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(54) **Creasing and folding machine**

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(56) References cited:
EP-B1- 1 425 239 DE-A1- 10 118 133
DE-A1- 10 118 133 JP-A- 2011 105 494

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to a creasing and folding machine for forming creases on a sheet and folding the sheet along the creases.

BACKGROUND OF THE INVENTION

[0002] A creasing and folding machine is generally configured to form creases on a sheet and fold the sheet along the creases. The conventional creasing and folding machine comprises: a creasing mechanism for forming the creases on the sheet; a folding mechanism for receiving the sheet from the creasing mechanism and folding the sheet along the creases; and a controller for controlling operations of the creasing mechanism and the folding mechanism (see, for example, Patent Document 1 and Patent Document 2).

[0003] The creasing mechanism comprises: a conveying roller for conveying the sheet, and a creasing section for creasing the sheet which is delivered from the conveying roller. The folding mechanism comprises: a plurality of folding knives for pressing the sheet along the creases at their edges; and a plurality of pairs of folding rollers each of which is composed of two folding rollers disposed opposite to each other with a gap therebetween, the gaps being opposite to the edges of the folding knives. The sheet is pressed by the folding knives, and inserted into the gaps, and then folded along the creases.

[0004] There are two ways for folding the sheet along the crease. As shown in Fig. 16A, one way is pressing a recess side of the crease by the folding knife and folding the sheet along the crease in the same direction as the fold direction of the crease. As shown in Fig. 16B, the other way is pressing a protrusion side of the crease by the folding knife and folding the sheet along the crease in a direction opposite to the fold direction of the crease.

[0005] When the sheet is a heavy paper sheet, as shown in Fig. 16A, if the sheet is folded in the same direction as the fold direction of the crease, the appearance of the folded sheet is poor because the sheet is not folded completely. Therefore, preferably as shown in Fig. 16B, the sheet is folded in the opposite direction to the fold direction of the crease so as to fold the sheet completely.

[0006] When the sheet is a thin paper sheet, if the sheet is folded in the opposite direction to the fold direction of the crease, the appearance of the folded sheet is poor because the folded portion of the sheet is not sharp. Therefore, the sheet is preferably folded in the same direction as the fold direction of the crease in such a way that the folded portion of the sheet is sharp.

[0007] In the conventional creasing and folding machine, the creasing section comprises: a convex block opposite to a first surface of the sheet; and a concave block opposite to a second surface of the sheet. The convex and concave blocks move toward each other so as

to form the crease which provides a recess on the first surface of the sheet and a protrusion on the second surface of the sheet. Thus, the creasing section has only one set of the convex and concave blocks. As a result, the creasing section can form only one type of the crease which provides a recess on the first surface of the sheet and a protrusion on the second surface of the sheet.

[0008] In the conventional creasing and folding machine, the folding mechanism is configured to press the second surface of the sheet by first folding knife and further press the first surface of the sheet by second folding knife so as to fold the sheet two times. Thus, the sheet is folded by the first folding knife in a direction opposite to the fold direction of the crease (see Fig. 16B), and further the sheet is folded by the second folding knife in the same direction as the fold direction of the crease (see Fig. 16A). As a result, when the sheet is a heavy paper sheet, the appearance of the folded sheet is poor because the folded portion of the sheet is not folded completely (see Fig. 16A) due to folding the sheet by the second folding knife in the same direction as the fold direction of the crease. When the sheet is a thin paper sheet, the appearance of the folded sheet is poor because the folded portion of the sheet is not sharp due to folding the sheet by the first folding knife in a direction opposite to the fold direction of the crease.

[0009]

Patent Document 1: EP 1,425,239 B

Patent Document 2: DE 101 18 133 A1

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0010] It is an object of the present invention to provide a creasing and folding machine which can achieve the folding with good appearance by selecting the press of the protrusion side of the crease or the press of the recess side of the crease depending on both heavy and thin paper sheets.

SOLUTION TO THE PROBLEMS

[0011] In order to achieve the objects, the present invention provides a creasing and folding machine, comprising:

a creasing mechanism for forming a plurality of creases on a sheet;
 a folding mechanism for receiving the sheet from the creasing mechanism and folding the sheet along the creases; and
 a controller for controlling operations of the creasing mechanism and the folding mechanism; wherein the creasing mechanism comprises:

a conveying roller for conveying the sheet; and

a creasing section for creasing the sheet which is delivered from the conveying roller; wherein

the folding mechanism comprises:

a plurality of folding knives for pressing the sheet along the creases at edges of the folding knives; and

a plurality of pairs of folding rollers each of which is composed of two folding rollers disposed opposite to each other with a gap therebetween, the gaps being opposite to the edges of the folding knives; wherein

the sheet is pressed by the folding knives so as to be inserted into the gaps and folded along the creases; wherein

the creasing section comprises:

first and second creasing units aligned in a conveying direction of the sheet; wherein

the first creasing unit comprises:

a first convex block opposite to a first surface of the sheet; and

a first concave block opposite to a second surface of the sheet, the first convex and concave blocks being moved toward each other so as to form a first crease of the creases which provides a recess on the first surface of the sheet and a protrusion on the second surface of the sheet; and wherein

the second creasing unit comprises:

a second concave block opposite to the first surface of the sheet; and

a second convex block opposite to the second surface of the sheet, the second concave and convex blocks being moved toward each other so as to form a second crease of the creases which provides a protrusion on the first surface of the sheet and a recess on the second surface of the sheet.

[0012] According to a preferred embodiment of the present invention,

when the sheet is a heavy paper sheet, the controller controls the creasing and the folding mechanisms in such a way that the folding knives press a protrusion side of the first or second crease.

[0013] According to further preferred embodiment of the present invention,

when the sheet is a thin paper sheet, the controller controls the creasing and the folding mechanisms in such a way that the folding knives press a recess side of the first or second crease.

[0014] According to further preferred embodiment of the present invention, the folding mechanism comprises:

5 the pairs of the folding rollers including two folding roller pairs, a first folding roller pair of the two folding roller pairs composed of a first folding roller and a second folding roller, and a second folding roller pair of the two folding roller pairs composed of the second folding roller and a third folding roller; and
10 the folding knives including first and second folding knives; wherein

a first folding unit is composed of the first folding roller pair and the first folding knife, wherein

15 a second folding unit is composed of the second folding roller pair and the second folding knife, wherein

the first folding unit folds the sheet in such a way that the first folding knife presses the first or second crease from the second surface of the sheet to the first surface of the sheet and inserts the sheet into the gap between the first and second folding rollers, wherein

the second folding unit folds the sheet in such a way that the second folding knife presses the first or second

25 crease from the first surface of the sheet to the second surface of the sheet and inserts the sheet into the gap between the second and third folding rollers, and wherein

when the sheet is a heavy paper sheet, the controller controls the creasing and the folding mechanisms in such

30 a way that the second creasing unit forms the second crease after the first creasing unit forming the first crease,

and the first folding knife presses the protrusion side of the first crease, and then the second folding knife presses the protrusion side of the second crease.

35 **[0015]** According to further preferred embodiment of the present invention,

the folding mechanism comprises:

40 the pairs of the folding rollers including two folding roller pairs, a first folding roller pair of the two folding roller pairs composed of a first folding roller and a second folding roller, and a second folding roller pair of the two folding roller pairs composed of the second folding roller and a third folding roller; and

45 the folding knives including first and second folding knives; wherein

a first folding unit is composed of the first folding roller pair and the first folding knife, wherein

50 a second folding unit is composed of the second folding roller pair and the second folding knife, wherein

the first folding unit folds the sheet in such a way that the first folding knife presses the first or second crease from the second surface of the sheet to the first surface of the

55 sheet and inserts the sheet into the gap between the first and second folding rollers, wherein

the second folding unit folds the sheet in such a way that the second folding knife presses the first or second

crease from the first surface of the sheet to the second surface of the sheet and inserts the sheet into the gap between the second and third folding rollers, and wherein when the sheet is a thin paper sheet, the controller controls the creasing and the folding mechanisms in such a way that the first creasing unit forms the first crease after the second creasing unit forming the second crease, and the first folding knife presses the recess side of the second crease, and then the second folding knife presses the recess side of the first crease.

EFFECT OF THE INVENTION

[0016] According to the present invention, the creasing section comprises first and second creasing units which are aligned in a conveying direction of the sheet. The first creasing unit comprises: a first convex block opposite to the first surface of the sheet; and a first concave block opposite to the second surface of the sheet. The first convex and concave blocks move toward each other so as to form a first crease which provides a recess on the first surface of the sheet and a protrusion on the second surface of the sheet. The second creasing unit comprises: a second concave block opposite to the first surface of the sheet; and a second convex block opposite to the second surface of the sheet. The second concave and convex blocks move toward each other so as to form a second crease which provides a recess on the second surface of the sheet and a protrusion on the first surface of the sheet.

[0017] In case that a folding knife is configured to press the second surface of the sheet, when the first creasing unit forms the crease and provides the protrusion on the second surface of the sheet, the folding knife can press the protrusion side of the crease. Therefore, it is possible to fold a heavy paper sheet with good appearance.

[0018] Further, in this case, when the second creasing unit forms the crease and provides the recess on the second surface of the sheet, the folding knife can also press the recess side of the crease. Therefore, it is also possible to fold a thin paper sheet with good appearance.

[0019] As above described, according to the creasing and folding machine of the present invention, the first and second folding units comprise two pairs of the concave and convex blocks which are disposed in different direction from each other. It is possible to form two types of the creases whose protrusion and recess sides are inverted each other. Thus, the sheet can be folded in two ways: in one way the folding knife presses the protrusion side of the crease, in the other way the folding knife presses the recess side of the crease. In the same way, the sheet can be folded in the direction same as or opposite to the fold direction of the crease. Consequently, it is possible to fold the sheet with good appearance for both heavy and thin paper sheets.

BRIEF DESCRIPTION OF THE DRAWING

[0020]

- 5 Fig. 1 is a side view schematically showing a creasing and folding machine according to one embodiment of the present invention.
- 10 Fig. 2 is a side view schematically showing an operation of a creasing mechanism when a sheet is a heavy paper sheet.
- 15 Fig. 3 is a side view schematically showing the operation of the creasing mechanism following Fig. 2.
- 20 Fig. 4 is a side view schematically showing an operation of a folding mechanism following Fig. 3.
- 25 Fig. 5 is a side view schematically showing the operation of the folding mechanism following Fig. 4.
- 30 Fig. 6 is a side view schematically showing the operation of the folding mechanism following Fig. 5.
- 35 Fig. 7 is a side view schematically showing the operation of the folding mechanism following Fig. 6.
- 40 Fig. 8 is a side view schematically showing the operation of the folding mechanism following Fig. 7.
- 45 Fig. 9 is a side view schematically showing the operation of the creasing mechanism when a sheet is a thin paper sheet.
- 50 Fig. 10 is a side view schematically showing the operation of the folding mechanism following Fig. 9.
- 55 Fig. 11 is a side view schematically showing the operation of the folding mechanism following Fig. 10.
- Fig. 12 is a side view schematically showing the operation of the folding mechanism following Fig. 11.
- Fig. 13 is a side view schematically showing the operation of the folding mechanism following Fig. 12.
- Fig. 14 is a side view schematically showing the operation of the folding mechanism following Fig. 13.
- Fig. 15 is a side view schematically showing the operation of the folding mechanism following Fig. 14.
- Fig. 16A is a side view schematically showing a paper folded in the same direction as a fold direction of a crease by a folding knife pressing a recess side of the crease when a sheet is a heavy paper sheet.
- Fig. 16B is a side view schematically showing the paper folded in opposite direction to the fold direction of the crease by the folding knife pressing a protrusion side of the crease when the sheet is the heavy paper sheet.

DETAILED EXPLANATION OF THE PREFERRED EMBODIMENTS

[0021] A preferred embodiment of a creasing and folding machine according to the present invention will be explained below with reference to the accompanying drawings.

[0022] As shown in Fig. 1, the creasing and folding machine comprises a creasing mechanism 1 for forming a plurality of creases on a sheet S. The creasing and folding machine further comprises a folding mechanism

2 for folding the sheet S along the creases. The sheet S is conveyed from the creasing mechanism 1. The creasing and folding machine further comprises a controller 3 for controlling operations of the creasing mechanism 1 and the folding mechanism 2. The creasing mechanism 1 further comprises first and second conveying roller pairs 10, 11 for conveying the sheet S. The first and second conveying roller pairs 10, 11 are aligned in a first conveying direction F of the sheet S. The first conveying roller pair 10 is disposed at the upstream of the first conveying direction F, while the second conveying roller pair 11 is disposed at the downstream of the first conveying direction F.

[0023] The first conveying roller pair 10 comprises a first drive roller 100 and a first idle roller 101. The first drive and idle rollers 100, 101 are disposed adjacent to each other in such a way that the rotation of the first drive roller 100 causes the rotation of the first idle roller 101. The second conveying roller pair 11 comprises a second drive roller 110 and a second idle roller 111. The second drive and idle rollers 110, 111 are disposed adjacent to each other in such a way that the rotation of the second drive roller 110 causes the rotation of the second idle roller 111.

[0024] The first and second idle rollers 101, 111 are disposed opposite to the first surface (upper surface) S1 of the sheet S, while the first and second drive rollers 100, 110 support the second surface (lower surface) S2 of the sheet S thereon.

[0025] The creasing mechanism 1 comprises a creasing section 45 for creasing the sheet S. The creasing section 45 is disposed between the first and second conveying roller pairs 10, 11. The creasing section 45 comprises first and second creasing units 4, 5. The first and second creasing units 4, 5 are aligned in a first conveying direction F of the sheet S. The first creasing unit 4 is disposed at the upstream of the first conveying direction F, while the second creasing unit 5 is disposed at the downstream of the first conveying direction F.

[0026] The first creasing unit 4 comprises first convex and concave blocks 40, 41. The first convex block 40 is disposed opposite to the first surface (upper surface) S1 of the sheet S, while the first concave block 41 is disposed opposite to the second surface (lower surface) S2 of the sheet S. The first convex and concave blocks 40, 41 extend horizontally and perpendicular to the first conveying direction F respectively. The first convex and concave blocks 40, 41 can be engaged with each other. The first convex block 40 is fixed, while the first concave block 41 is reciprocated by a first creasing drive mechanism 42. During reciprocal movement, the first concave block 41 moves toward and away from the first convex block 40. When the first convex and concave blocks 40, 41 are engaged with each other, the sheet S is nipped between the first convex and concave blocks 40, 41 so as to form a first crease 400. The first crease 400 is depressed in the first surface S1 of the sheet S and projected on the second surface S2 of the sheet S. In the same way, the

first crease 400 provides a recess on the first surface S1 of the sheet S and a protrusion on the second surface S2 of the sheet S.

[0027] The second creasing unit 5 comprises second convex and concave blocks 50, 51. The second convex block 50 is disposed opposite to the second surface (lower surface) S2 of the sheet S, while the second concave block 51 is disposed opposite to the first surface (upper surface) S1 of the sheet S. The second convex and concave blocks 50, 51 extend horizontally and perpendicular to the first conveying direction F respectively. The second convex and concave blocks 50, 51 can be engaged with each other. The second concave block 51 is fixed, while the second convex block 50 is reciprocated by a second creasing drive mechanism 52. During the reciprocal movement, the second convex block 50 moves toward and away from the second concave block 51. When the second convex and concave blocks 50, 51 are engaged with each other, the sheet S is nipped between the second convex and concave blocks 50, 51 so as to form a second crease 500. The second crease 500 is projected on the first surface S1 of the sheet S and depressed in the second surface S2 of the sheet S. In the same way, the second crease 500 provides a protrusion on the first surface S1 of the sheet S and a recess on the second surface S2 of the sheet S.

[0028] The folding mechanism 2 comprises first, second and third folding rollers 20, 21, 22. The folding mechanism 2 comprises first and second folding knives 23, 24. The first and second folding rollers 20, 21 are aligned in the first conveying direction F. The first and second folding rollers 20, 21 are disposed adjacent to each other with a small first gap 201 therebetween. An edge 23a of the first folding knife 23 is opposite to the first gap 201. The second and third rollers 21, 22 are aligned in a second conveying direction F'. The second conveying direction F' is arranged at approximately right angle to the first conveying direction F. The second and third folding rollers 21, 22 are disposed adjacent to each other with a small second gap 202 therebetween. An edge 24a of the second folding knife 24 is opposite to the second gap 202.

[0029] The first folding knife 23 is reciprocated by a first knife drive mechanism 230. During the reciprocal movement, the first folding knife 23 moves toward and away from the first gap 201 in a direction perpendicular to the first conveying direction F. The first folding knife 23 presses the creases 400, 500 of the sheet S from the second surface S2 of the sheet S to the first surface S1 of the sheet S.

[0030] The second folding knife 24 is reciprocated by a second knife drive mechanism 240. During the reciprocal movement, the second folding knife 24 moves toward and away from the second gap 202 in a direction perpendicular to the second conveying direction F'. The second folding knife 24 presses the creases 400, 500 of the sheet S from the first surface S1 of the sheet S to the second surface S2 of the sheet S.

[0031] The folding mechanism 2 comprises first, second and third press rollers 200, 210, 220. The first folding and press rollers 20, 200 nip the sheet S, the second folding and press rollers 21, 210 nip the sheet S, and the third folding and press rollers 22, 220 nip the sheet S.

[0032] A first folding unit 6 is composed of the first and second folding rollers 20, 21 and the first folding knife 23. A second folding unit 7 is composed of the second and third folding rollers 21, 22 and the second folding knife 24. The creasing mechanism 1 forms the creases 400, 500 on the sheet S, and the first folding unit 6 folds the sheet S along the creases 400, 500, and then the second folding unit 7 folds the sheet S along the creases 400, 500.

[0033] The creasing and folding machine comprises a motor 12 composed of a servomotor, a stepping motor and so on. The motor 12 is connected to the first and second drive rollers 100, 110 and the second folding roller 21 through a first timing belt 121. The drive of the motor 12 causes the rotations of the first and second drive rollers 100, 110 and the second folding roller 21. The first and third folding rollers 20, 22 are connected to each other through a second timing belt 122. The rotation of the second folding roller 21 causes the rotations of the first and third folding rollers 20, 22. The rotation of the motor 12 in a counterclockwise direction causes the counterclockwise rotations of the first and second drive rollers 100, 110 and the second folding roller 21. The rotation of the second folding roller 21 in a counterclockwise direction causes the clockwise rotations of the first and third folding rollers 20, 22.

[0034] The creasing and folding machine comprises position sensors 13, 13 which are disposed at the entrance of the creasing mechanism 1. For example, the position sensors 13, 13 are composed of light emitting and receiving elements for detecting an edge Sa of the sheet S. The position sensors 13, the motor 12, the first and second creasing drive mechanisms 42, 52, and the first and second folding knife drive mechanisms 230, 240 are connected to the controller 3. The controller 3 controls the operations of the creasing and folding mechanisms 1, 2 based on a preinstalled program when the position sensors 13 detect the edge Sa of the sheet S.

[0035] The first and second creasing drive mechanisms 42, 52 comprise, for example, a motor and a cam respectively. The drives of the cams of the first and second creasing drive mechanisms 42, 52 cause the reciprocal movements of the first concave block 41 and the second convex block 50. The first and second creasing drive mechanisms 42, 52 may be composed of a slide crank mechanism, a cylinder mechanism or a feed screw mechanism driven by a motor respectively.

[In case that the sheet is a heavy paper sheet]

[0036] The operation of the creasing and folding machine will be explained below with reference to Figs. 2-8 in which the sheet S is a heavy paper sheet.

[0037] The controller 3 is provided with a program for handling the heavy paper sheet S. After distances from the edge Sa of the sheet S to the first and second creases 400, 500 are inputted to the controller 3, the operations of the creasing mechanism 1 and the folding mechanism 2 are controlled by the controller 3 as follows.

[0038] As shown in Fig. 2, when the position sensors 13 detect the edge Sa of the sheet S, the sheet S is conveyed in the first conveying direction F in such a way that a position to be provided with the first crease 400 arrives at the first convex and concave blocks 40, 41 by controlling the amount of the rotations of the conveying rollers 10, 11. When the position to be provided with the first crease 400 arrives at the first convex and concave blocks 40, 41, the sheet S is stopped by the stops of the conveying rollers 10, 11. The first concave block 41 moves upwardly toward the first convex block 40. As a result, the first crease 400 is formed on the sheet S. The first crease 400 provides a recess on the first surface (upper surface) S1 of the sheet S and a protrusion on the second surface (lower surface) S2 of the sheet S.

[0039] Then, as shown in Fig. 3, the sheet S is conveyed in the first conveying direction F in such a way that a position to be provided with the second crease 500 arrives at the second convex and concave blocks 50, 51 by controlling the amount of the rotation of the conveying rollers 10, 11. When the position to be provided with the second crease 500 arrives at the second convex and concave blocks 50, 51, the sheet S is stopped by the stops of the conveying rollers 10, 11. The second convex block 50 moves toward the second concave block 51. As a result, the second crease 500 is formed on the sheet S. The second crease 500 provides a protrusion on the first surface (upper surface) S1 of the sheet S and a recess on the second surface (lower surface) S2 of the sheet S.

[0040] Then, as shown in Fig. 4, the sheet S is conveyed in the first conveying direction F in such a way that the first crease 400 arrives at the edge 23a of the first folding knife 23 by controlling the amount of the rotations of the conveying roller 11 and the first folding roller 20. The sheet S is discharged from the second conveying roller 11, and then the discharged sheet S is nipped and conveyed between the first folding and press rollers 20, 200. The second press roller 210 is separated from the second folding roller 21 in order not to convey the sheet S in a direction opposite to the first conveying direction F by an inverse rotation of the second folding roller 21. When the first crease 400 arrives at the edge 23a of the first folding knife 23, the sheet S is stopped by stopping the conveying roller 11 and the first and second folding rollers 20, 21.

[0041] Then, as shown in Fig. 5, the second press roller 210 moves upwardly toward the second folding roller 21, and then the first folding knife 23 moves. The first folding roller 20 rotates in a clockwise direction, while the second folding roller 21 rotates in a counterclockwise direction. The edge 23a of the first folding knife 23 presses the first

crease 400. As a result, the first crease 400 is inserted into the first gap 201 between the first and second folding rollers 20, 21. The edge 23a of the first folding knife 23 presses the protrusion side of the first crease 400. Then, the sheet S is inserted into the first gap 201 and folded along the first crease 400 and discharged from the first and second folding rollers 20, 21. The sheet S is folded in a direction opposite to the fold direction of the first crease 400.

[0042] Then, as shown in Fig. 6, the sheet S is conveyed in the second conveying direction F' in such a way that the second crease 500 arrives at the edge 24a of the second folding knife 24 by controlling the amount of the rotations of the first and second folding rollers 20, 21. The second conveying direction F' is arranged at approximately right angle to the first conveying direction F. The third press roller 220 is separated from the third folding roller 22 in order not to convey the sheet S in a direction opposite to the second conveying direction F' by an inverse rotation of the third folding roller 22. When the second crease 500 arrives at the edge 24a of the second folding knife 24, the sheet S is stopped by stopping the first and second folding rollers 20, 21.

[0043] Then, as shown in Fig. 7, the third press roller 220 moves laterally toward the third folding roller 22, and then the second folding knife 24 moves. The first folding roller 20 rotates in a clockwise direction, the second folding roller 21 rotates in a counterclockwise direction, and the third folding roller 22 rotates in a clockwise direction. The edge 24a of the second folding knife 24 presses the second crease 500. As a result, the second crease 500 is inserted into the second gap 202 between the second and third folding rollers 21, 22. The edge 24a of the second folding knife 24 presses the protrusion side of the second crease 500. Then, the sheet S is inserted into the second gap 202 and folded along the second crease 500 and discharged from the second and third folding rollers 21, 22. The sheet S is folded in a direction opposite to the fold direction of the second crease 500.

[0044] As shown in Fig. 8, the sheet S is folded along the first and second creases 400, 500. As above described, the machine of the present invention can fold the heavy paper sheet S in a direction opposite to the fold directions of the first and second creases 400, 500 (see Fig. 16B). As a result, the sheet S can be folded with good appearance because the sheet S can be folded completely.

[In case that the sheet is a thin paper sheet]

[0045] The operation of the creasing and folding machine will be explained below with reference to Figs. 9-15 in which the sheet S is a thin paper sheet.

[0046] The controller 3 is provided with a program for handling the thin paper sheet S. After distances from the edge Sa of the sheet S to the first and second creases 400, 500 are inputted to the controller 3, the operations of the creasing mechanism 1 and the folding mechanism

2 are controlled by the controller 3 as follows.

[0047] As shown in Fig. 9, when the position sensors 13 detect the edge Sa of the sheet S, the sheet S is conveyed in the first conveying direction F in such a way that a position to be provided with the second crease 500 arrives at the second convex and concave blocks 50, 51 by controlling the amount of the rotations of the conveying rollers 10, 11. When the position to be provided with the second crease 500 arrives at the second convex and concave blocks 50, 51, the sheet S is stopped by stopping the conveying rollers 10, 11. The second convex block 50 moves upwardly toward the second concave block 51. As a result, the second crease 500 is formed on the sheet S. The second crease 500 provides a protrusion on the first surface (upper surface) S1 of the sheet S and a recess on the second surface (lower surface) S2 of the sheet S.

[0048] Then, as shown in Fig. 10, the sheet S is conveyed in the first conveying direction F in such a way that a position to be provided with the first crease 400 arrives at the first convex and concave blocks 40, 41 by controlling the amount of the rotations of the conveying rollers 10, 11. When the position to be provided with the first crease 400 arrives at the first convex and concave blocks 40, 41, the sheet S is stopped by stopping the conveying rollers 10, 11. The first concave block 41 moves upwardly toward the first convex block 40. As a result, the first crease 400 is formed on the sheet S. The first crease 400 provides a recess on the first surface (upper surface) S1 of the sheet S and a protrusion on the second surface (lower surface) S2 of the sheet S.

[0049] Then, as shown in Fig. 11, the sheet S is conveyed in the first conveying direction F in such a way that the second crease 500 arrives at the edge 23a of the first folding knife 23 by controlling the amount of the rotations of the conveying roller 11 and the first folding roller 20. The sheet S is discharged from the second conveying roller 11, then the discharged sheet S is nipped and conveyed between the first folding and press rollers 20, 200. The second press roller 210 is separated from the second folding roller 21 in order not to convey the sheet S in a direction opposite to the first conveying direction F by an inverse rotation of the second folding roller 21. When the second crease 500 arrives at the edge 23a of the first folding knife 23, the sheet S is stopped by stopping the conveying roller 11 and the first and second folding rollers 20, 21.

[0050] Then, as shown in Fig. 12, the second press roller 210 moves upwardly toward the second folding roller 21, and then the first folding knife 23 moves. The first folding roller 20 rotates in a clockwise direction, while the second folding roller 21 rotates in a counterclockwise direction. The edge 23a of the first folding knife 23 presses the second crease 500. As a result, the second crease 500 is inserted into the first gap 201 between the first and second folding rollers 20, 21. The edge 23a of the first folding knife 23 presses the recess side of the second crease 500. Then, the sheet S is inserted into the first

gap 201 and folded along the second crease 500 and discharged from the first and second folding rollers 20, 21. The sheet S is folded in the same direction as the fold direction of the second crease 500.

[0051] Then, as shown in Fig. 13, the sheet S is conveyed in the second conveying direction F' in such a way that the first crease 400 arrives at the edge 24a of the second folding knife 24 by controlling the amount of the rotations of the first and second folding rollers 20, 21. The second conveying direction F' is arranged at approximately right angle to the first conveying direction F. The third press roller 220 is separated from the third folding roller 22 in order not to convey the sheet S in a direction opposite to the second conveying direction F' by an inverse rotation of the third folding roller 22. When the first crease 400 arrives at the edge 24a of the second folding knife 24, the sheet S is stopped by stopping the first and second folding rollers 20, 21.

[0052] Then, as shown in Fig. 14, the third press roller 220 moves laterally toward the third folding roller 22, and then the second folding knife 24 moves. The first folding roller 20 rotates in a clockwise direction, the second folding roller 21 rotates in a counterclockwise direction, and the third folding roller 22 rotates in a clockwise direction. The edge 24a of the second folding knife 24 presses the first crease 400. As a result, the first crease 400 is inserted into the second gap 202 between the second and third folding rollers 21, 22. The edge 24a of the second folding knife 24 presses the recess side of the first crease 400. Then, the sheet S is inserted into the second gap 202 and folded along the first crease 400 and discharged from the second and third folding rollers 21, 22. The sheet S is folded in the same direction as the fold direction of the first crease 400.

[0053] As shown in Fig. 15, the sheet S is folded along the first and second creases 400, 500. As above described, the machine of the present invention can fold the thin paper sheet S in the same direction as the fold-directions of the first and second creases 400, 500 (see Fig. 16A). As a result, the sheet S can be folded with good appearance because the folded portion of the sheet S can be sharp.

DESCRIPTION OF THE REFERENCE CHARACTERS

[0054]

1 creasing mechanism
 2 folding mechanism
 3 controller
 45 creasing section
 4 first creasing unit
 40 first convex block
 41 first concave block
 42 first creasing drive mechanism
 5 second creasing unit
 50 second convex block
 51 second concave block

52 second creasing drive mechanism
 400 first crease
 500 second crease
 10 first conveying roller
 5 100 first drive roller
 101 first idle roller
 11 second conveying roller
 110 second drive roller
 111 second idle roller
 10 6 first folding unit
 7 second folding unit
 20 first folding roller
 21 second folding roller
 22 third folding roller
 15 23 first folding knife
 23a edge of the first folding knife
 230 first folding knife drive mechanism
 24 second folding knife
 24a edge of the second folding knife
 20 240 second folding knife drive mechanism
 201 first gap
 202 second gap
 200 first press roller
 210 second press roller
 25 220 third press roller
 12 motor
 13 position sensor
 121 first timing belt
 122 second timing belt
 30 S sheet
 S1 first surface of the sheet
 S2 second surface of the sheet
 F first conveying direction
 F' second conveying direction

Claims

1. A creasing and folding machine, comprising:

a creasing mechanism (1) for forming a plurality of creases on a sheet (S);
 a folding mechanism (2) for receiving the sheet (S) from the creasing mechanism (1) and folding the sheet (S) along the creases; and
 a controller (3) for controlling operations of the creasing mechanism (1) and the folding mechanism (2); wherein
 the creasing mechanism (1) comprises:

a conveying roller (10,11) for conveying the sheet (S); and
 a creasing section (45) for creasing the sheet (S) which is delivered from the conveying roller (10,11); wherein

the folding mechanism (2) comprises:

a plurality of folding knives for pressing the sheet (S) along the creases at edges of the folding knives; and

a plurality of pairs of folding rollers each of which is composed of two folding rollers disposed opposite to each other with a gap therebetween, the gaps being opposite to the edges of the folding knives; wherein

the sheet (S) is pressed by the folding knives so as to be inserted into the gaps and folded along the creases; **characterized in that** the creasing section (45) comprises:

first and second creasing units (4,5) aligned in a conveying direction (F, F') of the sheet (S); wherein

the first creasing unit (4) comprises:

a first convex block (40) opposite to a first surface of the sheet (S1); and

a first concave block (41) opposite to a second surface of the sheet (S2), the first convex and concave blocks being moved toward each other so as to form a first crease (400) of the creases which provides a recess on the first surface of the sheet (S1) and a protrusion on the second surface of the sheet (S2); and wherein

the second creasing unit (5) comprises:

a second concave block (51) opposite to the first surface of the sheet (S1); and
a second convex block (50) opposite to the second surface of the sheet (S2), the second concave and convex blocks being moved toward each other so as to form a second crease (500) of the creases which provides a protrusion on the first surface of the sheet (S1) and a recess on the second surface of the sheet (S2).

2. The creasing and folding machine according to claim 1, wherein

when the sheet (S) is a heavy paper sheet, the controller (3) controls the creasing and the folding mechanisms (1,2) in such a way that the folding knives press a protrusion side of the first or second crease.

3. The creasing and folding machine according to claim 1, wherein

when the sheet (S) is a thin paper sheet, the controller (3) controls the creasing and the folding mechanisms (1,2) in such a way that the folding knives press a recess side of the first or second crease.

4. The creasing and folding machine according to claim 1, wherein the folding mechanism (2) comprises:

the pairs of the folding rollers including two folding roller pairs, a first folding roller pair (20,21) of the two folding roller pairs composed of a first folding roller (20) and a second folding roller (21), and a second folding roller pair (21,22) of the two folding roller pairs composed of the second folding roller (21) and a third folding roller (22); and the folding knives including first and second folding knives; wherein

a first folding unit (6) is composed of the first folding roller pair (20,21) and the first folding knife (23), wherein

a second folding unit (7) is composed of the second folding roller pair (21,22) and the second folding knife (24), wherein

the first folding unit (6) folds the sheet (S) in such a way that the first folding knife (23) presses the first or second crease from the second surface of the sheet (S2) to the first surface of the sheet (S1) and inserts the sheet (S) into the gap between the first and second folding rollers, wherein

the second folding unit (7) folds the sheet (S) in such a way that the second folding knife (24) presses the first or second crease from the first surface of the sheet (S1) to the second surface of the sheet (S2) and inserts the sheet (S) into the gap between the second and third folding rollers, and wherein

when the sheet (S) is a heavy paper sheet, the controller (3) controls the creasing and the folding mechanisms (1,2) in such a way that the second creasing unit (5) forms the second crease (500) after the first creasing unit (4) forming the first crease (400), and the first folding knife (23) presses the protrusion side of the first crease (400), and then the second folding knife (24) presses the protrusion side of the second crease (500).

5. The creasing and folding machine according to claim 1, wherein the folding mechanism (2) comprises:

the pairs of the folding rollers including two folding roller pairs, a first folding roller pair (20,21) of the two folding roller pairs composed of a first folding roller (20) and a second folding roller (21), and a second folding roller pair (21,22) of the two folding roller pairs composed of the second folding roller (21) and a third folding roller (22); and the folding knives including first and second folding knives; wherein

a first folding unit (6) is composed of the first folding roller pair (20,21) and the first folding knife (23), wherein

a second folding unit (7) is composed of the second folding roller pair (21,22) and the second folding knife (24), wherein

the first folding unit (6) folds the sheet (S) in such a way that the first folding knife (23) presses the first or second crease from the second surface of the sheet (S2) to the first surface of the sheet (S1) and inserts the sheet (S) into the gap between the first and second folding rollers, wherein

the second folding unit (7) folds the sheet (S) in such a way that the second folding knife (24) presses the first or second crease from the first surface of the sheet (S1) to the second surface of the sheet (S2) and inserts the sheet (S) into the gap between the second and third folding rollers, and wherein

when the sheet (S) is a thin paper sheet, the controller (3) controls the creasing and the folding mechanisms (1,2) in such a way that the first creasing unit (4) forms the first crease (400) after the second creasing unit (5) forming the second crease (500), and the first folding knife (23) presses the recess side of the second crease (500), and then the second folding knife (24) presses the recess side of the first crease (400).

Patentansprüche

1. Rill- und Falzmaschine, umfassend:

einen Rillmechanismus (1) zur Bildung einer Mehrzahl von Rillen auf einem Bogen (S),
einen Falzmechanismus (2) zur Aufnahme des Bogens (S) vom Rillmechanismus (1) und zum Falzen des Bogens (S) entlang der Rillen, und
eine Steuereinheit (3) zum Steuern des Betriebs des Rillmechanismus (1) und des Falzmechanismus (2), wobei
der Rillmechanismus (1) umfasst:

eine Transportrolle (10, 11) zum Transport des Bogens (S) und
einen Rillbereich (45) zum Rillen des Bogens (S), der von der Transportrolle (10,11) zugeführt wird, wobei

der Falzmechanismus (2) umfasst:

eine Mehrzahl von Falzmessern zum Pressen des Bogens (S) entlang der Rillen an den Kanten der Falzmesser, und
eine Mehrzahl von Falzrollenpaaren, wobei jedes davon aus zwei Falzrollen besteht, die einander gegenüber mit einem Spalt dazwischen angeordnet sind, wobei die Spalte

gegenüber den Kanten der Falzmesser liegen, wobei

der Bogen (S) durch die Falzmesser so gepresst wird, dass er in die Spalte eingeschoben und entlang der Rillen gefalzt wird, **dadurch gekennzeichnet, dass**

der Rillbereich (45) umfasst:

eine erste und eine zweite Rilleinheit (4, 5), die in Transportrichtung (F, F') des Bogens ausgerichtet sind, wobei

die erste Rilleinheit (4) umfasst:

einen ersten konvexen Block (40) gegenüber einer ersten Oberfläche des Bogens (S1) und

einen ersten konkaven Block (41) gegenüber einer zweiten Oberfläche des Bogens (S2), wobei der erste konvexe und der erste konkave Block so aufeinander zu bewegt werden, dass eine erste Rille (400) der Rillen gebildet wird, was eine Vertiefung auf der ersten Oberfläche des Bogens (S1) und eine Erhöhung auf der zweiten Oberfläche des Bogens (S2) ergibt, und wobei

die zweite Rilleinheit (5) umfasst:

einen zweiten konkaven Block (51) gegenüber der ersten Oberfläche des Bogens (S1) und

einen zweiten konvexen Block (50) gegenüber der zweiten Oberfläche des Bogens (S2), wobei der zweite konkave und der zweite konvexe Block so aufeinander zu bewegt werden, dass eine zweite Rille (500) der Rillen gebildet wird, was eine Erhöhung auf der ersten Oberfläche des Bogens (S1) und eine Vertiefung auf der zweiten Oberfläche des Bogens (S2) ergibt.

2. Rill- und Falzmaschine gemäß Anspruch 1, wobei wenn der Bogen (S) ein Bogen aus schwerem Papier ist, die Steuereinheit (3) den Rill- und den Falzmechanismus (1, 2) so steuert, dass die Falzmesser eine Erhöhungsseite der ersten oder der zweiten Rille pressen.

3. Rill- und Falzmaschine gemäß Anspruch 1, wobei wenn der Bogen (S) ein Bogen aus dünnem Papier ist, die Steuereinheit (3) den Rill- und den Falzmechanismus (1, 2) so steuert, dass die Falzmesser eine Vertiefungsseite der ersten oder der zweiten Rille pressen.

4. Rill- und Falzmaschine gemäß Anspruch 1, wobei

der Falzmechanismus (2) umfasst:

die Falzrollenpaare, einschließlich zweier Falzrollenpaare, wobei ein erstes Falzrollenpaar (20, 21) der zwei Falzrollenpaare aus einer ersten Falzrolle (20) und einer zweiten Falzrolle (21) besteht und ein zweites Falzrollenpaar (21, 22) der zwei Falzrollenpaare aus der zweiten Falzrolle (21) und einer dritten Falzrolle (22) besteht, und die Falzmesser, einschließlich eines ersten und eines zweiten Falzmessers, wobei

eine erste Falzeinheit (6) aus dem ersten Falzrollenpaar (20, 21) und dem ersten Falzmesser (23) besteht, wobei

eine zweite Falzeinheit (7) aus dem zweiten Falzrollenpaar (21, 22) und dem zweiten Falzmesser (24) besteht, wobei

die erste Falzeinheit (6) den Bogen (S) so falzt, dass das erste Falzmesser (23) die erste oder die zweite Rille von der zweiten Oberfläche des Bogens (S2) zur ersten Oberfläche des Bogens (S1) presst und den Bogen (S) in den Spalt zwischen der ersten und der zweiten Falzrolle schiebt, wobei

die zweite Falzeinheit (7) den Bogen (S) so falzt, dass das zweite Falzmesser (24) die erste oder die zweite Rille von der ersten Oberfläche des Bogens (S1) zur zweiten Oberfläche des Bogens (S2) presst und den Bogen (S) in den Spalt zwischen der zweiten und der dritten Falzrolle schiebt, und wobei

wenn der Bogen (S) ein Bogen aus schwerem Papier ist, die Steuereinheit (3) den Rill- und den Falzmechanismus (1, 2) so steuert, dass die zweite Rilleinheit (5) die zweite Rille (500) bildet, nachdem die erste Rilleinheit (4) die erste Rille (400) gebildet hat, und das erste Falzmesser (23) die Erhöhungsseite der ersten Rille (400) presst und anschließend das zweite Falzmesser (24) die Erhöhungsseite der zweiten Rille (500) presst.

5. Rill- und Falzmaschine gemäß Anspruch 1, wobei der Falzmechanismus (2) umfasst:

die Falzrollenpaare, einschließlich zweier Falzrollenpaare, wobei ein erstes Falzrollenpaar (20, 21) der zwei Falzrollenpaare aus einer ersten Falzrolle (20) und einer zweiten Falzrolle (21) besteht und ein zweites Falzrollenpaar (21, 22) der zwei Falzrollenpaare aus der zweiten Falzrolle (21) und einer dritten Falzrolle (22) besteht, und die Falzmesser, einschließlich eines ersten und eines zweiten Falzmessers, wobei

eine erste Falzeinheit (6) aus dem ersten Falzrollenpaar (20, 21) und dem ersten Falzmesser (23) besteht, wobei

eine zweite Falzeinheit (7) aus dem zweiten Falzrollenpaar (21, 22) und dem zweiten Falzmesser (24) besteht, wobei

die erste Falzeinheit (6) den Bogen (S) so falzt, dass das erste Falzmesser (23) die erste oder die zweite Rille von der zweiten Oberfläche des Bogens (S2) zur ersten Oberfläche des Bogens (S1) presst und den Bogen (S) in den Spalt zwischen der ersten und der zweiten Falzrolle schiebt, wobei

die zweite Falzeinheit (7) den Bogen (S) so falzt, dass das zweite Falzmesser (24) die erste oder die zweite Rille von der ersten Oberfläche des Bogens (S1) zur zweiten Oberfläche des Bogens (S2) presst und den Bogen (S) in den Spalt zwischen der zweiten und der dritten Falzrolle schiebt, und wobei

wenn der Bogen (S) ein Bogen aus dünnem Papier ist, die Steuereinheit (3) den Rill- und den Falzmechanismus (1, 2) so steuert, dass die erste Rilleinheit (4) die erste Rille (400) bildet, nachdem die zweite Rilleinheit (5) die zweite Rille (500) gebildet hat, und das erste Falzmesser (23) die Vertiefungsseite der zweiten Rille (500) presst und anschließend das zweite Falzmesser (24) die Vertiefungsseite der ersten Rille (400) presst.

Revendications

1. Machine de rainage-plier, comprenant :

un mécanisme de rainage (1) destiné à former une pluralité de rainures sur une feuille (S) ;
un mécanisme de pliage (2) destiné à recevoir la feuille (S) provenant du mécanisme de rainage (1) et à plier la feuille (S) le long des rainures ;
et

une unité de commande (3) destinée à commander les opérations du mécanisme de rainage (1) et du mécanisme de pliage (2) ; dans laquelle le mécanisme de rainage (1) comprend :

un rouleau d'acheminement (10,11) destiné à acheminer la feuille (S) ; et
une section de rainage (45) destinée à rainurer la feuille (S) qui est délivrée par le rouleau d'acheminement (10,11) ; dans laquelle

le mécanisme de pliage (2) comprend :

une pluralité de lames de pliage destinées à presser la feuille (S) le long des rainures au niveau de bords des lames de pliage ; et
une pluralité de paires de rouleaux de pliage, chacune étant composée de deux rouleaux de pliage disposés l'un en face de l'autre avec un espace entre eux, les espaces étant opposés aux bords des lames de

- pliage ; dans laquelle
- la feuille (S) est pressée par les lames de pliage de manière à être insérée dans les espaces et pliée le long des rainures ;
- 5 **caractérisée en ce que**
- la section de rainage (45) comprend :
- des première et seconde unités de rainage (4,5) alignées dans un sens d'acheminement (F, F') de la feuille (S) ; dans laquelle
- 10 la première unité de rainage (4) comprend :
- un premier bloc convexe (40) opposé à une première surface de la feuille (S1) ; et
- un premier bloc concave (41) opposé à une seconde surface de la feuille (S2), les premiers blocs convexe et concave étant déplacés l'un vers l'autre de manière à former
- 20 une première rainure (400) des rainures qui produit un renforcement sur la première surface de la feuille (S1) et une protubérance sur la seconde surface de la feuille (S2) ;
- 25 et dans laquelle
- la seconde unité de rainage (5) comprend :
- un second bloc concave (51) opposé à la première surface de la feuille (S1) ; et
- 30 un second bloc convexe (50) opposé à la seconde surface de la feuille (S2), les seconds blocs concave et convexe étant déplacés l'un vers l'autre de manière à former une seconde rainure (500) des rainures qui produit une protubérance sur la première surface de la feuille (S1) et un renforcement sur la seconde surface de la feuille (S2).
- 35
2. Machine de rainage-pliage selon la revendication 1, dans laquelle
- 40 quand la feuille (S) est une feuille de papier épaisse, l'unité de commande (3) commande les mécanismes de rainage et de pliage (1,2) de telle sorte que les lames de pliage pressent un côté à protubérance de la première ou seconde rainure.
- 45
3. Machine de rainage-pliage selon la revendication 1, dans laquelle
- 50 quand la feuille (S) est une feuille de papier mince, l'unité de commande (3) commande les mécanismes de rainage et de pliage (1,2) de telle sorte que les lames de pliage pressent un côté à renforcement de la première ou seconde rainure.
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4. Machine de rainage-pliage selon la revendication 1, dans laquelle
- le mécanisme de pliage (2) comprend :

les paires des rouleaux de pliage comportant deux paires de rouleaux de pliage, une première paire de rouleaux de pliage (20,21) des deux paires de rouleaux de pliage étant composée d'un premier rouleau de pliage (20) et d'un deuxième rouleau de pliage (21), et une seconde paire de rouleaux de pliage (21,22) des deux paires de rouleaux de pliage étant composée du deuxième rouleau de pliage (21) et d'un troisième rouleau de pliage (22) ; et

les lames de pliage comportant des première et seconde lames de pliage ; dans laquelle

une première unité de pliage (6) est composée de la première paire de rouleaux de pliage (20,21) et de la première lame de pliage (23), dans laquelle une seconde unité de pliage (7) est composée de la seconde paire de rouleaux de pliage (21,22) et de la seconde lame de pliage (24), dans laquelle

la première unité de pliage (6) plie la feuille (S) de telle façon que la première lame de pliage (23) presse la première ou seconde rainure de la seconde surface de la feuille (S2) contre la première surface de la feuille (S1) et insère la feuille (S) dans l'espace entre les premier et deuxième rouleaux de pliage, dans laquelle

la seconde unité de pliage (7) plie la feuille (S) de telle façon que la seconde lame de pliage (24) presse la première ou seconde rainure de la première surface de la feuille (S1) contre la seconde surface de la feuille (S2) et insère la feuille (S) dans l'espace entre les deuxième et troisième rouleaux de pliage, et dans laquelle

quand la feuille (S) est une feuille de papier épaisse, l'unité de commande (3) commande les mécanismes de rainage et de pliage (1,2) de telle façon que la seconde unité de rainage (5) forme la seconde rainure (500) après que la première unité de rainage (4) a formé la première rainure (400), et la première lame de pliage (23) presse le côté à protubérance de la première rainure (400), puis la seconde lame de pliage (24) presse le côté à protubérance de la seconde rainure (500).

5. Machine de rainage-pliage selon la revendication 1, dans laquelle
- le mécanisme de pliage (2) comprend :

les paires de rouleaux de pliage comportant deux paires de rouleaux de pliage, une première paire de rouleaux de pliage (20,21) des deux paires de rouleaux de pliage étant composée d'un premier rouleau de pliage (20) et d'un deuxième rouleau de pliage (21), et une seconde paire de rouleaux de pliage (21,22) des deux paires de rouleaux de pliage étant composée du deuxième rouleau de pliage (21) et d'un troisième rouleau de pliage (22) ; et

les lames de pliage comportant des première et seconde lames de pliage ; dans laquelle

une première unité de pliage (6) est composée de la première paire de rouleaux de pliage (20, 21) et de la première lame de pliage (23), dans laquelle une seconde unité de pliage (7) est composée de la seconde paire de rouleaux de pliage (21,22) et de la seconde lame de pliage (24), dans laquelle la première unité de pliage (6) plie la feuille (S) de telle façon que la première lame de pliage (23) presse la première ou seconde rainure de la seconde surface de la feuille (S2) contre la première surface de la feuille (S1) et insère la feuille (S) dans l'espace entre les premier et deuxième rouleaux de pliage, dans laquelle la seconde unité de pliage (7) plie la feuille (S) de telle façon que la seconde lame de pliage (24) presse la première ou seconde rainure de la première surface de la feuille (S1) contre la seconde surface de la feuille (S2) et insère la feuille (S) dans l'espace entre les deuxième et troisième rouleaux de pliage, et dans laquelle quand la feuille (S) est une feuille de papier mince, l'unité de commande (3) commande les mécanismes de rainage et de pliage (1,2) de telle façon que la première unité de rainage (4) forme la première rainure (400) après que la seconde unité de rainage (5) a formé la seconde rainure (500), et la première lame de pliage (23) presse le côté à renforcement de la seconde rainure (500), puis la seconde lame de pliage (24) presse le côté à renforcement de la première rainure (400).

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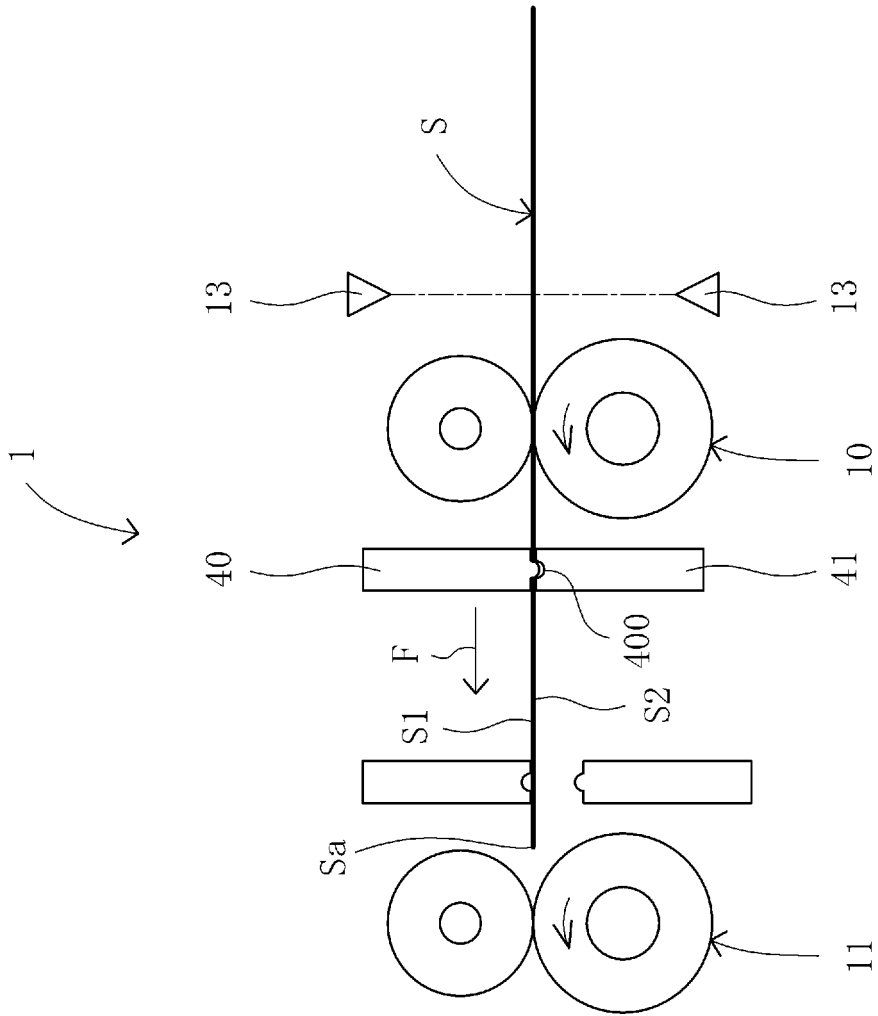


Fig. 2

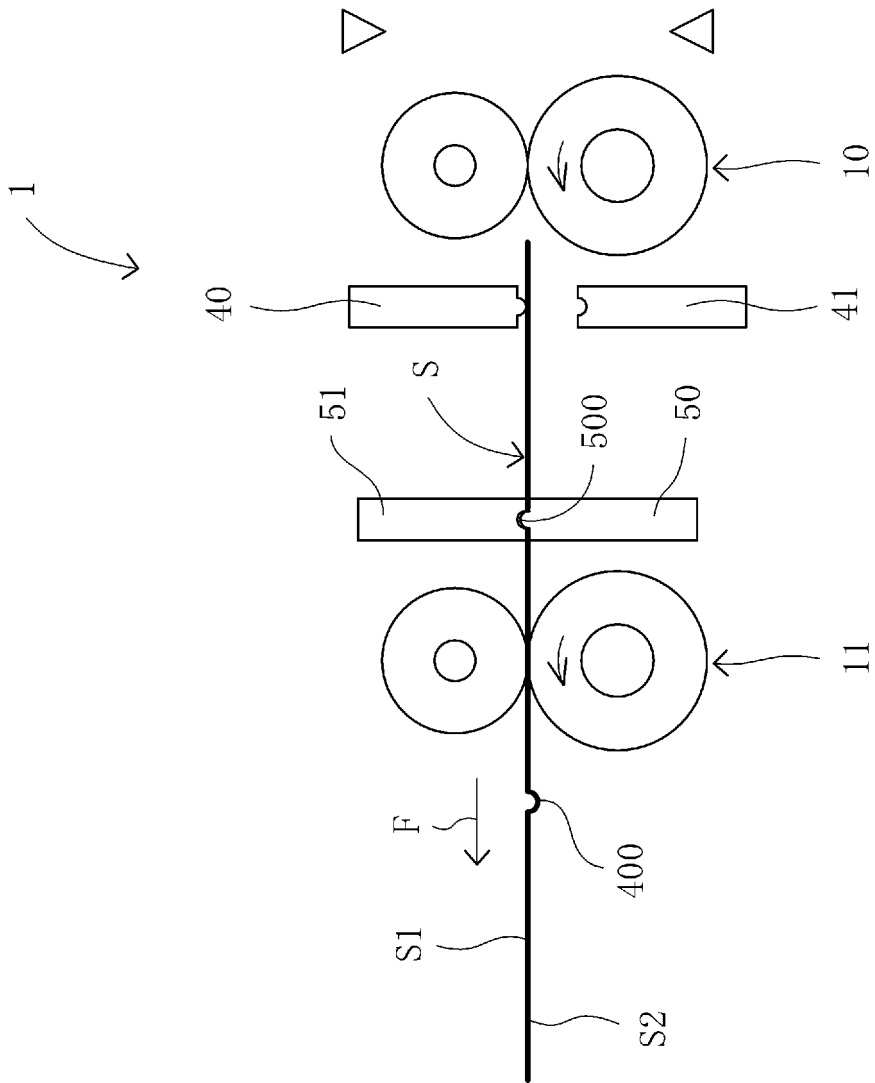


Fig. 3

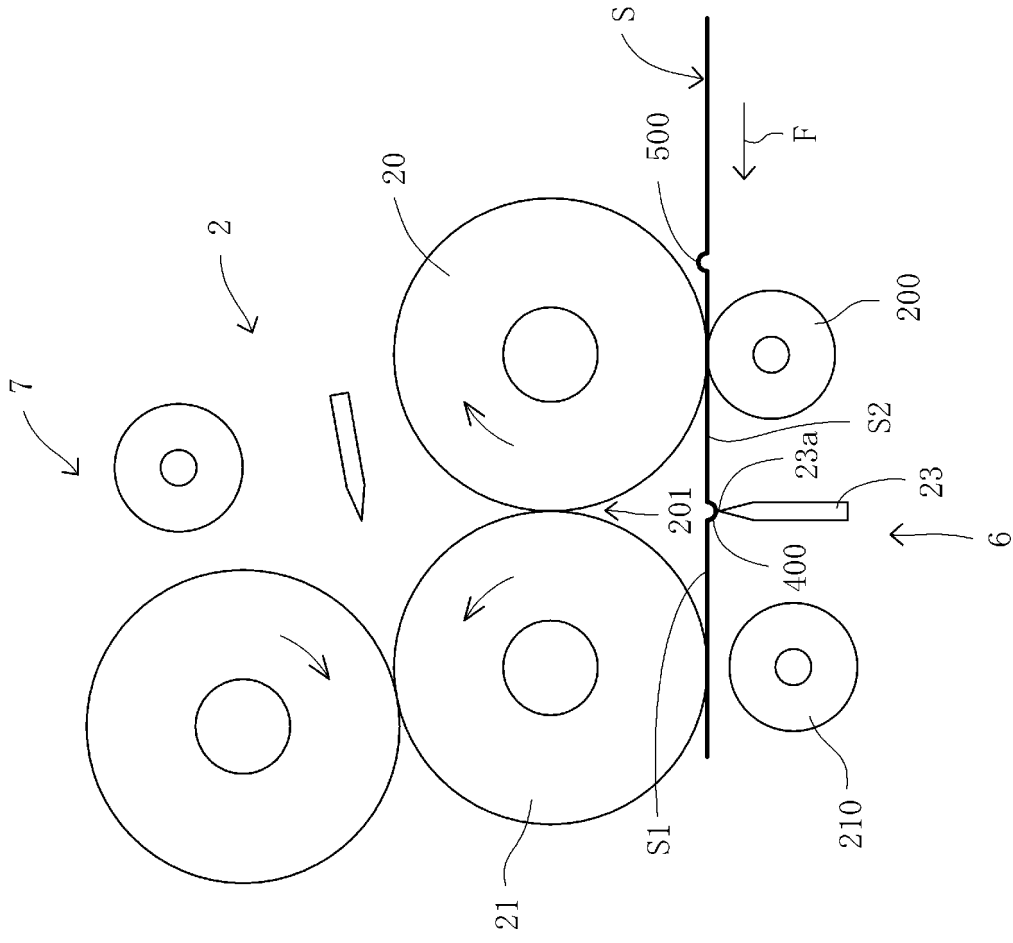


Fig. 4

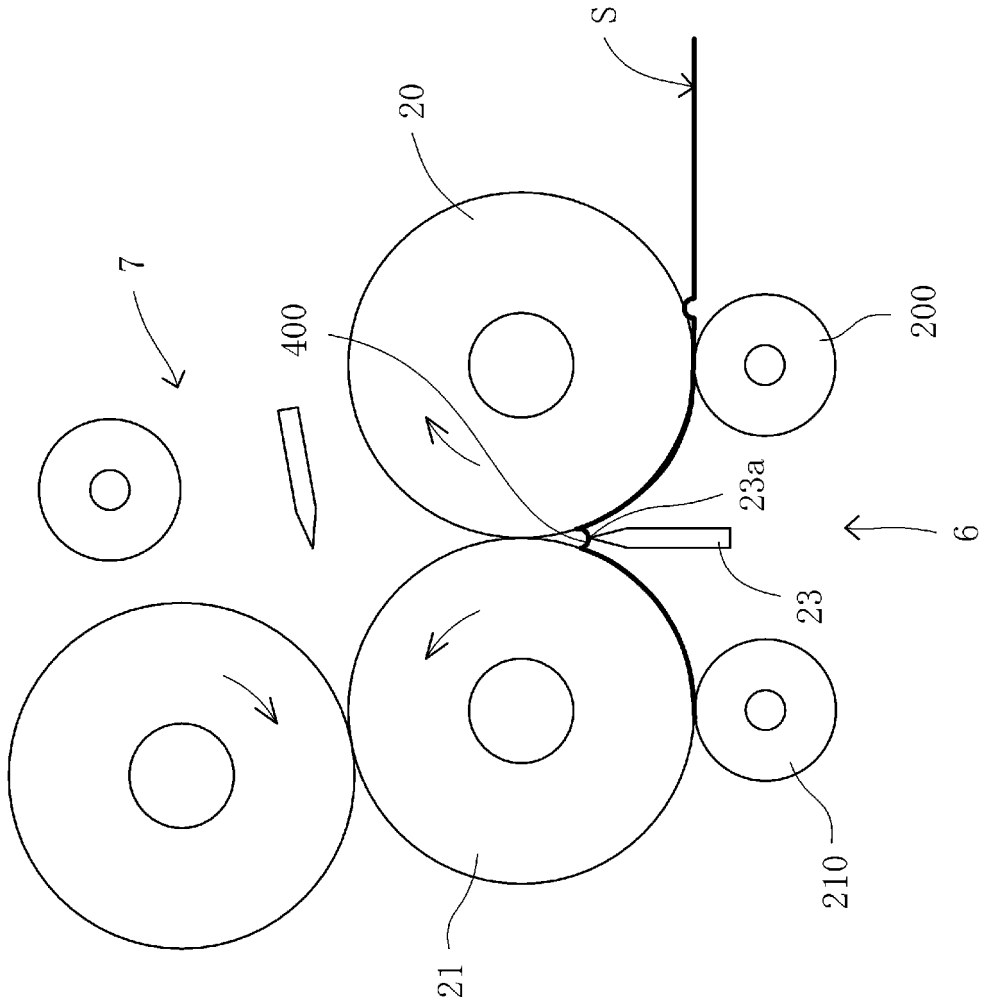


Fig. 5

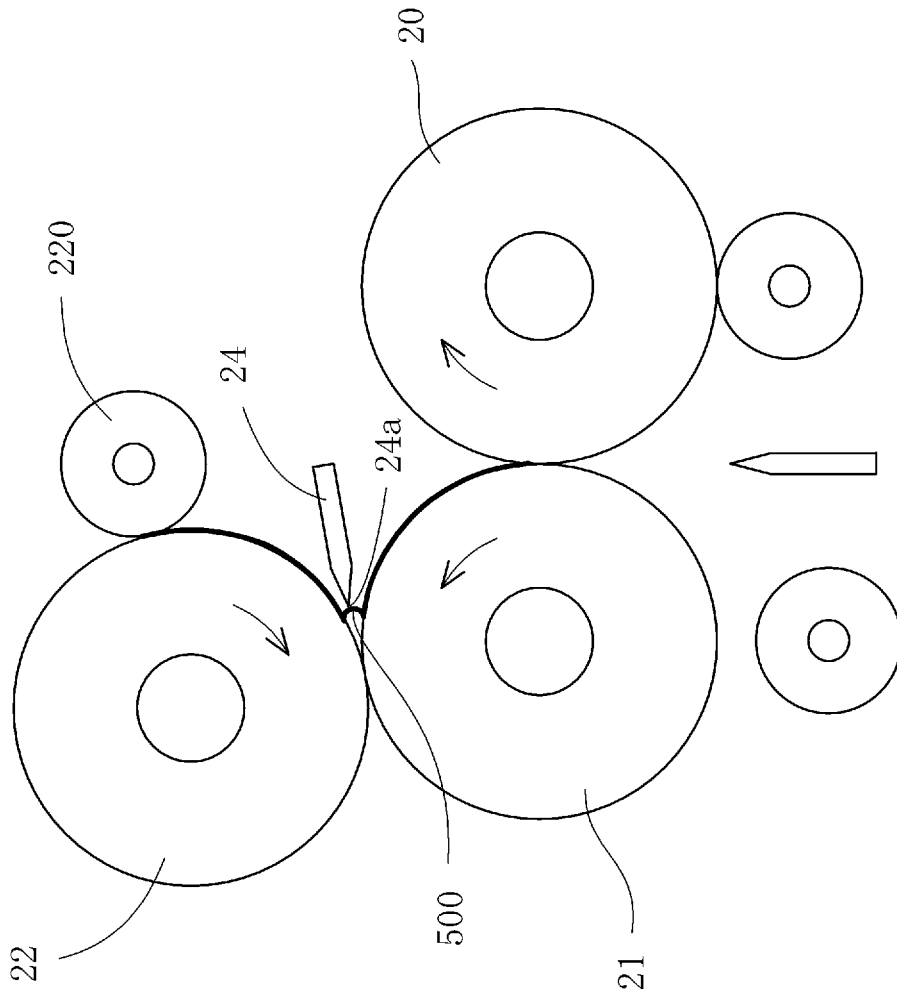


Fig. 7

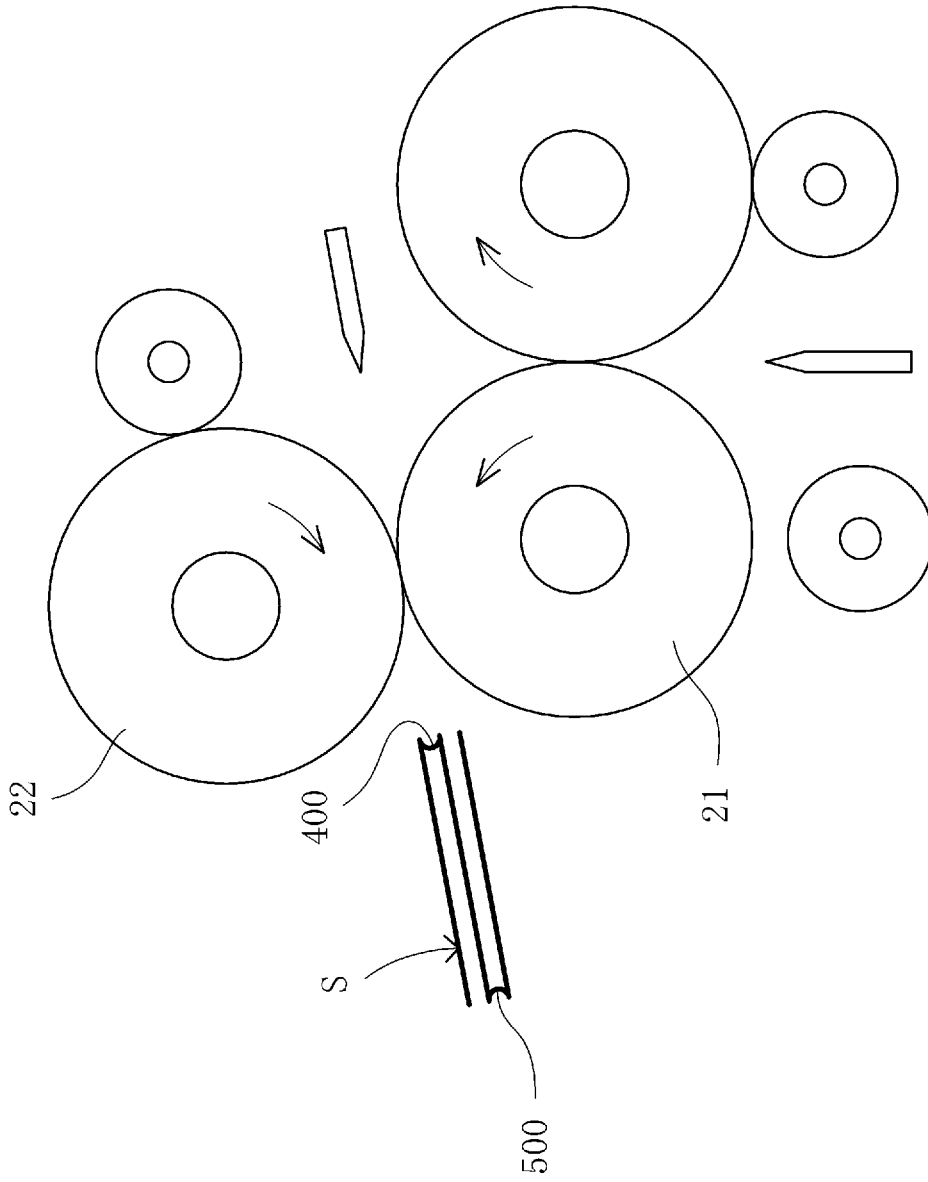


Fig. 8

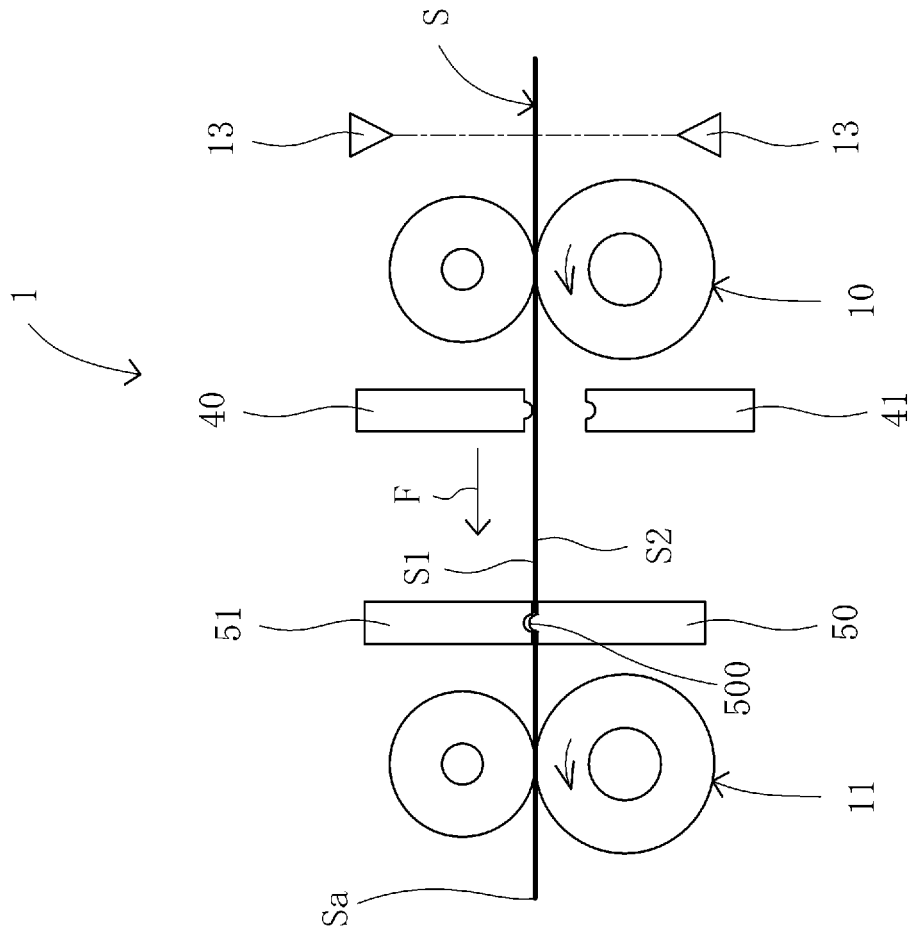


Fig. 9

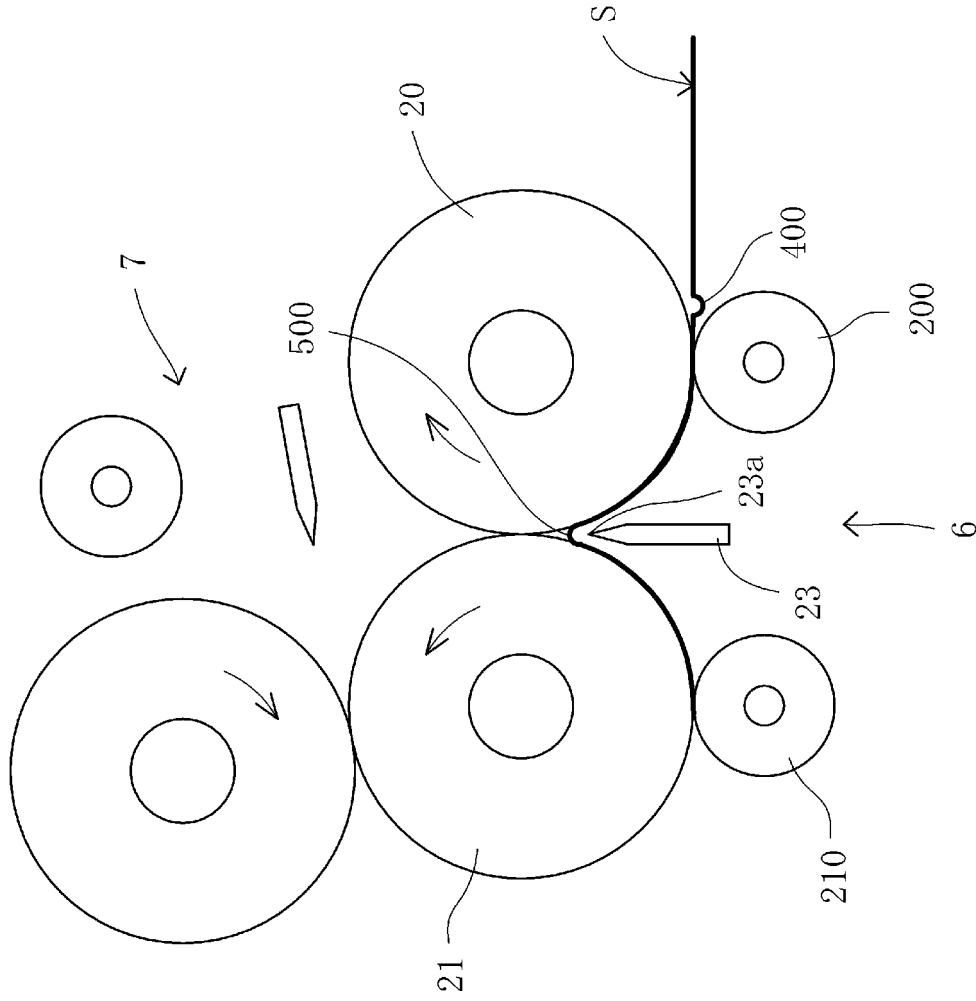


Fig. 12

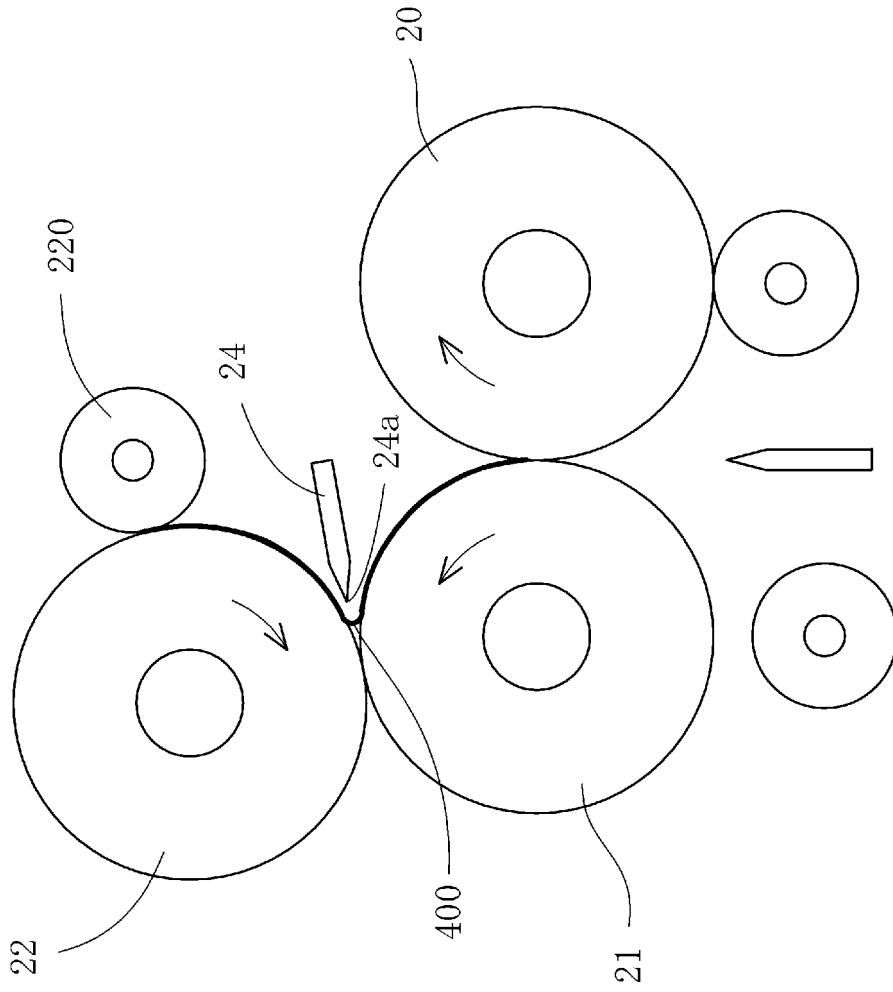


Fig. 14

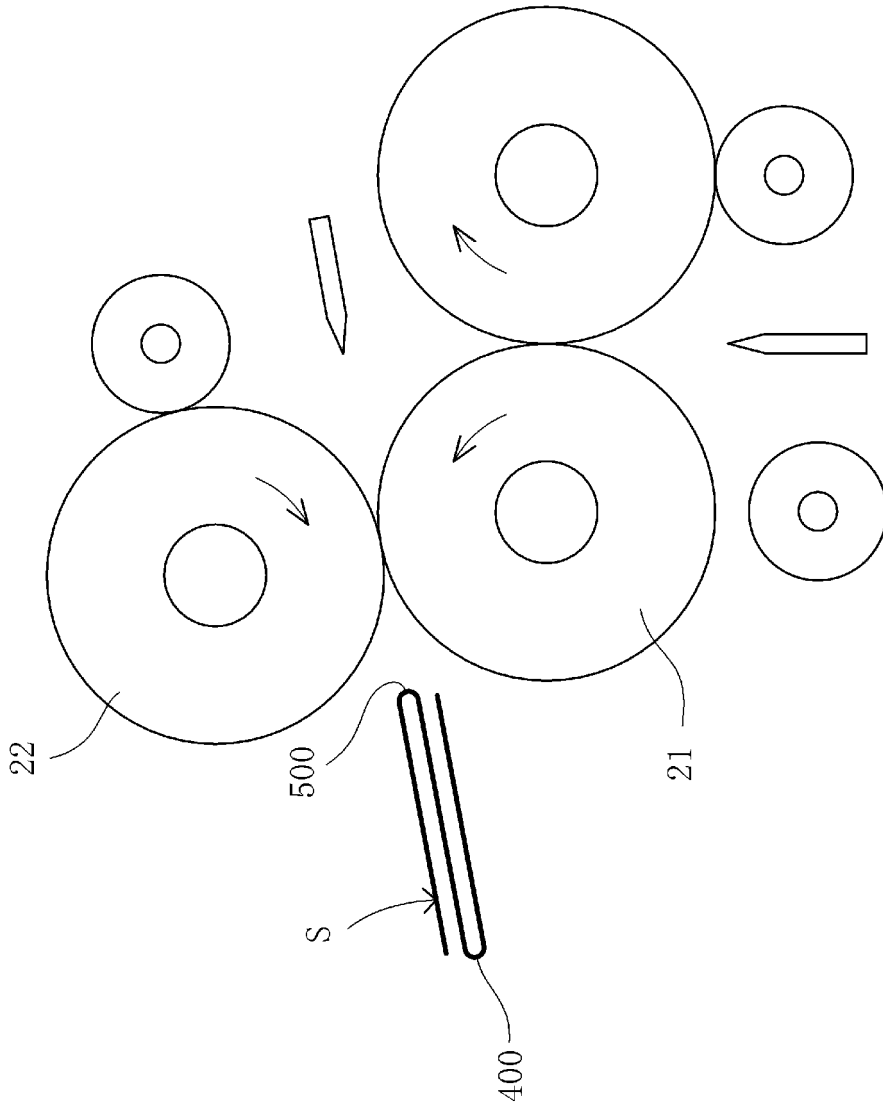
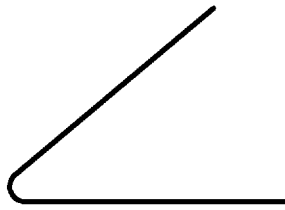


Fig. 15

(A)



(B)

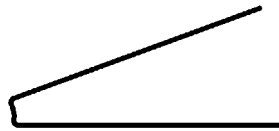


Fig. 16

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- EP 1425239 B [0009]
- DE 10118133 A1 [0009]