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(54) Title: A DISHWASHER COMPRISING A HEIGHT ADJUSTABLE LOWER RACK

Figure 1

(55) Abstract: The present invention relates to a dishwasher (1) comprising a body (2), a door (3) providing access into the body (2), and a height adjustable lower rack (5) wherein the items to be washed are placed.
Description

A DISHWASHER COMPRISING A HEIGHT ADJUSTABLE LOWER RACK

[0001] The present invention relates to a dishwasher comprising a body, a door providing access into the body, and a height adjustable lower rack wherein the items to be washed are placed.

[0002] Dishwashers are designed in a large number of different types in order to meet the different requirements of the consumers. Among these designs, for example dishwashers which are suitable for front or top loading and unloading are widely used. The dishwashers most widely used nowadays are the double rack dishwashers that are suitable for front loading and unloading.

[0003] The users, before starting the cycle of a double rack conventional dishwasher, generally open the door of the dishwasher entirely, pull the lower rack over the inner surface of the door by hand and place the items to be washed inside the lower rack. Afterwards, the users push the lower rack back into the body. The users repeat the similar processes for the upper rack. In double rack dishwashers, one of the operations the users perform with most difficulty is loading and unloading the lower rack. The users have to bend over and straighten up many times during this operation, are physically strained and feel uncomfortable with this situation.

[0004] In order to solve this problem, dishwashers are designed comprising apparatuses that provide the height adjustment of the lower rack by means of a motor or by hand.

[0005] In the state of the art European Patent Application No. EP1066789A1, a device that provides the height adjustment of the lower rack in order to solve this problem and a dishwasher wherein this device is used are explained. This device comprises two pairs of levers, upper portions of each being connected to the lower rack over a guide, middle portions of each being connected to each other over a joint that makes scissors-like movement, and lower portions of each being connected to the wheels rolling on the inner surface of the door and furthermore comprises a motor that actuates this levers. However, this device is too complex in terms of
structure and can operate only under the influence of high compressive and tensile forces. Furthermore, this device tends to malfunction easily. For instance, the items which are not placed properly during utilization can get caught to the lever arms that open/close like scissors. Thus, dishwashers wherein the height of the lower rack can be adjusted are needed to be developed.

[0006] The aim of the present invention is the realization of a dishwasher which is mechanically simple, that can operate without getting stuck in the case the lower rack is loaded irregularly, ergonomic for users, not straining the door mechanically, the production, assembly and maintenance of which is easy and wherein the height of the lower rack is enabled to be adjusted according to the requirement of the user.

[0007] The dishwasher realized in order to attain the aim of the present invention and explicated in the attached claims, comprises a retainer that enables the lower rack to be held from below when the lower rack is pulled from the body over an inner surface of the door and which is released from the lower rack when the lower rack is pushed back from the inner surface of the door into the body; an elevating mechanism that is embedded on the inner surface of the door, that opens/closes telescopically in a direction perpendicular to the inner surface of the door, that enables the retainer to be moved upwards or downwards linearly from a lower position located on the inner surface of the door and an upper position having a height difference with the lower position in the vertical direction, that becomes coplanar with the inner surface of the door and that discharges the operation path of the door in the closed position, and that enables the retainer to remain in the upper position in its open position; and a driving mechanism that is embedded on the inner surface of the door and that enables the elevating mechanism to be triggered or stopped. Thus, the user is enabled to ergonomically adjust the height of the lower rack. Thus, the user is furthermore enabled to load and unload the lower rack without elevating the lower rack to the position of the upper rack and bending over/straightening up.

[0008] In an embodiment of the present invention, both the elevating mechanism
and the driving mechanism are embedded on the inner surface of the door. Thus, both the elevating mechanism and the driving mechanism are prevented from attracting the attention of the user visually and enabled to occupy less space inside the dishwasher. The elevating mechanism becomes coplanar with the inner surface of the door and discharges the operation path of the door in the closed position. Thus, the user is enabled to close or open the door in the closed position of the elevating mechanism. Furthermore, the elevating mechanism, while in the closed position, enables the retainer to remain in the lower position and in the open position, the retainer to remain in the upper position. Thus, the user is enabled to pull the lower rack quickly and easily from inside the body over the retainer or to push back into the body over the retainer in the closed position of the elevating mechanism. Thus, the user is furthermore enabled to load the items to be washed into the lower rack without bending over or to unload the washed items from the lower rack without bending over in the open position of the elevating mechanism. Consequently, a dishwasher is realized that does not disturb the user visually and wherein the height of the lower rack can be adjusted ergonomically.

[0009] In an embodiment of the present invention, the elevating mechanism comprises more than one gear-shaft, one being screwed on the other so as to freely rotate around an axis perpendicular to the inner surface of the door. As the driving mechanism rotates the gear-shafts in the straight direction, the elevating mechanism moves telescopically, changing from the closed position to the open position and enables the retainer to rise up from its lower position to the upper position. As the driving mechanism rotates the gear-shafts in the reverse direction, the elevating mechanism moves telescopically, changing from the open position to the closed position and enables the retainer to move down from its horizontal upper position to its horizontal lower position. The gear-shafts in the elevating mechanism are disposed so as to extend telescopically one within the other. Thus, the elevating mechanism is enabled to occupy less space in its closed position and be embedded into the door.

[0010] In an embodiment of the present invention, each one of the more than one
gear-shaft in the elevating mechanism, is screwed to the threads opened to the inner side of the upper one of the other two gear-shafts, whereto it is screwed, and to the threads opened to the outer side of the of the lower shaft, so as to rotate freely around an axis perpendicular to the inner surface of the door. The lowermost one of the more than one gear-shaft has a flange that is seated on the inner surface of the door. The outer surface of the portion remaining under the flange is configured like a pulley that is suitable to hold a belt included in the driving mechanism. Furthermore, the lowermost gear-shaft is attached rotatably on a bush, having sintering bed therein, which is connected non-rotatably to the uppermost gear-shaft and secured to the door. As the motor included in the driving mechanism moves the belt in the straight direction, the lowermost gear-shaft rotates, enabling the gear-shafts to move away from one another and the elevating mechanism to change to the open position. As the motor included in the driving mechanism moves the belt in the reverse direction, the lowermost gear-shaft rotates, enabling the gear-shafts to move closer to one another and the elevating mechanism to change to the closed position. Driving of the elevating mechanism of the present invention by means of the motor in the driving mechanism is accomplished by a belt-pulley mechanism. But, the use of the belt-pulley mechanism is not necessary. In a version of an embodiment of the present invention, both the pulley of the motor and the outer surface remaining under the flange have interlocking threads. Thus, in a version of an embodiment of the present invention, the motor is enabled to directly drive the lowermost gear-shaft.

[0011] In an embodiment of the present invention, the outer peripheries of the gear-shafts have circular cross-sections. The diameters of the gear-shafts are designed to be matching to one another in order to be screwed one to the other. In the open position of the elevating mechanism, the diameter of the upper gear-shaft is realized to be larger than the diameter of the gear-shaft just below. Thus, the elevating mechanism is enabled to have the appearance of an upside down cone in the open position. Furthermore, the gear-shafts are configured as hollow cylinders. Thus, when the
elevating mechanism changes to the closed position, the gear-shafts are enabled to be entirely seated into one another. The upper surface of the uppermost gear-shaft is covered flatly by a cap. Thus, the washing water is prevented from entering into the elevating mechanism during washing.

In a version of an embodiment of the present invention, the diameter of the gear-shaft just above is realized to be smaller than the diameter of the gear-shaft just below preferably while the elevating mechanism is in the open position. Thus, the elevating mechanism in the open position is enabled to have the appearance of a cone seated on its base.

In an embodiment of the present invention, the elevating mechanism comprises three separate gear-shaft towers. Thus, the load amount for each gear-shaft tower is enabled to be decreased. In each three gear-shaft towers, the flat upper surfaces of the three uppermost gear-shafts are configured as retainers. Thus, the gear-shaft towers are enabled to have retainer function as well. The driving mechanism comprises a single motor that provides the actuation of a common belt attached to a pulley formed on each of the lowermost gear-shaft of the three separate gear-shaft towers. Thus, the driving mechanism is enabled to occupy less space and the gear-shaft towers are enabled to operate synchronously. In a version of an embodiment of the present invention, the driving mechanism comprises three separate motors that operate synchronously and directly actuate the three lowermost gear-shafts. Thus, the amount of load for each motor is enabled to be decreased. In a version of an embodiment of the present invention, four separate gear-shaft towers are used. Furthermore, the upper flat surfaces of the uppermost gear-shafts of the four gear-shaft towers are configured as retainers. Thus, the gear-shaft towers are enabled to have retainer function as well.

In an embodiment of the present invention, the three separate gear-shaft towers are placed by being embedded on the inner surface of the door such that the distances therebetween can form an equilateral triangle, with one edge being centered and parallel to the front wall of the body. Thus, the lower rack is enabled to be supported in a balanced manner. Preferably, two of the three gear-shaft towers are disposed to be centered
and parallel to the front wall of the body and furthermore to be away from
the user. Thus, the gear-shaft towers attract the attention of the user less.
In a version of an embodiment of the present invention, explicated above,
wherein "the four separate gear-shaft towers" are used, the four gear-shaft
towers are placed by being embedded on the inner surface of the door
such that the distance therebetween can form a square, with one edge
being centered and parallel to the front wall of the body. Thus, the lower
rack is enabled to be supported in a very balanced manner.

[0014] In an embodiment of the present invention, the retainer is realized as a
frame, formed of two carrier arms and one or more than one bracket
connecting these, suitable for the horizontal surface cross-section of the
lower rack and that enables the lower rack to be supported both from the
lateral side and the lower side. Thus, the elevating mechanism is enabled
to safely hold the lower rack while elevating or lowering the lower rack.
Furthermore, the frame-shaped retainer is enabled to be durable, light,
simple and easy to mount. In an embodiment of the present invention, the
frame-shaped retainer is connected inseparably to the uppermost
gear-shaft of each of the three separate gear-shaft towers over the
brackets. Thus, the lower rack is enabled to be supported in a safe
manner.

[0015] In an embodiment of the present invention, the frame-shaped retainer
comprises at least one bracket configured as a stopper that enables the
forwards movement of the lower rack on the inner surface of the door to be
limited. Thus, the user is prevented from pulling the lower rack forward
more than necessary while pulling the lower rack over the frame-shaped
retainer. Thus, the lower rack is enabled to be supported in a safe manner.

[0016] In an embodiment of the present invention, the carrier arms of the
frame-shaped retainer extend parallel to one another. Additionally, the
carrier arms of the frame-shaped retainer have preferably L-shaped
cross-sections enabling the lower rack to be grasped both from the lateral
sides and the lower side. Thus, the frame is prevented from being
deformed if the user places heavy items to be washed into the lower rack.

[0017] In an embodiment of the present invention, the carrier arms of the
frame-shaped retainer are configured as rails that enable more than one wheel situated below the lateral sides of the lower rack to move forwards by rolling on the carrier arms. Thus, the user is enabled to pull the lower rack over the retainer easily.

[0018] In an embodiment of the present invention, the driving mechanism is controlled remotely by wireless communication or directly from a control panel, comprising a control unit, preferably disposed on the movable door or the body.

[0019] In an embodiment of the present invention, the dishwasher comprises a safety unit that enables the driving mechanism to be deactivated while the upper rack is not entirely inside the body or the lower rack is partially inside the body or when the door is not entirely open. Thus, the users are prevented from using the elevating mechanism erroneously.

[0020] In an embodiment of the present invention, the control unit preferably controls the driving mechanism so as to stop the retainer at indefinite intermediary positions located between the lower and upper positions. Thus, the users are enabled to elevate the lower rack to a position suitable for their height and to perform loading or unloading at this position.

[0021] In an embodiment of the present invention, the control unit preferably controls the driving mechanism so as to stop the retainer at one of the predetermined intermediary positions located between the lower and upper positions. Thus, the users are enabled to select an intermediary position suitable for their height.

[0022] In an embodiment of the present invention, the control unit preferably enables the intermediary positions to be determined and programmed by the user. Thus, it is possible for the users determine an intermediary position suitable for their height and to save this intermediary position in the memory.

[0023] By means of the present invention, a dishwasher is realized which is mechanically simple, that can operate without getting stuck in the case the lower rack is loaded irregularly, not straining the door mechanically, the production, assembly and maintenance of which is easy and which allows the height of the lower rack to be adjusted ergonomically according to the
requirement of the user.

[0024] The model embodiments relating to the dishwasher realized in order to attain the aim of the present invention are illustrated in the attached figures, where:

[0025] Figure 1 - is the perspective view of the dishwasher in an intermediary position of the retainer between a lower horizontal position and an upper horizontal position, when the retainer holds the lower rack from below in an embodiment of the present invention.

[0026] Figure 2 - is the perspective view of the elevating mechanism and the driving mechanism when the elevating mechanism is in the open position in an embodiment of the present invention.

[0027] Figure 3 - is the perspective view of the elevating mechanism and the driving mechanism when the elevating mechanism is in the closed position in an embodiment of the present invention.

[0028] Figure 4 - is the sideways perspective view of the retainer, the gear-shafts, the elevating mechanism and the driving mechanism when the elevating mechanism is in the open position in an embodiment of the present invention.

[0029] The elements illustrated in the figures are numbered as follows:

1. Dishwasher
2. Body
3. Door
4. Inner surface
5. Lower rack
6. Upper rack
7. Retainer
8. Elevating mechanism
9. Gear-shaft
10. Pulley
11. Flange
12. Bush
13. Driving mechanism
14. Motor
15. Belt

[0030] The dishwasher (1) comprises a body (2), a door (3) providing access into the body (2), that opens and closes by rotating between a horizontal and a vertical position, a lower rack (5) and an upper rack (6) wherein items to be washed are placed (Figure 1).

[0031] The dishwasher (1) furthermore comprises a retainer (7) that enables the lower rack (5) to be held from below when the lower rack (5) is pulled from inside the body (2) over an inner surface (4) of the door (3) and that is released again from the lower rack (5) when the lower rack (5) is pushed back into the body (2) over the inner surface (4) of the door (3); an elevating mechanism (8) that is disposed on the inner surface (4) of the door (3), that opens/closes telescopically in a direction perpendicular to the inner surface (4) of the door (3), that has a closed position wherein it is coplanar with the surface (4) of the door (3) and an open position wherein it enables the retainer (7) to remain at the upper position and which enables the retainer (7) to be moved linearly between a lower position located on the inner surface (4) of the door (3) and an upper position having the same projection on the inner surface (4) of the door (3) and the lower position; and a driving mechanism (13) that is disposed on the inner surface (4) of the door (3) and that enables the elevating mechanism (8) to be triggered or stopped (Figure 1). Thus, the lower rack (5) is enabled to be elevated up to almost the position of the upper rack (6) (Figure 1). Thus, the user is enabled to place the items to be washed in the lower rack (5) or to take the washed items out of the lower rack (5) without bending over (Figure 1). Thus, it is possible for the user to ergonomically adjust the height of the lower rack (5).

[0032] In an embodiment of the present invention, both the elevating mechanism (8) and the driving mechanism (13) are embedded on the inner surface (4) of the door (3) (Figure 1). Thus, both the elevating mechanism (8) and the driving mechanism (13) are enabled to occupy less space inside the dishwasher (1) (Figure 1). The elevating mechanism (8) becomes coplanar with the inner surface (4) of the door (3) when in the closed position and does not obstruct the movement area of the door (3) (Figure 1 and Figure...
3). Thus, the user is enabled to close or open the door (3) while the elevating mechanism (8) is in the closed position. Furthermore, the elevating mechanism (8), while in the closed position, enables the retainer (7) to remain at the lower position and while in the open position enables the retainer (7) to remain at the upper position (Figure 1 and Figure 3). Thus, the user is enabled to pull the lower rack (5) quickly and easily from inside the body (2) over the retainer (7) or to push back into the body (2) over the retainer (7) while the elevating mechanism (8) is in the closed position. Thus, the user is furthermore enabled to place the items to be washed into the lower rack (5) without bending over or to take out the washed items from the lower rack (5) without bending over in the open position of the elevating mechanism (8) (Figure 1). Consequently, a dishwasher (1) is realized wherein the height of the lower rack (5) can be adjusted economically.

[0033] In an embodiment of the present invention, the elevating mechanism (8) comprises more than one gear-shaft (9), one being screwed on the other so as to freely rotate around an axis perpendicular to the inner surface (4) of the door (3) (Figure 4). The elevating mechanism (8) that moves telescopically as a motor (14) included in the driving mechanism (13) rotates the lowermost gear-shaft (9) in the straight direction, changes from the closed position to the open position and enables the retainer (7) to rise from the lower position to the upper position (Figure 1 and Figure 2). The elevating mechanism (8), that moves telescopically as the motor (14) included in the driving mechanism (13) rotates the lowermost gear-shaft (9) in the reverse direction, changes from the open position to the closed position and enables the retainer (7) to go down from the upper position to the lower position (Figure 1 and Figure 3).

[0034] The gear-shafts (9) included in the elevating mechanism (8) are disposed one into the other so as to move telescopically (Figure 4). Thus, the elevating mechanism (8) is enabled to occupy less space in its closed position and to be embedded into the door (3) (Figure 1 and Figure 3). It is appropriate to produce the gear-shafts (9) from metal or an artificial material. It is preferred to produce the gear-shafts (9) from a light and
furthermore hardened artificial material so that the door (3) is not strained mechanically.

[0035] In an embodiment of the present invention, each one of the more than one gear-shaft (9) in the elevating mechanism (8) is screwed to the threads opened on the inner side of the upper one of the other two gear-shafts (9), whereto it is screwed, and to the threads opened to the outer side of the lower gear-shaft (9), so as to rotate freely around an axis perpendicular to the inner surface (4) of the door (3) (Figure 4). The lowermost gear-shaft (9) of the more than one gear-shaft (9) has a flange (11) that is seated on the inner surface (4) of the door (3) (Figure 1 and Figure 4). The outer surface of the part remaining under the flange (11) is configured like a pulley (10) that is suitable to hold a belt (15) included in the driving mechanism (13) (Figure 4). Furthermore, the lowermost gear-shaft (9) is attached rotatably on a bush (12), having sintering bed therein, secured to the door (3) and which is connected non-rotatably to the uppermost gear-shaft (9) (Figure 4). Protrusions are formed on the gear-shafts (9) (Figure 4). These protrusions limit the movement of the gear-shafts (9) in the vertical direction and enable them to interlock (Figure 4). As the motor (14) included in the driving mechanism (13) moves the belt (15) in the straight direction, the lowermost gear-shaft (9) rotates and enables the gear-shafts (9) to move away from one another and to change the elevating mechanism (8) to the open position (Figure 2). As the motor (14) included in the driving mechanism (13) moves the belt (15) in the reverse direction, the lowermost gear-shaft (9) rotates and enables the gear-shafts (9) to move closer to one another and to change the elevating mechanism (8) to the closed position (Figure 3). In an embodiment of the present invention, actuation of the elevating mechanism (8) by the motor (14) in the driving mechanism (13) is realized by means of a belt-pulley (15, 10) mechanism (Figure 4). However, the use of the belt-pulley (15, 10) mechanism is not necessary. In a version of an embodiment of the present invention, not shown in the figures, both the pulley (10) of the motor (14) and the outer surface remaining under the flange (11) have threads that can interlock. Thus, in the version of an embodiment of the present
invention, not shown in the said figures, the motor (14) is enables to actuate the lowermost gear-shaft (9) directly. The pitch of the threads opened on the gear-shafts (9) is the same in all the gear-shafts (9). But, it is not necessary for the pitch of the threads to be the same. In a version of an embodiment of the present invention, not shown in the figures, in order for both the uppermost gear-shaft (9) and the lowermost gear-shaft (9) to open and close slowly, the pitch of the threads opened to these gear-shafts (9) and the one below and the one upper gear-shaft (9) connected to these, is enabled to be smaller than the pitch of the threads in the other gear-shafts (9). Thus, the movement of the lower rack (5) is slowed down both in the upper position and the lower position. Thus, the items to be washed are prevented from shaking and/or breaking during rising and stopping of the lower rack (5).

[0036] In an embodiment of the present invention, the outer peripheries of the gear-shafts (9) have circular cross-sections (Figure 3). The diameter of the gear-shafts (9) are designed to be matching to one another in order to be screwed one to the other. In the open position of the elevating mechanism (8), the diameter of the gear-shaft (9) above is realized to be larger than the diameter of the gear-shaft (9) one below (Figure 2 and Figure 3). Thus, the elevating mechanism (8) is enabled to have the appearance of an upside down cone in the open position. Furthermore, the inside of the gear-shafts (9) are configured as hollow cylinders (Figure 3). Thus, when the elevating mechanism (8) changes to the closed position, the gear-shafts (9) are enabled to be entirely placed into one another (Figure 3). Preferably nine gear-shafts (9) are used in the elevating mechanism (8) shown in the figures. The number of gear-shafts (9) used in the elevating mechanism (8) is not limited to this number. Depending on the height of the gear-shafts (9), fewer or more gear-shafts (9) can be used. An upper surface of the uppermost gear-shaft (9) is covered flatly by a cap (Figure 2). The cap is preferably produced from an elastic material. Thus, the washing water is prevented from entering into the elevating mechanism (8) during washing. In all these embodiments, preferably the outer diameter of the uppermost gear-shaft (9) is the same as the diameter of the flange (11)
on the lowermost gear-shaft (9). The diameters of the gear-shafts (9) increase linearly from the bottom towards the top (Figure 4). But, it is not necessary for the diameters to increase linearly. In a version of an embodiment of the present invention, not shown in the figures, the outer diameter of the uppermost gear-shaft (9) is increased so as to have a wider upper surface. The diameter of the flange (11) is also increased respectively. Thus, the elevating mechanism (8) is enabled to be durable. In a version of an embodiment of the present invention, not shown in the figures, the diameter of the gear-shaft (9) above is realized to be smaller than the diameter of the gear-shaft (9) just below preferably in the open position of the elevating mechanism (8). Thus, the elevating mechanism (8) is enabled to have the appearance of a cone seated on its base in the open position.

[0037] In an embodiment of the present invention, the elevating mechanism (8) comprises three separate gear-shaft (9) towers (Figure 1, Figure 2 and Figure 3). Thus, the load amount for each gear-shaft (9) tower is enabled to be decreased. In each three gear-shaft (9) towers, the flat surfaces of the uppermost gear-shaft (9) are configured as retainers (7) (Figure 1 and Figure 2). Thus, the gear-shaft (9) towers are enabled to have retainer (7) function as well. The driving mechanism (13) comprises a single motor (14) that provides the actuation of a common belt (15) attached to a pulley (10) formed on each of the lowermost gear-shaft (9) of the three separate gear-shaft (9) towers (Figure 2 and Figure 3). Thus, the driving mechanism (13) is enabled to occupy less space and the gear-shaft (9) towers to operate synchronously. In a version of an embodiment of the present invention, not shown in the figures, the driving mechanism (13) comprises three separate motors (14) that operate synchronously and directly actuate the three lowermost gear-shafts (9). Thus, the amount of load for each motor (14) is enabled to be decreased. In a version of an embodiment of the present invention, not shown in the figures, four separate gear-shaft (9) towers are used. Furthermore, the flat surfaces of the four uppermost gear-shafts (9) of the four gear-shaft (9) towers are configured as retainers (7). Thus, the gear-shaft (9) towers are enabled to have retainer (7)
function as well. In a version of an embodiment of the present invention, not shown in the figures, the outer diameter of the uppermost gear-shaft (9) is increased, so as to have a wider surface and to hold the lower rack (5) safely.

[0038] In an embodiment of the present invention, the three separate gear-shaft (9) towers, are embedded on the inner surface (4) of the door (3) such that the distance therebetween can form an equilateral triangle, with one edge being centered and parallel to the front wall of the body (2) (Figure 1). Thus, the lower rack (5) is enabled to be supported in a balanced manner (Figure 1). Preferably, two of the three gear-shaft (9) towers are disposed to be centered and parallel to the front wall of the body (2) and furthermore to stay away from the user (Figure 1). Thus, the gear-shaft (9) towers attract the attention of the user less. In a version of an embodiment of the present invention, wherein "four separate gear-shaft (9) towers" are used, explicated above and not shown in the figures, the four separate gear-shaft (9) towers are embedded on the inner surface (4) of the door (3) such that the distance therebetween can form a square, with one edge being centered and parallel to the front wall of the body (2). In the embodiments wherein three or four gear-shaft (9) towers are used, preferably the geometric centers of the area defined by the gear-shaft (9) towers and the cross-section of the lower rack (5) are enabled to overlap. Thus, the lower rack (5) is enabled to be supported in a balanced manner.

[0039] In an embodiment of the present invention, not shown in the figures, the retainer (7) is realized as a frame, formed of two carrier arms and one or more than one bracket connecting these, suitable for the lower cross-section of the lower rack (5) and that enables the lower rack (5) to be supported both from the lateral side and the lower side. Thus, the elevating mechanism (8) is enabled to safely hold the lower rack (5) while elevating or lowering the lower rack (5). Furthermore, the retainer (7) is enabled to be durable, light, simple and easy to be assembled. In an embodiment of the present invention, not shown in the figures, the frame-shaped retainer (7) is connected inseparably to the uppermost gear-shaft (9) of each of the three separate gear-shaft (9) towers by the
brackets. Thus, the lower rack (5) is enabled to be supported safely.

[0040] In an embodiment of the present invention, not shown in the figures, the frame-shaped retainer (7) comprises at least one bracket configured as a stopper that enables the forwards movement of the lower rack (5) over the inner surface (4) of the door (3) to be limited. Thus, the users are prevented from taking the lower rack (5) to the front more than necessary while pulling the lower rack (5) over the frame shaped retainer (7). Thus, the lower rack (5) is furthermore enabled to be supported in a safe manner.

[0041] In an embodiment of the present invention, not shown in the figures, the carrier arms of the frame-shaped retainer (7) extend parallel to one another. Furthermore, the carrier arms of the frame-shaped retainer (7) have preferably L-shaped cross-sections, enabling the lower rack (5) to be grasped both from the lateral sides and the lower side. Thus, the frame is prevented from being deformed if the user places heavy items to be washed into the lower rack (5).

[0042] In an embodiment of the present invention, not shown in the figures, the carrier arms of the frame-shaped retainer (7) are configured as rails that enable more than one wheel situated at the lateral sides of the lower rack (5) to move forwards by rolling on the carrier arms. Thus, the user is enabled to pull the lower rack (5) over the retainer (7) easily.

[0043] In all the embodiments of the present invention, the driving mechanism (13) is controlled remotely by wireless communication or directly through the control panel, not shown in the figures, preferably placed on the door (3). The control panel is connected to a control unit not shown in the figures. A remote control is used which can preferably perform infrared communication with the control unit.

[0044] In an embodiment of the present invention, the dishwasher (1) preferably comprises a safety unit within the control unit that provides the deactivation of the driving mechanism (13) when the upper rack (6) is not entirely inside the body (2) or when the lower rack (5) is partially inside the body (2) or when the door (3) is not entirely open. Thus, the user is prevented from using the elevating mechanism (8) erroneously. For this
aim, more than one sensor, not shown in the figures, is mounted to the body (2), the door (3) and to the racks (5, 6), that provides distance measurement. The signals received from the sensors are evaluated by the control unit. As a result of the said evaluation, the control unit enables the driving mechanism (13) to be deactivated or to remain active. Preferably, the user is warned in case of an incorrect operation. The source of the incorrect operation is displayed to the user by means of the lights located on the control panel or the remote control. For example, if the door (3) is not entirely open, a first light is enabled to be turned on. If the lower rack (5) or the upper rack (6) is at incorrect positions, a second or a third light is enabled to be turned on.

[0045] In the dishwasher (1) of the present invention, it is not necessary to use the safety unit, however it is preferred. In the dishwasher (1) of the present invention, the height adjustment of the lower rack (5) by the user is explained below.

[0046] After the washing process is over or when the items to be washed are to be loaded into the lower rack (5), the user enters the command of "upper position (L.I.K.)" through the control panel or by the remote control in order to elevate the lower rack (5). The driving mechanism (13) automatically starts the elevating process preferably at the end of a predetermined waiting time after the door (3) is entirely opened, after the lower rack (5) is entirely pulled over the retainer (7) by hand until the stopping mark and after the upper rack (6) is entirely pushed into the body (2). The dishwasher (1) warns the user by emitting light or making a sound preferably before starting the elevating process. The user enters the command of "lower position (A.K.)" through the control panel or by the remote control in order to lower the lower rack (5) through the control panel after unloading or loading the lower rack (5). If the door (3) is entirely open and the racks (5, 6) are at the right positions, the driving mechanism (13) starts the lowering process at the end of a predetermined waiting time. The dishwasher (1) warns the user by emitting light or making a sound preferably before starting the lowering process. When the lower rack (5) comes to the lower position, the user pushes the lower rack (5)
into the body (2) by hand.

[0047] In an embodiment of the present invention, the control unit preferably controls the driving mechanism (13) so as to stop the retainer (7) at indefinite intermediary positions located between its lower and upper positions. Thus, the users are enabled to elevate the lower rack (5) to a position suitable for their height and to perform loading or unloading at this position. After the washing process is over or when the items to be washed are to be loaded into the lower rack (5), the user opens the door (3) entirely, pulls the lower rack (5) over the retainer (7) and enables the upper rack (6) to be inside the body (2). Afterwards, the user enters the preferably arrow-shaped command of "up (Y.)" through the control panel or by the remote control by pressing continuously in order to elevate the lower rack (5). The driving mechanism (13) continues the elevating process during the pressing. When the user stops pressing, the lower rack (5) is stopped. If the user desires to slightly lower the lower rack (5), similarly he/she again enters the preferably arrow-shaped command of "down (A.)" through the control panel or by the remote control by pressing continuously. The driving mechanism (13) continues the lowering process during the pressing. When the user stops pressing, the lower rack (5) is stopped. The user enters the command of "lower position (A.K.)" through the control panel or by the remote control in order to lower the lower rack (5) after unloading or loading the lower rack (5). If the door (3) is entirely open and the racks (5, 6) are at the right positions, the driving mechanism (13) automatically starts the lowering process at the end of a predetermined waiting time. The dishwasher (1) warns the user by emitting light or making a sound preferably before starting the lowering process.

When the lower rack (5) comes to the lower position, the user pushes the lower rack (5) into the body (2) by hand.

[0048] In an embodiment of the present invention, the control unit controls the driving mechanism (13) for stopping the retainer (7) at one of the predetermined intermediary positions located between its lower and upper positions. Thus, the users are enabled to select an intermediary position most suitable for their height. At least one intermediary position is
preferred to be provided in the dishwasher (1) of the present invention. After the washing process is over or when the items to be washed are to be loaded into the lower rack (5), the user enters the command of desired "intermediary position (Ar.K.)" through the control panel or by the remote control in order to elevate the lower rack (5). If the door (3) is entirely open and the racks (5, 6) are at the right positions, the driving mechanism (13) starts the elevating process at the end of a predetermined waiting time. The dishwasher (1) warns the user by making a sound or emitting light preferably before starting the elevating process. The user enters the command of "lower position (A.K.)" through the control panel or by the remote control in order to lower the lower rack (5) after unloading or loading the lower rack (6). If the door (3) is entirely open and the racks (5, 6) are at the right positions, the driving mechanism (13) automatically starts the lowering process at the end of a predetermined waiting time. The dishwasher (1) warns the user by making a sound or emitting light preferably before starting the lowering process. When the lower rack (5) comes to the lower position, the user pushes the lower rack (5) into the body (2) by hand.

[0049] In an embodiment of the present invention, the control unit preferably enables the intermediary positions to be determined and programmed by the user. Thus, the users are enabled to record in the memory a position most suitable for their height as the intermediary position. The user opens the door (3) entirely, pulls the lower rack (5) over the retainer (7) and enters the preferably arrow-shaped command of "up (Y.)" through the control panel or by the remote control by pressing continuously. The driving mechanism (13) continues the elevating process during the pressing. When the user stops pressing, the lower rack (5) is stopped. If the user desires to slightly lower the lower rack (5), he/she again enters the preferably arrow-shaped command of "low (A.)" through the control panel or by the remote control by pressing continuously. The driving mechanism (13) continues the lowering process during the pressing. When the user stops pressing, the lower rack (5) is stopped. In order to save this position in the memory, the user enters the command of "record
in the memory (H.A.)" and then immediately presses the preferred
"intermediary position (Ar.K.)" button and saves this position in the
memory as the new "intermediary position (Ar.K.)". Since there can be
more than one user with different physical features in an average family,
having more than one programmable intermediary position makes the
dishwasher (1) ergonomic. Preferably three programmable intermediary
positions are provided in the remote control of the dishwasher (1) of the
present invention.

[0050] By means of the present invention, a mechanism (8) which is ergonomic,
mechanically simple, visually unnoticeable, light, that can operate without
getting stuck in case of improper loading of the lower rack (5) and not
straining the door (3) mechanically, allowing to easily adjust the height of
the lower rack (5) according to the need of the user, having ease of
production, assembly and maintenance and a dishwasher (1) comprising
this mechanism (8) are realized.
Claims

1. A dishwasher (1) comprising
   a body (2),
   a door (3) providing access into the body (2),
   a lower rack (5) and an upper rack (6) wherein the items to be washed are placed,
   characterized by
   a retainer (7) that enables the lower rack (5) to be held from below when the lower rack (5) is pulled from inside the body (2) over an inner surface (4) of the door (3) and that is released again from the lower rack (5) when the lower rack (5) is pushed back into the body (2) over the inner surface (4) of the door (3),
   an elevating mechanism (8) that is disposed on the inner surface (4) of the door (3), that opens/closes telescopically in a direction perpendicular to the inner surface (4) of the door (3), that has a closed position whereat it is coplanar with the surface (4) of the door (3) and an open position wherein it enables the retainer (7) to remain at the upper position and which enables the retainer (7) to be moved linearly between a lower position located on the inner surface (4) of the door (3) and an upper position having the same projection on the inner surface (4) of the door (3) and the lower position, and
   a driving mechanism (13) that is disposed on the inner surface (4) of the door (3) and that enables the elevating mechanism (8) to be triggered or stopped.

2. A dishwasher (1) as in Claim 1, characterized by the elevating mechanism (8) that comprises more than one gear-shaft (9), one being screwed on the other so as to freely rotate around an axis perpendicular to the inner surface (4) of the door (3), that changes from the closed position to the open position by telescopic movement and enables the retainer (7) to rise from the lower position to the upper position as the driving mechanism (13) rotates the gear-shafts (9) in the straight direction and that changes from the open position to the closed position by telescopic movement and enables the retainer (7) to be lowered from the upper position to the lower position as the driving mechanism (13) rotates the gear-shafts (9) in the reverse direction.

3. A dishwasher (1) as in Claim 2, characterized by the driving mechanism (13) that comprises a belt (15) enabling a pulley (10) of the lowermost gear-shaft
(9) in the elevating mechanism (8) to be rotated and a motor (14) that provides the actuation of the belt (15) and by the elevating mechanism (8) that opens when the lowermost gear-shaft (9) rotates and the gear-shafts (9) move away from one another as the motor (14) in the driving mechanism (13) moves the belt (15) in the straight direction, and that closes on a flange (11) of the lowermost gear-shaft (9) embedded on the inner surface (4) of the door (3) when the lowermost gear-shaft (9) rotates and the gear-shafts (9) move closer to one another as the motor (14) in the driving mechanism (13) moves the belt (15) in the reverse direction.

4. A dishwasher (1) as in Claim 2 or 3, characterized by the gear-shafts (9), the diameters of which increase from the bottom towards the top in the open position of the elevating mechanism (8).

5. A dishwasher (1) as in any one of the Claims 2 to 4, characterized by the elevating mechanism (8) formed of three separate gear-shaft (9) towers and the retainer (7) formed by the uppermost gear-shafts (9) of the three gear-shaft (9) towers.

6. A dishwasher (1) as in Claim 6, characterized by the three gear-shafts (9) disposed by being embedded one inside the other on the inner surface (4) of the door (3), such that the distances therebetween form an equilateral triangle.

7. A dishwasher (1) as in Claim 5 or 6, characterized by the retainer (7) formed of a frame that is added to the uppermost gear-shafts (9) of the three gear-shafts (9) towers.

8. A dishwasher (1) as in Claim 7, characterized by the frame comprising at least one stopper-shaped bracket that limits the forwards movement of the lower rack (5) on the inner surface (4) of the door (3).

9. A dishwasher (1) as in Claim 7 or 8, characterized by the frame comprising carrier arms having L-shaped cross-sections, extending parallel to one another and enabling the lower rack (5) to be grasped both from the lateral sides and the lower side.

10. A dishwasher (1) as in Claim 9, characterized by the rail-shaped carrier arms enabling more than one wheel disposed below the lateral sides of the lower rack (5) to move thereon by rolling.

11. A dishwasher (1) as in any one of the above claims, characterized by a control
unit that provides the controlling of the control panel, disposed on the door (3) or the body (2), and of the driving mechanism (13), directly through the control panel or remotely with wireless communication.

12. A dishwasher (1) as in Claim 11, characterized by the control unit that deactivates the driving mechanism (13) when the upper rack (6) is partially out of the body (2) or when the lower rack (5) is partially inside the body (2) or when the door (3) is not entirely open.

13. A dishwasher (1) as in Claim 11 or 12, characterized by the control unit that enables the retainer (7) to be stopped at the intermediary positions between the lower and upper positions by means of the driving mechanism (13).

14. A dishwasher (1) as in Claim 11 or 12, characterized by the control unit that enables the retainer (7) to be stopped at one of the predetermined intermediary positions between the lower and upper positions by means of the driving mechanism (13).

15. A dishwasher (1) as in Claim 14, characterized by the control unit that enables the predetermined intermediary positions to be programmed by the user.
A. CLASSIFICATION OF SUBJECT MATTER

INV. A47L15/50

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
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Further documents are listed in the continuation of Box C. [X] See patent family annex.

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Date of the actual completion of the international search: 13 March 2014
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