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DISH WASHER

Abstract

A dish washer is configured such that, when a handle of a door does not automatically pop up in a situation where power may not be supplied to the dish washer or a situation where power supply thereto is cut off, a user is able to manually partially pop up the handle and move the handle to an extended position, so that the user can open the door effectively even in the emergency situation, and convenience of the user can be improved.

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Background/Summary

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority to and benefit of Korean Patent Application No. 10-2024-0022973, filed on Feb. 16, 2024, which is hereby incorporated by reference as when fully set forth herein.

TECHNICAL FIELD

[0002] The present disclosure relates to a dish washer. More specifically, the present disclosure relates to a dish washer configured such that, when a door should be opened in an emergency situation but a handle does not automatically pop up, such as a situation where power may not be supplied to the dish washer or a situation where power supply thereto is cut off, a user is able to manually partially pop up a handle and manually move the handle to an extended position, so that the door may be opened effectively even in the emergency situation and convenience of the user may be improved.

BACKGROUND

[0003] A dish washer is an apparatus that washes dishes and cooking utensils as washing targets stored therein by spraying washing water thereto. The washing water may contain washing detergent.

[0004] Using the dish washer may allow a time and effort for washing the dishes and other washing targets after a meal to be reduced, thereby contributing to user convenience.

[0005] In order to store dishes inside the dish washer before a washing cycle, and to withdraw the washed and dried dishes after the washing cycle, the user should open and close the door.

[0006] The dish washer may include a door that is provided with a handle that the user may grasp to open and close the door.

[0007] In some cases, a dish washer may include a depressed type handle which the user grasps provided in the door. For instance, the handle of the dish washer may be provided in a form of a grip groove configured to be depressed from a front surface of the door toward a rear surface thereof by a predetermined depth. The handle may be provided in a depressed form from a portion of the front surface of the door toward an inside of the door. In some cases, a separate cover, etc., may not be disposed on the handle, and thus the handle may be always exposed to an outside. In some cases, the handle structure may accumulate external foreign substances such as dusts in the depressed space into which the hand of the user is inserted. The user may frequently clean the handle, thereby causing inconvenience to the user. In some cases, the handle may deteriorate the aesthetic sense of the front surface appearance of the door because the portion of the front surface of the door is concavely depressed.

[0008] In some cases, a dish washer may include a protruding type handle disposed on the door. For example, the handle may have a predetermined protruding height in a frontward direction from a front surface of the door, and may be always in a protruding state and have a 90 degrees-rotated U shape. In some cases, a user who does not recognize the protruding portion from the front surface of the door may collide with the protruding portion, thereby causing injury to the user. In some cases, the handle may collide with dishes and other kitchenware when the dishes are withdrawn from the dish washer and thus there is a possibility of causing damage to the handle itself or items such as dishes.

SUMMARY

[0009] The present disclosure describes a dish washer configured such that the handle is configured to extend in a protruding manner in a frontward direction from the door, such as when opening or closing the door, so that external foreign substances such as dusts are prevented from accumulating on the handle, thereby maintaining a clean state of the handle and improving user convenience.

[0010] The present disclosure further describes a dish washer configured such that the handle is configured to at least partially retract into an inside of the door when the use of the handle is not used, and a front end surface of the handle and a front surface of the door are configured to be

coplanar with each other in the retracted state such that the user feels a sense of unity of the handle and the door with each other, thereby improving the aesthetics of the appearance of the dish washer.

[0011] The present disclosure further describes a dish washer configured such that the handle is configured to at least partially retract into the inside of the door when the handle is not used, thereby reducing the possibility of user injury and handle damage that may occur due to collision of the user with the handle.

[0012] The present disclosure further describes a dish washer configured such that when a door should be opened in an emergency situation where a handle does not automatically pop up, such as a situation where power cannot be supplied to the dish washer or a situation where power supply thereto is cut off, a user is able to manually partially pop up a handle and manually move the handle to an extended position, so that the door may be opened effectively even in the emergency situation and convenience of the user may be improved.

[0013] According to one aspect of the subject matter described in this application, a dish washer includes a tub that defines a washing space configured to accommodate one or more objects to be washed therein, the tub having an open front surface in fluid communication with the washing space, a door configured to open and close the open front surface of the tub, a handle configured to reciprocate between (i) an extended position in which the handle protrudes forward from the door and (ii) a retracted position in which the handle is accommodated within the door, a handle driver disposed within the door and configured to reciprocate the handle from the retracted position toward the extended position or from the extended position toward the retracted position, and a pop-up device configured to, based on the handle being stopped at the retracted position, move the handle to a pop-up position in which the handle at least partially protrudes from an inside of the door toward an outside of the door. The pop-up device is configured to, based on the handle being retracted rearwardly toward the inside of the door by a predetermined retract stroke from the retracted position, move the handle to the pop-up position.

[0014] Implementations according to this aspect can include one or more of the following features. For example, the handle may include a handle body configured to reciprocate between the extended position and the retracted position based on a driving force of the handle driver, and a sliding block connected to the handle body and configured to move relative to the handle body, the sliding block being configured to transmit the driving force of the handle driver to the handle body, where the pop-up device is configured to, based on the handle being retracted rearwardly by the predetermined retract stroke from the retracted position, move the handle body relative to the sliding block in a frontward direction toward the outside of the door to thereby pop up the handle body relative to a surface of the door.

[0015] In some implementations, the pop-up device may include a latch fixed to the handle body, and a latch holder fixed to the sliding block and removably coupled to the latch, where the latch holder may include a compression spring configured to press the latch in the frontward direction toward the outside of the door. In some examples, the compression spring may be configured to, based on the handle body moving relative to the sliding block rearwards toward the inside of the door by the predetermined retract stroke, push and move the latch in the frontward direction toward the outside of the door. In some examples, the pop-up device may be configured to release an engagement between the latch and the latch holder before the latch moves in the frontward direction by force from the compression spring.

[0016] In some examples, the latch and the latch holder are configured to be re-engaged with each other based on the handle body being retracted rearwards toward the inside of the door. In some examples, the latch and the latch holder are configured to, based on being re-engaged with each other, restrict the handle body from moving relative to the sliding block in the frontward direction toward the outside of the door.

[0017] In some implementations, the handle body may include a first body that extends in a left-

right direction and is configured to be gripped by a user, and a second body that extends rearwards from the first body and defines an inner space configured to receive the sliding block therein, where the second body may include an inner panel that is disposed in the inner space and that divides the inner space into a front space and a rear space, the inner panel having a protruding surface that is convex toward the sliding block, and the latch is fixed to the protruding surface. In some examples, the latch holder may be fixedly disposed in an interior space of the sliding block. In some examples, the protruding surface of the second body may be configured to be retracted into the interior space of the sliding block based on the handle body being moved rearwards relative to the sliding block toward the inside of the door by the predetermined retract stroke.

[0018] In some implementations, the handle further may include a pop-up blocker configured to allow the handle body to pop up relative to the surface of the door and to restrict the handle body from popping up relative to the surface of the door, wherein the pop-up blocker is configured to, based on the handle being moved to the retracted position, allow the handle body to pop up relative to the surface of the door, and based on the handle being moved to the extended position, restrict the handle body from popping up relative to the surface of the door.

[0019] In some examples, the pop-up blocker may be disposed inside the handle body and configured to move relative to the handle body, where the handle body may include a stopper protrusion that is disposed at an inner surface of the handle body and positioned in front of the pop-up blocker, the stopper protrusion being spaced apart from the pop-up blocker. The stopper protrusion may be configured to limit a relative movement of the handle body relative to the pop-up blocker, and the handle body may be configured to, based on the handle being moved to the retracted position, define a first spacing between the stopper protrusion and the pop-up blocker in a frontward-backward direction. For example, a width of the first spacing is greater than the predetermined retract stroke.

[0020] In some examples, the handle body may be configured to, based on the handle being moved to the extended position, define a second spacing between the stopper protrusion and the pop-up blocker in the frontward-backward direction. For instance, a width of the second spacing is less than the predetermined retract stroke.

[0021] In some implementations, the handle driver may be configured to, based a user being detected within a predetermined range from the door, move the handle from the retracted position to the extended position. In some examples, the pop-up device may be configured to, based on a user pressing the handle at the retracted position, move the handle from the retracted position to the pop-up position.

[0022] In some implementations, the pop-up position is the extended position. In some examples, the handle is configured to be flush with a front surface of the door based on the handle being located at the retracted position. In some examples, the pop-up device may be one of a plurality of pop-up devices that are disposed at lateral end portions of the handle.

[0023] In some implementations, external foreign substances such as dusts may be prevented from accumulating on the handle, thereby maintaining a clean state of the handle and improving user convenience.

[0024] In some implementations, in the retracted state of the handle, the user feels a sense of unity of the handle and the door with each other, thereby improving the aesthetics of the appearance of the dish washer.

[0025] In some implementations, the dish washer may reduce the possibility of user injury and handle damage that may occur due to collision of the user with the handle.

[0026] In some implementations, when the door should be opened in an emergency situation where a handle does not automatically pop up, such as a situation where power cannot be supplied to the dish washer or a situation where power supply thereto is cut off, the user may be able to manually partially pop up the handle and manually move the handle to the extended position, so that the door may be opened effectively even in the emergency situation and convenience of the user may be

improved.

[0027] In addition to the above-mentioned effects, the specific effects of the present disclosure as not mentioned will be described below along with the descriptions of the specific details for carrying out the present disclosure.

Description

BRIEF DESCRIPTION OF DRAWINGS

[0028] FIG. 1 is a front perspective view showing an example of a dish washer.

[0029] FIG. 2 is a schematic cross-sectional view of the dish washer as shown in FIG. 1.

[0030] FIG. 3 is a front perspective view showing an example state in which a handle of a dish washer has been displaced to a retracted position.

[0031] FIG. 4 is a front perspective view showing an example state in which the handle as shown in FIG. 3 has been displaced to an extended position.

[0032] FIG. 5 is an enlarged side view of FIG. 3.

[0033] FIG. 6 is a schematic diagram illustrating an example configuration for recognizing a user and a pet in a distinguishing manner from each other using a proximity sensor disposed on a top surface of a door to determine the user's intention to open the door.

[0034] FIG. 7 is a rear perspective view of the door as shown in FIG. 3 and shows an example state in which a rear panel of the door is removed.

[0035] FIG. 8 is a rear perspective view showing an example of a handle driver as shown in FIG. 7.

[0036] FIG. 9 is an exploded perspective view of the handle driver as shown in FIG. 7.

[0037] FIG. 10 is an exploded perspective view showing an example of a pivot link, a link connector, and a connection pin among components of the handle driver as shown in FIG. 9.

[0038] FIG. 11 is a side view illustrating an example operation of the handle driver to initiate movement from the retracted position to the extended position for the handle.

[0039] FIG. 12 is a side view illustrating an example state in which movement to the extended position of the handle has been completed.

[0040] FIG. 13 is a side view illustrating an example operation of the handle driver to initiate movement from the extended position to the retracted position of the handle.

[0041] FIG. 14 is an enlarged view of a portion of FIG. 12, and is a diagram illustrating an example structure that prevents the handle from being moved backwards under an external force applied to the handle.

[0042] FIG. 15 is a rear perspective view illustrating an example of a handle frame on which the handle and the handle driver are installed which supports the handle and the handle driver.

[0043] FIG. 16 is an exploded perspective view for illustrating an example configuration of the handle.

[0044] FIG. 17 is an exploded perspective view showing an example of a manual pop-up device and a pop-up blocker provided in the handle as illustrated in FIG. 16.

[0045] FIG. 18 is a vertical cross-sectional view of the handle and the handle driver illustrating a state in which the handle has been displaced to the retracted position.

[0046] FIG. 19 is an enlarged view of a portion of FIG. 18.

[0047] FIG. 20 is a front perspective view of the door, and is a diagram illustrating an example position to which a user's pressing pressure is input for the manual pop-up of the handle.

[0048] FIG. 21 is a vertical cross-sectional view of the handle and the handle driver illustrating an example state in which the handle has been manually moved to the extended position by the user after the manual pop-up of the handle.

[0049] FIG. 22 is a vertical cross-sectional view of the handle and the handle driver illustrating an example state in which the handle has been automatically moved to the extended position.

[0050] FIG. 23 is an enlarged view of a portion of FIG. 22.

DETAILED DESCRIPTIONS

[0051] The above-mentioned purpose, features and advantages are described in detail below with reference to the attached drawings. Accordingly, a person skilled in the art in the technical field to which the present disclosure belongs will be able to easily implement the technical idea of the present disclosure. In describing the present disclosure, when it is determined that a detailed description of the known technology related to the present disclosure may unnecessarily obscure the gist of the present disclosure, the detailed description thereof is omitted. Hereinafter, one or more implementations will be described in detail with reference to the attached drawings. In the drawings, identical reference numerals are used to indicate identical or similar components.

[0052] Hereinafter, an overall structure of a dish washer **1** will be described in detail with reference to the attached drawings.

[0053] FIG. 1 is a front perspective view showing an example of the dish washer **1**. FIG. 2 is a simplified cross-sectional view briefly showing an internal structure of the dish washer **1**.

[0054] In some implementations, as shown in FIG. 1 and FIG. 2, the dish washer **1** may include a casing **10** that constitutes an exterior appearance, a tub **20** installed in an inner space of the casing **10** and having a washing space **21** defined therein where the washing target is washed, wherein a front surface of the tub is open, a door **30** that opens/closes the open front surface of the tub **20**, a driver **40** located under the tub **20** to supply, collect, circulate, and discharge the washing water for washing the washing target, a dish rack **50** removably provided in the inner washing space **21** of the tub **20** to receive therein the washing target, and a water sprayer installed adjacent to the dish rack **50** to spray the washing water for washing the washing target thereto.

[0055] In some examples, the washing target received in the dish rack **50** may be, for example, dishes such as bowls, plates, spoons, and chopsticks, and other cooking utensils. Hereinafter, unless otherwise specified, the washing target will be referred to as a dish.

[0056] The tub **20** may be formed in a box shape with an open front surface, and have a configuration of a so-referred to as washing tub.

[0057] The washing space **21** may be defined inside the tub **20**. The open front surface of the tub **20** may be opened/closing by the door **30**.

[0058] The tub **20** may be formed via pressing of a metal plate resistant to high temperature and moisture, for example, a stainless steel plate.

[0059] Moreover, on an inner surface of the tub **20**, a plurality of brackets may be disposed for the purpose of supporting and installing functional components such as the dish rack **50** and the water sprayer which will be described later thereon within the tub **20**.

[0060] In one example, the driver **40** may include a sump **41** that stores therein washing water, a sump cover **42** that distinguishes the sump **41** from the tub **20**, a water supply **43** that supplies washing water from an external source to the sump **41**, a water discharger **44** that discharges the washing water of the sump **41** to an outside, and a washing pump **45** and a supply flow path **46** that supply the washing water of the sump **41** to the water sprayer. The sump cover **42** may be disposed at a top of the sump **41** and may serve to distinguish the tub **20** and the sump **41** from each other.

[0061] Moreover, the sump cover **42** may have a plurality of collecting holes defined therein for collecting washing water sprayed into the washing space **21** through the water sprayer into the sump **41**.

[0062] That is, the washing water sprayed from the water sprayer toward the dish may fall down to a bottom of the washing space **21**, and may be collected again through the sump cover **42** and into the sump **41**.

[0063] The washing pump **45** may be disposed at one side of the sump **41** and may serve to pressurize the washing water and supply the pressurized washing water to the water sprayer.

[0064] One end of the washing pump **45** may be connected to the sump **41** and the other end thereof may be connected to the supply flow path **46**. The washing pump **45** may be equipped with

an impeller **451** and a motor **453**. When power is supplied to the motor **453**, the impeller **451** may rotate, and thus the washing water in the sump **41** may be pressurized, and then may be supplied to the water sprayer through the supply flow path **46**.

[0065] In some examples, a wash water heater may be provided in the washing pump **45** to heat the wash water supplied during a wash cycle or a heat rinse cycle.

[0066] In one example, the supply flow path **46** may serve to selectively supply the washing water supplied from the washing pump **45** to the water sprayer.

[0067] For example, the supply flow path **46** may include a first supply flow path **461** connected to a lower spraying arm **61**, and a second supply flow path **463** connected to an upper spraying arm **62** and a top nozzle **63**. The supply flow path **46** may be provided with a supply flow path switching valve **465** that selectively opens/closes the supply flow paths **461** and **463**.

[0068] In some implementations, the supply flow path switching valve **465** may be controlled so that the supply flow paths **461** and **463** are opened sequentially or simultaneously.

[0069] In one example, the water sprayer may be configured to spray the washing water to the dishes stored in the dish rack **50**.

[0070] More specifically, the water sprayer may include the lower spraying arm **61** located under the tub **20** to spray the washing water to a lower rack **51**, the upper spraying arm **62** located between the lower rack **51** and an upper rack **52** to spray the washing water to the lower rack **51** and the upper rack **52**, and the top nozzle **63** located on top of the tub **20** to spray the washing water to a top rack **53** or the upper rack **52**.

[0071] In particular, the lower spraying arm **61** and the upper spraying arm **62** may be rotatably disposed in the washing space **21** of the tub **20** and may spray the washing water toward the dish of the dish rack **50** while being rotating.

[0072] The lower spraying arm **61** may be rotatably supported on a top of the sump cover **42** so as to spray the washing water toward the lower rack **51** while being rotating and being disposed under the lower rack **51**.

[0073] Moreover, the upper spraying arm **62** may be rotatably supported by a spraying arm holder **467** so as to spray the washing water on the dish while being rotating and being disposed between the lower rack **51** and the upper rack **52**.

[0074] In some examples, in order to increase washing efficiency, additional means for diverting the washing water sprayed from the lower spraying arm **61** into an upward direction (diverting in a U-direction) may be provided at a lower surface **25** of the tub **20**.

[0075] A detailed configuration of the water sprayer has been already known in the art. Thus, a description of the specific configuration of the water sprayer will be omitted below.

[0076] The dish rack **50** for storing the dish therein may be disposed in the washing space **21**.

[0077] The dish rack **50** may be configured to extend or retract from or into the inner space of the tub **20** through the open front surface of the tub **20**.

[0078] For example, in FIG. **2**, the dish rack **50** may include the lower rack **51** located at a lower portion of the tub **20** to accommodate therein relatively large dishes, the upper rack **5** located on top of the lower rack **51** to accommodate therein medium-sized dishes, and the top rack **53** located at a top level of the tub **20** and capable of storing therein small dishes, etc. However, implementations of present disclosure are not limited thereto. Hereinafter, an example in which the dish washer **1** includes the three dish racks **50** as shown is described.

[0079] In some implementations, each of the lower rack **51**, the upper rack **52**, and the top rack **53** may be configured to extend or retract from or into the inner space of the tub **20** through the open front surface of the tub **20**.

[0080] For this purpose, guide rails may be respectively disposed on both opposing inner side surfaces constituting an inner surface of the tub **20**. By way of example, the guide rails may include an upper rail, a lower rail, and a top rail.

[0081] Wheels may be disposed on a bottom of each of the lower rack **51**, the upper rack **52**, and

the top rack **53**. The user may extend the lower rack **51**, the upper rack **52**, and the top rack **53** from the inner space of the tub **20** through the open front surface of the tub **20** and may place the dishes thereon, or easily withdraw the dishes that have been washed out thereof.

[0082] The guide rail may be implemented as a simple rail-type fixed guide rail to guide the extending or the retracting of the rack **50**, or a telescopic guide rail capable of guiding the extending or the retracting of the rack **50** and at the same time, increasing an extension distance thereof as the rack **50** further extends from the inner space of the tub.

[0083] In one example, the door **30** is configured for opening/closing the open front surface of the tub **20** as described above.

[0084] A hinge around which the door **30** is closed or opened may be provided at a bottom of the open front surface. Thus, the door **30** may pivot around the hinge as a pivot axis.

[0085] In some implementations, a handle **31** for opening the door **30** and a control panel **32** for controlling an operation of the dish washer **1** may be disposed on an outer side surface of the door **30**.

[0086] As shown, the control panel **32** may include a display **33** that visually displays information regarding a current operating status of the dish washer **1**, etc., and a button unit **34** including a selection button through which a user's course selection manipulation is input and a power button through which a user's manipulation for turning the dish washer on and off is input.

[0087] In one example, a rear panel **30b** constituting an inner side surface of the door **30** may constitute one surface of the tub **20** when the door **30** has been closed, and may constitute a seat surface on which the lower rack **51** of the dish rack **50** is supported when the door **30** is fully opened.

[0088] For this purpose, when the door **30** is fully opened downwardly, the rear panel **30b** of the door **30** may constitute a horizontal plane extending in the same direction as a direction in which the guide rail guiding the displacement of the lower rack **51** extends.

[0089] In one example, unlike a conventional handle, the handle **31** of the dish washer **1** may be configured to be at least partially accommodated in an inside of the door **30** when the handle is not in use, and to automatically extend in a protruding manner in a frontward direction from the door **30** when it is necessary to open and close the door **30**.

[0090] In that the handle is configured to retract so as to be at least partially accommodated in the inside of the door **30** or extend in a protruding manner in a frontward direction from the door **30** out of the inside of the door **30**, the handle **31** may be referred to as various names such as a pop-up handle, a retractable handle, an extendable handle, etc.

[0091] Hereinafter, the handle **31** configured to retract into or extend from the door **30** of the dish washer **1** will be referred to as the pop-up handle **31**.

[0092] In some examples, the rear panel **30b** defining the inside of the door **30** may further be provided with a detergent supply device for automatically supplying detergent into the inside of the tub **20**.

[0093] Furthermore, a door position sensor **36** may be disposed on an outer top surface of the tub **20** and may be configured to detect whether the door **30** is in a closed or open state. For example, the door position sensor **36** may include a door position sensor S_d or a latch sensor that detects a position of a door latch.

[0094] In one example, a drying air supply **80** may be disposed under the tub **20** and may be configured to generate and supply high-temperature or low-temperature drying air to the washing space inside the tub **20**.

[0095] As shown, the drying air supply **80** may be configured to include a filter member **883** for filtering outside air, a blower fan **825** for generating a drying air stream, a heater **84** for heating the drying air stream, and an air stream guide **83** disposed inside the tub **20** so as to guide the drying air stream.

[0096] A drying air supply hole may be defined in a lower surface of the tub **20** so that high-

temperature drying air generated by the drying air supply **80** may be introduced into the inside of the tub **20** through the drying air supply hole.

[0097] Thus, the high-temperature drying air or low-temperature drying air may be supplied from the drying air supply **80** into the inside of the tub **20** during the drying cycle **S5** such that the drying efficiency and sterilization effect on the dishes may be improved compared to a conventional dish washer.

[0098] In one example, the dish washer may be configured such that the air current supplied to the inside of the tub **20** and moistened while drying the dishes may be discharged to the outside, and the discharge of the air current may be accomplished via partial opening of the door **30** or via a separate air discharge means.

[0099] Hereinafter, with reference to FIGS. **3** to **5**, the appearance and the operation of the pop-up handle **31** disposed at the door **30** of the dish washer **1** will be described in detail.

[0100] As described above, the door **30** of the dish washer **1** may be provided with the pop-up handle **31** that may be reciprocally movable.

[0101] In some implementations, as described above, the door **30** may be configured to be pivotable around the hinge connected to a lower end of the door.

[0102] In consideration of the position of the hinge, as shown in FIG. **3** and FIG. **4**, the pop-up handle **31** may be positioned at a position close to a top surface of the door **30** where the user may easily grasp the handle, and may be disposed at the front panel **30a** constituting the front surface of the door **30**.

[0103] Furthermore, the pop-up handle **31** may extend along an extension direction of a front edge of the top surface of the door **30** and along a left-right direction so that the user may easily grasp the handle. The handle **31** may be formed to have an approximate 90 degrees-rotated U shape.

[0104] In order to extend or retract the pop-up handle **31**, an elongate opening **30e** having a shape corresponding to an appearance of the pop-up handle **31** may be defined in the front panel **30a** of the door **30** and extend along the extension direction of the front edge of the top surface of the door **30**, and have a depth along a front-rear (F-R) direction

[0105] The pop-up handle **31** may be configured to reciprocate along the forward and backward directions through the opening **30e** of the front panel **30a** under an operation of a handle driver **35** as described below.

[0106] More specifically, the pop-up handle **31** may be disposed to reciprocate between the most forward position and the most rearward position under the operation of the handle driver **35**.

[0107] For convenience, the most forward position to which the pop-up handle **31** is displaced in a forward direction is defined as an extended position **Pd**. The most rearward position to which the pop-up handle **31** is displaced in a backward direction is defined as a retracted position **Pa**.

[0108] FIG. **3** illustrates a state where the pop-up handle **31** has been displaced to the most rearward position, that is, the retracted position **Pa**, and thus has been retracted into the inside of the door **30**.

[0109] As shown, when the pop-up handle **31** has been displaced to the retracted position **Pa**, the pop-up handle **31** has been at least partially retracted into the inside of the door **30**.

[0110] In some examples, the pop-up handle **31** may pass through an entirety of the opening **30e** of the door **30** and be retracted into the inside of the door **30**.

[0111] Furthermore, when the pop-up handle **31** has been displaced to the retracted position **Pa**, the pop-up handle **31** may be in a state where the pop-up handle **31** does not protrude from the front panel **30a** of the door **30** in a frontward direction.

[0112] Furthermore, when the pop-up handle **31** has been displaced to the retracted position **Pa**, a front end surface of the pop-up handle **31** may be coplanar with a front surface of the front panel **30a** of the door **30** so as to form a continuous surface.

[0113] That is, no step may be formed between the front surface of the front panel **30a** of the door **30** and the front end surface of the pop-up handle **31** when the pop-up handle **31** has been displaced

to the retracted position Pa.

[0114] Thus, when the pop-up handle **31** has been displaced to the retracted position Pa, the opening **30e** of the front panel **30a** is entirely blocked, and at the same time, no step is formed between the front surface of the front panel **30a** and the front end surface of the pop-up handle **31**, such that the phenomenon in which foreign substances such as dusts accumulate on a convex portion of the door **30** or on the handle itself as in the conventional approach may be prevented.

[0115] In one example, as described below, the front end surface of the pop-up handle **31** may be a front surface of a decoration panel **315** that is provided separately from the handle body **311** that constitute the overall appearance of the pop-up handle **31**.

[0116] In some implementations, the decoration panel **315** may include a material having the same texture as that of the front panel **30a** of the door **30**.

[0117] Thus, the user may feel a sense of unity the decoration panel **315** and the front panel **30a** of the door **30**, and thus the aesthetic sensibility of the outer appearance of the door **30** may be improved and the aesthetics of the door which the user perceives may be improved.

[0118] FIG. 4 and FIG. 5 illustrate a state in which the pop-up handle **31** has been displaced from the retracted position Pa to the extended position Pd as the most forward position.

[0119] As described above, the door **30** of the dish washer **1** should be opened and closed in order to store the dishes that need to be washed in the dish washer or to withdraw the dishes that have been washed out of the dish washer **1**.

[0120] When the user's intention to open the door **30** is identified at a time for opening/closing of the door **30**, the pop-up handle **31** may be automatically moved from the retracted position Pa to the extended position Pd under the operation of the handle driver **35**.

[0121] For this purpose, the dish washer **1** may further be provided with a means for detecting the user's intention to open the door **30**.

[0122] For example, the means for detecting the user's intention to open the door **30** may include a proximity sensor S_p.

[0123] The proximity sensor S_p may be a sensor that may detect whether the user approached so as to be located within a specific range from the door **30**.

[0124] For example, the proximity sensor S_p may include any one of a radar sensor, an image sensor, or an infrared sensor (IR) Sensor.

[0125] However, implementations of the present disclosure are not limited thereto, and the proximity sensor S_p may be applied without limitation in terms of the type thereof as long as the proximity sensor S_p is a means that can identify proximity of the user to the door. The following description will be based on an example in which the radar sensor is applied as the proximity sensor S_p.

[0126] As shown in FIG. 3 and FIG. 4, the radar sensor as the proximity sensor S_p may be disposed on the control panel **32** and at a location close to the existing display **33** so as to easily identify the proximity of the user to the door, and to facilitate modularization thereof with the existing display **33**.

[0127] In this way, the radar sensor as the proximity sensor S_p may be disposed on the control panel **32** disposed on the top surface of the door **30** and may be configured to recognize the user and a pet that is not the user in the distinguishing manner from each other.

[0128] However, the dish washer **1** is not configured to immediately move the pop-up handle **31** even when the radar sensor recognizes that the user is located within a predetermined distance range from the door **30**.

[0129] This is because there may be cases where the user simply passes by the dish washer **1** without any intention to open the door **30**.

[0130] In some examples, the dish washer **1** may be further configured to add a time condition to identify the intention to open the door **30** through the proximity sensor S_p such as the radar sensor.

[0131] In some examples, when the dish washer **1** identifies that the user is present within a specific distance range from the door **30** through the radar sensor and continues to stay within the specific distance range for a specific time condition, the dish washer **1** may determine that the user has an intention to open the door **30**.

[0132] In some implementations, the specific distance range and the specific time condition may be set to vary depending on the environment in which the dish washer **1** is disposed and a physical condition of the user.

[0133] When the specific distance range condition and the specific time condition are satisfied, the operation of the handle driver **35** may be initiated and the pop-up handle **31** may be displaced forwardly from the retracted position Pa to the extended position Pd.

[0134] FIG. **4** and FIG. **5** illustrate the state in which the pop-up handle **31** has completed the forward movement to the extended position Pd.

[0135] When the pop-up handle **31** has completed its movement to the extended position Pd, the handle body **311** of the pop-up handle **31** may be exposed to the outside of the door **30** and may be grasped by the user.

[0136] In some implementations, a stroke Ls by which the pop-up handle **31** is displaced from the retracted position Pa to the extended position Pd may be in a range of 40 mm inclusive to 50 mm inclusive, for example, 45 mm.

[0137] The stroke Ls of the pop-up handle **31** is determined in consideration of that when the stroke Ls is too small, such as smaller than 40 mm, it is not easy for the user to grasp the handle, while when the stroke Ls is too large, such as larger than 50 mm, a size of the pop-up handle **31** in the forward and backward direction increases, thereby causing a problem in that the pop-up handle **31** does not retract entirely into the door **30**.

[0138] However, the numerical value of the movement stroke Ls of the pop-up handle **31** is only an example and may be set to vary depending on the overall size of the dish washer **1** and the size in the forward and backward direction of the door **30**.

[0139] FIG. **5** discloses a configuration that detects the user's intention to open the door **30** using a single radar sensor as a proximity sensor S_p.

[0140] As known in the art, the radar sensor may transmit the electromagnetic waves from a sensing surface thereof and may receive the electromagnetic waves reflected from the user or the object and may analyze the received electromagnetic waves and may perform a function of detecting the presence of the user or the object within a detection area as, a distance to the user or the object, and a moving speed of the user or the object based on the analysis result.

[0141] As illustrated, the detection area as of the radar sensor applied to the present disclosure may have an angular range of about 100 degrees along the frontward-backward direction and about 100 degrees along the left-right direction around the sensing surface.

[0142] In some implementations, as described above, the radar sensor functioning as the proximity sensor S_p may be configured to be disposed at a position as close as possible to a center of a top surface of the front panel **30a** of the door **30** defining the inside of the door **30** so as to easily identify whether the user is approaching an area in front of the door **30** and to distinguish between the user and a non-user such as a pet from each other.

[0143] Furthermore, as shown in FIG. **5**, since the radar sensor is positioned inside the door **30** and near the top surface of the front panel **30a** of the door **30**, the sensing surface of the radar sensor may be oriented to generally face upwardly of the door **30**.

[0144] Furthermore, the sensing surface of the radar sensor may be oriented to be tilted at a predetermined angle in a frontward direction of the door **30**.

[0145] Accordingly, the sensing surface of the radar sensor may be oriented in a frontward and upward direction of the door **30**.

[0146] In this way, since the sensing surface of the radar sensor is oriented to be tilted so as to face in a frontward and upward direction rather than in a frontward and downward direction of the door

30, the detection area as of the radar sensor may have a line tilted so as to face in a frontward and upward direction of the door **30**.

[0147] Since the sensing surface of the radar sensor is oriented to be tilted so as to face in a frontward and upward direction of the door **30** while being disposed in a tilting holder. Thus, even when an object that cannot be expected to use the dish washer **1**, such as a pet or an infant with a height smaller than at least the dish washer **1**, approaches an area in front of the door **30**, the radar sensor may be configured not to detect the pet or infant.

[0148] Accordingly, upon detecting the pet or the infant, the pop-up handle may be prevented from operating meaninglessly, and thus power loss may be minimized.

[0149] In some examples, the tilting angle at of the sensing surface of the radar sensor with respect to the vertical direction may be, for example, in a range of 25 degrees inclusive to 35 degrees inclusive, for example, 30 degrees.

[0150] However, the tilting angle at of the sensing surface of the radar sensor provided in the present disclosure with respect to the vertical direction may be adjusted according to the physical condition of the user who is expected to use the dish washer **1**.

[0151] For example, when the tilting angle at of the sensing surface of the radar sensor with respect to the vertical direction is set to 30 degrees, a minimum vertical detection height H_{min} of the radar sensor may be in a range of 100 cm inclusive to 110 cm inclusive, for example, 105 cm, and a maximum detection distance L_{max} based on the horizontal direction may be in a range of 75 cm inclusive to 85 cm inclusive, for example, 80 cm.

[0152] That is, when the tilting angle at is set to 30 degrees, a user with a height of 105 cm or larger may be recognized as approaching the door when he or she enters the detection range within 80 cm from the radar sensor based on the horizontal direction.

[0153] Alternatively, for example, when the tilt angle at is set to 15 degrees, a user with a height of 127 cm or more may be recognized as approaching to the door when he or she enters the detection range within 50 cm of the radar sensor in the horizontal direction.

[0154] Hereinafter, referring to FIG. 7 to FIG. 14, the detailed configuration of the handle driver **35** that actuates the pop-up handle **31** so that the pop-up handle **31** moves back and forth between the extended position P_d and the retracted position P_a is described.

[0155] In some implementations, referring to FIG. 7, in consideration of a shape of the handle body **311** of the pop-up handle **31** that extends in an elongate manner in the left-right direction, a pair of handle drivers **35** may be disposed separately and respectively on a left end and a right end of the pop-up handle **31**.

[0156] That is, the pair of handle drivers **35** may be separated from each other and spaced from each other along the left-right direction and may be respectively on a left end and a right end of the pop-up handle **31** so as to respectively transmit a driving force for moving the pop-up handle **31** to the left end and the right end of the pop-up handle **31** which are accommodated inside a handle housing **30d4**.

[0157] In this way, the pair of handle drivers **35** are disposed in a state separated from each other and spaced from each other along the left-right direction, the driving force generated from each of the handle drivers **35** may be transmitted to each of the left and right ends of the pop-up handle **31**.

[0158] Accordingly, since driving loads applied to the handle drivers **35** are distributed, the miniaturization of each of the handle drivers **35** may be achieved, and thus, the manufacturing cost may be reduced.

[0159] However, this is only an example. Alternatively, the pop-up handle **31** may be driven using only a single handle driver. Hereinafter, an example in which the pair of handle drivers **35** are provided will be described. However, implementations of present disclosure are not limited thereto.

[0160] As illustrated, the left handle driver **35** and the right handle driver **35** may have shapes symmetrical with each other and may be arranged symmetrically with each other around the pop-up handle **31**, and may be fixedly installed on a handle frame **30d**.

[0161] Therefore, the right and left handle drivers **35** may be configured to be identical with each other except for the fact that the left handle driver **35** and the right handle driver **35** have shapes symmetrical with each other and are arranged symmetrically with each other around the pop-up handle **31**.

[0162] Therefore, the following description will be based on the handle driver **35** disposed at the left side. Unless otherwise described, the following content may be equally applied to the handle driver **35** disposed at the right side.

[0163] As shown in FIG. 7 to FIG. 9, the handle driver **35** that generates the driving force for the reciprocating movement of the pop-up handle **31** may be configured to include a driving motor **351** that receives power and generates a rotational driving force, a driving cam **352** that spins under the rotational driving force of the driving motor **351**, a pivot link **353** that pivots around one end thereof in conjunction with the spin motion of the driving cam **352** so as to push or pull the pop-up handle **31**, a link connector **354** that connects the pivot link **353** and the pop-up handle **31** to each other, and a housing **355** that accommodates therein the driving motor **351**, the driving cam **352**, and the pivot link **353**.

[0164] The driving motor **351** is configured to receive power and generate a rotational driving force.

[0165] As described above, the pop-up handle **31** may be configured to repeatedly move forwards from the retracted position Pa toward the extended position Pd and move backwards from the extended position Pd toward the retracted position Pa and thus to reciprocate between the extended position Pd and the retracted position Pa.

[0166] In order to easily implement such reciprocating movement, the driving motor **351** constituting the handle driver **35** may be configured to generate a bidirectional rotation driving force.

[0167] Accordingly, the driving motor **351** applied to the handle driver **35** may be applied without limitation in terms of the type thereof as long as the driving motor **351** is capable of generating the bidirectional rotation driving force.

[0168] Hereinafter, among the bidirectional rotation driving (forces), the driving (driving force) in the direction in which an output shaft **3512** of the driving motor **351** rotates to move the pop-up handle **31** in the frontward direction toward the extended position Pd is referred to as forward direction rotation driving (forward direction rotation driving force), while the driving (driving force) in the direction in which the output shaft **3512** of the driving motor **351** rotates to move the pop-up handle **31** backwards toward the retracted position Pa is referred to as reverse direction rotation driving (or reverse direction rotation driving force).

[0169] In one example, as shown in FIG. 8, a motor body **3511** of the driving motor **351** may be accommodated in an accommodation space formed between a second housing **3552** and a third housing **3553**, and the output shaft **3512** of the driving motor **351** may extend thorough the second housing **3552** and be connected to the driving cam **352**.

[0170] As described below, the output shaft **3512** of the driving motor **351** may be inserted into a shaft hole **3522** of the driving cam **352**, and may be forcibly coupled to the shaft hole **3522**.

[0171] Thus, the output shaft **3512** of the driving motor **351** may rotate integrally with the driving cam **352**.

[0172] In one example, the driving cam **352** receives the rotation driving force from the output shaft **3512** of the driving motor **351** and transmits the received rotation driving force to the pivot link **353**.

[0173] More specifically, when the driving cam **352** rotates in the forward direction in conjunction with the rotation of the output shaft **3512** of the driving motor **351**, the driving cam **352** pressurizes the pivot link **353** so that the pivot link **353** pivots in the frontward direction. When the driving cam **352** rotates in the reverse direction in conjunction with the rotation of the output shaft **3512** of the driving motor **351**, the driving cam **352** pressurizes the pivot link **353** so that the pivot link **353**

pivots in the backward direction.

[0174] For this purpose, the driving cam **352** may be configured to include a cam body **3521** that spins under the rotation driving force transmitted from the output shaft **3512** of the driving motor **351**, and a driving pin **3523** that is disposed on one side surface of the cam body **3521** and protrudes toward the pivot link **353**.

[0175] The cam body **3521** may be provided in a form of a disk having an approximately uniform thickness, for example.

[0176] The shaft hole **3522** to which the output shaft **3512** of the driving motor **351** is forcibly inserted may extend through a center portion of the cam body **3521**.

[0177] In order to easily implement integral rotation of the cam body **3521** and the motor shaft **3512** via the forcible coupling between the output shaft **3512** and the shaft hole **3522**, the output shaft **3512** and the shaft hole **3522** may be connected to each other via a spline coupling, etc.

[0178] In one example, the driving pin **3523** plays a role of transmitting the rotation driving force of the cam body **3521** to the pivot link **353**.

[0179] As illustrated, the driving pin **3523** may be formed to protrude from one side surface facing the pivot link of the cam body **3521** toward the pivot link **353**, and may be positioned at a position spaced apart from the shaft hole **3522** by a predetermined distance in a radial direction.

[0180] Therefore, when the cam body **3521** spins around the shaft hole **3522**, the driving pin **3523** revolves around the shaft hole **3522**.

[0181] The driving pin **3523** is connected to the pivot link **353** while being inserted into a guide groove **3533** of the pivot link **353** as described later.

[0182] Accordingly, while the driving pin **3523** revolves around the shaft hole of the cam body **3521**, the driving pin **3523** pressurizes the pivot link **353** so that the pivot link **353** pivots in a frontward or backward direction.

[0183] In one example, a revolve range of the driving pin **3523** or a spin range of the cam body **3521** needs to be smaller than an extension length of the guide groove **3533** provided in the pivot link **353**. This is because when the revolve range is larger than the extension length of the guide groove **3533**, there is a possibility that the driving pin **3523** or the guide groove **3533** may be damaged.

[0184] In some implementations, a stopper protrusion **3524** may be configured to limit the revolve range of the driving pin **3523**, or the spin range of the cam body **3521** may be disposed on an edge of the cam body **3521** and protrude along a radial direction thereof.

[0185] As illustrated, the stopper protrusion **3524** may be implemented as a predetermined step formed on the edge of the cam body **3521**.

[0186] The stopper protrusion **3524** implemented as the step may be provided as a pair of stopper protrusions spaced apart from each other along a circumferential direction of the cam body which may limit the revolve range of the driving pin **3523** or the spin range of the cam body **3521** in both opposing directions.

[0187] In this way, the stopper protrusion **3524** may limit the revolve range of the driving pin **3523** or the spin range of the cam body **3521** to a circumferential range defined between the pair of stopper protrusions **3524**.

[0188] As shown in FIG. **9**, a cam stopper **3552b** corresponding to the pair of stopper protrusions **3524** may be provided inside the second housing **3552** that accommodates the driving cam **352**.

[0189] In one example, the pivot link **353** receives the driving force from the driving pin **3523** of the driving cam **352** so as to push the pop-up handle **31** so that the pop-up handle **31** moves forwards or pull the pop-up handle **31** so that the pop-up handle **31** moves backwards.

[0190] As shown in FIG. **10**, the pivot link **353** may be, for example, a bar-type link extending from a first end **3531** toward a second end **3532** thereof in a bar shape.

[0191] In some examples, the first end **3531** of the pivot link **353** as the bar-type link may be supported by the first housing **3551** and the second housing **3552** such that the pivot link only

relatively rotates with respect to the first housing **3551** and the second housing **3552**, that is, only pivots with respect to the first housing **3551** and the second housing **3552**.

[0192] Accordingly, the pivot link **353** may pivot around the first end **3531** when the pressing force of the driving pin **3523** of the driving cam **352** is applied thereto.

[0193] For this purpose, a pair of shaft bosses **3531a** that serve as a pivot center of an entirety of the pivot link **353** may be provided at both opposing sides of the first end **3531** of the pivot link **353**, respectively.

[0194] The pair of shaft bosses **3531a** may be formed to protrude toward the first housing **3551** and the second housing **3552** so as to have a predetermined protrusion height from one side surface and the other side surface of the first end **3531** of the pivot link **353**, respectively.

[0195] A bushing **356** or a bearing may be fitted around each of the pair of shaft bosses **3531a** to reduce friction. The pair of shaft bosses **3531a** may be connected to the first housing **3551** and the second housing **3552**, respectively, while each bushing **356** is fitted around each of the pair of shaft bosses **3531a**.

[0196] Each of the first housing **3551** and the second housing **3552** may be formed to have a cylindrical bushing receiving portion into which the bushing **356** may be inserted.

[0197] The pivot link **353** may be formed to have the guide groove **3533** into which the driving pin **3523** of the driving cam **352** as described above is inserted.

[0198] As illustrated, the guide groove **3533** may be formed between the first end **3531** and the second end **3532**, and may be defined in a first extension **353a** of the pivot link **353** as described below.

[0199] The guide groove **3533** may linearly extend along a length direction of the first extension **353a**. Movement of the driving pin **3523** may be guided along the extension direction of the guide groove **3533** so that the driving pin **3523** moves relative to the guide groove **3533** while being inserted into the guide groove **3533**.

[0200] In one example, the second end **3532** of the pivot link **353** may be connected to the handle body **311** of the pop-up handle **31** so as to be relatively movable with respect thereto, and may be configured to move the pop-up handle **31** forwards or backwards by pushing or pulling the handle body **311** when the pivot link **353** pivots.

[0201] The second end **3532** of the pivot link **353** may be connected to the handle body **311** via a connection pin **3534** so that the second end **3532** of the pivot link **353** may move relative to the handle body **311**. More specifically, the second end **3532** may be connected to a sliding block **316** disposed inside the handle body **311**.

[0202] In some examples, the link connector **354** may be further provided as a component for mutually connecting the second end **3532** of the pivot link **353** and the sliding block **316** of the handle body **311** to each other.

[0203] As illustrated, in one example, the link connector **354** may be configured to include a handle connection portion **3541** that is fastened to the sliding block **316** as described below, and a link connection portion **3542** that is indirectly connected to the second end **3532** via the connection pin **3534**.

[0204] The handle connection portion **3541** may be formed in a flat shape so as to make surface contact with the sliding block **316** in order to secure a maximum contact area with the sliding block **316**.

[0205] The handle connection portion **3541** may be formed to have a plurality of screw holes **3541h** defined therein so that a connecting means such as a screw bolt may pass through each screw hole.

[0206] The link connection portion **3542** may be indirectly connected to the second end **3532** of the pivot link **353** via the connection pin **3534**.

[0207] For this purpose, a pin guide hole **3543** may be formed in the link connection portion **3542** and extend through the link connection portion along the left-right direction.

[0208] As illustrated, the pin guide hole **3543** may linearly extend along the vertical direction. The movement of the connection pin **3534** may be guided so that the connection pin moves relative to the pin guide hole **3543** in the vertical direction while being inserted into the pin guide hole **3543**. [0209] Therefore, when the pivot link **353** pivots, the connection pin **3534** coupled to the second end **3532** of the pivot link **353** moves along the pin guide hole **3543**, thereby pushing the link connector **354** forwards or pulling the link connector backwards, thereby causing the pop-up handle **31** to move forwards or backwards.

[0210] In order to allow the connection pin **3534** to be connected in this way, left and right pin holes **3532h** through which the connection pin **3534** passes may extend through the second end **3532** of the pivot link **353** along the left-right direction and may be arranged along the left-right direction.

[0211] Furthermore, the second end **3532** of the pivot link **353** may be formed in a branched form as illustrated in order to prevent interference with the link connection portion **3542** that moves relative to the second end **3532**.

[0212] In one example, as described above, the pivot link **353** pivots around the first end **3531** to push or pull the link connector **354** and the sliding block **316** to generate the forward or backward movement stroke Ls of the pop-up handle **31**.

[0213] In order to minimize a pivot amount of the pivot link **353** and maximize the frontward-backward movement stroke Ls of the pop-up handle **31**, the second end **3532** of the pivot link **353** may extend in an inclined manner in the frontward direction toward the pop-up handle **31**.

[0214] That is, as shown in FIG. **10**, the pivot link **353** may include a first extension **353a** that extends radially from the first end **3531**, and a second extension **353b** that extends in a bent manner toward the pop-up handle **31** and between the first extension **353a** and the second end **3532**.

[0215] In this way, the second extension **353b** is formed to be bent or curved toward the pop-up handle **31**, thereby greatly increasing the stroke Ls by which the pop-up handle **31** is pushed or pulled.

[0216] Referring to FIG. **11** to FIG. **14**, a process in which the pop-up handle **31** moves forwards to the extended position Pd or moves backwards to the retracted position Pa under the operation of the handle driver **35** will be described below.

[0217] In some implementations, FIG. **11** illustrates a situation in which the pop-up handle **31** automatically moves forwards along the forward direction Dfw from the retracted position Pa toward the extended position Pd.

[0218] Referring to FIG. **11**, when the pop-up handle **31** has been displaced to the retracted position Pa and has been in a stopped state, the power is supplied to the driving motor **351**, such that the operation of the driving motor **351** is initiated, and the driving motor **351** generates the forward direction rotation driving force.

[0219] Accordingly, the forward direction rotation of the output shaft **3512** of the driving motor **351** may be initiated, and the forward direction spin of the driving cam **352** forcibly connected to the output shaft **3512** may be initiated.

[0220] At this time, when the forward direction rotation is initiated, the output shaft **3512** and the driving cam **352** may start to rotate counterclockwise based on the illustrated state.

[0221] In one example, as the forward direction spin of the driving cam **352** is initiated, a forward direction revolution of the driving pin **3523** may be initiated.

[0222] As shown in FIG. **11**, the driving pin **3523** which has been located at a lower end of the guide groove **3533** of the pivot link **353** may start to move to a top of the guide groove **3533**.

[0223] As the driving pin **3523** revolves in the forward direction, the driving pin moves to the top from the bottom of the guide groove **3533**, such that the driving pin **3523** presses the pivot link **353** such that the pivot link pivots forwards around the first end **3531**. That is, based on the illustrated state, the pivot link **353** pivots counterclockwise around the first end **3531**.

[0224] At this time, as the pivot link **353** pivots around the first end **3531**, the second end **3532** of

the pivot link **353** also pivots forwards, and the connection pin **3534** connected to the second end **3532** pivots forwards.

[0225] Accordingly, the driving pin **3523** which has been located at the bottom of the guide hole **3543** of the link connector **354** moves to the top of the guide hole **3543**.

[0226] As the connection pin **3534** moves to the top from the bottom of the guide hole **3543**, the connection pin **3534** presses the link connector **354** and the sliding block **316** to push forwards. That is, while the connection pin **3534** moves relative to the guide hole **3543** and along the guide hole **3543**, a pressure force is applied to the link connector **354** to push the link connector **354** forwards.

[0227] In this way, the operation of the handle driver **35** is initiated, such that the driving cam **352** has completely rotated along a preset rotation range. Then, the power supply to the driving motor **351** may be cut off, and the forward movement of the pop-up handle **31** to the extended position Pd may be completed.

[0228] FIG. **12** shows the state in which the pop-up handle **31** has completed the forward movement to the extended position Pd and has stopped.

[0229] When the forward movement of the pop-up handle **31** to the extended position Pd has been completed in this way, an entirety of the handle body **311** may be exposed to the outside of the door **30**, and thus, the user may easily perform the action of opening or closing the door **30** while holding the handle body **311**.

[0230] In some examples, as shown in FIG. **14**, when the pop-up handle **31** has been displaced to the extended position Pd, the first extension **353a** of the pivot link **353** has stood upright, and the driving pin **3523** of the driving cam **352** has been moved to the bottom of the guide groove **3533**.

[0231] Therefore, as shown, a predetermined intersection angle α may be defined between a virtual first extension line Lc1 connecting a center Cr of the driving pin **3523** and a rotation center Cc of the shaft hole **3522** as a rotation center of the cam body **3521** and a virtual second extension line Lc2 which is parallel to a moving direction Drw/Dfw of the pop-up handle **31** and passes through the rotation center Cc of the shaft hole **3522** of the cam body **3521**. However, the intersection angle α may be very small angle.

[0232] For example, the intersection angle α may be in a range of 0 degrees inclusive to 5 degrees inclusive.

[0233] The very small intersection angle α in a range of 5 degrees or smaller is defined in this way. Thus, a structure may be achieved in which the handle body **311** is fixed at the extended position Pd without being removed from the extended position Pd even when a user's pressure to open or close the door **30** is applied to the handle body **311** of the pop-up handle **31**.

[0234] That is, a structure in which the pop-up handle **31** may be effectively fixed at the extended position Pd may be achieved by means of a position arrangement of the pivot link **353** and the driving cam **352** while a separate fixing means is not disposed at the pop-up handle **31** and the handle frame **30d** as described below.

[0235] FIG. **13** illustrates a situation in which the pop-up handle **31** automatically moves backwards along the backward direction Drw from the extended position Pd toward the retracted position Pa.

[0236] Referring to FIG. **13**, the pop-up handle **31** has moved to the extended position Pd and has stopped. Then, after a predetermined waiting time has elapsed, the power is supplied to the driving motor **351**, the driving motor **351** starts operating, and the driving motor **351** generates the reverse rotation driving force.

[0237] Accordingly, the reverse rotation of the output shaft **3512** of the driving motor **351** starts, and the reverse spin of the driving cam **352** forcibly connected to the output shaft **3512** may start.

[0238] When the reverse rotation starts, the output shaft **3512** and the driving cam **352** may start to rotate clockwise based on the illustrated state.

[0239] Further, as the reverse spin of the driving cam **352** starts, the reverse revolution of the

driving pin **3523** may start.

[0240] As shown, the driving pin **3523** which has been positioned at the bottom of the guide groove **3533** of the pivot link **353** may start to move relative to the guide groove **3533** and to the top of the guide groove **3533**.

[0241] As the driving pin **3523** revolves in the reverse direction, the driving pin moves relative to the guide groove **3533** and to the top from the bottom of the guide groove **3533**, the driving pin **3523** presses the pivot link **353** to pivot in the rearward direction around the first end **3531**. That is, based on the shown state, the pivot link **353** pivots clockwise around the first end **3531**.

[0242] In some examples, as the pivot link **353** pivots around the first end **3531**, the second end **3532** of the pivot link **353** also pivots in the rearward direction, and the connection pin **3534** connected to the second end **3532** pivots in the rearward direction.

[0243] Accordingly, the driving pin **3523** which has been located at the top of the guide hole **3543** of the link connector **354** moves relative to the guide hole **3543** and to the bottom of the guide hole **3543**.

[0244] As the connection pin **3534** moves relative to the guide hole **3543** and from the top to the bottom of the guide hole **3543**, the connection pin **3534** applies the pressure the link connector **354** to pull the link connector **354** in the rearward direction. That is, while the connection pin **3534** moves relative to and along the guide hole **3543**, a pressure force is applied to the link connector **354** to pull the link connector **354** in the rearward direction.

[0245] In this way, the operation of the handle driver **35** has been initiated, and then, the driving cam **352** has completed the reverse pivot motion thereof along the preset rotation range. Then, the power supply to the driving motor **351** may be cut off, and the backward movement of the pop-up handle **31** to the retracted position Pa may have been completed.

[0246] As described above, the pop-up handle **31** is configured to move forwards or backwards under the forward direction driving force or the reverse direction driving force of the handle driver **35**.

[0247] However, as described above, the pop-up handle **31** may be configured to move horizontally or linearly along the forward direction Dfw or the backward direction Drw.

[0248] A means for implementing the horizontal or linear movement may be provided in the pop-up handle **31** and the handle frame **30d** in which the pop-up handle **31** is accommodated.

[0249] As described above, the pop-up handle **31** may be configured to include the handle body **311** that is exposed to the outside of the door **30** when having moved to the extended position Pd and thus is brought into a state in which the user can grip the handle body.

[0250] More specifically, as shown in FIG. **16**, the handle body **311** may include a first body **3111** that extends along the left-right direction and is configured to be grasped by the user when the user intends to open or close the door **30**, and a second body **3112** that extends rearwards from the first body **3111** and has a hollow shape.

[0251] In some examples, the second body **3112** includes a pair of second bodies **3112** which may be integrally connected to both opposing ends of the first body **3111**, respectively so as to form the approximate 90-degrees rotated U shape.

[0252] In some examples, guide protrusions **3112a** that protrude in left and right directions, respectively may be disposed on outer side surfaces of the pair of second bodies **3112**, respectively.

[0253] As shown, the guide protrusion **3112a** may have a shape having a uniform thickness in the vertical direction and may extend along a direction parallel to the forward direction Dfw or the backward direction Drw of the pop-up handle **31**.

[0254] FIG. **15** illustrates the handle frame **30d** including a handle housing **30d4** in which the handle body **311** is relatively movably accommodated.

[0255] The handle frame **30d** may include a panel portion **30d1** and an outer wall **30d3** that serve as a support surface or an attachment surface to support the handle driver **35** thereon.

[0256] The panel portion **30d1** and the outer wall **30d3** of the handle frame **30d** may be fixed to an

inner surface of the front panel **30a** or an inner panel **30c** of the door **30**.

[0257] In one example, the handle frame **30d** may further include the handle housing **30d4** to movably accommodate therein and support thereon the pop-up handle **31**.

[0258] As shown in FIG. **15**, the handle housing **30d4** may have a rail groove **30d45** defined therein into which the guide protrusion **3112a** of the handle body **311** is inserted.

[0259] The rail groove **30d45** may be formed in each of left and right side surfaces of the handle housing **30d4**, and may be defined by partially protruding each of the left and right side surfaces thereof toward the outer wall **30d3**.

[0260] Accordingly, in a state in which the guide protrusion **3112a** has been inserted into the rail groove **30d45**, the handle body **311** may move horizontally or linearly as the guide protrusion **3112a** moves along the rail groove **30d45**.

[0261] In one example, as illustrated, the handle housing **30d4** may be provided in a box shape with a front surface and a rear surface open so as to accommodate an entirety of the handle body **311** when the pop-up handle **31** has been displaced to the retracted position Pa.

[0262] The open front surface of the handle housing **30d4** may act as an opening **30d2** through which the handle body **311** extends or retracts.

[0263] The opening **30d2** of the first handle housing **30d4** may be formed at a position corresponding to a position of the opening **30e** of the front panel **30a** of the door **30** and may have a corresponding size to a size thereof.

[0264] In one example, as illustrated, a cut-away **30d44** may be defined in a lower surface **30d42** of the handle housing **30d4** to provide a movement path of the pivot link **353** of the handle driver **35**. However, a cut-away may not be formed in an upper surface **30d41** of the handle housing **30d4** so as to have a plate shape in order to maintain the rigidity of the handle housing **30d4**.

[0265] FIG. **16** illustrates a detailed configuration of the aforementioned pop-up handle **31**.

[0266] Referring to FIG. **16**, the pop-up handle **31** provided in the dish washer **1** may further include a handle substrate **313** that is disposed on a front surface of the handle body **311** and has at least one light-source element **3131** mounted thereon, a light-guide plate **314** that is disposed in front of the handle substrate **313** and diffuses visible light generated from the light-source element **3131**, and the decoration panel **315** that is disposed in front of the light-guide plate **314**.

[0267] The light-source element **3131** generates visible light or another type of light when the pop-up handle **31** moves, thereby visually notifying the user that the pop-up handle **31** is operating normally.

[0268] The light-source element **3131** may be applied without limitation in terms of the type thereof as the light-source element **3131** may receive power and generate predetermined visible light. In one example, the light-source element **3131** may be an LED (light emitting diode) element.

[0269] The following description will be based on an example in which the LED element is applied as the light-source element **3131**. However, implementations of the present disclosure are not limited thereto.

[0270] FIG. **16** illustrates a configuration in which a total of 9 LED elements are mounted on the handle substrate **313**. However, implementations of the present disclosure are not limited thereto, and the number of LED elements may be increased or decreased depending on a size and a shape of the first handle body **311**.

[0271] In one example, the light-guide plate **314** serves to diffuse the visible light generated from the light-source element **3131**.

[0272] More specifically, the visible light generated from the light-source element **3131** may be introduced into the light-guide plate **314** through a rear surface of the light-guide plate **314**. Then, the visible light received inside the light-guide plate **314** may be spread therein such that the visible light diffuses toward an edge of the light-guide plate **314**.

[0273] In some examples, the decoration panel **315** disposed in front of the light-guide plate **314** may be surface-treated to have the same texture as that of the front panel **30a** of the door **30** as

described above.

[0274] Therefore, the visible light introduced into the light-guide plate **314** cannot pass through the decoration panel **315** and may be projected to the outside through the edge of the light-guide plate **314**.

[0275] In order to project the visible light, the edge of the light-guide plate **314** may be exposed to the outside.

[0276] That is, the light-guide plate **314** may be positioned so as to be sandwiched between the decoration panel **315** and the front surface of the handle body **311**, while the edge of the light-guide plate **314** may not be covered with the decoration panel **315** and the front surface of the handle body **311**.

[0277] Therefore, as illustrated, the light generated from the light-source element **3131** may travel through the inside of the light-guide plate **314** and then through the edge of the light-guide plate **314** and then may be effectively projected to the outside. Thus, the user may effectively identify an operating state of the pop-up handle **31** based on the optical light projected through the edge of the light-guide plate **314**.

[0278] Furthermore, since the visible light is projected only through the edge of the light-guide plate **314**, a lighting effect similar to indirect lighting may be achieved, thereby improving aesthetic sensibility for the user.

[0279] In one example, the pop-up handle **31** of the dish washer **1** may further include a manual pop-up device **312** configured to manually pop up the handle body **311**.

[0280] As described above, the pop-up handle **31** provided in the dish washer **1** automatically moves using the power supplied to the handle driver **35**.

[0281] Therefore, in a situation where the pop-up handle **31** cannot move automatically, such as in a situation where power cannot be supplied to the handle driver **35** due to a power outage, a situation where the dish washer **1** is in a location where it cannot be connected to an external power source and thus, power supply to the handle driver **35** is cut off, or a situation where the handle driver **35** malfunctions, when the pop-up handle **31** is fixedly stopped at the retracted position Pa, the user cannot open the door **30** using the pop-up handle **31**.

[0282] The dish washer **1** may be equipped with the manual pop-up device **312** configured to manually move the pop-up handle **31** from the retracted position Pa to a pop-up position. For instance, the pop-up position is the extended position Pd. In some examples, the pop-up position may be between the retracted position Pa and the extended position Pd. In some examples, the pop-up position may be located forward relative to the extended position Pd.

[0283] For example, the manual pop-up device **312** may be configured to include a latch **3121** fixed to the handle body **311** and a latch holder **3122** fixed to the sliding block **316**.

[0284] The latches **3121** and the latch holder **3122** are configured to be removably coupled to each other, and may be components known in the art as a latch switch, a pop-up switch, a push button, etc.

[0285] Therefore, as known to the skilled person to the art, in a state in which the latch **3121** and the latch holder **3122** have been mutually coupled to each other, a pressure force is applied to the latch **3121** so that the latch **3121** is retracted into the inside of the latch holder **3122**. Thus, the coupling between the latch **3121** and the latch holder **3122** may be cancelled. Thus, the latch **3121** may be configured to bounce in an opposite direction to a direction of the pressure force under a restoring force of a compression spring **3122c** disposed inside the latch holder **3122**.

[0286] A minimum pressurized movement amount to deactivate or re-activate the engagement state between the latch **3121** and the latch holder **3122** may be defined as a retract stroke.

[0287] For example, the retract stroke may be in a range of 2.3 mm to 2.7 mm, for example, 2.5 mm.

[0288] In some examples, the handle body **311** is disposed in the handle housing **30d4** in a state in which the handle body can move relative to the sliding block **316** which is forcibly connected to

the link connector **354** of the handle driver **35**.

[0289] Therefore, when the connection between the latch **3121** and the latch holder **3122** has been removed, the handle body **311** is brought into a state where it may move relative to the handle housing **30d4** and the sliding block **316**. Thus, the restoring force of the compression spring **3122c** may be transmitted to the handle body **311** through the latch **3121**, and thus a front portion of the handle body **311** may partially pop-up out of the front panel **30a** of the door **30**.

[0290] When the front portion of the handle body **311** has partially popped up out of the front panel **30a** of the door **30**, the user may manually move the pop-up handle **31** by grasping the popped-up portion with a finger or tool and moving the pop-up handle forwards to the extended position Pd.

[0291] A detailed process of manually moving the pop-up handle **31** using the manual pop-up device **312** is described below with reference to FIG. **20**.

[0292] FIGS. **16** to **19** illustrate an example detailed configuration of the manual pop-up device **312** accommodated in the handle body **311**.

[0293] In a similar manner to the handle driver **35** as shown in FIG. **16**, the manual pop-up device **312** may be provided as a pair of manual pop-up devices. A left-side manual pop-up device **312** and a right-side manual pop-up device **312** may be installed on and fixed to the second body **3112** of the handle body **311** while being in a symmetrical arrangement with each other around the handle body **311**.

[0294] Therefore, both manual pop-up devices **312** may be configured to be identical with each other except for the symmetrical arrangement thereof.

[0295] Therefore, the following description will be based on the manual pop-up device **312** disposed at the left side. Unless otherwise described, the following descriptions may be equally applied to the manual pop-up device **312** disposed at the right side.

[0296] Each of the latch **3121** and the latch holder **3122** constituting the manual pop-up device **312** may be disposed and accommodated in the second body **3112** constituting the handle body **311**, more specifically, in an inner hollow space of the second body **3112**.

[0297] In this way, the latch **3121** and the latch holder **3122** constituting the manual pop-up device **312** are configured to be accommodated entirely in the inside of the second body **3112**, such that increase in the size of the handle body **311** in the front-rear direction due to the addition of the manual pop-up device **312** may be effectively prevented.

[0298] More specifically, the latch **3121** may be directly fixed to the second body **3112** while being disposed in the inside of the second body **3112** of the handle body **311**.

[0299] An inner panel **3112b** that divides an inner space of the second body **3112** into a front space and a rear space may be disposed in the second body **3112** and may be integrally formed with the second body.

[0300] A flange **3121b** of the latch **3121** may be fixed to a protruding surface **3112b1** of the inner panel **3112b** of the second body **3112** using a fastening means such as a bolt or the like.

[0301] As shown in FIG. **18** and FIG. **19**, the protruding surface **3112b1** of the inner panel **3112b** may be configured to protrude toward the sliding block **316**.

[0302] As described below, when the handle body **311** has been pressed toward the inside of the door **30** for manual pop-up and thus has moved relative to the sliding block **316** by a distance greater than the retract stroke, the protruding surface **3112b1** may enter the inside of the sliding block **316**.

[0303] The flange **3121b** of the latch **3121** may be fixed to the protruding surface **3112b1** that has entered the inside of the sliding block **316** during the manual pop-up, such that a relative movement stroke of the handle body **311** for canceling the engagement between the latch **3121** and the latch holder **3122** may be effectively secured while minimizing the size in the front-back direction of each of the latch **3121** and the latch holder **3122** and the size in the front-back direction of the sliding block **316**.

[0304] In one example, the flange **3121b** may be integrally formed with a latch protrusion **3121a**

that protrudes toward the latch holder **3122**.

[0305] As illustrated, the latch protrusion **3121a** may be configured to be caught with a catch arm **3122b** included in the latch holder **3122**. The latch protrusion **3121a** may be formed to have a hook shape so that the engagement and disengagement between the latch protrusion **3121a** and the catch arm **3122b** may be easily implemented.

[0306] The latch holder **3122** may be fixedly disposed in the inside of the sliding block **316** accommodated in the second body **3112** so as to be relatively movable with respect to the second body **3112**.

[0307] In a manner similar to the second body **3112**, the sliding block **316** may be provided in a hollow shape. A coupling rib **3161** may be disposed inside the sliding block **316** and may be integrally formed therewith and may support and fix the latch holder **3122**.

[0308] The latch holder **3122** may be forcibly coupled to the coupling rib **3161** by forcibly fitting a holder body **3122a** of the latch holder **3122** into an inner space defined by the coupling rib **3161**.

[0309] A front surface of the holder body **3122a** may be entirely open, and a pair of catch arms **3122b** may be configured to be movable in the forward and backward directions through the open front surface of the holder body **3122a**.

[0310] A spacing between the pair of catch arms **3122b** is gradually smaller as each of the catch arms extends toward the inside of the holder body **3122a**.

[0311] Therefore, as the latch **3121** moves rearwards so as to be re-engaged the latch with the latch holder **3122**, the latch protrusion **3121a** presses the pair of catch arms **3122b** to move the catch arms **3122b** into the inside of the holder body **3122a**. As the spacing between the pair of catch arms **3122b** is gradually smaller as each of the catch arms extends toward the inside of the holder body **3122a**, the latch protrusion **3121a** may be caught with the pair of catch arms **3122b**.

[0312] In one example, as shown in FIG. **18** and FIG. **19**, the compression spring **3122c** that presses the pair of catch arms **3122b** in a direction so as to push the catch arms may be disposed inside the holder body **3122a**.

[0313] As described above, the compression spring **3122c** generates a force that causes the latch **3121** and the handle body **311** to bounce in the opposite direction to the direction of the pressing force, that is, toward the outside of the door **30**.

[0314] In addition, other configurations of the manual pop-up device **312** may be known in the art, and therefore, a description of the other configurations will be omitted below.

[0315] In this way, the pop-up handle **31** of the dish washer **1** is configured so that the handle body **311** is manually popped up in a state where the handle body has been displaced to the retracted position Pa.

[0316] In some implementations, the pop-up handle may be configured to such that the handle body **311** may not pop up manually in a state where the user can grasp the pop-up handle **31**, such as a state in which the handle **31** has moved from the retracted position Pa to the extended position Pd.

[0317] For example, when the handle **31** is configured so that the handle body **311** manually pops-up in a state in which the pop-up handle **31** has moved to the extended position Pd, the handle body **311** may be manually popped up even in a situation where the user does not want to do so. This is likely to cause inconvenience to the user.

[0318] In some examples, the pop-up handle **31** of the dish washer **1** may further include a pop-up blocker **317** configured to prevent the manual pop-up of the handle body **311** from occurring in a state in which the pop-up handle **31** has been displaced to the extended position Pd.

[0319] When the handle body **311** has been displaced to the extended position, the pop-up blocker **317** may be configured to limit the relative movement of the handle body **311** to the sliding block **316** so that the relative movement amount of the handle body **311** thereto greater than or equal to the retract stroke is not generated, thereby preventing the manual pop-up of the handle body.

[0320] As shown in FIG. **17**, the pop-up blocker **317** may be configured to include a body **3171**

configured to move together with the link connector **354** when the handle driver **35** operates, and to limit the relative movement of the handle body **311** to be smaller than the retract stroke when the pop-up handle **31** has been displaced to the extended position Pd; and a pair of pin holes **3172** extending through the left and right side surfaces of the body **3171**, respectively.

[0321] As shown, the body **3171** of the pop-up blocker **317** may be disposed in rear of the link connector **354**, and may have a hollow box shape so that the link connection portion **3542** of the link connector **354** may be accommodated in the hollow space thereof.

[0322] Furthermore, in a similar manner to the link connector **354**, the body **3171** of the pop-up blocker **317** may be accommodated in the inner space of the second body **3112**.

[0323] In some examples, a front surface, a rear surface, and a bottom surface of the body **3171** of the pop-up blocker **317** may be entirely open so that interference thereof with the pivot link **353** that pivots when the handle driver **35** operates may be minimized.

[0324] Accordingly, the body **3171** of the pop-up blocker **317** may have a cross-section of a 90 degrees-rotated U shape.

[0325] A front edge of the body **3171** of the pop-up blocker **317** may function as a stopper that limits the relative movement of the handle body **311** with respect to the sliding block **316**.

[0326] An inner surface of the second body **3112** may have a stopper protrusion **3112c** formed thereon configured to collide with the front edge of the body **3171** of the pop-up blocker **317** when the handle body **311** moves relative to the sliding block **316**.

[0327] The stopper protrusion **3112c** may be formed on the inner surface of the second body **3112** and may extend in the front-back direction and may be positioned at each upper edge at which a top surface and each of both opposing side surfaces meet each other and each lower edge at which a lower surface and each of both opposing side surfaces meet each other, as shown in FIG. **18** and FIG. **19**.

[0328] A rear end of the stopper protrusion **3112c** is configured to collide with the front edge of the body **3171** of the pop-up blocker **317** according to the relative movement amount of the handle body **311**, and thus, the relative movement of the handle body **311** may be limited due to this collision.

[0329] In some examples, a predetermined frontward-backward spacing may be formed between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171**. This frontward-backward spacing may be set to vary depending on a position of the handle body **311**.

[0330] That is, as shown in FIG. **18** and FIG. **19**, when the pop-up handle **31** has been displaced to the retracted position Pa, a first spacing D1 along the frontward-backward direction may be defined between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171**.

[0331] Furthermore, when the pop-up handle **31** has been displaced to the extended position Pd as described below, a second spacing D2 along the frontward-backward direction may be defined between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171**.

[0332] The second spacing D2 may be larger than the first spacing D1. As the pop-up handle **31** is being displaced from the retracted position Pa to the extended position Pd, a frontward-backward spacing between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171** may gradually decrease from the first spacing D1 to the second spacing D2.

[0333] In some examples, the first spacing D1 may be larger than the retract stroke of the handle body **311**.

[0334] Furthermore, the second spacing D2 may be smaller than the retract stroke of the handle body **311**.

[0335] For example, the first spacing D1 may be in a range of 3 mm to 3.2 mm, and the second spacing D2 may be in a range of 0.5 mm to 1 mm.

[0336] In this way, the first spacing D1 is larger than the retract stroke of the handle body **311**, and the second spacing D2 is smaller than the retract stroke of the handle body **311**. Thus, the manual pop-up of the handle body **311** may be permitted at the retracted position Pa, while the manual pop-

up of the handle body **311** may be blocked at the extended position Pd.

[0337] This is because the relative movement amount due to the pressing of the handle body **311** cannot be greater than or equal to the retract stroke at the extended position Pd.

[0338] The pin holes **3172** respectively defined in both opposing side surfaces of the body **3171** may allow the spacing in the front-back direction between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171** to be variable.

[0339] More specifically, as shown in FIG. **17** to FIG. **19**, each of the pin holes **3172** respectively defined in both opposing side surfaces of the body **3171** may linearly extend similarly to the pin guide hole **3543** of the link connector **354**.

[0340] Both opposing ends of the connection pin **3534** may be respectively inserted into the pin holes **3172**.

[0341] Therefore, when the handle driver **35** operates, the connection pin **3534** moves in the vertical direction in a state in which the connection pin **3534** has been simultaneously inserted into the pin guide holes **3543** and the pin holes **3172**.

[0342] However, the extension direction of the pin hole **3172** may be oriented to define an intersection angle with respect to the extension direction of the pin guide hole **3543**.

[0343] That is, while the pin guide hole **3543** extends along the vertical direction at an approximately upright manner, the pin hole **3172** of the pop-up blocker **317** may extend at an inclination angle at which the pin hole tilts in the rearward direction.

[0344] Accordingly, a distance between the pin hole **3172** and the front edge of the body **3171** gradually increases as the pin hole **3172** extends from the bottom to the top of the pin hole **3172**.

[0345] In this way, the extension direction of the pin hole **3172** is oriented to define the inclined angle or the intersection angle with respect to the extension direction of the pin guide hole **3543**. Thus, the spacing in the front-back direction between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171** may vary in conjunction with the movement of the connection pin **3534**.

[0346] More specifically, as shown in FIG. **18** and FIG. **19**, when the pop-up handle **31** is driven to move from the retracted position Pa toward the extended position Pd, the connection pin **3534** which has been located at the bottom of the pin guide hole **3543** and the bottom of the pin hole **3172** moves upwardly.

[0347] As the connection pin **3534** moves upwards, the pop-up blocker **317** and the link connector **354** move together toward the extended position Pd such that the pop-up blocker **317** moves by a relatively movement amount than a movement amount of the link connector **354** due to the inclination angle of the pin hole **3172**.

[0348] That is, a relative movement between the pop-up blocker **317** and the link connector **354** occurs, and accordingly, the spacing in the front-back direction between the rear end of the stopper protrusion **3112c** and the front edge of the body **3171** may be gradually reduced.

[0349] This gradually reduced spacing has reached the second spacing D2 when the pop-up handle **31** has moved to the extended position Pd, and accordingly, the handle body **311** may be brought into a state where the manual pop-up thereof is prevented.

[0350] Hereinafter, referring to FIGS. **20** to **23**, the process of manually popping up the handle body **311** at the retracted position Pa and the process of retracting the manually popped-up handle body **311** to an original position will be described.

[0351] In some implementations, referring to FIG. **20**, as described above, the manual pop-up device **312** may be provided as a pair of manual pop-up devices **312**. The left-side manual pop-up device **312** and the right-side manual pop-up device **312** may be respectively installed on and fixed to the left and right second bodies **3112** that constitute the handle body **311**.

[0352] Therefore, in order to manually pop-up the pop-up handle **31** stopped at the retracted position Pa, the user should press both opposing ends of the handle body **311** to retract the handle body **311** toward the inside of the door **30**.

[0353] In some examples, when the both opposing ends of the handle body **311** are pressed individually and sequentially, there is a possibility that the handle body **311** will not pop up effectively.

[0354] Therefore, when the both opposing ends of the handle body **311** are pressed simultaneously such that the handle body **311** is retracted toward the inside of the door **30** such that the handle body **311** has a movement amount greater than or equal to the retract stroke. Thus, the handle body **311** may pop up toward the outside of the door **30**, i.e., in the frontward direction, under the action of the compression spring **3122c** of the manual pop-up device **312** as described above.

[0355] In this way, the handle body **311** can pop up only when the both opposing ends of the handle body **311** are pressed simultaneously. Thus, an effect of preventing the handle body **311** from popping up regardless of the user's intention may be achieved.

[0356] When the handle body **311** has popped up by the manual pop-up device **312** due to the user's pressure, the decoration panel **315** and light-guide plate **314** constituting a front end surface of the pop-up handle **31** may protrude outwardly from the front panel **30a** of the door **30**.

[0357] In this way, the front portion of the pop-up handle **31** partially protrudes outwardly from the front panel **30a** of the door **30**, such that the user may manually move the handle body **311** to the extended position Pd using a finger or a tool as shown in FIG. **21**.

[0358] The user may effectively open the door **30** while grasping the handle body **311** moved to the extended position Pd and pulling the handle body **311** in the frontward direction.

[0359] In some implementations, because the connection between the latch **3121** and the latch holder **3122** has been cancelled as shown in FIG. **21**, the sliding block **316** disposed inside the handle body **311** may not move while only the handle body **311** may move relative thereto and to the extended position Pd.

[0360] That is, the sliding block **316**, the link connector **354**, and the pop-up blocker **317** may be maintained in a stopped state at the retracted position Pa.

[0361] Further, the manually popped-up handle body **311** may be moved back to the original retracted position Pa by the user simply pushing the handle body **311** toward the inside of the door **30**.

[0362] In some implementations, when the user pushes and moves the handle body **311** to the retracted position Pa and then applies a pressure to retract the handle body **311** by the retract stroke, the latch **3121** may be re-engaged with the latch holder **3122**, and the handle body **311** may be re-coupled to the sliding block **316** via the manual pop-up device **312**.

[0363] FIG. **22** and FIG. **23** illustrate the state in which the handle body **311** and the sliding block **316** have been moved together to the extended position Pd under the operation of the handle driver **35** and have been stopped.

[0364] When the sliding block **316**, the link connector **354**, and the pop-up blocker **317** are moved together with the handle body **311** in the frontward direction to the extended position Pd, the second spacing D2 along the frontward-backward direction may be defined between the rear end of the stopper protrusion **3112c** disposed on the inner surface of the second body **3112** and the front edge of the pop-up blocker **317**.

[0365] In some implementations, as described above, the second spacing D2 is much smaller than the retract stroke for cancelling the coupling between the latch **3121** and the latch holder **3122**. Thus, even when a pressing force toward the inside of the door **30** is applied to the handle body **311**, the relative movement of the handle body **311** is not greater than or equal to the second spacing D2.

[0366] Therefore, the disconnection between the latch **3121** and the latch holder **3122** does not occur, and accordingly, the state in which the manual pop-up of the handle body **311** is prevented may be maintained.

[0367] Although the implementations of the present disclosure have been described in more detail with reference to the accompanying drawings, the present disclosure is not necessarily limited to

these implementations, and may be modified in a various manner within the scope of the technical spirit of the present disclosure. Accordingly, the implementations as disclosed in the present disclosure are intended to describe rather than limit the technical idea of the present disclosure, and the scope of the technical idea of the present disclosure is not limited by these implementations. Therefore, it should be understood that the implementations described above are not restrictive but illustrative in all respects. In addition, even though an effect of a configuration of the present disclosure is not explicitly described in describing the implementation of the present disclosure above, it is obvious that the predictable effect from the configuration should be recognized.

Claims

1. A dish washer comprising: a tub that defines a washing space configured to accommodate one or more objects to be washed therein, the tub having an open front surface in fluid communication with the washing space; a door configured to open and close the open front surface of the tub; a handle configured to reciprocate between (i) an extended position in which the handle protrudes forward from the door and (ii) a retracted position in which the handle is accommodated within the door; a handle driver disposed within the door and configured to reciprocate the handle from the retracted position toward the extended position or from the extended position toward the retracted position; and a pop-up device configured to, based on the handle being stopped at the retracted position, move the handle to a pop-up position in which the handle at least partially protrudes from an inside of the door toward an outside of the door, wherein the pop-up device is configured to, based on the handle being retracted rearwardly toward the inside of the door by a predetermined retract stroke from the retracted position, move the handle to the pop-up position.
2. The dish washer of claim 1, wherein the handle comprises: a handle body configured to reciprocate between the extended position and the retracted position based on a driving force of the handle driver; and a sliding block connected to the handle body and configured to move relative to the handle body, the sliding block being configured to transmit the driving force of the handle driver to the handle body, wherein the pop-up device is configured to, based on the handle being retracted rearwardly by the predetermined retract stroke from the retracted position, move the handle body relative to the sliding block in a frontward direction toward the outside of the door to thereby pop up the handle body relative to a surface of the door.
3. The dish washer of claim 2, wherein the pop-up device comprises: a latch fixed to the handle body; and a latch holder fixed to the sliding block and removably coupled to the latch, and wherein the latch holder comprises a compression spring configured to press the latch in the frontward direction toward the outside of the door.
4. The dish washer of claim 3, wherein the compression spring is configured to, based on the handle body moving relative to the sliding block rearwards toward the inside of the door by the predetermined retract stroke, push and move the latch in the frontward direction toward the outside of the door.
5. The dish washer of claim 4, wherein the pop-up device is configured to release an engagement between the latch and the latch holder before the latch moves in the frontward direction by force from the compression spring.
6. The dish washer of claim 5, wherein the latch and the latch holder are configured to be re-engaged with each other based on the handle body being retracted rearwards toward the inside of the door.
7. The dish washer of claim 6, wherein the latch and the latch holder are configured to, based on being re-engaged with each other, restrict the handle body from moving relative to the sliding block in the frontward direction toward the outside of the door.
8. The dish washer of claim 3, wherein the handle body comprises: a first body that extends in a left-right direction and is configured to be gripped by a user; and a second body that extends

rearwards from the first body and defines an inner space configured to receive the sliding block therein, wherein the second body comprises an inner panel that is disposed in the inner space and that divides the inner space into a front space and a rear space, the inner panel having a protruding surface that is convex toward the sliding block, and wherein the latch is fixed to the protruding surface.

9. The dish washer of claim 8, wherein the latch holder is fixedly disposed in an interior space of the sliding block.

10. The dish washer of claim 9, wherein the protruding surface is configured to be retracted into the interior space of the sliding block based on the handle body being moved rearwards relative to the sliding block toward the inside of the door by the predetermined retract stroke.

11. The dish washer of claim 2, wherein the handle further comprises a pop-up blocker configured to allow the handle body to pop up relative to the surface of the door and to restrict the handle body from popping up relative to the surface of the door, wherein the pop-up blocker is configured to: based on the handle being moved to the retracted position, allow the handle body to pop up relative to the surface of the door, and based on the handle being moved to the extended position, restrict the handle body from popping up relative to the surface of the door.

12. The dish washer of claim 11, wherein the pop-up blocker is disposed inside the handle body and configured to move relative to the handle body, wherein the handle body comprises a stopper protrusion that is disposed at an inner surface of the handle body and positioned in front of the pop-up blocker, the stopper protrusion being spaced apart from the pop-up blocker, wherein the stopper protrusion is configured to limit a relative movement of the handle body relative to the pop-up blocker, and wherein the handle body is configured to, based on the handle being moved to the retracted position, define a first spacing between the stopper protrusion and the pop-up blocker in a frontward-backward direction.

13. The dish washer of claim 12, wherein a width of the first spacing is greater than the predetermined retract stroke.

14. The dish washer of claim 12, wherein the handle body is configured to, based on the handle being moved to the extended position, define a second spacing between the stopper protrusion and the pop-up blocker in the frontward-backward direction.

15. The dish washer of claim 14, wherein a width of the second spacing is less than the predetermined retract stroke.

16. The dish washer of claim 1, wherein handle driver is configured to, based a user being detected within a predetermined range from the door, move the handle from the retracted position to the extended position.

17. The dish washer of claim 1, wherein the pop-up device is configured to, based on a user pressing the handle at the retracted position, move the handle from the retracted position to the pop-up position.

18. The dish washer of claim 1, wherein the pop-up position is the extended position.

19. The dish washer of claim 1, wherein the handle is configured to be flush with a front surface of the door based on the handle being disposed at the retracted position.

20. The dish washer of claim 1, wherein the pop-up device is one of a plurality of pop-up devices that are disposed at lateral end portions of the handle.
