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(72) Inventors:  
• **YANO Makoto**  
**Takamatsu-shi**  
**Kagawa 761-8032 (JP)**  
• **YABE Yuichiro**  
**Takamatsu-shi**  
**Kagawa 761-8032 (JP)**

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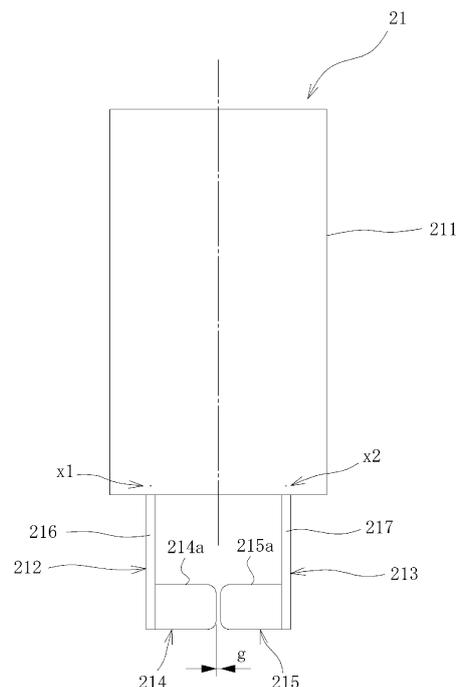
(74) Representative: **Grünecker Patent- und Rechtsanwälte**  
**PartG mbB**  
**Leopoldstraße 4**  
**80802 München (DE)**

(71) Applicant: **Purex Co., Ltd.**  
**Kagawa 761-8032 (JP)**

(54) **FABRIC CLAMPING CHUCK AND FABRIC HANDLING DEVICE**

(57) To provide a cloth clamping chuck and a cloth handling apparatus that can handle cloth so as to reduce falling of the cloth while avoiding damage to the cloth. A cloth clamping chuck 21 includes a pair of clamps 212, 213 disposed facing each other, and an opening-closing means that moves the pair of clamps 212, 213 relatively closer to or separated from each other. Each of the clamps 212, 213 has, at a leading end, a projecting part 214 or 215 that projects toward the other opposite clamp 213 or 212. Each of surfaces 214a, 215a of the projecting parts 214, 215 on a base end side of the clamps 212, 213 is formed either as a flat surface parallel to a facing direction of the pair of clamps 212, 213 or as an inclined surface inclining toward the above base end side while extending toward the other opposite projecting part 215 or 214.

FIG. 35



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**Description**

## Technical Field

**[0001]** The present invention relates to a cloth clamping chuck that clamps and removably holds cloth in a cloth washing factory or the like, and to a cloth handling apparatus that performs an operation such as lifting, pulling, or passing cloth by moving this cloth clamping chuck.

## Background Art

**[0002]** Machines used in a cloth washing factory or the like, including an automatic cloth spreading (feeding) machine that spreads cloth and a cloth separating machine that loosens a mass of cloth consisting of a plurality of entangled pieces of cloth, are equipped with cloth handling apparatuses that perform operations such as lifting, pulling, and passing cloth. For example, in the automatic cloth spreading machine of Patent Literature 1, the lifting device, the temporary holding device, the corner end locating device, the horizontal pulling device, etc. correspond to such cloth handling apparatuses.

**[0003]** Chucks in these types of cloth handling apparatuses have a pair of clamps and are configured to hold or release cloth as the pair of clamps is opened or closed by using a driving means, such as an air cylinder or a motor.

## Citation List

## Patent Literature

**[0004]** Patent Literature 1: Japanese Patent Laid-Open No. 2010-222724

## Summary of Invention

## Technical Problem

**[0005]** Conventional cloth clamping chucks include one in which, as shown in FIG. 41, the entire holding surfaces of clamps are flat and the entire holding surfaces come into contact with each other when the chuck is fully closed. However, one problem with a chuck of this shape is that falling of cloth often occurs when a large number of pieces of cloth are clamped or forcibly pulled up by the chuck. Moreover, leading ends of the clamps of this type of chuck come into close contact with each other when the chuck is fully closed, which raises another problem that, as shown in FIG. 42, when cloth being clamped is about to fall, the leading ends of the clamps pinch, for example, the pile of the cloth, causing damage such as unraveling of threads.

**[0006]** An object of the present invention is to solve the problems with the above related art and provide a cloth clamping chuck and a cloth handling apparatus that can handle cloth so as to reduce falling of the cloth while

avoiding damage to the cloth.

## Solution to Problem

**[0007]** The present invention provides a cloth clamping chuck including a pair of clamps disposed facing each other, and an opening-closing means that moves the pair of clamps relatively closer to or separated from each other. To this end, each of the clamps has, at a leading end, a projecting part that projects toward the other opposite clamp, and a surface of the projecting part on a base end side of the clamp is formed either as a flat surface parallel to the facing direction of the pair of clamps or as an inclined surface inclining toward the base end side while extending toward the other opposite projecting part.

**[0008]** In the cloth clamping chuck of the present invention, it is preferable that a gap be formed between the projecting parts facing each other in a fully closed position of the pair of clamps, and it is more preferable that the gap be set to be substantially equal to the thickness of two pieces of cloth to be clamped.

**[0009]** In the cloth clamping chuck of the present invention, it is preferable that at least one of the pair of clamps be provided so as to be able to swing around a swinging axis extending in a direction orthogonal to both an extension direction that is a direction from the base end toward the leading end of the clamp and the facing direction.

**[0010]** The present invention further provides a cloth handling apparatus including a cloth clamping chuck having a pair of clamps disposed facing each other, and an opening-closing means that moves the pair of clamps relatively closer to or separated from each other, and a moving means that moves the cloth clamping chuck. To achieve the above object, each of the clamps has, at a leading end, a projecting part that projects toward the other opposite clamp, and a surface of the projecting part on a base end side of the clamp is formed either as a flat surface parallel to the facing direction of the pair of clamps or as an inclined surface inclining toward the base end side while extending toward the other opposite projecting part.

**[0011]** In the cloth handling apparatus of the present invention, it is preferable that a gap be formed between the projecting parts facing each other in a fully closed position of the pair of clamps, and it is more preferable that the gap be set to be substantially equal to the thickness of two pieces of cloth to be clamped.

**[0012]** In the cloth handling apparatus of the present invention, it is preferable that at least one of the pair of clamps be provided so as to be able to swing around a swinging axis extending in a direction orthogonal to both an extension direction that is a direction from the base end toward the leading end of the clamp and the facing direction.

### Advantageous Effects of Invention

**[0013]** In the cloth clamping chuck of the present invention, when a portion of cloth is brought into contact between the pair of clamps in an open posture and the pair of clamps is closed by the opening-closing means, the portion of the cloth is clutched between the clamps. In this state, then moving the cloth handling apparatus, for example, upward, can lift the cloth. Here, the surface of the projecting part of each clamp on the base end side of the clamp (back surface) is formed either as a flat surface parallel to the facing direction of the pair of clamps in the fully closed position of the clamps or as an inclined surface inclining toward the base end side while extending toward the other opposite projecting part. Therefore, when the load of the weight of the cloth is applied to the back surfaces, the clamps swing further in a closing direction, so that a portion of the cloth on a back side from the projecting parts gets caught on the back surfaces of the projecting parts. Thus, falling (slipping out) of cloth is reduced.

**[0014]** In the cloth clamping chuck of the present invention, when cloth clamped by the cloth clamping chuck, which has a gap maintained between the projecting parts also in the fully closed position of the clamps, is about to fall, the projecting parts allow the cloth to fall without forcibly holding the cloth, so that a situation where the clamps cause damage to cloth can be more reliably avoided. When the dimension of this gap is set to be substantially equal to the thickness of two pieces of cloth, damage to cloth can be more reliably prevented while falling of cloth is reduced.

### Brief Description of Drawings

#### **[0015]**

FIG. 1 is a schematic overall view of an automatic cloth spreading machine.

FIG. 2 is an enlarged perspective view of a supply conveyor and a lifting device of the automatic cloth spreading machine of FIG. 1.

FIG. 3 is an enlarged perspective view of the supply conveyor and the lifting device of the automatic cloth spreading machine of FIG. 1.

FIG. 4 is an enlarged perspective view of the supply conveyor and the lifting device of the automatic cloth spreading machine of FIG. 1.

FIG. 5 is an enlarged perspective view of a temporary holding device and a corner end locating device of the automatic cloth spreading machine of FIG. 1.

FIG. 6 is an enlarged perspective view of the corner end locating device of the automatic cloth spreading machine of FIG. 1.

FIG. 7 is an enlarged perspective view of the corner end locating device of the automatic cloth spreading machine of FIG. 1.

FIG. 8 is an enlarged perspective view of the corner

end locating device of the automatic cloth spreading machine of FIG. 1.

FIG. 9 is an enlarged perspective view of the corner end locating device of the automatic cloth spreading machine of FIG. 1.

FIG. 10 is an enlarged perspective view of the corner end locating device and a corner end receiving device of the automatic cloth spreading machine of FIG. 1.

FIG. 11 is an enlarged perspective view of the corner end receiving device and a horizontal pulling device of the automatic cloth spreading machine of FIG. 1.

FIG. 12 is an enlarged perspective view of the horizontal pulling device of the automatic cloth spreading machine of FIG. 1.

FIG. 13 is an enlarged perspective view of the horizontal pulling device of the automatic cloth spreading machine of FIG. 1.

FIG. 14 is an enlarged perspective view of the horizontal pulling device of the automatic cloth spreading machine of FIG. 1.

FIG. 15 is an enlarged perspective view of the horizontal pulling device, a two-position holding device, an edge locating conveyor, and a vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 16 is an enlarged perspective view of the two-position holding device, the edge locating conveyor, and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 17 is an enlarged perspective view of the two-position holding device, the edge locating conveyor, and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 18 is an enlarged perspective view of the two-position holding device, the edge locating conveyor, and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 19 is an enlarged perspective view of the two-position holding device, the edge locating conveyor, and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 20 is an enlarged perspective view of the two-position holding device, the edge locating conveyor, and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 21 is an enlarged perspective view of the edge locating conveyor and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 22 is an enlarged perspective view of the edge locating conveyor and the vertically inverting device of the automatic cloth spreading machine of FIG. 1.

FIG. 23 is an enlarged perspective view of the edge locating conveyor, the vertically inverting device, a roller, and a hanging device of the automatic cloth spreading machine of FIG. 1.

FIG. 24 is an enlarged perspective view of the edge locating conveyor, the vertically inverting device, the

roller, and the hanging device of the automatic cloth spreading machine of FIG. 1.

FIG. 25 is an enlarged perspective view of the edge locating conveyor, the vertically inverting device, the roller, and the hanging device of the automatic cloth spreading machine of FIG. 1.

FIG. 26 is an enlarged perspective view of the roller and the hanging device of the automatic cloth spreading machine of FIG. 1.

FIG. 27 is an enlarged perspective view of the roller of the automatic cloth spreading machine of FIG. 1.

FIG. 28 is an enlarged perspective view of the roller, a forward-backward moving device, and a transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 29 is an enlarged perspective view of the roller, the forward-backward moving device, and the transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 30 is an enlarged perspective view of the forward-backward moving device and the transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 31 is an enlarged perspective view of the forward-backward moving device and the transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 32 is an enlarged perspective view of the forward-backward moving device and the transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 33 is an enlarged perspective view of the forward-backward moving device and the transfer conveyor of the automatic cloth spreading machine of FIG. 1.

FIG. 34 is an enlarged perspective view of the transfer conveyor of the automatic cloth spreading machine of FIG. 1 and a cloth folding machine in the next process.

FIG. 35 is a plan view of a cloth clamping chuck in one embodiment of the present invention.

FIG. 36 shows the internal structure of the cloth clamping chuck of FIG. 35, with FIG. 36 (a) showing clamps in a fully closed state and FIG. 36 (b) showing the clamps in a fully open state.

FIG. 37 is a view showing how the cloth clamping chuck of FIG. 35 holds and lifts cloth.

FIG. 38 is a view showing how cloth falls through a gap between projecting parts while the cloth clamping chuck of FIG. 35 holds and lifts the cloth.

FIG. 39 is a plan view showing main parts of a modified example of the cloth clamping chuck of FIG. 35.

FIG. 40 is a plan view showing main parts of a cloth clamping chuck in another embodiment of the present invention.

FIG. 41 is a view illustrating a problem that arises when lifting cloth by a conventional cloth clamping chuck.

FIG. 42 is a view illustrating another problem that arises when lifting cloth by the conventional cloth clamping chuck.

## 5 Description of Embodiments

**[0016]** Embodiments of the present invention will be described in detail below based on the drawings. A cloth clamping chuck of the present invention and a cloth handling apparatus including the cloth clamping chuck are suitable for performing operations such as lifting, pulling, and passing cloth in machines installed in a cloth washing factory or the like, including an automatic cloth spreading machine and a cloth separating machine. In the following, the present invention will be described by taking, as an example of use, an example in the case which the cloth clamping chuck of an embodiment and the cloth handling apparatus including this cloth clamping chuck are applied to an automatic cloth spreading machine.

**[0017]** FIG. 1 shows an overall view of the automatic cloth spreading machine, and FIG. 2 to FIG. 34 show individual devices that are parts of the automatic cloth spreading machine of FIG. 1. In the following description, the directions of front, rear, right, left, up, and down refer to those directions in the state of FIG. 1.

**[0018]** The automatic cloth spreading machine automatically spreads washed and dried pieces of cloth, such as towels, sheets, duvet covers, pillow covers, or Japanese bathrobes. As shown in FIG. 1, the automatic cloth spreading machine mainly includes a supply conveyor 1, a lifting device 2, a temporary holding device 3, a corner end locating device 4, a corner end receiving device 5, a horizontal pulling device 6, a two-position holding device 7, an edge locating conveyor 8, a vertically inverting device 9, a roller 10, a hanging device 11, a forward-backward moving device 12, a transfer conveyor 13, and a controller (not shown) that controls the operations of the devices 1 to 13. In FIG. 1, a suction conveyor A, a push-out device B, a return conveyor C, and a cloth folding machine D are shown as assisting or related devices. The return conveyor C returns cloth that has fallen during processing to the supply conveyor 1.

**[0019]** The automatic cloth spreading machine operates roughly as follows. Specifically, the supply conveyor 1 supplies washed and dried cloth to below the lifting device 2. The lifting device 2 lifts the cloth to a predetermined level. The temporary holding device 3 receives the lifted cloth, temporarily holds the cloth, and moves the cloth to a position at which the cloth is passed to the corner end locating device 4. The corner end locating device 4 receives an arbitrary portion of the cloth hanging from the temporary holding device 3 and reveals a corner end of the cloth. The corner end receiving device 5 holds this corner end, and moves the cloth toward the horizontal pulling device 6 while supporting the cloth in a drooping state. The horizontal pulling device 6 lays the cloth substantially horizontally in a front-rear direction. The two-position holding device 7 holds the laid cloth at two po-

sitions, one near a corner end and the other at an intermediate portion separated from the corner end by an appropriate distance, at the same level, moves the cloth to above the edge locating conveyor 8, and then releases the intermediate portion of the cloth being held. The edge locating conveyor 8 receives thereon another portion of the cloth held at the corner end by the two-position holding device 7, and moves that portion so as to reveal one long-side edge of the cloth. The vertically inverting device 9 holds the long-side edge of the cloth coming down from the edge locating conveyor 8, inverts the cloth upside down, and then holds the cloth in a drooping state. A hanging device 11 that moves above the roller 10 in a left-right direction along the roller 10 receives the long-side edge of the cloth from the vertically inverting device 9 and hangs the drooping cloth on the roller 10. The roller 10 delivers the cloth hung thereon such that the cloth droops toward the forward-backward moving device 12 while a short-side edge of the cloth is left on the roller 10. The forward-backward moving device 12 moves forward and receives the short-side edge of the cloth left on the roller 10, moves backward while holding the short-side edge of the cloth, and then moves the cloth in a spread state onto the transfer conveyor 13. The transfer conveyor 13 discharges the spread cloth and, for example, feeds the cloth into the cloth folding machine D in the next process.

**[0020]** Each device will be described in detail. First, as shown in FIG. 1 to FIG. 3, the supply conveyor 1 may be continuously run by a motor 1a during operation. A mass X consisting of, for example, about 10 to 50 washed and dried, still balled-up rectangular pieces of cloth Y is thrown onto the supply conveyor 1. The supply conveyor 1 transfers the mass X of the cloth Y to below the lifting device 2 (indicated by reference sign X' in FIG. 2). The suction conveyor A is provided at a terminal end of the supply conveyor 1 in a transfer direction. The suction conveyor A is composed of a perforated belt A1, a suction fan A2 that suctions the cloth Y on the supply conveyor 1 through the perforated belt A1, and a motor A3 that drives the perforated belt A1 to rotate and thereby transfers the suctioned cloth Y to directly below the lifting device 2 (indicated by reference sign X" in FIG. 3). A wall 1b that prevents the mass X from falling off the supply conveyor 1 is formed standing near a terminal end of the perforated belt A1. Furthermore, in addition to or instead of the suction conveyor A, the push-out device B that pushes the cloth on the supply conveyor 1 to directly below the lifting device 2 may be provided at the terminal end of the supply conveyor 1 in the transfer direction. The push-out device B is composed of a cylinder B1 and a push-out rod B2 that is moved forward and backward by the cylinder B1.

**[0021]** The lifting device 2 has a chuck 21 that holds an arbitrary portion of the cloth Y, and an upward-downward moving device that moves the chuck 21 upward and downward. In the shown example, the upward-downward moving device is composed of a driving belt 23 and

a motor 22. The upward-downward moving device may have any structure as long as it can move the chuck 21 upward and downward between a predetermined level and a transfer surface of the supply conveyor 1. For example, a chain-driven device or a slider unit that travels upward and downward along a rail may be used for the upward-downward moving device. When the chuck 21 of the lifting device 2 is moved by the driving belt 23 and the motor 22 to a lowermost position (the position indicated by the imaginary lines and reference sign 21' in FIG. 4), the chuck 21 comes into contact with the cloth Y located at the terminal end of the supply conveyor 1 so that the chuck 21 holds the contact portion of the cloth Y. In addition, the portion of the cloth held by the chuck 21 may be an arbitrary portion. Furthermore, when the chuck 21 is moved upward, the chuck 21 is raised to a predetermined level (uppermost position) indicated by the solid lines in FIG. 4 while holding the cloth Y, so that the chuck 21 then holds the cloth Y in a hanging state. Here, two or more pieces of cloth Y may be held and lifted by the chuck 21.

**[0022]** As shown in FIG. 1 and FIG. 4, the temporary holding device 3 has a chuck 31 and a forward-backward moving device (extending-contracting cylinder 32) that moves the chuck 31 forward and backward in the front-rear direction. When the chuck 21 of the lifting device 2 moves to the uppermost position, or the cloth Y held by the chuck 21 at the uppermost position is detected by a sensor (not shown), the extending-contracting cylinder 32 of the temporary holding device 3 extends and moves the chuck 31 forward to the position indicated by the imaginary lines (indicated by reference sign 31') in FIG. 4, and the chuck 31 of the temporary holding device 3 receives a portion near an upper end of the cloth Y lifted by the lifting device 2. (At this point, the chuck 21 of the lifting device 2 releases the cloth Y.) Thereafter, the extending-contracting cylinder 32 contracts so that the extending-contracting cylinder 32 moves the chuck 31 backward to a predetermined position as indicated by the solid lines in FIG. 4, with the cloth Y hanging from the chuck 31. In most cases, in addition, one of corner ends of the cloth appears at a lowermost end (indicated by reference sign Ya in FIG. 4) of the cloth Y hanging from the chuck 31.

**[0023]** As shown in FIG. 5 to FIG. 9, the corner end locating device 4 has: a chuck 41 that receives the cloth Y hung and held by the chuck 31 of the temporary holding device 3 at its backward position; a forward-backward moving device (extending-contracting cylinder 42) that moves the chuck 41 forward and backward; a platform 43 on an upper side of which the cloth Y is placed; a sensor 49 that is formed by a phototube, for example, and detects a terminal end portion (corner end Ya) of the cloth Y being dragged over the platform 43; a pressing plate 47 that holds a central portion of the cloth Y on the platform 43 between the pressing plate 47 and the platform 43; an extending-contracting cylinder 48 that moves the pressing plate 47 upward and downward; a pair of

corner end locating rollers 44, 45; and an extending-contracting cylinder 46 that moves the one corner end locating roller 45 closer to or separated from the other corner end locating roller 44.

**[0024]** When the chuck 31 of the temporary holding device 3 moves to the backward position while holding the cloth Y as shown in FIG. 5, then the extending-contracting cylinder 42 of the corner end locating device 4 extends and moves the chuck 41 forward, and the chuck 41 receives the cloth Y from the chuck 31 of the temporary holding device 3. Subsequently, as shown in FIG. 6, the extending-contracting cylinder 42 contracts, so that the chuck 41, while holding the cloth Y, pulls the cloth Y a predetermined distance over the platform 43 before releasing the cloth Y. Then, as shown in FIG. 7, the corner end locating roller 45 located on a far side moves downward from the position indicated by reference sign 45' and holds a leading end portion of the cloth Y between the corner end locating roller 45 and the corner end locating roller 44 on a near side. The pressing plate 47 moves downward from the raised position indicated by reference sign 47' and holds a central portion of the cloth Y between the pressing plate 47 and the platform 43. In this state, as shown in FIG. 8, both the corner end locating rollers 44, 45 rotate in the arrow directions, so that the cloth Y droops. When the terminal end portion (forming the corner end Ya) of the cloth Y being dragged over the platform 43 is detected by the sensors 49, 49 (or when the cloth Y is not detected by the sensors 49, 49), the rotation speed of both the corner end locating rollers 44, 45 is adjusted to switch to a low speed. If there is a plurality of pieces of cloth Y, pieces of cloth Z other than one piece of cloth Y that is held at the terminal end portion between the platform 43 and the pressing plate 47, will fall in the course of this series of actions. Thereafter, when the terminal end portion (corner end Ya) of the cloth Y is detected by other sensors 4a, 4a that are formed by phototubes, for example, and disposed between both the corner locating rollers 44, 45 (or when the cloth Y is not detected by the sensors 49, 49), the corner end locating rollers 44, 45 stop rotating, and the corner end Ya or a portion near the corner end Ya of the cloth Y is tucked and held between the corner end locating rollers 44, 45, which completes a corner end locating task.

**[0025]** In the shown example, the cloth Y lifted by the lifting device 2 is temporarily held by the temporary holding device 3 and then handed over to the chuck 41 of the corner end locating device 4. In another example (not shown), the temporary holding device 3 may be omitted and the cloth Y lifted by the lifting device 2 may be directly held by the chuck 41 of the corner end locating device 4.

**[0026]** As shown in FIG. 10, the corner end receiving device 5 has a chuck 51 disposed under the corner end locating rollers 44, 45, and a forward-backward moving device (extending-contracting cylinder 52) that moves the chuck 51 forward and backward in the left-right direction (see FIG. 1) within a range directly under a contact portion of the corner end locating rollers 44, 45. When

the corner end Ya or a portion near the corner end Ya of the cloth Y is being held by the pair of corner end locating rollers 44, 45 of the corner end locating device 4, the extending-contracting cylinder 52 of the corner end receiving device 5 extends and moves the chuck 51 forward in a leftward direction as indicated by the imaginary lines in FIG. 10. The chuck 51 holds the cloth Y at a position a little below the corner end Ya so that the chuck 51 moves backward toward the right side (toward the horizontal pulling device 6) with the cloth Y drooping from the chuck 51. A sensor 53 that detects the cloth Y is mounted on the chuck 51. The chuck 51 is activated upon the sensor 53 detecting that the chuck 51 has come close to the cloth Y, so that the chuck 51 can reliably hold the cloth Y.

**[0027]** A platform 64 is provided at a position in the immediate vicinity of a lower rear side of the chuck 51 in a state where the extending-contracting cylinder 52 of the corner end receiving device 5 is contracted (see FIG. 11). The platform 64 supports a terminal end side of the cloth Y when a portion near the upper end of the cloth (corner end Ya) is received and moved backward by the horizontal pulling device 6 to be described next.

**[0028]** In addition, in this embodiment, to reveal one corner end Ya of the rectangular cloth Y, the lifting device 2, the temporary holding device 3, and the corner end locating device 4 are used such that the corner end of the rectangular cloth Y in a balled-up state can be automatically located. Alternatively, this cloth corner end locating task may be performed, for example, by a worker manually finding one corner end of a balled-up piece of cloth Y. In this case, the worker may manually have the found corner end Ya of the cloth received by the chuck 51 of the corner end receiving device 5 or directly received by a chuck 61 of the horizontal pulling device 6 to be described below.

**[0029]** As shown in FIG. 11 to FIG. 14, the horizontal pulling device 6 has the chuck 61 and a forward-backward moving device that moves the chuck 61 forward and backward in the front-rear direction. In the shown example, the forward-backward moving device is composed of a driving belt 63 that holds the chuck 61, and a motor 62 that moves the chuck 61 forward and backward in the front-rear direction by rotating a pulley around which the driving belt 63 is wrapped. However, the forward-backward moving device may have any structure and, for example, an extending-contracting cylinder can also be used. As shown in FIG. 11, when the chuck 51 of the corner end receiving device 5 holds the cloth Y and moves backward, the chuck 61 of the horizontal pulling device 6 moves forward to the position indicated by the imaginary lines and reference sign 61', and the chuck 61 at this forward position holds the cloth at a position a little below the upper end portion (corner end Ya). Subsequently, after the chuck 51 of the corner end receiving device 5 releases the cloth Y, as shown in FIG. 12, the chuck 61 is moved backward while holding a portion near the corner end Ya of the cloth to thereby pull the cloth Y

horizontally over the platform 64. Then, as shown in FIG. 13, after the cloth Y is horizontally pulled a predetermined distance, an upper pressing plate 65 is moved downward by a cylinder 66 from the raised position indicated by reference sign 65' and holds the cloth Y between the upper pressing plate 65 and the platform 64. Also there-  
 5 after horizontal pulling continues, and when a sensor 67 disposed under the platform 64 detects a terminal end portion Yb of the cloth Y (or when the cloth Y is not detected by the sensor 67), the speed of horizontal pulling is switched to a low speed. As shown in FIG. 14, when  
 10 another sensor 68 disposed near the platform 64 detects the terminal end portion Yb of the cloth Y (or when the cloth Y is not detected by the sensor 68), horizontal pulling is stopped. Here, the cloth Y is in a state where the two corner ends other than the corner end Ya held by  
 15 the chuck 61 and the corner end Yb pressed by the upper pressing plate 65 are in line in the front-rear direction and one long-side edge Yc appears in the drooping portion (a state of having a triangular shape).

**[0030]** As shown in FIG. 15, the edge locating conveyor 8 that is driven by a motor 81 is installed to the right of the platform 64 and the upper pressing plate 65. The edge locating conveyor 8 is formed by a plurality of (in the shown example, nine) thin belts 8a extending in the left-right direction that is disposed at intervals in the front-rear direction.

**[0031]** As shown in FIG. 15 to FIG. 20, the two-position holding device 7 has: two chucks 71, 72 (hereinafter also referred to as an intermediate portion holding chuck 71 and a corner end holding chuck 72) mounted respectively at a rear end and a front end of a coupling rod 70 that extends in the front-rear direction; an upward-downward moving cylinder 73 that moves each of the chucks 71, 72 upward and downward; and a forward-backward moving device that moves each of the chucks 71, 72, along with the upward-downward moving cylinder 73, forward and backward in the left-right direction. The forward-backward moving device is composed of a driving belt 75 that holds the upward-downward moving cylinder 73 in a vertical state, and a motor 74 that rotates a pulley wrapped around the driving belt 75. However, the forward-backward moving device may have any structure as long as it can move the chucks 71, 72 in the left-right direction, and a forward-backward moving cylinder may also be used. The distance between the chucks 71, 72 may be made appropriately changeable according to the size etc. of the cloth Y to be processed, for example, by using a length-adjustable coupling rod 70 or adopting a structure that allows changes in the mounting positions of the chucks 71, 72 on the coupling rod 70.

**[0032]** As shown in FIG. 15, the corner end holding chuck 72 is located at a position at which it can hold a front-side end portion (corner end) Yb of the cloth Y laid by the horizontal pulling device 6, while the intermediate portion holding chuck 71 is located at a position at which it can hold an appropriate portion of an intermediate portion on the rear side of the laid cloth Y.

**[0033]** In its contracted state, the upward-downward moving cylinder 73 keeps each of the chucks 71, 72 on standby at positions above the laid cloth Y (the state indicated by the solid lines in FIG. 15), and in its extended state, the upward-downward moving cylinder 73 moves each of the chucks 71, 72 downward to positions at which they can hold an upper edge of the laid cloth Y as indicated by the imaginary lines in FIG. 15.

**[0034]** When the upward-downward moving cylinder 73 extends and then the two-position holding device 7 moves downward, as shown in FIG. 16, the corner end holding chuck 72 holds the front-side end portion (corner end) Yb of the cloth Y and the intermediate portion holding chuck 71 holds the intermediate portion on the rear side of the cloth Y. Here, as shown in FIG. 15, the opening degree of the chuck 69 provided near the rear side of the upper pressing plate 65 can be reduced from the wide-open state indicated by reference sign 69' to help the corner end holding chuck 72 hold the cloth Y. Thereafter,  
 20 the cloth Y is released from the chuck 61, the upper pressing plate 65, and the chuck 69 of the horizontal pulling device 6 that have been holding or restraining the cloth Y. Then, as shown in FIG. 17, the two-position holding device 7 is moved by the forward-backward moving device from a position above the edge locating conveyor 8 toward a terminal end side of the edge locating conveyor 8. The belts of the edge locating conveyor 8 have moved in the arrow direction indicated in FIG. 17, and a triangular portion (a portion near Yc) of the cloth Y can come into contact with the conveyor 8. Furthermore, air blown by a blowing device 82 installed between upper and lower portions of the belts of the conveyor 8 causes this triangular portion to trail in a flow direction of (move along) the conveyor 8.

**[0035]** Subsequently, as shown in FIG. 18, the chuck 71 on the rear side of the two-position holding device 7 releases the cloth Y, so that one-side part of the cloth Y (a part on the rear side from the corner end Yb) falls onto the moving belts of the edge locating conveyor 8. Since the front-side end portion (corner end Yb) of the cloth Y is still held by the corner end holding chuck 72, only the fallen portion of the cloth Y moves rightward as shown in FIG. 19. When this fallen portion of the cloth Y has moved a predetermined distance, the one long-side edge Yc of the cloth Y is disposed substantially orthogonal to the flow direction of the edge locating conveyor 8. When the long-side edge Yc is thus disposed, as shown in FIG. 20, the other chuck 72 releases the cloth Y, so that the entire cloth Y falls onto the edge locating conveyor 8. Two sensors 83 that detect the leading-side edge Yc of the cloth Y being transferred on the edge locating conveyor 8 are installed near a terminal end of the edge locating conveyor 8, and the edge locating conveyor 8 is switched to a low speed when the sensors 83 detect the cloth Y.

**[0036]** As shown in FIG. 21, the vertically inverting device 9 has: two chucks 92, 93 that are disposed near the terminal end portion of the edge locating conveyor 8 and

hold the one long-side edge Yc of the cloth Y; two sensors 94, 95 provided near each of the chucks 92, 93; a reversing shaft 96 that supports the chucks 92, 93; and a turning cylinder 91 that turns the reversing shaft 96. In addition, any mechanism may be used that can reverse the cloth Y hold by the two chucks 92, 93, and instead of the turning cylinder 91, a motor that rotates the reversing shaft 96 in normal and reverse directions may also be used. The two chucks 92, 93 are configured to move independently of each other based on signals output by the sensors 94, 95 upon detecting the side edge Yc of the cloth Y, and the side edge Yc of the cloth Y can be thereby held straight between the two chucks 92, 93.

**[0037]** The vertically inverting device 9 operates as follows. First, until the leading-side edge Yc of the cloth being transferred on the edge locating conveyor 8 is detected by the sensors 94, 95, each of the chucks 92, 93 remain on standby in a substantially horizontal (slightly upward-inclined) posture as shown in FIG. 20. When the leading-side edge Yc of the cloth Y being transferred on the edge locating conveyor 8 is detected by the sensors 94, 95, each of the chucks 92, 93 hold the leading-side edge Yc of the cloth based on detection signals from the sensors 94, 95. Immediately thereafter, the turning cylinder 91 contracts and causes each of the chucks 92, 93 to turn downward at a high speed while holding the side edge Yc of the cloth, and to assume the downward-facing posture shown in FIG. 22. Here, the cloth Y having been held by each of the chucks 92, 93 is rapidly swung down (an unfurling action is exerted on the cloth in a short-side direction), so that the cloth Y droops. Each of the chucks 92, 93 holding the side edge Yc of the cloth in the downward-facing posture, then release each held portion of the side edge Yc when these portions are passed to each of chucks 111, 112 of the hanging device 11 to be described below, and immediately thereafter are turned upward and returned to the original standby positions.

**[0038]** As shown in FIG. 23, the roller 10 and the hanging device 11 that hangs the cloth Y on the roller 10 are installed directly under a front-side portion of the edge locating conveyor 8, with the hanging device 11 located above the roller 10.

**[0039]** The hanging device 11 has a forward-backward moving platform 110 facing the vertically inverting device 9, the two chucks 111, 112 that are disposed on both sides of the forward-backward moving platform 110 and receive the cloth Y from the chucks 92, 93 of the vertically inverting device 9, and chuck sensors 113, 114. The hanging device 11 is moved forward and backward in the left-right direction (in the direction of a rotational axis of the roller 10) by a forward-backward moving device. In the shown example, the forward-backward moving device is composed of a driving belt 116 that holds the forward-backward moving platform 110 and a motor 115 that rotates a pulley around which the driving belt 116 is wrapped. However, the forward-backward moving device may have any structure as long as it can move the chucks 111, 112 forward and backward in the left-right

direction, and, for example, a forward-backward moving cylinder may also be used.

**[0040]** The hanging device 11 moves closer to the cloth Y held by the vertically inverting device 9 from the standby position shown in FIG. 23. As shown in FIG. 24, when the chuck sensors 113, 114 detect the cloth Y, the chucks 111, 112 are closed toward both sides of the forward-backward moving platform 110 and hold the cloth Y. Here, the position at which the chucks 111, 112 hold the cloth Y is a position near the position at which the chucks 92, 93 of the vertically inverting device 9 hold the cloth Y. In addition, the two chucks 111, 112 may be configured to move separately and independently, and in that case, the portion of the side edge Yc of the cloth Y between the two chucks 111, 112 can be held straighter. As shown in FIG. 25, after passing the cloth Y, the vertically inverting device 9 turns around and returns to the original position, and moves away from the path of the hanging device 11. Since the roller 10 is disposed such that the rotational axis thereof is parallel to the forward-backward moving direction of the hanging device 11, when the hanging device 11 holding the cloth Y in a drooping state moves backward, as shown in FIG. 25, the cloth Y is hung on the roller 10 and droops from the roller 10. Here, a side edge Yd on the opposite side from the long-side edge Yc held by the chucks 111, 112 is detected by a sensor 101, and the chucks 111, 112 release the cloth Y after a predetermined time has elapsed since the detection. The predetermined time is appropriately set such that the chucks 111, 112 release the cloth Y when the center of the cloth Y in a width direction thereof substantially coincides with the center of the roller 10 in a width direction thereof. In addition, the hanging device 11 continues to move backward a predetermined distance also after the chucks 111, 112 release the cloth Y.

**[0041]** As shown in FIG. 26, the roller 10 is composed of a first roller part 102 and a second roller part 103 disposed next to each other on the same axis. The first roller part 102 is connected to a motor 104 through a driving belt 105 and driven to rotate by the motor 104. The second roller part 103 is connected to a motor 106 through a driving belt 107 and driven to rotate by the motor 106. The rotation directions and the rotation speeds of the motors 104, 106 can be controlled separately and independently. It is preferable that the rotation directions and the rotation speeds of the motors 104, 106 be controlled separately and independently such that the direction of the cloth Y on the roller 10 can be corrected to the right direction (e.g., a direction in which a long-side direction of the cloth Y coincides with the front-rear direction) based on detection signals from a plurality of sensor groups 108, 109 that is arrayed under each of the roller parts 102, 103 parallel to the rotational axis of the rollers as shown in FIG. 27. For example, when the cloth Y is obliquely hung on the roller 10 as shown in FIG. 26, and only the sensor group 109 of the sensor groups 108, 109 detects the short-side edge Ye of the cloth Y as shown in FIG. 27, the first roller part 102 and the second roller

part 103 are repeatedly stopped, rotated in a normal direction, and rotated in a reverse direction based on a detection result of the sensor group 109, until the side-edge Ye becomes parallel to the sensor groups 108, 109 and both the sensor groups 108, 109 detect the short-side edge Ye of the cloth Y at the same time. In addition, in the shown example, each of the sensor groups 108, 109 consists of five sensors respectively. However, the number of the sensors is not limited to five, and four or less or six or more sensors may be provided according to the width of the cloth Y to be processed, and the sensors to be activated may be switched according to the cloth Y to be processed.

**[0042]** The forward-backward moving device 12 moves the cloth Y having been oriented in the right direction on the roller 10 onto the transfer conveyor 13. As shown in FIG. 28, the forward-backward moving device 12 has a holding unit that has a holding width larger than the width of the cloth Y and holds a short-side end portion of the cloth Y, and a forward-backward moving mechanism that moves the holding unit forward and backward in the front-rear direction. In the shown example, the above holding unit is composed of a holding platform 123a inclined facing the roller 10, and a holding plate 123b that is opened from and closed onto the holding platform 123a by a cylinder 124 or the like. Furthermore, the above forward-backward moving mechanism is composed of a driving belt 122 that is coupled to the holding platform 123a and a motor 121 that rotates a pulley around which the driving belt 122 is wrapped. However, a forward-backward moving cylinder may also be used for the forward-backward moving mechanism.

**[0043]** To move the cloth Y from the roller 10 onto the transfer conveyor 13 by the forward-backward moving device 12, as shown in FIG. 28, the first roller part 102 and the second roller part 103 are rotated toward the forward-backward moving device 12 at the same time and at the same speed, so that the side edge Ye of the cloth Y located near the sensor groups 108, 109 is moved closer to the forward-backward moving device 12. Furthermore, as shown in FIG. 29, the holding unit of the forward-backward moving device 12 is moved forward, and a leading end of the holding platform 123a of the holding unit with the holding plate 123b opened is pressed against a blowing member 10a installed under the roller 10, so as to hold a portion of the cloth Y on the roller 10, which is a portion on the side of the transfer conveyor 13, between the leading end of the holding platform 123a and the blowing member 10a. In this state, as shown in FIG. 30, air is ejected from the blowing member 10a and, at the same time, the first roller part 102 and the second roller part 103 are further rotated toward the forward-backward moving device 12. As a result, the above side edge Ye of the cloth Y is placed on the holding platform 123a. Thereafter, as shown in FIG. 31, the holding plate 123b is closed and the side edge Ye of the cloth Y is held between the holding plate 123b and the holding platform 123a. The portion of the cloth Y other than the

portion held between the holding platform 123a and the holding plate 123b of the holding unit droops from the holding platform 123a. In this state, as shown in FIG. 32, the holding unit of the forward-backward moving device 12 is moved toward the transfer conveyor 13. After the holding unit is moved backward a predetermined distance, as shown in FIG. 33, the holding plate 123b is opened again and the cloth Y is moved onto the transfer conveyor 13. In addition, the holding unit of the forward-backward moving device 12 continues to be moved backward a predetermined distance also after the holding plate 123b releases the cloth Y.

**[0044]** As shown in FIG. 33, the transfer conveyor 13 has a belt 133 having a large number of through-holes, a motor 132 that drives the belt 133, and a suction fan 131 that suctions the cloth Y on the belt 133 through the through-holes formed in the belt 133. As the cloth Y on the transfer conveyor 13 is thus suctioned, the side edge Ye of the cloth Y held by the holding unit of the forward-backward moving device 12 can fall and smoothly move onto the transfer conveyor 13. Thereafter, as shown in FIG. 34, the transfer conveyor 13 discharges the cloth Y and transfers (feeds) the cloth Y to the next process (here, the cloth folding machine D). In addition, the belt 133 of the transfer conveyor 13 need not be driven while the holding unit of the forward-backward moving device 12 moves the cloth Y onto the transfer conveyor 13. However, it is preferable that the belt 133 be driven from the viewpoint of increasing the number of pieces of cloth to be processed.

**[0045]** The automatic cloth spreading machine configured as described above requires simply feeding the washed and dried cloth Y onto the supply conveyor 1. Then, the cloth Y can be automatically spread and transferred (fed) to the next process by the lifting device 2, temporary holding device 3, corner end locating device 4, corner end receiving device 5, horizontal pulling device 6, two-position holding device 7, edge locating conveyor 8, vertically inverting device 9, roller 10, hanging device 11, forward-backward moving device 12, transfer conveyor 13, etc.

**[0046]** Next, an embodiment of the cloth clamping chuck of the present invention will be described in detail with reference to FIG. 35 to FIG. 40. In the example of the above-described automatic cloth spreading machine, the cloth clamping chuck of this embodiment can be applied to the chucks 21, 31, 41, 51, 61, 71, 72, etc. of the lifting device 2, temporary holding device 3, corner end locating device 4, corner end receiving device 5, horizontal pulling device 6, two-position holding device 7, etc. that are cloth handling apparatuses. In this case, the upward-downward moving device of the lifting device 2, the forward-backward moving device of the temporary holding device 3, the forward-backward moving device of the corner end locating device 4, the forward-backward moving device of the corner end receiving device 5, the forward-backward moving device of the horizontal pulling device 6, and the upward-downward moving cylinder 73

and the forward-backward moving device of the two-position holding device 7 correspond to the moving means of the cloth handling apparatus of the present invention. The following description is based on an example in which the cloth handling apparatus of the present invention is applied to the lifting device 2.

**[0047]** First, FIG. 35 is a plan view showing a cloth clamping chuck in one embodiment of the present invention. A cloth clamping chuck 21 in this embodiment includes a main body 211, and a pair of clamps 212, 213 that is held by the main body 211 and disposed facing each other and that can be moved relatively closer to or separated from each other. In the shown example, both the clamps 212, 213 are configured to open and close by swinging respectively around swinging axes x1, x2 (schematically represented by dots in FIG. 35). However, in a modified example (not shown), one clamp 212 or 213 may be swingable while the other clamp 213 or 212 may be fixed, and the one clamp 212 or 213 may be moved closer to or separated from the other clamp 213 or 212. The swinging axes x1, x2 extend in a direction orthogonal to both the facing direction described above of the clamps 212, 213 and an extension direction that is a direction from a base end toward a leading end of the clamps 212, 213 (the direction indicated by the long and short dashed line in FIG. 35).

**[0048]** At a leading end of each of the clamps 212, 213, a projecting part 214 or 215 projecting toward the other opposite clamp 213 or 212 is formed, and a part of each clamp outside the main body 211 has a substantially L-shape as seen in a plan view. The projecting parts 214, 215 are formed as parts separate from clamp main bodies 216, 217 that protrude straight from the main body 211, but may instead be integrally formed with the clamp main bodies 216, 217. In addition, if the clamp main bodies 216, 217 and the projecting parts 214, 215 are separate parts, these parts can be made of different materials. For example, the clamp main bodies 216, 217 can be made of a high-strength material, for example, metal such as carbon steel, while the projecting parts 214, 215 can be made of an easily moldable material, for example, a synthetic resin. Moreover, if the clamp main bodies 216, 217 and the projecting parts 214, 215 are separate parts, the projecting parts 214, 215 can be replaced with ones having different dimensions or shapes according to the purpose of use etc. In addition, the projecting parts 214, 215 may be removably fixed to the clamp main bodies 216, 217 through fasteners, such as screws or bolts, or may be fixed thereto with an adhesive etc.

**[0049]** What is important here is that surfaces of the projecting parts 214, 215 on a base end side of the clamps 212, 213 (the surfaces on the side of the main body 211; hereinafter also referred to as "back surfaces") 214a, 215a are formed as flat surfaces parallel to the facing direction of the pair of clamps 212, 213 (flat surfaces orthogonal to the above extension direction indicated by the long and short dashed line in FIG. 35). Furthermore, in a more advantageous embodiment, a gap g is formed

between the projecting parts 214, 215 facing each other in a fully closed position of the pair of clamps 212, 213. In a more preferable embodiment, the gap g is set to be substantially equal to the thickness of two pieces of cloth to be clamped. The "fully closed position" here means, for structural reasons, a position in which the pair of clamps 212, 213 are closest to each other.

**[0050]** FIG. 36 shows a driving unit as an opening-closing means that is provided inside the main body 211 and swings the pair of clamps 212, 213 around the swinging axes x1, x2. As shown in FIG. 36 (a), a part of each clamp inside the main body 211 is also bent toward the other clamp 212 or 213, and each of the clamps 212, 213 has a substantially rectangular C-shape as a whole. Each of the clamps 212, 213 are swingably held by the main body 211 through fulcrum pins 218, 219 serving as the swinging axes x1, x2. Furthermore, a cutout 221 is formed at ends of each of the clamps 212, 213 located inside the main body 211, and a driving pin 222b formed at a leading end of a rod 222a of a cylinder 222 to be described below is press-fitted into the cutout 221.

**[0051]** In the shown example, the driving unit is formed by the cylinder 222 that moves the rod 222a forward and backward by air pressure. FIG. 36 (b) shows a state where the rod 222a is moved forward to thereby simultaneously swing both the clamps 212, 213 around the fulcrum pins 218, 219 and open the clamps 212, 213. In addition, as long as the driving unit can swing the clamps 212, 213, any commonly known driving mechanism, such as a solenoid or a ball screw mechanism, may be used.

**[0052]** As shown in FIG. 37, in the cloth clamping chuck 21 of this embodiment, when a portion of the cloth Y is brought into contact between the pair of clamps 212, 213 in an open posture and the rod 222a of the cylinder 222 is moved backward, the pair of clamps 212, 213 swing around the fulcrum pins 218, 219 and close, so that a portion of the cloth Y is clutched between the clamps 212, 213. In this state, then moving the lifting device 2 as a cloth handling apparatus upward can lift the cloth Y. Here, the back surfaces 214a, 215a of the projecting parts 214, 215 of the clamps 212, 213 are formed as flat surfaces parallel to the facing direction of the pair of clamps 212, 213 in the fully closed position described above. Therefore, when the load of the weight of the cloth Y is applied to the back surfaces 214a, 215a, the clamps 212, 213 swing further in a closing direction, so that a portion of the cloth on a back side (main body side) from the projecting parts 214, 215 gets caught on the back surfaces 214a, 215a of the projecting parts 214, 215. Thus, falling (slipping out) of the cloth Y is reduced.

**[0053]** Furthermore, in the cloth clamping chuck 21 of this embodiment, the gap g is maintained between the projecting parts 214, 215 also in the fully closed position of the clamps 212, 213. Therefore, as shown in FIG. 38, when the cloth Y clamped by the cloth clamping chuck 21 is about to fall, the projecting parts 214, 215 allow the cloth Y to fall without forcibly holding the cloth Y, so that a situation where the clamps 212, 213 cause damage to

the cloth Y can be avoided. Furthermore, if the dimension of the gap g is set to be substantially equal to the thickness of two pieces of cloth Y, damage to the cloth Y can be more reliably prevented while falling of the cloth Y is reduced.

**[0054]** FIG. 39 is a plan view showing main parts of a modified example of the cloth clamping chuck 21 shown in FIG. 35 to FIG. 38. In the cloth clamping chuck 21 according to this modified example, each of the back surfaces 214a, 215a of the projecting parts 214, 215 is formed as an inclined surface inclining toward the main body 211 while extending toward the other opposite projecting part 214 or 215. This is the only difference from the configuration of the cloth clamping chuck described with FIG. 35 to FIG. 38. Also when the back surfaces 214a, 215a of the projecting parts 214, 215 are such inclined surfaces, the cloth Y can be caught between the projecting parts 214, 215 when the cloth Y is held, so that falling of the cloth Y can be reduced. In addition, it is preferable that an inclination angle  $\theta$  of the back surfaces 214a, 215a relative to a direction in which the clamp main bodies 216, 217 protrude from the main body 211 be not smaller than  $75^\circ$  nor larger than  $90^\circ$ . If the inclination angle of the back surfaces 214a, 215a is smaller than  $75^\circ$ , the cloth Y may get caught on the projecting parts 214, 215 to such an excessive degree that the cloth Y cannot be smoothly released from the cloth clamping chuck 21.

**[0055]** FIG. 40 is a plan view showing main parts of a cloth clamping chuck in another embodiment of the present invention. In the above embodiment, the clamps 212, 213 are configured to open and close by swinging around the swinging axes. In the cloth clamping chuck of this embodiment, a pair of clamps 212, 213 is configured to open and close by sliding in a facing direction thereof.

**[0056]** Specifically, the cloth clamping chuck mainly includes: a rail 224 installed along a front-side surface of a main body 211; a pair of sliders 225, 226 that travels along the rail 224; a driving unit (not shown) that is provided inside the main body 211 and drives the sliders 225, 226; and the clamps 212, 213 fixed to each of the sliders 225, 226. As long as the driving unit can move the sliders 225, 226 along the rail 224, any commonly known driving mechanism, such as an air cylinder, a solenoid, or a ball screw mechanism, may be used as the driving unit. Each of the clamps 212, 213 have projecting parts 214, 215 and a portion of cloth on a back side (the side of the main body 211) from the projecting parts 214, 215 gets caught on back surfaces 214a, 215a of the projecting parts 214, 215, so that falling (slipping out) of the cloth Y is reduced. Moreover, a gap is maintained between both the projecting parts 214, 215 in a fully closed position of the clamps 212, 213, so that damage associated with falling of the cloth Y can be prevented. Since these advantages are the same as in the above embodiment, no further details will be described.

## Industrial Applicability

**[0057]** The present invention can provide a cloth clamping chuck and a cloth handling apparatus that can handle cloth so as to reduce falling of the cloth while avoiding damage to the cloth.

## Reference Signs List

### 10 [0058]

1	Supply conveyor
2	Lifting device
3	Temporary holding device
15 4	Corner end locating device
5	Corner end receiving device
6	Horizontal pulling device
7	Two-position holding device
8	Edge locating conveyor
20 9	Vertically inverting device
10	Roller
11	Hanging device
12	Forward-backward moving device
13	Transfer conveyor
25 21	Cloth clamping chuck
211	Main body
212, 213	Clamp
214, 215	Projecting part
214a, 215a	Back surface
30 216, 217	Clamp main body
218, 219	Fulcrum pin
221	Cutout
222	Cylinder
222a	Rod
35 222b	Driving pin
224	Rail
225, 226	Slider
g	Gap
x1, x2	Swinging axis

## Claims

1. A cloth clamping chuck comprising a pair of clamps disposed facing each other, and an opening-closing means that moves the pair of clamps relatively closer to or separated from each other, **characterized in that:**

each of the clamps has, at a leading end, a projecting part that projects toward the other opposite clamp; and  
a surface of the projecting part on a base end side of the clamp is formed either as a flat surface parallel to a facing direction of the pair of clamps or as an inclined surface inclining toward the base end side while extending toward the other opposite projecting part.

2. The cloth clamping chuck according to claim 1, wherein a gap is formed between the projecting parts facing each other in a fully closed position of the pair of clamps. 5
3. The cloth clamping chuck according to claim 2, wherein the gap is set to be substantially equal to a thickness of two pieces of cloth to be clamped.
4. The cloth clamping chuck according to any one of claims 1 to 3, wherein at least one of the pair of clamps is provided so as to be able to swing around a swinging axis extending in a direction orthogonal to both an extension direction that is a direction from the base end toward the leading end of the clamp and the facing direction. 10 15
5. A cloth handling apparatus **characterized by** comprising the cloth clamping chuck according to any one of claims 1 to 4 and a moving means that moves the cloth clamping chuck. 20

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FIG. 1

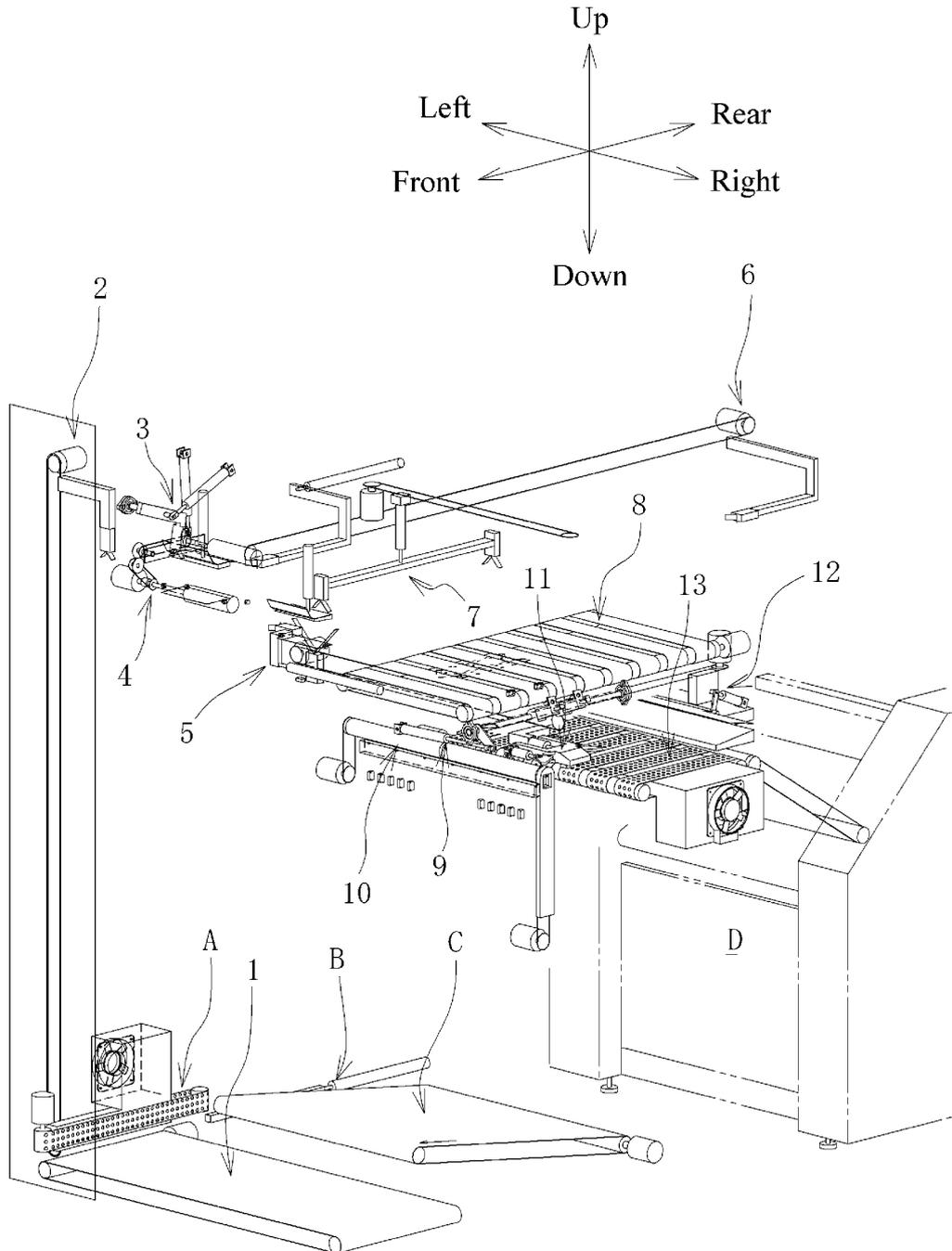


FIG. 2

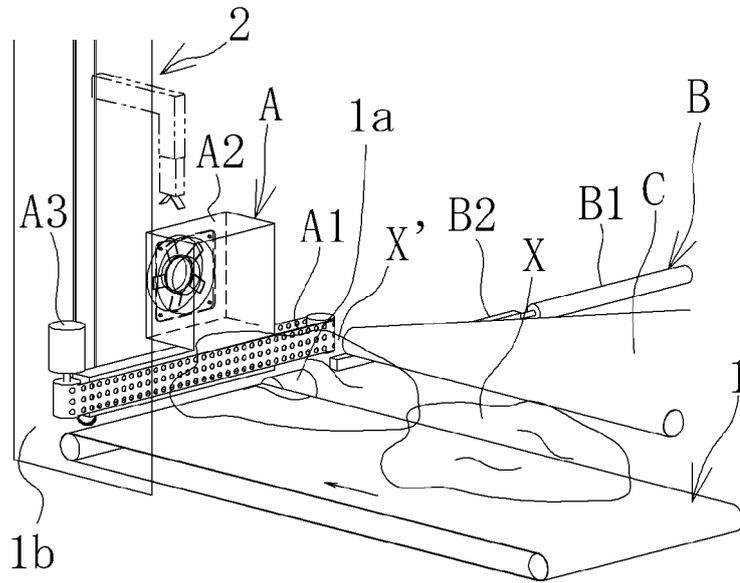


FIG. 3

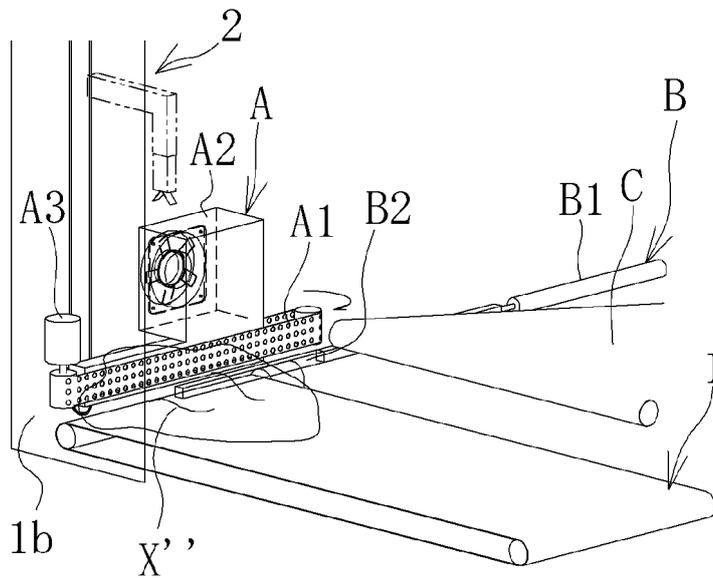


FIG. 4

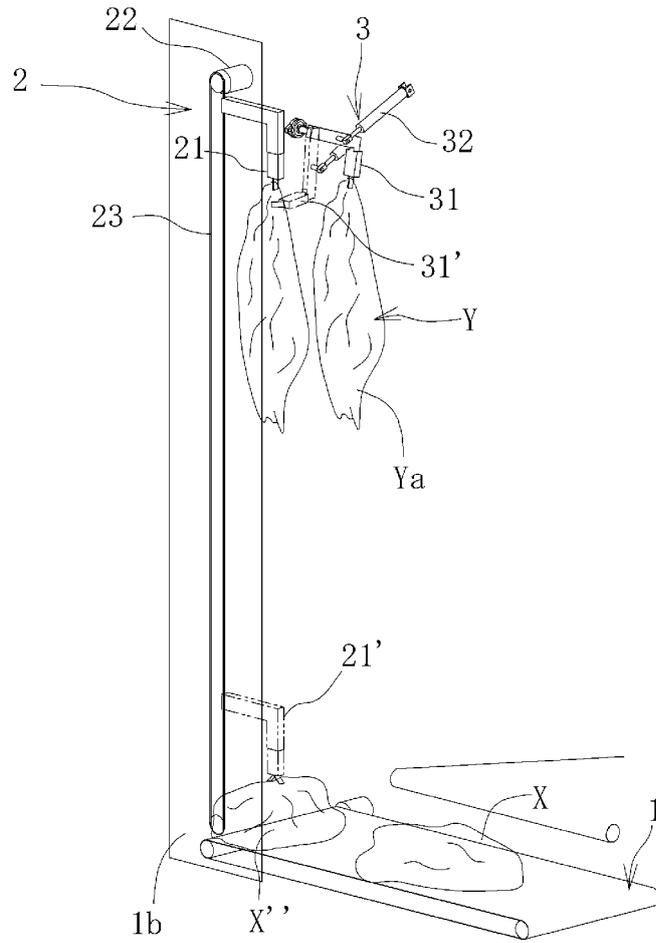


FIG. 5

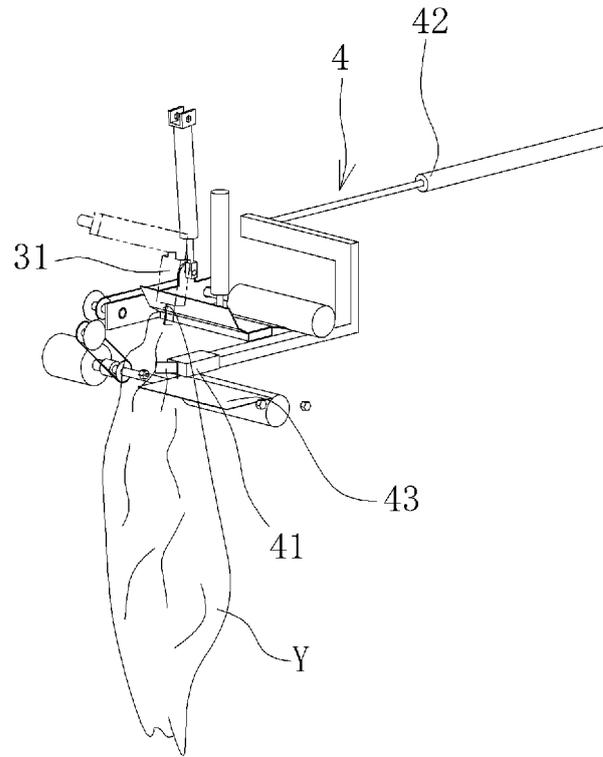


FIG. 6

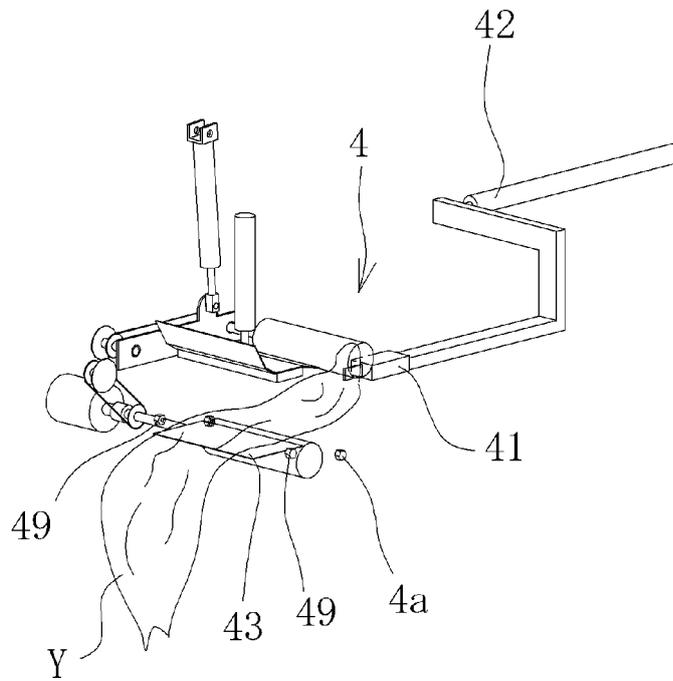


FIG. 7

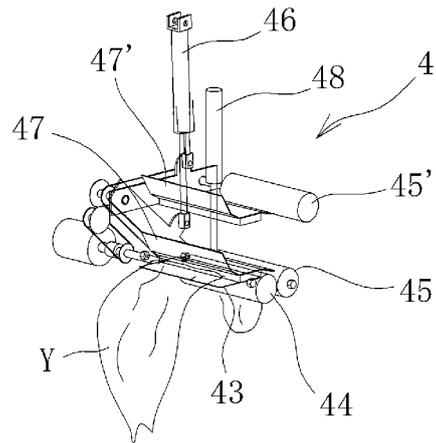


FIG. 8

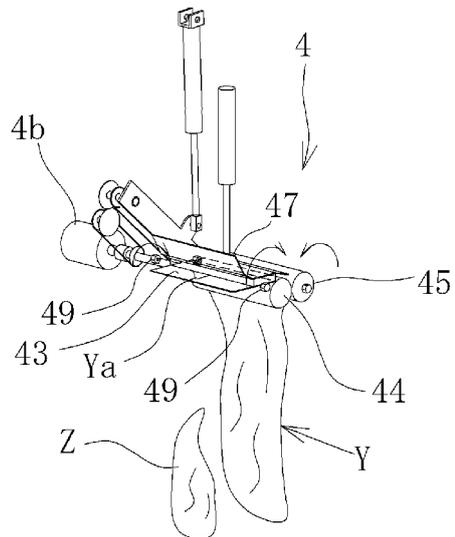


FIG. 9

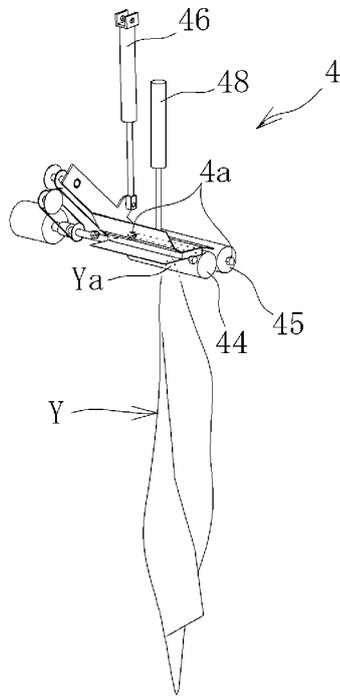


FIG. 10

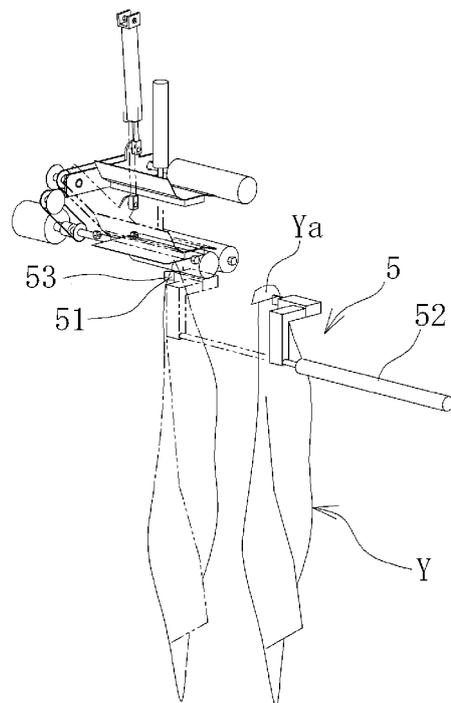


FIG. 11

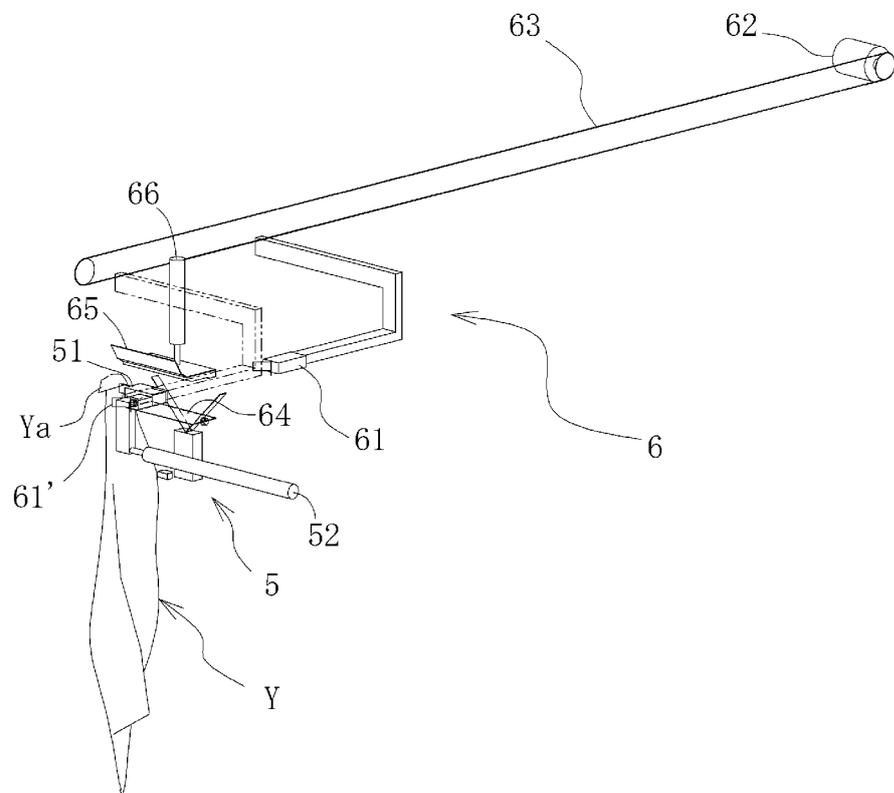


FIG. 12

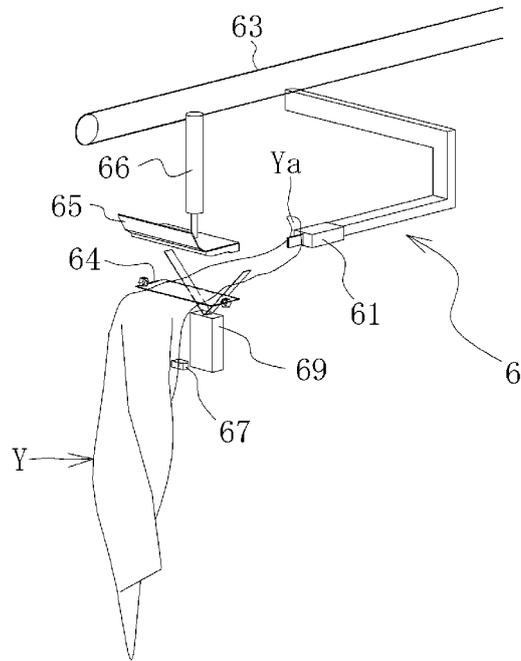


FIG. 13

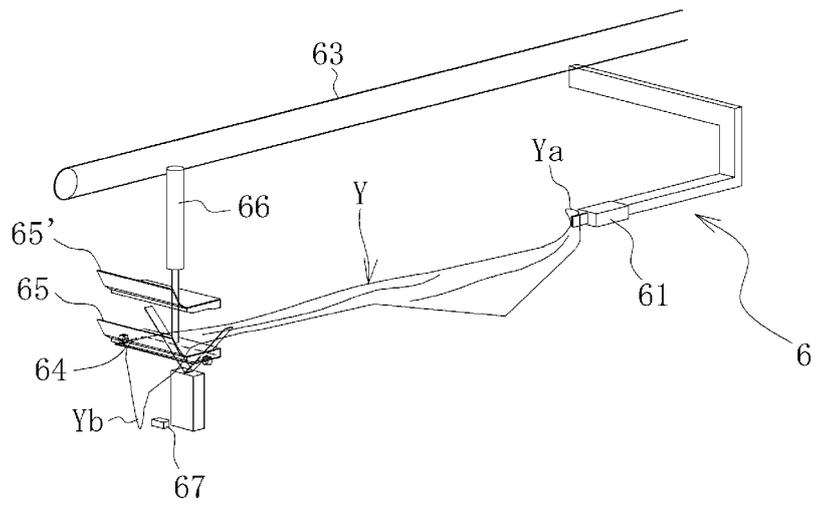


FIG. 14

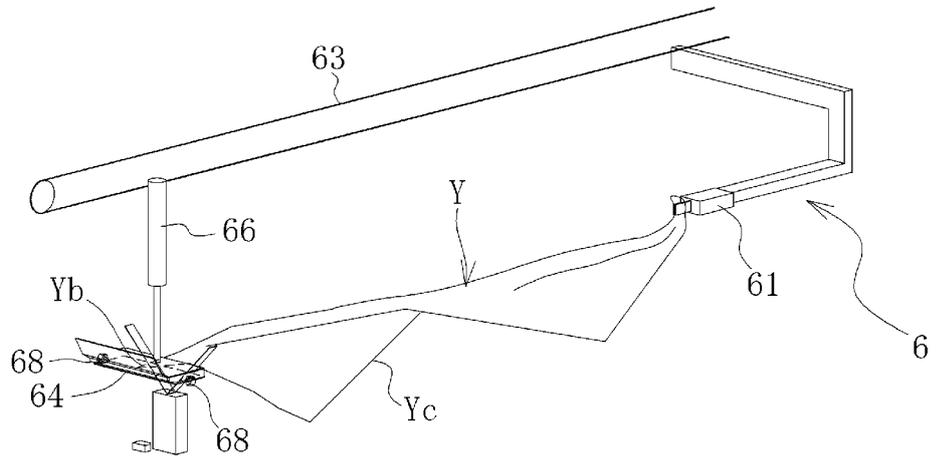


FIG. 15

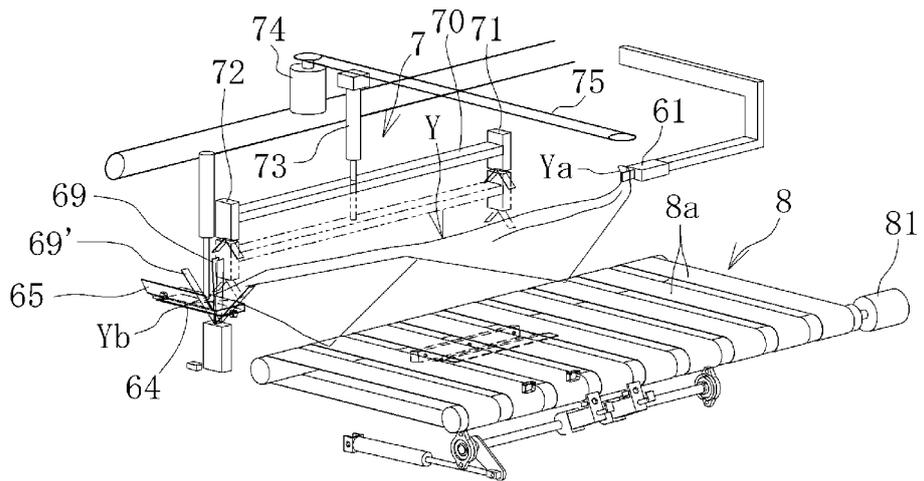


FIG. 16

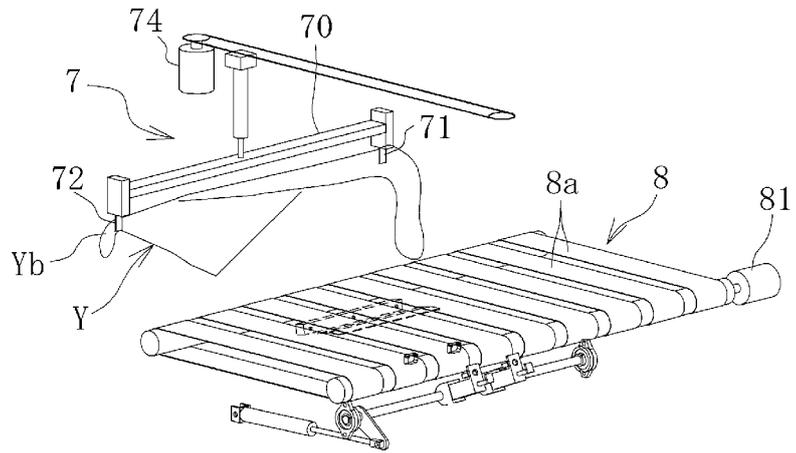


FIG. 17

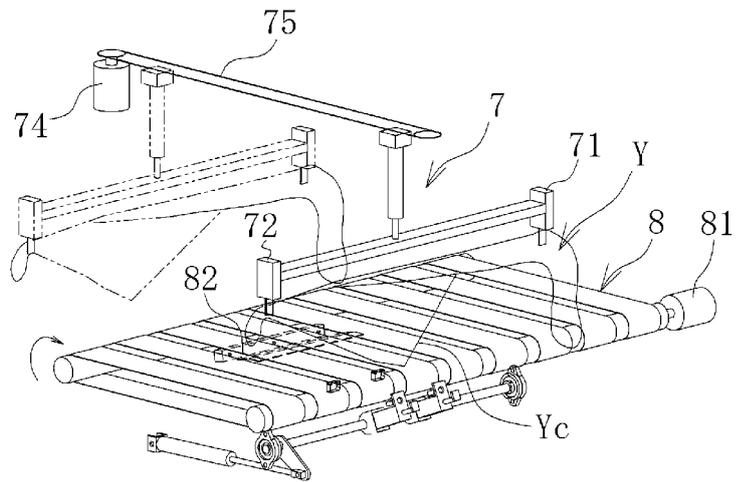


FIG. 18

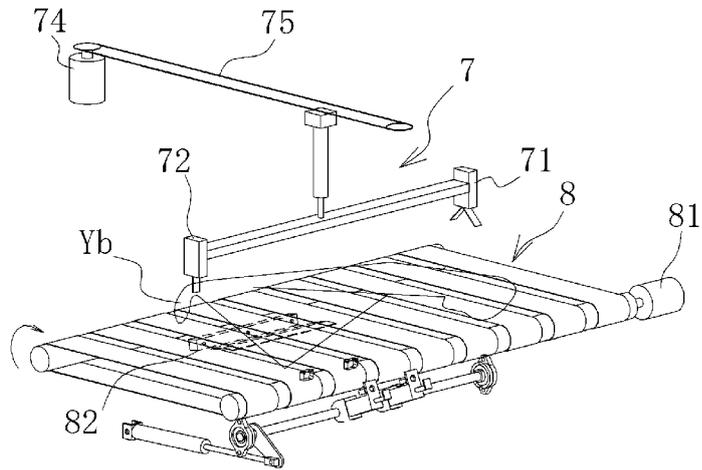


FIG. 19

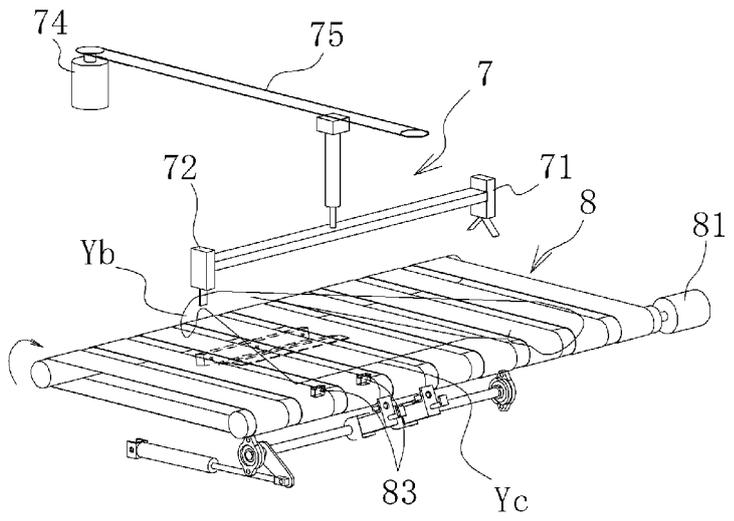


FIG. 20

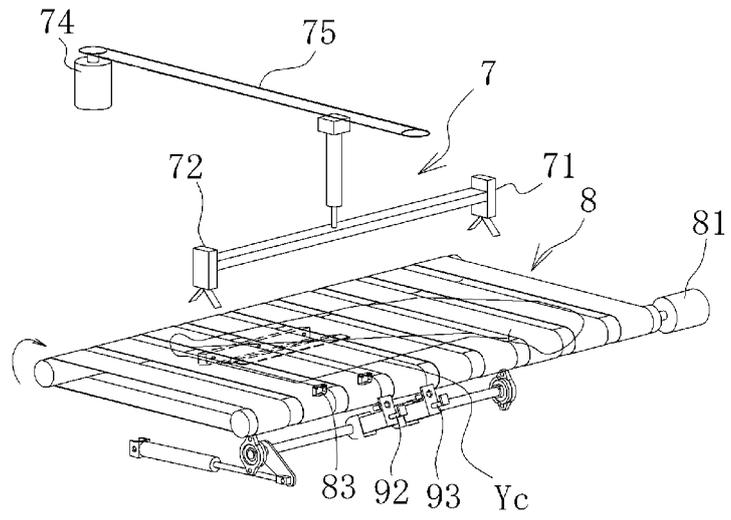


FIG. 21

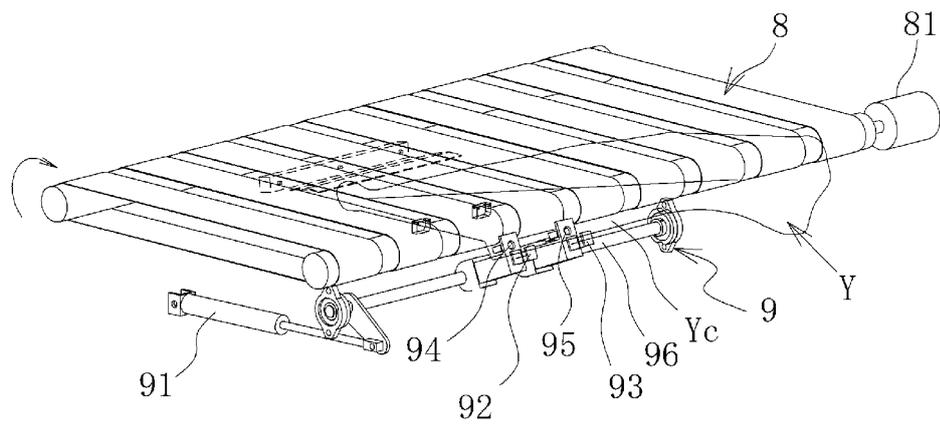


FIG. 22

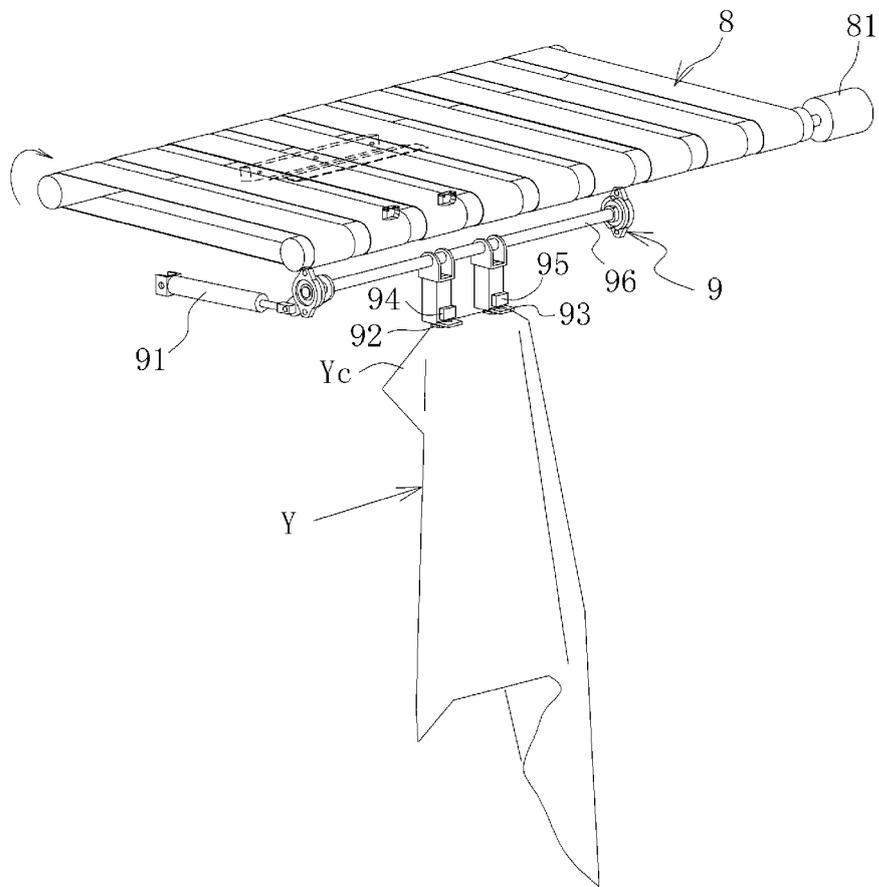


FIG. 23

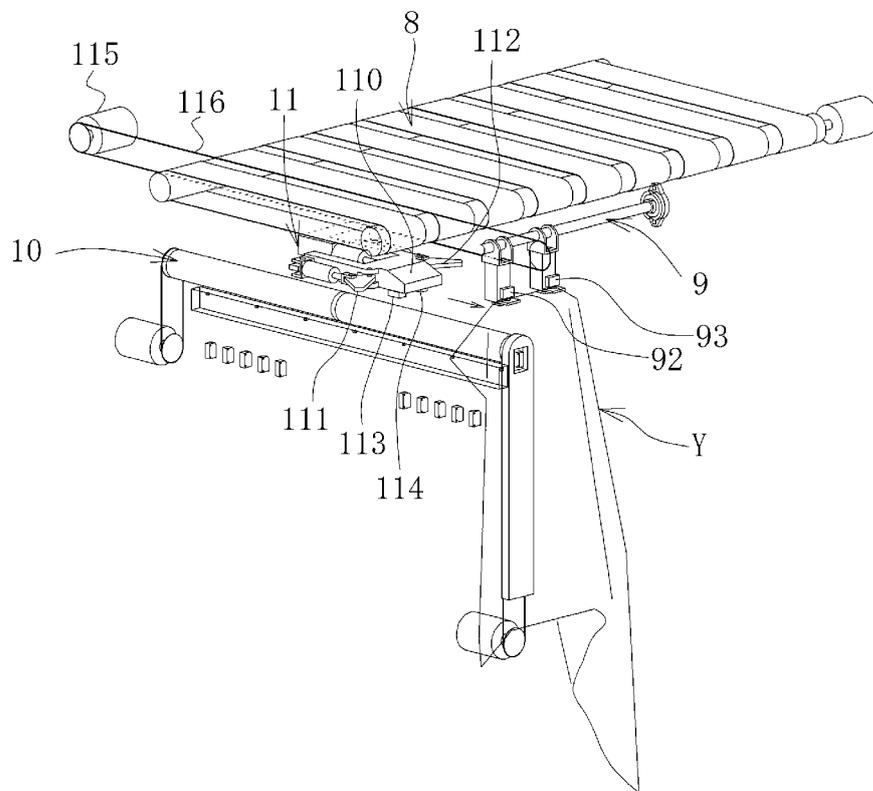




FIG. 25

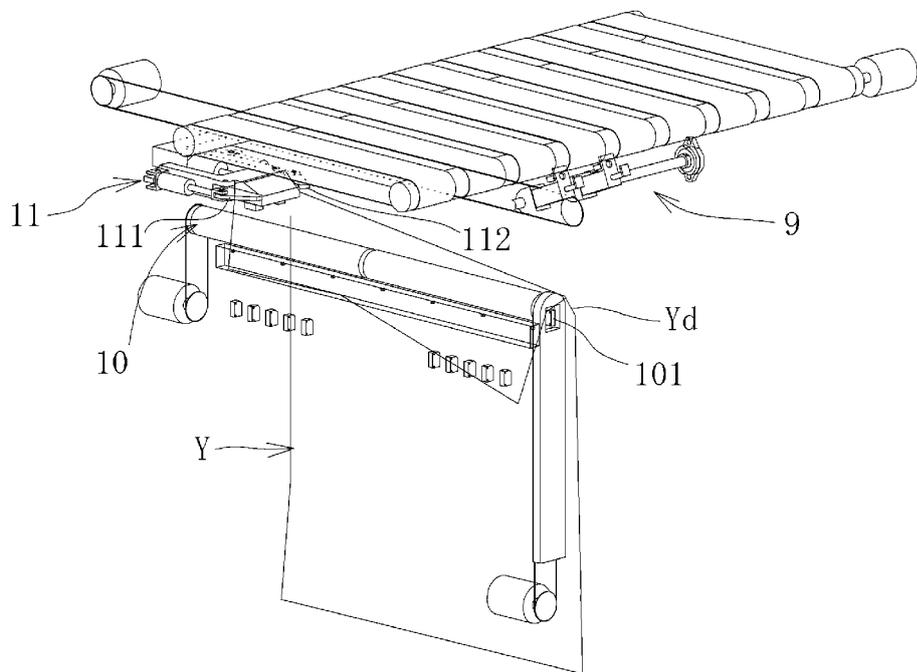


FIG. 26

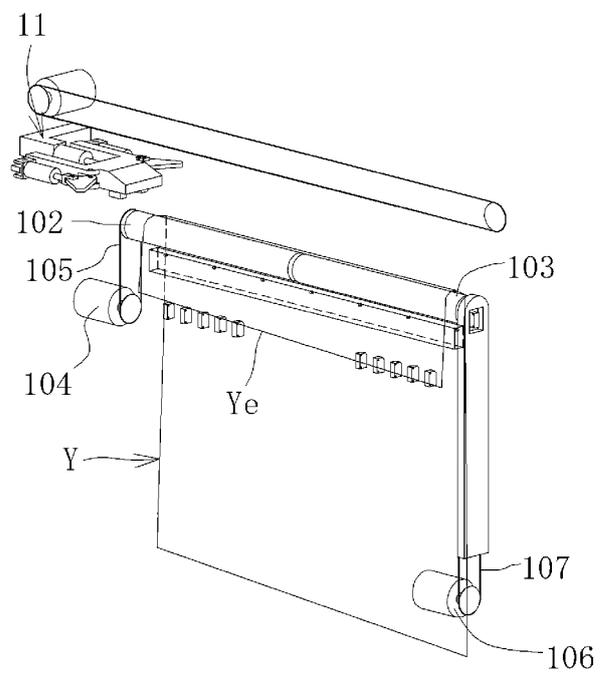


FIG.27

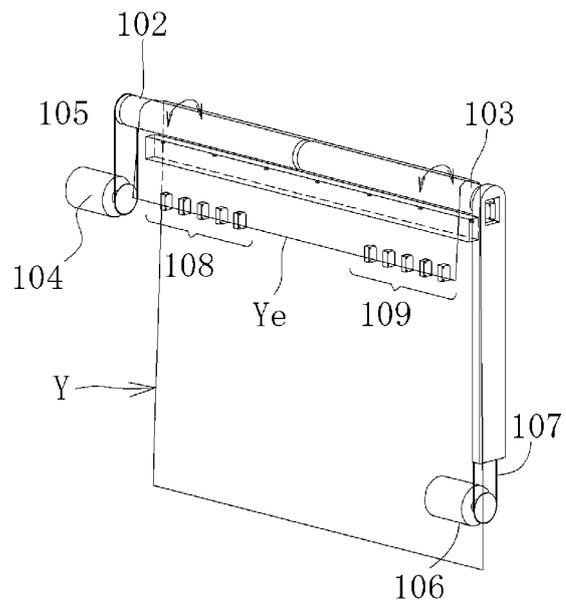


FIG. 28

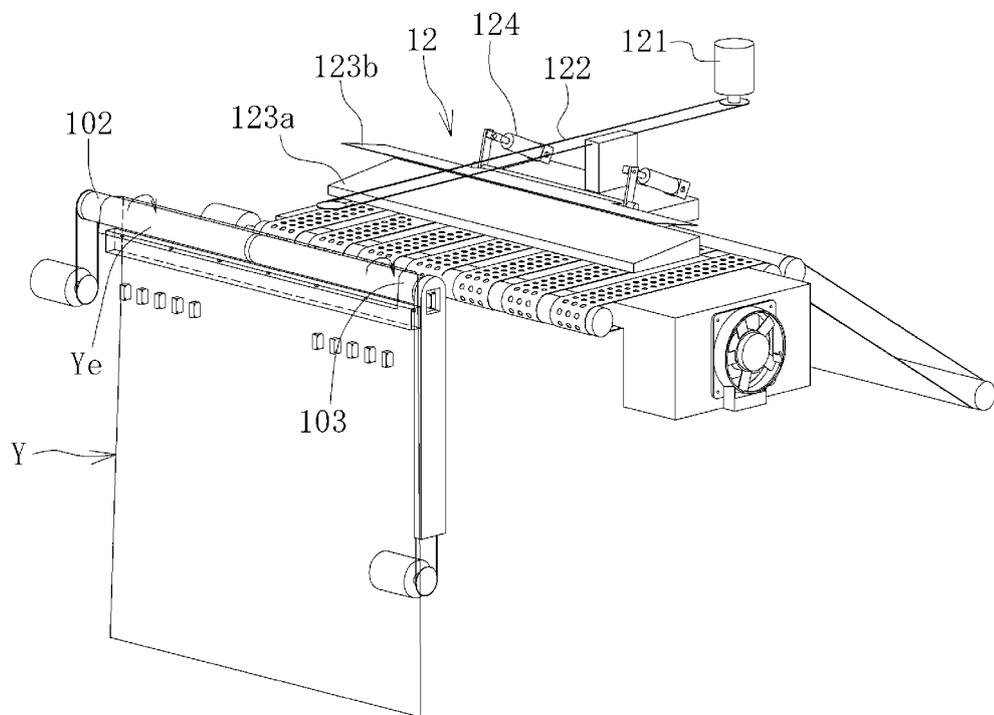




FIG. 30

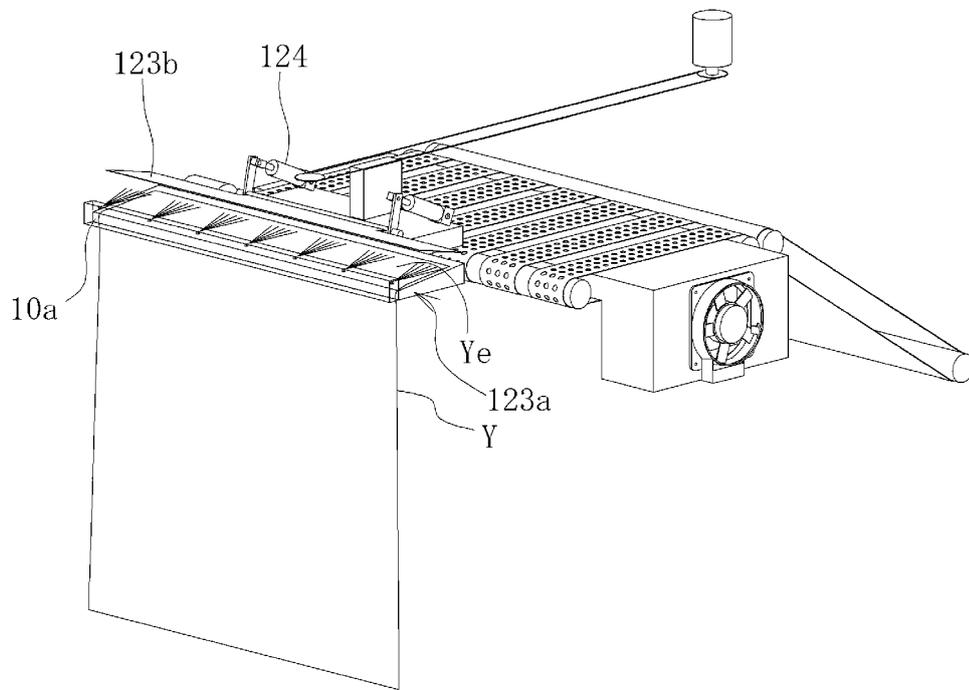


FIG. 31

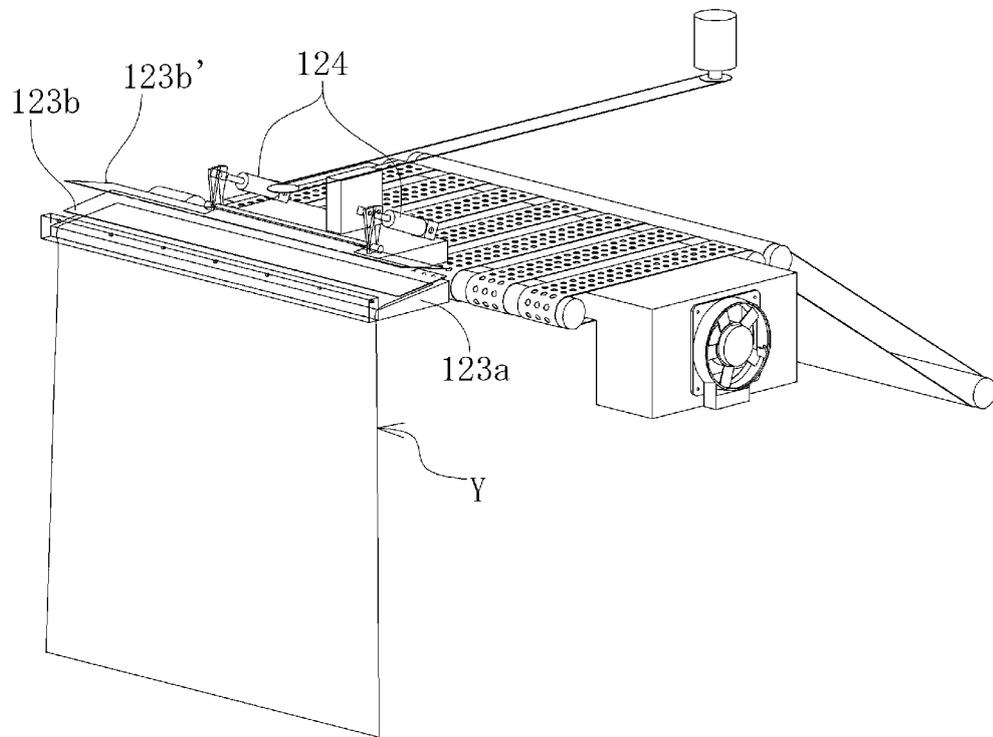


FIG. 32

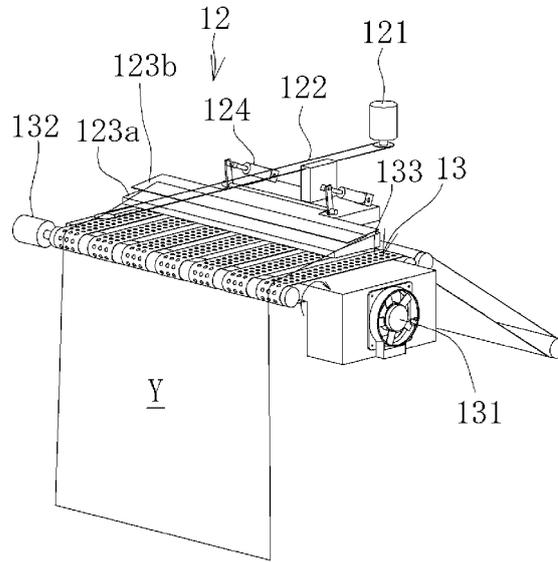


FIG. 33

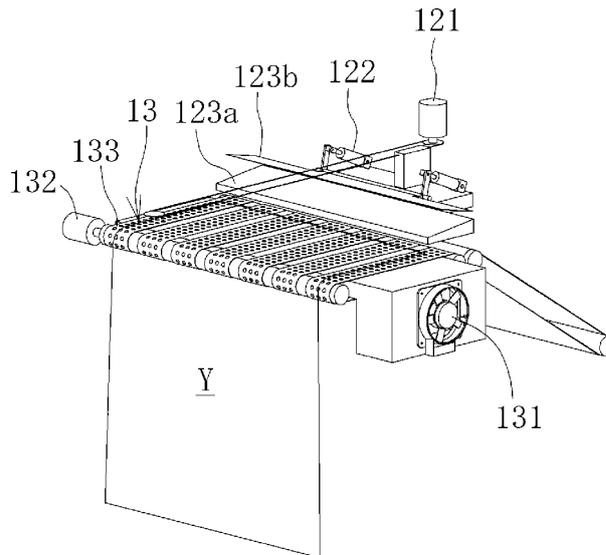


FIG. 34

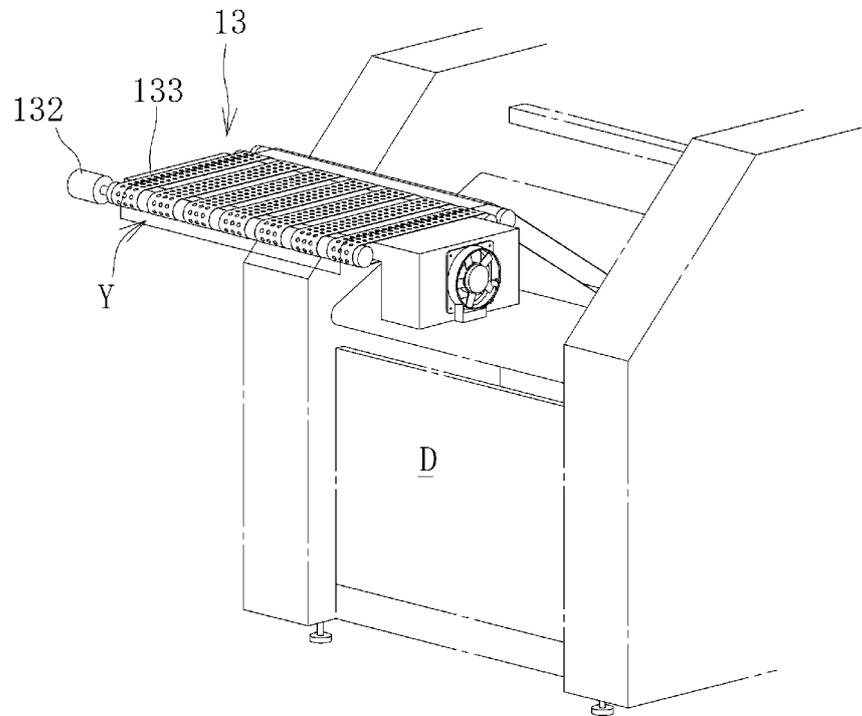


FIG. 35

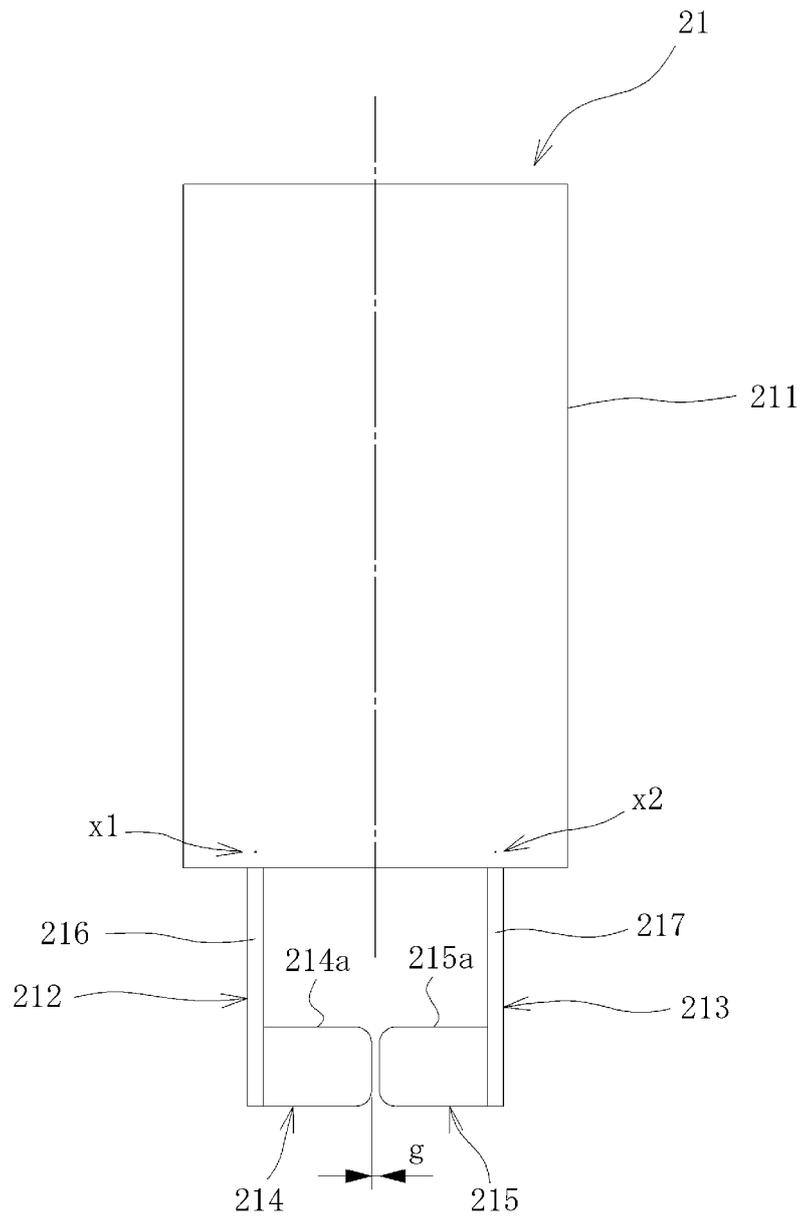


FIG. 36

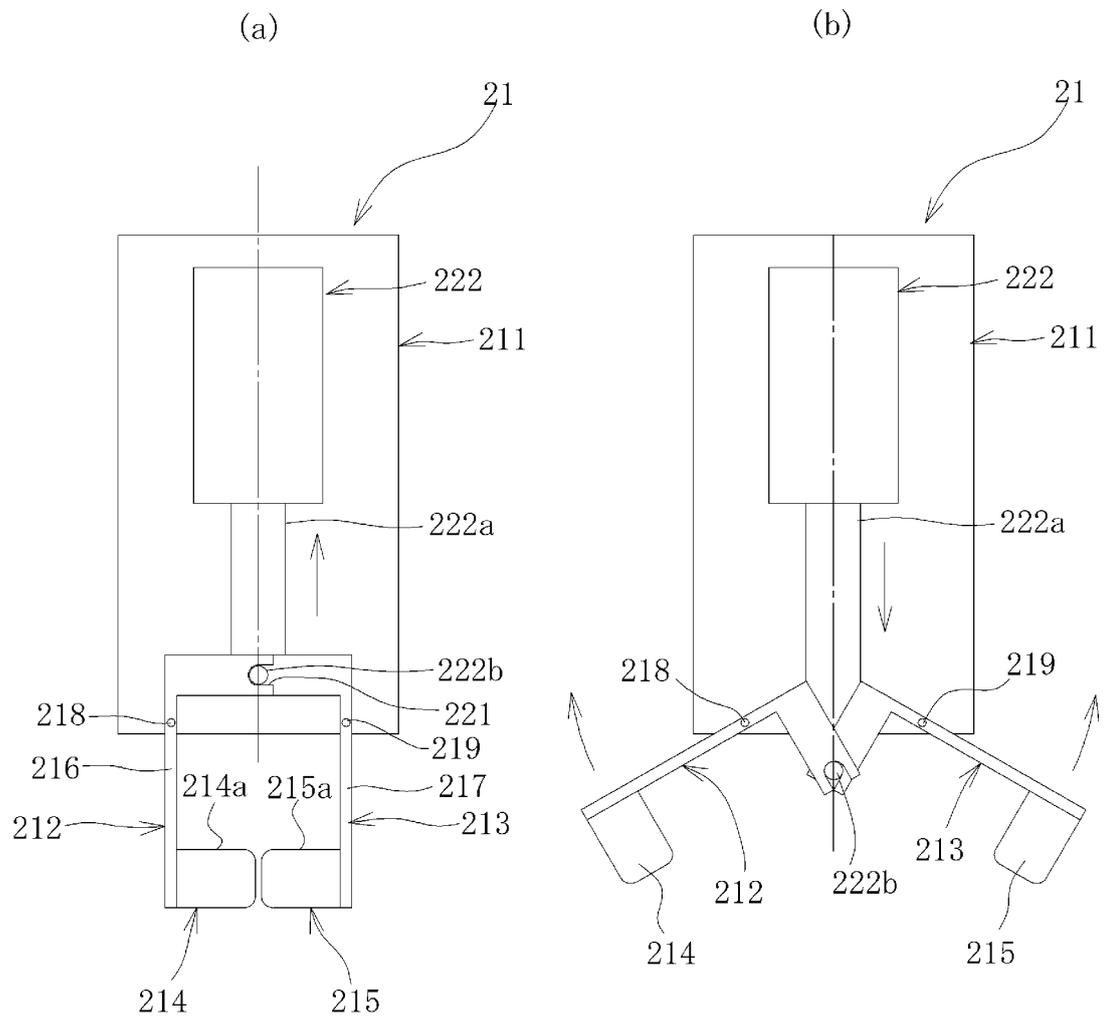


FIG. 37

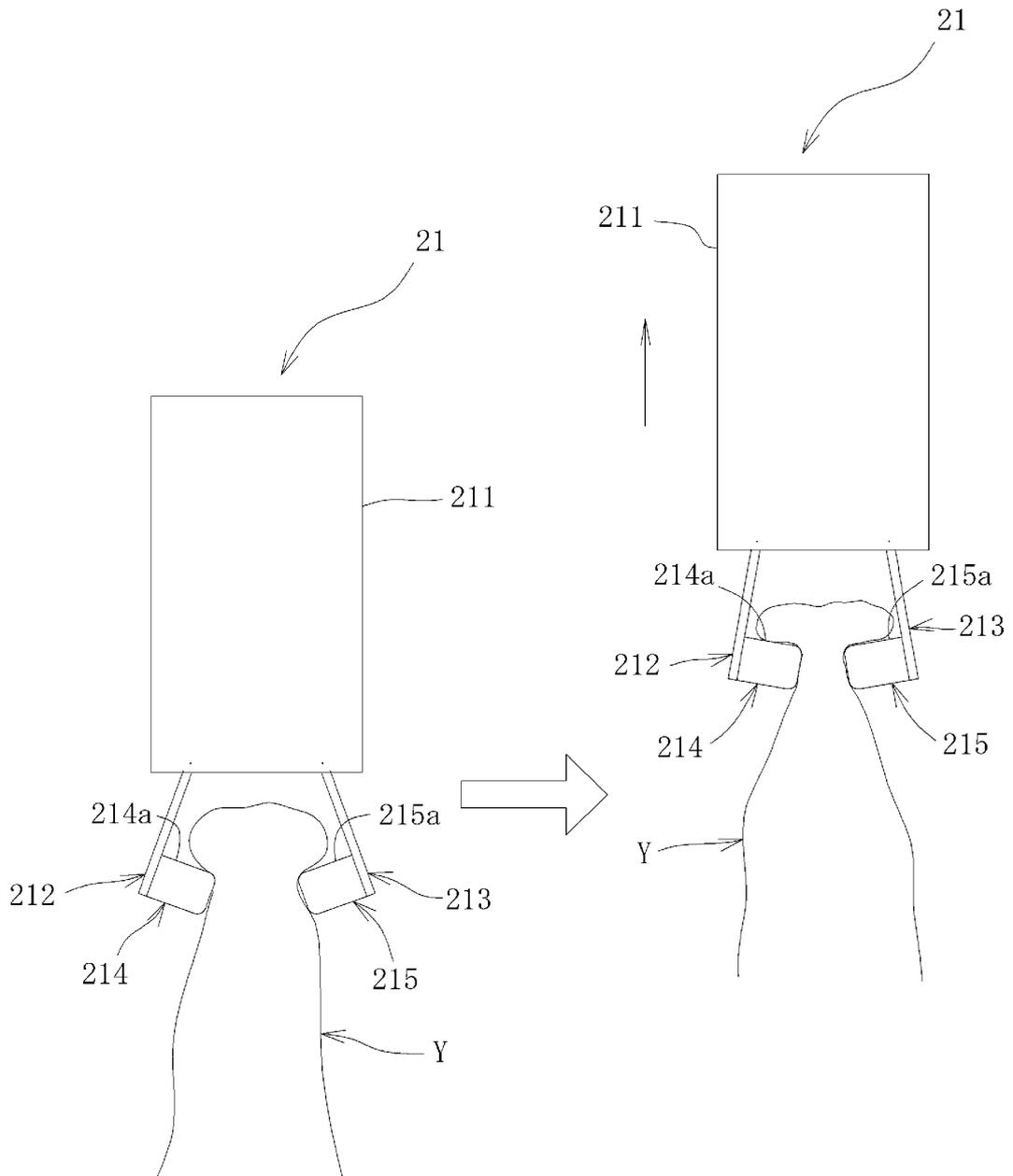


FIG. 38

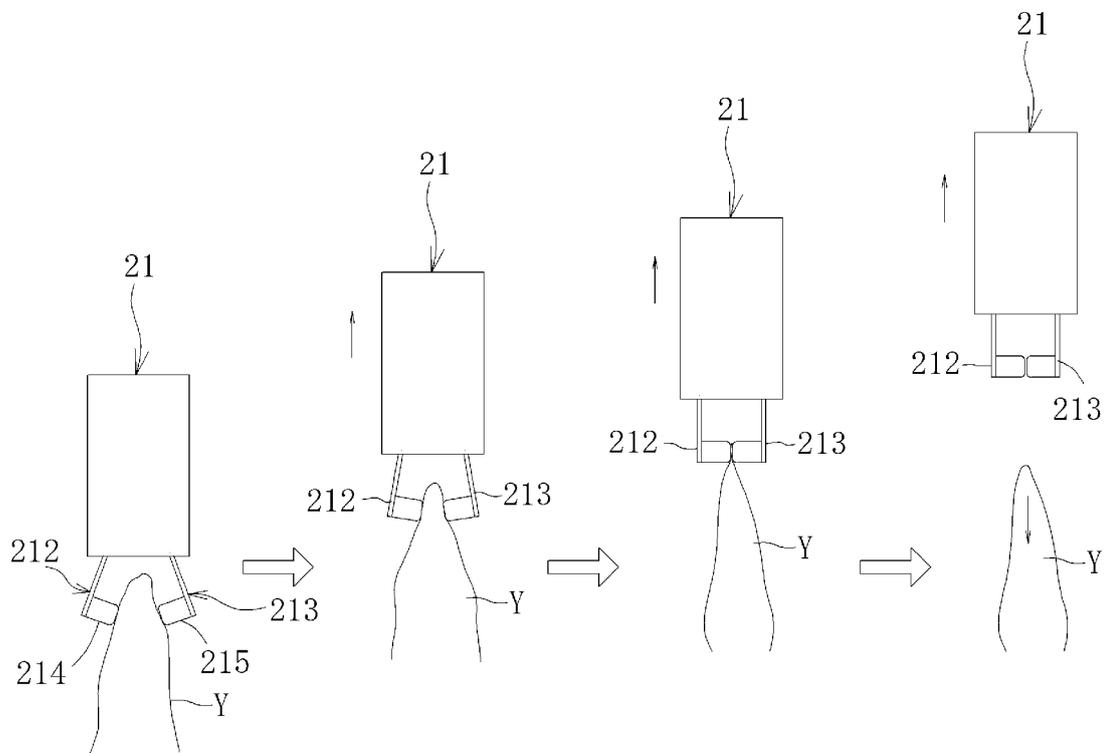


FIG. 39

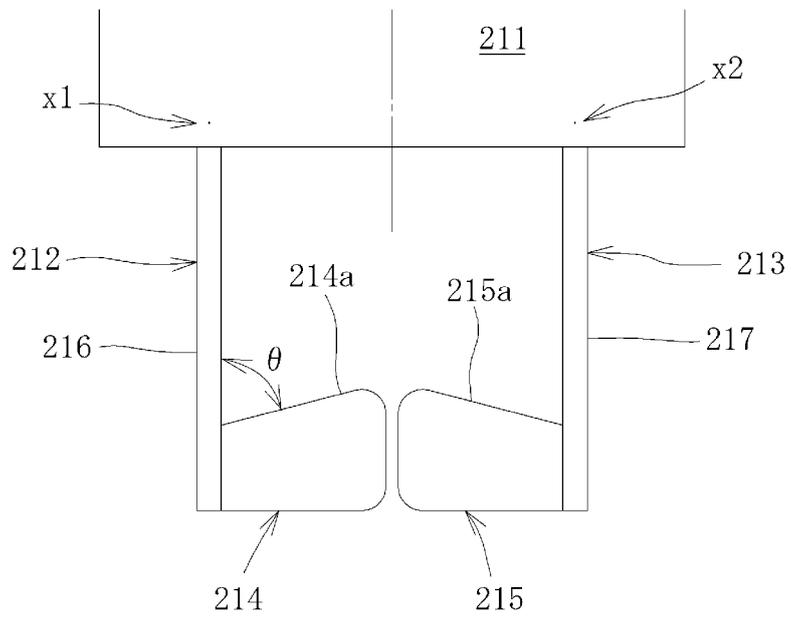


FIG. 40

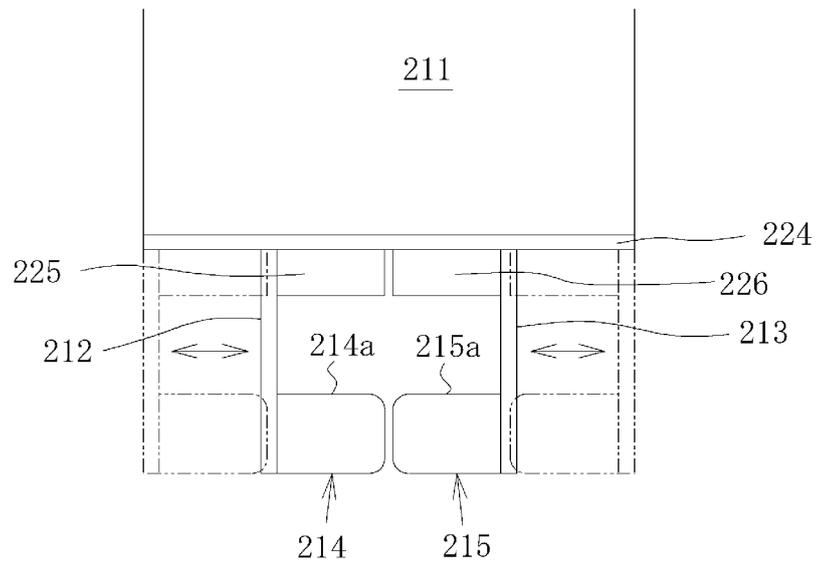


FIG. 41

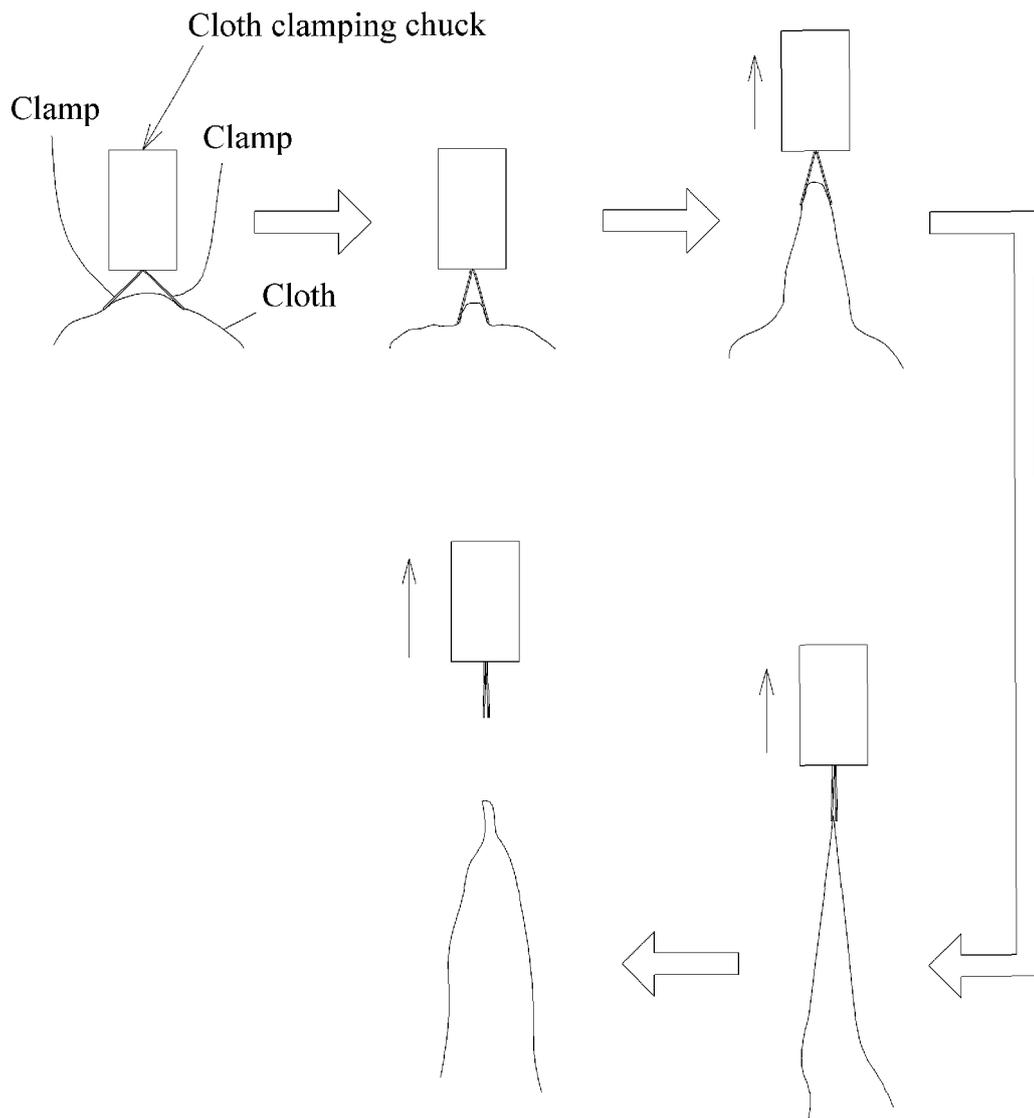
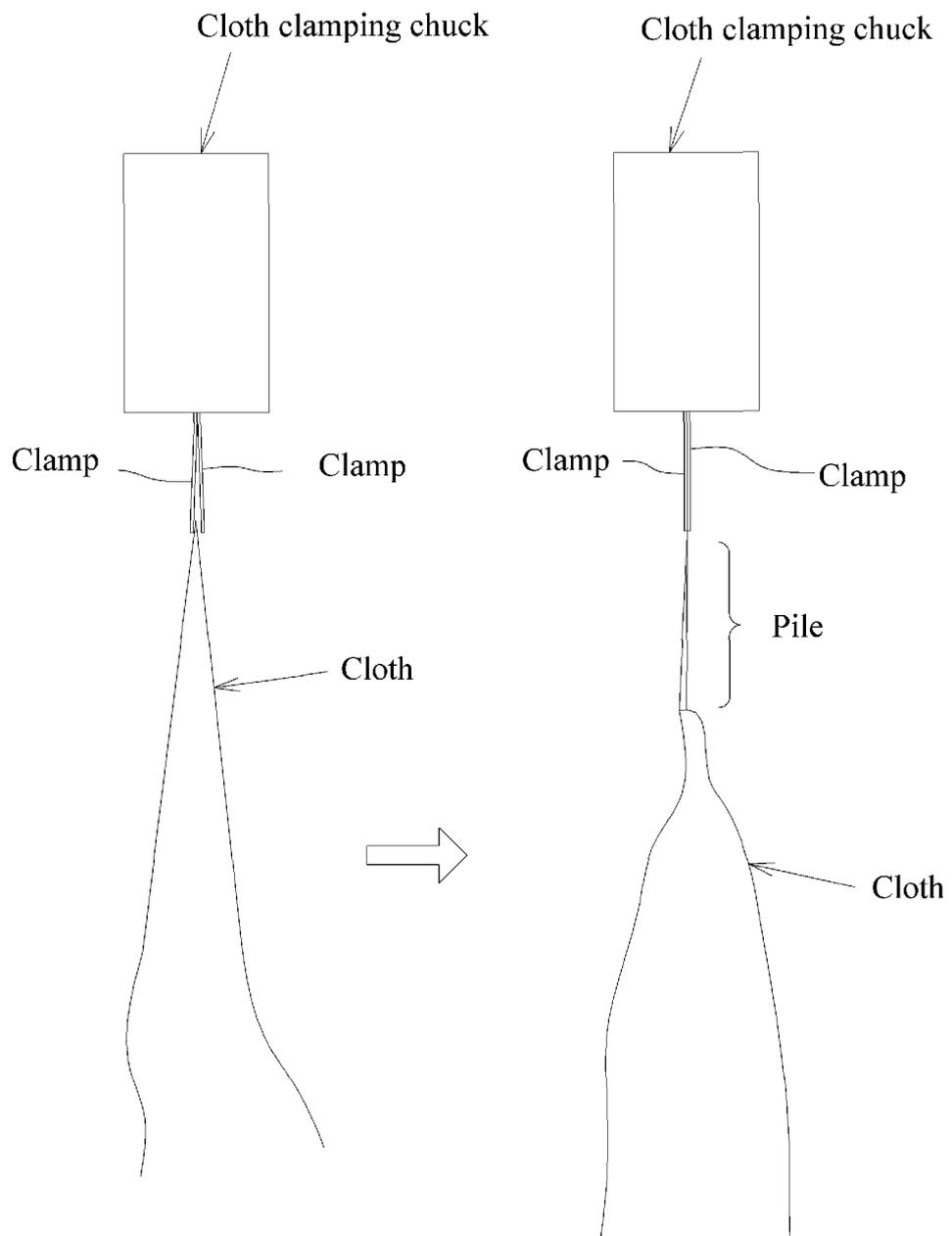


FIG. 42



INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2018/026147

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A. CLASSIFICATION OF SUBJECT MATTER  
Int.Cl. D06C3/00 (2006.01) i, D06C3/02 (2006.01) i, D06F67/04 (2006.01) i

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

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B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
Int.Cl. D06C3/00, D06C3/02, D06F67/04

15

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

Published examined utility model applications of Japan	1922-1996
Published unexamined utility model applications of Japan	1971-2018
Registered utility model specifications of Japan	1996-2018
Published registered utility model applications of Japan	1994-2018

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

25

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 10-29736 A (HAKKO SHOKAI KK) 03 February 1998, claims, paragraph [0006], fig. 1-16 (Family: none)	1-5
X	JP 59-216972 A (ASHIDA MFG CO., LTD.) 07 December 1984, claims, page 4, lower right column to page 5, lower right column, fig. 3, 6, 8 (Family: none)	1-5
A	JP 7-3619 A (ASHIDA MFG CO., LTD.) 06 January 1995, fig. 6 (Family: none)	1-5

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Further documents are listed in the continuation of Box C.  See patent family annex.

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\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance	"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
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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Date of the actual completion of the international search 03.10.2018	Date of mailing of the international search report 16.10.2018
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Name and mailing address of the ISA/ Japan Patent Office 3-4-3, Kasumigaseki, Chiyoda-ku, Tokyo 100-8915, Japan	Authorized officer  Telephone No.
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INTERNATIONAL SEARCH REPORT

International application No.  
PCT/JP2018/026147

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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 128265/1982 (Laid-open No. 32398/1984) (YOSHIDA, Akira) 28 February 1984, fig. 3 (Family: none)	1-5

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- JP 2010222724 A [0004]