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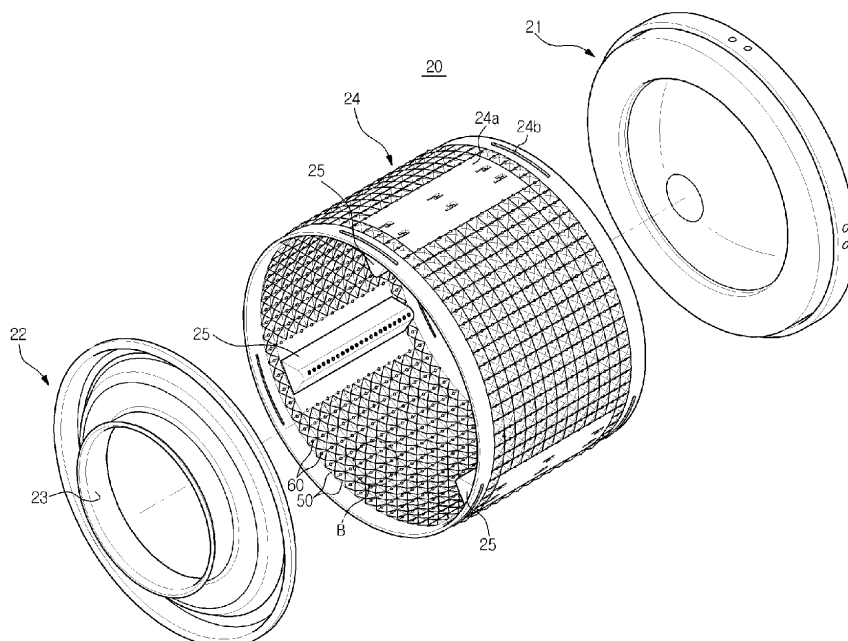
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(54) **Washing machine**

(57) A washing machine including a drum provided with a plurality of recess portions each provided as a polygonal pyramid recessed from one of an inner surface and an outer surface of the drum toward the remaining of the inner surface and the outer surface of the drum, and a plurality of through-holes configured to receive and

discharge wash water, the recess portion including a polygonal shape, and a plurality of edges extending from corners of the polygonal side to meet at an apex of the recess portion, and the through-hole is formed through at least one of sides that form the polygonal shape, thereby improving the washing performance due to the recess portion increasing friction with the laundry.

FIG. 2



Description

[0001] The present invention relates to a washing machine, and more particularly, to a washing machine capable of enhanced washing performance.

[0002] In general, a washing machine is provided with a tub and a drum configured to rotate inside the tub, and as a type of the washing machine, includes a drum type washing machine that is designed to wash laundry using falling water.

[0003] The drum type washing machine includes a tub to accommodate wash water, and a drum rotatably installed inside the tub. A lifter is disposed inside the drum to lift the laundry upward. A communicating hole is formed at a circumference portion of the drum, which is provided in a cylindrical shape, such that water of the tub is introduced into the drum or water of the drum is discharged from the drum during a draining operation or a spin-dry operation.

[0004] Therefore, it is an aspect of the present invention to provide a washing machine capable of improving the washing performance by enhancing the friction between the inner surface of a drum and the laundry.

[0005] Additional aspects of the invention will be set forth in part in the description which follows and, in part, will be obvious from the description, or may be learned by practice of the disclosure.

[0006] In accordance with one aspect of the present invention, a washing machine includes a tub, a drum, and a driving apparatus. The drum may be disposed inside the tub. The driving apparatus may be configured to rotate the drum. The drum may include a plurality of recess portions and a plurality of through-holes. Each of the plurality of recess portions is recessed in a form of a pyramid from one of an inner surface and an outer surface of the drum toward the remaining of the inner side and the outer side of the drum. The plurality of through-holes may be configured to drain water. The recess portion may include a polygonal side provided in the form of a polygon, and a plurality of edges extending from corners of the polygonal side to meet at a vertex of the recess portion. The through-hole may be formed through at least one of sides that form the polygonal side.

[0007] The drum may be disposed on an incline to have a front thereof higher than a rear thereof.

[0008] Each of the plurality of recess portions may be recessed in the form of a quadrangular pyramid so as to have a quadrangle side.

[0009] The plurality of through-holes may be formed at two of four sides forming the quadrangle side, the two sides opposite to each other in a rotation direction of the drum.

[0010] The plurality of through-holes may be formed through two of four sides forming the quadrangle side, the two sides opposite to each other in a direction of a shaft of the drum.

[0011] The plurality of through-holes may be formed through each of four sides forming the quadrangle side.

[0012] The plurality of through-hole may be formed through at least one of middle portions of four sides forming the polygonal side.

[0013] The plurality of recess portions may be formed adjacent to one another, and the through-hole may be formed at a side that is shared by adjacent two recess portions of the plurality of the recess portions.

[0014] In accordance with another aspect of the present invention, a washing machine includes a tub, a drum, and a driving apparatus. The drum may be disposed inside the tub. The driving apparatus may be configured to rotate the drum. The drum may include a plurality of recess portions and a plurality of through-holes. The plurality of recess portions may be provided in a form of a pyramid recessed from an inner surface to an outer surface of the drum. The plurality of through-holes may be formed through vertexes of the plurality of recess portions to drain water. The recess portion may include a polygonal side provided in a form of a polygon, a plurality of edges extending from corners of the polygonal side to meet at the vertex of the recess portion, and a plurality of side surfaces each provided between corresponding ones of the plurality of edges. Two of the plurality of side surfaces opposite to each other may be inclined with different angles from each other.

[0015] The two of the plurality of side surfaces inclined with the different angles may be disposed opposite to each other in a direction of a shaft of the drum.

[0016] A side surface provided at a rear of the drum among the plurality of side surfaces may have an inclination angle smaller than an inclination angle of a side surface provided at a front of the drum among the plurality of side surfaces.

[0017] The two of the plurality of side surfaces inclined with the different angles may be disposed opposite to each other in a circumferential direction of the drum.

[0018] A side surface provided upstream in a rotation direction of the drum among the plurality of side surfaces may have an inclination angle smaller than an inclination angle of a side surface provided at a downstream in the rotation direction of the drum among the plurality of side surfaces.

[0019] The recess portion may be provided in a quadrangular pyramid including four edges and four side surfaces formed between corresponding ones of the four edges.

[0020] As described above, the washing machine provided with the drum in accordance with the present disclosure allows a laundry to make a friction at sides of a recess portion, increasing the friction between the drum and the laundry, so that the washing efficiency is enhanced.

[0021] In addition, a communicating hole is provided at a side formed a polygon of a recess portion, thereby enabling more of through-holes to be formed when compared to a case that a through-hole is provided in the center of the recess portion, so that the drain operation and spin-dry operation are easily performed.

[0022] In addition, opposite two surfaces of the recess portion are formed to be inclined in different angles from each other so as to enhance the spin-dry operation via the through-hole.

[0023] These and/or other aspects of the invention will become apparent and more readily appreciated from the following description of the embodiments, taken in conjunction with the accompanying drawings in which:

FIG. 1 is a cross sectional view illustrating a washing machine in accordance with one embodiment of the present invention;

FIG. 2 is an exploded perspective view illustrating a drum applied to the washing machine in accordance with the one embodiment of the present invention; FIG. 3 is an enlarged view illustrating a portion 'B' of FIG. 2; and

FIGS. 4 to 15 are partially enlarged views illustrating recess portions of the washing machine in accordance with other embodiments of the present invention.

[0024] Reference will now be made in detail to the embodiments of the present invention, examples of which are illustrated in the accompanying drawings, wherein like reference numerals refer to like elements throughout.

[0025] FIG. 1 is a cross sectional view illustrating a washing machine in accordance with one embodiment of the present invention. The washing machine is a drum type washing machine including a body 10 provided at a front surface thereof with an inlet 14 for a laundry to be input, a tub 11 installed inside the body 10, a drum 20 rotatably installed inside the tub 11, and a door 15 to open and close the inlet 14 of the body 10.

[0026] The tub 11 is installed at a predetermined inclination angle (α) with respect to an installation surface of the washing machine in a way to have a front surface portion 11a with the inlet 14 disposed higher than a rear surface portion 11b. The interior of the tub 11 is installed on an incline in the same way as the tub 11.

[0027] The drum 20 is rotatably supported by a rotating shaft 12 that passes through the rear surface portion 11b of the tub 11 while being coupled to a rear surface portion 21 of the drum 20. A driving motor 13 is installed at an outside the rear surface portion 11b of the tub 11 to rotate the rotating shaft 12. As the driving motor 13 rotates the rotating shaft 12, the drum 21 inside the tub 11 is rotated. The driving motor 13 rotates the drum 20 at a low speed during a washing operation, and rotates the drum 20 at a high speed in one direction during a spin-dry operation.

[0028] A detergent supply apparatus 16 and a water supply apparatus 17 to supply the inside of the tub 11 with detergent and wash water, respectively, are installed at an upper portion of the tub 11. The detergent supply apparatus 16 is installed at a front side of the body 10. The water supply apparatus 17 includes a first water supply pipe 17b connecting an outside water supply pipe 17a to the detergent supply apparatus 16, a second water

supply pipe 17c connecting the detergent supply apparatus 16 to the tub 11, and a water supply control valve 17d installed on the first water supply pipe 17b to control the supply of water. In this manner, the water to be supplied to the inside of the tub 11 is supplied together with detergent to the tub 11.

[0029] A heater 18 is installed at a lower portion of the tub 11 to heat the wash water of the tub 11. In order to install the heater 18, a heater accommodating portion 11c protruding downward is provided at a lower portion of the tub 11. In this manner, the heater 18 is accommodated inside the heater accommodating portion 11c while the wash water is collected in the heater accommodating portion 11c.

[0030] The tub 11 is provided at a lower portion thereof with a drain apparatus 30 and a wash water circulating apparatus 40 installed thereto. The drain apparatus 30 is configured to drain wash water of the tub 11. The wash water circulating apparatus 40 is configured to supply the drum 20 with the wash water of the tub 11. The drain apparatus 30 includes a first drain pipe 32 connected to a drain hole 31 formed at a lower portion of the tub 11, a drain pump 33 installed on the first drain pipe 32, and a second drain pipe 34 connected at an exit side of the drain pump 33.

[0031] The wash water circulating apparatus 40 includes a flow path divert valve 41 installed on the second drain pipe 34 at the exit side of the drain pump 33, a circulating pipe 42 extending toward an inlet 23 of the drum 20, and a jetting nozzle 43 installed at an exit side of the circulating pipe 42. The flow path divert valve 41 is configured to convert a path to allow the wash water of the exit of the drain pump 33 to be drained to the outside or to allow the wash water to flow toward the circulating pipe 42. The flow path convert valve 41 may be implemented using an electromotive three-way valve that is conventionally used. As shown in FIG. 2, in a state where the flow path divert valve 41 is operated in a way to flow the wash water toward the circulating pipe 42, if the drain pump 33 is driven, the wash water in the tub 11 is jetted to the inside of the drum 20 through the first drain pipe 32 and the circulating pipe 42. In a state where the flow path divert valve 41 is operated in a way to flow the wash water toward the second drain pipe 34, which is configured to guide the wash water to the outside, if the drain pump 33 is driven, the wash water in the tub 11 is drained.

[0032] The drum 20 includes the rear surface portion 21 coupled to the rotating shaft 12, a front surface portion 22 having the inlet 23, and a circumference portion 24 provided in a cylinder shape and having both ends coupled to the front surface portion 22 and the rear surface portion 21, respectively. A plurality of lifters 25 are installed at an inner surface of the circumference portion 24 of the drum 20 to lift and drop the laundry inside the drum 20 during the rotation of the drum 20. A plurality of stirring protrusions 26 are formed at an inner surface of the rear surface portion 21 of the drum 20 to improve the washing performance.

[0033] As shown in FIG. 3, the circumference portion 24 of the drum 20 is provided with a plurality of recess portions 50 recessed in the form of a plurality of pyramids from the inner surface to the outer surface of the drum 20, and a plurality of through-holes 60 configured to allow water of the tub 11 to be introduced into the drum 20 or allow water of the drum 20 to be discharged to the tub 11.

[0034] The recess portion 50 includes a polygonal shape having a plurality of sides, and a plurality of edges 50b extending from corners or vertices of the polygonal shape to meet at an apex of the pyramid. In accordance with an embodiment of the present invention, each of the plurality of recess portions 50 is provided in the form of a quadrangular (quadrilateral) pyramid so as to have a quadrangle (quadrilateral) shape 50a including four sides, and a plurality of edges extending from corners, or vertices, of the quadrangle shape 50a. The plurality of recess portions 50 are disposed in a way to share at least one portion between adjacent recess portions 50 among the plurality of recess portions 50. Each recess portion 50 can also be considered as a pyramid without a base. The bottom of the pyramid is in this example shown as approximately square, but may generally be a quadrilateral or quadrangle with four sides, that form the peripheral edges of the pyramid.

[0035] A through-hole 60 is disposed through at least one of the four sides of the quadrangle shape 50a, also referred to as the base or bottom periphery. The sides or peripheral edges are also referred to as base edges. In one embodiment of the present invention, the through-hole 60 is formed at middle portions of two of the four sides forming the quadrangle shape 50a of the recess portion 50, the two sides being opposed in a circumferential direction of the drum 20. As described above, the quadrangle shape 50a of the recess portion 50 shares one of the four sides with an adjacent recess portion 50 to form a boundary between the adjacent recesses, so that the through-hole 60 is formed through the side that is shared between the adjacent recess portions 50.

[0036] As described above, the recess portions 50 and the through-holes 60 are formed, and when the drum 20 is rotated for a washing operation, the sides 50a disposed in the circumferential direction of the drum 20 cause friction with the laundry in the drum 20, thereby enhancing the washing efficiency.

[0037] Different from a case where the through-hole is disposed only in the centre of the recess 50, the through-holes 60 are formed at the sides 50a that form the periphery of each pyramidal recess 50, and more through-holes 60 are formed on the recess portion 50, thereby enhancing the drain and spin-dry efficiencies.

[0038] As shown in FIG. 2, a plurality of lifter installation portions 24a are installed for installation of the lifter 25 on the circumference portion 24 of the drum 20. The lifter installation portions 24a are provided while being spaced apart from one another in between the recess portions 50. The lifter installation portion 24 is provided in a planar shape for installation of the lifter 25 while the recess por-

tions 50 have strength larger than the lifter installation portion 24a due to the shape thereof. Such a local difference in strength may cause the drum 20 to be unequally bent when the drum 20 is manufactured. In order to prevent the drum 20 from being unequally bent, reinforcing portions 24b are formed at both sides of the lifter installation portion 24a of the circumference portion 24, respectively, in a manner to be recessed from the inner surface to the outer surface of the circumference portion 24. In addition, in order to reinforce the lifter installation portion 24a, a series of recess portions 50 may be provided at each side of the lift installation portion 24a.

[0039] Hereinafter, the operation of the washing machine configured as such will be described.

[0040] In a state where a laundry is input in the drum 20 and detergent is input in the detergent supply apparatus 16, as the washing machine is operated, the water supply control valve 17d of the water supply apparatus 17 is opened such that wash water is supplied to the tub 11. In this case, the detergent in the detergent supply apparatus 16 is supplied together with the wash water to the inside the tub 11 during the supply of water. After a predetermined amount of wash water is supplied, the supply of water is finished.

[0041] After the supplying of water, the drum 20 is rotated at a low speed by the operation of the driving motor 13, performing a washing operation. In this case, the wash water at the lower portion of the tub 11 is supplied to the inside of the drum 20 by the operation of the wash water circulating apparatus 40. In the washing process as such, the friction between the laundry and the inner surface of the drum 20 is increased due to the plurality of recess portions 50, thereby improving the washing performance.

[0042] After the washing operation is completed, a rinsing operation of repeating a spin dry and a water supply is performed, and after the rinsing operation, a spin-dry is performed at a high speed of rotation of the drum 20.

[0043] Although the through-holes 60 according to one embodiment of the present invention are formed through two of the four sides forming the quadrangle shape 50a of the recess portion 50, the two sides opposite to each other in the circumferential direction of the drum 20, the present invention is not limited thereto. As shown in FIG. 4, the through-holes 60 may be formed at two of the four sides that are opposite to each other in the direction of a shaft of the drum 20. As shown in FIG. 5, the through-holes 60 may be formed at all four sides forming the quadrangle shape 50a of the recess portion 50. As shown in FIG. 6, the through-holes 60 may be formed at the four corners of the recess portion 50.

[0044] Although the description of the above described embodiments has been made in relation that the recess portion 50 is recessed from the inner surface to the outer surface of the drum 20, the present invention is not limited thereto. On the contrary, the recess portion 50 may be recessed from the outer surface to the inner surface of the drum 20.

[0045] FIG. 7 illustrates an embodiment of the recess portion 50 recessed from the outer surface to the inner surface of the drum 20 and having the through-holes 60 formed at two of the four sides 50a' forming the quadrilateral shape, the two sides being opposite to each other in the circumferential direction of the drum 20. In a case of having the front surface portion 22 of the drum 20 disposed to be higher than the rear surface portion 21 described above, as the through-holes 60 are formed at the two opposite sides of the quadrangle shape 50a in the circumferential direction of the drum 20, the wash water, during a draining operation, moves to the rear of the drum 20 along sides disposed in the circumferential direction of a quadrangle shape 50a', which is positioned at a lower portion of the drum 20, and is drained through the through-holes 60, so that the draining efficiency is enhanced.

[0046] FIG. 8 illustrates an embodiment of the recess portion 50 recessed from the outer surface to the inner surface of the drum 20 and having the through-holes 60 formed at two sides of the four sides forming the quadrangle shape, the two sides opposite to each other in the shaft direction of the drum 20. As the through-holes 60 are formed at the two opposite sides of the quadrangle shape 50a' in the shaft direction of the drum 20, the wash water, during a spin-dry operation, moves in a circumferential direction while flowing along sides disposed in the shaft direction of a quadrangle shape 50a' and is drained through the through-holes 60, so that the spin-dry efficiency is enhanced.

[0047] FIG. 9 illustrates an embodiment of the recess portion 50 recessed from the outer surface to the inner surface of the drum 20 and having the through-holes 60 formed at middle portions of the four sides forming the quadrangle shape 50a', thereby enhancing the drain and spin-dry efficiencies.

[0048] FIG. 10 illustrates an embodiment of the recess portion 50 recessed from the outer surface to the inner surface of the drum 20 and having the through-holes 60 formed at an apex of the recess portion 50 at which edges 50b' meet each other.

[0049] Although the recess portion 50 is illustrated as being recessed in the form of a quadrangular pyramid, the present disclosure is not limited thereto. As shown in FIG. 11, a recess portion 70 may be recessed in the form of a hexagonal pyramid. Alternatively, the recess portion may be recessed in variety of different polygonal pyramids.

[0050] Although the lengths of the edges of the recess portion 50 are illustrated as being the same as one another, so forming a substantially symmetrical pyramid, the present disclosure is not limited thereto. FIG. 12 and 13 illustrate a recess portion 80 recessed from the outer side to the inner side of the drum 20 in the form of a quadrangle pyramid, and including two edges 80b formed at the rear of the drum 20 having lengths L1 different from length L2 of two edges 80b formed at the front of the drum 20, so that an inclination angle θ_1 of a side

surface 80c-1 formed at the rear of the drum 20 is different from an inclination angle θ_2 of a side surface 80c-2 formed at the front of the drum 20. In other words, the apex of the pyramid is off-centre.

[0051] In the embodiment, the lengths L1 of the two edges 80b formed at the rear of the drum 20 are provided to be larger than the lengths L2 of the two edges 80b formed at the rear of the drum 20. The recess portion 80 provided in the form of a quadrangle pyramid includes four edges 80b and four side surfaces, or faces, 80c formed between corresponding ones of the four edges 80b. The four side surfaces 80c include the side surface 80c-1 formed at the rear of the drum 20, the side surface 80c-2 formed at the front of the drum 20, and two side surfaces 80c-3 and 80c-4 opposite to each other in the circumferential direction of the drum 20. The inclination angle θ_1 of the side surface 80c-1 formed at the rear of the drum 20 is provided to be smaller than the inclination angle θ_2 of the side surface 80c-2 formed at the front of the drum 20.

[0052] Through the recess portion 80 formed as above, water moves from the rear to the front of the drum 20 along the inner surface of the drum 20 due to a centrifugal force during the spin-dry operation. During the process of water moving to the front, some of the water moving along the side surface 80c-1 formed at the rear of the drum 20 collides with the side surface 80c-2 formed at the front of the drum 20 that has a larger inclination angle (θ_2) when compared to the inclination angle (θ_1) of the surface 80c-1 formed at the rear of the drum 20, and temporarily stops moving. Even in this state, the water is subject to the centrifugal force, so the water is discharged to the outside the drum 20 via a through-hole 90, thereby enhancing the spin-dry via the through-hole 90.

[0053] Although the inclination angle θ_1 of the side surface 80c-1 formed at the rear of the drum 20 is provided to be smaller than the inclination angle θ_2 of the side surface 80c-2 formed at the front of the drum 20, the present disclosure is not limited thereto. On the contrary, the inclination angle θ_1 of the side surface 80c-1 may be provided to be larger than the inclination angle θ_2 of the side surface 80c-2.

[0054] Although the two side surfaces 80c-1 and 80c-2 opposite to each other in the shaft direction of the drum 20 are illustrated to have different inclination angles from each other, the present disclosure is not limited thereto. FIGS. 13 and 14 illustrates an embodiment of the recess portion 80 in which the two side surfaces 80c-3 and 80c-4 opposite to each other in the circumferential direction among the four surfaces of the recess portion 80 have different inclination angles from each other.

[0055] In this case, an inclination angle θ_3 of the side surface 80c-3 formed at a rear side of the rotation direction of the drum 20 is provided to be smaller than an inclination angle θ_4 of the side surface 80c-4 formed at a front side of the rotation direction of the drum 20.

[0056] If the drum 20 as such is rotated in one direction

for a spin-dry operation, the water in the drum 20 is rotated in the rotation direction of the drum 20 along the inner surface of the drum 20. During the process of water moving in the circumferential direction, water moving along the side surface 80c-3 formed at the rear side of the rotation direction of the drum 20 collides with the side surface 80c-4 formed at the front side of the rotation direction of the drum 20 that has a larger inclination angle (θ_4) when compared to the inclination angle (θ_3) of the surface 80c-3, and temporarily stops moving. Even in this state, the water is subject to the centrifugal force, so the water is discharged to the outside the drum 20 via the through-hole 90, thereby enhancing the spin-dry via the through-hole 90.

[0057] Although a few embodiments of the present invention have been shown and described, it would be appreciated by those skilled in the art that changes may be made in these embodiments without departing from the principles of the invention, the scope of which is defined in the claims. It will further be appreciated that features of the embodiments can be mixed, so that, for example, the off-centre pyramid of Figures 12 and 14 can also have through-holes through the sides as shown in Figures 3 to 9, and in other embodiments there may be combinations of holes in the sides as shown in Figures 3 to 9 together with holes in the apexes (apices).

Claims

1. A washing machine comprising:

a tub;
a drum disposed inside the tub; and
a driving apparatus configured to rotate the drum,
wherein the drum comprises a plurality of recess portions each provided in the form of a pyramid recessed from one of an inner surface and an outer surface of the drum toward the other of the inner surface and the outer surface of the drum, and a plurality of through-holes configured to drain water, and
each of the recess portions comprises a polygonal shape having a plurality of sides, and a plurality of edges extending from vertices of the polygonal shape to meet at an apex of the recess portion, and
the through-holes are formed through at least one of the sides, or wherein the through-holes are formed through the apex.

2. The washing machine of claim 1, wherein the drum is disposed on an incline to have a front thereof higher than a rear thereof.

3. The washing machine of claim 1 or 2, wherein each of the plurality of recess portions is recessed in the

form of a quadrangular pyramid so as to have a quadrangle shape at the base thereof.

4. The washing machine of claim 3, wherein the plurality of through-holes are formed through two of the four sides forming the quadrangle shape, the two sides being opposite to each other in a rotation direction of the drum.

5. The washing machine of claim 3, wherein the plurality of through-holes are formed through two of the four sides forming the quadrangle shape, the two sides being opposite to each other in a direction of a shaft of the drum.

6. The washing machine of claim 3, wherein the plurality of through-holes are formed through each of the four sides forming the quadrangle shape.

7. The washing machine of any one of the preceding claims, wherein the plurality of through-holes are formed through at least one of the middle portions of the sides forming the polygonal shape.

8. The washing machine of any one of the preceding claims, wherein the plurality of recess portions are formed adjacent to one another, and the through-hole is formed through a side that is shared by adjacent recess portions of the plurality of the recess portions.

9. A washing machine comprising:

a tub;
a drum disposed inside the tub; and
a driving apparatus configured to rotate the drum,
wherein the drum comprises a plurality of recess portions each provided in the form of a pyramid recessed from one of an inner surface and an outer surface of the drum toward the other of the inner surface and the outer surface of the drum, and a plurality of through-holes formed through apexes of the plurality of recess portions to drain water,
each of the recess portions comprises a polygonal shape having a plurality of sides, and a plurality of edges extending from vertices of the polygonal shape to meet at the apex of the recess portion, and wherein side surfaces are provided between corresponding ones of the plurality of edges, and
two of the side surfaces opposite to each other are inclined at different angles.

10. The washing machine of claim 9, wherein the two of the side surfaces inclined at different angles are disposed opposite to each other in a direction of a shaft

of the drum.

11. The washing machine of claim 10, wherein a side surface provided at a rear of the drum among the plurality of side surfaces has an inclination angle smaller than an inclination angle of a side surface provided at a front of the drum. 5
12. The washing machine of claim 9, wherein the two of the side surfaces inclined with the different angles are disposed opposite to each other in a circumferential direction of the drum. 10
13. The washing machine of claim 12, wherein a side surface provided upstream in a rotation direction of the drum among the plurality of side surfaces has an inclination angle smaller than an inclination angle of a side surface provided downstream in the rotation direction of the drum. 15
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14. The washing machine of claim 9, wherein the recess portion is provided in a quadrangular pyramid including four edges and four side surfaces formed between corresponding ones of the four edges. 25

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FIG. 1

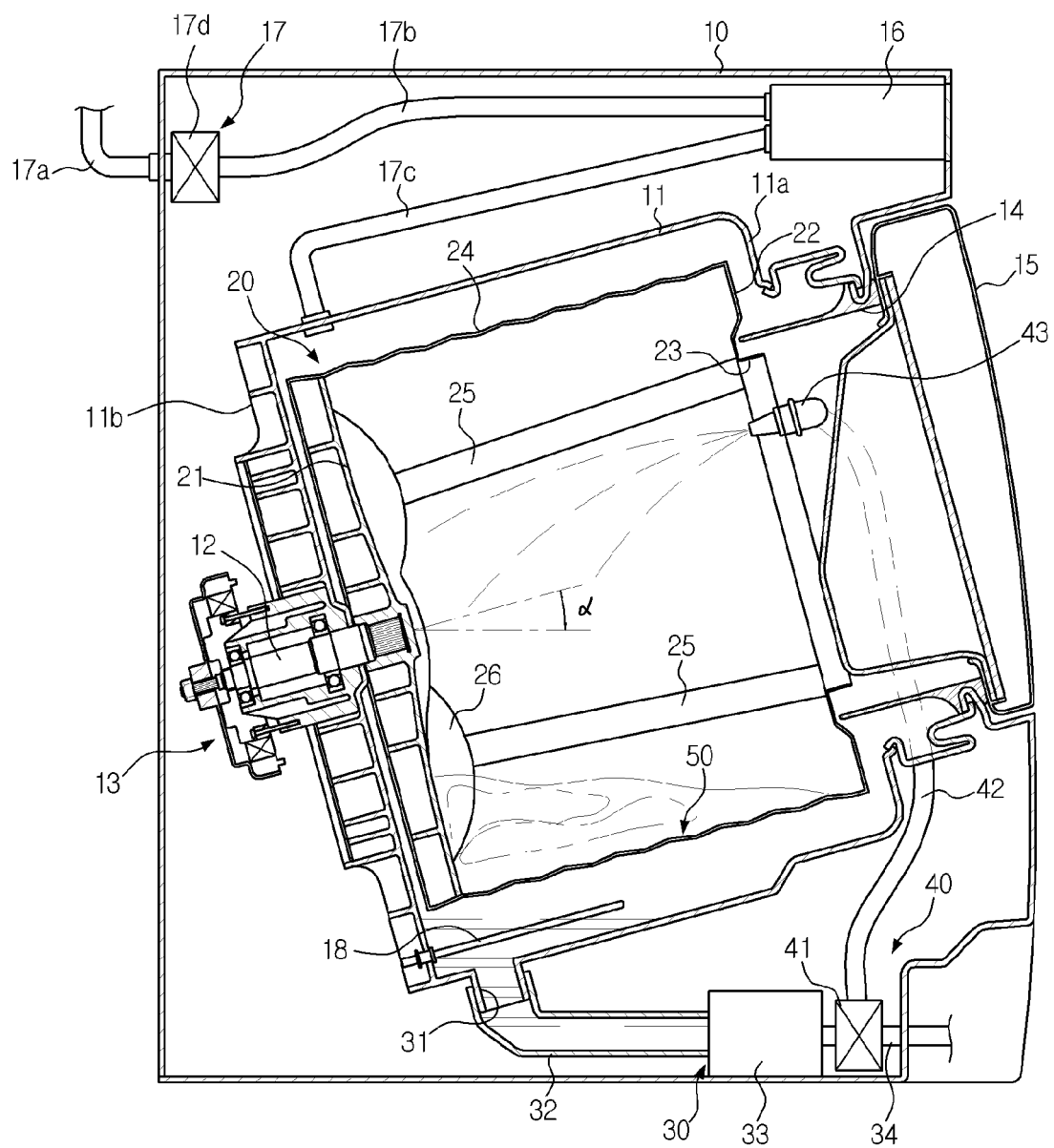


FIG. 2

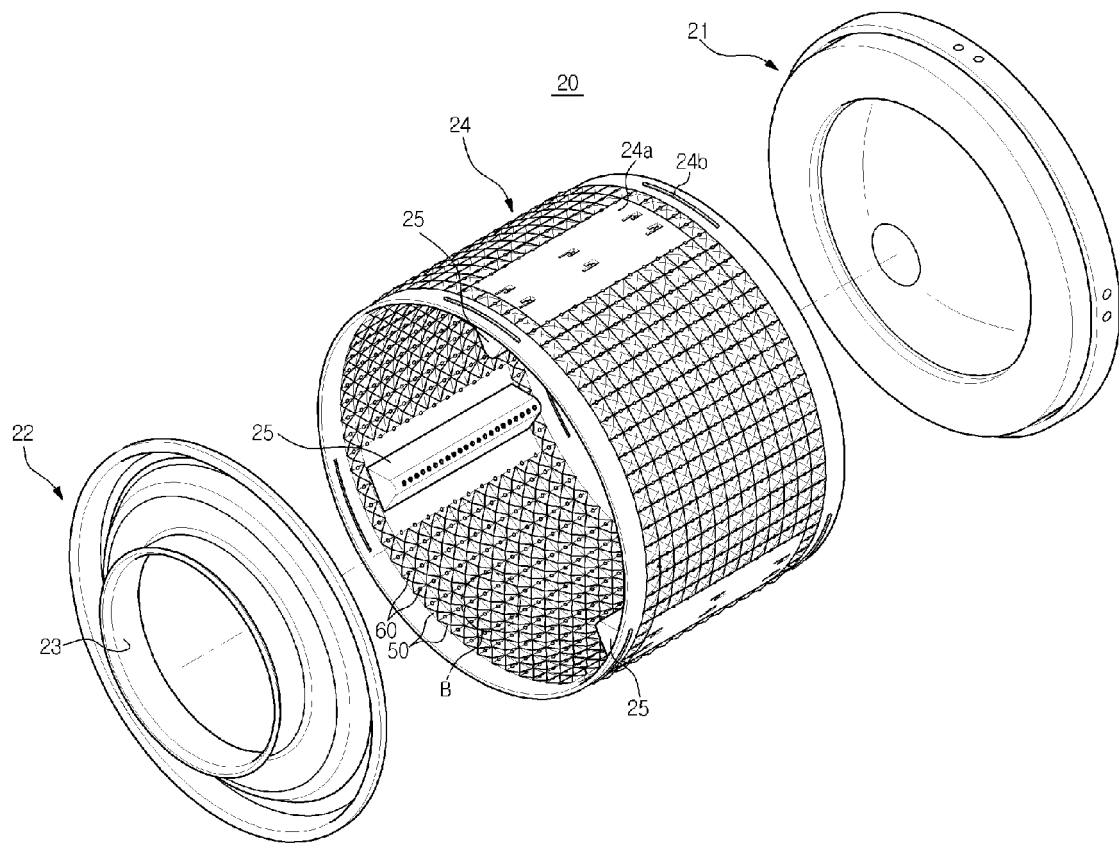


FIG. 3

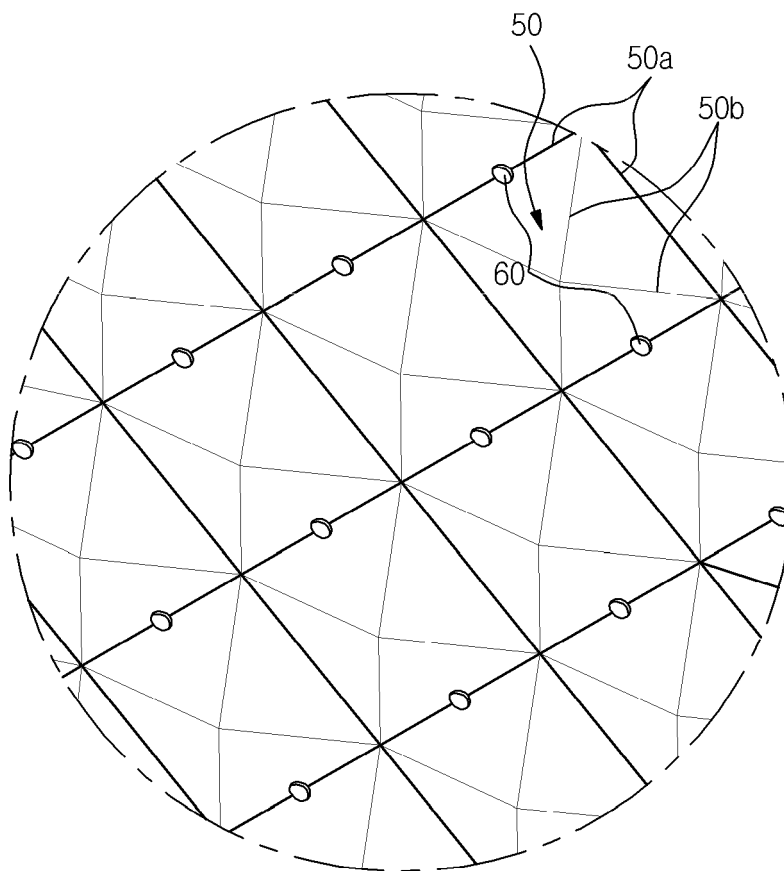


FIG. 4

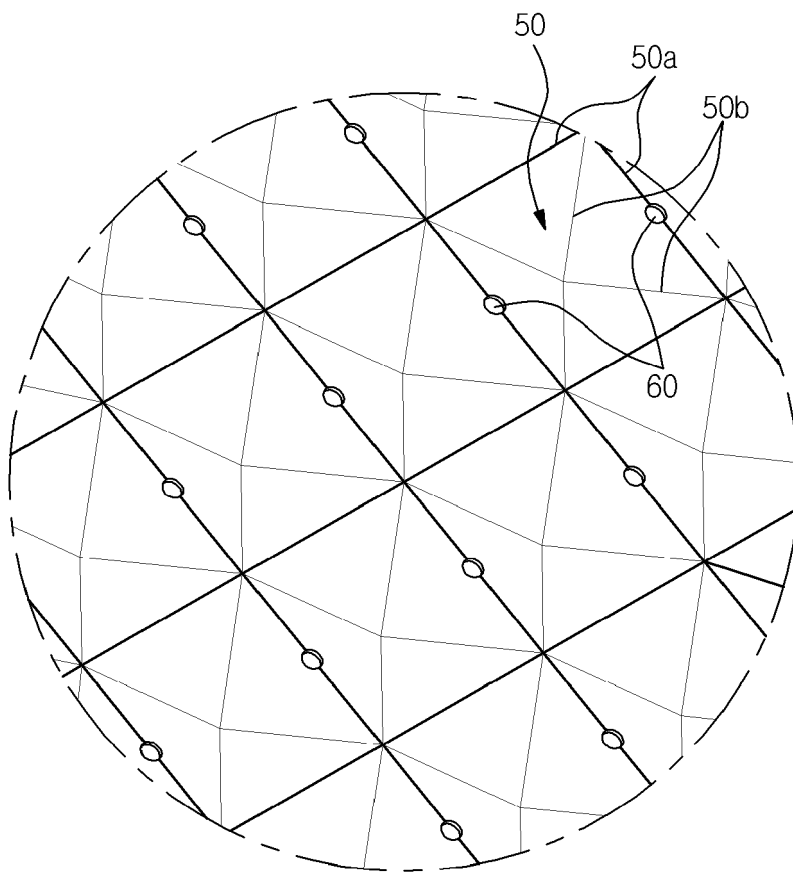


FIG. 5

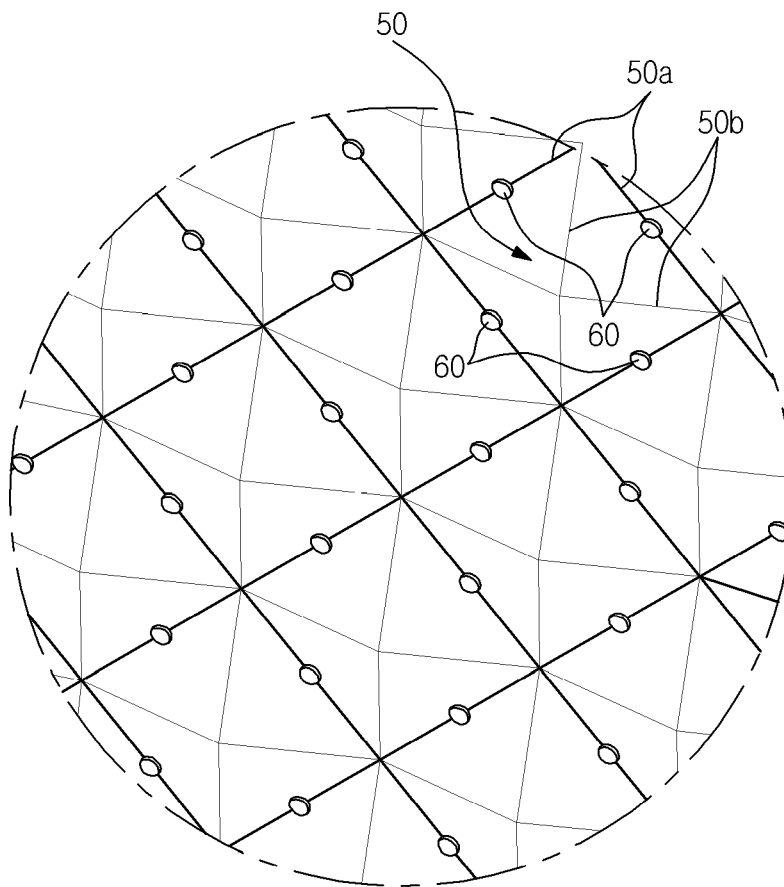


FIG. 6

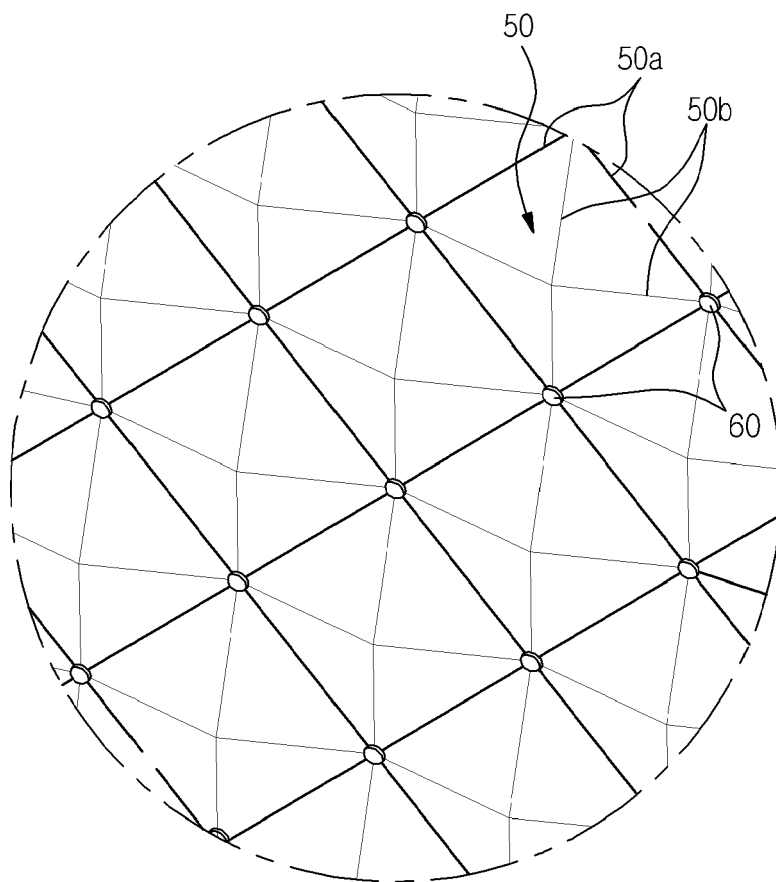


FIG. 7

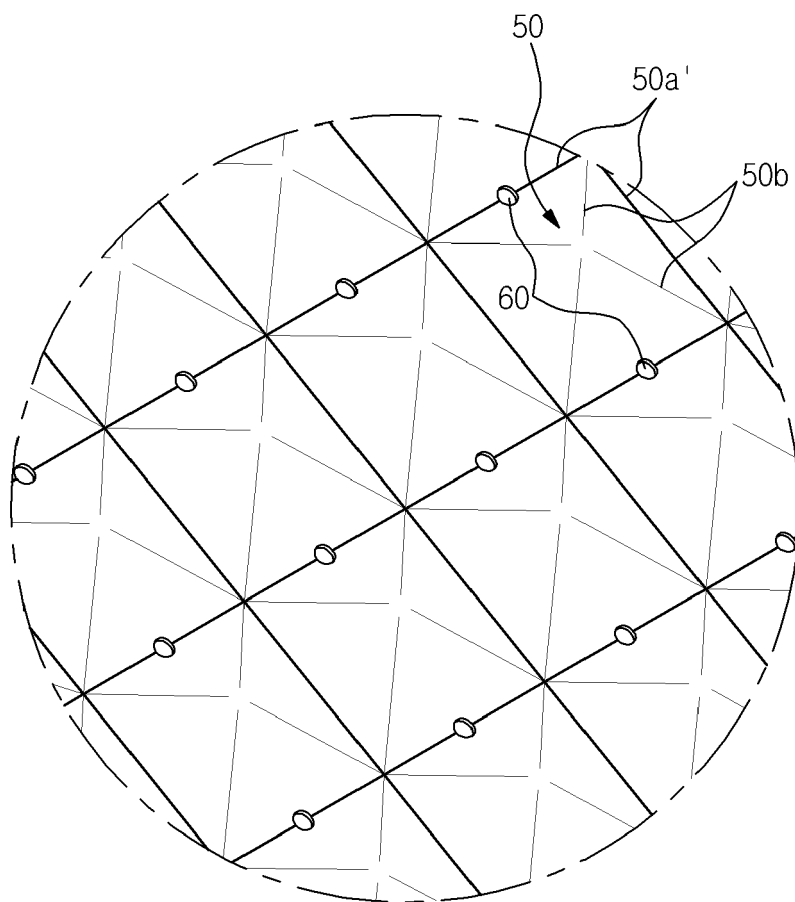


FIG. 8

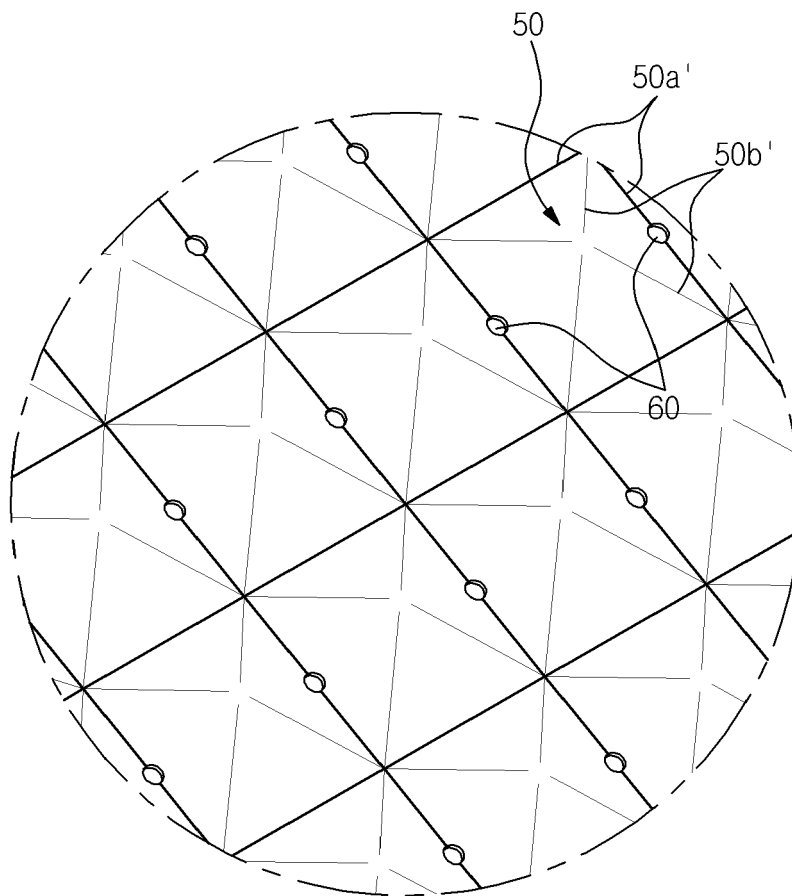


FIG. 9

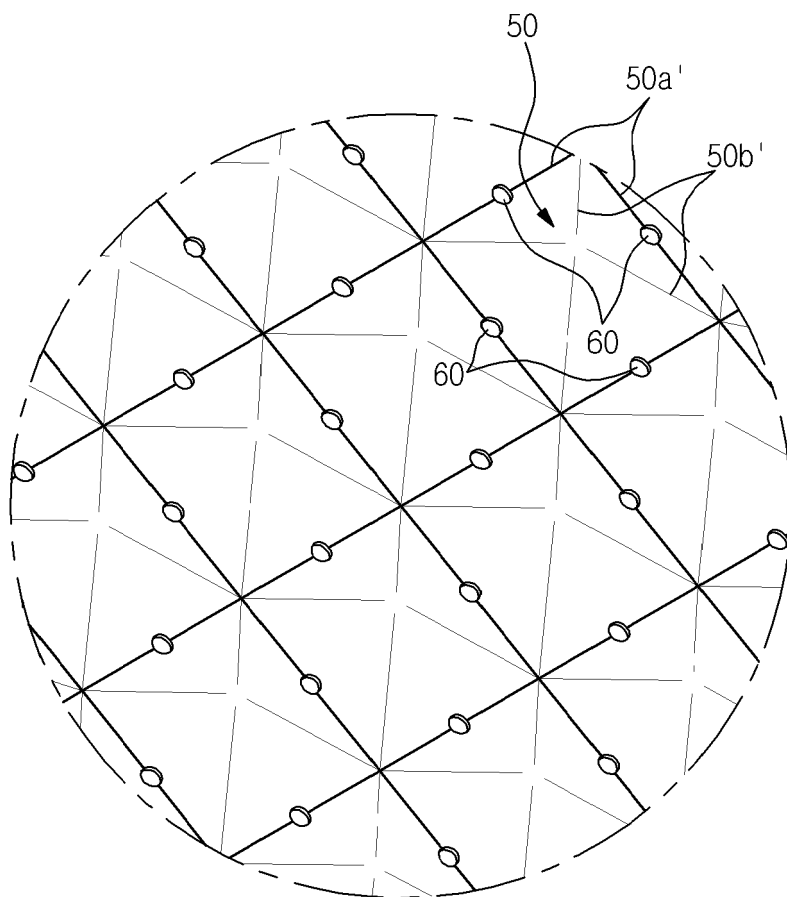


FIG. 10

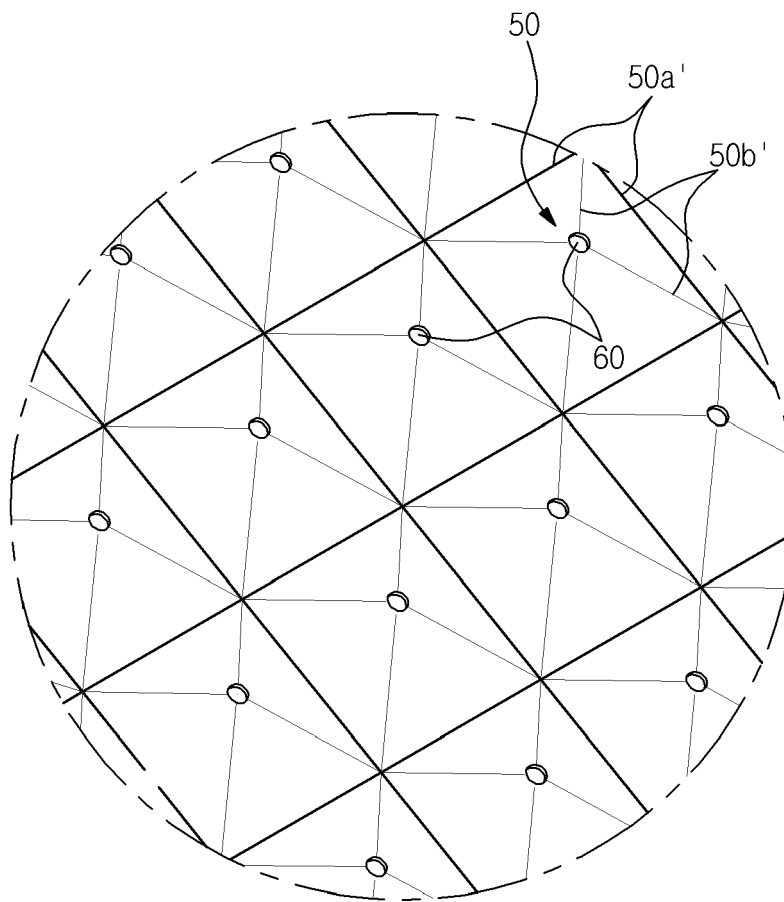


FIG. 11

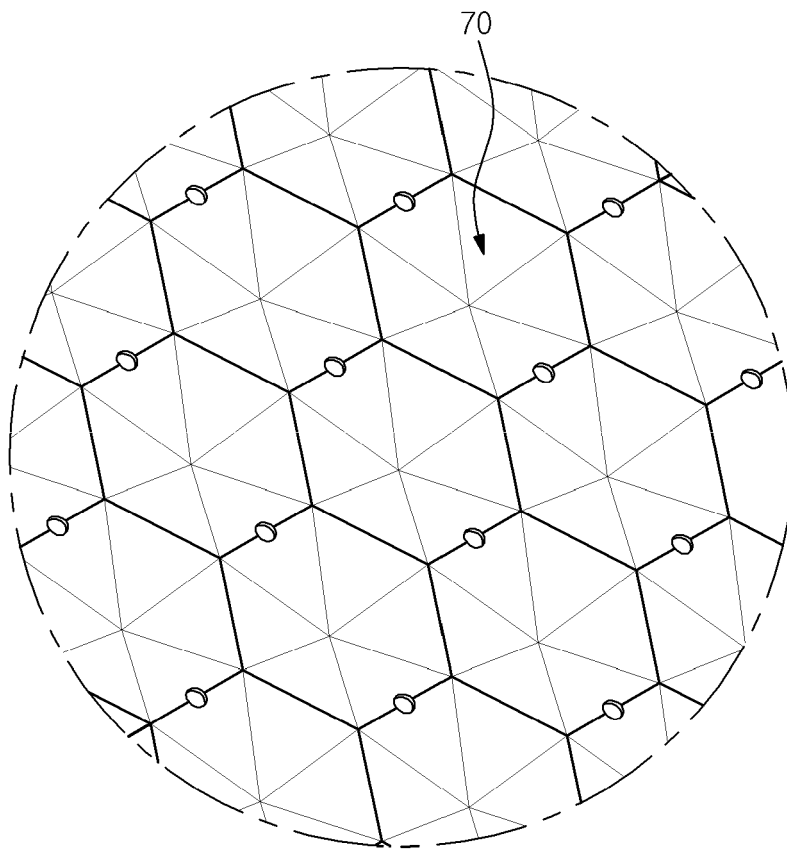


FIG. 12

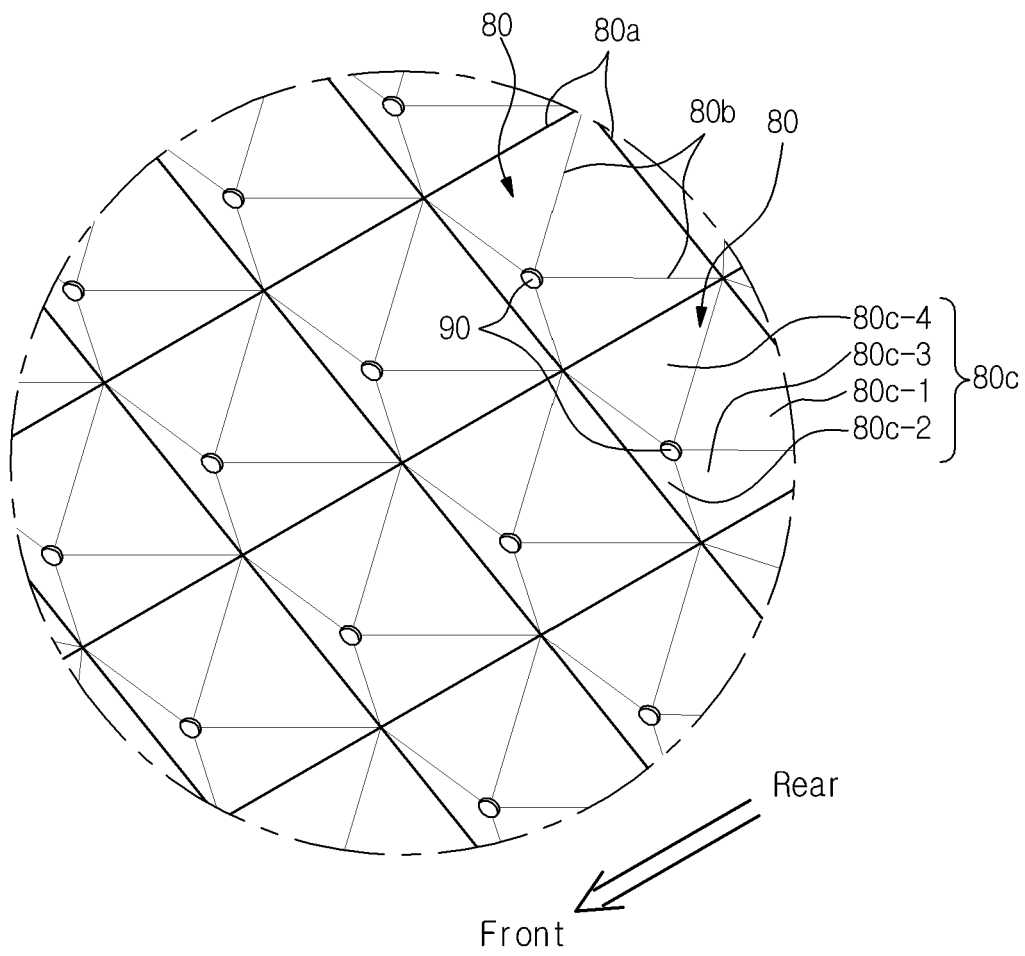


FIG. 13

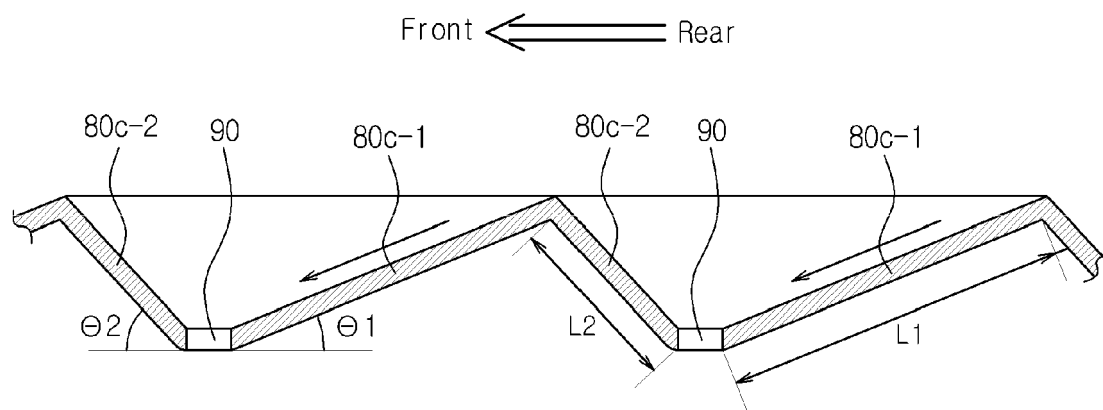


FIG. 14

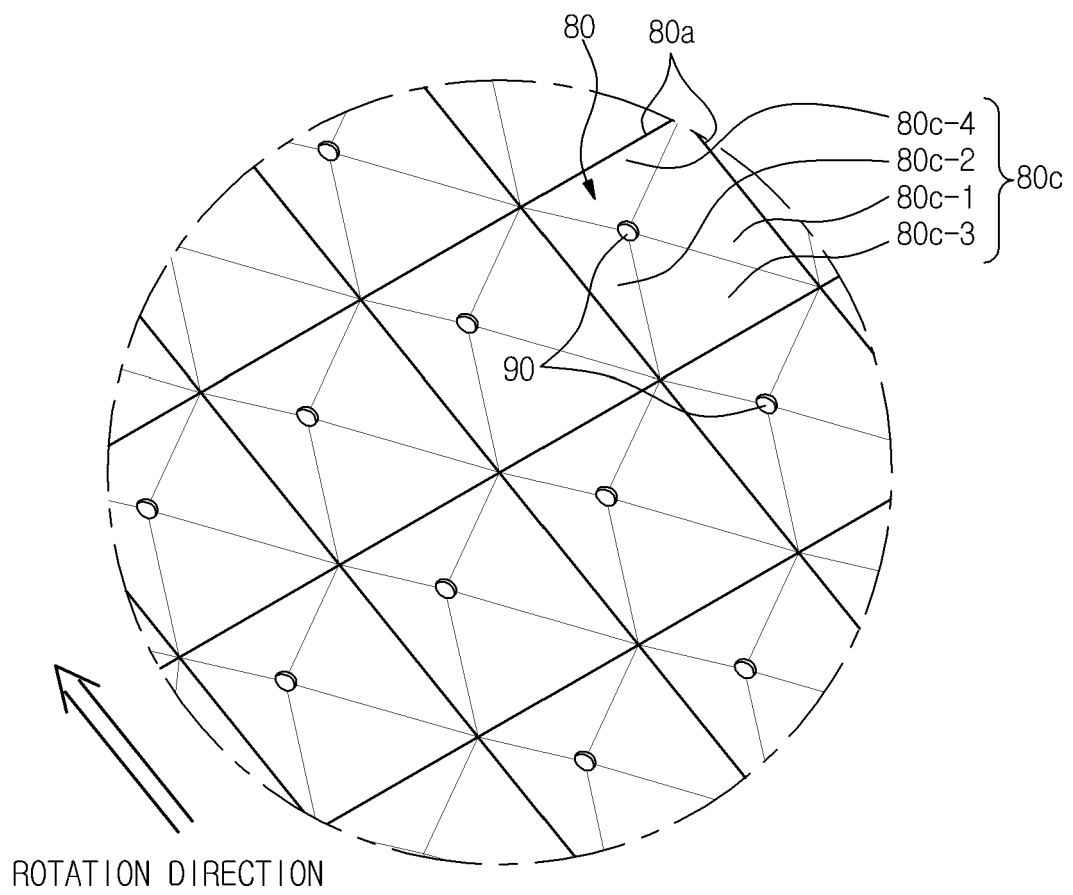
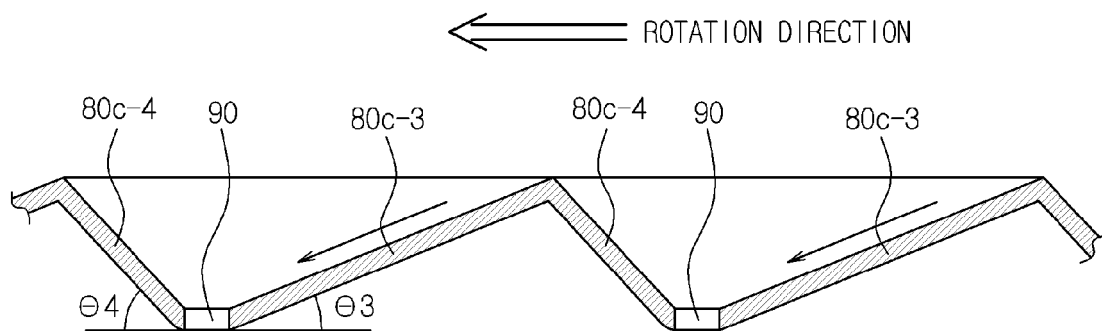


FIG. 15





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Application Number
EP 12 19 4575

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