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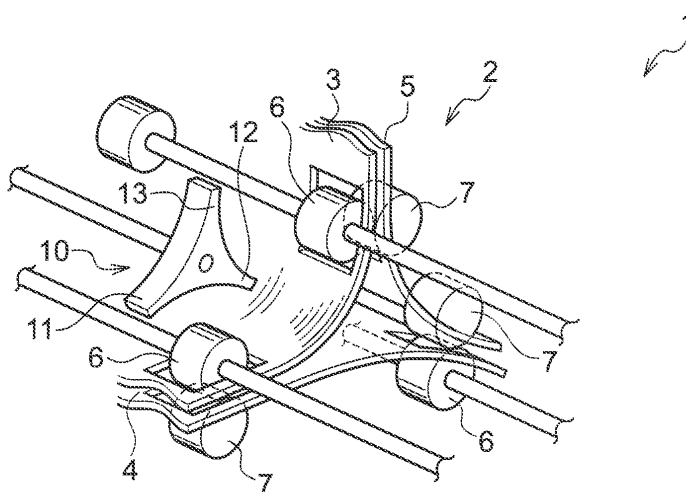
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(54) **DEVICE FOR SWITCHING BETWEEN CONVEYANCE PATHS FOR PAPER SHEETS OR THE LIKE**

(57) A device for switching between conveyance paths for paper sheets or the like is small sized and can switch the position of a conveyance path switching blade at high speed. The device is provided with the conveyance path switching blade (10) mounted in a branch section (2) at which three conveyance paths are branched so as to extend in different directions and guiding paper sheets or the like sent from any one of the conveyance

paths to either of the remaining two conveyance paths. The branch section (2) is constructed so that the paths extend in the three directions. The conveyance path switching blade (10) is rotated by a motor and has guide sections (11, 12, 13) protruding in three directions from the center of the rotation of the blade. The angle formed between one (11) of the guide sections and each of the remaining two guide sections (12, 13) is greater than the angle formed between the two conveyance paths.

FIG.1



Description

Technical Field

[0001] The present invention relates to a device for switching between conveyance paths for paper sheets or the like, which is provided in a device or the like for handling paper sheets or the like and is for switching conveyance directions of banknotes.

Background Art

[0002] A related art device for switching between conveyance paths for paper sheets or the like switches conveyance directions of banknotes between three directions by conveying and guiding the banknotes, which serve as an example of the paper sheets or the like, while driving solenoids of two types: a solenoid that serves as a drive source that drives a gate for switching a conveyance direction from one conveyance path to another conveyance path; and a solenoid that serves as a drive source that drives a stopping member for stopping rotation of the gate (for example, see paragraph [0013] and Fig. 1 of Japanese Patent Application Laid-Open (JP-A) No. 2006-213528).

DISCLOSURE OF INVENTION

Problem to be Solved by the Invention

[0003] However, in the related art described above, because two drive sources are used to change the conveyance direction of the paper sheets or the like (banknotes), the device for switching between conveyance paths for paper sheets or the like is larger. The present invention provides a means for solving this issue.

Means for Solving the Problem

[0004] One aspect of the present invention is a device for switching between conveyance paths for paper sheets or the like, including a conveyance path switching blade provided at a branch section at which conveyance paths branch in three directions, the conveyance path switching blade rotating to perform a switching operation for guiding paper sheets or the like sent from any one of the conveyance paths to either of the other two conveyance paths. The branch section is constructed so as to extend in three directions, the conveyance path switching blade includes guide sections that protrude in three directions from a center of the rotation, angles formed between one of the guide sections and the other two of the guide sections are larger than an angle formed between two of the conveyance paths, and the conveyance path switching blade is rotated by a motor.

[0005] Thus, the present invention is provided with the conveyance path switching blade provided with the three

protruding guide sections, and this conveyance path switching blade is rotated by a stepper motor. Therefore, there may be a single drive source and the device may be made small.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006]

Fig. 1 is an explanatory diagram illustrating a device for switching between conveyance paths for paper sheets or the like of an exemplary embodiment.

Fig. 2 is an explanatory diagram illustrating a state in which a branch section and conveyance path switching blades are arrayed.

Fig. 3 is an explanatory diagram illustrating a state in which the device for switching between conveyance paths for paper sheets or the like is viewed in an axial direction.

Fig. 4 is a block diagram illustrating the device for switching between conveyance paths for paper sheets or the like.

Fig. 5 is an explanatory diagram illustrating a state in which a first blade has been moved from position PA to position PB.

Fig. 6 is an explanatory diagram illustrating a state in which the first blade has been moved from position PB to position PC.

Fig. 7 is an explanatory diagram illustrating a state in which the first blade has been moved from position PC to position PD.

Fig. 8 is an explanatory diagram illustrating a state in which the first blade has been moved from position PD to position PE.

Fig. 9 is an explanatory diagram illustrating a state in which the first blade has been moved from position PE to position PF.

Fig. 10 is an explanatory diagram illustrating a rib shape between the conveyance path switching blades.

BEST MODE FOR CARRYING OUT THE INVENTION

[0007] Herebelow, an exemplary embodiment of a device for switching between conveyance paths for paper sheets or the like according to the present invention is described with reference to the drawing.

- First Exemplary Embodiment -

[0008] Fig. 1 is an explanatory diagram illustrating the device for switching between conveyance paths for paper sheets or the like of the exemplary embodiment.

Fig. 1 shows a device 1 for switching between conveyance paths for paper sheets or the like and describes an example in which banknotes serve as the paper sheets or the like.

A branch section 2 is formed of three curved banknote

guides 3, 4 and 5. The banknote guides 3, 4 and 5 are arrayed in a substantially triangular shape with gaps of a size through which banknotes may pass. Thus, the branch section 2 guides banknotes, which are conveyed along unillustrated banknote conveyance paths and whose conveyance directions are to be switched.

[0009] Cutouts (square holes in the drawings) are provided at pairs of locations of each of the banknote guides 3, 4 and 5.

The positions of the cutouts are, as illustrated in Fig. 1, a location of the banknote guide 3 that opposes the banknote guide 4 and a location that opposes the banknote guide 5. The cutouts provided in the banknote guide 4 are at a location that opposes the banknote guide 3 and a location that opposes the banknote guide 5. The cutout at the location that opposes the banknote guide 3 has its position set so as to be disposed to oppose the cutout in the banknote guide 3 that is provided at the location opposing the banknote guide 4.

[0010] The positions of the cutouts provided in the banknote guide 5 are at locations that oppose the banknote guides 3 and 4 and are disposed to oppose the cutouts provided in the banknote guides 3 and 4.

Feed rollers 6 are mounted so as to protrude into the gaps of the branch section 2 through the cutouts provided in the banknote guide 3 and the cutouts at the locations of the banknote guide 4 that oppose the banknote guide 5.

[0011] The shapes of these cutouts are not to be limited to square holes; they may be flat oval holes or the like. Press rollers 7 protrude into the gaps of the branch section 2 through the cutouts at the locations of the banknote guide 4 that oppose the banknote guide 3 and the cutouts in the banknote guide 5. Thus, the press rollers 7 are disposed to oppose the feed rollers 6 and nip banknotes against the feed rollers 6.

The cutouts have margins assured so as not to interfere with the feed rollers 6.

[0012] Conveyance paths extend in three directions from the branch section 2 of the present exemplary embodiment. These conveyance paths are provided in a radial pattern with intervals of 120°. Accordingly, the pairs of feed rollers 6 and press rollers 7 are arrayed at equal angles of 120° each.

A conveyance path switching blade 10 is provided in line with the banknote guides 3, 4 and 5 along an axial direction of the feed rollers 6 and press rollers 7. The conveyance path switching blade 10 includes guide sections that protrude in three directions from a center of rotation. One of these guide sections is a first blade 11. The conveyance path switching blade 10 is constructed such that angles formed between the first blade 11 and the other guide sections (a second blade 12 and a third blade 13) are larger (for example, 150°) than at least the angles formed between pairs of the conveyance paths extending from the branch section 2.

[0013] Thus, the conveyance path switching blade 10 functions so as to guide banknotes that are conveyed

from one of the conveyance paths while switching the conveyance direction toward either conveyance path of the other two conveyance paths. Here, a curved face is formed from the first blade 11 to the second blade 12 or the third blade 13, and this curved face acts as a guide surface for the banknotes.

So that the conveyance path switching blade 10 and the banknote guides 3, 4 and 5 do not interfere, cutouts formed as, for example, square holes are provided in the banknote guides 3, 4 and 5, and other structural components and the like are not disposed in a rotation track of the conveyance path switching blade 10.

[0014] Fig. 2 is an explanatory diagram illustrating a state in which the branch section and the conveyance path switching blades are arrayed.

Fig. 2 is shown in a state in which the branch section 2 is not illustrated.

In Fig. 2, toothed pulleys 15 are provided at one end of shafts, partways along which shafts the feed rollers 6 are mounted.

The feed rollers 6 of the present exemplary embodiment are provided at the cutouts of the banknote guide 3 and the cutouts of the banknote guide 4. Accordingly, there are three shafts and they are independently rotated. The toothed pulleys 15 are mounted so as to be fixed to two shafts, as illustrated in Fig. 2.

[0015] A toothed belt 16 is wound round the toothed pulleys 15. When one of the toothed pulleys 15 is rotated by driving of a motor 17 mounted at one end of one of the shafts, the rotation is transmitted to and rotates the other of the toothed pulleys 15 via the toothed belt 16. Only one of the motor 17 is illustrated for the present exemplary embodiment, but this is not to be limiting. It is sufficient that the feed rollers 6 can be rotated in directions to be capable of conveying banknotes both ways between direction a and direction b illustrated in Fig. 3, and between direction b and direction c and between direction c and direction a. Motors may accordingly be provided at the respective shafts.

[0016] A blade shaft 20 is provided so as to pass through a center of point symmetry of the branch section 2. The conveyance path switching blade 10 is plurally attached partways along the blade shaft 20.

A blade rotating mechanism 21 is formed of a gear 21a attached to one end of the blade shaft 20, a motor gear 21b provided so as to mesh with the gear 21a, and a stepper motor 22 that rotates the motor gear 21b. Driving of the stepper motor 22 is transmitted to the blade shaft 20 via the motor gear 21b and the gear 21a, and thus the conveyance path switching blades 10 rotate in forward and reverse directions.

[0017] A slit disc 25 is fixed to the other end of the blade shaft 20. A home position sensor 26 is also attached. Thus, the slit disc 25 functions to implement positioning of the first blade 11 of the conveyance path switching blade 10, which rotates together with the blade shaft 20.

The banknote guides 3, 4 and 5, motor 17, home position

sensor 26 and the like described above are supported by an unillustrated frame. The shafts of the feed rollers 6, the blade shaft 20 and the like are similarly rotatably supported by the frame.

[0018] Fig. 3 is an explanatory diagram illustrating a state in which the device for switching between conveyance paths for paper sheets or the like is viewed in the axial direction of the conveyance path switching blade. Predetermined positions of the first blade 11 are set. These positions are positions in which, as illustrated in Fig. 3, the first blade 11 is arrayed in the axial direction with any of the feed rollers 6 and press rollers 7 or the like. As illustrated in Fig. 3, a position at which the first blade 11 is arrayed with the press rollers 7 that protrude into the gaps of the branch section 2 through the cutouts in the banknote guide 4 that oppose the banknote guide 3 is a position PA, and a position at which the first blade 11 is arrayed with the feed rollers 6 that are disposed to oppose the press rollers 7 at position PA and provided at the banknote guide 3 is a position PB.

[0019] A position at which the first blade 11 is arrayed with the feed rollers 6 that are provided at the locations of the banknote guide 3 that oppose the banknote guide 4 is a position PC, and a position at which the first blade 11 is arrayed with the press rollers 7 that are disposed to oppose the feed rollers 6 at position PC and provided at the banknote guide 4 is a position PD.

A position at which the first blade 11 is arrayed with the feed rollers 6 that are provided at the locations of the banknote guide 5 that oppose the banknote guide 4 is a position PE, and a position at which the first blade 11 is arrayed with the press rollers 7 that are disposed to oppose the feed rollers 6 at position PE and provided at the banknote guide 5 is a position PF.

[0020] Therefore, switching angles when the first blade 11 of the conveyance path switching blade 10 moves through any of between positions PA and PB, between positions PC and PD, and between positions PE and PF are small, and switching angles when the first blade 11 moves through any of between positions PB and PC, between positions PA and PF, and between positions PD and PE are large.

The conveyance path switching blade 10 may be switched (rotated) between any of the above-mentioned positions.

[0021] Given this, the conveyance path switching blade 10 may switch and convey banknotes entering from the direction of any of arrow a, arrow b and arrow c in Fig. 3 to another of the conveyance directions.

Fig. 4 is a block diagram illustrating the device for switching between conveyance paths for paper sheets or the like.

A controller 30 shown in Fig. 4 controls operations of the respective sections in accordance with a control program stored in a memory 31.

[0022] The memory 31 memorizes, in addition to the stored control program, results of processing by the controller 30 and the like.

Operation of the structure described above is described. When the conveyance direction of banknotes entering the branch section 2 from the direction of arrow a shown in Fig. 3 is to be switched to the direction of arrow b, the controller 30 causes the first blade 11 of the conveyance path switching blade 10 to be disposed at position PA.

[0023] The unillustrated conveyance paths leading from the branch section 2 are provided in the radial pattern with intervals of 120°. In contrast, the first blade 11 and the second blade 12 of the conveyance path switching blade 10 are constructed with an interval of approximately 140°. Therefore, when the first blade 11 is disposed at position PA, the second blade 12 is disposed at position PD.

Therefore, banknotes guided by the first blade 11 and the second blade 12 of the conveyance path switching blade 10 may be conveyed from direction a to direction b or from direction b to direction a.

[0024] Fig. 5 is an explanatory diagram illustrating a state in which the first blade has been moved from position PA to position P13.

From the state in which banknotes are conveyed between direction a and direction b, when switching so as to convey banknotes between direction a and direction c, the controller 30 drives the stepper motor 22 and, via the motor gear 21 b, the gear 21 a and the blade shaft 20, rotates the conveyance path switching blade 10, in the counterclockwise direction as illustrated in Fig. 5, and moves it from position PA to position PB as illustrated in Fig. 5.

[0025] At this time, from position PA, the first blade 11 of the conveyance path switching blade 10 traverses the conveyance path in direction a and is disposed at the opposite side, of sides sandwiching that conveyance path, from the side of the original position.

Therefore, because the switching angle of the conveyance path switching blade 10 is small, the stepper motor 22 is rapidly rotated at a first predetermined speed to rotate the conveyance path switching blade 10.

[0026] When the first blade 11 is disposed at position PB, the third blade is disposed at position PE. Therefore, banknotes entering from direction a are guided to direction c by the conveyance path switching blade 10.

Thus, banknotes may be passed either way between direction a and direction c.

Fig. 6 is an explanatory diagram illustrating a state in which the first blade has been moved from position PB to position PC.

[0027] From the state in which banknotes are conveyed between direction a and direction c, when switching so as to convey banknotes between direction b and direction c, the controller 30 drives the stepper motor 22 and, via the motor gear 21b, the gear 21a and the blade shaft 20, rotates the conveyance path switching blade 10 in the counterclockwise direction and moves it from position PB to position PC as illustrated in Fig. 6.

At this time, going from position PB to position PC, the first blade 11 rotates from the vicinity of the conveyance

path in direction a to a vicinity of the conveyance path in direction b. Therefore, the switching angle of the conveyance path switching blade 10 is large,

[0028] Therefore, if the switching of the conveyance path switching blade 10 by the stepper motor 22 is performed at the first predetermined speed, there is a high possibility of operational problems due to loss of synchronization or the like. Thus, rather than the switching being performed at the relatively fast first predetermined speed, the switching is performed at a second predetermined speed, which is slower than when the switching angle is small.

Hence, when the first blade 11 is disposed at position PC, the second blade 12 is disposed at position PF. Thus, banknotes may be passed between direction b and direction c.

[0029] Herein, control is performed as fast as possible depending on rise control when starting the stepper motor 22 and fall control when stopping the same, and also acceleration control and the like. The various settings thereof may be suitably specified in accordance with well-known technologies.

Fig. 7 is an explanatory diagram illustrating a state in which the first blade has been moved from position PC to position PD.

[0030] From the state in which banknotes are conveyed between direction b and direction c, when switching so as to convey banknotes between direction a and direction b, the controller 30 drives the stepper motor 22 and, via the motor gear 21b, the gear 21a and the blade shaft 20, rotates the conveyance path switching blade 10 in the counterclockwise direction and moves it from position PC to position PD as illustrated in Fig. 7.

Going from position PC to position PD, the first blade 11 traverses the conveyance path in direction b and rotates to the opposite side of sides sandwiching that conveyance path. Therefore, because the switching angle of the conveyance path switching blade 10 is small, the stepper motor 22 is rapidly rotated at the first predetermined speed (a high speed) and switches the conveyance path switching blade 10.

[0031] Hence, when the first blade 11 is disposed at position PD, the third blade 13 is disposed at position PA. Thus, banknotes may be passed between direction a and direction b.

Fig. 8 is an explanatory diagram illustrating a state in which the first blade has been moved from position PD to position PE.

From the state in which banknotes are conveyed between direction a and direction b, when switching so as to convey banknotes between direction a and direction c, the controller 30 drives the stepper motor 22 and, via the motor gear 21b, the gear 21a and the blade shaft 20, rotates the conveyance path switching blade 10 in the counterclockwise direction and moves it from position PD to position PE as illustrated in Fig. 8.

[0032] Going from position PD to position PE, the first blade 11 rotates from the side of the conveyance path in

direction b to the side of the conveyance path in direction c. Therefore, because the switching angle of the conveyance path switching blade 10 is large, the conveyance path switching blade 10 is switched by the stepper motor 22 in the same manner as when being switched from position PB to position PC.

Hence, when the first blade 11 is disposed at position PE, the second blade 12 is disposed at position PB. Thus, banknotes may be passed between direction a and direction c.

[0033] Fig. 9 is an explanatory diagram illustrating a state in which the first blade has been moved from position PE to position PF.

From the state in which banknotes are conveyed between direction a and direction c, when switching so as to convey banknotes between direction b and direction c, the controller 30 drives the stepper motor 22 and, via the motor gear 21b, the gear 21a and the blade shaft 20, rotates the conveyance path switching blade 10 in the counterclockwise direction and moves it from position PE to position PF as illustrated in Fig. 8.

[0034] At this time, going from position PE to position OF, the first blade 11 traverses the conveyance path in direction c and rotates to the opposite side of sides sandwiching that conveyance path. Therefore, because the switching angle of the conveyance path switching blade 10 is small, the stepper motor 22 is rotated in the same manner as described above and switches the conveyance path switching blade 10.

Hence, when the first blade 11 is disposed at position PB, the third blade 13 is disposed at position PC. Thus, banknotes may be passed between direction b and direction c.

[0035] In the switching of conveyance directions described above, the conveyance path switching blade 10 is described as being rotated in the counterclockwise direction, but may be rotated in the clockwise direction. For example, when the first blade 11 is located at position PA, if the conveyance direction is to be switched such that banknotes are conveyed between direction b and direction c, the first blade 11 may be disposed from position PA to position PF by the conveyance path switching blade 10 being rotated in the clockwise direction.

[0036] As described hereabove, in the present exemplary embodiment, the conveyance path switching blade formed of the first blade, the second blade and the third blade is provided in a device for switching between conveyance paths for banknotes, and this conveyance path switching blade is rotated by a stepper motor and switches the conveyance direction of banknotes. Thus, the conveyance direction of banknotes may be switched with a single drive source. Consequently, the device for switching between conveyance paths for banknotes may be made small sized.

Furthermore, because there is a single drive source, the device for switching between conveyance paths for banknotes may be fabricated at a lower price.

[0037] When a switching angle of the conveyance path

switching blade is small to an extent in which the first blade traverses a conveyance path and is disposed at the opposite side, the stepper motor is rapidly rotated. Therefore, the conveyance direction may be switched promptly so as not to lose synchronization, and an effect is provided in that a lengthening of the duration taken for switching is prevented.

The above description is an example in which a plural number of conveyance path switching blades are fixed to a blade shaft. However, if integrally fabricated, for example, by resin molding, the respective conveyance path switching blades may be joined as illustrated in Fig. 10. Fig. 10 is an explanatory diagram illustrating a rib shape between the conveyance path switching blades. The shape of a rib 10a between the conveyance path switching blades may be a shape whose cross-section is pentagonal as illustrated in Fig. 10.

Claims

1. A device for switching between conveyance paths for paper sheets or the like, comprising:

a conveyance path switching blade provided at a branch section at which conveyance paths branch in three directions, the conveyance path switching blade rotating to perform a switching operation for guiding paper sheets or the like sent from any one of the conveyance paths to either of the other two conveyance paths, wherein the branch section is constructed so as to extend in three directions, and the conveyance path switching blade includes guide sections that protrude in three directions from a center of the rotation, angles formed between one of the guide sections and the other two of the guide sections are larger than an angle formed between two of the conveyance paths, and the conveyance path switching blade is rotated by a motor

2. The device for switching between conveyance paths for paper sheets or the like according to claim 1, wherein

the one of the guide portions of the conveyance path switching blade is a first blade and the other two of the guide portions are a second blade and a third blade, and guide surfaces for paper sheets or the like are structured from the first blade to the second blade and the third blade,

and, when the conveyance path switching blade is to be rotated and disposed such that the guide surface guides paper sheets or the like between conveyance paths, the device for switching between conveyance paths for paper sheets or the like changes a speed of the rotation between a case in which the first blade traverses the conveyance path closest

to a position before the rotation and is disposed at an opposite side of this conveyance, path and a case in which the first blade is rotated to move to a position in a vicinity of a conveyance path other than the conveyance path closest to the position before the rotation.

3. The device for switching between conveyance paths for paper sheets or the like according to claim 1, wherein the motor is a stepper motor.
4. The device for switching between conveyance paths for paper sheets or the like according to claim 2, wherein the speed in the case in which the first blade traverses the conveyance path closest to the position before the rotation and is disposed at the opposite side of this conveyance path is a higher speed than the speed in the case in which the first blade is rotated to move to a position in the vicinity of a conveyance path other than the conveyance path closest to the position before the rotation.

FIG.1

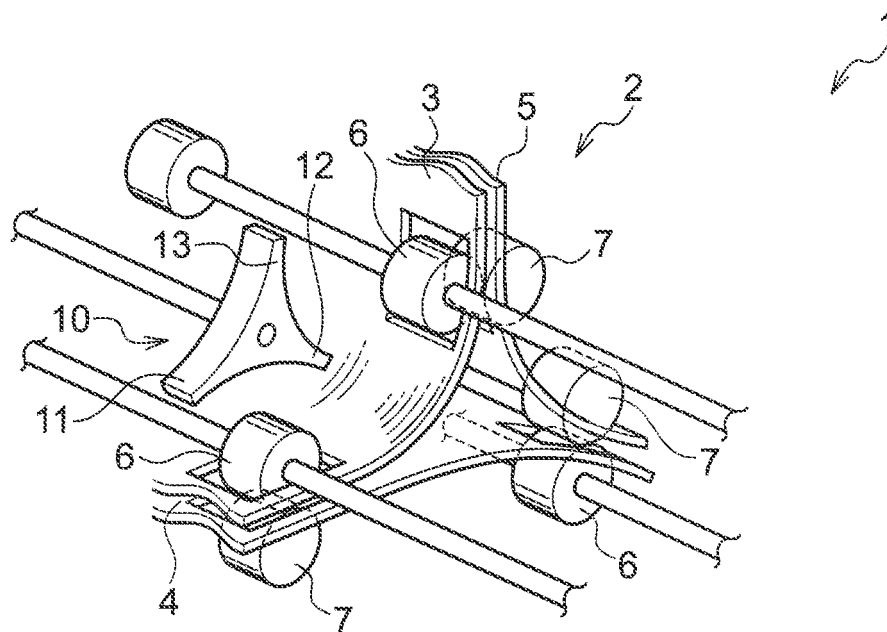


FIG.2

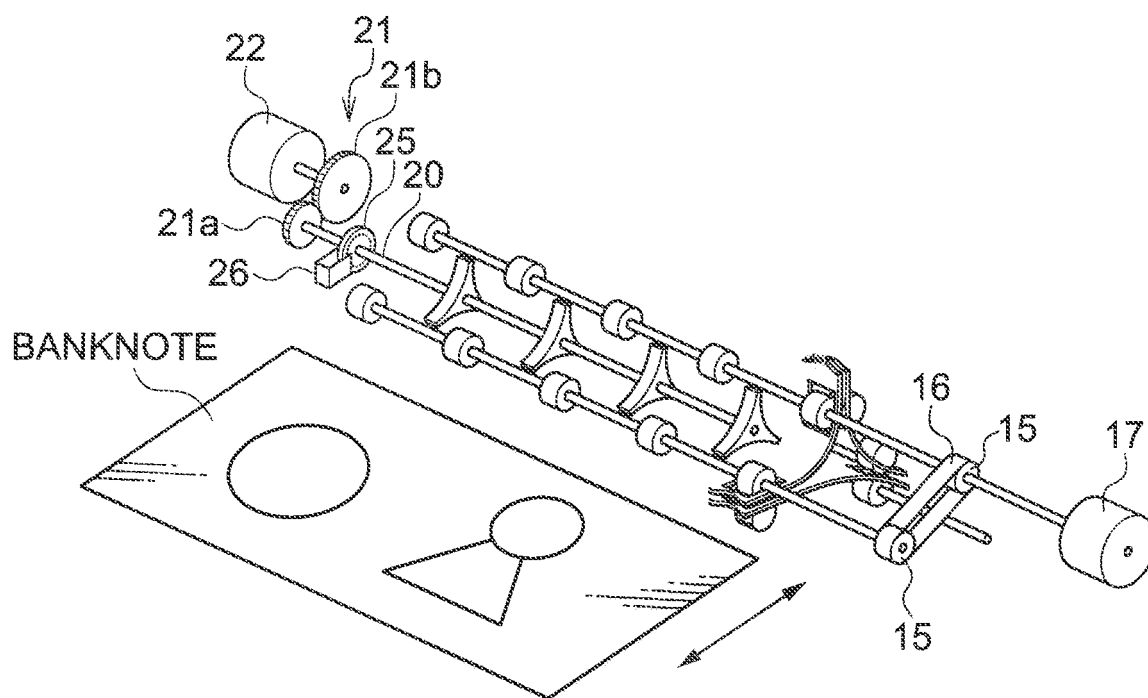


FIG.3

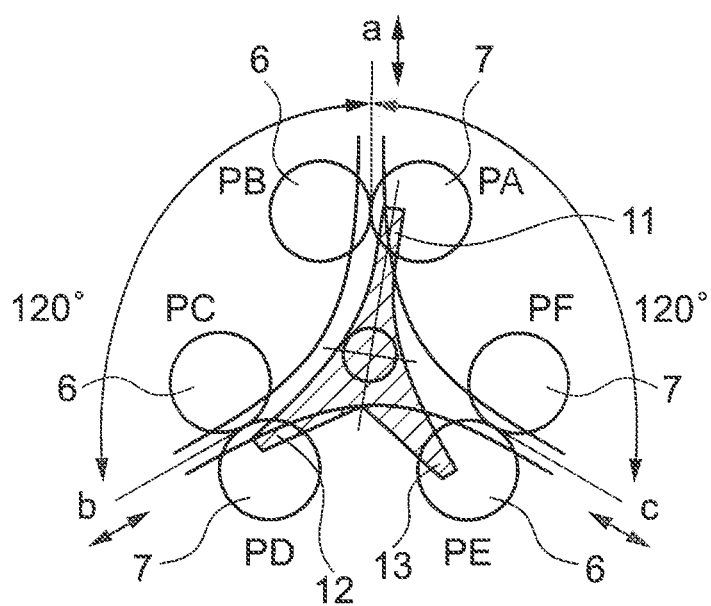


FIG.4

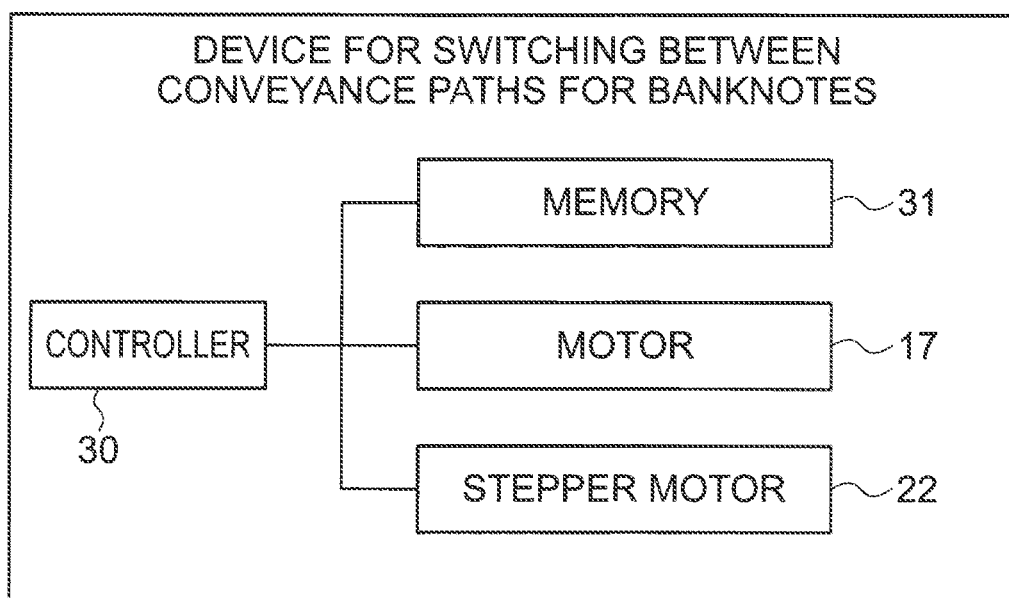


FIG.5

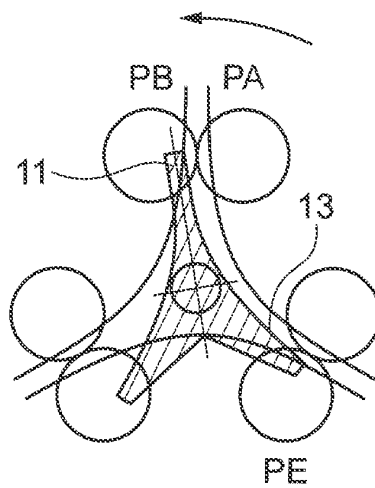


FIG.6

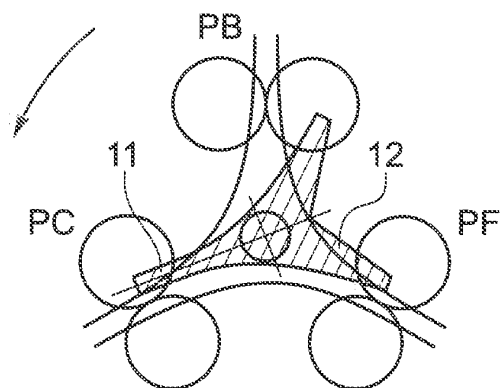


FIG.7

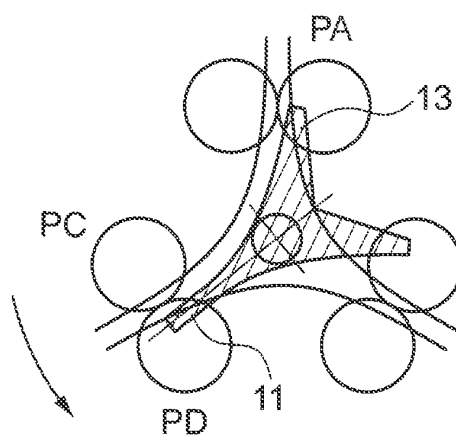


FIG.8

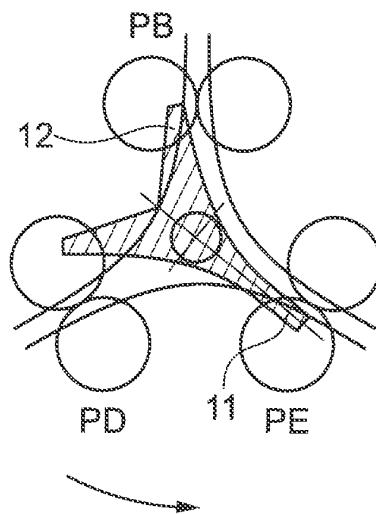


FIG.9

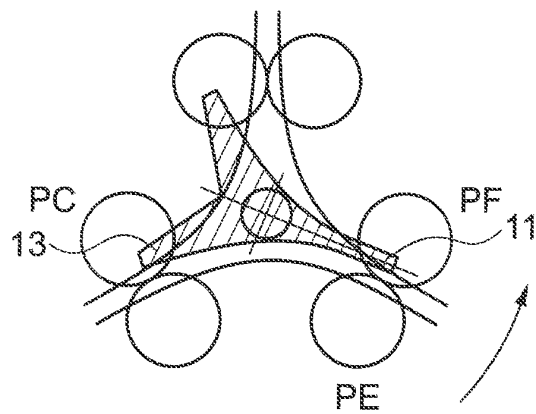
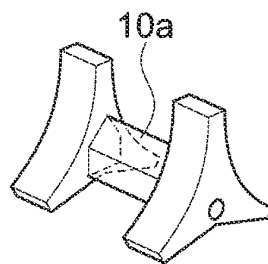


FIG.10



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2009/050345

A. CLASSIFICATION OF SUBJECT MATTER

B65H29/60 (2006.01) i

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B65H29/60

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

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2009
Kokai Jitsuyo Shinan Koho	1971-2009	Toroku Jitsuyo Shinan Koho	1994-2009

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y A	JP 7-187470 A (NEC Kofu Ltd.), 25 July, 1995 (25.07.95), Full text; all drawings (Family: none)	1, 3 2, 4
Y A	JP 2000-72306 A (Canon Inc.), 07 March, 2000 (07.03.00), Par. No. [0040]; Fig. 2 (Family: none)	1, 3 2, 4
E, X	JP 2009-70056 A (Glory Ltd.), 02 April, 2009 (02.04.09), Full text; all drawings (Family: none)	1-4

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

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Date of the actual completion of the international search
13 April, 2009 (13.04.09)Date of mailing of the international search report
28 April, 2009 (28.04.09)Name and mailing address of the ISA/
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Patent documents cited in the description

- JP 2006213528 A [0002]