so increasing the likelihood of a laundry item slipping accidentally between the tub and the drum.

5 [0007] DE 10 2006 031 352 discloses a front loadable washing machine comprising a housing provided with a front opening, a washing tub provided with a frontal opening, and a rotatable drum provided with a front filling opening. The front opening of the housing is liquid-tight connected to the frontal opening of the tub by a an elastic sleeve; in the annular gap between the opening of the drum and the opening of the tub there is arranged a check lip which abuts against an annular region of the drum.

DISCLOSURE OF THE INVENTION

[0008] It is an object of the present invention to provide a laundry machine designed to eliminate the aforementioned drawbacks, and which, in particular, is cheap and easy to produce,

20 [0009] According to the present invention, there is provided a laundry machine with an improved bellows, as claimed in the accompanying Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

30 Figure 1 shows a schematic side view of a laundry washing machine in accordance with the present invention;

35 Figure 2 shows a schematic section of a front and bottom portion of a bellows of the Figure 1 laundry washing machine;

Figure 3 shows an enlarged view of a front and top portion of a bellows of the Figure 1 laundry washing machine; and

40 Figures 4 and 5 shows a schematic view in perspective of a rib of the Figure 3 bellows.

PREFERRED EMBODIMENTS OF THE INVENTION

45 [0011] Number 1 in Figure 1 indicates as a whole a washing machine comprising a casing 2 resting on a floor 3 on a number of feet 4. Casing 2 supports a revolving perforated drum 5, which rotates about a horizontal rotation axis 6 (in alternative embodiments not shown, rotation axis 6 may be tilted), and front access to which is closed by a door 7 hinged to casing 2.

50 [0012] Drum 5 is rotated about rotation axis 6 by an electric motor 8 connected to drum 5 by a drive, which comprises a belt 9 connecting a pulley 10, fitted to the shaft of drum 5, directly to a pulley 11 fitted to the shaft of electric motor 8. In an alternative embodiment not shown, electric motor 8 is coaxial with drum 5, and the shaft of drum 5 is connected rigidly to the shaft of electric

motor 8.

[0013] Washing machine 1 also comprises a cylindrical tub 12 supported by casing 2 and enclosing drum 5. A back end of tub 12 is closed by a back wall 13, and a front end of tub 12, opposite the back end, is open to define a door opening, and is connected to a front panel 14 by an annular elastic watertight bellows 15.

[0014] With reference to Figures 2 and 3, a back end 16 of bellows 15 is interference-fitted rigidly to a front end of tub 12; a front end 17 of bellows 15, opposite back end 16, is interference-fitted rigidly to front panel 14; and bellows 15 comprises a vertical annular lip 18 close to a front end 19 of drum 5.

[0015] With reference to Figure 2, a bottom portion of vertical annular lip 18 has an inner edge 20 larger in diameter than the open front end 19 of drum 5, and which is substantially coplanar with and surrounds the open front end 19 of drum 5 radially. It is important to note that the bottom portion of vertical annular lip 18 has no horizontal projections parallel to rotation axis 6 (Figure 2). The bottom portion of vertical annular lip 18 has a number of horizontal through drain holes 21 opening into tub 12.

[0016] With reference to Figure 3, in a top portion of vertical annular lip 18, inner edge 20, which is smaller in diameter than open front end 19 of drum 5, is positioned facing and offset horizontally with respect to open front end 19 of drum 5, and has a horizontal projection 22 which fits partly inside drum 5.

[0017] With reference to Figure 2, the bottom portion of vertical annular lip 18 slopes slightly towards drum 5 by an angle generally ranging between 5° and 30°, and preferably between 10° and 20°; and flexure of the bottom portion of vertical annular lip 18 of bellows 15 in no way interferes with flexure of drum 5, so that, when bellows 15 and drum 5 are flexed by the laundry inside drum 5, the bottom portion of vertical annular lip 18 in no way interferes with open front end 19 of drum 5, thus preventing drum 5, as it rotates, from sliding on vertical annular lip 18. Ideally, flexure of vertical annular lip 18 should be tangent to that of drum 5, but, to allow for inevitable manufacturing tolerances, is preferably separated from flexure of drum 5 by a distance at least equal to the manufacturing tolerances.

[0018] When drum 5 is fully loaded, part of the laundry may fall out of drum 5 by gravity and weigh on the bottom portion of bellows 15, which thus flexes, so that vertical annular lip 18 is rotated forwards (i.e. towards door 7). By virtue of the design of the bottom portion of vertical annular lip 18 described above, however, forward rotation of vertical annular lip 18 (unlike conventional washing machines) produces no increase in the distance between inner edge 20 of the bottom portion of vertical annular lip 18 and the open front end 19 of drum 5. Indeed, the distance between inner edge 20 of the bottom portion of vertical annular lip 18 and the open front end 19 of drum 5 remains more or less constant (even allowing for downward flexing of drum 5 by the weight of the laundry), thus substantially preventing any laundry items from slipping

between vertical annular lip 18 and the open front end 19 of drum 5 (i.e. between drum 5 and tub 12) when drum 5 is fully loaded.

[0019] With reference to Figure 3, the top portion of vertical annular lip 18 comprises a horizontal rib 23, which projects horizontally from a back wall 24 of vertical annular lip 18, is larger in diameter than the open front end 19 of drum 5, and is located between vertical annular lip 18 and drum 5.

[0020] With reference to Figures 4 and 5, horizontal rib 23 extends radially along a limited area of the top portion of vertical annular lip 18, and gradually varies axially in size between a minimum of zero at the ends and a maximum at the centre. More specifically, the variation in the axial size of the rib, between a minimum of zero at the ends and a maximum at the centre, is roughly sinusoidal, as opposed to linear.

[0021] The function of horizontal rib 23 is to intercept any laundry items rotating with drum 5 and slipping partly between vertical annular lip 18 and the open front end 19 of drum 5, and to push the escaping laundry items back towards drum 5 (or, at any rate, prevent them from penetrating any further between vertical annular lip 18 and the open front end 19 of drum 5). When drum 5 is fully loaded, part of the laundry rests on the bottom portion of bellows 15, thus flexing bellows 15, which in turn bends horizontal rib 23 downwards (i.e. towards drum 5) to bring it closer to drum 5 and so improve its effectiveness.

[0022] Laundry washing machine 1 as described above has numerous advantages, by being cheap and easy to produce. More specifically, bellows 15 as described above is no more expensive than an equivalent standard bellows, and substantially prevents any laundry items from slipping between drum 5 and tub 12, when drum 5 is fully loaded, by virtue of the design of the bottom portion of vertical annular lip 18, and provision of horizontal rib 23. As such, the same drum 5 may safely be loaded with a larger amount of laundry, thus increasing the rated capacity of laundry washing machine 1, with no increase in the internal or external dimensions of the machine.

45 Claims

1. A laundry machine (1) comprising:

- a casing (2) having a hinged front door (7);
- a revolving perforated drum (5) rotating about a horizontal or tilted rotation axis (6);
- a tub (12) enclosing the drum (5); and
- an elastic annular bellows (15) having a back end (16) connected to a front end of the tub (12); a front end (17) connected to the casing (2), around the door (7); and a vertical annular lip (18) located close to a front end (19) of the drum (5);

- wherein the vertical annular lip (18) of the bellows (15) comprises at least one horizontal rib (23), which extends horizontally from a back wall (24) of the vertical annular lip (18), is larger in diameter than the open front end (19) of the drum (5), and is located between the vertical annular lip (18) and the drum (5), **characterized in that** said horizontal rib (23) extends radially along a limited area of the top portion of the vertical annular lip (18), and said top portion of said vertical annular lip (18) comprises an inner edge (20), smaller in diameter than said open front end (19), positioned facing and offset horizontally with respect to said open front end (19), and having a horizontal projection (22) which fits partly inside said drum (5).
2. A laundry machine (1) as claimed in Claim 1, wherein the horizontal rib (23) gradually varies axially in size between a minimum of zero at the ends and a maximum in the centre.
 3. A laundry machine (1) as claimed in Claim 2, wherein the variation in the axial size of the horizontal rib (23), between a minimum of zero at the ends and a maximum in the centre, is roughly sinusoidal.
 4. A laundry machine (1) as claimed in one or more of the preceding Claims, wherein at least a bottom portion of the vertical annular lip (18) of the bellows (15) has an inner edge (20) larger in diameter than the open front end (19) of the drum (5), and which is substantially coplanar with the open front end (19) of the drum (5) so as to surround the open front end (19) of the drum (5) radially,
 5. A laundry machine (1) as claimed in Claim 4, wherein at least the bottom portion of the vertical annular lip (18) of the bellows (15) has no horizontal projections parallel to the rotation axis (6).
 6. A laundry machine (1) as claimed in Claim 4 or 5, wherein at least a bottom portion of the vertical annular lip (18) of the bellows (15) slopes slightly towards the drum (5).
 7. A laundry machine (1) as claimed in Claim 6, wherein at least a bottom portion of the vertical annular lip (18) of the bellows (15) slopes towards the drum (5) by an angle ranging between 5° and 30°.
 8. A laundry machine (1) as claimed in Claim 6, wherein at least a bottom portion of the vertical annular lip (18) of the bellows (15) slopes towards the drum (5) by an angle ranging between 10° and 20°.
 9. A laundry machine (1) as claimed in any of Claims 4 to 8, wherein the flexure of at least a bottom portion of the vertical annular lip (18) of the bellows (15) in no way interferes with the flexure of the drum (5) so that when said bellows (15) and said drum (5) are flexed by the laundry inside said drum (5), said bottom portion of said vertical annular lip (18) in no way interferes with said open front end (19) of said drum (5), thus preventing said drum (5), as it rotates, from sliding on said vertical annular lip (18),
 10. A laundry machine (1) as claimed in Claim 9, wherein the flexure of at least a bottom portion of the vertical annular lip (18) of the bellows (15) is tangent to the flexure of the drum (5).
 11. A laundry machine (1) as claimed in Claim 9, wherein the flexure of at least a bottom portion of the vertical annular lip (18) of the bellows (15) is separated from the flexure of the drum (5) by a distance at least equal to the manufacturing tolerances.
 12. A laundry machine (1) as claimed in any of Claims 4 to 11, wherein the bottom portion of the vertical annular lip (18) of the bellows (15) has a number of horizontal through drain holes (21),

Patentansprüche

1. Waschmaschine (1), die Folgendes aufweist:

ein Gehäuse (2) mit einer vorderen Schwenktür (7),
eine sich drehende durchlochte Trommel (5), die sich um eine horizontale oder geneigte Drehachse (6) dreht,
eine Wanne (12), die die Trommel (5) umschließt, und
einen elastischen ringförmigen Balg (15) mit einem hinteren Ende (16), das mit einem vorderen Ende der Wanne (12) verbunden ist, einem vorderen Ende (17), das mit dem Gehäuse (2) um die Tür (7) herum verbunden ist, und einer vertikalen ringförmigen Lippe (18), die sich nahe einem vorderen Ende (19) der Trommel (5) befindet,
wobei die vertikale ringförmige Lippe (18) des Balgs (15) mindestens eine horizontale Rippe (23) aufweist, die sich horizontal von einer hinteren Wand (24) der vertikalen ringförmigen Lippe (18) erstreckt, im Durchmesser größer ist als das offene vordere Ende (19) der Trommel (5) und sich zwischen der vertikalen ringförmigen Lippe (18) und der Trommel (5) befindet, **dadurch gekennzeichnet, dass** sich die horizontale Rippe (23) radial entlang eines begrenzten Bereichs des oberen Abschnitts der vertikalen ringförmigen Lippe (18) erstreckt und der obere Abschnitt der vertikalen ringförmigen Lippe (18)

- einen inneren Rand (20) aufweist, der im Durchmesser kleiner ist als das offene vordere Ende (19), in Bezug auf das offene vordere Ende (19) zugewandt positioniert und horizontal versetzt ist und einen horizontalen Vorsprung (22) hat, der teilweise in die Trommel (5) passt. 5
2. Waschmaschine (1) nach Anspruch 1, wobei sich die horizontale Rippe (23) graduell axial in der Größe zwischen einem Minimum von null an den Enden und einem Maximum in der Mitte unterscheidet. 10
3. Waschmaschine (1) nach Anspruch 2, wobei der axiale Größenunterschied der horizontalen Rippe (23) zwischen einem Minimum von null an den Enden und einem Maximum in der Mitte ungefähr sinusförmig ist. 15
4. Waschmaschine (1) nach einem oder mehreren der vorhergehenden Ansprüche, wobei mindestens ein Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) einen inneren Rand (20) hat, der im Durchmesser größer ist als das offene vordere Ende (19) der Trommel (5), und der im Wesentlichen mit dem offen vorderen Ende (19) der Trommel (5) koplanar ist, um das offene vordere Ende (19) der Trommel (5) radial zu umgeben. 20
5. Waschmaschine (1) nach Anspruch 4, wobei mindestens der Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) keine horizontalen Vorsprünge hat, die parallel zu der Drehachse (6) sind. 30
6. Waschmaschine (1) nach Anspruch 4 oder 5, wobei mindestens ein Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) leicht hin zu der Trommel (5) abfällt. 35
7. Waschmaschine (1) nach Anspruch 6, wobei mindestens ein Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) hin zu der Trommel (5) in einem Winkel abfällt, der im Bereich von zwischen 5° und 30° liegt. 40
8. Waschmaschine (1) nach Anspruch 6, wobei mindestens ein Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) hin zu der Trommel (5) in einem Winkel abfällt, der im Bereich von zwischen 10° und 20° liegt. 45
9. Waschmaschine (1) nach einem der Ansprüche 4 bis 8, wobei die Biegung mindestens eines Bodenabschnitts der vertikalen ringförmigen Lippe (18) des Balgs (15) in keiner Weise die Biegung der Trommel (5) stört, so dass, wenn der Balg (15) und die Trommel (5) durch die Wäsche im Inneren der Trommel (5) gebogen werden, der Bodenabschnitt der vertikalen ringförmigen Lippe (18) in keiner Weise das offene vordere Ende (19) der Trommel (5) stört, wodurch verhindert wird, dass die Trommel (5), wenn sie sich dreht, auf der vertikalen ringförmigen Lippe (18) gleitet. 50
10. Waschmaschine (1) nach Anspruch 9, wobei die Biegung mindestens eines Bodenabschnitts der vertikalen ringförmigen Lippe (18) des Balgs (15) zu der Biegung der Trommel (5) tangential ist. 55
11. Waschmaschine (1) nach Anspruch 9, wobei die Biegung mindestens eines Bodenabschnitts der vertikalen ringförmigen Lippe (18) des Balgs (15) von der Biegung der Trommel (5) in einem Abstand getrennt ist, der mindestens gleich den Fertigungstoleranzen ist.
12. Waschmaschine (1) nach einem der Ansprüche 4 bis 11, wobei der Bodenabschnitt der vertikalen ringförmigen Lippe (18) des Balgs (15) eine Anzahl von horizontalen Durchgangsabflusslöchern (21) hat.

Revendications

1. Machine à laver (1), comprenant :

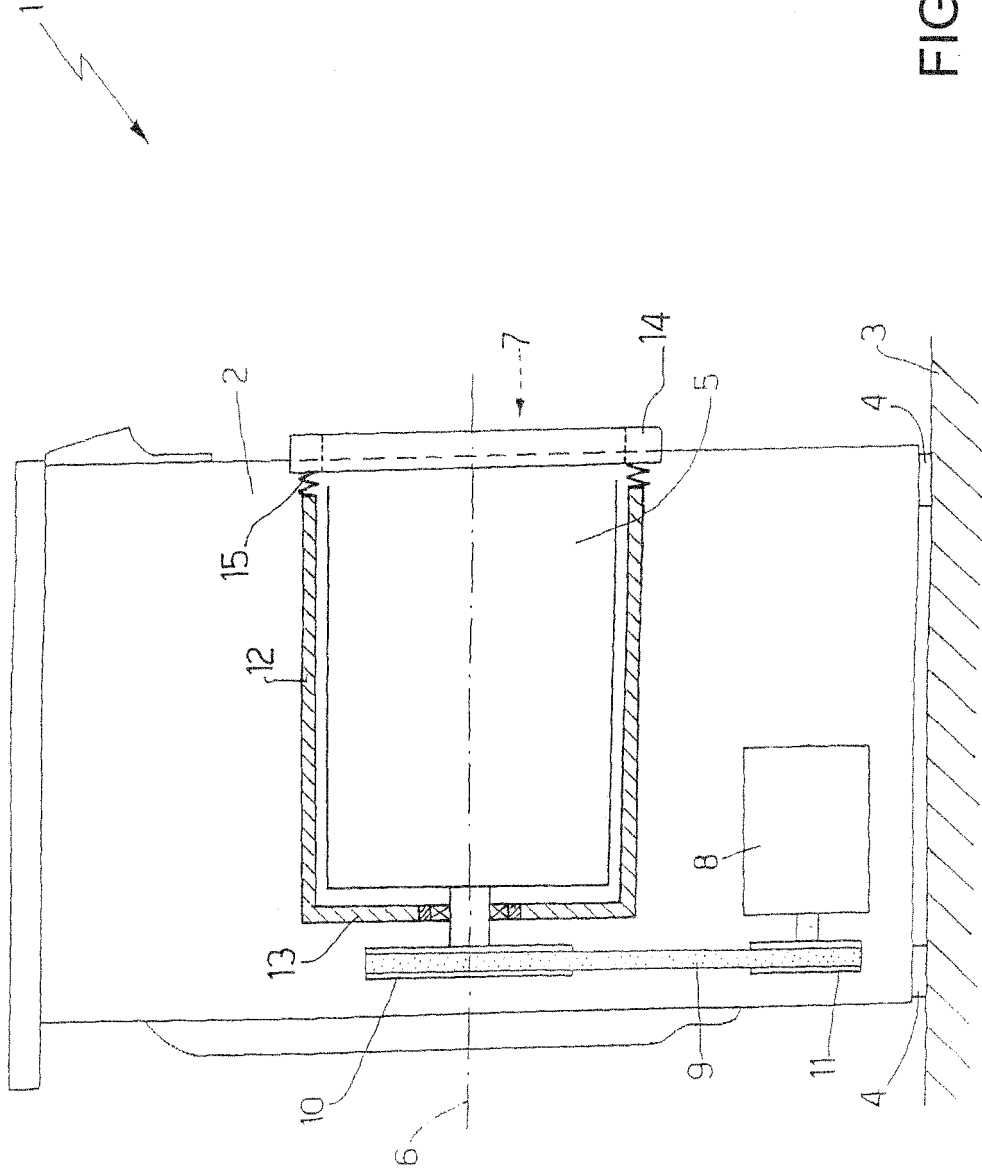
un boîtier (2) ayant une porte avant articulée (7);
 un tambour rotatif perforé (5) tournant autour d'un axe de rotation horizontal ou penché (6) ;
 une cuve (12) entourant le tambour (5) ; et
 un soufflet élastique annulaire (15) ayant une extrémité arrière (16) connectée à une extrémité avant de la cuve (12) ; une extrémité avant (17) connectée au boîtier (2) autour de la porte (7) ;
 et une lèvre annulaire verticale (18) située à proximité d'une extrémité avant (19) du tambour (5);

la lèvre annulaire verticale (18) du soufflet (15) comprenant au moins une nervure horizontale (23) qui s'étend horizontalement à partir d'une paroi arrière (24) de la lèvre annulaire verticale (18), qui a un plus grand diamètre que l'extrémité avant ouverte (19) du tambour (5), et qui est située entre la lèvre annulaire verticale (18) et le tambour (5),

caractérisée en ce que

ladite nervure horizontale (23) s'étend radialement le long d'une zone limitée de la partie supérieure de la lèvre annulaire verticale (18), et ladite partie supérieure de ladite lèvre annulaire verticale (18) comprend un bord intérieur (20), de plus petit diamètre que ladite extrémité avant ouverte (19), positionné en face de ladite extrémité avant ouverte (19) et décalé horizontalement par rapport à celle-ci et ayant une projection horizontale (22) qui s'ajuste en partie à l'in-

- térieur dudit tambour (5).
2. Machine à laver (1) selon la revendication 1, dans laquelle la nervure horizontale (23) varie progressivement axialement entre un minimum de zéro aux extrémités et un maximum au centre. 5
 3. Machine à laver (1) selon la revendication 2, dans laquelle la variation de la dimension axiale de la nervure horizontale (23), entre un minimum de zéro aux extrémités et un maximum au centre, est approximativement sinusoïdale. 10
 4. Machine à laver (1) selon une ou plusieurs des revendications précédentes, dans laquelle au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) présente un bord intérieur (20) de plus grand diamètre que l'extrémité avant ouverte (19) du tambour (5), et qui est sensiblement coplanaire avec l'extrémité avant ouverte (19) du tambour (5) de manière à entourer radialement l'extrémité avant ouverte (19) du tambour (5). 20
 5. Machine à laver (1) selon la revendication 4, dans laquelle au moins la partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) ne présente pas de projection horizontale parallèle à l'axe de rotation (6). 25
 6. Machine à laver (1) selon la revendication 4 ou 5, dans laquelle au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) est légèrement inclinée vers le tambour (5). 30
 7. Machine à laver (1) selon la revendication 6, dans laquelle au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) est inclinée vers le tambour (5) suivant un angle compris entre 5° et 30°. 35
 8. Machine à laver (1) selon la revendication 6, dans laquelle au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) est inclinée vers le tambour (5) suivant un angle compris entre 10° et 20°. 40
 9. Machine à laver (1) selon l'une quelconque des revendications 4 à 8, dans laquelle la flexion d'au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) n'entrave pas la flexion du tambour (5) de telle sorte que lorsque ledit soufflet (15) et ledit tambour (5) sont fléchis par le linge à l'intérieur dudit tambour (5), ladite partie inférieure de ladite lèvre annulaire verticale (18) n'entrave pas ladite extrémité avant ouverte (19) dudit tambour (5), ce qui empêche ledit tambour (5), à mesure qu'il tourne, de glisser sur ladite lèvre annulaire verticale (18). 50
 10. Machine à laver (1) selon la revendication 9, dans laquelle la flexion d'au moins une partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) est tangente à la flexion du tambour (5). 55
 11. Machine à laver (1) selon la revendication 9, dans laquelle la flexion d'au moins une partie inférieure de la lèvre annulaire verticale (18) du tambour (15) est séparée de la flexion du tambour (5) d'une distance au moins égale aux tolérances de fabrication.
 12. Machine à laver (1) selon l'une quelconque des revendications 4 à 11, dans laquelle la partie inférieure de la lèvre annulaire verticale (18) du soufflet (15) présente un certain nombre de trous de drainage traversants horizontaux (21).



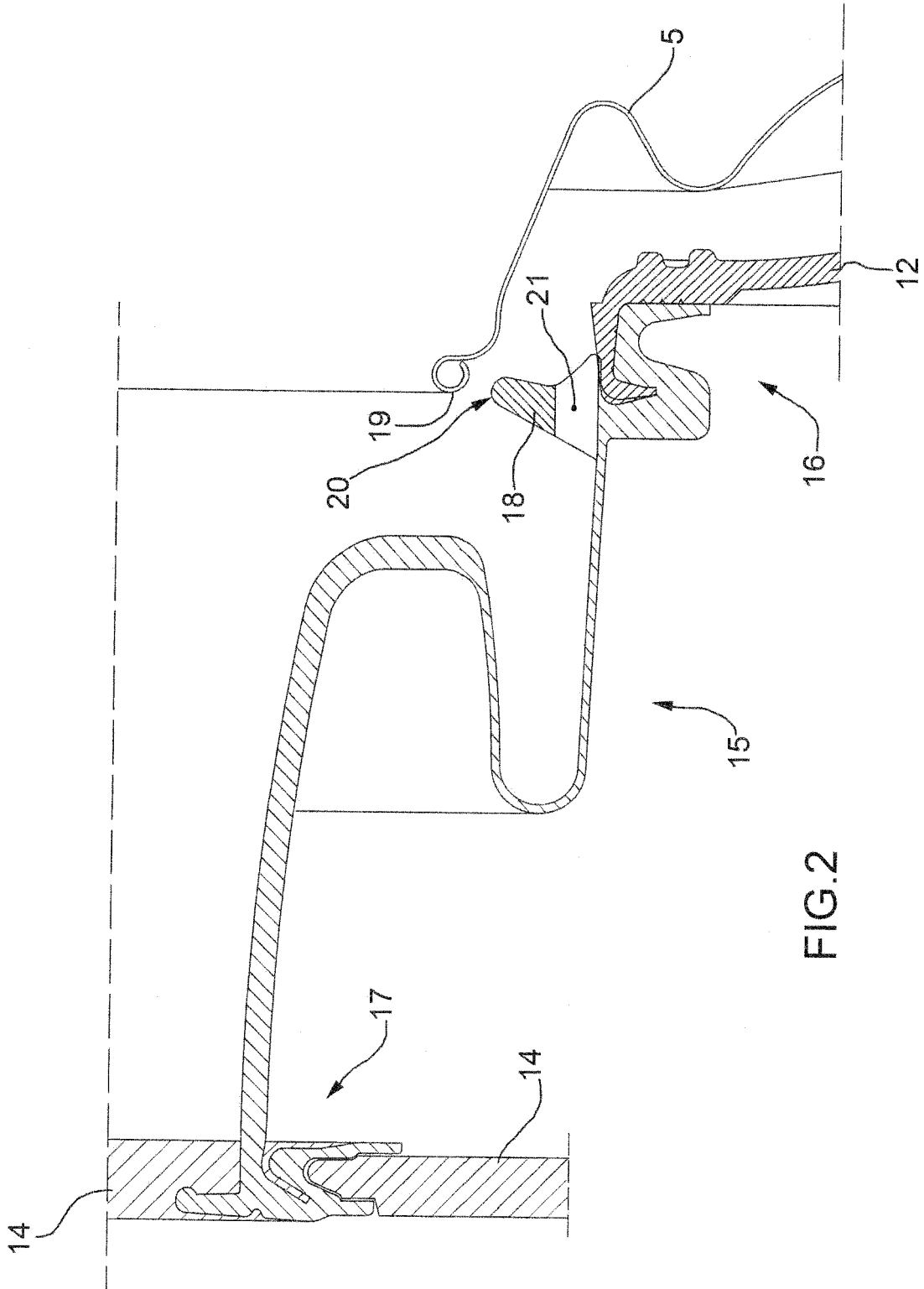


FIG.2

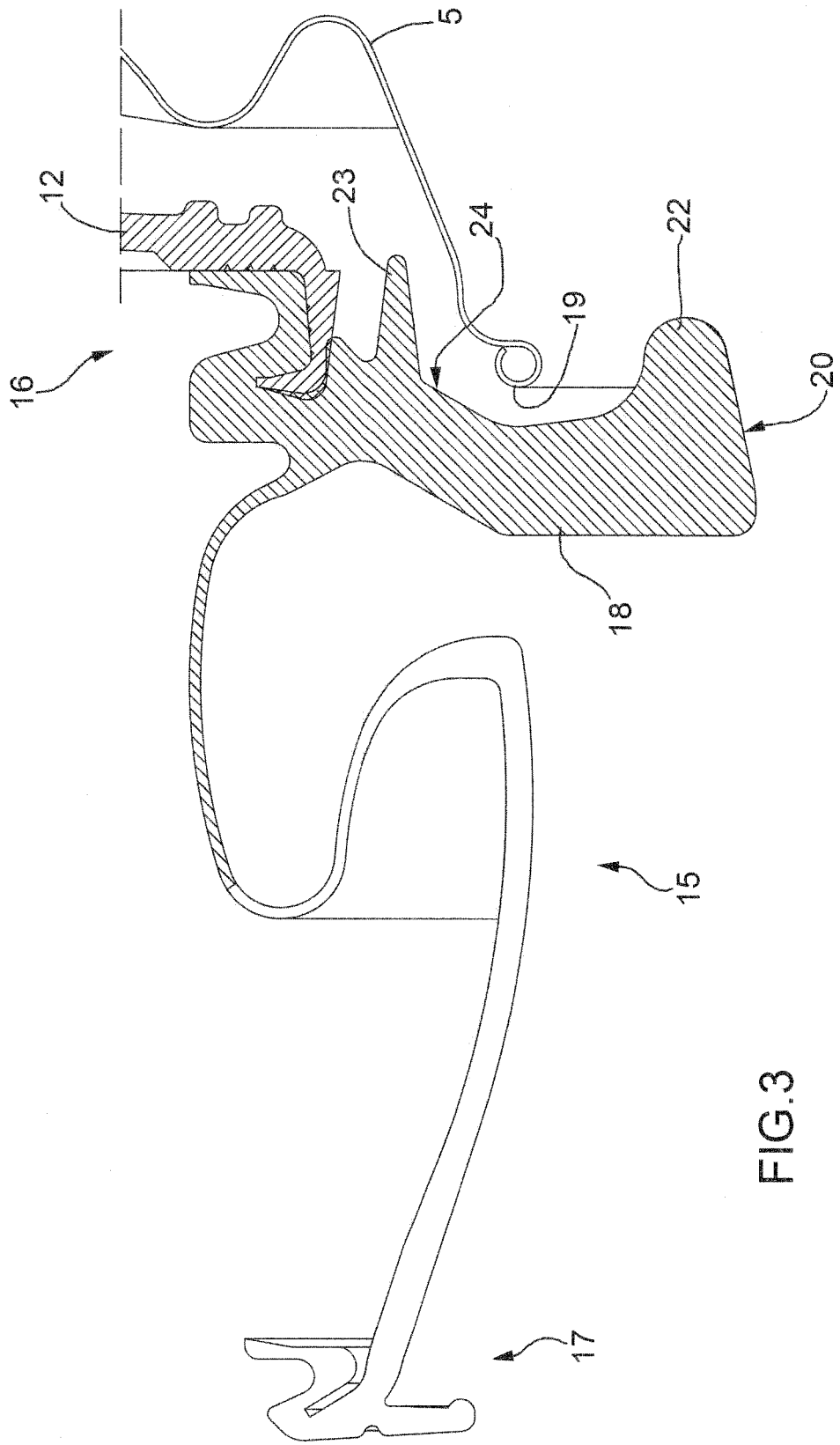


FIG.3

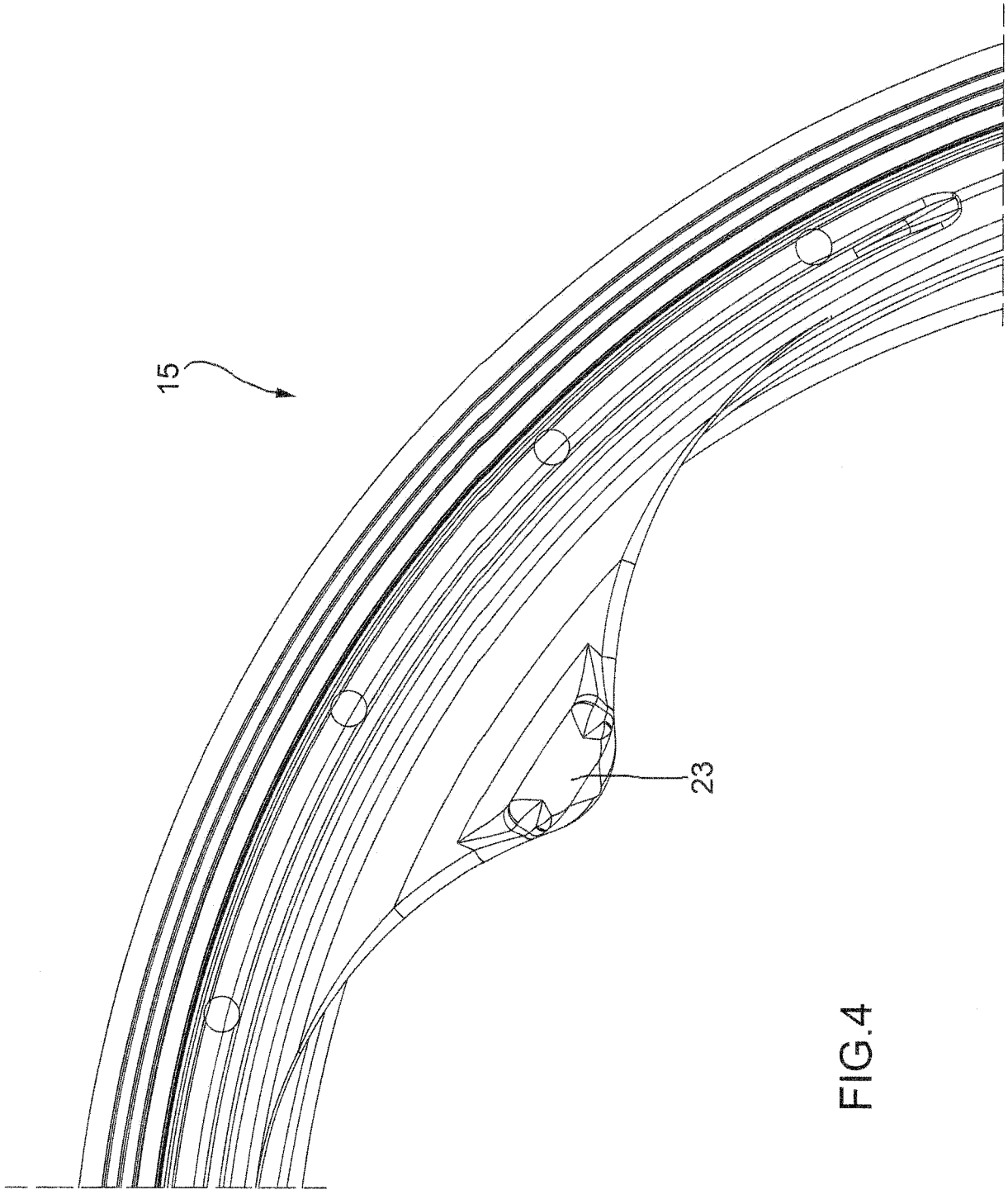


FIG.4

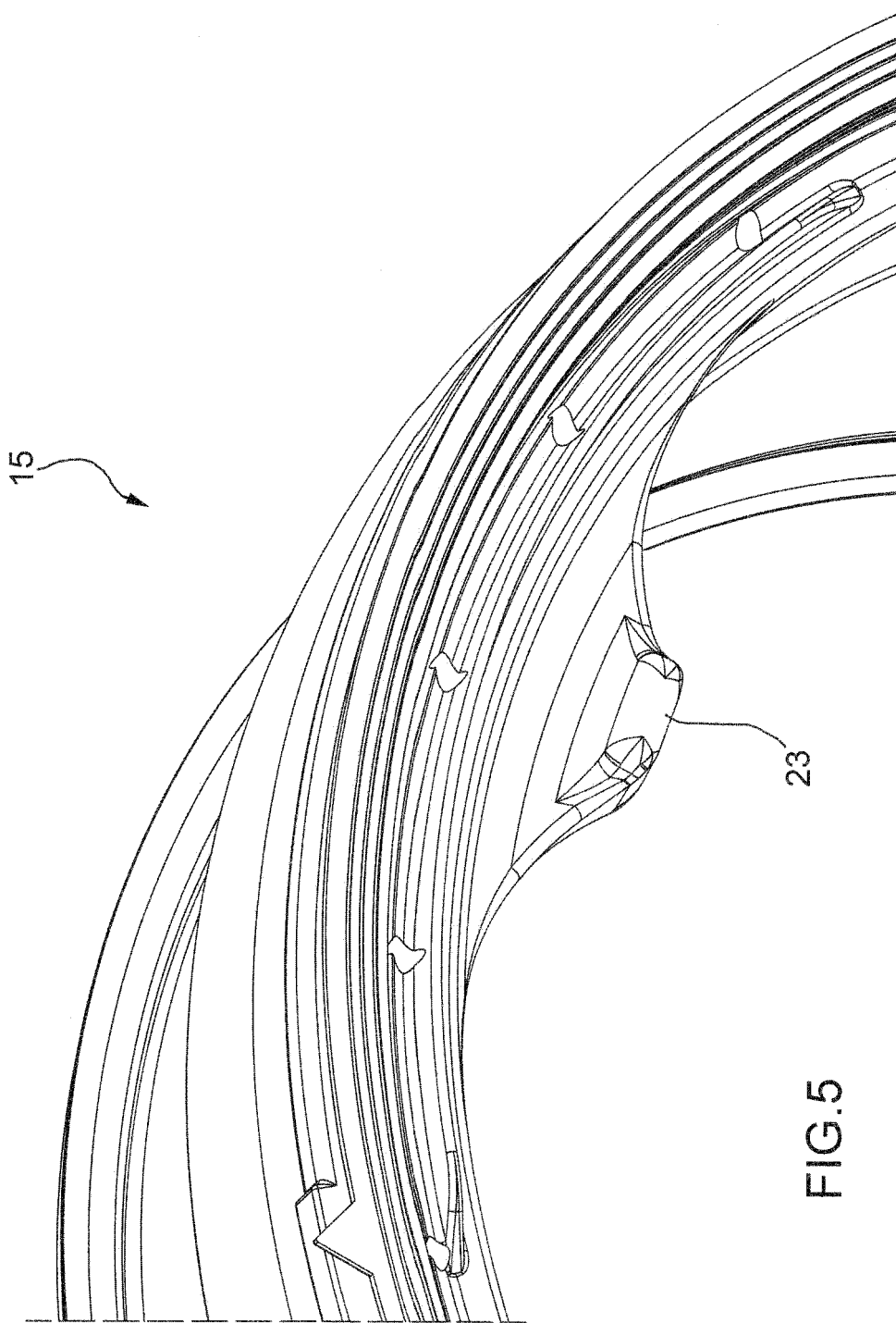


FIG.5

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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