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

Haushaltswasch- und Wäschetrocknermaschine

Machine à laver et sécher le linge domestique

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EP 2 604 749 B1

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, typically 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 closed-circuit, hot-air generator 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] More specifically, the closed-circuit, hot-air generator 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 front-loading laundry washing and drying machine currently on the market, the cooling down and dehumidification of the air drawn from the washing tub is performed inside a "air/air" or "cold-water/air" condenser which is attached/ integrated to/on the back of the washing tub, typically inside the boxlike casing, and which uses cold air (the air/air condensed) or cold tap water of the water mains (the cold-water/air condenser) as refrigerant.

[0006] The heating up of the dehumidified air coming out of the condenser is performed inside an air-duct assembly which, at the present time, is rigidly attached to the top of the washing tub so as to have a first end in direct communication with the condenser and a second end in direct communication with the washing tub close to the front mouth of the latter, and which internally houses an electric centrifugal fan (or blower) that circulates the air across the washing tub and a, preferably substantially flat, coil-shaped resistor that heats up the dehumidified air directed back into the washing tub.

[0007] In US 7322125, the coil-shaped resistor is arranged inside the outer tubular body of the air-duct assembly so as to be locally parallel to the bottom of the tubular body and is supported by two tongs-like clamping members which are rigidly fixed to, and extend upwards from, the bottom of the tubular casing of the air-duct assembly. The two prongs of each clamping member are structured for being inserted between two adjacent branches of the coil-shaped resistor body, very close to the bend of the resistor body connecting said branches, and for being elastically deformed against said two adjacent branches to locally clamp the resistor body.

[0008] Despite being very cost effective, the tongs-like clamping members referred above turned out to be inadequate to support the coil-shaped resistor in the laundry washing and drying machines wherein the drum rotating speed may exceed 1400 Rpm (revolution per minute). During the spinning phase of these laundry washing and drying machines, in fact, the resistor shakes/jerks very hardly on its reference laying plane, and the elastic structure of the tongs-like clamping members may allow the peripheral branches of the coil-shaped resistor to temporarily detach from the prongs of clamping member and violently bump against the adjacent lateral walls of the tubular casing of the air-duct assembly, damaging the external isolation shield of the resistor and/or the tubular casing.

[0009] WO 2007/021134 A2 discloses a drying duct assembly and a washing machine having the drying duct assembly. The drying duct assembly includes a duct lower, a duct upper coupled to an upper portion of the duct lower, a reflector seating on one of inner circumferences of the duct lower and the duct upper, a heater provided in the duct lower to generate heat, and a fan assembly provided on a side of the duct lower to suck air.

[0010] Aim of the present invention is to fix the coil-shaped resistor into the tubular casing of the air-duct assembly in a vibration-proof manner, i.e. in a manner which ensures that the coil-shaped resistor doesn't bump against the adjacent walls of the tubular casing of the air-duct assembly, even during the spinning phase of the washing cycle.

[0011] Applicant has found that by providing a laundry washing and drying machine in which one or more coil-shaped resistor bars of a air-heating device, comprising one or more intermediate branches and two opposite side branches, are fixed into a tubular body, fixed to the washing tub, by a supporting assembly comprising two retaining elements each of which is faced/aligned to a respective side branch and is shaped/structured to reach and

retain the corresponding side branch in such a way to be locally interposed between the body of the resistor bar and an adjacent lateral wall of the tubular body, each retaining element being fixed to the tubular body, it is possible to obtain an effective and stable fastening of the coil-shaped resistor into the tubular casing of the air-duct assembly, so as to avoid that, in particular during the spinning phase, the coil-shaped resistor bumps against the tubular casing.

[0012] The solution according to one or more embodiments of the present invention relates to a laundry washing and drying machine comprising:

- an outer boxlike casing,
- a hollow washing tub suspended in floating manner inside the casing,
- an air-duct assembly attached onto the washing tub and which comprises a tubular body, structured for channeling an airflow, comprising two lateral walls, and an air-heating device housed inside the tubular body and structured to heat up the air that flows across said tubular body; the air-heating device comprises at least one coil-shaped resistor bar extending inside the tubular body and comprising one or more intermediate branches and two opposite side branches each of which is interposed between the intermediate branches and a respective one of the lateral walls of the tubular body; the air-duct assembly comprises a supporting assembly structured to keep the at least one coil-shaped resistor bar locally spaced from the bottom of the tubular body. The supporting assembly comprises two retaining elements each of which is faced/aligned to a respective side branch of the coil-shaped resistor bar and is shaped/structured to reach and retain the corresponding side branch of the coil-shaped resistor bar in such a way to be locally interposed between the body of the resistor bar and the adjacent lateral wall of the tubular body, each retaining element being fixed to the tubular body.

[0013] Preferably, the supporting assembly may comprise an oblong plate element which rests on the bottom of the tubular body, beneath the at least one coil-shaped resistor bar, and extends crosswise inside the tubular body so as to cross/intersect all branches of the superjacent coil-shaped resistor bar, each retaining element being rigidly fixed to a respective distal end of the oblong plate element.

[0014] More preferably, the oblong plate element may be recessed into a complementary groove or slot provided on the bottom of the tubular body.

[0015] Advantageously the supporting assembly may comprise at least one fixing member which stably rigidly anchors the oblong plate element to the bottom of the tubular body.

[0016] Advantageously the two retaining elements may be made in one piece with the oblong plate element.

[0017] Preferably, the air-heating device may comprise a number of superimposed coil-shaped resistor bars.

[0018] Advantageously, the superimposed coil-shaped resistor bars may be rigidly coupled to one another by a number of spacer elements.

[0019] Preferably, the two retaining elements may be shaped/structured to reach and retain a corresponding side branch of each superimposed coil-shaped resistor bars.

[0020] Opportunely, each retaining element may comprise a rigid fork-shaped element which is faced/aligned to a respective side branch of the coil-shaped resistor bar and may be shaped/structured to reach and retain, into two spaced points at once, the corresponding side branch of the coil-shaped resistor bar.

[0021] Preferably each fork-shaped element may comprise a couple of substantially flat, reciprocally faced and spaced, fins or winglets that extend substantially perpendicular to the bottom of the tubular body, are oriented so to be locally substantially perpendicular to corresponding local sections of the side branch of the coil-shaped resistor bar, and are provided with at least one side indentation which is properly dimensioned/shaped to receive and clamp a corresponding section of the side branch of the coil-shaped resistor bar.

[0022] Opportunely, at least one of the two retaining elements may be provided with at least one additional rigid tailpiece that projects from the retaining element and rests and/or rigidly couples and/or is embedded with the tubular body.

[0023] Preferably, the supporting assembly may comprise at least one fixing member which stably rigidly anchors the at least one additional rigid tailpiece to the tubular body.

[0024] Advantageously, the air-duct assembly may comprise an air-pumping device which is housed inside the tubular body and may be structured to circulate an airflow across the tubular body.

[0025] Advantageously, the air-pumping device may comprise a centrifugal fan, and a portion of the tubular body may be shaped so as to form the outer volute or impeller hosing of the centrifugal fan.

[0026] Preferably, the air-duct assembly may comprise a measuring device structured for measuring the temperature of the air flowing inside the tubular body.

[0027] 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 air-duct assembly of the Figure 1 laundry washing and drying machine;

- Figure 3 is a partly exploded perspective view, with parts removed for clarity, of the Figure 2 air-duct assembly.
- Figure 4 is a top view, with parts removed for clarity, of the Figure 2 air-duct assembly;
- Figure 5 is a section view of the Figure 4 air-duct assembly according to section line V-V; and
- Figures 6 to 10 are schematic section views of further embodiments of the air-duct assembly of Figures 2-5.

[0028] 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.

[0029] With reference to Figure 1, reference number 1 indicates as a whole a front-loading laundry washing and drying machine 1 that advantageously comprises:

- a preferably, though not necessarily, substantially parallelepiped-shaped outer boxlike casing 2, 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.

[0030] In the example shown, washing tub 3 is 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).

[0031] 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 preferably substantially horizontally-oriented, longitudinal reference axis L of washing tub 3.

[0032] With reference to Figure 1, the laundry washing and drying machine 1 preferably comprises:

- a porthole door 5 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.

[0033] The laundry washing and drying machine 1 is also preferably provided with a, preferably closed-circuit, hot-air generator 7 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 dry the laundry.

[0034] Advantageously, the hot-air generator 7 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; and finally 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.

[0035] With reference to Figures 1 and 2, the hot-air generator 7 is housed inside the boxlike casing 2 and advantageously comprises:

- an air cooling device 8 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 and retain the surplus moisture in the air drawn from washing tub 3; and
- an air heating device 9 which, is rigidly attached to the washing tub 3, is fluidly connected to both washing tub 3 and air cooling device 8 to allow the dehumidified air to flow from the air cooling device 8 to the washing tub 3, and is structured to heat up the dehumidified air arriving from the air cooling device 8 before said air returns back into washing tub 3.

[0036] In the example shown, the air cooling device 8 preferably comprises a coldwater condenser 8 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 later.

[0037] With reference to Figures 2, 3 and 4, the air heating device 9 preferably comprises an air-duct assembly 9 which is preferably rigidly attached to the top of washing tub 3, and advantageously comprises:

- a rigid tubular outer body 12 which is structured for being firmly fixed to washing tub 3, preferably on the top of the latter, with a first opening or mouth 12a fluidly connected to, i.e. in direct communication with, the air cooling device 8, and 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 electric heating device 13 which is housed inside tubular body 12 and is structured to heat up, when electrically powered, the air that flows across tubular body 12; and preferably also
- an electric centrifugal fan 14 or other air-pumping device which is housed inside tubular body 12, preferably upstream of 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 8 for finally returning back to tubular body 12.

[0038] Preferably, though not necessarily, the air-duct assembly 9 furthermore comprises one or more temperature sensors 15 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. In the example shown, air-duct assembly 9 preferably comprises two temperature sensors 15 which are preferably, though not necessarily, located one close to the second opening or mouth 12b of the tubular body 12, and the other between the electric centrifugal fan 14 and the heating device 13.

[0039] In the example shown, the electric heating device 13 is preferably housed inside a mid portion of tubular body 12, whereas centrifugal fan 14 is preferably located upstream of heating device 13, preferably recessed on a portion of tubular body 12 suitably shaped to form the outer volute or impeller housing of centrifugal fan 14.

[0040] With reference to Figures 2, 3 and 4, in the example shown tubular body 12 preferably comprises at least two complementary hemi-shells 16 and 17 having their peripheral edges shaped/structured for being reciprocally coupled to compose/form the tubular body 12, and, preferably, an intermediate sealing gasket (not shown) which is preferably made of a suitable elastomeric material and is structured for being interposed between the peripheral edges of the hemi-shells 16, 17 to seal in substantially airtight manner the hemi-shells 16 and 17 to one another.

[0041] With reference to Figures 2 and 3, in the example shown tubular body 12 preferably comprises a substantially basin-shaped, lower hemi-shell 16 which is structured for being rigidly fixed to the top of the washing tub 3 preferably via a number of anchoring screws 18, and a substantially lid-shaped, upper hemi-shell 17 which is structured for being rigidly fixed to the basin-shaped lower hemi-shell 16 and is suitably shaped/dimensioned to rest in abutment on the whole annular upper rim of the hemi-shell 16 to completely close the basin-shaped lower hemi-shell 16.

[0042] Both upper and lower hemi-shells 16 and 17 are preferably made of a rigid metal material.

[0043] The clear section of tubular body 12 preferably increasers towards the second opening or mouth 12b of tubular body 12.

[0044] Preferably the substantially basin-shaped, lower hemi-shell 16 is shaped/dimensioned so as to directly house the electric heating device 13, whereas the substantially lid-shaped, upper hemi-shell 17 is preferably, though not necessarily, structured/shaped to directly support the one or more temperature sensors 15.

[0045] In addition to the above, a first portion of the outer volute of centrifugal fan 14 is preferably, though not necessarily, provided directly on the basin-shaped, lower hemi-shell 16 locally substantially coaxial to the first opening or mouth 12a of tubular body 12, whereas a second complementary portion of the outer volute of centrifugal fan 14 is provided on the lid-shaped upper hemi-shell 17, so that the complete outer volute or impeller casing of centrifugal fan 14 is composed when the upper and lower hemi-shells 16 and 17 are couplet to one another.

[0046] With reference to Figures 3, 4 and 5, the electric heating device 13 is arranged inside a mid portion of tubular body 12 having preferably a substantially rectangular cross-section, so as to be locally substantially parallel to the bottom 12c of the mid portion of tubular body 12, i.e. substantially parallel to the bottom of the basin-shaped lower hemi-shell 16, ad is rigidly attached/fixed to tubular body 12 via a support assembly 20 structured to keep the heating device 13 locally spaced from the bottom 12c of tubular body 12.

[0047] Advantageously, electric heating device 13 comprises a coupling plate or socket 21 which is structured for being rigidly fixed on a corresponding pass-trough opening provided on a lateral wall of tubular body 12, e.g. on a lateral wall of the basin-shaped, lower hemi-shell 16.

[0048] Advantageously, electric heating device 13 comprises one or more superimposed coil-shaped resistor bars 22 (two superimposed coil-shaped resistor bars 22 in the example shown), that preferably protrude from the coupling plate or socket 21 and extend inside tubular body 12 while, preferably, but not necessarily, remaining locally preferably parallel to a reference laying plane P which is locally substantially parallel to the bottom 12c of tubular body 12.

[0049] The one or more superimposed coil-shaped re-

sistor bars 22 are preferably rigidly coupled to one another advantageously by a number of spacers elements 23 suitably structured/ dimensioned to keep the coil-shaped resistor bars 22 locally spaced one another (preferably also parallel and aligned one another).

[0050] Each coil-shaped resistor bar 22 has a number of intermediate branches 22a preferably oriented locally substantially parallel to the longitudinal midline M of tubular body 12, and two opposite side branches 22b each of which is interposed between the intermediate branches 22b and a respective one of the lateral walls 12d of the tubular body 12; preferably each side branch 22b is directly faced, and preferably also locally substantially parallel, to the lateral walls 12d of the mid portion of tubular body 12, i.e. the lateral walls 12d of the basin-shaped lower hemi-shell 16.

[0051] With reference to Figure 4, in the example shown the two opposite side branches 22b of coil-shaped resistor bar 22 preferably locally diverge to one another, preferably in such a way to remain locally substantially parallel to the lateral walls 12d of the tubular body 12. This particular shape of the resistor bar/s 22 allows, together with the progressive increase of the clear section of tubular body 12, to maximize the heat transfer to the air flowing inside tubular body 12.

[0052] With reference to Figures 3, 4 and 5, the support assembly 20 of air-duct assembly 9 is structured to rigidly keep the one or more superimposed coil-shaped resistor bars 22 locally spaced from the bottom 12c of tubular body 12.

[0053] Advantageously the support assembly 20 of air-duct assembly 9comprises:

- a rigid oblong plate element 25 which rests on the bottom 12c of tubular body 12, beneath the coil-shaped resistor bar/s 22, and extends crosswise inside tubular body 12, preferably substantially along the whole mid portion of tubular body 12, so as to cross/intersect all branches 22a and 22b of the superjacent coil-shaped resistor bar 22;
- two (preferably rigid) retaining elements 26 each of which is (preferably rigidly) fixed to a respective distal end of the oblong plate element 25, protrudes upwards from the oblong plate element 25 so as to be faced/aligned to a respective side branch 22b of the superjacent coil-shaped resistor bar/s 22, and is shaped/structured to reach and retain a corresponding side branch 22b of each superjacent coil-shaped resistor bar 22, so as to be locally interposed between the body of the resistor bar 22 and the adjacent lateral wall 12d of tubular body 12 (this means that no parts of the resistor bar 22 is interposed between any part of the retaining element and the adjacent lateral wall 12d of tubular body 12); and
- at least one fixing member 28 which stably rigidly anchors the oblong plate element 25 to the bottom 12c of tubular body 12.

[0054] In other words, the two (preferably rigid) retaining elements 26 of support assembly 20 are arranged on opposite sides of electric heating device 13 so as to embrace the coil-shaped resistor bar/s 22 from opposite sides of the latter. Therefore the resistor bar/s can't be separated from the retaining element by the lateral movements of the tubular body 12 (which may occur for example during the spinning phase of the washing cycle), which made the fastening of the heating device 13 to the tubular outer body 12 very effective and stable.

[0055] In the example shown, the oblong plate element 25 is preferably recessed into a complementary groove or slot 25a provided on the bottom 12c of the mid portion of tubular body 12, i.e. on the bottom of the basin-shaped lower hemi-shell 16.

[0056] Preferably, though not necessarily, a rib or similar projection may also protrude from the bottom 12c of tubular body 12, i.e. from the bottom of the basin-shaped lower hemi-shell 16, and abuts sideways against a corresponding retaining element 26 of support assembly 20 to prevent the leaning (or folding/bending) of the retaining element 26 against the adjacent lateral wall 12d of tubular body 12.

[0057] With reference to Figure 3, in the example shown each retaining element 26 preferably comprises a rigid fork-shaped element 26 which is rigidly fixed to a respective distal end of the oblong plate element 25, protrudes upwards from the oblong plate element 25 so as to be faced/aligned to a corresponding side branch 22b of the superjacent coil-shaped resistor bar/s 22 and is shaped/structured to reach and retain, into two spaced points at once, the same side branch 22b of the coil-shaped resistor bar 22.

[0058] In the example shown, each rigid fork-shaped element 26 preferably comprises a couple of substantially flat, reciprocally faced and spaced, fins or winglets 27 that extend upwards substantially perpendicular to the bottom 12c of tubular body 12, are oriented so to be locally substantially perpendicular to corresponding local sections of the side branch 22b of the corresponding coil-shaped resistor bar/s 22, and are provided with a suitable number of side indentations 27a each of which is properly dimensioned/shaped to receive and clamp a corresponding section of a side branch 22b of a coil-shaped resistor bar 22.

[0059] The oblong plate element 25 and the two retaining elements 26 are preferably made of metal, and the two retaining elements 26 are furthermore preferably made in one piece with the oblong plate element 25 so as to form a monolithic rigid structure.

[0060] In other words, in the example shown, each fin or winglet 27 of the retaining elements 26 preferably protrudes from a respective major side edge of the oblong plate element 25, at the distal end of the oblong plate element 25.

[0061] With reference to Figures 3, 4 and 5, the fixing member 28 preferably comprises an anchoring screw 28 or rivet which engages in pass-trough manner the oblong

plate element 25 and extends/sinks into the bottom 12c of the mid portion of tubular body 12, i.e. into the bottom of the basin-shaped lower hemi-shell 16, to rigidly connect in unmovable manner the oblong plate element 25 to the bottom 12c of tubular body 12.

[0062] General operation of the front-loading laundry washing and drying machine 1 is clearly inferable from the above description, with no further explanation required.

[0063] The advantages connected to the particular structure of support assembly 20 of air-duct assembly 9 are large in number. First of all, the particular structure of support assembly 20 prevents the two opposite side branches 22b of each coil-shaped resistor bar 22 from moving towards the lateral walls 12d of tubular element 12 and bumping into said walls.

[0064] Furthermore the assembly of electric heating device 13 into tubular body 12 is greatly simplified allowing a relevant reduction of the overall production costs.

[0065] The coil-shaped resistor bar/s 22 of electric heating device 13, in fact, can be inserted into the support assembly 20 before the electric heating device 13 is introduced into the mid portion of tubular body 12. The subsequent screw of the anchoring screw 28 into the bottom of the mid portion of tubular body 12, i.e. into the bottom of the basin-shaped lower hemi-shell 16, allows rigidly and permanently blocking both the support assembly 20 and the electric heating device 13 directly on the bottom of tubular body 12.

[0066] Having recessed the oblong plate element 25 into the complementary groove or slot 25a in fact avoids any further movement of the oblong plate element 25 on the bottom of tubular boy 12.

[0067] Clearly, changes may be made to either the laundry washing and drying machine 1 as described herein without, however, departing from the scope of the present invention.

[0068] For example, with reference to Figure 6, in a first alternative embodiment each retaining elements 26 of support assembly 20 is shaped/structured to clamp the side branch 22b of only one corresponding coil-shaped resistor bar 22. In which case, spacers elements 23 are preferably provided to keep the coil-shaped resistor bars 22 rigidly coupled to one another.

[0069] In other words, the two fins or winglets 27 of each retaining elements 26 are shaped/structured to reach and retain the side branch 22b of only one coil-shaped resistor bar 22.

[0070] With reference to Figure 7, in a second alternative embodiment at least one of the two retaining elements 26of support assembly 20 is provided with an additional rigid tailpiece 29 that projects from the retaining elements 26preferably towards the lateral wall 12d of tubular body 12, and rests/abuts on a corresponding supporting portion 12e of tubular body 12; and support assembly 20 furthermore comprises an additional anchoring screw 30, rivet or other fixing member which rigidly fixes said tailpiece 29 to the supporting portion 12e of tubular body 12.

[0071] In the example shown, at least one of the two fins or winglets 27 of the retaining elements 26 is provided with a rigid tongue or flap 29 that extends from the tip of the fin or winglet 27 towards the lateral wall 12d of tubular body 12, and abuts/rests with its distal end on the top of a rigid stem 12e that protrudes upwards from the bottom 12c of tubular body 12. The anchoring screw 30 engages in pass-though manner the distal end of the rigid tongue or flap 29 and penetrates into the top of stem 12e to rigidly fix the tongue or flap 29 to the top of stem 12e.

[0072] With reference to Figure 8, in a third alternative embodiment at least one of the two retaining elements 26 of support assembly 20 is provided with an additional rigid tailpiece 31 that projects from the retaining elements 26 and extends preferably towards the lateral wall 12d of tubular body 12 up to reach and penetrate/embed into tubular body 12, so to be rigidly connected to tubular body 12.

[0073] Advantageously, in this embodiment the additional tailpiece 31 projects from the retaining elements 26 and extends towards the lateral wall 12d of tubular body 12 up to penetrate between the peripheral edges of the two hemi-shell 16 and 17 forming tubular body 12.

[0074] In other words, in this embodiment at least one of the two fins or winglets 27 of the retaining elements 26 is provided with a rigid tongue or flap 31 that extends from the tip of the fin or winglet 27 towards the lateral wall 12d of tubular body 12 up to abut/rest with its distal end on the peripheral edge of the lower hemi-shell 16 of tubular body 12, so that the distal end of the rigid tongue or flap 31 is rigidly entrapped/blocked between the hemi-shells 16 and 17 when tubular body 12 is composed.

[0075] With reference to Figure 9, in a fourth alternative embodiment the oblong plate element 25 of support assembly 20 rests firmly on the top of at least one raised socket or basement 25b (but there could be more than one socket or basements) that protrudes from the bottom 12c of tubular body 12, i.e. from the bottom of the basin-shaped lower hemi-shell 16.

[0076] With reference to Figure 10, in a fifth embodiment, support assembly 20 of air-duct assembly 9 lacks the oblong plate element 25 and the anchoring screw 28, and each retaining elements 26 is provided with at least one corresponding rigid tailpiece 32 that projects from the retaining element 26 and rigidly couples with a corresponding supporting portion 12f of tubular body 12.

[0077] In this embodiment, support assembly 20 furthermore comprises two additional anchoring screw 33, rivet or other fixing member each of which rigidly fixes the tailpiece 32 of a corresponding retaining elements 26 is to the corresponding supporting portion 12f of tubular body 12.

[0078] In other words, at least one of the two fins or winglets 27 of each retaining element 26 is provided with a rigid tongue or flap 32 that extends from the tip of the fin or winglet 27 and rigidly couples with the top of a rigid stem 12f that protrudes upwards from the bottom 12c of

tubular body 12. Each anchoring screw 33 engages in pass-though manner the distal end of the rigid tongue or flap 32 and penetrates into the top of stem 12f to rigidly fix the whole retaining element 26 to the top of stem 12f.

Claims

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

- an outer boxlike casing (2),
- a hollow washing tub (3) suspended in floating manner inside the casing (2),
- an air-duct assembly (9) attached onto the washing tub (3) and which comprises a tubular body (12), structured for channeling an airflow, comprising two lateral walls (12d), and an air-heating device (13) housed inside the tubular body (12) and structured to heat up the air that flows across said tubular body (12),

wherein said air-heating device (13) comprises at least one coil-shaped resistor bar (22) extending inside the tubular body (12) and comprising one or more intermediate branches (22a) and two opposite side branches (22b) each of which is interposed between the intermediate branches (22b) and a respective one of the lateral walls (12d) of the tubular body (12),
wherein said air-duct assembly (9) comprises a supporting assembly (20) structured to keep said at least one coil-shaped resistor bar (22) locally spaced from the bottom (12c) of said tubular body (12) and comprising
two retaining elements (26) each of which is aligned to a respective side branch (22b) of the coil-shaped resistor bar (22) **characterized in that** each of said retaining elements (26) is structured to reach and retain the corresponding side branch (22b) of said coil-shaped resistor bar (22) in such a way to be locally interposed between the body of the resistor bar (22) and the adjacent lateral wall (12d) of the tubular body (12), each retaining element (26) being fixed to said tubular body (12).

2. Laundry washing and drying machine according to Claim 1, wherein said supporting assembly (20) comprises an oblong plate element (25) which rests on the bottom (12c) of said tubular body (12), beneath said at least one coil-shaped resistor bar (22), and extends crosswise inside the tubular body (12) so as to intersect all branches (22a, 22b) of the superjacent coil-shaped resistor bar (22), each retaining element (26) being rigidly fixed to a respective distal end of said oblong plate element (25).

3. Laundry washing and drying machine according to Claim 2, wherein said oblong plate element (25) is recessed into a complementary groove or slot (25a) provided on the bottom (12c) of said tubular body (12).

4. Laundry washing and drying machine according to Claim 2 or 3, wherein said supporting assembly (20) comprises at least one fixing member (28) which stably rigidly anchors the oblong plate element (25) to the bottom (12c) of said tubular body (12).

5. Laundry washing and drying machine according to Claim 2, 3 or 4, wherein the two retaining elements (26) are made in one piece with the oblong plate element (25).

6. Laundry washing and drying machine according to any one of the preceding claims, wherein said air-heating device (13) comprise a number of superimposed coil-shaped resistor bars (22).

7. Laundry washing and drying machine according to Claim 6, wherein said superimposed coil-shaped resistor bars (22) are rigidly coupled to one another by a number of spacer elements (23).

8. Laundry washing and drying machine according to Claim 6 or 7, wherein said two retaining elements (26) are structured to reach and retain a corresponding side branch (22b) of each superimposed coil-shaped resistor bars (22).

9. Laundry washing and drying machine according to any one of the preceding claims, wherein each retaining element (26) comprises a rigid fork-shaped element (26) which is faced/aligned to a respective side branch (22b) of the coil-shaped resistor bar (22) and is shaped/structured to reach and retain, into two spaced points at once, the corresponding side branch (22b) of said coil-shaped resistor bar (22).

10. Laundry washing and drying machine according to Claim 9, wherein each fork-shaped element (26) comprises a couple of substantially flat, reciprocally faced and spaced, fins or winglets (27) that extend substantially perpendicular to the bottom (12c) of said tubular body (12), are oriented so to be locally substantially perpendicular to corresponding local sections of the side branch (22b) of the coil-shaped resistor bar (22), and are provided with at least one side indentation (27a) which is properly shaped to receive and clamp a corresponding section of the side branch (22b) of the coil-shaped resistor bar (22).

11. Laundry washing and drying machine according to any one of the preceding claims, wherein at least one of said two retaining elements (26) is provided with at least one additional rigid tailpiece (29, 31, 32)

that projects from the retaining element (26) and rests and/or rigidly couples or is embedded with said tubular body (12)

12. Laundry washing and drying machine according to Claim 11, wherein said supporting assembly (20) comprises at least one fixing member (30, 33) which stably rigidly anchors said at least one additional rigid tailpiece (29, 31, 32) to said tubular body (12).

13. Laundry washing and drying machine according to any one of the preceding claims, wherein the air-duct assembly (9) comprises an air-pumping device (14) which is housed inside the tubular body (12) and is structured to circulate an airflow across said tubular body (12).

14. Laundry washing and drying machine according to Claim 12, wherein said air-pumping device (14) comprises a centrifugal fan (14), and a portion of the tubular body (12) is shaped so as to form the outer volute or impeller hosing of said centrifugal fan (14).

15. Laundry washing and drying machine according to any one of the preceding claims, wherein the air-duct assembly (9) comprises a measuring device (15) structured for measuring the temperature of the air flowing inside the tubular body (12).

Patentansprüche

1. Wasch- und Wäschetrocknermaschine (1), umfassend:

- ein äußeres kastenähnliches Gehäuse (2),
- einen hohlen Waschbottich (3), der schwebend in dem Gehäuse (2) aufgehängt ist,
- eine Luftleitungsanordnung (9), die an dem Waschbottich (3) befestigt ist und einen röhrenförmigen Körper (12) umfasst, der zum Kanalisieren einer Luftströmung strukturiert ist, umfassend zwei Seitenwände (12d) und eine Lufterwärmungsvorrichtung (13), die im Inneren des röhrenförmigen Körpers (12) untergebracht ist und zum Erwärmen der Luft strukturiert ist, die durch den röhrenförmigen Körper (12) strömt,

wobei die Lufterwärmungsvorrichtung (13) mindestens eine spulenförmige Widerstandsstange (22) umfasst, die sich im Inneren des röhrenförmigen Körpers (12) erstreckt, und eine oder mehrere Zwischenverzweigungen (22a) und zwei gegenüberliegende Seitenverzweigungen (22b) umfasst, die jeweils zwischen den Zwischenverzweigungen (22b) und einer jeweiligen der Seitenwände (12d) des röhrenförmigen Körpers (12) angeordnet sind,
wobei die Luftleitungsanordnung (9) eine Stützanordnung (20) umfasst, die derart strukturiert ist, dass sie die mindestens eine spulenförmige Widerstandsstange (22) örtlich von dem Boden (12c) des röhrenförmigen Körpers (12) beabstandet hält, und die Folgendes umfasst:

zwei Halteelemente (26), von denen jedes mit einer entsprechenden Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) ausgerichtet ist, **dadurch gekennzeichnet, dass** jedes der Halteelemente (26) derart strukturiert ist, dass es die entsprechende Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) erreicht und derart hält, dass es örtlich zwischen dem Körper der Widerstandsstange (22) und der benachbarten Seitenwand (12d) des röhrenförmigen Körpers (12) angeordnet ist, wobei jedes Halteelement (26) an dem röhrenförmigen Körper (12) befestigt ist.

2. Wasch- und Wäschetrocknermaschine nach Anspruch 1, wobei die Stützanordnung (20) ein längliches Plattenelement (25) umfasst, das auf dem Boden (12c) des röhrenförmigen Körpers (12), unter der mindestens einen spulenförmigen Widerstandsstange (22) angeordnet ist und sich quer im Inneren des röhrenförmigen Körpers (12) erstreckt, und so alle Verzweigungen (22a, 22b) der darüber liegenden spulenförmigen Widerstandsstange (22) schneidet, wobei jedes Halteelement (26) starr an einem jeweiligen distalen Ende des länglichen Plattenelements (25) befestigt ist.

3. Wasch- und Wäschetrocknermaschine nach Anspruch 2, wobei das längliche Plattenelement (25) in eine komplementäre Rille oder einen Schlitz (25) versenkt ist, die bzw. der auf dem Boden (12c) des röhrenförmigen Körpers (12) bereitgestellt ist.

4. Wasch- und Wäschetrocknermaschine nach Anspruch 2 oder 3, wobei die Stützanordnung (20) mindestens ein Befestigungselement (28) umfasst, welches das längliche Plattenelement (25) stabil und starr an dem Boden (12c) des röhrenförmigen Körpers (12) verankert.

5. Wasch- und Wäschetrocknermaschine nach Anspruch 2, 3 oder 4, wobei die zwei Halteelemente (26) mit dem länglichen Plattenelement (25) einstückig ausgebildet sind.

6. Wasch- und Wäschetrocknermaschine nach einem der vorhergehenden Ansprüche, wobei die Lufterwärmungsvorrichtung (13) eine Anzahl übereinanderliegender spulenförmiger Widerstandsstangen (22) umfasst.

7. Wasch- und Wäschetrocknermaschine nach An-

spruch 6, wobei die übereinanderliegenden spulenförmigen Widerstandsstangen (22) durch eine Anzahl Abstandshalterelemente (23) starr miteinander verkoppelt sind.

8. Wasch- und Wäschetrocknermaschine nach Anspruch 6 oder 7, wobei die zwei Halteelemente (26) derart strukturiert sind, dass sie eine entsprechende Seitenverzweigung (22b) jeder übereinanderliegenden spulenförmigen Widerstandsstange (22) erreichen und zurückhalten.

9. Wasch- und Wäschetrocknermaschine nach einem der vorhergehenden Ansprüche, wobei jedes Halteelement (26) ein starres gabelförmiges Element (26) umfasst, das zu einer jeweiligen Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) gerichtet/ausgerichtet ist und derart geformt/strukturiert ist, dass es an zwei beabstandeten Punkten gleichzeitig die entsprechende Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) erreicht und diese zurückhält.

10. Wasch- und Wäschetrocknermaschine nach Anspruch 9, wobei jedes gabelförmige Element (26) ein Paar im Wesentlichen flache, einander gegenüberliegende und beabstandete Rippen oder Flügel (27) umfasst, die sich im Wesentlichen senkrecht zu dem Boden (12c) des röhrenförmigen Körpers (12) erstrecken und derart ausgerichtet sind, dass sie örtlich im Wesentlichen senkrecht zu entsprechenden lokalen Abschnitten der Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) liegen und mit mindestens einer Seiteneinkerbung (27a) bereitgestellt sind, die geeignet geformt ist, um einen entsprechenden Abschnitt der Seitenverzweigung (22b) der spulenförmigen Widerstandsstange (22) aufzunehmen und einzuspannen.

11. Wasch- und Wäschetrocknermaschine nach einem der vorhergehenden Ansprüche, wobei mindestens eines der zwei Halteelemente (26) mit mindestens einem zusätzlichen starren Schlussstück (29, 31, 32) bereitgestellt ist, das aus dem Halteelement (26) hervorsteht und auf dem röhrenförmigen Körpers (12) aufliegt und/oder damit starr verkoppelt ist oder damit eingebettet ist.

12. Wasch- und Wäschetrocknermaschine nach Anspruch 11, wobei die Stützanordnung (20) mindestens ein Befestigungselement (30, 33) umfasst, welches das mindestens eine zusätzliche starre Schlussstück (29, 31, 32) an dem röhrenförmigen Körper (12) stabil und starr verankert.

13. Wasch- und Wäschetrocknermaschine nach einem der vorhergehenden Ansprüche, wobei die Luftleitungsanordnung (9) eine Luftpumpenvorrichtung (14) umfasst, die im Inneren des röhrenförmigen Körpers (12) angeordnet und derart strukturiert ist, dass sie eine Luftströmung in dem röhrenförmigen Körper (12) umwälzt.

14. Wasch- und Wäschetrocknermaschine nach Anspruch 12, wobei die Luftpumpenvorrichtung (14) ein Fliehkraftgebläse (14) umfasst und ein Abschnitt des röhrenförmigen Körpers (12) derart geformt ist, dass er das Außengehäuse oder die Flügelradverschlauchung des Fliehkraftgebläses (14) bildet.

15. Wasch- und Wäschetrocknermaschine nach einem der vorhergehenden Ansprüche, wobei die Luftleitungsanordnung (9) eine Messvorrichtung (15) umfasst, die zum Messen der Temperatur der Luftströmung im Inneren des röhrenförmigen Körpers (12) strukturiert ist.

Revendications

1. Machine à laver et sécher le linge (1) comprenant :

- une carcasse extérieure de type boîte (2),
- une cuve de lavage creuse (3) suspendue de manière flottante à l'intérieur de la carcasse (2),
- un ensemble conduit d'air (9) fixé sur la cuve de lavage (3) et qui comprend un corps tubulaire (12), structuré pour canaliser un écoulement d'air, comprenant deux parois latérales (12d), et un dispositif de chauffage d'air (13) reçu à l'intérieur du corps tubulaire (12) et structuré pour chauffer l'air qui s'écoule à travers ledit corps tubulaire (12),

ledit dispositif de chauffage d'air (13) comprenant au moins une barre de résistance en forme de serpentin (22) s'étendant à l'intérieur du corps tubulaire (12) et comprenant une ou plusieurs branches intermédiaires (22a) et deux branches latérales opposées (22b), chacune desquelles étant interposée entre les branches intermédiaires (22b) et une paroi respective des parois latérales (12d) du corps tubulaire (12),
ledit ensemble conduit d'air (9) comprenant un ensemble de support (20) structuré pour maintenir ladite au moins une barre de résistance en forme de serpentin (22) espacée localement de la partie inférieure (12c) dudit corps tubulaire (12) et comprenant deux éléments de retenue (26), chacun desquels étant aligné avec une branche latérale respective (22b) de la barre de résistance en forme de serpentin (22), **caractérisée par le fait que** chacun desdits éléments de retenue (26) est structuré pour atteindre et retenir la branche latérale correspondante (22b) de ladite barre de résistance en forme de serpentin (22) de telle manière à être interposée localement

entre le corps de la barre de résistance (22) et la paroi latérale adjacente (12d) du corps tubulaire (12), chaque élément de retenue (26) étant fixé audit corps tubulaire (12).

2. Machine à laver et sécher le linge selon la revendication 1, dans laquelle ledit ensemble de support (20) comprend un élément en plaque oblong (25) qui repose sur la partie inférieure (12c) dudit corps tubulaire (12), au-dessous de ladite au moins une barre de résistance en forme de serpentin (22), et s'étend transversalement à l'intérieur du corps tubulaire (12) de façon à couper toutes les branches (22a, 22b) de la barre de résistance en forme de serpentin surjacente (22), chaque élément de retenue (26) étant fixé rigidement à une extrémité distale respective dudit élément en plaque oblong (25).

3. Machine à laver et sécher le linge selon la revendication 2, dans laquelle ledit élément en plaque oblong (25) est en renfoncement dans une rainure ou fente complémentaire (25a) ménagée sur la partie inférieure (12c) dudit corps tubulaire (12).

4. Machine à laver et sécher le linge selon l'une des revendications 2 ou 3, dans laquelle ledit ensemble de support (20) comprend au moins un élément de fixation (28) qui ancre de façon rigide et stable l'élément en plaque oblong (25) à la partie inférieure (12c) dudit corps tubulaire (12).

5. Machine à laver et sécher le linge selon l'une des revendications 2, 3 ou 4, dans laquelle les deux éléments de retenue (26) sont faits d'un seul tenant avec l'élément en plaque oblong (25).

6. Machine à laver et sécher le linge selon l'une quelconque des revendications précédentes, dans laquelle ledit dispositif de chauffage d'air (13) comprend un nombre de barres de résistance en forme de serpentin superposées (22).

7. Machine à laver et sécher le linge selon la revendication 6, dans laquelle lesdites barres de résistance en forme de serpentin superposées (22) sont couplées rigidement les unes aux autres par un nombre d'éléments d'espacement (23).

8. Machine à laver et sécher le linge selon l'une des revendications 6 ou 7, dans laquelle lesdits deux éléments de retenue (26) sont structurés pour atteindre et retenir une branche latérale correspondante (22b) de chacune des barres de résistance en forme de serpentin superposées (22).

9. Machine à laver et sécher le linge selon l'une quelconque des revendications précédentes, dans laquelle chaque élément de retenue (26) comprend un élément rigide en forme de fourche (26) qui est tourné vers/aligné avec une branche latérale respective (22b) de la barre de résistance en forme de serpentin (22) et est façonné/structuré pour atteindre et retenir, en deux points espacés à la fois, la branche latérale correspondante (22b) de ladite barre de résistance en forme de serpentin (22).

10. Machine à laver et sécher le linge selon la revendication 9, dans laquelle chaque élément en forme de fourche (26) comprend un couple d'ailettes sensiblement plates, mutuellement opposées et espacées (27) qui s'étendent sensiblement perpendiculairement à la partie inférieure (12c) dudit corps tubulaire (12), sont orientées de façon à être localement sensiblement perpendiculaires à des sections locales correspondantes de la branche latérale (22b) de la barre de résistance en forme de serpentin (22), et comportent au moins un renfoncement latéral (27a) qui est façonné de façon appropriée pour recevoir et serrer une section correspondante de la branche latérale (22b) de la barre de résistance en forme de serpentin (22).

11. Machine à laver et sécher le linge selon l'une quelconque des revendications précédentes, dans laquelle au moins l'un desdits deux éléments de retenue (26) comporte au moins une pièce de raccordement rigide supplémentaire (29, 31, 32) qui se projette à partir de l'élément de retenue (26) et repose sur et/ou se couple rigidement ou est incorporé audit corps tubulaire (12).

12. Machine à laver et sécher le linge selon la revendication 11, dans laquelle ledit ensemble de support (20) comprend au moins un élément de fixation (30, 33) qui ancre de façon rigide et stable ladite au moins une pièce de raccordement rigide supplémentaire (29, 31, 32) audit corps tubulaire (12).

13. Machine à laver et sécher le linge selon l'une quelconque des revendications précédentes, dans laquelle l'ensemble conduit d'air (9) comprend un dispositif de pompage d'air (14) qui est reçu à l'intérieur du corps tubulaire (12) et est structuré pour faire circuler un écoulement d'air à travers ledit corps tubulaire (12).

14. Machine à laver et sécher le linge selon la revendication 12, dans laquelle ledit dispositif de pompage d' air (14) comprend un ventilateur centrifuge (14), et une partie du corps tubulaire (12) est façonnée de façon à former le carter extérieur de volute ou de roue dudit ventilateur centrifuge (14).

15. Machine à laver et sécher le linge selon l'une quelconque des revendications précédentes, dans laquelle l'ensemble conduit d'air (9) comprend un dis-

positif de mesure (15) structuré pour mesurer la température de l'air s'écoulant à l'intérieur du corps tubulaire (12).

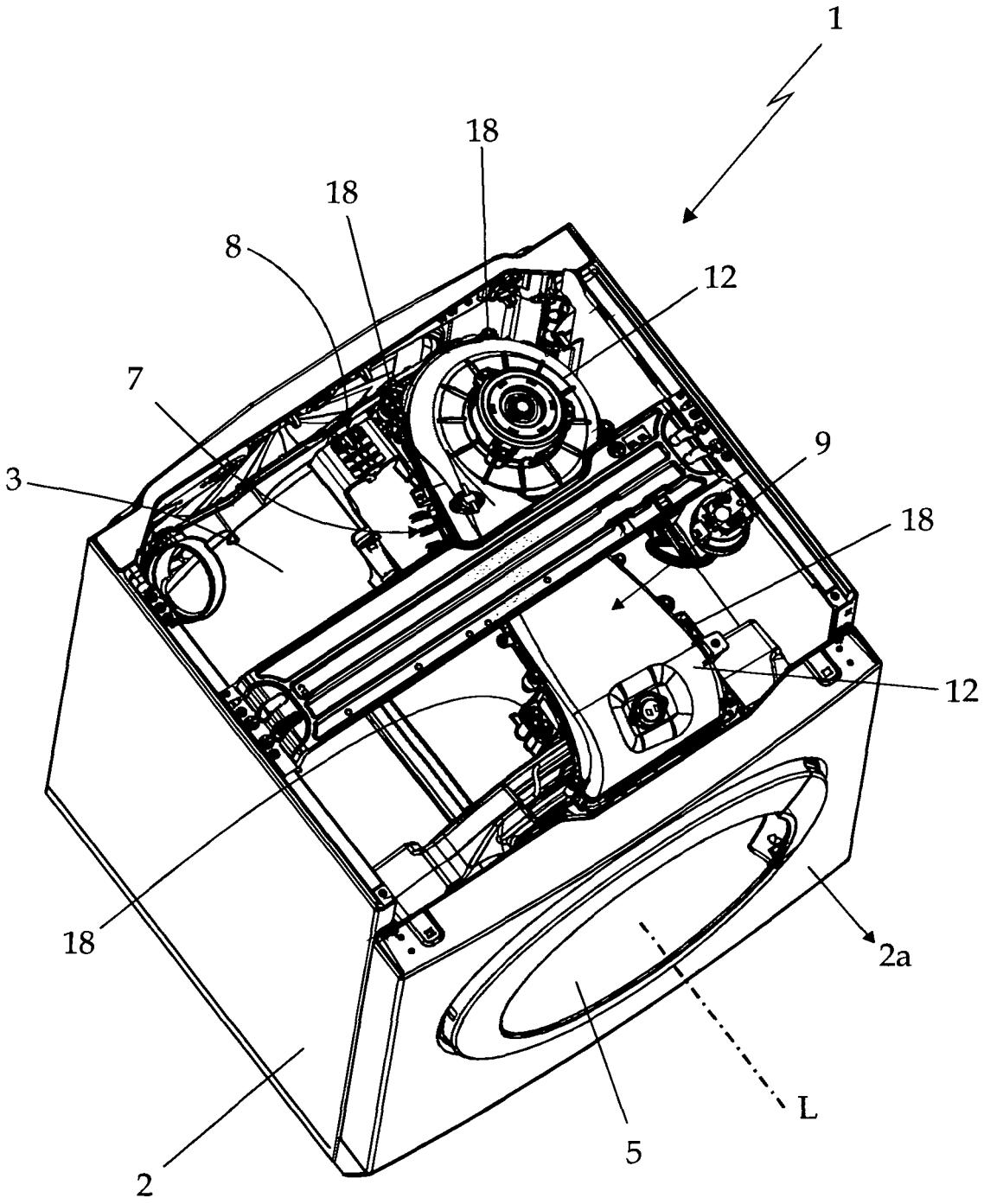


Fig. 1

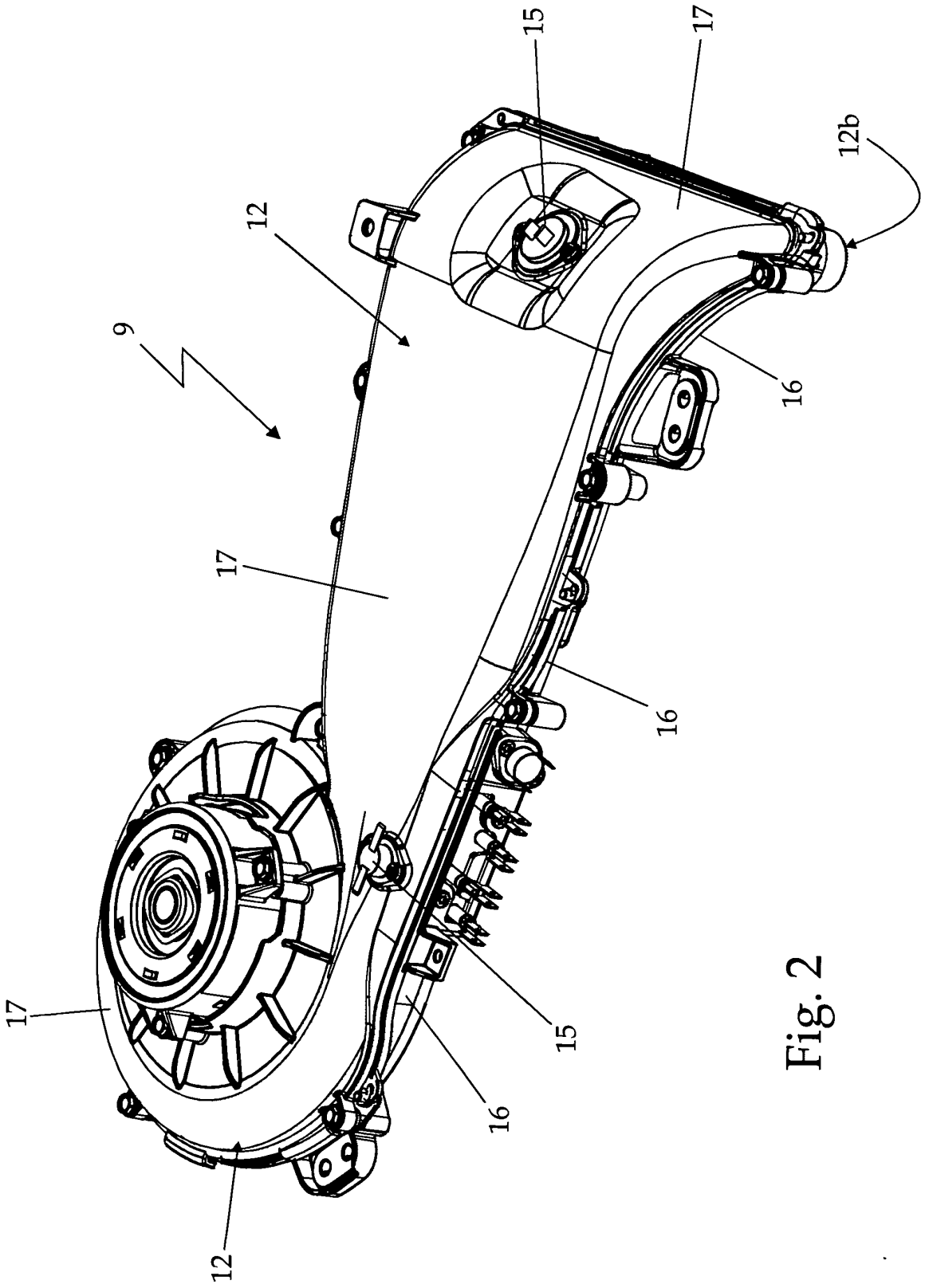


Fig. 2

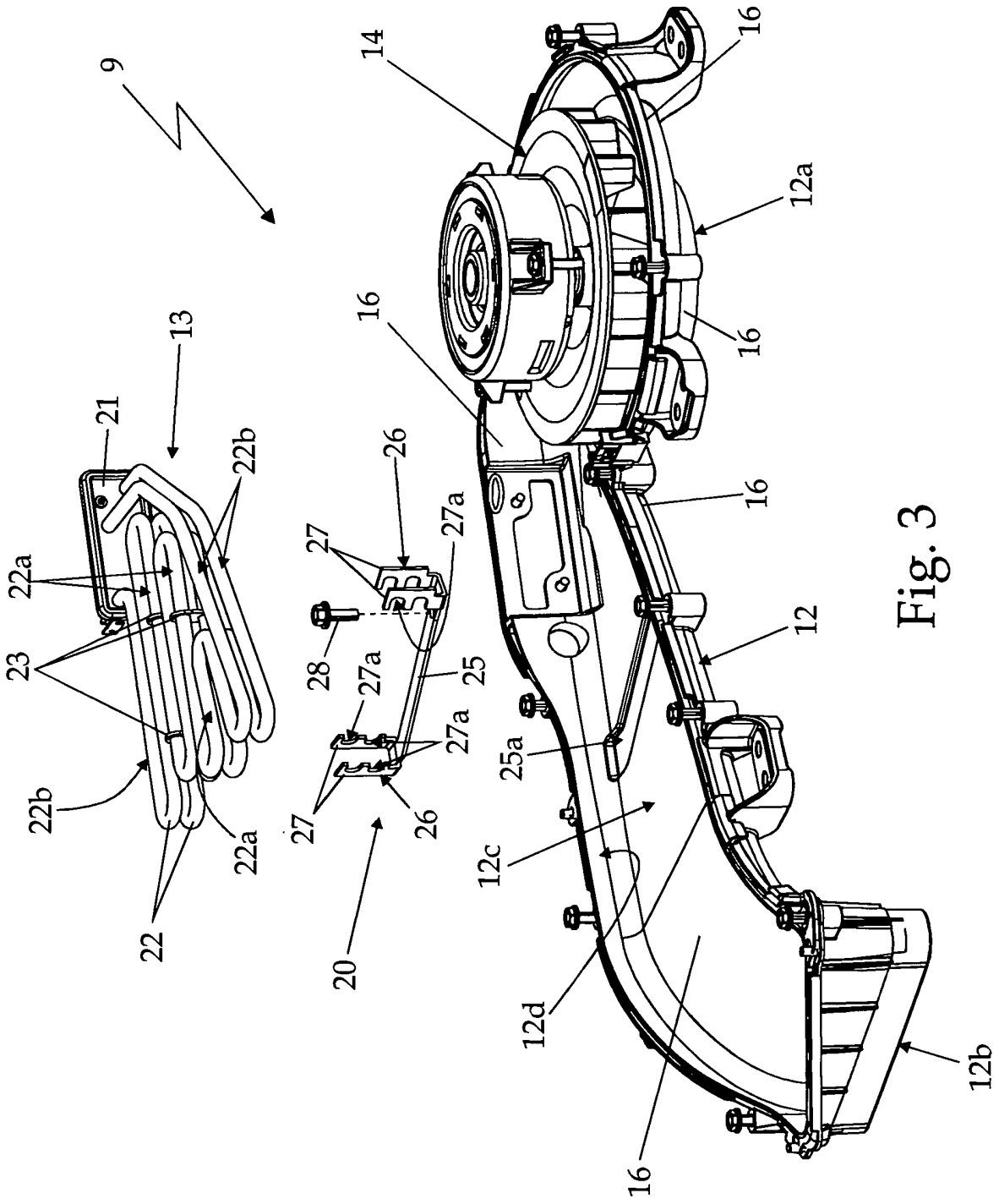

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Fig. 3

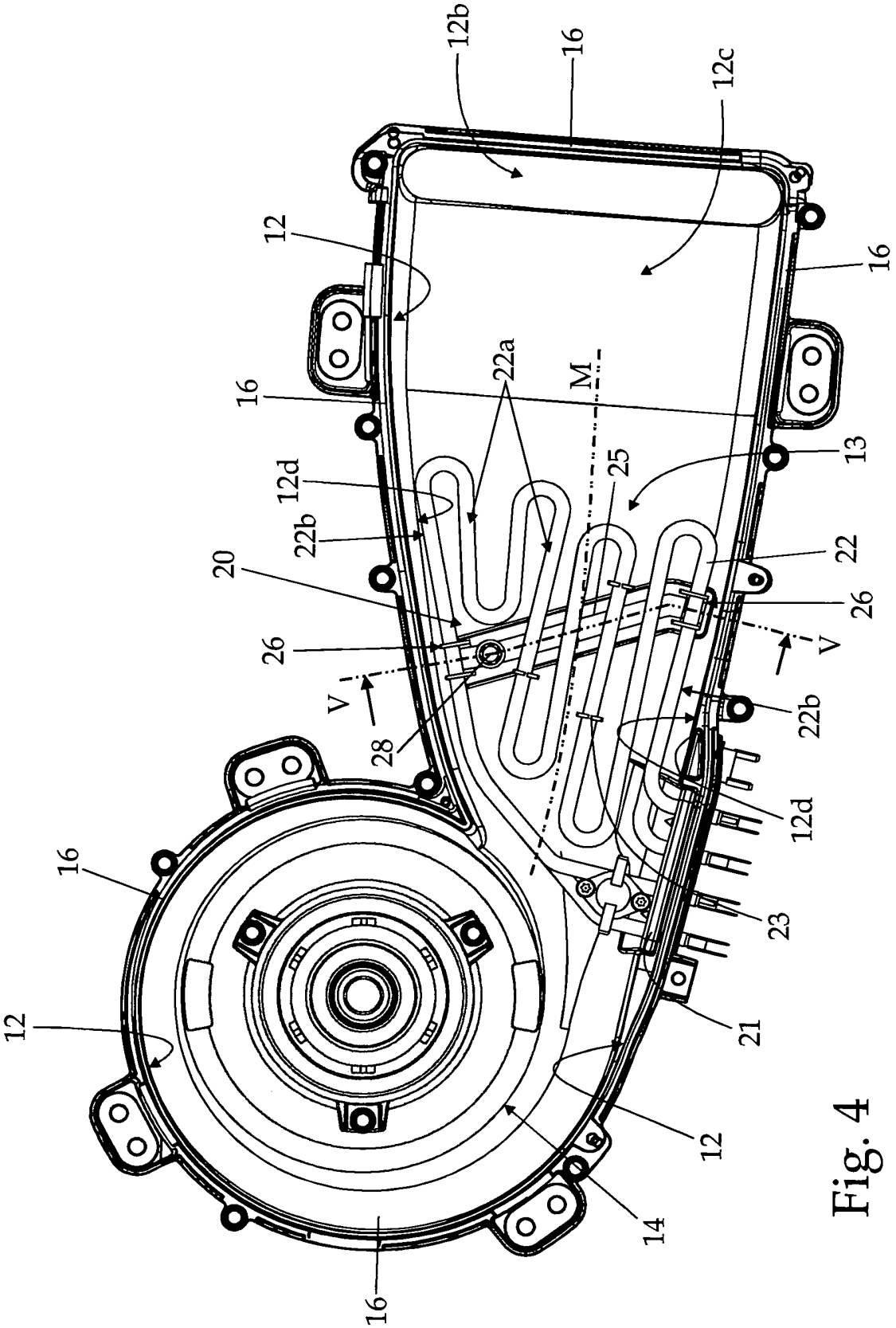

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Fig. 4

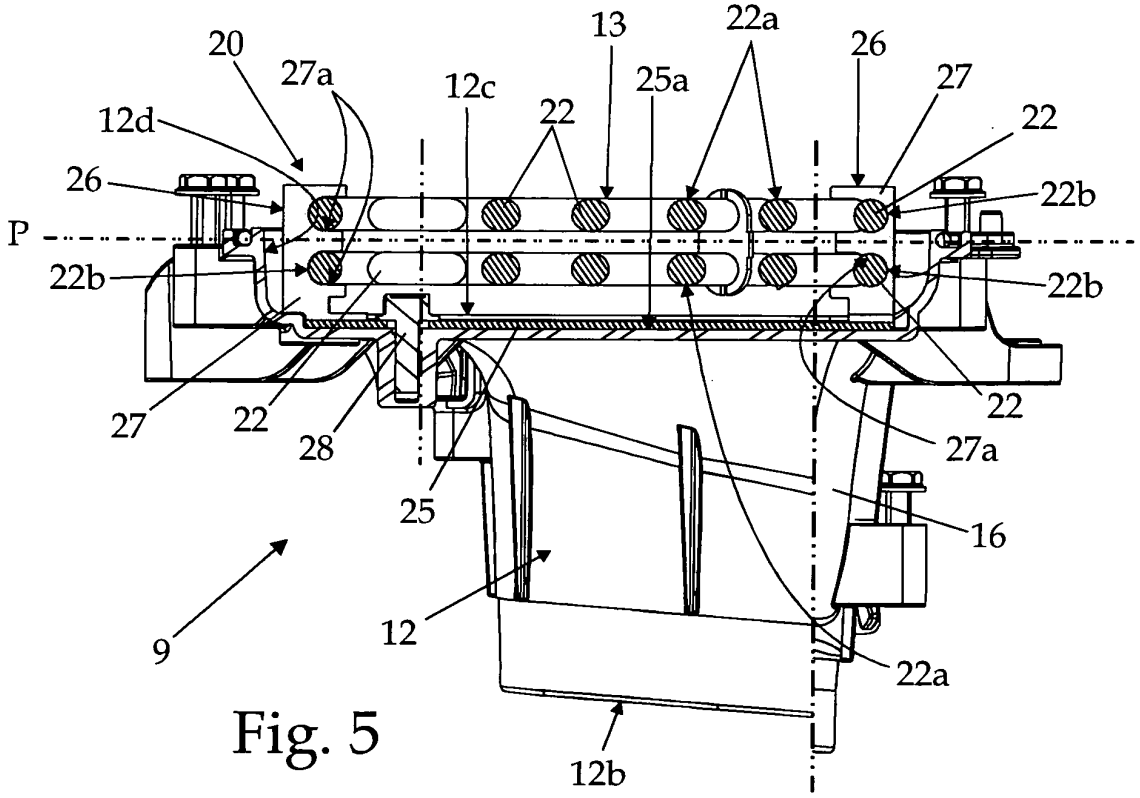

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Fig. 5

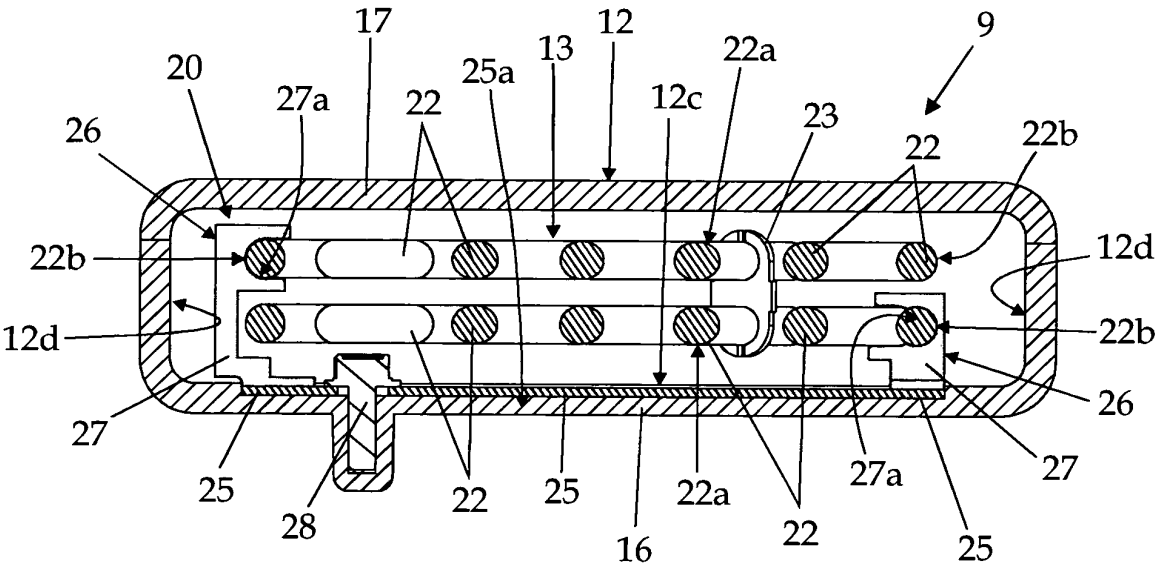

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Fig. 6

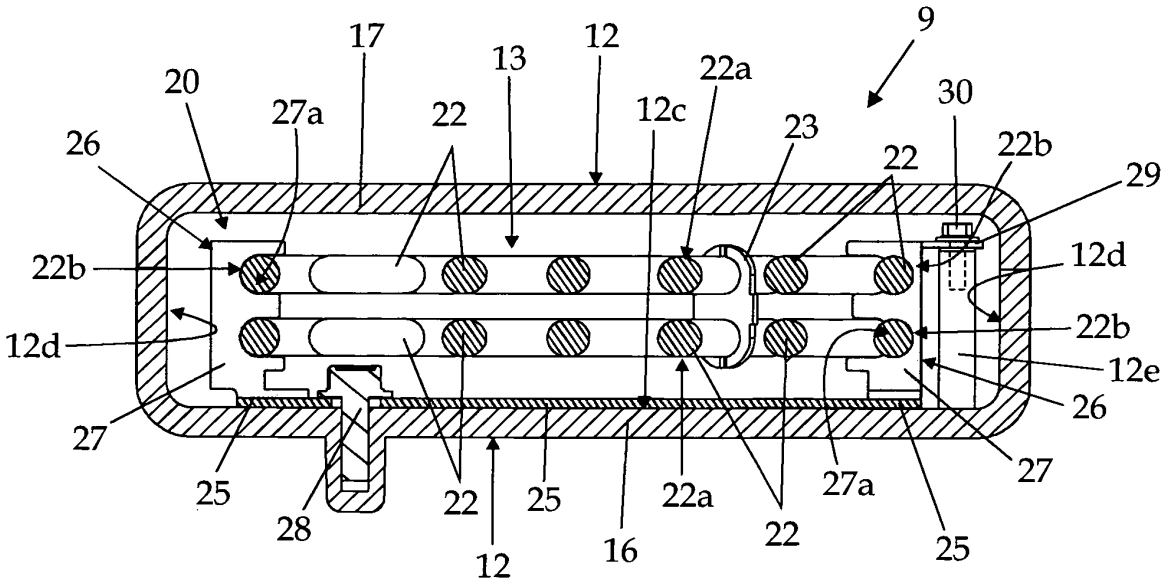

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Fig. 7

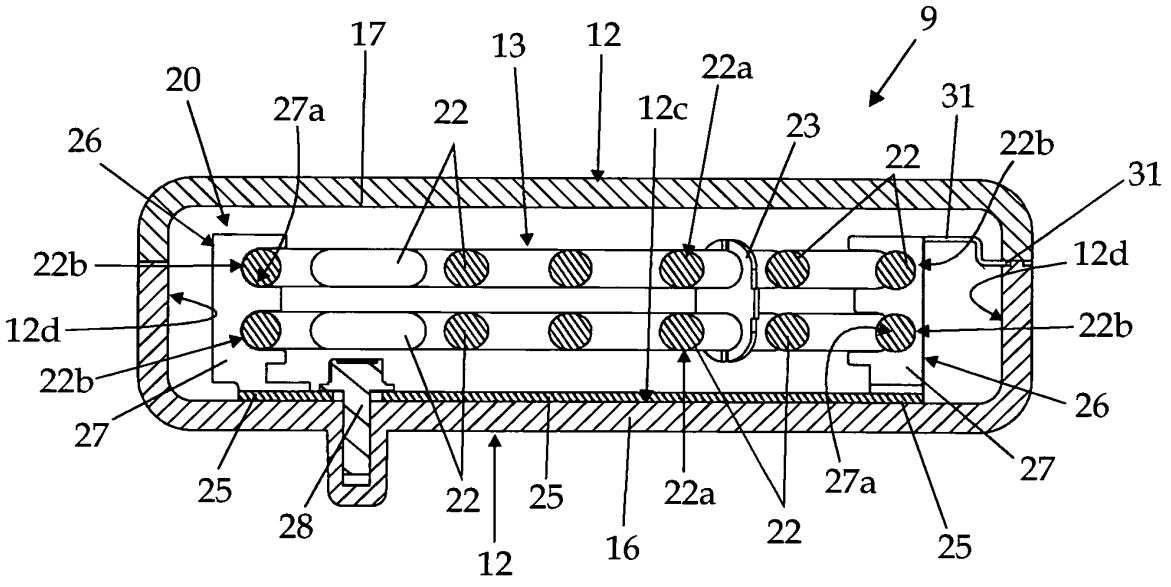

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Fig. 8

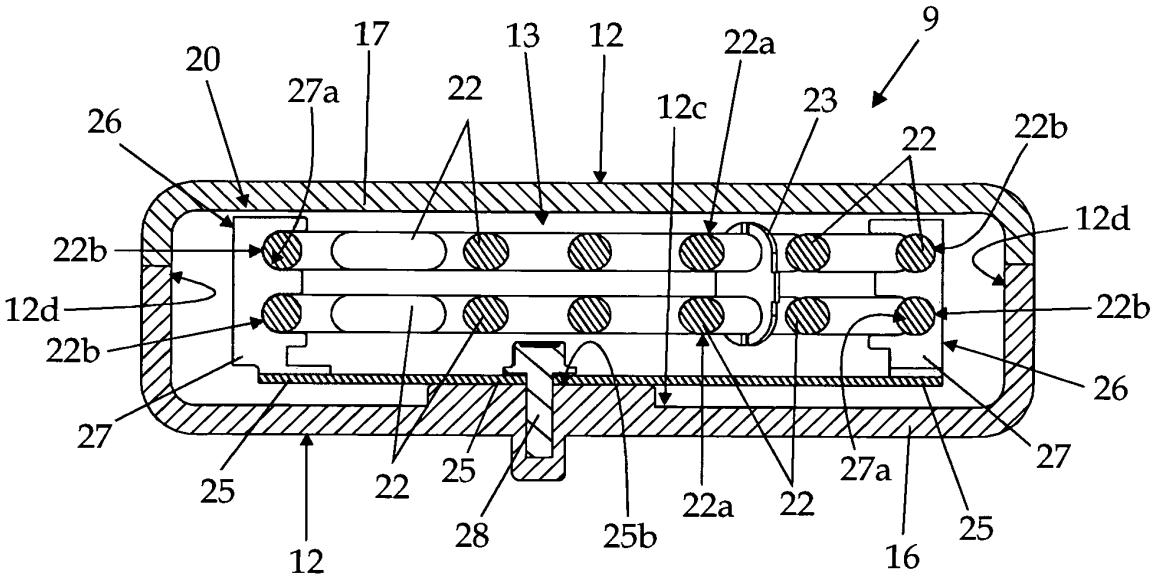

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Fig. 9

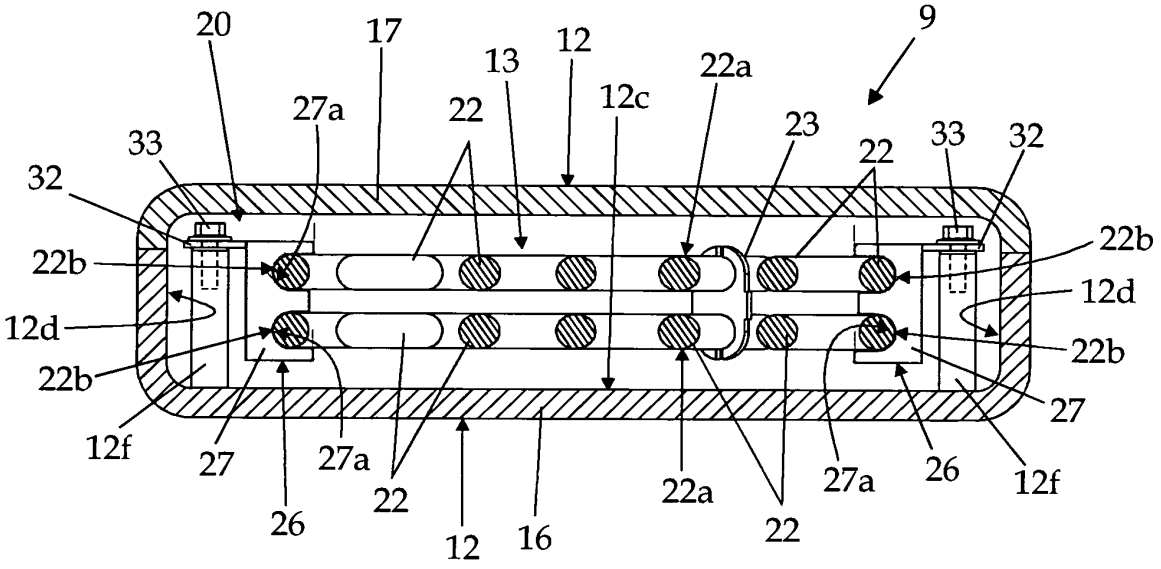

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Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 7322125 B **[0007]**
- WO 2007021134 A2 **[0009]**