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(54) POST-PROCESSING APPARATUS, AND METHOD OF PERFORMING POST-PROCESSING OF A SHEET

(57) A post-processing apparatus (3) includes a processing tray (18) for stacking a sheet (S) and a detection sensor (41) for detecting the presence or absence of the sheet placed on the processing tray. The post-processing apparatus includes a pinch roller (47) for moving towards the processing tray if the detection sensor does not detect the sheet, and a longitudinal alignment roller (40) configured to rotate by a predetermined amount while sandwiching the sheet in the processing tray with the pinch roller to elongate the sheet. By holding a rear end of the sheet in the processing tray with a paddle section (30) and elongating the sheet towards the downstream side with the longitudinal alignment roller, the presence or absence of the sheet is detected by the detection sensor.

FIG.1

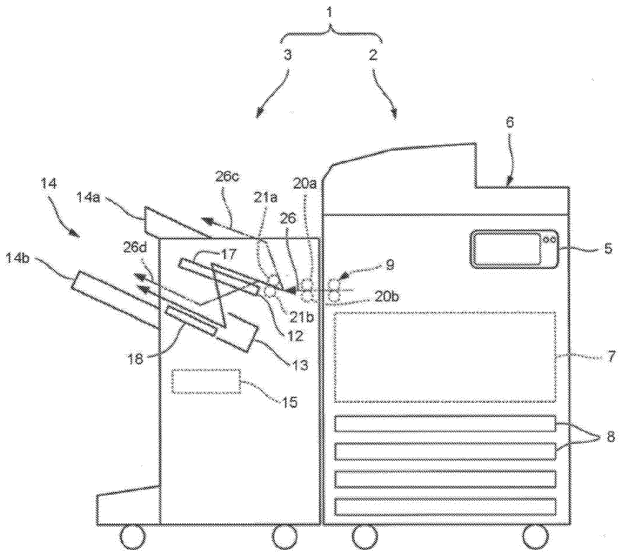

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FIG.3

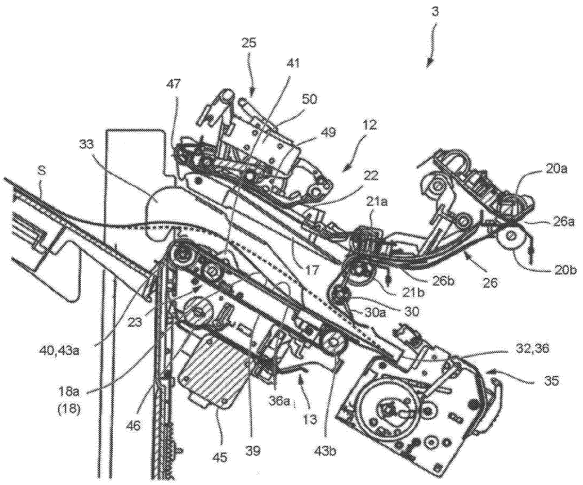


FIG.4

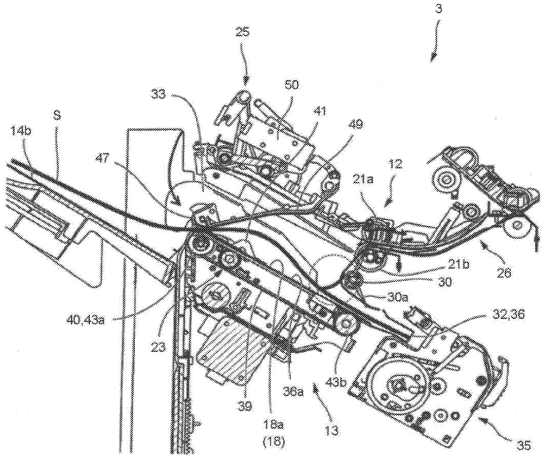
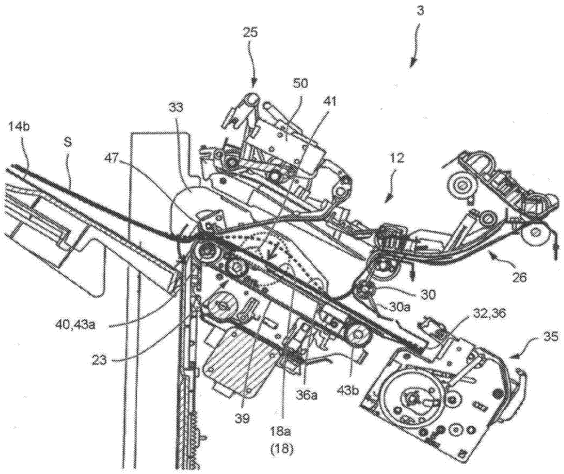


FIG.5



Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This application is based upon and claims the benefit of priority from Japanese Patent Application No. 2017-122271, filed June 22, 2017, the entire contents of which are incorporated herein by reference.

FIELD

[0002] Embodiments described herein relate generally to a post-processing apparatus.

BACKGROUND

[0003] There is known a post-processing apparatus for executing a specified post-processing on a sheet (paper) discharged from an image forming apparatus (e.g., a multifunction printing device (an MFP)).

[0004] In the post-processing apparatus, the sheet discharged from the MFP is sent to a standby tray. The sheet drops from the standby tray to a processing tray below the standby tray to be stacked. The processing tray has a detection sensor that detects the sheet. The processing tray aligns and supports the stacked sheets while executing a stapling processing on the sheet with a stapler used for post-processing.

[0005] In a processing in a stapling mode, if there is no sheet in a sheet feed cassette during processing and an operation stop command is received from the MFP, the post-processing apparatus stops. If the operation stop command is received from the MFP in the state in which the number of stacked sheets on the processing tray is less than a stapling number, the MFP is notified whether there is the paper in the processing tray. In the processing tray, if it is determined that there is no sheet, the sheet is forcibly discharged. Then, after restarting a job in the MFP, the sheet is stacked on the processing tray from the first sheet, and the stapling processing is executed after the stapling number is reached. If the sheet is present in the MFP, the post-processing apparatus stands by without discharging the sheet and waits for an operation restart command of the MFP. After restarting the job, the remaining sheet is stacked, and the stapling processing is executed after the stapling number is reached.

[0006] An inexpensive mechanical actuator type of a detection sensor for detecting the presence and absence of the sheet which is arranged in the processing tray may be used. The detection sensor of the mechanical actuator type does not operate unless a sheet load is applied to some extent.

[0007] Therefore, if the sheet is a thin paper or has a small width, or if a sheet size is large, there is a case in which the detection sensor cannot detect the sheet due to insufficient load, curvature, etc. of the sheet. Since the detection sensor cannot detect the sheet even though the sheet is present in the processing tray, the sheet is forcibly discharged according to an instruction from the MFP and the sheet which is not stapled is also discharged. Therefore, there is a problem that detection of the presence or absence of the sheet is not stable. If the sheet is forcibly discharged from the processing tray, the sheet needs to be laminated from the first sheet after resuming the job of the MFP, resulting in a loss in a processing time and the sheet and low efficiency.

SUMMARY OF THE INVENTION

[0008] It is an object of the present invention to improve prior art techniques and overcome at least some of the prior art problems as for instance above illustrated.

[0009] According to a first aspect, it is provided a post-processing apparatus, comprising: a processing tray configured to stack a sheet; a detection sensor configured to detect a presence or an absence of the sheet placed on the processing tray; a pressing roller configured to move to the processing tray when the detection sensor does not detect the sheet; and a conveyance roller configured to rotate by a predetermined amount while sandwiching the sheet with the pressing roller in the processing tray.

[0010] Optionally, the post-processing apparatus according to the first aspect may comprise: a paddle configured to hold the sheet at an upstream side of the conveyance roller in the processing tray.

[0011] Optionally, in the post-processing apparatus according to the first aspect, the paddle is configured to rotate to convey the sheet to the upstream side.

[0012] Optionally, in the post-processing apparatus according to the first aspect, the paddle is configured to hold a load which is larger than a conveyance force of the conveyance roller.

[0013] Optionally, the post-processing apparatus according to the first aspect further comprises:

> a controller configured to cause the conveyance roller to repeatedly rotate by a predetermined amount, wherein the detection sensor is configured to repeatedly detect the absence or the presence of the sheet.

[0014] According to a second aspect, it is provided a method of performing post-processing of a sheet, comprising: arranging the sheet on a processing tray; detecting, by a detection sensor, presence or absence of the sheet on the processing tray; moving a pressing roller to the processing tray when the detection sensor detects that the sheet is absent; causing, by a controller, rotation of a conveyance roller by a predetermined amount, and sandwiching the sheet between the conveyance roller and the pressing roller in the processing tray while the conveyance roller rotates.

[0015] Optionally, the method according to the second aspect further comprises: holding the sheet by a paddle at an upstream side of the conveyance roller.

[0016] Optionally, the method according to the second aspect further comprises: rotating the paddle to convey the sheet to the upstream side of the conveyance roller.

[0017] Optionally, the method according to the second aspect further comprises: holding, by the paddle, a load which exceeds a conveyance force of the conveyance roller.

[0018] Optionally, the method according to the second aspect further comprises: repeating rotation of the conveyance roller, so as to cause the conveyance roller to rotate by a predetermined amount a plurality of times, and repeating detection by the detection sensor of the absence or the presence of the sheet.

[0019] According to a third aspect, it is provided a post-processing system, comprising: a processing tray configured to receive at least one sheet; a controller configured to receive information indicative of whether the at least one sheet is present in the processing tray; a first roller and a second roller, the first roller being configured to rotate by a predetermined amount when the at least one sheet is sandwiched between the first roller and the second roller in the processing tray; and a paddle configured to hold the at least one sheet upstream of the first roller in the processing tray, and to press a rear end of the at least one sheet in a direction toward the processing tray when the at least one sheet moves from a standby tray to the processing tray.

[0020] Further aspects are defined by the appended independent claims; dependent claims provide further advantageous aspects.

DESCRIPTION OF THE DRAWINGS

[0021]

Fig. 1 is a schematic diagram illustrating an image forming system according to an embodiment;

Fig. 2 is a side sectional view illustrating the main portions of a post-processing apparatus according to the embodiment;

Fig. 3 is a side sectional view illustrating a first operation by the post-processing apparatus according to the embodiment;

Fig. 4 is a side sectional view illustrating a second operation by the post-processing apparatus according to the embodiment;

Fig. 5 is a side sectional view illustrating a third operation by the post-processing apparatus according to the embodiment;

Fig. 6 is a first flowchart illustrating a processing of the post-processing apparatus according to the embodiment;

Fig. 7 is a second flowchart illustrating a processing of the post-processing apparatus according to the embodiment;

Fig. 8 is a third flowchart illustrating a processing of the post-processing apparatus according to the embodiment; and

Fig. 9 is a fourth flowchart illustrating a processing of the post-processing apparatus according to the embodiment.

DETAILED DESCRIPTION

[0022] In accordance with an embodiment, a post-processing apparatus comprises a processing tray, a detection sensor, a pressing roller and a conveyance roller. The processing tray stacks a sheet. The detection sensor detects the presence or absence of the sheet placed on the processing tray. The pressing roller moves to the processing tray if the detection sensor does not detect the sheet. The conveyance roller rotates by a predetermined amount while sandwiching the sheet with the pressing roller in the processing tray to elongate the sheet.

[0023] Hereinafter, a post-processing apparatus of an embodiment is described with reference to the accompanying drawings.

[0024] With reference to Fig. 1 to Fig. 8, a post-processing apparatus 3 in an image forming system 1 of an embodiment is described. Fig. 1 shows a schematic embodiment of the image forming system 1. The image forming system 1 is provided with an image forming apparatus 2 (MFP) and the post-processing apparatus 3. The image forming apparatus 2 forms an image on a sheet-like image receiving medium (hereinafter, referred to as a "sheet S") such as a paper. The post-processing apparatus 3 executes a post-processing on a sheet S (or a sheet bundle formed by overlapping a plurality of sheets S, which is referred to as a sheet bundle SS) conveyed from the image forming apparatus 2.

[0025] The image forming apparatus 2 has a control panel (operation section) 5, a scanner section 6, a printer section 7, a sheet feed section 8, and a sheet discharge section 9. The control panel 5 is provided with various keys or a touch panel for receiving operations by a user. The control panel 5 receives an input relating to a type of a post-processing on the sheet S. The control panel 5 can select a sorting mode in which a sorting processing is executed, a stapling mode in which a stapling processing is executed, and a non-sorting mode in which the sorting processing and the stapling processing are not executed.

[0026] In a case in which the non-sorting mode is selected, the control panel 5 receives a selection of discharging the sheet S to a fixed tray 14a or a movable tray 14b of the post-processing apparatus 3. The image forming apparatus 2 sends information relating to the type of the post-processing input by the control panel 5 to the post-processing apparatus 3.

[0027] The scanner section 6 includes a reading section for reading image information which is a copied object. The scanner section 6 sends read image information to the printer section 7. The printer section 7 forms an output image with a developer such as a toner based on image information transmitted from the scanner section

6 or an external device. The printer section 7 applies heat and pressure to the toner image transferred onto the sheet S to fix the toner image on the sheet S.

[0028] The sheet feed section 8 supplies the sheets S one by one to the printer section 7 in accordance with a timing at which the printer section 7 forms the toner image. The sheet discharge section 9 conveys the sheet S discharged from the printer section 7 to the post-processing apparatus 3.

[0029] Next, the post-processing apparatus 3 is described.

[0030] As shown in Fig. 1, the post-processing apparatus 3 is arranged adjacently to the image forming apparatus 2. The post-processing apparatus 3 executes the post-processing designated through the control panel 5 to the sheet S conveyed from the image forming apparatus 2. For example, the post-processing is the stapling processing.

[0031] The post-processing apparatus 3 includes a standby section 12, a processing section 13, a discharge section 14 and a post-processing controller 15. The standby section 12 temporarily retains (buffers) the sheet S conveyed from the image forming apparatus 2. The standby section 12 includes a standby tray 17. For example, a plurality of succeeding sheets S stands by on the standby section 12 while the post-processing is executed on the former sheet S by the processing section 13. The standby section 12 is arranged above the processing section 13. For example, on the standby section 12, a plurality of preset sheets S stands by in an overlapped manner. If the processing section 13 is idle, the standby section 12 drops the sheet S that is being buffered towards the processing section 13.

[0032] The processing section 13 carries out the post-processing on the conveyed sheet S. The processing section 13 includes a processing tray 18. The processing section 13 carries out the stapling processing which is a binding processing with a staple on the sheet bundle SS reaching a stapling number obtained by gathering a plurality of sheets S. The processing section 13 discharges the sheet S on which the post-processing is carried out to the discharge section 14.

[0033] As shown in Fig. 1 and Fig. 2, the fixed tray 14a of the discharge section 14 is arranged at an upper side of the post-processing apparatus 3. The movable tray 14b is arranged at a side of the post-processing apparatus 3. The movable tray 14b is movable in a vertical direction along the side of the post-processing apparatus 3. A sheet S is discharged from the standby section 12 and the processing section 13 to the fixed tray 14a and the movable tray 14b.

[0034] The post-processing controller 15 controls the whole operation of the post-processing apparatus 3. As shown in Fig. 1 and Fig. 2, the post-processing controller 15 controls the standby section 12, the processing section 13 and the discharge section 14. The post-processing controller 15 controls the operations of inlet rollers 20a and 20b, outlet rollers 21a and 21b and an assisting guide 22 and controls the operations of a bundle claw driving mechanism 23 and a pinch roller driving mechanism 25. The post-processing controller 15 is formed by a control circuit including a CPU, a ROM and a RAM. The post-processing controller 15 is configured to communicate with one or more of the aforementioned components. For example, the post-processing controller 15 is configured to receive information from the detection sensor 41 indicative of whether the sheet is present or absent with respect to the processing tray.

[0035] The configuration of each section of the post-processing apparatus 3 is described in detail below with reference to Fig. 2 to Fig. 5.

[0036] An "upstream side" and a "downstream side" in the present embodiment mean an upstream side (the image forming apparatus 2 side) and a downstream side (the fixed tray 14a side or the movable tray 14b side) in a conveyance direction of the sheet S, respectively. In addition, a "front end" and a "rear end" mean a "downstream side end" and an "upstream side end" in the sheet conveyance direction, respectively. Furthermore, in the present embodiment, a direction (a sheet plane direction) substantially parallel to a plane of the sheet S and substantially orthogonal to the sheet conveyance direction is referred to as a sheet width direction W.

[0037] As shown in Fig. 1 and Fig. 2, the post-processing apparatus 3 includes a conveyance path 26 of the sheet S following the sheet discharge section 9 of the image forming apparatus 2. A pair of inlet rollers 20a and 20b, a pair of outlet rollers 21a and 21b, the standby section 12 and the processing section 13 are arranged in the conveyance path 26. The conveyance path 26 is provided inside the post-processing apparatus 3.

[0038] The conveyance path 26 has a sheet supply port 26a provided with the inlet rollers 20a and 20b and a sheet discharge port 26b provided with the outlet rollers 21a and 21b. The sheet supply port 26a faces the sheet discharge section 9 of the image forming apparatus 2. The sheet supply port 26a is supplied with the sheet S from the image forming apparatus 2. The sheet discharge port 26b faces the standby section 12. The sheet S passing through the conveyance path 26 is conveyed from the sheet discharge port 26b to the standby section 12.

[0039] As shown in Fig. 1 and Fig. 2, in the conveyance path 26, a second conveyance path 26c extending to the fixed tray 14a of the discharge section 14 branches. In the non-sorting mode, the second conveyance path 26c guides the sheet S towards the fixed tray 14a. If the sorting mode or the stapling mode is selected, the conveyance path 26 guides the sheet S to the standby section 12. In the conveyance path 26, a third conveyance path 26d extending towards a longitudinal alignment roller 40 (conveyance roller) in the processing section 13 at the downstream side in the conveyance direction of the standby section 12 branches.

[0040] In Fig. 3, the inlet rollers 20a and 20b are provided in the vicinity of the sheet supply port 26a. The inlet rollers 20a and 20b face each other in a radial direction

in parallel. The inlet roller 20a is a driving roller arranged above the conveyance path 26. The inlet roller 20b is a driven roller arranged below the conveyance path 26. The inlet rollers 20a and 20b sandwich the sheet S at a nip therebetween. The inlet rollers 20a and 20b convey the sandwiched sheet S to the downstream side in the conveyance direction.

[0041] The outlet rollers 21a and 21b are provided in the vicinity of the sheet discharge port 26b. The outlet rollers 21a and 21b face each other in a radial direction in parallel. The outlet roller 21a is a driven roller arranged above the conveyance path 26. The outlet roller 21b is a driving roller arranged below the conveyance path 26. The outlet rollers 21a and 21b sandwich the sheet S at a nip therebetween. The outlet rollers 21a and 21b convey the sandwiched sheet S to the downstream side in the conveyance direction.

[0042] The standby section 12 is described below.

[0043] As shown in Fig. 2 and Fig. 3, the standby section 12 includes the standby tray (buffer tray) 17 and the assisting guide 22. The rear end of the standby tray 17 is positioned in the vicinity of the outlet rollers 21a and 21b. The rear end of the standby tray 17 is positioned below the sheet discharge port 26b of the conveyance path 26. The standby tray 17 is inclined with respect to a horizontal direction in such a manner that it gradually increases in the direction of the downstream side of the sheet conveyance direction. On the standby tray 17, a plurality of the sheets S stands by in an overlapped manner while the post-processing is executed in the processing section 13.

[0044] The standby tray 17 has a pair of tray members that can move towards or away from each other in the sheet width direction W. The pair of tray members approaches each other to be capable of supporting the sheet S if the sheet S stands by on the standby tray 17. If the sheet S is moved from the standby tray 17 towards the processing tray 18 of the processing section 13, the pair of the tray members is separated from each other to drop (move) the supported sheet S to the processing tray 18.

[0045] The assisting guide 22 is provided above the standby tray 17. For example, the assisting guide 22 has substantially the same length as the standby tray 17 in the sheet conveyance direction. If the sheet S moves from the standby tray 17 to the processing tray 18, the assisting guide 22 moves the sheet S towards the processing tray 18. The assisting guide 22 has a swing axis at the end of the downstream side in the sheet conveyance direction. The assisting guide 22 swings the end of the upstream side in the sheet conveyance direction downwards with the swing axis to move the sheet S toward the processing tray 18.

[0046] Between the upstream side of the standby tray 17 and the upstream side of the processing tray 18, a paddle section 30 is provided. The paddle section 30 presses the sheet S towards the processing tray 18 by rotating around a rotation axis along the sheet width direction W. The paddle section 30 presses the rear end of the sheet S towards the processing tray 18 at the time the sheet S moves from the standby tray 17 to the processing tray 18. The paddle section 30 has a paddle 30a made of an elastic material such as rubber, and the paddle 30a presses the rear end of the sheet S toward the processing tray 18. The paddle 30a is configured to hold a load which is larger than a conveyance force / load of the alignment roller 40.

[0047] The paddle section 30 rotates counterclockwise in the figure with the paddle 30a contacting the sheet S. As a result, the sheet S falling down on the processing tray 18 moves or is pressed towards the upstream side in the sheet conveyance direction of the processing section 13. The paddle section 30, together with the longitudinal alignment roller 40 arranged at the downstream side and a rear end stopper 32 arranged at the upstream side of the processing section 13, makes up a longitudinal alignment device which executes alignment of the sheet S (a so-called longitudinal alignment) in the sheet conveyance direction.

[0048] The paddle section 30 can change an angle of the paddle 30a abutting against the sheet S of the processing tray 18 so as to adjust the movement of the sheet S or pressure of pressing on the sheet S. By exchanging the paddle 30a with a member having different rigidity, it is possible to adjust the movement or the pressure of pressing as well.

[0049] The processing section 13 is described below.

[0050] As shown in Fig. 2 and Fig. 3, the processing section 13 includes the processing tray 18, a horizontal alignment plate 33, the rear end stopper 32, a stapler (stapling processing section) 35, an ejector 36, a thruster 36a, a bundle claw (extrusion member) 38, a bundle claw belt 39 and the longitudinal alignment roller 40. The processing section 13 further includes a detection sensor 41 for detecting the presence or absence of the sheet S on a conveyance surface 18a on which the sheet S is placed in the processing tray 18.

[0051] The processing tray 18 is provided below the standby tray 17. The processing tray 18 is inclined with respect to the horizontal direction in such a manner that it gradually increases as proceeding to the downstream side in the sheet conveyance direction. For example, the processing tray 18 is inclined approximately parallel to the standby tray 17. The processing tray 18 has the conveyance surface 18a (on which the sheet S is placed) supporting the sheet S.

[0052] A pair of the horizontal alignment plate 33 is provided to face each other at both sides of the sheet width direction W of the conveyance surface 18a of the processing tray 18. A pair of the horizontal alignment plates 33 is provided away from each other in the sheet width direction W. The horizontal alignment plate 33 is movable in a direction approaching each other and a direction away from each other in the sheet width direction W. The horizontal alignment plate 33 serves as a horizontal alignment device which executes the alignment

(so-called horizontal alignment) of the sheet S in the sheet width direction W.

[0053] The rear end stopper 32 is provided at the end of the upstream side of the processing tray 18. The sheet S placed on the processing tray 18 is conveyed to the rear end stopper 32 if the longitudinal alignment roller 40 is driven to rotate clockwise in the figure. The longitudinal alignment roller 40 cooperates with the paddle section 30 to execute the longitudinal alignment of the sheet S by enabling the upstream side end of the sheet S to abut against the rear end stopper 32. By driving the longitudinal alignment roller 40 to rotate in a counterclockwise direction in the figure, through cooperation with the paddle section 30 that presses the rear end of the sheet S, a thin and lightweight sheet S and a curved sheet S are elongated. By being elongated to a flat shape, the sheet S abuts against the conveyance surface 18a and presses the end of a mechanical actuator type detection sensor 41.

[0054] A stapler 35 is arranged behind the processing tray 18. The stapler 35 can clinch the end of the sheet S aligned by abutting against the rear end stopper 32. If the stapling mode is selected, the stapler 35 executes the stapling processing at the end of the sheet bundle SS aligned by abutting against the rear end stopper 32.

[0055] The ejector 36 is provided at an initial position at the end of the upstream side of the processing tray 18. The ejector 36 is provided so as to overlap with the rear end stopper 32 in a side view. The ejector 36 can move the sheet S towards the downstream side in the conveyance direction. The ejector 36 advances the sheet bundle SS on which the stapling processing or the sorting processing is executed at the time of moving to the downstream side in the conveyance direction. The ejector 36 places the end of the sheet bundle SS at a position where the sheet bundle SS can be delivered to the bundle claw 38. The ejector 36 is moved towards the initial position before the movement.

[0056] The thruster 36a is arranged along the conveyance surface 18a. The thruster 36a is movable with the ejector 36 towards the downstream side of the sheet conveyance direction. The thruster 36a protrudes towards the downstream side in the conveyance direction from the longitudinal alignment roller 40 at the time of moving to the downstream side in the conveyance direction. The thruster 36a protrudes so as to extend the conveyance surface 18a to the downstream side in the conveyance direction with respect to the longitudinal alignment roller 40. The thruster 36a is immersed in the upstream side in the conveyance direction with respect to the longitudinal alignment roller 40 at the initial position before the movement. The thruster 36a is moved towards the initial position before the movement.

[0057] The bundle claw 38 shown in Fig. 2 is fixed to the bundle claw belt 39. The bundle claw belt 39 is endlessly stretched between a pair of belt pulleys 43a and 43b positioned at the upstream side and the downstream side in the conveyance direction of the processing tray 18. The belt pulley 43a at the downstream side in the conveyance direction is provided so as to overlap with the longitudinal alignment roller 40 in a side view. The belt pulley 43a at the downstream side in the conveyance direction is the driving pulley, and the bundle claw belt 39 is driven by the rotation of the driving pulley. The bundle claw belt 39 and the belt pulleys 43a and 43b make up the bundle claw driving mechanism 23 for driving the bundle claw 38.

[0058] The bundle claw 38 moves from the lower surface side (back surface side) to the conveyance surface 18a at the upper surface side along a winding direction of the bundle claw belt 39 along with driving of the bundle claw belt 39. The bundle claw 38 contacts with the end at the upstream side in the conveyance direction of the sheet S placed on the processing tray 18 at the conveyance surface 18a to convey the sheet S so as to press the sheet S to the downstream side in the conveyance direction of the processing tray 18. The bundle claw 38 moves towards the downstream side of the sheet conveyance direction at the upper surface side (conveyance surface 18a side) of the processing tray 18.

[0059] The bundle claw 38 moves to the lower surface side along the outer periphery of the belt pulley 43a at the front end side of the processing tray 18 after the sheet S is conveyed. Thereafter, the bundle claw 38 moves the lower surface side of the processing tray 18 to the upstream side of the sheet conveyance direction. The bundle claw 38 stands by with the lower surface side in the front of the belt pulley 43b at the rear end side of the processing tray 18 set as a home position HP. The bundle claw 38 moves toward the conveyance surface 18a side along the outer periphery of the belt pulley 43b at the rear end side of the processing tray 18 from the home position HP to convey the sheet bundle SS delivered from the ejector 36.

[0060] The bundle claw driving mechanism 23 is provided with a bundle claw driving motor 45 as a driving source shared by the bundle claw 38 (belt pulley 43a), the ejector 36 and the thruster 36a. The bundle claw driving motor 45 may be connected to the belt pulley 43a, but may be connected to the ejector 36 and the thruster 36a, such that the bundle claw driving motor 45 is capable of being disconnected via an electromagnetic clutch 46. The bundle claw driving mechanism 23 advances the ejector 36 and the thruster 36a with the driving force from the bundle claw driving motor 45 only if the electromagnetic clutch 46 is ON (connected) . The ejector 36 and the thruster 36a return to their initial positions before the advance by their own energization forces if the electromagnetic clutch 46 is OFF (disconnected) .

[0061] If the belt pulley 43a is driven to rotate in the counterclockwise direction in the figure, the bundle claw 38, the ejector 36 and the thruster 36a move above the conveyance surface 18a of the processing tray 18 from the upstream side to the downstream side (left side in the figure) in the conveyance direction. If the belt pulley 43a is driven to rotate in the clockwise direction in the

figure, the bundle claw 38, the ejector 36 and the thruster 36a move above the conveyance surface 18a of the processing tray 18 to the upstream side (right side in the figure) in the conveyance direction.

[0062] The longitudinal alignment roller 40 conveys the sheet S placed on the processing tray 18 towards the movable tray 14b of the discharge section 14 by being driven to rotate counterclockwise in the figure. The longitudinal alignment roller 40 applies a driving force to the sheet S by contacting with the sheet S placed on the processing tray 18 from below. At this time, as shown in Fig. 3, if the sheet S on the processing tray 18 bends and is separated from the longitudinal alignment roller 40, the driving force of the longitudinal alignment roller 40 cannot be applied to the sheet S. Thus, above the processing tray 18 (above the standby tray 17 in the embodiment), a pinch roller 47 which sandwiches the sheet S with the longitudinal alignment roller 40 is arranged.

[0063] The pinch roller 47 is a driven roller without a driving source. The pinch roller 47 is movable between a standby position (refer to Fig. 3) positioned above the standby tray 17 and a rotation position (refer to Fig. 2, Fig. 4 and Fig. 5) facing the longitudinal alignment roller 40. The pinch roller 47 is driven by the pinch roller driving mechanism 25 to move between the standby position and the rotation position. The pinch roller 47 moves to the rotation position below to press the longitudinal alignment roller 40 to sandwich the sheet S therebetween. In this way, it is possible to stably transmit the driving force of the longitudinal alignment roller 40 to the sheet S.

[0064] In the stapling mode, the sheet S placed on the conveyance surface 18a of the processing tray 18 is retained until the sheet bundle SS with the stapling number is stacked. There is a thin and lightweight sheet S or a bent sheet S, or a large size sheet S which is easy to bend such as A3. Therefore, there is a case in which the detection sensor 41 cannot detect a plurality of sheets S. In this case, as shown in Fig. 5, with the rear end portion of the sheet S pressed by the paddle section 30, the front end of the sheet S is sandwiched between the longitudinal alignment roller 40 and the pinch roller 47 and the sheet S is elongated to the downstream side. Even if the sheet S is thin and lightweight or curved, it can be elongated to be detected by the detection sensor 41.

[0065] The pinch roller driving mechanism 25 shown in Fig. 3 and Fig. 4 includes a support arm 49 for supporting the pinch roller 47 at the front end (leading end) while a base end (rear end) thereof is supported in a swingable manner around an axis along the sheet width direction W. A solenoid 50 is connected to the base end of the support arm 49. As shown in Fig. 3, if the solenoid 50 is driven to enable a plunger to protrude, the pinch roller 47 swings upwards through the support arm 49 around the axis and moves to the standby position. As shown in Fig. 4, if the solenoid 50 immerses (sucks) the plunger, the pinch roller 47 swings downwards through the support arm 49 and moves to the rotation position. At the rotation position, the pinch roller 47 presses the longitudinal alignment roller 40.

[0066] The detection sensor 41 for detecting the presence or absence of the sheet S is a mechanical actuator type. The detection sensor 41 protrudes from the conveyance surface 18a of the processing tray 18 such that, for example, a sensor section can advance and retreat. If the sheet S falls down from the standby tray 17, the sensor section of the detection sensor 41 is pressed by the load and displaced to detect the sheet S. The number of sheets S stacked on the processing tray 18 is detected by a sensor (not shown) in the conveyance path 26 in the post-processing apparatus 3.

[0067] The sheet S conveyed along the third conveyance path 26d from the conveyance path 26 passes through a relatively large step and space until it reaches the longitudinal alignment roller 40 of the processing tray 18. Therefore, the processing tray 18 may include a slope-like guide (not shown) which appears on the conveyance surface 18a. Thereby, in the non-sorting mode, if the movable tray 14b is selected as a discharge destination of the sheet S, the sheet S conveyed from the third conveyance path 26d can be guided steadily towards the longitudinal alignment roller 40 of the processing tray 18.

[0068] If the fixed tray 14a is selected as the discharge destination of the sheet S in the non-sorting mode, the post-processing controller 15 controls a branching member (not shown) to transfer the sheet S to the second conveyance path 26c and then discharge the sheet S to the fixed tray 14a.

[0069] If the sorting mode or the stapling mode is selected, the post-processing controller 15 controls the branching member to send the sheet S to the third conveyance path 26d, and then conveys the sheet S to the standby section 12. Thereafter, by controlling the standby section 12 and the processing section 13, the sheet S subjected to the buffer and the post-processing is discharged to the movable tray 14b.

[0070] The post-processing apparatus 3 of the image forming system 1 according to the present embodiment has the above-described configuration. A sheet presence and absence detection control method within the processing tray 18 is described below.

[0071] In the post-processing apparatus 3, the stapling mode is selected. The sheet S sent from the sheet discharge section 9 of the image forming apparatus 2 to the conveyance path 26 is sent to the standby tray 17 of the standby section 12. Aplurality of the sheets S is placed on the standby tray 17. If the stapling processing of the sheet bundle SS is ended at the processing tray 18 and the sheet bundle SS is discharged, the plurality of retained sheets S is dropped from the standby tray 17 to the processing tray 18. Further, if the remaining sheet S drops from the standby tray 17 to the processing tray 18 and the sheet bundle SS with the stapling number is formed, after the alignment processing, the stapling processing is executed by the stapler 35 after the alignment processing. If the stapling processing is ended, and

the sheet bundle SS drives the bundle claw belt 39 in the counterclockwise direction in the figure, the bundle claw 38 moves to the upstream side from the home position HP. Thereafter, the bundle claw 38 moves to the downstream side along the conveyance surface 18a, and delivers the sheet bundle SS pressed by the ejector 36 and extrudes it to the downstream side to discharge it.

[0072] Next, a plurality of the retained sheets S drops from the standby tray 17 onto the processing tray 18. At this time point, the image forming apparatus 2 pauses if there is no sheet S in the sheet feed section 8 of the image forming apparatus 2, for example. The post-processing apparatus 3 stops upon receiving an operation stop command from the image forming apparatus 2 and notifies the image forming apparatus 2 of stop completion information and the like.

[0073] In this state, if the sheet S is detected in the processing tray 18 by the detection sensor 41, it becomes the standby state until the image forming apparatus 2 is driven again. If the image forming apparatus 2 is driven again, in the processing tray 18, the remaining sheet S necessary for preset stapling processing is supplied and the stapling processing is restarted. As a cause of a pause (an operation stop state) of the image forming apparatus 2, in addition to depletion of the sheet S in the sheet feed section 8, there is a case in which the temperature of a fixing device is excessively increased or decreased, or a case in which manual stapler is selected.

[0074] In a case in which the absence of the sheet S is detected by the detection sensor 41, even if there is the sheet S in the processing tray 18, as shown in Fig. 3, if the sheet S is thin and lightweight or bent, the sheet S is not detected in some cases. Even if the detection sensor 41 detects the sheet S, if the user takes out the sheet S before the image forming apparatus 2 is driven again, the number of sheets required for the stapling processing is insufficient even though the remaining sheet S is supplied after the image forming apparatus 2 is driven again.

[0075] An embodiment of the sheet presence and absence detection control method in these cases is described below along the flowcharts in Fig. 6 to Fig. 8.

[0076] As shown in the first flowchart in Fig. 6, from a resting state of the image forming apparatus 2, the sheet S is replenished to the sheet feed section 8 to resume the job (ACT 1) . The post-processing apparatus 3 is driven again according to an instruction from the image forming apparatus 2. The detection sensor 41 detects whether or not there is the sheet S in the processing tray 18 of the post-processing apparatus 3 (ACT 2) . If the sheet S is detected (Yes), the image forming apparatus 2 is notified and the processing of the post-processing apparatus 3 is continued as it is in ACT 3. If the sheet S is not detected (No), whether the post-processing apparatus 3 is in the stapling mode is confirmed in ACT 4. If the post-processing apparatus 3 is not in the stapling mode (No), the processing of the post-processing apparatus 3 in that mode is continued. If the post-processing apparatus 3 is in the stapling mode (Yes), the sheet presence and absence detection control (sheet check) in the processing tray 18 is executed in the second flowchart of ACT 5.

[0077] In the second flowchart shown in Fig. 7, the paddle section 30 in the post-processing apparatus 3 shown in Fig. 3 is rotated counterclockwise in the figure. The rear end of the sheet S placed on the processing tray 18 is pulled out or pressed by the paddle 30a of the paddle section 30. In the example shown in Fig. 3, since the large sheet S such as A3 is curved, the sheet S cannot be detected by the detection sensor 41. The post-processing controller 15 controls the pinch roller driving mechanism 25 to rotate the pinch roller 47 downward (ACT 10) .

[0078] Thus, as shown in Fig. 4, the sheet S placed on the conveyance surface 18a of the processing tray 18 is sandwiched and held between the longitudinal alignment roller 40 and the pinch roller 47. The driving force of the longitudinal alignment roller 40 is applied to the sheet S by a pressing force of the pinch roller 47. By rotating the longitudinal alignment roller 40 by a predetermined amount counterclockwise in the figure in ACT 11, as shown in Fig. 5, the sheet S whose rear end is pressed by the paddle section 30 is elongated linearly towards the downstream side (ACT 12) . The predetermined amount of rotation of the longitudinal alignment roller 40 is set in advance according to the length and thinness of the sheet S in such a manner that the bending can be eliminated, a tension can be applied even if the sheet S is thin, and the sheet S can be detected by the detection sensor 41.

[0079] Since the tension is applied to the sheet S by the rotation of the longitudinal alignment roller 40 and the bending is eliminated, the presence or absence of the sheet S is determined again by the detection sensor 41 of the mechanical actuator type (ACT 13). If it is determined that there is the sheet S (Yes), the image forming apparatus 2 is notified, and the standby state is maintained (ACT 14). After restarting the job of the image forming apparatus 2, the remaining sheet S is supplied to the processing tray 18 through the standby tray 17 to be stacked until the sheet bundle SS with the stapling number is reached.

[0080] If it is determined that there is no sheet S by the detection sensor 41 (No), and it is detected that it is not the second work in ACT 15 and the flow returns to the processing in ACT 11. In ACT 11, the longitudinal alignment roller 40 is again rotated by a predetermined amount in a sheet discharge direction. The detection sensor 41 determines the presence or absence of the sheet S for the second time (referred to as a retry). If it is determined that there is the sheet S for the second time, the flow proceeds to the processing in ACT 14. If it is determined that there is no sheet, it is confirmed that the second determination is completed in ACT 15. The pinch roller driving mechanism 25 is controlled to raise the pinch roller 47 away from the longitudinal alignment roller 40 (ACT 16). The paddle section 30 returns to the home

position away from the conveyance surface 18a. The image forming apparatus 2 is notified that there is no sheet in the processing tray 18 (ACT 18), and the sheet presence and absence determination control is ended.

[0081] Returning to the first flowchart shown in Fig. 6, in ACT 6, the presence or absence of the sheet S in the processing tray 18 is confirmed again by the detection sensor 41. If there is no sheet (No), the flow proceeds to a job reception and waits for the start of processing of the image forming apparatus 2. If there is the sheet (Yes), the alignment processing of the sheet bundle SS is executed in the third flowchart in Fig. 8 (ACT 7).

[0082] In the third flowchart in Fig. 8, by resuming the job of the image forming apparatus 2, the remaining sheet S is supplied to the processing tray 18 and becomes the sheet bundle SS with the stapling number. In the alignment processing, in Fig. 5, the paddle section 30 is rotated counterclockwise in the figure by a predetermined amount to pull the sheet bundle SS toward the upstream side (ACT 21) . The longitudinal alignment roller 40 is rotated clockwise in the figure to pull the sheet bundle SS to the upstream side and make it abut against the rear end stopper 32 (ACT 22). In this way, the sheet bundle SS is aligned in the vertical direction. The completion of the pull of the sheet bundle SS towards the rear end stopper 32 is confirmed.

[0083] Next, a pair of horizontal aligning plates 33 at both sides of the sheet bundle SS is reciprocated twice in a direction approaching each other and in a direction away from each other in the sheet width direction W to execute the horizontal alignment of the sheet bundle SS (ACT 23). Then, the paddle section 30 is again rotated counterclockwise by the predetermined amount to pull the sheet bundle SS to the upstream side (ACT 24) . The rotation of the longitudinal alignment roller 40 is stopped and the alignment job of the sheet bundle SS is ended (ACT 25). Thereafter, the sheet bundle SS on the processing tray 18 is stapled by the stapler 35. The second longitudinal alignment processing in ACT 25 may be omitted.

[0084] As described above, in the present embodiment, in the resting state of the image forming apparatus 2, even if the sheet S is thin or bent, or even if the sheet S is large, the detection sensor 41 can reliably detect the presence or absence of the sheet. Moreover, by using the detection sensor 41 of the mechanical actuator type, cost can be reduced. In the stapling mode, by repeating prolongation of the sheet S and detection of the presence or absence of the sheet on the processing tray 18 twice, errors in the sheet detection can be eliminated. It is possible to prevent the sheet S in the processing tray 18 from being forcibly discharged without being detected by the detection sensor 41 and to reduce the processing time loss after resuming the job.

[0085] A modification of the present embodiment is described by using the same or similar components and members as those of the above-described embodiment with the same reference numerals.

[0086] In the embodiment described above, the image formation and the stapling processing on the sheet S are executed consecutively using the image forming apparatus 2 and the post-processing apparatus 3. As a modification of the above embodiment, the user may staple the sheet bundle SS with the stapling number manually without using the image forming apparatus 2. Even in such a case, if the sheet S of the sheet bundle SS is thin and lightweight or large, the sheet bundle SS bends in the processing tray 18 in some cases. In this case, the sheet presence and absence detection control can be executed in the post-processing apparatus 3 according to the present embodiment. This modification is described with reference to a fourth flowchart shown in Fig. 9.

[0087] In the resting state of the image forming apparatus 2, an operation button of the post-processing apparatus 3 is used to shift to a manual stapling mode. By further pressing an operation button, the stapling processing is executed.

[0088] In the manual stapling mode shown in the fourth flowchart in Fig. 9, the user supplies the sheet bundle SS with the stapling number to the processing tray 18. The detection sensor 41 determines the presence or absence of the sheet bundle SS in the processing tray 18 (ACT 31). If the detection sensor 41 determines that there is the sheet bundle SS (Yes), the stapling processing is executed with the stapler 35 in ACT 35. If it is determined that there is no sheet bundle SS (No), the flow shifts to the second flowchart in Fig. 7 to execute a sheet check of the sheet bundle SS in ACT 32.

[0089] As a result of the sheet check, if it is determined that there is no sheet bundle SS by the detection sensor 41 (No) in ACT 33, the processing is terminated. If there is the sheet bundle SS (Yes), the alignment processing of the sheet bundle SS is executed according to the third flowchart in Fig. 8 in ACT 34. Then, the stapling processing is executed in ACT 35, and the sheet bundle SS is bound with the stapler 35.

[0090] As described above, the post-processing apparatus 3 according to the present embodiment can also be applied to the manual stapling.

[0091] In the above embodiment, the post-processing apparatus 3 is separate from the image forming apparatus 2; however, for example, the post-processing apparatus 3 may be an image forming apparatus with an in-body finisher inside a housing thereof.

[0092] At the time of executing the sheet presence and absence detection control (sheet check) in the processing tray 18, in the embodiment and in the modification, if the determination sensor 41 determines that there is no sheet S, the same determination control is repeated twice. However, the sheet presence and absence detection control is not limited to being executed twice. If the determination accuracy of the presence and absence of the sheet by the detection sensor 41 is high, the determination control may be ended once or may be determined three or more times.

[0093] In the embodiment and the modification, the alignment processing of the sheet bundle SS is executed after the sheet presence and absence detection control, but the alignment processing may be omitted.

[0094] In the above embodiment, the sheet S on the processing tray 18 is elongated by the paddle section 30 and the longitudinal alignment roller 40, and the detection sensor 41 detects the presence or absence of the sheet S. The detection sensor 41 may be arranged between the paddle section 30 and the longitudinal alignment roller 40 to detect the sheet S by elongating the sheet S on the processing tray 18 only with the longitudinal alignment roller 40. In this case, the sheet S is sandwiched between the longitudinal alignment roller 40 and the pinch roller 47, and the longitudinal alignment roller 40 is rotated to elongate the sheet S to the extent that the sheet S of the processing tray 18 is not moved to the downstream side. By this means, the detection sensor 41 can detect the sheet S.

[0095] In the embodiment described above, if the operation pause instruction of the image forming apparatus 2 is received in the state in which the number of the sheets S in the processing tray 18 is less than the stapling number, the presence or absence of the sheet in the processing tray 18 is detected at the time of resuming the job. Instead of this, the presence or absence of the sheet in the processing tray 18 may be detected by the sheet presence and absence detection control in a time band before the job restart after the job of the image forming apparatus 2 is paused. Even in this case, if the user does not extract the sheet S from the processing tray 18, it is possible to accurately execute detection control of the presence or absence of the sheet as in the embodiment.

[0096] In the present embodiment, it is assumed that the above-described resting state or stopped state of the image forming apparatus 2 is included in the standby state of the sheet processing.

[0097] According to at least one embodiment described above, by including a pressing roller for pressing the sheet in the processing tray and a conveyance roller, it is possible to detect the sheet by elongating the sheet that cannot be detected by the detection sensor in the standby state of the image forming apparatus.

[0098] While certain embodiments have been described, these embodiments have been presented by way of example only, and are not intended to limit the scope of the invention. Indeed, the novel embodiments described herein may be embodied in a variety of other forms; furthermore, various omissions, substitutions and changes in the form of the embodiments described herein may be made without departing from the spirit of the invention. The accompanying claims and their equivalents are intended to cover such forms or modifications as would fall within the scope and spirit of the invention.

Claims

1. A post-processing apparatus, comprising:

   a processing tray configured to stack a sheet;
   a detection sensor configured to detect a presence or an absence of the sheet placed on the processing tray;
   a pressing roller configured to move to the processing tray when the detection sensor does not detect the sheet; and
   a conveyance roller configured to rotate by a predetermined amount while sandwiching the sheet with the pressing roller in the processing tray.

2. The post-processing apparatus according to claim 1, further comprising:
   a paddle configured to hold the sheet at an upstream side of the conveyance roller in the processing tray.

3. The post-processing apparatus according to claim 2, wherein
   the paddle is configured to rotate to convey the sheet to the upstream side.

4. The post-processing apparatus according to claim 2 or 3, wherein
   the paddle is configured to hold a load which is larger than a conveyance force of the conveyance roller.

5. The post-processing apparatus according to any of claims 1 to 4, further comprising:

   a controller configured to cause the conveyance roller to repeatedly rotate by a predetermined amount,
   wherein the detection sensor is configured to repeatedly detect the absence or the presence of the sheet.

6. A method of performing post-processing of a sheet, comprising:

   arranging the sheet on a processing tray;
   detecting, by a detection sensor, presence or absence of the sheet on the processing tray;
   moving a pressing roller to the processing tray when the detection sensor detects that the sheet is absent;
   causing, by a controller, rotation of a conveyance roller by a predetermined amount, and
   sandwiching the sheet between the conveyance roller and the pressing roller in the processing tray while the conveyance roller rotates.

7. The method according to claim 6, further comprising:
   holding the sheet by a paddle at an upstream side

of the conveyance roller.

8. The method according to claim 7, further comprising:
rotating the paddle to convey the sheet to the upstream side of the conveyance roller.

9. The method according to claim 7 or 8, further comprising:
holding, by the paddle, a load which exceeds a conveyance force of the conveyance roller.

10. The method according to any of claims 6 to 9, further comprising:

repeating rotation of the conveyance roller, so as to cause the conveyance roller to rotate by a predetermined amount a plurality of times, and repeating detection by the detection sensor of the absence or the presence of the sheet.

11. A post-processing system, comprising:

a processing tray configured to receive at least one sheet;
a controller configured to receive information indicative of whether the at least one sheet is present in the processing tray;
a first roller and a second roller, the first roller being configured to rotate by a predetermined amount when the at least one sheet is sandwiched between the first roller and the second roller in the processing tray; and
a paddle configured to hold the at least one sheet upstream of the first roller in the processing tray, and to press a rear end of the at least one sheet in a direction toward the processing tray when the at least one sheet moves from a standby tray to the processing tray.

FIG.1

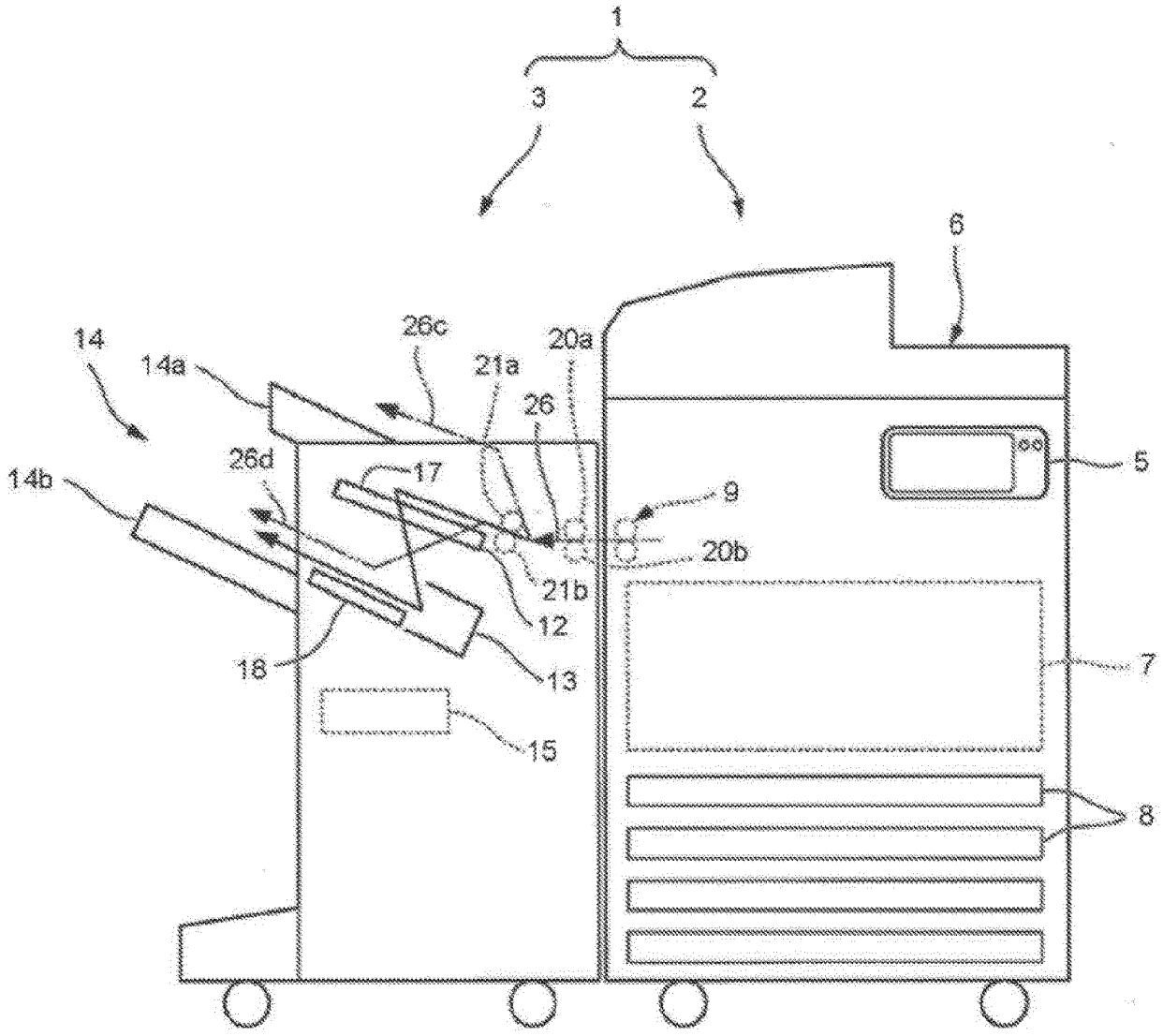
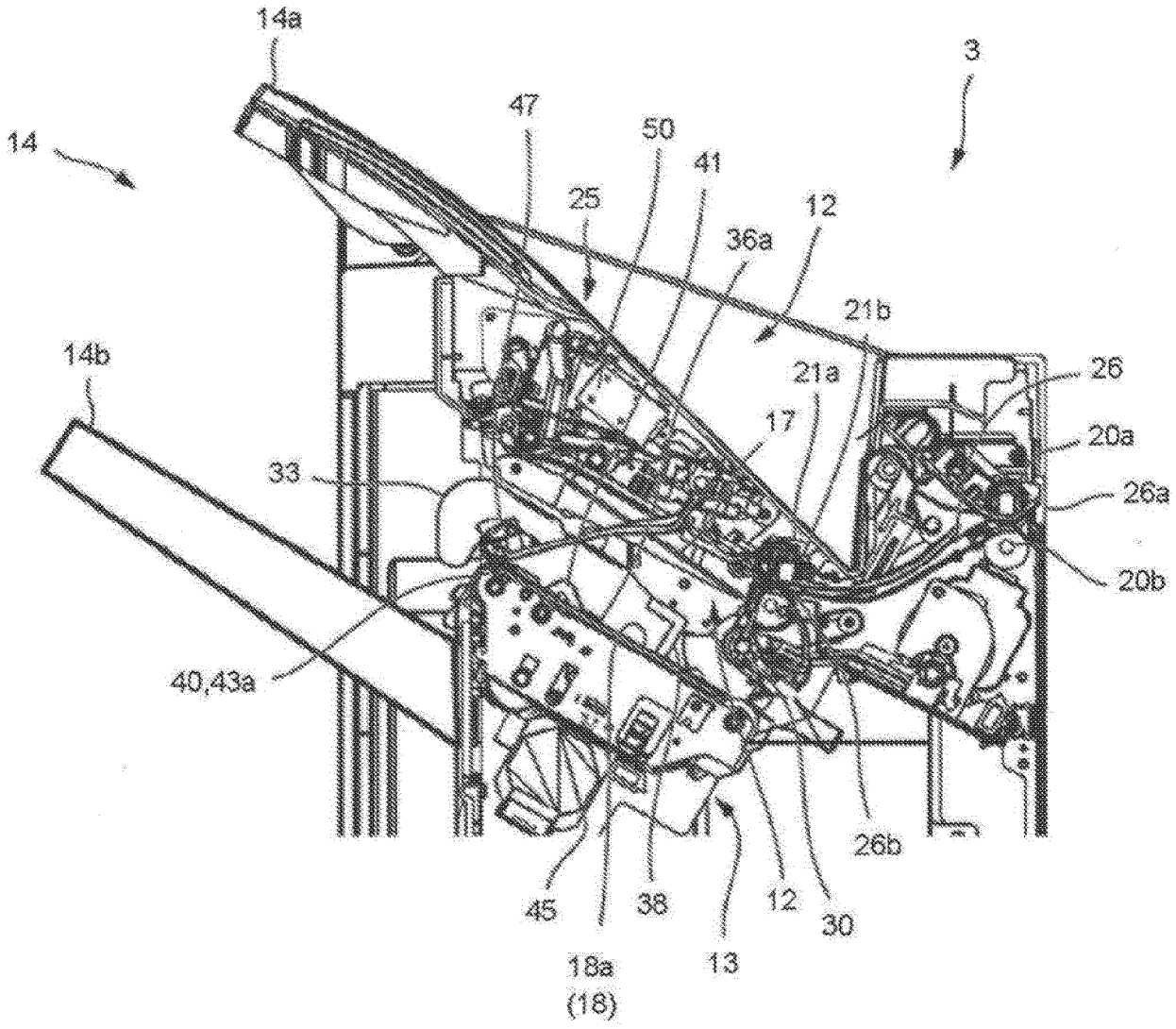


FIG.2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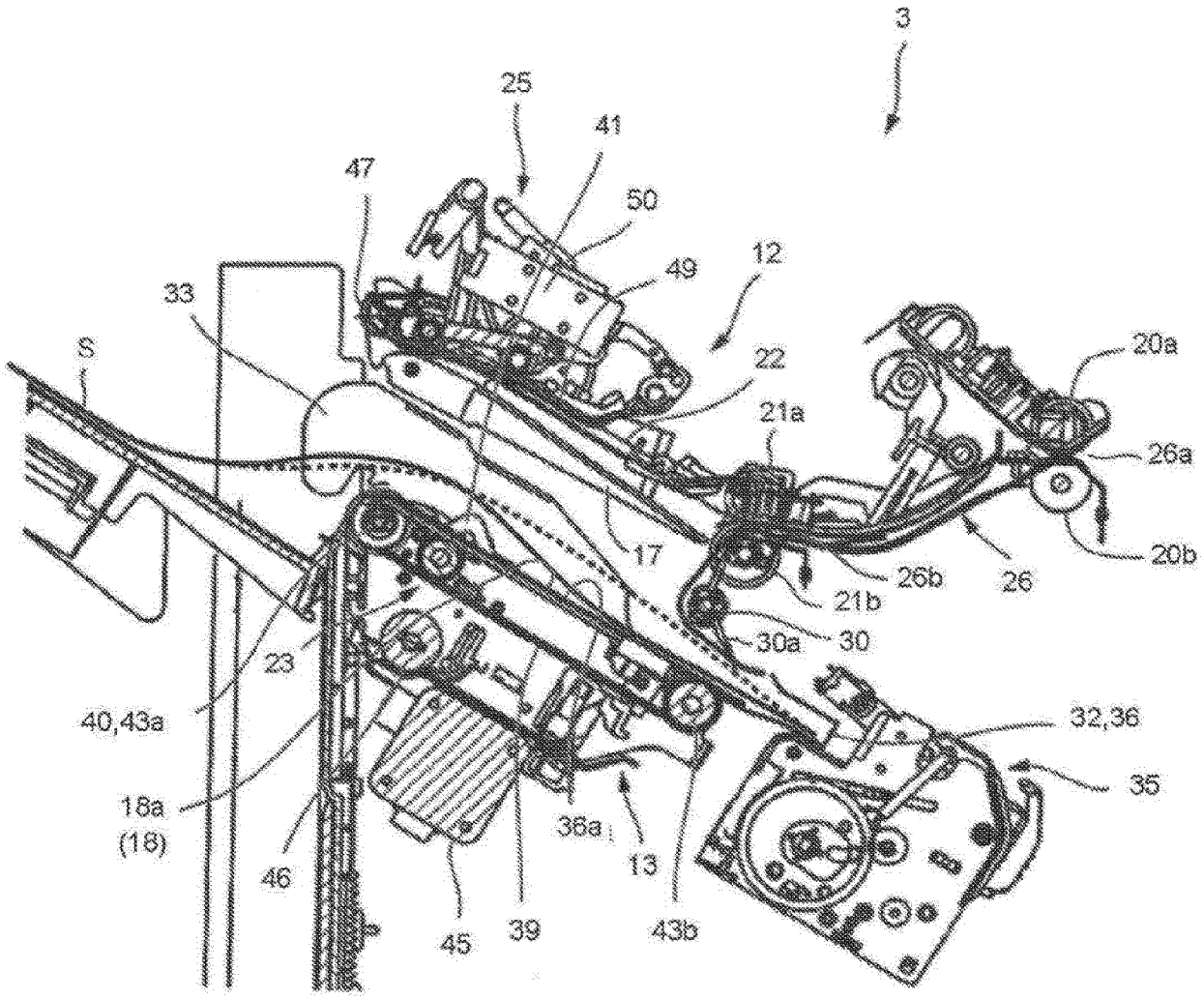
47
50
41
14
25
12
36a
21b
14b
21a
26
17
20a
33
26a
20b
40,43a
26b
45
38
12
30
18a
(18)
13

FIG.3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41
47
50
49
12
33
S
22
20a
21a
26a
17
26b
26
20b
21b
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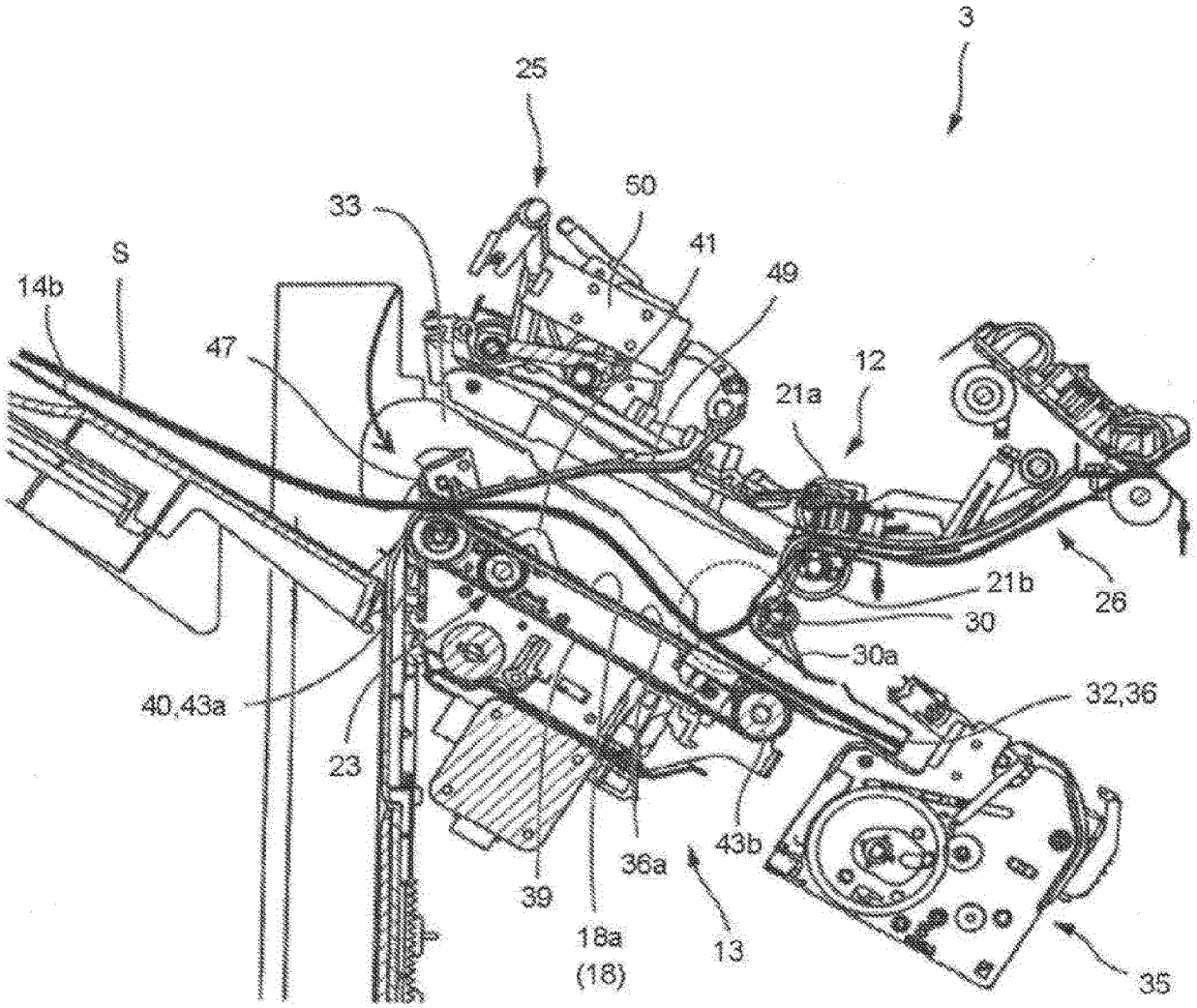
18a
(18)
36a
13
46
45
39
43b

FIG.4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33
41
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S
14b
47
12
21a
21b
26
30
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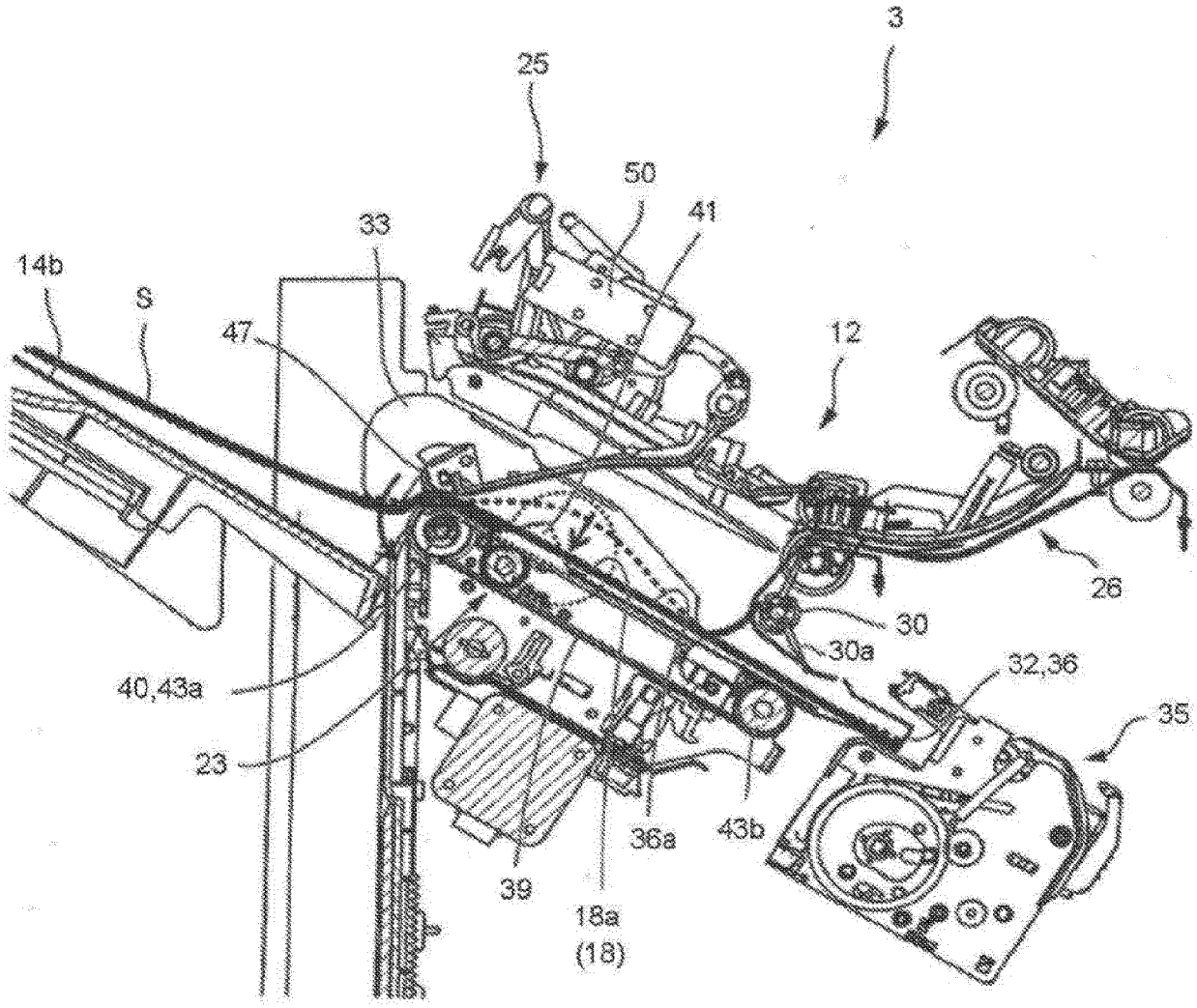
36a
39
18a
(18)
13
35

FIG.5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41
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14b
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39
18a
(18)

FIG.6

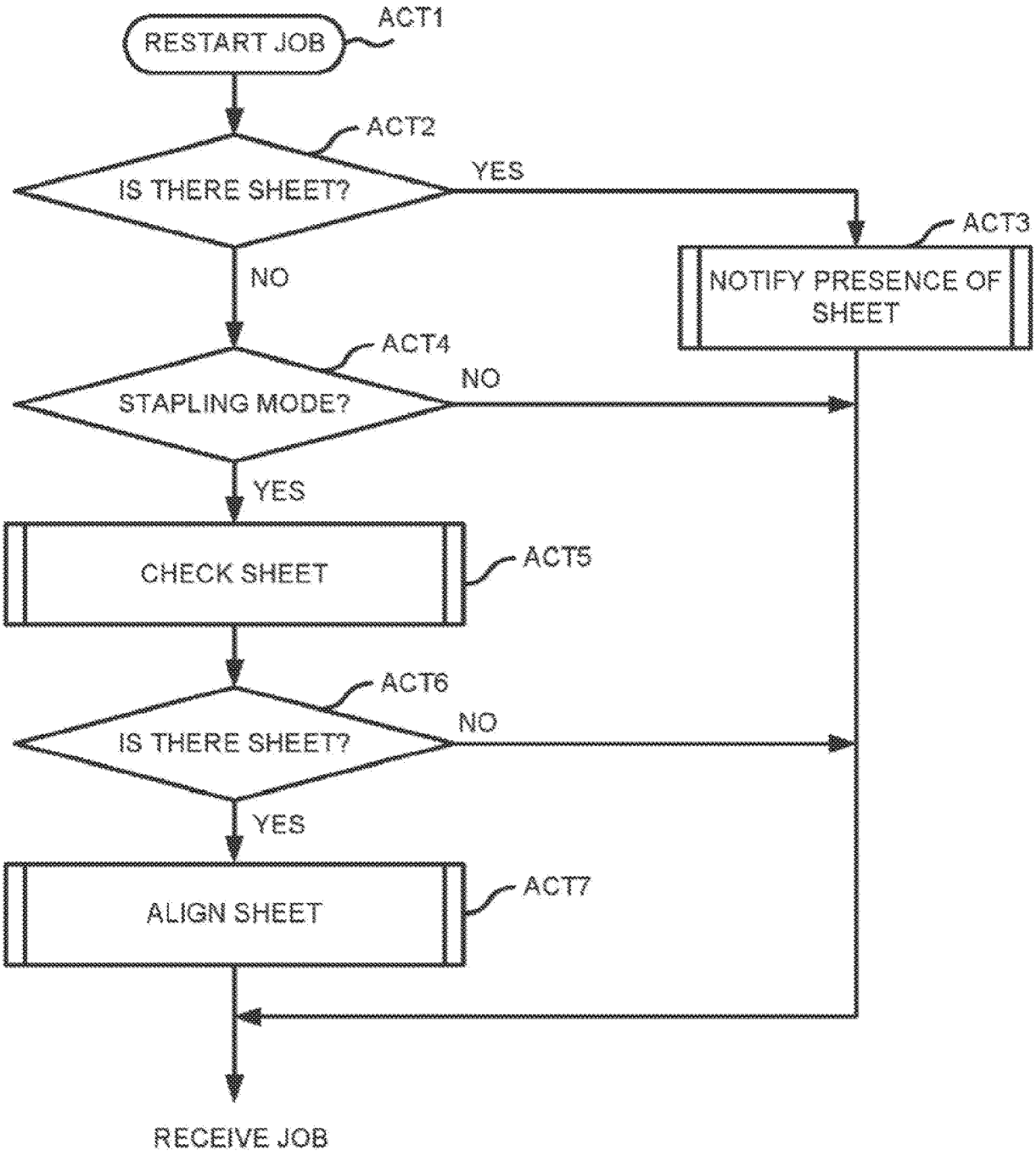

RESTART JOB
ACT1
ACT2
IS THERE SHEET?
YES
NO
ACT3
NOTIFY PRESENCE OF SHEET
ACT4
STAPLING MODE?
NO
YES
CHECK SHEET
ACT5
ACT6
IS THERE SHEET?
NO
YES
ALIGN SHEET
ACT7
RECEIVE JOB

FIG.7

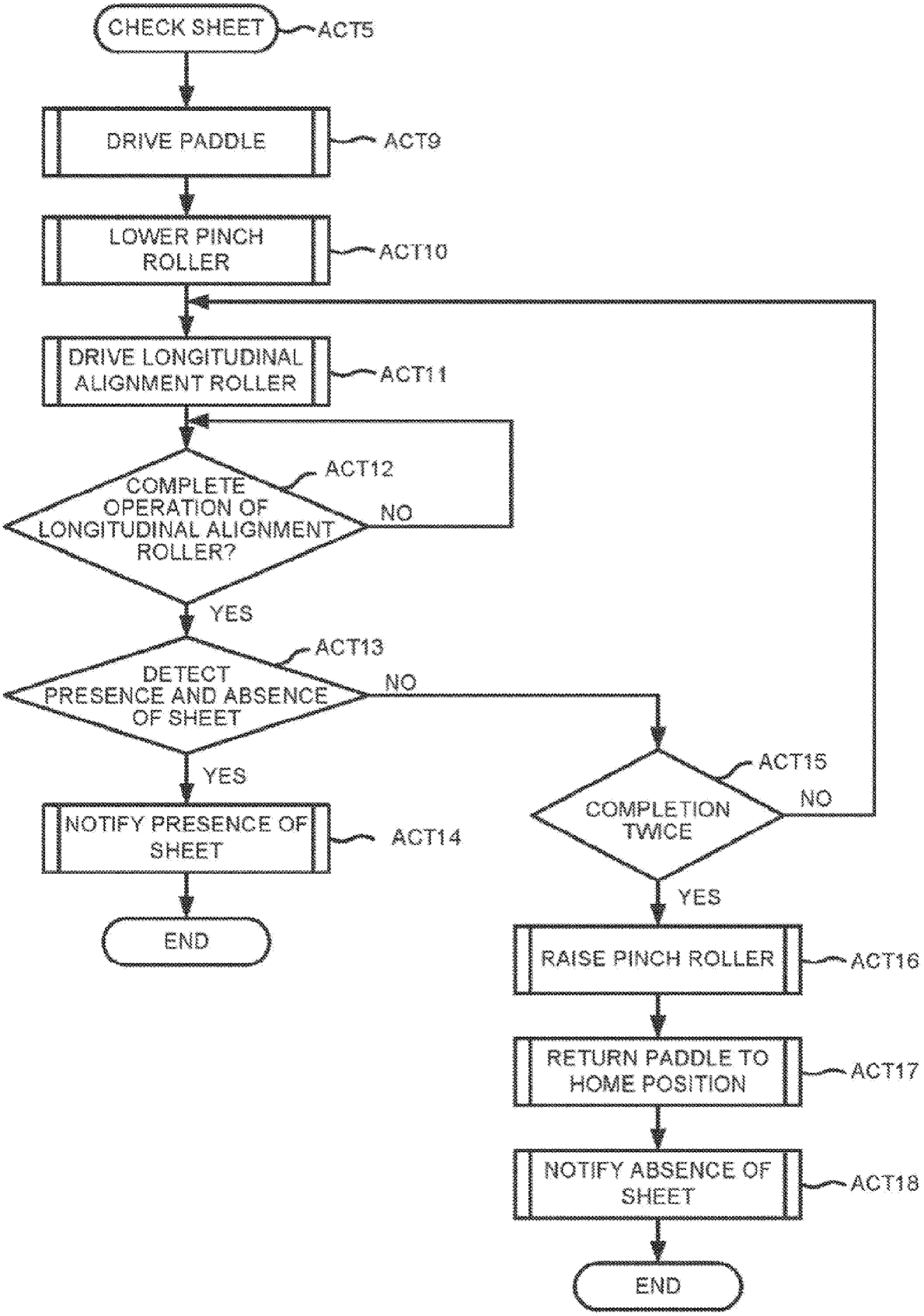

CHECK SHEET
ACT5
DRIVE PADDLE
ACT9
LOWER PINCH ROLLER
ACT10
DRIVE LONGITUDINAL ALIGNMENT ROLLER
ACT11
COMPLETE OPERATION OF LONGITUDINAL ALIGNMENT ROLLER?
ACT12
NO
YES
DETECT PRESENCE AND ABSENCE OF SHEET
ACT13
NO
YES
NOTIFY PRESENCE OF SHEET
ACT14
END
COMPLETION TWICE
ACT15
NO
YES
RAISE PINCH ROLLER
ACT16
RETURN PADDLE TO HOME POSITION
ACT17
NOTIFY ABSENCE OF SHEET
ACT18
END

FIG.8

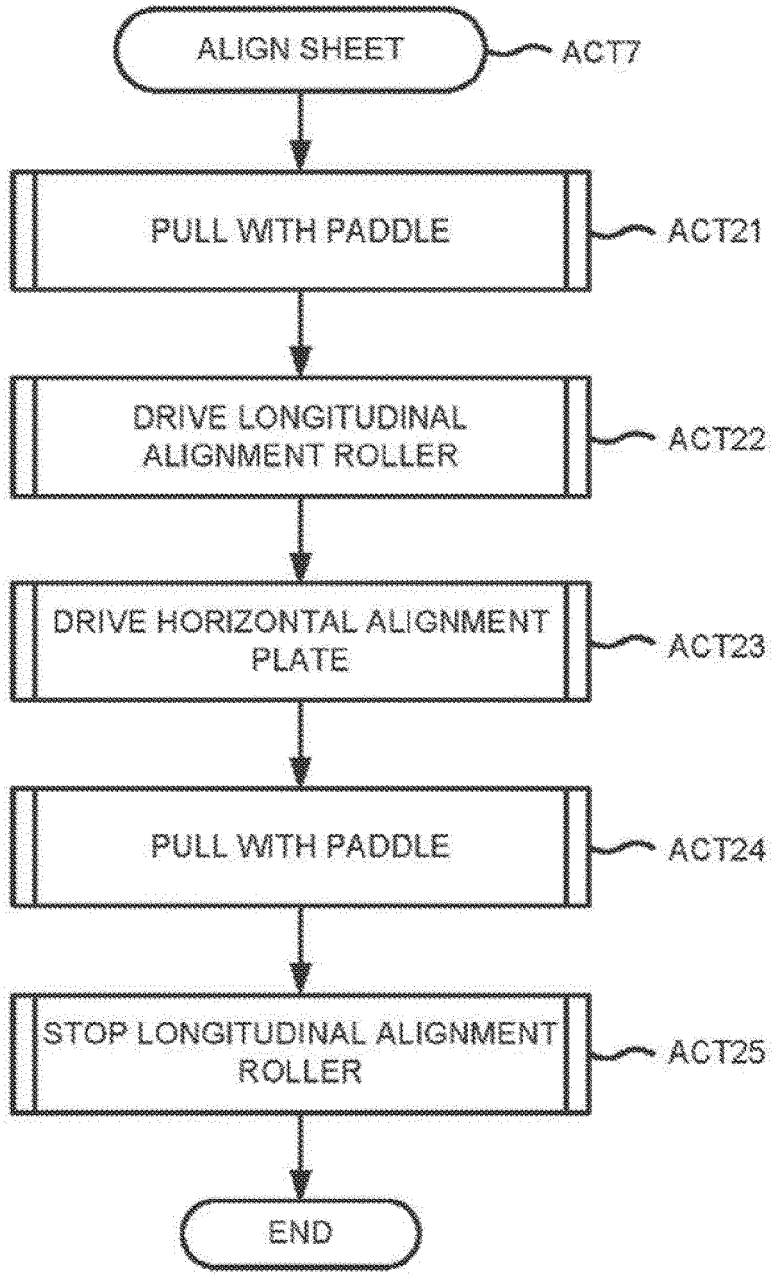
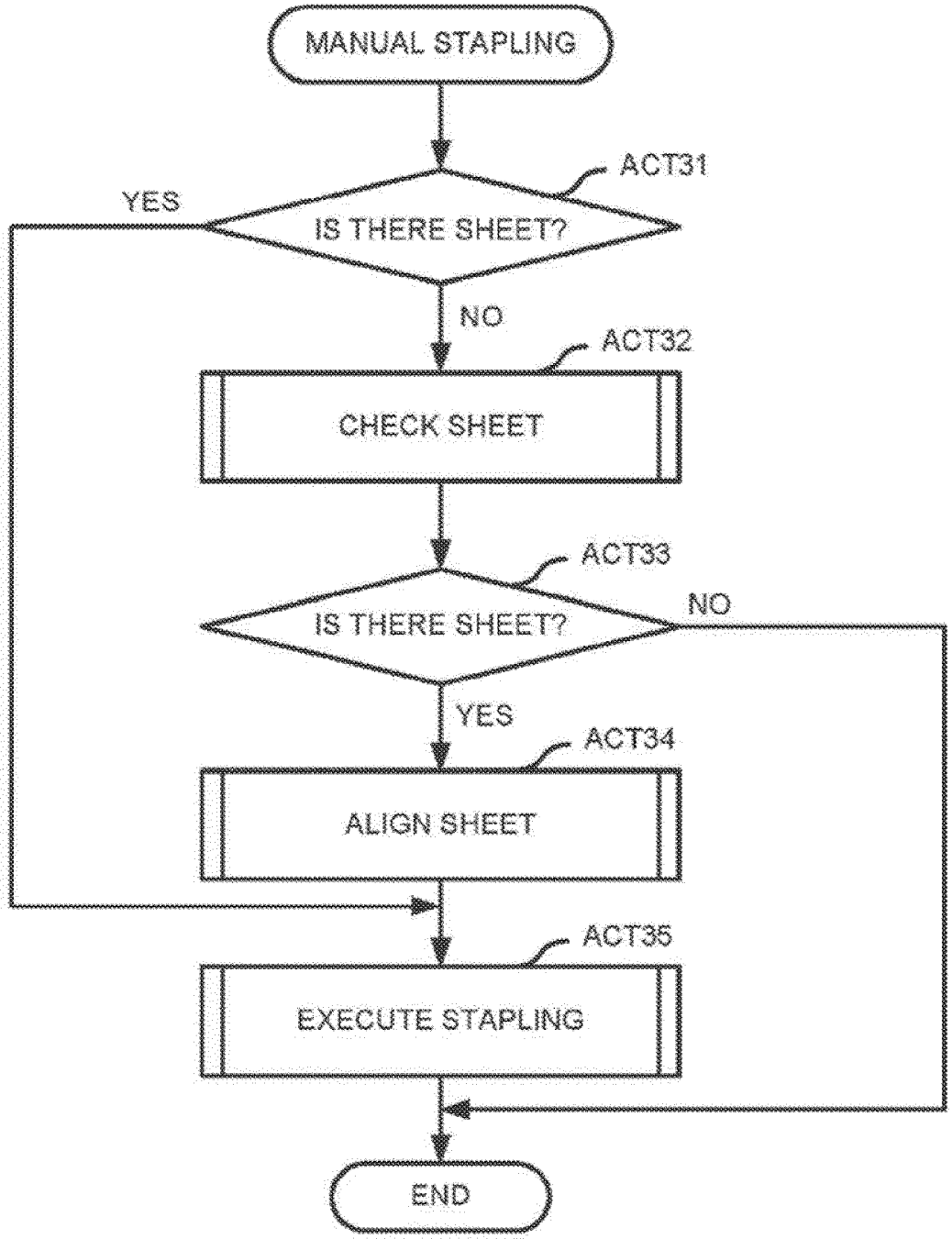

ALIGN SHEET
ACT7
PULL WITH PADDLE
ACT21
DRIVE LONGITUDINAL ALIGNMENT ROLLER
ACT22
DRIVE HORIZONTAL ALIGNMENT PLATE
ACT23
PULL WITH PADDLE
ACT24
STOP LONGITUDINAL ALIGNMENT ROLLER
ACT25
END

FIG.9


MANUAL STAPLING
ACT31
IS THERE SHEET?
YES
NO
ACT32
CHECK SHEET
ACT33
IS THERE SHEET?
NO
YES
ACT34
ALIGN SHEET
ACT35
EXECUTE STAPLING
END

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 0695

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	JP 2005 022833 A (CANON KK) 27 January 2005 (2005-01-27) * the whole document *	6 1	INV. B65H31/02 B65H31/36 B65H43/02
A	US 2015/165809 A1 (KOMIYAMA DAIKI [JP] ET AL) 18 June 2015 (2015-06-18) * the whole document *	2-4,7-9	B65H31/30
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B65H
G03G

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 November 2018	Ureta, Rolando

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02-11-2018

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		US 5478062 A	26-12-1995
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