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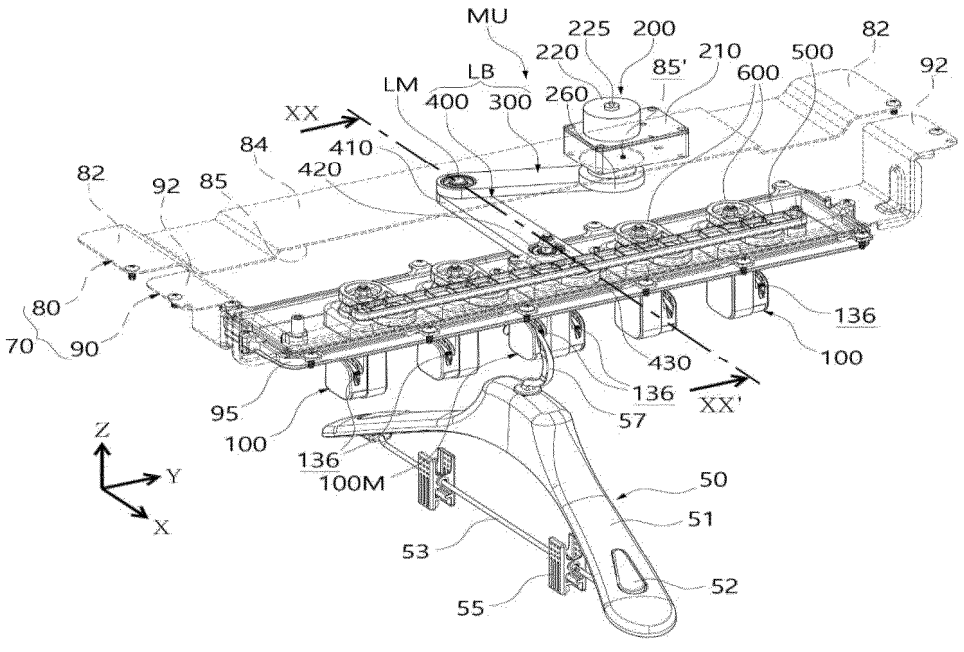
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(54) CLOTHING TREATMENT APPARATUS

(57) Proposed is a clothing treatment apparatus (1). The apparatus (1) includes a moving hanger (100) configured to rotate about a hanger shaft (150) and a drive unit (MU) configured to rotate the hanger shaft (150). The drive unit (MU) includes an eccentric disk (260) having an eccentric portion (265) offset from a motor shaft (225) of a motor assembly (200). The drive unit (MU) further includes a plurality of link bars (LB) that connect the eccentric portion (265) and the hanger shaft (150) and are rotatable relative to each other. Link driving caused by the plurality of link bars (LB) prevents slippage during the driving process, thereby reducing loss of kinetic energy.

【FIG. 5】



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Description

[0001] A clothing treatment apparatus is an apparatus for washing and drying clothing, and for removing wrinkles generated in the clothing. Examples of apparatuses classified as the clothing treatment apparatus include a washing machine for washing clothing, a dryer for drying clothing, a washer/dryer having both washing and drying functions, a clothing care apparatus for refreshing clothing, and a steamer for removing wrinkles from clothing.

[0002] In addition to a clothing treatment apparatus of a conventional type that washes clothing by immersing the clothing in water with a detergent, recently, a clothing treatment apparatus that maintains clothing in a fresh and clean state without washing has been used. Such a clothing treatment apparatus supplies either high-temperature air or steam to clothing to deodorize the clothing, thereafter dries the clothing, and at the same time may also remove wrinkles from the clothing.

[0003] Such a clothing treatment apparatus may repeatedly rotate or shake a moving hanger on which clothing is hung to remove fine dust or foreign substances adhering to the clothing. In this case, to drive the moving hanger, a driving force of a motor may be used. More specifically, a rotational force of the motor may be transmitted to the moving hanger through a pulley and belt structure. The pulley may rotate in opposite directions by a predetermined angle, thereby repeatedly driving the moving hanger.

[0004] However, when a driving force is transmitted through a pulley and belt structure as described above, slippage may occur between the belt and the pulley during operation. Such slippage not only leads to a loss of kinetic energy but also makes accurate power transmission difficult.

[0005] In addition, in a drive device configured with a belt and pulley, it is difficult to maintain a predetermined speed ratio between the motor and the pulley, and since the belt deforms according to changes in tension, output stability may decrease when a load fluctuates significantly. Furthermore, the belt has the disadvantage that, over time, wear, elongation, or hardening may occur, requiring periodic replacement.

[0006] To overcome this issue, a power transmission structure using a plurality of gears instead of a belt and a pulley may be considered. However, in this case, a motor and a moving hanger, which constitute a drive unit, are required to be arranged close to each other, so interference between the components is likely to occur, and the height of the drive unit also increases.

[0007] Meanwhile, a conventional clothing treatment apparatus may have a structure in which a moving hanger is rotated within a predetermined angular range by using a driving force of a motor. To this end, a lever connected to the moving hanger is provided with an elongated slot, and an eccentric shaft connected to the motor moves within the slot to rotate the lever in both directions. However, such a structure has a problem in that friction occurs as the eccentric shaft moves within the slot, resulting in energy loss. In addition, continuous contact between the eccentric shaft and the inner surface of the slot causes wear, thereby reducing the durability of the clothing treatment apparatus.

[0008] The present invention is specified by the independent claim. Preferred embodiments are defined by the dependent claims. The present disclosure is intended to solve the problems of the conventional technology as described above, and an objective of the present disclosure is to connect a moving hanger and a motor by a plurality of links.

[0009] Another objective of the present disclosure is to ensure that the driving force of the motor is not lost and is efficiently transmitted to the moving hanger through the plurality of links.

[0010] Another objective of the present disclosure is to effectively utilize an operating space inside a clothing treatment apparatus through the plurality of links.

[0011] Another objective of the present disclosure is to ensure that the operation of the moving hanger accurately follows input values of a drive unit (motor).

[0012] According to the features of the present disclosure a clothing treatment apparatus of the present disclosure may include a moving hanger configured to rotate about a hanger shaft and a drive unit configured to rotate the hanger shaft. The drive unit may include an eccentric disk having an eccentric portion offset from a motor shaft of a motor assembly. The drive unit may further include a plurality of link bars that connect the eccentric portion and the hanger shaft and are rotatable relative to each other. Link driving caused by the plurality of link bars may prevent slippage during the driving process, thereby reducing loss of kinetic energy.

[0013] The plurality of link bars may include a first link bar connected to the eccentric portion to operate in connection with rotation of the eccentric portion, and a second link bar connected to the first link bar and configured to rotate about the hanger shaft as a rotation center.

[0014] The first link bar may include a first end portion rotatably connected to the eccentric portion and configured to revolve around the motor shaft along the eccentric portion. The first link bar may further include a second end portion rotatably coupled to the second link bar and configured to reciprocate along an arcuate path while maintaining a predetermined radius from the hanger shaft.

[0015] The second end portion of the first link bar and an interlocking end portion of the second link bar may be disposed on a common link rotation axis. The second end portion of the first link bar and the interlocking end portion of the second link bar may be connected to each other so as to be independently rotatable about the link rotation axis.

[0016] Each of the motor shaft and the hanger shaft may be arranged in a direction of a Z-axis. The plurality of link bars may rotate or linearly move on an X-Y plane orthogonal to the Z-axis.

[0017] The plurality of link bars may include the first link bar having each of opposite end portions configured to perform rotational or arcuate movement in the X-Y plane. The plurality of link bars may include the second link bar having a rotational center portion configured to rotate about the hanger shaft fixed on the X-Y plane, and the interlocking end portion spaced apart from the rotational center portion and connected to the first link bar. The interlocking end portion may perform arcuate movement along the first link bar in the X-Y plane.

[0018] The first link bar may include the first end portion rotatably connected to the eccentric portion and configured to revolve around the motor shaft along the eccentric portion. The first link bar may include the second end portion rotatably coupled to the second link bar and configured to perform reciprocating movement within a predetermined range of rotation angles. The hanger shaft may operate in connection with the rotation of the second end portion and have the same range of rotation angles as the second end portion.

[0019] When a distance between the motor shaft and the eccentric portion is defined as D1, a distance between a link connection portion at which the first link bar and the second link bar are connected and the eccentric portion is defined as D2, a distance between the link connection portion and the hanger shaft is defined as D3, and a distance between the hanger shaft and the motor shaft is defined as D4, following relationships may be satisfied: $D1+D2 \leq D3+D4$, $D1+D3 \leq D2+D4$, $D1+D4 \leq D2+D3$.

[0020] The link connection portion may be rotated along an arcuate path between a first position and a second position. An angle ($\angle P1P4P3a$) between the motor shaft (P1) and the link connection portion (P3a) at the first position with respect to the hanger shaft (P4) may be

$$\angle P1P4P3a = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D1+D2)^2)}{2(D3 \times D4)}\right),$$

and

an angle ($\angle P1P4P3b$) between the motor shaft (P1) and the link connection portion (P3b) at the second position with respect to the hanger shaft (P4) may be

$$\angle P1P4P3b = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D2-D1)^2)}{2(D3 \times D4)}\right).$$

[0021] With respect to a front-rear direction orthogonal to the hanger shaft, an operating space may be divided into a first region and a second region. The motor assembly, the eccentric disk, and the first link bar may be disposed in the first region. The hanger shaft may be disposed in the second region. The second link bar may be connected to the eccentric disk in the first region and may be connected to the hanger shaft in the second region.

[0022] The motor shaft may extend from the motor assembly in a direction parallel to the hanger shaft. The eccentric disk may be disposed below the motor assembly and may be connected to the motor shaft

[0023] With respect to the front-rear direction orthogonal to the hanger shaft, the link connection portion at which the plurality of link bars is connected to each other may be disposed behind the motor shaft.

[0024] With respect to the front-rear direction orthogonal to the hanger shaft, the motor shaft may be disposed between the link connection portion at which the plurality of link bars is connected to each other and the hanger shaft.

[0025] Each of the motor shaft and the hanger shaft may be disposed in a Z-axis direction. The eccentric disk and the plurality of link bars may be arranged at different heights along the Z-axis direction.

[0026] A mounting frame may be disposed in the operating space. The motor assembly and the second link bar may be supported by the mounting frame.

[0027] The mounting frame may include a first mounting frame on which the motor assembly is disposed. The mounting frame may include a second mounting frame disposed parallel to the first mounting frame and supporting the second link bar.

[0028] With respect to the front-rear direction orthogonal to the hanger shaft, the first mounting frame may be disposed behind the second mounting frame. The hanger shaft and the moving hanger may be disposed on the second mounting frame.

[0029] Each of the motor shaft and the hanger shaft may be disposed in the Z-axis direction. The first mounting frame and the second mounting frame may be arranged at different heights along the Z-axis direction.

[0030] With respect to the axial direction of the hanger shaft, a first bearing may be disposed between the second link bar and the hanger shaft. A second bearing coaxial with the first bearing may be disposed between the hanger shaft and the mounting frame.

[0031] The motor assembly may be disposed on a first surface of the mounting frame. The eccentric disk may be disposed to face a second surface of the mounting frame opposite to the first surface.

[0032] Moving hangers may be connected to the plurality of interlocking link parts, respectively. The second link bar and the plurality of interlocking link parts may be connected to each other by a sync bar, so that the plurality of interlocking link parts may be synchronized with the rotational movement of the second link bar through the sync bar.

[0033] A bearing may be disposed at a link connection portion at which the first link bar and the second link bar are connected to each other. The first link bar or the second link bar may be provided with a link boss portion coupled to the bearing.

[0034] The motor assembly may include a plurality of gears configured to reduce rotational speed of the motor shaft. An output gear among the plurality of gears may rotate the eccentric disk.

[0035] The motor assembly may include a plurality of gears configured to reduce rotational speed of the motor shaft. The plurality of gears may be provided with an output shaft that rotates the eccentric disk while rotating in conjunction with the motor shaft of the motor assembly. The motor shaft and the output shaft may be concentrically disposed to form the same rotational center.

[0036] The plurality of link bars may include the first link bar and the second link bar respectively configured as rigid bodies.

[0037] The plurality of link bars may include the first link bar and the second link bar that are rotated relative to each other. The second link bar may be connected to the hanger shaft, and a fixing bar may be provided between the second link bar and the motor assembly.

[0038] The drive unit may include: (i) a first driving point rotated by the motor assembly; (ii) a second driving point configured to revolve around the first driving point; (iii) a third driving point that maintains a predetermined linear distance from the second driving point and reciprocates along an arcuate path while maintaining a predetermined radius from the hanger shaft; and (iv) a fourth driving point formed on the hanger shaft and maintaining a predetermined linear distance from the motor shaft.

[0039] As described above, the clothing treatment apparatus according to the present disclosure may have the following effects.

[0040] In the clothing treatment apparatus of the present disclosure, the moving hanger and the motor may be connected by a plurality of links, and the moving hanger may be operated through driving of the links. Such link driving may prevent slippage during the driving process, thereby reducing waste of kinetic energy.

[0041] In addition, in the clothing treatment apparatus of the present disclosure, since power is transmitted from a driving source (motor) to a final output part (moving hanger) through the link bars, accurate power transmission may be achieved. As a result, precise control of the moving hanger may be made possible.

[0042] In particular, according to the clothing treatment apparatus of the present disclosure, when input values (speed of the motor and rotation number thereof) are controlled, output values (rotation angle range of the moving hanger) may accurately follow the input values. Accordingly, the operation reliability of the clothing treatment apparatus may be improved, and more precise clothing care may be achieved.

[0043] In addition, in the clothing treatment apparatus of the present disclosure, since the plurality of links operate while rotating relative to each other, wear may be reduced compared to a conventional belt-driven method, thereby enabling stable operation over a long period and improving durability.

[0044] In addition, the drive unit constituting the clothing treatment apparatus of the present disclosure may be configured as a four-bar linkage mechanism, allowing the drive unit (motor) and the moving hanger to be spaced apart from each other. As a result, interference between components may be prevented, and the operating space may be utilized more efficiently.

[0045] In addition, in the clothing treatment apparatus of the present disclosure, the moving hanger may be rotated within the same angular range as the rotation angle range of the link connection portion where the first link bar and the second link bar are connected. Since the moving hanger is fully and operatively interlocked with the rotation of the link bars in this manner, kinetic energy may be transmitted effectively without waste, and the angular control of the moving hanger may be performed more precisely.

[0046] In addition, in the clothing treatment apparatus of the present disclosure, the input shaft and the output shaft of the motor assembly may be configured coaxially, thereby facilitating control of the output shaft and enabling stable operation.

[0047] In particular, since the end of the motor shaft can be fixed to the eccentric disk coupled coaxially to the output shaft, the motor shaft may be driven stably without wobbling during rotation.

[0048] In addition, in the clothing treatment apparatus of the present disclosure, the first link bar and the second link bar, which constitute the plurality of link bars, may respectively be configured as rigid bodies. As a result, precise operation control of the drive unit including the link bars may be achieved, deformation of the link bars may be minimized, and the

accuracy of the driving mechanism may be improved.

[0049] In addition, in the clothing treatment apparatus of the present disclosure, a plurality of components, including the motor, the link bars, the hanger shaft, and the moving hanger, may be mounted in different regions (or on different mounting frames). When the plurality of components is thus distributed, the efficient use of the operating space may be increased, interference between components may be prevented, thereby improving the efficiency and stability of the entire driving system.

[0050] In addition, in the clothing treatment apparatus of the present disclosure, the motor assembly, the eccentric disk, the plurality of link bars, and the hanger shaft may constitute a type of four-bar linkage mechanism, in which the motor assembly and the hanger shaft may be fixed to respective mounting frames, and a separate ground link therebetween may be omitted. When a separate ground link between the motor assembly and the hanger shaft is thus omitted, the number of components required to constitute the four-bar linkage mechanism may be reduced. In addition, the motor assembly and the hanger shaft may be arranged on different mounting frames with different positions and heights in the front-rear direction, thereby increasing freedom of design.

BRIEF DESCRIPTION OF THE DRAWINGS

[0051] The above and other objectives, features, and other advantages of the present disclosure will be more clearly understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view showing a clothing treatment apparatus according to a first embodiment of the present disclosure;

FIG. 2 is a perspective view showing the upper structure of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 3 is a perspective view showing the inside of a treatment space of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 4 is a perspective view showing an operating space of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 5 is a perspective view showing the structure of a moving hanger and a drive unit constituting the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 6 is a perspective view in which a mounting frame of FIG. 5 is removed and the structure of the drive unit is shown in an enlarged view;

FIG. 7 is a perspective view in which a motor housing of FIG. 6 is removed and the structure of the drive unit is shown in an enlarged view;

FIGS. 8 to 13 are operational views sequentially showing a state in which the moving hanger is operated by the drive unit of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 14 is a plan view showing the structure of the moving hanger and the drive unit constituting the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 15 is a plan view showing the structure of the drive unit of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIGS. 16(a) and 16(b) are plan views showing states in which the moving hanger is rotated in a first direction and a second direction, respectively, by the drive unit of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 17 is a perspective view showing the structure of a plurality of link bars, the moving hanger, and a sync bar constituting the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 18 is an exploded perspective view showing the components of FIG. 17;

FIG. 19 is an exploded perspective view showing the moving hanger and a hanger shaft of the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 20 is a cross-sectional view taken along line XX-XX' of FIG. 5;

FIG. 21 is a cross-sectional view shown by enlarging the square region of FIG. 19;

FIG. 22 is an exploded perspective view showing a motor assembly and a first link bar constituting the clothing treatment apparatus according to the first embodiment of the present disclosure;

FIG. 23 is a cross-sectional view taken along line XXIII-XXIII' of FIG. 20;

FIG. 24 is a plan view showing the structure of a drive unit and a moving hanger of a clothing treatment apparatus according to a second embodiment of the present disclosure;

FIG. 25 is a cross-sectional view showing the structure of a motor assembly and a first link bar of a clothing treatment apparatus according to a third embodiment of the present disclosure;

FIG. 26 is a plan view showing the structure of a drive unit and a moving hanger of a clothing treatment apparatus according to a fourth embodiment of the present disclosure; and

FIG. 27 is a plan view showing the structure of a drive unit and a moving hanger of a clothing treatment apparatus according to a fifth embodiment of the present disclosure.

DETAILED DESCRIPTION

[0052] Hereinafter, some embodiments of the present disclosure will be described in detail with reference to exemplary drawings. In assigning reference numerals to components of each drawing, it should be noted that the same reference numerals are assigned to the same components as much as possible, even if they are shown in different drawings. Furthermore, in describing the embodiments of the present disclosure, detailed descriptions of well-known configurations or functions will be omitted when it is determined that such descriptions may obscure the understanding of the embodiments of the present disclosure.

[0053] The present disclosure relates to a clothing treatment apparatus 1 having a structure for rotating moving hangers 100 for managing clothes. The moving hangers 100 may shake off foreign substances adhering to clothes and remove wrinkles while repeatedly rotating. In the present disclosure, each of the moving hangers 100 may be operated by a drive unit MU, and the drive unit MU may include a motor assembly 200 and a plurality of link bars LB for transmitting rotational power of the motor assembly 200 to the moving hanger 100. Hereinafter, the structures of the drive unit MU and the moving hanger 100 will be mainly described in detail.

[0054] Referring to FIG. 1, the clothing treatment apparatus 1 according to the present embodiment may include a treatment space S1 configured to accommodate clothing. The treatment space S1 may be defined by an inner casing 20 surrounding the treatment space S1 and a door 3 configured to open and close an entrance of the inner casing 20. An outer casing 2 may be disposed outside the inner casing 20 to surround the inner casing 20. In FIG. 1, the outer casing 2 is illustrated with a dotted line for ease of understanding. In another example, the inner casing 20 and the outer casing 2 may be configured as a single casing. For reference, hereinafter, the term "clothing" is used as a concept including not only upper garments such as dress shirts or blouses but also lower garments such as jeans, and all types of garments that require regular care.

[0055] In FIG. 1 and other drawings, an X-axis represents a front-rear direction, a Y-axis represents a left-right direction, and a Z-axis represents an up-down direction, respectively. Hereinafter, the terms front-rear direction, left-right direction, and up-down direction are based on these axial directions. For reference, a hanger 50 may be rotated about a rotation shaft formed in a Z-axis direction.

[0056] An air treatment part 4 may be disposed at a lower portion of the outer casing 2 to supply at least one of hot air and steam into the treatment space S1. The air treatment part 4 may be disposed in a machine room (not shown) formed at a lower portion of the outer casing 2 and separated from the treatment space S1. The air treatment part 4 may include at least one of a blower unit (not shown), a heat pump unit (not shown), and a steam unit (not shown) disposed in the machine room.

[0057] The air treatment part 4 may include a discharge part 5 configured to discharge hot air or steam. Although not illustrated, the air treatment part 4 may further include a water supply tank for supplying steam and a drainage tank for discharging wastewater. In the present embodiment, the air treatment part 4 may be disposed below the inner casing 20. The configuration and position of the air treatment part 4 may be variously modified. For example, the air treatment part 4 may be disposed at the rear or side of the outer casing 2.

[0058] The outer casing 2 may include a main frame 10. The main frame 10 may be disposed to surround the periphery of the inner casing 20. The main frame 10 may constitute a frame enclosing the inner casing 20. Referring to FIG. 2, the main frame 10 may include side frames 11 and an upper frame 13. An operating space S2, which will be described below, may be formed between the upper frame 13 and the upper surface of the inner casing 20.

[0059] The inner casing 20 may include side portions 21 and a top portion 23. A front surface of the inner casing 20, which is not surrounded by the side portions 21 and the top portion 23, may be open toward the front. The open front may be opened and closed by the door 3. The top portion 23 of the inner casing 20 may partition the treatment space S1 from the operating space S2.

[0060] As shown in FIGS. 1 and 2, the operating space S2 may be formed on the upper side of the inner casing 20, with the operating space S2 separated from the treatment space S1. The operating space S2 may be a space in which the drive unit MU and a mounting frame 70, which will be described below, are disposed. The drive unit MU disposed in the operating space S2 may operate within the operating space S2 to rotate the moving hanger 100.

[0061] Here, the drive unit MU may include an eccentric disk 260 and a plurality of link bars LB interlocking with the drive unit MU. Hereinafter, the drive unit MU will be used to indicate a structure including these components.

[0062] The hanger 50 may be disposed in the treatment space S1. The hanger 50 may be hung on the moving hanger 100, which will be described below. When the moving hanger 100 operates in a state in which the hanger 50 is hung on the moving hanger 100, the hanger 50 and clothes hung on the hanger 50 may be rotated by the moving hanger 100. In FIG. 2, an arrow indicates directions in which the hanger 50 is rotated by the moving hanger 100. Although only one hanger 50 is illustrated in FIG. 2, a plurality of hangers 50 may be hung on the moving hanger 100.

[0063] Referring to the structure of the hanger 50, the hanger 50 may be made exclusively for the moving hanger 100 of

the present embodiment, or the hanger 50 may be a general hanger. As shown in FIGS. 2 and 3, the hanger 50 may include a pair of hanging arms 51 extending to opposite sides. The pair of hanging arms 51 may have anti-slip portions 52 protruding therefrom to increase frictional force thereof with clothes. Reference numeral 53 denotes a support bar connecting the pair of hanging arms 51. The support bar 53 may be provided with clamping portions 55, which may be used to fix clothes.

[0064] For reference, among the plurality of moving hangers 100 shown in FIG. 3, the moving hanger 100 positioned at the center is assigned a distinguishing reference numeral 100M. The moving hanger 100 at the center may be connected to a hanger shaft 150, which will be described below, and may be directly rotated by the drive unit MU. Other moving hangers 100 disposed on the opposite sides of the central moving hanger 100M may interlock with the central moving hanger 100M and may be operated by interlocking link parts 600. Hereinafter, the moving hanger 100 positioned at the center will be referred to as a main hanger 100M to distinguish it from the other moving hangers 100.

[0065] An upper portion of the hanger 50 may be provided with a hanging hook 57. The hanging hook 57, which is a portion caught on the moving hanger 100, may be fitted into a hanging groove 136 formed in the moving hanger 100. The hanging hook 57 may be fixed so as not to rotate relative to the pair of hanging arms 51. When the hanging hook 57 is rotated by the moving hanger 100, the hanger 50 as a whole may rotate. Such a structure of the hanger 50 is merely one example, and may variously be modified.

[0066] The mounting frame 70 may be disposed in the operating space S2. The mounting frame 70 may support the drive unit MU, a link unit, the interlocking link parts 600, and the moving hanger 100, which will be described below. The mounting frame 70 may be arranged to extend across the operating space S2. For reference, the link unit may include the plurality of link bars LB, which will be described later.

[0067] The mounting frame 70 may be configured as one or a plurality of mounting frames 80 and 90. In the present embodiment, the mounting frame 70 may include a first mounting frame 80 and a second mounting frame 90. Each of opposite end portions 82 of the first mounting frame 80 may be fixed to the upper frame 13. Each of opposite end portions 92 of the second mounting frame 90 may be fixed to the upper frame 13.

[0068] The drive unit MU may be disposed on the first mounting frame 80. The drive unit MU may include the motor assembly 200, the eccentric disk 260, and the plurality of link bars LB, which will be described below. The second mounting frame 90 may be disposed in parallel with the first mounting frame 80, and a second link bar 400, which will be described below, may be supported on the second mounting frame 90. The second mounting frame 90 may support the hanger shaft 150, the moving hanger 100, and the interlocking link parts 600.

[0069] With respect to the front-rear direction (X-axis direction) perpendicular to the hanger shaft 150, the first mounting frame 80 may be disposed behind the second mounting frame 90. The first mounting frame 80 may be disposed behind the second mounting frame 90, and thus the first mounting frame 80 and the second mounting frame 90 may respectively support the motor assembly 200 and the hanger shaft 150 to be maintained spaced apart from each other in the front-rear direction.

[0070] A motor shaft 225 and the hanger shaft 150 may be disposed along the Z-axis direction, and in this case, the first mounting frame 80 and the second mounting frame 90 may be arranged at different heights along the Z-axis direction. With reference to FIG. 2, the first mounting frame 80 may be disposed at a higher position than the second mounting frame 90. In this case, a plurality of components, including the motor assembly 200 and the interlocking link parts 600, may be arranged at various positions, allowing extensive use of the operating space S2. Furthermore, this structure enables smooth operation of the components while preventing interference therebetween, and increases freedom of design.

[0071] Referring to FIG. 2, the motor assembly 200 may be disposed on a first surface 84 of the mounting frame 70. The eccentric disk 260, which will be described below, may be disposed to face a second surface 85 of the mounting frame 70, which is opposite to the first surface 84. Here, the first surface 84 of the mounting frame 70 may serve as an upper surface thereof, and the second surface 85 may serve as a lower surface thereof. In this case, the operating space S2 may be efficiently utilized, and the motor assembly 200 and the eccentric disk 260 may be aligned in the Z-axis direction to improve the efficiency of power transmission.

[0072] Referring to FIG. 3, a partition panel 95 may be disposed on the upper side of the treatment space S1. The partition panel 95 may be disposed between the treatment space S1 and the operating space S2. The partition panel 95 may block a passage (not shown) between the treatment space S1 and the operating space S2 so that the operating space S2 is not exposed to the treatment space S1. The partition panel 95 may be fixed to at least one of the top portion 23 of the inner casing 20 and the second mounting frame 90.

[0073] The partition panel 95 may be provided with moving holes 99 that are open in the vertical direction, and at least a portion of each of the moving hangers 100 may be disposed in the treatment space S1 through each of the moving holes 99. More specifically, a portion of the moving hanger 100 may be disposed in the treatment space S1 to fix the hanger 50, while the other portion of the moving hanger 100 may be disposed in the operating space S2 to be connected to the hanger shaft 150 and the second link bar 400. The portion of the moving hanger 100 disposed in the treatment space S1 includes a hanging portion 135.

[0074] FIG. 4 illustrates the operating space S2. As shown, the drive unit MU, which includes the motor assembly 200,

the eccentric disk 260, and the plurality of link bars LB, the hanger shaft 150, a sync bar 500, and the interlocking link parts 600 may be disposed in the operating space S2. The aforementioned components may operate within the operating space S2, and such operations may result in the rotation of the moving hanger 100.

[0075] The drive unit MU may interlock with the hanger shaft 150 to rotate the hanger shaft 150. More specifically, the motor assembly 200 may rotate the eccentric disk 260, and the eccentric disk 260 may actuate the plurality of link bars LB. The plurality of link bars LB may rotate the hanger shaft 150, and ultimately, the main hanger 100M may be rotated This series of operations may occur simultaneously and continuously. Hereinafter, the operations of these components will be described in detail.

[0076] Referring to FIGS. 5 and 6, the drive unit MU may include the motor assembly 200. The motor assembly 200 may be disposed on the first mounting frame 80. A drive motor 220 of the motor assembly 200 may generate rotational force while being fixed to the first mounting frame 80 and may rotate the motor shaft 225. The drive motor 220 may generate rotational force by receiving electric power, and a wire harness for supplying the electric power is omitted in the drawings.

[0077] With respect to the first mounting frame 80, the eccentric disk 260 may be disposed below the motor assembly 200. The eccentric disk 260 may be considered as a component of the drive unit MU. The eccentric disk 260 may be disposed concentrically with the drive motor 220. That is, the rotational axis of the eccentric disk 260 may be coaxial with the motor shaft 225. The eccentric disk 260 may be rotated by the drive motor 220 and actuate the plurality of link bars LB.

[0078] Referring to FIG. 6, an eccentric portion 265 constituting the eccentric disk 260 is shown in dashed lines. The eccentric portion 265 may be coupled to a first link bar 300 so as not to be exposed to the outside, but is illustrated in dashed lines for ease of understanding. The eccentric portion 265 may be disposed at a position eccentric from the rotational center of the eccentric disk 260. The eccentric portion 265 may revolve around the motor shaft 225. This revolution of the eccentric portion 265 may be converted into a reciprocating motion of the first link bar 300.

[0079] The plurality of link bars LB may include the first link bar 300 and the second link bar 400. The first link bar 300 may have opposite end portions configured to perform rotational motion, respectively. The second link bar 400 may be connected to the hanger shaft 150 and a portion of the second link bar 400 connected to the first link bar 300 may be rotated about the hanger shaft 150 as a rotational axis. More specifically, the second link bar 400 may include an interlocking end portion 410 and a sync end portion 430 on opposite sides of a rotational center portion 420 fixed to the hanger shaft 150. The interlocking end portion 410 may be rotatably connected to the first link bar 300 to constitute a link connection portion LM. The sync end portion 430 may be connected to the sync bar 500 to linearly move the sync bar 500.

[0080] Each of the first link bar 300 and the second link bar 400 may have an elongated rod shape extending in one direction. The first link bar 300 and the second link bar 400 may both be configured as rigid bodies so that bending or deformation is minimized during operation thereof. The first link bar 300 and the second link bar 400 may have different lengths. In this embodiment, the second link bar 400 is longer than the first link bar 300, but contrarily, the first link bar 300 may be longer than the second link bar 400. Details related to the lengths of the plurality of link bars LB will be described again later.

[0081] In FIG. 6, the motor shaft 225 may extend in the Z-axis direction. Reference numeral MX denotes the rotational center of the motor passing through the center of the motor shaft 225. In this case, a disk rotation axis X1 of the eccentric disk 260 may be defined concentrically with the rotational center MX of the motor shaft 225. The eccentric portion 265 may revolve around the disk rotation axis X1.

[0082] Each of the first link bar 300 and the second link bar 400 may each have a rotation axis formed in the Z-axis direction together with the motor shaft 225. That is, a link rotation axis X2, which is a rotation axis of the link connection portion LM where the first link bar 300 and the second link bar 400 are connected to each other, and a drive axis X3, which is a rotation axis of the second link bar 400, may each be defined in the Z-axis direction, which is the same as the axial extension line MX of the motor shaft 225. The extension line MX of the motor shaft 225, the disk rotation axis X1, the link rotation axis X2, and the drive axis X3 may all be defined in parallel with each other. In this case, the drive axis X3 of the second link bar 400 may be defined by the hanger shaft 150. That is, the hanger shaft 150 may serve as the drive axis X3 of the second link bar 400.

[0083] In a portion where the sync end portion 430 of the second link bar 400 is connected to the sync bar 500, a sync rotation axis X4 may be defined. Since the sync end portion 430 and the sync bar 500 rotate relative to each other, the sync rotation axis X4 may be defined at the portion where the sync end portion 430 and the sync bar 500 rotate relative to each other. In addition, in a portion where each of the interlocking link parts 600 is connected to the sync bar 500, an interlocking rotation axis X5 may be defined. Since the interlocking link part 600 and the sync bar 500 rotate relative to each other, the interlocking rotation axis X5 may be defined at the portion where the interlocking link part 600 and the sync bar 500 rotate relative to each other. More precisely, the interlocking rotation axis X5 may be defined by a link shaft 160 disposed at the rotational center of the interlocking link part 600. In this case, the two rotation axes X4 and X5 may also be defined in the Z-axis direction.

[0084] FIG. 7 illustrates the drive unit MU, the moving hangers 100, the sync bar 500, and the interlocking link parts 600 with a motor housing 210 of the motor assembly 200 removed. As shown, when the motor shaft 225 of the drive motor 220 constituting the motor assembly 200 rotates, gears may interlock therewith. Here, the gears may include an input gear 230,

a transmission gear 240, and an output gear 250. When the input gear 230 rotates (in the direction of arrow ①), a first transmission gear 241 of the transmission gear 240 meshed with the input gear 230 may rotate (in the direction of arrow ②). A second transmission gear 243 constituting the transmission gear 240 may also rotate coaxially with the first transmission gear 241 (in the direction of arrow ③). The output gear 250 meshed with the second transmission gear 243 may be rotated concentrically with the input gear 230 (in the direction of arrow ④).

[0085] The rotational force resulting from the interlocking of the gears may be transmitted to the eccentric disk 260. The eccentric disk 260 may rotate concentrically with the motor shaft 225, whereby the eccentric portion 265 may be rotated (in the direction of arrow ⑤). Since the eccentric portion 265 is connected to a first end portion 310 of the first link bar 300, the first link bar 300 may be rotated by the eccentric portion 265 (in the direction of arrow ⑥). More specifically, the first end portion 310 of the first link bar 300 may be rotated in a direction away from the motor assembly 200. Here, the rotation of the first end portion 310 may refer to a movement along a curved path, such as an arc-shaped path. The first end portion 310 may also be referred to as an eccentric connecting portion 315.

[0086] The entirety of the first link bar 300, including the first end portion 310 and a second end portion 320, may not be fixed on an X-Y plane, and each of the portions may move within the X-Y plane. Accordingly, the second end portion 320 may also rotate in conjunction with the rotation of the first end portion 310 (in the direction of arrow ⑦). Here, the rotation of the second end portion 320 may refer to a movement along an arc-shaped path. The second end portion 320 may also be referred to as a bar connecting portion.

[0087] Since the second end portion 320 constitutes the link connection portion LM together with the interlocking end portion 410 of the second link bar 400, the interlocking end portion 410 may rotate along the same path as the second end portion 320 (in the direction of arrow ⑦). In this case, the second link bar 400 may be rotated about the hanger shaft 150 formed at the rotational center portion 420 (in the direction of arrow ⑧). That is, while the rotational center portion 420 of the second link bar 400 is fixed to the X-Y plane by the hanger shaft 150, both the interlocking end portion 410 and the sync end portion 430 formed at the opposite ends of the rotational center portion 420 may simultaneously rotate in the same direction.

[0088] When the hanger shaft 150 rotates, the main hanger 100M connected to the hanger shaft 150 may rotate in the same direction (in the direction of arrow ⑨). In addition, the hanger 50 (not shown in FIG. 7) hung on the main hanger 100M may also rotate together with the main hanger 100M to treat clothes.

[0089] Meanwhile, when the second link bar 400 rotates about the hanger shaft 150, the sync end portion 430 may be simultaneously rotated in the same direction as the interlocking end portion 410. In this process, the sync bar 500 connected to the sync end portion 430 may perform a linear motion in one direction (in the direction of arrow ⑩). The interlocking link parts 600 connected to the sync bar 500 may rotate about respective link shafts 160 (in the direction of arrow ⑪), thereby rotating the moving hangers 100 connected to lower portions thereof (in the direction of arrow ⑫).

[0090] Although only operations in one direction are illustrated by arrows in FIG. 7, operations in the opposite direction may also be performed by the rotation of the eccentric disk 260. While the eccentric disk 260 rotates about the motor shaft 225 within a range of 0° to 180°, the operations described above may be performed, but while the eccentric disk 260 rotates within a range of 180° to 360°, the operations in the opposite direction may be performed. Here, the ranges of 0° to 180° and 180° to 360° are arbitrarily defined phases and may vary depending on a reference point.

[0091] Specifically, the gears may always rotate in the same direction. However, since the eccentric portion 265 revolves about the motor shaft 225, at the moment when the phase changes with respect to 180°, the first end portion 310 of the first link bar 300 may be pulled in the opposite direction, that is, in a direction approaching the motor assembly 200. During this process, the second end portion 320 may also be pulled in the same direction, whereby the link connection portion LM may move together. Accordingly, the hanger shaft 150 may rotate in the opposite direction, and the main hanger 100M may also be rotated in the direction opposite to the previous direction. In addition, when the sync bar 500 and the interlocking link parts 600, which are operatively connected to the second link bar 400, rotate in the opposite direction, the rotation direction of the remaining moving hangers 100 may also be changed.

[0092] Such direction reversals may be repeatedly performed during the continuous rotation of the drive motor 220 in one direction. In this process, the main hanger 100M and the remaining moving hangers 100 continuously change their rotation direction, thereby removing foreign substances adhering to clothes more effectively and also reducing wrinkles.

[0093] These direction-reversal operations are illustrated in FIGS. 8 to 13. FIGS. 8 and 9 show the plurality of link bars LB arranged at a reference position. FIGS. 10 and 11 show a state in which the plurality of link bars LB is moved from the reference position and the main hanger 100M and the remaining moving hangers 100 are rotated in a first direction. FIGS. 12 and 13 show a state in which the plurality of link bars LB is moved in the opposite direction from the reference position and the main hanger 100M and the remaining moving hangers 100 are rotated in a second direction.

[0094] Referring to FIGS. 8 and 9, the first link bar 300 may be aligned with a virtual centerline C at the reference position. Here, the centerline C may refer to a virtual line extending in the front-rear direction, i.e., the X-axis direction. The main hanger 100M and the remaining moving hangers 100 may face forward. Accordingly, the two hanging arms 51 of the hanger 50 may be aligned symmetrically with respect to the centerline C, without being tilted to either side. In this state, when the drive unit MU operates, the link connection portion LM may rotate in opposite directions (see the directions of

arrows ① and ②). Here, although the reference position is based on the centerline C, the centerline C may also have angular displacement in the direction of arrow ① or arrow ②.

[0095] During the operations of the plurality of link bars LB, the link connection portion LM may repeatedly pass over the centerline C. That is, as the link connection portion LM rotates in opposite directions, the link connection portion LM may pass over the centerline C, and in this process, the main hanger 100M may be rotated in opposite directions. When the operation of the drive unit MU stops, the first link bar 300 may be realigned to the reference position.

[0096] Referring to FIGS. 10 and 11, a state in which the operation of the drive unit MU causes the plurality of link bars LB to rotate is illustrated. As shown, when the drive unit MU operates, the link connection portion LM, which connects the plurality of link bars LB, may be rotated in the first direction (in the direction of arrow ①). Accordingly, the main hanger 100M may also be rotated about the hanger shaft 150 in the same direction (in the direction of arrow ①). Comparing FIG. 11 with FIG. 9, it is seen that the hanger 50 has rotated together with the main hanger 100M.

[0097] More specifically, when the eccentric disk 260 rotates in conjunction with the drive motor 220, the eccentric portion 265 may revolve about the motor shaft 225. When the eccentric portion 265 revolves, the first link bar 300 may be rotated along with the eccentric portion 265. In

[0098] FIG. 10, the first link bar 300 is shown to be pushed in a direction away from the motor shaft 225 by the eccentric portion 265. Since the entire first link bar 300 is not fixed and can rotate, the link connection portion LM may also rotate together with the first link bar 300 in this process. Furthermore, in conjunction with the rotation of the link connection portion LM, the first link bar 300 may rotate about the hanger shaft 150, and in this process, the hanger shaft 150 and the main hanger 100M may also be rotated.

[0099] In conjunction with the rotation of the main hanger 100M, the sync bar 500 may move along a linear path (see the direction of arrow ②). The linear movement of the sync bar 500 may lead to the rotations of the interlocking link parts 600. Referring to FIG. 10, the interlocking link parts 600 may rotate about the link shafts 160. In this case, link end portions 630 formed at one end portions of the interlocking link parts 600 may also rotate in the same direction as the link connection portion LM (in the direction of arrow ③), thereby rotating the moving hangers 100.

[0100] Referring to FIG. 10, the link connection portion LM is rotated counterclockwise with respect to the centerline C. This may be seen as the link connection portion LM having rotated and moved from the reference position (see FIG. 8). The rotation angle of the link connection portion LM may be the same as the rotation angle of the hanger shaft 150, and, as a result, the hanger 50 may be rotated together by the rotation angle of the link connection portion LM.

[0101] Referring to FIGS. 12 and 13, a state in which the operation of the drive unit MU causes the plurality of link bars LB to rotate is illustrated. As shown, when the drive unit MU operates, the link connection portion LM, which connects the plurality of link bars LB, may be rotated in a second direction (the direction of arrow ①). Accordingly, the main hanger 100M may also be rotated about the hanger shaft 150 in the same direction (in the direction of arrow ①). Comparing FIG. 13 with FIGS. 9 and 11, it is seen that the hanger 50 has rotated together with the main hanger 100M.

[0102] In conjunction with the rotation of the main hanger 100M, the sync bar 500 may move along a linear path (see the direction of arrow ②). The linear movement of the sync bar 500 may lead to the rotations of the interlocking link parts 600. Referring to FIG. 12, the interlocking link parts 600 may rotate about the link shafts 160. In this case, the link end portions 630 formed at the one end portions of the interlocking link parts 600 may also rotate in the same direction as the link connection portion LM (in the direction of arrow ③), thereby rotating the moving hangers 100.

[0103] Referring to FIG. 12, the link connection portion LM is rotated clockwise relative to the centerline C. This may be seen as the link connection portion LM having rotated and moved from the reference position (see FIG. 8). The rotation angle of the link connection portion LM may be the same as the rotation angle of the hanger shaft 150, and, as a result, the hanger 50 may rotate together by the rotation angle of the link connection portion LM.

[0104] Comparing FIGS. 11 and 13, with respect to the reference position, the main hanger 100M and the hanger 50 may be rotated in opposite directions. Such opposite-direction rotations may be continuously performed in conjunction with the revolution of the eccentric portion 265.

[0105] As shown in FIGS. 8 to 13, the link connection portion LM may reciprocally rotate along an arc-shaped path in the X-Y plane. During the rotation of the link connection portion LM, the second link bar 400 may have a reference position arranged in the front-rear direction, which is perpendicular to the Z-axis. Here, the reference position means that the second link bar 400 is aligned with the centerline C. In this case, the link connection portion LM may be rotated in opposite directions with respect to the reference position.

[0106] Referring to FIG. 14, with respect to the front-rear direction (X-axis direction) perpendicular to the hanger shaft 150, the operating space may be divided into a first region T1 and a second region T2. In FIG. 14, a virtual line dividing the operating space in the front-rear direction is illustrated as a chain line. The operating space may be divided into the two regions with respect to this virtual dividing line. For reference, the virtual dividing line may extend across the second link bar 400.

[0107] The motor assembly 200, the eccentric disk 260 (not shown in FIG. 14), and the first link bar 300 may be arranged in the first region T1. The hanger shaft 150 may be arranged in the second region T2. In this case, the second link bar 400 may be connected to the eccentric disk 260 in the first region T1 and may be connected to the hanger shaft 150 in the

second region T2. The sync bar 500 and the interlocking link parts 600 may be arranged in the second region T2. In this embodiment, a plurality of components, including the drive unit MU, may be distributed and arranged in different regions. In this case, interference among the components may be prevented, enabling smooth operation of the components and increasing freedom of design.

[0108] Meanwhile, referring to FIG. 12, with respect to the front-rear direction perpendicular to the hanger shaft 150, the link connection portion LM, at which the plurality of link bars LB is connected, may be disposed behind the motor shaft 225. When the link connection portion LM is disposed behind the motor shaft 225, an area occupied by the motor shaft 225 and the motor assembly 200 in the front-rear direction may be reduced, and a larger range of rotation angles may be obtained through the plurality of link bars LB

[0109] In this embodiment, with respect to the front-rear direction (X-axis direction in FIG. 12) perpendicular to the hanger shaft 150, the motor shaft 225 may be disposed between the hanger shaft 150 and the link connection portion LM, at which the plurality of link bars LB are connected. More specifically, the hanger shaft 150 may be disposed in front of the motor shaft 225, while the link connection portion LM may be disposed behind the motor shaft 225.

[0110] Referring to FIGS. 15 and 16, the operation of the drive unit MU and its range of rotation angle will now be described FIG. 15 is a plan view illustrating the configuration of the drive unit MU according to this embodiment. The eccentric disk 260, the first link bar 300, the second link bar 400, the motor assembly 200, and the hanger shaft 150 together may constitute a four-bar linkage mechanism. In this embodiment, there is no separate link between the motor assembly 200 and the hanger shaft 150. However, since the motor assembly 200 and the hanger shaft 150 are fixed to different mounting frames 80 and 90, respectively, and a predetermined distance therebetween is maintained, it may be regarded that a kind of ground link is provided between the motor assembly 200 and the hanger shaft 150.

[0111] In FIG. 15, a distance between the motor shaft 225 and the eccentric portion 265 is indicated as D1. Here, the motor shaft 225 may constitute a first driving point P1 rotated by the motor assembly 200. The eccentric portion 265 may constitute a second driving point P2 that revolves around the first driving point P1.

[0112] A distance between the link connection portion LM, at which the first link bar 300 and the second link bar 400 are connected, and the eccentric portion 265 is indicated as D2. The link connection portion LM may constitute a third driving point P3 that reciprocates along an arcuate path while maintaining a predetermined radius D3 from the hanger shaft 150. In this case, the third driving point P3 may reciprocate along the arcuate path while maintaining a predetermined linear distance D2 from second driving point P2. Here, D3 may be regarded as a distance between the link connection portion LM and the hanger shaft 150.

[0113] A distance between the hanger shaft 150 and the motor shaft 225 is indicated as D4. Here, the hanger shaft 150 may constitute a fourth driving point P4 that maintains a predetermined linear distance from the motor shaft 225. The fourth driving point P4 may be fixed on the X-Y plane and may be rotatable about the Z-axis.

[0114] Here, the second driving point P2 and the third driving point P3 may rotate together while maintaining the predetermined distance D2 from each other. The distance D3 between the third driving point P3 and the fourth driving point P4 may serve as the rotation radius of the third driving point P3.

[0115] In this case, the above-mentioned distances may satisfy all of the following relationships: $D1 + D2 \leq D3 + D4$, $D1 + D3 \leq D2 + D4$, and $D1 + D4 \leq D2 + D3$. When these relationships are satisfied, the first link bar 300 and the second link bar 400 may interlock with each other during the revolution of the eccentric portion 265, thereby continuously rotating the hanger shaft 150 in two opposite directions.

[0116] Meanwhile, in FIG. 15, P3a indicates a first position P3a representing the position of the third driving point P3 when the link connection portion LM is rotated counterclockwise by its maximum angle. Referring to FIG. 16(a), the link connection portion LM has rotated from its reference position aligned with the centerline C to the first position P3a, and the link connection portion LM that has moved to the first position P3a is denoted as LM2.

[0117] In FIG. 15, P3b indicates a second position P3b representing the position of the third driving point P3 when the link connection portion LM is rotated clockwise by its maximum angle. Referring to FIG. 16(b), the link connection portion LM has rotated in the opposite direction from its reference position aligned with the centerline C to the second position P3b, and the link connection portion LM that has moved to the second position P3b is denoted as LM3.

[0118] In this case, the link connection portion LM may repeatedly reciprocate along an arcuate path between the first position P3a and the second position P3b. The angle $\angle P1P4P3a$ between the first driving point P1, which is the position of the motor shaft 225, and the third driving point P3, which is the position of the link connection portion LM at the first position P3a, with the fourth driving point P4, which is the position of the hanger shaft 150, as the center, has the following relationship.

$$(D1+D2)^2=(D3^2+D4^2)-2(D3\times D4)\times\cos\angle P1P4P3a$$

[0119] Therefore, the angle ($\angle P1P4P3a$) between the motor shaft 225 (P1) and the link connection portion LM (P3a) at the first position, with the hanger shaft 150 (P4) as the center, is as follows.

$$\angle P1P4P3a = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D1+D2)^2)}{2(D3 \times D4)}\right)$$

[0120] From this, the maximum rotation angle of the third driving point P3 in the first direction (counterclockwise) may be calculated. In other words, by adjusting the distances D1 to D4, the maximum rotation angle $\alpha 1$ of the third driving point P3 in the first direction (counterclockwise) may be obtained.

[0121] Meanwhile, the angle ∠P1P4P3b between the first driving point P1, which is the position of the motor shaft 225, and the third driving point P3b, which is the position of the link connection portion LM at the second position, with the fourth driving point P4, which is the position of the hanger shaft 150, as the center, has the following relationship.

$$(D2-D1)^2 = (D3^2 + D4^2) - 2(D3 \times D4) \times \cos \angle P1P4P3b$$

[0122] Therefore, the angle ∠P1P4P3b between the motor shaft 225 (P1) and the link connection portion LM (P3b) at the second position, with the hanger shaft 150 (P4) as the center, is as follows.

$$\angle P1P4P3b = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D2-D1)^2)}{2(D3 \times D4)}\right)$$

[0123] From this, the maximum rotation angle of the third driving point P3 in the second direction (clockwise) may be calculated. In other words, by adjusting the distances D1 to D4, the maximum rotation angle $\alpha 2$ of the third driving point P3 in the second direction (clockwise) may be obtained.

[0124] As a result, the maximum rotation angle range α of the third driving point P3, which is the position of the link connection portion LM, may be obtained from $\alpha 1 + \alpha 2$. The maximum rotation angle range α of the link connection portion LM may correspond to the rotation angle range of the hanger shaft 150 and thus to the rotation angle range of the hanger 50. In this way, in the present embodiment, since the rotation angle range of the first link bar 300 corresponds to the rotation angle range of the hanger 50, power may be fully transmitted during the driving process, minimizing energy loss.

[0125] Specifically, referring to FIG. 16(a), with respect to a hanger 50a arranged at the reference position, the rotational state of a hanger 50b, which has rotated by the maximum rotation angle $\alpha 1$ in the first direction (counterclockwise), may be compared. Reference numeral C1 indicates a virtual line extending along the center of the second link bar 400 rotated in the first direction, relative to the centerline C at the reference position. Referring to FIG. 16(b), with respect to the hanger 50a at the reference position, the rotational state of the hanger 50c, which has rotated by the maximum rotation angle $\alpha 2$ in the second direction (clockwise), may be compared. Reference numeral C2 indicates a virtual line extending along the center of the second link bar 400 rotated in the second direction, relative to the centerline C at the reference position. In this way, the hanger 50 may process clothes while alternating its rotation in opposite directions up to the respective maximum angle ranges.

[0126] Meanwhile, referring to FIG. 16(a), in this process, the sync bar 500 and the plurality of interlocking link parts 600 may also operate in synchronization with the main hanger 100M. Referring to FIG. 16(a), a sync bar 500a at the reference position can move linearly in conjunction with the sync end portion 430 of the second link bar 400. Reference numeral 500b indicates, in dashed lines, the position of a sync bar 500b after being moved by the sync end portion 430. The sync bar 500 may rotate the plurality of interlocking link parts 600 while moving linearly. Reference numeral 600a represents the plurality of interlocking link parts at the reference positions, and reference numeral 600b represents, in dashed lines, the plurality of interlocking link parts 600b after being moved by the sync bar 500b.

[0127] Referring to FIG. 16(b), when the sync end portion 430 of the second link bar 400 rotates in the opposite direction, the plurality of interlocking link parts 600 may operate in synchronization with the main hanger 100M in the opposite direction. Referring to FIG. 16(b), the sync bar 500a at the reference position may move linearly in conjunction with the sync end portion 430 of the second link bar 400. Reference numeral 500c represents, in dashed lines, the position of a sync bar 500c after being moved by the sync end portion 430. The sync bar 500 may rotate the plurality of interlocking link parts 600 while moving linearly. Reference numeral 600c represents, in dashed lines, the plurality of interlocking link parts 600c after being moved by the sync bar 500c.

[0128] FIGS. 17 and 18 illustrate the main hanger 100M, the hanger shaft 150, the plurality of link bars LB, and the sync bar 500 that constitute the clothing treatment apparatus of the present embodiment. As is shown, the first link bar 300 may include the eccentric connecting portion 315 provided at the first end portion 310 thereof. The eccentric connecting portion 315 may be rotatably coupled to the eccentric portion 265 of the eccentric disk 260. In this embodiment, the eccentric

connecting portion 315 may have a through-hole or recessed shape in the Z-axis direction, into which the eccentric portion 265 is inserted. Conversely, the eccentric connecting portion 315 may protrude in the Z-axis direction and be fitted into the eccentric portion 265 recessed in the Z-axis direction. Reference numeral X1' indicates the axial extension line of the rotational axis of the eccentric connecting portion 315, which revolves around the disk rotation axis X1 (see FIG. 6).

[0129] Referring to FIG. 7, the eccentric disk 260 and the plurality of link bars LB may be arranged at different heights along the Z-axis direction. In this embodiment, with respect to the Z-axis direction, the eccentric disk 260 may be disposed at a higher position than the plurality of link bars LB, and the second link bar 400 may be disposed below the first link bar 300. By arranging the eccentric disk 260 and the plurality of link bars LB at different heights in this manner, interference may be prevented during operation, and the freedom of design may be increased.

[0130] A link bearing 300B may be disposed at the second end portion 320 of the first link bar 300. The link bearing 300B may allow the first link bar 300 and the second link bar 400 to smoothly rotate relative to each other. A link hole 325 may be formed at the center of the link bearing 300B. A link boss portion 415 provided on the second link bar 400 may be fitted into the link hole 325 and may serve as a rotational shaft. Conversely, a protruding rotational shaft may be provided at the second end portion 320 of the first link bar 300 and may be fitted into the interlocking end portion 410 of the second link bar 400.

[0131] Referring to the second link bar 400, the second link bar 400 may include the interlocking end portion 410 and the sync end portion 430 on the opposite sides of the rotational center portion 420. The link boss portion 415 may protrude from the interlocking end portion 410 to be rotatably connected to the first link bar 300. The rotational center portion 420 may include a shaft coupling groove 425 so as to be coupled to the hanger shaft 150. The sync end portion 430 may include a sync coupling hole 435 so as to be coupled to the sync bar 500.

[0132] A central bearing 400B1 may be disposed in the shaft coupling groove 425 formed in the rotational center portion 420. The central bearing 400B1 may facilitate smooth relative rotation between the hanger shaft 150 and the second link bar 400. However, in this embodiment, since the second link bar 400 rotates together with the hanger shaft 150, the central bearing 400B1 may be omitted. A component with reference numeral 400B2 may be provided to facilitate smooth relative rotation between the sync end portion 430 of the second link bar 400 and the sync bar 500, and may be disposed between the sync coupling hole 435 and a sync fastening boss 520 of the sync bar 500.

[0133] The sync bar 500 may be configured as a rigid body extending longitudinally in one direction. The sync bar 500 may include the sync fastening boss 520 to be coupled to the sync end portion 430 of the second link bar 400. The sync fastening boss 520 may be connected not only to the sync end portion 430 but also to the plurality of interlocking link parts 600, and thus may be provided at positions corresponding to the interlocking link parts 600, respectively. In this embodiment, a total of five sync fastening bosses 520 are provided.

[0134] The sync fastening boss 520 may be configured as a snap-fit structure, in which it is elastically deformed and inserted into the sync coupling hole 435. After being inserted into the sync coupling hole 435 in the elastically deformed state, the sync fastening boss 520 may return to its original shape when fully inserted. Alternatively, the sync bar 500, the second link bar 400, and the plurality of interlocking link parts 600 may be connected by separate fasteners.

[0135] Referring to FIGS. 17 and 18, the main hanger 100M and the hanger shaft 150 will be described. The main hanger 100M may be coupled to the hanger shaft 150. The hanger shaft 150 may rotate together with the main hanger 100M. To this end, the hanger shaft 150 is fixed to the main hanger 100M. In this embodiment, the hanger shaft 150 may be fixed to the main hanger 100M by insert molding. Alternatively, the hanger shaft 150 may be coupled to the main hanger 100M by a separate fastener, or the hanger shaft 150 may be provided with threads and screwed to the main hanger 100M.

[0136] A first end portion of a shaft body 151, which constitutes the frame of the hanger shaft 150, may be provided with a hanger coupling portion 153 inserted into which the main hanger 100M. The hanger coupling portion 153 may be considered as a part that is fixed inside the main hanger 100M during the insert molding process. To prevent relative rotation between the hanger shaft 150 and the main hanger 100M, the hanger coupling portion 153 may have a polygonal cross-sectional shape. Reference numeral 154 denotes a fixing end portion provided at the end of the hanger coupling portion 153 in a direction increasing in diameter. The fixing end portion 154 may prevent the hanger shaft 150 from moving out of the main hanger 100M in the axial (Z-axis) direction.

[0137] A second end portion of the shaft body 151 may be provided with a link coupling portion 155. The link coupling portion 155 may be coupled to the shaft coupling groove 425 formed at the rotational center portion 420 of the second link bar 400. More specifically, as shown in FIG. 19, a shaft coupling hole 426 may be formed through the shaft coupling groove 425 in the axial direction (Z-axis direction), and the link coupling portion 155 may be fitted into the shaft coupling hole 426. In this case, the link coupling portion 155 and the shaft coupling hole 426 may be formed in corresponding polygonal shapes so that slippage between the hanger shaft 150 and the second link bar 400 may be prevented. Reference numeral 156 denotes a threaded portion to be coupled to a shaft nut 158.

[0138] Referring to the structure of the main hanger 100M, the main hanger 100M may include a hanger body 110 coupled to the hanger shaft 150. The hanger body 110 may include a fixing block 111 in which a portion of the hanger shaft 150 is embedded. The hanger body 110 may be provided with a coupling flange 113 formed in the axial direction and coupled to the hanger shaft 150. A flange hole 115 may be formed inside the coupling flange 113. A portion of the hanger

shaft 150 may be positioned at a lower portion of the flange hole 115, and the remaining portion may protrude upwardly from the flange hole 115 so as to be connected to the second link bar 400. Reference numeral 112 denotes an assembly hole into which a fastener is inserted so that the hanger body 110 is coupled to an outer body 130.

[0139] A lower cover 120 may be coupled to a lower portion of the hanger body 110. The lower cover 120 may constitute a lower portion of the main hanger 100M and may have a curved structure to enhance the aesthetic appearance of the main hanger 100M. The lower cover 120 may include one or more lower covers, and two lower covers 120 may be coupled to the main hanger 100M.

[0140] The outer body 130 may be coupled to the hanger body 110. The outer body 130 may be coupled to the hanger body 110 and, together with the hanger body 110, may constitute the exterior of the main hanger 100M. The outer body 130 may be provided with a cover plate 131 that surrounds the fixing block 111. The cover plate 131 may surround the fixing block 111 so that the fixing block 111 is not exposed. A cover coupling portion 132 for coupling the lower cover 120 may be provided at a lower portion of the hanger body 110.

[0141] The outer body 130 may be provided with the hanging portion 135. The hanger 50 may be hung on the hanging portion 135. The hanging portion 135 may protrude from a side surface of the outer body 130. The hanging groove 136 into which a hanging hook 57 of the hanger 50 is inserted may be formed in the hanging portion 135. The hanging groove 136 may be open upward (in the Z-axis direction) and in the front-rear direction (in the X-axis direction). In the present embodiment, two hanging portions 135 and two hanging grooves 136 may be formed in the main hanger 100M. In another example, one hanging portion 135 and one hanging groove 136 may be formed in the main hanger 100M.

[0142] As shown in FIGS. 18 and 19, the hanger shaft 150 may be provided with a shaft bearing 150B. The shaft bearing 150B may be disposed between the hanger shaft 150 and the second mounting frame 90 so that the hanger shaft 150 can smoothly rotate relative to the second mounting frame 90. The hanger shaft 150 may pass through the shaft bearing 150B and be connected to the second link bar 400.

[0143] The shaft bearing 150B may be stacked coaxially with the central bearing 400B1. The shaft bearing 150B may be stacked on the lower side of the central bearing 400B1. The central bearing 400B1 and the shaft bearing 150B may be referred to as a first bearing and a second bearing, respectively.

[0144] Next, referring to FIGS. 20 and 21, the coupling structure of the main hanger 100M, the second link bar 400, and the second mounting frame 90 will be described. For reference, FIG. 21 is an enlarged view of a rectangular box portion indicated by a single-dashed line in FIG. 20. As shown, the second end portion 320 of the first link bar 300 and the interlocking end portion 410 of the second link bar 400 may be disposed on the common link rotation axis X2 (see FIG. 6). Referring to FIG. 20, which is shown in cross-section, the link boss portion 415 of the interlocking end portion 410 may be fitted into the link bearing 300B provided at the second end portion 320 so as to constitute a rotation shaft. Accordingly, the second end portion 320 of the first link bar 300 and the interlocking end portion 410 of the second link bar 400 are connected to each other so as to rotate independently about the link rotation axis X2.

[0145] The motor shaft 225 and the hanger shaft 150 may each be disposed in the Z-axis direction, and the plurality of link bars LB may rotate or linearly move in the X-Y plane perpendicular to the Z-axis. More specifically, the opposite end portions of the first link bar 300 may perform rotational or arcuate motion in the X-Y plane, while the rotational center portion 420 of the second link bar 400 may rotate about the hanger shaft 150 while remaining fixed in the X-Y plane. The interlocking end portion 410 of the second link bar 400, which is spaced apart from the rotational center portion 420, may be connected to the first link bar 300 and may perform arcuate motion along the first link bar 300 in the X-Y plane.

[0146] The hanger shaft 150, which is interlocked with the second link bar 400, may be disposed concentrically with the main hanger 100M along the Z-axis. The sync bar 500 may be disposed at a position spaced apart from the hanger shaft 150 along the second link bar 400. As shown in FIG. 21, the sync bar 500 may be disposed at a position spaced apart from the rotational center portion 420 of the second link bar 400. Accordingly, when the second link bar 400 rotates about the rotational center portion 420, the sync bar 500 may rotate together on the opposite side of the interlocking end portion 410.

[0147] As shown in FIG. 21, the second mounting frame 90 may be disposed below the second link bar 400 to support the second link bar 400 in the axial direction. More specifically, a support end portion 93 provided on the second mounting frame 90 may support the shaft bearing 150B from below, thereby providing a space in which the shaft bearing 150B is seated. The shaft bearing 150B may facilitate relative rotation between the hanger shaft 150 and the second mounting frame 90.

[0148] The partition panel 95 may be disposed below the second mounting frame 90. The partition panel 95 may be disposed between the treatment space S1 and the operating space S2 to prevent the operating space S2 from being exposed to the treatment space S1. In the present embodiment, the partition panel 95 may be fixed to the top portion 23 of the inner casing 20. The partition panel 95 may be disposed below the second mounting frame 90. In another example, the partition panel 95 may be fixed to the second mounting frame 90 or may be configured as a portion of the second mounting frame 90.

[0149] Referring to FIG. 21, the partition panel 95 may be provided with a mounting flange 96. The mounting flange 96 may be arranged to surround the support end portion 93 of the second mounting frame 90. The partition panel 95 may be provided with a sealing fixing portion 97. A sealing member SM may be disposed in the sealing fixing portion 97 to block a

gap between the treatment space S1 and the operating space S2. More specifically, the sealing member SM may prevent moisture or hot air from the treatment space S1 from being transmitted to the operating space S2.

[0150] The structure of the motor assembly 200 will be described in detail As described above, referring to FIG. 4, the motor housing 210, which constitutes the frame of the motor assembly 200, may be mounted on the first surface 84 of the first mounting frame 80 described above. The motor housing 210 may have a substantially hexahedral shape, and the drive motor 220 may protrude upward from the motor housing 210. In another example, the motor housing 210 may completely enclose the drive motor 220.

[0151] Referring to FIGS. 22 and 23, the motor assembly 200 may include the motor housing 210 and a housing cover 215. The motor housing 210 and the housing cover 215 may define an internal space 211. The input gear 230, the transmission gear 240, and the output gear 250 may be disposed in the internal space 211. The plurality of gears may be operated by the rotational force of the drive motor 220, thereby reducing speed and increasing torque.

[0152] A bearing accommodating portion 212 may be provided at a lower portion of the motor housing 210. One or more output bearings 200B1 and 200B2 may be disposed inside the bearing accommodating portion 212. In the present embodiment, a pair of output bearings 200B1 and 200B2 may be disposed in the bearing accommodating portion 212. Referring to FIG. 23, a partition rib 213 may protrude inside the bearing accommodating portion 212, and the output bearings 200B1 and 200B2 may be respectively disposed above and below the partition rib 213. The output bearings 200B1 and 200B2 may facilitate relative rotation between the motor assembly 200 and the eccentric disk 260. To this end, the output bearings 200B1 and 200B2 may be disposed between the inner circumferential surface of the bearing accommodating portion 212 and the outer circumferential surface of a disk shaft 262 of the eccentric disk 260.

[0153] In the present embodiment, the pair of output bearings 200B1 and 200B2 may be disposed along the axial direction to support the disk shaft 262 of the eccentric disk 260 in the axial direction. Accordingly, the eccentric disk 260 may rotate stably without wobbling under torque applied during the operation of the plurality of link bars LB.

[0154] Referring to FIG. 22, the housing cover 215 may be provided with a motor hole 216 and a gear shaft hole 217. The motor shaft 225 may pass through the motor hole 216 and be inserted into the internal space 211. A transmission shaft 245 of the transmission gear 240 may be inserted into the gear shaft hole 217. The gear shaft hole 217 may support the transmission shaft 245 to be rotatable.

[0155] The motor shaft 225 may pass through the motor hole 216 and be coupled to the input gear 230 disposed in the internal space 211. The input gear 230 may be coupled to the motor shaft 225 and rotate simultaneously with the motor shaft 225. The input gear 230 may be engaged with the first transmission gear 241 of the transmission gear 240 to rotate the entire transmission gear 240. The input gear 230 and the output gear 250 may be disposed concentrically along the motor shaft 225.

[0156] The transmission gear 240, which is rotated by the input gear 230, may include the first transmission gear 241 and the second transmission gear 243. The first transmission gear 241 and the second transmission gear 243 may be integrally formed and rotate simultaneously. The first transmission gear 241 may have a larger diameter and more teeth than the input gear 230. Accordingly, a first reduction may be achieved between the input gear 230 and the first transmission gear 241.

[0157] The second transmission gear 243 may have a smaller diameter and fewer teeth than the first transmission gear 241. At the same time, the second transmission gear 243 may have a smaller diameter and fewer teeth than the output gear 250. Accordingly, a second reduction may be achieved between the second transmission gear 243 and the output gear 250.

[0158] The rotational shaft of the output gear 250 may serve as an output shaft. The output shaft may be disposed concentrically to form the same rotational center as the motor shaft 225. In the present embodiment, the output gear 250 may be rotatably coupled to the disk shaft 262 of the eccentric disk 260, and as a result, the disk shaft 262 may serve as the output shaft.

[0159] A shaft through-hole 253 may be formed to be open at the center of the output gear 250. The motor shaft 225 may further protrude in the axial direction through the shaft through-hole 253. The motor shaft 225 passing through the shaft through-hole 253 may be connected to the eccentric disk 260. The motor shaft 225 may be connected to the eccentric disk 260 and may be supported by the eccentric disk 260.

[0160] More specifically, the eccentric disk 260 may include a disk-shaped disk body 261 and the disk shaft 262 protruding in the axial direction from the disk body 261. The eccentric portion 265 may protrude from the disk body 261 in the opposite direction of the disk shaft 262. Since the eccentric portion 265 is disposed at an off-center position relative to the center of the disk body 261, the eccentric portion 265 may revolve around the disk shaft 262.

[0161] The disk shaft 262 may be provided with a shaft support portion 263. The shaft support portion 263 may protrude toward the motor shaft 225 and have a hollow space at a center thereof. The end of the motor shaft 225 may be inserted into the shaft support portion 263. When the end of the motor shaft 225 is inserted into the shaft support portion 263, the motor shaft 225 may rotate stably while being supported by the shaft support portion 263.

[0162] Referring to FIG. 23, the end of the motor shaft 225 may be seen to be inserted into the shaft support portion 263. The end of the motor shaft 225 may not be fixed to the shaft support portion 263 but may be supported so as to be rotatable

relative to the shaft support portion 263. Accordingly, during high-speed rotation of the motor shaft 225, the motor shaft 225 may maintain accurate axial alignment thereof without misalignment. In this case, the driving force of the drive motor 220 may be transmitted to the gears without loss, and vibration and operating noise of the drive motor 220 may be prevented.

[0163] Referring to FIG. 23, the rotational center MX of the motor shaft 225 passing through the center of the motor shaft 225 and the rotational center MX' of the transmission shaft 245 of the transmission gear 240 may be parallel to each other. The rotational center MX of the motor shaft 225 and the rotational center MX' of the transmission shaft 245 may be spaced apart from each other and extend side by side.

[0164] In this case, a distance D1 between the rotational center of the input gear 230 and the rotational center of the first transmission gear 241 and a distance D2 between the rotational center of the output gear 250 and the rotational center of the second transmission gear 243 may be equal. In this case, the input gear 230 and the output gear 250 may be disposed concentrically, and the motor shaft 225 may be inserted into the shaft support portion 263 after passing through the input gear 230 and the output gear 250.

[0165] Meanwhile, a snap ring SR and a preload washer PW may be disposed on the disk shaft 262. The snap ring SR may support the gears 230 and 250 in the axial direction. The preload washer PW may elastically support the gears 230 and 250 to maintain a distance between the gears and the shaft, thereby enabling stable operation.

[0166] FIG. 24 is a plan view illustrating the structure of the drive unit MU and the moving hanger 100 constituting the clothing treatment apparatus 1 according to a second embodiment of the present disclosure. Only the structural differences from the previously described embodiment are explained. A fixing bar 700 may be provided between the motor assembly 200 and the second link bar 400. The fixing bar 700 may remain stationary without operating. The fixing bar 700 may connect the motor assembly 200 and the second link bar 400, more specifically, the motor assembly 200 and the hanger shaft 150. Since the fixing bar 700 secures these components, either the first mounting frame 80 or the second mounting frame 90 may be omitted.

[0167] FIG. 25 is a cross-sectional view illustrating the structure of the motor assembly 200 and the first link bar 300 constituting the clothing treatment apparatus 1 according to a third embodiment of the present disclosure. Only the structural differences from the previously described embodiments are explained. The motor assembly 200 may be disposed below the first link bar 300. That is, the motor assembly 200 may transmit rotational power thereto from below, and the first link bar 300, which is disposed relatively above, may be rotated by the motor assembly 200. Although not illustrated, in this case, the second link bar 400 may be disposed above the first link bar 300 in the axial (Z-axis) direction.

[0168] FIG. 26 is a plan view illustrating the structure of the drive unit MU and the moving hanger 100 constituting the clothing treatment apparatus 1 according to a fourth embodiment of the present disclosure. Only the structural differences from the previously described embodiments are explained. The drive unit MU may include a plurality of drive units MU. In the drawing, a total of two drive units MU are spaced apart from each other. These drive units MU may operate independently. Each of the drive units MU may be connected to a separate sync bar 500. In this way, the plurality of drive units MU may operate at different speeds, or one of the plurality of drive units MU may not be driven.

[0169] FIG. 27 is a plan view illustrating the structure of the drive unit MU and the moving hanger 100 constituting the clothing treatment apparatus 1 according to a fifth embodiment of the present disclosure. Only the structural differences from the previously described embodiments are explained. In addition to the motor assembly 200, the plurality of link bars LB, and the hanger shaft 150 constituting the drive unit MU, the sync bar 500 and the interlocking link parts 600 may be omitted. In this case, the motor assembly 200 and the plurality of link bars LB may interlock with each other to rotate only the single hanger shaft 150. Such a structure may be arranged repeatedly, so that each of the hanger shafts 150 may operate independently.

[0170] Meanwhile, although not illustrated, the plurality of link bars LB may include three or more link bars. For example, the plurality of link bars LB may constitute a five-bar linkage mechanism together with the eccentric disk 260.

[0171] Although the preferred embodiments of the present invention have been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope of the present invention as disclosed in the accompanying claims. Therefore, the preferred embodiments described above have been described for illustrative purposes, and should not be intended to limit the technical scope of the present invention, and the scope of the present invention are not limited to the embodiments. The protective scope of the present invention should be interpreted by the accompanying claims, and all technical scope should be interpreted as being included in the scope of the present invention.

Claims

1. A clothing treatment apparatus comprising:

a casing (2, 20) having a treatment space (S1) formed therein;
a moving hanger (100) having a hanging portion (135) disposed in the treatment space (S1) and configured to

rotate about a hanger shaft (150); and
a drive unit (MU) disposed in an operating space (S2) separate from the treatment space (S1) and configured to rotate the hanger shaft (150),
wherein the drive unit (MU) comprises:

a motor assembly (200) configured to rotate a motor shaft (225);
an eccentric disk (260) configured to rotate about the motor shaft (225) and having an eccentric portion (265) offset from the motor shaft (225); and
a plurality of link bars (LB) connecting the eccentric portion (265) and the hanger shaft (150) and connected rotatably to each other.

2. The clothing treatment apparatus of claim 1, wherein the plurality of link bars (LB) comprises:

a first link bar (300) connected to the eccentric portion (265) to operate in connection with rotation of the eccentric portion (265); and
a second link bar (400) connected to the first link bar (300) and configured to rotate about the hanger shaft (150) as a rotation center; and/or
wherein the first link bar (300) comprises:

a first end portion (310) rotatably connected to the eccentric portion (265) and configured to revolve around the motor shaft (225) along the eccentric portion (265); and
a second end portion (320) rotatably coupled to the second link bar (400) and configured to reciprocate along an arcuate path while maintaining a predetermined radius from the hanger shaft (150).

3. The clothing treatment apparatus of claim 2, wherein the second end portion (320) of the first link bar (300) and an interlocking end portion (410) of the second link bar (400) are disposed on a common link rotation axis (X2) so as to be independently rotatable relative to each other about the link rotation axis (X2); and/or
wherein a bearing (300B) is disposed at a link connection portion (LM) at which the first link bar (300) and the second link bar (400) are connected to each other, and the first link bar (300) or the second link bar (400) is provided with a link boss portion (415) coupled to the bearing (300B).

4. The clothing treatment apparatus of claim 3, wherein each of the motor shaft (225) and the hanger shaft (150) is disposed in a direction of a Z-axis, and the plurality of link bars (LB) performs rotational or arcuate movement in an X-Y plane orthogonal to the Z-axis; and/or

wherein the first link bar (300) has each of opposite end portions configured to perform rotational or arcuate movement in the X-Y plane, and
the second link bar (400) has a rotational center portion (420) configured to rotate about the hanger shaft (150) fixed on the X-Y plane, and the interlocking end portion (410) performs arcuate movement along the first link bar (300) in the X-Y plane.

5. The clothing treatment apparatus of claim 3 or 4, wherein the second end portion (320) of the first link bar (300) is configured to perform reciprocating movement within a predetermined range of rotation angles, and the hanger shaft (150) operates in connection with the rotation of the second end portion (320) to have the same range of rotation angles as the second end portion (320); and/or
wherein the link connection portion (LM) reciprocally rotates along an arc in an X--Y plane orthogonal to a Z-axis, and during the rotation of the link connection portion (LM), the second link bar (400) has a reference position aligned in a front-rear direction orthogonal to the Z-axis direction, and the link connection portion (LM) rotates in both directions about the reference position.

6. The clothing treatment apparatus of any one of claims 2 to 5, wherein when a distance between the motor shaft (225) and the eccentric portion (265) is defined as D1,

a distance between a link connection portion (LM) at which the first link bar (300) and the second link bar (400) are connected and the eccentric portion (265) is defined as D2,
a distance between the link connection portion (LM) and the hanger shaft (150) is defined as D3, and
a distance between the hanger shaft (150) and the motor shaft (225) is defined as D4,
following relationships are satisfied:

$$D1 + D2 \leq D3 + D4,$$

$$D1 + D3 \leq D2 + D4,$$

and

$$D1 + D4 \leq D2 + D3.$$

7. The clothing treatment apparatus of claim 6, wherein the link connection portion is rotated along an arcuate path between a first position and a second position,

an angle (∠P1P4P3a) between the motor shaft (P1) and the link connection portion (P3a) at the first position with respect to the hanger shaft (P4) is

$$\angle P1P4P3a = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D1+D2)^2)}{2(D3 \times D4)}\right),$$

and
an angle (∠P1P4P3b) between the motor shaft (P1) and the link connection portion (P3b) at the second position with respect to the hanger shaft (P4) is

$$\angle P1P4P3b = \cos^{-1}\left(\frac{(D3^2 + D4^2 - (D2-D1)^2)}{2(D3 \times D4)}\right).$$

8. The clothing treatment apparatus of any one of claims 2 to 7, wherein with respect to a front-rear direction orthogonal to the hanger shaft (150), the operating space (S2) is divided into a first region (T1) where the motor assembly (200), the eccentric disk (260), and the first link bar (300) are disposed, and a second region (T2) where the hanger shaft (150) is disposed; and/or
wherein the second link bar (400) is connected to the eccentric disk (260) in the first region (T1) and is connected to the hanger shaft (150) in the second region (T2).

9. The clothing treatment apparatus of any one of the preceding claims, wherein the motor shaft (225) extends from the motor assembly (200) in a direction parallel to the hanger shaft (150), and the eccentric disk (260) is disposed below the motor assembly (200) and is connected to the motor shaft (225); and/or
wherein the eccentric disk (260) and the plurality of link bars (LB) are arranged at different heights along a Z-axis direction.

10. The clothing treatment apparatus of any one of the preceding claims, wherein with respect to a front-rear direction orthogonal to the hanger shaft (150), a link connection portion (LM) at which the plurality of link bars (LB) is connected to each other is disposed behind the motor shaft (225); and/or
wherein the motor shaft (225) is disposed between the link connection portion (LM) and the hanger shaft (150).

11. The clothing treatment apparatus of any one of the preceding claims, wherein a mounting frame (70) is disposed in the operating space (S2) to support the motor assembly (200) and the second link bar (400); and/or
wherein the mounting frame (70) comprises:

a first mounting frame (80) on which the motor assembly (200) is disposed; and
a second mounting frame (90) disposed parallel to the first mounting frame (80) and supporting the second link bar (400).

12. The clothing treatment apparatus of claim 11, wherein with respect to a front-rear direction orthogonal to the hanger shaft (150), the first mounting frame (80) is disposed behind the second mounting frame (90), and the hanger shaft

(150) and the moving hanger (100) are disposed on the second mounting frame (90); and/or
wherein the motor assembly (200) is disposed on a first surface (84) of the mounting frame (70), and the eccentric disk (260) is disposed to face a second surface (85) of the mounting frame (70) opposite to the first surface (84).

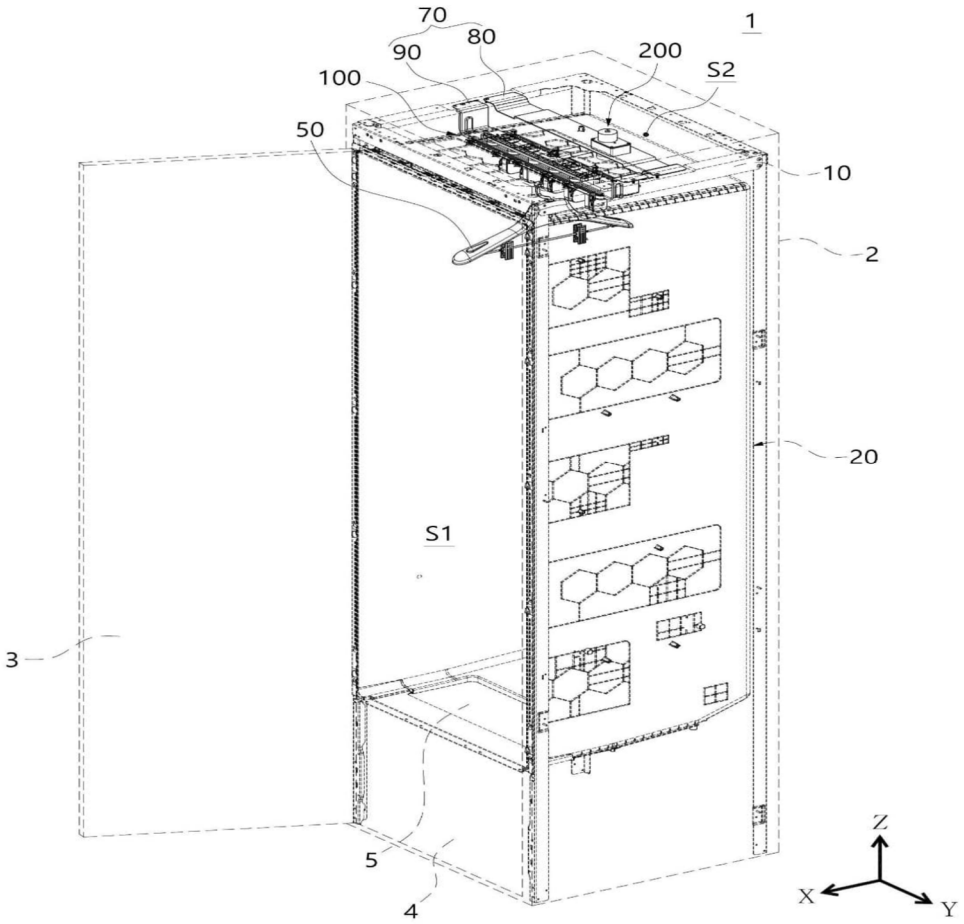
13. The clothing treatment apparatus of any one of the preceding claims, wherein a link connection portion (LM) is provided with a link rotation axis (X2) in a Z-axis direction parallel to the motor shaft (225) and the hanger shaft (150), so that the first link bar (300) and the second link bar (400) rotate relative to each other about the link rotation axis (X2).

14. The clothing treatment apparatus of any one of the preceding claims,

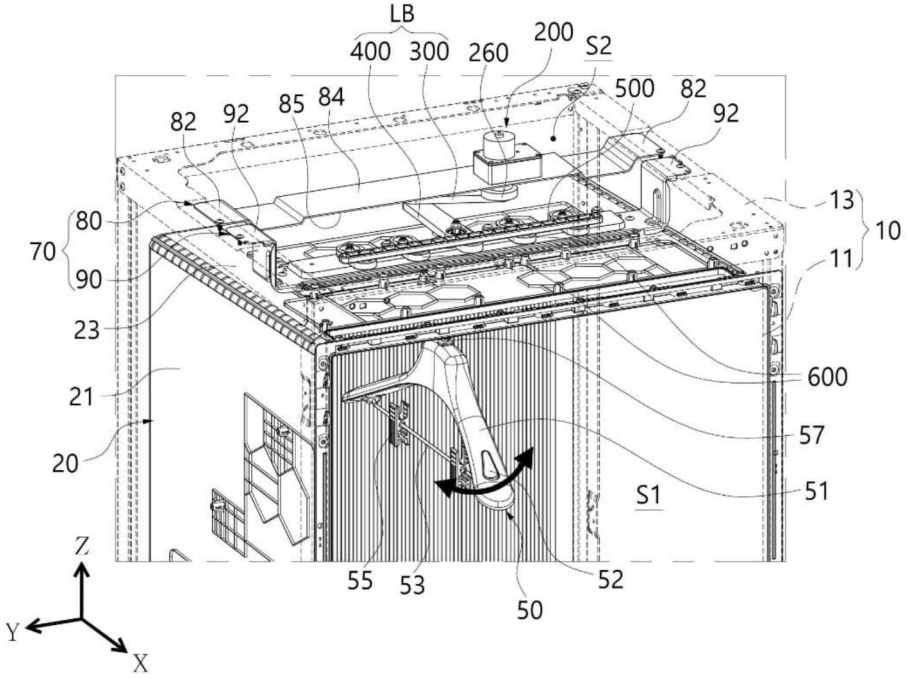
wherein the motor assembly (200) comprises a plurality of gears (230, 240, 250) configured to reduce rotational speed of the motor shaft (225), and an output gear (250) among the plurality of gears rotates the eccentric disk (260); and/or
wherein the plurality of gears (230, 240, 250) is provided with an output shaft (262) that rotates the eccentric disk (260) while rotating in conjunction with the motor shaft (225) of the motor assembly (200), and the motor shaft (225) and the output shaft (262) are concentrically disposed to form the same rotational center.

15. The clothing treatment apparatus of any one of claims 2 to 14, wherein a plurality of interlocking link parts (600) is rotatably disposed in the operating space (S2), moving hangers (100) are connected to the plurality of interlocking link parts (600) respectively, and
the second link bar (400) and the plurality of interlocking link parts (600) are connected to each other by a sync bar (500) so that the plurality of interlocking link parts (600) is synchronized with the rotational movement of the second link bar (400).

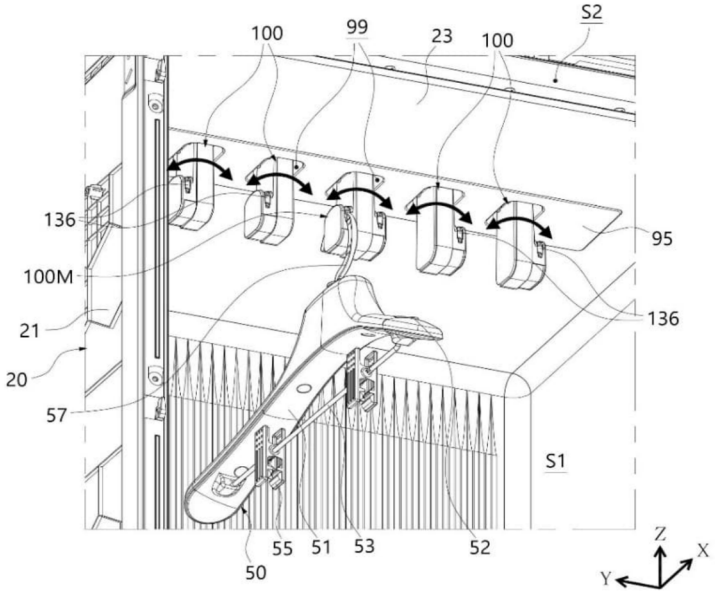
【FIG. 1】


70
80
90
100
50
1
200
S2
10
2
20
S1
3
5
4
Z
X
Y

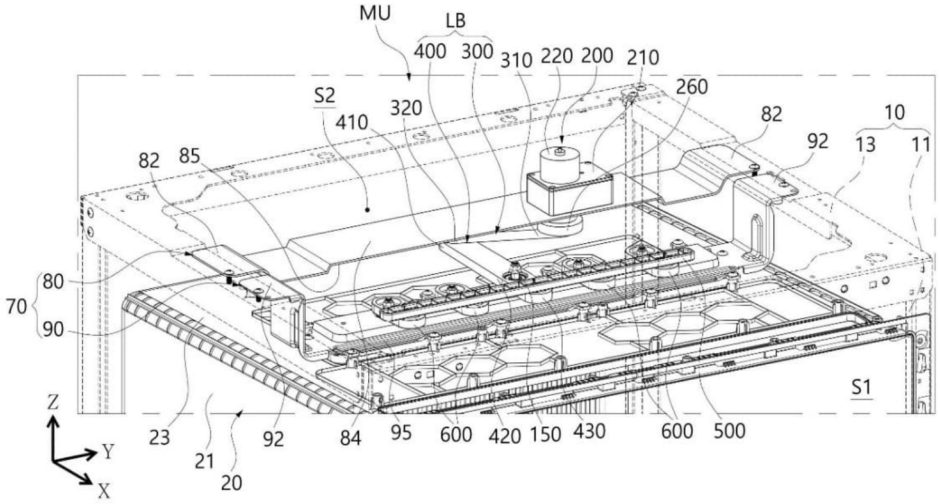
【FIG. 2】


LB
400
300
260
200
S2
500
82
92
85
84
13
10
70
80
90
11
23
600
21
57
20
51
S1
55
53
52
50
Z
Y
X

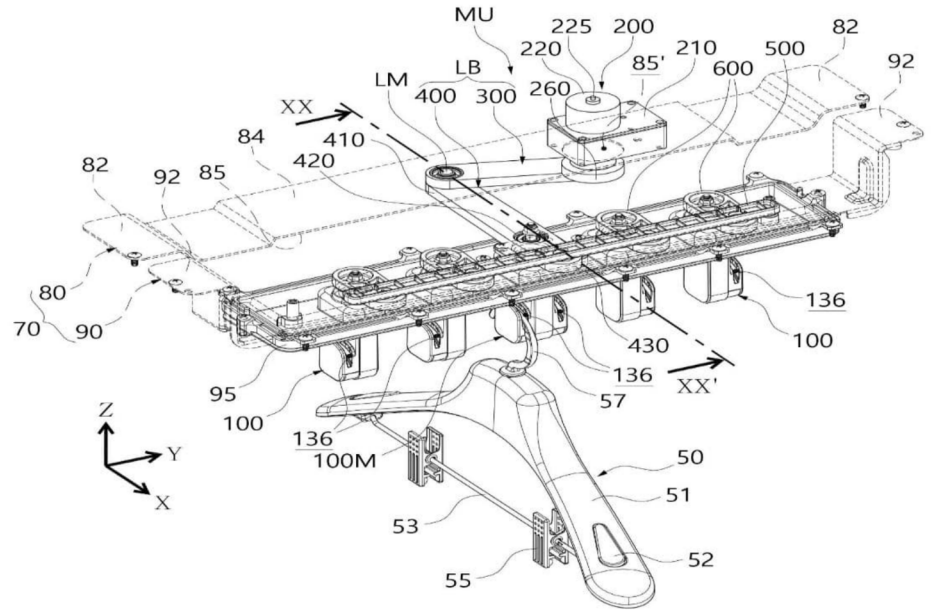
【FIG. 3】



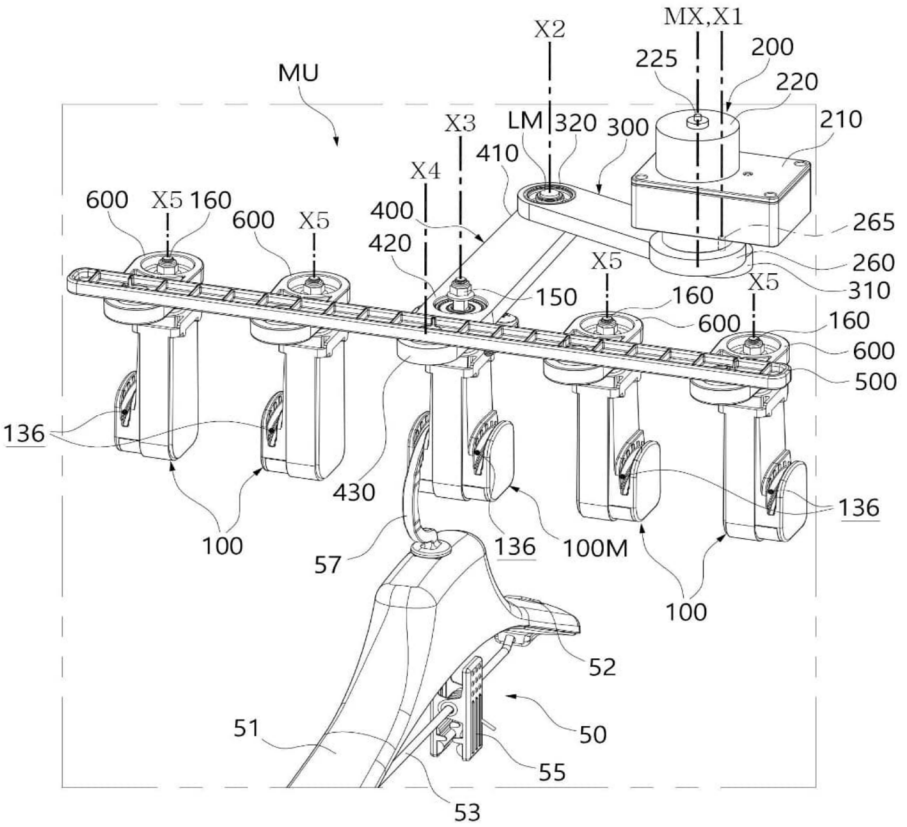
【FIG. 4】



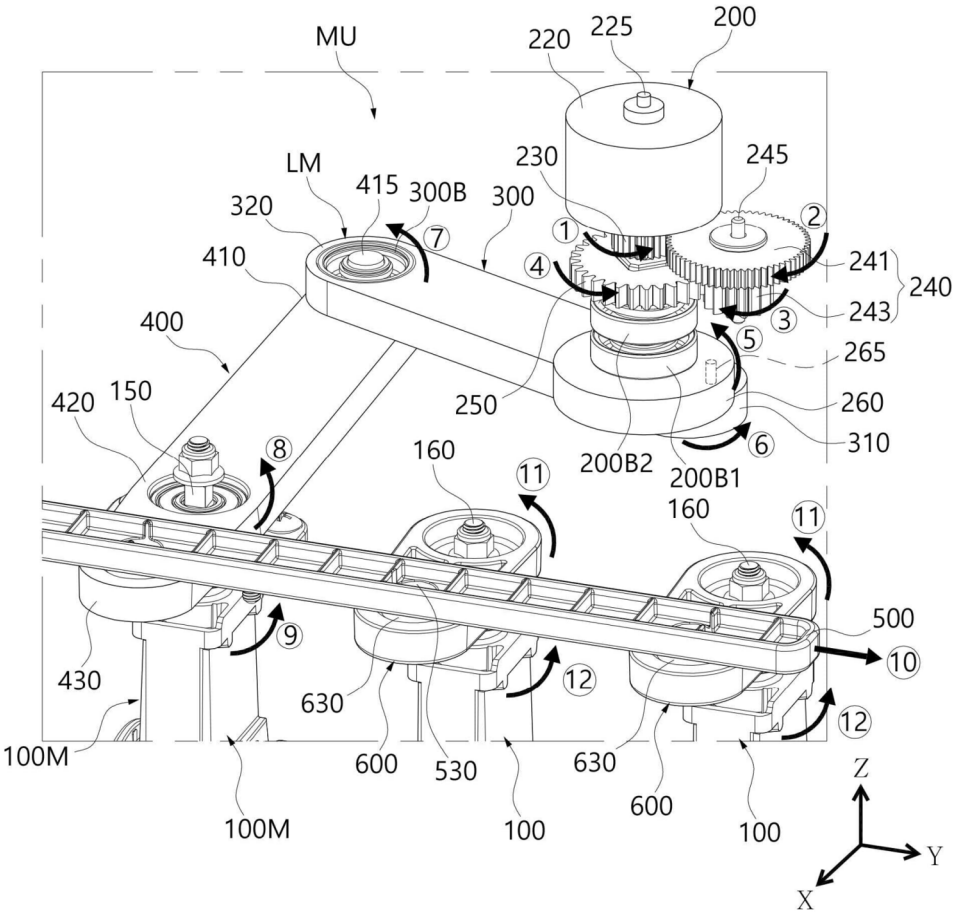
【FIG. 5】



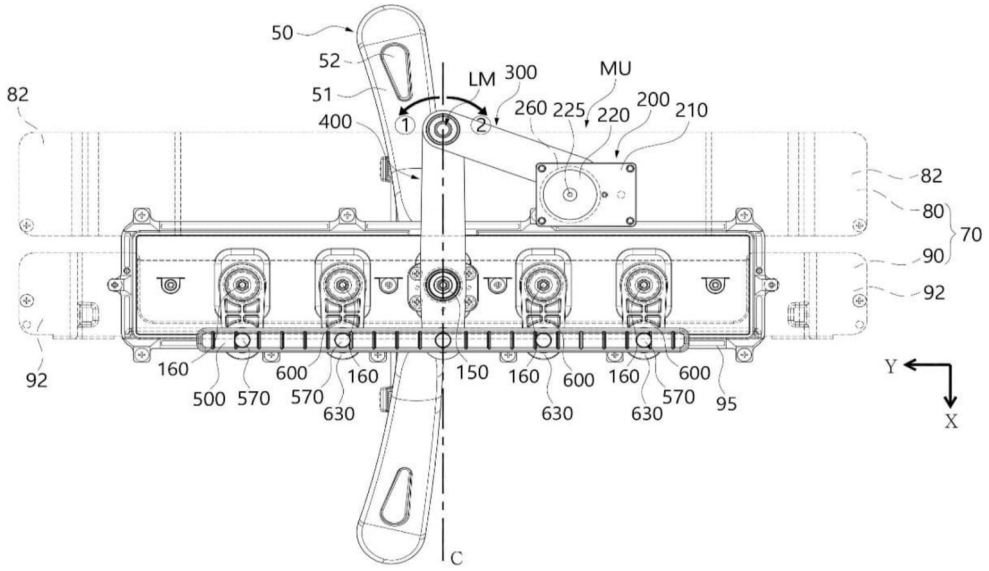
【FIG. 6】


MU
X2
MX,X1
225
200
220
210
X3
LM
320
300
410
X4
400
420
600
X5
160
265
260
310
150
500
136
430
100
57
52
51
50
55
53

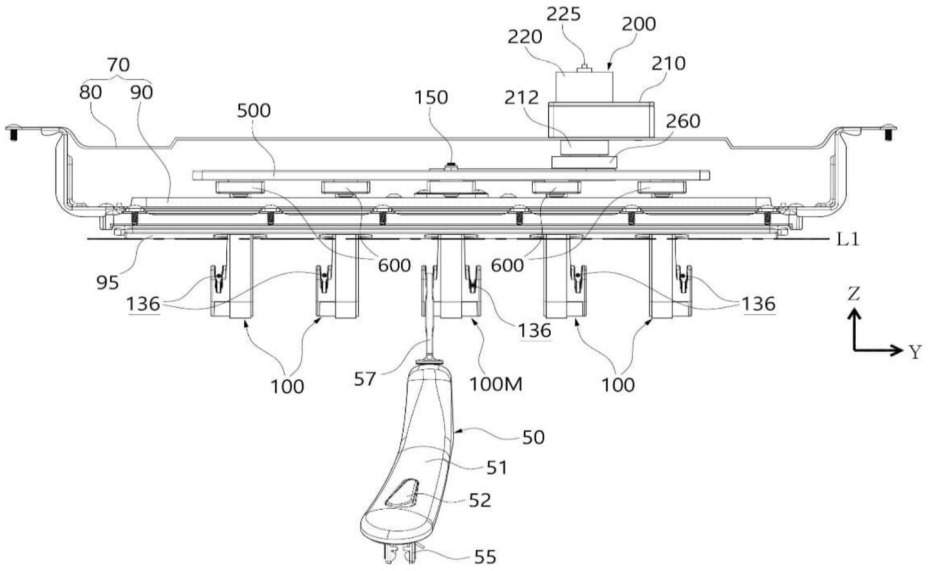
【FIG. 7】


MU
220
225
200
LM
415
300B
320
300
230
245
410
400
420
150
250
241
240
243
265
260
310
160
200B2
200B1
500
430
630
600
530
100M
100
Z
Y
X

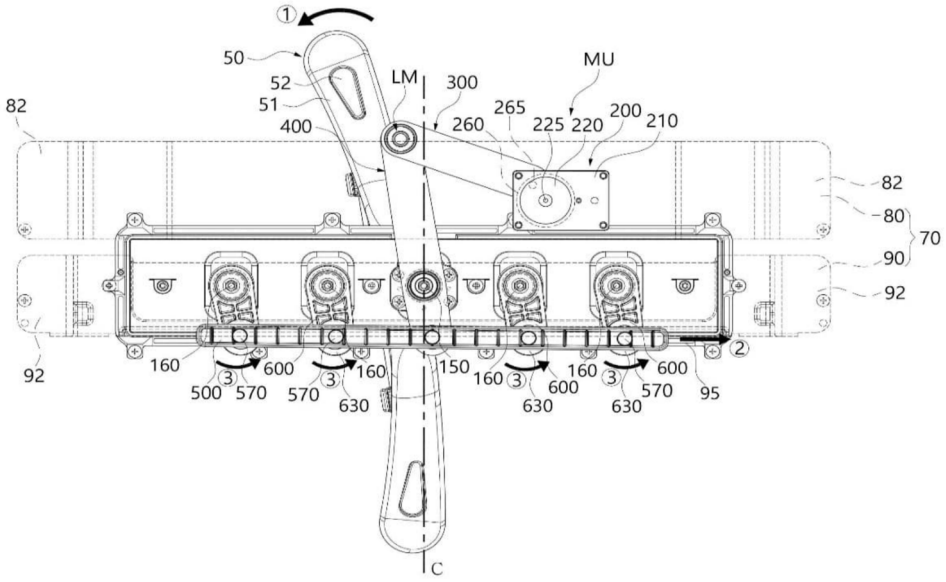
【FIG. 8】



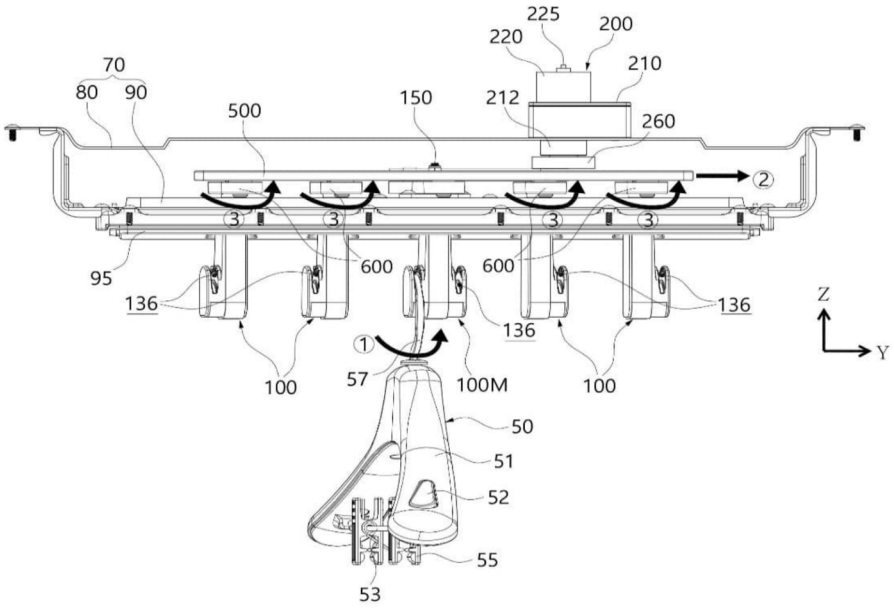
【FIG. 9】



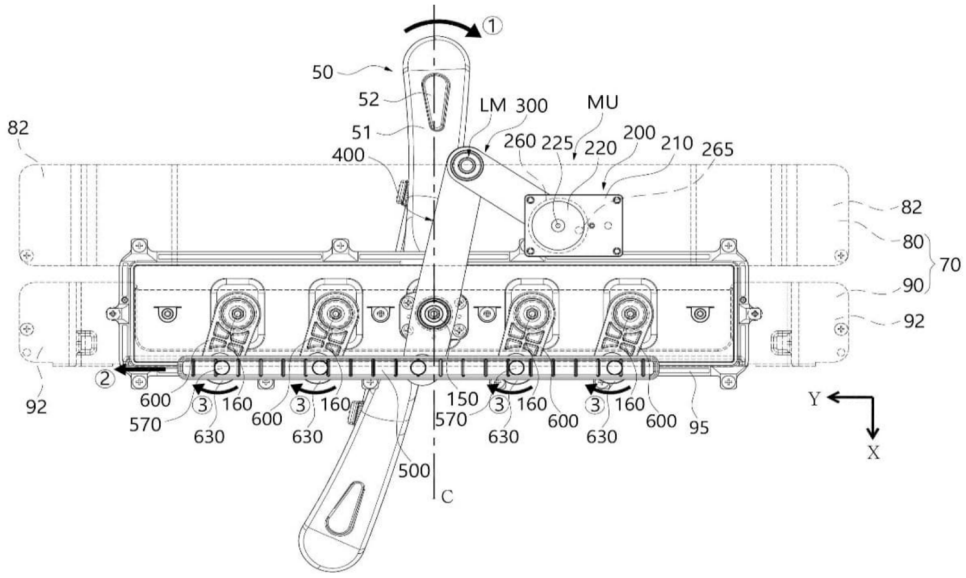
【FIG. 10】



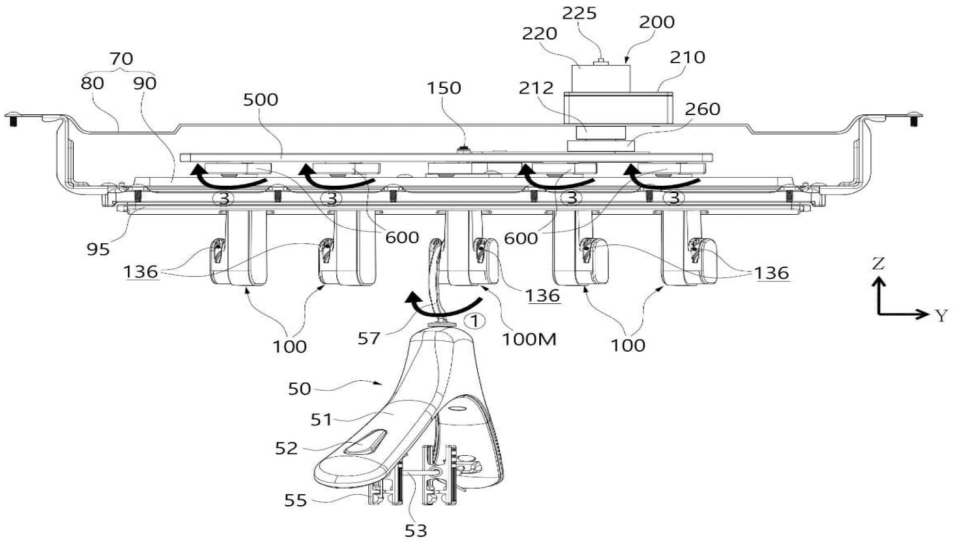
【FIG. 11】



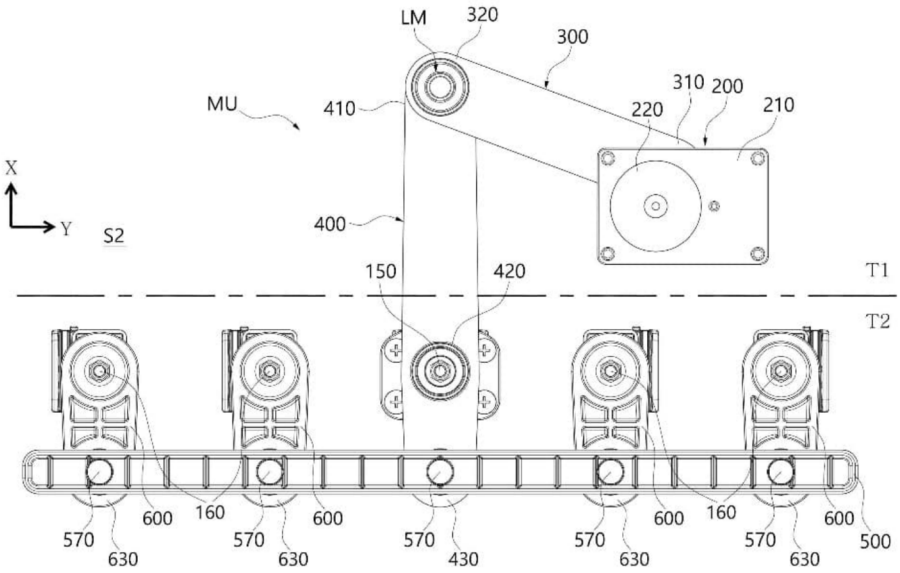
【FIG. 12】



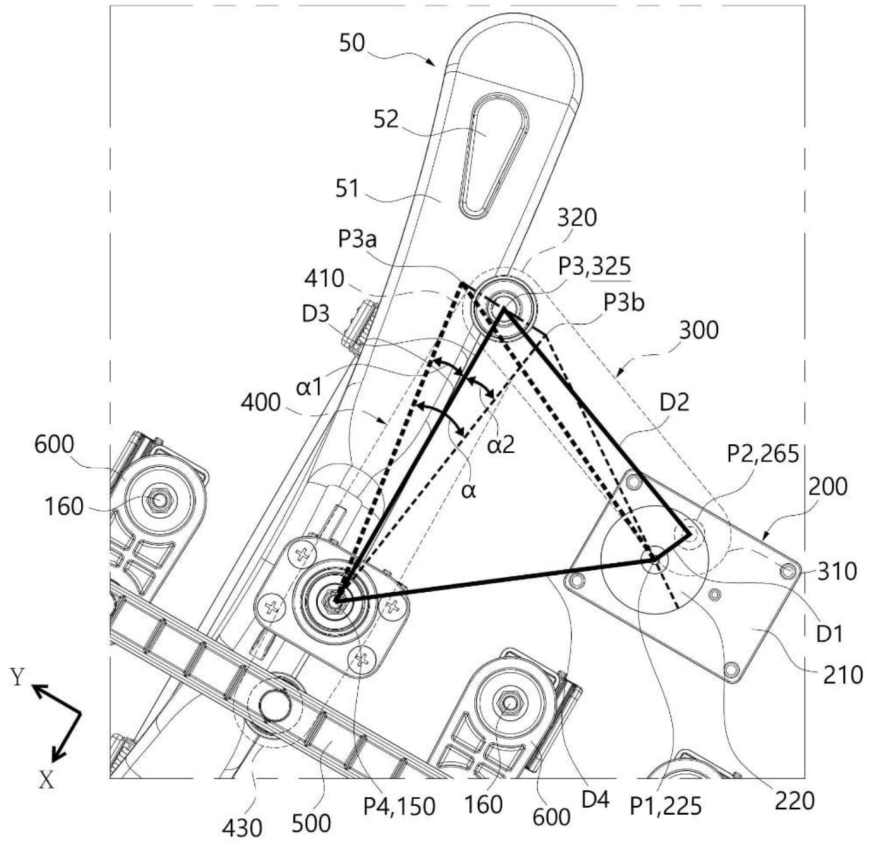
【FIG. 13】



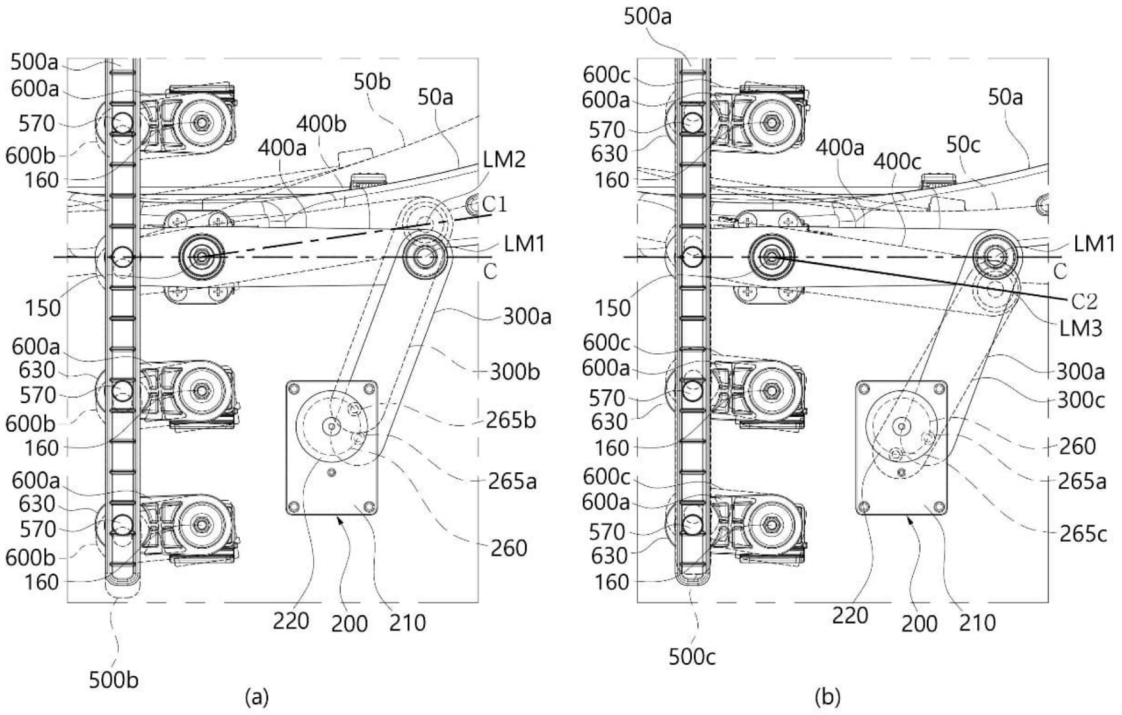
【FIG. 14】


LM
320
300
MU
410
310
200
220
210
X
Y
S2
400
150
420
T1
T2
570
630
600
160
570
630
600
570
430
570
630
600
160
570
630
600
500

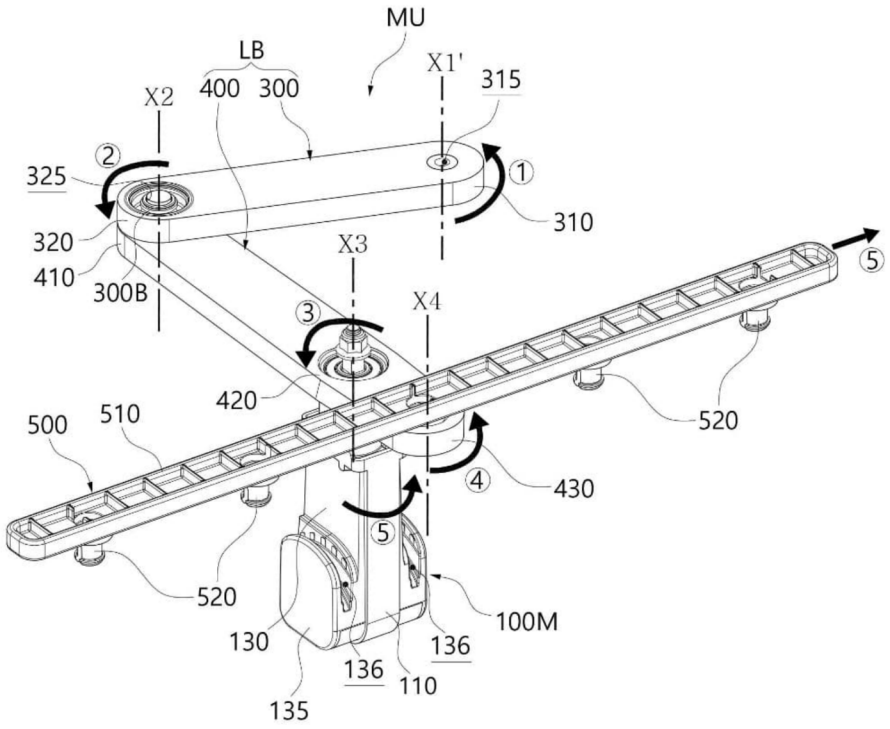
【FIG. 15】


50
52
51
320
P3a
P3,325
410
P3b
D3
300
α1
400
D2
600
α2
P2,265
160
α
200
310
D1
210
Y
X
430
500
P4,150
160
600
D4
P1,225
220

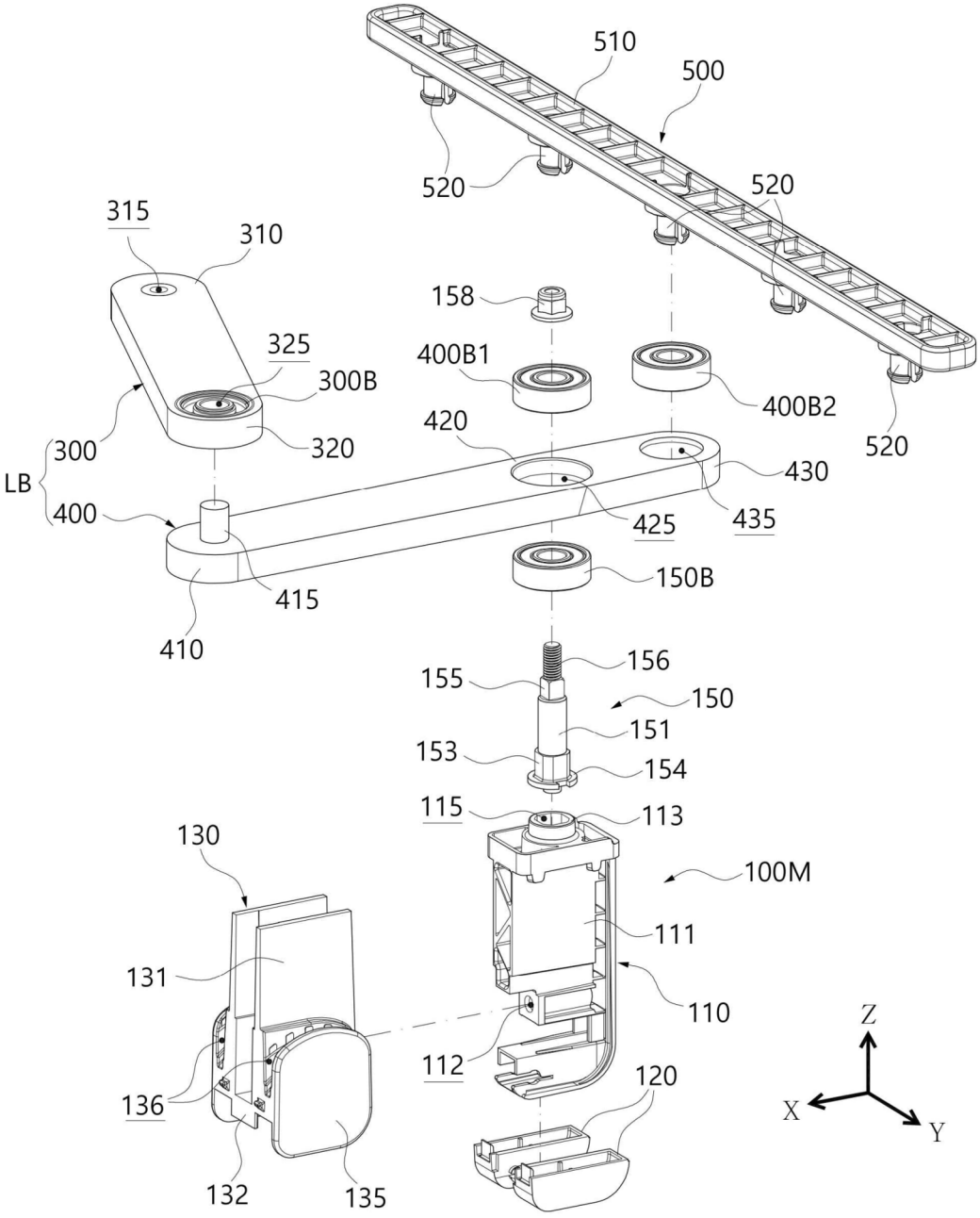
【FIG. 16】


500a
600a
570
600b
160
50b
50a
400b
400a
LM2
C1
LM1
C
150
300a
600a
630
570
600b
160
300b
265b
600a
630
570
600b
160
265a
260
220
200
210
500b
(a)
500a
600c
600a
570
630
160
50a
400a
400c
50c
LM1
C
C2
LM3
150
600c
600a
570
630
160
300a
300c
260
600c
600a
570
630
160
265a
265c
220
200
210
500c
(b)

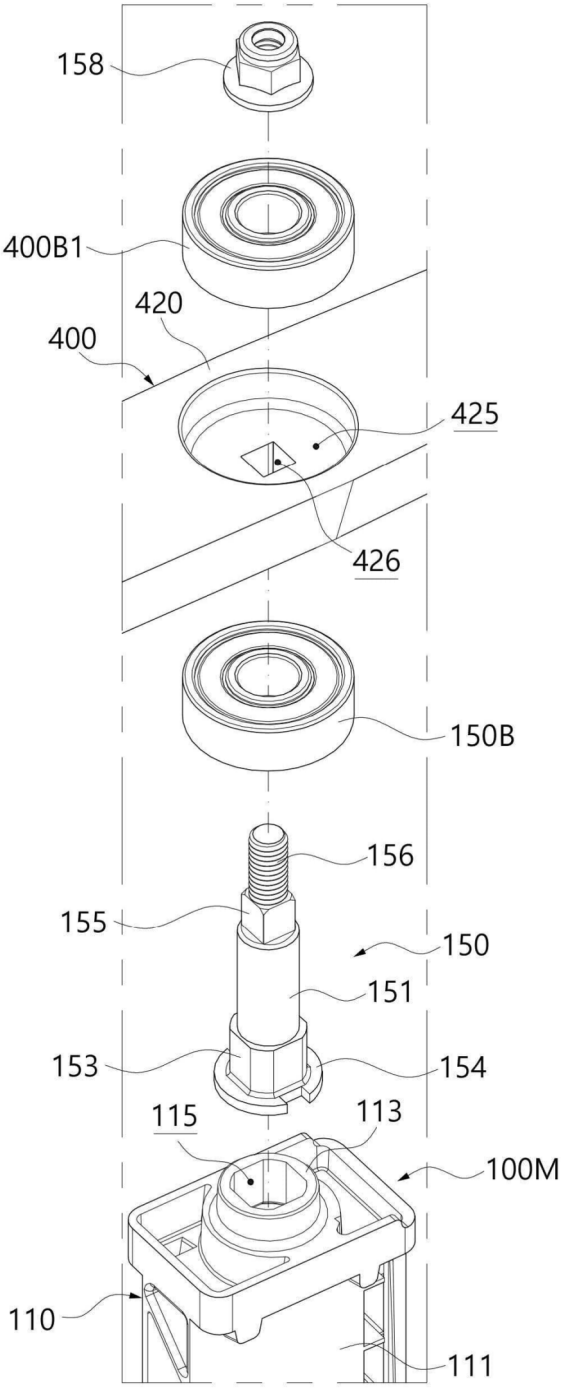
【FIG. 17】


MU
LB
400
300
X1'
315
X2
325
320
410
300B
310
X3
X4
420
500
510
520
430
100M
130
136
110
135

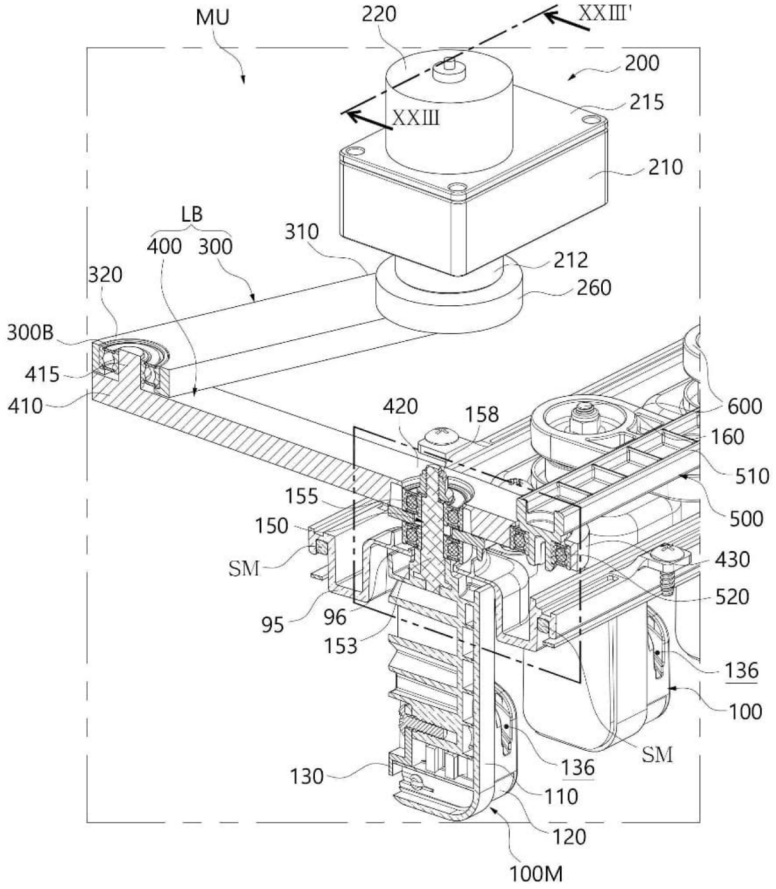
【FIG. 18】


510
500
520
520
315
310
158
325
400B1
300B
400B2
300
320
420
520
LB
430
400
425
435
150B
415
410
155
156
150
151
153
154
115
113
130
100M
111
131
110
112
120
136
132
135
Z
X
Y

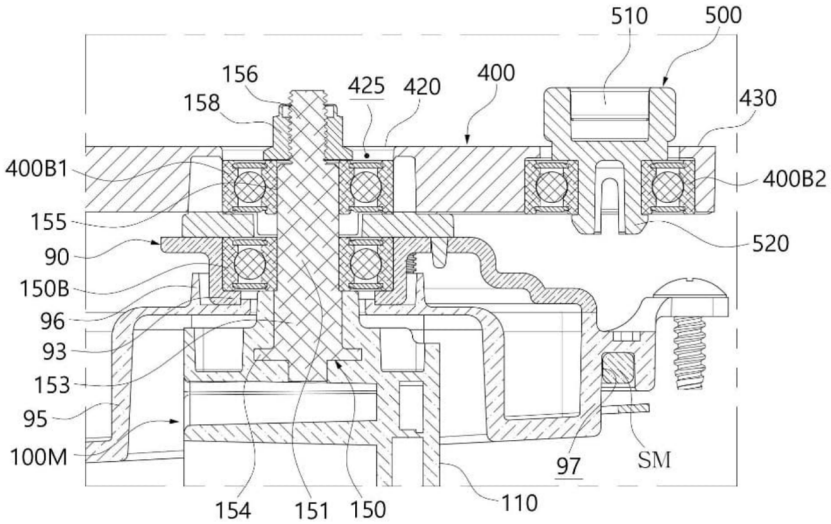
【FIG. 19】


158
400B1
420
400
425
426
150B
156
155
150
151
153
154
115
113
100M
110
111

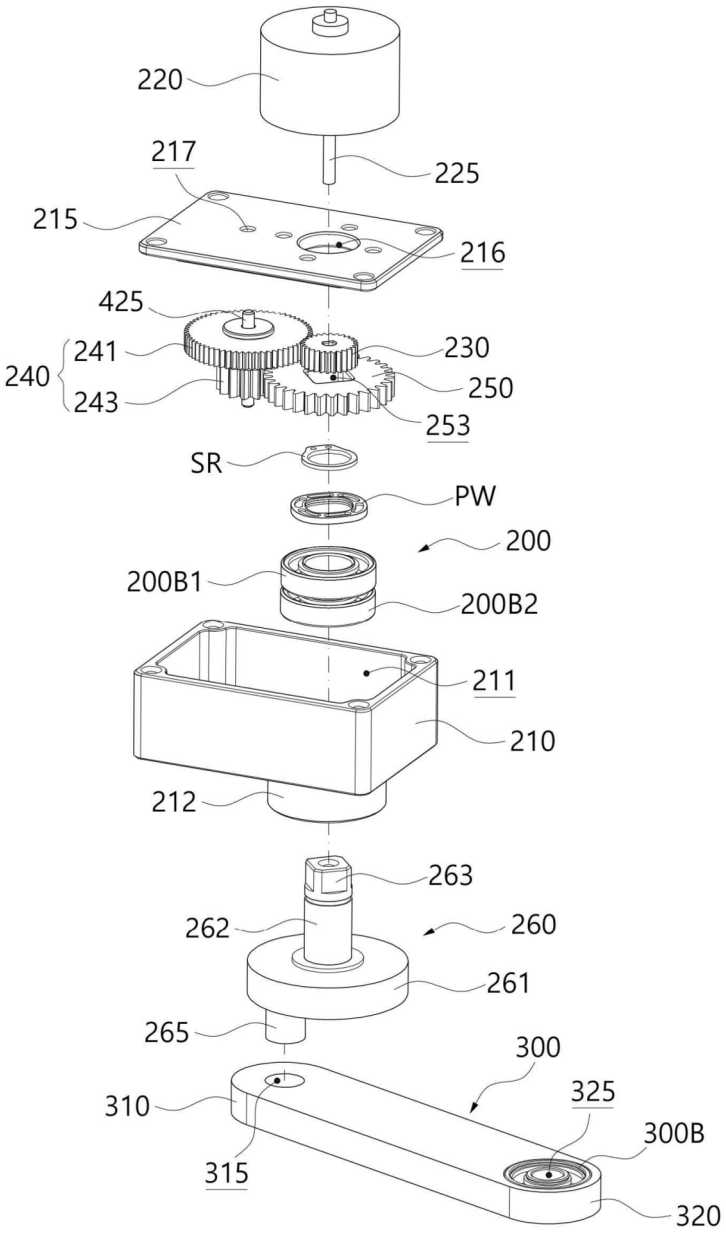
【FIG. 20】


MU
220
XXIII'
200
215
XXIII
210
LB
400 300
310
212
260
320
300B
415
410
420
158
600
160
510
500
155
150
SM
430
520
95
96
153
136
100
130
136
SM
110
120
100M

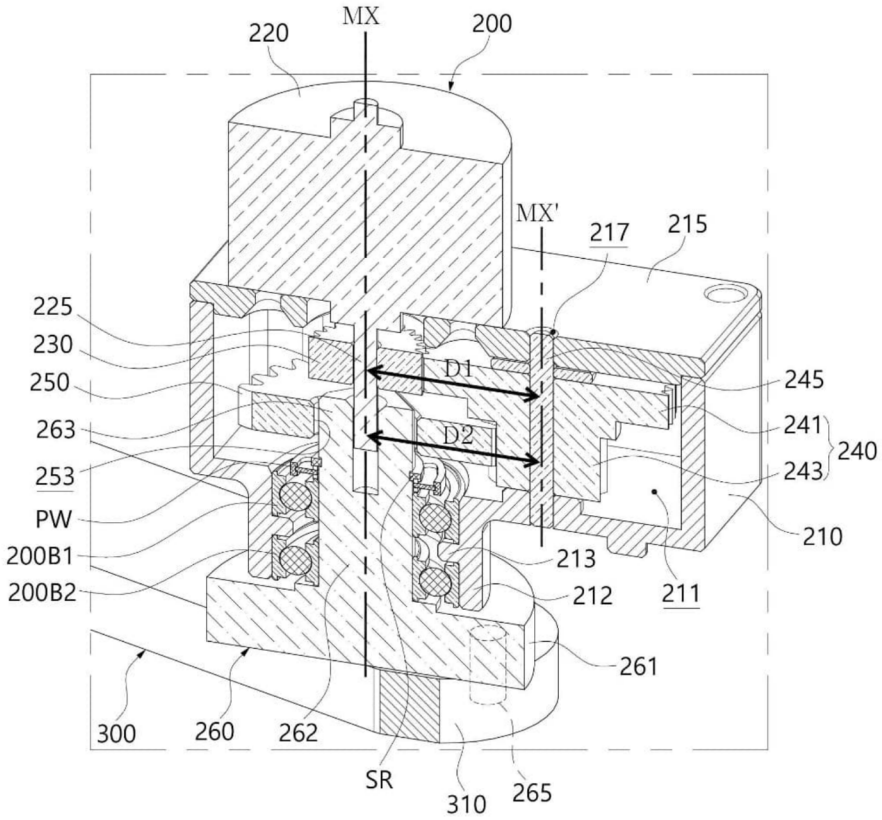
【FIG. 21】


510
500
156
158
425
420
400
430
400B1
400B2
155
520
90
150B
96
93
153
95
100M
97
SM
154
151
150
110

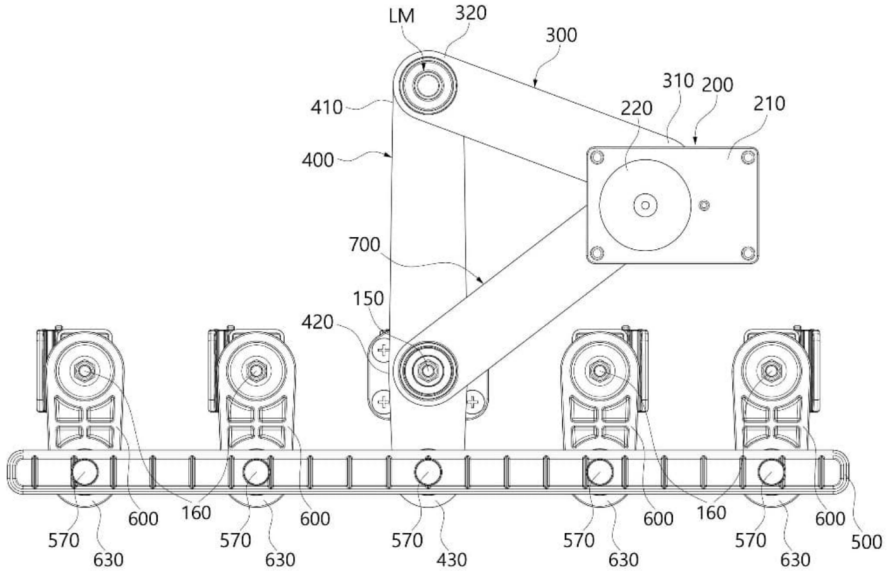
【FIG. 22】


220
217
225
215
216
425
241
240
243
230
250
253
SR
PW
200
200B1
200B2
211
210
212
263
262
260
261
265
300
325
310
300B
315
320

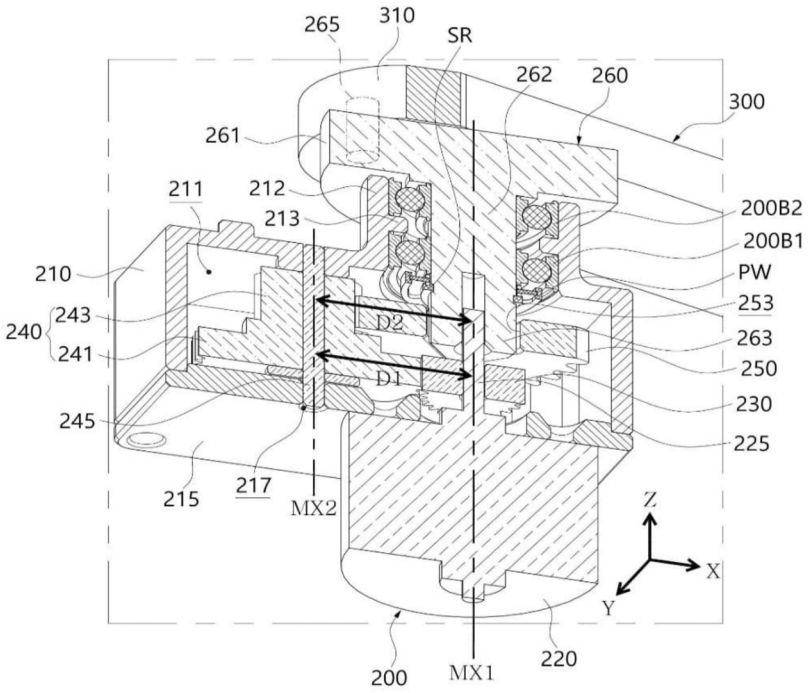
【FIG. 23】


MX
220
200
MX'
217
215
225
230
250
263
253
PW
200B1
200B2
D1
D2
245
241
240
243
210
213
212
211
261
300
260
262
SR
310
265

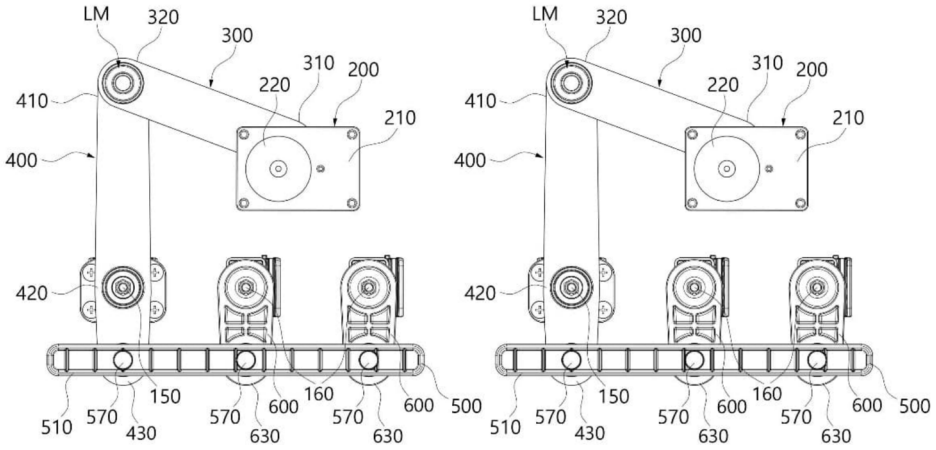
【FIG. 24】


LM
320
300
310
200
210
220
410
400
700
150
420
570
630
600
160
570
630
600
570
430
570
630
600
160
570
630
600
500

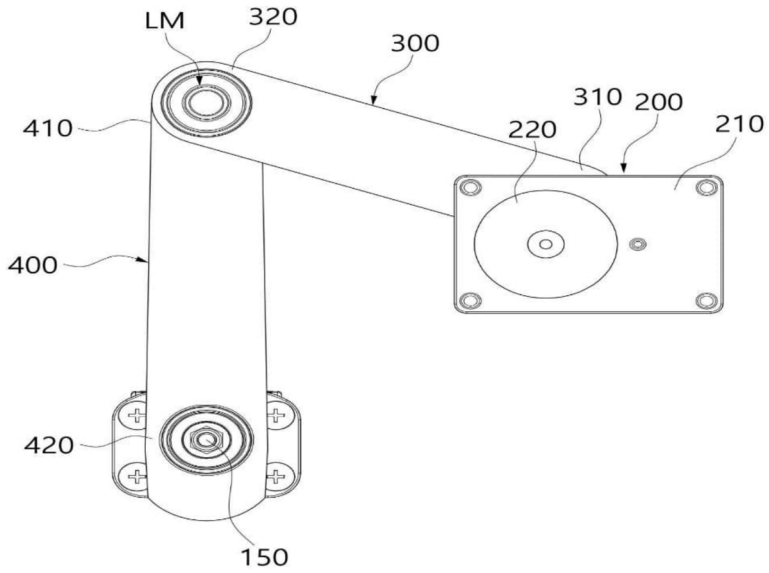
【FIG. 25】



【FIG. 26】



【FIG. 27】



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EUROPEAN SEARCH REPORT

Application Number
EP 26 16 7049

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 219 240 073 U (PANASONIC HOME APPLIANCES CHINA CO LTD; PANASONIC HOME APPLIANCES HANG) 23 June 2023 (2023-06-23) * paragraphs [0040] - [0053] * * figures 1-5 *	1-8, 10-15	INV. D06F73/02 D06F57/00 ADD. D06F58/12
X	CN 114 318 810 B (GUANGZHOU YIJIA INTELLIGENT ELECTRONIC TECH LIMITED COMPANY ET AL.) 9 April 2024 (2024-04-09) * paragraphs [0052] - [0091] * * figures 1-15 *	1-4,6-15	
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D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	6 August 2026	Weidner, Maximilian

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06-08-2026

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