



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
04.09.2024 Bulletin 2024/36

(51) International Patent Classification (IPC):
D06F 89/02 ^(2006.01) **A41H 43/02** ^(2006.01)

(21) Application number: **22890333.2**

(52) Cooperative Patent Classification (CPC):
A41H 43/02; D06F 89/02

(22) Date of filing: **01.11.2022**

(86) International application number:
PCT/KR2022/016930

(87) International publication number:
WO 2023/080602 (11.05.2023 Gazette 2023/19)

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC ME MK MT NL
NO PL PT RO RS SE SI SK SM TR**
Designated Extension States:
BA
Designated Validation States:
KH MA MD TN

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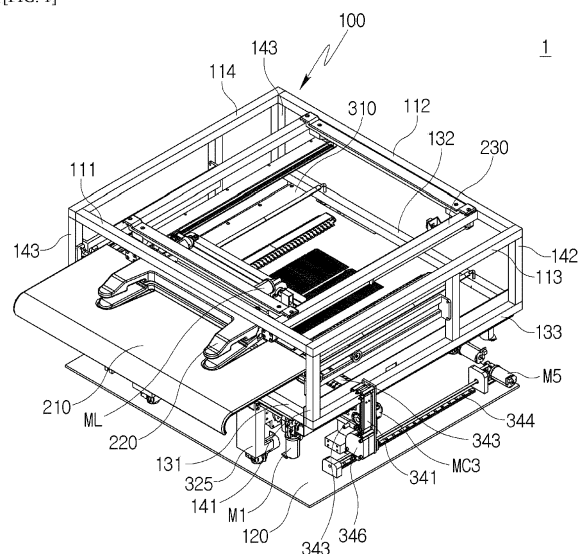
(30) Priority: **02.11.2021 KR 20210149017**

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(54) **CLOTHES-FOLDING MACHINE, AND METHOD FOR CONTROLLING CLOTHES-FOLDING MACHINE**

(57) The present disclosure relates to a garment folding machine including a folding arm configured to push and fold a garment while being extended in length along a first direction and push and support the garment while moving downward, in which the folding arm folds the garment during horizontal folding, and the folding arm guides a folding line of the garment during vertical folding, such that it is possible to reduce the overall number of bars for folding the garment and reduce the number of motors for operating the bars, such that a movement route for the folding arm may be simplified, and an overall volume of the garment folding machine may be reduced.

[FIG. 1]



Description

[Technical Field]

[0001] The present disclosure relates to a garment folding machine and a method of controlling the same, and more particularly, to a garment folding machine, which is capable of folding a garment by using an arm of a chain structure, and a method of controlling the same.

[Background Art]

[0002] Garments are made of soft materials such as natural fibers or synthetic fibers and need to be folded to appropriate sizes and shapes so that the garments are stored and carried.

[0003] Usually, it is necessary to perform a process of folding the garments significantly often or perform a process of folding a large quantity of garments in order to accommodate the garments after washing the garments or to store the garments for a long period of time in accordance with a change in season. However, a process of manually and directly folding the garments causes a waste of time and resources. In a case in which the garments are folded by unskilled persons, the shapes and the sizes of the folded garments are not uniform, which causes a problem in that additional labor is required to fold the garments for the purpose of displaying or storing the garments.

[0004] Therefore, there is a gradually increasing need for an automatic folding machine capable of quickly folding a garment without variation.

[0005] Regarding the garment folding machines in the related art, U.S. Patent No. US 8,973,792 B1 (March 10, 2015) discloses a configuration including tape, which are extendable and contractible, and rotary bars, which are rotatable and horizontally movable, in which the tape guides a folding line of a garment, and the rotary bar moves to fold the garment.

[0006] However, in the garment folding machine disclosed in the preceding document, the tape just guides the folding line by fixing the garment, but a longitudinal supporting force of the tape is limited. For this reason, the tape cannot perform a function of folding the garment, and the separate rotary bar configured to provide turning and folding the garment needs to be provided.

[0007] For this reason, there is a limitation in that at least four tapes and at least four rotary bars need to be provided to fold the garment horizontally and vertically to a preset size.

[0008] In addition, in the case of the garment folding machine in the preceding document that moves the rotary bars that are relatively large in size and rigid, there is a limitation in that the garment folding machine occupies a large space to prevent interference between the plurality of rotary bars while the plurality of rotary bars moves.

[0009] In addition, in case that the garment is loaded

or unloaded, the plurality of rotary bars may block a route through which the garment is loaded or unloaded, which causes a limitation in that the garment cannot be automatically loaded and unloaded.

[0010] Meanwhile, U.S. Patent No. US 3,869,073 A (March 4, 1975) discloses a garment folding apparatus.

[0011] In the garment folding apparatus disclosed in the preceding document, a clamping arm may hold a garment and fold a hemline by blowing air, and then the clamping arm may rotate to fold the garment horizontally.

[0012] However, in the preceding document, there is a limitation in that a separate device or process of holding the garment with the clamping arm is required, and a folding line of the garment cannot be guided even though a bar for folding the garment is used.

[Disclosure]

[Technical Problem]

[0013] The present disclosure has been made in an effort to solve the problems with household garment folding machines in which a configuration for guiding a folding line of a garment and a configuration for folding the garment are separately provided, and an object of the present disclosure is to provide a garment folding machine, which includes a configuration capable of performing both a function of folding a garment and a function of guiding a folding line of the garment, and a method of controlling the same.

[0014] Another object of the present disclosure is to provide a garment folding machine, which is capable of folding a garment having a long length to a uniform size by folding a hemline of the garment, and a method of controlling the same.

[0015] Still another object of the present disclosure is to provide a garment folding machine, which is capable of automatically loading or unloading a garment by preventing an obstacle from being disposed in a space in which the garment moves during a process of loading or unloading the garment, and a method of controlling the same.

[Technical Solution]

[0016] In order to achieve the above-mentioned object, the present disclosure provides a garment folding machine including a folding arm configured to push and fold a garment while being extended in length along a first direction and push and support the garment while moving downward.

[0017] In case that a length of the garment loaded along a loading part is equal to or longer than a predetermined length, a part of the garment may remain on the loading part in a state in which the loading of the garment ends. The folding arm may perform the hemline folding by pushing the garment placed on the loading part.

[0018] In this case, a guide arm is extended in length along a second direction and moves downward to support the garment, such that a folding line of the garment may be guided.

[0019] The folding arm may include a chain assembly made by hinge-coupling a plurality of chains.

[0020] In this case, the chain assembly may be contracted in length in a wound state, and the chain assembly in a stretched state may be extended in length and push and fold the garment.

[0021] With the folding arm and the guide arm, the chain assembly may be contracted in length before the garment is loaded or after the folding of the garment ends.

[0022] In addition, the pair of folding arms may move so that an interval therebetween increases after the folding of the garment ends.

[Advantageous Effects]

[0023] As described above, according to the garment folding machine and the method of controlling the same according to the present disclosure, the folding arm folds the garment during the horizontal folding, and the folding arm guides the folding line of the garment during the vertical folding. Therefore, it is possible to reduce the overall number of bars for folding the garment and reduce the number of motors for operating the bars, such that the movement route for the folding arm may be simplified, and the overall volume of the garment folding machine may be reduced.

[0024] In addition, the folding arm folds the hemline of the garment, such that the garment having a length equal to or longer than a predetermined length may be folded to a uniform size.

[0025] In addition, the length of the guide arm and the length of the folding arm are reduced while the garment is loaded or unloaded, such that obstacles in the space, in which the garment is transferred, may be removed, and the garment may be automatically loaded or unloaded.

[Description of Drawings]

[0026]

FIGS. 1 to 3 are views for explaining a basic configuration of a garment folding machine according to an embodiment of the present disclosure.

FIGS. 4 and 5 are views for explaining a folding arm of the garment folding machine according to the embodiment of the present disclosure.

FIGS. 6 to 8 are views for explaining a chain assembly of the garment folding machine according to the embodiment of the present disclosure.

FIGS. 9A and 9B are views for explaining a process in which a garment is loaded by a loading unit in the garment folding machine according to the embodiment of the present disclosure.

FIG. 10 is a view for explaining a process in which hemline folding is performed in the garment folding machine according to the embodiment of the present disclosure.

FIG. 11 is a view for explaining a movement of the folding arm and a movement of a guide arm after the hemline folding in the garment folding machine according to the embodiment of the present disclosure.

FIGS. 12 and 13 are views for explaining a process in which the folding arm supports a garment during vertical folding in the garment folding machine according to the embodiment of the present disclosure. FIGS. 14 and 15 are views for explaining a configuration of the folding arm and a configuration of a folding bar for the vertical folding in the garment folding machine according to the embodiment of the present disclosure.

FIGS. 16 and 17 are views for explaining a process in which the folding bar performs the vertical folding in the garment folding machine according to the embodiment of the present disclosure.

FIG. 18 is a schematic view for explaining a process in which a garment is vertically folded.

FIGS. 19 and 20 are views for explaining a position of the folding arm in a state in which horizontal folding is prepared in the garment folding machine according to the embodiment of the present disclosure.

FIG. 21 is a view for explaining an operation in which the folding arm moves to perform the horizontal folding in the garment folding machine according to the embodiment of the present disclosure.

FIG. 22 is a block diagram for explaining a control configuration in the garment folding machine according to the embodiment of the present disclosure.

FIG. 23 is a flowchart for explaining a method of controlling the garment folding machine according to the embodiment of the present disclosure.

[Mode for Invention]

[0027] Hereinafter, exemplary embodiments of the present disclosure will be described in detail with reference to the accompanying drawings.

[0028] The present disclosure may be variously modified and may have various embodiments, and particular embodiments illustrated in the drawings will be specifically described below. The description of the embodiments is not intended to limit the present disclosure to the particular embodiments, but it should be interpreted that the present disclosure is to cover all modifications, equivalents and alternatives falling within the spirit and technical scope of the present disclosure.

[0029] In the description of the present disclosure, the terms such as "first" and "second" may be used to describe various constituent elements, but the constituent elements may not be limited by the terms. These terms are used only to distinguish one constituent element from another constituent element. For example, a first com-

ponent may be named a second component, and similarly, the second component may also be named the first component, without departing from the scope of the present disclosure.

[0030] The term "and/or" may include any and all combinations of a plurality of the related and listed items.

[0031] When one constituent element is described as being "coupled" or "connected" to another constituent element, it should be understood that one constituent element can be coupled or connected directly to another constituent element, and an intervening constituent element can also be present between the constituent elements. When one constituent element is described as being "coupled directly to" or "connected directly to" another constituent element, it should be understood that no intervening constituent element is present between the constituent elements.

[0032] The terminology used herein is used for the purpose of describing particular embodiments only and is not intended to limit the present disclosure. Singular expressions may include plural expressions unless clearly described as different meanings in the context.

[0033] The terms "comprises," "comprising," "includes," "including," "containing," "has," "having" or other variations thereof are inclusive and therefore specify the presence of stated features, integers, steps, operations, elements, components, and/or combinations thereof, but do not preclude the presence or addition of one or more other features, integers, steps, operations, elements, components, and/or combinations thereof.

[0034] Unless otherwise defined, all terms used herein, including technical or scientific terms, may have the same meaning as commonly understood by those skilled in the art to which the present disclosure pertains. The terms such as those defined in a commonly used dictionary may be interpreted as having meanings consistent with meanings in the context of related technologies and may not be interpreted as ideal or excessively formal meanings unless explicitly defined in the present application.

[0035] Further, the following embodiments are provided to more completely explain the present disclosure to those skilled in the art, and shapes and sizes of elements illustrated in the drawings may be exaggerated for a more apparent description.

[0036] FIGS. 1 to 3 are views for explaining a basic configuration of a garment folding machine according to an embodiment of the present disclosure, FIGS. 4 and 5 are views for explaining a folding arm of the garment folding machine according to the embodiment of the present disclosure, and FIGS. 6 to 8 are views for explaining a chain assembly of the garment folding machine according to the embodiment of the present disclosure.

[0037] Hereinafter, a garment folding machine 1 according to the present disclosure will be described with reference to FIGS. 1 to 8.

[0038] Referring to FIGS. 1 to 8, the garment folding machine 1 according to the present disclosure includes

a frame unit 100 that serves as an external framework.

[0039] The frame unit 100 is disposed at an outer edge of the garment folding machine 1 and defines a minimum operating space in the garment folding machine 1. The frame unit 100 may stably support several members constituting the garment folding machine 1.

[0040] More specifically, the frame unit 100 includes an upper frame 110, a lower plate 120, a horizontal frame 130, and a vertical frame 140.

[0041] For reference, in the garment folding machine 1 according to the present embodiment, directions may be defined based on a state in which the frame unit 100 stands on the ground surface. For example, a direction, in which a garment is loaded based on an internal operating space, which is surrounded by the frame unit 100, and an imaginary vertical line thereof, may be referred to as a front side or a front surface. A direction, which is opposite to the front side or the front surface based on the internal operating space, may be referred to as a rear side or a rear surface. In addition, when viewed in the direction in which the garment is loaded into the internal operating space, a right direction may be referred to as a right side, and a left direction may be referred to as a left side. In addition, in the state in which the garment folding machine 1 stands on the ground surface, a direction close to the ground surface may be referred to as a lower side, and a direction distant from the ground surface may be referred to as an upper side.

[0042] The upper frame 110 may be horizontally disposed at an upper end of the garment folding machine 1, and an upper operating space of the garment folding machine 1 may be defined by the upper frame 110.

[0043] For example, the upper frame 111 may include a first upper frame 111 disposed at a front side of the garment folding machine 1, a second upper frame 112 disposed at a rear side of the garment folding machine 1, and third and fourth upper frames 113 and 114 configured to connect the first upper frame 111 and the second upper frame 112.

[0044] The lower plate 120 may be disposed horizontally at a lower end of the garment folding machine 1 and support the garment folding machine 1 on a floor surface (ground surface). A lower operating space of the garment folding machine 1 may be defined by the lower plate 120.

[0045] The horizontal frame 130 may be disposed horizontally between the upper frame 110 and the lower plate 120. A loading unit 200, a folding unit 300, and an unloading unit 400, which will be described below, may be mounted and supported on the horizontal frame 130. For example, the horizontal frame 130 may include a first horizontal frame 131 disposed at the front side of the garment folding machine 1, a second horizontal frame 132 disposed at the rear side of the garment folding machine 1, and third and fourth horizontal frames 133 and 134 configured to connect the first horizontal frame 131 and the second horizontal frame 132.

[0046] Meanwhile, the vertical frame 140 includes a first vertical frame 141 and a third vertical frame 143 dis-

posed at the front side from which the garment is inputted, and a second vertical frame 142 and a fourth vertical frame 144 disposed to be opposite to the first vertical frame 141 and the third vertical frame 143 and configured to define a rear operating space of the garment folding machine 1.

[0047] A finishing cover (not illustrated) may be stably attached to an outer peripheral side of the frame unit 100, and the finishing cover serves to define an external appearance of the garment folding machine 1 and protect the members disposed in the garment folding machine 1. In addition, an input unit (not illustrated), a display unit 700, an alarm unit 800, and the like may be provided on a front portion of the finishing cover, the input unit (not illustrated) is configured to receive a control instruction from a user, the display unit 700 is configured to visually provide the user with information on operating states of the garment folding machine 1, and the alarm unit 800 is configured to aurally provide the user with information on the operating states of the garment folding machine 1.

[0048] Because the frame unit 100 is provided as described above, the folding unit 300 to be described below may be supported so that the function of folding the garment is smoothly performed, such that a required space may be saved and an overall volume of the garment folding machine 1 may be reduced.

[0049] Meanwhile, the garment folding machine 1 may include the loading unit 200, the folding unit 300, and the unloading unit 400.

[0050] The loading unit 200, the folding unit 300, and the unloading unit 400 may be supported on the frame unit 100, and an operating space for the loading unit 200, an operating space for the folding unit 300, and an operating space for the unloading unit 400 may be defined by the frame unit 100.

[0051] For example, the operating space of the loading unit 200 and the operating space of the folding unit 300 may be defined as spaces between the horizontal frame 130 and the upper frame 110, and the operating space of the unloading unit 400 may be defined as a space between the horizontal frame 130 and the lower plate 120.

[0052] The loading unit 200 serves to load the garment. The loading unit 200 serves to load the garment, which is inputted to a loading part 210, at a predetermined position of an upper surface of a loading plate 310.

[0053] In this case, the garments not only mean upper garments manufactured by using natural fibers or synthetic fibers so as to be worn by persons, but also include all products such as lower garments, towels or bedclothes that may be provided by being folded to have desired sizes and thicknesses by the garment folding machine 1.

[0054] For example, the loading unit 200 includes a clip assembly 220 configured to hold the garment inputted along the loading part 210.

[0055] FIGS. 1 to 3 illustrate the clip assembly 220 configured to hold the garment at two points. For conven-

ience, the clip assembly 220 configured to hold the garment at the two points will be described, but the present disclosure is not limited thereto.

[0056] A holding force of the clip assembly 220 may be generated by a non-illustrated electromagnetic driving member. Any means well known in the art, such as an electric motor or a solenoid, may be applied as the electromagnetic driving member.

[0057] The clip assembly 220 may be provided with a clip part sensor (not illustrated) that automatically detects whether a garment C, which is an object to be held, reaches a holding position in the clip assembly 220. Therefore, when the clip part sensor detects that the garment C has reached the holding position, the electromagnetic driving member operates, and the clip assembly 220 is closed, such that the garment C may be automatically held.

[0058] Meanwhile, as another method, a user may operate the electromagnetic driving member by loading the garment C to the holding position in the clip assembly 220 and then manipulating an input means such as an operation start button, or a touch screen.

[0059] When the garment is completely held at a first position corresponding to an initial position, the clip assembly 220 draws the garment into the garment folding machine 1 and moves the garment to a second position corresponding to a loading position on the upper surface of the loading plate 310 while holding the garment and moving rearward by a predetermined distance. When the clip assembly 220 completely moves to the second position, the clip assembly 220 releases the garment.

[0060] Therefore, when the process of holding the garment C is completed by closing the clip assembly 220, an operation of a loading unit motor ML is initiated, and the clip assembly 220 is moved to the second position disposed rearward of the first position and then stopped.

[0061] In addition, after the clip assembly 220 releases the garment, the clip assembly 220 additionally moves to a third position, that is, a position disposed further rearward from the second position. When the clip assembly 220 reaches the third position, the folding unit 300 operates.

[0062] The loading unit 200 includes the loading unit motor ML configured to generate power for moving the clip assembly 220 in a forward/rearward direction. As an example, the loading unit motor ML has a pinion gear fixed to the clip assembly 220 and connected to an output shaft of the loading unit motor ML, and the pinion gear engages with a rectilinear gear fixed to a frame 230 of the loading unit 200, such that rotational power of the loading unit motor ML may be converted into a force for rectilinear motion in the forward/rearward direction.

[0063] In the illustrated embodiment, the loading unit motor ML is configured to be moved together with the clip assembly 220. That is, the loading unit motor ML is connected to the clip assembly 220, and the pinion gear (not illustrated) is provided on the output shaft of the loading unit motor ML.

[0064] In addition, a rack gear (not illustrated) is mount-

ed on the frame 230, and the pinion gear engages with the rack gear. Therefore, when the operation is initiated as the current is supplied to an unloading motor, the pinion gear rotates, and the rack gear rectilinearly moves along a longitudinal direction of the rack gear.

[0065] However, the above-mentioned method of converting the motion using the pinion gear and the rack gear is provided for illustration only, and any means may be applied without limitation as long as this means may convert the rotational motion of the loading unit motor ML into the rectilinear reciprocating motions of the clip assembly 220.

[0066] Meanwhile, clip position detection sensors SL for specifying the first to third positions are provided on the frame 230 of the loading unit 200. In more detail, the clip position detection sensors SL include an initial position detection sensor SL1 configured to detect whether the clip assembly 220 is positioned at the first position, a clip open position detection sensor SL2 configured to detect whether the clip assembly 220 is positioned at the second position, and a stop position detection sensor SL3 configured to detect whether the clip assembly 220 is positioned at the third position.

[0067] Meanwhile, the loading unit 200 of the present disclosure may further include a garment detection sensor SC configured to detect whether the garment is present on the loading part 210. For example, the garment detection sensor SC may be disposed rearward of the loading part 210 and detect whether a rear end of the garment remains on the loading part 210.

[0068] With this configuration, the garment folding machine 1 of the present disclosure may use the garment detection sensor SC and determine that a length of the garment is equal to or longer than a predetermined length. When a length of the garment is equal to or longer than the predetermined length, the garment folding machine 1 may perform a hemline folding function.

[0069] The folding unit 300 serves to fold the garment loaded by the loading unit 200.

[0070] More specifically, the folding unit 300 includes the loading plate 310, a first folding arm 320, a second folding arm 330, a first guide arm 340, a second guide arm 350, a first folding bar 360, a second folding bar 370, a folding plate 380, and a support plate 390 to fold the garment, which is loaded by the loading unit 200, to a predetermined size and shape.

[0071] The garment, which is loaded by the loading unit 200, may be seated (land) on the loading plate 310. For example, the loading plate 310 may be formed in a flat plate shape, and a lower surface of the loading plate 310 may be supported by the support plate 390.

[0072] With this configuration, the garment may be placed on the loading plate 310, and the first folding arm 320, the second folding arm 330, the first guide arm 340, the second guide arm 350, the first folding bar 360, the second folding bar 370, and the folding plate 380 may operate to fold the garment.

[0073] The loading plate 310 may move according to

the embodiment. For example, the loading plate 310 may be moved in the forward/rearward direction by an operation of a conveyor 410. As another example, the loading plate 310 may rotate to be inclined with respect to the ground surface. With this configuration, the garment, which is folded by the folding unit 300, may be unloaded.

[0074] The folding arms 320 and 330 may be disposed at the front side of the garment folding machine 1. Specifically, the folding arms 320 and 330 may be provided as a pair of folding arms 320 and 330 and disposed in parallel at the front side of the garment folding machine 1. For example, the folding arms 320 and 330 may include the first folding arm 320 disposed at the front left side of the garment folding machine 1, and the second folding arm 330 disposed at the front right side of the garment folding machine 1.

[0075] The first folding arm 320 and the second folding arm 330 may rectilinearly move along the direction (hereinafter, referred to as a 'first direction') in which the garment is loaded, and the first folding arm 320 and the second folding arm 330 may push and fold the garment. In this case, the rectilinear movement may mean that the folding arms move while being extended in length along the first direction from the front side toward the rear side of the garment folding machine 1.

[0076] The folding arms 320 and 330 include chain housings 321 and 331, chain gears 322 and 332, chain assemblies 323 and 333, a plurality of movement rails 324, 325, 334, and 335, chain springs 326 and 336, chain drive motors MC1 and MC2, and a plurality of movement motors M1, M2, M3, and M4.

[0077] Specifically, the first folding arm 320 includes a first chain housing 321, a first chain gear 322, a chain assembly 323, a first movement rail 324, a second movement rail 325, a first chain spring 326, a first chain drive motor MC1, a first movement motor M1, and a second movement motor M2.

[0078] The first chain housing 321 may be disposed at the front side of the garment folding machine 1. The first chain gear 322 may be provided on the first chain housing 321, and the chain assembly 323 may be movably accommodated in the first chain housing 321. For example, a guide groove may be formed in the first chain housing 321 and guide a movement of the chain assembly 323.

[0079] With this configuration, before the first chain drive motor MC1 operates, the chain assembly 323 may be accommodated in the first chain housing 321. Further, when the first chain drive motor MC1 operates, the chain assembly 323 may be extended in length along the first direction from the first chain housing 321.

[0080] The first chain gear 322 may be provided on the first chain housing 321 and connected to the first chain drive motor MC1 to receive power. The first chain gear 322 may engage with the chain assembly 323 and move the chain assembly 323 by using the power transmitted from the first chain drive motor MC1.

[0081] The first folding arm 320 may include a plurality of chains 3231 and 3232. In this case, the plurality of

chains 3231 and 3232 may be coupled to one another and constitute the single chain assembly 323. Specifically, the plurality of chains 3231 and 3232 may be hingedly coupled to one another and rotate relative to one another. Therefore, the chain assembly 323 may decrease in overall length when the chains 3231 and 3232 are rolled into one another (wound), and the chain assembly 323 may increase in overall length when the chains 3231 and 3232 are stretched in the first direction (forward/rearward direction). Therefore, the chain assembly 323 may change in length in accordance with relative rotations between the chains 3231 and 3232.

[0082] With this configuration, the first folding arm 320 may push and fold the garment while being extended in length along the first direction.

[0083] Meanwhile, the chains 3231 and 3232 include front-end chains 3231 and connection chains 3232. The front-end chain 3231 may be disposed at a front-end of the chain assembly 323 and apply a force for pushing the garment. Further, the connection chain 3232 may be rotatably coupled to the front-end chain 3231 or another connection chain 3232. Therefore, the front-end chain 3231 is disposed at the front-end of the chain assembly 323, and the plurality of connection chains 3232 is disposed rearward of the front-end chain 3231 and sequentially coupled along the first direction, such that the chain assembly 323 may have an arm shape having a predetermined length.

[0084] In this case, the front-end may mean an end based on a proceeding direction in which the length of the chain assembly 323 increases, i.e., a direction toward a rear surface of the garment folding machine 1 based on a time point at which the length of the chain assembly 323 is increased by the operation of the first chain drive motor MC1. Therefore, a front-end direction may mean a direction in which the chain assembly 323 is extended in length, and a rear end direction may be a direction opposite to the front-end direction.

[0085] The front-end chain 3231 includes a chain main body 3231a, a front-end roller 3231b, hinge coupling parts 3231c, a push part 3231d, a stopper 3231e, a shaft 3231f, and a torsion spring 3231g.

[0086] The chain main body 3231a is formed in a block shape having a predetermined thickness. For example, based on a state in which the chain assembly 323 is stretched toward the garment, a lower surface of the chain main body 3231a may be formed in a flat shape, and the chain main body 3231a may be formed in a shape inclined upward at a predetermined angle or protruding while having a predetermined curvature. Therefore, as illustrated in FIG. 7, a cross-section made by cutting the chain main body 3231a in a leftward/rightward direction may have a shape similar to a trapezoidal shape or an arcuate shape with a cut upper end. With this configuration, in case that the chain main body 3231a moves downward, pushes an upper surface of the garment, and turns the garment (performs vertical folding), a line about which the garment is folded may become clear.

[0087] The front-end roller 3231b may be disposed at a front-end portion of the chain main body 3231a and come into contact with the garment or the folding plate 380. For example, the front-end roller 3231b may be formed in a cylindrical shape and disposed at a foremost side in the direction in which the front-end chain 3231 is extended in length. With this configuration, in case that the length of the chain assembly 323 increases, the front-end roller may come into contact with the garment or the folding plate 380 first.

[0088] The front-end roller 3231b may roll when the chain assembly 323 comes into contact with the garment or the folding plate 380. Therefore, even though the chain assembly 323 comparatively strongly comes into contact with the garment or the folding plate 380, the rolling motion may disperse an impact, which may prevent damage to the garment or the chain assembly 323 caused by the impact.

[0089] The hinge coupling part 3231c may be formed in a hole or groove shape in the chain main body 3231a and accommodate therein the shaft 3231f and the torsion spring 3231g. A first hinge coupling part 3232b of the connection chain 3232 may be hingedly coupled to the hinge coupling part 3231c. That is, the hinge coupling part 3231c of the front-end chain 3231a may be coupled while sharing the shaft 3231f with the first hinge coupling part 3232b of the connection chain 3232. With this configuration, the front-end chain 3231 and the connection chain 3232 may be coupled to be rotatable relative to each other.

[0090] The push part 3231d protrudes from the chain main body 3231a toward the rear side of the garment folding machine 1, and the front-end roller 3231b is rotatably coupled to the push part 3231d.

[0091] The push part 3231d protrudes from the chain main body 3231a. A thickness of the push part 3231d in the upward/downward direction may be smaller than a thickness of the chain main body 3231a in the upward/downward direction. With this configuration, it is possible to minimize a volume of the chain assembly 323 in case that the chain assembly 323 is contracted. In addition, in case that the chain assembly 323 is extended in length, a force applied by the chain assembly 323 to push the garment or the folding plate 380 is concentrated, which makes the folding line of the garment clear.

[0092] The stopper 3231e may be formed with a stepped portion on the chain main body 3231a and supported by being brought into contact with a stopper 3232d of the connection chain 3232. Specifically, in case that the chain assembly 323 is extended in length, the stopper 3231e may stop the rotation of the front-end chain 3231 and the rotation of the connection chain 3232 while coming into contact with the stopper 3232d of the connection chain 3232. With this configuration, the chain assembly 323 may be kept in a stretched state.

[0093] The stopper 3231e may protrude from the chain main body 3231a toward the front side of the garment folding machine 1 and be supported by being brought

into contact with a support projection 3232e.

[0094] The stopper 3231e may protrude from an upper portion of the chain main body 3231a. A thickness of the stopper 3231e in the upward/downward direction may be smaller than a thickness of the chain main body 3231a in the upward/downward direction. With this configuration, it is possible to minimize a volume of the chain assembly 323 in case that the chain assembly 323 is contracted.

[0095] The shaft 3231f may be coupled to the hinge coupling part 3231c and the first hinge coupling part 3232b. The shaft 3231f may serve as an axis about which the front-end chain 3231 and the connection chain 3232 rotate relatively.

[0096] The torsion spring 3231g is accommodated in the hinge coupling part 3231c and disposed to surround an outer peripheral surface of the shaft 3231f. The torsion spring 3231g may apply a restoring force to the relative rotation of the front-end chain 3231 and the connection chain 3232. For example, the torsion spring 3231g may apply the elastic force so that the front-end chain 3231 and the connection chain 3232 are stretched. Therefore, when the front-end chain 3231 and the connection chain 3232 are in a rolled state, the restoring force may be applied in a direction in which the front-end chain 3231 and the connection chain 3232 are stretched (in a direction in which the stopper 3231e of the front-end chain 3231 and the support projection 3232e of the connection chain 3232 move to be close to each other). With this configuration, when the chain assembly 323 exits the first chain housing 321 as the first chain drive motor MC1 operates, the front-end chain 3231 and the connection chain 3232 may be stretched by the restoring force of the torsion spring 3231g, and the chain assembly 323 may be extended in length.

[0097] The connection chain 3232 includes a chain main body 3232a, the first hinge coupling part 3232b, a second hinge coupling part 3232c, a push part 3232d, the support projection 3232e, a shaft 3232f, and a torsion spring 3232g.

[0098] The chain main body 3232a is formed in a block shape having a predetermined thickness. For example, based on a state in which the chain assembly 323 is stretched toward the garment, a lower surface of the chain main body 3232a may be formed in a flat shape, and the chain main body 3232a may be formed in a shape inclined upward at a predetermined angle or protruding while having a predetermined curvature. Therefore, a cross-section made by cutting the chain main body 3232a in a leftward/rightward direction may have a shape similar to a trapezoidal shape or an arcuate shape with a cut upper end.

[0099] The first hinge coupling part 3232b may protrude from the chain main body 3232a and be coupled to the hinge coupling part 3231c of the front-end chain 3231 or the second hinge coupling part 3232c of another connection chain 3232 disposed at the front side (based on the direction in which the length increases). For ex-

ample, the first hinge coupling part 3232b may be formed in a cylindrical shape partially opened.

[0100] The second hinge coupling part 3232c may be formed in a hole or groove shape in the chain main body 3232a and accommodate therein the shaft 3232f and the torsion spring 3232g. The first hinge coupling part 3232b of another connection chain 3232, which is disposed at the rear side, may be hingedly coupled to the second hinge coupling part 3232c. That is, the plurality of connection chains 3232, which is continuously coupled to one another, may be coupled to be rotatable relative to one another while sharing the shafts 3231f.

[0101] The stopper 3232d may protrude from the chain main body 3232a toward the front side of the garment folding machine 1 and be supported by being brought into contact with the support projection 3232e.

[0102] The stopper 3232d may protrude from an upper portion of the chain main body 3232a. A thickness of the stopper 3232d in the upward/downward direction may be smaller than a thickness of the chain main body 3232a in the upward/downward direction. With this configuration, it is possible to minimize a volume of the chain assembly 323 in case that the chain assembly 323 is contracted.

[0103] The support projection 3232e may be formed with a stepped portion on the chain main body 3232a and supported by being brought into contact with the stopper 3231e or 3232d of the front-end chain 3231 or another connection chain 3232 disposed at the front side. Specifically, in case that the chain assembly 323 is extended in length, the support projection 3232e may stop the rotation between the two chains while coming into contact with the stopper 3231e or 3232d of the front-end chain 3231 or another connection chain 3232 disposed at the front side (in the front-end direction). With this configuration, the chain assembly 323 may be kept in a stretched state. That is, the chain assembly 323 may be kept in the stretched state (the state in which the length is increased) as the support projection 3232e of the connection chain 3232 disposed in the rear end direction is supported by being brought into contact with the stopper 3231e or 3232d of the front-end chain 3231 or the connection chain 3232 disposed in the front-end direction.

[0104] The shaft 3232f may be coupled to the first hinge coupling part 3232b and the second hinge coupling part 3232c. The shaft 3231f may serve as an axis about which the two connection chains 3232 rotate relatively.

[0105] The torsion spring 3232g is accommodated in the second hinge coupling part 3232c and disposed to surround an outer peripheral surface of the shaft 3232f. The torsion spring 3232g may apply a restoring force to the relative rotation between the two connection chains 3232. For example, the torsion spring 3232g may apply the elastic force so that the two connection chains 3232 are stretched. With this configuration, when the chain assembly 323 exits the first chain housing 321 as the first chain drive motor MC1 operates, the connection chain 3232 may be stretched by the restoring force of the tor-

sion spring 3232g, and the chain assembly 323 may be extended in length.

[0106] Meanwhile, the first folding arm 320 includes the first movement rail 324. The first movement rail 324 may be fixedly coupled to the support plate 390. The first movement rail 324 may be coupled to be movable relative to the first chain housing 321 and configured to receive power from the first movement motor M1. The first movement rail 324 may guide the leftward/rightward movement of the first chain housing 321.

[0107] For example, a screw thread may be formed on the first movement rail 324, and a groove may be formed in the first chain housing 321 and accommodate the screw thread of the first movement rail 324. Further, the first movement rail 324 may be connected to the first movement motor M1 by means of at least one gear and receive power generated by the operation of the first movement motor M1. Therefore, when the first movement motor M1 operates, the first movement rail 324 may rotate, and the first chain housing 321 may move along the first movement rail 324.

[0108] Meanwhile, the first folding arm 320 includes the second movement rail 325. The second movement rail 325 may be fixedly coupled to the lower plate 120. The second movement rail 325 may be coupled to the first chain housing 321 and configured to receive power from the second movement motor M2. The second movement rail 325 may guide the upward/downward movement of the first chain housing 321.

[0109] For example, a rack gear may be formed on the second movement rail 325, and the second movement rail 325 may be connected to the second movement motor M2 by means of at least one gear that engages with the rack gear, such that the second movement rail 325 may receive power generated by the operation of the second movement motor M2. Therefore, when the second movement motor M2 operates, the second movement rail 325 may move to move the first chain housing 321 upward or downward.

[0110] Meanwhile, upper and lower surfaces of the chain assembly 323 are surrounded by a film F. That is, the film F is provided to surround the chain assembly 323 in a length change direction of the chain assembly 323. For example, the film F of the first folding arm 320 is provided to surround the chain assembly 323 in the forward/rearward direction (first direction) of the garment folding machine.

[0111] In this case, one end of the film F may be fixedly coupled to the first chain housing 321, and the other end of the film F may be coupled to the first chain spring 326 to be described below. With this configuration, the film F may transmit the elastic force of the first chain spring 326 to the chain assembly 323 and support the chain assembly 323.

[0112] The first folding arm 320 includes the first chain spring 326. The first chain spring 326 may be disposed at one side of the first chain housing 321. For example, the first chain spring 326 may be a spiral spring and dis-

posed at a rear end of the first chain housing 321.

[0113] Therefore, when the chain assembly 323 is extended in length toward the rear side of the garment folding machine 1 (along the first direction) as the first chain drive motor MC1 operates, the film F may be loosened while surrounding the upper and lower surfaces of the chain assembly 323 and extended in length together with the chain assembly 323. In contrast, when the operation of the first chain drive motor MC1 ends, the first chain spring 326 may pull the film F by the restoring force of the first chain spring 326 and pull the chain assembly 323 toward the first chain housing 321.

[0114] Therefore, the first folding arm 320 of the present disclosure may slide in the leftward/rightward direction and the upward/downward direction of the garment folding machine 1 and push the garment or the folding plate 380 by means of the change in length of the chain assembly 323.

[0115] The second folding arm 330 includes a second chain housing 331, a second chain gear 332, a chain assembly 333, a third movement rail 334, a fourth movement rail 335, a second chain spring 336, a second chain drive motor MC2, a third movement motor M3, and a fourth movement motor M4.

[0116] The second folding arm 330 may be disposed in parallel with the first folding arm 320.

[0117] Meanwhile, in order to avoid the repeated description, the description of the configuration and effect of the first folding arm 320 may be applied to the description of the second folding arm 330 of the present disclosure, except for the components that will be particularly described.

[0118] That is, the second chain housing 331, the second chain gear 332, the chain assembly 333, the third movement rail 334, the fourth movement rail 335, the second chain spring 336, the second chain drive motor MC2, the third movement motor M3, and the fourth movement motor M4 of the second folding arm 330 may be respectively identical in structures and functions to the first chain housing 321, the first chain gear 322, the chain assembly 323, the first movement rail 324, the second movement rail 325, the first chain spring 326, the first chain drive motor MC1, the first movement motor M1, and the second movement motor M2 of the first folding arm 320. Therefore, the same description may be applied.

[0119] The second folding arm 330 may slide in the upward/downward direction or the leftward/rightward direction simultaneously with the first folding arm 320. In addition, the second folding arm 330, together with the first folding arm 320, may push the garment or the folding plate 380 by changing the lengths of the chain assemblies 323 and 333. In this case, in case that the second folding arm 330 and the first folding arm 320 move in the upward/downward direction, the second folding arm 330 and the first folding arm 320 may move upward or downward together. In contrast, in case that the second folding arm 330 and the first folding arm 320 move in the left-

ward/rightward direction, the second folding arm 330 and the first folding arm 320 may move symmetrically.

[0120] The guide arms 340 and 350 may be disposed at the lateral sides of the garment folding machine 1 based on the leftward/rightward direction. For example, the guide arms 340 and 350 may be disposed as a pair of guide arms at two opposite lateral sides of the garment folding machine 1 one by one. That is, the guide arms 340 and 350 may include the first guide arm 340 disposed at the left side of the garment folding machine 1, and the second guide arm 350 disposed at the right side of the garment folding machine 1. Meanwhile, the first guide arm 340 may be disposed at the right side of the garment folding machine 1, and the second guide arm 350 may be disposed at the left side of the garment folding machine 1.

[0121] The first guide arm 340 and the second guide arm 350 may guide the folding line of the garment while rectilinearly moving along a second direction intersecting the first direction. For example, the first guide arm 340 and the second guide arm 350 may come into contact with and support the garment by rectilinearly moving along the second direction perpendicular to the first direction.

[0122] The guide arms 340 and 350 include guide chain housings 341 and 351, guide chain gears 342 and 352, chain assemblies 343 and 353, a plurality of movement rails 344, 345, 354, and 355, chain springs 346 and 356, chain drive motors MC3 and MC4, and a plurality of movement motors M5, M6, M7, and M8.

[0123] Specifically, the first guide arm 340 includes a first guide chain housing 341, a first guide chain gear 342, a chain assembly 343, a fifth movement rail 344, a sixth movement rail 345, a first guide chain spring 346, a first guide chain drive motor MC3, a fifth movement motor M5, and a sixth movement motor M6.

[0124] The first guide chain housing 341 may be disposed at one side of the garment folding machine 1 based on the leftward/rightward direction. The first guide chain gear 342 may be provided on the first guide chain housing 341, and the chain assembly 343 may be movably accommodated in the first guide chain housing 341. For example, a guide groove may be formed in the first guide chain housing 341 and guide a movement of the chain assembly 343.

[0125] Meanwhile, the first guide chain housing 341 may be shorter in length than the first chain housing 321. This is because the chain assembly 323 accommodated in the first chain housing 321 needs to push and fix the overall length of the garment, whereas the chain assembly 343 accommodated in the first guide chain housing 341 pushes and fixes only half the width of the garment in the leftward/rightward direction.

[0126] The first guide chain gear 342 may be provided on the first guide chain housing 341 and connected to the first guide chain drive motor MC3 to receive power. The first guide chain gear 342 may engage with the chain assembly 343 and move the chain assembly 343 by using

the power transmitted from the first guide chain drive motor MC3.

[0127] The first guide arm 340 may include the chain assembly 343 made by coupling a plurality of chains.

[0128] Meanwhile, in order to avoid the repeated description, the description of the chain assembly 323 of the first folding arm 320, which is identical in configuration and effect to the chain assembly 343 of the first guide arm 340, may be applied to the description of the chain assembly 343 of the first guide arm 340, except for the components of the first guide arm 340 that will be particularly described.

[0129] The chain assembly 343 of the first guide arm 340 may be shorter in overall length than the chain assembly 323 of the first folding arm 320. This is because the first guide arm 340 needs to support the garment by operating more quickly than the first folding arm 320 during the process of folding the garment, and a length by which the chain assembly 343 of the first guide arm 340 needs to be extended is shorter than a length by which the chain assembly 323 of the first folding arm 320 needs to be extended.

[0130] With this configuration, the first guide arm 340 may guide the folding line of the garment while being extended in length along the second direction.

[0131] Meanwhile, the first guide arm 340 includes the fifth movement rail 344. The fifth movement rail 344 may be fixedly coupled to the lower plate 120. The fifth movement rail 344 may be coupled to be movable relative to the first guide chain housing 341 and configured to receive power from the fifth movement motor M5. The fifth movement rail 344 may guide the forward/rearward movement of the first guide chain housing 341.

[0132] For example, a screw thread may be formed on the fifth movement rail 344, and a groove may be formed in the first guide chain housing 341 and accommodate the screw thread of the fifth movement rail 344. Further, the fifth movement rail 344 may be connected to the fifth movement motor M5 by means of at least one gear and receive power generated by the operation of the fifth movement motor M5.

[0133] Therefore, when the fifth movement motor M5 operates, the first guide movement rail 344 may rotate to move the first guide chain housing 341.

[0134] Meanwhile, the first guide arm 340 includes the sixth movement rail 345. The sixth movement rail 345 may be fixedly coupled to the horizontal frame 130. The sixth movement rail 345 may be coupled to the first guide chain housing 341 and configured to receive power from the sixth movement motor M6. The sixth movement rail 345 may guide the upward/downward movement of the first guide chain housing 341.

[0135] For example, a rack gear may be formed on the sixth movement rail 345, and the sixth movement rail 345 may be connected to the sixth movement motor M6 by means of at least one gear that engages with the rack gear, such that the sixth movement rail 345 may receive power generated by the operation of the sixth movement

motor M6.

[0136] Therefore, when the sixth movement motor M6 operates, the sixth movement rail 345 may move to move the first guide chain housing 341.

[0137] Meanwhile, the upper and lower surfaces of the chain assembly 343 are surrounded by the film F. That is, the film F is provided to surround the chain assembly 343 in the leftward/rightward direction (second direction) of the garment folding machine 1. For example, one end of the film F may be fixedly coupled to the first guide chain housing 341, and the other end of the film F may be coupled to the first guide chain spring 346 to be described below.

[0138] The first guide arm 340 includes the first guide chain spring 346. The first guide chain spring 346 may be disposed at one side of the first guide chain housing 341. For example, the first guide chain spring 346 may be a spiral spring and disposed at a lower end of the first guide chain housing 341.

[0139] Therefore, when the chain assembly 343 is extended in length toward the inside of the garment folding machine 1 (along the second direction) as the first guide chain drive motor MC3 operates, the film F may be loosened while surrounding the upper and lower surfaces of the chain assembly 343 and extended in length together with the chain assembly 343. In contrast, when the operation of the first guide chain drive motor MC3 ends, the first guide chain spring 346 may pull the film F by the restoring force of the first guide chain spring 346 and pull the chain assembly 343 toward the inside of the first guide chain housing 341.

[0140] Therefore, the first guide arm 340 of the present disclosure may slide in the forward/rearward direction and the upward/downward direction of the garment folding machine 1 and guide the folding line of the garment by means of the change in length of the chain assembly 343.

[0141] The second guide arm 350 includes a second guide chain housing 351, a second guide chain gear 352, a chain assembly 353, a seventh movement rail 344, an eighth movement rail 345, a second guide chain spring 346, a second guide chain drive motor MC4, a seventh movement motor M7, and an eighth movement motor M8.

[0142] The second guide arm 350 may be disposed to face the first guide arm 340.

[0143] Meanwhile, in order to avoid the repeated description, the description of the configuration and effect of the first guide arm 340 may be applied to the description of the second guide arm 350 of the present disclosure, except for the components that will be particularly described.

[0144] That is, the second guide chain housing 351, the second guide chain gear 352, the chain assembly 353, the seventh movement rail 344, the eighth movement rail 345, the second guide chain spring 346, the second guide chain drive motor MC4, the seventh movement motor M7, and the eighth movement motor M8 of the second guide arm 350 may be respectively identical

in structures and functions to the first guide chain housing 341, the first guide chain gear 342, the chain assembly 343, the fifth movement rail 344, the sixth movement rail 345, the first guide chain spring 346, the first guide chain drive motor MC3, the fifth movement motor M5, and the sixth movement motor M6 of the first guide arm 340. Therefore, the same description may be applied.

[0145] The second guide arm 350 may slide in the upward/downward direction or the forward/rearward direction simultaneously with the first guide arm 340. In addition, the second guide arm 350, together with the first guide arm 340, may support the garment by changing the lengths of the chain assemblies 343 and 353.

[0146] Meanwhile, unlike the present embodiment, a single guide arm may be provided in another embodiment of the present disclosure. In this case, the guide arm may have the chain assembly longer in length than that of the first guide arm 340 or the second guide arm 350 according to the embodiment of the present disclosure. With this configuration, it is possible to maintain the guide function related to hemline folding or horizontal folding of the garment, reduce the number of components for overall folding, and improve spatial efficiency.

[0147] The folding bars 360 and 370 may be disposed at the rear side of the garment folding machine 1. For example, the folding bars 360 and 370 may be disposed as a pair of folding bars at the rear end of the garment folding machine 1. That is, the folding bars 360 and 370 may include the first folding bar 360 disposed at the rear left side of the garment folding machine 1, and the second folding bar 370 disposed at the rear right side of the garment folding machine 1. Meanwhile, the first folding bar 360 may be disposed at the rear right side of the garment folding machine 1, and the second folding bar 370 may be disposed at the rear left side of the garment folding machine 1.

[0148] The first folding bar 360 and the second folding bar 370 may fold the garment while moving upward and rotating.

[0149] Specifically, the first folding bar 360 includes a first bar main body 361, a ninth movement rail 364, a tenth movement rail 365, a first bar rotation motor MB1, a ninth movement motor M9, and a tenth movement motor M10.

[0150] At least a part of the garment, particularly, a sleeve of the garment may be placed on the first bar main body 361, and the garment may be folded by a movement of the first bar main body 361. For example, the first bar main body 361 may be formed in a rod shape and disposed approximately in parallel with the ground surface. One end of the first bar main body 361 may be formed to be bent downward and connected to the first bar rotation motor MB1 by means of at least one gear. With this configuration, when the first bar rotation motor MB1 rotates, the first bar main body 361 may rotate about one end of the first bar main body 361.

[0151] Therefore, in a state in which the folding arms 320 and 330 push and support the garment, a part of the

garment including the sleeve is placed on the first bar main body 361. When the first bar main body 361 moves and rotates, the vertical folding may be performed along the guide line determined as outer ends of the folding arms 320 and 330.

[0152] Meanwhile, the first folding bar 360 includes the ninth movement rail 364. The ninth movement rail 364 may be fixedly coupled to the support plate 390. The ninth movement rail 364 may be coupled to be movable relative to a gearbox embedded with the first bar rotation motor MB1, and the ninth movement rail 364 may be configured to receive power from the ninth movement motor M9. The ninth movement rail 364 may guide the leftward/rightward movement of the first bar main body 361.

[0153] For example, the ninth movement rail 364 may be connected to the ninth movement motor M9 by means of at least one gear and receive power generated by the operation of the ninth movement motor M9.

[0154] Therefore, when the ninth movement motor M9 operates, the first bar main body 361 and the gearbox embedded with the first bar rotation motor MB1 may move.

[0155] Meanwhile, the first folding bar 360 includes the tenth movement rail 365. The tenth movement rail 365 may be coupled to the gearbox embedded with the first bar rotation motor MB1, and the tenth movement rail 365 may be configured to receive power from the tenth movement motor M10. The tenth movement rail 365 may guide the upward/downward movements of the first bar main body 361 and the gearbox embedded with the first bar rotation motor MB1.

[0156] Therefore, when the tenth movement motor M10 operates, the tenth movement rail 365 may move to move the first bar main body 361 and the gearbox embedded with the first bar rotation motor MB1 in the upward/downward direction.

[0157] The second folding bar 370 includes a second bar main body 371, an eleventh movement rail 374, a twelfth movement rail 375, a second bar rotation motor MB2, an eleventh movement motor M11, and a twelfth movement motor M12.

[0158] The second folding bar 370 and the first folding bar 360 may be disposed symmetrically.

[0159] Meanwhile, in order to avoid the repeated description, the description of the configuration and effect of the first folding bar 360 may be applied to the description of the second folding bar 370 of the present disclosure, except for the components that will be particularly described.

[0160] That is, the second bar main body 371, the eleventh movement rail 374, the twelfth movement rail 375, the second bar rotation motor MB2, the eleventh movement motor M11, and the twelfth movement motor M12 of the second folding bar 370 may be respectively identical in structures and functions to the first bar main body 361, the ninth movement rail 364, the tenth movement rail 365, the first bar rotation motor MB1, the ninth move-

ment motor M9, and the tenth movement motor M10 of the first folding bar 360. Therefore, the same description may be applied.

[0161] The first folding bar 360 and the second folding bar 370 may rotate sequentially. For example, the first folding bar 360 may rotate first and perform the vertical folding on one side of the garment, and then the second folding bar 370 may rotate and perform the vertical folding on the other side of the garment. This is to prevent a collision that may occur when the first folding bar 360 and the second folding bar 370 rotate simultaneously.

[0162] The folding plate 380 may be rotatably coupled to the loading plate 310 and rotated by the folding arms 320 and 330. For example, the folding plate 380 may be formed in a flat plate shape and coupled to the loading plate 310 by means of a hinge 381. In this case, an axis of the hinge 381 may be disposed in the second direction.

[0163] The folding plate 380 may be disposed below at least a part of the garment and support a lower side of a part of the garment. Therefore, when the folding plate 380 rotates about the hinge 381, the folding plate 380 and the loading plate 310 overlap each other, such that the garment provided between the folding plate 380 and the loading plate 310 is folded.

[0164] With this configuration, when the chain assemblies 323 and 333 of the folding arms 320 and 330 are extended in length and rotate the folding plate 380 in the state in which the garment is placed at the upper sides of the loading plate 310 and the folding plate 380, the garment may be horizontally folded along the hinge 381 as a reference line.

[0165] Meanwhile, although not illustrated, the folding plate 380 may have a torsion spring. In case that the folding plate 380 is folded, the torsion spring coupled to the hinge 381 may apply a restoring force to return the folding plate 380 to an original position. Therefore, when the lengths of the chain assemblies 323 and 333 of the folding arms 320 and 330 are decreased, the folding plate 380 may return to the original position while being rotated by the restoring force of the torsion spring.

[0166] The loading plate 310 may be disposed above the support plate 390, and the folding arms 320 and 330, the guide arms 340 and 350, and the folding bars 360 and 370 may be coupled to the support plate 390. For example, the support plate 390 may be formed in a flat plate shape and coupled to the horizontal frame 130.

[0167] Meanwhile, although not illustrated, at least a part of a middle portion of the support plate 390 may be formed in an opened shape. With this configuration, the chain assemblies 323 and 333 of the folding arms 320 and 330 may be disposed below the folding plate 380 and extended in length without interfering with the support plate 390. In addition, the conveyor 410 may come into contact with the loading plate 310 and move the loading plate 310. In addition, a space in which the folded garment is unloaded may be provided.

[0168] The unloading unit 400 may transfer the garment folded by the folding unit 300.

[0169] For example, the unloading unit 400 may include the conveyor 410 configured to move the loading plate 310, and a conveyor drive motor MU configured to provide power to the conveyor 410. When the conveyor drive motor MU operates, the conveyor 410 may move the loading plate 310 and move the garment, which is positioned on the loading plate 310, to a position to which a user's hand is easily accessible.

[0170] In addition, the unloading unit 400 may further include a rail (not illustrated) and a plate lifting motor (not illustrated) for lifting a rear end of the loading plate 310 upward. The unloading unit 400 may lift one end of the loading plate 310, on which the garment is placed, and allow the loading plate 310 to have a predetermined angle with respect to the ground surface so that the garment may slide along the loading plate 310 and move to the lower plate 120. In this case, the folding arms 320 and 330 and the folding bars 360 and 370 may move to two opposite sides in the leftward/rightward direction to define a space so that the user easily takes out the garment.

[0171] Meanwhile, FIG. 22 is a block diagram for explaining a configuration for controlling the garment folding machine according to the embodiment of the present disclosure.

[0172] The configuration for controlling the garment folding machine according to the embodiment of the present disclosure will be described with reference to FIG. 22.

[0173] A control unit 500 may control the loading unit 200, the folding unit 300, and the unloading unit 400.

[0174] The control unit 500 is provided to control an operation of the garment folding machine 1 based on the user's instruction applied through an input unit (not illustrated). The control unit 500 may include a printed circuit board and elements mounted on the printed circuit board. When the user selects types of garments or folding courses through the input unit and then inputs a control instruction for the operation, the control unit 500 may control the operation of the garment folding machine 1 based on a preset algorithm.

[0175] Meanwhile, the control unit 500 may be electrically connected to the input unit (not illustrated) to receive a user's control instruction, and electrically connected to the display unit 700 and the alarm unit 800 to provide the display unit 700 and the alarm unit 800 with the information on the operating state of the garment folding machine 1, thereby transmitting the corresponding information to the user.

[0176] In addition, the control unit 500 controls a power conversion part 510 and a current detection part 520. The power conversion part 510 converts power, which is inputted from an external power source 600, and supplies the power to the loading unit 200, the folding unit 300, and the unloading unit 400. The current detection part 520 detects the electric current supplied from the power conversion part 510 to the loading unit 200, the folding unit 300, and the unloading unit 400.

[0177] In addition, the control unit 500 may further in-

clude a memory 530 configured to store information inputted in advance or inputted through the input unit (not illustrated), and the timer 540 capable of measuring the time.

[0178] Meanwhile, the control unit 500 may be electrically connected to the loading unit 200, the folding unit 300, and the unloading unit 400 so as to transmit or receive signals therebetween.

[0179] For example, the control unit 500 may transmit a drive control signal to the loading unit motor ML of the loading unit 200. In addition, the control unit 500 may receive signals, which indicate the position of the clip assembly 220 and whether the garment remains on the loading unit 200, from the clip position detection sensors SL1, SL2, and SL3 and the garment detection sensor SC of the loading unit 200.

[0180] In addition, the control unit 500 may transmit drive control signals to the plurality of motors MC1, MC2, MC3, MC4, MB1, MB2, M1, M2, M3, M4, M5, M6, M7, M8, M9, M10, M11, and M12 of the folding unit 300. In addition, although not illustrated, the control unit 500 may receive signals, which indicate whether the loading plate 310, the first folding arm 320, the second folding arm 330, the first guide arm 340, the second guide arm 350, the first folding bar 360, the second folding bar 370, and the folding plate 380 operate at accurate positions, from the sensors provided in the folding unit 300.

[0181] In addition, the control unit 500 may transmit a drive control signal to the conveyor drive motor MU of the unloading unit 400. In addition, although not illustrated, the control unit 500 may receive signals, which indicate whether the garment is unloaded, from the sensors provided in the unloading unit 400.

[0182] With this configuration, the control unit 500 may determine whether the garment C passes, and the control unit 500 may perform the hemline folding, the vertical folding, or the horizontal folding on the garment C.

[0183] A specific control operation of the control unit 500 according to the present disclosure will be described below.

[0184] FIGS. 9 to 21 are views for explaining a process in which the garment is folded by the garment folding machine according to the embodiment of the present disclosure, and FIG. 23 is a flowchart for explaining a method of controlling the garment folding machine according to the embodiment of the present disclosure.

[0185] The method of controlling the garment folding machine according to the embodiment of the present disclosure will be described below with reference to FIGS. 1 to 23.

[0186] The method of controlling the garment folding machine according to the embodiment of the present disclosure includes a loading step S100, a folding step S200, and an unloading step S300.

[0187] In the loading step S100, the garment is loaded into the garment folding machine 1.

[0188] In the loading step S100, when the garment enters the holding position, the control unit 500 may operate

the clip assembly 220 to hold the garment. In the state in which the clip assembly 220 holds the garment, the control unit 500 may move the clip assembly 220 to transfer the garment to the loading plate 310.

[0189] Specifically, when the garment enters the holding position, the control unit 500 identifies whether the garment C enters the holding position by means of the clip part sensor (not illustrated). When the control unit 500 identifies that the garment C enters the holding position, the control unit 500 operates the electromagnetic driving member and performs control so that the clip assembly 220 may automatically hold the garment C while being closed.

[0190] Meanwhile, as another method, the user may operate the electromagnetic driving member by loading the garment C to the holding position in the clip assembly 220 and then manipulating an input means such as an operation start button, or a touch screen.

[0191] When the garment is completely held at the first position corresponding to the initial position, the control unit 500 performs control so that the clip assembly 220 draws the garment into the garment folding machine 1 and moves the garment to the second position corresponding to the loading position on the upper surface of the loading plate 310 while holding the garment and moving rearward by a predetermined distance. When the clip assembly 220 completely moves to the second position, the clip assembly 220 releases the garment.

[0192] That is, when the process of holding the garment C is completed by closing the clip assembly 220, the operation of the loading unit motor ML is initiated, and the clip assembly 220 is moved to the second position disposed rearward of the first position and then stopped.

[0193] Next, the control unit 500 may perform control to move the clip assembly 220 to the third position. That is, after the clip assembly 220 releases the garment, the clip assembly 220 is moved to the third position, which is disposed rearward of the second position, and then stopped.

[0194] Meanwhile, the garment folding machine 1 of the present disclosure may use the garment detection sensor SC and determine that a length of the garment is equal to or longer than a predetermined length. When a length of the garment is equal to or longer than the predetermined length, the garment folding machine 1 may perform a hemline folding function (S150).

[0195] Specifically, the control unit 500 may use the stop position detection sensor SL3 and identify whether the clip assembly 220 has reached the third position. When the control unit 500 identifies that the clip assembly 220 has reached the third position, the control unit 500 may stop the loading unit motor ML and use the garment detection sensor SC to identify whether the garment is present on the loading part 210.

[0196] In this case, when the garment detection sensor SC detects that the garment remains on the loading part 210, the control unit 500 may perform the hemline folding

step S200.

[0197] That is, in case that the length of the garment is equal to or longer than the predetermined length, the front-end of the garment may be placed on the loading plate 310, and the rear end of the garment may still remain on the loading part 210 when the clip assembly 220 releases the garment. Therefore, when the garment detection sensor SC detects that the garment remains on the loading part 210, the control unit 500 may determine that the length of the garment is equal to or longer than a preset hemline folding length L, and the control unit 500 may perform the hemline folding step S200. In this case, the hemline folding length L may be set to be shorter than a shortest distance from the front-end of the garment to the loading part 210. In case that a length of the hemline is excessively short, the hemline slips out again after the hemline folding is performed. Therefore, the above-mentioned configuration is provided to fold the garment with a predetermined length of allowance.

[0198] Meanwhile, according to the embodiment, before the hemline folding step S200, the loading plate 310, on which the garment is placed, may be moved by a predetermined distance to facilitate the hemline folding on the garment. That is, the control unit 500 may perform control to operate the conveyor drive motor MU so that the conveyor 410 moves the loading plate 310 forward or rearward by a predetermined distance. This is to prevent a situation in which it is difficult to perform the hemline folding to the accurate size when the garment is creased while moving downward to the loading plate 310 or when tension is applied to the garment because of a difference in height between the loading part 210 and the loading plate 310.

[0199] In contrast, when the garment detection sensor SC detects that no garment is present on the loading part 210, the hemline folding step S200 may not be performed, and the vertical folding step S300 may be performed.

[0200] In the hemline folding step S200, in case that a length of the loaded garment is equal to or longer than a predetermined length, the garment may be folded by setting a folding line perpendicular to the direction in which the garment is loaded.

[0201] In the hemline folding step S200, the garment may be fixed by the first guide arm 340 and the second guide arm 350, and the first folding arm 320 and the second folding arm 330 may be used to push the garment, such that the hemline of the garment may be folded.

[0202] First, the control unit 500 may operate the fifth movement motor M5 and the sixth movement motor M6 and move the first guide arm 340 to a preset hemline folding guide position. In addition, the control unit 500 may operate the seventh movement motor M7 and the eighth movement motor M8 and move the second guide arm 350 to a preset hemline folding guide position. In this case, the first guide arm 340 and the second guide arm 350 may be disposed at positions facing each other (S210).

[0203] In this case, the hemline folding means that the garment is folded along a vertical reference line based on the proceeding direction (loading direction) of the garment in case that a length by which the garment is loaded is equal to or longer than a predetermined length. The direction perpendicular to the proceeding direction of the garment is not limited to a configuration in which a line in the proceeding direction of the garment and a folding line are perfectly disposed at 90 degrees, but the direction perpendicular to the proceeding direction of the garment includes a configuration in which the line in the proceeding direction of the garment and the folding line are disposed within an error range of 0 degree to 30 degrees.

[0204] Next, the control unit 500 may operate the first guide chain drive motor MC3 and the second guide chain drive motor MC4. In this case, the chain assemblies 343 and 353 may be extended in length while being stretched and disposed above the garment. The chain assemblies 343 and 353 may be extended in length to a length at which the upper surface of the garment may be pushed. In this case, the control unit 500 may operate the sixth movement motor M6 and the eighth movement motor M8 and move the first guide chain housing 341 and the second guide chain housing 351 downward. Therefore, the chain assembly 343 of the first guide arm 340 and the chain assembly 353 of the second guide arm 350 may push the garment with predetermined pressure while moving downward. Therefore, the garment may be supported by the first guide arm 340 and the second guide arm 350, and a hemline folding position may be guide (S220).

[0205] Meanwhile, the control unit 500 may operate the first movement motor M1 and the second movement motor M2 and move the first folding arm 320 to the preset hemline folding position. In addition, the control unit 500 may operate the third movement motor M3 and the fourth movement motor M4 and move the second folding arm 330 to the preset hemline folding position. In this case, the first folding arm 320 and the second folding arm 330 may be disposed at positions parallel to each other (S230).

[0206] Next, the control unit 500 may operate the first chain drive motor MC1 and the second chain drive motor MC2. In this case, the timing at which the control unit 500 operates the first chain drive motor MC1 and the second chain drive motor MC2 is set at least after the chain assemblies 343 and 353 of the first and second guide arms 340 and 350 are extended in length.

[0207] In this case, the chain assemblies 322 and 333 may be extended in length while being stretched. The chain assemblies 322 and 333 may be extended in length to a length at which the garment placed on the loading part 210 and the loading plate 310 may be pushed. Therefore, the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 may push the garment with predetermined pressure in the direction in which the lengths thereof increase. Therefore, in the state in which the garment is supported

by the first guide arm 340 and the second guide arm 350, the hemline of the garment is folded by being pushed by the first folding arm 320 and the second folding arm 330 (S240).

[0208] In the vertical folding step S300, the garment may be folded by setting a folding line in the direction in which the garment is loaded, after the hemline folding step S200.

[0209] In the vertical folding step S300, the garment may be fixed by the first folding arm 320 and the second folding arm 330, and the garment may be folded along a vertical line by using the first folding bar 360 and the second folding bar 370.

[0210] First, in a state in which the hemline folding step S200 has been performed, the control unit 500 may continuously operate the first chain drive motor MC1 and the second chain drive motor MC2 and further increase the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330. In this case, the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 may be extended in length to maximum lengths (S310).

[0211] Further, the control unit 500 may operate the first guide chain drive motor MC3, the second guide chain drive motor MC4, the sixth movement motor M6, and the eighth movement motor M8 and remove the chain assembly 343 of the first guide arm 340 and the chain assembly 353 of the second guide arm 350 from the garment while the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 are extended in length. In this case, motor operation directions of the first guide chain drive motor MC3, the second guide chain drive motor MC4, the sixth movement motor M6, and the eighth movement motor M8 are opposite to operation directions of the first guide chain drive motor MC3, the second guide chain drive motor MC4, the sixth movement motor M6, and the eighth movement motor M8 in the hemline folding step S200 (S320).

[0212] Meanwhile, in case that the vertical folding step S300 is immediately performed without performing the hemline folding step S200, the control unit 500 may extend the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 to the maximum lengths by operating only the first chain drive motor MC1 and the second chain drive motor MC2 without operating the first guide chain drive motor MC3, the second guide chain drive motor MC4, the sixth movement motor M6, and the eighth movement motor M8 (S310').

[0213] Meanwhile, after the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 are extended in length to the maximum lengths, the control unit 500 may adjust an interval between the first folding arm 320 and the second folding arm 330 by operating the first movement motor M1 and the third movement motor M3, as necessary. In

this case, the first folding arm 320 and the second folding arm 330 may slide along the second direction. For example, the first folding arm 320 and the second folding arm 330 may symmetrically and simultaneously move to be close to or distant from each other. As another example, the first folding arm 320 or the second folding arm 330 may move independently (S330). Therefore, it is possible to adjust a width by which the garment is folded by adjusting the interval between the first folding arm 320 and the second folding arm 330.

[0214] After the adjustment of the interval between the first folding arm 320 and the second folding arm 330 ends, the control unit 500 may perform control to operate the second movement motor M2 and the fourth movement motor M4 so that the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 push and support the garment (S340). In this case, the control unit 500 operates the second movement motor M2 and the fourth movement motor M4 so that the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 move downward. Therefore, the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 may push the garment with predetermined pressure while moving downward. Therefore, the garment may be supported by the first folding arm 320 and the second folding arm 330, and the vertical folding position may be guided (S340).

[0215] In this case, the vertical folding means that the garment is folded about a reference line parallel to the proceeding direction of the garment. The direction parallel to the proceeding direction of the garment is not limited to a configuration in which the line in the proceeding direction of the garment and the folding line are perfectly disposed at 0 degree, but the direction parallel to the proceeding direction of the garment includes a configuration in which the line in the proceeding direction of the garment and the folding line are disposed within an error range of 0 degree to 30 degrees.

[0216] Meanwhile, in the state in which the garment is supported by the first folding arm 320 and the second folding arm 330, the sleeve of the garment may deviate from the loading plate 310 and sag downward by gravity. Alternatively, in case that a protruding projection 311 is formed on the loading plate 310 (see FIG. 17), the two opposite ends of the garment based on the leftward/rightward direction or the sleeve may be caught by the protruding projection 311. In this state, the control unit 500 may perform control to move the first folding bar 360 and the second folding bar 370 so that the first bar main body 361 and the second bar main body 371 support the sleeve of the garment. That is, the control unit 500 may operate the ninth movement motor M9, the tenth movement motor M10, the eleventh movement motor M11, and the twelfth movement motor M12 and move the first folding bar 360 and the second folding bar 370 to the positions at which the first bar main body 361 and the second bar main body 371 come into contact with the sleeve of the garment

(S350).

[0217] Thereafter, the control unit 500 may operate the tenth movement motor M10 and the twelfth movement motor M12 and move the first bar main body 361 and the second bar main body 371 upward (S360). With this configuration, the sleeve of the garment may be lifted, and the reference line for the vertical folding may be formed on the garment (S360).

[0218] Next, the control unit 500 may operate the first bar rotation motor MB1 and the second bar rotation motor MB2, such that the first bar main body 361 and the second bar main body 371 may rotate and shake (or push) the sleeve of the garment, such that the vertical folding of the garment may be completed. Meanwhile, the first bar main body 361 and the second bar main body 371 may rotate simultaneously. However, the first bar main body 361 and the second bar main body 371 may rotate at a predetermined time interval. This is to prevent a collision between the first bar main body 361 and the second bar main body 371 while the first bar main body 361 and the second bar main body 371 rotate (S370).

[0219] A horizontal folding step S400 may be performed after the rotation of the first folding bar 360 and the rotation of the second folding bar 370 end.

[0220] In the horizontal folding step S400, the garment may be folded by setting a folding line perpendicular to the direction in which the garment is loaded, after the vertical folding step S300.

[0221] In the horizontal folding step S400, the folding plate 380 may be rotated by the first folding arm 320 and the second folding arm 330, and the folding plate 380 may fold the garment by the rotational motion.

[0222] In this case, the horizontal folding means that the garment is folded about a reference line perpendicular to the proceeding direction (loading direction) of the garment. The direction perpendicular to the proceeding direction of the garment is not limited to a configuration in which a line in the proceeding direction of the garment and a folding line are perfectly disposed at 90 degrees, but the direction perpendicular to the proceeding direction of the garment includes a configuration in which the line in the proceeding direction of the garment and the folding line are disposed within an error range of 0 degree to 30 degrees.

[0223] First, the control unit 500 moves the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 upward and decreases the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330. That is, the control unit 500 may operate the second movement motor M2 and the fourth movement motor M4 to move the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330. The control unit 500 may operate the first chain drive motor MC1 and the second chain drive motor MC2 to decrease the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding

arm 330. In this case, the operation directions of the second movement motor M2, the fourth movement motor M4, the first chain drive motor MC1, and the second chain drive motor MC2 are opposite to the operation directions in the vertical folding step S300. In addition, the control unit 500 may decrease the lengths when the front-end of the chain assembly 323 of the first folding arm 320 and the front-end of the chain assembly 333 of the second folding arm 330 are disposed to be closer to the front side of the garment folding machine 1 than a front end of the folding plate 380 (S410).

[0224] Thereafter, the control unit 500 operates the second movement motor M2 and the fourth movement motor M4 to move the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 downward to a predetermined horizontal folding preparation height h3. In this case, a height from the ground surface to the horizontal folding preparation height h3 may be smaller than a height at which the folding plate 380 is disposed based on the ground surface. That is, the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 move downward to be closer to the ground surface than the folding plate 380.

[0225] Therefore, the front-end of the chain assembly 323 of the first folding arm 320 and the front-end of the chain assembly 333 of the second folding arm 330 are positioned at positions closer to the front lower side than the end of the folding plate 380.

[0226] Meanwhile, according to the embodiment, the horizontal folding step S400 may further include step S415 of guiding a horizontal folding position by means of the first guide arm 340 and the second guide arm 350.

[0227] For example, the control unit 500 may operate the fifth movement motor M5 and the sixth movement motor M6 and move the first guide arm 340 to a preset horizontal folding guide position. In addition, the control unit 500 may operate the seventh movement motor M7 and the eighth movement motor M8 and move the second guide arm 350 to the preset horizontal folding guide position. In this case, the first guide arm 340 and the second guide arm 350 may be disposed at positions facing each other.

[0228] Next, the control unit 500 may operate the first guide chain drive motor MC3 and the second guide chain drive motor MC4. In this case, the chain assemblies 343 and 353 may be extended in length while being stretched and disposed above the garment. The chain assemblies 343 and 353 may be extended in length to a length at which the upper surface of the garment may be pushed. In this case, the control unit 500 may operate the sixth movement motor M6 and the eighth movement motor M8 and move the first guide chain housing 341 and the second guide chain housing 351 downward. Therefore, the chain assembly 343 of the first guide arm 340 and the chain assembly 353 of the second guide arm 350 may push the garment with predetermined pressure while moving downward. Therefore, the garment may be sup-

ported by the first guide arm 340 and the second guide arm 350, and the horizontal folding position may be guided. In this case, the horizontal folding line of the garment may become clearer, and the garment may be folded neatly.

[0229] The control unit 500 operates the first chain drive motor MC1 and the second chain drive motor MC2 and increases the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330. Therefore, the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 are extended in length along the first direction. Further, the control unit 500 operates the second movement motor M2 and the fourth movement motor M4 and moves the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 upward to a predetermined plate turning height h4. In this case, the plate turning height h4 is higher than the horizontal folding preparation height h3. In this case, the extension in length of the chain assemblies 323 and 333 and the upward movements of the chain assemblies 323 and 333 may, of course, be performed simultaneously. Alternatively, the extension in length and the upward movements may be alternately performed. In addition, the extension in length and the upward movements may be performed simultaneously after the chain assemblies 323 and 333 are extended by predetermined lengths (S420).

[0230] Therefore, the folding plate 380 may fold the garment while being rotated and inverted by the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330.

[0231] After the horizontal folding is performed by rotating the folding plate 380, the control unit 500 may return the first folding arm 320, the second folding arm 330, the first guide arm 340, and the second guide arm 350 to the original positions (S430).

[0232] For example, the control unit 500 moves the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330 upward and decreases the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330. That is, the control unit 500 may operate the second movement motor M2 and the fourth movement motor M4 to move the chain assembly 323 of the first folding arm 320 and the chain assembly 333 of the second folding arm 330. The control unit 500 may operate the first chain drive motor MC1 and the second chain drive motor MC2 to decrease the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330 until the length of the chain assembly 323 of the first folding arm 320 and the length of the chain assembly 333 of the second folding arm 330 become minimum lengths. In addition, the control unit 500 operates the first movement motor M1 and the third movement motor M3 so that the first chain housing 321

and the second chain housing 331 are farthest in distance. Therefore, according to the garment folding machine 1 of the present disclosure, after the horizontal folding, the volumes of the first folding arm 320 and the second folding arm 330 may be minimized, and the distance between the first folding arm 320 and the second folding arm 330 may be increased, such that the space in which the garment may be unloaded may be maximized.

[0233] Further, the control unit 500 moves the chain assembly 343 of the first guide arm 340 and the chain assembly 353 of the second guide arm 350 upward and decreases the length of the chain assembly 343 of the first guide arm 340 and the length of the chain assembly 353 of the second guide arm 350. That is, the control unit 500 may operate the sixth movement motor M6 and the eighth movement motor M8 to move the chain assembly 343 of the first guide arm 340 and the chain assembly 353 of the second guide arm 350 upward. The control unit 500 may operate the first guide chain drive motor MC3 and the second guide chain drive motor MC4 to decrease the length of the chain assembly 343 of the first guide arm 340 and the length of the chain assembly 353 of the second guide arm 350 so that the length of the chain assembly 343 of the first guide arm 340 and the length of the chain assembly 353 of the second guide arm 350 become minimum lengths.

[0234] Meanwhile, when the first folding arm 320 and the second folding arm 330 are contracted in length, the folding plate 380 is returned to the original position by the restoring force of the torsion spring.

[0235] Meanwhile, in an unloading step S500, the folded garment may be transferred, such that the user may easily take out the garment.

[0236] In the unloading step S500, the control unit 500 may transfer the garment, which is placed on the loading plate 310, to a position to which the user's hand is easily accessible.

[0237] For example, in the unloading step S500, the control unit 500 may operate the conveyor drive motor MU and move the loading plate 310 by the transfer motion of the conveyor 410. In addition, the control unit 500 may control the plate lifting motor (not illustrated) and lift the rear end of the loading plate 310. Therefore, the garment, which is placed on the loading plate 310, may be transferred to a portion between the pair of folding arms (i.e., the first folding arm 320 and the second folding arm 330).

[0238] Therefore, according to the present disclosure, obstacles in the space, in which the garment is transferred, may be removed while the garment is unloaded, such that the garment may be automatically unloaded.

[0239] While the present disclosure has been described with reference to the specific embodiments, the specific embodiments are only for specifically explaining the present disclosure, and the present disclosure is not limited to the specific embodiments. It is apparent that the present disclosure may be modified or altered by those skilled in the art without departing from the technical spirit of the present disclosure.

[0240] All the simple modifications or alterations to the present disclosure fall within the scope of the present disclosure, and the specific protection scope of the present disclosure will be defined by the appended claims.

Claims

1. A garment folding machine comprising:
 - a frame unit configured to define an external framework;
 - a loading unit into which a garment is loaded; and
 - a folding unit configured to fold the garment loaded into the loading unit,
 wherein the folding unit comprises:
 - a folding arm configured to be extended in length along a first direction to push and fold the garment; and
 - a guide arm configured to be extended in length along a second direction intersecting the first direction to come into contact with and support the garment.
2. The garment folding machine of claim 1, wherein the folding arm rectilinearly moves along the first direction when the garment loaded into the loading unit has a length equal to or longer than a predetermined length.
3. The garment folding machine of claim 1, wherein the folding arm moves downward along a gravitational direction and comes into contact with and supports the garment.
4. The garment folding machine of claim 3, wherein the folding arm supports the garment by moving downward along the gravitational direction in a state in which the folding arm is extended in length along the first direction.
5. The garment folding machine of claim 3, wherein the folding arm slides along the second direction and adjusts a width by which the garment is folded.
6. The garment folding machine of claim 3, wherein the folding unit further comprises a folding bar configured to fold the garment by the rotational motion.
7. The garment folding machine of claim 1, wherein the folding unit further comprises a folding plate, configured to support a lower side of the garment, and folding the garment by being rotated by the folding arm.
8. The garment folding machine of claim 7, wherein the

folding arm moves downward to be closer to a ground surface than the folding plate and extended in length along the first direction to rotate the folding plate.

9. The garment folding machine of claim 1, wherein the folding arm comprises a chain assembly in which a plurality of chains is hingedly coupled along the first direction, and a length of the chain assembly changes in accordance with relative rotations between the chains.

10. The garment folding machine of claim 9, wherein the chain comprises:

a chain main body configured to accommodate therein a shaft and a torsion spring;
a stopper protruding from the chain main body;
and
a support projection formed with a stepped portion on the chain main body, and
wherein when the chain assembly is stretched, the stopper of the chain, which is disposed in a front-end direction, is brought into contact with and supported by the support projection of the chain disposed in a rear end direction.

11. The garment folding machine of claim 9, wherein the folding arm comprises a film configured to surround the chain assembly along a length change direction of the chain assembly.

12. A method of controlling a garment folding machine, the method comprising:

a loading step of loading a garment;
a hemline folding step of folding the garment by setting a folding line perpendicular to a direction in which the garment is loaded when a length of the loaded garment is equal to or longer than a predetermined length;
a vertical folding step of folding the garment by setting a folding line in the direction in which the garment is loaded after the hemline folding step;
and
a horizontal folding step of folding the garment by setting a folding line perpendicular to the direction in which the garment is loaded after the vertical folding step.

13. The method of claim 12, wherein in the hemline folding step, the garment is folded when the garment remains on a loading part, into which the garment is loaded, after the loading step.

14. The method of claim 12, wherein in the hemline folding step, a folding arm is extended in length and pushes and folds the garment, and wherein in the vertical folding step, the folding arm,

which is extended in length in the hemline folding step, moves downward along a gravitational direction and pushes and supports the garment.

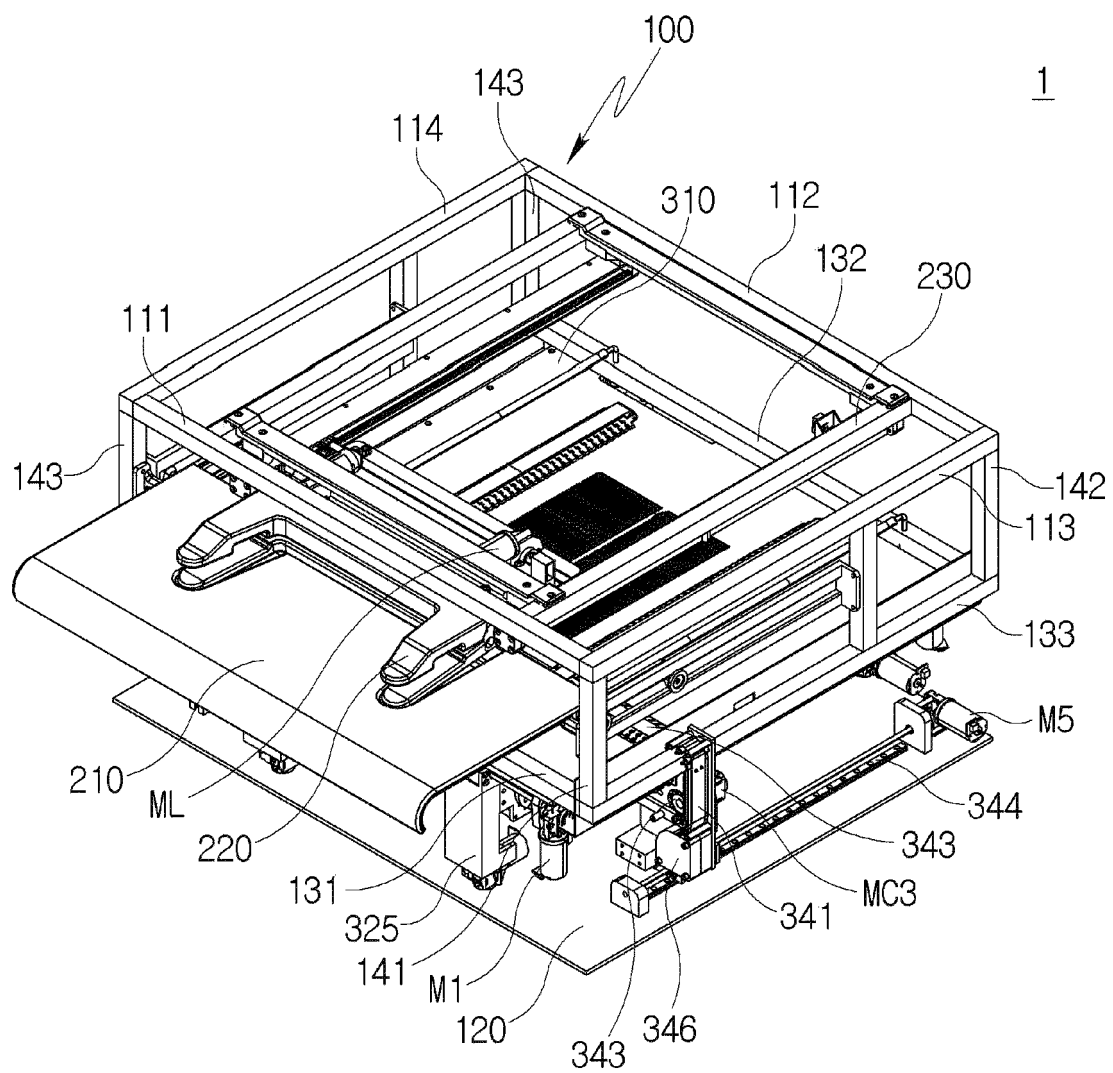
15. The method of claim 12, wherein in the vertical folding step, a folding arm moves downward, in a state in which the folding arm is extended in length, and the folding arm pushes and supports the garment, and wherein in the horizontal folding step, the folding arm is contracted in length and moves downward, and then the folding arm is extended in length again and pushes a folding plate to fold the garment.

16. The method of claim 12, wherein in the horizontal folding step, after a pair of folding arms is extended in length and rotates a folding plate, the pair of folding arms moves so that an interval between the pair of folding arms increases, and the pair of folding arms is contracted in length.

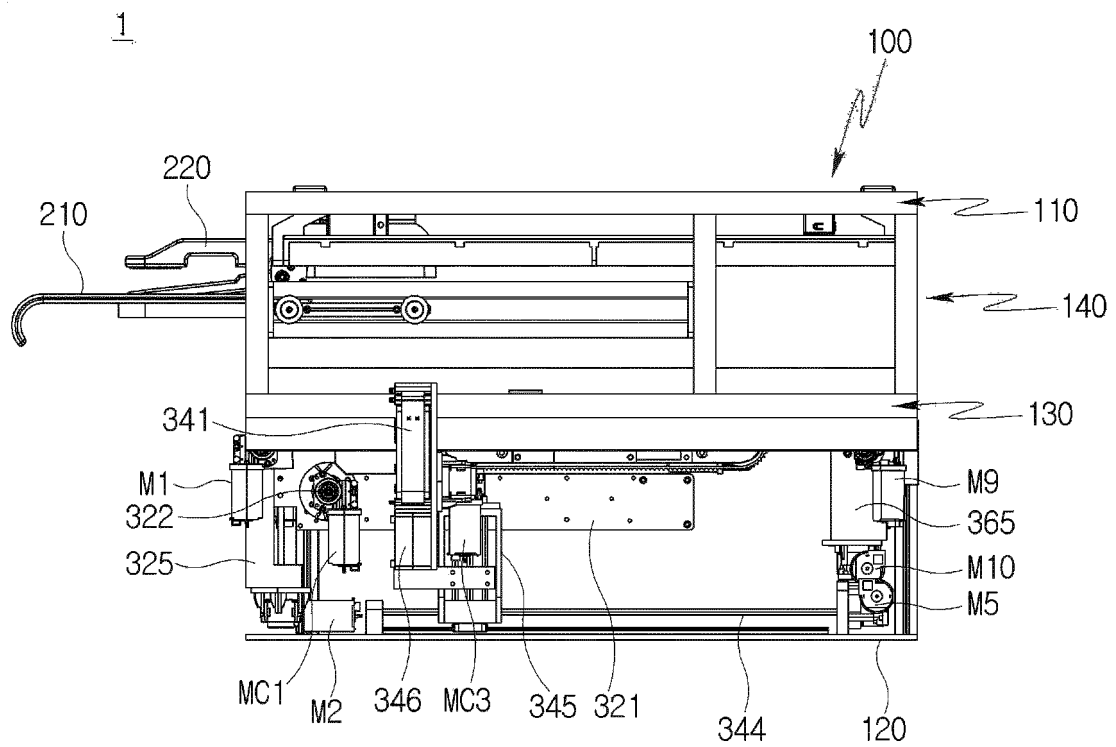
17. The method of claim 16, further comprising:

an unloading step of transferring the garment after the horizontal folding step, wherein in the unloading step, the garment is transferred to a portion between the pair of folding arms.

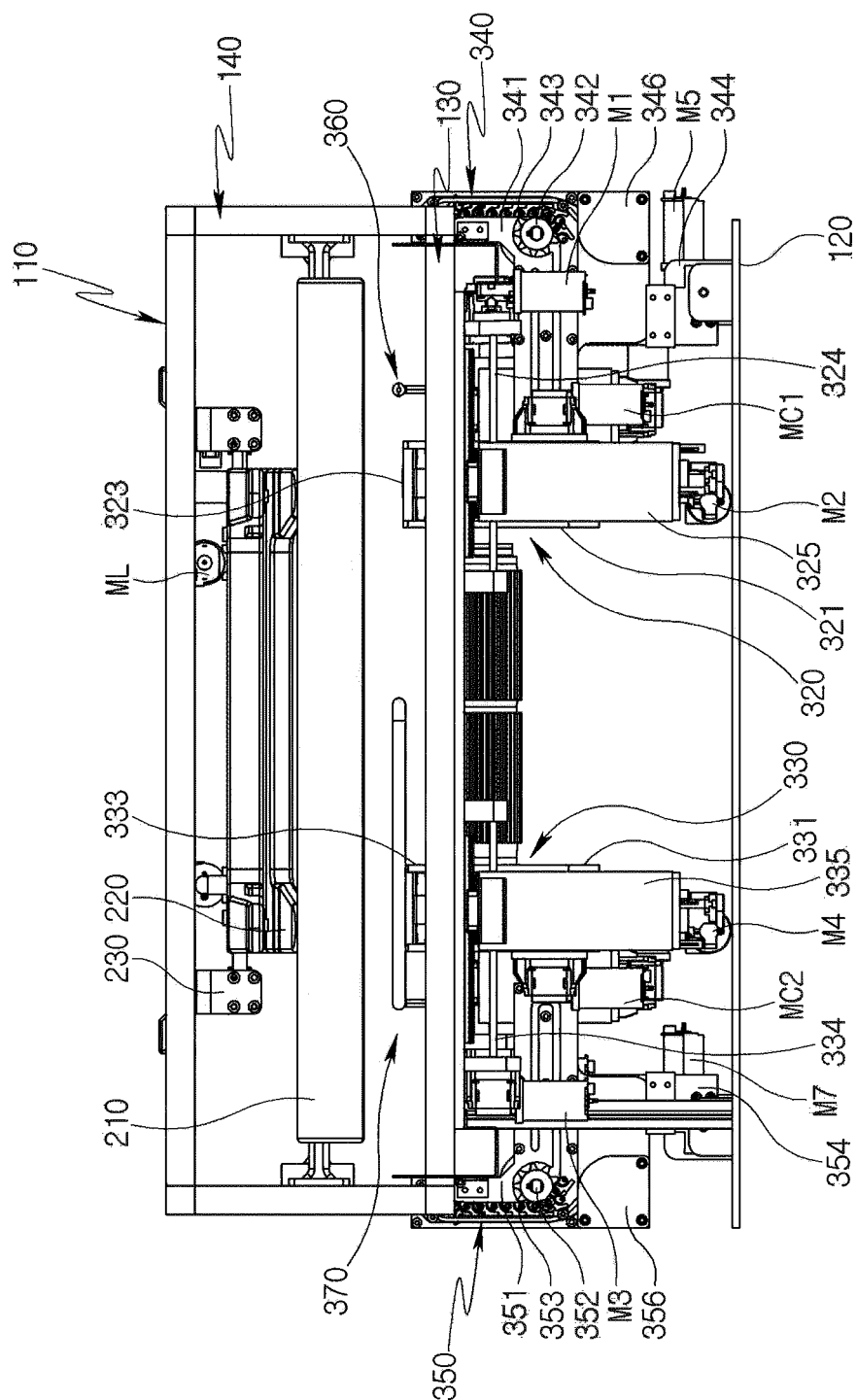
[FIG. 1]



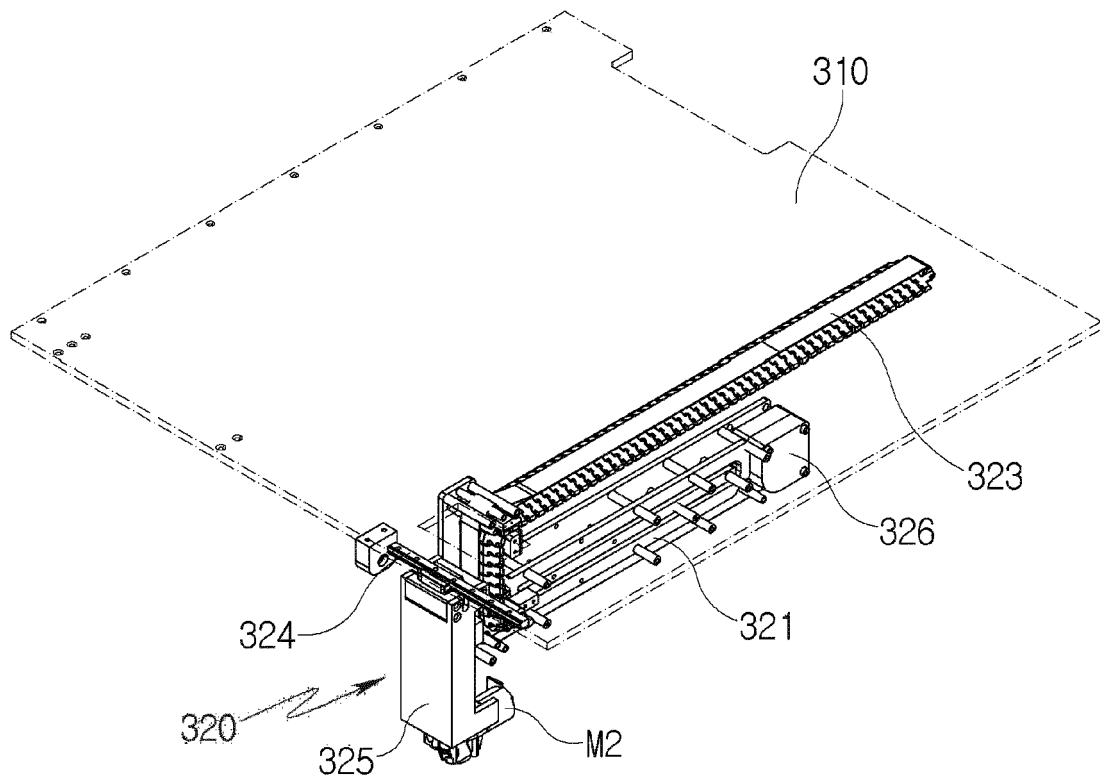
[FIG. 2]



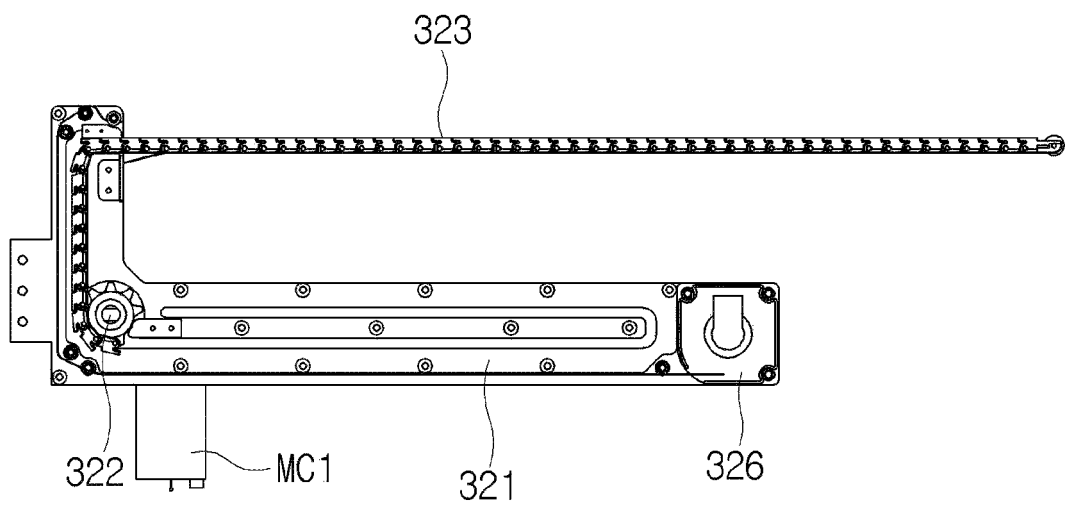
[FIG. 3]



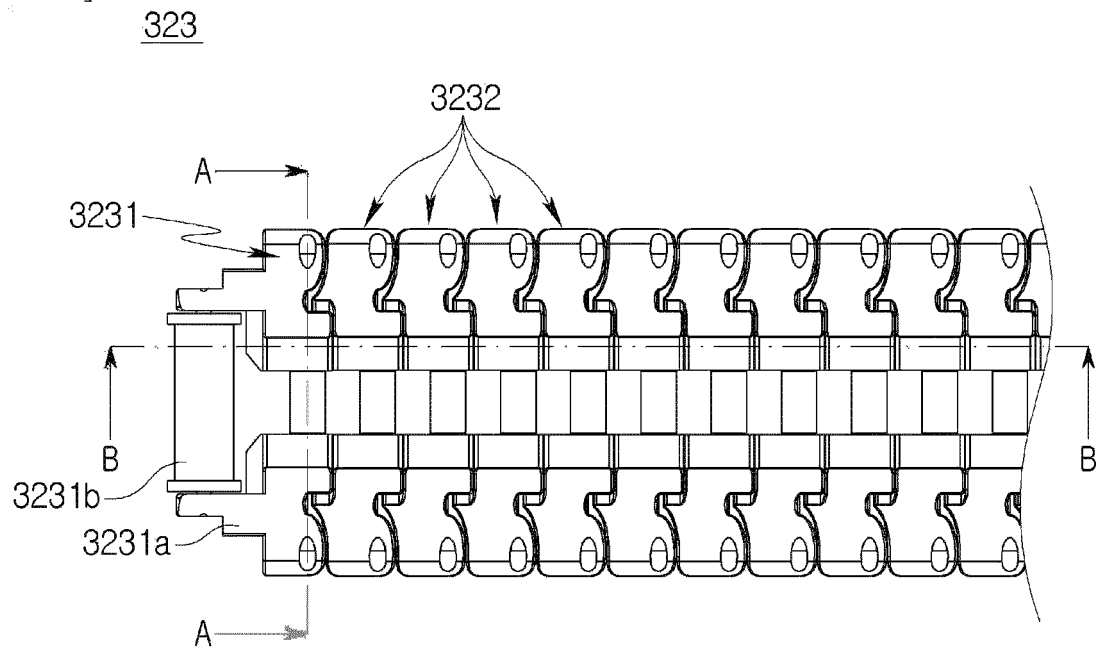
[FIG. 4]



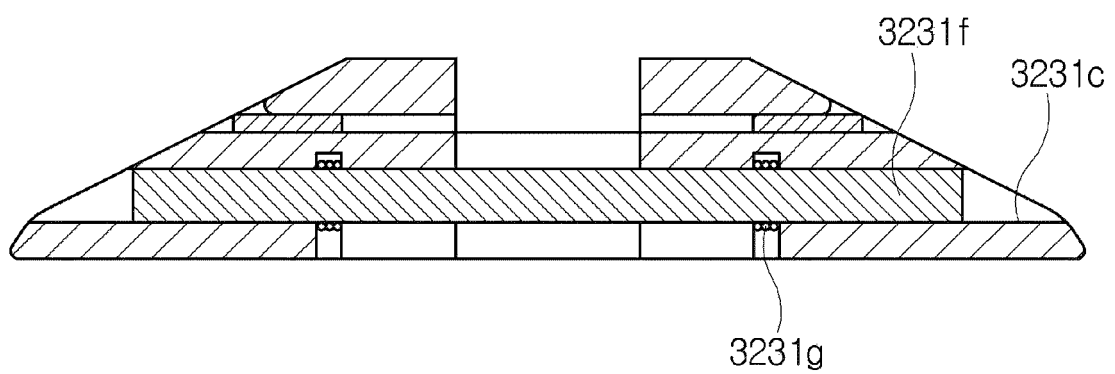
[FIG. 5]



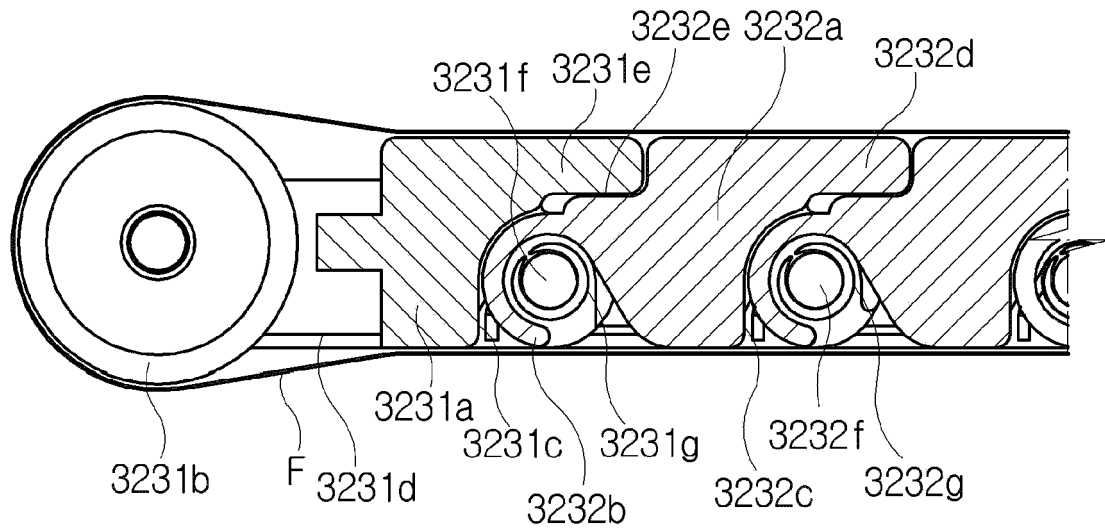
[FIG. 6]



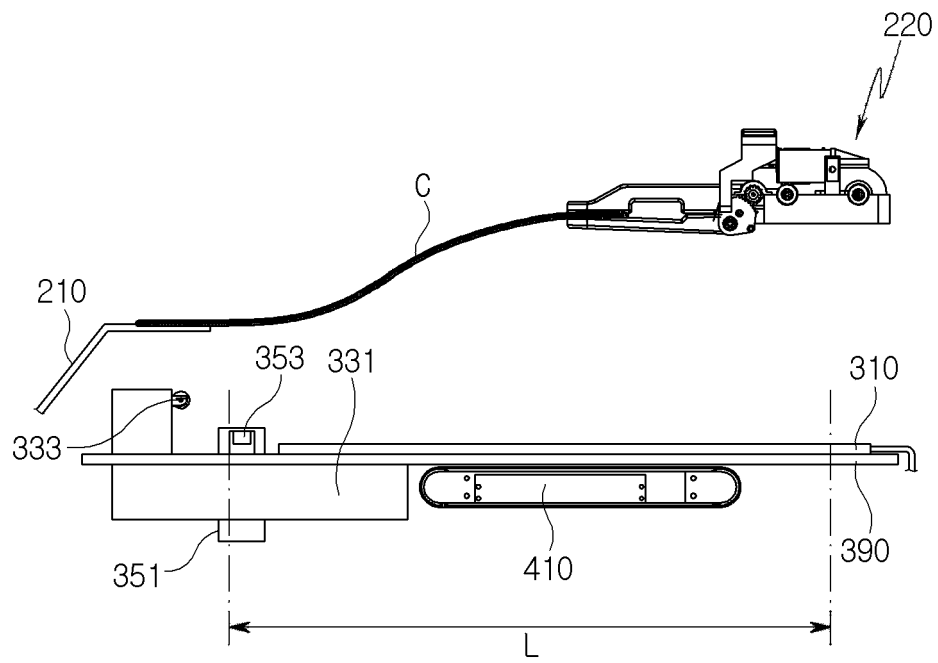
[FIG. 7]



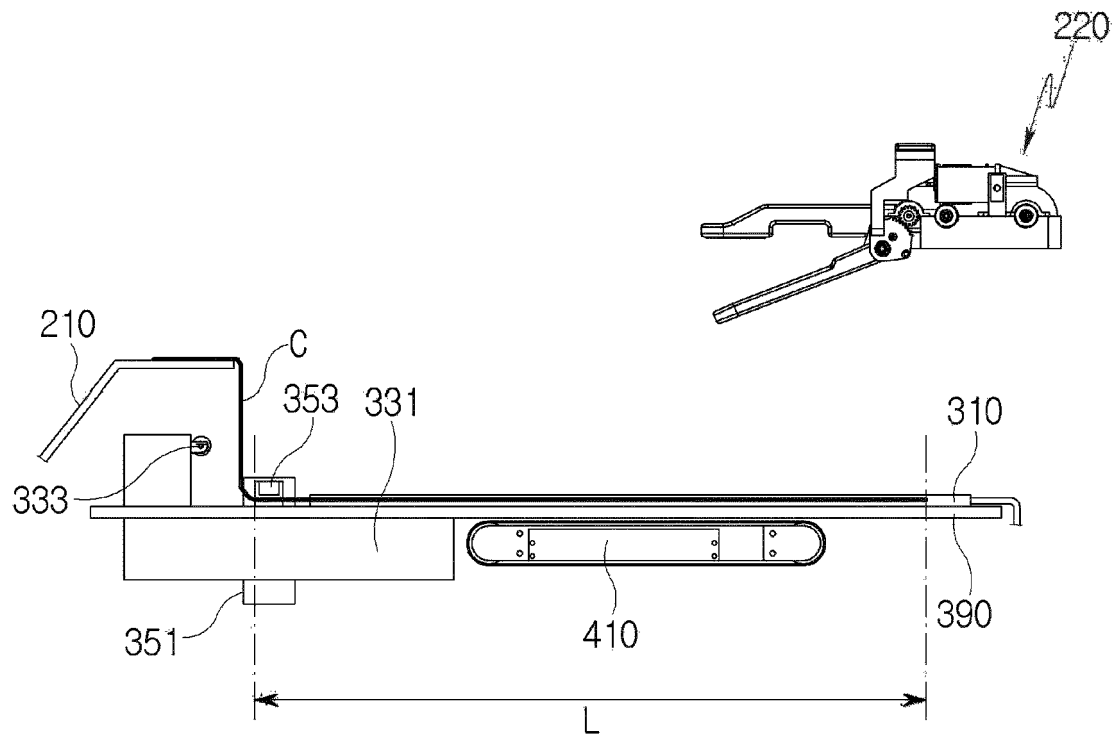
[FIG. 8]



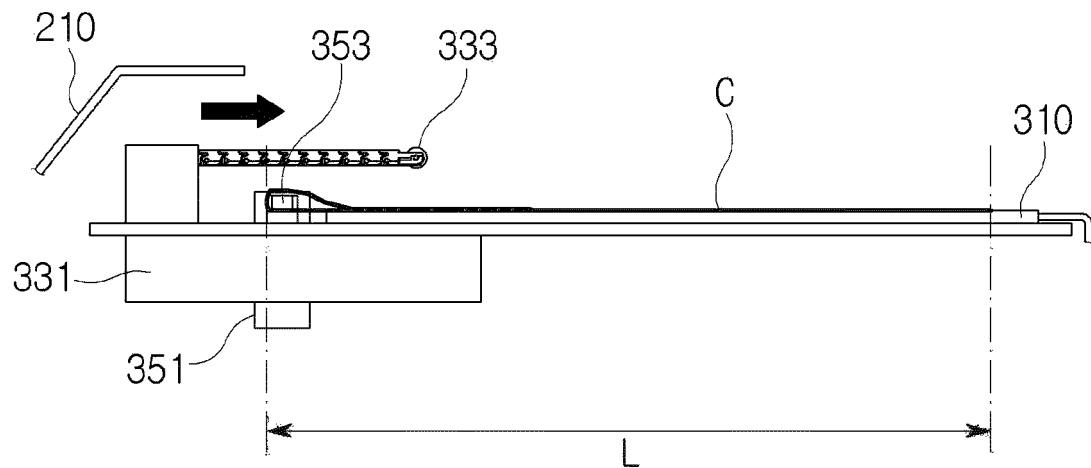
[FIG. 9A]



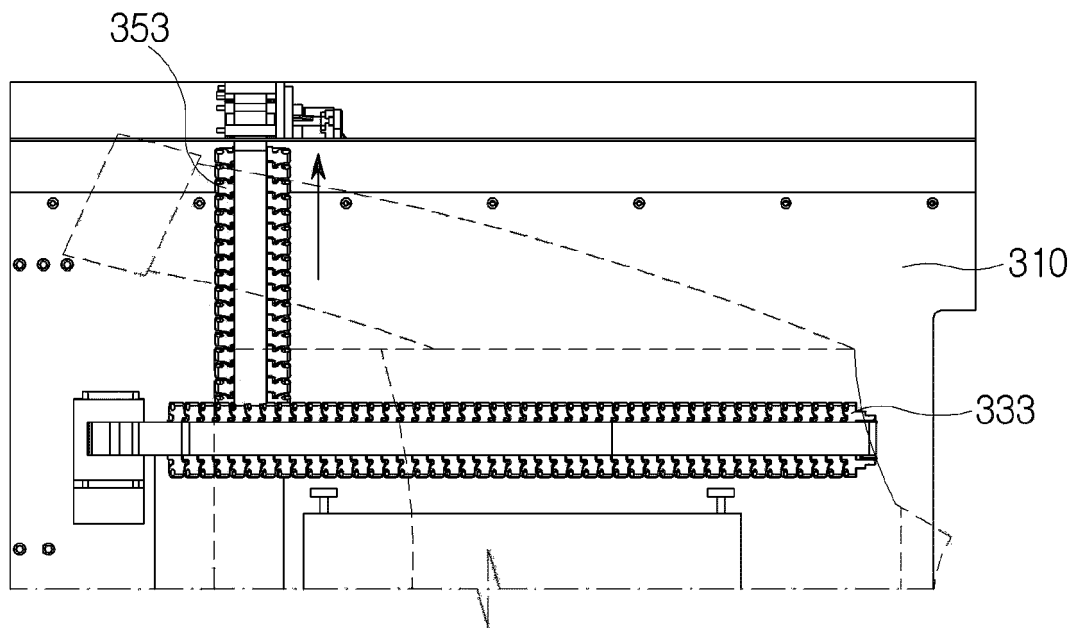
[FIG. 9B]



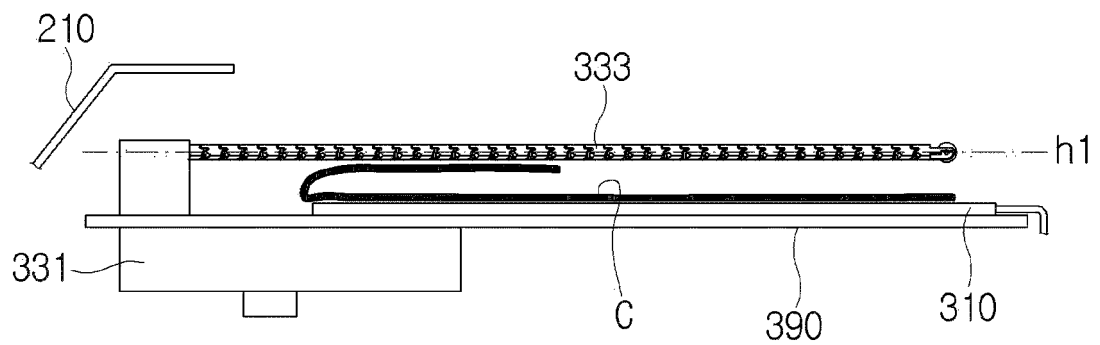
[FIG. 10]



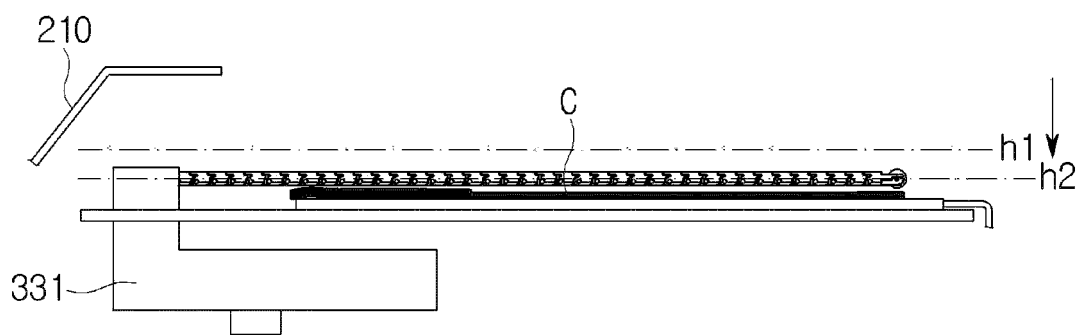
[FIG. 11]



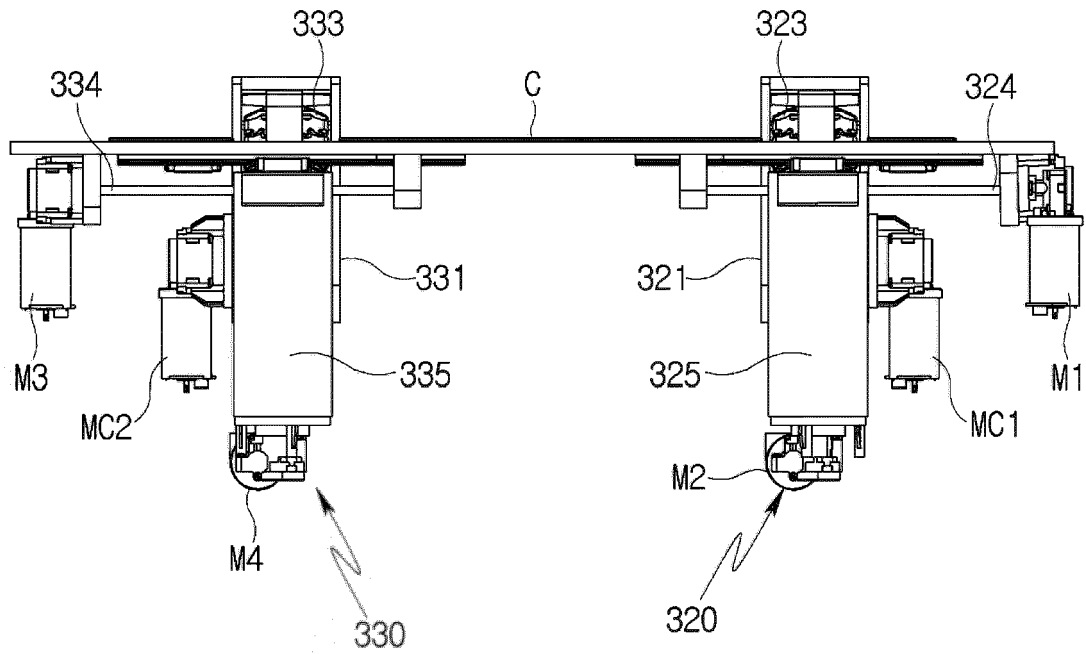
[FIG. 12]



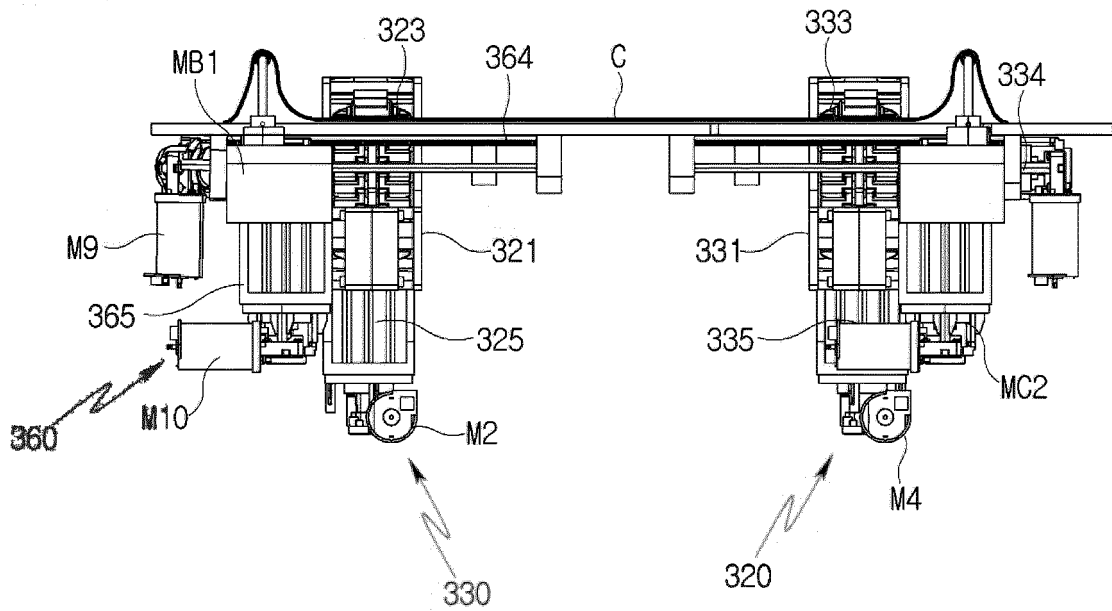
[FIG. 13]



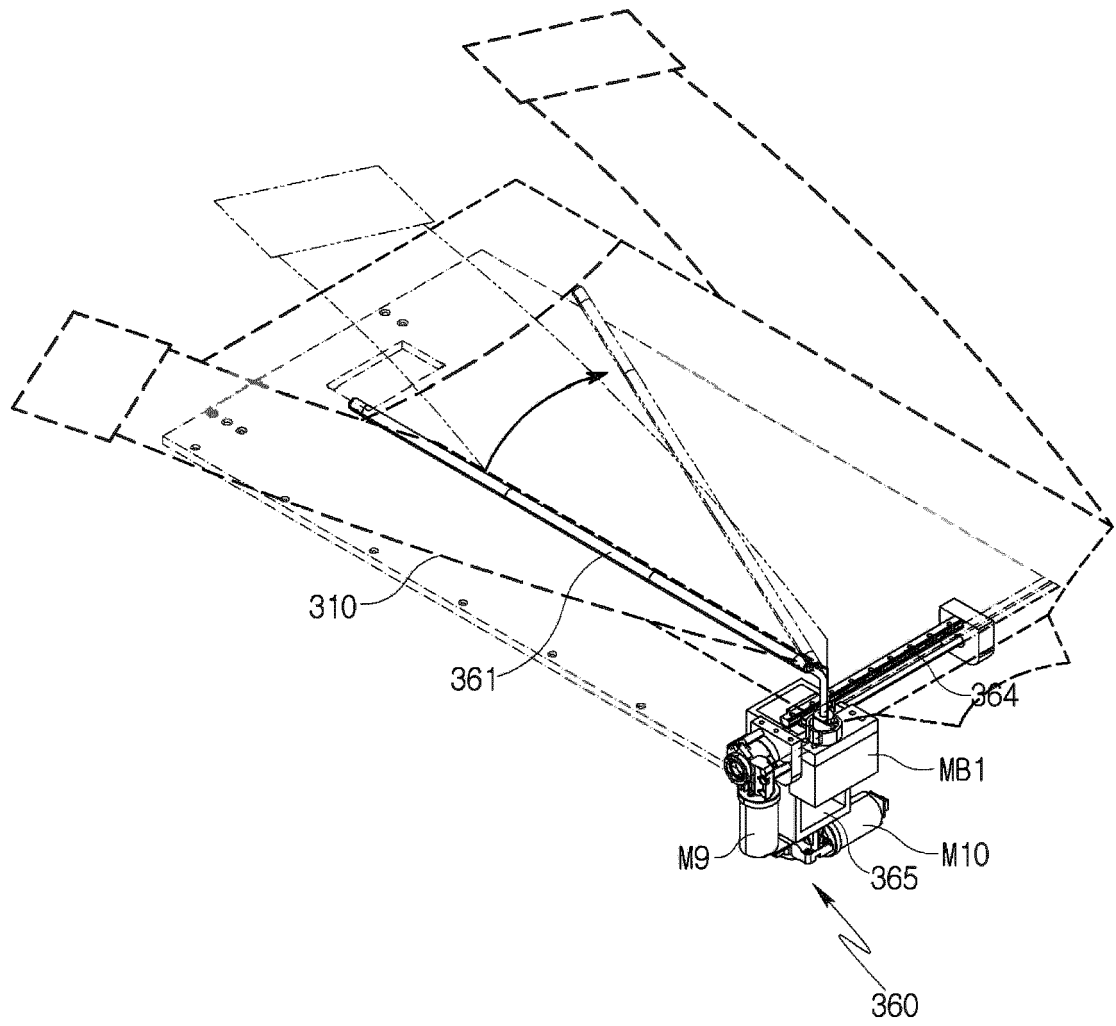
[FIG. 14]



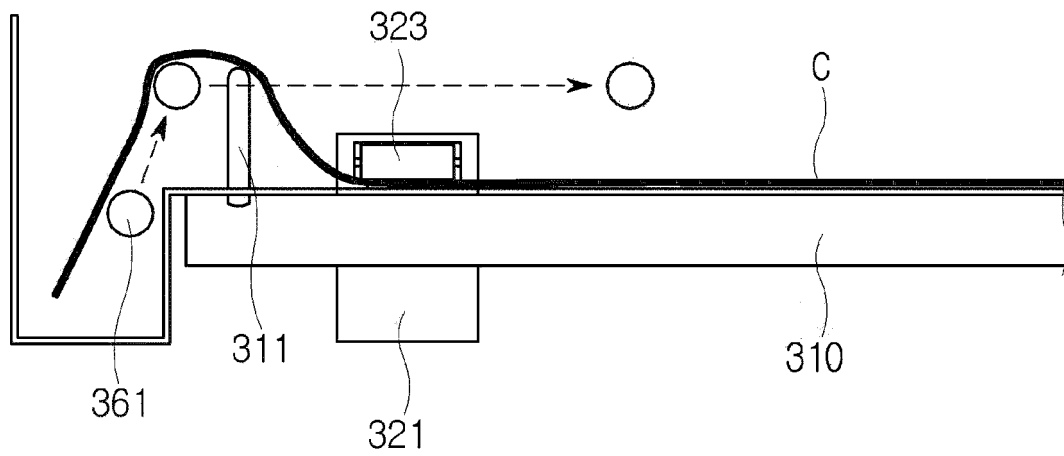
[FIG. 15]



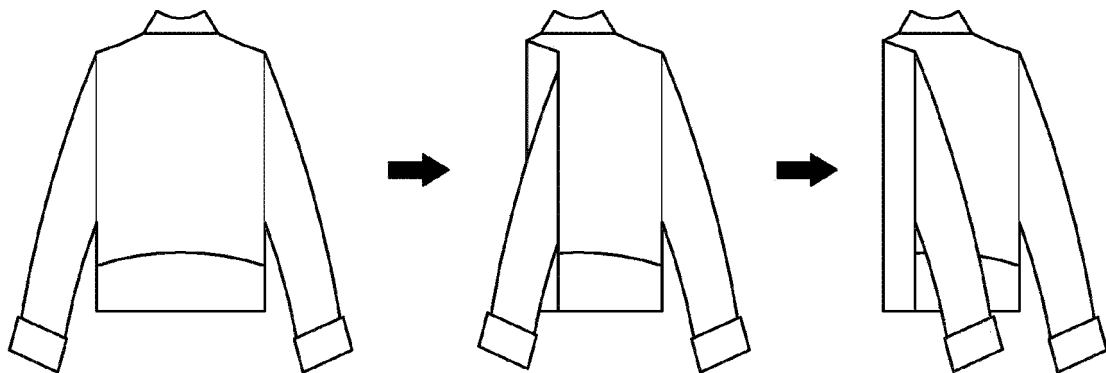
[FIG. 16]



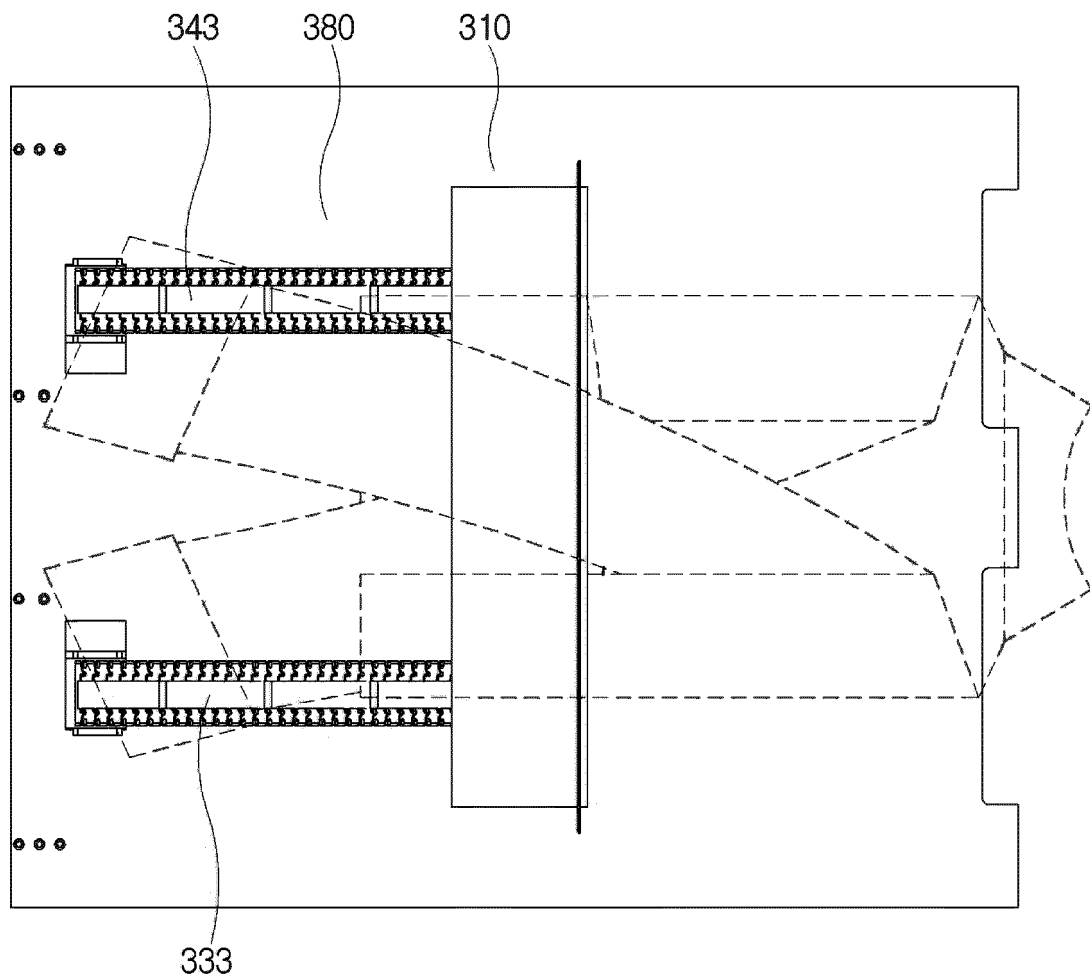
[FIG. 17]



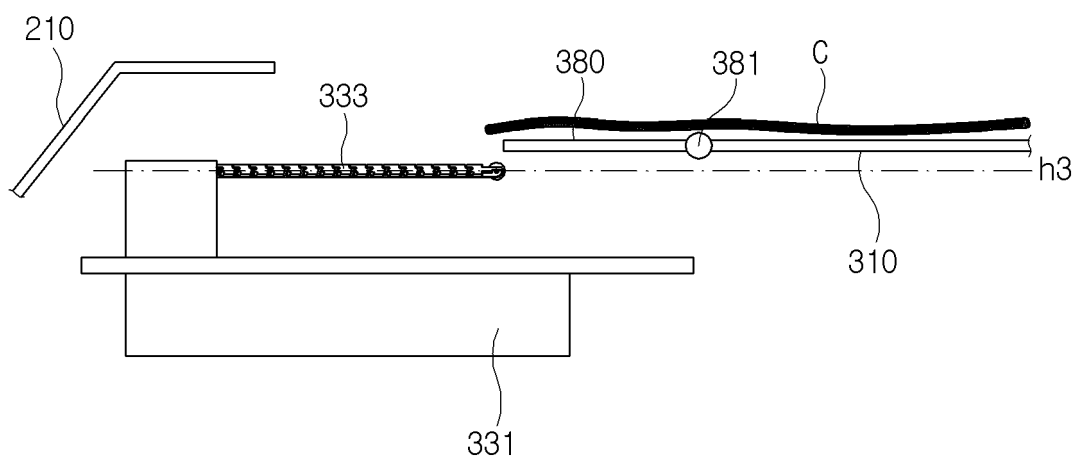
[FIG. 18]



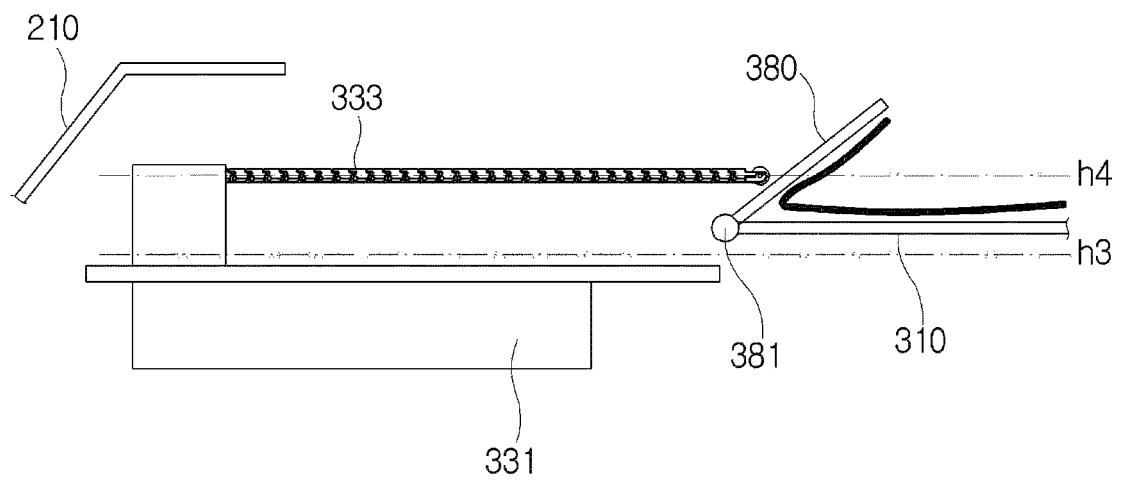
[FIG. 19]



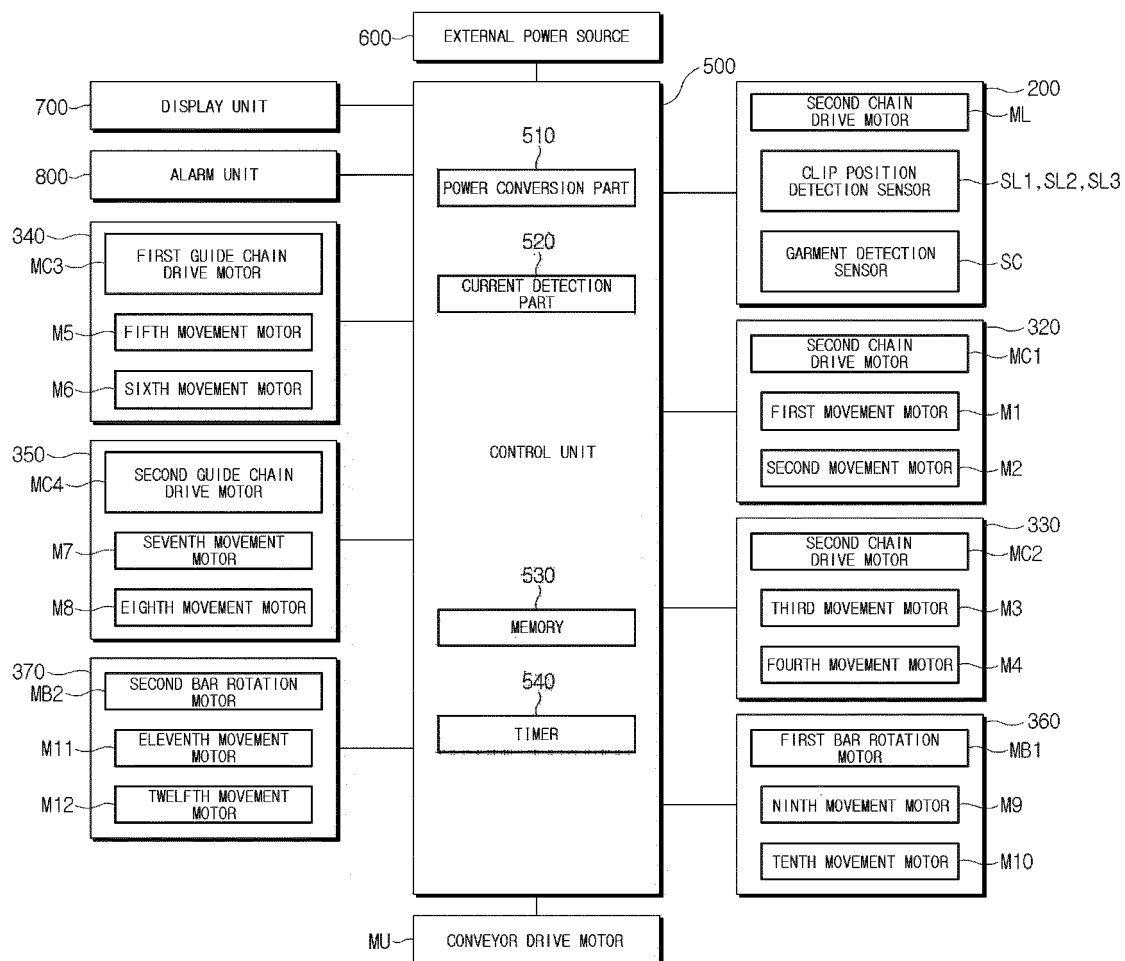
[FIG. 20]



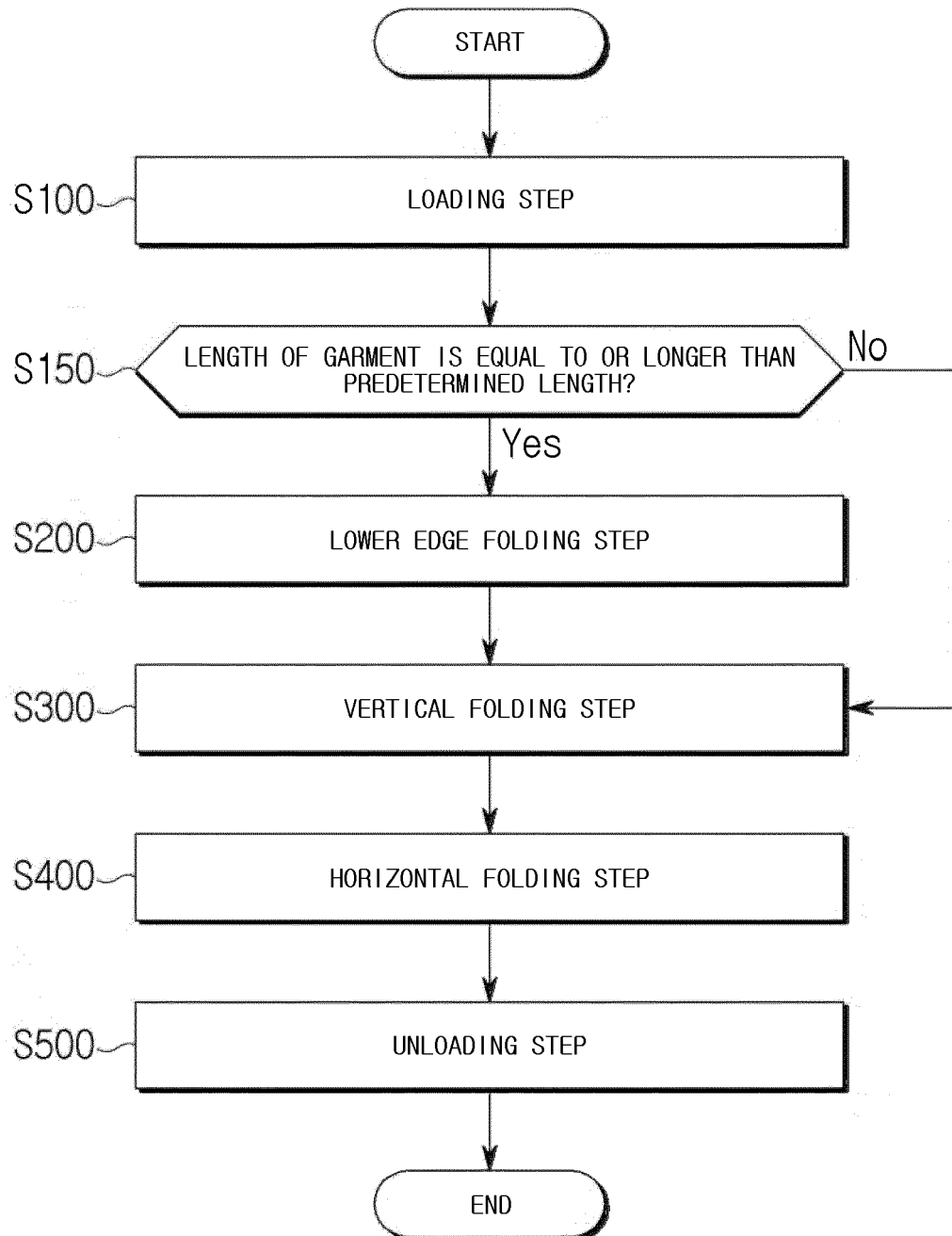
[FIG. 21]



[FIG. 22]



[FIG. 23]



INTERNATIONAL SEARCH REPORT

International application No.

PCT/KR2022/016930

A. CLASSIFICATION OF SUBJECT MATTER

D06F 89/02(2006.01)i; A41H 43/02(2006.01)i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

D06F 89/02(2006.01); A41H 43/02(2006.01); B65B 59/00(2006.01); B65G 47/22(2006.01)

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

Korean utility models and applications for utility models: IPC as above

Japanese utility models and applications for utility models: IPC as above

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

eKOMPASS (KIPO internal) & keywords: 의류(clothes), 폴딩암(folding arm), 가이드암(guide arm), 체인(chain)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A		9-11
Y	JP 2002-119800 A (MAEJIMA, Yozo) 23 April 2002 (2002-04-23) See paragraphs [0020]-[0021] and [0026] and figures 10-11.	1-8,12-17
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A	KR 10-2020-0047641 A (FOLDIMATE INC.) 07 May 2020 (2020-05-07) See paragraphs [0067]-[0069], claims 1-2 and 6 and figures 1-2.	1-17
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
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"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

13 February 2023

Date of mailing of the international search report

14 February 2023

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INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

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