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(54) Intermediate cylinder for a sheet-feed press

(57) An intermediate cylinder for a sheet-feed press, in which a plurality of sheet gripping portions (16) are provided on a circumference, and a guide element constituting a cylinder portion for supporting a sheet is interposed between the sheet gripping portions. In the intermediate cylinder, each guide element is made up of a pair of guide plates (32a, 32b; 32c, 32d) having a shape which divides an arc connecting the sheet gripping portions (16) into two, and the base portions of the guide plates are supported near the sheet gripping portions (16) so as to be capable of swinging. Further, there is provided guide plate driving means for swinging the guide plates toward the center of the circumference to provide a function as a skeleton type intermediate cylinder (Fig 1) and for swinging the guide plates in the direction such that the guide plates go away from the center of the circumference to provide a function as a cylindrical type intermediate cylinder (Fig 2).

FIG.1

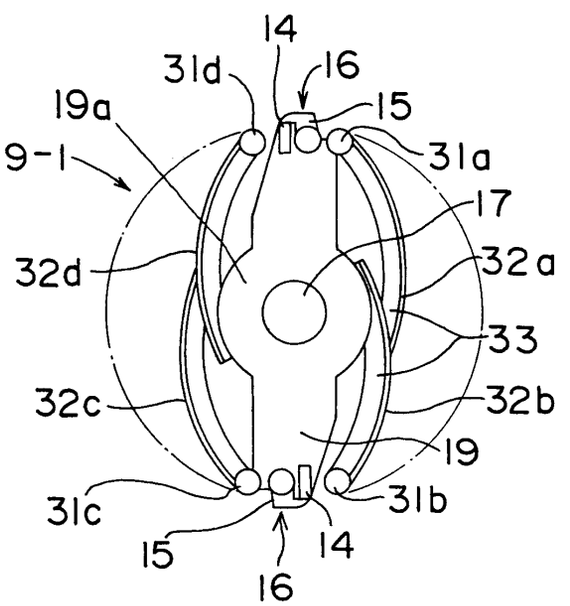

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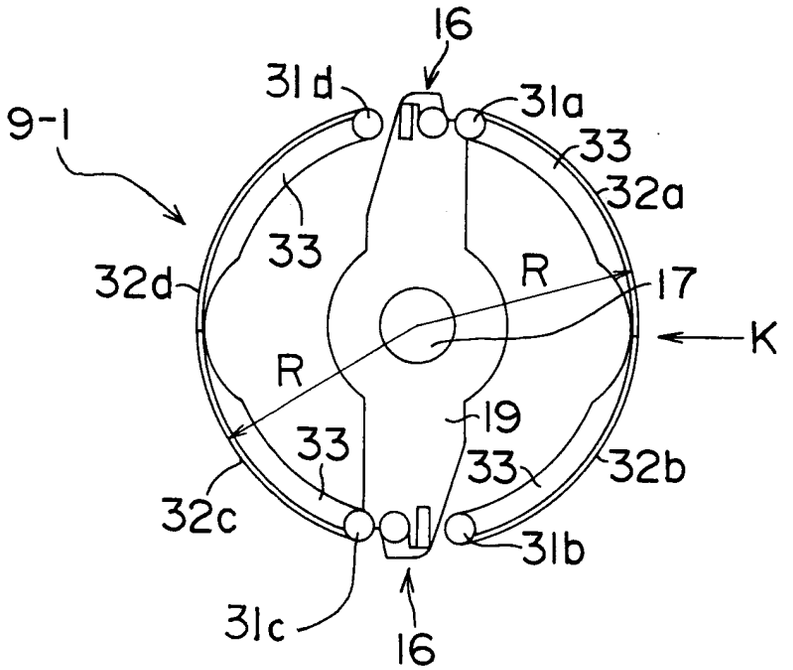
FIG.2



Description

[0001] The present invention relates to an intermediate cylinder for transferring sheets, which is provided on a sheet-feed press.

[0002] A typical sheet-feed press has a sheet feeding section 1, a plurality of sets of printing sections 2a to 2d, a sheet discharging section 3, and the like as principal elements as shown in Fig. 12 of the accompanying drawings.

[0003] On this sheet-feed press, sheets 4 stacked on a table in the sheet feeding section 1 are separated one from the other from the uppermost layer. After being delivered by means of a transport conveyor 5, the separated sheet is transferred to a feeding cylinder 6, and further sent to between a blanket cylinder 7a and an impression cylinder 8a in a first-stage printing section 2a, by which first color printing is performed.

[0004] The sheet 4 for which first color printing has been completed is sent out from between the blanket cylinder 7a and the impression cylinder 8a and transferred to an intermediate cylinder 9. Then, the sheet is sent from this intermediate cylinder 9 to between a blanket cylinder 7b and an impression cylinder 8b in a printing section 2b of the next stage, by which second color printing is performed.

[0005] Thereafter, multi-color printing is performed on the sheet 4 in succession by the printing sections 2c and 2d located at subsequent stages. The sheet 4, which is sent out from between a blanket cylinder 7d and an impression cylinder 8d in the printing section 2d at the final stage, is transferred to a chain conveyor 10 for sheet discharge to be sent to the sheet discharging section 3, and is stacked in succession on a table in a sheet stacking section 11.

[0006] The sheet 4 on which printing is performed by using the sheet-feed press is made of either of two materials: One material is paper, and the other is metal sheet or synthetic resin. The sheets made of paper include thin paper with a thickness of about 0.04 mm and thick paper with a thickness of about 1.0 mm.

[0007] Generally, a sheet made of thin paper has low rigidity. Therefore, for example, when the paper is sent from one printing section 2 to the printing section 2 at the next stage, fluttering occurs at the trailing edge of sheet. On the other hand, for a sheet with high rigidity, which is made of thick paper, metal sheet, etc., the trailing edge thereof is separated from the impression cylinder 8 by a centrifugal force caused by the rotation transfer and a restoring force for the bend of the sheet itself, and the sheet collides heavily with a sheet guide 12 provided under the intermediate cylinder 9. That is to say, there is a tendency for paper jerking to occur.

[0008] The fluttering and paper jerking cause contamination of printed surfaces and folds and flaws of sheets, thereby substantially decreasing the print quality. For this reason, to avoid this disadvantage, a skeleton type intermediate cylinder 9-A shown in FIG. 13 and a cylindrical type intermediate cylinder 9-B shown in FIG. 14, which have been known as a typical example of the intermediate cylinder 9, are used appropriately according to the property of sheet used frequently.

[0009] The skeleton type intermediate cylinder 9-A shown in FIG. 13 is mainly used for a sheet 4 made of thick sheet. This skeleton type intermediate cylinder 9-A has a publicly known bearer (not shown) at each end in the axial direction, and gripper pads 14 and a plurality of sets of grippers 15 are disposed between these bearers. The gripper pad 14 and the gripper 15 constitute a sheet gripping portion 16. Also, the bearers are connected to each other by a cylinder body 18 rotating around a shaft 17.

[0010] This skeleton type intermediate cylinder 9-A has a feature in that the contact of a printed surface of the sheet 4 is made as small as possible. The sheet 4 transferred by rotation can be bent from point P close to the gripper 15. That is to say, by increasing the distance from operation point P to the trailing edge of the sheet 4, the function of reducing the return reaction force of the sheet 4 is improved. According to this intermediate cylinder 9-A, the aforesaid paper jerking, in which the trailing edge of the sheet 4 comes impulsively into contact with the sheet guide provided under the intermediate cylinder, can be reduced. Consequently, flaws and folds of the sheet 4 are decreased.

[0011] However, conversely, for the intermediate cylinder 9-A of this type, the free zone of trailing edge of the transferred sheet 4 increases. Therefore, when the sheet 4 is made of thin paper, greater fluttering of the sheet occurs.

[0012] On the other hand, the cylindrical type intermediate cylinder 9-B shown in FIG. 14 is mainly used for a sheet 4 made of thin sheet. The intermediate cylinder 9-B of this type consists of a roll rotating around the shaft 17, and a plurality of sets of the grippers 15 opposed on the opposite sides of the shaft 17 are disposed in parallel in the lengthwise direction of the shaft 17.

[0013] This cylindrical type intermediate cylinder 9-B has a feature in that the area for supporting the sheet 4 is increased. The sheet 4 transferred by rotation is guided along the outer peripheral surface of the cylinder body 18 by the downstream side of the gripper 15. Therefore, the function of reducing fluttering of trailing edge of the sheet 4 is increased. Consequently, troubles such as wrinkles produced at the trailing edge of sheet and overlapping and damage caused by the fluttering of paper are decreased.

[0014] However, for the intermediate cylinder 9-B of this type, the free zone of the sheet 4 decreases. Therefore, when the sheet 4 is made of thick paper, stronger paper jerking occurs.

[0015] On a multi-color press, the sheet is supplied successively to the plurality of sets of printing sections 2 where different ink color is used, so that the transfer of sheet between the adjacent printing sections requires stability.

[0016] However, for the sheet 4 to be printed, the condition during transfer thereof varies greatly depending on the rigidity of the sheet. As described above, both of the aforementioned skeleton type intermediate cylinder 9-A and the cylindrical type intermediate cylinder 9-B, which are used as a general intermediate cylinder, are not ideal as a means for transferring a sheet 4 ranging from thin paper sheet to thick paper sheet reliably without any trouble. Therefore, when the specifications of the sheet 4 do not comply with the type of the intermediate cylinder, unstable sheet transfer produces troubles such as flaws, contamination, and folds of paper edge.

[0017] In effect, in the case where the sheet thickness changes significantly on the same sheet-feed press, even if either of the intermediate cylinders 9-A and 9-B is used, the whole range of paper thickness cannot be accommodated. For this reason, of the intermediate cylinders 9-A and 9-B, either one which is preferable in terms of frequency is obliged to be used, by which printing is actually performed neglecting the troubles such as overlapping and damage caused by the fluttering of the transferred sheet 4.

[0018] To solve the above problem, a double-size intermediate cylinder 9-C as shown in FIG. 15 has been proposed in recent years. This intermediate cylinder 9-C is based on the publicly known skeleton type. Specifically, the intermediate cylinder 9-C is configured so that two shafts 20a and 20b parallel to the shaft 17 are rotatably provided between a pair of bearers (not shown) fixed to both ends in the axial direction of the cylinder body 19, and the base end of a respective arcuate cover 21a, 21b is connected to each of the shafts 20a, 20b.

[0019] The shafts 20a and 20b are provided on the downstream side in the direction of rotation of the intermediate cylinder 9-C in such a manner as to be close to the sheet gripping portion 16, and are positioned symmetrically with respect to the shaft 17. The arcuate covers 21a,21b are bent so as to have a radius of curvature R (see FIG. 16) substantially corresponding to the radius of movement path of sheet gripping point P1 at the sheet gripping portion 16.

[0020] In the intermediate cylinder 9-C constructed as described above, when the shafts 20a and 20b are turned by using a driving means (not shown), a state in which the arcuate covers 21a and 21b are stored towards the axis as shown in Fig. 15 and a state in which the arcuate covers 21a and 21b are spread out in the radial direction as shown in FIG. 16 are achieved.

[0021] If the arcuate covers 20a and 20b are in the stored towards the engine state as shown in Fig. 15, the same effect as that of the intermediate cylinder 9-A shown in Fig. 13 can be achieved. That is to say, an impact caused by the upward movement of trailing edge of the sheet produced at the time of printing of thick paper sheet can be reduced.

[0022] Also, if the arcuate covers 20a and 20b are spread out, the sheet 4 can be conveyed while being supported on the surfaces of the arcuate covers 20a and 20b, so that fluttering of the sheet produced at the time of printing of thin paper sheet can be decreased.

[0023] Thus, the intermediate cylinder 9-C of this type can be used for both thick paper sheet and thin paper sheet.

[0024] However, this intermediate cylinder 9-C, which is configured so that one arcuate cover 21a, 21b positioned at each side is operated so as to be spread and stored, has the following problems:

(1) As shown in FIG. 17, when the arcuate covers 20a and 20b are stored so as to have the function as the skeleton type intermediate cylinder, a space (indicated by arrow F) formed between the surface of the arcuate cover 21a, 21b and the rotation path of sheet holding point P1 of the sheet gripping portion 16 cannot be made large. Therefore, at the time of printing of thick paper sheet 4, an impact caused by the upward movement of the trailing edge of the sheet 4 transferred to the impression cylinder 8 cannot be avoided fully.

(2) When the arcuate covers 20a and 20b are stored, in order to increase the aforesaid space (portion F in FIG. 17), it is necessary only that the spread length (arc length) of the arcuate cover 21a, 21b be shortened. In this case, however, a circle breaking portion (portion G in FIG. 16) formed when the arcuate covers 20a and 20b are spread increases. Therefore, the support range for thin paper sheet becomes smaller so that the trailing edge of the unsupported sheet flutters, causing wrinkles, damage, etc.

[0025] Thus, the above-described intermediate cylinder 9-C has both the function as the skeleton type intermediate cylinder used for thick paper sheets and the function as the cylindrical type intermediate cylinder used for thin paper sheets, but it cannot be said that either function is sufficiently satisfactory. Therefore, there has been a strong demand for a versatile intermediate cylinder which can stably transfer sheets ranging from thin paper sheet to thick paper sheet.

[0026] The present invention has been made in view of the above situation, and accordingly an object thereof is to provide an intermediate cylinder for a sheet-feed press, which can transfer a sheet stably regardless of the rigidity of sheet.

[0027] According to a first mode of the invention, there is provided an intermediate cylinder for a sheet-feed press, in which a plurality of sheet gripping portions are provided on a circumference, and guide elements constituting a cylinder portion for supporting a sheet are interposed between the sheet gripping portions, wherein each guide element is made up of a pair of guide plates having a shape which divides an arc connecting the sheet gripping portions into two, and the base portions, of the guide plates are supported near the sheet gripping portions so as to be capable of swinging, and further,

there is provided guide plate driving means for swinging the guide plates toward the center of the circumference to provide a function as a skeleton type intermediate cylinder and for swinging the guide plates in the direction such that the guide plates go away from the center of the circumference to provide a function as a cylindrical type intermediate cylinder.

[0028] According to a second mode of the invention, in the first mode of the invention, the guide plate driving means has a drive element provided individually for each of the guide plates.

[0029] According to a third mode of the invention, in the second mode of the invention, the drive element has a spring for urging the corresponding guide plate to one direction and an actuator for urging the same to the other direction.

[0030] According to a fourth mode of the invention, in the first mode of the invention, the guide plate driving means has a drive element for applying a swinging force to one guide plate of the guide plates and a power transmission element for moving the other guide plate following the one guide plate.

[0031] According to a fifth mode of the invention, in the fourth mode of the invention, the drive element has power converting means for converting the rotational power of a rotation actuator and the actuator into the swinging force and a link in which the power transmission element transmits the motion of the one guide plate to the other guide plate.

[0032] According to a sixth mode of the invention, in the first mode of the invention, there is provided a stopper member for regulating the swinging position of each of the guide plates on the side of the center of the circumference, so that the inside surface of one guide plate coming into contact with the stopper member is formed so as to be capable of being brought into close contact with the contact surface of the stopper member, and the inside surface of the other guide plate is formed so as to be capable of being brought into close contact with the outside surface of the one guide plate in contact with the stopper member.

[0033] According to a seventh mode of the invention, in the first mode of the invention, the swinging end portion of each of the guide plate is formed into a comb tooth shape to avoid interference between the swinging end portions of the guide plates.

[0034] According to a eighth mode of the invention, in the seventh mode of the invention, there is provided a stopper member for regulating the swinging position of each of the guide plates on the side of the center of the circumference, so that the inside surface of the guide plate is formed so as to be capable of being brought into close contact with the surface of the stopper member.

[0035] According to the present invention, when the guide plates are swung to the center side to set the intermediate cylinder as a skeleton type intermediate cylinder, a space formed between the surface of the guide plate and the rotation path of sheet holding portion at the sheet gripping portion 16 can be made large. Therefore, at the time of printing of a thick paper sheet, an impact caused by the upward movement of the trailing edge of the sheet transferred to an impression cylinder is avoided fully, so that damage to paper surface can be prevented.

[0036] Also, when the guide plates are spread in a direction such that the guide plates go away from the center to set the intermediate cylinder as a cylindrical type intermediate cylinder, a guide surface for sheet can be formed over the substantially whole region in the circumferential direction except the sheet gripping portion. Therefore, at the time of printing of a thin paper sheet, the whole paper range of the sheet transferred to the impression cylinder can be supported by the guide surface. Thereby, the fluttering of the trailing edge of sheet is eliminated, so that the occurrence of printing troubles such as wrinkles, flaws, and overlapping can be prevented.

[0037] That is to say, merely by changing the setting of the guide plates, the skeleton type intermediate cylinder and the cylindrical type intermediate cylinder can easily be changed over. Therefore, even when sheets of various rigidities such as thick paper sheets and thin paper sheets are used in printing, a problem of the occurrence of damage, contamination, etc. on the printed surface is eliminated, so that high-quality printed matters can be manufactured.

[0038] The invention is described further hereinafter, by way of example only, with reference to the accompanying drawings, in which:-

FIG. 1 is a schematic view of an intermediate cylinder in accordance with the present invention, showing a state in which guide plates are stored;

FIG. 2 is a schematic view showing a state in which the guide plates of the intermediate cylinder shown in FIG. 1 are spread out;

FIG. 3 is a view taken in the direction of arrow K of FIG. 2;

FIG. 4 is a schematic view showing a state in which a thick paper sheet is transferred to an impression cylinder;

FIG. 5 is a schematic view typically showing a driving mechanism for the guide plate;

FIG. 6 is a side view of the driving mechanism for the guide plate;

FIG. 7 is a view taken in the direction of arrow B of FIG. 5;

FIG. 8 is a schematic view of a guide plate having a tip end portion formed into a comb tooth shape;

FIG. 9 is a schematic view of an intermediate cylinder in accordance with another embodiment of the present invention, showing a state in which guide plates are stored;

FIG. 10 is a schematic view showing a state in which the guide plates of the intermediate cylinder shown in FIG. 9 are spread out;

FIG. 11 is a sectional view taken along the line X-X of FIG. 9;
FIG. 12 is a schematic view typically showing a configuration of a sheet-feed press;
FIG. 13 is a schematic view typically showing a conventional skeleton type intermediate cylinder;
FIG. 14 is a schematic view typically showing a conventional cylindrical type intermediate cylinder;
FIG. 15 is a schematic view showing a state in which guide plates of a conventional double-size intermediate cylinder are stored;
FIG. 16 is a schematic view showing a state in which the guide plates of the intermediate cylinder shown in FIG. 15 are spread out; and
FIG. 17 is a schematic view showing a state in which a thick paper sheet is transferred to an impression cylinder by the intermediate cylinder shown in FIG. 15.

[0039] Embodiments of the present invention will be described below with reference to the accompanying drawings. In the drawings used for the following description, the same reference numerals are applied to the same elements as those of the conventional intermediate cylinder shown in FIGS. 15 to 17.

[0040] FIGS. 1 and 2 show an intermediate cylinder 9-1 for a sheet-feed press in accordance with the present invention. This intermediate cylinder 9-1 is based on the configuration of a publicly known skeleton type intermediate cylinder without a cylindrical cylinder.

[0041] As shown in FIG. 3, which is a view taken in the direction of arrow K of FIG. 2, the intermediate cylinder 9-1 has a bearer 30 at each end in the axial direction thereof, and four shafts 31a to 31d are provided between the bearers 30. The shafts 31a to 31d are rotatably mounted at positions close to sheet gripping portions 16 consisting of a gripper pad 14 and a gripper 15 in such a manner as to lie parallel to a shaft 17.

[0042] The intermediate cylinder of this example has the function of a double-size intermediate cylinder in which the shape of cylinder changes. The set of shafts 31a and 31b and the set of shafts 31c and 31d, which are positioned on the opposite sides in the circumferential direction of a pair of sheet gripping portions 16, form respective pairs.

[0043] The base ends of the arcuate guide plates 32a to 32d are fixed to the shafts 31a to 31d, respectively. The arcuate guide plates 32a to 32d are bent so as to have a radius of curvature R substantially corresponding to the radius of movement path (circumference) of the sheet gripping points at the sheet gripping portions 16. That is to say, the guide plates 32a to 32d have a shape such that a cylinder with a radius R is divided in the circumferential direction.

[0044] The arcuate guide plates 32a to 32d are provided with ribs 33 for increasing the rigidity thereof, and are coupled to the shafts 31a to 31d via the ribs 33.

[0045] According to the intermediate cylinder 9-1 constructed as described above, by swinging the guide plates 32a to 32d around the shafts 31a to 31d, a state in which the guide plates 32a to 32d are stored towards the axis as shown in FIG. 1 and a state in which the guide plates 32a to 32d are spread out in the radial direction as shown in FIG. 2 can be set. In the state shown in FIG. 2, the guide plates 32a to 32d form a cylindrical body.

[0046] When the spread guide plates 32a to 32d are stored towards the axis side as shown in FIG. 1, the total outer peripheral length of the guide plate 32 ranging from the shaft 31a to the shaft 31b or ranging from the shaft 31c to the shaft 31d becomes shorter than that when spread out as a result of the construction.

[0047] Therefore, in changing the setting, in order to avoid interference between the swinging end portions of the guide plates 32a and 32b and between the swinging end portions of the guide plates 34c and 32d, the operation is performed so that one guide plate, for example, the guide plate 32b is swung before the guide plate 32a is stored, and the guide plate 32d is swung before the guide plate 32c is stored.

[0048] The storage positions of the guide plates 32a to 32d are regulated by an internal cylinder portion 19a of a cylinder body 19 functioning as a stopper member. Therefore, the inside surfaces of the guide plates 32b, 32d are formed so as to be brought into close contact with an arcuate contact surface of the internal cylinder portion 19a, and the inside surfaces of the guide plates 32a, 32c are formed so as to be brought into close contact with the arcuate outside surfaces of the guide plates 32b, 32d which are in contact with the cylinder portion 19a, by which the guide plates 32a to 32d are positioned closer to the side of the cylinder body 19.

[0049] FIG. 5, FIG. 6, and FIG. 7, which is an enlarged view taken in the direction of arrow B of FIG. 5, typically show a driving mechanism for the guide plates 32. For this driving mechanism, a respective ratchet 34 and an arm 35 are fixed to the end portion of each shaft 31, and the tensile force of an extension spring 36 is applied to one end of the arm 35. Also, a claw member 38 is supported on the bearer 30 via a shaft 37 to act on the ratchet 34.

[0050] In FIG. 7, when the rear end portion of the claw member 38a is pushed by an air cylinder 40a, the claw portion of the claw member 38a comes out of the ratchet 34a. Thereby, the shaft 31a is rotated counterclockwise by the tensile force of the extension spring 36a, so that the guide plate 32a is swung in the same direction.

[0051] The other guide plates 32b to 32d are also swung in the same manner, by which the guide plates 32a to 32d are spread into a cylindrical form.

[0052] On the other hand, air cylinders 41a to 41d are disposed on the outer peripheral sides of the guide plates 32a to 32d, respectively. When one of the air cylinders 41 is extended to push the associated guide plate 32, the guide plate 32 is swung toward the axis of the shaft 17 and stored as shown in FIG. 1. The air cylinders

40 and 41 are supported by a frame 39. Also, the air cylinders 40 and 41 are supplied with driving air from an air supply device 42.

[0053] As described above, the intermediate cylinder 9-1 of this embodiment is based on the skeleton type intermediate cylinder as shown in FIG. 13. Specifically, the shafts 31a to 31d are provided between the bearers 30, and the guide plates 32a to 32d are supported by the shafts 31a to 31d so as to swing.

[0054] Therefore, by swinging the guide plate 32a to 32d around the shafts 31a to 31d, the guide plates 32a to 32d can be spread out in the radial direction of the intermediate cylinder 9-1 or can be stored against the side of the shaft 17 of the intermediate cylinder 9-1.

[0055] Moreover, since the configuration is such that the pair of the arcuate guide plates 32a and 32b and the pair of arcuate guide plates 32c and 32d are disposed on opposite sides of the sheet gripping portion 16, the following effects can be achieved.

(1) As shown in FIG. 4, when the arcuate guide plates 32a to 32d are stored to set the intermediate cylinder 9-1 as a skeleton type intermediate cylinder, a space (portion F in FIG. 4)) formed between the surface of the arcuate guide plates 32 and the rotation path of sheet holding portion at the sheet gripping portion 16 can be made large.

As a result, at the time of printing of a thick paper sheet 4, an impact caused by the upward movement of the trailing edge of the sheet transferred to an impression cylinder 8 is avoided fully, so that damage to the paper surface can be prevented.

(2) When the arcuate guide plates 32a to 32d are spread to set the intermediate cylinder 9-1 as a cylindrical type intermediate cylinder, a guide surface for sheets can be formed over substantially the whole region in the circumferential direction except the sheet gripping portion 16. Therefore, at the time of printing of a thin paper sheet, the whole paper range of the sheet 4 transferred to the impression cylinder 8 can be supported by the guide surface. Thereby, fluttering of the trailing edge of sheet is eliminated, so that the occurrence of printing troubles such as wrinkles, flaws, and overlapping can be prevented.

[0056] That is to say, according to the above-described intermediate cylinder 9-1, merely by changing the setting of the guide plates 32, the skeleton type intermediate cylinder described in item (1) and the cylindrical type intermediate cylinder described in item (2) can easily be changed over. Therefore, even when sheets of various rigidities such as thick paper sheets and thin paper sheets are used in printing, the prior problem of the occurrence of damage, contamination, etc. on the printed surface is eliminated, so that high-quality printed matters can be manufactured.

[0057] Although the tip end portions of the guide plates 32a, 32b (32c, 32d) are formed straight as shown in FIG. 3, it can be formed into a comb tooth shape as shown in FIG. 8. In this case, the comb teeth of the guide plate 32a (32c) and those of the guide plate 32b (32d) are formed so as to be alternate.

[0058] According to this configuration, when the guide plates 32a to 32d are stored as shown in FIG. 1, the comb teeth of the guide plates 32a and 32b (32c and 32d) pass each other, so that interference between the swinging end portions of the guide plates 32a and 32b (32c and 32d) is avoided. Consequently, both of the guide plates 32a and 32b (32c and 32d) can be brought into contact with the cylinder body 19. This contributes to the increase in the size of portion F shown in FIG. 4.

[0059] When both of the guide plates 32a and 32b (32c and 32d) are brought into contact with the cylinder body 19 by providing the comb teeth as described above, both of the inside surfaces of the tip end portions of the guide plates 32a and 32b (32c and 32d) are formed so as to be in close contact with the cylinder surface of the cylinder body 19.

[0060] When the comb teeth are not provided, as described above, after one of the guide plates 32a and 32b (32c and 32d) has been stored, the other guide plate must be stored. However, when the comb teeth are provided, the guide plates 32a and 32b (32c and 32d) can be stored at the same time. Therefore, the time taken for storage can be shortened.

[0061] FIGS. 9 and 10 are schematic views showing another embodiment of an intermediate cylinder for a sheet-feed press in accordance with the present invention. Also, FIG. 11 is a sectional view taken along the line X-X of FIG. 9.

[0062] In this intermediate cylinder 9-2, instead of the construction in which the guide plate 32 is swung by the shaft 31 as shown in FIG. 1, a drive rod 43 (see FIG. 11) is additionally provided, and the rotational force of the drive rod 43 is applied to the guide plate 32 via a link or the like, by which the guide plate 32 is swung.

[0063] The intermediate cylinder 9-2 is provided with arcuate guide plates 32a' to 32d' which are supported by shafts 31a' to 31d', respectively, so as to swing. These shafts 31a' to 31d' and the arcuate guide plates 32a' to 32d' correspond to the shafts 31a to 31d and the arcuate guide plates 32a to 32d.

[0064] The drive rod 43 is inserted in a rotary actuator 46 fixed to a cylinder body 45. Therefore, the drive rod 43 is rotated by the operation of the rotary actuator 46.

[0065] One end of a link 47 is fixed to the drive rod 43. The other end of the link 47 is pivotally mounted to one end of a link 49 via a pin 48. The other end of the link 49 is pivotally mounted to the guide plate 32a' via a pin 50. The above is a description of driving elements for the guide plate 32a', and the driving elements for the guide plate 32d' are configured in the same way.

[0066] On the other hand, the tip end portions of the guide plates 32a' and 32b' are connected to each other via a link 51 and pins 52 and 53, and the tip end portions

of the guide plates 32c' and 32d' are connected to each other in the same way.

[0067] An air hole 54 is formed at one end portion of the cylinder body 45. One end of the air hole 54 is connected to an air source (not shown) via a rotary joint 55 and a pipe 56, and the other end thereof is connected to the rotary actuator 46 via a pipe 57.

[0068] When pressurized air is supplied to the rotary actuator 46 via the air hole 54, the actuator 46 is operated to turn the drive rod 43, so that the guide plates 32a' and 32c' are swung via the links 47 and 49.

[0069] The swinging motions of the guide plates 32a' and 32c' are transmitted to the guide plates 32b' and 32d' via the link 51, by which the guide plates 32b' and 32d' are also swung following the swinging motions of the guide plates 32a' and 32c'.

[0070] According to the intermediate cylinder 9-2 of this embodiment, the same effects and operation as those of the intermediate cylinder 9-1 shown in FIG. 1 can be achieved. Also, the driving mechanism for the guide plates 32a' to 32d' can be made simple, and the mechanical stability of the guide plates 32a' to 32d' when the skeleton type intermediate cylinder is set and when the cylindrical type intermediate cylinder is set is enhanced.

Claims

1. An intermediate cylinder for a sheet-feed press, in which a plurality of sheet gripping portions (16) are provided on the circumference, and guide elements constituting cylinder portions for supporting a sheet are interposed between said sheet gripping portions (16), characterized in that

   each said guide element is made up of a pair of guide plates (32a, 32b; 32c, 32d) having a shape which divides an arc connecting said sheet gripping portions (16) into two, and the base portions of the guide plates are supported near said sheet gripping portions (16) so as to be capable of swinging, and
   further, there is provided guide plate driving means for swinging said guide plates (32a, 32b; 32c, 32d) toward the center of said circumference to provide a function as a skeleton type intermediate cylinder and for swinging said guide plates (32a, 32b; 32c, 32d) in a direction such that said guide plates go away from the center of said circumference to provide a function as a cylindrical type intermediate cylinder.

2. An intermediate cylinder for a sheet-feed press according to claim 1, wherein said guide plate driving means has a respective drive element provided individually for each of said guide plates (32a to 32d).

3. An intermediate cylinder for a sheet-feed press according to claim 2, wherein each said drive element has a spring (36) for urging the corresponding guide plate to one direction and an actuator (41) for urging the same to the other direction.

4. An intermediate cylinder for a sheet-feed press according to claim 1, wherein said guide plate driving means has a drive element (47) for applying a swinging force to one guide plate (32a'; 32c') of said guide plates and a power transmission element (51) for moving the other guide plate (32b', 32d') following the one guide plate.

5. An intermediate cylinder for a sheet-feed press according to claim 4, wherein said drive element has power converting means for converting the rotational power of a rotation actuator (46) and said actuator into said swinging force and a link in which said power transmission element (51) transmits the motion of said one guide plate to the other guide plate.

6. An intermediate cylinder for a sheet-feed press according to claim 1, wherein there is provided a stopper member (19) for regulating the swinging position of each of said guide plates on the side of the center of said circumference, so that the inside surface of one guide plate coming into contact with said stopper member is formed so as to be capable of being brought into close contact with the contact surface of said stopper member, and the inside surface of the other guide plate is formed so as to be capable of being brought into close contact with the outside surface of said one guide plate in contact with said stopper member.

7. An intermediate cylinder for a sheet-feed press according to claim 1, wherein the swinging end portion of each of said guide plate is formed into a comb tooth shape to avoid interference between the swinging end portions of said guide plates.

8. An intermediate cylinder for a sheet-feed press according to claim 7, wherein there is provided a stopper member for regulating the swinging position of each of said guide plates on the side of the center of said circumference, so that the inside surface of said guide plate is formed so as to be capable of being brought into close contact with the surface of said stopper member.

FIG.1

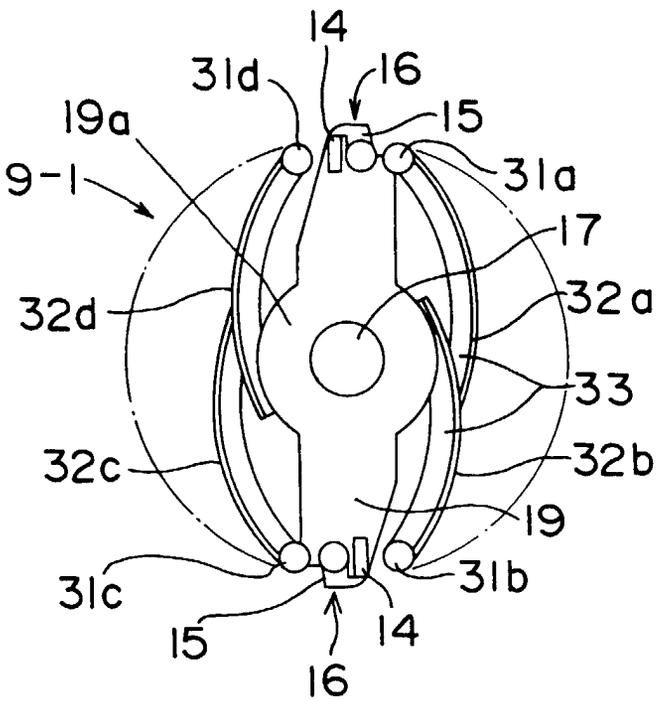

14
31d
16
19a
15
9-1
31a
17
32d
32a
33
32c
32b
19
31c
31b
15
14
16

FIG.2

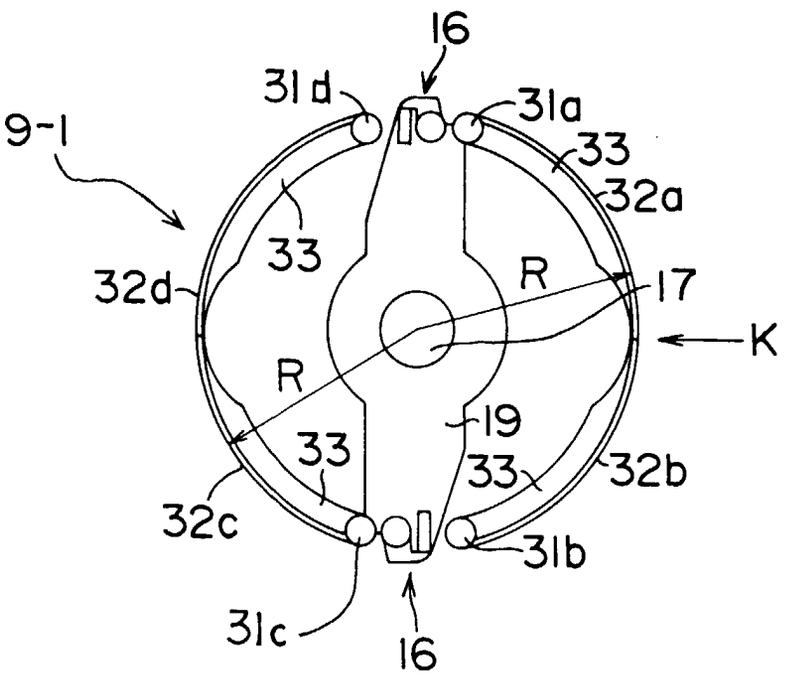

16
31d
31a
9-1
33
32a
33
R
32d
17
K
R
19
33
33
32b
32c
31b
31c
16

FIG. 3

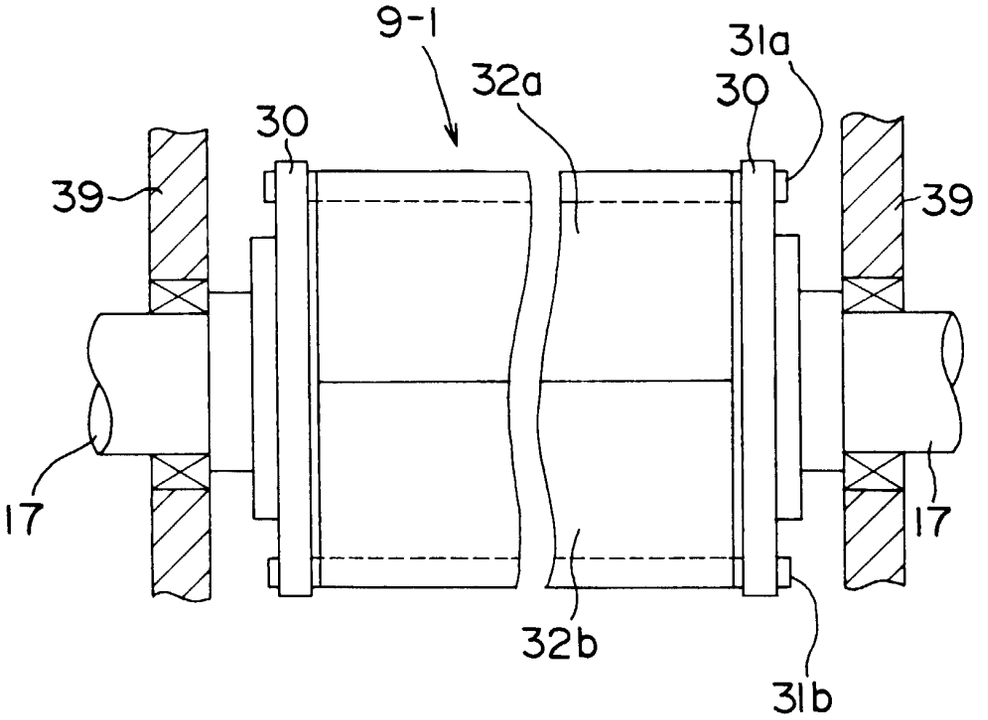
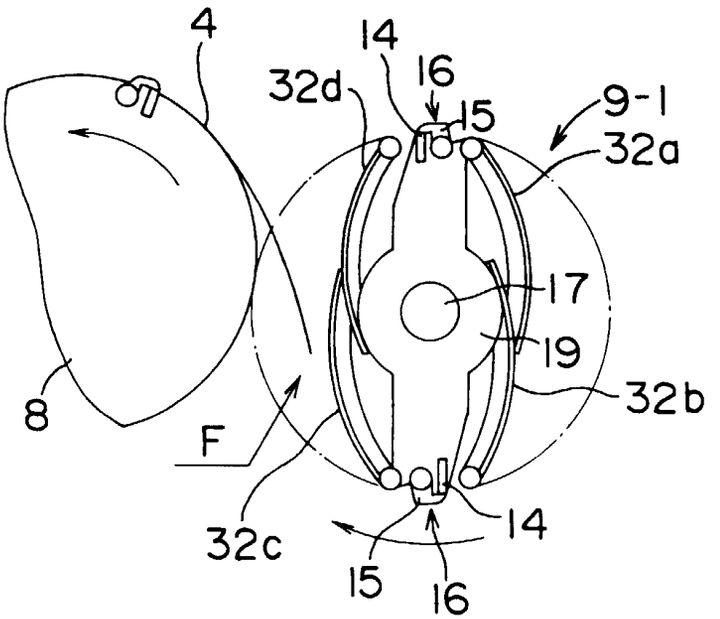

9-1
32a
31a
30
30
39
39
17
17
32b
31b

FIG. 4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14
16
32d
15
9-1
32a
17
19
32b
8
F
32c
15
16
14

FIG.5

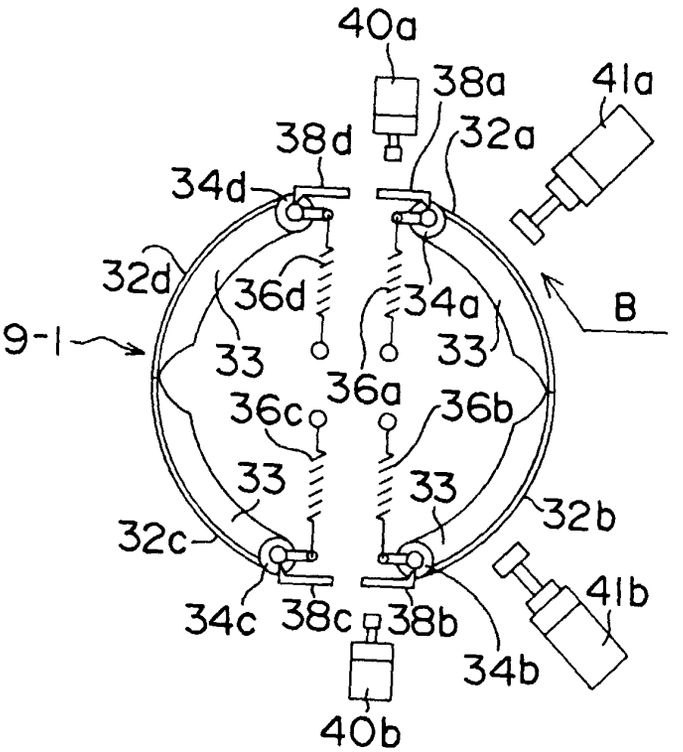

40a
38a
41a
38d
32a
34d
32d
36d
34a
B
9-1
33
33
36a
36c
36b
33
33
32b
32c
41b
34c
38c
38b
34b
40b

FIG.6

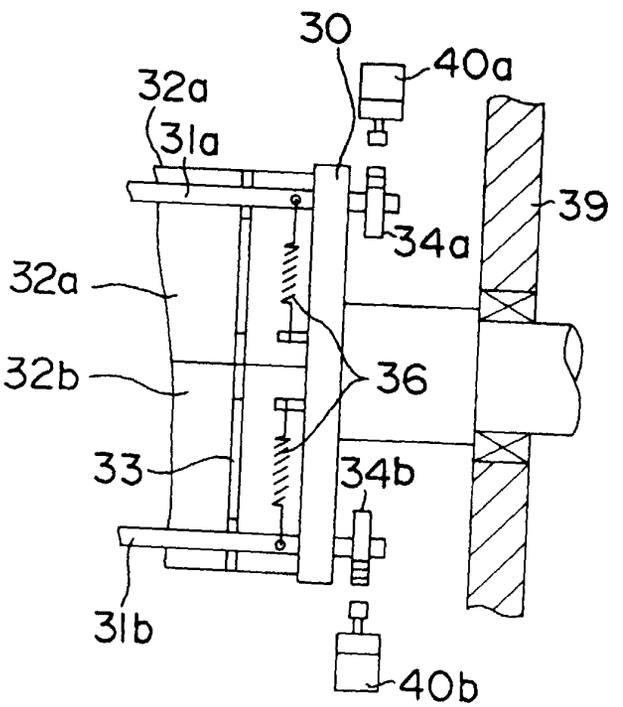

30
40a
32a
31a
39
34a
32a
32b
36
33
34b
31b
40b

FIG.7

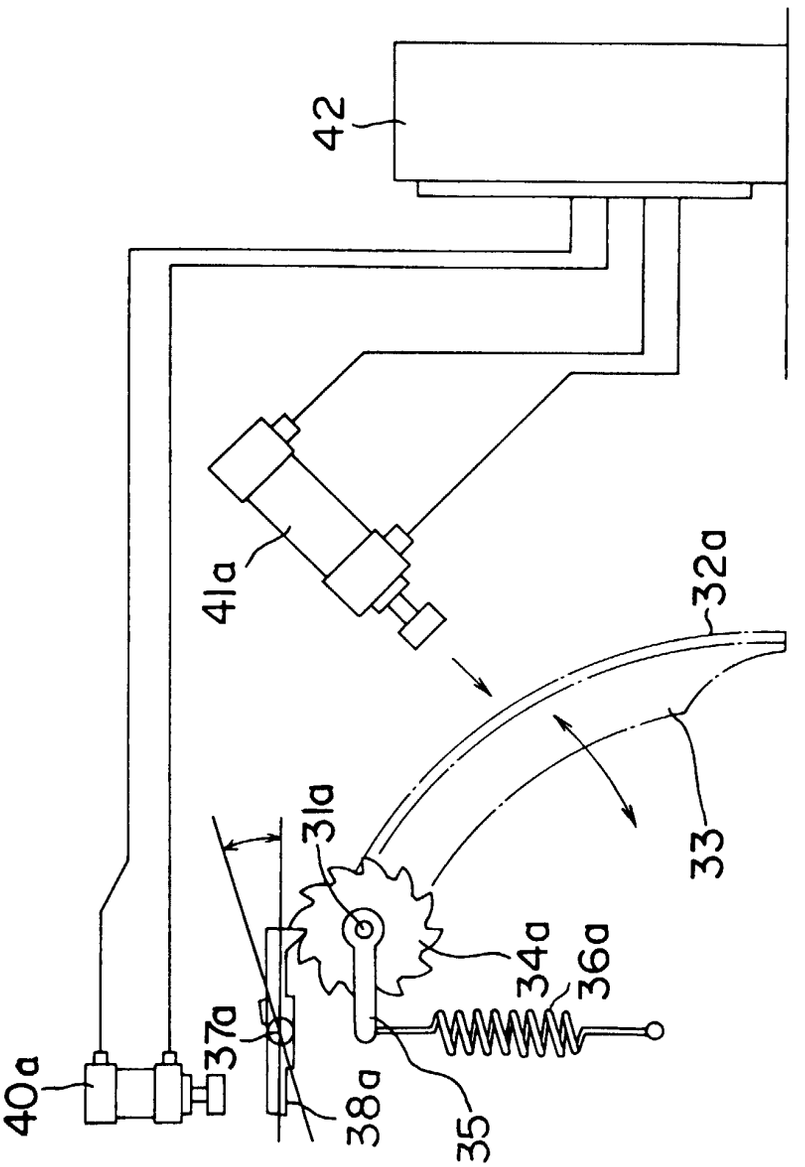


FIG.8

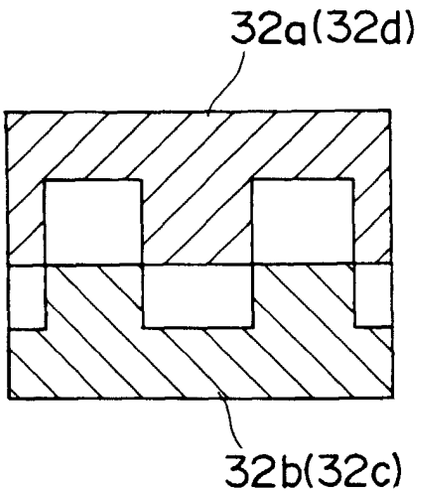


FIG.9

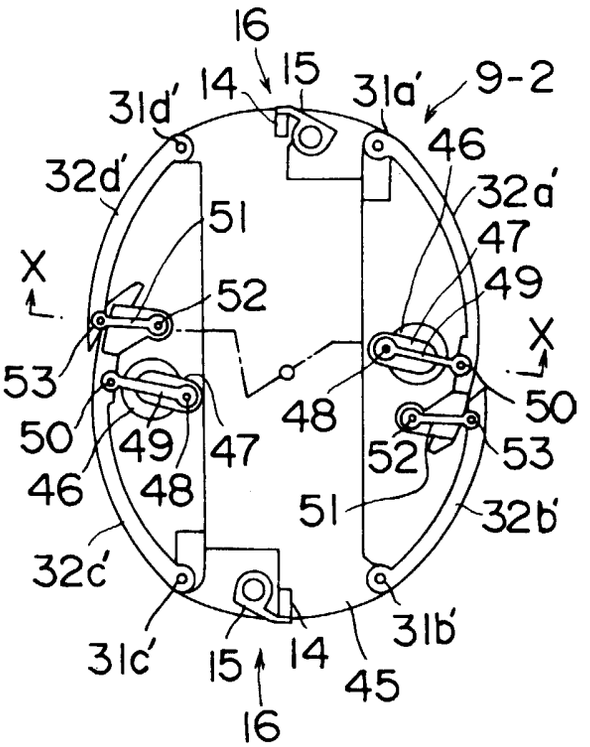

16
15
14
31d'
31a'
9-2
46
32d'
32a'
51
47
X
52
49
X
53
48
50
50
49
47
52
53
46
48
51
32b'
32c'
31b'
31c'
15
14
45
16

FIG.10

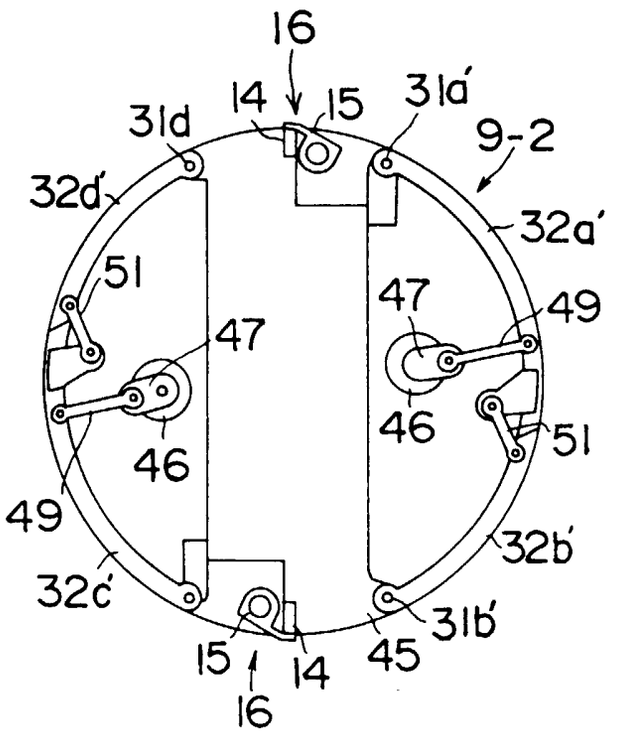

16
14
15
31a'
31d
9-2
32d'
32a'
51
47
47
49
46
46
51
49
32b'
32c'
31b'
15
14
45
16

FIG.11

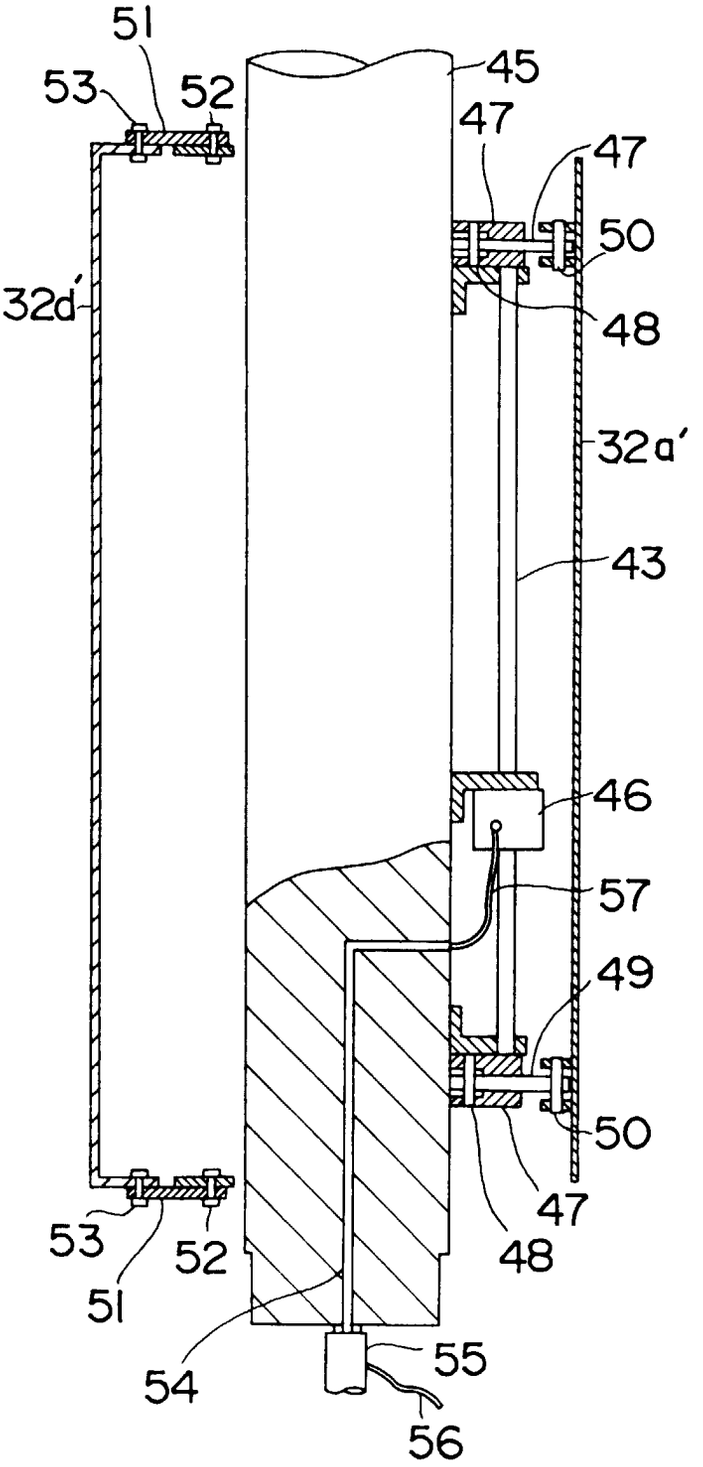


FIG.12

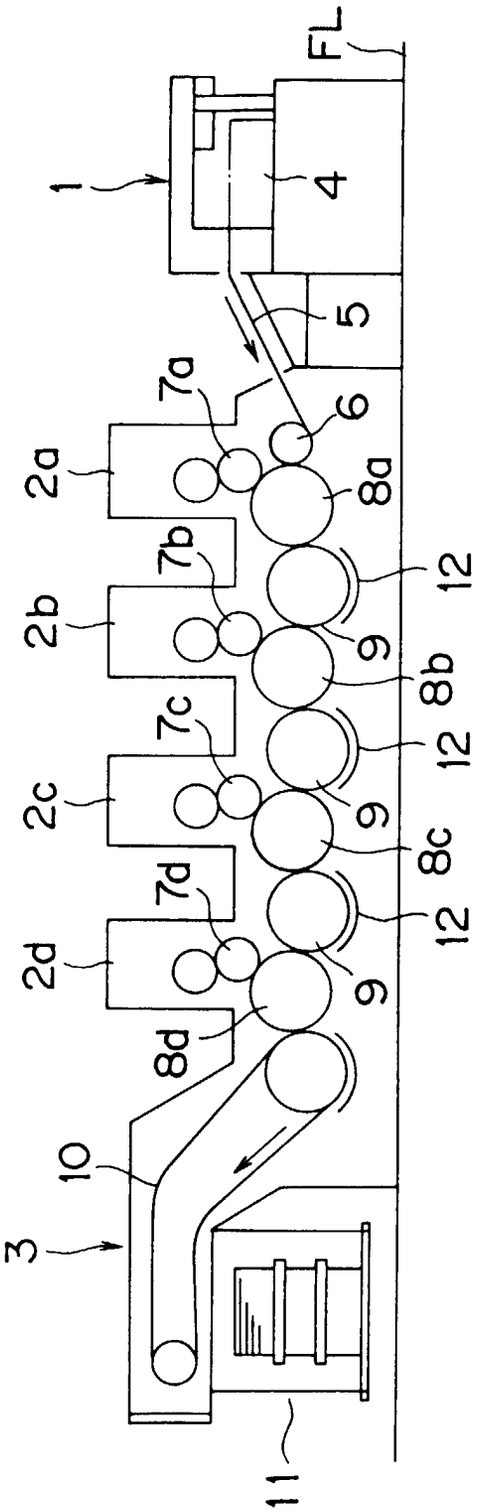


FIG.13

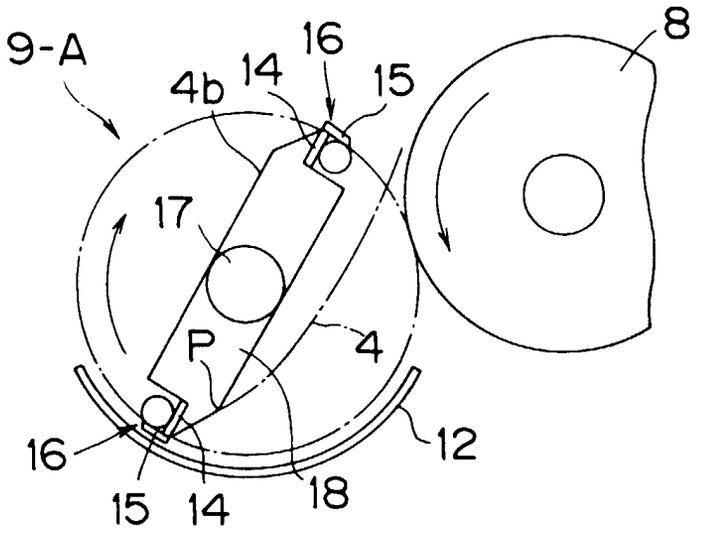


FIG.14

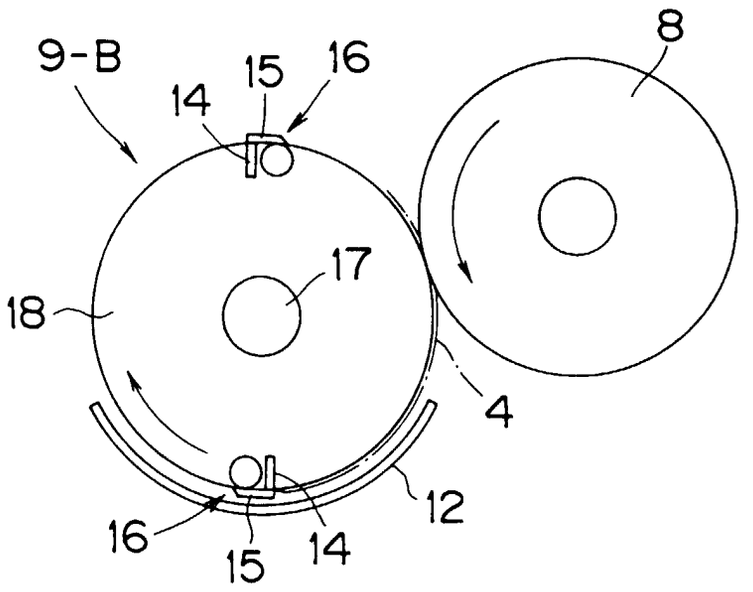


FIG.15

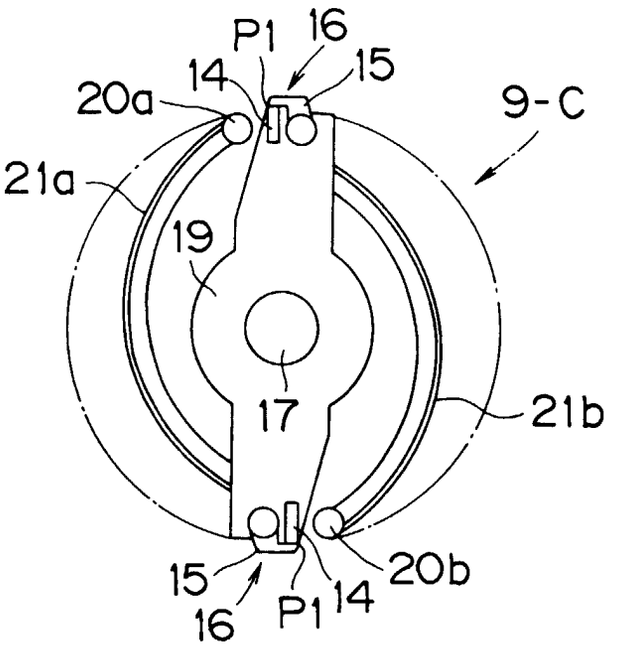

P1
16
15
14
20a
9-C
21a
19
17
21b
15
16
P1
14
20b

FIG.16

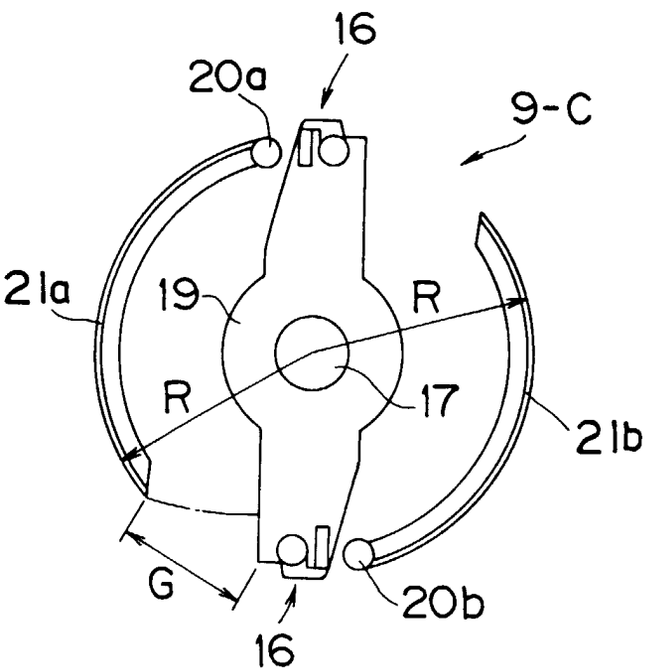
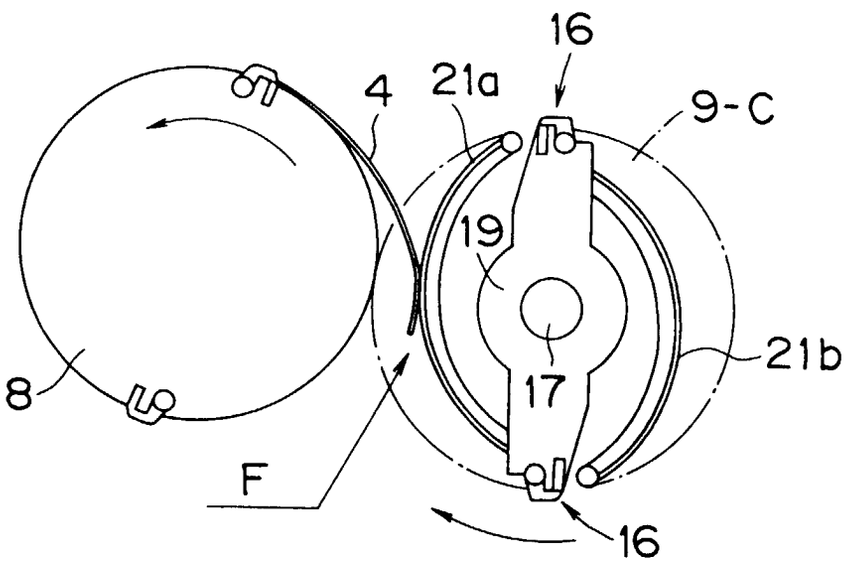

16
20a
9-C
21a
19
R
R
17
21b
G
16
20b

FIG.17



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EUROPEAN SEARCH REPORT

Application Number
EP 99 30 5254

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	US 5 579 691 A (VOGE MICHAEL) 3 December 1996 (1996-12-03) * the whole document *	1	B41F22/00 B41F21/10
A	EP 0 703 072 A (HEIDELBERGER DRUCKMASCH AG) 27 March 1996 (1996-03-27) * the whole document *	1	
A	EP 0 185 965 A (HEIDELBERGER DRUCKMASCH AG) 2 July 1986 (1986-07-02) * figures *	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)

B41F
B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	17 April 2000	Madsen, P

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17-04-2000

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