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(54) ROTATABLE DRUM FOR LAUNDRY WASHING MACHINES AND ASSEMBLY METHOD OF THE ROTATABLE DRUM

DREHTROMMEL FÜR WASCHMASCHINEN UND VERFAHREN ZUR MONTAGE DER DREHTROMMEL

TAMBOUR ROTATIF POUR MACHINES À LAVER ET PROCÉDÉ D'ASSEMBLAGE DU TAMBOUR ROTATIF

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Description

DESCRIPTION

[0001] The present invention relates to a rotatable drum for laundry washing machines and to the assembly method of said drum.

[0002] It is underlined that in the present application the expression "washing machine" may as well indicate a "simple" washing machine (i.e. a washing machine which can only wash and rinse the laundry) and a washing-drying machine (i.e. a washing machine which can also dry the laundry), both of the front-loading type and of the top-loading type.

[0003] The following description refers, purely by way of example, to a rotatable drum for a front-loading laundry washing machine, without this implying any loss of generality.

[0004] As is known, front-loading laundry washing machines generally comprise a substantially parallelepiped-shaped outer box casing structured for resting on the floor; a substantially bell-shaped (i.e. cylindrical and hollow) washing tub which is suspended in floating manner inside the casing by means of a number of coil springs and shock-absorbers, directly facing a laundry loading and unloading opening realized in the front face of the casing; a door hinged to the front face of the casing to rotate to and from a closing position in which the door closes the opening in the front face of the casing to seal the washing tub; a substantially cylindrical and hollow rotatable drum for housing the laundry to be washed, and which is housed substantially horizontally inside the washing tub to rotate about its longitudinal axis; and an electric motor assembly for rotating the rotatable drum about its longitudinal axis inside the washing tub.

[0005] To assure adequate water circulation across the rotatable drum during all phases of the washing cycle, the drum is typically provided with a large number of through holes which are generally evenly distributed on the cylindrical lateral wall of the drum.

[0006] As a general rule, efficiency of the washing and rinsing phases of the laundry washing cycle increases together with the overall perforated area of the lateral wall of the rotatable drum, thus several attempts have been made to maximise the overall perforated area of the rotatable drum either increasing the holes density for surface unit, or increasing the nominal diameter of the through holes.

[0007] Unfortunately the increase of the holes density implies a conspicuous rising of the overall production costs of the drum and may also compromise the stiffness of rotatable drum, whereas an excessive increase of the hole nominal diameter may cause severe textiles damages.

[0008] In fact, if the nominal diameter of the through holes on the cylindrical lateral wall of the drum is too high, particularly during the spin phase of the washing cycle the textile portion resting immediately above each through hole is not properly supported and tends to radially bend outwards of the drum through the hole, thus causing an excessive local stretching of the textile fibers.

[0009] On the other hand, during the washing and rinsing phases, if the nominal diameter of the through holes is too small, the fast-flowing outflow of the washing water out of the rotatable drum is thwarted with negative effects on the washing and rinsing efficiency.

[0010] Moreover, in the recent years the volume ratio between the average volume of the laundry stored in the drum and the nominal internal volume of the drum has significantly increased (i.e. nowadays the drum of the laundry washing machine is proportionally filled with much more laundry than in the past), causing an appreciable increase of the average thickness of laundry resting on the inner surface of the cylindrical lateral wall of the drum. This increase of the laundry density for surface unit implies that the laundry is strongly pressed against the inner surface of the drum, thus significantly reducing or even partially blocking the outflow of the washing water through the drum holes.

[0011] EP 1174536 discloses a laundry machine drum comprising a sheet material skin including an arrangement of a plurality of perforations therethrough. Each of one or more of the perforations includes a shear cut in the sheet material. The sheet is deformed in the region of the shear cut such that the edge of the sheet material of one side of the shear cut is offset from the edge of the sheet material of the other side of the shear cut over at least some of the length of the shear cut. An opening is formed between the offset edges. The apparent area of the opening is greater when viewed from at least one direction substantially parallel to the general plane of the drum skin in the region of the perforation than when viewed from a direction substantially perpendicular to the general plane of the drum skin in the region of the perforation.

[0012] WO2008077394 discloses a structured material web, particularly a metal web, having a multidimensional structure comprising beads or creases and structures disposed next to each other and each formed by a surface section enclosed by the beads or the creases, wherein each of the structures has a dedicated location with a hole, and the surface section in every other location of the structure is formed by an incline toward the dedicated location.

[0013] It is the aim of the present invention to provide a rotatable drum for laundry washing machines designed to eliminate the drawbacks referred above, and which is cheap and easy to produce.

[0014] According to the present invention, there is provided a rotatable drum for laundry washing machines comprising a substantially cylindrical lateral wall provided with a plurality of through holes, the cylindrical lateral wall of the drum is also provided with one or more, outwards-projecting, first bulges with at least one of the through holes located therein.

[0015] Furthermore and preferably, though not neces-

sarily, each first bulge has said at least one first through hole located roughly at its center, and/or a number of second through holes which are located at the vertexes of a polygon locally roughly centered to the first bulge.

[0016] In an advantageous embodiment each first bulge has six second through holes which are located at the vertexes of a hexagon locally roughly centered to the first bulge.

[0017] Preferably, but not necessarily, the first bulges comprise a lateral wall and a bottom, the one or more through holes located in each first bulge being placed in its bottom.

[0018] In a preferred embodiment the bottom of the first bulges is substantially flat.

[0019] Advantageously, but not necessarily, the first bulges are realized on the cylindrical lateral wall so as to be aligned one another along a number of adjacent longitudinal rows staggered one another.

[0020] Preferably, but not necessarily, the perimeter (i.e. the boundary, the border) of the first bulges is substantially circular in shape.

[0021] Furthermore, according to the invention, the cylindrical lateral wall of the rotatable drum is also provided with a number of outwards-projecting second bulges each of which is roughly centered to a respective through hole.

[0022] In a preferred embodiment each second bulge is shaped so as to form a respective outwards-projecting funnel which is substantially truncated cone in shape.

[0023] The present invention concerns also an assembly method of a rotatable drum of a laundry washing machine wherein the rotatable drum comprises a substantially cylindrical lateral wall provided with a plenty of through holes; the assembly method comprises the steps of:

- punching a metal-sheet so as to realize, on the latter, a number of through holes spaced one another; spaced one another;
    - pressing (e.g. deep-drawing, drawing, dishing) the metal-sheet around one or more of the through holes, so as to realize, on the metal-sheet, a number of first bulges, each of which comprises one or more of the through holes locally spaced apart from the natural reference laying plane of the metal-sheet;
    - cylindrically bending the metal-sheet so as to form a cylindrical coil in which the first bulges radially protrude outwards;
    - connecting the two opposite lateral edges of the metal-sheet, so as to form a cylindrical sleeve.

[0024] Preferably, but not necessarily, the metal-sheet is substantially flat.

[0025] According to the invention, the assembly method comprises the step of pressing the metal-sheet so as to realize, around each through hole, a respective outwards-projecting second bulge which is substantially centered to the corresponding through hole.

[0026] Preferably, but not necessarily, each second bulge is shaped so as to form, on the metal-sheet, an outwards-projecting funnel, which is substantially truncated cone in shape.

[0027] Preferably, but not necessarily, in the assembly method according to the invention the metal-sheet is pressed so that each first bulge has at least a first through hole located roughly on its centre.

[0028] Advantageously, but not necessarily, in the assembly method according to the invention the metal-sheet is punched so as to form, on the latter, several groups of through holes, each of which comprises a number of through holes located at the vertexes of a polygon; and afterwards the metal sheet is pressed so as to realize a number of first bulges each of which comprises a number of through holes located at the vertexes of a polygon locally roughly centered to this first bulge.

[0029] Preferably, but not necessarily, in the assembly method according to the invention the metal-sheet is pressed so to realize a number of first bulges aligned along a number of adjacent longitudinal rows, which are staggered one another.

[0030] Opportunely, but not necessarily, in the assembly method according to the invention the second bulges and the first bulges are pressed on the metal-sheet at the same Preferably, but not necessarily, the in the assembly method according to the invention the metal-sheet is pressed so that each first bulge comprises a lateral wall and a bottom, the one or more through holes located in each first bulge being placed in its bottom.

[0031] Preferably, but not necessarily, the bottom of the fist bulges is substantially flat.

[0032] Another aspect of the present invention concerns a washing machine comprising a rotatable drum comprising a substantially cylindrical lateral wall provided with a plurality of through holes, the cylindrical lateral wall of the drum is also provided with one or more, outwards-projecting, first bulges with at least one of the through holes located therein.

[0033] In the washing machine according to the invention, preferably, though not necessarily, each first bulge has at least a first through hole located roughly at its center, and/or a number of second through holes which are located at the vertexes of a polygon locally roughly centered to the first bulge.

[0034] In an advantageous embodiment of the washing machine according to the invention, each first bulge has six second through holes which are located at the vertexes of a hexagon locally roughly centered to the first bulge.

[0035] Preferably, but not necessarily, in the washing machine according to the invention the first bulges comprise a lateral wall and a bottom, the one or more through holes located in each first bulge being placed in its bottom.

[0036] In a preferred embodiment of the washing ma-

chine according to the invention, the bottom of the first bulges is substantially flat.

[0037] Advantageously, but not necessarily, in the washing machine according to the invention the first bulges are realized on the cylindrical lateral wall so as to be aligned one another along a number of adjacent longitudinal rows staggered one another.

[0038] Preferably, but not necessarily, in the washing machine according to the invention the perimeter (i.e. the boundary, the border) of the first bulges is substantially circular in shape.

[0039] Furthermore and preferably, though not necessarily, in the washing machine according to the invention the cylindrical lateral wall of the rotatable drum is also provided with a number of outwards-projecting second bulges each of which is roughly centered to a respective through hole.

[0040] In a preferred embodiment of the washing machine according to the invention, each second bulge is shaped so as to form a respective outwards-projecting funnel which is substantially truncated cone in shape.

[0041] 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 schematic lateral view, with parts in section and parts removed for clarity, of a front-loading laundry washing machine provided with a rotatable drum realized in accordance with the teachings of the present invention;
- Figure 2A is an isometric view, with parts in section and parts removed for clarity, of the rotatable drum shown in Fig. 1;
- Figure 2B is an enlarged detail of Fig. 2A;
- Figure 3 is an enlarged plant view of a rectified portion of the inner surface of the cylindrical lateral wall of the rotatable drum of Figure 2A;
- Figures 4 is a section view of the cylindrical lateral wall of the drum of Fig. 3;
- Figures 5 and 6 show schematically two steps of the assembly method of the rotatable drum of Fig. 2A, with parts in section and parts removed for clarity.

[0042] With reference to Figure 1, number 1 indicates as a whole a rotatable drum suitable to be mounted into a laundry washing machine or a laundry washing and drying machine, hereinafter addressed with number 2, for housing the laundry to be washed.

[0043] It is underlined that the washing machine 2 according to the invention which is schematically illustrated in the enclosed Figures is advantageously of the front-loading type; it is however clear that the invention is applicable, substantially without any crucial modification, to a top-loading washing machine.

[0044] It is also underlined that the invention can be applied, substantially without any modification, both to a "simple" washing machine (i.e. a washing machine which can only wash and rinse the laundry), for example the one illustrated in Figure 1, and to a washing-drying machine (i.e. a washing machine which can also dry the laundry).

[0045] The washing machine 2 illustrated in Figure 1 advantageously comprises: an outer box casing 3, preferably, though not necessarily, parallelepiped-shaped, structured for resting on the floor; a hollow washing tub 4, substantially cylindrical, suspended in floating manner inside the casing 3 via a suspension system preferably, though not necessarily, comprising a number of coil springs 5 (only one shown in Figure 1) connecting the upper portion of washing tub 4 to the top of casing 3, and one or more vibration dampers 6 (only one shown in Figure 1) connecting the lower portion of washing tub 4 to the bottom of casing 3; the rotatable drum 1 is positioned in axially rotating manner inside the washing tub 4 for rotating about its longitudinal axis L; and an electric motor assembly 7 for rotating, on command, rotatable drum 1 about its longitudinal axis L inside washing tub 4.

[0046] As indicated above, the washing machine 1 illustrated in the enclosed Figures is a front-loading washing machine, and therefore the washing tub 4 is suspended substantially horizontally inside casing 3, with the front opening (not indicated in the enclosed Figures) of the washing tub 4 directly faced to a laundry loading and unloading opening (also not indicated in the enclosed Figures) formed in the front face 3a of casing 3.

[0047] Moreover, the front-loading laundry washing machine 2 advantageously comprises: an elastic-deformable bellows 8, preferably substantially cylindrical, which connects the front opening of washing tub 4 to the laundry loading and unloading opening formed in the front face 3a of casing 3; and a porthole door 9 which is advantageously hinged to the front face 3a of the casing 3 so as to rotate to and from a closing position in which the porthole door 9 closes the laundry loading and unloading opening located in the front face 3a, so as to watertight seal the washing tub 4.

[0048] Rotatable drum 1, in turn, is preferably, though not necessarily, housed into the washing tub 4 so that its longitudinal axis L is oriented substantially horizontally and approximately coincides with the longitudinal axis of washing tub 4 (clearly the invention may be applied without any crucial modification also to a washing machine, not illustrated, in which the washing tub and the rotatable drum are inclined with respect to the horizontal plane).

[0049] With reference to Figure 1, the laundry washing machine 2 is also advantageously provided: with a fresh water supply circuit 10 which is structured for supplying a given amount of tap water into washing tub 4; with a washing water recirculating and draining circuit 11 which is structured for sucking the washing water from the bottom of the washing tub 4 and feeding this water back inside rotatable drum 1 during the washing and rinsing phases of the washing cycle, or alternatively draining the water accumulated on the bottom of the washing tub 4 directly into a waste-water exhaust duct (non shown) located outside the casing 3; and a water heater 12, for

example an electrical resistor, which is located preferably on the bottom of washing tub 4, preferably, thought not necessarily, into an outwards-projecting basin-shaped seat 4a realized on the bottom of washing tub 4, and is structured for heating the washing water accumulated on the bottom of washing tub 4.

[0050] In a different embodiment, the washing water recirculating and draining circuit 11 may be replaced by a washing water draining circuit which is structured for solely sucking the washing water from the bottom of washing tub 4 and feeding this water directly into the waste-water exhaust duct (non shown) located outside the casing 3.

[0051] Outer casing 3, washing tub 4, the suspension system, the electric motor assembly 7, bellows 8, porthole door 9, the fresh water supply circuit 10, the washing water recirculating and draining circuit 11 and the water heater 12 are commonly know parts in the laundry washing machine technical field, and therefore not described in detail.

[0052] With reference to Figure 1, 2A, 2B and 3, the rotatable drum 1 comprises a substantially cylindrical and hollow body 13 preferably, thought not necessarily, made of metal material, for example stainless-steel; advantageously the rotatable drum 1 may optionally comprise also a number (three in the example shown) of transversal protruding ribs 14, which are located on the inner surface of the cylindrical lateral wall 13a of body 13, evenly spaced one another. Moreover these transversal protruding ribs 14 preferably, thought not necessarily, extend substantially parallel to the longitudinal axis L of the body 13, i.e. of the rotatable drum 1, and project from the inner surface of the cylindrical lateral wall 13a towards the center of the drum 1 so as to lift the laundry during rotation of rotatable drum 1.

[0053] With reference to Figures 2A, 2B, 3 and 4, alike traditional rotatable drums, rotatable drum 1 is provided with a plurality of through holes 15 which are conveniently distributed at least on the cylindrical lateral wall 13a (however analogous through holes may be optionally provided also on one or more of the bases of the hollow cylindrical body 13) so as to assure adequate water circulation across the drum during all phases of the washing cycle.

[0054] However, differently from traditional rotatable drums, the rotatable drum 1 is provided, on the inner surface of its cylindrical lateral wall 13a, with a plurality of outwards-projecting, basin-shaped (or sink-shaped) bulges (or recesses or indentations) 16, realized so that the concave surface of each first bulge 16 is oriented towards the centre of the rotatable drum 1; preferably, but not necessarily, each first bulge 16 is provided with a lateral wall, not indicated in the enclosed Figures, and with a bottom 16a (see Fig. 2A) which is preferably, but not necessarily, substantially flat.

[0055] Advantageously one or more of the through holes 15 are positioned inside the first bulges 16, so as to be locally outwards spaced apart from the nominal inner cylindrical surface S of lateral wall 13a (see Figure 4).

[0056] Preferably, but not necessarily the through holes 15 are positioned on the bottom 16a of the respective first bulges 16; in this case the bottom 16a of each first bulge 16 is locally radially displaced towards the external of the drum 1 (i.e. towards the washing tub 4 when the rotatable drum 1 is placed inside the latter), and it is provided with at least one through hole 15.

[0057] The first bulges 16 and the respective through holes 15 may advantageously cover the whole cylindrical lateral wall 13a, or also, as in the embodiment illustrated in the enclosed Figures, only one or more regions of this cylindrical lateral wall 13a; preferably, but not necessarily, in the second case, as in the example illustrated in the enclosed Figures, the one or more regions of the cylindrical lateral wall 13a which are not provided with the first bulges 16 may be imperforated.

[0058] Preferably, but not necessarily, the outwards-projecting first bulges 16 may be realized on the cylindrical lateral wall 13a of the rotatable drum 1 so as to be aligned one another along a number of adjacent longitudinal rows r which extend substantially parallel to the longitudinal axis L of the rotatable drum 1, and which are staggered one another.

[0059] Preferably (as in the example shown in the enclosed Figures), though not necessarily, the perimeter (i.e. the border, the boundary) of the first bulges 16 is substantially circular in shape.

[0060] In the example shown in the enclosed Figures each first bulge 16 is advantageously provided with a first through hole 15 located roughly at the centre of the bottom 16a of the first bulge 16, and/or with a number of second through holes 15 which are preferably, but not necessarily, located at the vertexes of a polygon which is preferably, though not necessarily, substantially regular in shape and is locally roughly centered to the first bulge 16, preferably centered to the bottom 16a of the first bulge 16.

[0061] Advantageously, the lateral wall of the first bulges 16 may have either a substantially cylindrical profile or a substantially truncated cone profile tapered towards the bottom 16a; in both cases the bottom 16a is preferably substantially flat.

[0062] However the first bulges 16 may advantageously have substantially any shape, and they are preferably, but not necessarily, provided with a substantially flat bottom 16a.

[0063] With reference to the example of Figure 3, each first bulge 16 is preferably, though not necessarily, provided with a first through hole 15 located roughly at the center of the first bulge 16, preferably at the center of the bottom 16a of the first bulge 16, and with six second through holes 15 which are located at the vertexes of a regular hexagon roughly centered to the first through hole 15; in this case bottom 16a of each first bulge 16 is therefore advantageously provided with seven through holes 15 substantially equally spaced one another. In this example the bottom 16a of the first bulges 16 is advanta-

geously substantially flat.

[0064] Obviously, in a different embodiment each first bulge 16 may have, on the bottom 16a, only the six second through holes 15 which are located at the vertexes of the hexagon centered to the bottom 16a of the first bulge 16.

[0065] According to the invention, with reference to Figures 2A, 2B, 3 and 4, the first bulges 16 are provided with a number of substantially circular, outwards-projecting, second bulges (or indentations, flaring, bendings towards the external of the rotatable drum) 17, each of which is roughly centered to a respective through hole 15.

[0066] In the example shown in the enclosed Figures, each second bulge 17 is preferably, though not necessarily, shaped so as to form, on the bottom 16a of the corresponding first bulge 16, a respective substantially truncated cone-shaped, outwards-projecting, short funnel, which extends locally substantially perpendicular to the cylindrical lateral wall 13a of the rotatable drum 1, and tapers towards the outside of the rotatable drum 1.

[0067] General operation of the laundry washing and/or drying machine 2 is substantially identical to that of a traditional laundry washing and/or drying machine, therefore no further explanation are required.

[0068] As regards the rotatable drum 1, the particular shape of its cylindrical lateral wall 13a enables the creation, during the rotation of the drum, of a thin water cushion between the laundry and the bottom 16a of the first bulges 16. This water cushion supports the laundry and improves the outflow of the washing water from the rotatable drum 1 without damaging the laundry textiles.

[0069] With reference to Figures 5 and 6, assembly of the rotatable drum 1 comprises the step of punching a substantially flat metal-sheet 20 preferably, though not necessarily, made of stainless-steel, so as to realize, on the latter, a number of through holes 15 conveniently spaced one another; and afterwards the step of pressing (e.g. deep-drawing, drawing, dishing) the metal-sheet 20 around the through holes 15, so as to realize, on metal-sheet 20, a number of first bulges (or recesses or indentations) 16, preferably substantially basin-shaped (or sink-shaped) each of which comprises one or more through holes 15 locally spaced apart from the natural reference laying plane N of the metal-sheet 20.

[0070] Preferably the first bulges 16 comprise a bottom on which the through holes 15 are placed.

[0071] Preferably, but not necessarily, the assembly of the rotatable drum 1 comprises the step of pressing (e.g. deep-drawing, drawing, dishing) the metal-sheet 20 in such a way that the bottom of the first bulges 16 is substantially flat, so that the one ore more through holes 15 present in this bottom are substantially not deformed by the pressing of the first bulges 16.

[0072] In the example shown, the perimeter (i.e. the border, the boundary) of the first bulges 16 is preferably, though not necessarily, substantially circular in shape. Moreover in the example shown, the first bulges 16 are preferably, though not necessarily, obtained on metal-sheet 20 so as to be arranged in side-by-side rows which are longitudinally staggered one another.

[0073] Assembly of the rotatable drum 1 preferably, though not necessarily, comprises the step of pressing the metal-sheet 20, so as to realize, on metal-sheet 20, a number of first bulges 16, each of which has a through hole 15, preferably located approximately at centre of the bottom of the first bulge.

[0074] As an alternative, assembly of the rotatable drum 1 preferably, though not necessarily, comprises the step of punching the metal-sheet 20, so as to form, on metal sheet 20, several groups of through holes 15, each of which comprises a number of through holes 15 located at the vertexes of a polygon having preferably, though not necessarily, a regular shape, and optionally also another through hole 15 located roughly at centre of this polygon; and afterwards the step of pressing the metal-sheet 20 around one or more of the through holes 15, so as to realize, on the metal-sheet 20, a number of first bulges 16, each of which has, on the bottom, a number of through holes 15 located at the vertexes of a polygon having preferably, though not necessarily, a regular shape and locally roughly centered to bottom of the first bulge 16, and optionally also an other through hole 15 located at centre of the bottom of the first bulge 16.

[0075] Advantageously the assembly of the rotatable drum 1 preferably, though not necessarily, comprises the step of punching the metal-sheet 20 so as to realize, on the metal-sheet 20, several groups of through holes 15, each of which comprises six through holes located at the vertexes of a regular hexagon, and optionally also an other through hole located roughly at centre of said hexagon.

[0076] With reference to Figure 6, preferably, though not necessarily, assembly of the rotatable drum 1 also comprises the step of, either contemporaneously or successively, pressing (e.g. deep-drawing, drawing, dishing) the bottom of each first bulge 16, so as to realize, around each through hole 15, a respective substantially circular, outwards-projecting, second bulge (or indentation, flaring, bending towards the external of the rotatable drum) 17 which is substantially centered to the corresponding through hole 15.

[0077] Preferably, though not necessarily, the pressing of the first bulges 16 and the second bulges 17 is performed via a male half-mould 24 and a female half-mould 25 which are located on opposite sides of the flat metal-sheet 20, aligned one another, and which are pushed one towards and against the other in a direction d (see Fig. 6) locally substantially perpendicular to the reference laying plane N of metal-sheet 20, so as to warp the flat metal-sheet 20 in between.

[0078] In the example shown in the enclosed figures, each second bulge 17 is preferably, though not necessarily, shaped so as to form, on metal-sheet 20, an outwards-projecting short funnel, which is substantially truncated cone in shape and extends locally perpendicular and spaced apart from the natural reference laying plane

N of metal-sheet 20.

[0079] Afterwards, the assembly of the rotatable drum 1 comprises the step of cylindrically bending the metal-sheet 20 so as to form a cylindrical coil, in which the first and second bulges 16 and 17 radially protrude outwards (i.e. towards the external of the rotatable drum 1); and the step of side-to-side connecting the two facing opposite lateral edges of the metal-sheet 20 preferably, though not necessarily, by clinching or welding, so as to form a cylindrical sleeve.

[0080] If the rotatable drum 1 is to be mounted into a front-loading washing machine, the assembly of the rotatable drum 1 further comprises the step of fitting, on the two axial ends of the rigid cylindrical sleeve formed by the metal-sheet 20, respectively a ring-shaped flange (provided with an opening for loading/unloading the laundry) and a rigid disc-shaped plate, both preferably, though not necessary, made of stainless-steel, and then the step of side-to-side connecting, preferably, though not necessarily, via clinching or welding, the external circular border of the flange and of the plate to the cylindrical sleeve formed by metal-sheet 20, so as to realize a bell-shaped (i.e. cylindrical, hollow, closed at one base and partially opened at the other base) body. Advantageously, but not necessarily, through holes, first bulges, and optionally second bulges, analogous to the ones described above, may be present also in the ring-shaped flange and/or in the disc-shaped plate.

[0081] Alternatively, if the rotatable drum 1 is to be mounted into a top-loading washing machine, assembly of the rotatable drum 1 comprises the step of fitting, on the two axial ends of the cylindrical sleeve formed by the metal-sheet 20, respectively two rigid disc-shaped plates, both preferably, though not necessary, made of stainless-steel, and then the step of side-to-side connecting, preferably, though not necessarily, via clinching or welding, the external circular border of the two plates to the cylindrical sleeve formed by the metal-sheet 20, so as to realize a hollow cylindrical body. Moreover, if the rotatable drum 1 is to be mounted into a top-loading washing machine, on the cylindrical sleeve formed by metal-sheet 20 there is an opening, not illustrated in the enclosed Figures, adapted for allowing the loading/unloading of the laundry; this opening is advantageously closeable by one or more lids associated (for example hinged, or slidably associated) to the rotatable drum 1. Advantageously, but not necessarily, through holes, first bulges, and optionally second bulges, analogous to the ones described above, can be present also in one or both the disc-shaped plates and/or on the one or more lids.

[0082] The particular structure of the cylindrical lateral wall of the rotatable drum has lots of advantages.

[0083] First of all, the particular shape of the first bulges realized on the cylindrical lateral wall of the drum, together with the particular arrangement of the through holes in the first bulges, enables the creation of a thin water cushion between the laundry and the internal of the first bulges, which improves the outflow of the washing water from rotatable drum without damaging the laundry textiles.

[0084] Moreover, if a drum according to the invention is used in a washing-drying machine, the claimed particular configuration of the through holes with respect to the first bulges improves the air flow trough the drum, improving in this way the drying performances.

[0085] Moreover, thanks to the second bulges, the sharp edges of the through hole on the cylindrical lateral wall of the drum are outwards oriented, and the laundry is therefore prevented from coming in contact with these sharp edges.

[0086] Finally the particular layout of the outwards-projecting first (and also second) bulges increases the overall stiffness of rotatable drum with respect to traditional rotatable drums made with metal-sheets having the same thickness.

[0087] Clearly, changes may be made to rotatable drum, to the laundry washing and/or drying machine and to the assembly method of the rotatable drum as described above without, however, departing from the scope of the present invention; for example a drum provided with a cylindrical lateral wall according to the invention could be used also in a tumble dryer.

Claims

1. Rotatable drum (1) for laundry washing machines (2) comprising a substantially cylindrical lateral wall (13a) provided with a plurality of through holes (15), wherein said cylindrical lateral wall (13a) is also provided with one or more, outwards-projecting, first bulges (16), which radially protrude towards the external of the rotatable drum (1), with at least one of said through holes (15) located therein,
   characterized in that
   said first bulges (16) are provided with a number of outwards-projecting second bulges (17), which radially protrude towards the external of the rotatable drum (1) each of which is roughly centered to a respective through hole (15).

2. Rotatable drum as claimed in Claim 1, wherein each first bulge (16) has said at least one first through hole (15) located roughly at its center, and/or a number of second through holes (15) which are located at the vertexes of a polygon locally roughly centered to the first bulge (16).

3. Rotatable drum as claimed in Claim 1 or 2, wherein each first bulge (16) has six second through holes (15) which are located at the vertexes of a hexagon locally roughly centered to the first bulge (16).

4. Rotatable drum as claimed in anyone of the foregoing claims, wherein said first bulges (16) comprise a lateral wall and a bottom (16a), the one or more

through holes (15) located in each first bulge (16) being placed in its bottom (16a).

5. Rotatable drum as claimed in anyone of the foregoing claims, wherein said first bulges (16) are realized on the cylindrical lateral wall (13a) so as to be aligned one another along a number of adjacent longitudinal rows (r) staggered one another.

6. Rotatable drum as claimed in anyone of the foregoing claims, wherein the perimeter of said first bulges (16) is substantially circular in shape.

7. Rotatable drum as claimed in any one of the foregoing claims, wherein each second bulge (17) is shaped so as to form a respective outwards-projecting funnel which is substantially truncated cone in shape.

8. Assembly method of a rotatable drum (1) of a laundry washing machine (2) wherein the rotatable drum (1) comprises a substantially cylindrical lateral wall (13a) provided with a plurality of through holes (15); the assembly method comprising the steps of:

- punching a metal-sheet (20) so as to realize, on the latter, a number of through holes (15) spaced one another;
- pressing the metal-sheet (20) around one or more of said through holes (15), so as to realize, on said metal-sheet (20), a number of first bulges (16), each of which comprises one or more of said through holes (15) locally spaced apart from the natural reference laying plane (N) of the metal-sheet (20);
- cylindrically bending said metal-sheet (20) so as to form a cylindrical coil in which said first bulges (16) radially protrude outward, i.e. towards the external of the rotatable drum (1);
- connecting the two opposite lateral edges of said metal-sheet (20), so as to form a cylindrical sleeve,

the assembly method being **characterized by** also comprising the step of pressing the bottom of each first bulge (16) so as to realize, around each through hole (15), a respective outwards-projecting second bulge (17), which radially protrude towards the external of the rotatable drum (1), which is substantially centered to the corresponding through hole (15).

9. Assembly method as claimed in Claim 8, wherein each second bulge (17) is shaped so as to form, on the metal-sheet (20), an outwards-projecting funnel, which is substantially truncated cone in shape.

10. Assembly method as claimed in anyone of Claims 8-9, wherein the metal-sheet (20) is pressed so that each first bulge (16) has at least a first through hole (15) located roughly on its centre.

11. Assembly method as claimed in any one of Claims 8-10, **characterized in that** the metal-sheet (20) is punched so as to form, on the latter, several groups of through holes (15), each of which comprises a number of through holes (15) located at the vertexes of a polygon; and afterwards the metal sheet (20) is pressed so as to realize a number of first bulges (16) each of which comprises a number of through holes (15) located at the vertexes of a polygon locally roughly centered to said first bulge (16).

12. Assembly method as claimed in any one of Claims 8-11, **characterized in that** the metal-sheet (20) is pressed so to realize a number of the first bulges (16) aligned along a number of adjacent longitudinal rows, which are staggered one another.

13. Assembly method as claimed in any one of Claims 8-12, wherein the metal-sheet (20) is pressed so that each first bulge (16) comprises a lateral wall and a bottom (16a), the one or more through holes (15) located in each first bulge (16) being placed in its bottom (16a).

Patentansprüche

1. Drehbare Trommel (1) für Wäschewaschmaschine (2), aufweisend eine im Wesentlichen zylindrische, seitliche Wand (13a), welche mit einer Vielzahl von Durchgangslöchern (15) versehen ist, wobei die zylindrische, seitliche Wand (13a) auch mit einem oder mehreren nach außen vorspringenden, ersten Ausbuchtungen (16) versehen ist, welche radial in Richtung des äußeren Bereichs der drehbaren Trommel (1) vorstehen, mit mindestens einem der Durchgangslöcher (15), welches darin angeordnet ist,
dadurch gekennzeichnet, dass
die ersten Ausbuchtungen (16) mit einer Anzahl von nach außen vorspringenden zweiten Ausbuchtungen (17) versehen sind, welche radial in Richtung des äußeren Bereichs der drehbaren Trommel (1) vorstehen, von denen jede zu einem jeweiligen Durchgangsloch (15) ungefähr zentriert ist.

2. Drehbare Trommel nach Anspruch 1, wobei jede erste Ausbuchtung (16) das mindestens eine erste Durchgangsloch (15), welches ungefähr in deren Zentrum angeordnet ist, und/oder eine Anzahl von zweiten Durchgangslöchern (15) besitzt, welche an den Ecken eines Polygons angeordnet sind, welche lokal zur ersten Ausbuchtung (16) ungefähr zentriert ist.

3. Drehbare Trommel nach Anspruch 1 oder 2, wobei

jede erste Ausbuchtung (16) sechs zweite Durchgangslöcher (15) besitzt, welche an den Ecken eines Sechsecks angeordnet sind, welches lokal zur ersten Ausbuchtung (16) ungefähr zentriert ist.

4. Drehbare Trommel nach einem der vorhergehenden Ansprüche, wobei die ersten Ausbuchtungen (16) eine seitliche Wand und einen Boden (16a) aufweisen, wobei das eine oder die mehreren, in jeder ersten Ausbuchtung (16) angeordneten Durchgangslöcher (15) in ihrem Boden (16a) angeordnet sind.

5. Drehbare Trommel nach einem der vorhergehenden Ansprüche, wobei die ersten Ausbuchtungen (16) an der zylindrischen, seitlichen Wand (13a) ausgeführt sind, um so entlang einer Anzahl von benachbarten longitudinalen, zueinander versetzten Reihen (r) zueinander ausgerichtet zu sein.

6. Drehbare Trommel nach einem der vorhergehenden Ansprüche, wobei der Umfang der ersten Ausbuchtungen (16) von im Wesentlichen kreisförmiger Gestalt ist.

7. Drehbare Trommel nach einem der vorhergehenden Ansprüche, wobei jede zweite Ausbuchtung (17) gestaltet ist, um so einen jeweiligen nach außen vorspringenden Trichter zu bilden, welcher von im Wesentlichen kegelstumpfartiger Form ist.

8. Montageverfahren einer drehbaren Trommel (1) einer Wäschewaschmaschine (2), wobei die drehbare Trommel (1) eine im Wesentlichen zylindrische, seitliche Wand (13a) aufweist, welche mit einer Anzahl von Durchgangslöchern (15) versehen ist; wobei das Montageverfahren die folgenden Schritte aufweist:

Stanzen eines Metallblechs (20), um so in dem Letzteren eine Anzahl von zueinander beabstandeten Durchgangslöchern (15) auszuführen;
Pressen des Metallblechs (20) um eines oder mehrere der Durchgangslöcher (15), um so auf dem Metallblech (20) eine Anzahl von ersten Ausbuchtungen (16) herzustellen, von welchen jede ein oder mehrere Durchgangslöcher (15) aufweist, welche lokal von der natürlichen Bezugsebene (N) des Metallblechs (20) beabstandet sind;
zylindrisches Biegen des Metallblechs (20), um so eine zylindrische Rolle zu bilden, in welcher die ersten Ausbuchtungen (16) radial nach außen vorstehen, d.h. in Richtung des Äußeren der drehbaren Trommel (1);
Verbinden der beiden seitlichen Ränder des Metallblechs (20), um so eine zylindrische Hülse zu bilden,
wobei das Montageverfahren **dadurch gekennzeichnet ist, dass** es auch den Schritt des Pressens des Bodens von jeder ersten Ausbuchtung (16) aufweist, um so um jedes Durchgangsloch (15) herum eine jeweilige zweite nach außen vorspringende Ausbuchtung (17) herzustellen, welche radial in Richtung des Äußeren der drehbaren Trommel (1) vorsteht, welche im Wesentlichen zu dem entsprechenden Durchgangsloch (15) zentriert ist.

9. Montageverfahren nach Anspruch 8, wobei jede zweite Ausbuchtung (17) gestaltet ist, um so auf dem Metallblech (20) einen jeweiligen nach außen vorspringenden Trichter zu bilden, welcher von im Wesentlichen kegelstumpfartiger Form ist.

10. Montageverfahren nach einem der Ansprüche 8 bis 9, wobei das Metallblech (20) gepresst wird, so dass jede erste Ausbuchtung (16) mindestens ein erstes Durchgangsloch (15) besitzt, welches ungefähr in ihrem Zentrum angeordnet ist.

11. Montageverfahren nach einem der Ansprüche 8 bis 10, **dadurch gekennzeichnet, dass** das Metallblech (20) gestanzt wird, um so in dem Letzteren mehrere Gruppen von Durchgangslöchern (15) zu bilden, von denen jede eine Anzahl von Durchgangslöchern (15) aufweist, welche an den Ecken eines Polygon angeordnet sind; und danach das Metallblech (20) gepresst wird, um so eine Anzahl von ersten Ausbuchtungen (16) herzustellen, von denen jede eine Anzahl von Durchgangslöchern (15) aufweist, welche an den Ecken eines Polygons angeordnet sind, welches zur ersten Ausbuchtung (16) lokal ungefähr zentriert ist.

12. Montageverfahren nach einem der Ansprüche 8 bis 11, **dadurch gekennzeichnet, dass** das Metallblech (20) gepresst wird, um so eine Anzahl von ersten Ausbuchtungen (16) herzustellen, welche entlang einer Anzahl von benachbarten, longitudinalen Reihen ausgerichtet sind, welche zueinander versetzt sind.

13. Montageverfahren nach einem der Ansprüche 8 bis 12, wobei das Metallblech (20) gepresst wird, so dass die erste Ausbuchtung (16) eine seitliche Wand und einen Boden (16a) aufweist, wobei das eine oder die mehreren, in jeder ersten Ausbuchtung (16) angeordneten Durchgangslöcher (15) in ihrem Boden (16a) angeordnet sind.

Revendications

1. Tambour rotatif (1) pour lave-linge (2) comprenant une paroi latérale (13a) sensiblement cylindrique, pourvue d'une pluralité de trous traversants (15),

dans lequel ladite paroi latérale (13a) cylindrique est aussi pourvue d'un ou plusieurs premiers renflements (16) dépassant vers l'extérieur, qui font une saillie radiale vers l'extérieur du tambour rotatif (1), avec au moins un desdits trous traversants (15) qui y est situé,
caractérisé en ce que lesdits premiers renflements (16) sont pourvus d'un certain nombre de seconds renflements (17) dépassant vers l'extérieur, qui font une saillie radiale vers l'extérieur du tambour rotatif (1) et dont chacun est à peu près centré sur un trou traversant (15) respectif.

2. Tambour rotatif selon la revendication 1, dans lequel chaque premier renflement (16) comporte ledit premier trou traversant (15) situé à peu près en son centre et/ou un certain nombre de seconds trous traversants (15) qui sont situés aux sommets d'un polygone centré localement à peu près sur le premier renflement (16).

3. Tambour rotatif selon la revendication 1 ou 2, dans lequel chaque premier renflement (16) comporte six seconds trous traversants (15) qui sont situés aux sommets d'un hexagone centré localement à peu près sur le premier renflement (16).

4. Tambour rotatif selon l'une quelconque des revendications précédentes, dans lequel lesdits premiers renflements (16) comprennent une paroi latérale et un fond (16a), le ou les trous traversants (15) situés dans chaque premier renflement (16) étant placés dans son fond (16a).

5. Tambour rotatif selon l'une quelconque des revendications précédentes, dans lequel lesdits premiers renflements (16) sont réalisés sur la paroi latérale (13a) cylindrique de façon à être alignés les uns avec les autres suivant un certain nombre de rangées longitudinales (r) adjacentes en quinconce.

6. Tambour rotatif selon l'une quelconque des revendications précédentes, dans lequel le périmètre desdits premiers renflements (16) est de forme sensiblement circulaire.

7. Tambour rotatif selon l'une quelconque des revendications précédentes, dans lequel chaque second renflement (17) est façonné de façon à constituer un entonnoir dépassant vers l'extérieur respectif qui est de forme sensiblement tronconique.

8. Procédé d'assemblage d'un tambour rotatif (1) d'un lave-linge (2) dans lequel le tambour rotatif (1) comprend une paroi latérale (13a) sensiblement cylindrique, pourvue d'une pluralité de trous traversants (15), le procédé d'assemblage comprenant les étapes consistant à :

- poinçonner une tôle (20) de façon à réaliser sur cette dernière un certain nombre de trous traversants (15) espacés les uns des autres ;
- emboutir la tôle (20) autour d'un ou plusieurs desdits trous traversants (15), de façon à réaliser sur ladite tôle (20) un certain nombre de premiers renflements (16), chacun d'entre eux comprenant un ou plusieurs desdits trous traversants (15) espacés localement du plan de pose (N) de référence naturelle de la tôle (20) ;
- cintrer en forme de cylindre ladite tôle (20) afin de constituer un rouleau cylindrique dans lequel lesdits premiers renflements (16) font saillie vers l'extérieur, c.-à-d. vers l'extérieur du tambour rotatif (1) ;
- raccorder les deux bords latéraux opposés de ladite tôle (20) afin de constituer un manchon cylindrique,

le procédé d'assemblage étant **caractérisé en ce qu'**il comprend aussi l'étape consistant à emboutir le fond de chaque premier renflement (16) de façon à réaliser, autour de chaque trou traversant (15), un second renflement (17) respectif dépassant vers l'extérieur, qui fait une saillie radiale vers l'extérieur du tambour rotatif (1) et qui est à peu près centré sur le trou traversant (15) correspondant.

9. Procédé d'assemblage selon la revendication 8, dans lequel chaque second renflement (17) est façonné de façon à constituer sur la tôle (20) un entonnoir dépassant vers l'extérieur qui est de forme sensiblement tronconique.

10. Procédé d'assemblage selon la revendication 8 ou 9, dans lequel la tôle (20) est emboutie de façon à ce que chaque premier renflement (16) comporte au moins un premier trou traversant (15) situé à peu près en son centre.

11. Procédé d'assemblage selon l'une quelconque des revendications 8 à 10, **caractérisé en ce que** l'on poinçonne la tôle (20) de façon à constituer, sur cette dernière, plusieurs groupes de trous traversants (15), chacun d'entre eux comprenant un certain nombre de trous traversants (15) situés aux sommets d'un polygone ; et après on emboutit la tôle (20) de façon à réaliser un certain nombre de premiers renflements (16), chacun d'entre eux comprenant un certain nombre de trous traversants (15) situés aux sommets d'un polygone centré localement à peu près sur ledit premier renflement (16).

12. Procédé d'assemblage selon l'une quelconque des revendications 8 à 11, **caractérisé en ce que** l'on emboutit la tôle (20) de façon à réaliser un certain nombre de premiers renflements (16) alignés suivant un certain nombre de rangées longitudinales

adjacentes qui sont en quinconce.

13. Procédé d'assemblage selon l'une quelconque des revendications 8 à 12, dans lequel on emboutit la tôle (20) de façon à ce que chaque premier renflement (16) comprenne une paroi latérale et un fond (16a), le ou les trous traversants (15) situés dans chaque premier renflement (16) étant placés dans son fond (16a).

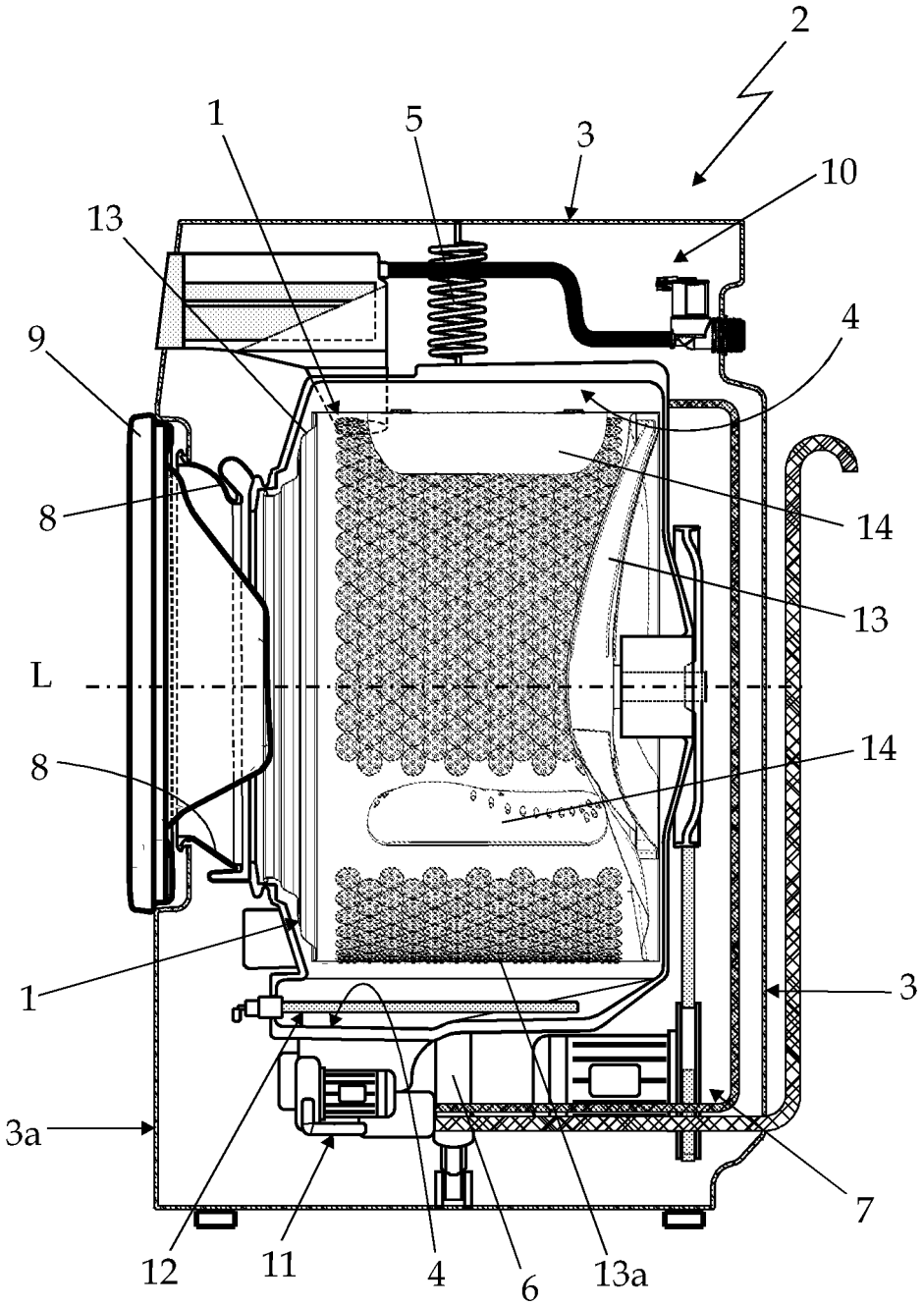


Fig. 1

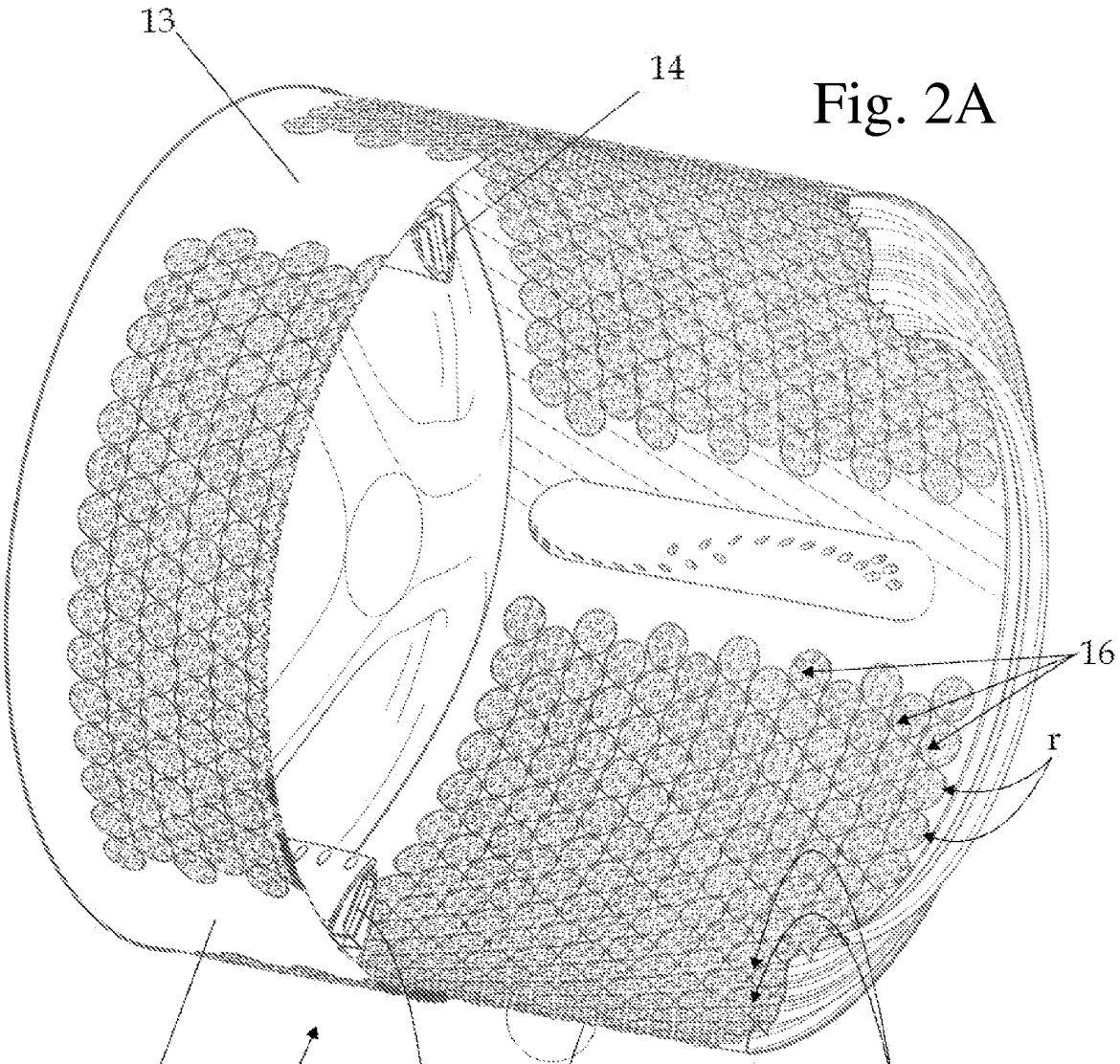


Fig. 2A

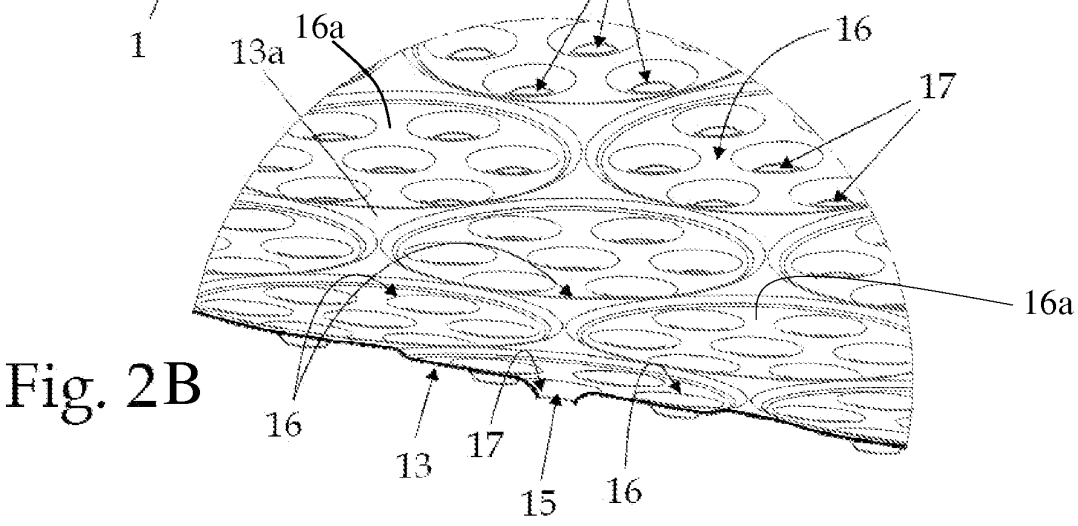
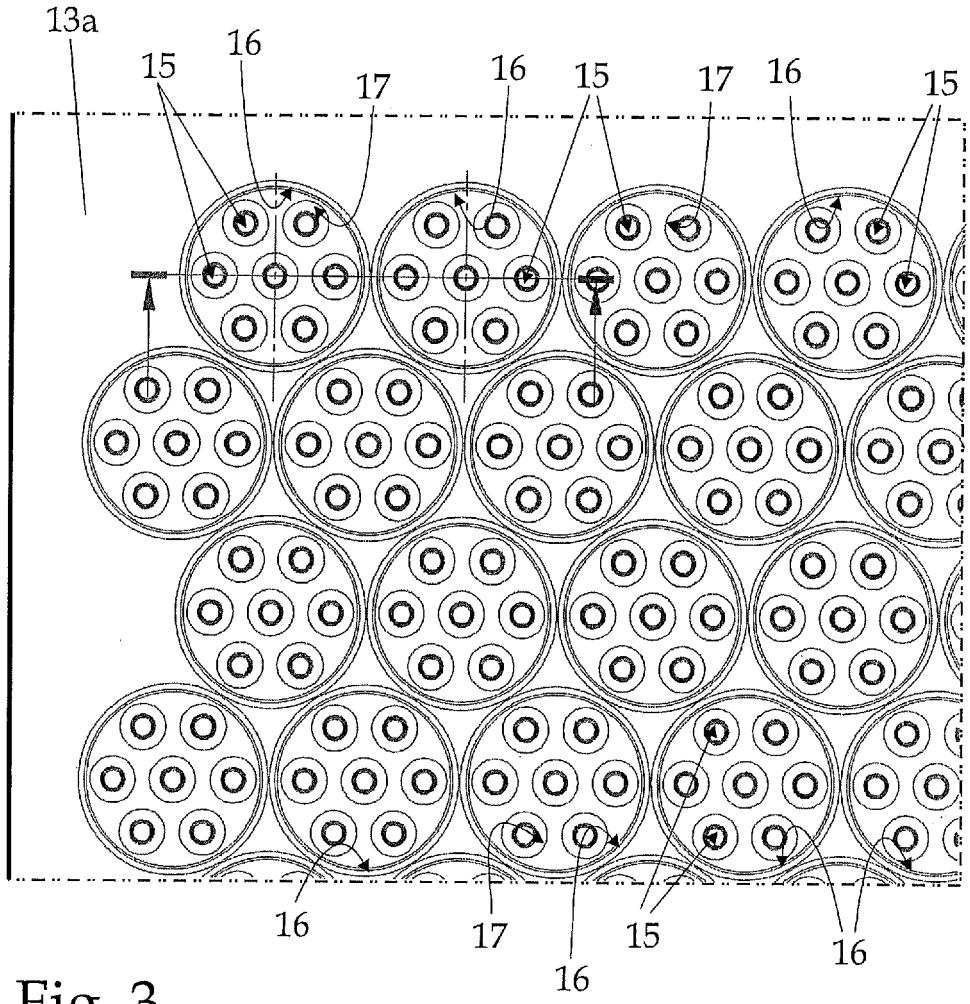


Fig. 2B


13a
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16
17
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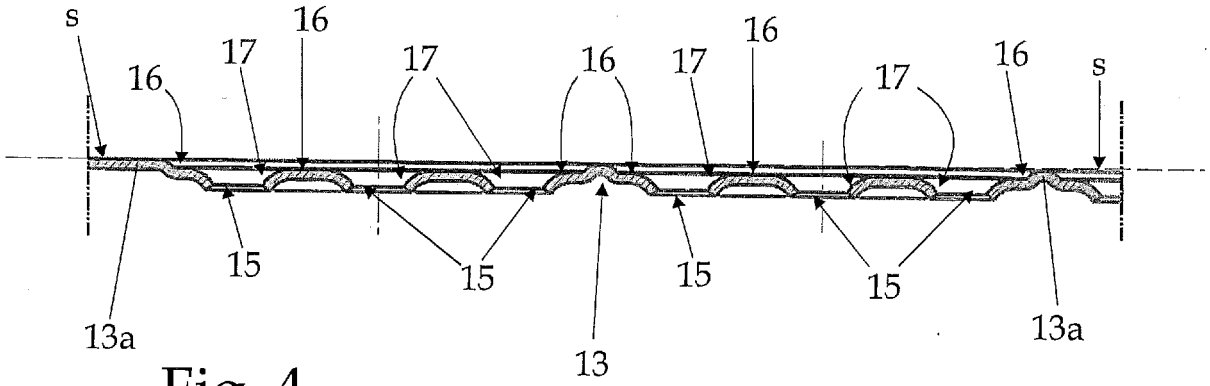
16

Fig. 3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13a
13
13a

Fig. 4

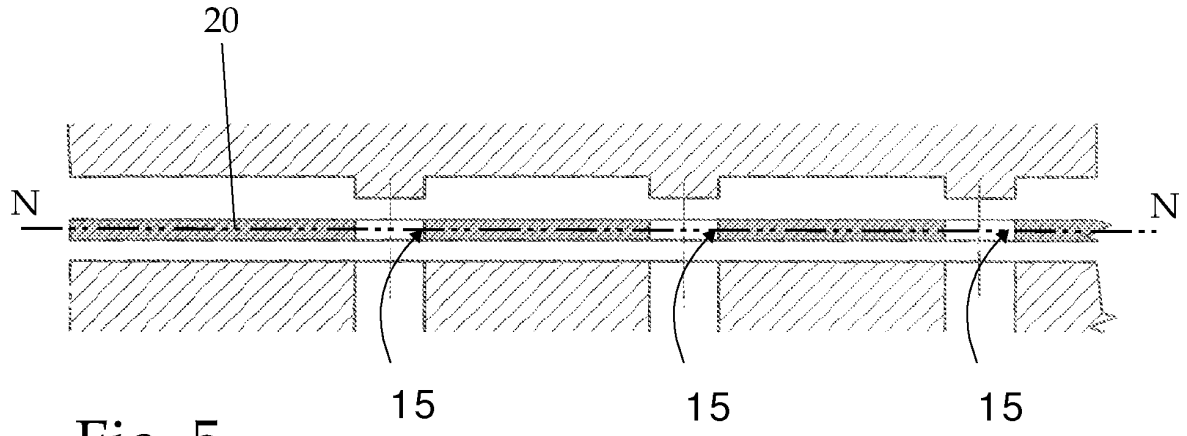

Fig. 5

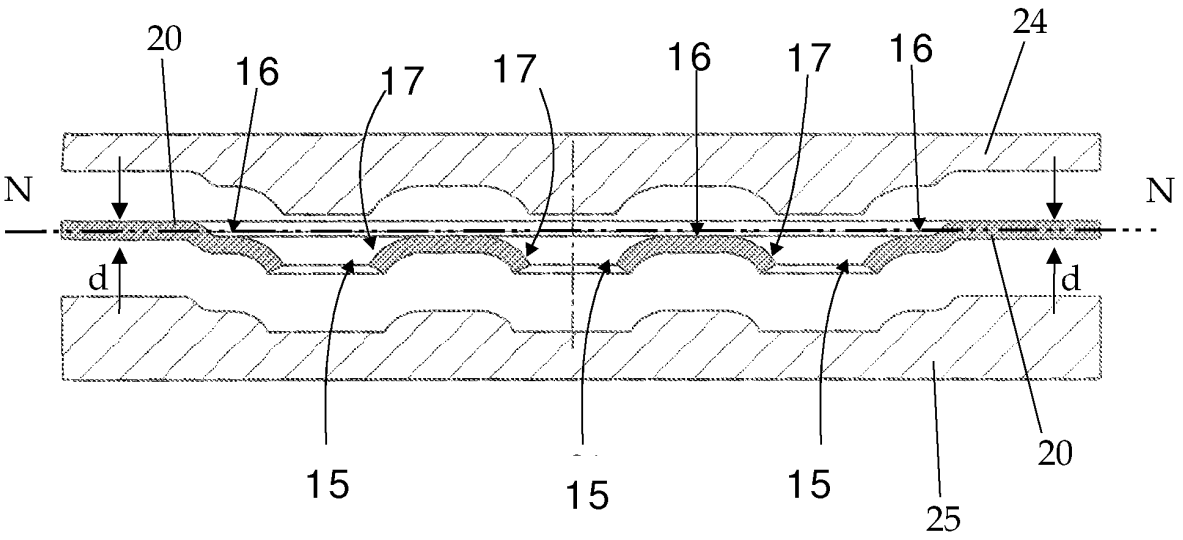

Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- WO 2008077394 A **[0012]**