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Yoon et al.

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(45) **Date of Patent: Aug. 19, 2025**

(54) **LAUNDRY TREATING APPARATUS**

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(73) Assignee: **LG Electronics Inc.**, Seoul (KR)

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(51) **Int. Cl.**
D06F 58/08 (2006.01)
D06F 58/06 (2006.01)
D06F 58/26 (2006.01)

(52) **U.S. Cl.**
CPC ***D06F 58/08*** (2013.01); ***D06F 58/06*** (2013.01); ***D06F 58/26*** (2013.01)

(58) **Field of Classification Search**
CPC D06F 58/08; D06F 58/06; D06F 58/04; D06F 58/26
See application file for complete search history.

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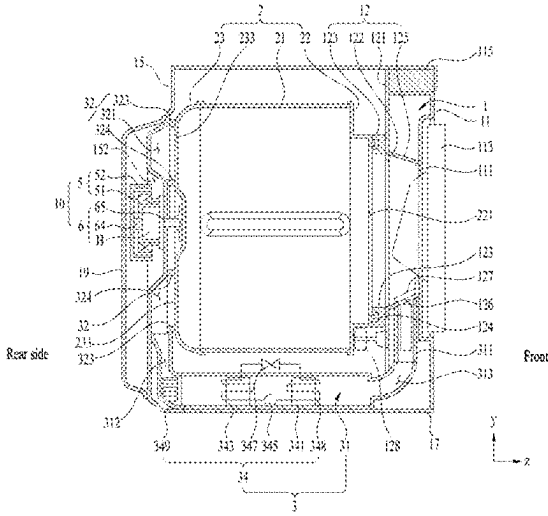
(57) **ABSTRACT**

A laundry treatment apparatus includes a drum configured to receive laundry. The drum includes a cylindrical drum body and a rear cover defining a rear surface of the drum. The rear cover includes a plurality of rear-cover-reinforcing ribs that radially extend from a center of the rear cover and are connected to a periphery of the rear cover. The laundry treatment apparatus is configured to circulate hot and dry air through an inside of the drum.

20 Claims, 16 Drawing Sheets



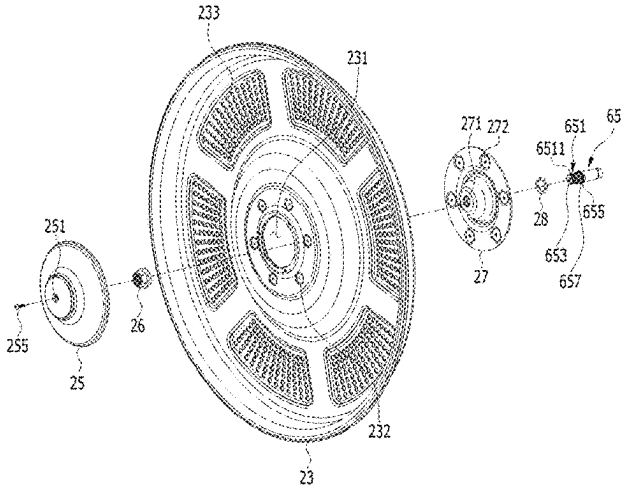


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FIG. 1

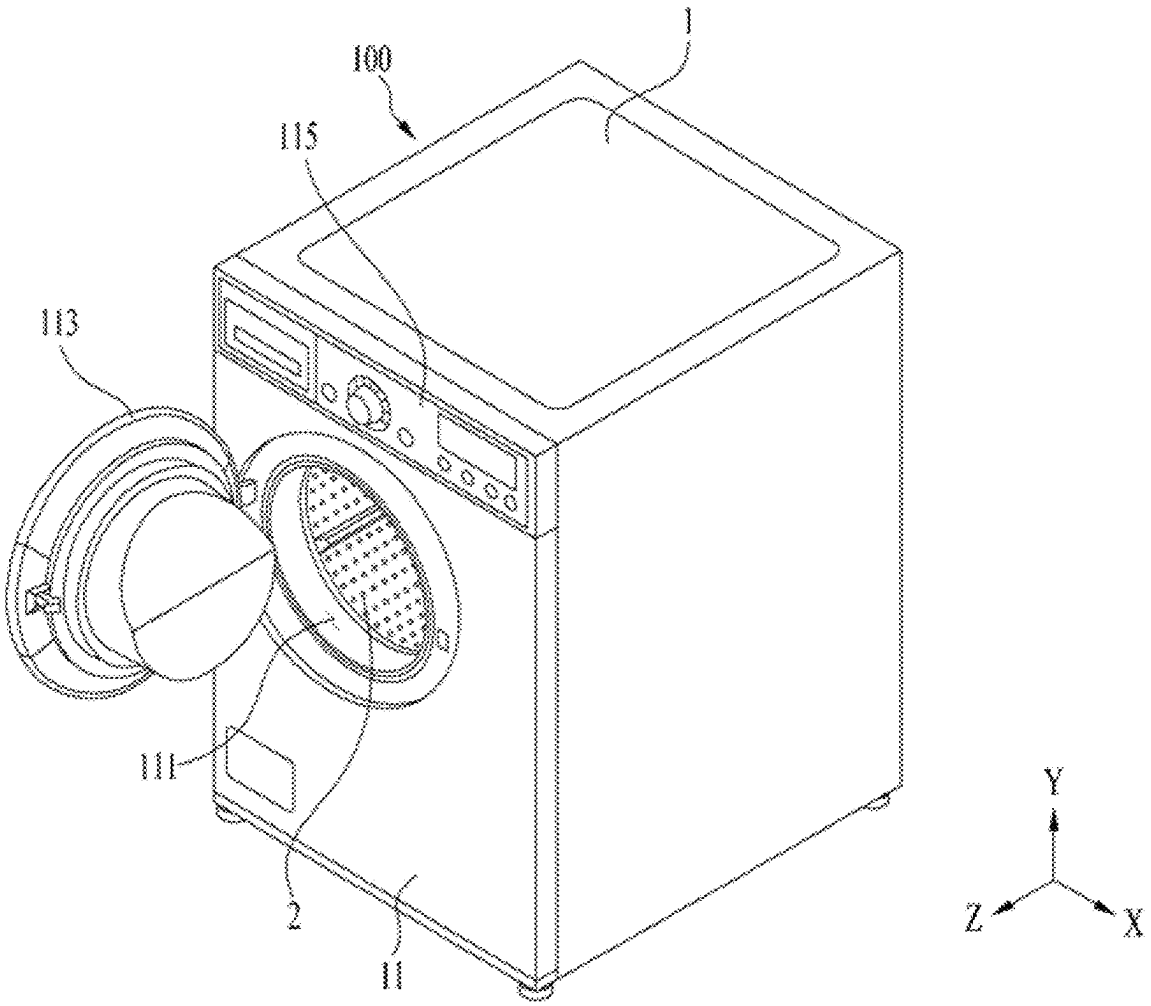
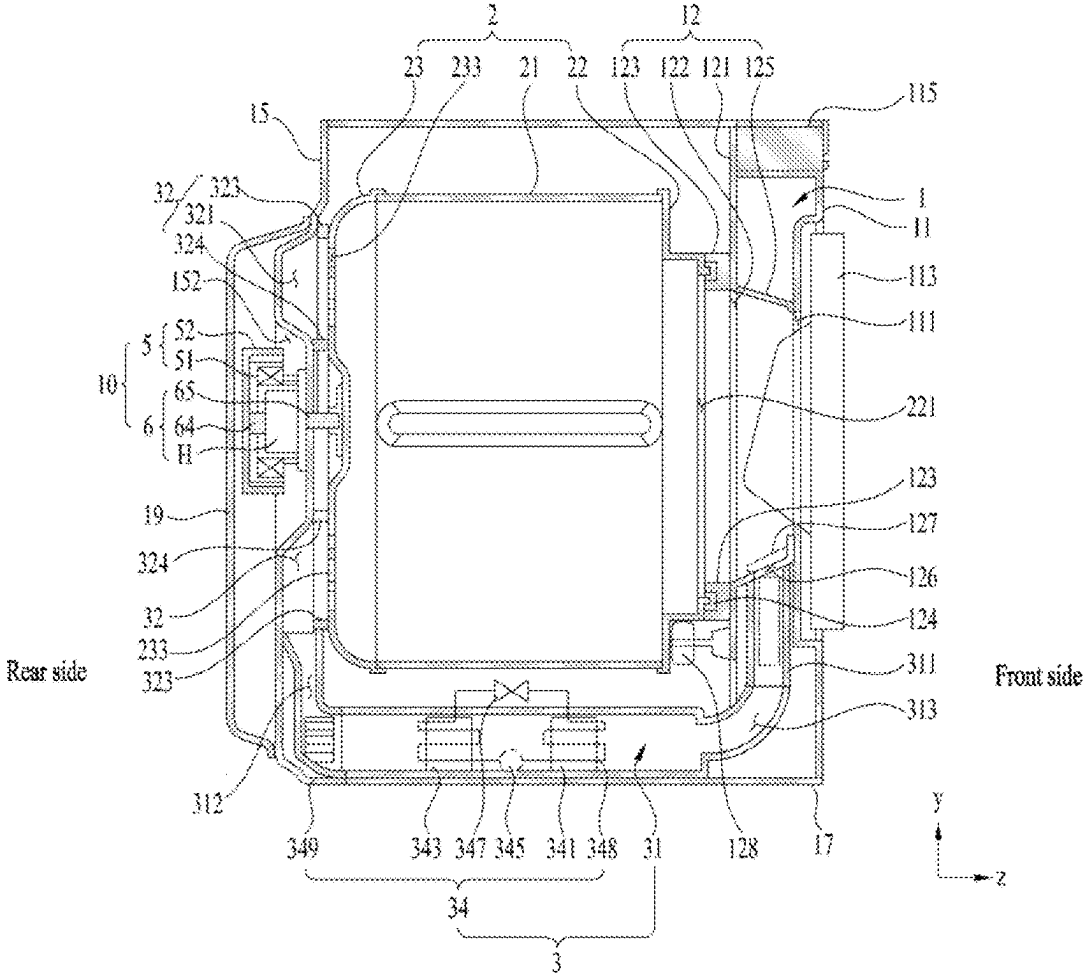


FIG. 2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123
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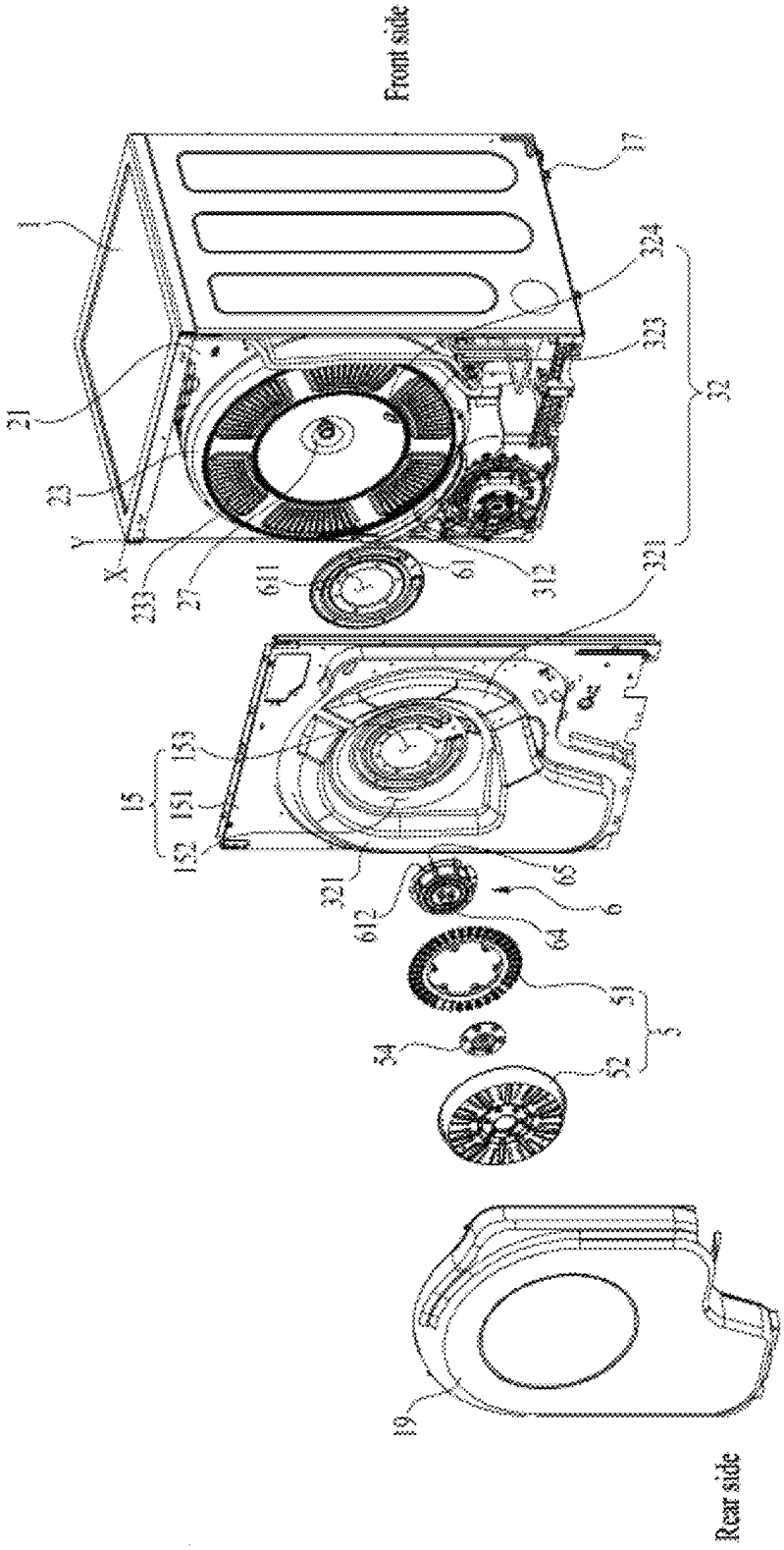
111
5
52
51
10
65
6
64
H
221
123
19
127
324
126
32
124
233
311
Rear side
323
Front side
313
312
349
343
347
345
341
348
31
128
17
34
3
y
z

FIG. 3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32
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Y
X
233
27
611
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153
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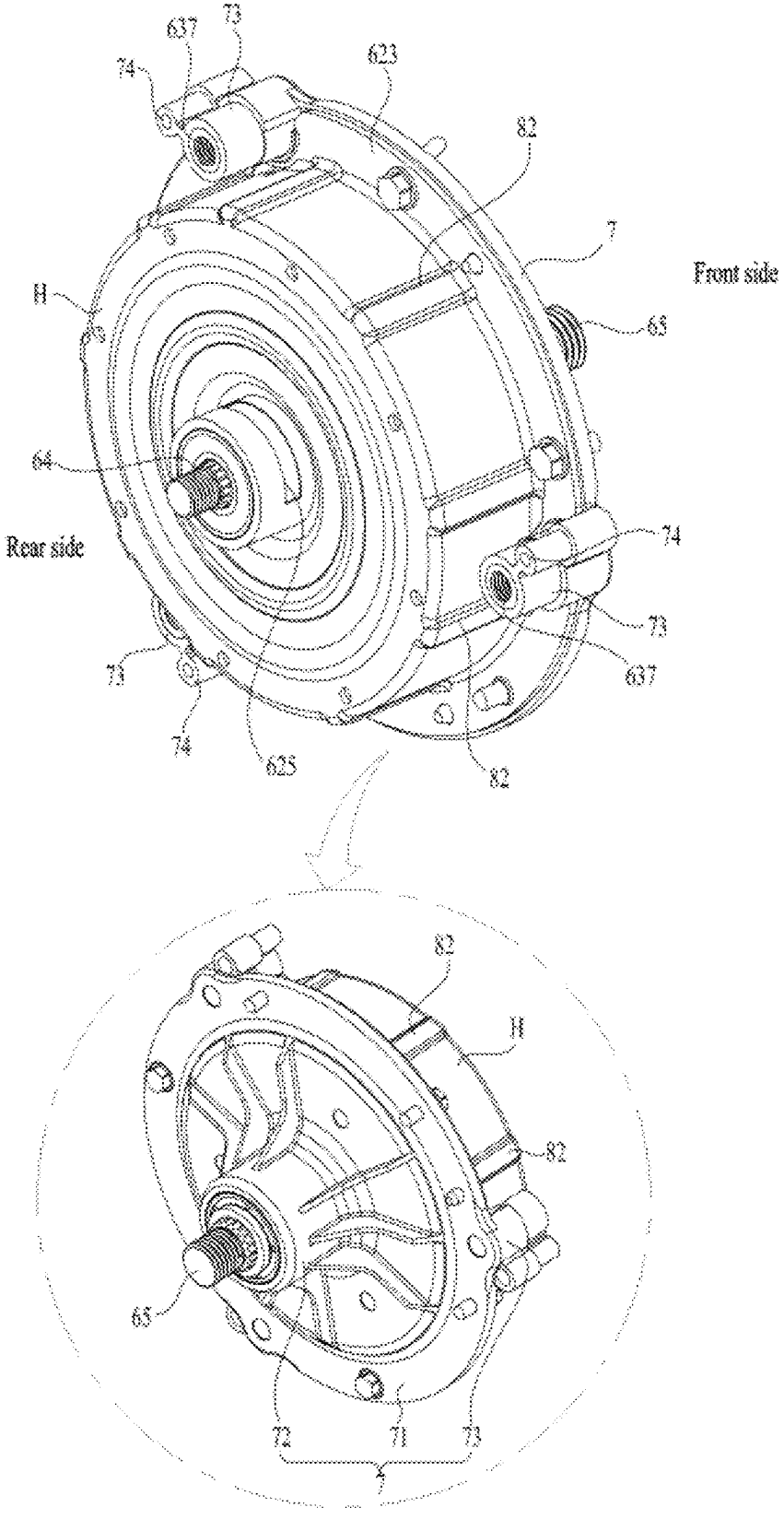
6
64
51
5
54
52
19
Rear side

FIG. 4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637
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Front side
H
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65
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73
7

FIG. 5

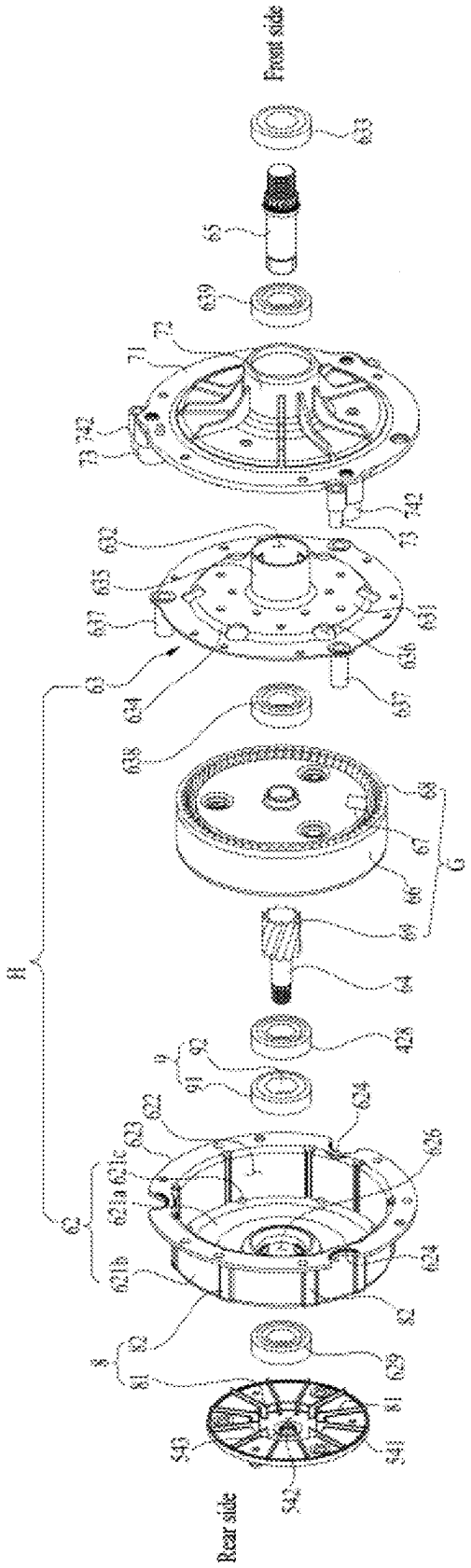
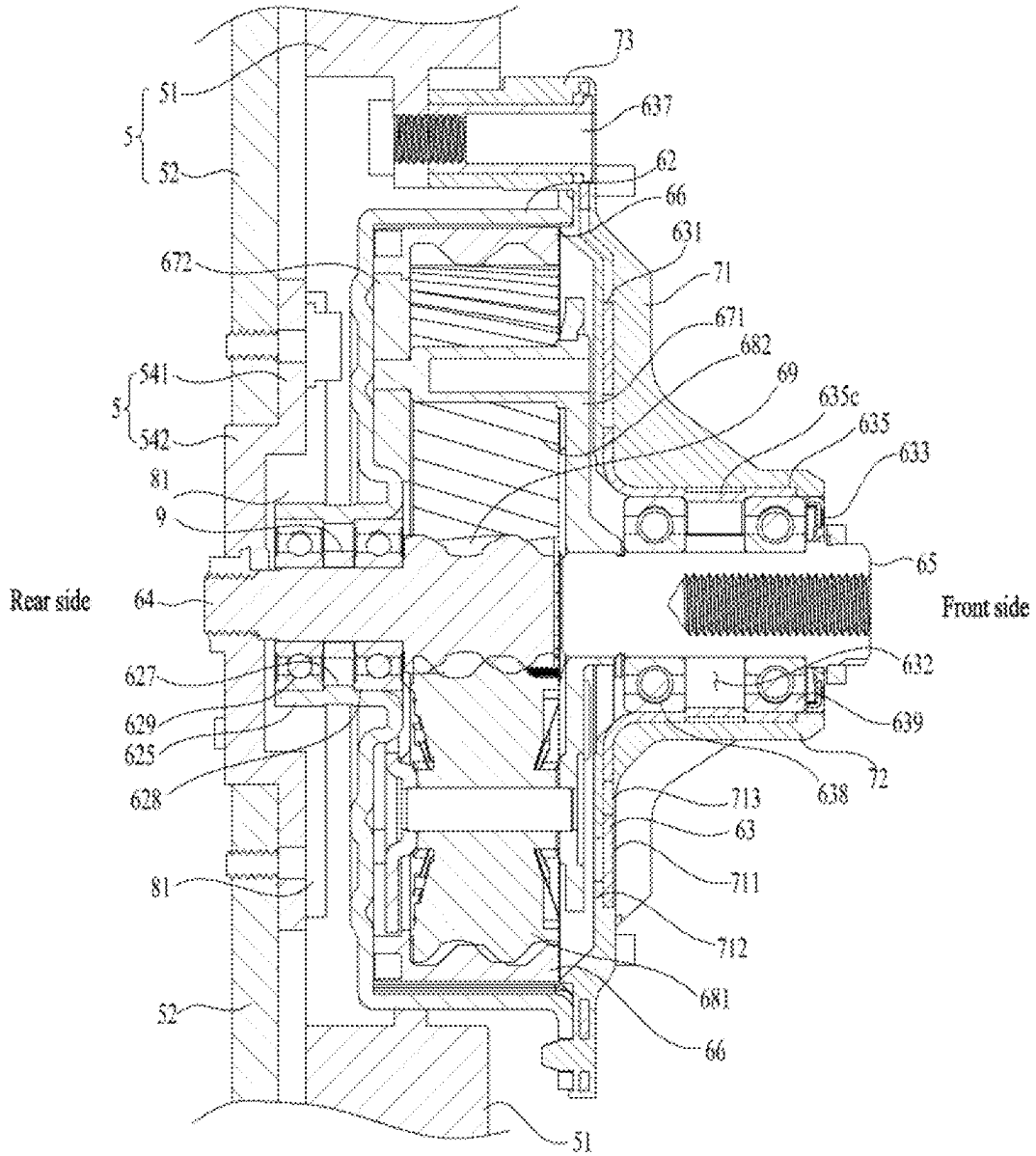


FIG. 6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Rear side
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Front side
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66
51

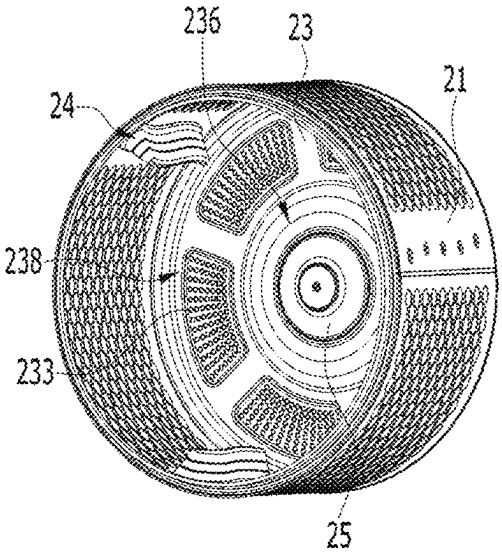


FIG. 7A

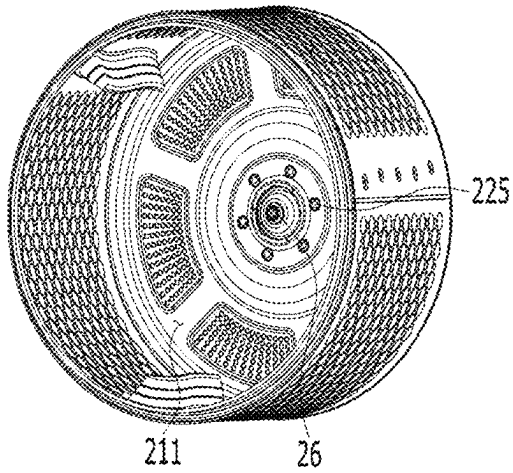


FIG. 7B

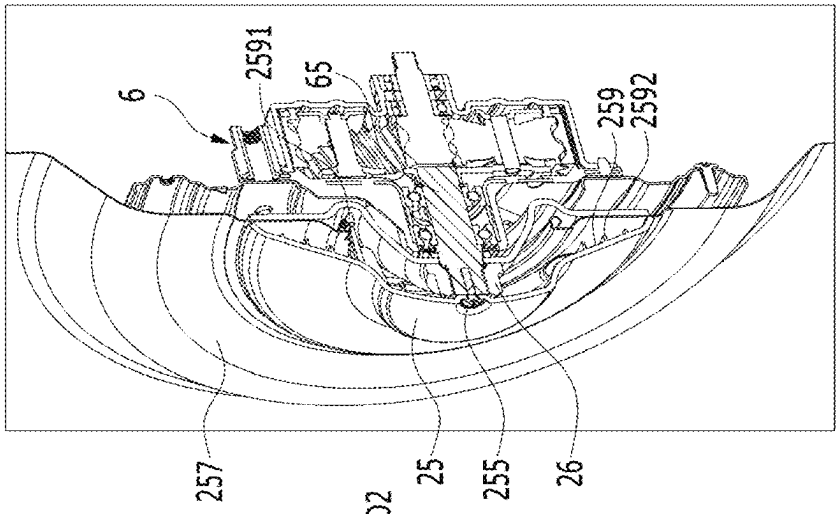


FIG. 8C

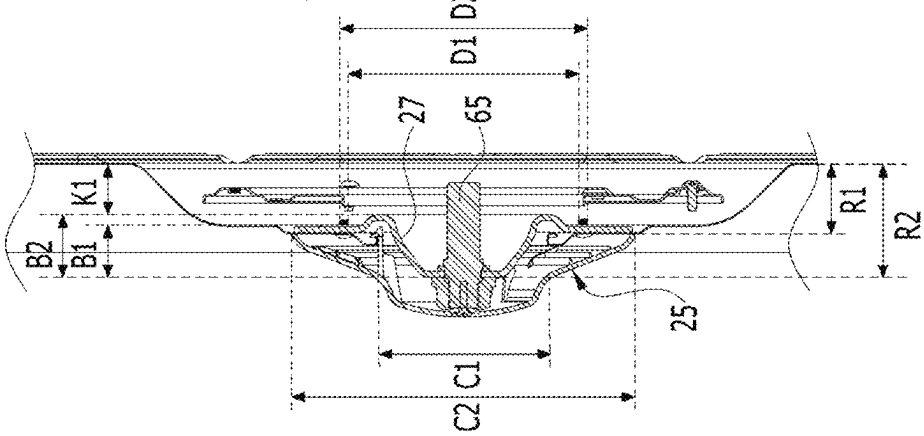


FIG. 8B

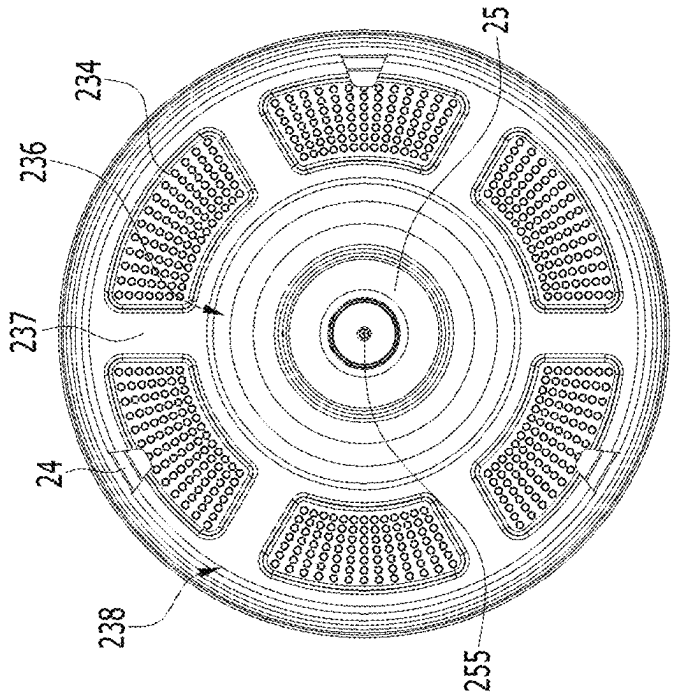
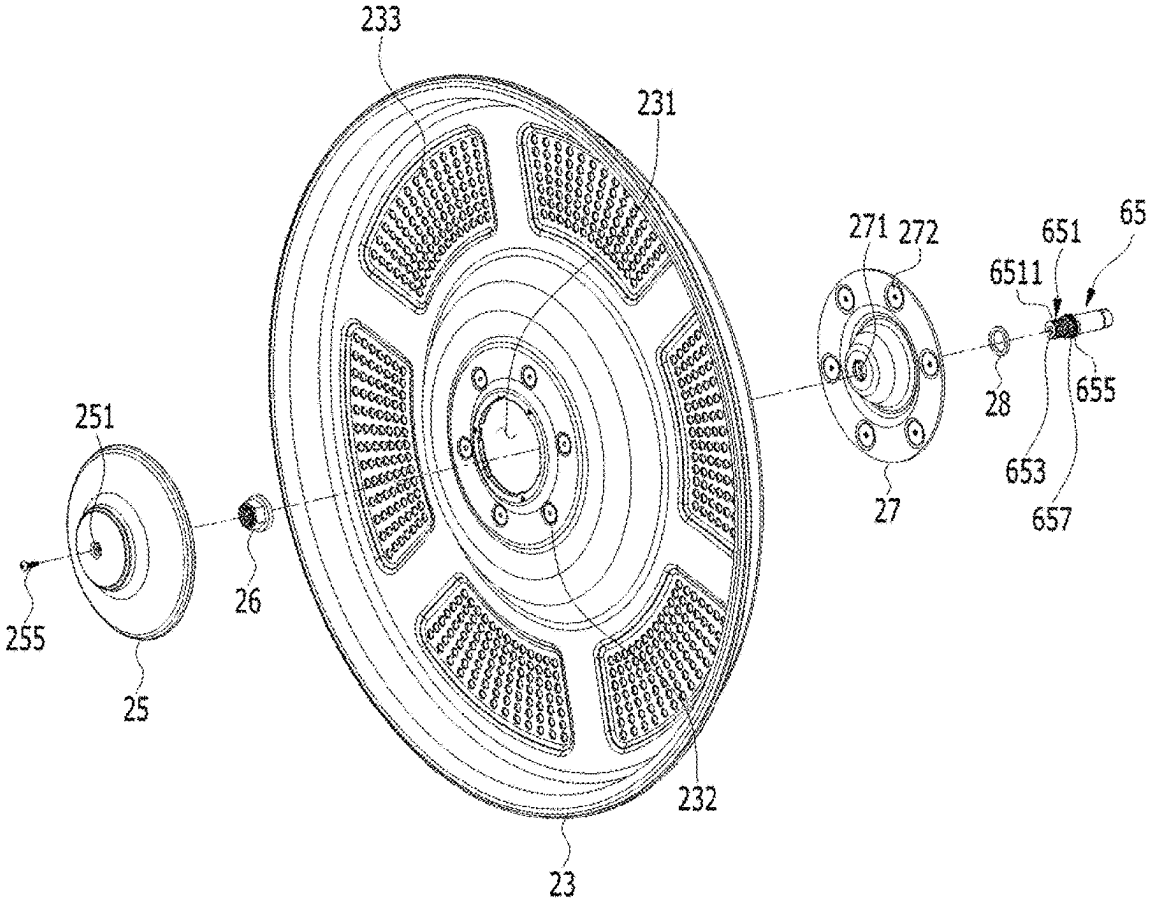


FIG. 8A

FIG. 9



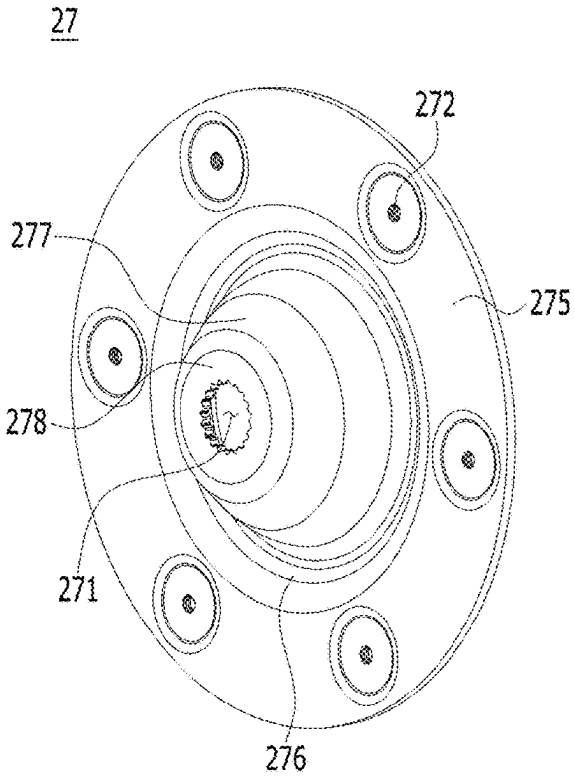


FIG. 10A

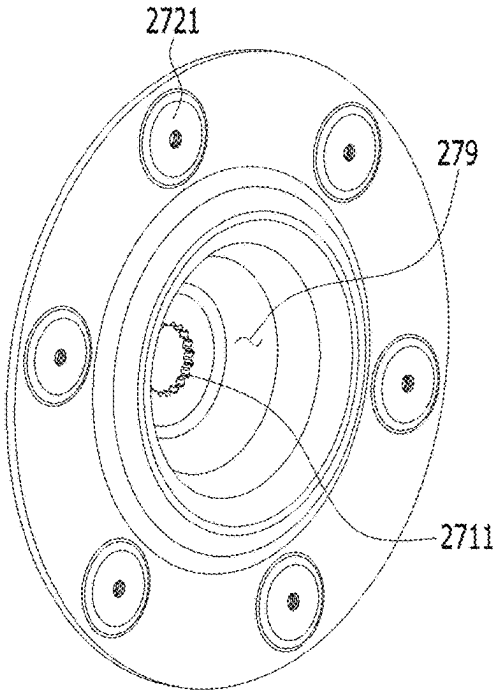


FIG. 10B

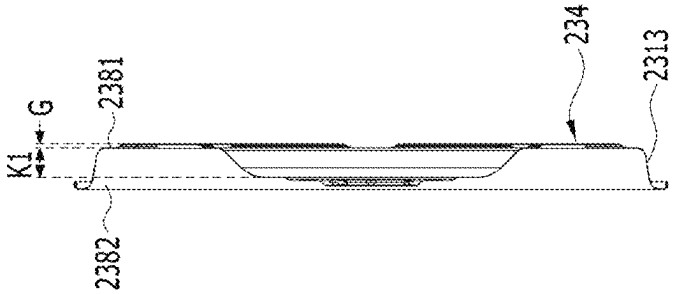


FIG. 11C

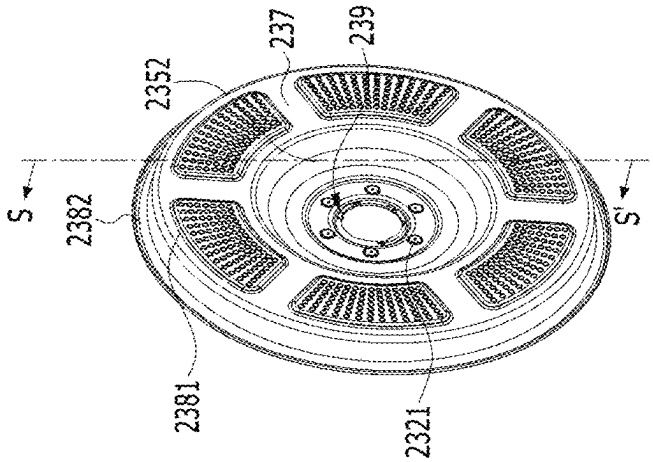


FIG. 11B

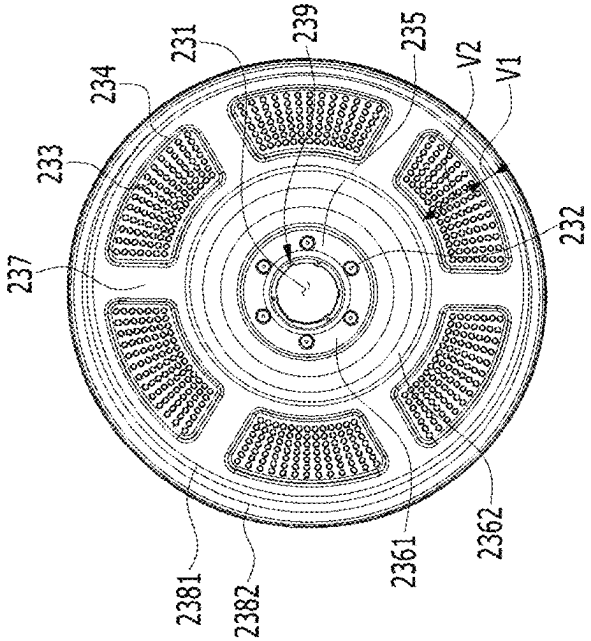


FIG. 11A

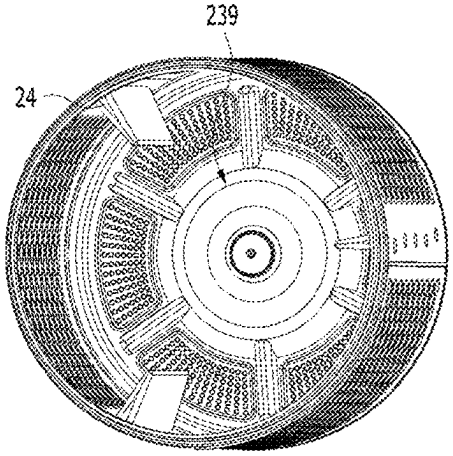


FIG. 12A

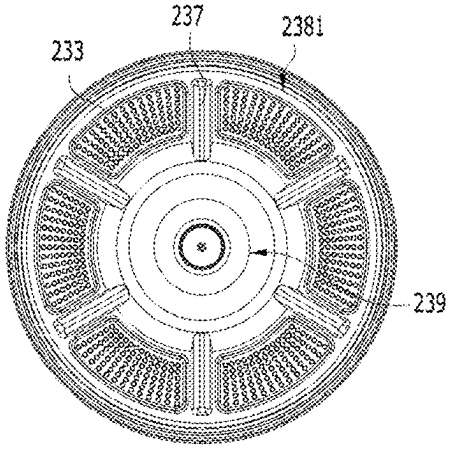
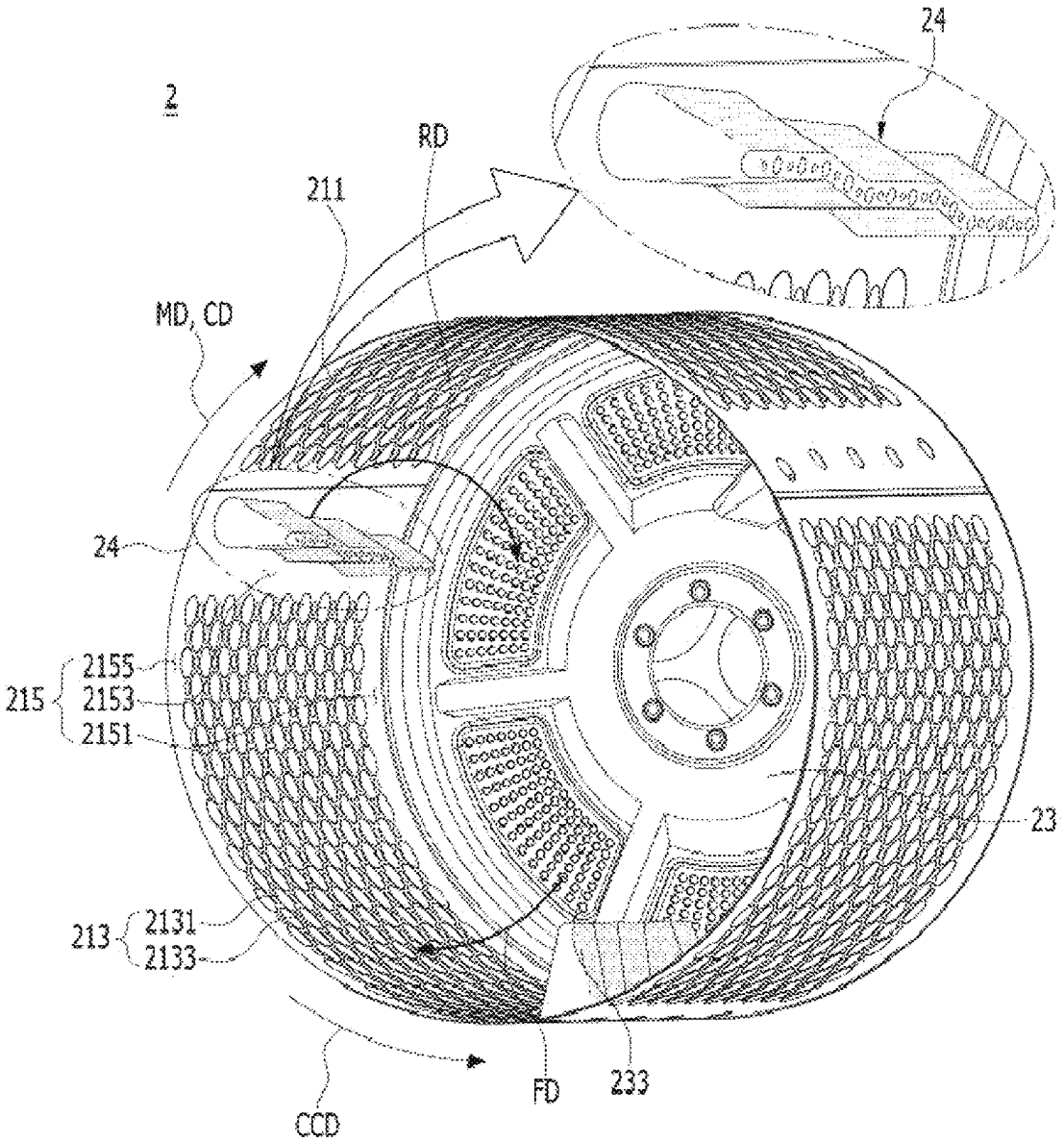


FIG. 12B

FIG. 13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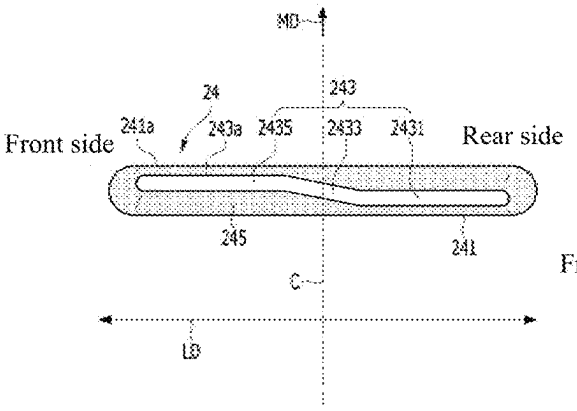


FIG. 14A

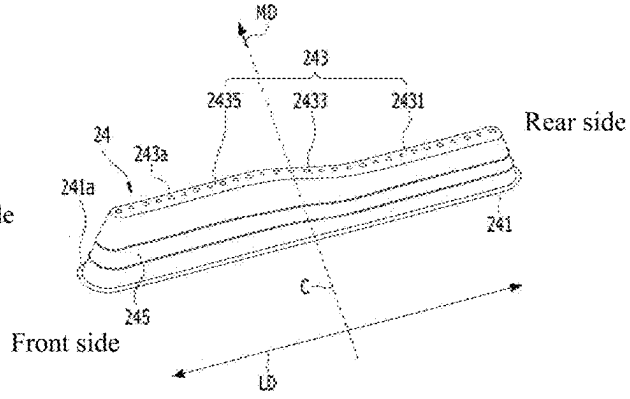
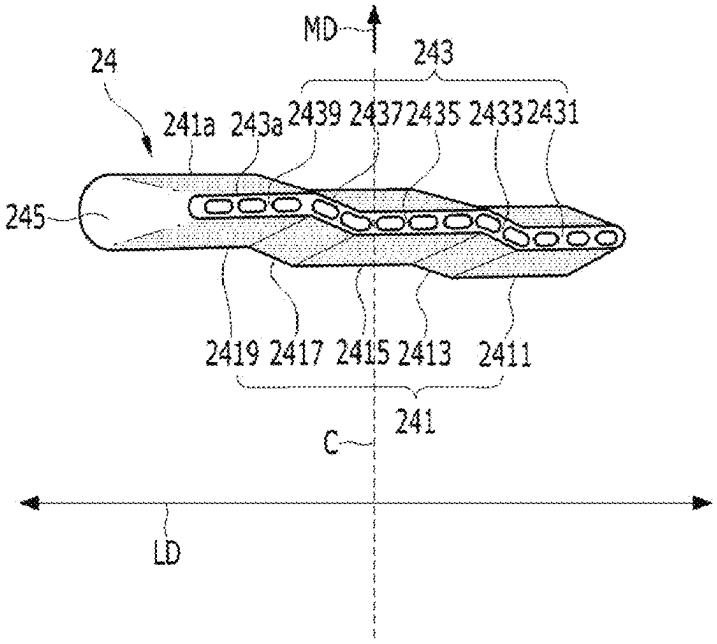


FIG. 14B

FIG. 15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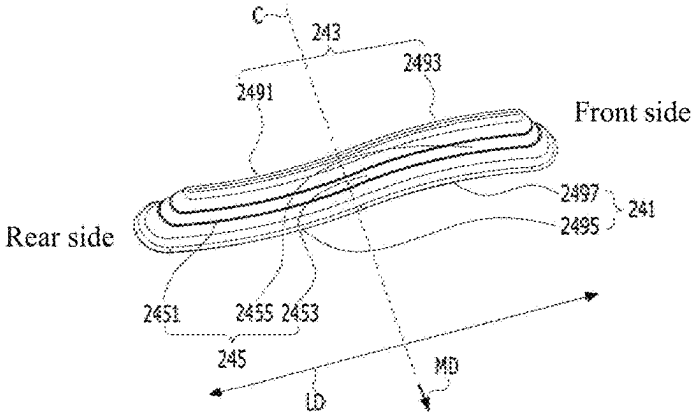

FIG. 16A

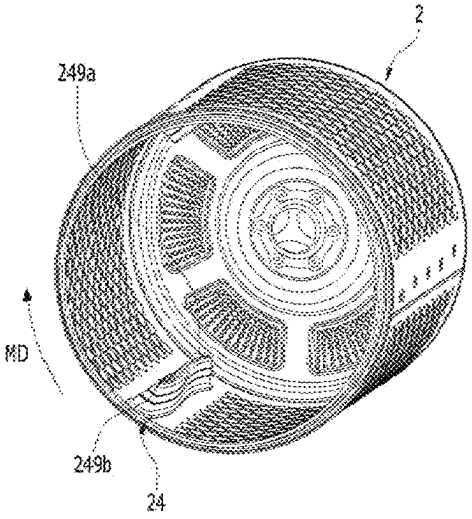

FIG. 16B

LAUNDRY TREATING APPARATUS

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of Korean Patent Application Nos. 10-2021-0017344, filed on Feb. 8, 2021, and 10-2021-0024266, filed on Feb. 23, 2021, the disclosures of which are hereby incorporated by reference as if fully set forth herein.

TECHNICAL FIELD

The present disclosure relates to a laundry treatment apparatus, and more particularly to a reinforcing rib configured to reinforce the rear surface of a drum.

BACKGROUND

A laundry treatment apparatus refers to an apparatus designed to wash and dry laundry and/or to remove wrinkles from laundry in a home or a laundromat. For example, a laundry treatment apparatus may include a washing machine configured to wash laundry, a dryer configured to dry laundry, a combined washing and dryer configured to perform both washing and drying, a laundry management machine configured to refresh laundry, and a steamer configured to remove wrinkles from laundry.

Dryers may be classified into an exhaustion-type dryer and a circulation-type dryer, which are both configured to perform a drying procedure including generating hot air using a heater and exposing laundry to the hot air to remove moisture from the laundry. For instance, the dryers may be configured to evaporate the moisture contained in an object to be treated, such as clothes, bedclothes and the like, received in a drum (or a tub) by supplying hot air to the object to be treated. Here, the dryers may be classified into a condensation type and an exhaustion type according to the method by which hot and humid air including moisture is treated.

In some cases, a dryer may be configured to perform a drying procedure and omit a structure for supplying water to laundry or discharging water. In some cases, a dryer may also omit a tub that receives water therein. The simplified internal structure of the dryer may improve drying efficiency by directly supplying hot air to a drum receiving laundry therein.

In some cases, a dryer may transmit rotational force to a drum to rotate the drum receiving laundry therein using a belt surrounding the drum. In some cases, the belt may not be capable of precisely controlling the rotational speed of the drum or changing the direction of rotation of the drum. In some cases, the dryer may reduce the drying time and improve drying efficiency by changing the rotational speed and the direction of rotation of the drum provided in the dryer.

In some examples, a dryer may have a structure in which hot air is introduced through a rear support defining the rear surface of a drum. In this structure, when the outer circumferential surface of the drum is rotated by means of a belt, hot air may be supplied through a portion of the rear supporter, that is, a crescent-shaped opening. In some cases, the hot air supplied through the portion of the rear support may not be rotated together with the drum during rotation of the drum. As a result, the period of time for which the hot air is in contact with laundry may be limited.

In some cases, a direct-coupling-type (or a direct-driving-type) dryer may include a motor directly connected to the rear side of a drum to order to change the rotational speed and rotational direction of the dryer drum. In some cases, components, which would conventionally be positioned below a drum to transmit power to the drum, may be omitted, thereby making it possible to enlarge a flow channel through which the hot air currents.

In some cases, when the intensity of airflow is increased due to the enlargement of the flow channel (for example, when the capacity of a fan is increased), laundry positioned in the drum may be pushed forwards. In this case, the laundry in the drum may not be normally mixed, thereby deteriorating drying efficiency. Particularly, in the case in which the lifter extends in forward and rearward directions, the laundry positioned in the drum may be agitated in the rotational direction of the drum, thereby deteriorating drying efficiency.

SUMMARY

The present disclosure describes a laundry treatment apparatus that can enable hot air to be supplied while being rotated during rotation of a drum.

The present disclosure describes a laundry treatment apparatus that can increase the rigidity of a rear cover to thus suppress twisting of the rear cover.

The present disclosure describes a laundry treatment apparatus that can help to prevent laundry from being adhered to the rear surface of a drum and thus from being damaged when hot air is supplied.

The present disclosure describes a laundry treatment apparatus capable of efficiently agitating laundry during rotation of a drum.

The present disclosure describes a laundry treatment apparatus that can agitate the laundry positioned in a drum in forward and rearward directions and in the rotational direction of the drum.

The present disclosure describes a laundry treatment apparatus that can agitate the heated air in a drum by virtue of rotation of the drum.

The present disclosure describes a laundry treatment apparatus that can help to prevent laundry, which is agitated in a drum, from becoming stuck inside the drum.

According to one aspect of the subject matter described in this application, a laundry treatment apparatus includes a drum that is configured to receive laundry and includes a drum body that has a cylindrical shape and a rear cover that defines a rear surface of the drum, and a drive unit including a drum shaft configured to rotate the drum. The rear cover includes a rear cover central portion that protrudes toward an inside of the drum and defines a rear cover through-hole passing through the rear cover in an axial direction of the drum shaft, a rear cover peripheral portion that defines an outer circumference of the rear cover, a plurality of rear-cover-reinforcing ribs that connect the rear cover central portion to the rear cover peripheral portion in a radial direction of the drum shaft, and a rear cover recess disposed between the plurality of rear-cover-reinforcing ribs, where the rear cover recess is recessed away from the drum relative to the plurality of rear-cover-reinforcing ribs in the axial direction, and the rear cover defines a plurality of air introduction holes at the rear cover recess.

Implementations according to this aspect can include one or more of the following features. For example, the rear cover peripheral portion can include a rear cover rim that has a ring shape and is connected to the plurality of rear-cover-

reinforcing ribs, and a rear cover side surface that extends radially outward from the rear cover rim, where the rear cover side surface is bent from the rear cover rim and coupled to the drum body. In some examples, a distance from the rear cover recess to the rear cover rim in the axial direction can be equal to a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction. In other words, the rear cover rim and the plurality of rear-cover-reinforcing ribs can be located at the same axial position. In some examples, a radial width of the rear cover rim in the radial direction can be less than a radial width of the rear cover recess in the radial direction.

In some examples, the rear cover can further include a plurality of rear cover recesses that are disposed radially between the rear cover rim and the rear cover central portion and disposed between the plurality of rear-cover-reinforcing ribs in a circumferential direction of the rear cover, where the rear cover recess is one of the plurality of rear cover recesses.

In some implementations, a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction can be less than or equal to a distance from the rear cover recess to a portion of the rear cover central portion having the rear cover through-hole in the axial direction. In other words, the rear cover central portion can protrudes toward the inside of the drum relative to the plurality of rear-cover-reinforcing ribs in the axial direction.

In some implementations, the rear cover central portion can include a central flat surface that defines the rear cover through-hole, and a central side surface that extends radially outward from a periphery of the central flat surface and surrounds the central flat surface, where the plurality of rear-cover-reinforcing ribs extend outward from the central side surface in the radial direction. In some examples, the central side surface can include a curved surface. In some implementations, a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction can be less than or equal to a distance from the rear cover recess to the central flat surface in the axial direction. In some implementations, boundaries of the plurality of rear-cover-reinforcing ribs have a round shape and are connected to the rear cover recess.

In some implementations, the laundry treatment apparatus can include a lifter disposed on an inner circumferential surface of the drum body and configured to interfere with the laundry based on rotation of the drum, where a longitudinal axis of the lifter passes through the rear cover and is disposed between two of the plurality of rear-cover-reinforcing ribs. In some examples, the lifter extends in the axial direction and has a curved shape. In some examples, the lifter can protrude from the inner circumferential surface of the drum body toward a rotational center of the drum body, and a side surface of the lifter can be tapered toward the rotational center of the drum body.

In some implementations, the lifter extends in the axial direction and has a stepped shape, where the lifter has a plurality of lifting surfaces including a first lifting surface that extends in the axial direction, a second lifting surface that extends from the first lifting surface and is inclined with respect to the first lifting surface, and a third lifting surface that extends from the second lifting surface in the axial direction to thereby define a step with respect to the first lifting surface in a circumferential direction of the drum body.

In some implementations, the laundry treatment apparatus can include a drying unit configured to circulate air through the drum, where the drying unit is configured to supply the air to the drum to thereby absorb moisture from the laundry. For instance, the drying unit can include an exhaust passage configured to receive the air discharged from the drum, a heat-exchanging unit disposed in the exhaust passage and configured to dehumidify the air and then heat the air, and a supply passage configured to guide the air from the exhaust passage toward the drum.

In some implementations, the drive unit can further include a motor including a stator configured to generate a rotating field and a rotor configured to be rotated by the rotating field, a rotor shaft disposed between the rear cover and the motor, the rotor shaft having one end fixed to the rotor and configured to be rotated by the rotor, and a power transmission unit including one or more gears that are configured to transmit rotational power of the rotor shaft to the drum shaft.

In some implementations, the laundry treatment apparatus can include a shaft bracket that is fixed to the rear cover and covers the rear cover through-hole, where the shaft bracket is coupled to the drum shaft and configured to transmit rotational power from the drum shaft to the drum, and a rotating-shaft-coupling member that couples the drum shaft to the shaft bracket. The shaft bracket can define a shaft-coupling hole such that the drum shaft can be inserted into the shaft-coupling hole and protrude toward the drum.

In some implementations, the laundry treatment apparatus can include a protective cover that is disposed in the drum and covers the drum shaft and the shaft bracket. In some implementations, the rotating-shaft-coupling member can have a cylindrical shape and protrude from a front surface of the shaft bracket toward the drum, where the rotating-shaft-coupling member defines an inner thread at an inner circumferential surface thereof, and an end portion of the drum shaft has an outer thread coupled to the inner thread.

In some implementations, air introduction holes can be defined at a portion depressed in the outward direction of the drum and supply hot air to the rear surface of the drum. The rear-cover-reinforcing ribs can increase the rigidity of the rear cover and can project forwards further than the depressed portion in which the air introduction holes are formed. In other words, the present disclosure provides a laundry treatment apparatus having a difference in height between the rear-cover-reinforcing ribs and the depressed portion.

In some examples, the rear-cover-reinforcing ribs can serve as wings of a kind of fan for rotating air introduced through the air introduction holes. In other words, the rear-cover-reinforcing ribs are capable not only of increasing the rigidity of the rear cover but also of rotating the air introduced into the drum in the circumferential direction during rotation of the drum.

The air, which is rotated by the rear-cover-reinforcing ribs (or bridges), can be in contact with rotating laundry for a long period of time, thereby improving the drying performance of the laundry treatment apparatus.

In some implementations, the laundry treatment apparatus includes the air introduction holes formed through the rear cover, the drying unit configured to supply heated air toward the air introduction holes from the outside of the drum, the drive unit configured to rotate the drum in a main rotational direction, which is set to be one of a clockwise direction and a counterclockwise direction, and a lifter provided on the inner circumferential surface of the drum body so as to agitate laundry.

The lifter can include a portion that extends toward a front cover from a rear cover and is inclined in the main rotational

direction. When the drum is rotated in the main rotational direction, the lifter can guide the laundry toward the rear cover.

The drive unit can include the motor, fixed to a fixed panel and generating rotational force, and the drum shaft, which is connected at one end thereof to the motor and at the other end thereof to the rear cover so as to transmit the rotational force of the motor to the drum.

The drum body can include an anti-slip portion formed on the inner circumferential surface thereof so as to be convex or concave in order to prevent slippage of laundry, and a slip-inducing portion, which is defined as a portion of the inner circumferential surface of the drum body on which the anti-slip portion is not formed.

In some implementations, the slip-inducing portion can include a first slip-inducing portion, which extends not only in the longitudinal direction of the drum shaft but also in the clockwise direction or in the counterclockwise direction at the rear end of the drum body, and a second slip-inducing portion, which extends from the first slip-inducing portion in the longitudinal direction of the drum shaft and to which the lifter is coupled.

The anti-slip portion can include a first anti-slip portion, which is convex from the inner circumferential surface of the drum body, and a second anti-slip portion, which is concave from the inner circumferential surface of the drum body and has a size smaller than that of the first anti-slip portion.

In some implementations, the rear cover can include a drive recess, which projects forwards and to which the drum shaft is coupled, a plurality of rear cover ribs radially extending from the drive recess, and an introduction plate, which is provided between the plurality of rear cover ribs and through which the air introduction holes are formed.

In some examples, the lifter can be provided at a location that is spaced apart from an introduction plate in the longitudinal direction of the drum shaft. The lifter can be provided at a location that overlaps the air introduction holes in the longitudinal direction of the drum shaft. The drive recess can be rounded. The introduction plate can project rearwards further than the plurality of rear cover ribs. The lifter can project toward the rotational center of the drum body from the inner circumferential surface of the drum body and can be tapered in the direction in which the lifter projects.

The lifter can include a fixed surface, which is brought into contact with the inner circumferential surface of the drum body, a projecting surface, which is spaced apart from the fixed surface toward the rotational center of the drum body, and an extending surface extending between the fixed surface and the projecting surface.

In some examples, a first portion of the lifter, which is positioned before the center of the length of the drum body in the longitudinal direction of the drum shaft, may, in the main rotational direction of the drum shaft, be spaced apart from a second portion of the lifter, which is positioned behind the center of the length of the drum body in the longitudinal direction of the drum shaft.

In some examples, the projecting surface can include a first projecting lifting surface, which extends from the rear side of the drum body in the longitudinal direction of the drum shaft, a second projecting lifting surface, which obliquely extends from the first projecting lifting surface in a direction which is inclined in the main rotational direction, and a third projecting lifting surface, which extends from the second projecting lifting surface in the longitudinal direction of the drum shaft. The fixed surface can extend in the longitudinal direction of the drum shaft. The second projecting lifting surface can be positioned at the center of the length of the drum body in the longitudinal direction of the drum shaft.

In some examples, the projecting surface can include a first projecting lifting surface that extends from the rear side of the drum body in the longitudinal direction of the drum shaft, a second projecting lifting surface that extends from the first projecting lifting surface in a direction which is inclined in the main rotational direction, a third projecting lifting surface that extends from the second projecting lifting surface in the longitudinal direction of the drum shaft, a fourth projecting lifting surface that extends from the third projecting lifting surface in a direction which is inclined in the main rotational direction, and a fifth projecting lifting surface that extends from the fourth projecting lifting surface in the longitudinal direction of the drum shaft.

In some implementations, the fixed surface can include a first fixed lifting surface that extends from the rear side of the drum body in the longitudinal direction of the drum shaft, a second fixed lifting surface that extends from the first fixed lifting surface in a direction which is inclined in the main rotational direction, a third fixed lifting surface that extends from the second fixed lifting surface in the longitudinal direction of the drum shaft, a fourth fixed lifting surface that extends from the third fixed lifting surface in a direction which is inclined in the main rotational direction, and a fifth fixed lifting surface that extends from the fourth fixed lifting surface in the longitudinal direction of the drum shaft. In some examples, The third projecting lifting surface and the third fixed lifting surface can be positioned at the center of the length of the drum body in the longitudinal direction of the drum shaft.

In some implementations, the lifter can extend in a wave fashion. The projecting surface can include a first projecting laundry-tossing surface, which extends so as to be convex in the main rotational direction, and a second projecting laundry-tossing surface, which extends so as to be convex in the direction opposite the main rotational direction. In some examples, the fixed surface can include a first fixed laundry-tossing surface, which extends so as to be convex in the main rotational direction, and a second fixed laundry-tossing surface, which extends so as to be convex in the direction opposite the main rotational direction.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an example of a laundry treatment apparatus.

FIG. **2** illustrates a cross-section of the laundry treatment apparatus.

FIG. **3** illustrates an example of the internal structure of the laundry treatment apparatus.

FIG. **4** illustrates an example of a power transmission unit.

FIG. **5** is an exploded view showing the power transmission unit

FIG. **6** illustrates a cross-section of the power transmission unit.

FIG. **7**A illustrates an example of a drum and a protective cover, and FIG. **7**B illustrates an example of a shaft bracket and an example of a coupling nut with the protective cover being removed.

FIG. **8**A illustrates an example of a rear cover of the drum when viewed from the front, FIG. **8**B illustrates a cross-section of an example of an assembly of the protective cover, the drum-drum shaft, the shaft bracket and the rear cover,

and FIG. **8**C illustrates an example of an assembly of the protective cover, the drum-drum shaft, the shaft bracket, and the rear cover.

FIG. **9** is an exploded view showing the rear cover of the drum.

FIGS. **10**A and **10**B illustrate the shaft bracket when viewed from the front and the rear.

FIG. **11**A illustrates the rear cover when viewed from the front, FIG. **11**B illustrates the rear cover when viewed from the rear, and FIG. **11**C is a cross-sectional view of the rear cover taken along line S-S' in FIG. **11**B.

FIGS. **12**A and **12**B illustrate another example of the rear-cover-reinforcing rib.

FIG. **13** is a perspective view showing an example of a drum body.

FIGS. **14**A and **14**B are perspective views showing an example of a lifter.

FIG. **15** is a perspective view showing the lifter.

FIGS. **16**A and **16**B are perspective views showing the lifter.

DETAILED DESCRIPTION

One or more implementations of the present disclosure will be described with the accompanying drawings.

FIG. **1** illustrates an example of a laundry treatment apparatus **100**.

In some implementations, the laundry treatment apparatus **100** can include a cabinet **1** and a drum **2**, which is rotatably provided in the cabinet **1** and defines a space for receiving laundry (an object to be washed or dried). As illustrated in FIG. **2**, the cabinet **1** can be provided therein with a drying unit **3** configured to supply hot and dried air (air having a temperature higher than an ambient temperature and a dryness higher than the dryness of indoor air) to thus remove moisture from the laundry.

In some examples, referring to FIGS. **1** and **2**, the cabinet **1** can include a front panel **11** defining the front surface of the laundry treatment apparatus **100** and a base panel **17** defining the bottom surface of the laundry treatment apparatus **100**. The front panel **11** can be provided with an entrance **111** communicating with the drum **2**. The entrance can be configured to be opened and closed by a door **113**.

The front panel **11** can be provided with a control panel **115**. The control panel **115** can include an input unit, into which control commands are input by a user, and a display unit configured to output information such as control commands, which are capable of being selected by the user. The input unit can include a power supply request unit configured to request supply of power to the laundry treatment apparatus **100**, a course input unit configured to allow a user to select a desired course among a plurality of courses, and an execution request unit configured to request execution of the course that is selected by the user.

The drum **2** can be configured to have the form of a hollow cylinder. FIG. **2** illustrates an example in which the drum **2** is composed of a cylindrical drum body **21**, which is open at the front and rear surfaces thereof, a front cover **22** defining the front surface of the drum body **21**, and a rear cover **23** defining the rear surface of the drum body **21**. The front cover **22** can include a drum entrance **221**, through which the inside of the drum body **21** communicates with the outside, and the rear cover **23** can include an air introduction hole **233** (see FIG. **3**), through which external air is introduced into the drum body **21**.

The drum body **21** can further include a lifter **24** (see FIG. **7**A). The lifter **24** can be configured such that a board, which extends toward the rear cover **23** from the front cover **22**, projects toward the rotational center of the drum **2** from the drum body **21** (that is, toward the rotational center of the drum **2** from the circumferential surface of the drum **2**).

When the laundry treatment apparatus **100** is designed to perform only drying of laundry, there is no need to provide drum through-holes, which are formed through the drum body **21** so as to allow the inside of the drum **2** to communicate with the outside.

The drum **2** can be rotatably held by at least one of a first support **12** or a second support **15**. In this implementation, the rear cover **23** can be held by the second support **15** so as to be rotatable by a motor **5** (see FIG. **3**), and the front cover **22** is rotatably connected to the first support **12**.

The first support **12** can be composed of a support panel **121**, which is fixed to the cabinet **1** and is positioned between the front panel **11** and the front cover **22**. The support panel **121** can be fixed to the base panel **17**, and can be positioned between the front panel **11** and the front cover **22**. Here, the rear surface of the front panel **11** (the surface that faces the support panel **121**) can be fixed to the support panel **121**, and the lower end of the front panel **11** can be fixed to the base panel **17**.

The support panel **121** can include a support panel through-hole **122**, a drum connection body **123** (see FIG. **2**) connecting the support panel through-hole **122** with the drum entrance **221**, and a panel connection body **125** connecting the support panel through-hole **122** with the entrance **111**. The support panel through-hole **122** can be formed through the support panel **121** so as to allow the entrance **111** to communicate with the drum entrance **221**.

As illustrated in FIG. **2**, the drum connection body **123** can be composed of a pipe fixed to the rear surface of the support panel **121** (the surface that faces the drum entrance). One end of the drum connection body **123** can be configured so as to surround the support panel through-hole **122**, and the free end of the drum connection body **123** can be configured so as to support the front cover **22**. In other words, the free end of the drum connection body **123** can be configured so as to be inserted into the drum entrance **221** or to be in contact with the free end of the front cover **22** defining the drum entrance **221**.

FIG. **2** illustrates an example in which the free end of the drum connection body **123** is in contact with the free end of the front cover **22**. Here, the drum connection body **123** can be provided with a ring-shaped connection damper **124**. The connection damper **124** can serve to minimize the risk of the drum entrance **221** being separated from the drum connection body **123** (the risk of the air in the drum leaking into the cabinet) when the drum **2** rotates or vibrates.

The panel connection body **125** can be composed of a pipe fixed to the front surface of the support panel **121** (the surface that faces the front panel). One end of the panel connection body **125** can be configured so as to surround the support panel through-hole **122**, and the other end of the panel connection body **125** can be configured so as to be connected to the entrance **111**. Consequently, the laundry supplied to the entrance **111** can be transferred to the drum body **21** through the panel connection body **125**, the support panel thorough-hole **122**, the drum connection body **123**, and the drum entrance **221**.

The support panel **121** can include an exhaust port **126**, which is formed through the panel connection body **125**. A filter **127** can be detachably fixed to the exhaust port **126**. The filter **127** can be configured to have any structure capable of filtering contaminants from the air that flows to the exhaust port **126** from the drum **2**.

The support panel **121** can further include a drum support **128** configured to prevent the drum **2** from drooping. The drum support **128** can include a first roller, which is fixed to the support panel **121** so as to rotatably support the drum **2**, and a second roller. In some examples, as illustrated in FIG. **3**, the first roller can support the drum body **21**. In some examples, the rollers can support the front cover **22**.

The second support **15** can be composed of a fixed panel **151**, which is fixed to the cabinet **1** so as to be spaced apart from the rear cover **23**. FIG. **3** illustrates an example in which the fixed panel **151** is fixed to the base panel **17** so as to define the rear surface of the laundry treatment apparatus **100** (i.e. the rear surface of the cabinet **1**).

The fixed panel **151** can include a motor-mounting recess **152**, which defines a space in which the motor **5** is mounted. The motor-mounting recess **152** can be composed of a groove depressed toward the rear cover **23** of the drum **2** from the fixed panel **151**. The fixed panel **151** can include a fixed panel through-hole **153** through which a shaft configured to rotate the drum **2** extends. The fixed panel through-hole **153** can be positioned in the motor-mounting recess **152**.

As described above, when the drum **2** is composed of the drum body **21**, the front cover **22** fixed to the drum body **21**, and the rear cover **23** fixed to the drum body **21**, the rigidity of the drum **2** is increased, compared to a structure in which the front surface and the rear surface of the drum body **21**, which are open, are respectively and rotatably connected to the support panel **121** and the fixed panel **151**. The increased rigidity of the drum **2** enables minimization of deformation of the drum body **21** during rotation of the drum **2**, thereby minimizing a problem in which laundry is jammed between the drum body **21** and the fixed panel **151** (i.e. thereby enabling minimization of the load on the motor).

As illustrated in FIG. **2**, the drying unit can include an exhaust passage **31** connected to the exhaust port **126**, a supply passage **32** configured to guide the air in the exhaust passage **31** toward the drum body **21**, and a heat-exchanging unit **34**, which is disposed in the exhaust passage **31** so as to sequentially perform dehumidification and heating of the air.

The exhaust passage **31** can include a first duct **311** connected to the exhaust port **126**, a second duct **312** connected to the supply passage **32**, and a third duct **313** connecting the first duct to the second duct **312**. The third duct **313** can be fixed to the base panel **17**.

The heat-exchanging unit **34** can be implemented as any device capable of sequentially performing dehumidification and heating of the air that is introduced into the exhaust passage **31**. FIG. **2** illustrates an example in which the heat-exchanging unit **34** is implemented as a heat pump. Specifically, the heat-exchanging unit **34** can include a first heat exchanger (a heat adsorption part) **341** configured to remove moisture from the air introduced into the exhaust passage **31**, a second heat exchanger (a heat radiation part) **343** configured to heat the air that has passed through the heat adsorption part **341**, and a fan **349** configured to cause the air discharged from the drum **2** to sequentially pass through the heat adsorption part and the heat radiation part and then to be transferred to the supply passage **32**.

The heat adsorption part **341** and the heat radiation part **342** can be sequentially disposed in the direction in which air currents, and can be connected to each other via a refrigerant pipe **348** constituting a refrigerant circulation passage. Refrigerant can be transferred along the refrigerant pipe **348** by means of a compressor **345**, which is positioned outside the exhaust passage **31**, and the refrigerant pipe **348** can be provided with a pressure regulator **347** configured to regulate the pressure of the refrigerant.

As illustrated in FIG. **3**, an air introduction hole **233** formed in the rear cover **23** of the drum **2** can be implemented as a plurality of holes which are arranged so as to surround the center of the rear cover **23** (i.e., the rotational center of the drum **2**). Here, the supply passage **32** can include a supply duct **321**, which is provided at the fixed panel **151** so as to define a transfer path for the air discharged from the second duct **312**, and a first passage-defining portion **323** and a second passage-defining portion **324**, which serve to guide the air in the supply duct **321** toward the air introduction hole **233**.

The supply duct **321** can be formed in such a manner that the fixed panel **151** is bent in a direction away from the rear cover **23** so as to define a passage (an air transfer passage). Furthermore, the supply duct **321** can be configured so as to have a ring form surrounding the motor-mounting recess **152**, and the second duct **312** can be connected to the circumferential surface of the supply duct **321**.

The first passage-defining portion **323** can be configured so as to surround the outer circumferential surface of the ring constituted by the air introduction hole **233**, and the second passage-defining portion **324** can be configured so as to surround the inner circumferential surface of the ring constituted by the air introduction hole **233**.

The first passage-defining portion **323** and the second passage-defining portion **324** can be fixed to the rear cover **23**, and can also be fixed to the supply duct **321**. FIG. **3** illustrates an example in which the first and second passage-defining portions **323** and **324** are fixed to the rear cover **23**. In FIG. **3**, the free end of the first passage-defining portion **323** can surround the outer circumferential surface of the passage (the ring-shaped passage) defined by the supply duct **321**, and the free end of the second passage-defining portion **324** can surround the inner circumferential surface of the passage defined by the supply duct **321**. The first passage-defining portion **323** and the second passage-defining portion **324** can be made of rubber or felt.

The motor **5**, configured to rotate the drum **2** can include a stator **51**, which is positioned in the motor-mounting recess **152** so as to generate a rotating field, and a rotor **52**, which is rotated due to rotation of the rotating field. The rotational movement of the rotor **52** is transmitted to the drum **2** via a power transmission unit **6** fixed to the fixed panel **151**, and the stator **51** can be fixed to one of the fixed panel **151** and the power transmission unit **6**. When the stator **51** is fixed to the power transmission unit **6**, there is an advantage in maintenance of coaxiality between a rotor shaft **64** and a drum shaft **65**, which are provided at the power transmission unit **6** (it is possible to minimize vibration of the laundry treatment apparatus and deterioration of the durability of the power transmission unit **6**).

In order to prevent the motor **5** provided in the motor-mounting recess **512** from being exposed to the outside (to thus improve the durability of the motor and to prevent the occurrence of an accident), the fixed panel **151** can be further provided with a cover panel **19** configured to prevent the motor **5** from being exposed to the outside. In addition, the cover panel **19** can be configured to have a shape capable of preventing the supply duct **321** from being exposed to the outside (a shape surrounding the supply duct **321**). The reason for this is not only to minimize leakage of heat to the outside of the supply duct **321** but also to prevent an accident that can occur when a human body comes into contact with the supply duct **321**.

The laundry treatment apparatus **100** can include a drive unit **10** configured to rotate the drum **20**. The drive unit **10** can include the motor **5** configured to generate rotational force, and the power transmission unit **6** configured to transmit the rotational force to the drum **2**. In other words, the rotor shaft **64** of the motor **5**, which is rotated due to the rotation of the rotating field, can be connected to the power transmission unit **6** rather being directly connected to the drum **2**, as illustrated in FIG. **3**. The power transmission unit **6** can be connected to the drum **2** via the additional drum shaft **65**. The reason for this is to lower the rotational speed of the motor **5** via the power transmission unit **6** and to increase the torque of the motor **5**.

Specifically, the drive unit **10** can include the stator **51**, configured to generate a rotating field, and the power transmission unit **6** composed of the motor **5** including the rotor, which is rotated due to the rotation of the rotating field, the rotor shaft **64**, which is positioned between the rear cover **23** and the motor **5** and which is fixed at one end thereof to the rotor **52** so as to be rotated therewith, the drum shaft **65**, which is coupled at one end thereof to a shaft bracket **27** so as to rotate the drum **2**, and a gear unit G configured to transmit the rotational movement of the rotor shaft **64** to the drum shaft **65**.

FIGS. **4** and **5** illustrate an example of the power transmission unit **6**. The power transmission unit **6** can include a housing H (see FIG. **5**) fixed to the fixed panel **151**, the rotor shaft **64** rotatably fixed to the bottom surface of the housing H (the surface of the housing H that faces the rotor), the drum shaft **65** rotatably fixed to the upper surface of the housing H (the surface of the housing H that faces the fixed panel), and the gear unit G (see FIG. **5**), which is provided in the housing H so as to transmit the rotational movement of the rotor shaft **64** to the drum shaft **65**. The rotor shaft **64** can be implemented as a shaft, which is fixed at one end thereof to the rotor **52** and is positioned at the other end thereof in the housing H, and the drum shaft **65** can be implemented as a shaft, which is fixed at one end thereof to the rear cover **23** and is positioned at the other end thereof in the housing H.

The housing H can be fixed to the fixed panel **151**, and can be positioned in a space (the external space of the cabinet) isolated from the space in which the drum **2** is disposed. The reason for this is to improve the durability of the power transmission unit **6** by minimizing transmission of the heat in the cabinet (the heat generated from the drum or the drying unit) to the inside of the housing H.

The rotor shaft **64** can be coupled to the rotor **52** via the shaft coupler **54** shown in FIG. **3**. The shaft coupler **54** can include a disc-shaped coupling body and a shaft-coupling hole, which is formed through the coupling body and is coupled to one end of the rotor shaft **64**.

The drum shaft **65** can be inserted into the fixed panel through-hole **153**, and can be coupled to the drum **2**. The rear cover **23** can be provided with the shaft bracket **27** (see FIG. **3**) to which the drum shaft **65** is fixed. The reason for this is to distribute the stress applied to the center of the rear cover **23** during rotation of the drum shaft **65**.

In order to prevent drooping of the housing H and to minimize deformation of the motor-mounting recess **152**, the housing H can be fixed to the fixed panel **151** via a transmitting bracket **61** and a housing coupler **612**.

As illustrated in FIG. **3**, the transmitting bracket **61** can have a bracket through-hole **611** through which the drum shaft **65** extends, and the housing coupler **612** can be implemented as a bolt connecting the housing H to the transmitting bracket **61**. The transmitting bracket **61** can be made of the same material as the fixed panel **151**, and can be made of a material having a strength higher than that of the fixed panel **151**.

In some examples, as shown in FIG. **3**, the transmitting bracket **61** can be fixed to the surface of the fixed panel **151** that faces the rear cover **23**. In some examples, the transmitting bracket **61** can be fixed to the surface of the fixed panel **151** that faces the cover panel **19**.

As illustrated in FIG. **5**, the housing H can include a housing body **62**, which is configured to have a hollow cylindrical form with an opening hole formed in the surface thereof that faces the fixed panel **151**, and a housing cover **63**, which is fixed to the housing body **62** and closes the opening hole.

The housing body **62** can have a reception space **622** in which the gear unit G is mounted. The reception space **622** can communicate with the outside via the opening hole. The reception space **622** can include a housing base **621***a* to which the rotor shaft **64** is fixed, and a housing circumferential wall **621***b*, which extends toward the housing cover **63** from the periphery of the housing base **621***a*.

As illustrated in FIG. **5**, the housing body **62** can include a rotor shaft support **625**, which extends toward the rotor **52** from the housing base **621***a*. The rotor shaft support **625** can be implemented as a pipe surrounding a rotor shaft through-hole **626** formed through the housing body **62**. In other words, the rotor shaft through-hole **626** can be formed through the rotor shaft support **625** so as to communicate with the reception space **622**.

The rotor shaft **64**, which is inserted into the rotor shaft through-hole **626**, can be rotatably supported by the rotor shaft support **625** via rotor shaft bearings **628** and **629**. The rotor shaft bearings can include a first rotor shaft bearing **628** and a second rotor shaft bearing **629**, which is fixed in the rotor shaft through-hole **626** so as to be positioned between the first rotor shaft bearing **628** and the rotor **52**.

The free end of the rotor shaft support **625** can be inserted into a coupling body bent portion **542** formed at the shaft coupler **54**. The length of the rotor shaft support **625** must be increased in order to hold the two rotor shaft bearings **628** and **629**. Accordingly, when the free end of the rotor shaft support **625** is inserted into the coupling body bent portion **542**, there is an effect of minimizing the amount of space to mount the motor **5** and the power transmission unit **6** (the volume of the laundry treatment apparatus).

The housing cover **63** can be configured to have any form capable of opening and closing the opening hole formed in the housing body **62**. FIG. **5** illustrates an example in which the housing cover **63** includes a disc-shaped cover body **631**. The housing cover **63** can be fixed to the housing body **62** via a cover-fixing plate **623** provided on the housing circumferential wall **621***b*.

The housing cover **63** can include a drum shaft support **635**, which extends toward the fixed panel **151** from the cover body **631**, a drum shaft through-hole **632**, which is formed through the drum shaft support **635** and into which the drum shaft **65** is inserted, and drum shaft bearings **638** and **639**, which are provided at the drum shaft support **635** so as to rotatably hold the drum shaft **65** in the drum shaft through-hole **632**.

The housing cover **63** can include a mounting portion **637**, which is provided at the cover body **631** and to which the stator **51** is fixed. The mounting portion **637** can be configured to have any form capable of being coupled to a stator coupler (for example, a bolt or the like). For example, the drawing illustrates an example in which the mounting portion **637** is configured to have a hollow cylindrical form.

The mounting portion **637** can include a plurality of mounting portions, which are arranged along the circumferential surface of the cover body **631**, and the stator bracket **515** can include the same number of stator brackets as the mounting portion **637**.

When the mounting portion **637** is configured to have a cylindrical form that projects toward the rotor **52** from the cover body **631**, the cover-fixing plate **623** can have a fixing plate through-hole **624** into which the mounting portion **637** is inserted. The reason for this is to minimize the outside diameter of the cover-fixing plate **623** (i.e., to minimize the amount of space to mount the housing).

In order to increase the strength of the housing cover **63**, the cover body **631** can include a bent portion **634**, which is formed by a region including the drum shaft through-hole **632** projecting toward the fixed panel **151**.

The drum shaft bearings can include a first drum shaft bearing **638** and a second drum shaft bearing **639**, which are fixed to the drum shaft support **635** and are positioned in the drum shaft through-hole **632**. In order to prevent external air from being supplied to the drum shaft bearings **638** and **639**, the housing cover **63** can further include a seal **633**, which is fixed to the drum shaft support **635** so as to close the drum shaft through-hole **632**.

The housing H can be fixed to the fixed panel **151** via the housing coupler **612**, and the stator **51** can be fixed to the housing H by inserting the stator coupler into a coupler through-hole **516** and fixing the same to the mounting portion **637**. The rotor **52** can be fixed to the housing H via the rotor shaft **64**. In other words, because the stator **51** and the rotor **52** are fixed to the housing H (i.e., because the stator **51** and the rotor **52** vibrate together with the housing H), it is possible to minimize deterioration of coaxiality between the rotor shaft and the drum shaft **65**. The gear unit G can include a ring gear **66**, which is fixed to the housing circumferential wall **621***b* and is positioned in the reception space **622**, a drive gear **69**, which is fixed to the rotor shaft **64** and is positioned in the reception space **622**, a cage **67**, which is positioned in the reception space and to which the other end of the drum shaft **65** is fixed, and a driven gear **98**, which is rotatably fixed to the cage **67** so as to connect the drive gear **69** to the ring gear **66**. As illustrated in FIG. **6**, in order to minimize the risk of separation of the rotor shaft bearings **628** and **629** or the rotor shaft support **625** due to application of external force to the rotor shaft **64**, the laundry treatment apparatus **100** can include a damper **9**.

The damper **9** can be provided in the rotor shaft through-hole **626** so as to be positioned between the first rotor shaft bearing **628** and the second rotor shaft bearing **629**, in order to attenuate vibrations of the first rotor shaft bearing **628** transmitted to the second rotor shaft bearing **629**.

The damper **9** can be implemented as an elastic body (for example, rubber or the like), which is fixed to the circumferential surface of the rotor shaft **64** and is positioned between the first rotor shaft bearing **628** and the second rotor shaft bearing **629**. As illustrated in FIG. **5**, the damper **9** can include a damping body **91** having a diameter larger than the diameter of the rotor shaft **64** but smaller than the diameter of the rotor shaft through-hole **626** (i.e., a damping body having a diameter smaller than the outside diameter of the rotor shaft bearing), and a damping body through-hole **92**, which is formed through the damping body **91** and into which the rotor shaft **64** is inserted.

As illustrated in FIG. **6**, in order to minimize vibration of the housing H, one end of the damping body **91** can be in contact with the first rotor shaft bearing **628**, and the other end of the damping body **91** can be in contact with the second rotor shaft bearing **629**.

The rotor shaft support **625** can further include a stopper (first stopper) **627**, which projects from the center of the rotor shaft through-hole **626** and is positioned between the first rotor shaft bearing **628** and the second rotor shaft bearing **629**. The first stopper **627** can serve as means for limiting the range within which the first rotor shaft bearing **628** moves toward the second rotor shaft bearing **629** or the range within which the second rotor shaft bearing **629** moves toward the first rotor shaft bearing **628**.

Because the damping body **91** is coupled to the circumferential surface of the rotor shaft **64** (because the damping body **91** is rotated together with the rotor shaft **64**), the radius of the damping body **91** (the outside radius of the damper) can be set to be less than the distance between the center of the rotor shaft through-hole **626** and the first stopper **627**.

In order to minimize the risk of the drum shaft bearings **638** and **639** being separated from the housing H due to application of external force to the drum shaft **65**, the drum shaft support **635** can include a stopper (a second stopper) **635***c* for limiting the range within which the first drum shaft bearing **638** and the second drum shaft bearing **639** move.

In order to minimize the amount of heat that is transmitted to the inside of the housing H and to radiate heat of the housing H to the outside, the laundry treatment apparatus can further include a radiating unit **8**. As illustrated in FIG. **5**, the radiating unit **8** can include at least one of a first radiator **81**, which is disposed at the coupling body **541** so as to discharge the air between the housing body **62** and the rotor **52** to the outside of the rotor **52**, or a second radiator **82**, which is disposed on the housing circumferential wall **621***b* of the housing body **62** so as to radiate the heat in the reception space **622** to the outside of the reception space **622**.

The first radiator **81** can be implemented as a blade projecting toward the housing base **621***a* from the coupling body **541**. Because the coupling body **541** and the first radiator **81** are rotated when the rotor **52** rotates, the air between the rotor **52** and the housing body **62** is discharged to the outside of the rotor **52** through the rotor through-hole **531** while the temperature of the housing H is lowered.

In some examples, as illustrated in FIG. **5**, the first radiator **81** can include a plurality of blades, which are radially arranged about a shaft-coupling hole **543**. In some examples, the first radiator **8** can include a single blade provided at the coupling body **541**.

When the coupling body **541** includes the coupling body bent portion **542**, the first radiator **81** can be implemented as a blade, which extends to the periphery of the coupling body **541** from the coupling body bent portion **542**. Consequently, because the height of the blade (the length of the blade in a direction toward the housing body from the coupling body) increases, there is an effect of increasing the amount of air that is discharged.

The second radiator **82** can be implemented as at least one of a housing projection projecting from the housing circumferential wall **621***b* (for example, a cooling fin or the like) or a housing bent portion, which is bent toward the reception space **622** from the housing circumferential wall **621***b* (for example, a bent groove or the like). Because the second radiator **82** increases the surface area of the housing circumferential wall **621***b*, it is possible to enable the housing body **62** to easily exchange heat with external air.

FIG. **7**A illustrates an example of the drum **2** provided in the laundry treatment apparatus **100**. Referring to FIG. **7**A,

the drum **2** can include the cylindrical drum body **21** and the rear cover **23** defining the rear surface of the drum body **21**. The drum body **21** can include the lifter **24**. The lifter **24** can be implemented as a board, which extends toward the rear cover **23** from the front cover **22** and projects toward the rotational center of the drum **2** from the drum body **21** (i.e., which projects toward the rotational center from the circumferential surface of the drum **2**).

In some implementations, the inner circumferential surface of the drum body **21** can be embossed. Specifically, the inner circumferential surface of the drum body **21** can have curved recesses, which are depressed toward the outer circumferential surface of the drum body **21** and are repeatedly arranged at regular intervals. The depressed recesses can include first-type recesses each having a larger radius and second-type recesses each having a smaller radius. Each of the second-type recesses can be positioned between adjacent first-type recesses.

In some examples, the lifter **24** can have the form of a flat plate. In some examples, the lifter **24** can have the form of a curved plate having a corrugated surface. Specifically, the lifter **24** can be curved so as to become concave moving toward the rear end from the front end of the drum **2** and then to become convex from an inflection point. The reason for this is to move laundry rearwards rather than forwards in order to efficiently dry the laundry using hot air introduced from the air introduction hole **233** in the rear cover **23**.

The lifter **24** can include at least one lifter provided on the inner circumferential surface of the drum body **21**.

The air introduction hole **233**, which is provided at the rear cover **23** of the drum **2**, can be implemented as a plurality of holes, which are arranged so as to surround the center of the rear cover **23** (i.e., the rotational center of the drum **2**). As described above, the supply passage **32** can include the supply duct **321**, which is provided at the fixed panel **151** so as to define the transfer passage for the air discharged from the second duct **312**, and the first passage-defining portion **323** and the second passage-defining portion **324**, which are configured to guide the air in the supply duct **321** to the air introduction hole **233**.

The drum **2** can include a protective cover **25** configured to prevent the shaft bracket **27** and the drum shaft **65** from being exposed to a laundry reception space from the center of the rear cover **23**.

FIG. **7**B illustrates a portion of the shaft bracket **27**, the drum shaft **65**, a rotating-shaft-coupling member **26**, and a bracket-coupling member **225**, which are exposed when the protective cover **25** is removed.

The laundry treatment apparatus can include the drum **2**, which includes the cylindrical drum body **21** and the rear cover **23** defining the rear surface of the drum body **21** and receives laundry therein, the drive unit **10** including the drum shaft configured to rotate the drum **2**, a rear cover through-hole **231** formed through the rear cover **23** in the axial direction of the drum shaft **65**, the shaft bracket **27** coupled to the drum shaft **65** so as to close the rear cover through-hole **231**, and the protective cover **25**, which is positioned at the rear cover **23** so as to prevent the shaft bracket **27** and the drum shaft **65** from coming into contact with the laundry.

Accordingly, when the protective cover **25** is removed, the shaft bracket **27** and the drum shaft **65** can be exposed. In some examples, the shaft bracket **27** and the drum shaft **65** can be made of metal. In some cases, scratches and the like can be formed due to accessories or a zipper attached to laundry, and rust may be generated due to wet laundry. In order to prevent these problems, the protective cover **25** can be provided. The protective cover **25** can be made of plastic. The protective cover **25** can be configured to have the form of a dome in order to shield the shaft bracket **27** and the drum shaft **65**. Specifically, the protective cover **25** can be depressed in an axial direction away from the rear cover **23**. Consequently, the rear surface of the protective cover **25**, that is, a protective cover rear surface **259** can cover a predetermined region around the center of the through-hole **231**. The predetermined region, which is covered by the protective cover **25**, can be the region of the rear cover **23** including the rear cover through-hole **231**, which is shielded by the protective cover **25** and is thus not exposed to the outside.

FIG. **7**A illustrates an example in which the predetermined region, which is covered by the protective cover **25**, includes the bracket-coupling member **225** configured to couple the shaft bracket **27** to the rear cover **23**. Unlike this, the protective cover **25** can expose the bracket-coupling member **225** and can shield the rear cover through-hole **231** and only a portion of the region around the rear cover through-hole **231**, as illustrated in FIG. **9**.

FIG. **8**A illustrates an example of the rear cover **23**. The rear cover **23** can include the rear cover through-hole **231** (see FIG. **9**) formed in the center thereof, in which the shaft bracket **27** and the drum shaft **65** are inserted and coupled. The rear cover through-hole **231** can be formed through the rear cover **23** in the axial direction of the drum shaft **65**. The drum shaft **65** must be connected to the drum **2** for rotation of the drum **2**. Accordingly, the drum shaft **65** can be coupled to the shaft bracket **27** provided in the center of the rear cover **23**, and the shaft bracket **27** can be fixed to the rear cover **23**, thereby closing the rear cover through-hole **231**.

Referring to FIGS. **8**A and **9**, the protective cover **25** can be fixed to the drum shaft **65**. The protective cover **25** can include a cover-coupling hole **251**, which is formed through the center of the protective cover **25** in the axial direction. By virtue of the cover-coupling hole **251**, the protective cover **25** and the drum shaft **65** can be coupled to each other by means of a protective-cover-fastening member **255**.

The protective-cover-fastening member **255** can be a fastening member such as a screw. The portion of the protective cover **25** around the cover-coupling hole **251** can be depressed so as to correspond to the size of the protective-cover-fastening member **255** such that the head portion of the protective-cover-fastening member **255**, that is, the head of the screw does not project from the protective cover **25**. The reason for this is to prevent damage to laundry caused by the projecting head portion.

The thread of the protective-cover-fastening member **255** can be formed in a direction such that the drum shaft **65** and the protective cover **25** are more tightly fastened to each other when the protective-cover-fastening member **255** rotates in the same direction as the drum **2**. The reason for this is to prevent the protective-cover-fastening member **255** from being loosened and separated from the drum shaft and to thus prevent the rear cover **23** from being separated from the protective cover **25** during rotation of the drum **2**.

The drum shaft **65** is coupled to the rear cover **23** via the shaft bracket **27**, and the rear cover **23** is coupled to the drum shaft **65**. Accordingly, because the rear cover **23** and the protective cover **25** rotate at the same speed when the drum shaft **65** rotates, there is no slippage or friction due to the speed difference between the rear cover **23** and the protective cover **25**.

Referring to FIG. **11**A, the rear cover **23** can include the rear cover through-hole **231**, which is formed in the center

thereof and into which the shaft bracket **27** is inserted, a plurality of shaft-bracket-coupling holes **232** arranged around the rear cover through-hole **231** at regular intervals, and a shaft bracket coupler **235**, which includes the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232** and bulges forwards to form a region to which the protective cover **25** is coupled.

The shaft bracket coupler **235** can project in the forward direction of the drum **2** further than the air introduction hole **233**. The reason for this is to reduce the volume occupied by the drive unit **10** when the drive unit **10** is positioned behind the drum **2**. Specifically, the drive unit, particularly, the drum shaft **65** of the power transmission unit can project forwards, and the projecting portion can be received in a drum shaft reception space **279**, which is defined by the depressed portion of the shaft bracket coupler **235**. Because the drum shaft **65** and the shaft bracket **27** are received in a rear surface recess **2311** (see FIG. **11**B) formed in a rear coupling surface **2352** that is the rear surface of the rear cover **23**, it is possible to reduce the overall size of the structure for coupling the drum **2** to the drive unit **10**.

The rear cover **23** can include a plurality of rear-cover-reinforcing ribs **237**, which extend radially from the shaft bracket coupler **235** like spokes and are connected to the periphery of the rear cover **23**. The plurality of rear-cover-reinforcing ribs **237** are intended to increase the strength of the rear cover **23**. A plurality of air introduction holes **233** can be formed through the rear cover **23** between respective ones of the plurality of rear-cover-reinforcing ribs **237**.

FIG. **10**A illustrates an example of the shaft bracket **27**, which is fixed to the rear cover **23** so as to close the rear cover through-hole **231**. The shaft bracket **27** can be inserted into the rear cover through-hole **231**, and can have a shaft-coupling hole **271**, which is formed through the shaft bracket **27** so as to allow the drum shaft **65** to project into the drum **2**. The shaft bracket **27** can be configured to project toward the rear cover **23**. The shaft-coupling hole **271** can be positioned at the projecting portion of the shaft bracket **27**.

FIG. **8**B illustrates a cross-section of an assembly in which the rear cover **23**, the shaft bracket **27**, the drum shaft **65**, and the protective cover **25** are coupled to one another. The drum shaft **65** can be coupled into the shaft-coupling hole **271**. The drum shaft **65** can include a drum shaft flange **655** (see FIG. **9**), which extends radially from the outer circumferential surface of the drum shaft **65**, in order to prevent the drum shaft **65** from being inserted into the shaft-coupling hole **271** beyond a predetermined point when the drum shaft **65** is inserted into the shaft-coupling hole **271** beyond a predetermined distance. In other words, the drum shaft flange **655** can serve as a guide for assembly when the drum shaft **65** is inserted into the shaft bracket **27**.

The shaft bracket **27** can be fixed to the rear cover **23**. The shaft bracket **27** can be fixed to the shaft bracket coupler **235**. As described above, in the case in which the shaft bracket is configured so as to project in the forward direction of the rear cover **23**, the portion of the shaft bracket **27** that includes the shaft-coupling hole **271** can be inserted into the rear cover through-hole **231** and can project into the drum **2** when the shaft bracket **27** is fixed to the rear cover **23**.

Accordingly, when the drum shaft **65** is coupled to the shaft bracket **27**, a predetermined portion of the drum shaft **65** can project into the drum **2**.

FIG. **8**C illustrates a cross-section of a structure in which the drum shaft **65** of the power transmission unit **6** is inserted into the shaft-coupling hole **271** and projects therefrom and the shaft bracket **27** is inserted into the rear cover through-hole **231** and projects therefrom.

The protective cover **25** can have the cover-coupling hole **251**, which is formed through the center thereof in the axial direction. The drum shaft **65** can have a cover-positioning hole **653** formed axially in the end of the drum shaft **65** that is inserted into the drum **2** so as to correspond to the cover-coupling hole **251**. The protective-cover-fastening member **255** can be threaded into the cover-positioning hole **653** through the cover-coupling hole **251** so as to fix the protective cover **25** to the drum shaft **65**.

The protective cover **25** can be connected to the drum shaft **65** in any manner other than the threading manner, as long as the protective cover **25** is capable of being coupled to the drum shaft **65** and rotated therewith. Because the reason why the protective cover **25** is coupled to the drum shaft **65** is to enable the protective cover **25** to rotate at the same speed as the drum **2**, the protective cover **25** can also be coupled to the rear cover **23** rather than the drum shaft **65**.

Referring to FIG. **8**B, the outside diameter C**1** of the protective cover **25** can be larger than the inside diameter C**2** of the rear cover through-hole **231**. Because the protective cover **25** is intended to prevent at least the shaft bracket **27** and the drum shaft **65** from being exposed, the protective cover **25** must have a size sufficient to cover the rear cover through-hole **231**.

As described above, the rear cover **23** can have a plurality of shaft-bracket-coupling holes **232**, which is formed around the rear cover through-hole **231** for coupling to the shaft bracket **27**.

FIG. **8**B illustrates an example in which the plurality of shaft-bracket-coupling holes **232** is an even number of shaft-bracket-coupling holes and each pair of shaft-bracket-coupling holes that diametrically face each other maintain the maximum distance D**2** therebetween. Because the multiple shaft-bracket-coupling holes **232** are arranged on a concentric circle about the rear cover through-hole **231**, the minimum distance D**1** and the maximum distance D**2** can be obtained based on the distance between each pair of shaft-bracket-coupling holes **232** that are diametrically opposed to each other in consideration of the diameter of the shaft-bracket-coupling holes **232**.

Because half of the outside diameter C**2** of the protective cover **25** is larger than the maximum distance among the distances between the center of the rear cover **23** and the plurality of shaft-bracket-coupling holes **232** (half of D**2**) even when the number of the shaft-bracket-coupling holes **232** is an odd number, it is possible to prevent the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232** from being exposed.

Referring to FIG. **8**B, the shaft bracket coupler **235** is depressed or elevated in the forward direction of the drum **2** from the rear surface of the rear cover **23** (the rightmost surface in FIG. **8**B) by a first predetermined distance R**1**. When the shaft bracket **27** is coupled to the region of the rear cover **23** around the rear cover through-hole **231**, the shaft bracket **27** can project into the drum **2** from the rear surface of the rear cover **23** by a second predetermined distance R**2**. Accordingly, because the shaft bracket coupler **235** is elevated by the first distance R**1**, the shaft bracket **27** can project into the drum **2** by the difference between the second distance R**2** and the first distance R**1** (R**2**−R**1**).

In other words, the shaft bracket **27** can have the shaft-coupling hole **271**, which is formed therethrough in the axial direction, and the drum shaft **65** can be coupled to the shaft bracket **27** through the shaft-coupling hole **271** and can be inserted into the drum **2**.

Referring to FIG. **8**C, the protective cover **25** can include a rear cover rear surface **259**, which faces the rear cover **23**,

and at least one cover hook **2591**, which projects in the axial direction from the protective cover rear surface **259** and is inserted into the inner circumferential surface of the rear cover through-hole **231** so as to be coupled thereto in a hooking manner. The cover hook **2591** can prevent the protective cover **25** from being separated from the rear cover through-hole **231**, and can be in close contact with the rear cover **23**. Consequently, it is possible to prevent laundry from being jammed between the rear cover **23** and the cover hook **2591**.

The protective cover **25** can further include a cover-reinforcing rib **252**, which is positioned on the protective cover rear surface **259** so as to radially surround the cover hook **2591** and to support the protective cover **25**. Because the protective cover **25** is configured to have a dome form, which is depressed in a particular direction, the protective cover **25** can have reduced strength. In order to compensate for the reduction in strength, the protective cover **25** can include the cover-reinforcing rib **252**. In order to prevent the cover-reinforcing rib **252** from being exposed to the outside, the cover-reinforcing rib **252** can be provided at the protective cover rear surface **259**.

The cover-reinforcing rib **252** can include a plurality of cover-reinforcing ribs, which are concentrically arranged about the cover-coupling hole **251**.

FIG. **9** is an exploded view illustrating main components assembled with the rear cover.

The protective cover **25** can have the cover-coupling hole **251**, which is formed through the center thereof in the axial direction. The drum shaft **65** can have the cover-positioning hole **653**, which is formed in the axial direction in the end thereof that is inserted into the drum **2** so as to correspond to the cover-coupling hole **251**. The protective cover fastening member **255** can be threaded in the cover-positioning hole **653** through the cover-coupling hole **251**.

As described above, when the shaft bracket **27** is coupled to the rear cover **23**, a portion of the shaft bracket **27** can be inserted into the drum **2** through the rear cover through-hole **231**. In other words, the drum shaft **65** can be inserted into the shaft-coupling hole **271**, can be coupled to the shaft bracket **27**, and can project into the drum **2**.

The drum shaft **65** can include the drum shaft flange **655**, which extends radially from the outer circumferential surface of the drum shaft **65**, a drum shaft insertion portion **651** including a drum shaft thread **6511**, which is formed in the outer circumferential surface thereof between the end of the drum shaft **65** that is inserted into the shaft-coupling hole **271** and the drum shaft flange **655**, and a drum shaft transmission portion **657** coupled to the shaft bracket **27** between the drum shaft thread **6511** and the drum shaft flange **655**. When the drum shaft **65** is coupled to the shaft bracket **27** and the rear cover **23**, the drum shaft insertion portion **651** can be inserted into the shaft-coupling hole **271**, and can project into the drum **2**.

When the drum shaft **65** is coupled to the shaft-coupling hole **271**, the drum shaft flange **655** can come into contact with the rear surface of the shaft bracket **27**, thereby preventing the drum shaft **65** from being further inserted.

Because the outside diameter of the shaft bracket **27** is larger than the inside diameter of the rear cover through-hole **231**, the shaft bracket **27** can be fixed to the rear surface of the rear cover **23** while closing the rear cover through-hole **231**.

The radius of the shaft-coupling hole **271** can be smaller than the radius of the drum shaft flange **655** but can be equal to or larger than the radius of the drum shaft insertion portion **651**. Therefore, the drum shaft insertion portion **651** can freely pass through the shaft-coupling hole **271** but may not pass through the drum shaft flange **655**. The shaft bracket coupler **235** can be configured to have a shape corresponding to the shape of the shaft-coupling hole **271**. Accordingly, when the inner circumferential surface of the shaft-coupling hole **271** has, for example, a serrated shape, the outer circumferential surface of the shaft bracket coupler **235** can be provided with a serrated shape corresponding to the serrated shape of the shaft-coupling hole **271** so as to be engaged therewith.

The reason for this is because the drum shaft insertion portion **651** must be coupled to the shaft-coupling hole **271** so as to transmit the rotational force of the drum shaft **65** to the shaft bracket **27**. Accordingly, in order to transmit the rotational force without slipping therebetween, the corresponding surfaces between the drum shaft insertion portion **651** and the shaft-coupling hole **271** can have corresponding toothed or serrated forms.

The outer circumferential surface of the drum shaft insertion portion **651** can be provided with the drum shaft thread **6511**. The reason for this is to couple the shaft bracket **27** to the drum shaft **65** via a coupling nut or a rotating-shaft-coupling member **26** when the drum shaft insertion portion **651** is inserted into the shaft-coupling hole **271** and projects into the drum **2**. For example, the rotating-shaft-coupling member **26** can have a cylindrical shape and protrude from a front surface of the shaft bracket **27** toward the drum. The rotating-shaft-coupling member **26** defines an inner thread at an inner circumferential surface thereof, and an end portion of the drum shaft **65** has an outer thread coupled to the inner thread.

The rotating-shaft-coupling member **26** can also be received in the protective cover **25** so as not be exposed by virtue of the depressed shape of the protective cover **25**.

The protective cover **25** can have the cover-coupling hole **251** formed through the center thereof. The drum shaft **65** can have the cover-positioning hole **653**, which is formed in the axial direction in the end of the drum shaft **65** that is inserted into the drum **2** so as to correspond to the cover-coupling hole **251**. Accordingly, the protective cover **25** can be fixed to the drum shaft **65** through the cover-coupling hole **251** and the cover-positioning hole **653**.

The protective cover **25** can be coupled to the drum shaft **65** in any manner other than in the screwing manner as long as the protective cover **25** is capable of being coupled to the drum shaft **65** and rotated therewith. Because why the protective cover **25** is coupled to the drum shaft **65** is to cause the protective cover **25** to be rotated at the same speed as the drum **2**, the protective cover **25** can be coupled to the rear cover **23** rather than the drum shaft **65**.

When the drum shaft insertion portion **651** is coupled to the shaft-coupling hole **271**, a drum shaft washer **28** can further be interposed between the drum shaft flange **655** and the shaft bracket **27**. When the drum shaft washer **28** is fitted over the drum shaft **65** and the drum shaft insertion portion **651** is coupled to the shaft-coupling hole **271**, the drum shaft washer **28** can be positioned between the drum shaft flange **655** and the shaft bracket **27**. The drum shaft washer **28** can serve to reduce frictional force generated between the drum shaft flange **655** and the shaft bracket **27** when the drum shaft **65** is engaged with the shaft bracket **27** and rotated therewith.

FIGS. **10**A and **10**B illustrate an example of the shaft bracket **27** when viewed from the front and the rear. The shaft bracket **27** can include a shaft coupler **278**, which has the shaft-coupling hole **271**, in which the drum shaft **65** is coupled, and which defines the central portion of the shaft

bracket **27**, a shaft bracket flange **275**, which extends in a radially outward direction of the shaft coupler **278** and is fixed to the rear cover **23**, and a shaft bracket sloping portion **277** obliquely extending between the shaft coupler **278** and the shaft bracket flange **275** and connecting the shaft coupler **278** and the shaft bracket flange **275** to each other.

In other words, the shaft bracket **27** can include the ring-shaped shaft coupler **278** having the shaft-coupling hole **271**, the shaft bracket flange **275**, which is radially spaced apart from the shaft coupler **278** based on the shaft-coupling hole **271** and is fixed to the rear cover **23**, and the shaft bracket sloping portion **277**, which obliquely extends between the shaft coupler **278** and the shaft bracket flange **275** and connects them to each other.

The shaft coupler **278** can be configured to have a ring-shaped flat plate having the shaft-coupling hole **271** formed through the center thereof. The ring-shaped flat plate (or the ring flat plate) can serve as a stopper which catches on the drum shaft flange **655** when the drum shaft **65** is inserted into the shaft-coupling hole **271**.

The inner circumferential surface of the shaft-coupling hole **271** can have a serrated shape or a toothed shape. The outer circumferential surface of the drum shaft insertion portion **651** of the drum shaft **65** can also have a shape corresponding to the serrated or toothed shape of the shaft-coupling hole **271** such that the drum shaft **65** is engaged with the shaft-coupling hole **271** so as to transmit rotational force. The shaft coupler **278** including the shaft-coupling hole **271** can project in the forward direction of the drum **2** further than other portion of the shaft bracket **27**. Consequently, the shaft coupler **278** can be inserted into the rear cover through-hole **231**, and can be coupled to the drum shaft **65**, thereby reducing the size of the assembly of the drum **2** and the drive unit **10**.

When the shaft coupler **278** including the shaft-coupling hole **271** is positioned in the center of the shaft bracket **27**, the shaft bracket flange **275**, which is provided in a radial direction of the shaft-coupling hole **271**, can have a plurality of rear-cover-coupling hole **272** formed through the shaft bracket flange **275** for coupling to the rear cover **23**.

Referring to FIG. **9**, the rear cover **23** can have the plurality of shaft-bracket-coupling holes **232**, which are arranged around the rear cover through-hole **231** so as to respectively correspond to the plurality of rear-cover-coupling holes **272**. The rear cover **23** and the shaft bracket **27** can be coupled to each other by means of the bracket-coupling member **225** after the plurality of shaft-bracket-coupling holes **232** are respectively aligned with the plurality of rear-cover-coupling holes **272**.

The shaft bracket sloping portion **277** can include a first sloping portion **2771**, which radially and obliquely extends from the shaft coupler **278**, and a second sloping portion **2772**, which radially extends from the first sloping portion **2771** and is connected to the shaft bracket flange **275**.

Referring to FIG. **10**A, the first sloping portion **2771** can be inclined outwards moving in a direction away from the rear cover **23** in the axial direction. In other words, the first sloping portion **2771** can be configured so as to increase in cross-sectional area moving radially outwards from the shaft-coupling hole **671**. In other words, the first sloping portion **2771** can be configured to have a cone-shaped outer surface having a cross-sectional area, which increases moving radially from the shaft-coupling hole **671**. In some examples, the second sloping portion **2772** can be inclined in a direction opposite the direction in which the first sloping portion **2771** is inclined, and can connect the first sloping **2771** to the shaft bracket flange **275**.

The portion of the shaft bracket **27** at which the first sloping portion **2771** is connected to the second sloping portion **2772** can be positioned so as to be closer to the motor **5** than to the rear cover **23** based on the shaft bracket flange **275**. Accordingly, when the shaft bracket **27** is placed on the ground surface, the portion of the shaft bracket **27** at which the first sloping portion **2771** is connected to the second sloping portion **2772** can come into contact with the ground surface.

Referring to FIGS. **8**C and **10**B, the first cone-shaped sloping portion **2771**, which increases in cross-sectional area moving away from the shaft-coupling hole **271**, can define the drum shaft reception space **279** capable of accommodating the drum shaft **65** when viewed from the rear. The reason for this is to correspond to the contour of the power transmission unit **6** and to thus minimize the space occupied by the power transmission unit **6**. In other words, the drum shaft reception space **279** can accommodate the drum shaft **65** connected to the power transmission unit **6**, the housing cover **63**, and a portion of an insulator.

Because the portion of the shaft bracket **27** at which the first sloping portion **2771** is connected to the second sloping portion **2772** is positioned so as to be closer to the motor **5** than to the rear cover **23** based on the shaft bracket flange **275**, the first sloping portion **2771** and the second sloping portion **2772** can define a shaft bracket recess **276**. In other words, the shaft bracket recess **276** can be a depressed portion defined between the first sloping portion **2771** and the shaft bracket flange **275**.

Referring to FIG. **8**B, the distance B**2** between the cover hook **2591** and the shaft bracket recess **276** can be greater than the distance B**1** between the cover hook **2591** and the shaft bracket flange **275**.

The shaft bracket recess **276** is intended to accommodate the hook portion when the cover hook **2591** is engaged with the rear cover through-hole **231**. Specifically, the inner circumferential surface of the rear cover **23** may not be formed by merely forming a circular hole in the rear cover **23** by cutting the rear cover **23** but can be formed by forming a circular hole in the rear cover **23** by cutting the rear cover **23** and then bending a portion of the inner circumferential surface of the rear cover through-hole **231** that corresponds to the cover hook **2591** in a direction of the rear surface of the rear cover **23**. Accordingly, there is a need to design the shaft bracket **27** in consideration of the case in which the cover hook **2591** is engaged with the rear cover through-hole **231**. In some examples, the shaft bracket **27** can include the shaft bracket recess **276**.

Referring to FIG. **10**B, the plurality of rear-cover-coupling holes **272** can be depressed toward the rear surface of the shaft bracket **27**. The reason for this is to minimize projection of the head of the bracket-coupling member **225** from the shaft bracket **27** when the plurality of shaft-bracket-coupling holes **232** are aligned with the plurality of rear-cover-coupling holes **272** and are coupled thereto via the bracket-coupling member **225**. When the dome-shaped protective cover **25** is coupled to the rear cover **23**, the bracket-coupling member **225** will be positioned at the highest portion of the protective cover **25** rather than at the center of the protective cover **25**. The reason for this is because the height of the peripheral portion of the protective cover **25** is lower than the height of the central portion of the protective cover **25** and thus because the bracket-coupling member **225** can interfere with the protective cover **25** when the bracket-coupling member **225** excessively projects.

FIGS. **11**A and **11**B are views of the rear cover **23** when viewed from the front surface and the rear surface thereof.

Referring to FIG. **11**A, the rear cover **23** can include the rear cover through-hole **231** formed in the center thereof, through which the shaft bracket **27** is inserted, the plurality of shaft-bracket-coupling holes **232**, which are formed through the rear cover **23** and are arranged around the rear-cover-coupling hole **272** at regular intervals, and the shaft-bracket-coupling portion **235**, which has the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232** formed in the rear cover **23** and which is elevated in the forward direction of the drum **2** and is coupled to the protective cover **25**.

The shaft-bracket-coupling portion **235** can project in the forward direction of the drum **2** further than the portion in which the air introduction hole **233** is formed. The reason for this is to reduce the volume occupied by the drive unit when the drive unit **10** is positioned behind the drum **2**. In other words, the drum shaft **65** of the drive unit **10**, particularly, the power transmission unit **6** projects forwards. The projecting portion can be received in the drum shaft reception space defined by the depressed portion of the shaft-bracket-coupling portion **235**. Subsequently, the drum shaft **65** and the shaft bracket **27** can be received in the rear surface recess **2311** (see FIG. **11**B) formed in the rear coupling surface **2352**, which is the rear surface of the rear cover **23**, thereby reducing the size of the assembly of the drum **2** and the drive unit **10**.

The rear cover **23** can include the plurality of rear-cover-reinforcing ribs **237**, which extend radially from the shaft-bracket-coupling portion **235** like spokes and are connected to the periphery of the rear cover **23**. The rear-cover-reinforcing ribs **237** are intended to increase the strength of the rear cover **23**. The plurality of air introduction holes **233** can be formed through the rear cover **23** between the plurality of rear-cover-reinforcing ribs **237**.

As described above, the supply duct **321**, which is provided at the fixed panel **151** and defines the transfer passage for the air discharged from the second duct **312**, can guide the air in the supply duct **321** to the air introduction hole **233** through the first passage-defining portion **323** and the second passage-defining portion **324**.

The height of the plurality of the rear-cover-reinforcing ribs **237** can be equal to or greater than the height of a rear cover rim **2381** based on the height of the introduction plate **234**. The reason for this is because the rear cover rim **2381** can prevent laundry from being positioned close to the inner circumferential surface of the drum body when the height of the rear cover rim **2381** is greater than the height of the introduction plate **234**.

FIG. **11**A illustrates an example in which the height of the rear-cover-reinforcing ribs **237** is equal to the height of the rear cover rim **2381** based on the introduction plate **234**.

The length V**1** of the rear cover rim **2381** in the radial direction can be less than the length V**2** of the introduction plate **234** in the radial direction. The reason for this is to supply sufficient hot air to the inside of the drum **2**. Furthermore, the reason for this is because the rear cover rim **2381** is heated by the hot air, thereby causing damage to the laundry when the length of the rear cover rim **2381** is greater than the length V**2** of the introduction plate **234**.

The introduction plate **234** can be formed in the area defined by the rear cover rim **2381**, the rear cover central portion **236**, and the plurality of rear-cover-reinforcing ribs **237**. Consequently, it is possible to efficiently supply hot air to the inside of the drum **2** while reinforcing the rigidity of the rear cover **23**.

The height of the plurality of rear-cover-reinforcing ribs **237** can be less than the height of the rear cover central portion **236**. In other words, the height of the plurality of rear-cover-reinforcing ribs **237** can be equal to or less than the height of a central flat surface **2361** in which the rear cover through-hole **231** is positioned.

In order to prevent damage to laundry, the portions at which the plurality of rear-cover-reinforcing ribs **237** meet the introduction plate **234** can be rounded.

The shaft bracket **27** can be fixed to the shaft-bracket-coupling portion **235**. As described above, when the shaft bracket **27**, which projects toward the rear cover **23**, is fixed to the rear cover **23**, the portion of the shaft bracket **27** including the shaft-coupling hole **271** can be inserted into the rear cover through-hole **231** and can project into the drum **2**.

The protective cover **25** can be coupled to a coupling front surface, which defines the front surface of the shaft-bracket-coupling portion **235**. In other words, the protective cover **25** can be coupled to the rear cover central portion **236**.

The cover hook **2591** can be engaged with the rear cover through-hole **231**. Here, for engagement with the cover hook **2591**, the portion of the inner circumferential surface of the rear cover through-hole **231** that is engaged with the cover hook **2591**, can be bent toward the rear surface of the rear cover **23** such that the cover hook **2591** is engaged with the bent portion of the circumferential surface of the rear cover through-hole **231**. Accordingly, the shaft bracket **27**, which is coupled to the rear coupling surface **2352**, can include the shaft bracket recess **276**.

As described above, in order to minimize projection of the head of the bracket-coupling member **225** from the shaft bracket **27** when the plurality of shaft-bracket-coupling holes **232** and the plurality of rear-cover-coupling holes **272** are coupled to each other by means of the bracket-coupling member **225**, the plurality of shaft-bracket-coupling holes **232** can also depressed. Accordingly, the plurality of rear-cover-coupling holes **272** can also be depressed.

Referring to FIGS. **11**A and **11**B, introduction plate **234**, which are depressed toward the rear surface of the rear cover **23**, can be formed between the plurality of rear-cover-reinforcing ribs **237**. The plurality of air introduction holes **233** can be positioned at the introduction plate **234**. The reason for this is because the air introduction holes **233** can be blocked by laundry during rotation of the drum **2** when the air introduction holes **233** are positioned at same surface as the rear-cover-reinforcing ribs **237**. In addition, in order to swirl hot air introduced through the air introduction holes **233**, it is advantageous that the rear-cover-reinforcing ribs **237** and the air introduction holes **233** are formed in the same level rather than in different levels.

The rear coupling surface **2352**, which defines the rear surface of the shaft-bracket-coupling portion **235**, can be coupled to the shaft bracket **27**. Specifically, the shaft bracket flange **275** can be coupled to the rear coupling surface **2352**.

The rear cover **23** can include a rear cover side surface defining the side surface thereof. The reason for this is to facilitate coupling of the rear cover **23** to the drum body **21**.

Alternatively, the rear cover **23** can include the rear cover through-hole **231**, through the shaft bracket **27** and the drum shaft **65** are inserted, and the plurality of shaft-bracket-coupling holes **232** formed around the rear cover through-hole **231**. The shaft bracket **27** can include the plurality of rear-cover-coupling holes **272**, the number of which is the same as the number of shaft-bracket-coupling holes **232** so as to respectively correspond to the plurality of shaft-bracket-coupling holes **232**. After the shaft bracket **27** and the rear cover **23** can be positioned such that the plurality of

rear-cover-coupling holes **272** are aligned with the plurality of shaft-bracket-coupling holes **232**, the shaft bracket **27** and the rear cover **23** can be coupled to each other by means of the bracket-coupling member **225**. As a result, the shaft bracket **27** can be fixed to the rear cover **23**, and can close the rear cover through-hole **231**.

The protective cover **25** can be configured to have a dome form so as to shield the shaft bracket **27** and the drum shaft **65**. In other words, the protective cover **25** can be depressed in the axial direction away from the rear cover **23**. Accordingly, the rear surface of the protective cover **25**, that is, the protective cover rear surface **259** can cover a predetermined area defined about the center of the rear cover through-hole **231**.

The predetermined area of the rear cover through-hole **231**, which is covered by the protective cover **25**, means an area including the rear cover through-hole **231**, which is not exposed to the outside when the protective cover **25** covers the rear cover **23**.

Referring to FIG. **7**A, the predetermined area, which is covered by the protective cover **25**, can be a circular area including the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232**. Accordingly, FIG. **7**A illustrates an example where the protective cover **25** covers the shaft bracket **27**, the drum shaft **65**, and the bracket-coupling member **225**.

Unlike this, the periphery of the protective cover **25** is positioned between the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232** so as to prevent exposure of the rear cover through-hole **231** but to allow exposure of the plurality of shaft-bracket-coupling holes **232** to the outside.

The reason for this is because the plurality of the shaft-bracket-coupling holes **232** are aligned with the plurality of rear-cover-coupling holes **272** and are coupled thereto by means of bracket-coupling member **225** and thus the plurality of shaft-bracket-coupling holes **232** are closed by the bracket-coupling member **225**. Therefore, it is difficult for the moisture contained in laundry to have an influence on the drive unit through the plurality of shaft-bracket-coupling holes **232**. Consequently, although the protective cover **25** may not cover the plurality of shaft-bracket-coupling holes **232**, the main function of the protective cover **25** of preventing exposure of the drum shaft **65** and the shaft bracket **27** may not be deteriorated.

Accordingly, the periphery of the protective cover **25** can be positioned between the rear cover through-hole **231** and the plurality of shaft-bracket-coupling holes **232** so as to prevent exposure of the rear cover through-hole **231** but to allow exposure of the plurality of shaft-bracket-coupling holes **232** to the outside.

In other words, the radius of the protective cover **25**, which is the half of the outside diameter of the protective cover **25**, can be larger than the outside diameter of the rear cover through-hole **231** but can be smaller than the minimum distance between the center of the rear cover **23** and the plurality of shaft-bracket-coupling holes **232**.

In some implementations, in order to prevent laundry from being damaged by the projecting bracket-coupling member **225**, the bracket-coupling member **225** may not project from the rear cover **23** when the plurality of shaft-bracket-coupling holes **232** are coupled to the plurality of rear-cover-coupling holes **272**, which respectively correspond to the plurality of shaft-bracket-coupling holes **232**, by means of the bracket-coupling member **225**.

When the bracket-coupling member **225** is, for example, a screw, each of the plurality of shaft-bracket-coupling holes **232** and the plurality of rear-cover-coupling holes **272** corresponding to the shaft-bracket-coupling holes **232** can be depressed so as to correspond to the head of the screw such that the head of the screw is received in each of the plurality of shaft-bracket-coupling holes **232**.

In other words, the plurality of shaft-bracket-coupling holes **232** can be depressed toward the rear surface of the rear cover **23** so as to prevent the bracket-coupling member **225** from projecting from the rear cover **23**.

FIG. **11**C illustrates the difference G between the introduction plate **234** and the rear cover rim **2381** or the rear-cover-reinforcing ribs **237** and the difference K**1** between the rear-cover-reinforcing ribs **237** and the central flat surface **2361**.

The rear-cover-reinforcing ribs **237** can project toward the inside of the drum from the introduction plate **234**. The rear cover central portion **236** can be depressed inwards further than the rear-cover-reinforcing ribs **237**.

Referring to FIG. **11**C, the height of a rear cover side surface **2382** can be greater than the depth to which the rear cover central portion **236** is depressed from the rear cover rim **2381**.

FIGS. **12**A and **12**B illustrate another implementation of the rear cover **23**. A lifter **24** can extend in the axial direction toward the rear cover **23** from the drum entrance **221**. The lifter **24** can be configured to have a plate form projecting toward the rotational center of the drum **2**. The length of the drum **2** in the radial direction can be greater than the length of the lifter in the radial direction shown in FIG. **7**A. Consequently, the hot air in the drum **2** can be efficiently mixed during rotation of the drum **2** such that the rotating hot air efficiently transmits heat to the laundry in the drum **2**.

For efficient rotation of the hot air, the height of the plurality of rear-cover-reinforcing ribs **437** can be equal to or greater than the height of the rear cover rim **438** based on the rear cover recesses. The reason for this is because the rear cover rim **2381** can prevent laundry from being positioned close to the inner circumferential surface of the drum body when the height of the rear cover rim **2381** is greater than the height of the rear-cover-reinforcing ribs **237**.

FIG. **11**A illustrates an example in which the height of the rear-cover-reinforcing ribs **237** is equal to the height of the rear cover rim **2381** based on the introduction plate **234**. In some examples, FIG. **12**B illustrates an example in which the height of the rear-cover-reinforcing ribs **437** is greater than the height of the rear cover rim **4381**. This implementation can be more efficient for rotating hot and dry air introduced into the drum **2**.

Because conventional components, which would, if present, be positioned below the drum **2**, are replaced with the drying unit **3**, the volume occupied by the drying unit **3** can increase. Particularly, when the cross-sectional area of the passages (the exhaust passage **31** and the supply passage **32**), through which air currents, increases, the capacity of a fan **349** disposed in at least one of the passages can be increased.

When the capacity of the fan **349** increases, the intensity of the air current flowing in the passages increases. In this case, the hot air, which is introduced into the drum body **21** through the air introduction holes **233**, can move the laundry positioned in the drum body **21** forwards.

When the laundry positioned in the drum body **21** is moved forwards, there can be problems in which it is difficult for hot air to come into contact with the entire laundry and in which the laundry, which is moved forwards, blocks the exhaust port **126**.

FIG. **13** illustrates the shape of the lifter **24** capable of solving the above-mentioned problems. Specifically, FIG. **13** illustrates the lifter **24**, and additionally illustrates the lifter **24** in an enlarged view.

As illustrated in FIG. **13**, the lifter **24** can be coupled to the inner circumferential surface of the drum body **21** so as to agitate laundry during rotation of the drum body **21**. The lifter **24** can extend toward the front end from the rear end of the drum body **21**. Here, the lifter **24** can be spaced apart from both the rear cover **23** and the front cover **22**.

The lifter **24** can extend toward the front cover **22** from the rear cover **23**, and can include a portion which is inclined in the main rotational direction MD of the drum **2**.

As described above, the rotational direction of the drum **2** can be changed. The main rotational direction of the drum **2** refers to the direction in which the drum **2** is mainly rotated. Specifically, the laundry treatment apparatus **100** can perform a drying procedure of supplying heated air or moisture in order to remove moisture or wrinkles from laundry. The main rotational direction of the drum **2** can be the direction in which the drum **2** is dominantly rotated in the drying procedure.

Alternatively, the main directional direction MD can be the direction in which the drum **2** is dominantly rotated during a portion of the drying procedure. Specifically, a period of time may be spent heating air in the initial stage of the drying procedure, and the temperature of laundry may be almost equal to the temperature of air, thus deteriorating drying efficiency, in the terminating stage of the drying procedure. Accordingly, the main rotational direction MD can be the direction in which the drum **2** is dominantly rotated during the interval between the point at which a predetermined period of time has elapsed since the starting point of the drying procedure and the point before a predetermined period of time from the ending point of the drying procedure.

In some examples, one of the clockwise direction CD and the counterclockwise direction CCD can be set to be the main rotational direction, and the drive unit **10** can rotate the drum **2** in the main rotational direction. Specifically, the drive unit **10** can be set so as to dominantly rotate the drum **2** in one direction among the clockwise direction CD and the counterclockwise direction CCD during the drying procedure.

The lifter **24** can be configured to have one of various forms. The specific form of the lifter **24** will be described in detail with reference to FIG. **9** and subsequent drawings.

Consequently, the lifter **24** can guide the laundry positioned in the drum **2** in the rearward direction RD toward the rear cover **23** when the drum **2** is rotated in the main rotational direction MD.

The lifter **24** is capable of agitating the laundry positioned in the drum **2** not only in the clockwise direction CD and in the counterclockwise direction CCD but also in the rearward direction RD. Consequently, when the drum **2** is rotated in the main rotational direction MD, it is possible to more efficiently dry the laundry positioned in the drum **2**.

When the lifter includes the sloped portion, which is sloped in the main rotational direction MD, there can be a problem in which the laundry in the drum **2** is concentrated toward the rear cover **23**.

In order to solve the problem in which laundry is concentrated in one direction, the inner circumferential surface **211** of the drum body **21** can be provided with an anti-slip portion **213** configured to prevent slippage of the laundry and a slip-inducing portion **215** configured to induce slippage of the laundry.

The anti-slip portion **213** can be configured to be convex or concave from the inner circumferential surface of the drum body **210**.

The slip-inducing portion **215** can be defined as a portion which is defined on the inner circumferential surface **211** of the drum body **21** by the anti-slip portion **213**. In other words, the slip-inducing portion **215** can be a portion on the inner circumferential surface **211** of the drum body **21** in which the anti-slip portion **213** is not formed. Here, the slip-inducing portion **215** can be a curved surface having a predetermined curvature.

The anti-slip portion **213** can include a first anti-slip portion **2131**, which is convex from the inner circumferential surface **211** of the drum body **21**, and a second anti-slip portion **2133**, which is concave from the inner circumferential surface **211** of the drum body **21** and has a size smaller than the first anti-slip portion **2131**.

Each of the first anti-slip portion **2131** and the second anti-slip portion **2133** can include a plurality of anti-slip portions, and the plurality of first anti-slip portions **2131** and the plurality of second anti-slip portions **2133** can be alternately arranged.

The anti-slip portions **213** can extend forwards and rearwards on the inner circumferential surface **211** of the drum body **21**. Here, the anti-slip portions **213** can extend from a location spaced apart from the rear cover **23** to a location spaced apart from the front cover **22**. The reason for this is to prevent the laundry positioned in the drum **2** from being concentrated toward one of the front cover **22** and the rear cover **23**.

The anti-slip portions **213** can extend forwards and rearwards on the inner circumferential surface **211** of the drum body **21**, and can be spaced apart from each other in the circumferential direction. The lifter **24** can be positioned between the anti-slip portions **213**.

The slip-inducing portion **215** can include a first slip-inducing portion **2151**, which extends not only in the longitudinal direction of the drum shaft **65** but also in the clockwise direction CD or in the counterclockwise direction CCD at the rear end of the drum body **21**, a second slip-inducing portion **2153** extending from the first slip-inducing portion **2151** in the longitudinal direction of the drum shaft **65**, and a third slip-inducing portion **2155**, which extends in the clockwise direction CD or in the counterclockwise direction CCD from the distal end of the second slip-inducing portion **2153**.

The lifter **24** can be coupled to the second slip-inducing portion **2153**.

Accordingly, the lifter **24** can easily come into contact with the laundry positioned in the drum **2**. The first slip-inducing portion **2151** can assist the heated air, which is introduced through the air introduction holes **233**, in moving in the forward direction FD and in pushing the laundry positioned at the rear cover **23**. Consequently, even when the lifter **24** guides the laundry positioned in the drum **2** toward the rear cover **23**, it is possible to prevent a phenomenon in which heated air may not be introduced into the drum **2** because the laundry is concentrated to the rear cover **23**.

On the other hands, the rear cover **23** can include a rear cover central portion **236**, which projects forwards and to which the drum shaft **65** is coupled, a plurality of rear-cover-reinforcing ribs **237** radially extending from the rear cover central portion **236**, and an introduction plate **234**, which is provided between the plurality of rear-cover-reinforcing ribs **237** and through which the air introduction holes **233** are formed.

The rear cover central portion **236** can project toward the front cover **22** from the center of the surface of the rear cover **23** that faces the front cover **22**.

The rear cover central portion **236** can include a coupling plate **2311**, which is spaced apart from the plurality of rear-cover-reinforcing ribs **237** toward the front cover **22** and to which the drum shaft **65** is fixed, and a mounting-space-defining portion **2313**, which extends toward the plurality of rear-cover-reinforcing ribs **237** from the coupling plate **2311** so as to define a space for receiving the drum shaft **65** therein.

The rear cover central portion **236** can be rounded. Consequently, it is possible to prevent the laundry, which is guided to the rear cover **23** by the lifter **24**, from becoming stuck in the rear cover central portion **236**.

The plurality of rear-cover-reinforcing ribs **237** can radially extend from the outer periphery of the mounting-space-defining portion **2313**. Here, the plurality of rear-cover-reinforcing ribs **237** can be spaced apart from each other at regular intervals and can extend. FIG. **8** illustrates an example in which six rear-cover-reinforcing ribs **237** are spaced apart from one another at regular intervals.

The introduction plate **234** can include a plurality of introduction plates, which are respectively positioned between the plurality of rear-cover-reinforcing ribs **237**. FIG. **8** illustrates an example in which six introduction plates **237** are respectively provided between the six rear-cover-reinforcing ribs **237**. The plurality of introduction plates **237** can be spaced apart from each other in the circumferential direction so as to surround at least a portion of the rear cover central portion **236**.

When a plurality of introduction plates **237** and a plurality of rear-cover-reinforcing ribs **237** are provided, the air introduction holes **233** can be respectively provided in the plurality of introduction plates **237**.

Each of the air introduction holes **233** can include a plurality of air introduction holes **233**, which is formed through the introduction plate **234** so as to guide heated air into the drum **2**, and an rear cover rim **2381** surrounding the plurality of.

The introduction plate **234** can project rearwards from the rear cover rim **2381**.

The introduction plate **234** and the rear cover rim **2381** can be spaced apart from the periphery of the rear cover **23**. Here, the rear cover **23** can further include an rear cover side surface **2382**, which surrounds the plurality of rear-cover-reinforcing ribs **237** and the rear cover rim **2381** and extends to the peripheral edge of the rear cover **23**.

As a result, the heated air, which is introduced through the air introduction holes **233**, can create a more intensive airflow. The reason for this is because the intensity of airflow, which is capable of being created by the fan **349**, is limited, and thus the intensity of heated air, which is introduced through the air introduction holes **233**, is increased when the ratio of the area the air introduction holes **233** to the area of the rear cover is decreased.

Particularly, considering that the lifter **24** is capable of agitating the laundry positioned in the drum **2** forwards and rearwards, reducing in the ratio of the area of the air introduction holes **233** to the area of the rear cover can improve the efficiency with which the laundry is agitated forwards and rearwards.

In addition, considering that the rear cover **23** is a rotatable component and the introduction plate **234** projects rearwards, the plurality of rear-cover-reinforcing ribs **237** can agitate the heated air in the drum **2**. The reason for this is because the rear-cover-reinforcing ribs **237** projects forwards further than the introduction plate **234** and thus serves as blades configured to agitate the heated air in the drum **2**.

Furthermore, considering that the lifter **24** is a component configured to agitate the laundry positioned in the drum **2**, the lifter **24** can be positioned at a location spaced apart from the introduction plate **234** in the longitudinal direction of the drum shaft **65**. In this case, the heated air introduced through the air introduction holes **233** can easily come into contact with the laundry by means of the lifter **24**.

In some implementations, the lifter **24** can be positioned so as to overlap each of the air introduction holes **233** in the longitudinal direction of the drum shaft **65**.

Hereinafter, various implementations of the lifter **24** will be described with reference to FIGS. **14** to **16**.

Considering that the heated air, which is introduced through the air introduction holes **233**, pushes laundry forwards, the lifter **24** can guide the laundry toward the rear cover **23**.

Specifically, when the drum **2** is rotated in the main rotational direction MD, the portion of the lifter **24** that is positioned before the center C of the length of the drum body **21** in the longitudinal direction of the drum shaft **65** can guide the laundry positioned in the drum **2** toward the rear cover **23** (agitation of the laundry in the circumferential direction and in forward and rearward directions).

In some examples, when the drum **2** is rotated in the main rotational direction MD, the portion of the lifter **24** that is positioned behind the center C of the length of the drum body **21** in the longitudinal direction of the drum shaft **65** can agitate the laundry positioned at the rear cover **23** in the clockwise direction CD or in the counterclockwise direction CCD (agitation of the laundry only in forward and rearward directions).

The lifter **24** can project toward the rotational center of the drum body **21** from the inner circumferential surface of the drum body **21**. Here, the lifter **24** can be tapered in a direction in which the lifter **24** projects from the drum body **21**.

The lifter **24** can include a fixed surface **241**, which is brought into contact with the inner circumferential surface **211** of the drum body **21**, a projecting surface **243**, which is spaced apart from the fixed surface **241** toward the rotational center of the drum body **21**, and an extending surface **245** extending between the fixed surface **241** and the projecting surface **243**.

The fixed surface **241** can serve as a fixed end of the lifter **24**, and the projecting surface **243** can serve as a free end of the lifter **24**.

When the projecting surface **243** is orthogonally projected in a direction opposite the direction toward the rotational center of the drum body **21**, the projecting surface **243** can overlap the fixed surface **241**.

FIG. **14**A illustrates an example of the lifter **24** when viewed from the rotational center of the drum **2**. FIG. **14**B is a perspective view of the lifter **24**.

As illustrated in FIGS. **14**A and **14**B, the portion of the lifter **24** that is positioned before the center C of the length of the drum body **21** in the longitudinal direction LD of the drum shaft **65** may, in the main rotational direction MD, be spaced apart from the portion of the lifter **24** that is positioned behind the center C of the length of the drum body **21** in the longitudinal direction LD of the drum shaft **65**.

Specifically, in some implementations, the projecting surface **243** can include a first projecting lifting surface **2431**, which extends from the rear side of the drum body **21** in the longitudinal direction LD of the drum shaft **65**, a second projecting lifting surface **2433**, which extends obliquely

from the first projecting lifting surface **2431** in a direction which is inclined in the main rotational direction MD, and a third projecting lifting surface **2435**, which extends from the second projecting lifting surface **2433** in the longitudinal direction LD of the drum shaft **65**.

In some implementations, the fixed surface **241** can extend from the rear side of the drum body **21** in the longitudinal direction LD of the drum shaft **65**. The second projecting lifting surface **2433** can be positioned at the center C of the length of the drum body **21** in the longitudinal direction LD of the drum shaft **65**. In some cases, as illustrated in FIG. **15**, the lifter **24** can be bent once (the second projecting lifting surface). In other examples, the lifter **24** can be bent twice or more.

Because the direction in which a portion of the projecting surface **243** extends is different from the direction in which the fixed surface **241** extends, the extent to which the extending surface **245** is tapered can vary along the length of the lifter **24**. Particularly, because there is a difference in position between the end **241***a* of the fixed surface **241** in the main rotational direction MD and the end **243***a* of the projecting surface **243** in the main rotational direction MD, agitation of laundry can be more facilitated.

In some implementations, as illustrated in FIG. **15**, the lifter **24** can be stepped in the main rotational direction MD moving toward the front side from the rear side of the drum body **21** (referred to as a "stepped shape").

In some examples, the portion of the lifter **24** that is positioned before the center C of the length of the drum body **21** in the longitudinal direction LD of the drum shaft **65** can be spaced apart, in the main rotational direction MD, from the portion of the lifter **24** that is positioned behind the center C of the length of the drum body **21** in the longitudinal direction LD of the drum shaft **65**.

In some examples, the projecting surface **243** can include a first projecting lifting surface **2431**, which extends from the rear side of the drum body **21** in the longitudinal direction LD of the drum shaft **65**, a second projecting lifting surface **2433**, which extends from the first projecting lifting surface **2431** in a direction which is inclined in the main rotational direction MD, a third projecting lifting surface **2435**, which extends from the second projecting lifting surface **2433** in the longitudinal direction LD of the drum shaft **65**, a fourth projecting lifting surface **2437**, which extends from the third projecting lifting surface **2435** in a direction which is to inclined in the main rotational direction MD, and a fifth projecting lifting surface **2439**, which extends from the fourth projecting lifting surface **2437** in the longitudinal direction LD of the drum shaft **65**.

In some examples, the fixed surface **241** can include a first fixed lifting surface **2411**, which extends from the rear side of the drum body **21** in the longitudinal direction LD of the drum shaft **65**, a second fixed lifting surface **2413**, which extends from the first fixed lifting surface **2411** in a direction which is inclined in the main rotational direction MD, a third fixed lifting surface **2415**, which extends from the second fixed lifting surface **2413** in the longitudinal direction LD of the drum shaft **65**, a fourth fixed lifting surface **2417**, which extends from the third fixed lifting surface **2415** in a direction which is inclined in the main rotational direction MD, and a fifth fixed lifting surface **2419**, which extends from the fourth fixed lifting surface **2417** in the longitudinal direction LD of the drum shaft **65**.

Consequently, the difference in position between the end **241***a* of the fixed surface **241** and the end **243***a* of the projecting surface **243** can be reduced, compared to the previous implementation. Here, although the case in which laundry slips along the extending surface **245** is reduced, the rotational force of the lifter **24** can be more efficiently transmitted to the laundry. In some examples, the lifter **24** can be capable of more easily agitating laundry in forward and rearward directions.

FIG. **16**A is a view illustrating an example of the lifter **24**. FIG. **16**B is a view illustrating the lifter **24** shown in FIG. **16**A, which is coupled to the drum **2**.

In some implementations, as illustrated in FIGS. **16**A and **16**B, the lifter **24** can extend forwards from the rear side of the drum body **21** like a wave (that is, in a "wave shape"). In some examples, the front end and the rear end of the lifter **24** can overlap each other in the longitudinal direction LD of the drum shaft **65**. In some examples, the projecting surface **243** can include a first projecting laundry-tossing surface **2491**, which extends so as to be convex in the main rotational direction MD, and a second projecting laundry-tossing surface **2493**, which extends so as to be convex in the direction opposite the main rotational direction MD.

In some implementations, the fixed surface **241** can include a first fixed laundry-tossing surface **2495**, which extends so as to be convex in the main rotational direction MD, and a second fixed laundry-tossing surface **2497**, which extends so as to be convex in the direction opposite the main rotational direction MD.

In some implementation, the side surface of the extending surface **245** that faces in the main rotational direction MD can include a first extending surface **2451**, which extends from the rear side of the drum body **21** in a direction which is inclined in the main rotational direction MD, a second extending surface **2453**, which extends from the first extending surface **2451** in a direction which is inclined in the direction opposite the main rotational direction MD, and a third extending surface **2455**, which extends from the second extending surface **2453** in a direction which is inclined in the main rotational direction MD.

The first extending surface **2451** can define a first laundry-receiving portion **249***a*, configured to receive laundry therein in order to prevent the laundry positioned at the rear cover **23** from moving forwards, and the second extending surface **2453** and the third extending surface **2455** can define a second laundry-receiving portion **249***b*, configured to receive therein laundry positioned at the front cover **22** and to guide the laundry toward the rear cover **23** by means of the lifter **24**.

In some implementations, the lifter **24** can help to prevent laundry positioned at the rear side from being pushed and of allowing laundry positioned at the front side to move rearwards. In some implementations, the laundry treating apparatus can supply hot air while rotating the hot air during rotation of a drum. As a result, it can be possible to improve drying performance by increasing the period of time for which hot air is in contact with laundry.

In some implementations, the laundry treating apparatus can increase the rigidity of a rear cover and thus suppressing twisting of the rear cover.

In some implementations, the laundry treating apparatus can help to prevent laundry from sticking to the rear surface of a drum and thus from being damaged when hot air is supplied.

In some implementations, the laundry treating apparatus can efficiently agitate laundry during rotation of a drum.

In some implementations, the laundry treating apparatus can agitate the laundry positioned in a drum in forward and rearward directions and in the rotational direction of the drum.

In some implementations, the laundry treating apparatus can mix the heated air in a drum in the rotational direction of the drum.

In some implementations, the laundry treating apparatus can help to prevent laundry, which is agitated in a drum, from becoming stuck inside the drum.

It will be apparent to those skilled in the art that various modifications and variations can be made in the present disclosure without departing from the spirit or scope of the disclosure. Thus, it is intended that the present disclosure cover the modifications and variations of this disclosure provided they come within the scope of the appended claims and their equivalents.

What is claimed is:

1. A laundry treatment apparatus comprising:

a drum configured to receive laundry, the drum comprising a drum body that has a cylindrical shape and a rear cover that defines a rear surface of the drum; and

a drive unit comprising a drum shaft configured to rotate the drum,

wherein the rear cover comprises:

a rear cover central portion that defines a rear cover through-hole passing through the rear cover in an axial direction of the drum shaft, the rear cover central portion protruding toward an inside of the drum,

a rear cover peripheral portion that defines an outer circumference of the rear cover,

a plurality of rear-cover-reinforcing ribs that connect the rear cover central portion to the rear cover peripheral portion in a radial direction of the drum shaft, and

a rear cover recess disposed between the plurality of rear-cover-reinforcing ribs, the rear cover recess being recessed away from the drum relative to the plurality of rear-cover-reinforcing ribs in the axial direction, and

wherein the rear cover defines a plurality of air introduction holes at the rear cover recess.

2. The laundry treatment apparatus of claim **1**, wherein the rear cover peripheral portion comprises:

a rear cover rim that has a ring shape and is connected to the plurality of rear-cover-reinforcing ribs; and

a rear cover side surface that extends radially outward from the rear cover rim, the rear cover side surface being bent from the rear cover rim and coupled to the drum body.

3. The laundry treatment apparatus of claim **2**, wherein a distance from the rear cover recess to the rear cover rim in the axial direction is equal to a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction.

4. The laundry treatment apparatus of claim **2**, wherein a radial width of the rear cover rim in the radial direction is less than a radial width of the rear cover recess in the radial direction.

5. The laundry treatment apparatus of claim **2**, wherein the rear cover further comprises a plurality of rear cover recesses that are disposed radially between the rear cover rim and the rear cover central portion and disposed between the plurality of rear-cover-reinforcing ribs in a circumferential direction of the rear cover, the rear cover recess being one of the plurality of rear cover recesses.

6. The laundry treatment apparatus of claim **1**, wherein a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction is less than or equal to a distance from the rear cover recess to a portion of the rear cover central portion having the rear cover through-hole in the axial direction.

7. The laundry treatment apparatus of claim **1**, wherein the rear cover central portion comprises:

a central flat surface that defines the rear cover through-hole; and

a central side surface that extends radially outward from a periphery of the central flat surface and surrounds the central flat surface, and

wherein the plurality of rear-cover-reinforcing ribs extend outward from the central side surface in the radial direction.

8. The laundry treatment apparatus of claim **7**, wherein the central side surface includes a curved surface.

9. The laundry treatment apparatus of claim **7**, wherein a distance from the rear cover recess to the plurality of rear-cover-reinforcing ribs in the axial direction is less than or equal to a distance from the rear cover recess to the central flat surface in the axial direction.

10. The laundry treatment apparatus of claim **1**, wherein boundaries of the plurality of rear-cover-reinforcing ribs have a round shape and are connected to the rear cover recess.

11. The laundry treatment apparatus of claim **1**, further comprising a lifter disposed on an inner circumferential surface of the drum body and configured to interfere with the laundry based on rotation of the drum, and

wherein a longitudinal axis of the lifter passes through the rear cover and is disposed between two of the plurality of rear-cover-reinforcing ribs.

12. The laundry treatment apparatus of claim **11**, wherein the lifter extends in the axial direction and has a curved shape.

13. The laundry treatment apparatus of claim **12**, wherein the lifter protrudes from the inner circumferential surface of the drum body toward a rotational center of the drum body, and

wherein a side surface of the lifter is tapered toward the rotational center of the drum body.

14. The laundry treatment apparatus of claim **11**, wherein the lifter extends in the axial direction and has a stepped shape, and

wherein the lifter has a plurality of lifting surfaces comprising:

a first lifting surface that extends in the axial direction,

a second lifting surface that extends from the first lifting surface and is inclined with respect to the first lifting surface, and

a third lifting surface that extends from the second lifting surface in the axial direction to thereby define a step with respect to the first lifting surface in a circumferential direction of the drum body.

15. The laundry treatment apparatus of claim **1**, further comprising a drying unit configured to circulate air through the drum, the drying unit being configured to supply the air to the drum to thereby absorb moisture from the laundry.

16. The laundry treatment apparatus of claim **15**, wherein the drying unit comprises:

an exhaust passage configured to receive the air discharged from the drum;

a heat-exchanging unit disposed in the exhaust passage and configured to dehumidify the air and then heat the air; and

a supply passage configured to guide the air from the exhaust passage toward the drum.

17. The laundry treatment apparatus of claim **1**, wherein the drive unit further comprises:

a motor comprising a stator configured to generate a rotating field and a rotor configured to be rotated by the rotating field;

a rotor shaft disposed between the rear cover and the motor, the rotor shaft having one end fixed to the rotor and configured to be rotated by the rotor; and

a power transmission unit comprising one or more gears that are configured to transmit rotational power of the rotor shaft to the drum shaft.

18. The laundry treatment apparatus of claim **1**, further comprising:

a shaft bracket that is fixed to the rear cover and covers the rear cover through-hole, the shaft bracket being coupled to the drum shaft and configured to transmit rotational power from the drum shaft to the drum; and

a rotating-shaft-coupling member that couples the drum shaft to the shaft bracket,

wherein the shaft bracket defines a shaft-coupling hole, and the drum shaft is inserted into the shaft-coupling hole and protrudes toward the drum.

19. The laundry treatment apparatus of claim **18**, further comprising a protective cover that is disposed in the drum and covers the drum shaft and the shaft bracket.

20. The laundry treatment apparatus of claim **18**, wherein the rotating-shaft-coupling member has a cylindrical shape and protrudes from a front surface of the shaft bracket toward the drum, the rotating-shaft-coupling member defining an inner thread at an inner circumferential surface thereof, and

wherein an end portion of the drum shaft has an outer thread coupled to the inner thread.

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