(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 873 296 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.01.2008 Bulletin 2008/01

(51) Int Cl.:
D06F 23/04 *(2006.01)* ***D06F 21/04*** *(2006.01)*

(21) Application number: **07110208.1**

(22) Date of filing: **13.06.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **13.06.2006 IT TO20060429**

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(54) **Laundry washing machine, in particular of the front-loading type**

(57) A laundry-washing machine comprises a basket (10) mounted inside a tank (6) for rotating around a substantially horizontal axis, the tank (6) being designed to contain a washing and/or rinsing liquid. At least one dragging element (20) is provided within the basket (10), having a first chamber (A) designed to collect cyclically, during the rotation of the basket (10), liquid lying in the lower area of the tank (6). The first chamber (A) is in fluid communication with a second chamber (B) of the dragging element (20), which is adapted to sprinkle into the basket (10), as a result of the rotation thereof, liquid collected from the tank (6) by means of the first chamber (A).

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Description

[0001] The present invention relates to a laundry-washing machine, in particular of the front-loading type.

[0002] European-type laundry-washing machines typically comprise a pierced basket for containing laundry, which is substantially cylinder-shaped and mounted so as to rotate around a substantially horizontal axis. The basket is mounted inside a tank, elastically supported within a cabinet of the machine. The machine is equipped with water supply means, controlled so as to feed into the tank a washing or rinsing liquid, up to a given level. During machine operation, a motor sets the basket into rotation, thus causing the partial and temporary immersion of laundry into the washing or rinsing bath lying inside the lower area of the tank.

[0003] In order to improve the effectiveness of washing and/or rinsing steps, some laundry-washing machines are equipped with a system for re-circulating the treatment liquid. In some solutions part of the liquid collected in the tank is taken by means of a pump and fed into the basket, for instance by way of nozzle means mounted in the upper portion of the tank or mounted at a hub of the basket. Though such systems are averagely effective, they imply the use of a pump and suitable ducts and are thus generally quite expensive.

[0004] In other cheaper solutions, conversely, the circulation effect is obtained by exploiting the traditional dragging elements provided for inside the basket. As is known, in order to help laundry being agitated and mixed in the basket, the latter is usually provided with inner ribs protruding from the circumferential wall of said basket towards the center thereof. Such dragging elements, obtained by shaping said circumferential wall or configured as components fastened to the latter, are hollow inside and as a rule have an approximately triangular section.

[0005] The circumferential wall of the basket has, at the dragging element, inlet passages, through which part of the liquid making up the washing or rinsing bath lying on the bottom of the tank can get into the dragging element, when the latter lies in the area of lower dead point of the basket. The dragging element is also provided with outlet passages in the portion thereof facing the inside of the basket, usually on the tip of the dragging element. Thus, as a result of the rotation of the basket, when the dragging element reaches the area of the upper dead point, water contained in the dragging element can be fed into the basket by means of said outlet passages and onto the underlying laundry. A certain effect of re-circulation of washing or rinsing liquid is thus obtained. A solution of this type is described for instance in document EP-A-0244365.

[0006] Prior-art solutions with liquid re-circulation obtained with one or more dragging elements have a relatively low effectiveness, basically because the liquid collected by the dragging element mainly gets out before reaching the above said area of the upper dead point.

[0007] In general terms, the present invention aims at carrying out a laundry-washing machine of the type with a re-circulation system making use of at least one dragging element having an increased effectiveness with respect to the prior art. Another aim of the invention is to carry out such a machine in which the above said dragging element is structurally simple and cheap. A further aim of the present invention is to carry out such a machine in which the dragging element can advantageously perform additional functions, besides laundry agitation and re-circulation of washing or rinsing liquid.

[0008] These and other aims, which shall be more apparent in the following, are achieved according to the present invention by means of a laundry-washing machine having the features of the appended claims. The claims are an integral and substantial part of the technical teaching given in connection with the invention.

[0009] Briefly, according to the invention, the basket of the laundry-washing machine is provided with at least one dragging element defining two chambers being in fluid communication, wherein the first chamber is essentially designed to collect the liquid which is present in the lower area of the tank, and whereas the second chamber is essentially designed to sprinkle the said liquid into the basket, as a result of the rotation thereof. In the preferred embodiment, the two chambers are arranged side by side according to a direction which is substantially parallel to the axis of rotation of the basket and are separated from one another by means of a partition wall having a plurality of passages for the liquid.

[0010] Due to these characteristics, the liquid loaded into the first chamber is not drained in advance, during the passage of the dragging element from the lower to the upper dead point, but gets within the second chamber, to be then sprinkled onto the laundry by means of openings thereof.

[0011] In a particularly advantageous embodiment, the second chamber has a respective door and is arranged for receiving a washing agent, for instance in liquid or powder form, or possibly as tablets. With such a solution, therefore, the functions of the dragging element are increased and the latter can be used for introducing into the washing tank, for instance, a detergent required for performing a pre-washing step - in case of treatment cycles including said operating step - or a detergent required for performing the actual washing step, when the treatment cycle includes no pre-washing.

[0012] This solution enables to bring the detergent rapidly and completely into contact with the washing bath and with the laundry. The fact that the dragging element at each rotation of the basket is brought into contact with the bath lying in the tank ensures the full removal of the detergent and the self-cleaning of the dragging element. In the preferred embodiment, the body of the dragging element is made up of a main piece to which the above said door is hinged. Said two components can be obtained by simple molding operations of thermoplastic material. To said main piece a device for locking/unlocking the door is associated, designed to keep the door closed

when the machine is running.

[0013] The characteristics of the invention shall be evident from the following detailed description, given by way of mere example of a possible embodiment of the invention, with reference to the accompanying drawings, in which:

- Figure 1 is a perspective view of a laundry-washing machine according to the invention;
- Figure 2 is a perspective view of a laundry basket of the machine of Figure 1;
- Figure 3 is a perspective view of a part of the basket of Figure 2, and
- Figure 4 is a perspective view, partially broken, of the basket of the machine according to the invention (rotated of 180° around a vertical axis with respect to Figure 2).

[0014] Referring in particular to Figure 1, reference 1 globally designates a laundry-washing machine according to the invention, comprising a cabinet designated with 2. In the upper part of the front face of the cabinet there are a control panel 3 and a device for washing agent dispenser 4. In the intermediate region of said front face an access opening 5 is defined, facing a corresponding opening of a washing tank, indicated with 6. It should be noted that, at the opening 5, to the front wall of the cabinet 2 a door or port is associated, which is not shown in the figure: however, the hinge of said port, designated by 7, and part of the respective locking/unlocking device, designated by 8, can be seen.

[0015] Inside the tank 6 a drum or basket is rotatably mounted, indicated by 10. The basket 10, designed to contain laundry to be washed, can rotate around a substantially horizontal axis. It should be pointed out that the terms "substantially horizontal" are here meant to designate also the condition wherein the axis of rotation of the basket is slightly inclined with respect to the horizontal, up to a maximum of 15°-20°.

[0016] The above said basket, substantially cylindrical, can be seen in schematic view in Figure 2. As in the prior art, the basket 10 comprises a rear wall 11, a front wall 12 and a peripheral or circumferential wall 13. The front wall 12 is equipped with a respective opening 12a for access to the basket inside. As can be seen in Figure 1, this opening 12a is basically coaxial with the front opening 5 of the cabinet 2 and with the opening of the tank 6.

[0017] The peripheral wall 13 of the basket is mainly perforated, i.e. most of its angular development is concerned by an array of holes 14. It should be noted that, for simplicity's sake, only a limited part of the array of hole 14 has been shown: actually, however, such an array extends on the prevailing portion of said peripheral wall 13, except for a region thereof, as shall be disclosed below.

[0018] In the embodiment of the invention shown in the figures, the basket 10 is equipped with only one dragging element, designated as a whole by 20, whose body has a main part 21 fastened inside the basket, at the peripheral wall 13.

[0019] As said, according to the main aspect of the invention, the dragging element 20 has at least two different chambers, which can be partially seen in Figure 4, where they are designated by A and B. In the embodiment shown by way of example, the chamber A is delimited partly by the body of the dragging element 20 and partly by a region 13a of the peripheral wall 13 of the basket, whereas the chamber B is wholly defined in the body of the dragging element 20. The two chambers A, B extend longitudinally in a direction substantially parallel to one another and to the axis of rotation of the basket 10, i.e. transversally to the basket.

[0020] As can be seen in Figure 4, piece 21 comprises an upper wall 21a, from whose intermediate zone there extends downwards (referring to the figure) a wall 21b separating the chambers A and B from one another. From the intermediate wall 21b then a bottom wall 21c extends, generally curved or substantially shaped as a cylindrical sector, connecting to the upper wall 21 a by way of a small end wall 21d. The piece 21 further comprises side walls 21e, which can be seen for instance in Figure 3, which are basically parallel and close the rear 11 and front 12 walls of the basket 10, inside the latter. The lower profile of such side walls 21e is also generally curved, in accordance with the degree of curvature of the circumferential wall 13 of the basket.

[0021] On its end close to the wall 21d, the piece 21 has a part 22 having holes for the fastening thereof to the circumferential wall 13, for instance by way of screws, rivets or similar means. On the opposite end of the portion 21, from the wall 21a there extends downwards a series of column-shaped projections, designated by 23, also used for fastening the piece 21 to the peripheral wall 13, for instance by way of screws tightened from outside the basket 10.

[0022] In the upper wall 21 a there is an opening, at which a small door 24 is mounted, which can be shifted between a closing and an opening position, according to a horizontal axis, indicated by X in Figure 3. The means for hinging the door 24 can be of any known type and comprise, for example, projections of said door fitted into proper seats of the piece 21. The door 24 is provided with a plurality of through holes, indicated with 24a. In the central area of the piece 21, in a position close to the intermediate wall 21b, piece 21 also defines a seat or housing for a device for locking/unlocking the door 24, this device being indicated as a whole with 25. The device 25, preferably integrating at least one elastic element (such as a helical spring) can be of any known conception, for instance of the type commonly used on detergent dispensers for dish-washing machines, in connection with respective folding lids. The device 25 includes a small lever for manual actuation, indicated with 25a, protruding in a respective seat 26 defined at the upper face of the dragging element, such an upper face being globally formed by the wall 21a and the small door 24.

[0023] From the above, and as can be seen in Figure 4, it can be noted that the chamber B is practically wholly delimited within the body of the dragging element 20, and precisely by the intermediate wall 21b, the bottom wall 21c, the end wall 21d, the respective portions of the side walls 21e, the door 24. Conversely, the chamber A is delimited only partly by the piece 21, and precisely by the respective portion of upper wall 21a, by the intermediate wall 21b and by the respective portions of the side wall 21 e.

[0024] The array of holes 14 occupies the prevailing part of the angular development of the peripheral wall 13, but for a given region thereof, in correspondence of which the chamber A is arranged. As can further be inferred from Figure 4, such region, referred to with numeral 13a, is mainly entire and free of the holes 14 (unperforated): in such a region, however, there are provided one or more openings having dimensions which are considerably greater than those of the holes of the array 14. In the preferred embodiment of the invention, the region 13a has at least two of said openings, one of which is indicated with 27, here having a generally elongated shape.

[0025] From Figure 3 it can be inferred that, in a possible implementation, at least the chamber B can be divided, by means of transversal walls 21f, into several half-chambers; each of said half-chambers communicates with the chamber A by means of one or more passages 28 formed in the intermediate wall 21b.

[0026] The chamber B, whose bottom wall 21c is free of openings, is adapted to be loaded manually with a washing agent, by opening the small door 24 before putting the laundry to be washed into the basket 10.

[0027] The machine 1 comprises all known elements for its normal operation (control system, motor and transmission for the basket, level sensing means, one or more water-loading solenoid valves, drain pump, etc.), which are not relevant for understanding of the present invention and are therefore not shown and described in detail here.

[0028] The laundry-washing machine according to the invention, for what is relevant here, works as follows. Before starting a washing cycle, if desired, the user loads a pre-washing or washing agent into the compartment B, by bringing the basket 10 substantially in the position as can be seen in Figure 1. Before introducing the laundry into the basket 10, the user moves the lever 25a of the device 25, so as to enable the small door 24 to open, which opens towards the inside of the basket 10. The door 24 can be biased to the opening position by way of an elastic element, such as a helical spring mounted at one of its hinging pins. After the detergent has been leaded the user can close the small door 24, causing hooking the device 25 back. Now the user can load the laundry into the machine, i.e. into the basket. After closing the port of the machine, not shown, and - if desired - introducing one or more additional washing agents into the dispenser 4, the user can select the desired washing cycle and start it, in a per se known manner, by means of the panel 3 (for instance, if a pre-washing detergent has been loaded into the chamber B, a washing detergent and a liquid softener can be introduced into the dispenser 4).

[0029] The control system of the machine 1 then controls the loading of a given amount of water into the tank 6, by means of a suitable level sensor, such as a pressure switch. The control system then controls the motor, which sets the basket 10 into rotation at the normal washing speed, for instance of 40-50 rpm. During the initial step of the treatment program, the revolutions of the basket 10 cause the detergent contained in the chamber B to get out through the holes 24a of the small door 24. Removal of the detergent occurs both by gravity and because of the cyclical immersions of the dragging element 20 into the washing bath lying in the lower part of the tank.

[0030] As far as the most relevant aspect of the invention is concerned, during rotation the dragging element 20 cyclically reaches the lower region of the tank, here generally defined as the area of the dead point of the basket. In the length of rotation during which the region 13a of the wall 13 is immersed in the washing/rinsing bath, part of the liquid can get into the chamber A, through the opening or openings 27 (note that the rotation here taken into account is a clockwise rotation of the basket 10, with reference to Figures 1 and 2). Part of the liquid can also enters the chamber A through the passages existing between the projections 23 (see Figure 4). As the angular movement of the basket 10 continues, the water collected in the chamber A cannot fall into the basket 10 because of the absence of openings in the wall 21a. The angular movement of the basket 10, and therefore the rising of the dragging element 20 towards the area of the upper dead point, causes a given amount of water to accumulate in the chamber A, at least for a level corresponding to the distance between the intermediate wall 21b and the profile of the openings 27 closest to this wall. The water contained herein passes through the passages 28 of the intermediate wall 21b and thus reaches the chamber B. From said chamber B water is then sprinkled into the basket through the holes 24a of the small door 24. It is thus possible to obtain the desired re-circulation effect. The washing cycle then continues in a substantially known manner as for usual laundry-washing machines.

[0031] Practical tests carried out by the Applicant made it possible to verify that the proposed solution allows to improve the re-circulation function with respect to the prior art. The division of the dragging element 20 into at least two communicating chambers results in that the amount of water that can be sprinkled when the dragging element is in the area close to the upper dead point is far higher than in the traditional techniques, also thanks to the increased capacity or volume of the dragging element.

[0032] It should further be pointed out that, differently from usual prior-art dragging elements, the element 20

according to the invention has a substantially upper face which is flat and parallel to the axis of rotation of the basket, i.e., in a section orthogonal to the axis of the basket, saidu surface corresponds to a chord intersecting the circular profile of the basket. The Applicant could verify that such an arrangement enables to obtain a good agitation and/or mixing effect of the laundry, with the possibility of increasing the liquid capacity of the dragging element 20, though without taking too much of the volume designed for laundry inside the basket.

[0033] The main piece 21 of the dragging element 20 can be obtained by a simple molding operation of thermoplastic material. Fixing of this piece to the circumferential wall 13 of the basket is also very simple. The small door 24 is also obtained by one molding operation. The further complements of the dragging element 20 (device 25, likely spring for the small door 24, fastening means) are basically commercial components, which are extremely cheap.

[0034] From the above description the characteristics and advantages of the present invention are clear. It is clear that several changes can be made by the man skilled in the art to the laundry-washing machine as described by way of example, without leaving the scope of the invention as defined in the appended claims.

[0035] The invention was described with reference to a front-loading laundry-washing machine, but it can be implemented, at least as far as its main concept is concerned, also to top-loading machines. The invention clearly applies also to machines for washing and drying laundry.

[0036] The configuration of the piece 21 can obviously vary with respect to the one shown by way of example in the drawings. The fastening projections 23 could be replaced by a portion similar to the one (22) on the opposite end of the piece 21.

[0037] In the preferred version, in which the dragging element also acts as container/dispenser for a washing agent, the control system of the machine can be arranged so as to position the basket with the dragging element at the lower dead point automatically, at the end of a washing cycle, according to a technique which is known in the field of top-loading laundry-washing machines.

Claims

1. A laundry-washing machine, in particular of the front-loading type, comprising a laundry basket (10) mounted inside a tank (6) so as to rotate around a substantially horizontal axis, the tank (6) being supported within a cabinet (2) and adapted to contain a washing and/or rinsing liquid, wherein the basket (10) has two end walls (11, 12) and a peripheral wall (13), at least the prevailing part of the peripheral wall (13) having an array of holes (14), at least one dragging element (20) being provided within the basket (10), arranged at the peripheral wall (13), the dragging element (20) having a first chamber (A) adapted to collect cyclically, during rotation of the basket (10), liquid being present in the lower area of the tank (6), **characterized in that** the first chamber (A) is in fluid communication with a second chamber (B) of the dragging element (20), the second chamber (B) being designed to sprinkle into the basket (10), as a result of the rotation thereof, liquid collected from the tank (6) by means of the first chamber (A).

2. The machine according to claim 1, wherein the first and the second chamber (A, B) extend longitudinally according to a direction which is substantially parallel to the axis of rotation of the basket.

3. The machine according to claim 1 or 2, wherein the first and the second chamber (A, B) are adjacent to one another and connected by means of one or more passages (28) formed in an intermediate wall (21b) of a body (21, 24) of the dragging element (20).

4. The machine according to claim 3, wherein said body (21, 24) is mounted within the basket (10) and has a bottom wall (21c), resting on, or adjacent to, a respective portion of the peripheral wall (13) and is at least partly shaped as a cylindrical sector, the bottom wall (21b) delimiting in particular at least part of the second chamber (B).

5. The machine according to claim 1, wherein the second chamber (B) is designed to be loaded manually with a washing agent and has an access passage facing inside the basket (10), in correspondence of which a respective door (24) is mounted, the door (24) having in particular one or more through holes (24a).

6. The machine according to claim 3 or 4, wherein said body (21, 24) has an region (21a, 24) exposed inside the basket (10) which includes a first wall portion (21a) delimiting part of the first chamber (A), and a second wall portion (24) delimiting part of the second chamber (B), wherein in particular the first wall portion (21) is prevalently unperforated and the second wall portion (24) has one or more passages (24a).

7. The machine according to claims 5 and 6, wherein the door (24) forms at least part of said second wall portion.

8. The machine according to claim 6, wherein the upper wall or face (21a, 24) is mainly flat.

9. The machine according to claim 6, wherein the upper wall or face (21a, 24) is substantially parallel to the axis of rotation of the basket (10).

10. The machine according to at least one of the pre-

ceding claims, wherein the first chamber (A) is delimited partly by a region (13a) of the peripheral wall (13) of the basket (10).

11. The machine according to claim 10, wherein in said region (13a) of the peripheral wall (13) at least one opening (27) is formed, having a larger passage section than that of the holes of said array (14), wherein in particular said array (14) does not extend in said region (13a).

12. The machine according to at least one of claims 3 to 5, wherein at least one of said first and second chamber (A, B) is entirely delimited by said body (21, 24).

13. The machine according to claim 5, wherein the dragging element (20) is provided with with a locking/unlocking device (25) for the door (24).

14. The machine according to at least one of the preceding claims, wherein the second chamber (B) is divided into two or more half chambers.

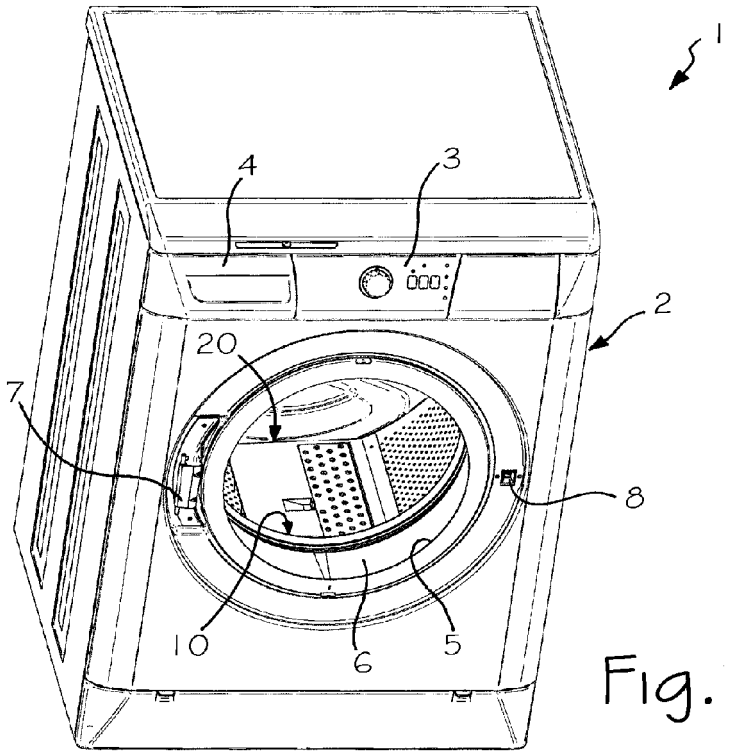

Fig. 1

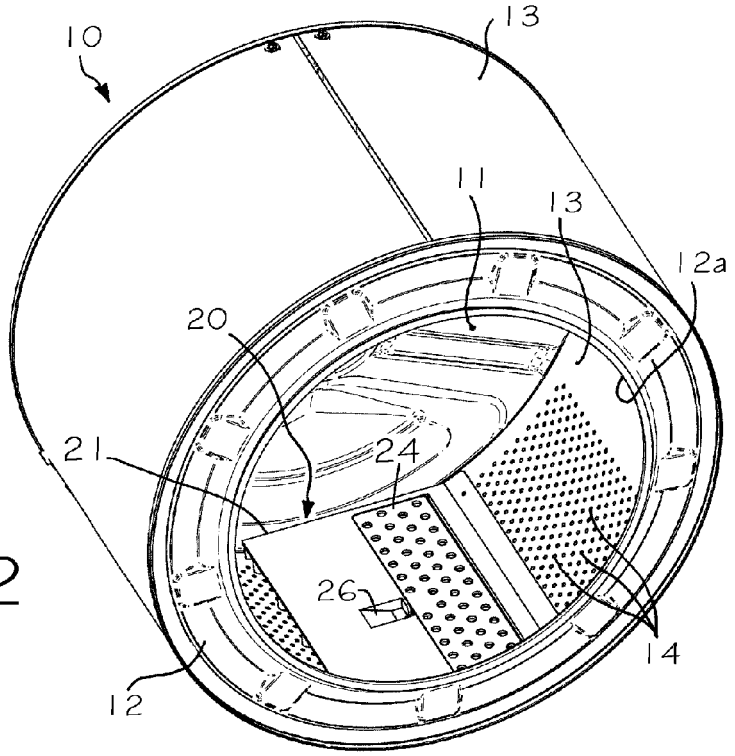

Fig. 2

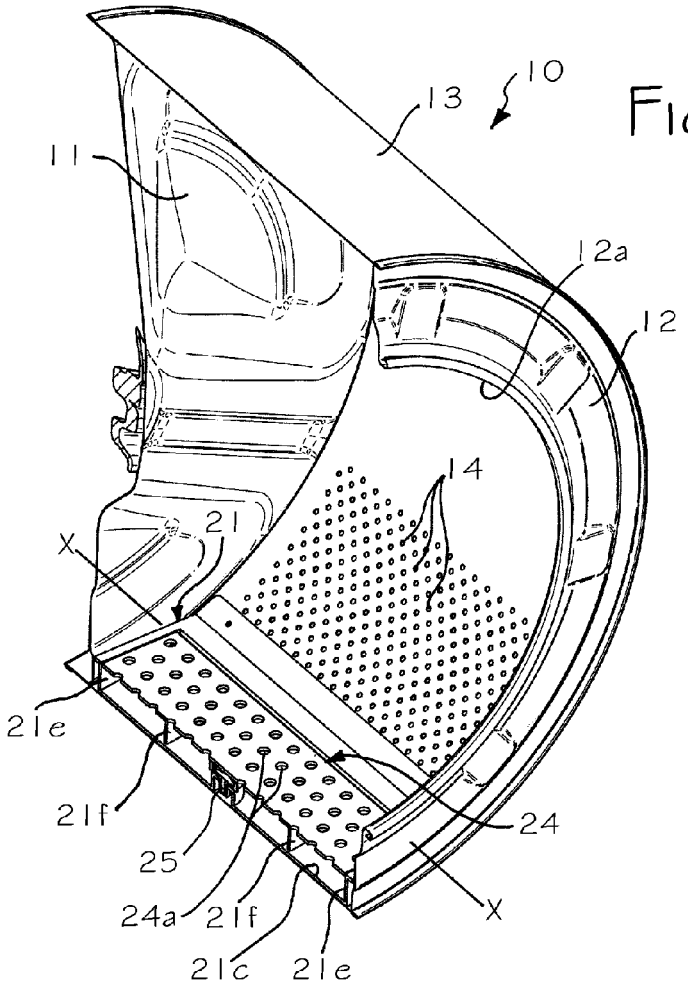
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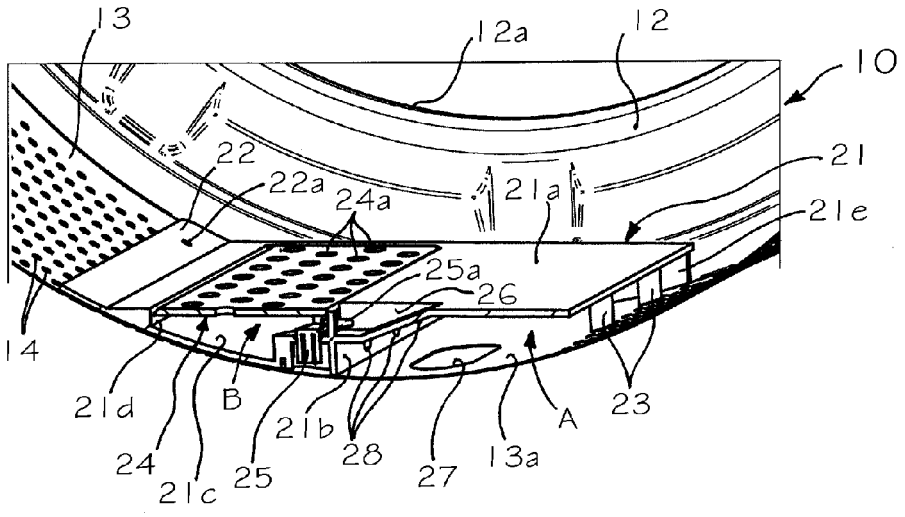
Fig. 3

Fig. 4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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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