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Inventor(s)

CHOI; Dongjun et al.

DISHWASHER

Abstract

A dishwasher includes a tub defining a washing chamber opened to a front side of the tub, a door configured to open and close the washing chamber, the door including a front face having an opening, a handle that is disposed at the door and defines a handle space connected to the opening of the door, and a handle cover disposed at the opening and configured to open and close the handle space based on rotating relative to the front face of the door. An upper portion of the handle cover is configured to move into the handle space, and a center of rotation of the handle cover is disposed below the opening of the door.

Inventors: CHOI; Dongjun (Seoul, KR), JO; Yeona (Seoul, KR), KIM; Yongnam (Seoul, KR), OH; Minkyu (Seoul, KR), CHO; Sangwoog (Seoul, KR), PARK; Sunghyun (Seoul, KR), KANG; Jinwon (Seoul, KR)

Applicant: LG Electronics Inc. (Seoul, KR)

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application claims priority to Korean Patent Application No. 10-2024-0022960, filed on Feb. 16, 2024, and Korean Patent Application No. 10-2024-0054645, filed on Apr. 24, 2024, the entire contents of which are hereby incorporated by reference in the present application.

TECHNICAL FIELD

[0002] The present disclosure relates to a dishwasher, and more particularly, to a dishwasher with a handle.

BACKGROUND

[0003] A dishwasher is a machine that removes food debris stuck on items to be washed, such as dishes loaded in a tub, and cleans the items by spraying water onto the items. The dishwasher can have a door that opens and closes the tub. The door can have a handle to allow the user to open and close the door.

[0004] In some cases, dishwashers may provide automatic opening and closing of the door after they finish washing. To allow the user to open the door, the dishwasher may have a handle regardless of the availability of the automatic door open and close function.

[0005] For example, the handle can have a space for the user's hand to slip in, where this space in the handle may be exposed to the outside to provide user access. In some cases, a dishwasher may include a door handle fitted to a door. The door handle may be rotatably fitted to the door, and the handle can have a durability issue since the user applies force to the handle to open the door.

[0006] In some cases, a dishwasher may include a control panel for opening and closing an entrance to a door handle. The center of rotation of the control panel may be located at a lower edge where the control panel and a handle space engage with each other, which may cause the central axis of rotation to be exposed to the outside when the control panel is opened. In some cases, control equipment may be provided at the rear of the control panel, where the angle to which the control panel opens the handle space may not be large enough to provide the handle.

[0007] In some cases, a dishwasher may have a recessed-type handle provided at a door and configured to be gripped by a user when opening or closing the door. For instance, the handle of the dishwasher may have the form of a grip recess that is recessed backward from a front face of the door to a predetermined depth.

SUMMARY

[0008] The present disclosure describes a dishwasher with a handle cover for opening and closing a handle of a door.

[0009] In some implementations, the handle cover has an axis of rotation that is not exposed to the outside. For example, the axis of rotation of the handle cover can be located at a lower portion relative to an opening of the door. In some examples, the axis of rotation of the handle cover can be located inside an exterior of the door.

[0010] The present disclosure further describes a dishwasher in which a distance between the axis of rotation of the handle cover and a front face of the door is decreased. In some examples, the dishwasher allows the user easy access to the handle.

[0011] The present disclosure further describes a dishwasher that automatically opens and closes the handle cover. For example, the dishwasher can include a motor that provides a reduced motor torque to rotate the handle cover.

[0012] The present disclosure further describes a dishwasher that structurally allows the handle cover to rotate smoothly. For instance, components for rotating the handle cover are efficiently arranged in a narrow space inside the door. In some examples, the handle and the handle cover can extend longer in a width direction of the door than in a height direction of the door.

[0013] The present disclosure further describes a dishwasher that ensures that the handle cover opens at a large angle. The present disclosure further describes a dishwasher that can help prevent the user's fingers from getting caught in a handle cover that automatically opens and closes. The present disclosure further describes a dishwasher with a handle cover that can automatically open and close and that also can be manually opened and closed by the user. For instance, the motion of the handle cover may not be restrained by the motor when the user manually opens or closes the handle cover.

[0014] The present disclosure further describes a dishwasher that opens and closes by elasticity. In some implementations, the handle cover can open fast when opened and can close slowly when closed.

[0015] The present disclosure further describes a dishwasher that provides an aesthetic outward appearance.

[0016] Technical aspects to be accomplished by the disclosure are not limited to the above-mentioned technical aspects, and other technical aspects not mentioned herein will be clearly understood from the following description by those skilled in the art to which the disclosure pertains.

[0017] According to one aspect of the subject matter described in this application, a dishwasher includes a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub, a door configured to open and close the washing chamber, the door including a front face having an opening, a handle that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door, and a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating about a center of rotation relative to the front face of the door, the handle cover including an upper portion configured to move into the handle space based on the handle cover opening the handle space. The center of rotation of the handle cover is disposed below the opening of the door.

[0018] Implementations according to this aspect can include one or more of the following features. For example, the door can further include a door cover that defines the front face of the door, where the center of rotation of the handle cover is disposed rearward relative to the door cover. In some examples, the door cover can include a rim that defines a lower edge of the opening of the door and that is disposed above the center of rotation of the handle cover.

[0019] In some implementations, the handle cover can include a cover part configured to open and close the opening of the door, a shaft that defines the center of rotation of the handle cover, and a boss that accommodates the shaft, where the rim is disposed vertically above the boss and covers at least a part of the boss. In some examples, the handle cover can define a recess at a lower end of the cover part, where the rim is configured to insert into the recess of the handle cover based on the handle cover closing the handle space such that a front face of the handle cover and the front face of the door cover are coplanar.

[0020] In some implementations, the dishwasher can further include a driving unit configured to rotate the handle cover relative to the door, where the driving unit includes a link that is rotatably connected to the handle cover and spaced apart from the center of rotation of the handle cover. In some examples, the driving unit can further include a motor and a connector that is connected to the link and configured to be rotated by the motor.

[0021] In some examples, the handle cover can be configured to, based on the handle cover opening the handle space, define an angle between the handle cover and the link, where the angle is smaller than 90 degrees. In some examples, a center of rotation of the connector can be disposed between a motor shaft of the motor and the center of rotation of the handle cover in a vertical direction and in a front-rear direction.

[0022] In some implementations, the dishwasher can include a driving unit configured to rotate the handle cover, the driving unit including a motor disposed below the handle cover, where the handle

cover extends in a width direction of the door. Lateral ends of the handle cover in the width direction can define lateral ends of the door, respectively, or the handle cover can extend toward the lateral ends of the door that are spaced apart from the lateral ends of the handle cover. In some examples, a length of the driving unit in the width direction of the door is greater than a distance between one of the lateral ends of the door and one of the lateral ends of the handle cover.

[0023] In some implementations, the dishwasher can include a spring configured to apply elastic force to the handle cover to thereby cause the handle cover to close the handle space, where one of the lateral ends of the handle cover and one of the lateral ends of the door are spaced apart from each other, and the spring is disposed between the one of the lateral ends of the handle cover and the one of the lateral ends of the door.

[0024] In some implementations, the dishwasher can include a door cover that defines the front face of the door, where the handle cover includes a decoration disposed at a front side of the handle cover, and the decoration and the door cover are made of a same material and configured to be coplanar based on the handle cover closing the handle space.

[0025] In some implementations, the handle can include a housing that is disposed inside the door and defines the handle space, where the handle cover is rotatably attached to the housing. For instance, the housing can include a side wall and a guide that has an arc shape and is defined at the side wall, where the handle cover includes a cover part configured to be disposed at the opening of the door based on the handle cover closing the handle space, and a slider that is disposed at the cover part and configured to move along the guide.

[0026] According to another aspect, a dishwasher includes a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub, a door configured to open and close the washing chamber, the door including a front face having an opening, a handle that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door, a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating relative to the front face of the door, the handle cover including an upper portion configured to move into the handle space based on the handle cover opening the handle space, and a driving unit configured to rotate the handle cover, the driving unit including a motor disposed below the handle cover.

[0027] Implementations according to this aspect can include one or more of the following features. For example, the handle can further include a housing that is disposed inside the door and defines the handle space, where the driving unit is disposed below the housing. In some implementations, the housing can include a bottom face configured to face a rear face of the handle cover based on the handle cover opening the handle space, the bottom face defining a through-hole, where the driving unit can further include a link that passes through the through-hole and is connected to the handle cover.

[0028] In some implementations, the housing further includes a bottom face configured to face a rear face of the handle cover based on the handle cover opening the handle space, a stepped portion disposed below a front end of the bottom face, and a shaft holder that protrudes from the stepped portion, the shaft holder supporting a portion of the handle cover that defines an axis of rotation of the handle cover.

[0029] According to another aspect, a dishwasher includes a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub, a door configured to open and close the washing chamber, the door including a front face having an opening, a handle housing that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door, a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating relative to the front face of the door in a first direction and a second direction, respectively, the handle cover including an upper portion configured to move into the handle space based on the handle cover opening the handle space, and a driving system configured to rotate the handle cover. The driving

system includes a motor disposed below the handle housing and configured to rotate the handle cover in the first direction, and a spring disposed at an outer side of the handle housing in a width direction of the door and configured to apply force to the handle cover in the second direction opposite to the first direction.

[0030] Implementations according to this aspect can include one or more of the following features. For example, the driving system can further include a driving unit that rotates the handle cover and that includes the motor.

[0031] In some examples, the driving unit can include a pinion that is coupled to a motor shaft of the motor and rotates integrally with the motor shaft. In some examples, the driving unit can include an actuator configured to be rotated by the motor. In some examples, the driving unit can include a connector that is configured to be rotate by the motor. For example, the connector can include a lever that abuts the actuator.

[0032] In some examples, the connector can rotate the handle cover. The connector can be connected to the handle cover so as to rotate when the handle cover rotates. For example, the lever part can be disposed in the first direction with respect to the actuator. The lever part can rotate with the actuator when the actuator rotates in the first direction. The connector may not be restrained by the actuator when the handle cover rotates in the first direction.

[0033] In some implementations, the connector can have a space that extends in the second direction opposite to the first direction, from the lever part with respect to the center of rotation of the actuator. In some examples, the connector can include a body having the lever part, and a recess extending in the second direction opposite to the first direction from the lever part with respect to the center of rotation of the actuator, into which the actuator is inserted.

[0034] In some examples, the actuator can include a first gear part which meshes with the pinion. For example, the first gear part can be positioned forward relative to the pinion. In some examples, the actuator can include an arm that extends outward of the first gear part along the radius of rotation of the actuator, where the arm can rotate integrally with the first gear part. In some examples, the actuator can include a finger that is inserted into the connector recess. The finger can protrude from the arm.

[0035] In some examples, the driving unit can include a driving unit shaft that provides the centers of rotation of the connector and the actuator. The driving unit shaft can penetrate the connector and the actuator. For example, the driving unit can include a link connected to the handle cover. The driving unit can include a link rotatably connected to the handle cover. The link can be connected to the handle cover at a position spaced apart in a radial direction from the center of rotation of the handle cover.

[0036] In some examples, the link can have a first connecting portion to be connected to the handle cover and a second connecting portion to be connected to the connector. For example, the first connecting portion can be connected to the handle cover at a position spaced apart in the radial direction from the center of rotation of the handle cover.

[0037] In some implementations, the dishwasher can further include a bracket that is coupled to the handle cover and connected to the first connecting portion of the link. The first connecting portion can be rotatably coupled to the bracket. The bracket can be spaced apart in the radial direction from the center of rotation of the handle cover.

[0038] In some examples, the angle between the handle cover and the link can be smaller than 90 degrees when the handle cover is open. For example, the angle between the handle cover and the link can be smaller than 90 degrees in the process in which the handle cover rotates between closed state and open state.

[0039] In some examples, the connector can be connected to the link. The connector can include a joint that extends from the body and is connected to the second connecting portion. The second connecting portion can be rotatably coupled to the joint.

[0040] The center of rotation of the connector can be disposed vertically between the motor shaft of

the motor and the center of rotation of the handle cover. The center of rotation of the connector can be disposed between the motor shaft of the motor and the center of rotation of the handle cover in a front-rear direction.

[0041] In some examples, the connector can include a second gear part. For example, the second gear part can be disposed on an outer side of the body. In some examples, the driving system can include a rotary damper that meshes with the second gear part of the connector.

[0042] For example, the rotary damper can be a unidirectional damper which applies force to the connector in the second direction opposite to the first direction when the connector rotates in the first direction. The rotary damper can be a bidirectional damper which applies force to the connector in the first direction when the connector rotates in the second direction.

[0043] In some examples, the spring can be disposed between a lateral end of the handle cover and a lateral end of the door. In some examples, the housing of the handle can include a spring housing disposed on an outer side of the handle cover in the width direction of the door. The spring housing can accommodate the spring.

[0044] In some examples, the handle cover can include a handle cover shaft that provides the center of rotation of the handle cover. The handle cover shaft can extend in the width direction of the door. The handle cover shaft can penetrate a side wall of the housing.

[0045] In some examples, the driving system can include a holder to be connected to the spring. The holder can be coupled to the handle cover shaft and rotate with the handle cover shaft. The holder can be disposed at the spring housing. The handle cover can be rotatably coupled to the housing.

[0046] In some implementations, the driving system can include: a motor, an actuator that rotates by the motor to rotate the handle cover in the first direction; and a strap that connects the actuator and the handle cover and bends by an external force when the handle cover rotates in the first direction while the motor is stopped.

[0047] In some implementations, the cover part can be connected to the door in such a way as to be rotatable between a foremost position in which the cover part is maximally rotated forward and a rearmost position in which the cover part is maximally rotated rearward.

[0048] In some examples, when the cover part is moved to the foremost position, the opening can be closed off by the cover part. In some examples, when the cover part is moved to the foremost position, no stepped portion may be formed between a front end face of the cover part and the front face of the door. In some examples, the front end face of the cover part can have a surface that has the same texture as the front face of the door. In some examples, when the cover part is moved to the rearmost position, the opening can be fully opened.

[0049] In some implementations, the dishwasher can include: a return spring that exerts restorative force to the cover part so that the cover part rotates to the foremost position; and a driving unit that prevents or allows the rotation of the cover part to the foremost position by the return spring, in conjunction with the angle of rotation of the door.

[0050] In some examples, the door can be rotatably disposed between a closed position in which the open front face of the tub is closed and a fully open position in which the open front face of the tub is fully open, and when the door is rotated less than the angle of rotation for a cover release position which is defined between the closed position and the fully open position, the driving unit can prevent the cover part from rotating to the foremost position.

[0051] In some examples, when the door is rotated by an angle greater than or equal to the angle of rotation for the cover release position, the driving unit can allow the cover part to rotate to the foremost position. For example, the angle of rotation for the cover release position can range from 45 to 55 degrees.

[0052] In some examples, the driving unit can include: a rack gear that is connected to the cover part and rotates with the cover part; a first pinion gear that engages the first gear portion of the rack gear and rotates in a direction opposite to the rack gear; a second pinion gear that engages the first

pinion gear and rotates in the same direction as the rack gear; a shaft that rotatably supports the second pinion gear; a one-way clutch that regulates a connection between the second pinion gear and the shaft; a ratchet gear that is rotatably supported on the shaft and rotates integrally with the shaft; and a latch link that is configured to rotate about an axis of rotation disposed at a position spaced downward apart from the shaft, and that engages or disengages the ratchet gear in conjunction with the angle of rotation of the door.

[0053] In some examples, when the cover part rotates rearward, the one-way clutch can prevent a torque of the second pinion gear from being transmitted to the shaft, and when the cover part rotates forward, the one-way clutch can allow the torque of the second pinion gear to be transmitted to the shaft.

[0054] In some examples, the latch link can further include a weight balance disposed opposite the latch portion with respect to the axis of rotation, wherein the entire center of mass of the latch link can be formed on the weight balance.

[0055] In some examples, when the door is in closed position, a virtual extended line connecting the axis of rotation of the latch link and the center of mass can form a predetermined intersecting angle with respect to a vertical direction, and the predetermined intersecting angle can be greater or equal to the angle of rotation for the cover release position.

[0056] In some examples, the driving unit can further include a rotary damper that reduces the rotational speed of the rack gear, wherein the rack gear can have a second gear portion that engages a damper gear of the rotary damper. In some examples, the return spring can include a torsion spring, one end of which is connected to the door, and the other end of which is connected to the cover part.

Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0057] FIG. 1 is a perspective view showing an example of a dishwasher.

[0058] FIG. 2 is a perspective view showing an example of an open state of a door of the dishwasher.

[0059] FIG. 3 is a schematic view showing an example of an interior of the dishwasher.

[0060] FIG. 4 is a perspective view showing the door of the dishwasher in FIG. 1 when a handle cover is open.

[0061] FIGS. 5A and 5B are cross-sectional views of the door illustrated in FIG. 4 and illustrates the handle cover and a driving unit.

[0062] FIG. 6 is a perspective view illustrating an example of a handle housing and the handle cover in the handle illustrated in FIGS. 5A and 5B.

[0063] FIG. 7 is a perspective view showing an interior of the door of the dishwasher when viewed from the rear.

[0064] FIG. 8 is an exploded perspective view showing the driving unit of the dishwasher illustrated in FIG. 7.

[0065] FIGS. 9A to 9C are schematic views showing how the driving unit illustrated in FIG. 8 operates, in which FIG. 9A depicts the handle closed by the handle cover, FIG. 9B depicts the handle opened by the driving unit by rotating the handle cover, and FIG. 9C depicts that the driving unit is rotating the handle cover in a direction that closes the handle when the handle cover is open, before the handle cover closes the handle.

[0066] FIGS. 10A to 10C are cross-sectional views showing how the driving unit illustrated in FIGS. 9A to 9C operates.

[0067] FIGS. 11A and 11B are schematic views showing an example operation in which the handle cover opens while the driving unit is stopped, in which FIG. 11A depicts the handle closed by the

handle cover, and FIG. **11B** depicts that the handle cover is open while the driving unit is stopped.

[0068] FIGS. **12A** and **12B** are cross-sectional views showing how the driving unit illustrated in FIGS. **11A** and **11B** operates.

[0069] FIG. **13** is a cross-sectional view showing how the handle cover, the link, and the connector are connected to one another while the handle cover is open.

[0070] FIG. **14** is a cross-sectional view showing an example of a handle cover and driving unit of an example of a dishwasher.

[0071] FIGS. **15A** and **15B** are cross-sectional views showing an example of a driving unit of a dishwasher, in which FIG. **15A** depicts the handle closed by the handle cover, and FIG. **15B** depicts the handle opened by the driving unit by rotating the handle cover.

[0072] FIG. **16** is a cross-sectional view showing that the handle cover is in open state while the driving unit of the dishwasher disclosed in FIGS. **15A** and **15B** is stopped.

[0073] FIGS. **17** and **18** are cross-sectional perspective views showing an example of a handle cover and driving unit of a dishwasher.

[0074] FIG. **19** is a rear perspective view of the driving unit of FIGS. **17** and **18**.

[0075] FIG. **20** is an exploded perspective view of the driving unit illustrated in FIG. **19**.

[0076] FIG. **21** is a side view illustrating an example of a driving unit which allows rearward rotation of a cover part by an external force but prevents forward rotation thereof, when the door is in closed position.

[0077] FIG. **22** is a side view illustrating an example of a driving unit which allows forward rotation of the cover part when the door reaches a cover release position.

[0078] FIG. **23** is a partial enlarged view of FIG. **21**, which is a view for explaining the relative angles of placement and rotation of the ratchet gear and latch link of the driving unit while the cover part is prevented from rotating forward.

[0079] FIG. **24** is a partial enlarged view of FIG. **22**, which is a view for explaining the relative angles of placement and rotation of the ratchet gear and latch link of the driving unit while the cover part is allowed to rotate forward.

[0080] FIG. **25** and FIG. **26** are partial exploded views of a ratchet gear and a latch link, for explaining a structure in which the ratchet gear and a latch portion of the latch link engage each other.

DETAILED DESCRIPTION

[0081] Hereinafter, one or more implementations of the present specification will be described in detail with reference to the accompanying drawings, but the same or similar components are assigned the same reference numerals regardless of reference numerals, and overlapping descriptions thereof will be omitted.

[0082] Referring to FIG. **1**, the dishwasher includes a tub **1**. The tub **1** can provide a washing chamber **11**. The washing chamber **11** can be provided inside the tub **1**.

[0083] The tub **1** can have the shape of a hexahedron whose one side is open (see FIG. **2**). The front of the tub **1** can be open.

[0084] The washing chamber **11** can open to the front (see FIG. **2**). A direction from the opening of the washing chamber **11** toward the rear, that is, a front-rear direction, can be referred to as a depth direction of the washing chamber **11**.

[0085] The dishwasher can include a door **2** that opens up and closes off the washing chamber **11**. The door **2** can be disposed at the front of the tub **1**. The door **2** can be rotatably coupled to the front of the tub **1**.

[0086] A bottom of the door **2** can be coupled to the tub **1**. The door **2** can be hinged to a front bottom portion of the tub **1**. The dishwasher can include a hinge **28** that rotatably attaches the door **2** to the tub **1**.

[0087] The door **2** can open in such a way that a top portion of the door **2** faces forward (see FIG. **2**). The door **2** can rotate in a first direction d1 (see FIGS. **10A** to **10C**) to be described later in

which a handle cover **4** opens, thereby closing off the tub **1**. The door **2** can rotate in a second direction **d2** (see FIGS. **10A** to **10C**) to be described later in which the handle cover **4** closes, thereby opening up the tub **1**.

[0088] The door **2** can include a front face **211**. An opening **20** (see FIG. **4**) can be provided on the front face **211** of the door **2**.

[0089] The door **2** can include a door cover **21**. The door cover **21** can provide the front face **211** of the door **2**. The door cover **21** can provide a lateral face **218** of the door **2**. The door cover **21** can provide a top face **213** of the door **2**.

[0090] The dishwasher can include a handle **3**. The handle **3** can provide a space that connects to the opening **20** of the door **2**. The handle **3** can be disposed at the rear of the opening **20**.

[0091] The handle **3** can be disposed at the front of the door **2**. The handle **3** can be disposed at an upper portion of the door **2**. The handle **3** can be disposed at an upper portion of the front face **211** of the door **2**. An upper portion **212** of the front face **211** of the door **2** can be disposed above the handle **3**.

[0092] The dishwasher can include a handle cover **4**. The handle cover **4** can open and close the handle **3**.

[0093] The dishwasher can include a base **12**. The base **12** can provide a bottom surface of the dishwasher.

[0094] The bottom of the tub **1** can be spaced upward from the base **12**. A machine chamber **13** can be provided between the bottom of the tub **1** and the base **12**. Components like a controller **14** (e.g., a printed circuit board (PCB)), a sump **61** to be described later, and a pump **62** can be disposed in the machine chamber **13**.

[0095] An interface **23** can be disposed at the top of the door **2**. The interface **23** can be disposed on the top face **213** of the door.

[0096] The interface **23** can receive input commands from the user. The interface **23** can provide the user with information related to the dishwasher.

[0097] For example, the user can enter commands relating to a washing stroke and washing options via the interface **23**. For example, the interface **23** can show information on a washing stroke and washing options.

[0098] The controller **14** can control the dishwasher. The controller **14** can receive input commands from the user via the interface **23**. The controller **14** can provide the user with information on the dishwasher via the interface **23**.

[0099] Hereinafter, the components to be described below can be controlled by the controller **14**.

[0100] Referring to FIG. **2**, the dishwasher can further include a casing **15**. The casing **15** can be disposed outside the tub **1**.

[0101] The casing **15** can include a cabinet **16** and a top plate **17**. The cabinet **16** can cover a side wall of the tub **1**. The top plate **17** can cover a top face of the tub **1**.

[0102] As stated above, the washing chamber **11** can open forward, and the door **2** can open up and close off the washing chamber **11**.

[0103] The dishwasher can include racks **67** disposed in the washing chamber **11**. Items to be cleaned, such as cookware, dishware, and cutlery, can be placed on the racks **67**.

[0104] The racks **67** can include a first rack **671**. The first rack **671** can be disposed at a lower portion of the washing chamber **11**.

[0105] The racks **67** can include a second rack **672** disposed above the first rack **671**. The height at which the second rack **672** is disposed can be adjusted.

[0106] The dishwasher can include spray arms **661** and **662**. The spray arms **661** and **662** can spray wash water toward the racks **67**.

[0107] The spray arms **661** and **662** can be disposed under the racks **67**. The spray arms **661** and **662** can spray wash water toward the top.

[0108] The spray arms **661** and **662** can include a first spray arm **661**. The first spray arm **661** can

be disposed under the first rack **671**.

[0109] The spray arms **661** and **662** can include a second spray arm **662**. The second spray arm **662** can be disposed below the second rack **672**.

[0110] The door **2** can be opened in such a way that the upper portion of the door **2** faces forward. The door **2** can rotate in the second direction **d2** (see FIGS. **10A** to **10C**) to be described later in which the handle cover **4** closes the handle **3**, thereby opening up the tub **1**.

[0111] The door **2** can include an inner panel **22**. The inner panel **22** can face upward while the door **2** is open. When the user places items to be cleaned in the rack, water dripping from these items or the rack can drop to the inner panel **22**.

[0112] The dishwasher can include a steam nozzle **665**. The steam nozzle **665** can be provided on the door **2**. The steam nozzle **665** can be provided on the inner panel **22**.

[0113] The dishwasher can include a dispenser **26**. The dispenser **26** can be provided on the inner panel **22**.

[0114] Referring to FIG. **3**, the racks **67** can be pulled out forward from the washing chamber **11**. The racks **67** can be pushed in and disposed in the washing chamber **11**.

[0115] The racks **67** can include a third rack **673**. The third rack **673** can be disposed above the first rack **671**. The third rack **673** can be disposed above the second rack **672**. The third rack **673** can be disposed at the uppermost position among the plurality of racks **67**.

[0116] The spray arms **661** and **662** can include a nozzle. The nozzle can spray wash water.

[0117] The spray arms **661** and **662** can be rotatably provided.

[0118] The first spray arm **661** can be disposed under the first rack **671**. The first spray arm **661** can spray wash water toward the first rack **671**.

[0119] The first spray arm **661** can be rotatably provided. The first spray arm **661** can be rotated by a motor. Alternatively, the first spray arm **661** can rotate by the reaction force of wash water sprayed a first nozzle **6613** from.

[0120] The second spray arm **662** can be disposed under the second rack **672**. The second spray arm **662** can be coupled to the second rack **672**. The second spray arm **662** can spray wash water toward the second rack **672**.

[0121] The second spray arm **662** can be rotatably provided. The second spray arm **662** can rotate by the reaction force of wash water is sprayed from a second nozzle **6623**.

[0122] Alternatively, the second spray arm **662** can be rotated by a motor.

[0123] The dishwasher can include a top nozzle **663**. The top nozzle **663** can be disposed above the racks **67**. The top nozzle **663** can be disposed at the ceiling of the washing chamber **11**. The top nozzle **663** can spray wash water toward the bottom. The top nozzle **663** can spray wash water toward the racks **67**. The top nozzle **663** can spray wash water toward the third rack **33**.

[0124] The door **2** can include a door cover **21**. The door cover **21** can be exposed to the outside while the door **2** closes off the washing chamber **11**.

[0125] The door **2** can include an inner panel **22**. The inner panel **22** can face toward the washing chamber **11** while the door **2** closes off the washing chamber **11**. The inner panel **22** can provide a front face of the washing chamber **11** while the door **2** closes off the washing chamber **11**.

[0126] The dishwasher can include a dispenser **26**. The dispenser **26** can contain a detergent. The dispenser **26** can contain a tablet-type detergent. Alternatively, the dispenser **26** can receive a powder-type detergent.

[0127] In some examples, some of the nozzles of the spray arms **661** and **662** can face toward the dispenser **26** disposed at the door **2**.

[0128] The dishwasher can supply steam to the washing chamber **11**. A steam nozzle **665** can supply steam to the washing chamber **11**. The steam nozzle **665** can be disposed at the front of the washing chamber **11** and supply steam toward the rear. The steam nozzle **665** can be disposed at a lower portion of the washing chamber **11** and supply steam toward the top. The steam nozzle **665** can be disposed at a front lower portion of the washing chamber **11** and supply steam toward the

top rear.

[0129] The steam nozzle **665** can be disposed at the door **2**. The steam nozzle **665** can be provided on the inner panel **22**. The steam nozzle **665** can be disposed at a lower portion of the inner panel **22**. The steam nozzle **665** can be slanted off the horizontal.

[0130] The dishwasher can include a sump **61**. The sump **61** can be supplied with water from an external water source such as a tap. The sump **61** can store the water supplied from the outside.

[0131] The sump **61** can be supplied with water from an external water source through a water supply tube **64**. The water supply tube **64** can be connected to the external water source.

[0132] The water supply tube **64** can connect the external water source and the sump **61**.

[0133] The water supply valve **641** can regulate the water supply tube **64**. The water supply tube **64** can control the flow of water running from an external water source to the sump **61**.

[0134] The sump **61** can be provided beneath the tub **1**. The sump **61** can be disposed under the bottom of the tub **1**. The sump **61** can be disposed in the machine chamber. The sump **61** can be connected to the bottom of the tub **1** and disposed in the machine chamber.

[0135] The sump **61** can store water drained from the washing chamber **11**.

[0136] The dishwasher can include a filter **611**. The filter **611** can filter out impurities from the water flowing from the washing chamber **11** to the sump **61**. The filter **611** can be disposed in the sump **61**.

[0137] The dishwasher can include a pump **62** that supplies wash water to the washing chamber **11**. The pump **62** can pump water out of the sump **61**. The pump **62** can pump water and supply the water to the spray arms **661** and **662**. The pump **62** can pump water and supply the water to the top nozzle **663**.

[0138] The pump **62** can include an impeller **623**, a pump housing **625** holding the impeller **623**, and a washing motor **621** that rotates the impeller **623**. The washing motor **621** can be a motor that can vary in rotational speed. For example, the washing motor **621** can be a brushless DC (BLDC) motor.

[0139] The dishwasher can include a heater **63** that heats wash water. The heater **63** can be connected to the pump **62**. The heater **63** can heat the water drawn into the pump **62**.

[0140] A switching valve **65** can be connected to the washing pump **62**. The switching valve **65** can be supplied with wash water from the pump **62**.

[0141] The switching valve **65** can be connected to the spray arms **661** and **662** and the top nozzle **663**. The switching valve **65** can distribute wash water. The switching valve **65** can selectively supply wash water to at least one of the first spray arm **661**, the second spray arm **662**, and the top nozzle **663**.

[0142] A pump intake tube **642** can connect the sump **61** and the pump **62**. When the pump **62** is actuated, the water in the sump **61** can enter the pump **62** through the intake tube **642**.

[0143] A discharge tube **644** can be connected to the pump **62**. The discharge tube **644** can guide the water discharged from the pump **62** toward the spray arms **661** and **662** and the top nozzle **663**.

[0144] The discharge tube **644** can be connected to the switching valve **65**. The discharge tube **644** can connect the pump **62** and the switching valve **65**.

[0145] Connecting tubes **651**, **652**, and **653** can connect the spray arms **661** and **662** and the top nozzle **663** to the switching valve **65**.

[0146] The connecting tubes **651**, **652**, and **653** can include a first connecting tube **651** connected to the first spray arm **661**. The first connecting tube **651** can be provided inside the first spray arm **661**.

[0147] The connecting tubes **651**, **652**, and **653** can include a second connecting tube **652** connected to the second spray arm **662**. The second connecting tube **652** can be provided on a rear wall of the tub **1**.

[0148] The connecting tubes **651**, **652**, and **653** can include a third connecting tube **653** connected to the top nozzle **663**. The third connecting tube **653** can be provided on an upper surface **114** of the

tub **1**.

[0149] When the pump **62** is actuated, the wash water discharged from the pump **62** can enter the switching valve **65**. The wash water drawn into the switching valve **65** can flow to at least one of the plurality of connecting tubes **651**, **652**, and **653** by the switching valve **65**.

[0150] Once the wash water has flowed to the first connecting tube **651**, the wash water can be sprayed from the first nozzle **6613** of the first spray arm **661**. Once the wash water has flowed to the second connecting tube **652**, the wash water can be sprayed from the second nozzle **6623** of the second spray arm **662**. Once the wash water has flowed to the third connecting tube **653**, the wash water can be sprayed from the top nozzle **663**.

[0151] The wash water sprayed to the washing chamber **11** collects at the bottom and enters the sump **61**. The wash water drawn into the sump **61** can be sprayed to the washing chamber **11** by the pump **62** and re-circulated.

[0152] The sump **61** can be connected to a drainage pump **69**. A drainage tube can connect the sump **61** and the drainage pump **69**. When the drainage pump **69** is actuated, the water in the sump **61** can be drained out of the dishwasher.

[0153] Referring to FIG. **4**, a dishwasher includes a door **2**, a handle **3** provided on the door **2**, and a handle cover **4** for opening and closing the handle **3**.

[0154] The door **2** can include a door cover **21** that provides a front face **211**, a top face **213**, and a lateral face **218**. The front face **211** of the door **2** can include an upper portion **212** disposed on an upper side of the handle **3**.

[0155] An interface **23** can be disposed on the top face **213** of the door **2**.

[0156] The door **2** can include an inner panel **27**. The inner panel **27** can be shorter in a lateral direction than the door cover **21**. Hereinafter, the lateral direction also can refer to the width direction of the door **2**.

[0157] The front face **211** of the door **2** can have an opening **20**.

[0158] The handle **3** can be disposed at the rear of the opening **20**. The handle **3** can have a handle space **30** that connects to the opening **20**.

[0159] In some examples, the opening **20** can refer to a part of the handle space **30** of the handle **3**, e.g., a front end of the handle space **30**. The opening **20** can refer to a portion disposed in the same plane as the front face **211** of the door **2**.

[0160] For example, the handle cover **4** of FIG. **1** is in closed state, and the handle cover **4** of FIG. **4** is in open state.

[0161] The handle cover **4** can close off the handle space **30** of the handle **3** (see FIG. **1**). The handle cover **4** can be disposed at the opening **20** and close off the handle space **30** of the handle **3**.

[0162] The handle cover **4** can open up the handle space **30** of the handle **3**. The handle cover **4** can rotate in the first direction **d1** (see FIGS. **10A** to **10C**) so as to get into the handle space **30** of the handle **3**. The handle cover **4** can rotate in the first direction **d1** to open up the handle space **30** of the handle **3**.

[0163] The axis of rotation of the handle cover **4** can be located at a lower side or lower portion of the handle cover **4**.

[0164] The handle cover **4** can rotate such that an upper portion of the handle cover **4** gets into the handle space **30** of the handle **3**. The handle cover **4** can rotate and open up the handle space **30** such that an upper portion of the handle cover **4** gets into the handle space **30** of the handle **3**.

[0165] The handle **3** can extend in the width direction of the door **2**. Opposite ends of the handle **3** can be contiguous to the lateral face **218** of the door **2**. Alternatively, the handle **3** can extend all the way to the lateral face **218** of the door **2**.

[0166] The handle cover **4** can extend in the width direction of the door **2**. Opposite ends of the handle cover **4** can be contiguous to the lateral face **218** of the door **2**. Alternatively, the handle cover **4** can extend all the way to the lateral face **218** of the door **2**.

[0167] Referring to FIGS. **5A** and **5B** and FIG. **6**, the center of rotation of the handle cover **4** can be

positioned at a lower side or lower portion of the handle cover **4**.

[0168] The handle cover **4** can include a cover part **42** that closes the handle space **30**. The cover part **42** can be disposed at the opening **20** (see FIG. **4**) and close the handle space **30**.

[0169] The handle cover **4** can include a boss **44** that encloses a shaft **43** that provides the center of rotation of the handle cover **4**. The boss **44** can extend downward from the cover part **42**.

[0170] The front surface of the cover part **42** can be positioned further forward than the front portion of the boss **44**. The front surface of the cover part **42** can be positioned further forward than the rotation center (e.g., shaft **43**) of the handle cover **4**.

[0171] The front surface of the cover part **42** can be aligned on the same plane as the front face **211** of the door cover **21**. The rotation center (e.g., shaft **43**) of the handle cover **4** can be positioned behind the front face **211** of the door cover **21**.

[0172] The cover part **42** can include a decoration **40**, which will be described later. The decoration **40** can form the front surface of the cover part **42**. The decoration **40** can be aligned on the same plane as the front face **211** of the door cover **21**.

[0173] A rearward recess **45** can be disposed between the boss **44** and the cover part **42**.

[0174] The door cover **21** can include a rim **210** that forms not the upper portion **212** but an upper edge of the front face **211** located under the opening **20**. The rim **210** can form a lower edge or lower periphery of the opening **20**. The rim **210** can extend rearward from the upper edge of the front face **211**.

[0175] The center (e.g., shaft **43**) of rotation of the handle cover **4** can be positioned lower than the opening **20** of the door **2**. The center of rotation of the handle cover **4** can be positioned at the rear of the door cover **21**.

[0176] The rim **210** can be positioned higher than the center (e.g., shaft **43**) of rotation of the handle cover **4**. The rim **210** can be positioned vertically above at least part of the boss **44**. The rim **210** can enclose at least part of the boss **44**.

[0177] The axis (e.g., shaft **43**) of rotation of the handle cover **4** may not be exposed to the outside through the opening **20**.

[0178] The rim **210** can be inserted into the recess **45** of the handle cover **4**. The rim **210** can be inserted into the recess **45** of the handle cover **4** while the handle cover **4** closes the handle **3**.

[0179] The handle **3** can be disposed inside the door **2**.

[0180] The handle **3** can further include a housing **31** that defines a handle space **30** of the handle **3**.

[0181] The housing **31** can be disposed in the door **2**. The housing **31** can be disposed inside the door **2**.

[0182] The housing **31** can provide a handle space **30** that connects to the opening **20** of the door **2**. The housing **31** can be disposed at the rear of the opening **20**.

[0183] The housing **31** can include a first housing **311** that is disposed at the rear of the opening **20**. The first housing **311** can provide a first recess **301** that connects to the opening **20** and is disposed at the rear of the opening **20**.

[0184] The housing **31** can include a second housing **312** that is disposed above the first housing **311**. The second housing **312** can provide a second recess **302** that is disposed above the first recess **301** and connects to the first recess **301**.

[0185] The first recess **301** can extend all the way to opposite ends of the housing **31** in the width direction of the door **2**. The second recess **302** can extend a shorter distance than the first recess **301** in the width direction of the door **2**. The second recess **302** can be disposed midway along the width of the door **2**.

[0186] An interface **23** and an interface controller **24** can be disposed above the second housing **312**.

[0187] The handle cover **4** can be rotatably coupled to the housing **31**. The housing **31** can include a shaft holder **323** that supports the shaft **43** of the handle cover **4**. The housing **31** can include a

shaft hole **393** (see FIG. **6**) that supports the shaft **43** of the handle cover **4**.

[0188] The dishwasher can include a driving system **5** for rotating the handle cover **4**. The driving system **5** can include a motor and a driving unit **50** to be actuated by the motor.

[0189] The driving unit **50** can be positioned under the housing **31**.

[0190] The housing **31** can include a bottom **32**. The bottom **32** can include a bottom face **321**. The bottom face **321** can face a rear face of the handle cover **4** when the handle cover **4** is open.

[0191] The bottom face **321** can be slanted in such a way that the rear is positioned higher.

[0192] The driving unit **50** can be positioned under the bottom face **321**, and some of the components thereof can pass through a through-hole **325** and be connected to the handle cover **4**.

[0193] When the handle cover **4** is opened, the driving unit **50** may not be placed between the handle cover **4** and the bottom face **321**, but instead the handle cover **4** and the bottom face **321** can come into contact with each other or be contiguous to each other.

[0194] The housing **31** can include a through-hole **325** formed in the bottom face **321**.

[0195] A link **56** (see FIG. **8**) of the driving unit **50** to be described later can pass through the through-hole **325** and be connected to the handle cover **4**.

[0196] The housing **31** can include a stepped portion **322** formed under a front end of the bottom face **321**. The stepped portion **322** can be formed by bending the bottom face **321** down from the front.

[0197] The shaft holder **323** can protrude from the stepped portion **322**.

[0198] A stopper **47** can be disposed at a bottom edge of the handle cover **4**. The stopper **47** can protrude downward from the boss **44**.

[0199] The stopper **47** can be placed on the opposite side of the cover part **42** with respect to the axis (e.g., shaft **43**) of rotation. For example, while the handle cover **4** closes the handle **3**, the cover part **42** can be disposed above the axis (e.g., shaft **43**) of rotation, and the stopper **47** can be disposed under the axis (e.g., shaft **43**) of rotation.

[0200] The stopper **47** can be disposed above the stepped portion **322**. The stopper **47** can be disposed in a space formed at the front of the bottom face **321** by the stepped portion **322**.

[0201] The handle cover **4** is located at the opening **20**, and therefore, while the handle **3** is closed as shown in FIGS. **5A** and **5B**, the stopper **46** can prevent the handle cover **4** from rotating further in the first direction by coming into contact with the bottom face **321** or the stepped portion **322**.

[0202] The handle cover **4** can include a body **41** and a decoration **40** disposed at the front of the body **41**. The body **41** can include the aforementioned cover part **42**. The body **41** can include the boss **44**, the recess **45**, and the stopper **47**.

[0203] The body **41** can be a different material than the decoration **40**. The body **41** can be made of plastic. The body **41** can be an injection-molded product.

[0204] The decoration **40** can include the same material as the door cover **21**. For example, the decoration **40** can be made of metal or coated with metal.

[0205] When the handle cover **4** is in closed state, the decoration **40** can be disposed in the same plane as the front face **211** and the upper portion **212** of the door cover **21**.

[0206] Referring to FIG. **6**, the driving system **5** can include a spring **59** that applies elastic force to the handle cover **4** in a direction in which the handle cover **4** closes the handle **3**. The spring **59** can apply force to the handle cover **4** in the second direction **d2** (see FIGS. **10A** to **10C**) opposite to the first direction **d1** (see FIGS. **10A** to **10C**).

[0207] The spring **59** can be a torsion spring.

[0208] The spring **59** can be disposed on an outer side of the handle housing **31** in the width direction of the door **2**. The spring **59** can be disposed between a lateral end of the handle cover **4** and the lateral face **218** of the door **2**.

[0209] A spring housing **39** for holding the spring **59** can be provided on an outer side of the handle space **30** inside the housing **31** in the width direction of the door **2**.

[0210] The spring housing **39** can be formed integrally with the housing **31**.

[0211] The spring housing **39** can be disposed on an outer side of the handle cover **4** in the width direction of the door **2**. The spring housing **39** can be disposed on an outer side of a side wall of the housing **31** in the width direction of the door **2**.

[0212] The handle cover **4** can include a handle cover shaft **43** that provides the center of rotation of the handle cover **4**. The handle cover shaft **43** can extend in the width direction of the door **2**. The handle cover shaft **43** can penetrate a side wall **38** of the housing **31**.

[0213] The handle cover **4** can rotate integrally with the handle cover shaft **43**.

[0214] The handle cover shaft **43** can include a coupling **435** that is coupled to the holder **591**. The coupling **435** can have a non-circular outer perimeter. For example, the coupling **435** can have a hexagonal column shape.

[0215] The driving system **5** can include a holder **591** to be connected to the spring **59**. The holder **591** can be disposed at the spring housing **39**.

[0216] The holder **591** can be coupled to the handle cover shaft **43** and rotate with the handle cover shaft **43**. The holder **591** can include a coupling hole that has a shape corresponding to the coupling **435** of the handle cover shaft **43**.

[0217] The holder **591** can include a slider **593** that protrudes toward the side wall **38**. The slider **593** can be radially spaced apart from the handle cover shaft **43**.

[0218] The spring housing **39** can include an arc-shaped guide **594** into which the slider **593** is inserted.

[0219] In some examples, the decoration **40** of the handle cover **4** can include a coupling **401** that protrudes toward the body **41**. The decoration **40** can be coupled to the body **41** through the coupling **401**.

[0220] Referring to FIG. 7, the driving unit **50** can be positioned under the housing **31**.

[0221] The handle **3** and the handle cover **4** can extend longer laterally than vertically. The handle **3** and the handle cover **4** can extend all the way to opposite sides of the door **2** or can extend contiguous to opposite sides of the door **2**.

[0222] For example, the length w_3 of the handle **3** and the cover **4** in the width direction of the door **2** can be greater than the distance w_2 between the handle **3** or cover **4** and the lateral face **218** of the door **2**. The distance w_2 between the handle **3** or cover **4** and the lateral face **218** of the door **2** can be smaller than the width w_1 of the driving unit **50**.

[0223] The spring **59** can be disposed on an outer side of the housing **31** in the width direction of the door **2**. The spring **59** can be disposed between the housing **31** and the lateral face **218** (see FIG. 1) of the door **2**.

[0224] In some examples, a plurality of driving units **50** can be provided. The driving system **5** can include a connecting shaft **53** that connects a pinion **523** (see FIG. 8) of a motor **52** (see FIG. 8) of one of the driving units and a pinion **523** of a motor **52** of another driving unit.

[0225] The dishwasher can include a sensor **25**. The sensor **25** can sense an object near the dishwasher. For example, if the user approaches the dishwasher, the sensor **25** can sense this, and the controller **14** can actuate the driving unit **50** to open the handle cover **4**.

[0226] Referring to FIG. 8, the driving system **5** can further include a driving unit **50** that rotates the handle cover **4**.

[0227] The driving unit **50** can include a motor **52**. The motor **52** can have a motor shaft **521**.

[0228] The driving unit **50** can include a pinion **523** that is coupled to the motor shaft **521** of the motor **52** and rotates integrally with the motor shaft **521**.

[0229] The driving unit **50** can include an actuator **54** that rotates by the motor **52**.

[0230] The actuator **54** can include a first gear part **543** which meshes with the pinion **523**.

[0231] The first gear part **543** can be positioned forward of the pinion **523**. The first gear part **543** can be positioned higher than the pinion **523**.

[0232] The actuator **54** can include an arm **542** that extends outward of the first gear part **543** along the radius of rotation of the actuator **54**. The arm **542** can rotate integrally with the gear part **543**.

[0233] The actuator **54** can include a finger **541** that is connected to a connector to be described later. The finger **541** can be inserted into a recess **552** of the connector **55** to be described later.

[0234] The finger **541** can protrude from the arm **542**.

[0235] The driving unit **50** can include a connector **55** that rotates by the motor **52**.

[0236] The connector **55** can have a lever part **551** that abuts the actuator **54**.

[0237] The lever part **551** can be disposed in the first direction **d1** (see FIGS. **10A** to **10C**) with respect to the actuator **54**. The lever part **551** can rotate with the actuator **54** when the actuator **54** rotates in the first direction **d1**.

[0238] The connector **55** may not be restrained by the actuator **54** when the handle cover **4** rotates in the first direction **d1**.

[0239] The connector **55** can have a recess **552** that extends in the second direction **d2** (see FIGS. **10A** to **10C**) opposite to the first direction **d1**, from the lever part **551** with respect to the center of rotation of the actuator **54**.

[0240] The connector **55** can include a body **550** having the lever part **551** and a recess **552** extending in the second direction **d2** opposite to the first direction **d1** from the lever part **551** with respect to the center of rotation of the actuator **54**, into which the actuator **54** is inserted.

[0241] The connector **55** can cause the handle cover **4** to rotate. The connector **55** can be connected to the handle cover **4** so as to rotate when the handle cover **4** rotates.

[0242] The driving unit **50** can include a driving unit shaft **53** that provides the center of rotation of the connector **55** and the actuator **54**. The driving unit shaft **53** can penetrate the connector **55** and the actuator **54**.

[0243] The driving unit **50** can include a link **56** that is connected to the handle cover **4**. The link **56** can be rotatably connected to the handle cover **4**. The link **56** can be connected to the handle cover **4** at a position spaced apart from the center of rotation of the handle cover **4**.

[0244] The link **56** can have a first connecting portion **564** to be connected to the handle cover **4** and a second connecting portion **565** to be connected to the connector **55**.

[0245] The first connecting portion **564** can be connected to the handle cover **4** at a position spaced apart in a radial direction **r** (see FIGS. **10A** to **10C**) from the center of rotation of the handle cover **4**.

[0246] The dishwasher can further include a bracket **57** that is coupled to the handle cover **4** and connected to the first connecting portion **564** of the link **56**. The first connecting portion **564** can be rotatably coupled to the bracket **57**.

[0247] The bracket **57** can be spaced apart in the radial direction **r** from the center (e.g., shaft **43**) of rotation of the handle cover **4**.

[0248] The connector **55** can be connected to the link **56**. The connector **55** can include a joint **556** that extends from the body **550** and is connected to the second connecting portion **565**. The second connecting portion **565** can be rotatably coupled to the joint **556**.

[0249] The connector **55** can include a second gear part **558**. The second gear part **558** can be disposed on an outer side of the body **550**.

[0250] The driving system **5** can include a rotary damper **58** that meshes with the second gear part **558** of the connector **55**.

[0251] The rotary damper **58** can be a unidirectional damper which applies force to the connector **55** in the second direction **d2** opposite to the first direction **d1** when the connector **55** rotates in the first direction **d1**.

[0252] Alternatively, the rotary damper **58** can be a bidirectional damper which applies force to the connector **55** in the first direction **d1** when the connector **55** rotates in the second direction **d2**.

[0253] The driving unit **50** can include a driving unit housing **51**. The driving unit housing **51** can include a first driving unit housing **511** and a second driving unit housing **512** which are held together.

[0254] First and second bearings **531** and **532** can be disposed in the driving unit housing **51**. The

first and second bearings **531** and **532** can rotatably support the driving unit shaft **53** on the driving unit housing **51**.

[0255] FIGS. **9A** to **9C** and FIGS. **10A** to **10C** are a schematic view and cross-sectional view showing how the driving unit **50** operates, in which FIGS. **9A** and **10A** depict the handle closed by the handle cover, FIGS. **9B** and **10B** depict the handle opened by the driving unit by rotating the handle cover, and FIGS. **9C** and **10C** depict that the driving unit is rotating the handle cover in a direction that closes the handle when the handle cover is open, before the handle cover closes the handle.

[0256] Referring to FIG. **9A** and FIG. **10A**, the handle cover **4** can close off the handle space **30** of the handle **3**. The handle cover **4** can be disposed at the opening **20** and close off the handle space **30** of the handle **3**.

[0257] Referring to FIG. **9B** and FIG. **10B**, the handle cover **4** can open up the handle space **30** of the handle **3**. The handle cover **4** can rotate in the first direction **d1** (see FIGS. **10A** to **10C**) so as to get into the handle space **30** of the handle **3**. The handle cover **4** can rotate in the first direction **d1** and open up the handle space **30** of the handle **3**.

[0258] When the motor **52** rotates, the actuator **54** rotates since the pinion **523** is meshed with the first gear part **543** of the actuator **54**.

[0259] The finger **541** of the actuator **54** applies force to the lever part **551** of the connector **55** to rotate the connector **55** in the first direction **d1**.

[0260] The link **56** coupled to the bracket **57** rotates the handle cover in the first direction **d1**, and the handle cover **4** is opened.

[0261] Referring to FIG. **13**, the angle between the handle cover **4** and the link **56** can be smaller than 90 degrees when the handle cover **4** is open. The angle θ between the handle cover **4** and the link **56** can be smaller than 90 degrees in the process in which the handle cover **4** rotates between closed state and open state.

[0262] Referring to FIG. **9C** and FIG. **10C**, when the motor **52** rotates in a direction opposite to when the handle cover **4** opens, the actuator **54** rotates in the second direction **d2** as the pinion **523** and the gear part **543** are meshed together.

[0263] When the actuator **54** rotates in the second direction **d2**, the force of the finger **541** restraining the lever part **551** is released, and the spring **59** applies force F_s to the handle cover **4** in the second direction **d2**. The handle cover **4** is opened by the spring **59** and rotates the connector **55** in the second direction **d2** through a link.

[0264] When the connector **55** rotates in the second direction **d2**, the damper **58** applies force to the connector **55** in the first direction **d1**, the connector **55** rotates in the second direction **d2** more slowly than the actuator **54**, and the finger **541** and the lever part **551** are spaced apart from each other.

[0265] By the spring **59**, the handle cover **4** goes back to closed state as illustrated in FIG. **9A** and FIG. **10A**.

[0266] If an external object, such as the user's hand or the like, stops the handle cover **4** from rotating in the second direction **d2** in the process in which the handle cover **4** is closed, even if the actuator **54** rotates, the finger **541** moves within the recess **552** of the connector **55**, and, as a result, the connector **55** does not rotate. Consequently, the handle cover **4** can be stopped by an external force regardless of whether the motor is running or not, in the process of being closed.

[0267] Referring to FIGS. **10A** to **10C**, the center (e.g., shaft **53**) of rotation of the connector **55** can be vertically placed between the motor shaft **521** of the motor **52** and the center (e.g., shaft **43**) of rotation of the handle cover **4**. The center (e.g., shaft **53**) of rotation of the connector **55** can be placed between the motor shaft **521** of the motor **52** and the center (e.g., shaft **43**) of rotation of the handle cover **4** in the front-rear direction.

[0268] FIGS. **11A** and **11B** and FIGS. **12A** to **12B** are a schematic view and cross-sectional view showing an operation in which the handle cover opens while the driving unit is stopped, in which

FIGS. 11A and 12A depict the handle closed by the handle cover, and FIGS. 11B and 12B depict that the handle cover is open while the driving unit is stopped.

[0269] Referring to FIG. 11A and FIG. 12A, the handle cover 4 can close off the handle space 30 of the handle 3. The handle cover 4 can be disposed at the opening 20 and close off the handle space 30 of the handle 3.

[0270] Referring to FIG. 11B and FIG. 12B, the handle cover 4 can open up the handle space 30 of the handle 3. The handle cover 4 can rotate in the first direction d1 (see FIGS. 10A to 10C) so as to get into the handle space 30 of the handle 3. The handle cover 4 can rotate in the first direction d1 and open up the handle space 30 of the handle 3.

[0271] While the motor 52 is stopped, the pinion 523 and the actuator 54 can remain stopped.

[0272] When an external force is applied to the handle cover 4 in the first direction d1, the handle cover 4 opens as it rotates about the central axis of the shaft 43 of rotation of the handle cover 4, and the connector 55 rotates about the driving unit shaft 53.

[0273] In this process, the position of the finger 541 relative to the recess 552 of the connector 55 is moved, and the movement of the handle cover 4 does not affect the motor 52.

[0274] When the external force applied to the handle cover 4 in the first direction d1 is released, the handle cover 4 rotates in the second direction d3 by the spring 59, and returns slowly to closed state by the damper 58 as illustrated in FIG. 11A and FIG. 12A.

[0275] In some implementations, referring to FIG. 14, the housing 7 can include arc-shaped guides 781 and 782 on a side wall 78, and the handle cover 8 includes a cover part 82 and sliders 871 and 872 that are disposed on the cover part 82 and protrude toward the side wall 78.

[0276] The guides 781 and 782 can include a first guide 781 and a second guide 782 which have a concentric arc shape but have different radii.

[0277] The radius R1 of the first guide 781 can be smaller than the radius R2 of the second guide 782.

[0278] The first and second sliders 871 and 872 can be radially spaced by R1 and R2, respectively, from the center of rotation and be inserted into the first and second guides 781 and 782, respectively.

[0279] In some implementations, although the center of rotation of the handle cover 8 of the dishwasher is located at the opening 20 of the handle 3, the central axis of the handle cover 4 may not be exposed to the outside since the center of rotation is not a physical axis.

[0280] The other components are identical to those in the foregoing implementation, so descriptions thereof will be omitted.

[0281] Referring to FIGS. 15A and 15B and 16, the driving unit of a dishwasher is different from the foregoing implementations in that the connector and the link are replaced with a strap 96.

[0282] The actuator 94 includes an arm 942, a gear part 943, and a connecting portion 946 connected to the strap 96.

[0283] The strap 96 is connected to the bracket 57 and the connecting portion 946 of the actuator 94.

[0284] The strap 96 is made of a flexible material that bends by gravity unless tensile force is exerted.

[0285] Referring to FIGS. 15A and 15B, the handle cover 4 can open up and close off the opening 20. When the handle cover 4 is in closed state, one end of the strap 96 can be fixed to the actuator 94 and tensile force can be exerted on the strap 96 by the elastic force of a spring exerted on the handle cover 4.

[0286] When the gear part 943 of the actuator 94 meshes with the pinion 523 and therefore the motor 52 rotates, the actuator 94 rotates, causing the handle cover 4 to rotate in the first direction d1 through the strap 96.

[0287] Referring to FIG. 16, when the motor 52 rotates in the opposite direction, the distance between the connecting portion 946 of the actuator 94 and the bracket 57 becomes smaller, and

therefore the tensile force is released and the handle cover **4** is closed by the spring **59**. When the spring **59** is closed, the damper **58** applies force to the handle cover **4** in the first direction and therefore the handle cover **4** can be slowly closed.

[0288] The other components are identical to those in the foregoing implementation, so descriptions thereof will be omitted.

[0289] Referring to FIGS. **17** to **26**, a dishwasher will be described.

[0290] Referring to FIGS. **17** and **18**, the handle cover **4** can include a body **41** by way of example. The body **41** can include a cover part **42** that corresponds in outward appearance to the opening **20** of the front face **211** of the door. Hereinafter, the cover part **42** can be referred to as a first cover body **42**.

[0291] The handle cover **4** can include a second cover body **421** extending downward from the first cover body **42**. The second cover body **421** can be coupled to a rear face of the first cover body **42**.

[0292] The handle cover **4** can include a decoration **40** to be coupled to a front face of the first cover body **42**.

[0293] The first cover body **42** forms an overall exterior of the handle cover **4** and serves to give rigidity to the handle cover **4**.

[0294] The first cover body **42** can be formed in the shape of a plate that is longer in lateral width than in vertical width.

[0295] The second cover body **421** is coupled to the rear face of the first cover body **42** and serves to rotatably support the first cover body **42**.

[0296] As described previously, a cover hinge **430** can be provided on the second cover body **421** so that the handle cover **4** is configured to rotate about the bottom. The cover hinge **430** can be disposed under the opening **20** of the door **2**. The center of rotation of the handle cover **4** can be disposed under the opening **20** of the door **2**. The cover hinge **430** can be located at the rear of the door cover **21**. The center of rotation of the handle cover **4** can be located at the rear of the door cover **21**.

[0297] In the handle cover **4** of the foregoing implementation, a boss **44** is formed at the bottom of the body **41**, and the shaft **43** of the handle cover **4** is inserted into the boss **44**. In this implementation, the cover hinge **430** can hold the shaft **43** of the handle cover **4** like the boss **44** does, or the shaft **43** of the handle cover **4** can protrude from the cover hinge **430**.

[0298] As illustrated in the drawings, the cover hinge **430** can be connected to the housing **31** to rotate relative to the housing **31**. Like in the foregoing implementation, the housing **31** can include a first housing **311** and a second housing **312**. The first housing **311** and the second housing **312** can be separately provided and held together, or can be integrally formed.

[0299] In some examples, the cover hinge **430** can be vertically formed at a lower position than the bottom of the first cover body **42**.

[0300] As such, when the second cover body **421** rotates to the foremost position, the second cover body **421** comes into contact with the housing **31**, and therefore the handle cover **4** is kept from rotating further forward. Accordingly, the second cover body **421** and the cover hinge **430** can serve as a stopper that stops the handle cover **4** from rotating further forward.

[0301] A return spring (not shown) that exerts restorative force to the handle cover **4** can be connected to the cover hinge **430** so that the handle cover **4** rotates to the foremost position.

[0302] The return spring can include, but not limited to, a torsion spring, one end of which is connected to the door **2** or the housing **31**, and the other end of which is connected to the cover hinge **430** of the handle cover **4**.

[0303] In some examples, the driving unit **36** can include a rack gear **361** to be described later, and one end of the rack gear **361** can be connected to the second cover body **421**.

[0304] Accordingly, the rack gear **461** moves together with the forward or rearward rotation of the handle cover **4**.

[0305] A detailed construction of the driving unit **36** including the rack gear **361** will be described

with reference to FIG. 19 and the subsequent figures.

[0306] The decoration **40** is coupled to the front face of the first cover body **42** and serves to form a front face **211** of the handle cover **4**.

[0307] In this case, the decoration **40** can be formed of a material having the same texture as the front face **211** of the door **2**.

[0308] As such, a sense of integrity can be created between a decorative panel **315** and the front face **211** of the door **2**, the outward appearance of the door **2** can be aesthetically improved, and the user can feel more aesthetic pleasure.

[0309] Moreover, as illustrated in FIG. 17, once the handle cover **4** is rotated to the foremost position, the decoration **40** can become parallel to the front face **211** so that the decoration **40** and the front face **211** of the door **2** form a continuous surface together.

[0310] That is, in some examples, no stepped portion may be formed between the front face **211** of the door **2** and the front surface of the handle **3**.

[0311] As such, once the handle cover **4** is rotated to the foremost position, the opening **20** at the front face **211** is fully closed off, and, at the same time, no stepped portion may be formed between the front face **211** and the decoration **40**, thereby preventing the build-up of impurities such as dust in a recessed portion of the door **2** or on the handle itself.

[0312] In some examples, as described previously, the handle cover **4** can be configured to automatically return from the rearmost position illustrated in FIG. 18 toward the foremost position by the restorative force of a return spring connected to the cover hinge **430**.

[0313] In some cases, when the handle cover **4** returns to the foremost position while the user's fingers are in the handle space **30** inside the housing **31**, the user's fingers can get caught and stuck between the opening **20** of the front face **211** and the top of the handle cover **4**.

[0314] In some implementations, to prevent the user from being injured by getting their fingers caught, a driving unit **36** can be further included to restrict a forward rotation of the handle cover **4** by operating in conjunction with an angle of rotation of the door **2** created when the door **2** is opened or closed.

[0315] For example, the driving unit **36** can restrain the handle cover **4** from rotating by the return spring to change the state of the opening **20** from open to closed, or can allow the handle cover **4** to rotate. In some examples,

[0316] In this case, the forward rotation of the handle cover **4** can be allowed or prevented according to the angle of rotation of the door **2**.

[0317] The door **2** of a dishwasher can open up the tub **1** as it rotates forward around a hinge portion as the axis of rotation, as described previously.

[0318] In some implementations, the door **2** can be rotatably disposed between a closed position in which the open front face of the tub **1** is closed and a fully open position in which the open front face of the tub **1** is fully open.

[0319] As will be described below, the position of the door **2** based on which the forward rotation of the handle cover **4** is allowed or prevented can be a cover release position which is defined between the closed position and the fully open position.

[0320] When the user rotates the door **2** less than the angle of rotation corresponding to the cover release position, the driving unit **36** can prevent the handle cover **4** from rotating to the foremost position, and when the user rotates the door **2** by the angle of rotation corresponding to the cover release position, the driving unit **36** can allow the handle cover **4** to rotate to the foremost position.

[0321] In some examples, the cover release position can be expected to be a position where it is highly likely the user will pull out their hand from the handle **3** after the door **2** starts opening. More specifically, the angle of rotation of the door **2** corresponding to the cover release position can range from 45 to 55 degrees, e.g., 50 degrees.

[0322] A detailed description of how the forward rotation of the handle cover **4** is allowed or prevented in conjunction with the angular range of rotation will be given below with reference to

FIG. 21 and the subsequent drawings.

[0323] Hereinafter, referring to FIG. 19 and FIG. 20, a detailed construction of the driving unit 36 configured to allow or prevent the forward rotation of the handle cover 4 will be described.

[0324] Referring to FIG. 19 and FIG. 20, by way of example, the driving unit 36 can include a driving unit housing 368 having a predetermined receiving space inside, a rack gear 361 whose one end of which is connected to the handle cover 4, that rotates with the handle cover 4, a rotary damper 362 connected to the rack gear 361, for reducing the rotational speeds of the rack gear 361 and the handle cover 4, a pinion gear 363 that rotates by a torque transmitted from the rack gear 361, a one-way clutch 364 with an outer wheel connected to the pinion gear 363, a ratchet gear 365 connected to an inner wheel of the one-way clutch 364, a latch link 366 having a latch portion 3661a that engages gear teeth of the ratchet gear 365, and a weight balance 367 forming the center of mass of the latch link 366.

[0325] The driving unit housing 368 constitutes the exterior of the driving unit 36 and serves to internally hold and protect the components of the driving unit 36 to be described later.

[0326] For ease of assembly, the driving unit housing 368 can include a first driving unit housing 3681 and a second driving unit housing 3682 which form separate units that are separated in a lateral direction.

[0327] A predetermined receiving space can be formed between the first driving unit housing 3681 and the second driving unit housing 3682.

[0328] The driving unit housing 368 can be disposed under the handle cover 4 inside the door 2, in order to facilitate the function of allowing or preventing the forward rotation of the handle cover 4.

[0329] In some examples, the rack gear 361 serves to transmit pressure from the user or the restorative force of the return spring to the pinion gear 363 to be described later, while rotating with the handle cover 4.

[0330] A rack body 3611 of the handle cover 4 can be connected to the handle cover 4 so as to rotate with the handle cover 4.

[0331] More specifically, a front end of the rack body 3611 which is one end can be integrally connected to the second cover body 421 based on what is illustrated in the drawings.

[0332] Moreover, the rack body 3611 can be configured to have a cylindrical shape having an arc-shaped cross section, so as to move in conjunction with the rotation of the handle cover 4 and minimize the range of movement of the rack gear 361.

[0333] In this case, the center of the arc shape of the rack body 3611 can lie at the axis of rotation of the cover hinge 430 of the handle cover 4, as illustrated in FIG. 21 and FIG. 22.

[0334] Hereinafter, the axis of rotation of the rack body 3611 and the axis of rotation of the handle cover 4 can be referred to as a first rotational axis X1, to make them distinguishable from the axes of rotation to be described later.

[0335] As such, since the rack body 3611 has a cylindrical shape in which it is configured to rotate about the first rotational axis X1 which is concentric with the axis of rotation of the handle cover 4, the rack body 3611 can be configured to rotate about the first rotational axis X1 by the rotation of the handle cover 4.

[0336] Accordingly, it is possible to minimize the range of movement of the rack body 3611 and prevent an increase in the overall size of the driving unit 36.

[0337] In some examples, as described previously, the rack body 3611 rotates with the handle cover 4 in conjunction with the forward and rearward rotations of the handle cover 4.

[0338] Hereinafter, the direction of rotation of the rack body 3611 for the rearward movement of the handle cover 4 can be defined as a first rotational direction R1, and the direction of rotation of the rack body 3611 for the forward movement of the handle cover 4 can be defined as a second rotational direction R2.

[0339] As illustrated in the drawings, a first gear portion 3612 and a second gear portion 3613 can be integrally formed on an outer periphery of the rack body 3611.

[0340] The first gear portion **3612** can engage a first pinion gear **3631** to be described later.

[0341] Thus, the rack body **3611** can rotate with the first pinion gear **3631** by the first gear portion **3612**, or can be prevented from rotating with the first pinion gear **3631**.

[0342] The second gear portion **3613** can engage a damper gear **3621** of the rotary damper **362**.

[0343] As illustrated in the drawings, since the second gear portion **3613** can remain constantly in engagement with the damper gear **3621** of the rotary damper **362**, the speed of rotation of the rack body **3611** in both the first rotational direction **R1** and the second rotational direction **R2** can be reduced by the damping unit **3622** of the rotary damper **362**.

[0344] Accordingly, the rotation of the rack body **3611** and the rotational movement of the handle cover **4** can be performed smoothly, thereby decreasing the likelihood of the user's fingers getting pinched or hit when the handle cover **4** rotates forward.

[0345] FIG. **19** and FIG. **20** illustrate by way of example a construction in which the first gear portion **3612** is disposed midway on the outer periphery of the rack body **3611** and a pair of second gear portions **3613** are disposed on either side of the first gear portion **3612**. However, the present disclosure is not limited to this, and the arrangement and shapes of the first gear portion **3612** and the second gear portion **3613** can vary with the size and shape of the handle cover **4**, the arrangement position of the driving unit **36**, and so on.

[0346] In some examples, the pinion gear **363** engages the first gear portion **3612** of the rack gear **361** and serves to rotate with the rack gear **361** or prevents the rotation of the rack gear **361**.

[0347] FIG. **19** and the subsequent drawings illustrate by way of example an implementation in which a first pinion gear **3631** directly engaged to the first gear portion **3612** of the rack gear **361** and a second pinion gear **3632** engaged to the first pinion gear **3631** are included. Although the present disclosure is not limited to this, the following description will be given with respect to a construction including the first pinion gear **3631** and the second pinion gear **3632**.

[0348] The first pinion gear **3631** rotates in a direction opposite to the direction of rotation of the rack gear **361** by engaging the first gear portion **3612** of the rack gear **361**, and serves to simply transmit the torque of the first gear portion **3612** of the rack gear **361** to the second pinion gear **3632**.

[0349] Thus, when the rack gear **361** rotates in the first rotational direction **R1**, the first pinion gear **3631** rotates in the second rotational direction **R2**, and when the rack gear **361** rotates in the second rotational direction **R2**, the first pinion gear **3631** rotates in the second rotational direction **R2**.

[0350] The first pinion gear **3631**, which is in idle state since it serves to simply transmit torque, can be supported on a first shaft **SH1** forming the second rotational axis **X2** in such a way as to rotate relative to the first shaft **SH1**.

[0351] The second pinion gear **3632** can engage the first pinion gear **3631** and serve to reduce the torque transmitted from the first pinion gear **3631**.

[0352] Accordingly, the second pinion gear **3632** can have more gear teeth arranged along the outer periphery compared to the first pinion gear **3631**.

[0353] The second pinion gear **3632** can be rotatably supported on a second shaft **SH2** forming a third rotational axis **X3**.

[0354] It is to be noted that the second pinion gear **3632** can be connected to the second shaft **SH2** through the one-way clutch **364**. By way of example, the second pinion gear **3632** can be connected to the outer wheel of the one-way clutch **364**.

[0355] That is, when the second pinion gear **3632** rotates in the first rotational direction **R1**, it can rotate relative to the second shaft **SH2** connected to the inner wheel of the one-way clutch **364** by the one-way clutch **364**, whereas, when the second pinion gear **3632** rotates in the second rotational direction **R2**, it can be supported on the second shaft **SH2** in such a manner as not to rotate relative to the second shaft **SH2**.

[0356] In this way, by the one-way clutch **364**, only the torque for the second rotational direction **R2** can be transmitted to the ratchet gear **365** to be described later through the second shaft **SH2**.

[0357] Accordingly, as will be described later, while the ratchet gear **365** is restrained by the latch portion **3661a** of the latch link **366** so as to prevent the rotation for the second rotational direction **R2**, the second shaft **SH2** and the second pinion gear **3632** may not be able to rotate in the second rotational direction **R2**.

[0358] Consequently, the rotation of the rack gear **361** in the second rotational direction **R2** can be prevented, and the forward rotation of the handle cover **4** can be prevented.

[0359] It is to be noted that, as will be described later, the second shaft **SH2** and the second pinion gear **3632** can rotate in the second rotational direction **R2** while the ratchet gear **365** is released.

[0360] As such, the rotation of the rack gear **361** in the second rotational direction **R2** can be allowed, and the forward rotation of the handle cover **4** can be allowed. Thus, the handle cover **4** can rotate forward toward the foremost position by the restorative force of the return spring.

[0361] In this way, the second shaft **SH2** can be connected to the ratchet gear **365** and the inner wheel of the one-way clutch **364** and supported in such a way as to rotate with them. Accordingly, opposite ends of the second shaft **SH2** can be connected to the driving unit housing **368** through a first bearing **B1**.

[0362] The ratchet gear **365** can be connected to the aforementioned second shaft **SH2** and serve to allow or prevent the rotation of the second shaft **SH2** in the second rotational direction **R2** by the action of the latch link **366** to be described later.

[0363] Accordingly, the ratchet gear **365** needs to rotate integrally with the second shaft **SH2**, and, in some examples, the second shaft **SH2** can penetrate through an axial hole formed at the center of the ratchet gear **365** and be coupled in such a manner as not to perform relative rotation.

[0364] A plurality of asymmetrical gear teeth **3651** can be provided on the outer periphery of the ratchet gear **365** as will be described later.

[0365] As opposed to the first pinion gear **3631** and second pinion gear **3632**, the ratchet gear **365** is not intended to transmit torque, and serves to allow or prevent the rotation of the second shaft **SH2** in the second rotational direction **R2** depending on whether or not the ratchet gear **365** engages the latch portion **3661a** of the latch link **366** to be described later.

[0366] Accordingly, the gear teeth **3651** of the ratchet gear **365** can be configured to have a predetermined asymmetrical shape so as to easily engage and disengage the latch link **366**.

[0367] In some examples, the latch link **366** can prevent the rotation of the ratchet gear **365** in the second rotational direction **R2** by engaging the ratchet gear **365** as it pivots by gravity in conjunction with the angle of rotation of the door **2**, or can allow the rotation of the ratchet gear **365** in the second rotational direction **R2** by disengaging the ratchet gear **365**.

[0368] By way of example, as illustrated in the drawings, the latch link **366** can be a bar-type link that extends in a bar shape from a first end toward a second end.

[0369] More specifically, the latch link **366** can include a first link body **3661** that extends approximately linearly from a shaft hole **3663** to be described later toward the first end and a second link body **3662** that extends approximately linearly from the shaft hole **3663** toward the second end.

[0370] In this case, as will be described later, the first link body **3661** and the second link body **3662** can extend in opposite directions to each other with respect to the shaft hole **3663**, so as to easily engage and disengage the ratchet gear **365** as they pivot by the action of gravity.

[0371] In some examples, the latch portion **3661a** can be disposed at the first end of the first link body **3661** to engage the above-mentioned gear teeth **3651** of the ratchet gear **365**.

[0372] The latch portion **3661a** can be provided in the form of a hook, for example, so as to easily engage and disengage the gear teeth **3651** of the ratchet gear **365** as the latch link **366** pivots.

[0373] It should be noted that, as will be described later, the latch portion **3661a** can be configured to have surface contact with the gear teeth **3651** of the ratchet gear **365** so as to maximally prevent the ratchet gear **365** from rotating in the second rotational direction **R2** while the ratchet gear **365** is engaged.

[0374] A weight balance hole **3662a** into which a first weight **3671** of the weight balance **367** to be described later is inserted and coupled can be formed at the second end of the second link body **3662**.

[0375] As illustrated in the drawings, the weight balance hole **3662a** can be formed to have a non-circular cross-section corresponding in outward appearance to the first weight **3671**.

[0376] In some examples, as described previously, the latch link **366** serves to allow or prevent the rotation of the ratchet gear **365** in the second directional direction **R2** as it pivots by gravity in conjunction with the angle of rotation of the door **2**.

[0377] To create as much torque as possible by gravity, the linear distance from the shaft hole **3663** as the center of rotation to the weight balance hole **3662a** to which the weight balance **367** is coupled can be set to be much larger than the linear distance from the shaft hole **3663** to the latch portion **3661a**.

[0378] That is, the extension length of the second link body **3662** can be much greater than the extension length of the first link body **3661**.

[0379] In some examples, a third shaft **SH3** pivotally supporting the latch link **366** can be coupled between the first and second ends of the latch link **366**.

[0380] A shaft hole **3663** through which the third shaft **SH3** penetrates and extends can be provided between the first end and the second end so that the third shaft **SH3** is inserted and coupled therein.

[0381] The latch link **366** can be supported in such a way as to pivot around a fourth rotational axis **X4** formed on the third shaft **SH3**.

[0382] In some examples, the latch link **366** needs to be supported so as to easily pivot by gravitational force acting on the weight balance **367**. In some examples, both ends of the third shaft **SH3** can be connected to the driving unit housing **368** through the second bearings **B2**.

[0383] In some examples, the weight balance **367** can be coupled to the second end of the latch link **366** opposite the latch portion **3661a** with respect to the aforementioned fourth rotational axis and serve to move the center of mass of the entire latch link **366** to the weight balance **367**.

[0384] More specifically, the center of mass of the entire latch link **366** can be formed at the weight balance **367** while the weight balance **367** and the latch link **366** are held together by the weight balance **367**.

[0385] Accordingly, the weight balance **367** can serve as a weight that generates torque for the latch portion **3661a** so as to keep the latch portion **3661a** and the gear teeth **3651** of the ratchet gear **365** engaged according to the angular range of rotation of the door **2**, or that brings the latch portion **3661a** to a stop so as to keep the latch portion **3661a** and the gear teeth **3651** of the ratchet gear **365** disengaged.

[0386] FIGS. **19** and **20** illustrate by way of example a construction in which the weight balance **367** includes a first weight **3671** to be inserted and coupled into the aforementioned weight balance hole **3662a** of the latch link **366** and a pair of second weights **3672** to be respectively coupled to opposite ends of the first weight **3671**.

[0387] Although the present disclosure is not limited to this, a description will be given with respect to an implementation in which the weight balance **367** includes one first weight **3671** and a pair of second weights **3672**.

[0388] As illustrated in the drawings, the first weight **3671** can be configured to have a thin shape that extends longer laterally than vertically.

[0389] The first weight **3671** can be coupled to the latch link **366** in such a way as to be inserted and penetrated into the aforementioned weight balance hole **3662a**.

[0390] Moreover, opposite ends of the first weight **3671** can be coupled to the second weight **3672** in such a way as to be inserted into an insertion hole **3672a** formed at the second weight **3672**.

[0391] In some examples, the lateral length of the first weight **3671** can be greater than the lateral length of the weight balance hole **3662a** of the latch link **366**.

[0392] In some examples, as illustrated in the drawings, the first weight **3671** can have a non-

circular cross-section. Since the first weight **3671** has a non-circular cross-section, the first weight **3671** and the second weight **3672** can be prevented from rotating relative to the latch link **366** about the weight balance hole **3662a**.

[0393] That is, once the first weight **3671** and the second weight **3672** are connected in such a way as to rotate relative to the latch link **366** about the weight balance hole **3662a**, the relative position of the center of mass of the weight **367** may change with the pivotal position of the latch link **366**, and the latch portion **3661a** and the gear teeth **3651** of the ratchet gear **365** can be disengaged from each other according to the change in the position of the center of mass before the door **2** reaches the cover release position.

[0394] In some examples, by keeping the relative position of the center of mass of the weight balance **367** constant regardless of the pivotal position of the latch link **366**, it is possible to prevent the latch portion **3661a** and the gear teeth **3651** of the ratchet gear **365** from disengaging from each other before the door **2** reaches the cover release position.

[0395] In some examples, the second weight **3672** to be coupled to opposite ends of the first weight **3671** can be provided in the shape of a block that is smaller in lateral width than the first weight **3671** and larger in front-rear width and vertical width.

[0396] Accordingly, the total weight of the pair of second weights **3672** can be greater than the first weight **3671**.

[0397] Moreover, the pair of second weights **3672** can be placed symmetrically with respect to the first weight **3671**.

[0398] As such, the combined center of mass of the weight balance **367** and the latch link **366** can be formed inside the pair of second weights **3672**.

[0399] Hereinafter, referring to FIGS. **21** to **24**, a description will be given of how the rotation of the ratchet gear **365** in conjunction with the angle of rotation of the door **2** is restrained and released.

[0400] FIG. **21** and FIG. **23** illustrate that the ratchet gear **35** is restrained by the latch link **366** so as to prevent rotation in the second rotational direction **R2** while the door **2** is closed and the handle space **30** is closed by the handle cover **4**.

[0401] Referring to FIG. **21**, if the user pushes the handle cover **4** in order to open the door **2** while the door **2** is closed and the handle space **30** is closed by the handle cover **4**, the handle cover **4** can start moving rearward.

[0402] As the handle cover **4** moves rearward, the rack gear **361** connected to the handle cover **4** rotates in the first rotational direction **R1** along the first rotational axis **X1**.

[0403] When the rack gear **361** rotates in the first rotational direction **R1**, the first pinion gear **3631** engaging the first gear portion **3612** of the rack gear **361** rotates in the second rotational direction **R2**.

[0404] Also, when the first pinion gear **3631** rotates in the second rotational direction **R2**, the second pinion gear **3632** engaging the first pinion gear **3631** can rotate in the first rotational direction **R1**.

[0405] In this case, although the second pinion gear **3632** rotates with the rotation of the first pinion gear **3631**, the one-way clutch **364** prevents the rotation of the second pinion gear **3632** from being transmitted to the second shaft **SH2**.

[0406] This is because, as described previously, the one-way clutch **364** is configured to not transmit the torque for the first rotational direction **R1** to the second shaft **SH2**.

[0407] Accordingly, the torque is not transmitted to the second shaft **SH2** and the ratchet gear **365**, and they can be kept in stopped state.

[0408] Once the pressure from the user is released after continuing rearward movement of the handle cover **4**, the rack gear **361** can rotate as much as a corresponding angle and then stop. That is, the rack gear **361** can be configured to stop at a middle position even if the handle cover **4** is not rotated to the rearmost position.

[0409] In this case, after the rack gear **361** is stopped, a restorative force for the second rotational direction **R2** can be applied to the handle cover **4** and the rack gear **361** by a return spring that acts upon the cover hinge **430** of the handle cover **4**.

[0410] However, since the ratchet gear **365** is restrained by engaging the latch portion **3661a** of the latch link **366**, as illustrated in FIG. **21**, the rotation of the ratchet gear **365** in the second rotational direction **R2** is prevented.

[0411] Accordingly, the second shaft **SH2**, the second pinion gear **3632**, the first pinion gear **3631**, and the rack gear **361** can be prevented from rotating in the second rotational direction **R2**, and the handle cover **4** can be currently kept in stopped position.

[0412] FIG. **23** illustrates as described above that the ratchet gear **365** is prevented and restrained from rotating in the second rotational direction **R2** by engaging the latch portion **3661a** of the latch link **366**.

[0413] As illustrated in FIG. **23**, once the latch portion **3661a** of the latch link **366** engages the ratchet gear **365** while the door **2** is closed, the center of mass **CM** of the weight balance **367** can be rotated forward by a predetermined angle.

[0414] More specifically, a first intersecting angle **a1** can be formed between a vertical line **VL** passing through the fourth rotational axis **X4** and a virtual first extended line **L1** passing through the fourth rotational axis **X4** and the center of mass **CM** of the weight balance **367**.

[0415] In this way, by forming a first intersecting angle **a1** between a vertical line **VL** passing through the fourth rotational axis **X4** and a virtual first extended line **L1** passing through the fourth rotational axis **X4** and the center of mass **CM** of the weight balance **367**, a rotational force or torque can be created by a gravitational force acting on the center of mass **CM** so that the latch link **366** rotates counterclockwise about the fourth rotational axis **X4**.

[0416] By the rotational force or torque created by the gravitational force, an action force that pushes the gear teeth **3651** of the ratchet gear **365** can be generated at the latch portion **3661a** placed opposite with respect to the fourth rotational axis **X4**.

[0417] By this action force of the latch portion **3661a**, the ratchet gear **365** can continuously remain prevented and restrained from rotating in the second rotational direction **R2**.

[0418] In this case, the first intersecting angle **a1** can be set equal to the angle of rotation of the door **2** corresponding to the above-described cover release position.

[0419] Accordingly, the first intersecting angle **a1** can range from 45 to 55 degrees, e.g., 50 degrees.

[0420] In some examples, as illustrated in the drawings, a predetermined second intersecting angle **a2** can be formed between the virtual first extended line **L1** and a virtual second extended line **L2** passing through the fourth rotational axis **X4** and parallel to the extension direction of the second link body **3662** of the latch link **366**.

[0421] That is, the center of mass **CM** of the weight balance **367** can be formed at a position displaced toward the rear by the second intersecting angle **a2** with respect to the extension direction of the second link body **3662** of the latch link **366**.

[0422] In some examples, as illustrated in FIG. **23**, while the latch portion **3661a** of the latch link **366** engages the ratchet gear **365**, a predetermined third intersecting angle **a3** can be formed between a virtual third extended line **L3** passing through the fourth rotational axis **X4** and a front end portion of the latch portion **3661a** and a virtual fourth extended line **L4** passing through the third rotational axis **X3** as the center of rotation of the ratchet gear **365** and the fourth rotational axis **X4**.

[0423] As illustrated in the drawings, the third intersecting angle **a3** can be smaller than the first intersecting angle **a1** and the angle of rotation of the door **2** corresponding to the cover release position.

[0424] Accordingly, as will be described later, when the door **2** is rotated until the angle of rotation corresponding to the cover release position is reached, the third intersecting angle **a3** increases

gradually, thereby allowing the latch portion **3661a** of the latch link **366** and the gear teeth of the ratchet gear **365** to easily disengage from each other.

[0425] FIGS. **22** and **24** illustrate that the door **2** is opened and rotated by an angle of rotation corresponding to the cover release position, and that the ratchet gear **365** is released by the latch link **366** so as to rotate in the second rotational direction **R2**.

[0426] Referring to FIG. **22** and FIG. **24**, when the angle of rotation of the door **2** reaches the angle of rotation corresponding to the cover release position after the door **2** starts opening, the ratchet gear **365** and the latch portion **3661a** of the latch link **366** can be disengaged from each other.

[0427] More specifically, as the angle of rotation of the door **2** increases, the intersecting angle formed between the virtual fourth extended line **L4** and the vertical line **VL** increases gradually, but the aforementioned first intersecting angle **a1** becomes gradually smaller.

[0428] Afterwards, when the door **2** continues to be open and the angle of rotation of the door **2** reaches the angle of rotation corresponding to the cover release position, as illustrated in FIG. **24**, the intersecting angle formed between the vertical line **VL** passing through the fourth rotational axis **X4** and the aforementioned fourth extended line **L4** can be larger than the angle of rotation corresponding to the cover release position.

[0429] In this case, when the angle of rotation of the door **2** reaches the angle of rotation corresponding to the cover release position, the first intersecting angle **a1** can be 0 degree, and the virtual first extended line **L1** can be vertically aligned.

[0430] This is because, as described previously, the first intersecting angle **a1** and the angle of rotation corresponding to the cover release position are set equal.

[0431] Thus, the virtual first extended line **L1** can be kept vertically aligned by the gravitational force acting on the center of mass **CM** of the weight balance **367**, even if the angle of rotation of the door **2** exceeds the angle of rotation corresponding to the cover release position.

[0432] Accordingly, the position of the latch link **366** is kept constant regardless of the angle of rotation of the door **2**, and the intersecting angle formed between the vertical line **VL** passing through the fourth rotational axis **X4** and the above-described virtual fourth extended line **L4** increases gradually, whereby the distance between the ratchet gear **365** and the latch portion **3661a** increases gradually, and therefore the ratchet gear **365** and the latch portion **3661a** can be automatically disengaged from each other.

[0433] In some examples, once the ratchet gear **365** and the latch portion **3661a** are disengaged from each other, the ratchet gear **365** and the third shaft **SH3** can be released from the restrained state for the second rotational direction **R2**.

[0434] Accordingly, the second pinion gear **3632**, the first pinion gear **3631**, and the rack gear **361** connected to the third shaft **SH3** through the one-way clutch **364** can be released from the restrained state for the second rotational direction **R2**, and, as described previously, the handle cover **4** and the rack gear **361** can start rotating in the second rotational direction **R2** as illustrated in FIG. **22** by the restorative force of the return spring connected to the cover hinge **430** of the handle cover **4**.

[0435] As such, after starting rotating in the second rotational direction **R2**, the handle cover **4** can reach the aforementioned foremost position and then stop, and the opening **20** of the front face **211** of the door **2** can be closed off again.

[0436] Hereinafter, referring to FIG. **25** and FIG. **26**, examples of the shape of the gear teeth **3651** of the ratchet gear **365** according to the present disclosure will be described.

[0437] As described previously, the gear teeth of the ratchet gear can be configured to have a predetermined asymmetrical shape so as to easily engage and disengage the latch link **366**.

[0438] More specifically, each of the gear teeth of the ratchet gear can be formed to have an asymmetrical shape with respect to the radius of the ratchet gear.

[0439] FIG. **25** illustrates an example of the gear teeth of the ratchet gear.

[0440] As illustrated in FIG. **25**, the gear teeth **3651a** of the ratchet gear **365a** can be formed in

such a way that one side making direct contact with the latch portion **3661a** of the latch link **366** and the other side facing the one side extend in different directions, so as to have an asymmetrical shape with respect to the radius.

[0441] In this case, the one side can extend radially, as illustrated in the drawings, and the other side can extend at a slant toward the second rotational direction **R2**.

[0442] As such, the rotation in the second rotational direction **R2** can be maximally prevented by defining the extension direction of one side and the extension direction of the other side.

[0443] In some examples, the ratchet gear **365a** can be configured in such a way that the circumferential width of each individual gear tooth **3651a** stays approximately constant along the radius.

[0444] Moreover, the circumferential width of each individual gear tooth **3651a** which stays constant can be larger than the circumferential width of the latch portion **3661a**.

[0445] Hence, each individual gear tooth **3651a** of the ratchet gear **365a** can have high rigidity.

[0446] However, this large circumferential width of each individual gear tooth **3651** can narrow the space between adjacent gear teeth. Even then, the circumferential width of the latch portion **3661a** can be made correspondingly smaller, thereby allowing the latch portion **3661a** to easily disengage and re-engage.

[0447] In some examples, FIG. **26** illustrates the gear teeth of the ratchet gear according to a second implementation.

[0448] As illustrated in FIG. **26**, the gear teeth **3651b** of the ratchet gear **365b** according to another implementation can be formed in such a way that one side making direct contact with the latch portion **3661a** of the latch link **366** and the other side facing the one side extend in the same direction, so as to have an asymmetrical shape with respect to the radius.

[0449] In this case, the one side and the other side can extend at a slant toward the second rotational direction **R2**.

[0450] As such, the rotation in the second rotational direction **R2** can be maximally prevented by defining the same extension direction for both one side and the other side.

[0451] In some examples, the ratchet gear **365a** according to the second implementation can be configured in such a way that the circumferential width of each individual gear tooth **3651b** decreases gradually along the radius.

[0452] Moreover, as illustrated in the drawings, the circumferential width of each individual gear tooth **3651b** can be smaller than the circumferential width of the latch portion **3661a**.

[0453] Hence, each individual gear tooth **3651b** of the ratchet gear **365a** can have relatively low rigidity, but the space between adjacent gear teeth can be relatively large, thereby allowing the latch portion **3661a** to easily disengage and re-engage.

[0454] In some implementations, the dishwasher includes components for rotating the handle cover that are efficiently arranged in a narrow space inside the door. In some implementations, the dishwasher includes the handle and the handle cover that extend longer in a width direction of the door than a height direction. In some implementations, the dishwasher ensures that the handle cover opens at a large angle. In some implementations, the dishwasher helps prevent the user's fingers from getting caught in a handle cover that automatically opens and closes. In some implementations, the dishwasher with a handle cover automatically opens and closes and also can be manually opened and closed by the user.

[0455] In some implementations, the dishwasher allows the motion of the handle cover that is not restrained by the motor when the user manually opens or closes the handle cover. In some implementations, the dishwasher opens and closes by elasticity. In some implementations, the dishwasher opens fast when the handle cover is opened and closes slowly when the handle cover is closed. In some implementations, there is provided a dishwasher that provides better aesthetic outward appearance.

[0456] Any or other implementations of the present disclosure described above are not mutually

exclusive or distinct. Any or other implementations of the present disclosure described above can be used jointly or combined in each configuration or function.

[0457] The above detailed description should not be construed as restrictive in all respects and should be considered as illustrative. The scope of the present disclosure should be determined by a reasonable interpretation of the appended claims, and all modifications within the equivalent scope of the present disclosure are included in the scope of the present disclosure.

Claims

1. A dishwasher comprising: a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub; a door configured to open and close the washing chamber, the door comprising a front face having an opening; a handle that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door; and a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating about a center of rotation relative to the front face of the door, the handle cover comprising an upper portion configured to move into the handle space based on the handle cover opening the handle space, wherein the center of rotation of the handle cover is disposed below the opening of the door.
2. The dishwasher of claim 1, wherein the door further comprises a door cover that defines the front face of the door, and wherein the center of rotation of the handle cover is disposed rearward relative to the door cover.
3. The dishwasher of claim 2, wherein the door cover comprises a rim that defines a lower edge of the opening of the door and that is disposed above the center of rotation of the handle cover.
4. The dishwasher of claim 3, wherein the handle cover comprises: a cover part configured to open and close the opening of the door; a shaft that defines the center of rotation of the handle cover; and a boss that accommodates the shaft, and wherein the rim is disposed vertically above the boss and covers at least a part of the boss.
5. The dishwasher of claim 4, wherein the handle cover defines a recess at a lower end of the cover part, and wherein the rim is configured to insert into the recess of the handle cover based on the handle cover closing the handle space such that a front face of the handle cover and the front face of the door cover are coplanar.
6. The dishwasher of claim 1, further comprising a driving unit configured to rotate the handle cover relative to the door, the driving unit comprising a link that is rotatably connected to the handle cover and spaced apart from the center of rotation of the handle cover.
7. The dishwasher of claim 6, wherein the driving unit further comprises: a motor; and a connector that is connected to the link and configured to be rotated by the motor.
8. The dishwasher of claim 6, wherein the handle cover is configured to, based on the handle cover opening the handle space, define an angle between the handle cover and the link, the angle being smaller than 90 degrees.
9. The dishwasher of claim 7, wherein a center of rotation of the connector is disposed between a motor shaft of the motor and the center of rotation of the handle cover in a vertical direction and in a front-rear direction.
10. The dishwasher of claim 1, further comprising a driving unit configured to rotate the handle cover, the driving unit comprising a motor disposed below the handle cover, wherein the handle cover extends in a width direction of the door, and wherein lateral ends of the handle cover in the width direction define lateral ends of the door, respectively, or the handle cover extends toward the lateral ends of the door that are spaced apart from the lateral ends of the handle cover.
11. The dishwasher of claim 10, wherein a length of the driving unit in the width direction of the door is greater than a distance between one of the lateral ends of the door and one of the lateral ends of the handle cover.

- 12.** The dishwasher of claim 10, further comprising a spring configured to apply elastic force to the handle cover to thereby cause the handle cover to close the handle space, wherein one of the lateral ends of the handle cover and one of the lateral ends of the door are spaced apart from each other, and wherein the spring is disposed between the one of the lateral ends of the handle cover and the one of the lateral ends of the door.
- 13.** The dishwasher of claim 1, further comprising a door cover that defines the front face of the door, wherein the handle cover comprises a decoration disposed at a front side of the handle cover, and wherein the decoration and the door cover are made of a same material and configured to be coplanar based on the handle cover closing the handle space.
- 14.** The dishwasher of claim 1, wherein the handle further comprises a housing that is disposed inside the door and defines the handle space, and wherein the handle cover is rotatably attached to the housing.
- 15.** The dishwasher of claim 14, wherein the housing comprises: a side wall; and a guide that has an arc shape and is defined at the side wall, and wherein the handle cover comprises: a cover part configured to be disposed at the opening of the door based on the handle cover closing the handle space, and a slider that is disposed at the cover part and configured to move along the guide.
- 16.** A dishwasher comprising: a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub; a door configured to open and close the washing chamber, the door comprising a front face having an opening; a handle that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door; a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating relative to the front face of the door, the handle cover comprising an upper portion configured to move into the handle space based on the handle cover opening the handle space; and a driving unit configured to rotate the handle cover, the driving unit comprising a motor disposed below the handle cover.
- 17.** The dishwasher of claim 16, wherein the handle further comprises a housing that is disposed inside the door and defines the handle space, and wherein the driving unit is disposed below the housing.
- 18.** The dishwasher of claim 17, wherein the housing comprises: a bottom face configured to face a rear face of the handle cover based on the handle cover opening the handle space, the bottom face defining a through-hole, wherein the driving unit further comprises a link that passes through the through-hole and is connected to the handle cover.
- 19.** The dishwasher of claim 17, wherein the housing further comprises: a bottom face configured to face a rear face of the handle cover based on the handle cover opening the handle space; a stepped portion disposed below a front end of the bottom face; and a shaft holder that protrudes from the stepped portion, the shaft holder supporting a portion of the handle cover that defines an axis of rotation of the handle cover.
- 20.** A dishwasher comprising: a tub that defines a washing chamber, the washing chamber being opened to a front side of the tub; a door configured to open and close the washing chamber, the door comprising a front face having an opening; a handle housing that is disposed at the door and defines a handle space connected to the opening of the door, the handle space being defined rearward relative to the opening of the door; a handle cover disposed at the opening of the door and configured to open and close the handle space based on rotating relative to the front face of the door in a first direction and a second direction, respectively, the handle cover comprising an upper portion configured to move into the handle space based on the handle cover opening the handle space; and a driving system configured to rotate the handle cover, wherein the driving system comprises: a motor disposed below the handle housing and configured to rotate the handle cover in the first direction, and a spring disposed at an outer side of the handle housing in a width direction of the door and configured to apply force to the handle cover in the second direction opposite to the first direction.

