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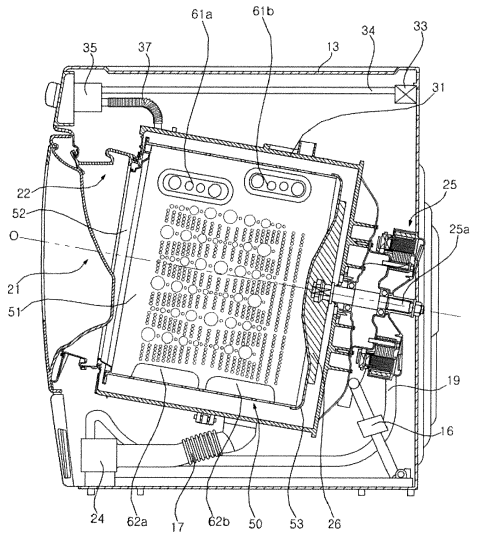
(54) LAUNDRY TREATING APPARATUS

(57) A laundry treating apparatus according to the present disclosure includes a drum (51) configured to rotate about a rotation axis extending in a front-rear direction, and a lifter disposed in the drum. The lifter (61a, 61b, 62a, 62b, 63a, and 63b) includes a lifter frame (620) installed on an inner circumferential surface of the drum, and a frame cover (640) coupled to the lifter frame and protruding radially inward from the inner circumferential surface of the drum. The lifter frame has water flow throughholes (624) formed in an upper surface (623) and a lateral surface (622) of the lifter frame so as to allow the inside and the outside of the lifter frame to communicate with each other, and the frame cover has a water flow discharge hole (646h) formed by penetrating a part of an upper surface of the frame cover and through which washing water that has passed through the water flow throughhole is discharged into the drum.

FIG. 1



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Description

[0001] This present application claims the benefit of priority to Korean Patent Application No. 10-2019-0013926, entitled "LAUNDRY TREATING APPARATUS," filed on February 1, 2019, and Korean Patent Application No. 10-2019-0135452, entitled "LAUNDRY TREATING APPARATUS," filed on October 29, 2019, in the Korean Intellectual Property Office.

[0002] The present disclosure relates to a laundry treating apparatus having a rotary drum in which lifters are provided.

[0003] Korean Patent Application Publication No. 10-2018-0072336 (hereinafter, referred to as 'related Art 1') discloses a washing machine in which a rolling motion of laundry is performed. A drum having lifters configured to lift up laundry is rotated at a predetermined speed, such that the laundry in the drum is raised to a predetermined height and then rolls down along an inner circumferential surface of the drum. The rolling motion induces an effect of gently rubbing the laundry by means of friction generated between the laundry and the drum while the laundry rolls.

[0004] Since the greater the height of the lifter, the more easily the laundry may be lifted up, it is difficult to implement the rolling motion if the height of the lifter exceeds a certain level. The reason is that because the laundry is lifted up high due to drag force of the lifter and thus a drop height of the laundry also increases even if the drum is rotated at a low speed, the laundry falls directly onto a bottom portion of the drum instead of rolling (that is, a tumbling motion occurs).

[0005] In a case in which the height of the lifter is low, laundry which is falling down while rolling (that is, laundry that has not yet reached a lowest point of the drum) may climb over the lifter during the rolling motion even if the drum is rotated at a higher speed than in the related art, and as a result, the laundry may roll for a longer time.

[0006] However, because laundry which has fallen down to the approximately lowest point of the drum needs to be lifted up by the lifter, it is necessary to consider a structure in which friction greater than a certain level can be generated between the lifter and the laundry.

[0007] Korean Patent Application Publication No. 10-2017-0082055 (hereinafter, referred to as 'related art 2') discloses a washing machine having a plurality of lifters on an inner circumferential surface of a drum that rotates about an approximately horizontal rotation axis.

[0008] The lifter includes a first member coupled to an inner circumferential surface of the drum, and a second member that is mounted on the first member and protrudes to the inside of the drum so as to lift up laundry when the drum is rotated.

[0009] The second member is formed approximately in the shape of a dome so as to define a space in which the laundry is accommodated. The first member includes a first portion mounted on the inner circumferential surface of the drum, and a second portion convexly protruding from the mounting portion and inserted into the space.

[0010] A base of the dome shape of the second member is in contact with the second portion, but a vertex of the dome shape spaced apart from the base in a radial direction is spaced apart from the second portion.

[0011] Since the vertex of the dome shape cannot be supported by the first member, there is a disadvantage in that an internal space of the second member, particularly the vertex of the dome shape, is depressed when the second member is pressed by an external force.

[0012] That is, because an upper plate of the first member and an upper plate of the second member do not correspond to each other, it is not possible to appropriately deal with deformation caused by the external force.

[0013] In particular, in a case in which the second member is made of metal, for example, stainless steel, there is a disadvantage in that, due to plastic deformation of the materials, the second member cannot be restored to its original shape.

[0014] In addition, if the second member cannot be restored to its original shape due to plastic deformation, the balance between the lifters is broken. Accordingly, eccentricity occurs during rotation of the drum and an imbalance occurs even due to the load applied to the drum by the lifters, and in a severe case the drum may thus be deformed or damaged.

[0015] In addition, when a gap between an outer surface of the first member and an inner surface of the second member becomes small due to the deformation of the second member, foreign substances may be trapped in the gap, which causes hygienic problems.

[0016] In particular, even when washing water is introduced into the lifter through a washing water inlet hole formed in the first member, the washing water is quickly discharged through a washing water flow discharge hole formed in the second member. This is because the washing water inlet hole and the washing water flow discharge hole are formed in an upper plate of the first member and an upper plate of the second member, respectively, which correspond to each other.

[0017] Therefore, there is a disadvantage in that it is difficult to effectively clean the interior of the lifter because the washing water stays in the lifter for a relatively short time even when the washing water is introduced into the lifter.

[0018] Korean Patent Application Publication No. 10-2007-0048913 (hereinafter, referred to as 'related art 3') discloses a method of manufacturing a drum for a washing machine. According to the manufacturing method, a cylindrical drum is manufactured by forming mounting holes for mounting lifters in a quadrangular metal plate and then rolling the metal plate.

[0019] Korean Utility Model Registration No. 20-0358903 (hereinafter, referred to as 'related art 4') discloses a structure in which a lifter is installed in a drum by using mounting holes. The mounting holes are arranged in a front-rear direction of the drum at predetermined intervals, and a set of mounting holes arranged in

this manner is used to mount one lifter. That is, hooks, which correspond in number to the set of mounting holes, are formed in the lifter, and the hooks are caught by the mounting holes, respectively.

[0020] Japanese Patent Application Publication No. JP 2004057657 A (hereinafter, referred to as 'related art 5') discloses a structure in which a pair of lifters (or baffles), which constitutes a set, is disposed, in a row in a front-rear direction, on an inner circumferential surface of a drum, and the lifters are disposed at predetermined intervals along a circumferential direction of the drum.

[0021] Meanwhile, a manufacturer needs to design drums with different capacities depending on product specifications. In this case, the manufacturer may selectively manufacture a drum (that is, a large-capacity drum) elongated in the front-rear direction and a relatively short drum (that is, a small-capacity drum) by cutting, based on a design dimension, a metal plate to a length of a side of the metal plate corresponding to a length in the front-rear direction of the drum to be manufactured.

[0022] However, the distance between the pair of lifters needs to be changed in accordance with the length in the front-rear direction of the drum. Yet, because the hooks formed on the lifters are fastened only to the designated mounting holes in the disclosures of the above related art, the interval between the pair of lifters is inevitably constant even when the length of the drum varies. The structure, in which the interval between the lifter positioned at a front side and the lifter positioned at a rear side is inevitably constant regardless of the length of the drum as described above, has a disadvantage in that the laundry positioned at a front or rear end of the drum cannot come into contact with the lifters due to the distance between a front end of the lifter positioned at the front side and a front end of the drum or between the lifter positioned at the rear side and a rear end of the drum increasing as the length of the drum increases.

[0023] Korean Utility Model Registration No. 20-0358903 (hereinafter, referred to as 'related art 6') discloses a washing machine having a drum provided with a lifter. A hook protrudes from one surface of the lifter, and a hook throughhole is formed in the drum such that the hook is caught by the hook throughhole.

[0024] The hook includes a neck extending from a lifter main body, and a head expanding from an end of the neck so as to have a larger width than the neck. The lifter is installed such that the head is caught by an outer surface of the drum in a state in which the neck is positioned in the hook throughhole.

[0025] However, in order to injection-mold the lifter having the hook as described above, a mold includes an upper mold configured to form an upper surface of the lifter main body, and a lower mold configured to form a lower surface of the lifter main body. However, there is a disadvantage in that undercutting occurs due to a part of the head vertically overlapping the lifter main body.

[0026] An aspect of the present disclosure is to provide a laundry treating apparatus in which frictional action between lifters and laundry (fabrics) smoothly occurs.

[0027] Another aspect of the present disclosure is to provide a laundry treating apparatus capable of improving an operation of rubbing laundry by using friction between lifters and laundry even when a height of the lifter is decreased.

[0028] Still another aspect of the present disclosure is to provide a laundry treating apparatus capable of maintaining friction between lifters and laundry at a predetermined level or higher, thereby smoothly performing an operation of lifting up laundry by using the lifters.

[0029] Yet another aspect of the present disclosure is to provide a laundry treating apparatus in which rigidity of a lifter is increased, such that the lifter is not easily deformed.

[0030] Still yet another aspect of the present disclosure is to provide a laundry treating apparatus in which sufficient rigidity of a lifter is ensured even when a frame cover, which defines an external shape of the lifter, is formed by a thin metal plate.

[0031] Aspects of the present disclosure are not limited to those mentioned above, and other aspects not mentioned above may be clearly understood by those skilled in the art from the following description.

[0032] A laundry treating apparatus according to an embodiment of the present disclosure includes a drum configured to rotate about a rotation axis extending in a front-rear direction, and a lifter disposed in the drum.

[0033] The lifter may include a lifter frame fixed to the drum, and a frame cover configured to cover the lifter frame.

[0034] The lifter frame may include water flow throughholes respectively formed in a frame upper plate and a frame sidewall, to allow the inside and the outside of the lifter frame to communicate with each other, and the frame cover may include a water flow discharge hole formed in a cover upper plate through which washing water that has passed through the water flow throughholes is discharged into the drum.

[0035] The number of water flow throughholes may be relatively larger than the number of water flow discharge holes.

[0036] Upper surfaces and lateral surfaces of the lifter frame and the frame cover may correspond to one another.

[0037] The lateral surface of each of the lifter frame and the frame cover may be formed to be inclined.

[0038] At least a part of the water flow throughhole and at least a part of the water flow discharge hole may be disposed so as not to be aligned with one another in a vertical direction perpendicular to the inner circumferential surface of the drum.

[0039] The lifter frame may be made of synthetic resin, and the frame cover may be made of metal.

[0040] The frame cover may include a cover upper plate constituting a lifter upper plate portion, and a cover sidewall constituting a lifter sidewall portion. A coupling tab may be formed at a lower end of the frame cover,

and a tab binding port into which the coupling tab is inserted may be formed in the lifter frame.

[0041] The lifter frame may include a frame base fixed to the inner circumferential surface of the drum and having a seating groove into which the lower end of the frame cover is inserted, a frame upper plate spaced apart from the frame base in a direction toward the inside of the drum, and a frame sidewall configured to connect the frame upper plate and the frame base. The tab binding port may be formed in the seating groove.

[0042] The inner surface of the frame cover may be spaced apart from the frame upper plate by a spacer protruding from the frame upper plate toward the inner surface of the frame cover.

[0043] The spacer may be in contact with the inner surface of the frame cover, but the present disclosure is not limited thereto, and a contactless spacer may be provided.

[0044] The drum may have at least one water flow inlet hole formed in a region covered with the frame cover, and the lifter frame may have at least one water flow throughhole which allows the inside and the outside of the lifter frame to communicate with each other.

[0045] The frame cover may have a dome protruding upward at a position corresponding to the spacer. A plurality of the domes may be formed to be spaced apart from one another, and the water flow discharge hole may be formed between the adjacent dome.

[0046] A plurality of the lifters may be provided, and the plurality of the lifters may include a plurality of front lifters disposed in a circumferential direction of the drum, and a plurality of rear lifters disposed in the circumferential direction of the drum at rear sides of the plurality of front lifters.

[0047] A laundry treating apparatus according to another embodiment of the present disclosure includes a tub configured to receive washing water, a drum configured to receive laundry and rotate in the tub about a rotation axis extending in a front-rear direction, and a lifter disposed in the drum.

[0048] The lifter includes a lifter frame fixed to the inner circumferential surface of the drum and made of synthetic resin, and a frame cover made of metal and configured to cover the lifter frame.

[0049] A water flow discharge hole formed by penetrating a part of an upper surface of the frame cover and an upper plate protrusion protruding from the upper surface of the frame cover may be formed in the frame cover by plastically processing the frame cover.

[0050] According to the laundry treating apparatus according to the present disclosure, the effect of rubbing laundry is improved by the frictional action between the laundry and a washing protrusion formed on the lifter.

[0051] Further, it is possible to lift up the laundry to a predetermined level or higher by using the frictional action between the washing protrusion and the laundry even when the height of the lifter is decreased in comparison with the related art.

[0052] In addition, the flow of the fabrics is improved, and fabric distribution is smoothly performed by the frictional action between the washing protrusion and the laundry.

[0053] Further, the water flow throughholes are formed at positions in addition to the positions at which the water flow discharge holes are formed. Accordingly, it is possible to ensure more diverse flow paths of the washing water along which the washing water is guided to separation spaces between the lifter frame and the frame cover and then discharged into the drum, thereby improving the effect of cleaning the interior of the lifter.

[0054] In addition, since the upper surfaces and the lateral surfaces of the lifter frame and the frame cover are formed to correspond to one another, respectively, it is possible to exhibit higher rigidity and thus minimize deformation and damage when the lifter is deformed by external force.

[0055] Further, since the frame sidewall and the cover sidewall are formed to be inclined as described above, the washing water passing through the water flow throughhole may clean the interior of the lifter while colliding with the inclined surfaces, and the washing water may be naturally guided to the water flow discharge hole along the inclined surfaces.

[0056] The above and other aspects, features, and advantages of the present disclosure will become apparent from the detailed description of the following aspects in conjunction with the accompanying drawings, in which:

FIG. 1 is a cross-sectional view of a laundry treating apparatus according to an exemplary embodiment of the present disclosure;

FIG. 2 is a perspective view of a lifter illustrated in FIG. 1;

FIG. 3 is an exploded perspective view of the lifter illustrated in FIG. 2;

FIG. 4 is a plan projection view of the lifter illustrated in FIG. 2;

FIG. 5 is a view illustrating a raw material (a) cut to manufacture a large-capacity drum, and a raw material (b) cut to manufacture a small-capacity drum;

FIG. 6 is an enlarged view (a) of a part of the drum corresponding to a part A illustrated in FIG. 5 and an enlarged view (b) of a part of the drum corresponding to a part B illustrated in FIG. 5;

FIG. 7 is an enlarged view (a) of a part B illustrated in (a) of FIG. 5 and an enlarged view (b) of a part C illustrated in (b) of FIG. 5;

FIG. 8 is a top plan view of a lifter frame, and FIG. 9 is a bottom plan view of the lifter frame;

FIG. 10 is a cross-sectional view taken along a line A-A illustrated in FIG. 2;

FIG. 11 is a front view of the lifter frame, and FIG. 12 is a side view of the lifter frame;

FIG. 13 is a top plan view of a frame cover, FIG. 14 is a front view of the frame cover, and FIG. 15 is a side view of the frame cover;

FIG. 16 is a view illustrating a pair of front and rear lifters illustrated in FIG. 1;

FIG. 17 is a view illustrating the lifters illustrated in FIG. 16 when viewed from a front side;

FIG. 18 is a view (a) illustrating a state in which the drum illustrated in FIG. 1 is deployed and a developed view (b) of the drum having the lifters disposed according to another exemplary embodiment of the present disclosure;

FIG. 19 is a view (a) illustrating a change in height of a first fabric caused by the rear lifter in accordance with a rotation angle of the drum and a view (b) illustrating a change in height of a second fabric caused by the front lifter that constitutes a set together with the rear lifter;

FIG. 20 is a view illustrating a modified example in which lifters are disposed, in which (a) illustrates a small-capacity drum, and (b) illustrates a large-capacity drum; and

FIG. 21 is a view illustrating another exemplary embodiment of the lifter.

[0057] Advantages and features of the present disclosure and methods for achieving them will become apparent from the exemplary embodiments described below with reference to the accompanying drawings. However, the present disclosure is not limited to the exemplary embodiments disclosed herein but may be implemented in various different forms. The exemplary embodiments are provided to make the description of the present disclosure thorough and to fully convey the scope of the present disclosure to those skilled in the art. It is to be noted that the scope of the present disclosure is defined only by the claims.

[0058] The shapes, sizes, ratios, angles, the number of elements given in the drawings are merely exemplary, and thus, the present disclosure is not limited to the illustrated details. Like reference numerals designate like elements throughout the specification.

[0059] In relation to describing the present disclosure, when the detailed description of the relevant known technology is determined to unnecessarily obscure the gist of the present disclosure, the detailed description may be omitted.

[0060] The terminology used herein is for the purpose of describing particular example embodiments only and is not intended to be limiting. As used herein, the singular forms "a," "an," and "the" may be intended to include the plural forms as well, unless the context clearly indicates otherwise. The terms "comprises," "comprising," "including," and "having," are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or groups thereof. The method steps, processes, and operations described herein are not to be construed as necessarily requiring their performance in the particular order discussed or illustrated, unless specifically identified as an order of performance. It is also to be understood that additional or alternative steps may be employed.

[0061] When an element or layer is referred to as being "on," "engaged to," "connected to," or "coupled to" another element or layer, it may be directly on, engaged, connected or coupled to the other element or layer, or intervening elements or layers may be present. In contrast, when an element is referred to as being "directly on," "directly engaged to," "directly connected to," or "directly coupled to" another element or layer, there may be no intervening elements or layers present. Other words used to describe the relationship between elements should be interpreted in a like fashion (for example, "between" versus "directly between," "adjacent" versus "directly adjacent," etc.). As used herein, the term "and/or" includes any and all combinations of one or more of the associated listed items.

[0062] The terms "connected" and "coupled" are not restricted to physical or mechanical connections or couplings, and can include electrical connections or couplings, whether direct or indirect. The connection can be such that the objects are permanently connected or releasably connected. The term "communicatively coupled" is defined as connected, either directly or indirectly through intervening components, and the connections are not necessarily limited to physical connections, but are connections that accommodate the transfer of data, fluids, or other matter between the so-described components.

[0063] Although the terms "first," "second," "third," etc. may be used herein to describe various elements, components, regions, layers and/or sections, these elements, components, regions, layers and/or sections should not be limited by these terms. These terms may be only used to distinguish one element, component, region, layer or section from another region, layer or section. Terms such as "first," "second," and other numerical terms when used herein do not imply a sequence or order unless clearly indicated by the context. Thus, a first element, component, region, layer or section discussed below could be termed a second element, component, region, layer or section without departing from the teachings of the example embodiments.

[0064] Spatially relative terms, such as "inner," "outer," "beneath," "below," "lower," "above," "upper," and the like, may be used herein for ease of description to describe one element or feature's relationship to another element(s) or feature(s) as illustrated in the figures. Spatially relative terms may be intended to encompass different orientations of the device in use or operation in addition to the orientation depicted in the figures. For example, if the device in the figures is turned over, elements described as "below" or "beneath" other elements or features would then be oriented "above" the other elements or features. Thus, the example term "below" can encompass both an orientation of above and below. The device may be otherwise oriented (rotated 90 degrees

or at other orientations) and the spatially relative descriptors used herein interpreted accordingly.

[0065] The term "or" as used herein is to be interpreted as an inclusive or meaning any one or any combination. Therefore, "A, B or C" means any of the following: "A; B; C; A and B; A and C; B and C; A, B and C". An exception to this definition will occur only when a combination of elements, functions, steps or acts are in some way inherently mutually exclusive.

[0066] Hereinafter, a washing machine will be described as an example of a laundry treating apparatus, but the laundry treating apparatus is not limited to the washing machine. The laundry treating apparatus is an apparatus for treating laundry (or an object to be dried) such as clothes inputted into a drum 51 and may be a dryer or a washing-drying machine.

[0067] Referring to FIG. 1, a laundry treating apparatus according to an exemplary embodiment of the present disclosure may include a casing 13 configured to define an exterior, a water storage tub 31 disposed in the casing 13 and configured to store washing water, a washing tub 50 rotatably installed in the water storage tub 31 and configured to receive inserted laundry, and a motor 25 configured to rotate the washing tub 50. A damper 16 configured to absorb vibration of the water storage tub 31 may be provided in the casing 13.

[0068] A drum 51 may be rotated about a rotation axis O extending in a front-rear direction, and the drum 51 may constitute the washing tub 50. The rotation axis is approximately horizontal. However, the term "horizontal" does not mean "geometrically horizontal" in a strict sense. In a case in which an inclination is closer to a horizontal axis than a vertical axis even though the inclination is formed at a certain angle with respect to the horizontal axis as illustrated in FIG. 1, it will be said that the drum 51 or the washing tub 50 is rotated about the horizontal axis.

[0069] A laundry insertion port is formed in a front surface of the casing 13, and a door 21 configured to open or close the laundry insertion port may be rotatably provided on the casing 13. A tubular gasket 22 is provided such that the laundry insertion port and an inlet of the water storage tub 31 communicate with each other. The gasket 22 is made of a soft material (for example, rubber). A front end of the gasket 22 may be connected to a circumference of the laundry insertion port of the casing 13, and a rear end of the gasket 22 may be connected to a circumference of the inlet of the water storage tub 31.

[0070] A water supply valve 33, a water supply pipe 34, and a water supply hose 37 may be installed in the casing 13. When the water supply valve 33 is opened and the washing water is supplied, the washing water that has passed through the water supply pipe 34 may be mixed with detergent in a dispenser 35 that stores the detergent, and then the washing water may be supplied to the water storage tub 31 through the water supply hose 37.

[0071] An input port of a pump 24 is connected to the water storage tub 31 through the drain hose 17, and a discharge port of the pump 24 is connected to drain pipes 19. The water discharged from the water storage tub 31 through the drain hose 17 is pumped by the pump 24, flows through the drain pipes 19, and then is discharged to the outside of the laundry treating apparatus.

[0072] The washing tub 50 may include the drum 51, a front cover 52 coupled to a front end of the drum 51, and a rear cover 53 coupled to a rear end of the drum 51. The drum 51 may be formed in the form of a tubular (or cylindrical) body made by rolling up a metal plate (for example, made of stainless steel) having a plurality of throughholes 51h (see FIG. 5) and then joining both ends of the metal plate. The water stored in the water storage tub 31 may be introduced into the washing tub 50 through the throughholes 51h. A plurality of embossed portions 51a (see FIG. 5), which are convexly formed by plastic processing, may be formed on an inner circumferential surface of the drum 51, and the throughholes 51h may be formed between the embossed portions 51a.

[0073] An opening portion may be formed in the front cover 52 so that laundry may be inserted into the drum 51. The inlet of the water storage tub 31 communicates with the opening portion. The front cover 52 may be made of the same type of material as the drum 51.

[0074] The rear cover 53 closes an opened rear side of the drum 51, and a spider 26 connected to a driving shaft 25a of the motor 25 may be coupled to a rear surface of the rear cover 53. The spider 26 is configured to transmit rotational force of the driving shaft 25a to the washing tub 50, and the driving shaft 25a of the motor 25 may be coupled to a center of the spider 26.

[0075] A plurality of lifters 61a, 61b, 62a, 62b, 63a, and 63b are provided in the drum 51. When the drum 51 is rotated, the laundry is lifted up by the lifters 61a, 61b, 62a, 62b, 63a, and 63b.

[0076] The plurality of lifters 61a, 61b, 62a, 62b, 63a, and 63b include first and second lifters disposed in the front-rear direction of the drum 51. Hereinafter, an example in which the first lifters are front lifters 61a, 62a, and 63a and the second lifters are rear lifters 61b, 62b, and 63b spaced apart from the front lifters in the rearward direction will be described. However, the first lifter may be the rear lifter and the second lifter may be the front lifter depending on the embodiment.

[0077] Referring to FIGS. 1 and 18, the plurality of front lifters 61a, 62a, and 63a, together with the plurality of rear lifters 61b, 62b, and 63b, define sets (or pairs), respectively. Three sets of lifters 61 (61a and 61b), 62 (62a and 62b), and 63 (63a and 63b) may be disposed at equal angles about the rotation axis O, but the present disclosure is not necessarily limited thereto. For example, four sets of lifters may be disposed at an interval of 90 degrees or five sets of lifters may be disposed at an interval of 72 degrees about the rotation axis O.

[0078] Hereinafter, an example in which the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b have the same structure will be described, but the present

disclosure is not necessarily limited thereto.

[0079] Referring to FIGS. 2 to 4, each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b includes a lifter frame 620 fixed to the drum 51, and a frame cover 640 configured to cover the lifter frame 620. The frame cover 640 protrudes radially inward (toward the inside of the drum 51) from the inner circumferential surface of the drum 51 and comes into contact with the laundry. The frame cover 640 is fixed to the drum 51 by means of the lifter frame 620 instead of being fixed directly to the drum 51.

[0080] The lifter frame 620 may be made of synthetic resin. The lifter frame 620 is preferably formed by injection molding, but the present disclosure is not limited thereto.

[0081] A lifter made of metal is not only excellent in strength, but also luxurious and hygienic. In order to couple the lifter directly to a drum made of metal, it is necessary to weld the lifter to a raw material cut out in a shape of the deployed drum, roll up the raw material in a cylindrical shape, and then weld together the ends of the raw material where they meet each other. However, raw material that was flat becomes curved during the process of rolling up the raw material, and as a result, there is a concern that stress may be applied to the welded portions between the lifter and the drum and cause the welded portions to separate.

[0082] In order to address this concern, the present disclosure proposes a configuration in which a frame cover 640 made of metal is fixed to the drum 51 by means of a lifter frame 620 made of synthetic resin.

[0083] Meanwhile, referring to FIG. 3 and FIGs. 8 to 12, the whole of an outer surface 620a (see FIG. 8) of the lifter frame 620 has a convex shape, and an inner surface 620b (see FIG. 9) of the lifter frame 620 has a concave shape. Specifically, the lifter frame 620 may include a frame base 621, a frame upper plate 623, and a frame sidewall 622.

[0084] The frame base 621 is fixed to the inner circumferential surface of the drum 51. The frame base 621 may have a ring shape (or a closed shape formed by a single line) opened at a central portion thereof.

[0085] The frame upper plate 623 is spaced apart from the frame base 621 in the direction toward the inside of the drum 51 and connected to the frame base 621 by means of the frame sidewall 622. The frame sidewall 622 may be formed in the form of a tubular (or cylindrical) body, such that a lower end of the frame sidewall 622 is connected to the frame base 621, and an upper end of the frame sidewall 622 is connected to the frame upper plate 623.

[0086] The frame sidewall 622 is shaped such that a contour of a cross section thereof gradually decreases upward from the lower end connected to the frame base 621 (or in the radial direction of the drum 51) (or gradually decreases in a direction away from the inner circumferential surface of the drum 51), and the contour of the cross section is smallest at a portion that meets the frame upper plate 623.

[0087] One or more water flow inlet holes may be formed in the drum 51 so as to allow the washing water stored in the water storage tub 31 to be introduced to the inside of the frame cover 640. Any opening portion formed in a region covered by the frame cover 640 may be a water flow inlet hole. For example, some of the throughholes 51h, which are positioned inside the frame cover 640, may be water flow inlet holes. Furthermore, mounting slots 511a and 511b, fastening holes 513a and 513b, and opening portions 512a and 512b, which will be described below, may be water flow inlet holes.

[0088] One or more water flow throughholes 624 and 624a may be formed in the lifter frame 620. Any opening may be a water flow throughhole 624 as long as the opening is formed in the lifter frame 620 and allows the inside and the outside of the lifter frame 620 to communicate with each other.

[0089] The water flow throughhole 624 may be formed in the frame sidewall 622 and/or the frame upper plate 623. The washing water stored in the concave space of the lifter frame 620 may be discharged through the water flow throughhole 624.

[0090] In this case, a water flow throughhole 624 formed in the frame upper plate 623 may be referred to as a first water flow throughhole, and a water flow throughhole 624 formed in the frame sidewall 622 may be referred to as a second water flow throughhole.

[0091] One or more water flow discharge holes 646h may be formed in the frame cover 640 to discharge the washing water in the lifters 61a, 61b, 62a, 62b, 63a, and 63b into the drum 51. The washing water in the concave space inside the lifter frame 620 may pass through the water flow throughhole 624, and then may be discharged into the drum 51 through the water flow discharge hole 646h.

[0092] An outer surface 640a of the frame cover 640, which is exposed to the inside of the drum 51 and comes into contact with the laundry, has a convex shape, and an inner surface of the frame cover 640 has a concave shape that corresponds to the convex outer surface 620a of the lifter frame 620. The frame cover 640 may be made of metal, preferably stainless steel, but the present disclosure is not limited thereto. The frame cover 640 may be formed by plastically processing (for example, pressing) a metal plate having a predetermined thickness.

[0093] The frame cover 640 may include a cover sidewall 645 extending upward from a lower end adjoining the frame base 621, and a cover upper plate 646 configured to cover an upper side of the cover sidewall 645. The cover upper plate 646 is approximately parallel to the frame upper plate 623. In particular, the cover upper plate 646 may be formed to have a corresponding surface parallel to the frame upper plate 623 and have substantially the same area as the frame upper plate 623. The plurality of water flow discharge holes 646h may be formed in the cover upper plate 646.

[0094] The cover sidewall 645 is shaped such that a contour of a cross section thereof gradually decreases

upward from the lower end (or in the radial direction of the drum 51) (or gradually decreases in the direction away from the inner circumferential surface of the drum 51), and the contour of the cross section is smallest at a portion that meets the cover upper plate 646. In this case, the cover sidewall 645 may be formed to also have a corresponding surface parallel to the frame sidewall 622.

[0095] Since the upper surfaces and the lateral surfaces of the lifter frame 620 and the frame cover 640 are formed to correspond to one another, respectively, as described above, higher rigidity may be exhibited, and thus deformation and damage when the lifter is deformed by external force may be reduced.

[0096] The lifter frame 620 includes spacers 625 that protrude from the frame upper plate 623 so as to allow the frame cover 640 to be spaced apart from the lifter frame 620. The spacer 625 protrudes from the frame upper plate 623 to the inner surface of the frame cover 640.

[0097] The inner surface of the frame cover 640 may be spaced apart from the frame upper plate 623 to a degree equal to or greater than a length (or height) of the spacer 625 protruding from the frame upper plate 623. The spacer 625 may be spaced apart from the inner surface of the frame cover 640 at a predetermined distance. In this case, the inner surface of the frame cover 640 is spaced apart from the frame upper plate 623 at a distance equal to a sum of the height of the spacer 625 and the interval between the spacer 625 and the inner surface of the frame cover 640. When the frame cover 640 is pressed by external force, the frame cover 640 comes into contact with the frame upper plate 623, such that the frame cover 640 is prevented from being deformed any further.

[0098] Alternatively, the spacer 625 may be configured to come into contact with the frame cover 640, depending on the embodiment. In this case, the spacer 625 protrudes from the outer surface 620a of the lifter frame 620 and adjoins the inner surface of the frame cover 640. Because the spacer 625 supports the inner surface of the frame cover 640 in the state in which the frame upper plate 623 is spaced apart from the frame cover 640, the state in which the frame cover 640 is spaced apart from the frame upper plate 623 may be maintained even though the frame cover 640 is pressed toward the lifter frame 620 by external force.

[0099] The spacer 625 may have a cross-shaped rib structure. Specifically, the spacer 625 may include a vertical rib 625a extending on the frame upper plate 623 in a longitudinal direction of the lifter frame 620 (or the front-rear direction), and a horizontal rib 625b extending while crossing (that is intersecting) the vertical rib 625a. The vertical rib 625a and the horizontal rib 625b may be orthogonal to each other.

[0100] A portion of the spacer 625, where the vertical rib 625a and the horizontal rib 625b intersect each other, may be maximally spaced apart from the frame upper plate 623. Depending on the embodiment, the intersecting portion is spaced apart from the inner surface of the frame cover 640 in the case of the contactless type spacer 625, and the intersecting portion is in contact with the inner surface of the frame cover 64 in the case of the contact type spacer 625.

[0101] Referring to FIG. 10, the inner surface of the cover upper plate 646 may be spaced apart from the outer surface of the frame upper plate 623. That is, a predetermined separation space (or a gap gl) may be formed between the inner surface of the cover upper plate 646 and the outer surface of the frame upper plate 623, and the separation space g1 may serve as a flow path that guides the washing water to the water flow discharge hole 646h.

[0102] A separation space g2 may also be formed between the frame sidewall 622 and the cover sidewall 645. A seating groove 621r (see FIGS. 8 and 9) to be described below is formed in the frame base 621 and disposed at a position toward the outside of the frame base 621 spaced apart from the frame sidewall 622 at a predetermined distance. Therefore, the lower end of the cover sidewall 645 positioned in the seating groove 621r is spaced apart from the frame sidewall 622. Because the lower end of the frame cover 640 is spaced apart from the frame sidewall 622 by the seating groove 621r and the cover upper plate 646 is spaced apart from the frame upper plate 623 by the spacer 625, two points of the frame cover 640, which are the lower end of the frame cover 640 and the portion of the frame cover 640 supported by the spacer 625, are forcibly spaced apart from the lifter frame 620, and as a result, the state in which the cover sidewall 645 positioned between the two points is spaced apart from the lifter frame 620 is maintained.

[0103] The washing water introduced into each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b is introduced into the separation spaces g1 and g2, and water flows formed in the separation spaces g1 and g2 during the rotation of the washing tub 50 clean the outer surface of the lifter frame 620 and the inner surface of the frame cover 640. Foreign substances produced during the cleaning process may be discharged through the water flow discharge hole 646h formed in the frame cover 640 or through the water flow inlet hole formed in the drum 51. The flow paths are formed between the lifter frame 620 and the frame cover 640 by the separation spaces g1 and g2, and as a result, this configuration may be advantageous in maintaining the lifters 61a, 62a, 63a, 61b, 62b, and 63b in a clean state.

[0104] In particular, since the water flow throughholes 624 are formed at positions in addition to the positions at which the water flow discharge holes 646h are formed (the second water flow throughhole is formed in the frame sidewall 622), it is possible to ensure diverse flow paths of the washing water along which the washing water is guided to the separation spaces g1 and g2 between the lifter frame 620 and the frame cover 640 and then discharged into the drum 51.

[0105] In a case in which the water flow throughhole 624 and the water flow discharge hole 646h are formed

to correspond to each other, the washing water guided to the separation spaces g1 and g2 between the lifter frame 620 and the frame cover 640 may be quickly discharged into the drum 51 through a shortest path.

[0106] Due to the fact that an effect of cleaning the interior of the lifter cannot be expected in such a case, there is a need for the washing water to flow for a maximally long period of time through more diverse paths in the separation spaces g1 and g2 between the lifter frame 620 and the frame cover 640.

[0107] Thus, in the case in which the water flow throughholes 624 are formed at the positions in addition to the positions at which the water flow discharge holes 646h are formed, it is possible to improve the effect of cleaning the interior of each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b.

[0108] In this case, the number of water flow throughholes 624 may be relatively larger than the number of water flow discharge holes 646h.

[0109] In addition, an opened area of the water flow discharge hole 646h may be relatively smaller than an opened area of the water flow throughhole 624.

[0110] Thus, the washing water may be easily circulated in the separation spaces g1 and g2 between the lifter frame 620 and the frame cover 640, and as a result, this configuration may be more advantageous in maintaining the lifters 61a, 62a, 63a, 61b, 62b, and 63b in a clean state.

[0111] Further, it may be even more preferable for at least a part of the water flow throughhole 624 formed in the frame upper plate 623 and at least a part of the water flow discharge hole 646h formed in the cover upper plate 646 to be disposed so as not to be aligned with one another in a vertical direction perpendicular to the inner circumferential surface of the drum 51.

[0112] That is, the configuration in which the water flow throughhole 624 and the water flow discharge hole 646h are disposed such that the water flow throughhole 624 and the water flow discharge hole 646h are not completely aligned with one another when the lifter is viewed from above further complicates the path through which the washing water is discharged, thereby contributing to improving the effect of cleaning the interior of each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b.

[0113] In addition, the frame sidewall 622 may connect the frame upper plate 623 and the frame base 621 in an inclined manner. To this end, the frame upper plate 623 may be relatively smaller than the frame base 621 so as to allow a horizontal projection plane of the frame upper plate 623 to be positioned within the circumference of the frame base 621.

[0114] Further, in the case in which the frame sidewall 622 is formed to be inclined, the cover sidewall 645 corresponding to the frame sidewall 622 is also formed to be inclined.

[0115] Since the frame sidewall 622 and the cover sidewall 645 are formed to be inclined as described above, the washing water passing through the water flow throughhole 624 may clean the interior of the lifter while colliding with the inclined surfaces, and the washing water may be naturally guided to the water flow discharge hole 646h along the inclined surfaces.

[0116] The frame cover 640 may have domes 641, 642, 643, and 644 formed at the positions corresponding to the spacers 625. That is, the spacers 625 may be disposed below the domes 641, 642, 643, and 644.

[0117] In the case in which the plurality of spacers 625 are formed in the exemplary embodiment, the plurality of domes 641, 642, 643, and 644 may be formed at the positions corresponding to the plurality of spacers 625, respectively.

[0118] The domes 641, 642, 643, and 644 may be formed on the cover upper plate 646. An inner surface of each of the domes 641, 642, 643, and 644, which faces the spacer 625, may be concavely formed, and an outer surface of each of the domes 641, 642, 643, and 644 may be convexly formed. The concave inner surface of each of the domes 641, 642, 643, and 644 may be spaced apart from the spacer 625. However, the present disclosure is not limited thereto, the spacer 625 may be in contact with the concave inner surface.

[0119] The domes 641, 642, 643, and 644 are convexly formed by pressing the cover upper plate 646, which is made of metal. The plurality of domes 641, 642, 643, and 644 may be disposed in the longitudinal direction of the cover upper plate 646 (or the longitudinal direction of the lifters 61a, 61b, 62a, 62b, 63a, and 63b). The one or more water flow discharge holes 646h may be formed between the adjacent domes 641, 642, 643, and 644.

[0120] Assuming that the cover upper plate 646 has a plurality of regions spaced apart from one another in the longitudinal direction, the water flow discharge holes 646h may be formed in the respective regions. In the exemplary embodiment, the water flow discharge holes 646h are formed in three regions, and the three (that is, a plurality of) water flow discharge holes 646h are arranged in each of the regions in a width direction of the cover upper plate 646.

[0121] The spacers 625 may be positioned between the plurality of regions. That is, the spacers 625 may be positioned between the adjacent two regions among the plurality of regions when the cover upper plate 646 is viewed from above.

[0122] The domes 641, 642, 643, and 644 may include two or more domes of which the depth of the concave portion of the inner surfaces thereof is different from each other. In more detail, the domes 641, 642, 643, and 644 may include large domes 641 and 644, each of which have a concave portion of a first depth, and small domes 642 and 643, each of which have a concave portion of a second depth smaller than the first depth. The height of the spacers 625a and 625d corresponding to the large domes 641 and 644 may be greater than the height of the spacers 625b and 625c corresponding to the small domes 642 and 643.

[0123] The domes 641, 642, 643, and 644 may include

the two or more domes having different sizes. Each of the domes 641, 642, 643, and 644 may have a circular shape, but the present disclosure is not necessarily limited thereto. Here, the 'size' may be determined based on the shape when the concave portion of the inner surface of each of the domes 641, 642, 643, and 644 are viewed from above, and for example, the 'size' may be defined as a diameter of the concave portion. However, since the difference between the inner diameter and the outer diameter of each of the domes 641, 642, 643, and 644 is merely due to the thickness of the material, the size may be defined based on the outer diameter of each of the domes 641, 642, 643, and 644.

[0124] The size of the spacer 625 may also vary depending on the size of each of the domes 641, 642, 643, and 644. That is, in the case in which there are the large domes 641 and 644 and the small domes 642 and 643 as illustrated in FIG. 13, the spacer 625 corresponding to the large domes 641 and 644 may be larger than the spacer 625 corresponding to the small domes 642 and 643.

[0125] The two small domes 643 and 644 may be positioned between the pair of large domes 641 and 642, and the water flow discharge holes 646h may be formed between the domes 641, 642, 643, and 644. The plurality of water flow discharge holes 646h may be arranged in a direction crossing the lifters 61a, 61b, 62a, 62b, 63a, and 63b (or a direction orthogonal to the length of each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b).

[0126] Since the domes 641, 642, 643, and 644 protrude from the cover upper plate 646, the gaps between the laundry and the surfaces at the periphery of the discharge holes 646h may be maintained even when laundry is placed on the domes 641, 642, 643, and 644. Therefore, the discharge holes 646h may be prevented from being clogged with laundry, and the water discharged into the gaps from the discharge holes 646h may be applied to the laundry.

[0127] The water stored in the water storage tub 31 is introduced into the lifters 61a, 61b, 62a, 62b, 63a, and 63b through the opening portion. The lifter frame 620 is a structure having one or more of the water flow through-holes 624, and the water introduced into the lifters 61a, 61b, 62a, 62b, 63a, and 63b may reach the water flow discharge holes 646h through the water flow through-holes 624.

[0128] The washing water introduced into the lifters 61a, 61b, 62a, 62b, 63a, and 63b is raised by the rotation of the washing tub 50 in the state in which the washing water is in the lifters 61a, 61b, 62a, 62b, 63a, and 63b, and the washing water is discharged (or sprayed) through the water flow discharge holes 646h in this process.

[0129] Referring to FIGS. 2, 3, 10, and 13 to 15, each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b includes a lifter upper plate portion spaced apart from the inner circumferential surface of the drum 51, and a lifter sidewall portion having a lower end adjoining the inner circumferential surface of the drum, and an upper end connected to the lifter upper plate portion, and one or more washing protrusions 603 and 604 are formed on the lifter sidewall portion. The washing protrusions 603 and 604 protrude from an outer surface of the lifter sidewall portion and extend in the form of a ring along the outer surface of the lifter sidewall portion.

[0130] In the case in which each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b includes the lifter frame 620 and the frame cover 640 in the exemplary embodiment, the cover upper plate 646 and the cover sidewall 645 of the frame cover 640 are the lifter upper plate portion and the lifter sidewall portion, respectively.

[0131] Since each of the washing protrusions 603 and 604 is formed in the form of a ring, the lifters 61a, 61b, 62a, 62b, 63a, and 63b are not easily deformed even when external force is applied in any direction. In particular, in the case in which the frame cover 640 is formed as a plate made of metal (for example, stainless steel) and having a small thickness, sufficient rigidity may be maintained.

[0132] The frame cover 640 may include one or more washing protrusions 603 and 604 having a ring shape or one or more washing rings protruding from the outer surface of the cover sidewall 645. The plurality of washing protrusions 603 and 604 may be disposed in parallel with one another. In the exemplary embodiment, two washing protrusions 603 and 604 are provided, but the present disclosure is not necessarily limited thereto. In the case in which the frame cover 640 is made of metal, the washing protrusions 603 and 604 may be formed by pressing.

[0133] Each of the washing protrusions 603 and 604 has a shape corresponding (or similar) to the contour of the cover sidewall 645, and preferably, the washing protrusion may protrude to a predetermined height from the cover sidewall 645. Since the contour of the cover sidewall 645 decreases upward, among the washing protrusions 603 and 604, the washing protrusion that is positioned at an upper side is smaller than the other washing protrusion.

[0134] A frictional force applied between the laundry and the washing protrusions 603 and 604 generates an effect of rubbing the laundry, thereby improving washing power. In addition, because the washing protrusions 603 and 604 assist in the operation of lifting up the laundry, physical force (for example, force for lifting up or striking the laundry) of a level as in the related art may be applied to the laundry even when the height of each of the lifters 61a, 61b, 62a, 62b, 63a, and 63b is decreased to be smaller than that in the related art.

[0135] The frame cover 640 may be coupled to the lifter frame 620. Referring to FIGS. 2 and 3, one or more coupling tabs 648 may be formed at the lower end of the frame cover 640. As illustrated in FIG. 14, the coupling tabs 648 may be formed at a left side 645L or a right side 645R at the lower end when the frame cover 640 is viewed from the front side. The left side 645L and the right side 645R may be straight sections extending in the front-rear direction.

[0136] Referring to FIGS. 8 and 9, tab binding ports 621h, through which the coupling tabs 648 pass from above, may be formed in the lifter frame 620. The tab binding ports 621h may be formed at positions corresponding to the coupling tabs 648, respectively. A coupling tab 648 passes through the tab binding port 621h, and the passing portion of the coupling tab 648 is bent and caught by a rim of the tab binding port 621h (or a bottom surface of the frame base 621), such that the lifter frame 620 and the frame cover 640 may be coupled to each other.

[0137] Meanwhile, the seating groove 621r, which corresponds to the lower end of the frame cover 640, may be formed in the frame base 621 of the lifter frame 620. The lower end of the frame cover 640 may be inserted and seated in the seating groove 621r. In this case, the tab binding port 621h may be formed in the seating groove 621r.

[0138] Hereinafter, a structure in which the lifter frame 620 and the drum 51 are coupled to each other will be described.

[0139] Referring to FIGS. 8, 9, 11, and 12, one or more insertion protrusions 627 may be formed on each of the front lifters 61a, 62a, and 63a and/or the rear lifters 61b, 62b, and 63b. Further, referring to FIGS. 5 to 7, the drum 51 may have mounting slots 511a1 in a first group G1 and mounting slots 511a2 in a second group G2. Each of the groups G1 and G2 may include the one or more mounting slots 511a1(1) to 511a1(4). Here, the 'group' is a set of mounting slots and may include one or a plurality of mounting slots.

[0140] The mounting slots 511a1 in the first group G1 and the mounting slots 511a2 in the second group G2 may include a number of the mounting slots 511a1(1) to 511a1(4) and 511a2(1) to 511a2(4) that corresponds to the number of the one or more insertion protrusions 627. That is, in the case in which the mounting slots in the first group G1 and the second group G2 are used to install the front lifters 61a, 62a, and 63a, the number of mounting slots 511a1 in the first group G1 and the number of mounting slots 511a2 in the second group G2 may correspond to the number of insertion protrusions 627 provided on each of the front lifters 61a, 62a, and 63a.

[0141] Likewise, depending on the embodiment, in the case in which the mounting slots in the first group G1 and the second group G2 are used to install the rear lifters 61b, 62b, and 63b, the number of mounting slots 511a1 in the first group G1 and the number of mounting slots 511a2 in the second group G2 may correspond to the number of insertion protrusions 627 provided on each of the rear lifters 61b, 62b, and 63b.

[0142] The one or more insertion protrusions 627 formed on each of the front lifters 61a, 62a, and 63a or the rear lifters 61b, 62b, and 63b may be selectively fastened to the mounting slots 511a2 in the first group G1 or the second group G2. The position at which the lifter is installed may be determined depending on whether the one or more insertion protrusions 627 formed on each of the lifters 61a, 62a, 63a, 61b, 62b, and 63b are inserted into the mounting slots that constitute any one of the first group G1 or the second group G2.

[0143] Hereinafter, the example in which the mounting slots 511a, which constitute the first group G1 and the second group G2, are used to install the front lifters 61a, 62a, and 63a will be described, but the mounting slots may be formed in the same manner in order to install the rear lifters 61b, 62b, and 63b.

[0144] The mounting slots 511a2 in the second group G2 are formed in a region shifted rearward within a range in which the mounting slots 511a2 in the second group G2 partially overlap the mounting slots 511a1 in the first group G1. For reference, in FIG. 6, a first region M1 indicates a region in which the mounting slots 511a1 in the first group G1 are formed, and a second region M2 indicates a region in which the mounting slots 511a2 in the second group G2 are formed. Hereinafter, as illustrated in FIG. 6, the mounting slots 511a2 in the second group G2 are disposed rearward from the mounting slots 511a1 in the first group G1.

[0145] Referring to FIGS. 5 to 7, the mounting slots 511a2 in the second group G2 are spaced apart from the mounting slots 511a1 in the first group G1 in the rearward direction at a predetermined distance D. Therefore, when the insertion protrusions 627 are installed in the mounting slots 511a1 in the first group G1, each of the front lifters 61a, 62a, and 63a is positioned further forward by a distance D in comparison with a case in which the insertion protrusions 627 are installed in the mounting slots 511a2 in the second group G2. As illustrated in FIG. 5, the metal plate of the large-capacity drum 51 further extends forward by a distance E in comparison with a case in which the drum is the small-capacity drum. In the case of the large-capacity drum (FIG. 5A), the front lifters 61a, 62a, and 63a are installed by using the mounting slots 511a1 in the first group G1, such that the front lifters 61a, 62a, and 63a may be installed relatively further forward in comparison with the case in which the drum is the small-capacity drum (FIG. 5B). Therefore, the laundry positioned in the region corresponding to the distance E may easily come into contact with the front lifters 61a, 62a, and 63a while the drum 51 rotates.

[0146] The mounting slots 511a in the respective groups G1 and G2 may be disposed in rows in the front-rear direction. Particularly, the mounting slots 511a in each of the groups G1 and G2 are disposed in two rows. Further, when the entire configuration is viewed without distinguishing the groups, the mounting slots 511a may be arranged along common reference lines extending in the front-rear direction. Preferably, in the embodiment, the mounting slots are disposed on two straight lines parallel to each other.

[0147] In more detail, the mounting slots 511a1 in the first group G1 may include two or more first mounting slots 51 1a1(1) and 511a1(2) arranged at a first interval T in a first row P1 extending in the front-rear direction. Furthermore, the mounting slots 511a1 in the first group

G1 may further include two or more first mounting slots 511a1(3) and 511a1(4) arranged at the first interval T in a second row P2 parallel to the first row P1.

[0148] The mounting slots 511a2 in the second group G2 may include two or more second mounting slots 511a2(1) and 511a2(2) arranged in the first row P1 at positions shifted, by a second interval D smaller than the first interval T, rearward from the mounting slots 511a1 in the first group G1.

[0149] Furthermore, the mounting slots 511a2 in the second group G2 may further include two or more second mounting slots 511a2(3) and 511a2(4) arranged in the second row P2 at positions shifted, by the interval T, rearward from the mounting slots 511a1 in the first group G1.

[0150] Hereinafter, the mounting slots 511a1 and 511a2, which can be used to install the front lifters 61a, 62a, and 63a, are defined as being in a front lifter installation group, and the mounting slots 511b (see (a) of FIG. 6), which can be used to install the rear lifters 61b, 62b, and 63b, are defined as being in a rear lifter installation group.

[0151] The plurality of front or rear lifters 61a, 62a, 63a, 61b, 62b, and 63b may be disposed in a circumferential direction of the drum 51, such that the plurality of front lifter installation groups may be disposed in the circumferential direction, and likewise, the plurality of rear lifter installation groups may also be disposed in the circumferential direction.

[0152] Hereinafter, the mounting slot belonging to the front lifter installation group is referred to as the front mounting slot 511a, and the mounting slot belonging to the rear lifter installation group is referred to as the rear mounting slot 511b.

[0153] Referring to FIGS. 8 to 12, the insertion protrusion 627 may protrude from the frame base 621. The insertion protrusion 627 may include a vertical portion 627a (see FIG. 11) protruding downward from the bottom surface of the frame base 621, and a catching portion 627b bent in the horizontal direction from the vertical portion 627a. The catching portion 627b may protrude toward the inside of the ring-shaped frame base 621 when viewed from above.

[0154] As illustrated in FIG. 11, the insertion protrusions 627 may be formed at left and right sides of the frame base 621, respectively, when the lifter frame 620 is viewed from the front side. Two or more insertion protrusions 627 may be formed along one side of the frame base 621 (or in the front-rear direction).

[0155] Specifically, the insertion protrusion 627(L) formed at the left side of the frame base 621 may include the catching portion 627b which is bent rightward. On the contrary, the insertion protrusion 627(R) formed at the right side of the frame base 621 may include the catching portion 627b which is bent leftward.

[0156] Referring to FIG. 6, each of the mounting slots 511a and 511b may be shaped to have a length L1 in the approximately front-rear direction of the drum 51. Each of the mounting slots 511 and 511b may include an insertion section S1 having a predetermined width W1, and a binding section S2 extending rearward or forward from the insertion section S1 and having a smaller width (W2 < W1) than the insertion section S1. In the exemplary embodiment, the binding section S2 extends rearward from a rear end of the insertion section S1, but the present disclosure is not necessarily limited thereto. On the contrary, the binding section S2 may extend forward from a front end of the insertion section S1.

[0157] Furthermore, as illustrated in FIG. 20, to be described below, in the exemplary embodiment, the binding section S2 of the front mounting slot 511a may extend forward from the front end of the insertion section S1, and the binding section S2 of the rear mounting slot 511b may extend rearward from the rear end of the insertion section S1.

[0158] Meanwhile, referring to FIGS. 5 to 7, when installing the lifter frame 620 in the drum 51, the insertion protrusion 627 of the lifter frame 620 passes through the insertion section S1, and the lifter frame 620 is pushed rearward, such that the vertical portion 627a is moved forward along the binding section S2, and thus the catching portion 627b is positioned below the binding section S2. In this case, since the bottom surface of the frame base 621 is in close contact with the inner circumferential surface of the drum 51, and a width W3 (see FIG. 11) of the catching portion 627b is larger than the width W2 of the binding section S2, the catching portion 627b cannot pass through the binding section S2 from the lower side to the upper side.

[0159] Referring to FIGS. 8 to 11, the frame sidewall 622 may include a sidewall left portion 622L having a lower end connected to a left side 621a of the frame base 621, and a sidewall right portion 622R having a lower end connected to a right side 621b of the frame base 621. At least one of the sidewall left portion 622L or the sidewall right portion 622R may define an acute angle with respect to the frame base 621. Particularly, at least one of the sidewall left portion 622L or the sidewall right portion 622R may be symmetric with each other when viewed from the front side.

[0160] The frame sidewall 622 may have a mold ejection port 624a formed at a position corresponding to the insertion protrusion 627 when the lifter frame 620 is viewed vertically downward from above. The mold ejection port 624a may be formed in at least one of the sidewall left portion 622L or the sidewall right portion 622R.

[0161] The lifter frame 620 may be formed by injection molding. In this case, the mold may include an upper mold that forms the upper surface of the lifter frame 620, and a lower mold that forms the lower surface of the lifter frame 620.

[0162] The upper surface of the insertion protrusion 627 may be formed by the upper mold. Since the insertion protrusion 627 is positioned at the lower side of the frame sidewall 622, an opening portion, through which a portion of the upper mold defining the upper surface of the insertion protrusion 627 may pass during the process of

opening the mold, needs to be formed in a region that overlaps the insertion protrusion 627 in a direction in which the upper mold is opened on the frame sidewall 622 (or a vertically upward direction from the frame base 621) so that a mold portion of the upper mold, which forms the upper surface of the insertion protrusion 627 (particularly, the upper surface of the catching portion 627b), may be moved upward (or so that the upper mold may be withdrawn without undercutting during the process of opening the mold), and the mold ejection port 624a is the opening portion.

[0163] As illustrated in FIG. 8, when the lifter frame 620 is viewed vertically downward from above (hereinafter, referred to as 'a plan view of the lifter frame'), the catching portion 627b of the insertion protrusion 627 is positioned in the mold ejection port 624a (or overlaps the mold ejection port 624a). Particularly, the entire catching portion 627b is positioned in the mold ejection port 624a. Further, in the plan view of the lifter frame, an outer periphery of the catching portion 627b is spaced apart from a rim of the mold ejection port 624a, excluding the portion 627a connected to the vertical portion 627a.

[0164] Referring to FIGS. 9 and 10, a catching protrusion 626 may be formed on at least one of the front lifters 61a, 62a, and 63a or the rear lifters 61b, 62b, and 63b. The catching protrusion 626 may protrude downward from the concave inner surface 620b of the lifter frame 620.

[0165] Referring to FIG. 6, the opening portions 512a and 512b, into which the catching protrusions 626 are inserted, may be formed in the drum 51. The pair of opening portions 512a1 and 512a2 for installing the front lifters 61a, 62a, and 63a may be spaced apart from one another by an interval D in the front-rear direction.

[0166] The catching protrusion 626 is selectively inserted into any one of the pair of opening portions 512al and 512a2 depending on whether the insertion protrusions 627 are inserted into the mounting slots 511a1 in the first group G1 or the mounting slot 511a2 in the second group G2.

[0167] Catching tabs 514a and 514b, which each come into contact with (or are caught by) the lower end of the catching protrusion 626, may be formed on rims of the opening portions 512a and 512b. The catching tabs 514a and 514b may come into contact with the lateral surfaces of the catching protrusions 626 in the opening portions 512a and 512b, thereby restricting lateral movement of the catching protrusions 626.

[0168] Meanwhile, the positions of the catching tabs 514a and 514b may be determined based on the relative positions of the mounting slots 511a and 511b with respect to the insertion section S1 of the binding section S2. That is, as illustrated in FIG. 6, when the binding section S2 is positioned rearward from the insertion section S1, the catching tabs 514a and 514b are positioned in a first concave portion 626a at the front side of the catching protrusions 626. The catching tabs 514a and 514b may extend rearward from the front end of the opening portion 512 to restrict the movement of the catching protrusions 626 when the catching protrusion 626 is about to move forward (that is, the insertion protrusion 627 is about to move from the binding section S2 to the insertion section S1).

[0169] On the contrary, like the mounting slot 511a illustrated in FIG. 20, when the binding section S2 is positioned forward from the insertion section S1, the catching tabs 514a and 514b are positioned in a second concave portion 626b at the rear side of the catching protrusions 626. The catching tabs 514a and 514b may extend forward from the rear end of the opening portion 512 to restrict the movements of the catching protrusions 626 when the catching protrusion 626 is about to move rearward (that is, the insertion protrusion 627 is about to move from the binding section S2 to the insertion section S1).

[0170] The catching tabs 514a and 514b may be bent at a predetermined angle to the outside of the drum 51 based on the portion connected to the rims of the opening portions 512a and 512b. The lateral surfaces of the catching protrusions 626 may come into contact with the catching tabs 514a and 514b even in the state in which the catching protrusions 626 are not inserted into the opening portions 521a and 512b.

[0171] When the lifter frame 620 is about to move (that is, about to move in a direction opposite to a direction in which the lifter frame 620 is installed) such that the vertical portion 627a moves from the binding section S2 to the insertion section S1, the movement is restricted as the catching tabs 514a and 514b interfere with the lower ends of the catching protrusions 626.

[0172] Referring to FIG. 9, at the lower end of the catching protrusion 626, the first concave portion 626a may be formed at a side facing the catching tabs 514a and 514b. In the state in which the lifter frame 620 has been completely installed, the catching tabs 514a and 514b may be positioned in the first concave portion 626a.

[0173] At the lower end of the catching protrusion 626, the second concave portion 626b may be further formed at a side opposite to the first concave portion 626a. When the lifter frame 620 is installed in a state in which the front and rear sides of the lifter frame 620 are changed, the catching tabs 514a and 514b may be positioned in the second concave portion 626b.

[0174] Referring to FIG. 9, fastening bosses 628 may be formed on at least one of the front lifters 61a, 62a, and 63a or the rear lifters 61b, 62b, and 63b. The fastening boss 628 may protrude downward from the inner surface 620b of the lifter frame 620. The fastening boss 628 may extend from the frame upper plate 623. Two or more fastening bosses 628 may be provided to be spaced apart from one another in the front-rear direction.

[0175] Referring to FIGS. 5 and 6, fastening holes 513a and 513b may be formed in the drum 51. The fastening holes 513a and 513b may include a first fastening hole 513al formed at a position corresponding to the fastening boss 528 when the insertion protrusion 627 of the lifter frame 620 is installed in the mounting slot 511a1 in the

first group G1, and a first fastening hole 513a2 formed at a position corresponding to the fastening boss 528 when the insertion protrusion 627 of the lifter frame 620 is installed in the mounting slot 511a2 in the second group G2. The pair of first fastening holes 513a1(1) and 513a1(2) are provided to correspond to the pair of fastening bosses 528, and the second fastening holes 513a2 including a pair of second fastening holes 513a2(1) and 513a2(2) may be provided.

[0176] Referring to FIG. 7, the fastening boss 628 may be selectively fastened to the first fastening hole 513al or the second fastening hole 513a2 by means of a predetermined fastening member (hereinafter, for exemplary purposes, a screw 98) based on whether the insertion protrusion 627 is inserted into the mounting slot 511a1 in the first group G1 or the mounting slot 511a2 in the second group G2.

[0177] In the state in which the insertion protrusion 627 is inserted into the mounting slot 511a and the lifter frame 620 is temporarily assembled, the screw 98 passes through the fastening hole 513a from the outside of the drum 51 and is then fastened to the fastening boss 628, such that the lifter frame 620 may be completely installed.

[0178] Meanwhile, as described above, as illustrated in (a) of FIG. 7 or (b) of FIG. 7, the installation position of the lifter frame 620 may vary depending on whether the insertion protrusion 627 is inserted into the mounting slot 511a1 or the mounting slot 511a2. In any case, the mounting slots 511a1 and 511a2, the opening portions 512a1 and 512a2, and the fastening holes 513al and 513a2 are hidden by the frame cover 640 in the state in which the lifter is completely installed. That is, the mounting slots 511a1 and 511a2, the opening portions 512a1 and 512a2, and the fastening holes 513a1 and 513a2 are positioned inside the frame cover 640, and thus are not exposed to the inside of the drum 51.

[0179] In other words, in the state in which the at least one insertion protrusion 627 provided on each of the lifters 61a, 62a, 63a, 61b, 62b, and 63b is fastened to the mounting slot (for example, 511a1) in any one group (for example, G1) among the mounting slots 511a in the first group Gland the second group G2, the mounting slot (for example, 511a2) in the other group (for example, G2) may be hidden inside the drum 51 by the lifter.

[0180] In more detail, in the state in which the at least one insertion protrusion 627 provided on each of the front lifters 61a, 62a, and 63a is inserted into the mounting slot in any one group (for example, G1) of the first group G1 and the second group G2, the front end (FE) (see FIG. 4) of each of the front lifters 61a, 62a, and 63a may be positioned forward from the mounting slots 511a1(1) to 511a1(4) and 511a2(1) to 511a2(4) belonging to the first group G1 and the second group G2. Here, the front end FE may be the front end of the lifter cover 640.

[0181] In addition, the rear end of each of the front lifters 61a, 62a, and 63a may be positioned rearward from any of the mounting slots 511a1(1) to 511a1(4) and 511a2(1) to 511a2(4) belonging to the first group G1 and the second group G2.

[0182] Depending on the point of view, in the state in which the at least one insertion protrusion 627 is inserted into one of the mounting slots 511a2(1) to 511a2(4) in the second group G2 (see (a) of FIG. 20), a distance D1 from the front end of the drum 51 to the front end FE (see FIG. 4) of each of the front lifters 61a, 62a, and 63a may be shorter than a distance D2 from the front end of the drum 51 to the front end of each of the mounting slots 511a1(1) to 511a1(4) in the first group G1 (that is, the front end of the mounting slot positioned at the foremost side among the mounting slots in the first group) (D1 < D2).

[0183] In addition, in the state in which the at least one insertion protrusion 627 is inserted into one of the mounting slots 511a1(1) to 511a1(4) in the first group G1 (see (b) of FIG. 20), a distance D3 from the front end of the drum 51 to the rear end of each of the front lifters 61a, 62a, and 63a may be longer than a distance D4 from the front end of the drum 51 to the rear end of the mounting slot in the second group G2 (that is, the rear end of the mounting slot positioned at the rearmost side among the mounting slots in the second group) (D3 > D4). Since all of the mounting slots 511a1(1) to 511a1(4) and 511a2(1) to 511a2(4) used to install the front lifters 61a, 62a, and 63a are positioned between the front ends and the rear ends of the front lifters 61a, 62a, and 63a, the mounting slots may be hidden by being covered by the front lifters 61a, 62a, and 63a.

[0184] Meanwhile, a distance D5 (see FIG. 9) from the front end FE of each of the front lifters 61a, 62a, and 63a to the fastening boss 628 may be longer than the interval D (see FIG. 6) (D5 > D). In this case, even in the state in which the fastening boss 628 is coupled to the second fastening hole 513a2 (see FIG. 7) (in the exemplary embodiment, the state in which the fastening member 98 passes through the second fastening hole 513a2 and is fastened to the fastening boss 628), the front end FE of each of the front lifters 61a, 62a, and 63a is positioned forward from the first fastening hole 513al (see FIG. 7), such that the first fastening hole 513a1 is still hidden by each of the front lifters 61a, 62a, and 63a.

[0185] Manufacturers of laundry treating apparatuses sometimes produce various types of products having drums having different capacities. In this case, a metal plate having the mounting slots 511a and 511b, the opening portions 512a and 512b, the fastening holes 513a and 513b, and the like is cut out based on a predetermined standard, the raw material 51' or 51" (see FIG. 5) cut out in this manner is rolled up, and the ends of the raw material are joined together so as to manufacture the drum 51. In this case, the metal plate is cut to a predetermined length based on the standard of the drum. In order to manufacture two drums having different lengths, it is necessary to differently adjust the interval between the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b in accordance with the length of the drum.

[0186] For example, as illustrated in FIG. 5, the interval

between the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b when the length of the drum 51' is long (see (a) of FIG. 5) needs to be greater than the interval between the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b when the length of the drum 51" is short (see (b) of FIG. 5), so that the laundry may be uniformly lifted up by the front and rear lifters 61b, 62b, and 63b even in the case of the large-capacity drum 51.

[0187] Therefore, extra mounting slots 511a are further formed in the drum 51 in order to adjust the installation position of at least one of the front lifters 61a, 62a, and 63a or the rear lifters 61b, 62b, and 63b in the front-rear direction when the length of the drum is changed.

[0188] In the present exemplary embodiment, the extra mounting slots 511a are provided to adjust the installation positions of the front lifters 51a, 52a, and 53a, but the present disclosure is not necessarily limited thereto. Depending on exemplary embodiments, the extra mounting slots 511b may be provided to adjust the installation positions of the rear lifters 61b, 62b, and 63b.

[0189] The extra mounting slots 511a may be formed in the lifter frame 620 such that the extra mounting slots 511a correspond in number to the mounting slots 511a (hereinafter, referred to as 'installation slots') into which the insertion protrusions 627 are inserted, and the extra mounting slots 511a may be formed at points spaced apart from the respective installation slots at a predetermined distance D in the frontward or rearward direction. The installation position of the lifter frame 620 may be changed by the distance D by separating the insertion protrusion 627 from the mounting slot (for example, 511a1) and then inserting the insertion protrusion 627 into the extra mounting slot (for example, 511a2).

[0190] Meanwhile, in the exemplary embodiment, the extra opening portions 512a are provided to adjust the installation positions of the front lifters 51a, 52a, and 53a, but the present disclosure is not necessarily limited thereto. Depending on the embodiment, the extra opening portions 512b may also be provided to adjust the installation positions of the rear lifters 61b, 62b, and 63b.

[0191] Meanwhile, in the exemplary embodiment, the extra fastening holes 513a are provided to adjust the installation positions of the front lifters 51a, 52a, and 53a, but the present disclosure is not limited thereto. Depending on the embodiment, the extra fastening holes 513b may also be provided to adjust the installation positions of the rear lifters 61b, 62b, and 63b.

[0192] FIG. 20 illustrates another exemplary embodiment of the present disclosure. In order to install the lifter frame 620 by means of the front mounting slot 511a, the lifter frame 620 needs to be pushed forward after the insertion protrusion 627 is inserted into the insertion section S1. In order to install the lifter frame 620 by means of the rear mounting slot 511b, the lifter frame 620 needs to be pushed rearward after the insertion protrusion 627 is inserted into the insertion section S1.

[0193] On the contrary, in order to separate the lifter frame 620 from the drum 51, the lifter frame 620 is pushed forward or rearward to move the catching portion 627b of the insertion protrusion 627 from the binding section S2 and align the catching portion 627b with the insertion section S1, and the lifter frame 620 is lifted up, such that the catching portion 627b passes through the insertion section S1, and the lifter frame 620 may be separated from the drum 51.

[0194] FIG. 16 is a view illustrating a pair of front and rear lifters illustrated in FIG. 1. FIG. 17 is a view illustrating the lifters illustrated in FIG. 16 when viewed from the front side. FIG. 18 is a view (a) illustrating a state in which the drum illustrated in FIG. 1 is deployed and a developed view (b) of the drum showing the arrangement of the lifters according to another exemplary embodiment of the present disclosure. FIG. 19 is a view (a) illustrating a change in height of a first fabric caused by the rear lifter in accordance with a rotation angle of the drum and a view (b) illustrating a change in height of a second fabric caused by the front lifter that constitutes a set together with the rear lifter. Hereinafter, description will be made with reference to FIGS. 16 to 19.

[0195] Each of the front lifters 61a, 62a, and 63a is disposed on the inner circumferential surface of the drum 51 and extending in the front-rear direction. The plurality of front lifters 61a, 62a, and 63a are disposed based on the rotation axis O at equal angles.

[0196] The rear lifters 61b, 62b, and 63b are disposed on the inner circumferential surface of the drum 51 and positioned rearward from the front lifters 61a, 62a, and 63a. Like the front lifters 61a, 62a, and 63a, the rear lifters 61b, 62b, and 63b are disposed based on the rotation axis O at equal angles.

[0197] The rear lifters 61b, 62b, and 63b are disposed to form a predetermined phase angle with the front lifters 61a, 62a, and 63a with respect to the rotation axis O. Here, the 'phase angle' is made by defining, as a rotation angle of the drum 51, a point in time at which the lifters 61a, 62a, 63a, 61b, 62b, and 63c reach a point on the circumference. Assuming that the drum 51 is rotated clockwise CW in the exemplary embodiment, the rear lifters 61b, 62b, and 63b reach the same height prior to the front lifters 61a, 62a, and 63a by a degree corresponding to the phase angle $\Delta\theta$.

[0198] As illustrated in FIGS. 16 and 17, assuming that each of the lifters 61a, 62a, 63a, 61b, 62b, and 63b has a length C1 extending in the front-rear direction and a width C2 defined in the left-right direction (or a direction orthogonal to the longitudinal direction), a circumferential distance (C3 = $\Delta\theta$r, see FIG. 19) corresponding to the phase angle is larger than 0 and equal to or smaller than two times the width C2 in the circumferential direction of each of the front lifters 61a, 62a, and 63a.

[0199] Referring to FIG. 18, a no-lifter region SE, in which there is no front lifter or rear lifter, is formed between any one pair of front/rear lifters (for example, 61a and 61b) and another pair of front/rear lifters (for example, 62a and 62b) on the inner circumferential surface of

the drum 51. The no-lifter region SE may extend from the front end to the rear end of the drum 51.

[0200] Specifically, the no-lifter region SE passes between the two adjacent sets of lifters from the front end of the drum 51 and extends to the rear end of the drum 51. Specifically, the no-lifter region SE extends straight from the front end of the drum 51 to the rear end of the drum while passing between the two adjacent front lifters (for example, 61a and 62a) among the plurality of front lifters 61a, 62a, and 63a and between the two rear lifters 61b and 62b that each form the phase angle $\Delta\theta$ with each of the two adjacent front lifters 61a and 62a.

[0201] Since the no-lifter region SE extends straight from the front end to the rear end of the drum 51, the laundry may be uniformly distributed to the front and rear regions of the drum 51 in the no-lifter region SE.

[0202] Typically, the washing machine detects eccentricity of the drum 51 before performing a spin-drying process, and when the detected eccentricity is within a reference value, the drum is accelerated such that the rotational speed of the drum 51 reaches a predetermined spin-drying speed (or spin-drying RPM). Otherwise, a fabric distribution is performed to change the position of fabrics in the drum 51. The fabric distribution is repeated if the detected eccentricity does not reach the reference value. When the number of times the fabric distribution is repeated reaches a predetermined number of times, it is determined that the fabric distribution has failed, and the spin-drying is stopped.

[0203] In the washing machine according to the present exemplary embodiment, a first fabric positioned at the rear side of the drum 51 (that is, the fabric to be lifted up by the rear lifters 61b, 62b, and 63b) and a second fabric positioned at the front side of the drum 51 (that is, the fabric to be lifted up by the front lifters) flow with a time difference (or a phase difference) by the phase angle $\Delta\theta$ formed by the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b, and as a result, the fabric distribution may be more smoothly performed.

[0204] More specifically, referring to FIG. 19, when the drum 51 is rotated clockwise CW in a state in which the rear lifters 61b, 62b, and 63b are positioned at a lowest point ($\theta = 0$) of the drum 51, the first fabric begins to be lifted up first by the rear lifters 61b, 62b, and 63b, and then the second fabric begins to be lifted up by the front lifters 61a, 62a, and 63a after the time corresponding to the phase angle $\Delta\theta$ has passed.

[0205] Assuming that the fabrics roll ($\theta < \pi / 2$) and that a position P at which the fabric lifted up by the lifters 61a, 62a, 63a, 61b, 62b, and 63b falls is a position Pd, the first fabric lifted up by the rear lifters 61b, 62b, and 63b reaches the position (or height) Pd and falls first, and then the second fabric lifted up by the front lifters 61a, 62a, and 63a reaches the position Pd and falls.

[0206] The first fabric and the second fabric move with a time difference without forming lumps, and thus may be evenly distributed. As a result, it is possible to reduce the number of times the fabric distribution is repeated, reduce the instances of failure to enter the spin-drying stage, and reduce the overall washing time including the spin-drying time.

[0207] In addition, since the fabrics flow with a phase difference when the fabrics roll or tumble, friction or collision between the fabrics caused by the relative movement occurs more frequently, such that contamination may be more effectively removed by the washing operation (that is, washing power is improved).

[0208] Meanwhile, FIG. 20 is a view illustrating a modified example in which the lifters are disposed, in which (a) illustrates a small-capacity drum and (b) illustrates a large-capacity drum. Referring to FIG. 20, one set of front lifters 61a, 62a, and 63a and rear lifters 61b, 62b, and 63b may be disposed in a row in the front-rear direction. That is, the front lifters 61a, 62a, and 63a and the rear lifters 61b, 62b, and 63b, which constitute one set, may be arranged on the same line without being spaced apart from one another in the circumferential direction.

[0209] FIG. 21 is a view illustrating another exemplary embodiment of the lifter. The exemplary embodiment illustrated in FIG. 21 provides a lifter 64 including a lifter frame 620' and a frame cover 640' slightly different in shape from those in the above-mentioned exemplary embodiments, but similar in detailed configuration to those in the above-mentioned exemplary embodiments. Therefore, constituent elements identical to the constituent elements according to the above-described exemplary embodiments will be assigned the same reference numerals, and a specific description thereof will be omitted.

[0210] While the invention has been explained in relation to its embodiments, it is to be understood that various modifications thereof will become apparent to those skilled in the art upon reading the specification. Therefore, it is to be understood that the invention disclosed herein is intended to cover such modifications as fall within the scope of the appended claims.

Claims

1. A laundry treating apparatus comprising:

a drum(51) configured to rotate about a rotation axis(O) extending in a front-rear direction; and

a lifter(61a, 61b, 62a, 62b, 63a, and 63b) disposed on an inner circumferential surface of the drum(51) and configured to revolve about the rotation axis(O) when the drum(51) rotates,

wherein the lifter(61a, 61b, 62a, 62b, 63a, and 63b) comprises:

a lifter frame(620) installed on the inner circumferential surface of the drum(51); and

a frame cover(640) coupled to the lifter frame(620) and protruding radially inwardly from the inner circumferential surface of the drum(51),

wherein the lifter frame(620) comprises:

a frame base(621) coupled to the inner circumferential surface of the drum(51);
a frame upper plate(623) spaced apart from the frame base(621) in a direction toward the inside of the drum(51);
a frame sidewall(622) connecting the frame upper plate(623) and the frame base(621);
a first first water flow throughhole(624) provided at the frame upper plate(623) allowing the inside and the outside of the lifter frame(620) to communicate with each other; and
a second first water flow throughhole(624) provided at the frame sidewall(622) allowing the inside and the outside of the lifter frame(620) to communicate with each other, and
wherein the frame cover(640) comprises:

a cover upper plate(646) having an inner surface facing the frame upper plate(623);
a cover sidewall(645) having a lower end coupled to the frame base(621) and an upper end connected to the cover upper plate(646); and
a water flow discharge hole(646h) provided at the cover upper plate(646) so that washing water that has passed through the first first water flow throughhole(624) or the second first water flow throughhole(624) is discharged therethrough into the drum(51).

2. The laundry treating apparatus of claim 1, wherein the frame upper plate(623) and the cover upper plate(646) have corresponding surfaces parallel to each other, and the frame sidewall(622) and the cover sidewall(645) have corresponding surfaces parallel to each other.

3. The laundry treating apparatus of claim 1 or 2, wherein the frame upper plate(623) is relatively smaller than the frame base(621) so as to allow a horizontal projection plane of the frame upper plate(623) lies within a circumference of the frame base(621), and the frame sidewall(622) connects the frame upper plate(623) and the frame base(621) in an inclined manner.

4. The laundry treating apparatus of any one of claims 1 to 3, wherein the first first water flow throughhole(624) and the water flow discharge hole(646h) are respectively provided in plurality, and wherein at least a part of the first first water flow throughhole(624) and at least a part of the water flow discharge hole(646h) are disposed so as not to be aligned with one another in a vertical direction perpendicular to the inner circumferential surface of the drum(51).

5. The laundry treating apparatus of any one of claims 1 to 4, wherein the drum(51) has a water flow inlet hole at a region covered with the frame cover(640), for introducing the washing water into the lifter(61a, 61b, 62a, 62b, 63a, and 63b).

6. The laundry treating apparatus of any one of claims 1 to 5, wherein the lifter frame(620) further comprises a spacer(625) protruding from the frame upper plate(623) toward an inner surface of the cover upper plate(646) so as to allow the inner surface of the cover upper plate(646) to be spaced apart from the frame upper plate(623).

7. The laundry treating apparatus of claim 6, wherein the spacer(625) is spaced apart from or in contact with the inner surface of the cover upper plate(646).

8. The laundry treating apparatus of claim 6 or 7, wherein the cover upper plate(646) has a dome(641, 642, 643, and 644) protruding upward at a position corresponding to the spacer(625).

9. The laundry treating apparatus of claim 8, wherein the dome(641, 642, 643, and 644) is concave with respect to the inner surface of the cover upper plate(646) and convex with respect to an outer surface of the cover upper plate(646), and at least a part of the spacer(625) is positioned in a concave portion of the dome(641, 642, 643, and 644).

10. The laundry treating apparatus of claim 8 or 9, insofar as dependent upon claim 4, wherein the dome(641, 642, 643, and 644) is provided in plurality, and the plurality of the domes(641, 642, 643, and 644) are arranged spaced apart from one another in a longitudinal direction of the cover upper plate(646), and the plurality of the water flow discharge holes(646h) are arranged between two neighboring domes(641, 642, 643, and 644).

11. The laundry treating apparatus of claim 10, wherein between the two neighboring domes(641, 642, 643, and 644) are arranged more than one of the water flow discharge holes(646h) in a width direction of the cover upper plate(646).

12. The laundry treating apparatus of any one of the pre-

ceding claims, wherein the lifter frame(620) is made of synthetic resin, and the frame cover(640) is made of metal.

13. The laundry treating apparatus of any one of the preceding claims, wherein the frame base(621) has a seating groove(621r) along a circumference of the frame base(621), the frame cover(640) has a coupling tab(648) protruding from a lower end thereof, and the lifter frame(620) has a tab binding port(621h) formed in the seating groove(621r), whereby the coupling tab(648) is inserted into the tab binding port(621h) so that the lifter frame(620) is coupled with the frame cover(640).

14. The laundry treating apparatus of any one of the preceding claims, wherein the lifter(61a, 61b, 62a, 62b, 63a, and 63b) is provided in plurality, including:

a plurality of front lifters(61a, 62a, and 63a) arranged along a circumferential direction of the drum(51); and
a plurality of rear lifters(61b, 62b, and 63b) arranged along the circumferential direction of the drum(51) at rear sides of the respective front lifters(61a, 62a, and 63a).

FIG. 1

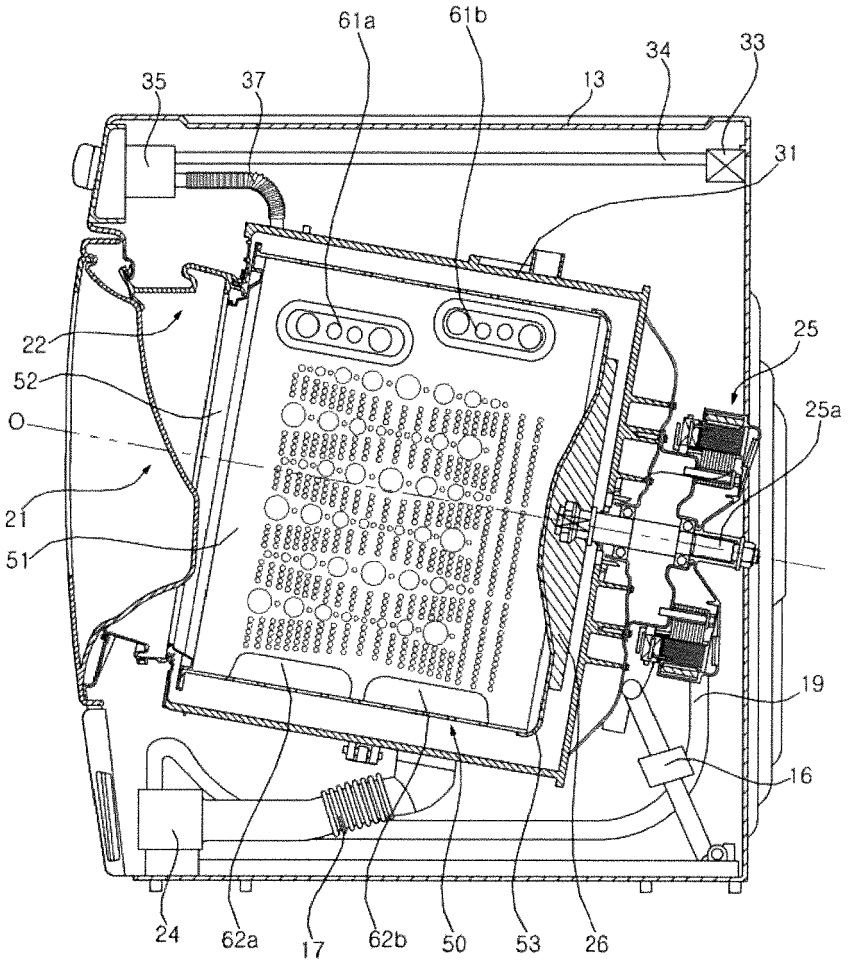

61a
61b
34
33
35
37
13
31
22
25
52
25a
O
21
51
19
16
24
62a
17
62b
50
53
26

FIG. 2

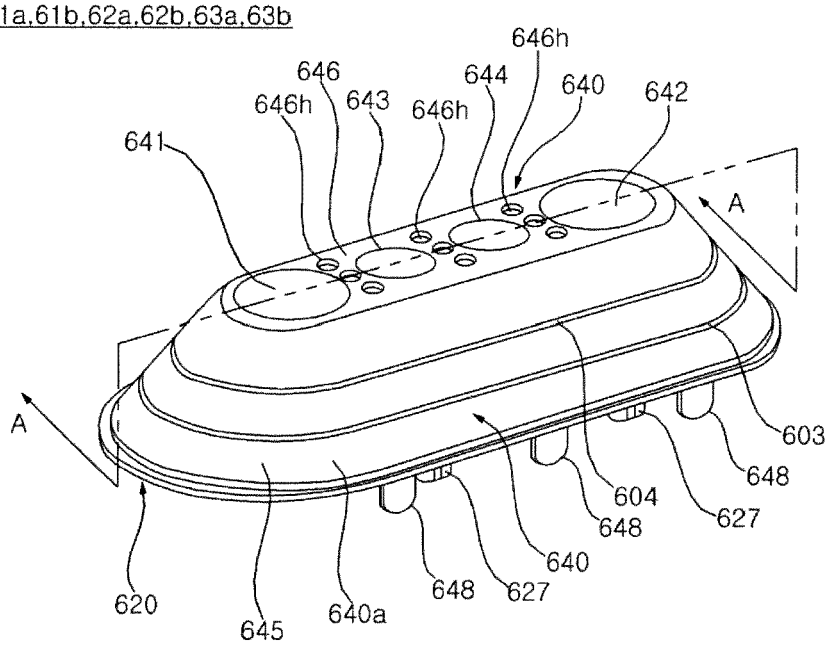

61a,61b,62a,62b,63a,63b
646h
646
644
640
642
646h
643
646h
641
A
A
603
648
604
627
648
640
648
627
620
645
640a

FIG. 3

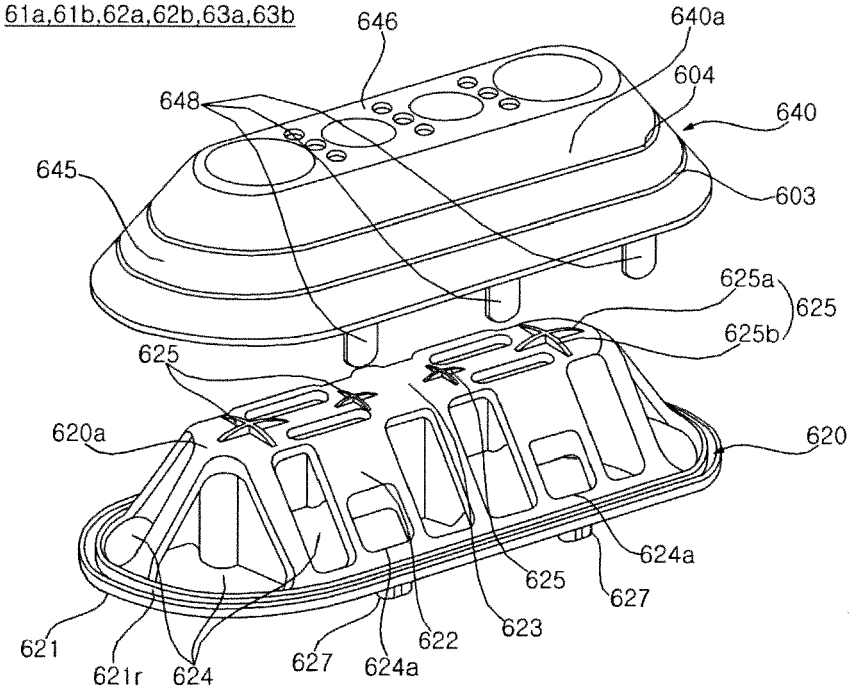

61a,61b,62a,62b,63a,63b
646
640a
604
648
640
645
603
625a
625
625b
625
620a
620
624a
625
627
623
622
621
621r
624
627
624a

FIG. 4

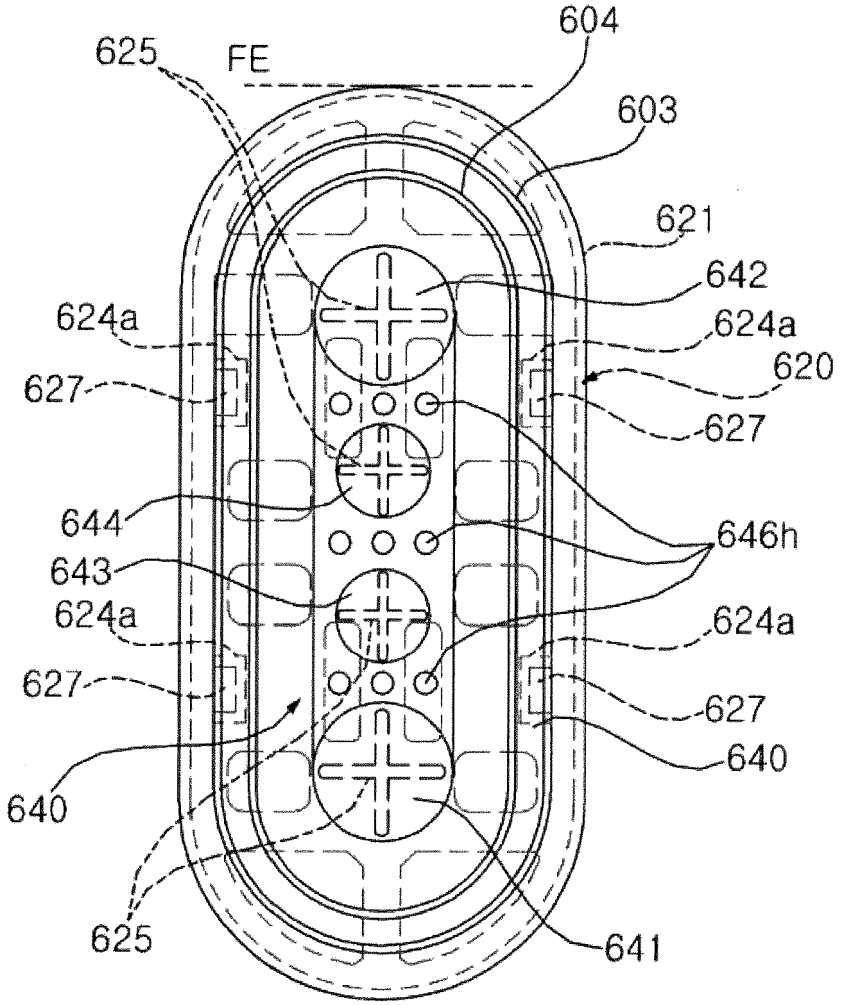

625
FE
604
603
621
642
624a
624a
620
627
627
644
646h
643
624a
624a
627
627
640
640
625
641

FIG. 5

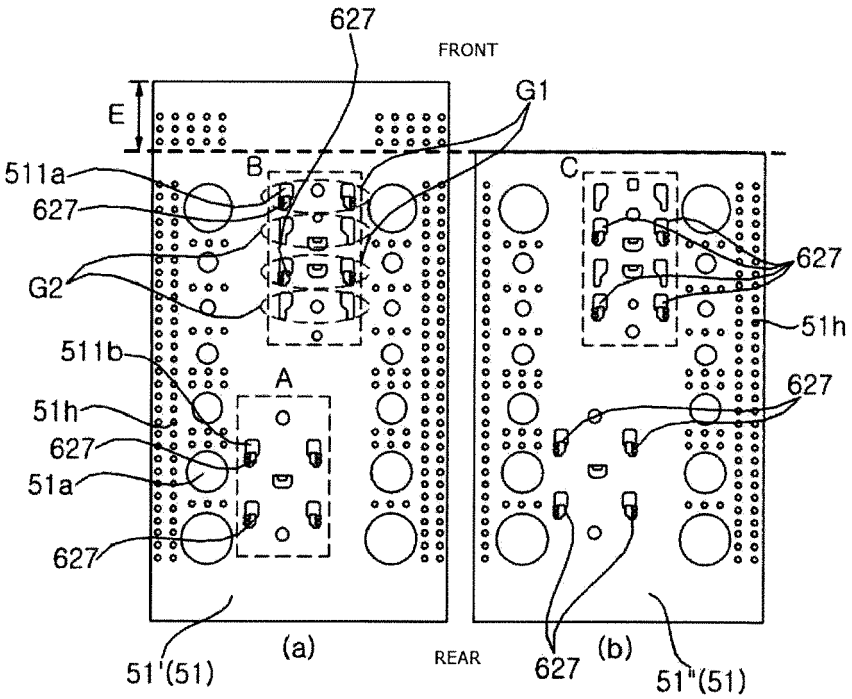

627
FRONT
E
G1
511a
627
B
C
627
G2
51h
511b
A
627
51h
627
51a
627
51'(51)
(a)
REAR
627
(b)
51"(51)

FIG. 6

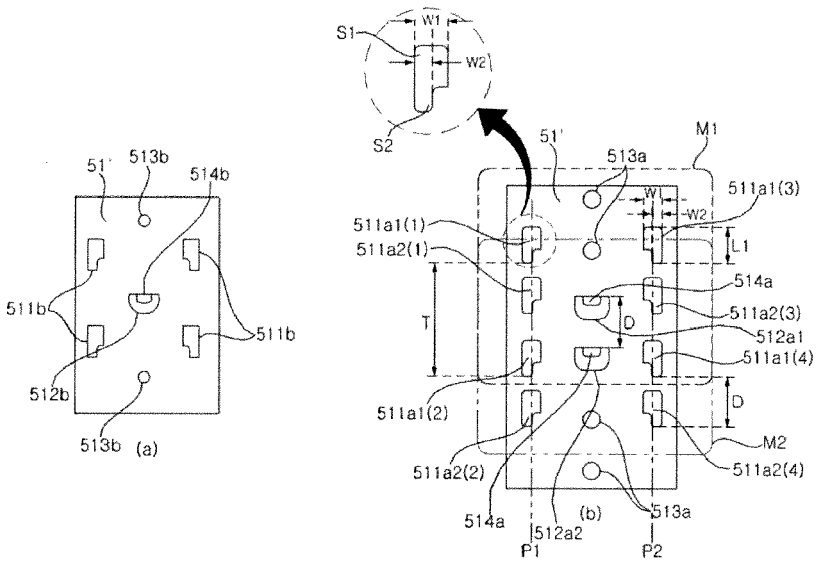

S1
W1
W2
S2
51'
513b
514b
511b
511b
512b
513b (a)
51'
513a
M1
511a1(3)
W1
W2
511a1(1)
511a2(1)
L1
514a
T
D
511a2(3)
512a1
511a1(4)
D
511a1(2)
M2
511a2(2)
511a2(4)
514a
512a2
(b)
513a
P1
P2

FIG. 7

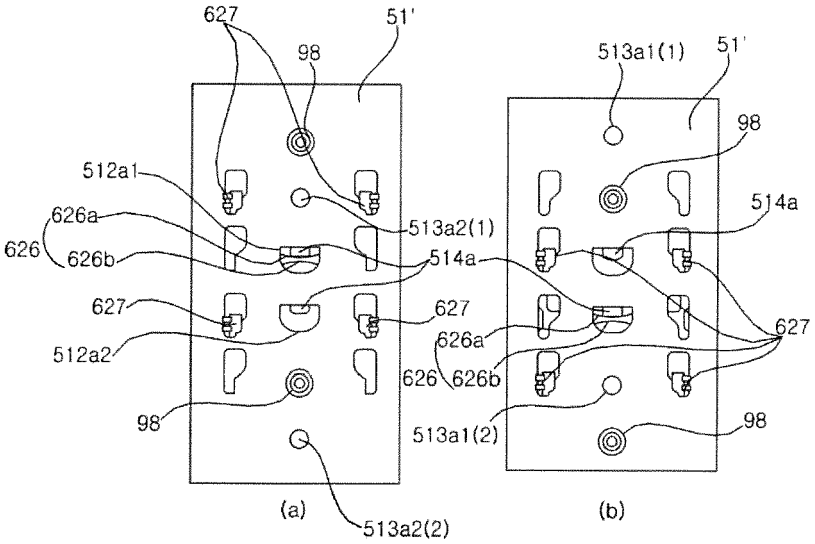

627
51'
98
512a1
626a
626
626b
627
512a2
98
513a2(1)
514a
627
513a2(2)
(a)
513a1(1)
51'
98
514a
627
626a
626
626b
513a1(2)
98
(b)

FIG. 8

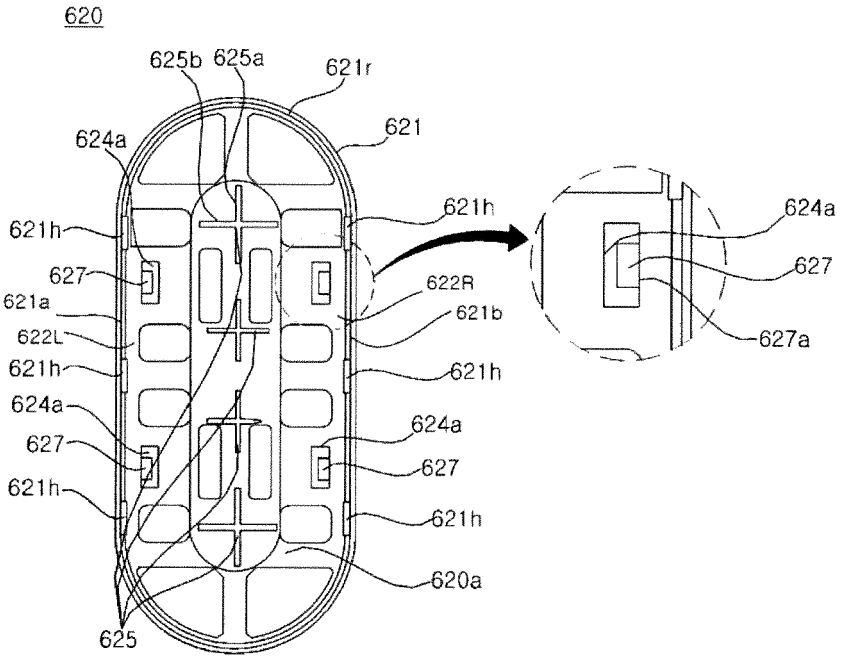

620
625b
625a
621r
621
624a
621h
627
621a
622L
621h
624a
627
621h
625
621h
622R
621b
621h
624a
627
621h
620a
624a
627
627a

FIG. 9

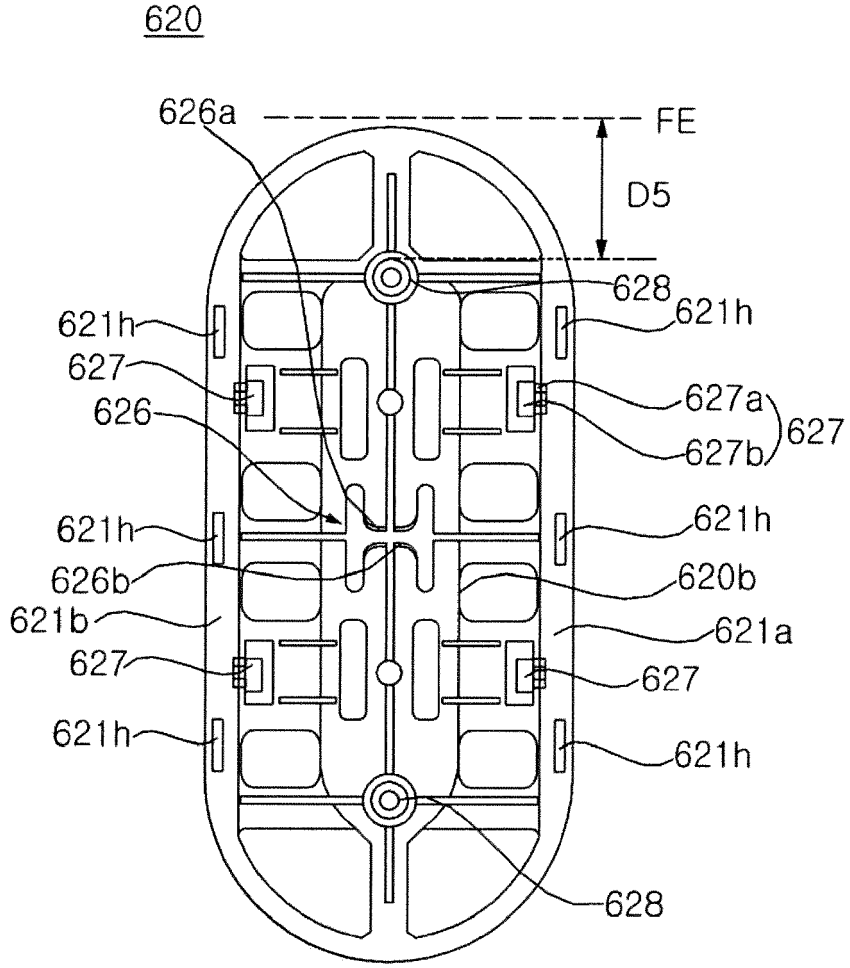

620
626a
FE
D5
628
621h
627
626
627a
627b
627
621h
626b
620b
621b
621a
627
627
621h
621h
628

FIG. 10

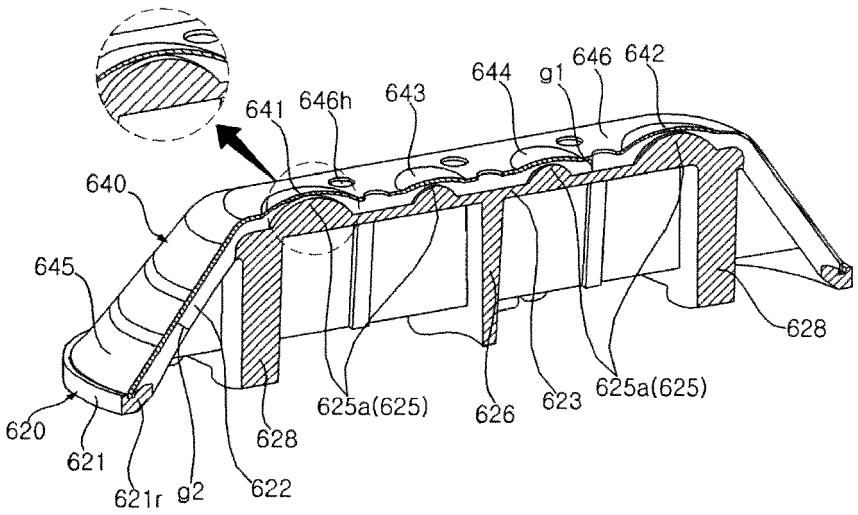

641
646h
643
644
g1
646
642
640
645
628
620
621
621r
g2
622
628
625a(625)
626
623
625a(625)

FIG. 11

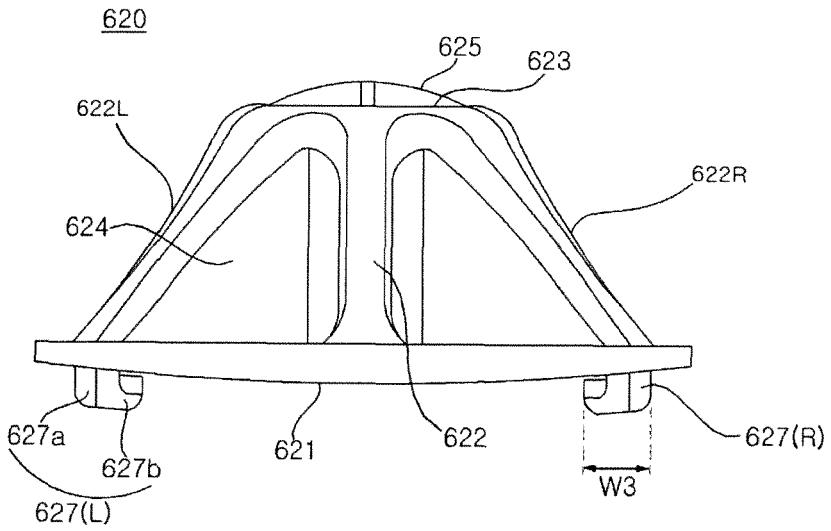

620
625
623
622L
622R
624
627a
627b
627(L)
621
622
627(R)
W3

FIG. 12

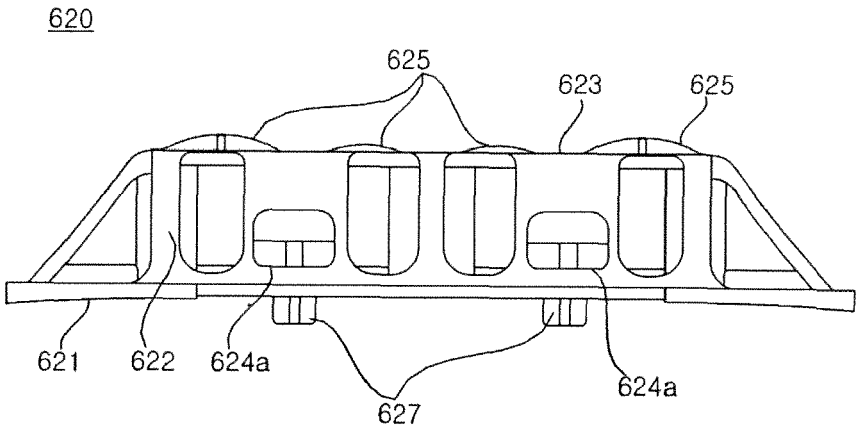

620
625
623
625
621
622
624a
627
624a

FIG. 13

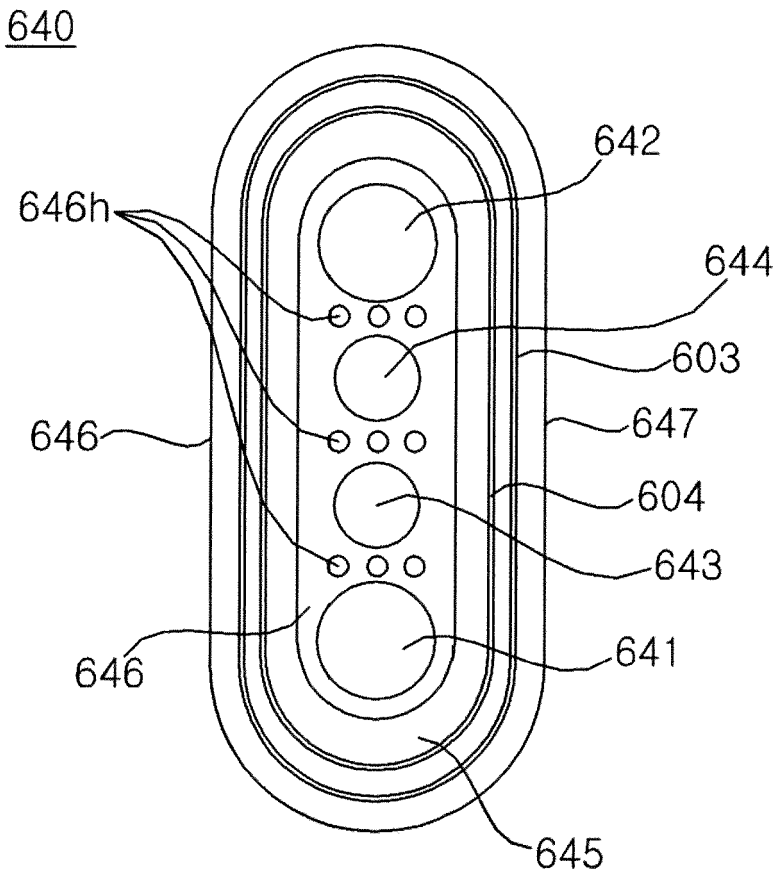

640
642
646h
644
603
646
647
604
643
646
641
645

FIG. 14

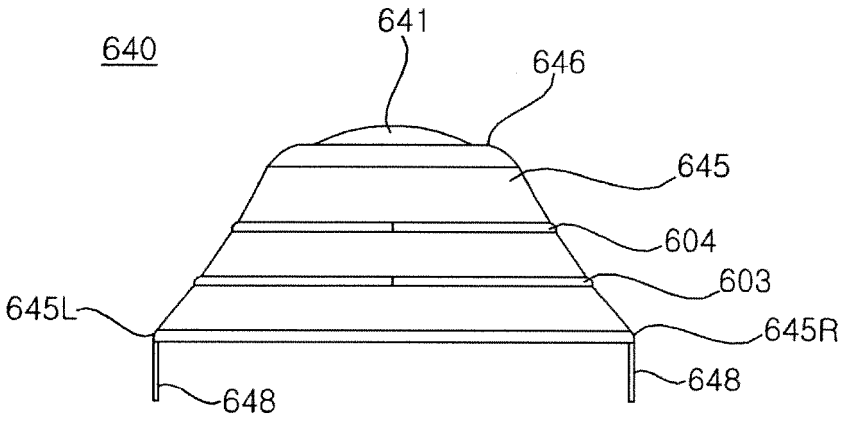

641
640
646
645
604
603
645L
645R
648
648

FIG. 15

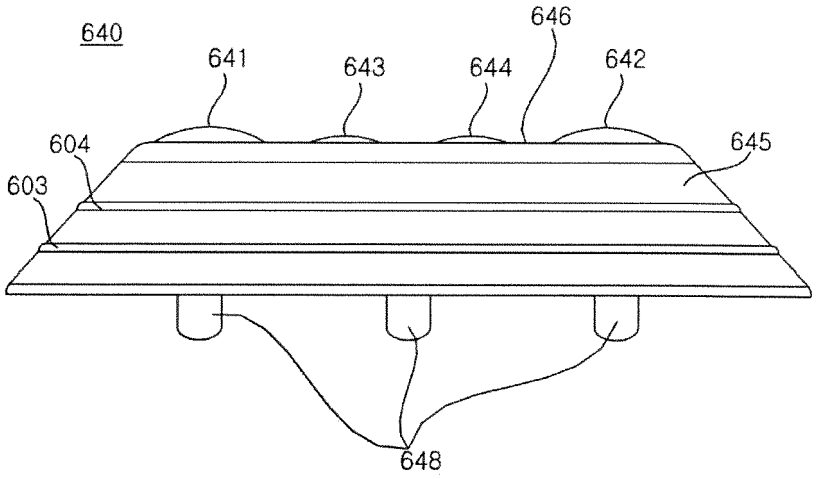


FIG. 16

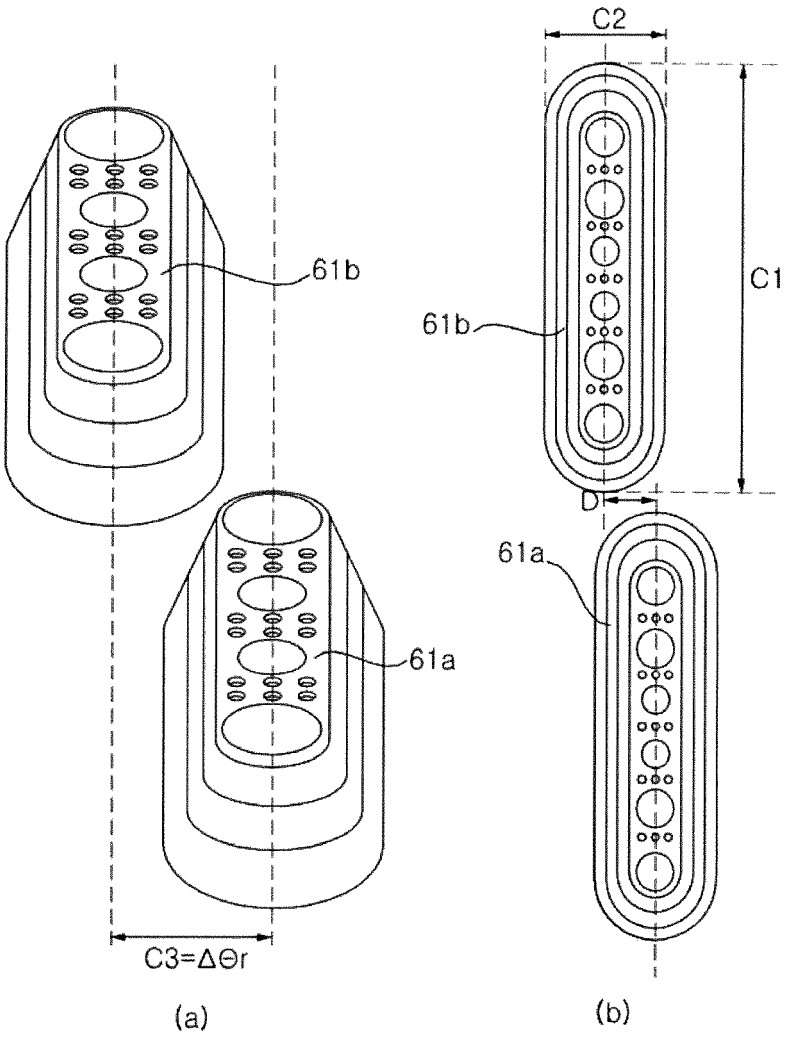


FIG. 17

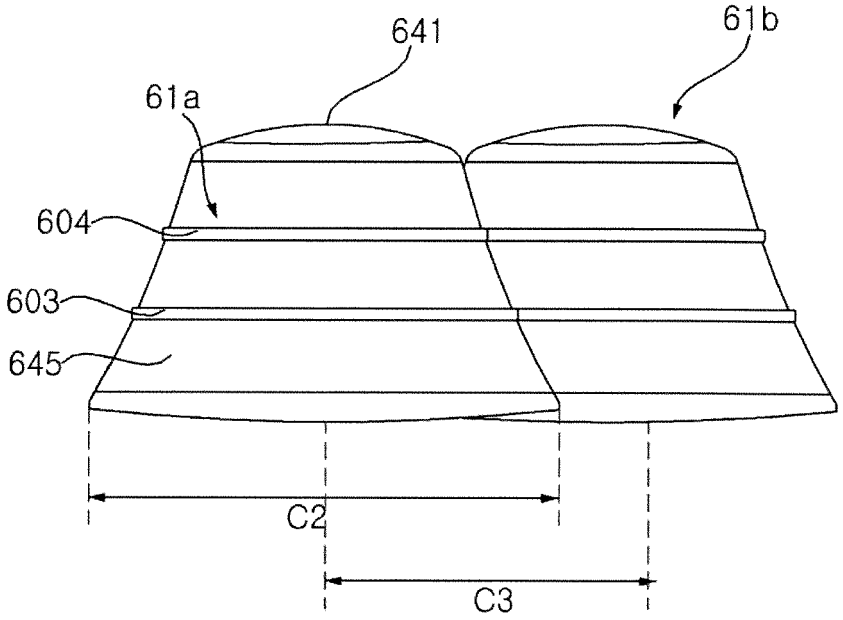

641
61b
61a
604
603
645
C2
C3

FIG. 18

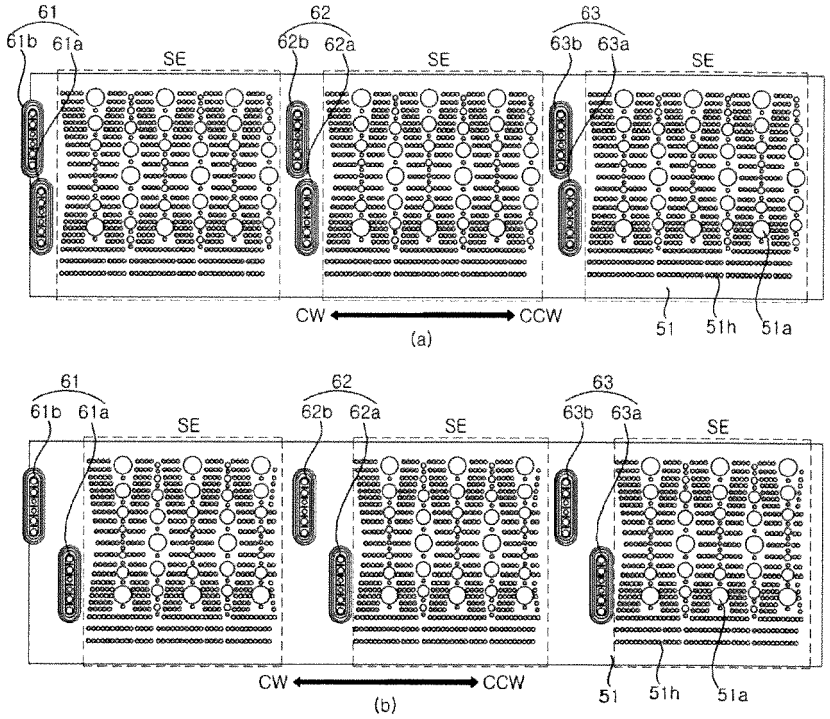

61
62
63
61b
61a
62b
62a
63b
63a
SE
SE
SE
CW
CCW
(a)
51
51h
51a
61
62
63
61b
61a
62b
62a
63b
63a
SE
SE
SE
CW
CCW
(b)
51
51h
51a

FIG. 19

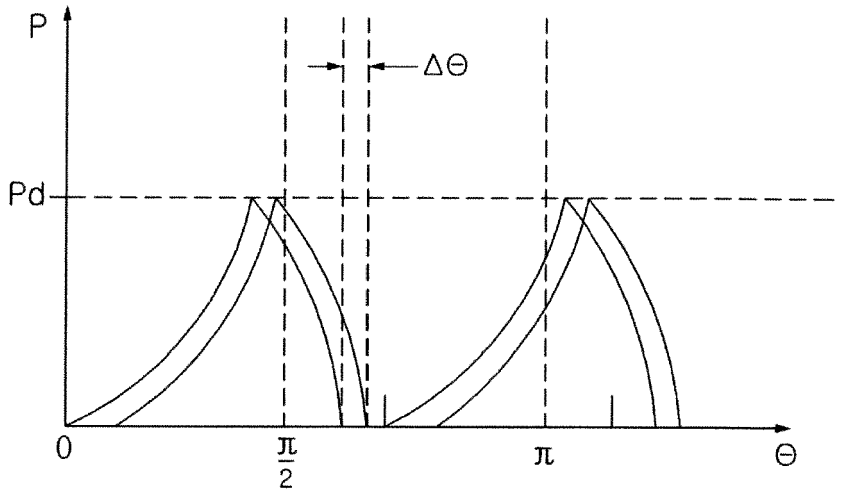

P
ΔΘ
Pd
0
π/2
π
Θ

FIG. 20

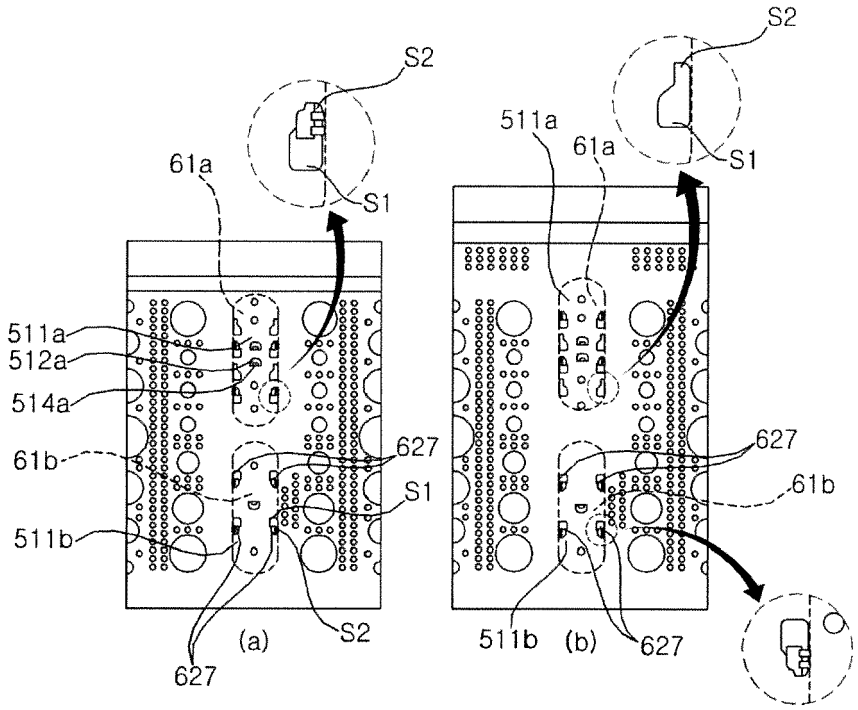
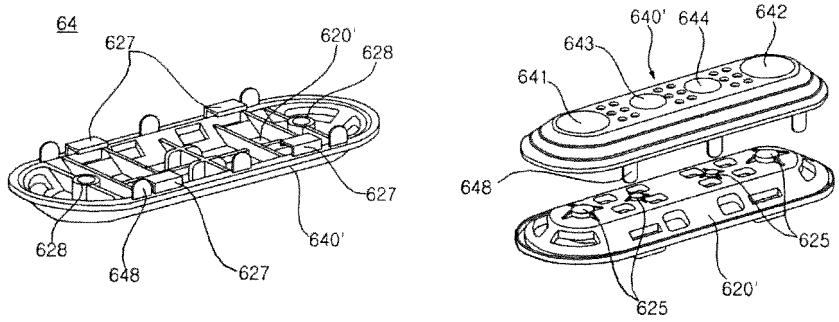

S2
61a
S1
511a
512a
514a
61b
627
S1
511b
S2
627
(a)
S2
511a
61a
S1
627
61b
511b
(b)
627

FIG. 21


64
627
620'
628
627
640'
628
648
627
640'
644
642
643
641
648
625
620'
625

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
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