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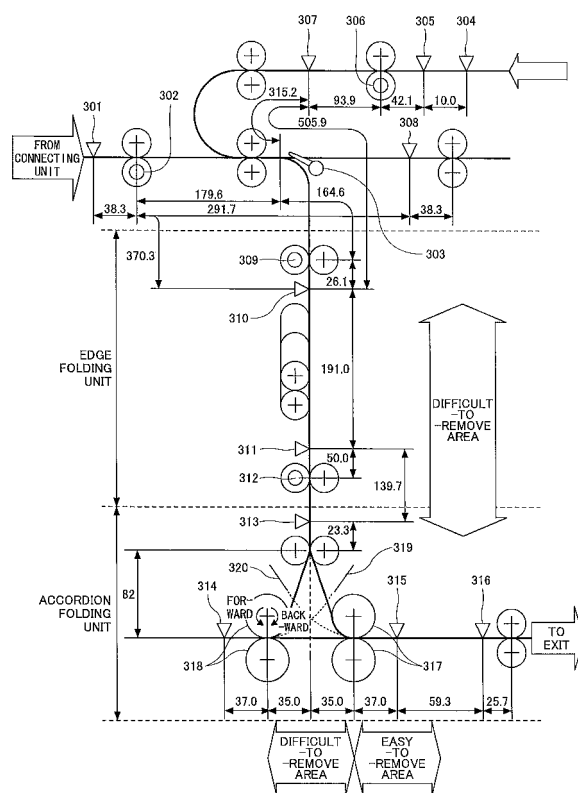
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(54) **Paper Folding Device And Image Forming Apparatus**

(57) A disclosed paper folding device is capable of processing paper sheets consecutively and designed to stop supplying the paper sheets into a paper conveying path and to stop a paper folding process when a paper jam occurs. The paper folding device includes a paper folding unit configured to perform the paper folding process; a first paper detecting unit configured to detect a remaining paper sheet remaining at a first position in the paper conveying path when the paper jam occurs; and a remaining paper conveying unit configured to perform a conveying process for conveying the remaining paper sheet detected by the first paper detecting unit from the first position to a second position in the paper conveying path.

FIG.3



Description**BACKGROUND OF THE INVENTION**

1. Field of the Invention

[0001] A certain aspect of the present invention relates to a paper folding device and an image forming apparatus.

2. Description of the Related Art

[0002] There are image forming apparatuses (e.g., printers and copiers) capable of printing or copying an image (e.g., design drawing) on a large paper sheet such as A0 paper or A1 paper. Normally, such large paper sheets are folded after printing for easy storage. To save time and reduce user workload of folding paper sheets, paper folding devices that can be attached to printers or copiers are available.

[0003] In a paper folding device, when a paper jam occurs while multiple paper sheets are being processed in succession, all paper conveying systems are stopped. As a result, paper sheets that are not causing the paper jam also remain in the paper folding device. In such a case, the operation of the paper folding device can be properly resumed only after a paper sheet causing the paper jam (jammed paper sheet) and other remaining paper sheets are all removed. Having to remove all paper sheets remaining in a paper folding device is troublesome for the operator and has been a factor reducing the efficiency of a paper folding process.

[0004] Some paper folding devices have been proposed to solve or reduce the above problem. Patent document 1 discloses an image forming apparatus that when an invalid paper sheet is detected, automatically ejects the invalid paper sheet while normally completing preceding jobs.

[0005] Patent document 2 discloses a paper processing apparatus that can resume processing on a paper sheet or paper sheets remaining in the apparatus from a point where the processing is interrupted by a paper jam after the paper jam is cleared.

[0006] Patent document 3 discloses a recording paper processing apparatus configured to temporarily hold a set of recording paper sheets supplied one by one from the outside and stacked in the order supplied, and to punch or bind the recording paper sheets being held. The disclosed recording paper processing apparatus includes a paper clamping unit for clamping a part of the recording paper sheets to be processed and a moving mechanism that moves the paper clamping unit to the uppermost position if a paper jam occurs in a path for ejecting processed recording paper sheets.

[0007] Patent document 4 discloses a paper folding device that automatically and efficiently ejects paper sheets other than a jammed paper sheet when a paper jam occurs to reduce workload of the operator in remov-

ing paper sheets.

[Patent document 1] Japanese Patent Application Publication No. 2006-321648

[Patent document 2] Japanese Patent Application Publication No. 2005-335903

[Patent document 3] Japanese Examined Patent Application Publication No. 08-011656

[Patent document 4] Japanese Patent Application Publication No. 05-238595

[0008] Thus, various technologies have been proposed to efficiently restore a paper folding device or an image forming apparatus including a paper folding device after a paper jam occurs. However, even with the disclosed technologies, at least a jammed paper sheet causing a paper jam in a device must be removed while the device is stopped. Also, if paper sheets other than a jammed paper sheet are in a device when the device is stopped due to a paper jam, the paper sheets are also left in the device. Therefore, if a paper jam occurs in a device, remaining paper sheets other than a jammed paper sheet (particularly, paper sheets located downstream of a spot where the paper jam has occurred) must also be removed before the operations of the device can be resumed. Accordingly, it is troublesome for the operator to search for and remove all paper sheets remaining in a device when a paper jam occurs.

[0009] Meanwhile, up-to-date paper folding devices have multiple sensors in a paper conveying path to report to the operator the position where a paper sheet is stuck. However, there is a case where paper sheets are left in a complex conveying mechanism of a paper folding device. Also, there is a case where a paper sheet is left in a paper folding unit of a paper folding device and is trapped by a folding knife. Thus, merely reporting the position of a jammed paper sheet does not greatly reduce time and workload of the operator necessary for removing paper sheets left in a complicated part of a paper folding device.

[0010] Technologies disclosed in patent documents 3 and 4 try to reduce the workload of the operator by providing a complex paper-ejection path for ejecting paper sheets or by cutting paper sheets. However, such an approach is not preferable in terms of production costs and simplicity of a paper folding device. Also, a paper jam may also occur in an additionally provided paper-ejection path.

SUMMARY OF THE INVENTION

[0011] Aspects of the present invention provide a paper folding device and an image forming apparatus that solve or reduce one or more problems caused by the limitations and disadvantages of the related art.

[0012] An aspect of the present invention provides a paper folding device capable of processing paper sheets consecutively and designed to stop supplying the paper

sheets into a paper conveying path and to stop a paper folding process when a paper jam occurs. The paper folding device includes a paper folding unit configured to perform the paper folding process; a first paper detecting unit configured to detect a remaining paper sheet remaining at a first position in the paper conveying path when the paper jam occurs; and a remaining paper conveying unit configured to perform a conveying process for conveying the remaining paper sheet detected by the first paper detecting unit from the first position to a second position in the paper conveying path.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013]

FIG. 1 is a cut-away front view of a paper folding device connected to a copier according to an embodiment of the present invention;

FIG. 2 is a cut-away side view of a paper folding device according to an embodiment of the present invention;

FIG. 3 is a drawing illustrating paper conveying paths from paper feeding units to an accordion folding unit in a paper folding device according to an embodiment of the present invention; and

FIG. 4 is a flowchart showing a process performed when a paper jam occurs.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0014] An embodiment of the present invention provides a paper folding device capable of processing paper sheets consecutively and designed to stop supplying paper sheets into a paper conveying path and to stop a paper folding process when a paper jam occurs. The paper folding device of this embodiment includes a paper folding unit configured to perform the paper folding process; a first paper detecting unit configured to detect a remaining paper sheet remaining at a first position in the paper conveying path when the paper jam occurs; and a remaining paper conveying unit configured to perform a conveying process for conveying the remaining paper sheet detected by the first paper detecting unit from the first position to a second position in the paper conveying path. This configuration makes it possible to convey a paper sheet (remaining paper sheet) remaining in the paper conveying path, which is different from a jammed paper sheet that is stuck in the paper conveying path, from the first position where it is difficult for the operator to remove the remaining paper sheet to the second position where it is easier for the operator to remove the remaining paper sheet. This in turn makes it possible to reduce the time and workload necessary to remove the remaining paper sheet.

[0015] In a paper folding device, it is particularly difficult to remove a paper sheet from a paper folding unit that

constitutes a part of a paper conveying path. A paper folding unit may include an edge folding unit, an accordion folding unit, and a cross folding unit. In the paper folding device of this embodiment, the first position may indicate a part of the paper conveying path corresponding to the paper folding unit. Meanwhile, the second position may indicate a part of the paper conveying path other than the part corresponding to the paper folding unit.

[0016] The paper folding device of this embodiment may further include a reporting unit configured to report whether the remaining paper sheet detected by the first paper detecting unit still exists at the first position after the remaining paper conveying unit performs the conveying process for conveying the remaining paper sheet from the first position to the second position. This configuration makes it possible to report to the operator whether a paper sheet exists at the first position where it is difficult to remove the paper sheet. This in turn makes it possible to reduce the time and workload necessary to remove a remaining paper sheet

[0017] The paper folding device of this embodiment may further include a second paper detecting unit configured to detect the remaining paper sheet conveyed by the remaining paper conveying unit to the second position. In this case, the reporting unit may be configured to report whether the remaining paper sheet exists at the second position based on the detection result of the second paper detecting unit. This configuration allows the operator to determine whether a paper sheet exists in the second position and makes it possible to easily and efficiently remove a remaining paper sheet.

[0018] In the paper folding device of this embodiment, the remaining paper conveying unit may be configured to perform the conveying process when the paper folding device is restarted or a cover (e.g., an inspection cover or a maintenance cover) of the paper folding device is opened and closed after the paper jam occurs. With this configuration, the remaining paper conveying unit is driven to convey the remaining paper sheet to the second position when the paper folding device is restarted or a cover connected to a restart switch is closed after driving mechanisms of the paper conveying path are turned off and a jammed paper sheet is removed by opening the cover. Thus, this configuration makes it possible to easily remove the remaining paper sheet.

[0019] The paper folding device of this embodiment may also include a folding knife unit including a folding knife and configured to fold a paper sheet with the folding knife. Normally, it is difficult to remove a paper sheet from the paper conveying path around the folding knife unit. Therefore, if the paper folding device includes a folding knife unit, the remaining paper conveying unit is preferably configured to convey the remaining paper sheet in conjunction with the folding knife unit. Alternatively, the remaining paper conveying unit may be configured to convey the remaining paper sheet while the folding knife is retracted.

[0020] In the paper folding device of this embodiment,

the first paper detecting unit and the second paper detecting unit may also be configured to detect a paper jam. In other words, the first paper detecting unit and the second paper detecting unit may be implemented by paper jam detection sensors provided in the paper conveying path. This configuration makes it possible to reduce the production costs of the paper folding device and to simplify the configuration of the paper folding device. In other words, the paper folding device of this embodiment may be produced with substantially the same number of parts and production costs as those of a related-art paper folding device.

[0021] The remaining paper conveying unit of the paper folding device of this embodiment may also be configured to convey a paper sheet from the first position to the second position during the paper folding process. In other words, the remaining paper conveying unit may be implemented by driving mechanisms including rollers for conveying a paper sheet during the paper folding process. In this case, for example, a control unit of the paper folding device may be configured to control the driving mechanisms to function as the remaining paper conveying unit when a paper jam occurs. This configuration makes it possible to reduce the production costs of the paper folding device and to simplify the configuration of the paper folding device. In other words, the paper folding device of this embodiment may be produced with substantially the same number of parts and production costs as those of a related-art paper folding device.

[0022] The paper folding unit of the paper folding device of this embodiment may include an accordion folding unit constituting a part of the paper conveying path and the first paper detecting unit is preferably disposed in the accordion folding unit. An accordion folding unit of a paper folding device normally has a complicated mechanism and therefore it is generally difficult to remove a paper sheet from an accordion folding unit. Therefore, conveying the remaining paper sheet detected by the first paper detecting unit in the accordion folding unit to the second position makes it easier to remove the remaining paper sheet.

[0023] Also, the first position may indicate multiple positions in the paper conveying path. The first position may be determined according to the configuration of a paper folding device. The second position may be set at a paper-catch tray so that the remaining paper sheet can be removed without opening the cover of the paper folding device.

[0024] The paper folding device of this embodiment may be used in combination with an image forming apparatus or incorporated in an image forming apparatus. Accordingly, an image forming apparatus with the paper folding device of this embodiment makes it possible to reduce the time and workload necessary to remove a jammed paper sheet and other remaining paper sheets.

[0025] Below, preferred embodiments of the present invention are described in more detail with reference to the accompanying drawings.

[0026] FIG. 1 is a cut-away side view of a paper folding device 1 connected to a copier (image forming apparatus) 200 according to an embodiment of the present invention. In other words, FIG. 1 shows an image forming apparatus including a paper folding device according to an embodiment of the present invention. FIG. 2 is a cut-away side view (seen from a direction indicated by an arrow A) of the paper folding device 1 shown in FIG. 1. Exemplary configurations of the paper folding device 1 and the copier 200 are described below with reference to FIGs. 1 and 2.

[0027] The paper folding device 1 is connectable to the back of the copier 200. The paper folding device 1 includes a connecting unit 2 used as a first paper feeding unit (for an online process) through which a paper sheet on which an image is formed by the copier 200 is carried into the paper folding device 1; an edge folding unit 3 for folding a leading edge of the paper sheet conveyed from the connecting unit 2; an accordion folding unit 4 for accordion-folding the paper sheet with the folded leading edge to form accordion folds in the paper conveying direction; a conveying direction switching unit 5 for changing the conveying direction of the accordion-folded paper sheet by 90 degrees; a cross folding unit 6 for folding the paper sheet being conveyed in the changed conveying direction (such that the paper sheet is folded, for example, into the A4 size), a reversing unit 7 for turning the paper sheet folded by the cross folding unit 6 upside down; a rotating unit 8 for rotating the turned paper sheet such that it is oriented in a predetermined direction; and a tray 9 on which the rotated paper sheet is placed. Here, a paper sheet may indicate not only a sheet of paper but also a sheet made of a material other than paper. Here, a process of folding a paper sheet after an image is formed on the paper sheet by the copier 200 is called an online process. The online process can be requested on an operations unit 220 of the copier 200.

[0028] The paper folding device 1 also includes a manual-feed unit 11 including a manual feed tray 12 used as a second paper feeding unit (for an offline process) for directly inserting a paper sheet into the paper folding device 1 independent of the copier 200. Here, a process of folding a paper sheet by inserting the paper sheet through the manual-feed unit 11 into the paper folding device 1 independent of the copier 200 is called an offline process. The offline process can be requested on an operations unit 20 of the paper folding device 1.

[0029] An exemplary online process of folding a paper sheet after an image is formed on the paper sheet by the copier 200 is described below. First, a paper size and a type of fold are set with the operations unit 220 of the copier 200. The copier 200 includes an image scanning unit 205 for scanning an image on a document, an imaging unit 206, and a manual-feed tray 208 disposed below the imaging unit 206. When a paper sheet is placed on the manual-feed tray 208, the paper sheet is fed into the imaging unit 206 by a resist roller 207 at an appropriate timing. In the imaging unit 206, a latent image is

formed on a photoconductor (not shown) according to image data, the latent image is developed with toner to form a toner image, the toner image is transferred onto the paper sheet, and a fusing unit 210 fuses the toner image onto the paper sheet. If the paper sheet is to be folded, the paper sheet with the fused toner image is ejected by recorded paper ejecting rollers 211 into the paper folding device 1. If the paper sheet is not to be folded, the paper sheet is directed to upper ejecting rollers 209 by a switching claw (not shown) and is ejected onto a paper catch tray of the copier 200 by the upper ejecting rollers 209.

[0030] The paper sheet ejected into the paper folding device 1 by the recorded paper ejecting rollers 211 passes through the connecting unit 2 and is fed into the edge folding unit 3 where a leading edge of the paper sheet is folded if necessary. The edge folding unit 3 folds the leading edge of the paper sheet while conveying the paper sheet. After the leading edge of the paper sheet is folded by the edge folding unit 3, the accordion folding unit 4 accordion-folds the paper sheet in the paper conveying direction and feeds the accordion-folded paper sheet into the conveying direction switching unit 5. The conveying direction switching unit 5 performs a skew correction on the accordion-folded paper sheet, punches the paper sheet if necessary, and feeds the paper sheet into the cross folding unit 6. The cross folding unit 6 accordion-folds the paper sheet again in a direction orthogonal to the accordion folds formed by the accordion folding unit 4 and thereby folds the paper sheet into a specified size (e.g., A4 size).

[0031] The reversing unit 7 turns the folded paper sheet upside down such that its toner image surface faces downward when the paper sheet is ejected onto the tray 9. Then, the rotating unit 8 rotates the paper sheet by 90 degrees to the left or right according to the type of fold such that the paper sheet or an image on the paper sheet is oriented in a proper direction, and ejects the paper sheet onto the tray 9.

[0032] Next, an exemplary offline process of folding a paper sheet inserted from the manual-feed unit 11 of the paper folding device 1 independent of the copier 200 is described. In the offline process, the distance between side guides 15 (see FIG. 2) is adjusted to match the width of a paper sheet. The paper sheet is placed on the manual feed tray 12 and its leading edge in the length direction is inserted between manual-feed rollers 13 (see FIG. 1). When the paper sheet is detected by a paper size sensor 14, the manual-feed rollers 13 rotate at a given timing to pull in the paper sheet and then stop temporarily. When a paper size and a type of fold are set with the operations unit 20 of the paper folding device 1 and a start button is pressed, the manual-feed rollers 13 start rotating again to feed the paper sheet in the direction of an arrow into the edge folding unit 3. Steps thereafter are substantially the same as those in the online process and therefore their descriptions are omitted here.

[0033] FIG. 3 is a drawing illustrating paper conveying

paths from paper feeding units to an accordion folding unit in the paper folding device 1 shown in FIGs. 1 and 2. An exemplary control process for conveying a paper sheet and an area where it is difficult to remove remaining paper sheets when a paper jam occurs are described below with reference to FIG. 3. When a paper sheet is fed from the copier 200 into the paper folding device 1 via a connecting unit (connecting unit 2), an entry clutch (CL) 302 is turned on. At the same time, an edge folding unit motor (not shown) for conveying the paper sheet to an accordion folding unit (accordion folding unit 4) and an accordion folding unit motor (not shown) for rotating rollers in forward and backward directions by a specified folding width to fold the paper sheet are turned on. The paper sheet fed from the connecting unit is detected by an entry sensor 301 to determine whether a paper jam has occurred. If the entry sensor 301 is not turned on within a predetermined period of time, it is determined that a paper jam has occurred upstream of the entry sensor 301 (here, it is assumed that the entry sensor 301 is turned on when a paper sheet is detected and is turned off when no paper sheet is detected; this also applies to other sensors described below).

[0034] Meanwhile, the paper folding device 1 has a direct ejection port for ejecting a paper sheet without folding the paper sheet. A paper sheet can be directed to the direct ejection port by a path switching solenoid (SOL) 303 for switching paper conveying paths. In addition to the connecting unit for receiving a paper sheet from the copier 200, the paper folding device 1 includes a manual-feed unit (manual-feed unit 11) for manually inserting a paper sheet. When a paper sheet is inserted into the manual-feed unit, a paper-width detection sensor 304 detects the width of the paper sheet. Then, when the insertion of the paper sheet is detected by a manual-feed entry sensor 305, a manual-feed clutch (CL) 306, the edge folding unit motor (not shown) for conveying the paper sheet to the accordion folding unit, and the accordion folding unit motor (not shown) for rotating rollers in forward and backward directions by a specified folding width to fold the paper sheet are turned on. The paper sheet is then detected by a manual-feed intermediate sensor 307 to determine whether a paper jam has occurred. If the manual-feed intermediate sensor 307 is not turned on within a predetermined period of time, it is determined that a paper jam has occurred upstream of the manual-feed intermediate sensor 307.

[0035] The paper sheet inserted from the connecting unit or the manual-feed unit is guided by the path switching SOL 303 and conveyed by an intermediate clutch (CL) 309 into an edge folding unit (edge folding unit 3). The paper sheet is detected by an edge folding unit intermediate sensor 310 to determine whether a paper jam has occurred. If the edge folding unit intermediate sensor 310 is not turned on within a predetermined period of time, it is determined that a paper jam has occurred upstream of the edge folding unit intermediate sensor 310.

[0036] In the paper folding device 1, an area between

the edge folding unit intermediate sensor 310 and rear folding rollers 317 is where it is difficult to remove remaining paper sheets (hereafter called a difficult-to-remove area). In the difficult-to-remove area, a paper sheet is partially folded, is placed between many rollers, and is trapped by folding knives. Therefore, it is difficult to remove a paper sheet from the difficult-to-remove area by just opening the cover of the paper folding device 1. In this embodiment, when a paper jam occurs, paper sheets other than a jammed paper sheet (causing the paper jam) that remain in the difficult-to-remove area are conveyed to the position of a rear sensor 315 so that they can be easily removed.

[0037] FIG. 4 is a flowchart showing a process of conveying a remaining paper sheet other than a jammed paper sheet to the position of the rear sensor 315 when a paper jam occurs. An exemplary control process in the paper folding device 1 performed when a paper jam occurs is described below with reference to FIGs. 3 and 4. Here, it is assumed that the control process is performed by a control unit (not shown) of the paper folding device 1.

[0038] When a paper jam occurs in the paper conveying paths of the paper folding device 1 shown in FIG. 3, the control unit stops driving mechanisms (a paper conveying system including SOLs, CLs, and motors) of the paper folding device 1. Then, the control unit determines whether folding knives 319 and 320 are retracted into home positions (HPs) (401; numbers in parentheses correspond to step numbers in FIG. 4). If the folding knives 319 and 320 are not in the home positions, the control unit causes the folding knives 319 and 320 to retract into the home positions (402). In the next step, the operator manually restarts the paper folding device 1 by operating a restart switch or by opening and closing a cover connected to the restart switch (490).

[0039] The control unit determines whether an edge folding unit exit sensor 311 and an accordion folding unit entry sensor 313 are turned off (403). If both of the sensors 311 and 313 are turned off, the control unit causes the paper folding device 1 to enter a standby mode (404). If at least one of the sensors 311 and 313 is turned on in step 403, the control unit turns on the intermediate CL 309 and an edge folding unit exit clutch (CL) 312 (405) and starts the edge folding unit motor and the accordion folding unit motor (406).

[0040] Then, the control unit determines whether the edge folding unit exit sensor 311 (407) is turned on (this indicates that a paper sheet is present at the corresponding position). If the edge folding unit exit sensor 311 is turned on, the control unit determines whether the accordion folding unit entry sensor 313 is turned on. If the accordion folding unit entry sensor 313 is turned on, i.e., if both of the sensors 311 and 313 are turned on, the control unit determines whether the rear sensor 315 is turned on (413). If the accordion folding unit entry sensor 313 is turned off in step 408, i.e., if only the edge folding unit exit sensor 311 is turned on, the control unit monitors the accordion folding unit entry sensor 313 while the paper

sheet is conveyed by 250 mm (i.e., during a period of time necessary to convey the paper sheet 250 mm) (409). In this embodiment, it is assumed that if a paper sheet detected by the edge folding unit exit sensor 311 is conveyed properly 250 mm, the paper sheet at least reaches the accordion folding unit entry sensor 313 (see distances between elements shown in FIG. 3).

[0041] If the accordion folding unit entry sensor 313 is not turned on while the paper sheet is conveyed 250 mm, the control unit determines that the paper sheet is not being conveyed properly because of a mechanical problem in the edge folding unit. In this case, the control unit stops the edge folding unit motor and the accordion folding unit motor (410), turns off the intermediate CL 309 and the edge folding unit exit CL 312 (411), and reports to the operator that a paper jam has occurred upstream of the accordion folding unit entry sensor 313 (412).

[0042] Referring back to steps 408 and 413, if a paper sheet is detected by the accordion folding unit entry sensor 313, the control unit determines whether the rear sensor 315 is turned on. If the rear sensor 315 is turned off, the control unit conveys the paper sheet 350 mm while monitoring the rear sensor 315 (417). In this embodiment, it is assumed that if a paper sheet detected by the accordion folding unit entry sensor 313 is conveyed properly by 350 mm, the paper sheet at least reaches the rear sensor 315 (see distances between elements shown in FIG. 3). If the rear sensor 315 is turned on, the control unit determines that the paper sheet has reached a position where it can be easily removed. In this case, the control unit stops the edge folding unit motor and the accordion folding unit motor (414), turns off the intermediate CL 309 and the edge folding unit exit CL 312 (415), and reports to the operator that a paper jam has occurred at the rear sensor 315 (or that a paper sheet exists at the rear sensor 315) (416). If the rear sensor 315 is not turned on while the paper sheet is conveyed 350 mm, the control unit determines that the paper sheet is not being conveyed properly because of a mechanical problem in the accordion folding unit. In this case, the control unit causes the folding knife 320 to push the paper sheet forward (or to fold the paper sheet in the forward direction) so that the paper sheet is caught between the rear folding rollers 317 (418).

[0043] After step 418, the control unit monitors the rear sensor 315 again (419) while conveying the paper sheet 200 mm (420). In this embodiment, it is assumed that if a paper sheet in the accordion folding unit is conveyed properly by 200 mm, the paper sheet at least reaches the rear sensor 315 (see distances between elements shown in FIG. 3). If the rear sensor 315 is turned on, the control unit determines that the paper sheet has reached a position where it can be easily removed. In this case, the control unit stops the edge folding unit motor and the accordion folding unit motor (414), turns off the intermediate CL 309 and the edge folding unit exit CL 312 (415), and reports to the operator that a paper jam has occurred at the rear sensor 315 (or that a paper sheet exists at the

rear sensor 315) (416).

[0044] If the rear sensor 315 is not turned on while the paper sheet is conveyed 200 mm, the control unit stops the edge folding unit motor and the accordion folding unit motor (421), turns off the intermediate CL 309 and the edge folding unit exit CL 312 (422), and reports to the operator that a paper jam has occurred upstream of the rear sensor 315 (423).

[0045] Thus, an aspect of the present invention makes it possible to provide a paper folding device that allows an operator to easily remove a paper sheet other than a jammed paper sheet without adding a complex paper-ejection path (or without changing or adding a paper conveying path) and to provide an image forming apparatus including the paper folding device.

[0046] The present invention is not limited to the specifically disclosed embodiments, and variations and modifications may be made without departing from the scope of the present invention.

Claims

1. A paper folding device capable of processing paper sheets consecutively and designed to stop supplying the paper sheets into a paper conveying path and to stop a paper folding process when a paper jam occurs, the device comprising:
 - a paper folding unit configured to perform the paper folding process;
 - a first paper detecting unit configured to detect a remaining paper sheet remaining at a first position in the paper conveying path when the paper jam occurs; and
 - a remaining paper conveying unit configured to perform a conveying process for conveying the remaining paper sheet detected by the first paper detecting unit from the first position to a second position in the paper conveying path.
2. The paper folding device as claimed in claim 1, wherein the first position indicates a part of the paper conveying path corresponding to the paper folding unit and the second position indicates a part of the paper conveying path other than the part corresponding to the paper folding unit.
3. The paper folding device as claimed in claim 1 or 2, further comprising:
 - a reporting unit configured to report whether the remaining paper sheet detected by the first paper detecting unit still exists at the first position after the remaining paper conveying unit performs the conveying process for conveying the remaining paper sheet from the first position to the second position.
4. The paper folding device as claimed in claim 3, further comprising:
 - a second paper detecting unit configured to detect the remaining paper sheet conveyed by the remaining paper conveying unit to the second position,
 - wherein the reporting unit is configured to report whether the remaining paper sheet exists at the second position based on the detection result of the second paper detecting unit.
5. The paper folding device as claimed in any one of claims 1 through 4, wherein the remaining paper conveying unit is configured to perform the conveying process when the paper folding device is restarted or a cover of the paper folding device is opened and closed after the paper jam occurs.
6. The paper folding device as claimed in any one of claims 1 through 5, further comprising:
 - a folding knife unit including a folding knife and configured to fold a paper sheet with the folding knife,
 - wherein the remaining paper conveying unit is configured to convey the remaining paper sheet in conjunction with the folding knife unit.
7. The paper folding device as claimed in any one of claims 1 through 5, further comprising:
 - a folding knife unit including a folding knife and configured to fold a paper sheet with the folding knife,
 - wherein the remaining paper conveying unit is configured to convey the remaining paper sheet while the folding knife is retracted.
8. The paper folding device as claimed in any one of claims 1 through 7, wherein the first paper detecting unit and the second paper detecting unit are also configured to detect a paper jam.
9. The paper folding device as claimed in any one of claims 1 through 8, wherein the remaining paper conveying unit is also configured to convey a paper sheet from the first position to the second position during the paper folding process.
10. The paper folding device as claimed in any one of claims 1 through 9, wherein
 - the paper folding unit includes an accordion folding unit; and
 - the first paper detecting unit is disposed in the ac-

cordion folding unit.

11. An image forming apparatus comprising the paper folding device as claimed in any one of claims 1 through 10.

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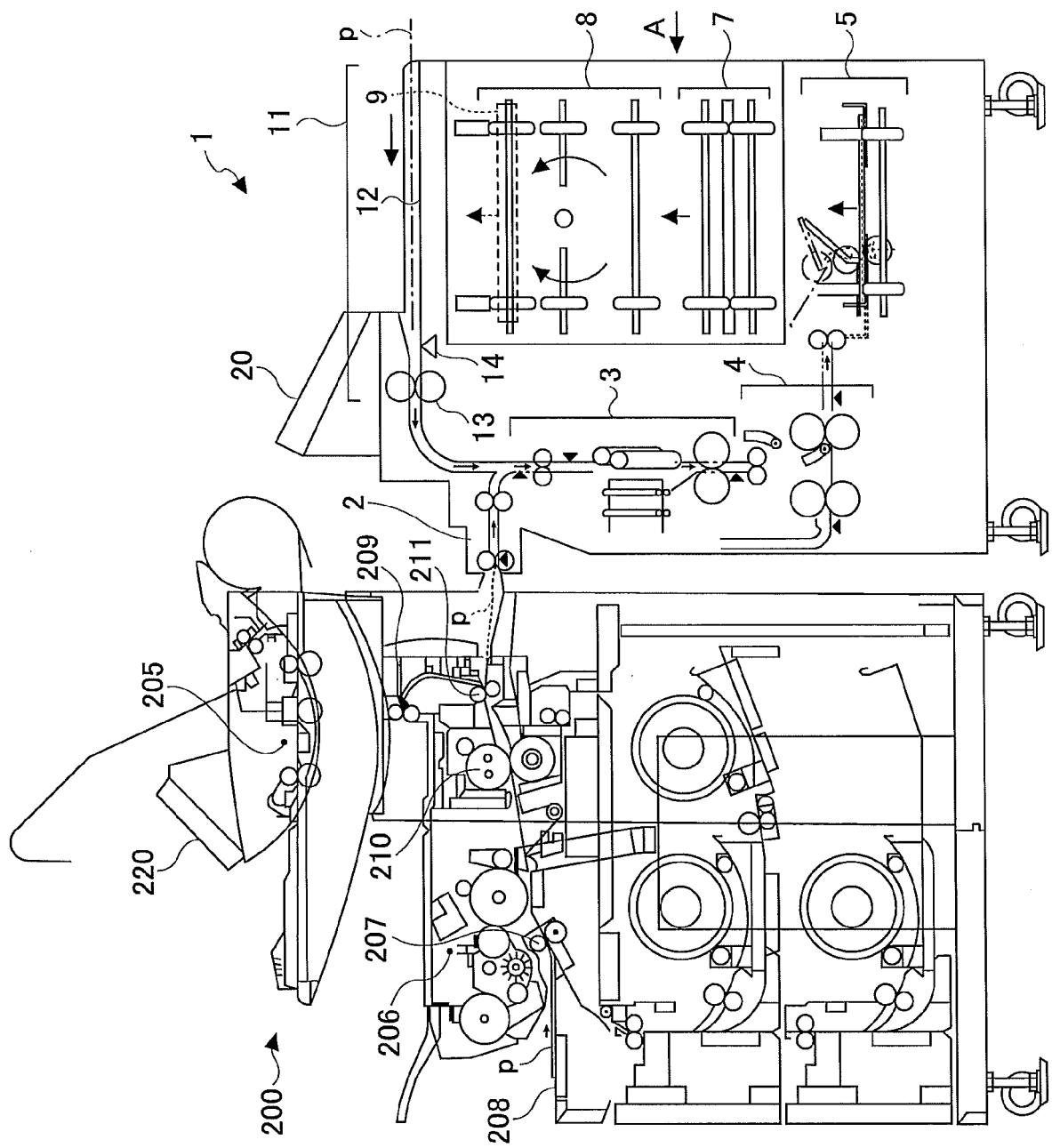


FIG. 1

FIG.2

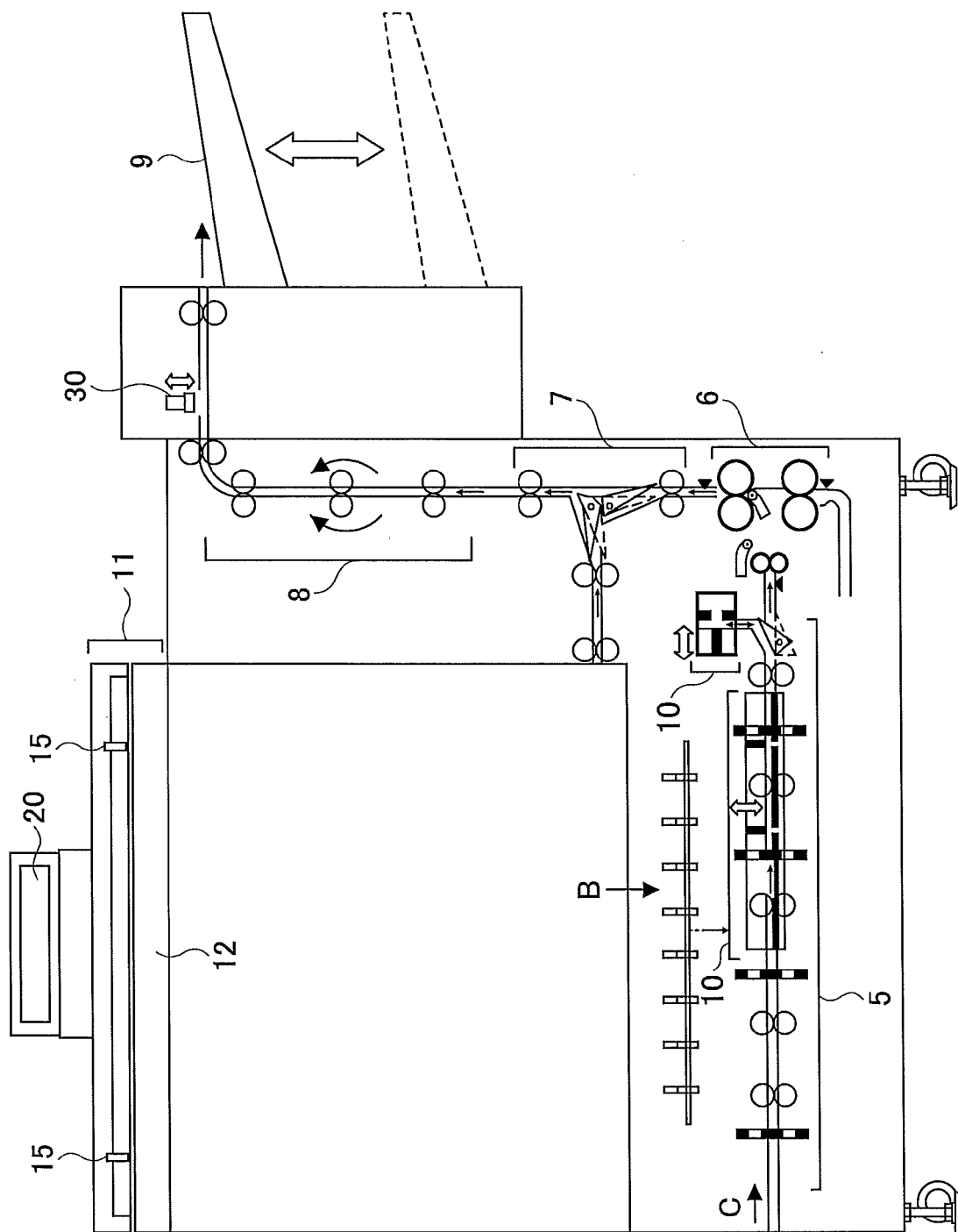


FIG.3

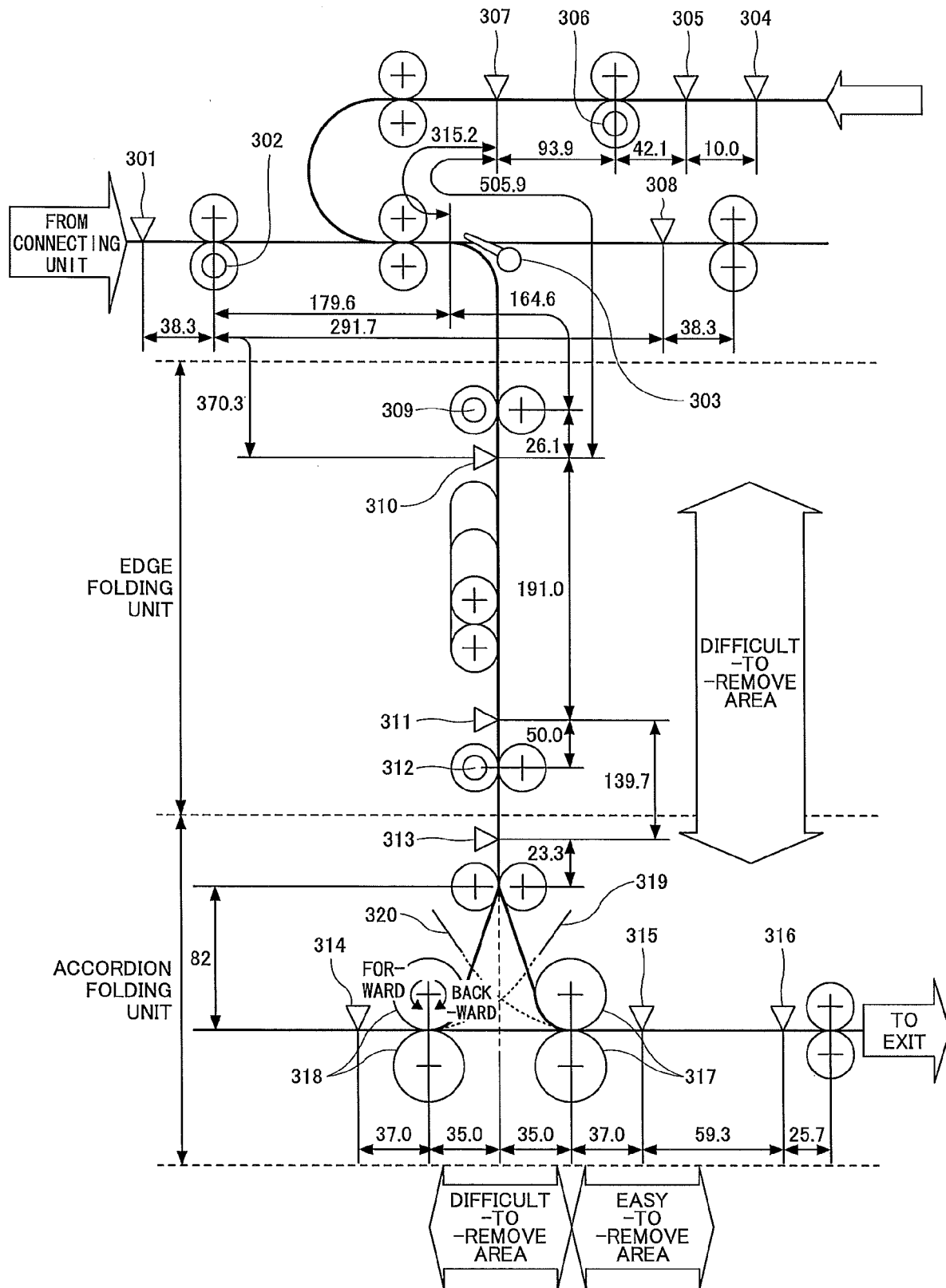
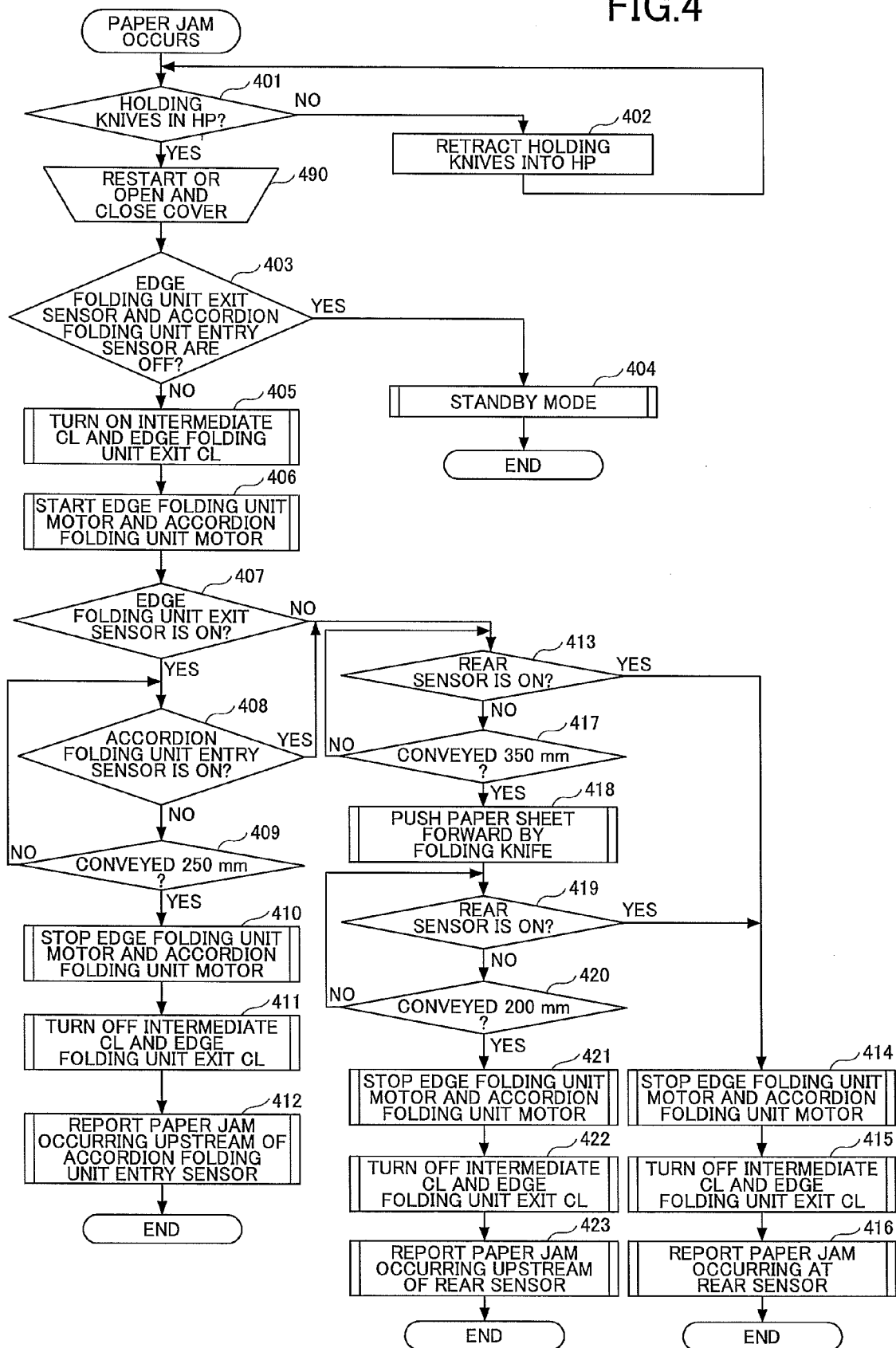


FIG.4



REFERENCES CITED IN THE DESCRIPTION

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