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(54) MATERIAL SUPPLY APPARATUS

MATERIALZUFÜHRVORRICHTUNG

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Description

Technical Field

[0001] The present invention relates to a material supply apparatus for use in a press apparatus. More specifically, the present invention relates to a material supply apparatus for supplying a sheet material or a blank material as a workpiece to a robot, etc., for conveying the workpiece between dies.

Background Technique

[0002] In FIG. 8 of Patent Document 1, a stack loading mechanism of a destack feeder is shown. The loading mechanism is configured to ascend sheet materials stacked on a palette together with the palette with a lifting device and support the lower surface of the palette with claw members. Then, the sheet material is vacuumed from above and taken out with a feeder. When all of the sheet materials are taken out, the palette is moved sideways. Thereafter, the claw members are moved horizontally to create a path so that a new palette on which replenishment sheet materials are stacked can be ascended from below. When the new palette is ascended, the claw members are moved horizontally to its original positions to support the new palette.

[0003] Patent Document 1 describes a configuration in which the claw members are urged to cause a rotational movement toward palette support positions and the rotational movement is stopped at the palette support positions in addition to cause the horizontal movement of the claw members (see, paragraph [0072]). The claw members are configured to be moved upward with a lower palette and return by an urging force when disengaged from the palette to support the lower surface of the passed palette.

[0004] In Patent Document 2, a conveyance device for sheet-like materials (sheet material and blank material) is described. In a palette of the conveyance device, a plurality of through-holes is formed at approximately equal intervals. A comb-like member is provided in such a manner that the comb-like member can be protruded and retracted through the through-holes. The stacked materials on the palette can be ascended without ascending the palette, because the comb-like member is ascended. Thereafter, a fork having a plurality of claw-like members enters between the teeth of the lifted comb-like members and the comb-like member is descended, so that the stacked sheet materials are transferred to the fork. During that time, the empty palette is descended and sheet materials can be loaded on the new palette.

[0005] Regular sheet materials having rectangular shape obtained by cutting a long metal strip in a rectangular shape are supplied in such form that are loaded on the palette and bound with the palette. On the other hand, blank materials obtained by blanking a sheet metal in a predetermined shape in advance are supplied in a state

in which the blank materials are loaded on the magazine having a base plate and several guide rods standing on the base plate. An opening is formed at the center of the base plate of such a magazine, the stack of blank materials is supported with a rod member penetrating the opening with the magazine remained, and is also positioned by a plurality of guide rods even at the uppermost ascended position.

10 Prior Art

Patent Document

[0006]

Patent Document 1: Japanese Unexamined Patent Application Publication No. 2008-200744
Patent Document 2: Japanese Unexamined Patent Application Publication No. 2012-170980

[0007] JP 2001 163457 A was also found to present a material supply apparatus which discloses the features according to the preamble of claim 1.

25 SUMMARY OF THE INVENTION

Problems to be Solved by the Invention

[0008] Normally, when exchanging an empty palette with a new palette on which sheet materials are loaded, the take-out operation of the sheet material is somewhat got stacked up. For example, it is required to move a palette positioned at the take-out position aside and place a new palette on which many sheet materials are stacked to the same position. Therefore, during the placement operation, there is a tendency that the take-out operation temporarily stops, which in turn causes temporal stopping of the press operation. Similar problems occur even in a material supply apparatus using a magazine on which blank materials are loaded.

[0009] Furthermore, when the sheet material is taken out one by one from the top, the height of the stack gradually decreases. In order to cope with it, the robot hand requires a buffer device such as a spring, which tends to increase the equipment cost. In addition, since the robot hand requires a lift stroke by the buffer, it takes time for the take-out operation by that amount.

[0010] It is therefore an object of the present invention to provide a material supply apparatus capable of maintaining a height of an uppermost surface of blank materials without interfering with a take-out operation and/or a press operation.

Means for Solving the Problems

[0011]

(1) The material supply apparatus according to the

present invention is configured to supply a material to a feeder or the like which takes out stacked materials one by one in order from a top so as to convey the material to a predetermined apparatus.

The material supply apparatus includes:

a lift unit configured to load the materials and guided in an ascendable and descendable manner;

a lift drive unit configured to drive the lift unit to ascend and descend;

a support unit configured to receive the materials replenished from below by the lift unit, and to support the materials during the lift unit descends for replenishing next materials, the support unit being guided in an ascendable and descendable manner;

a support drive unit configured to drive the support unit to ascend and descend;

a position detection unit configured to detect current height position information of the materials including a current height position of the uppermost surface of the materials; and characterized in that

a control unit is configured to control the support drive unit so that the height position of the uppermost surface of the materials is maintained at a preliminarily registered height position based on the current height position information during the lift unit descent, and to control the lift drive unit so that the height position of the uppermost surface of the materials is maintained at a preliminary registered height position based on the current height position information, during the support unit descent; wherein the control unit is further configured to control the lift drive unit so that the remaining materials supported by the support unit are put on the top of the replenished materials on the lift unit when the lift unit ascends while supporting the replenished materials, and thereafter to control the support drive unit so that the support unit descends and receives the replenished materials from the lift unit.

(3) It is preferable that

the material supply apparatus further includes a support detection unit configured to detect support/non-support of the lowermost surface by the support unit; and that the control unit is configured to control the support drive unit so that the height position of the uppermost surface of the materials on the support unit is maintained at a preliminarily registered height position based on the current height position information, when the support detection unit detects support; and

to control the lift drive unit so that the height position of the uppermost surface of the materials on the lift unit is maintained at a preliminarily registered height

position based on the current height position information, when the support detection unit detects no-support.

(4) In the material supply apparatus, it is further preferable that

the support unit is configured to support the lowermost face of the replenished materials, when a height position of the lowermost surface is at a predetermined height position

and not to support the lowermost surface of the materials when a height position of the lowermost surface is lower than the predetermined height position. The "current height position information" denotes a concept of a distance from any criteria such as a floor surface to the upper surface of the materials and its corresponding amount, and includes information capable of being converted from the number of blank materials, the ascending amount of the support unit and/or the lift unit, etc. In the embodiment, the position detection unit is preliminarily arranged at a known height position, and when it is detected that the blank materials have reached the known height position, the current height position information of the blank materials is detected.

The "selection unit" corresponds to S4, S6, and S7 in the embodiment.

The "control unit" corresponds to S5 and S9 in the embodiment.

(5) In the material supply apparatus, it is further preferable that

the support unit includes a claw portion urged in a direction projecting into an ascending path of the materials to be replenished so as to interfere with the materials, and

the claw portion is configured to be pushed and retracted from the ascending path by the materials to be replenished when the materials are relatively ascended and to be projected to the ascending path again after passing the materials to be replenished to thereby support the lowermost surface of the materials.

(6) In the material supply apparatus, it is preferable that

the lift unit is configured to support center area of the materials; and

the support unit is configured to support periphery area of the materials.

(7) In the material supply apparatus, it is preferable that the support unit includes a claw portion urged in a direction projecting into an ascending path of the materials to be replenished so as to interfere with the materials, and

the support detection unit is configured to detect whether the claw portion is projected to the ascending path of the materials or the claw portion is retracted from the ascending path; and

the support detection unit determines the state that the claw position is projected as a support state, and

determines the state that the claw position is retracted as a non-support state.

(8) It is preferable that the material supply apparatus further includes a remaining amount detection unit configured to detect amount of remaining materials supported by the support unit, and that the control unit is further configured to replenish the materials on the lift unit to the support unit, when the amount of remaining materials becomes less than a predetermined amount.

(9) It is preferable that the material supply apparatus further includes a support detection unit configured to detect support/non-support of the lowermost surface by the support unit; and

a selection unit configured to select the support drive unit based on a support detection of the support detection unit and select the lift drive unit based on a non-support detection of the support detection unit; and that

the control unit is further configured to descend the lift unit for preparing next replenish, when the selection unit selects the support drive unit, and to descend the support unit so as to receive materials from the lift unit, when the select unit selects the lift drive unit.

(10) In the material supply apparatus, it is preferable that,

each of the lift drive unit and the support drive unit has an electric motor, a male screw driven to rotate by the electric motor, a female screw screwed on the male screw, and an encoder for detecting rotation number of the male screw, and

each of the lift unit and the support unit is fixed to the female screw, respectively.

[Effects of the Invention]

[0012]

(1) In the material supply apparatus of the present invention, even when the lift unit is being descended for stack exchange, the support unit supports a predetermined amount of stacked materials. Moreover, as the uppermost material is taken out, the support drive unit is driven, so that the height of the upper surface of the stacked materials can be maintained at a predetermined height. Therefore, the stacked materials can be replenished without interrupting the take-out operation. For this reason, the interruption loss can be reduced. Since the height of the upper surface can be maintained at a predetermined height, a buffer device to be attached a robot hand or the like becomes unnecessary, which can simplify the robot hand. Further, the take-out operation time can be shortened.

(2) In the above-mentioned material supply apparatus, in cases where the control unit is configured to control the support drive unit to descend the support

unit with putting the remaining materials supported by the support unit onto the top of the replenished materials on the lift unit, when the lift unit ascends with supporting the new replenished materials, and to receive the replenished materials from the lift unit, and the control unit is configured to control the lift drive unit so that the height position of the uppermost surface of the materials is maintained at a preliminarily registered height position based on the current height position information, during the support unit descends, the lift unit and the support unit can support materials alternately, and material can maintain to supply the material smoothly.

(5) In the above-mentioned material supply apparatus, in cases where the support unit is provided with a claw portion urged in a direction projecting into the ascending path of materials to be replenished so as to interfere with the materials and the claw portion is pushed by the materials as the lift mechanism is relatively ascended, retracted from the ascending path, and then protruded again into the ascending path after the materials have passed to support the lowermost surface of the materials, the stacked materials to be replenished can be replenished from below continuously.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a functional block diagram showing one embodiment of a material supply apparatus according to the present invention. Note that in this figure, the direction of right and left drive mechanisms is changed so that the relationship between the right and left drive mechanisms can be easily understood. This figure corresponds to a schematic rear view.

FIG. 2 is a side view showing an embodiment of a system using the material supply apparatus.

FIG. 3 is a schematic diagram showing one embodiment of a hardware configuration.

FIG. 4A is a top view of the material supply apparatus, and FIG. 4B is a schematic front view of the material supply apparatus shown in FIG. 4A. In FIG. 4B, note that some members such as a lift unit and a support unit which should be appeared on the front are omitted so that members hidden behind can be seen.

FIG. 5A is a schematic front view of a lift mechanism and a support mechanism. In this figure, note that the distance between the right and left drive mechanisms is increased so that details can be easily confirmed. FIG. 5B is a partially enlarged view of FIG. 5A. FIG. 6A is a schematic view taken along the line a-a in FIG. 6C, FIG. 6B is a schematic view taken along the line b-b in FIG. 6C, and FIG. 6C is a schematic front view showing the main part of the material supply apparatus. In FIG. 6C, note that the direction of

the right and left drive mechanisms is changed so that the relationship between the right and left drive mechanisms can be easily understood.

FIG. 7 is a schematic diagram of a flowchart of an embodiment of processing of a program used in the apparatus of the present invention.

FIG. 8A is a schematic diagram showing the operation of the material supply apparatus. In this figure, note that the direction of the right and left drive mechanisms is changed so that the relationship between the right and left drive mechanisms can be easily understood.

FIG. 8B is a schematic diagram showing the operation continued from FIG. 8A. In this figure, note that the direction of the right and left drive mechanisms is changed so that the relationship between the right and left drive mechanisms can be easily understood.

FIG. 9 is a schematic view showing another embodiment of a claw portion.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

<First Embodiment>

"1. Outline"

[0014] Initially, using FIG. 2, the outline of a tandem press line equipped with a material supply apparatus according to an embodiment of the present invention will be described. The tandem press line 30 is composed of three press apparatuses 31, 31, and 31 arranged in line. The material supply apparatus 1 of the present invention is arranged on the left side of the tandem press line 30. A material 32 (see FIG. 1) to be supplied from the material supply apparatus 1 is conveyed to a press apparatus 31 shown on the right side of the material supply apparatus 1 in the figure with the feeder 33 (shown by the two-dot chain line in FIG. 2). Subsequently, the material is sequentially conveyed to the adjacent right press apparatus.

[0015] The feeder 33 is a conventionally known conveyance device configured to sequentially take out one of stacked materials from above and convey the workpiece between dies such as a transfer press and a tandem press.

[0016] In the feeder 33, the feed bar repeats the following series of operation. That is, the feed bar is moved by a half pitch from an intermediate position to an upstream side, descended (moved downward) to grip (hold) a material with a vacuum cup, ascended (lifted), moved forward (advanced) to the next die, and descended (moved downward). Then, the feed bar releases the holding, and places the material to the next press position. Thereafter, the feed bar is ascended and retracted (returned) to the original intermediate position again.

"2. Outline of Material Supply Apparatus"

[0017] As shown in FIG. 1, the material supply apparatus 1 is mounted on a frame 34. On the frame 34, right and left drive mechanisms are provided. The left side of this figure shows a lift mechanism A and the right side shows a support mechanism B.

[0018] The lift mechanism A is provided with, for example, a lift unit 2 configured to load materials 32 and guided in an ascendable and descendable manner, and a lift drive unit 3 configured to ascend and descend the lift unit 2.

[0019] On the other hand, the support mechanism B is provided with, for example, a support unit 4 and a support drive unit 5. The support unit 4 is configured to support a lowermost surface of materials 32 supplied from below with the lift unit 2 when the height position of the lowermost surface is at a predetermined height and not to support when the height position is lower than the predetermined height. The support unit 4 is guided in an ascendable and descendable manner. The support drive unit 5 is configured to ascend and descend the support unit 4.

[0020] In this embodiment, a general-purpose motor is used as the drive unit, but a servo motor may be used.

[0021] The material supply apparatus 1 is provided with a position detection unit 6, a support detection unit 7, a selection unit 8, and a control unit 9. The position detection unit 6 is configured to detect current height position information 6a including a current height position of the uppermost surface of the materials 32. The support detection unit 7 is configured to detect whether or not the support unit 4 supports the lowermost surface of the materials. The selection unit 8 is configured to select the support drive unit 5 based on a support detection by the support detection unit 7 and select the lift drive unit 3 based on a non-support detection by the support detection unit 7. The control unit 9 is configured to control the lift drive unit 3 selected by the selection unit 8 so that the height position of the uppermost surface of the materials 32 is maintained at a preliminarily registered height position 6b registered on the basis of the current height position information 6a.

[0022] Here, the selection unit 8 and the control unit 9 constitute a controller 20 (see FIG. 1).

"3. Hardware Configuration"

[0023] FIG. 3 shows an embodiment of a hardware configuration of the controller 20 (see FIG. 1) of the material supply apparatus 1. In this controller 20, for example, a computer is used.

[0024] The computer is equipped with a CPU 40. To the CPU 40, a nonvolatile memory 41, a volatile memory 42, a drive 44 for reading a device 43 such as a storage device (for example, DVD) using light, or a storage device using magnetism, and a communication circuit 45 for communicating with the outside via a network are con-

nected via a bus line 46. Further, in the nonvolatile memory 41, a data table 47 in which the height position information 6b (see FIG. 1) and the like are registered, a program 48 for processing the control of the material supply apparatus of the present invention, and an OS (operating system) 49 are recorded.

[0025] The program 48 operates using the function of the OS 49 or operates independently. For example, the program 48 and the OS 49 are stored in the DVD 43, and are installed in the nonvolatile memory 41 via the drive 44 or the communication circuit 45. In this embodiment, the functions shown in FIG. 1 are realized using the CPU 40 and the program 48, but a part or entirety thereof may be realized by a logic circuit such as a microcomputer, for example, a sequencer or the like.

"4. Details of Material Supply Apparatus"

[0026] Hereinafter, each configuration of the material supply apparatus 1 of the present invention will be described in detail with reference to FIGs. 4 and 5.

[0027] As shown in the figures, the lift mechanism A and the support mechanism B are mounted on the frame 34 side by side. On the frame 34, three guide rails 35 (35a, 35b, 35b) are arranged alternately with respect to the drive mechanisms A and B. Among them, arranged between the drive mechanisms A and B is a center guide rail 35a, and arranged on the outer sides of the drive mechanisms A and B are right and left guide rails 35b and 35b, respectively.

[0028] The lift drive unit 3 of the lift mechanism A is provided near the lower end of the frame 34. On the extension line above the lift drive unit 3, bearings 10 and 10 are arranged so as to be aligned in the vertical direction. These bearings 10 and 10 are fixed to the frame 34 via stoppers 10a and 10a (see FIG. 5A) as fixing members. The bearings 10 and 10 pivotally support both ends of a long male screw 11. The lower end of the male screw 11 is connected to an output shaft (not shown) of the lift drive unit 3 via a coupling 12. On the other hand, the other end of the male screw 11 is connected to an input side shaft of an encoder 13 via a coupling 12.

[0029] A female screw 14 is screwed on the male screw 11. The female screw 14 is provided with a cantilevered bracket 15. The lift unit 2 is fixed to the bracket 15.

[0030] The bracket 15 includes a central portion 15a extending inward from the female screw 14 (toward the center in the right-left direction in FIG. 4B) and reaching a position overlapping with the center guide rail 35a in the right-left direction in FIG. 4B and a hanging portion 15b extending downward from the central portion 15a. Upper and lower guide blocks 15c and 15c are provided on the central portion 15a and the hanging portion 15b and guided by the center guide rail 35a (see FIG. 4A). The guide block 15c serves as a rotation stopper of the female screw 14. Therefore, when the male screw 11 rotates, the female screw 14 moves up and down. The guide block 15c and the center guide rail 35a are prefer-

ably constituted by a block and a rail of a linear guide bearing.

[0031] On the other hand, a contact portion 14a (see FIG. 5A) is provided on the frame side of the female screw 14. The contact portion 14a comes into contact with the stoppers 10a and 10a at its upper ascending limit and lower descending limit so that its movement is restricted.

[0032] Although the female screw 14 and the male screw 11 are trapezoidal screws, other screws may be used, and those screws having high positional accuracy are preferable. For example, a ball screw may be used.

[0033] The lift unit 2 is composed of a bar-like member 2a extending vertically and having a lower end fixed to the central portion 15a of the bracket 15 and a material receiver 2b (see FIG. 5A) provided at the upper end of the bar-like member 2a.

[0034] The encoder 13 detects the rotation number of the male screw 11 or the rotation number information 13a (see FIG. 1) which can be converted into the rotation number. The control unit 9 (see FIG. 1) can grasp the moving amount of the lift unit 2 or the support unit 4 based on the rotation number information 13a of the encoder 13 and the preliminarily registered screw pitch of the female screw 14. For example, by detecting the arrival of the lift unit 2 or the support unit 4 (see FIG. 5A) at a preset position such as the uppermost ascended position or the lowermost descended position thereof and resetting the count of the encoder 13 based on the detection to set a base point, the position with respect to the base point can be grasped based on the integrated rotation number information 13a of the encoder 13.

[0035] Such accumulated rotation number information 13a may be stored in the memories 41 and 42 (see FIG. 3). Further, the screw pitch, the rotation number information 13a (the count number for one sheet of the material), etc., are registered in advance in the data table 47.

[0036] Since the support mechanism B has many parts common to the above-described lift mechanism A, the same reference numeral is allotted to the common part, and the description thereof will be omitted.

[0037] The support unit 4 is a plate-like member having an L-shape in a side view. The upper plate is cantilevered by a side plate and is provided with an opening larger than the shape of the material (blank member) 32. Around the inner periphery of the opening, three rod-shaped guides 4a (see FIG. 4A) are provided at approximately equal intervals. The guide 4a is configured to guide the side surface of the stacked materials 32, and both ends of which are somewhat sharp. The guide 4a is provided with a support detection unit 7 (see FIG. 5B).

[0038] As shown in FIG. 4A, ascending/descending guide blocks 4b and 4b are provided at the right and left ends of the support unit 4, so that the ascending/descending operation of the right ascending/descending guide block 4b and that of the left ascending/descending guide block 4b are guided by the right guide rail 35b and the left guide rail 35b of the frame 34, respectively. The right ascending/descending guide blocks 4b and the left

ascending/descending guide blocks 4b are arranged up and down, respectively. It is preferable that the ascending/descending guide blocks 4b and the right and left guide rails 35b be blocks and rails of linear guide bearings.

[0039] As shown in FIG. 5B, the support detection unit 7 is rotatable about a shaft 7a provided in the guide 4a, and includes a claw portion 7b protruding toward the inner side of the three guides 4a and a contact point 7c protruding outwardly. The claw portion 7b is urged so as to project inward. When the claw portion 7b is protruded, the tip end surface indicated by the reference numeral 7d becomes substantially parallel to the lower surface of the materials 32, and this surface supports the materials 32. On the other hand, when the claw portion 7b is retracted in the guide 4a, the surface denoted by the reference numeral 7e becomes substantially parallel to the guide 4a.

[0040] In the vicinity of the contact point 7c in the guide 4a, a limit switch 16 is provided. When the contact point 7c leaves from the limit switch 16, i.e., when the claw portion 7b rotates against the urging force, the limit switch 16 causes a state change.

[0041] Since the lift unit 2 supports substantially the center of the materials 32, the lift unit 2 does not interfere with the guides 4a, the claw portions 7b, and the table 17.

[0042] As shown in FIG. 6C, the position detection unit 6 is fixed to the table 17 (see FIG. 4A) provided at the upper end of the frame 34. As shown in FIG. 6A, an opening 17a corresponding to the shape of the blank material is formed in the table 17, and four table guides 17b for positioning the materials 32 ascending along the inner peripheral surface of the opening 17a are provided. The table guides 17b are arranged so as to avoid the above-mentioned guides 4a. Notches 17c for allowing the guides 4a of the support unit 4 to pass through are formed at the inner edge of the opening 17a to avoid interference with the guides 4a.

[0043] The position detection unit 6 is a conventionally known sensor such as an optical type sensor and an electromagnetic type sensor.

[0044] Rails 18 are arranged in the horizontal direction (see the arrow C in FIG. 4C) in a manner as to intersect with the ascending path of the material receiver 2b of the lift unit 2, and the magazine 19 is conveyed along the rails 18. The rails 18 and the wheels are composed of rails and bearing blocks of linear guide bearings, but may be composed of rails and wheels.

[0045] In the magazine 19, replenishment materials 32 are loaded. The magazine 19 includes a bottom plate 19a in which blocks guided by the rails 18 are provided on the bottom surface. The bottom plate 19a is provided in the vicinity of the center of the bottom plate 19a with an opening which can pass through the material receiver 2b. On the outside of the opening, three bar-shaped magazine guides 19b are arranged at substantially equal intervals so that these magazine guides 19b can guide the outer periphery of the materials 32.

[0046] The material receiver 2b passes through the opening of the bottom plate 19a of the magazine 19 from below to the above to ascend the materials 32.

5 "5. Flowchart"

[0047] Next, using the flowchart of FIG. 7, an example of a process flow of the program 48 used in the material supply apparatus 1 will be described.

(S0): The "current height position information" which is the upper surface position of the materials 32 is checked. In this embodiment, the "current height position information" is checked based on the presence or absence of detection of the materials 32 by the position detection unit 6 and the number of times of conveyance after the detection by the position detection unit 6. In the early production stage, there is a case in which there is no detection by the position detection unit 6 and therefore the "current height position information" is unknown due to insufficient information.

(S1): When the upper surface position of the materials 32 checked in S0 is low or unknown, since replenishment of the materials is necessary, the process proceeds to S3. When the upper surface position of the materials 32 is at a predetermined height and replenishment is not necessary, the process proceeds to S2.

(S2): The feeder 33 takes out one piece of the material 32 and conveys it. Upon completion of the conveyance, the CPU 40 changes the "current height position information" which is the upper surface position of the materials 32 to lower by one material.

(S3): As a preliminary step of replenishing the materials 32, it is judged whether the position of the lift unit 2 is at the uppermost ascended position or below thereof. When it is judged that the position of the lift unit 2 is below the uppermost ascended position, the process proceeds to S4. When the position of the lift unit 2 is at the uppermost ascended position, since the materials 32 are insufficient even if it is ascended up to the uppermost ascended position, it is determined that there is no material. Thus, the program 48 is ended and the material supply apparatus 1 is stopped.

(S4): It is judged whether the lift unit 2 is in a stopped state or in operation. When it is in a stopped state, the process proceeds to S5. When it is in operation, the process proceeds to S6. The drive motor of the lift drive unit 3 is not always operating while constantly being monitored by the CPU 40. Receiving a command signal such as the operation direction and the operation amount from the CPU 40 by the driver of the drive motor, the drive motor performs a predetermined operation under the control of the driver. For this reason, it is confirmed here whether or not the driver has completed the control.

(S5): The lift unit 2 is ascended. The ascending amount is determined by the calculation by the CPU 40 based on information such as how many sheets 32 the feeder 33 conveyed. However, since the calculation cannot be performed due to the insufficient information immediately after the start of production, the lift unit 2 is ascended until the position detection unit 6 detects the materials 32. During that time, the feeder 33 cannot be performed and therefore becomes in a standby state. However, since this standby state occurs only one time immediately after the production start, which does not affect the production. During the normal production, as described in S4, after making the CPU 40 issue an ascend instruction signal of the lift unit 2, the program 48 makes the process proceed to the next step S6 without waiting for the completion of ascending the lift unit 2. For this reason, the processing in S5 can be completed in a very short time, and therefore the feeder 33 does not become a standby state, which enables continuous conveyance.

(S6): The state (protruded state or retracted state) of the claw portion 7b of the support unit 4 is detected by the limit switch 16. When the claw portion 7b is in a state in which the claw portion 7b is protruded from the guide 4a of the support unit 4, the process proceeds to S7. When the claw portion 7b is in a state in which the claw portion 7b is retracted in the guide 4a, the process proceeds to S10. The memory 41 is provided with a memory area for storing the detection result in S6 and a memory area for storing the last detection result (detection result in S6 in the previous loop of the program). When the latest detection result of S6 is input, the CPU 40 transfers the data stored in the memory area storing the detection result to the memory area storing the last detection result and writes the newest detection result of S6 which has just been input in the memory area for storing the detection result. In this manner, the detection result and the last detection result are always stored.

(S7): When it is detected in S6 that the claw portion 7b is in a state of being protruded from the guide 4a, there is a case that it cannot be judged whether the claw portion 7b is protruded with the claw portion 7b supporting the material 32, or whether the claw portion 7b is protruded because the height of the material 32 is too low or there exists no material 32 at all. Therefore, referring to the last detection result stored in the memory 41 in S6, based on the last detection result, when it is judged that the claw portion 7b is retracted in the guide 4a, the process proceeds to S8, and when it is judged that the claw portion 7b is retracted in the guide 4a, the process proceeds to S9.

(S8): The fact that the flow of the program 48 has reached S8 denotes that the material 32 which was supported by the lift unit 2 immediately before is currently supported by the claw portions 7b of the sup-

port unit 4. For this reason, the lift unit 2 can start descending in order to lift the materials on the next magazine. The descending of the lift unit 2 is performed up to the lowermost descended position. As described in S4, after making the CPU 40 issue a descend instruction signal of the lift unit 2, the program 48 makes the process proceed to the next step S9 without waiting for the descent completion of the lift unit 2. For this reason, the process of S8 can be completed in a very short time.

(S9): The support unit 4 is ascended. The ascending amount is determined by the calculation by the CPU 40 based on information such as how many sheets of materials 32 the feeder 33 conveyed. However, in cases where the information is insufficient immediately after the start of production, the support unit 4 is not ascended. Also in cases where the support unit 4 is at the uppermost ascended position, the support unit 4 is not ascended. After proceeding to S9, the flow of the program 48 returns to S0 again. In the same manner as in the case of the driving motor of the lift drive unit 3 in S4, the flow of the program 48 proceeds to the next without waiting for the completion of the operations of the support unit 4 and the support drive unit 5.

(S10): The support unit 4 is descended. The descent amount is appropriately set from the thickness of the material 32 or the like, which is a value slightly larger than the plate thickness such that almost no gap is formed between the upper surface 7d of the claw portion 7b and the lower surface of the material 32 when the support unit 4 is descended by the descent amount from the state in which the claw portion 7b is retracted in the guide 4a and the claw portion 7b is projected from the guide 4a. After proceeding to S10, the flow of the program 48 returns to S0 again. As for the descent of this support unit 4, in the same manner as in the ascent in S9, the flow of the program 48 proceeds to the next without waiting for completion of the operation.

"6. Supply Method"

[0048] Next, with reference to FIGs. 8A and 8B, one embodiment of a schematic process for supplying materials using the material supply apparatus 1 of the present invention will be described.

(R1): No material has been supplied to the support unit 4. In the magazine 19, materials to be supplemented are stacked. The material receiver 2b of the lift unit 2 is ascended through the opening of the bottom plate of the magazine 19 from below. With this, the lift unit 2 supports the bottom center of the stacked materials 32.

(R2): As the lift unit 2 is ascended, the periphery of the materials 32 pushes the claw portion 7b away. Therefore, when all the materials 32 are positioned

above the claw portions 7b, the claw portions 7b project inward to support the lower surface of the peripheral edge of the materials 32, so that the support unit 4 holds all of the replenished materials 32. (R3): The lift unit 2 is descended and stands by below the magazine 19. The control unit 9 controls such that the support unit 4 is gradually ascended so as to maintain the height of the upper surface of the materials at a predetermined height.

(R4): The material receiver 2b of the lift unit 2 is ascended through the opening of the bottom plate of the magazine 19, and the materials 32 on the lift unit 2 and the materials 32 supported by the support unit 4 become integrated. Then, the lift unit 2 receives the materials 32 from the support unit 4.

(R5): The support unit 4 is descended and the lift unit 2 is ascended relative to the support unit 4. As a result, the claw portions 7b are positioned below the bottom surface of the materials 32, which causes the claw portions 7b to protrude inward. Then, the process returns to (R2), and (R2)-(R5) are repeated.

<Other Embodiments>

[0049] FIG. 9 shows another embodiment of a support detection unit. The support detection unit 21 is provided with a plate-like claw portion 22. This claw portion 22 is urged by an urging member 23 in a direction projecting into the ascending path of replenishment materials 32 so as to interfere with the materials 32. The lower surface 24 of the tip end of the claw portion 22 is formed into an inclined surface inclined upward in a radial inward direction. Ascending replenishment materials 32 are ascended along the inclined surface, so that the claw portion 22 is gradually pushed away from the ascending path. Thereafter, after passing the replenishment materials 32, the claw portion 22 again is protruded into the ascending path and the upper surface of the claw portion 22 comes into contact with the lowermost surface of the replenishment materials 32 to support the materials 32.

<Still Another Embodiment>

[0050] The position detection unit 6 may be configured to detect the height of the uppermost surface of the materials 32. In this case, since the height is detected, it is possible to detect such a problem that a plurality of materials is taken out. Furthermore, by comparing the height of the uppermost surface of the materials with the position of the support unit 4 based on the encoder 13, it is possible to grasp the remaining number of materials 32, etc. Therefore, it is possible to immediately ascend the uppermost surface of the materials 32 to a preliminarily registered height position when resuming from the trouble.

"7. Other"

[0051] It is enough that the number of tandem press

lines is two or more. Furthermore, the material supply apparatus 1 can be applied to an apparatus having multi-step dies with one press machine.

[0052] As the urging member of the support detection units 7 and 21, a spring or an air damper can be used. Further, the support detection unit 7 and 22 may be composed of a thin-plate shaped member not having the inclined surface of the claw portion 22 of the support detection unit 21. The thin-plate shaped member is configured to be retracted so that the existing materials can be repeatedly loaded on the uppermost surface of the replenishment materials.

[0053] In the first embodiment, the drive unit is driven by an amount corresponding to one sheet registered in advance based on the encoder 13, and the drive unit is stopped after being driven by the predetermined amount. It may be configured, however, that the position detection unit 6 detects that the next materials arrive at the uppermost surface and the drive unit is stopped based on the detection.

[0054] The above-described limit switch 16 may be always on or off. Further, either ON or OFF of the limit switch 16 may correspond to support or non-support of the lowermost surface.

[0055] Further, the support detection unit 7 may detect support/non-support of materials in combination with other information, for example, the rotation number information of the encoder of the lift drive unit 3.

Description of Symbols

[0056]

- 1: material supply apparatus
- 2: lift unit
- 2a: bar-like member
- 2b: material receiver
- 3: lift drive unit
- 4: support unit
- 4a: guide
- 4b: ascending/descending guide block
- 5: support drive unit
- 6: position detection unit
- 6a: current height position information
- 6b: registered height position information
- 7: support detection unit
- 7a: shaft
- 7b: claw portion
- 7c: contact point
- 7d: tip end face
- 7e: surface
- 8: selection unit
- 9: control unit
- 10: bearing
- 10a: stopper
- 11: male screw
- 12: coupling
- 13: encoder

13a:	rotation number information	
14:	female screw	
14a:	contact portion	
15:	bracket	
15a:	central portion	5
15b:	hanging portion	
15c:	guide block	
16:	limit switch	
17:	table	
17a:	opening	10
17b:	table guide	
17c:	notch	
18:	rail	
19:	magazine	
19a:	bottom plate	15
19b:	magazine guide	
20:	controller	
21:	support detection unit	
22:	claw portion	
23:	urging member	20
24:	inclined surface	
30:	tandem press line	
31:	press apparatus	
32:	material	
33:	feeder	25
34:	frame	
35:	guide rail	
35a:	center guide rail portion	
35b:	left guide rail, right guide rail	
40:	CPU	30
41:	nonvolatile memory	
42:	volatile memory	
43:	device	
44:	drive	
45:	communication circuit	35
46:	bus line	
47:	data table	
48:	program	
49:	OS	
A:	lift mechanism	40
B:	support mechanism	

Claims

1. A material supply apparatus configured to supply a material to a feeder or the like which takes out stacked materials one by one in order from the top so as to convey the material to a predetermined apparatus, comprising:
 - a lift unit (2) configured to load the materials and guided in an ascendable and descendable manner;
 - a lift drive unit (3) configured to drive the lift unit (2) to ascend and descend;
 - a support unit (4) configured to receive the materials replenished from below by the lift unit (2),

and to support the materials during a descent of the lift unit for replenishing materials, the support unit (4) being guided in an ascendable and descendable manner;

a support drive unit (5) configured to drive the support unit (4) to ascend and descend;

a position detection unit (6) configured to detect current height position information of the materials including a current height position of the uppermost surface of the materials; and **characterized in that**

a control unit (9) is configured to control the support drive unit (5) so that the height position of the uppermost surface of the materials is maintained at a preliminarily registered height position based on the current height position information during the lift unit (2) descent, and to control the lift drive unit (3) so that the height position of the uppermost surface of the materials is maintained at a preliminarily registered height position based on the current height position information, during the support unit (4) descent; wherein the control unit (9) is further configured to control the lift drive unit (3) so that the remaining materials supported by the support unit (4) are put on the top of the replenished materials on the lift unit (2) when the lift unit ascends while supporting the replenished materials, and thereafter to control the support drive unit (5) so that the support unit (4) descends and receives the replenished materials from the lift unit (2).

2. The material supply apparatus as recited in claim 1, further comprising a support detection unit (7) configured to detect support/non-support of the lowermost surface by the support unit (4); wherein the control unit (9) is configured to control the support drive unit (5) so that the height position of the uppermost surface of the materials on the support unit is maintained at a preliminarily registered height position based on the current height position information, when the support detection unit (7) detects support; and to control the lift drive unit (3) so that the height position of the uppermost surface of the materials on the lift unit is maintained at a preliminarily registered height position based on the current height position information, when the support detection unit (7) detects no-support.
3. The material supply apparatus as recited in claim 1, wherein the support unit (4) is configured to support the lowermost face of the replenished materials, when a height position of the lowermost surface is at a predetermined height position and not to support the lowermost surface of the materials when a height position of the lowermost surface is lower than the predetermined height position.

4. The material supply apparatus as recited in claim 1, wherein the support unit (4) includes a claw portion (7b) urged in a direction projecting into an ascending path of the materials to be replenished so as to interfere with the materials, and
 wherein the claw portion (7b) is configured to be pushed and retracted from the ascending path by the materials to be replenished when the materials are relatively ascended and to be projected to the ascending path again after passing the materials to be replenished to thereby support the lowermost surface of the materials.
5. The material supply apparatus as recited in claim 1 or 2, wherein the lift unit (2) is configured to support a center area of the materials; and the support unit (4) is configured to support a peripheral area of the materials.
6. The material supply apparatus as recited in claim 2, wherein the support unit includes a claw portion (7b) urged in a direction projecting into an ascending path of the materials to be replenished so as to interfere with the materials, and
 wherein the support detection unit (7) is configured to detect whether the claw portion (7b) is projected to the ascending path of the materials or the claw portion is retracted from the ascending path; and the support detection unit (7) determines the state that the claw position is projected as a support state, and determines the state that the claw position is retracted as a non-support state.
7. The material supply apparatus as recited in claim 1, further comprising a remaining amount detection unit configured to detect amount of remaining materials supported by the support unit, wherein the control unit (9) is further configured to replenish the materials on the lift unit to the support unit, when the amount of remaining materials becomes less than a predetermined amount.
8. The material supply apparatus as recited in claim 1, further comprising a support detection unit (7) configured to detect support/non-support of the lowermost surface by the support unit (4); and a selection unit (8) configured to select the support drive unit (5) based on a support detection of the support detection unit (7) and select the lift drive unit based on a non-support detection of the support detection unit;
 wherein the control unit (9) is further configured to descend the lift unit for preparing next replenish, when the selection unit (8) selects the support drive unit (5), and
 to descend the support unit (4) so as to receive materials from the lift unit (2), when the selection unit

selects the lift drive unit (3).

9. The material supply apparatus as recited in claim 1, wherein each of the lift drive unit (3) and the support drive unit (5) has an electric motor, a male screw (11) driven to rotate by the electric motor, a female screw (14) screwed on the male screw, and an encoder (13) for detecting rotation number of the male screw, and
 wherein each of the lift unit (2) and the support unit (4) is fixed to the female screw (14), respectively.

Patentansprüche

1. Materialzuführvorrichtung, die derart ausgebildet ist, dass sie ein Material einem Beschicker oder dergleichen zuführt, der gestapelte Materialien eines nach dem anderen, von oben angefangen entnimmt, um das Material zu einer vorbestimmten Vorrichtung zu befördern, aufweisend:

eine Hebeeinheit (2), die derart ausgebildet ist, dass sie die Materialien lädt, und die aufwärts und abwärts geführt wird;

eine Hebe-Antriebseinheit (3), die derart ausgebildet ist, dass sie die Hebeeinheit (2) aufwärts und abwärts bewegt;

eine Halteeinheit (4), die derart ausgebildet ist, dass sie die von der Hebeeinheit (2) von unten nachgefüllten Materialien aufnimmt und die Materialien bei einer Abwärtsbewegung der Hebeeinheit zum Nachfüllen von Materialien hält, wobei die Halteeinheit (4) aufwärts und abwärts geführt wird;

eine Halte-Antriebseinheit (5), die derart ausgebildet ist, dass sie die Halteeinheit (4) aufwärts und abwärts bewegt;

eine Positionsdetektiereinheit (6), die derart ausgebildet ist, dass sie aktuelle Höhenpositionsinformationen der Materialien, einschließlich einer aktuellen Höhenposition der obersten Fläche der Materialien, detektiert; und

dadurch gekennzeichnet, dass

eine Steuereinheit (9) derart ausgebildet ist, dass sie die Halte-Antriebseinheit (5) so steuert, dass sie die Höhenposition der obersten Fläche der Materialien in einer zuvor auf der Basis der aktuellen Höhenpositionsinformationen registrierten Höhenposition während der Abwärtsbewegung der Hebeeinheit (2) aufrechterhalten wird, und die Hebe-Antriebseinheit (3) so steuert, dass die Höhenposition der obersten Fläche der Materialien in einer zuvor auf der Basis der aktuellen Höhenpositionsinformationen registrierten Höhenposition während der Abwärtsbewegung der Halteeinheit (4) aufrechterhalten wird; wobei die Steuereinheit (9) ferner derart ausge-

- bildet ist, dass sie die Hebe-Antriebseinheit (3) so steuert, dass die von der Halteeinheit (4) gehaltenen Restmaterialien oben auf den nachgefüllten Materialien auf der Hebeeinheit (2) platziert werden, wenn sich die Hebeeinheit abwärts bewegt, während sie die nachgefüllten Materialien hält, und danach die Halte-Antriebseinheit (5) so steuert, dass sich die Halteeinheit (4) abwärts bewegt und die nachgefüllten Materialien aus der Hebeeinheit (2) aufnimmt.
2. Materialzuführvorrichtung nach Anspruch 1, die ferner eine Halte-Detektionseinheit (7) aufweist, die derart ausgebildet ist, dass sie ein Halten/Nicht-halten der untersten Fläche durch die Halteeinheit (4) detektiert; bei der die Steuereinheit (9) derart ausgebildet ist, dass sie die Halte-Antriebseinheit (5) so steuert, dass die Höhenposition der obersten Fläche der Materialien auf der Halteeinheit auf einer zuvor auf der Basis der aktuellen Höhenpositionsinformationen registrierten Höhenposition aufrechterhalten wird, wenn die Halte-Detektionseinheit (7) ein Halten detektiert; und die Hebeeinheit (3) so steuert, dass die Höhenposition der obersten Fläche der Materialien auf der Hebeeinheit auf einer zuvor auf der Basis der aktuellen Höhenpositionsinformationen registrierten Höhenposition aufrechterhalten wird, wenn die Halte-Detektionseinheit (7) ein Nichthalten detektiert.
 3. Materialzuführvorrichtung nach Anspruch 1, bei der die Halteeinheit (4) derart ausgebildet ist, dass sie die unterste Fläche der nachgefüllten Materialien hält, wenn eine Höhenposition der untersten Fläche in einer vorbestimmten Höhenposition ist, und die unterste Fläche der Materialien nicht hält, wenn eine Höhenposition der untersten Fläche niedriger als die vorbestimmte Höhenposition ist.
 4. Materialzuführvorrichtung nach Anspruch 1, bei der die Halteeinheit (4) einen Klauenabschnitt (7b) aufweist, der in eine Richtung gedrängt wird, in der er in einen Aufwärtsweg der nachzufüllenden Materialien vorsteht, um mit den Materialien zu interferieren, und bei der der Klauenabschnitt (7b) derart ausgebildet ist, dass er von den nachzufüllenden Materialien aus dem Aufwärtsweg gedrückt und zurückgezogen wird, wenn die Materialien relativ aufwärts bewegt werden, und wieder in den Aufwärtsweg vorsteht, nachdem sich die nachzufüllenden Materialien vorbeibewegt haben, wodurch er die unterste Fläche der Materialien hält.
 5. Materialzuführvorrichtung nach Anspruch 1 oder 2, bei der die Hebeeinheit (2) derart ausgebildet ist, dass sie einen mittleren Bereich der Materialien hält;
 6. Materialzuführvorrichtung nach Anspruch 2, bei der die Halteeinheit einen Klauenabschnitt (7b) aufweist, der in eine Richtung gedrängt wird, in der er in einen Aufwärtsweg der nachzufüllenden Materialien vorsteht, um mit den Materialien zu interferieren, und bei der die Halte-Detektionseinheit (7) derart ausgebildet ist, dass sie detektiert, ob der Klauenabschnitt (7b) in den Aufwärtsweg der Materialien vorsteht oder der Klauenabschnitt aus dem Aufwärtsweg zurückgezogen ist; und die Halte-Detektionseinheit (7) den Zustand, in dem die Klauenposition eine vorstehende ist, als Haltezustand bestimmt und den Zustand, in dem die Klauenposition eine zurückgezogene ist, als Nichthaltezustand bestimmt.
 7. Materialzuführvorrichtung nach Anspruch 1, die ferner eine Restmengen-Detektionseinheit aufweist, die derart ausgebildet ist, dass sie eine Menge an Restmaterialien detektiert, die von der Halteeinheit gehalten werden, bei der die Steuereinheit (9) ferner derart ausgebildet ist, dass sie die Materialien auf der Hebeeinheit in der Halteeinheit nachfüllt, wenn die Menge an Restmaterialien kleiner als eine vorbestimmte Menge wird.
 8. Materialzuführvorrichtung nach Anspruch 1, die ferner eine Halte-Detektionseinheit (7) aufweist, die derart ausgebildet ist, dass sie ein Halten/Nicht-halten der untersten Fläche durch die Halteeinheit (4) detektiert; und die eine Auswahleinheit (8) aufweist, die derart ausgebildet ist, dass sie die Halte-Antriebseinheit (5) auf der Basis einer Halte-Detektion der Halte-Detektionseinheit (7) auswählt und die Hebeeinheit auf der Basis einer Nichthalte-Detektion der Halte-Detektionseinheit auswählt; bei der die Steuereinheit (9) ferner derart ausgebildet ist, dass sie die Hebeeinheit zur Vorbereitung der nächsten Nachfüllung abwärts bewegt, wenn die Auswahleinheit (8) die Halte-Antriebseinheit (5) auswählt, und die Halteeinheit (4) abwärts bewegt, damit diese Materialien aus der Hebeeinheit (2) aufnimmt, wenn die Auswahleinheit die Hebe-Antriebseinheit (3) auswählt.
 9. Materialzuführvorrichtung nach Anspruch 1, bei der jede der Hebe-Antriebseinheit (3) und der Halte-Antriebseinheit (5) einen Elektromotor, eine Außengewindeschraube (11), die durch den Elektromotor zum Drehen angetrieben wird, eine Innen-

gewindeschraube (14), die mit der Außengewindeschraube verschraubt ist, und einen Kodierer (13) zum Detektieren einer Drehzahl der Außengewindeschraube aufweist, und
 bei der jede der Hebeeinheit (2) und der Halteeinheit (4) jeweils an der Innengewindeschraube (14) befestigt ist.

Revendications

1. Appareil de fourniture de matériau configuré pour fournir un matériau à un dispositif d'alimentation ou similaire qui fait sortir des matériaux empilés un par un dans l'ordre depuis le haut de façon à transporter le matériau vers un appareil prédéterminé, comprenant :
 - une unité de levage (2) configurée pour charger les matériaux et guidée de manière montante et descendante ;
 - une unité d'entraînement de levage (3) configurée pour entraîner l'unité de levage (2) en montée et en descente ;
 - une unité de support (4) configurée pour recevoir les matériaux réapprovisionnés par le bas par l'unité de levage (2), et pour supporter les matériaux pendant une descente de l'unité de levage pour le réapprovisionnement de matériaux, l'unité de support (4) étant guidée de manière montante et descendante ;
 - une unité d'entraînement de support (5) configurée pour entraîner l'unité de support (4) en montée et en descente ;
 - une unité de détection de position (6) configurée pour détecter des informations de position de hauteur actuelle des matériaux incluant une position de hauteur actuelle de la surface la plus haute des matériaux ; et **caractérisé en ce que** une unité de commande (9) est configurée pour commander l'unité d'entraînement de support (5) de sorte que la position de hauteur de la surface la plus haute des matériaux soit maintenue à une position de hauteur enregistrée préalablement d'après les informations de position de hauteur actuelle pendant la descente de l'unité de levage (2), et pour commander l'unité d'entraînement de levage (3) de sorte que la position de hauteur de la surface la plus haute des matériaux soit maintenue à une position de hauteur enregistrée préalablement d'après les informations de position de hauteur actuelle, pendant la descente de l'unité de support (4) ;
 - dans lequel l'unité de commande (9) est en outre configurée pour commander l'unité d'entraînement de levage (3) de sorte que les matériaux restants supportés par l'unité de support (4) soient mis sur le haut des matériaux réapprovi-

sionnés sur l'unité de levage (2) lorsque l'unité de levage monte tout en supportant les matériaux réapprovisionnés, et ensuite pour commander l'unité d'entraînement de support (5) de sorte que l'unité de support (4) descende et reçoive les matériaux réapprovisionnés depuis l'unité de levage (2).

2. Appareil de fourniture de matériau selon la revendication 1, comprenant en outre une unité de détection de support (7) configurée pour détecter un support/non-support de la surface la plus basse par l'unité de support (4) ; dans lequel l'unité de commande (9) est configurée pour commander l'unité d'entraînement de support (5) de sorte que la position de hauteur de la surface la plus haute des matériaux sur l'unité de support soit maintenue à une position de hauteur enregistrée préalablement d'après les informations de position de hauteur actuelle, lorsque l'unité de détection de support (7) détecte un support ; et pour commander l'unité d'entraînement de levage (3) de sorte que la position de hauteur de la surface la plus haute des matériaux sur l'unité de levage soit maintenue à une position de hauteur enregistrée préalablement d'après les informations de position de hauteur actuelle, lorsque l'unité de détection de support (7) détecte un non-support.
3. Appareil de fourniture de matériau selon la revendication 1, dans lequel l'unité de support (4) est configurée pour supporter la face la plus basse des matériaux réapprovisionnés, lorsqu'une position de hauteur de la surface la plus basse est à une position de hauteur prédéterminée et pour ne pas supporter la surface la plus basse des matériaux lorsqu'une position de hauteur de la surface la plus basse est plus basse que la position de hauteur prédéterminée.
4. Appareil de fourniture de matériau selon la revendication 1, dans lequel l'unité de support (4) comporte une portion de griffe (7b) sollicitée dans une direction en saillie dans un trajet de montée des matériaux à réapprovisionner de façon à interférer avec les matériaux, et dans lequel la portion de griffe (7b) est configurée pour être poussée et rétractée du trajet de montée par les matériaux à réapprovisionner lorsque les matériaux sont montés relativement et pour être en saillie à nouveau sur le trajet de montée après le passage des matériaux à réapprovisionner pour supporter ainsi la surface la plus basse des matériaux.
5. Appareil de fourniture de matériau selon la revendication 1,

- cation 1 ou 2,
dans lequel l'unité de levage (2) est configurée pour supporter une zone centrale des matériaux ; et l'unité de support (4) est configurée pour supporter une zone périphérique des matériaux. 5
6. Appareil de fourniture de matériau selon la revendication 2,
dans lequel l'unité de support comporte une portion de griffe (7b) sollicitée dans une direction en saillie dans un trajet de montée des matériaux à réapprovisionner de façon à interférer avec les matériaux, et dans lequel l'unité de détection de support (7) est configurée pour détecter si la portion de griffe (7b) est en saillie sur le trajet de montée des matériaux ou si la portion de griffe est rétractée du trajet de montée ; et 10
l'unité de détection de support (7) détermine l'état où la position de griffe est en saillie comme un état de support, et détermine l'état où la position de griffe est rétractée comme étant un état de non-support. 15 20
7. Appareil de fourniture de matériau selon la revendication 1,
comprenant en outre une unité de détection de quantité restante configurée pour détecter une quantité de matériaux restants supportés par l'unité de support, 25
dans lequel l'unité de commande (9) est en outre configurée pour réapprovisionner les matériaux sur l'unité de levage vers l'unité de support, lorsque la quantité de matériaux restants devient inférieure à une quantité prédéterminée. 30
8. Appareil de fourniture de matériau selon la revendication 1, 35
comprenant en outre une unité de détection de support (7) configurée pour détecter un support/non-support de la surface la plus basse par l'unité de support (4) ; et 40
une unité de sélection (8) configurée pour sélectionner l'unité d'entraînement de support (5) d'après une détection de support de l'unité de détection de support (7) et sélectionner l'unité d'entraînement de levage d'après une détection de non-support de l'unité de détection de support ; 45
dans lequel l'unité de commande (9) est en outre configurée pour faire descendre l'unité de levage pour la préparation d'un réapprovisionnement suivant, lorsque l'unité de sélection (8) sélectionne l'unité d'entraînement de support (5), et 50
pour faire descendre l'unité de support (4) de façon à recevoir des matériaux depuis l'unité de levage (2), lorsque l'unité de sélection sélectionne l'unité d'entraînement de levage (3). 55
9. Appareil de fourniture de matériau selon la revendication 1,
- dans lequel chacune de l'unité d'entraînement de levage (3) et de l'unité d'entraînement de support (5) possède un moteur électrique, une vis mâle (11) entraînée en rotation par le moteur électrique, une vis femelle (14) vissée sur la vis mâle, et un encodeur (13) pour détecter un nombre de rotations de la vis mâle, et
dans lequel chacune de l'unité de levage (2) et de l'unité de support (4) est fixée respectivement à la vis femelle (14).

FIG.1

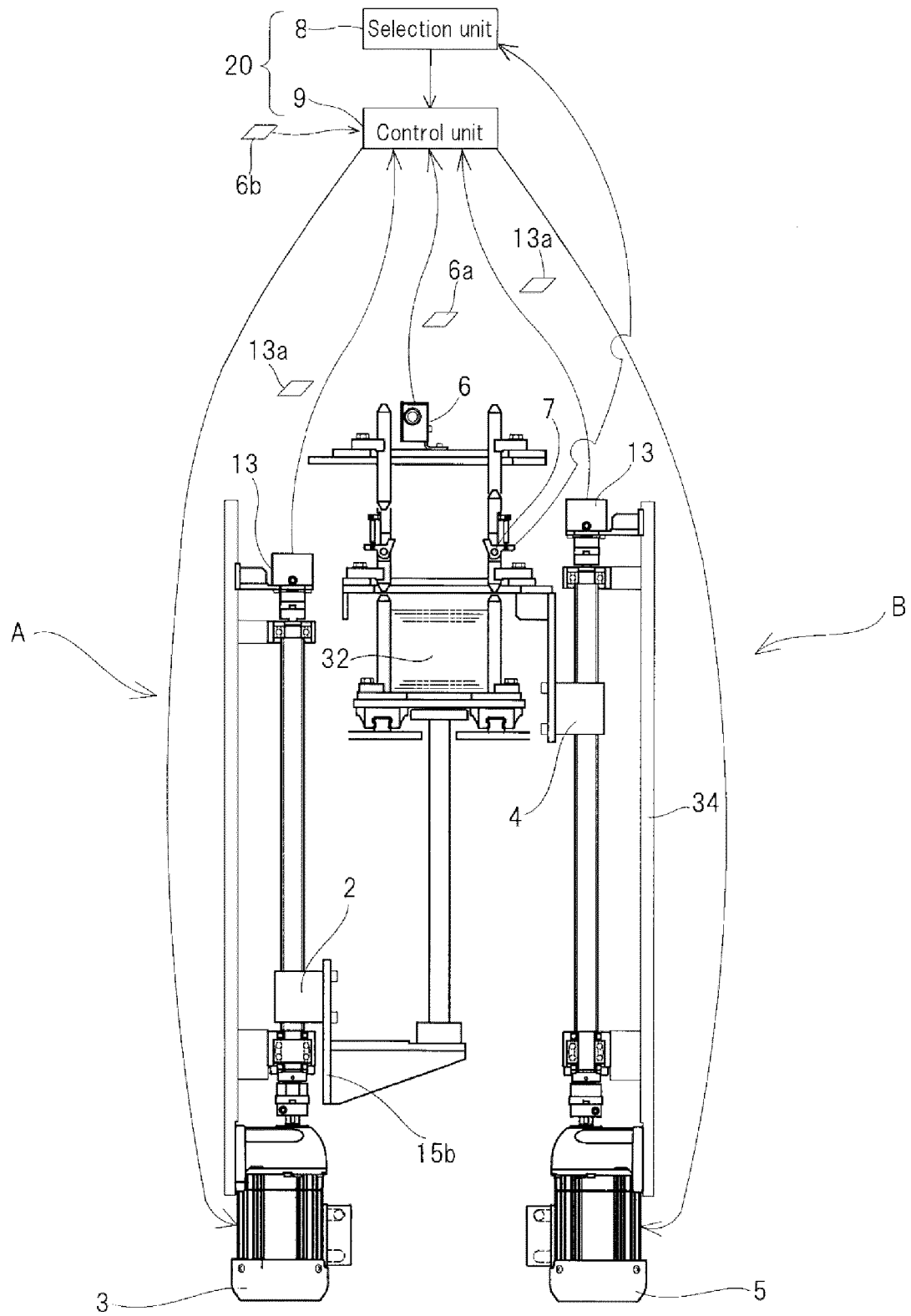


FIG.2

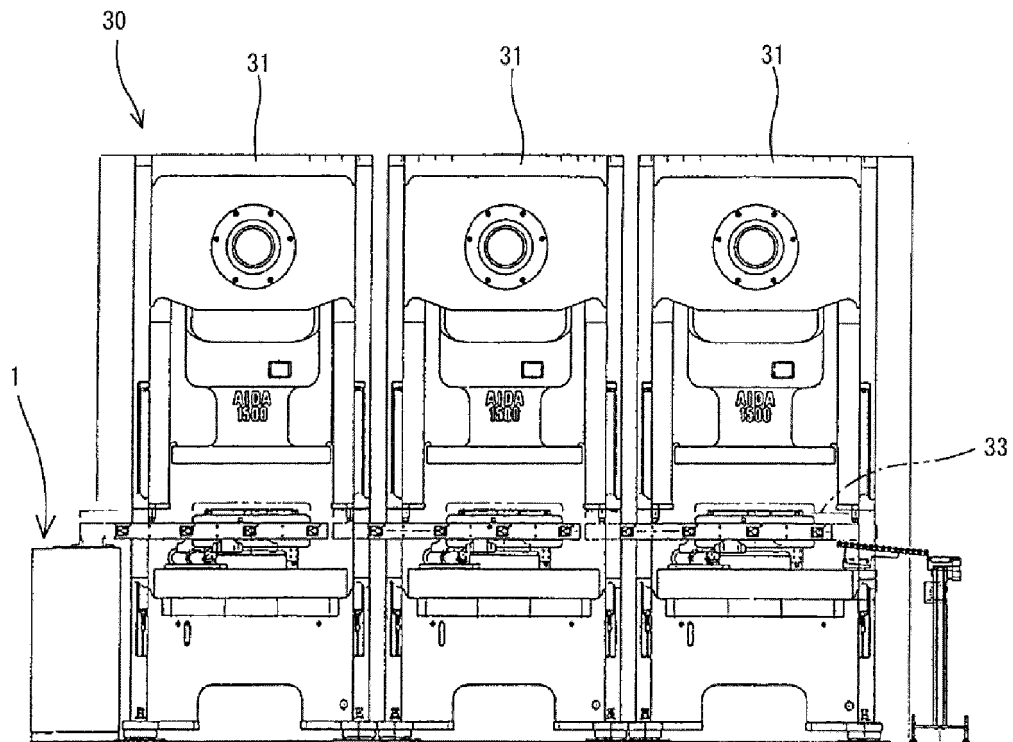


FIG.3

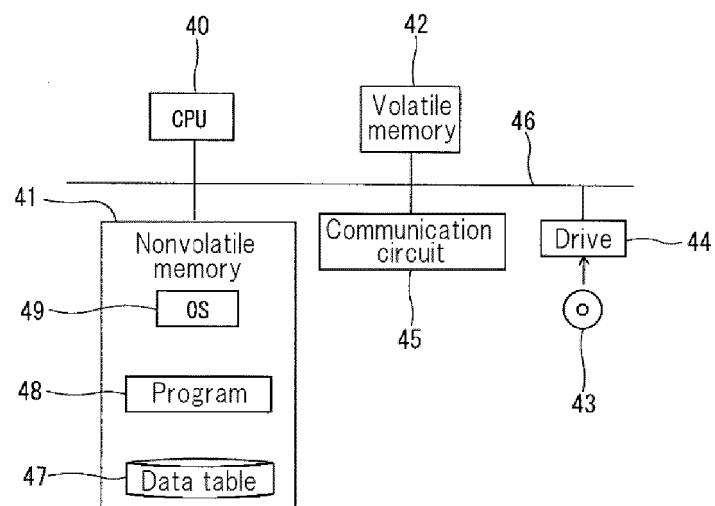


FIG.4A

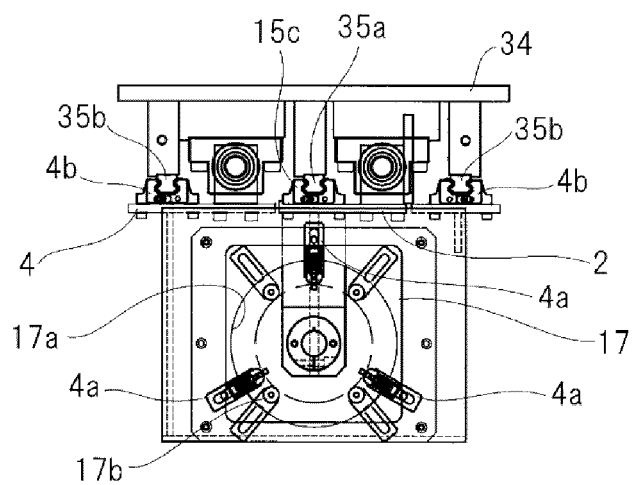


FIG.4B

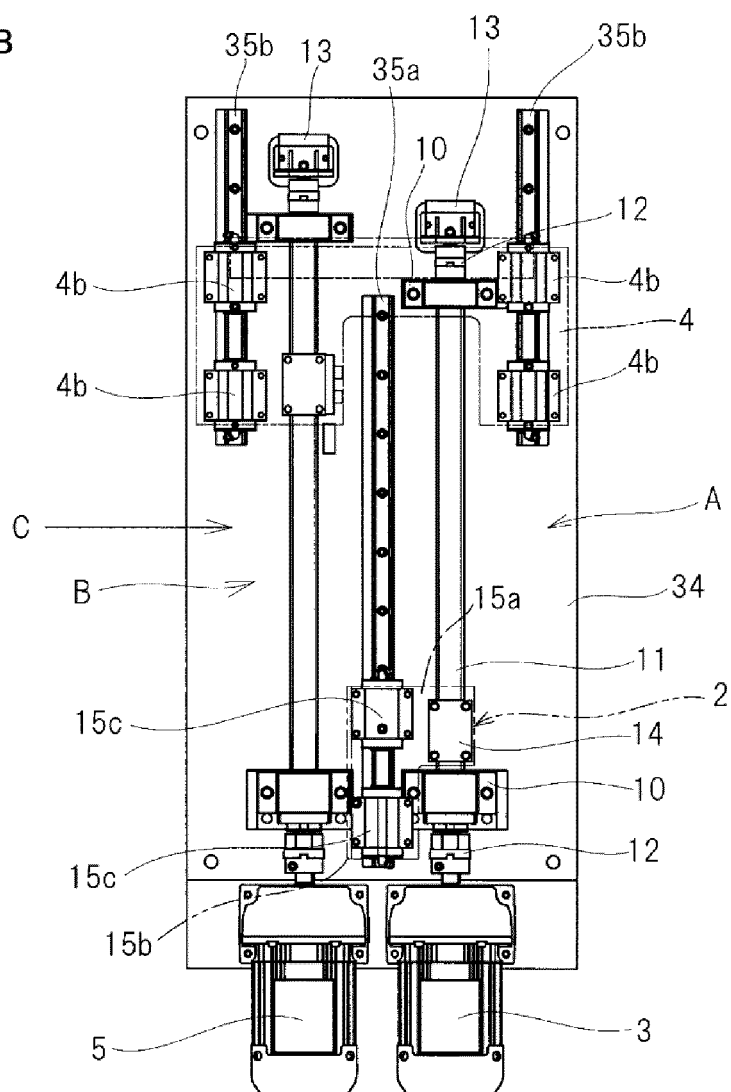


FIG.5A

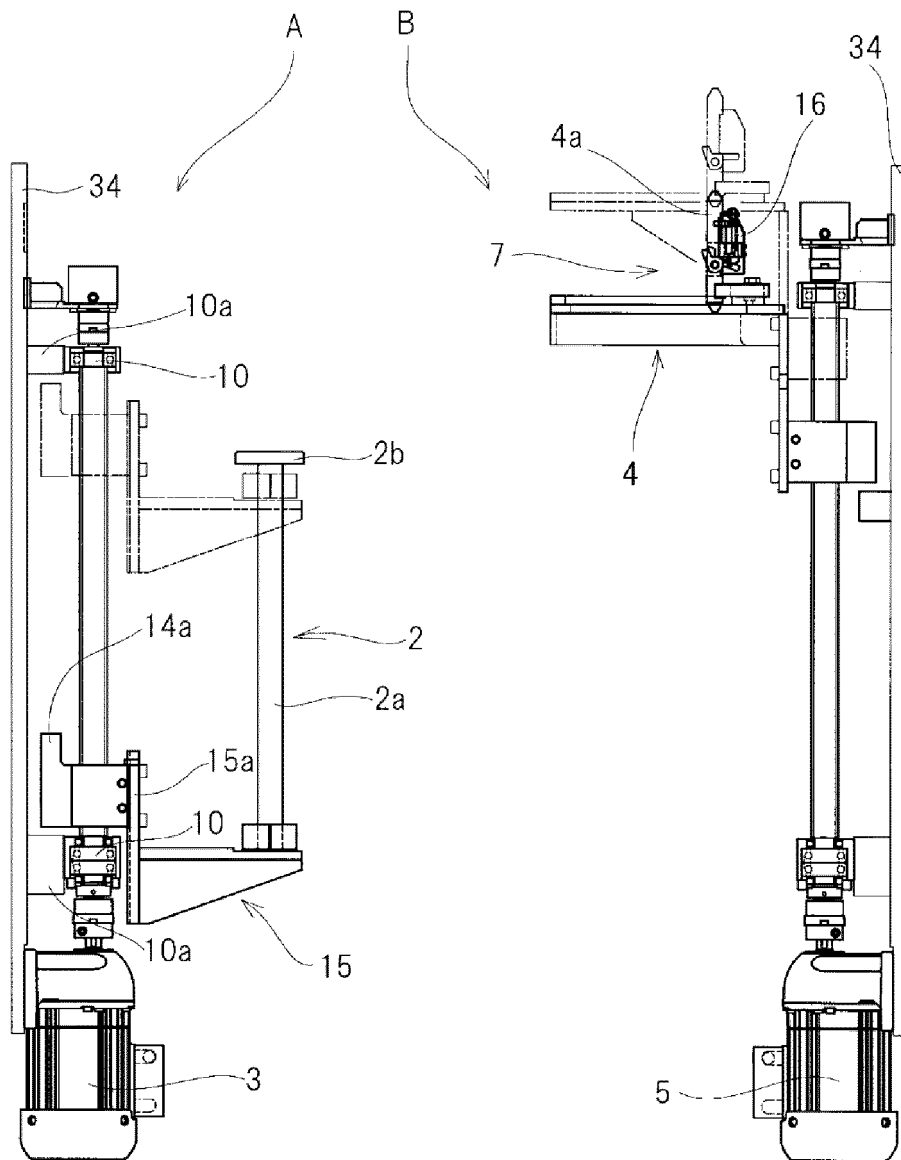


FIG.5B

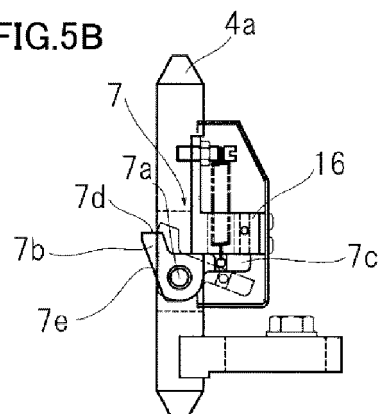


FIG.6

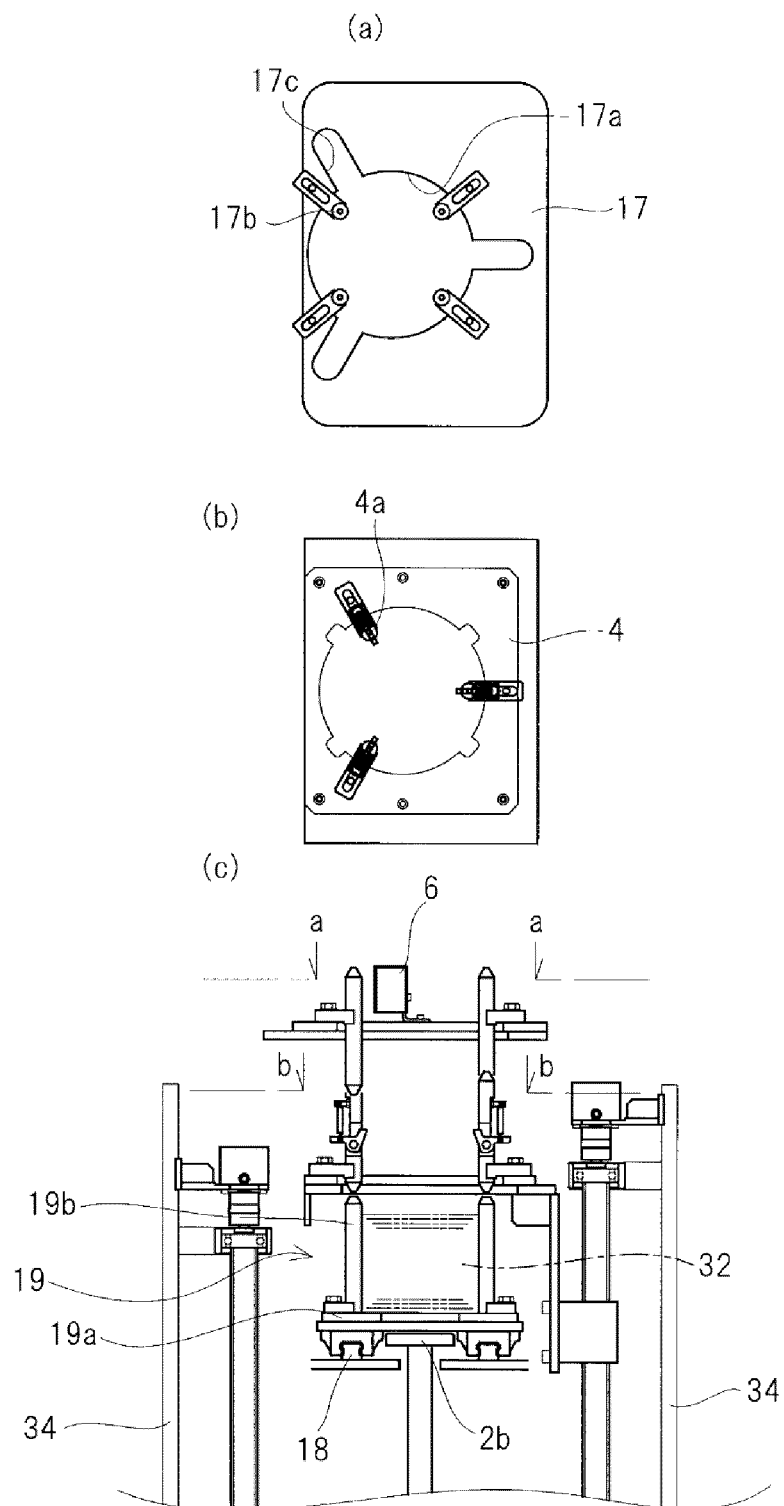


FIG. 7

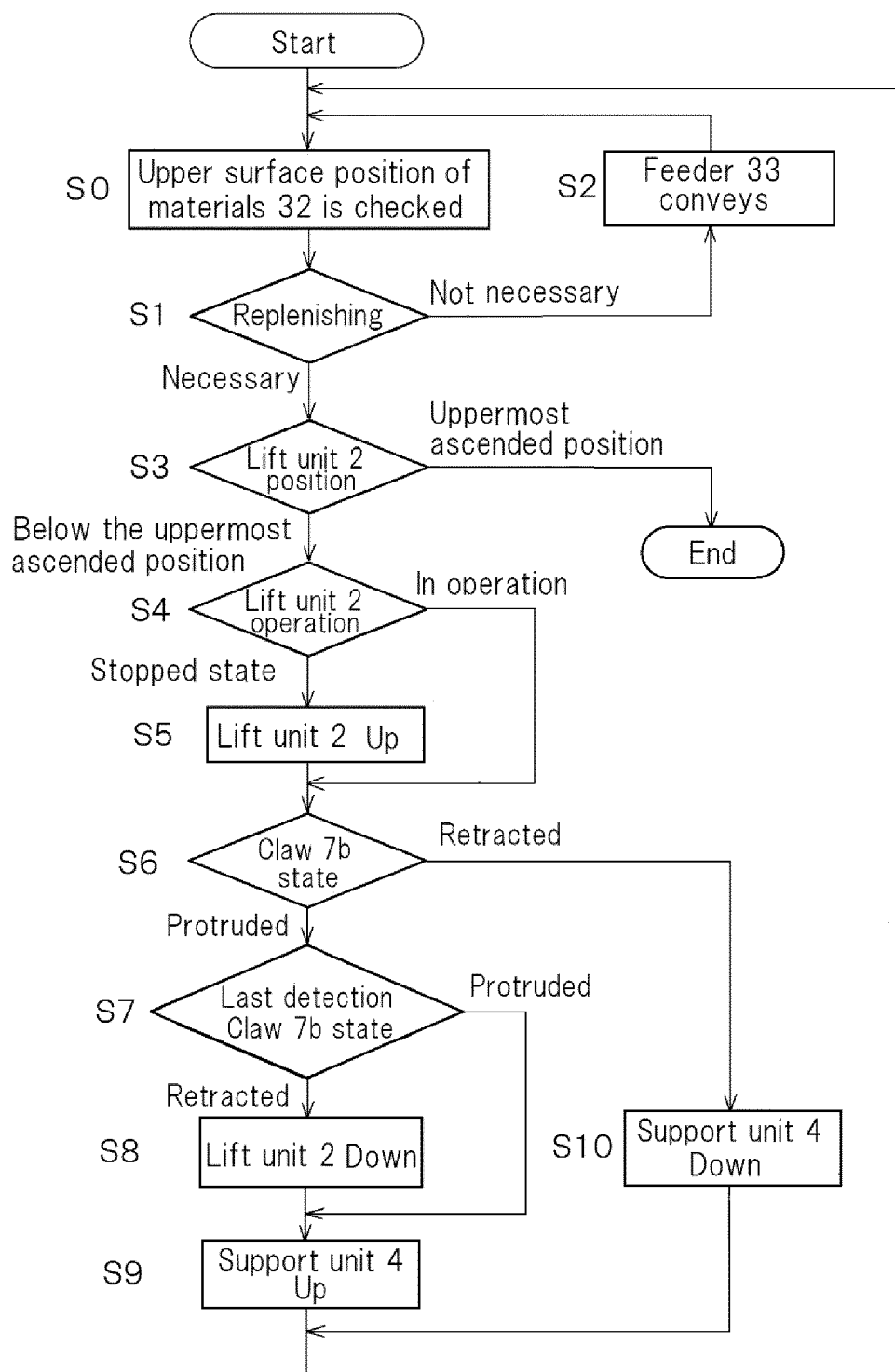


FIG.8A

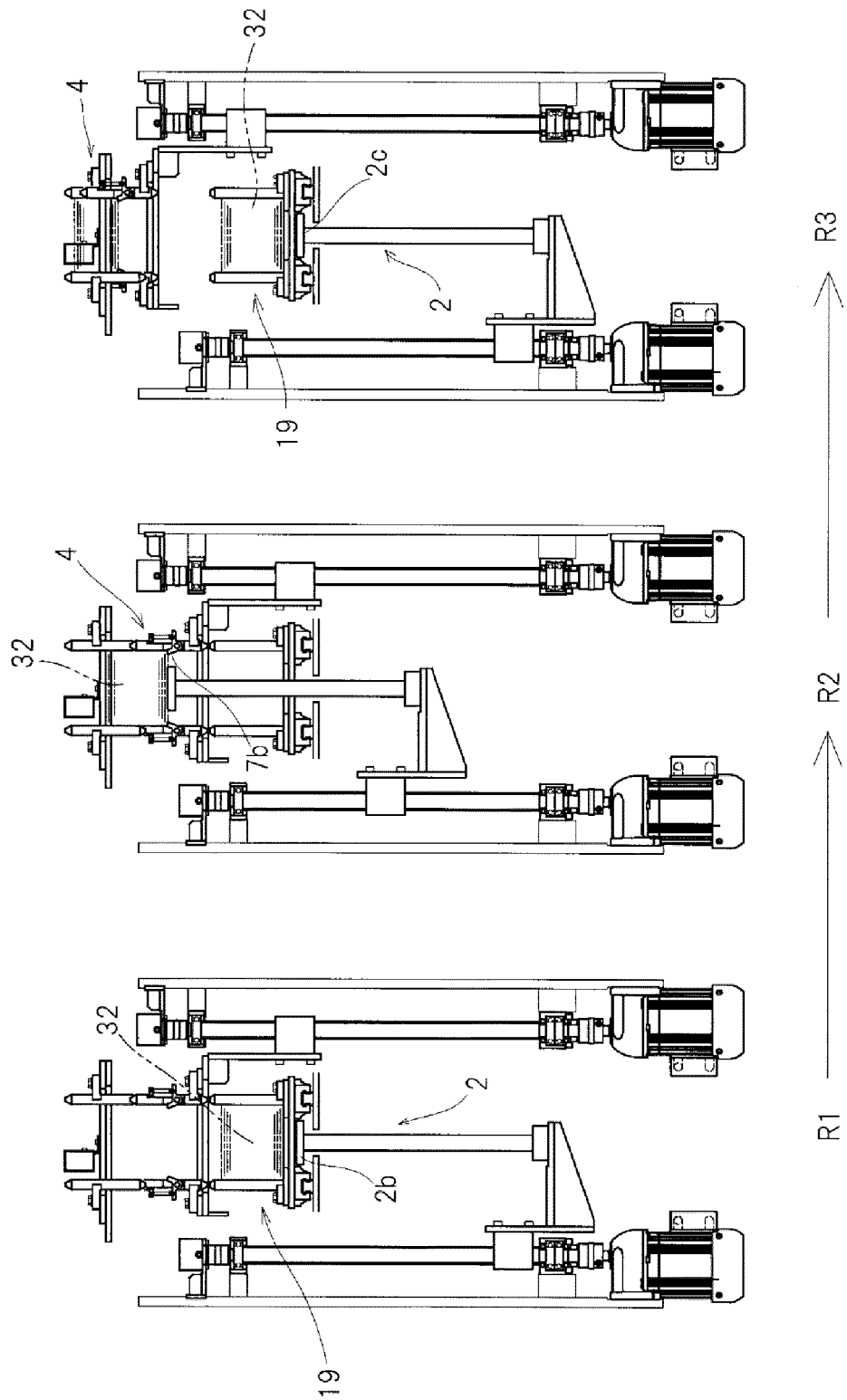


FIG.8B

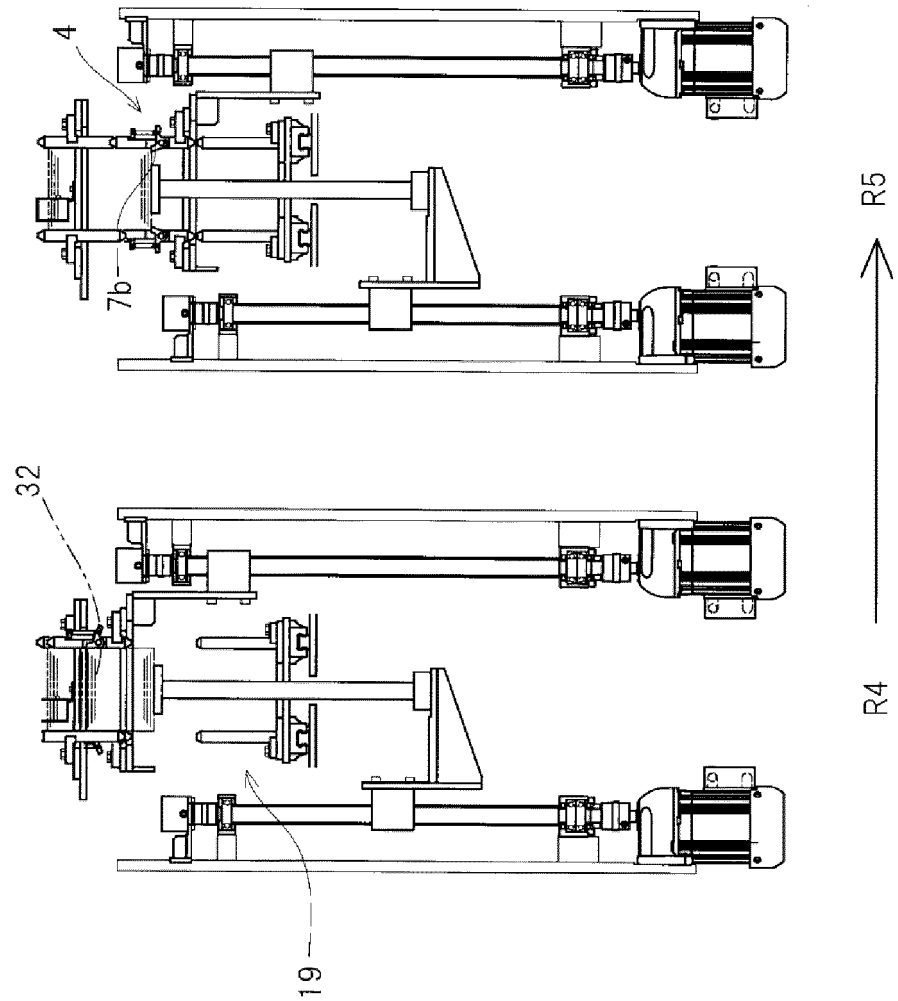
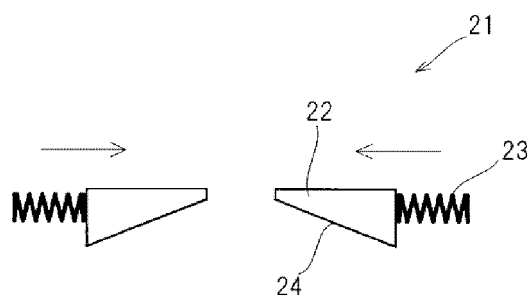


FIG.9



REFERENCES CITED IN THE DESCRIPTION

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