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(54) Sheet feeding apparatus for an image forming apparatus

Blattzuführvorrichtung für ein Bilderzeugungsgerät

Dispositif d'alimentation en feuilles pour un appareil de formation d'images

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Description

[0001] The present invention relates to a sheet feeding apparatus for feeding a sheet, and to image reading apparatus and image forming apparatus provided therewith.

[0002] As automatic original feeding apparatus there are apparatus of an original circulating method (RDF) and a non-circulating method (ADF). In the former RDF case, there are apparatus for completing exposure while an original passes an exposure section, and discharging the original onto a region above (or below) an original mounting section; further, in the case of setting of plural sets of copies of originals, there are apparatus for obtaining plural sets of copies by successively recirculating the originals.

[0003] The combination of RDF with the flow reading mode for finishing exposure during a moving state of original as described is free of the loss time corresponding to the moving time of exposure apparatus as against a fixed reading mode for once stopping the original and then moving the exposure apparatus along an original region. Therefore, the combination has advantages that it contributes to shortening of changing time of original and, in turn, to the speed increasing technology and productivity increasing technology of copying system and that, when comparison is made in a predetermined original changing time, it enables the original to be circulated at lower moving speed than in the fixed reading mode, thereby also contributing to the quieting (noise reducing) technology.

[0004] First describing examples of the combination with RDF, there also exists systems enabling to achieve the speed increase and productivity increase of copying system by the combination with the flash exposure technology. The detailed description of the flash exposure technology is omitted herein, but, when compared with the aforementioned exposure apparatus, it employs the structure for completing exposure of the all surface of an original at one time and needs to use a high-power light source and a belt type photosensitive member, thus increasing the size of apparatus, the cost, and electric power consumption. It is, therefore, the present status that applications of this technology are limited to some large-scale high-speed machines.

[0005] The latter ADF apparatus has such structure that an original is fixed at a predetermined position on a platen, exposure of copying section is repeated a necessary copy set number times by translationally moving the exposure apparatus, the original is discharged onto a predetermined discharge tray after completion of exposure, and this operation is successively repeated to obtain plural sets of copies from a series of originals. The copying system is combined with a sorter provided on the output side thereof, which eliminates the need for repetitively circulating the originals many times. Therefore, this apparatus has an advantage of relatively small damage of original.

[0006] Under the above circumstances of existence of the conventional technology, a variety of proposals have been made in order to achieve the speed increase and quieting in recent years.

[0007] A first example of the apparatus devised is a sheet medium conveying apparatus wherein the originals on a sheet mounting table are fed by automatically selecting one of two feeding means provided at the both ends of the sheet mounting table, depending upon the conditions including the size of original and a set mode, and an original is conveyed up to an image reading section of the copier body to be read there.

[0008] For example, an original-recirculatable system is arranged, as shown in Fig. 8, so that in the original fixed reading mode (for feeding the original through a first feeding means) a plurality of sheet originals P loaded on a sheet original mounting table 304 are separated one by one by first separating means 306, they are conveyed by feeding means 338 to be successively loaded at an arbitrary position on platen 303, an image of each original is read while moving an image reading section (optical system) 380 in the direction a in the copier body 301, and the original is reloaded on the sheet mounting table 304 by discharge means 311. In the original flow reading mode (for feeding the original through a second feeding means) the plurality of sheet originals P loaded on the original tray 304 are separated one by one by second separating means 314 to be conveyed by feeding means 315, the optical system 380 is fixed at a position the distance L apart from the home position (illustrated by a dashed line) of optical system 380, an image is read while the sheet original P is conveyed at constant speed on the platen 303 by a wide belt 307, and the original is loaded onto the sheet original mounting table 304 by the discharge means 311.

[0009] When the flow reading mode is selected, for example, under such conditions that a user puts originals of a small size (A4, B5, LTR, or the like) on the original tray 304, a start key (not illustrated) of the copier body is on, a first entrance sensor 322 is on, and a sheet medium length detecting sensor 368 is off, the operation advances in the flow reading mode. First, the original tray 304 falls down to a predetermined position about the fulcrum of 340, a stopper (sheet stack conveying means) 321 conveys the stack of sheet originals P toward the second separating means 314 to move the stack up to the position of stack conveying position detecting sensor 328 (before the stack conveying position detecting sensor 328 becomes on), feeding from the second feeding means 315 is started to feed the original to the platen 303, the image of the original is read in the aforementioned original flow reading mode, and then the sheet original is discharged from the discharge roller 311 onto the original tray 304. The stopper 321 pushes the rear end of sheet original toward the second separating section every discharge of original so as to enhance alignment. For one more circulation, after the all sheet originals are discharged, the stack is conveyed

together to be again fed and to be again copied.

[0010] The above devised apparatus was suitable for the productivity increase, because it is the original recirculating method processing apparatus to achieve the high original changing speed in the flow reading mode, and also suitable for the quieting, as described above; however, it required circulation of originals of a setting number times for obtaining plural copies thereof. The apparatus thus had the structure requiring the advanced technologies for realizing the system that gave less damage on the originals, for example, by decreasing the stress on the originals upon passage through the separating means of the above apparatus, curling of original upon passage through the bent path, and so on, and that had high reliability by decreasing the probability of conveyance failure upon handling of original.

[0011] Particularly, in the above apparatus, the separating and feeding means of original P employs the bottom separating and feeding method of a conventional belt retard system comprised of a retard belt and a feeding roller, as shown in Fig. 8. This method is a method for aligning the originals at their leading edges and feeding them, and it thus has an advantage that even a stack of originals with different sizes mixed can be separated and fed. However, it has a problem of soiling of original occurring when a printed surface of the first original P rubs the back surface of the second original P upon feeding from the lowermost of the originals P mounted in the face-up state. Various means have been considered to overcome it, and considerable improvements have been achieved in the soiling.

[0012] When the originals P had poorly fixed images and the number of originals P was large, the above soiling was conspicuous when seen in a stack of many originals P after copy. A further improvement was thus demanded. A separating and feeding method using air is known as feeding means for solving the problem of soiling of original. The structure of this air feeding is free of not only the problem of soiling of original but also the problem of abrasion of the belt and rubber in the retard system, and it thus has advantages of excellent durability and reliability.

[0013] In the above structure of air feeding it is, however, necessary to prevent accompanied conveyance by making use of the weight of originals P by mounting the originals on the original mounting tray 2 inclined at an angle of rise in the sheet feeding direction toward the air separating means, and to align the originals P at the trailing edges thereof.

[0014] Therefore, the air feeding method has a problem that it is not ready for handling a stack of originals P of different sizes mixed, different from the aforementioned retard system.

[0015] Further, in the air feeding method, when the originals have'holes at the leading edges thereof in the original feeding direction, the separation air directed toward the leading edges of originals leaks through the hole portions, so that the second and after originals become reluctant to float. The air feeding method thus has another problem that it is not suitable for the originals with holes at the leading edges in the original feeding direction.

[0016] Sheet feeding apparatuses with two feeding means are known from EP-A-0 612 000 having two friction separating means and US-A-5 069 436 having two air separating means.

[0017] It is an object of the present invention to provide a sheet feeding apparatus making use of the advantages of the prior art sheet feeding apparatuses while avoiding their disadvantages.

[0018] This object is achieved by a sheet feeding apparatus having the features of claim 1.

[0019] Advantageous further developments are set out in the dependent claims.

[0020] A sheet reading apparatus and an image forming apparatus comprising such a sheet feeding apparatus are defined in claims 12 and 13, respectively.

[0021] The selecting means is preferred to select the air separating/feeding means in a normal mode.

[0022] A sheet feeding apparatus is preferred to comprise a switchback conveying means including a switchback conveying path, the switchback conveying means conveying the sheet separated by the first separating means through the switchback conveying path from one end of the image reading section into the image reading section and thereafter switching the sheet back to convey the sheet through the switchback conveying path out of the image reading section and a closed loop conveying means including a closed loop conveying path forming a closed loop, the closed loop conveying means conveying the sheet separated by the second separating means through the closed loop conveying path, thereby conveying the sheet from the other end of the image reading section into the image reading section, the closed loop conveying means conveying the sheet out of the image reading section from the side opposite to the side where the sheet was conveyed thereinto.

[0023] The switchback conveying means is preferred to temporarily stop the sheet on the image reading section while the image reading apparatus is reading an image, and the closed loop conveying means continues conveyance of the sheet conveyed into the image reading section even while the image reading apparatus is reading the image, and the closed loop conveying means carries the sheet out thereof from the side opposite to the side where the sheet was conveyed thereinto.

[0024] The first separating means is preferred to be means for separating an original loaded on the tray, the means being provided on one side of the tray, and the second separating means is preferred to be means for separating an original loaded on the tray, the means being provided on another side of the tray different from the one side of the tray where the first separating means is provided, and at least one of the switchback conveying means and the closed loop conveying means returns a conveyed original to the tray.

[0025] A sheet feeding apparatus is preferred to comprise a moving means for moving a stack of sheets mounted on the tray to a predetermined separation position on the tray and a control means for controlling the moving means and the separating means, and the second separating means is means for separating the lowermost sheet from the other sheets by blowing of air to a lower portion of a leading edge of the stack of sheets having been conveyed to the separation position, and the control means controls the second separating means to start the blowing of air from the second separating means, prior to arrival of the stack of sheets at the separation position.

[0026] A sheet feeding apparatus is preferred to comprise thickness detecting means for detecting a thickness of the stack of sheets mounted on the tray at that time, and the control means changes a blowing amount of air from the second separating means, according to a detection result of the thickness detecting means.

[0027] The moving means is preferred to comprise pushing means for pushing a trailing edge of the stack of sheets to move the stack of sheets, and a conveying belt set on a tray surface of the tray, and the conveying belt rotates in synchronism with the movement of the stack of sheets by the pushing means.

[0028] A sheet feeding apparatus is preferred to comprise a thickness detecting means for detecting a thickness of the stack of sheets mounted on the tray at that time, and the control means is preferred to change a blowing amount of air from the separating means, according to a detection result of the thickness detecting means.

[0029] The moving means is preferred to comprise a pushing means for pushing a trailing edge of the stack of sheets to move the stack of sheets, and a conveying belt set on a tray surface of the tray, and the conveying belt rotates in synchronism with the movement of the stack of sheets by the pushing means.

[0030] As described above, the sheet feeding apparatus and image forming apparatus of the present invention can perform secure separation and feeding of original.

Fig. 1 is a drawing to show the schematic structure of an image forming apparatus as the first embodiment of the present invention;

Fig. 2 is a drawing to show the structure of an automatic original feeding apparatus;

Fig. 3 is a drawing to show the structure for drive of the automatic original feeding apparatus;

Fig. 4 is a drawing to show the details of an air separating-feeding mechanism;

Fig. 5 is a drawing to show the details of the air separating-feeding mechanism;

Fig. 6 is a drawing to show the structure for control by a controlling device;

Fig. 7 is a flowchart to show the control operation of original conveyance; and

Fig. 8 is a drawing to show the conventional apparatus.

[0031] The preferred embodiments of the present invention will be described by reference to the drawings.

[0032] The present embodiment is characterized in that, in transferring an original mounted on the original tray to an air feedable position (an air separating position), blowing of separating air (at least preparation for blasting, for example, setting of an air quantity according to the thickness of original stack) is started prior to arrival of original at the air separating position. It is also characterized in that upon the conveyance the adsorption belt is rotated in synchronism with movement of the original stack.

[0033] First, the image forming apparatus 100 of the present embodiment will be schematically described referring to Fig. 1.

[0034] The automatic original feeding apparatus 1 conveys an original mounted on the original tray up to a predetermined read position. The automatic original feeding apparatus 1 will be described in detail hereinafter.

[0035] As well known, the optical system is composed of third mirror 101, second mirror 102, first mirror 103, original illuminating lamp 104, zoom lens 106, fourth mirror 114, and so on. The optical system transmits information of an original on platen 105 onto photosensitive drum 107.

[0036] The above optical system is constructed so as to be capable of both fixed reading and flow reading. Specifically, upon the fixed reading the original is fixed at a constant position and an exposure section 133 translationally moves on the platen to read the image. On the other hand, upon the flow reading the exposure section is fixed at a predetermined position and the original is moved to read the image. The home position of the optical system in the fixed reading (original: fixed, optical system: moving) is at a first image head (fixed reading image head) position G (see Fig. 2). A second image head (flow reading image head) position H is the fixed position of the optical system in the flow reading. The second image head position H is located the distance L right from the first image head position G.

[0037] Next, the image thus read by the optical system is formed on a transfer medium separately prepared, by an image forming section. The image forming section is provided, as well known, with drum cleaner 108, pre-exposure lamp 109, primary charger 110, blank exposure lamp 112, potential sensor 113, hopper section 114 of toner, developing unit 115, multifeeder 116, side tray 117, roller electrode 118, transfer pre-charger 119, registration roller 120, refeeding section (for both-side copy) 121, transfer-separation charger 122, upper front tray 123, lower front tray 124, conveying section 125, intermediate tray 126, second conveying section 127, fixing unit 128, waste toner collecting vessel 129, sheet discharging section 130, copy-sheet-output-side

device (sorter) 200, and so on.

[0038] Each section of the image forming apparatus is generally controlled by control device 300.

[0039] As described previously, the present embodiment is mainly characterized by the automatic original feeding apparatus 1. Therefore, the following description is focused mainly on the automatic original feeding apparatus 1.

[0040] The structure of the automatic original feeding apparatus 1 of the present embodiment will be described referring to Fig. 2 and Fig. 3.

[0041] The automatic original feeding apparatus 1 has two original conveying paths (switchback path and closed loop path). The two conveying paths are used separately by selection, depending upon the set mode and the original size.

[0042] The switchback path is used in the case of the originals of a large size (for example, B4, A3, etc.) and in the case of originals of different sizes mixed. The conveying direction in the switchback path is indicated by arrow A in the drawing. In feeding through the switchback path, an original of original stack P mounted on the original tray 2 is guided through a path PH1 and then is positioned at the predetermined position on the platen 105 of image forming apparatus 100, and the exposure operation is carried out thereat by the optical system. After completion of the exposure operation, the original is returned in the direction C (through a discharge path PH2) again onto the original tray 2.

[0043] On the other hand, the closed loop path is used in a one-side copy mode of originals of a small size. In the drawing the conveying direction in the closed loop path is indicated by arrow B. An original P on the original tray 2 is guided through a predetermined path PH3 and is positioned at the predetermined position on the platen 105 of the image forming apparatus 100. After completion of the exposure operation, the original is returned in the direction C (through the discharge path PH2) again onto the original tray 2.

[0044] In each of the two conveying paths there are various sensors, rollers, and so on installed. The structure of each conveying path will be described below. It is, however, noted that each portion does not always belong to only either one of the conveying paths, but there are also some portions used in common to the both conveying paths.

[Switchback path]

[0045] The original tray 2 is one for mounting the originals thereon. It is the matter of course that the original tray 2 is also used upon conveyance through the closed loop path. The original tray 2 is constructed so as to be movable up and down by tray up/down motor 59. An original P mounted on the original tray 2 is fed to the right (through the closed loop path) or to the left (through the switchback path) on the drawing, depending upon the conveying path used at that time. The original tray 2 is moved up upon conveyance through the switchback path or down upon conveyance through the closed loop path. The original tray 2 is inclined at a predetermined angle left side down from the relation with separating/feeding means (retard belt 5', feeding roller 5", etc. in the switchback path; adsorption belt 7 and air separating device 426 in the closed loop path) described hereinafter.

[0046] Recycle levers 3 are separating members for separating the original group before copy from that after copy. The recycle levers 3 are provided in the original mounting section. The tip of the recycle levers 3 extends through slots provided in side regulating plate 4 up to the tray of original tray 2. The recycle levers 3 are provided at two positions in order to be ready for originals of various sizes. The recycle levers 3 are driven by recycle motor 58 mounted in the tray side regulating plate 4. The recycle levers 3 form parts of stack thickness detecting mechanism 200 described hereinafter.

[0047] Conveying roller 5, retard belt 5', and feeding roller 5" are members for separating and feeding the originals when the switchback path is used. These are driven by separating motor 52.

[0048] The conveying roller 6' is one for guiding the original to the platen 105.

[0049] Inverting flapper 15 is used for inverting the original upon discharge and upon both-side copy. The inverting flapper 15 is driven by inverting flapper solenoid 73.

[0050] Inverting roller 6 is driving means for registration and inversion of original upon conveyance through the switchback path and is driven by inverting motor 55. The present embodiment employs a DC motor as the inverting motor 55 and it is controlled by PLL control to enable constant speed control between conveying belt 40 and inverting roller 6. Attached to the shaft of inverting motor 55 are a clock disk 56 and a clock detecting sensor 57 for permitting the PLL control. It can also contemplated that a stepping motor is adopted as the inverting motor 55 and is controlled in synchronism with the separating motor 52 (for constant speed control).

[0051] Conveying/discharging roller 16 is used for guiding the original discharged from the platen 105 again to the platen 105 (or the tray 2). The conveying/discharging roller 16 is driven by discharge motor 61. The discharge motor 61 is also equipped with a clock disk 62 and a clock sensor 63 for enabling speed control upon transfer of original from the inverting roller 6 and upon discharge of original.

[0052] The conveying belt 40 is used for conveying the original on the platen 105. The conveying belt 40 is driven by stepping motor 51. The stepping motor is used because of its high controllability, i.e., good control response of start or stop. In addition, the present embodiment necessitates the constant speed operation at high accuracy between the conveying belt 40 (a backup roller driven by the conveying belt) and the registration roller 11, which is also one of reasons for the use of stepping

motor.

[0053] The region of the switchback path where the inverting roller 6 and conveying/discharging roller 16 are set is shared with the closed loop path. Namely, the inverting roller 6 and conveying/discharging roller 16 are also used upon feeding of original through the closed loop path. The conveying belt 40 is also shared with the closed loop path.

[0054] Various sensors (empty sensor 30, separation sensor 31, switchback registration sensor 32, inversion sensor 33, and discharge sensor 39) for monitoring the conveying status of original are installed at respective positions of the switchback path. The empty sensor 30 is used for detecting that the original is set on the tray 2. The separation sensor 31 is used for detecting that the original is separated. The switchback registration sensor 32 is used for taking timings of registration of original and correction of oblique feed. The inversion sensor 33 is used for detecting that the original is moved back in the switchback from the platen. The discharge sensor 39 is used for detecting discharge of sheet.

[Closed loop path]

[0055] The adsorption belt 7 is one for adhering to the original and conveying it. This adsorption belt 7 is set in a notch portion 404 provided in the center of the front part of original tray 2 (see Fig. 4 and Fig. 5). The adsorption belt 7 is perforated so as to have many holes 406. A suction duct 20 connected to a suction blower (not illustrated) is set on the back side (inside the track) of the adsorption belt 7. When the suction blower is actuated, the air is sucked from the holes 406 of suction belt 7 through the suction duct 20. This suction causes the lowermost original out of the originals mounted on the original tray 2 to be adhered to the adsorption belt 7. When the suction belt 7 is rotated in that state, the original thus adhered can be conveyed. The suction duct 20 is provided with air valve 21 for controlling on/off of suction (see Fig. 3). The air valve 21 is constructed to be opened or closed by solenoid 22.

[0056] An air separating device 426 is provided for blowing air obliquely from above to the lower part of the original stack placed at the predetermined air separating position of the original tray 2, thereby certainly separating the lowermost original (see Fig. 4 and Fig. 5). The blowing of air is effected by blowing off the air supplied from a blower (not illustrated) through blowoff port 409 provided in the lower part of separating air duct 410. An air valve 408 for changing the air quantity according to the thickness of the original stack is provided in the separating air duct 410. The air valve 408 is constructed to be drive-controlled by stepping motor 9 so that the valve travel can be adjusted thereby.

[0057] Shutter 41 (see Fig. 2 and Fig. 3) is provided for pushing the trailing edges of the originals (the left edges on the drawing) mounted on the original tray 2 to convey the original stack to the air-separable position. The originals are mounted on the original tray 2 so that the trailing edges thereof abut the shutter 41. The shutter 41 is driven by stack transfer motor 80. When the originals are conveyed through the switchback path, the shutter 41 is retracted by solenoid 81 so as to be prevented from impeding conveyance of original. This stack transfer motor 80 is also used for jogging the original returning to the original tray 2 through the closed loop path again toward the separating/feeding means.

[0058] The stack thickness detecting mechanism 200 (see Fig. 2 and Fig. 3) is provided for detecting the thickness of the original stack mounted on the original tray 2. The stack thickness detecting mechanism 200 of the present embodiment is arranged to detect the thickness of the stack of originals, based on an angle of rotation of recycle levers 3. The stack thickness detecting mechanism 200 is constructed specifically of a gear system for amplifying an amount of rotation of recycle levers 3, a slit plate for outputting the amount of rotation amplified as the number of pulses generated, and a photosensor or the like. Of course, the recycle levers 3 also constitute parts of the stack thickness detecting mechanism 200. These gear system and other elements are set inside the side regulating plate 4. The stack thickness detecting mechanism 200 outputs the detection result (specifically, a pulse signal in which the number of pulses generated vary depending upon the thickness of stack) to the control device 300 described hereinafter.

[0059] The conveying roller 10 is provided for conveying the original separated by the air separating device 426 etc. and is driven by the separating motor 52.

[0060] Registration roller 11 is driven by stepping motor 64. The stepping motor is used because the constant speed property relative to the conveying belt 40 is of the significance (for assuring high-accuracy registration). A clock disk 65 is attached to the drive shaft of stepping motor 64. A clock detecting sensor 66 is provided for detecting out-of-step of the stepping motor 64.

[0061] Backup roller 14a is provided in a turn path section in order to make handling of a thick sheet or the like more advantageous. The backup roller 14a also serves as a feeding roller for a sheet inserted through feeding port 13 of manual feeding path. The backup roller 14a is driven by turn roller 8 driven by the conveying belt 40. The peripheral velocity of the backup roller 14a is arranged so as to be equal to the velocity of the conveying belt 40.

[0062] Turn flapper 14 is provided for guiding the original under conveyance so as to prevent the original from being caught by platen edge 105a, and the turn flapper 14 is constructed so that the position of the height thereof can be adjusted depending upon the circumstances at that time. For example, when the original is conveyed through the closed loop path to the platen, the turn flapper 14 is located higher than a platen edge section 105a. When the original is fed through the manual path feeding port 13, the turn flapper 14 is also located higher than the platen edge section 105a. Conversely, when after

completion of copy the original is again moved back in the direction E, the turn flapper 14 is retracted so as to be lower than the platen edge section 105a in order to scoop the original up from the platen edge section 105a. The turn flapper 14 is driven by solenoid 76a.

[0063] Flapper 14' is provided for guiding an original manually fed, to the manual feeding port 13. The flapper 14' is driven by solenoid 76b. Numeral 12 designates a manual feeding roller.

[0064] The separating motor 52 is provided for driving the conveying roller 5, retard belt 5', feeding roller 5", adsorption belt 7, and conveying roller 10. When the separating motor 52 is rotated forward, it drives the conveying roller 5, retard belt 5', and feeding roller 5". When the separating motor 52 is rotated backward, it drives the adsorption belt 7 and conveying roller 10. Transmission of driving force between the separating motor 52 and the adsorption belt 7 is effected through clutch 70. Accordingly, the separating belt 7 can be actuated or stopped without stopping the separating motor 52 by turning the clutch 70 on or off. The separating motor shaft of the separating motor 52 is equipped with a clock disk 53 and a clock sensor 54 for speed control.

[0065] The stack transfer motor 80 is the stack transfer driving means and is also a drive source for jogging the original returned after handling of sheet through the closed loop, again toward the separating/feeding means. In the present embodiment it is a stepping motor.

[0066] Various sensors (empty sensor 30, original set sensor 34, closed loop separation sensor 35, closed loop registration sensor 36, image head sensor 37, and manual feeding set and discharge sensor 38) for monitoring the conveying status of original are provided at respective positions of the closed loop path. The empty sensor 30 is shared with the switchback path. The original set sensor 34 is provided for detecting whether the set original is of a half size (A4, LTR, or B5) or is longer than those, based on presence or absence of the trailing edge of original when the originals are set. The original set sensor 34 also functions as an original stack leading edge detecting sensor. The closed loop separation sensor 35 is a sensor for detecting that the original is separated. The closed loop registration sensor 36 is a sensor for taking the timings of closed loop registration and correction of oblique feed. The image head sensor 37 is a sensor for positioning the original on the platen.

[0067] Next, the structure for control in the image forming apparatus, especially in the automatic original feeding apparatus 1 herein, will be described referring to Fig. 6.

[0068] The automatic original feeding apparatus 1 is generally controlled by the control device 300. The control device 300 is mainly constructed of the aforementioned microprocessor unit (MPU) incorporating ROM and RAM. As shown in Fig. 6, signals from the various sensors etc. described above are supplied to the input ports of the MPU. Further, the loads described above are connected through a driver to the output ports of the MPU.

[0069] The control device 300 executes the programs stored in the ROM and RAM to control the above-stated sections, thereby realizing the various functions. For example, the control device 300 has a function for adjusting the valve travel of air valve 408 according to the thickness of original stack by controlling the stepping motor 9. The data necessary for the various controls (for example, information (LUT) indicating the relation between the number of pulses outputted from the stack thickness detecting mechanism 200 and the amount of rotation of separating air valve 408) is preliminarily stored in (or supplied with necessity to) the ROM and RAM. The functions of the control device 300 will be described in further detail in the description of the operation.

[0070] The "friction separating/feeding means" and "first separating means" in the present invention are realized by the retard belt 5', feeding roller 5", separating motor 52, etc. in the present embodiment. The "air separating/feeding means" and "second separating means" are realized by the adsorption belt 7, air separating device 426, and so on. The "selecting means" is realized by the control device 300 etc. The "image reading section" corresponds to the platen 105. The "first conveying means" and "switchback conveying means" are realized by the feeding roller 6, conveying belt 40, conveying/discharging roller 16, and so on. The "second conveying means" and "closed loop conveying means" are realized by the registration roller 11, conveying belt 40, conveying roller 6, and so on.

[0071] The "sheet" in the present invention corresponds to the original stated in the present embodiment. The "sheet tray" corresponds to the original tray 2. The "moving means" corresponds to the shutter 41, adsorption belt 7, and the mechanism for actuating these members. The "pushing means" corresponds to the shutter 41, stack transfer motor 80, and so on. The "conveying belt" corresponds to the adsorption belt 7, separating motor 52, and so on. The "separating means" corresponds to the air separating device 426, the blower, and so on. The "separation position" corresponds to the air separation position where the original can be separated by the air separating device 426. The "control means" corresponds to the control device 300. The "thickness detecting means" corresponds to the recycle levers 3 and the stack thickness detecting mechanism 200.

[0072] The original conveying operation in the present embodiment will be described.

[0073] The original tray 2 is normally located on the upper side. When the stack of originals is set on the original tray 2, the control device 300 detects the original size etc. to determine which conveying path should be used, depending upon the detection result. For example, when the empty sensor 30 is on and the original set sensor 34 is off, the control device 300 determines that the size of originals mounted on the original tray 2 at

that time is the half size (A4 or B5 herein) and thus determines use of the closed loop path. In practice, the control device also determines the size of either A4, LTR, or B5 by simultaneously carrying out detection of the empty sensor 30, the original set sensor 34, and the original width (though not illustrated). The operation after this will be described in separate sections of [1] conveyance of original through the switchback path and [2] conveyance of original through the closed loop path.

[1] Conveyance of original through the switchback path

[0074] When the user turns the copy button (not illustrated) on, the recycle levers 3 are placed on the uppermost original.

[0075] Separation-conveyance is carried out in order from the lowermost original of the stack of originals P mounted on the original tray 2. The original separated is guided through the path PH1 and is then positioned at the predetermined position on the platen 105 of the image forming apparatus 100. Then the exposure operation by the optical system is carried out. After completion of the exposure operation, the original is returned in the direction C (through the discharge path PH2) and again moved back onto the original tray 2.

[0076] After the all originals have been conveyed, the recycle levers 3 move down to be lower than the mounting surface of the original tray 2. This causes the control device to recognize completion of circulation of the originals in one cycle.

[2] Conveyance of original through the closed loop path (see Fig. 7)

[0077] The control device 300 is in a standby state to wait for on of the copy button (not illustrated) (step 700). When the user turns the copy button (not illustrated) on, the control device 300 actuates the recycle motor 58 to start descent of the recycle levers 3 toward the original. The control device also actuates the tray up/down motor 59 to start descent of the original tray 2 (step 702). Then the control device waits before the original tray 2 is moved down to the position of air-separable height (step 704). After the original tray 2 is lowered down to the predetermined position, the up/down motor 59 is stopped (step 706).

[0078] During this period, when the recycle levers 3 land on the original stack, the stack thickness detecting mechanism 200 outputs a pulse signal according to the position (angle) of the recycle levers 3, i.e., according to the thickness of the original stack mounted on the original tray 2 at this time, to the control device 300. The control device 300 checks whether the thickness of the original stack was detected (step 708), and the control device 300 stops the recycle motor 58 when it is confirmed (step 710).

[0079] Then the control device 300 determines the valve travel of the separating air valve 408, based on the number of pulses at this time. Then the control device controls the stepping motor 9 so as to achieve the determined valve travel, thus starting adjustment of valve travel of the separating air valve 408. In tandem therewith, the control device 300 actuates the blower to start blowing of air by the air separating device 426 (step 712). Then the control device 300 waits before the separating air valve 408 comes to a set angle (step 714). When it is confirmed that the separating air valve 408 is set at the set angle (it should be noted that the setting does not always have to be confirmed, but it may be assumed that the valve becomes set at the set angle after a lapse of a predetermined time), the control device 300 actuates the stack transfer motor 80 to make the shutter 41 push the original stack, thus starting moving of the stack to the air separation position. At the same time as it, the separating motor 52 and clutch 70 are actuated to start rotation of the adsorption belt 7. At the same time as it, the rotation of the conveying roller 10 is also started (step 716). At this time the control device 300 controls the stack transfer motor 80 and separating motor 52 so that the moving speed of shutter 41 becomes equal to the rotating speed of the adsorption belt 7. Namely, the moving speed of the original stack by the shutter 41 is synchronized with the rotation of the adsorption belt 7. Accordingly, the stack will not be disturbed with increase in the moving speed of the original stack.

[0080] During transfer of the original stack the control device 300 monitors whether the leading edges (the right edges in Fig. 1) of the originals reach the air separation position, based on the detection result of the original set sensor 34 (step 718). When the leading edges reach the air separation position, the stack transfer motor 80 is turned off to stop the movement of the original stack (step 720). In practice, the arrival at the air separation position is assumed when the original set sensor 34 detects the leading edge of moving original (or after a lapse of a predetermined time from the time of the detection).

[0081] After this, the control device 300 actuates the suction blower to start suction of original to the adsorption belt 7 and the control device 300 also turns the clutch 70 on to start the rotation of the adsorption belt 7 (step 722). In this case, the separating air valve 408 has already started blowing of air in the air quantity suitable for the thickness of the original stack at that time, and the separation of original can be done immediately.

[0082] After the start of the separation operation, the control device 300 monitors whether the original is separated, based on the detection result of the closed loop original separation sensor 35 (step 724). Then, confirming that the original is separated and fed, the control device turns the clutch 70 off to temporarily stop the rotation of the adsorption belt 7. It also closes the air valve 21 (step 726).

[0083] After this, the control device 300 checks whether the original thus separated at that time is the

last original (step 728). If the original is not the last original, the same process will be repeated, returning to the step 722. On the other hand, if the original is the last original, the operation will be terminated.

[0084] The original thus separated in this way is guided through the path PH3 to be positioned at the predetermined position on the platen 105 of the image forming apparatus 100 (see Fig. 2). Then, after completion of the exposure operation, the original is returned in the direction C (through the discharge path PH2) onto the original tray 2.

[0085] The embodiment described above permits the original stack to be conveyed quickly to the air-separable position without causing stack deviation of the original stack. This can decrease the fast copy time (Fcot). Further, since the air quantity of the separating air is adjusted to the optimum value according to the thickness of the original stack, prior to the start of air separation-feeding, an original can be separated by air immediately after the original stack reaches the air-feedable point. This can also decrease the fast copy time (Fcot).

[0086] In the embodiment described above, the conveying belt 40 and registration roller 11 were driven by the stepping motor. Instead thereof, however, the constant speed control in the transfer section may be realized by the PLL control of DC motor. In another arrangement, the conveying belt and registration roller may be simultaneously actuated by a common drive source through on/off of clutch by use of one drive source and clutch means or the like.

[0087] In the present embodiment the thickness of the original stack was detected utilizing the recycle levers. It is, however, needless to mention that a mechanism for detecting the thickness of the original stack can be provided separately and independently from the recycle levers.

[0088] In the present embodiment, in transferring the original stack to the air-feedable position (air separating position) by the shutter 41, the blowing of separating air was started before the original stack reached the air separation position. However, the apparatus may be arranged to start at least preparation for blowing (for example, setting of the air quantity according to the thickness of the original stack), whereby the fast copy time (Fcot) can be decreased, though the effect thereof is less (than in the above embodiment). The apparatus may also be modified in such a manner that adhesion to the adsorption belt 7 is also carried out upon rotation of the adsorption belt 7 in synchronism with the movement of the original stack.

[0089] As described above, the sheet conveying apparatus of the present invention employs the separating and feeding method by the retard system in the switchback path and the air separating and feeding method in the closed loop path.

[0090] Since the separation by air feeding is carried out during the flow reading or the like through the closed loop path, normally most frequently used, such as processing of many originals in terms of the productivity, the apparatus of the invention is free of the problems of the original damage and durability due to the edge soiling and separation at the leading edge of original. Further, in the case of the originals having the binding holes, the originals will be set on the original tray so that the hole side is naturally directed to the left when seen from the user. Therefore, the hole side of the originals is located in the upstream end in the feeding direction upon air feeding through the closed loop path, so that the apparatus is free of the problem of floating failure of original due to leakage of the separating air through the holes upon the air feeding as described previously.

[0091] In the case of feeding of the originals of different sizes mixed, the originals can be fed by the retard method through the switchback path, so that the apparatus can handle a wider range of originals than the apparatus employing only the air feeding method, thus enhancing the operability.

[0092] The features achieved by the provision of two separating/feeding means of the different methods are as follows.

[0093] The flow reading of small size sheets (A4, B5, etc.), which are used most frequently, is set as a standard mode and the air separating/feeding section is used preferentially.

[0094] In analog copiers, it is essential to move the original from right to left on the platen upon the flow reading, and the air feeding section is thus located on the right side.

[0095] The friction separating section is used for large-size sheets and for sheets of different sizes mixed. The conventional apparatus needed a mechanism for sliding the rear edge regulating plate, for feeding the originals of the small size and large size by use of one RDF, and the size of the RDF itself was large. The RDF of the present invention employed the folding tray and friction separating section for the large sizes, thus compactifying the body of RDF.

[0096] The friction separating/feeding section is used for perforated originals. The perforated originals, which were hard to deal with heretofore by air separation, can be separated more certainly by use of the friction separating section.

[0097] According to the feature of air separation and feeding, when the sheets are mounted on the sheet tray, the thickness detecting means detects the thickness of the sheet stack. The moving means moves the sheet stack mounted on the sheet tray to the predetermined separation position. When the moving means is composed of the conveying belt and pushing means, the conveying belt rotates in synchronism with the movement of the sheet stack by the pushing means. This permits the stack to retain its shape even with increase in the speed of movement of the sheet stack.

[0098] The control means makes the separating means start the blowing of air prior to the arrival of the sheet stack at the separation position. In this case, the

blowing amount of air is set according to the detection result of the thickness detecting means. Since the separating means has already started blowing of air at the time of arrival of sheets at the separation position, separation can be done immediately.

Claims

1. A sheet feeding apparatus comprising:

a friction separating/feeding means (5', 5", 52, 6, 6') for separating and feeding a sheet (P) by making use of frictional force;
an air separating/feeding means (7, 20, 21, 426, 408, 409, 410) for separating and feeding the sheet (P) by making use of air; and
a selecting means (300) for selecting either one of said friction separating/feeding means (5', 5", 52, 6, 6') and said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) and for making the means selected by the selecting means separate and feed the sheet dependent on the sheet.

2. A sheet feeding apparatus according to claim 1, wherein

said selecting means (300) is provided with a sheet size detecting sensor (30; 34), or with instructing means capable of instructing an original sheet size mixing mode or with a mode for original sheets with binding holes.

3. A sheet feeding apparatus according to claim 1, wherein

a first conveying means (6, 40) for guiding the sheet (P) separated and fed by said friction separating/feeding means (5', 5", 52, 6, 6') to an image reading section (105);

a second conveying means (11, 40) for guiding the sheet (P) separated and fed by said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) to said image reading section (105).

4. A sheet feeding apparatus according to any of claims 1 to 3, wherein

said selecting means (300) is adapted to select said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) in a normal mode.

5. A sheet feeding apparatus according to any of claims 1 to 4, wherein

a tray (2) on which the sheet (P) is to be loaded;
wherein said friction separating/feeding means (5', 5", 52, 6, 6') is adapted to separate said sheet (P) loaded on said tray (2) and include feeding means and retard means; and

said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) is adapted to separate said sheet (P) loaded on said tray (2), and include an air knife and vacuum suction conveying means.

6. A sheet feeding apparatus according to claim 5 as far as it refers back to claim 3, wherein

a switchback conveying means includes a switchback conveying path (PH1, A) and said first conveying means (6, 40), said switchback conveying means adapted to convey the sheet (P) separated by said friction separating/feeding means (5', 5", 52, 6, 6') through said switchback conveying path (PH1, A) from one end of said image reading section (105) into said image reading section (105) and thereafter adapted to switch said sheet (P) back to convey said sheet (P) out of said image reading section (105); and

a closed loop conveying means including said second conveying means (11, 40) and a closed loop conveying path forming a closed loop, said closed loop conveying means adapted to convey the sheet (P) separated by said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) through said closed loop conveying path, thereby conveying said sheet (P) from the other end of said image reading section (105) into said image reading section (105), said closed loop conveying means adapted to convey said sheet (P) out of said image reading section (105) from the side opposite to the side where the sheet (P) was conveyed thereinto.

7. A sheet feeding apparatus according to claim 6, wherein

said switchback conveying means is adapted to temporarily stop said sheet (P) on said image reading section (105) and wherein said closed loop conveying means is adapted to perform continuous conveyance of said sheet (P) conveyed into said image reading section (105) and said closed loop conveying means is adapted to carry the sheet (P) out thereof from the side opposite to the side where the sheet was conveyed thereinto.

8. A sheet feeding apparatus according to claim 6, wherein

said friction separating/feeding means (5', 5", 52, 6, 6') is means for separating said sheet (P) loaded on said tray (2), said means being provided on one side of said tray (2), wherein said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) is means for separating said sheet (P) loaded on said tray (2), said means being provided on another side of said tray (2) different from the one side of said tray (2) where said friction separating/feeding means (7, 20, 21, 426, 408, 409, 410) is provided , and

wherein at least one of said switchback con-

veying means and said closed loop conveying means is adapted to return a conveyed sheet to said tray (2).

9. A sheet feeding apparatus according to claim 8, wherein

a moving means (41) for moving a stack of sheets mounted on said tray (2) to a predetermined separation position on said tray (2); and

a control means for controlling said moving means (41) and said separating means (5', 5 " , 52, 6, 6', 7, 20, 21, 426, 408, 409, 410);

wherein said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) is means for separating the lowermost sheet (P) from the other sheets by blowing of air to a lower portion of a leading edge of the stack of sheets (P) having been conveyed to said separation position,

wherein said control means is adapted to control said air separating/feeding means (7, 20, 21, 426, 408, 409, 410) to start said blowing of air from said air separating/feeding means (7, 20, 21, 426, 408, 409, 410), prior to arrival of said stack of sheets (P) at said separation position.

10. A sheet feeding apparatus according to claim 9, wherein

a thickness detecting means (200) for detecting a thickness of said stack of sheets (P) mounted on said tray (2) at that time,

wherein said control means is adapted to change a blowing amount of air from said air separating/feeding means (7, 20, 21, 426, 408, 409, 410), according to a detection result of said thickness detecting means (200).

11. A sheet feeding apparatus according to claim 9 or 10,

wherein

said moving means (41) comprises a pushing means for pushing a trailing edge of said stack of sheets (P) to move said stack of sheets (P), and a conveying belt set on a tray surface of said tray (2),

wherein said conveying belt is adapted rotates in synchronism with the movement of said stack of sheets by said pushing means.

12. A sheet reading apparatus comprising:

the sheet feeding apparatus as set forth in any of claims 1 to 11; and

a reading means for reading the sheet having been fed thereto by said sheet feeding apparatus.

13. An image forming apparatus comprising:

the sheet feeding apparatus as set forth in any of claims 1 to 11;

a reading means for reading an image of a sheet having been fed thereto by said sheet feeding apparatus; and

an image forming means for forming the image of the sheet having been read by said reading means, on a recording medium of a sheet shape.

Patentansprüche

1. Blattzufuhrgerät mit:

einer Reibungs- Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') zum Trennen und Zuführen eines Blatts (P) durch Gebrauch machen von der Reibungskraft;

einer Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) zum Trennen und Zuführen des Blatts (P) durch Gebrauch machen von Luft; und

einer Auswähleinrichtung (300) zum Auswählen von entweder der Reibungs- Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') oder der Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410), und um zu bewirken, dass die durch die Auswähleinrichtung gewählte Einrichtung das Blatt abhängig von dem Blatt trennt und zuführt.

2. Blattzufuhrgerät gemäß Anspruch 1, wobei die Auswähleinrichtung (300) mit einem Blattgrößenerfassungssensor (30; 34) bereitgestellt ist, oder mit einer Anleitungseinrichtung, die in der Lage ist einen Vorlagenblattgrößen-Mischmodus anzuleiten, oder mit einem Modus für Vorlagenblätter mit Bindungslöchern.

3. Blattzufuhrgerät gemäß Anspruch 1, wobei eine erste Fördereinrichtung (6, 40) zum Führen des Blatts (P) vorgesehen ist, das durch die Reibungs-Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') getrennt und zu einem Bildleseabschnitt (105) zugeführt wird;
eine zweite Fördereinrichtung (11, 40) zum Führen des Blatts (P) vorgesehen ist, das durch die Luft-Trennungs/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) getrennt und zu dem Bildleseabschnitt (105) zugeführt wird.

4. Blattzufuhrgerät gemäß jedem der Ansprüche von 1 bis 3, wobei die Auswähleinrichtung (300) angepaßt ist, die Luft-Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) in einem normalen Modus auszuwählen.

5. Blattzufuhrgerät gemäß jedem der Ansprüche von

1 bis 4, wobei
ein Tablett (2) vorgesehen ist, auf dem das Blatt (P) abzulegen ist;
wobei die Reibungs- Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') angepaßt ist, das auf dem Tablett (2) abgelegte Blatt (P) zu trennen, und eine Zufuhreinrichtung und eine Zurückhalteeinrichtung hat; und
die Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) angepaßt ist, das auf dem Tablett (2) abgelegte Blatt (P) zu trennen, und eine Luftmesser- und Unterdruck-Saugfördereinrichtung hat.

6. Blattzufuhrgerät gemäß Anspruch 5, so weit er sich auf Anspruch 3 bezieht, wobei
eine Zurückschalteffördereinrichtung einen Zurückschalteförderweg (PH1, A) und die erste Fördereinrichtung (6, 40) aufweist, und die Zurückschaltefördereinrichtung angepaßt ist, das durch die Reibungs- Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') getrennte Blatt (P) durch den Zurückschalteförderweg (PH1, A) von einem Ende des Bildleseabschnittes (105) in den Bildleseabschnitt (105) zu befördern, und danach angepaßt ist, das Blatt (P) zurück zu schalten, um das Blatt (P) durch den Zurückschalteförderweg aus dem Bildleseabschnitt (105) heraus zu befördern; und
eine geschlossene Schleife-Fördereinrichtung mit der zweiten Fördereinrichtung (11, 40) und einem geschlossene Schleife-Förderweg, der eine geschlossene Schleife bildet, wobei die geschlossene Schleife-Fördereinrichtung angepaßt ist, das durch die Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) getrennte Blatt (P) durch den geschlossene Schleife-Förderweg zu befördern, und dabei das Blatt (P) von dem anderen Ende des Bildleseabschnitts (105) in den Bildleseabschnitt (105) hinein zu befördern, und die geschlossene Schleife-Fördereinrichtung angepaßt ist, das Blatt (P) aus dem Bildleseabschnitt (105) heraus zu befördern, von der Seite gegenüber der Seite, bei der das Blatt (P) hinein befördert wurde.

7. Blattzufuhrgerät gemäß Anspruch 6, wobei
die Zurückschalteffördereinrichtung angepaßt ist, das Blatt vorübergehend auf dem Bildleseabschnitt (105) zu stoppen, und wobei die geschlossene Schleife-Fördereinrichtung angepaßt ist, eine kontinuierliche Beförderung des Blatts (P) durchzuführen, das in den Bildleseabschnitt (105) befördert wurde und die geschlossene Schleife-Fördereinrichtung angepaßt ist, das Blatt (P) daraus heraus zu tragen, von der Seite gegenüber zu der Seite, bei der das Blatt hinein befördert wurde.

8. Blattzufuhrgerät gemäß Anspruch 6, wobei
die Reibungs- Trennungs-/ Zufuhreinrichtung (5', 5", 52, 6, 6') eine Einrichtung zum Trennen des auf dem Tablett (2) abgelegten Blatts (P) ist, wobei die Einrichtung auf einer Seite des Tabletts (2) bereitgestellt ist, und die Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) eine Einrichtung zum Trennen des auf dem Tablett (2) abgelegten Blatts (P) ist, und die Einrichtung auf der anderen Seite des Tabletts (2) bereitgestellt ist, unterschiedlich zu der einen Seite des Tabletts (2), bei der die Reibungs- Trennungs-/Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) bereitgestellt ist, und
wobei zumindest eine der beiden Fördereinrichtungen, nämlich entweder die Zurückschalteffördereinrichtung oder die geschlossene Schleife-Fördereinrichtung angepaßt ist, ein befördertes Blatt zu dem Tablett (2) zurück zu bringen.

9. Blattzufuhrgerät gemäß Anspruch 8, wobei
eine Bewegungseinrichtung (41) zum Bewegen eines Blätterstapels, befestigt auf dem Tablett (2) an einer vorbestimmten Trennposition auf dem Tablett (2) vorgesehen ist; und
eine Steuereinrichtung zum Steuern der Bewegungseinrichtung (41) und der Trenneinrichtungen (5', 5", 52, 6, 6' , 7, 20, 21, 426, 408, 409, 410);
wobei die Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) eine Einrichtung zum Trennen des untersten Blatts (P) von den anderen Blättern ist, durch das Abblasen von Luft zu einem niedrigen Abschnitt einer Führungskante des Blätter (P) -stapels, der zu der Trennposition befördert wurde,
wobei die Steuereinrichtung angepaßt ist, die Luft-Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) zu steuern, das Abblasen der Luft von der Luft-Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) vor der Ankunft des Blätter (P) -stapels bei der Trennposition zu beginnen.

10. Blattzufuhrgerät gemäß Anspruch 9, wobei
eine Dickenerfassungseinrichtung (200) zum Erfassen einer Dicke des Blätter (P) -stapels vorgesehen ist, der zu diesem Zeitpunkt auf dem Tablett (2) angebracht ist,
wobei die Steuereinrichtung angepaßt ist, ein Ausmaß der von der Luft- Trennungs-/ Zufuhreinrichtung (7, 20, 21, 426, 408, 409, 410) abgeblasenen Luft gemäß dem Erfassungsergebnis der Dickenerfassungseinrichtung (200) zu ändern.

11. Blattzufuhrgerät gemäß Anspruch 9 oder 10, wobei
die Bewegungseinrichtung (41) eine Schiebeeinrichtung zum Schieben einer nachlaufenden Kante des Blätter (P) - stapels hat, um den Blätter (P) -stapel zu bewegen, und
ein auf der Tablettoberfläche des Tabletts (2) aufgesetztes Förderband,
wobei das Förderband angepaßt ist synchron mit

der Bewegung des Blätterstapels durch die Schiebeeinrichtung zu drehen.

12. Blattlesegerät mit:

dem Blattzufuhrgerät gemäß jedem der Ansprüche von 1 bis 11; und
einer Leseeinrichtung zum Lesen des Blatts, das durch das Blattzufuhrgerät darin eingeführt wurde.

13. Bilderzeugungsgerät mit:

dem Blattzufuhrgerät gemäß jedem der Ansprüche von 1 bis 11;
einer Leseeinrichtung zum Lesen des Blatts, das durch das Blattzufuhrgerät darin eingeführt wurde; und
einem Bilderzeugungsgerät zum Erzeugen des Bildes des durch die Leseeinrichtung gelesenen Blatts auf einem Aufzeichnungsmedium in Blattform.

Revendications

1. Appareil d'alimentation en feuilles comportant:

un moyen (5', 5 ", 52, 6, 6') de séparation/alimentation par friction destiné à séparer et faire avancer une feuille (P) en utilisant une force de friction;
un moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air destiné à séparer et faire avancer la feuille (P) en utilisant de l'air; et
un moyen de sélection (300) destiné à sélectionner l'un dudit moyen (5', 5", 52, 6, 6') de séparation/alimentation par friction et dudit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air et à amener ledit moyen sélectionné par le moyen de sélection à séparer et faire avancer la feuille en fonction de la feuille.

2. Appareil d'alimentation en feuilles selon la revendication 1, dans lequel
ledit moyen de sélection (300) est pourvu d'un capteur (30; 34) de détection de format de feuille, ou d'un moyen d'instruction destiné à l'instruction d'un mode de mélange de formats des feuilles originales ou d'un mode pour des feuilles originales à trous de reliure.

3. Appareil d'alimenation en feuilles selon la revendication 1, comportant
un premier moyen de transport (6, 40) destiné à guider la feuille (P) séparée et avancée par ledit moyen (5', 5 ", 52, 6, 6') de séparation/alimentation par friction jusqu'à une section (105) de lecture d'image;
un second moyen de transport (11, 40) destiné à guider la feuille (P) séparée et avancée par ledit moyen (7, 20, 21, 426, 408, 410) de séparation/alimentation par air jusqu'à ladite section (105) de lecture d'image.

4. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 3, dans lequel
ledit moyen de sélection (300) est conçu pour sélectionner ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air dans un mode normal.

5. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 4, comportant
un plateau (2) sur lequel la feuille (P) doit être chargée;
dans lequel ledit moyen (5', 5", 52, 6, 6') de séparation/alimentation par friction est conçu pour séparer ladite feuille (P) chargée sur ledit plateau (2) et comprend un moyen d'advance et un moyen de retrait; et
ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air est conçu pour séparer ladite feuille (P) chargée sur ledit plateau (2), et comprend un moyen à lame d'air et de transport par dépression.

6. Appareil d'alimentation en feuilles selon la revendication 5 en dépendance de la revendication 3, dans lequel
un moyen de transport a aiguillage comprend un chemin de transport à aiguillage (PH1, A) et ledit premier moyen de transport (6, 40), ledit moyen de transport à aiguillage étant conçu pour transporter la feuille (P) séparée par ledit moyen (5', 5", 52, 6, 6') de séparation/alimentation par friction à travers ledit chemin de transport à aiguillage (PH1, A) a partir d'une extrémité de ladite section (105) de lecture d'image jusque dans ladite section (105) de lecture d'image et, étant conçu pour ensuite aiguiller ladite feuille (P) en retour pour transporter la feuille (P) en sortie de ladite section (105) de lecture d'image; et
un moyen de transport à boucle fermée comprenant ledit second moyen de transport (11, 40) et un chemin de transport en boucle fermée formant une boucle fermée, ledit moyen de transport à boucle fermée étant conçu pour transporter la feuille (P) séparée par ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air en la faisant passer dans ledit chemin de transport à boucle fermée, transportant ainsi ladite feuille (P) depuis l'autre extrémité de ladite section (105) de lecture d'image jusque dans ladite section (105) de lecture

d'image, ledit moyen de transport à boucle fermée étant conçu pour transporter ladite feuille (P) en sortie de ladite section (105) de lecture d'image depuis le côté opposé au côté où la feuille (P) a été transportée en entrée dans cette section.

7. Appareil d'alimentation en feuilles selon la revendication 6, dans lequel

ledit moyen de transport à aiguillage est conçu pour arrêter temporairement ladite feuille (P) sur ladite section (105) de lecture d'image et dans lequel ledit moyen de transport à boucle fermée est conçu pour exécuter un transport continu de ladite feuille (P) transportée en entrée dans ladite section (105) de lecture d'image et ledit moyen de transport à boucle fermée étant conçu pour en faire sortir la feuille (P) depuis le côté opposé au côté où la feuille y a été transportée en entrée.

8. Appareil d'alimentation en feuilles selon la revendication 6, dans lequel

ledit moyen (5', 5'', 52, 6, 6') de séparation/alimentation par friction est un moyen destiné à séparer ladite feuille (P) chargée sur ledit plateau (2), ledit moyen étant prévu sur un côté dudit plateau (2), dans lequel ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air est un moyen destiné à séparer ladite feuille (P) chargée sur ledit plateau (2), ledit moyen étant prévu sur un autre côté dudit plateau (2) différent du côté précédent dudit plateau (2) où ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par friction est prévu, et

dans lequel au moins l'un dudit moyen de transport à aiguillage et dudit moyen de transport à boucle fermée est concu pour ramener une feuille transportée vers ledit plateau (2).

9. Appareil d'alimentation en feuilles selon la revendication 8, comportant

un moyen de déplacement (41) destiné à déplacer une pile de feuilles montée sur ledit plateau (2) jusqu'à une position prédéterminée de séparation sur ledit plateau (2); et

un moyen de commande destiné à commander ledit moyen de déplacement (41) et ledit moyen de séparation (5', 5'', 52, 6, 6', 7, 20, 21, 426, 408, 409, 410);

dans lequel ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air est un moyen destiné à séparer la feuille (P) la plus basse des autres feuilles en projetant de l'air vers une partie inférieure d'un bord avant de la pile de feuilles (P) ayant été transportée jusque dans ladite position de séparation,

dans lequel ledit moyen de commande est conçu pour commander ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air pour commencer ladite projection d'air depuis ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air, avant l'arrivée de ladite pile de feuilles (P) dans ladite position de séparation.

10. Appareil d'alimentation en feuilles selon la revendication 9, comportant

un moyen (200) de détection d'épaisseur destiné à détecter une épaisseur de ladite pile de feuilles (P) montée à ce moment sur ledit plateau (2),

dans lequel ledit moyen de commande est conçu pour faire varier la quantité d'air soufflée depuis ledit moyen (7, 20, 21, 426, 408, 409, 410) de séparation/alimentation par air, en fonction d'un résultat de détection dudit moyen (200) de détection d'èpaisseur.

11. Appareil d'alimentation en feuilles selon la revendication 9 ou 10, dans lequel

ledit moyen de déplacement (41) comporte un moyen de poussée destiné à pousser un bord arrière de ladite pile de feuilles (P) pour déplacer ladite pile de feuilles (P), et une bande de transport disposée sur une surface dudit plateau (2),

dans lequel ladite bande de transport est conçue pour tourner en synchronisme avec le déplacement de ladite pile de feuilles par ledit moyen de poussée.

12. Appareil de lecture de feuilles comportant:

l'appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 11; et
un moyen de lecture destiné a lire la feuille qui lui a été amené par ledit appareil d'alimentation en feuilles.

13. Appareil de formation d'images comportant:

l'appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 11;
un moyen de lecture destine a lire une image d'une feuille qui lui a été amené par ledit appareil d'alimentation en feuille; et
un moyen de formation d'images destiné à former l'image sur la feuille ayant été lue par ledit moyen de lecture, sur un support d'enregistrement de la forme d'une feuille.

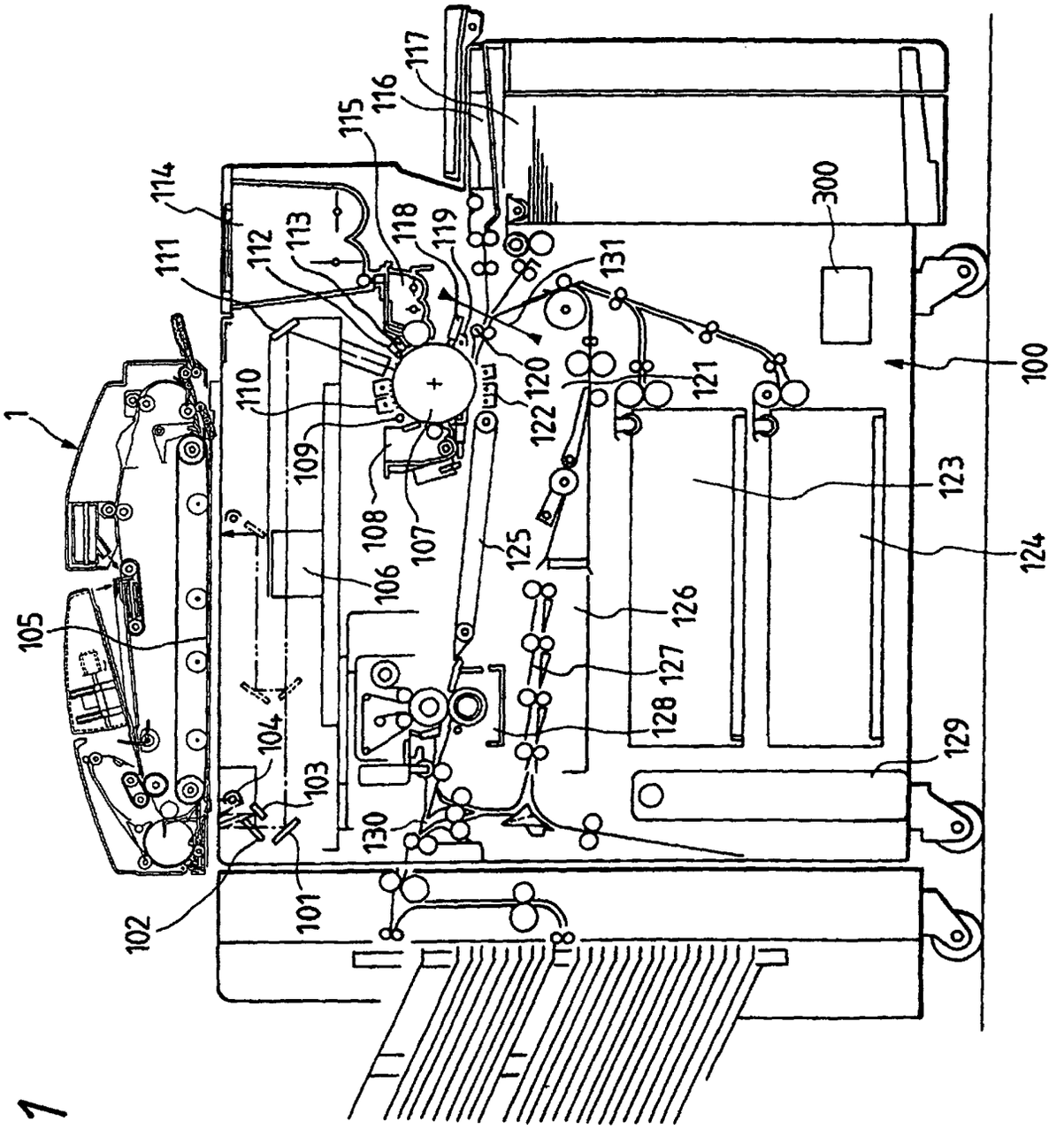

1
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
300

FIG. 1

FIG. 2

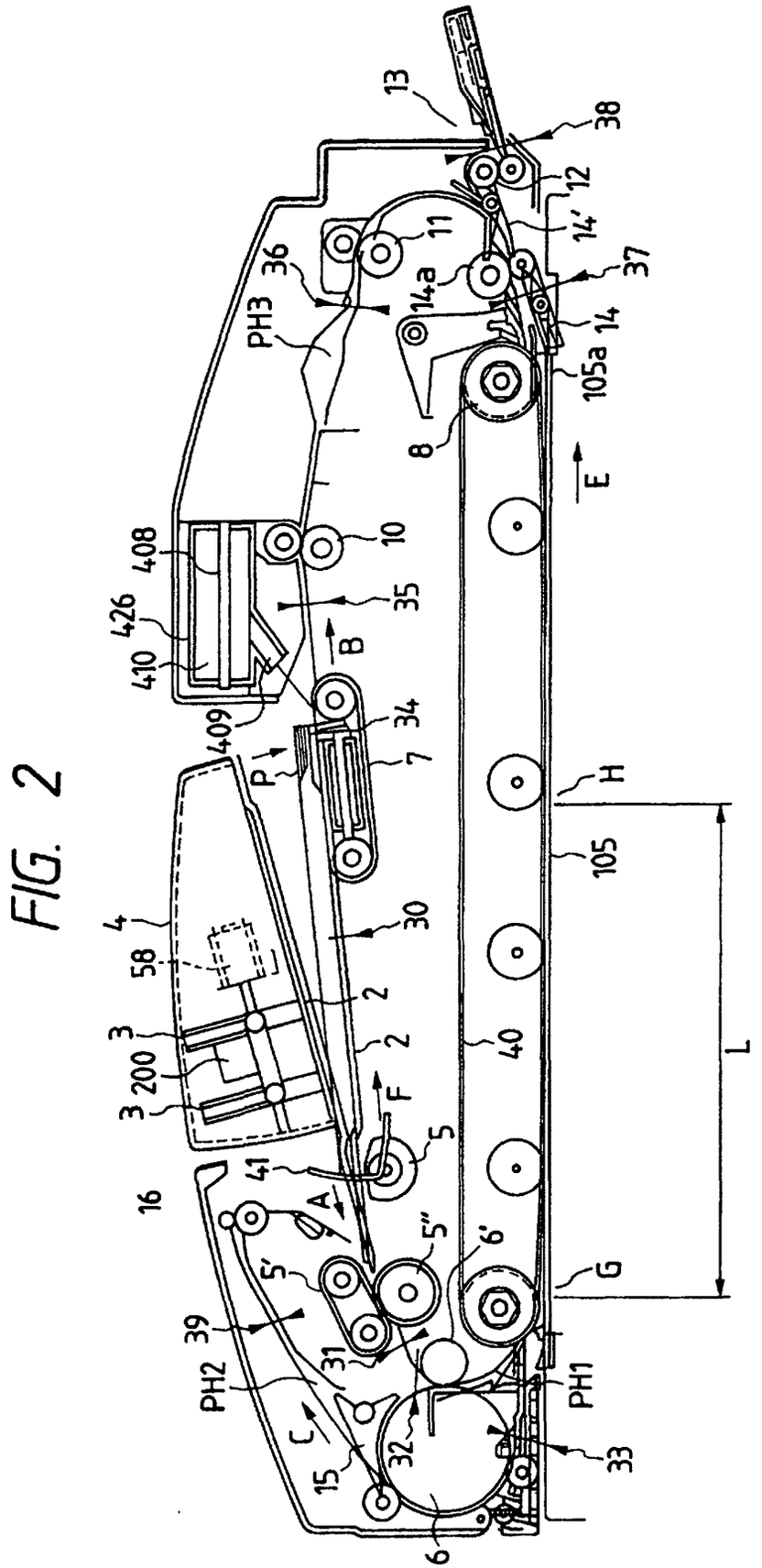

13
38
12
14'
11
37
36
14a
PH3
14
105a
8
E
10
408
35
426
B
410
409
34
P
7
H
105
30
4
58
2
3
200
40
F
L
5
41
16
A
5"
6'
5'
G
39
31
PH1
PH2
C
32
33
15
6

FIG. 3

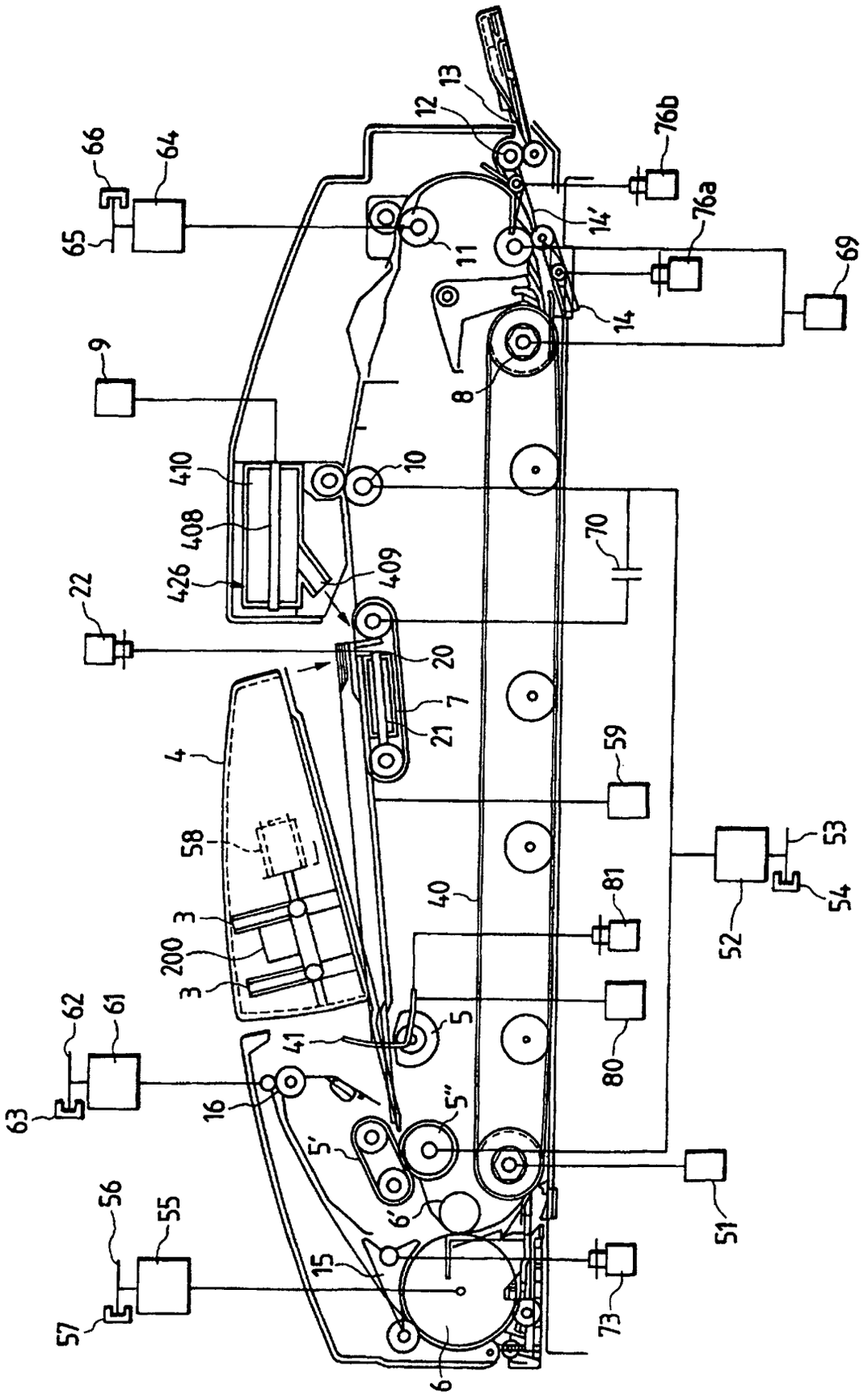

66
64
65
12
13
76b
14'
76a
11
69
14
9
8
410
10
408
70
426
409
22
20
7
21
4
59
58
53
54
81
40
3
200
52
3
62
61
5
41
80
63
16
5''
5'
56
55
6'
51
15
73
57
6

FIG. 4

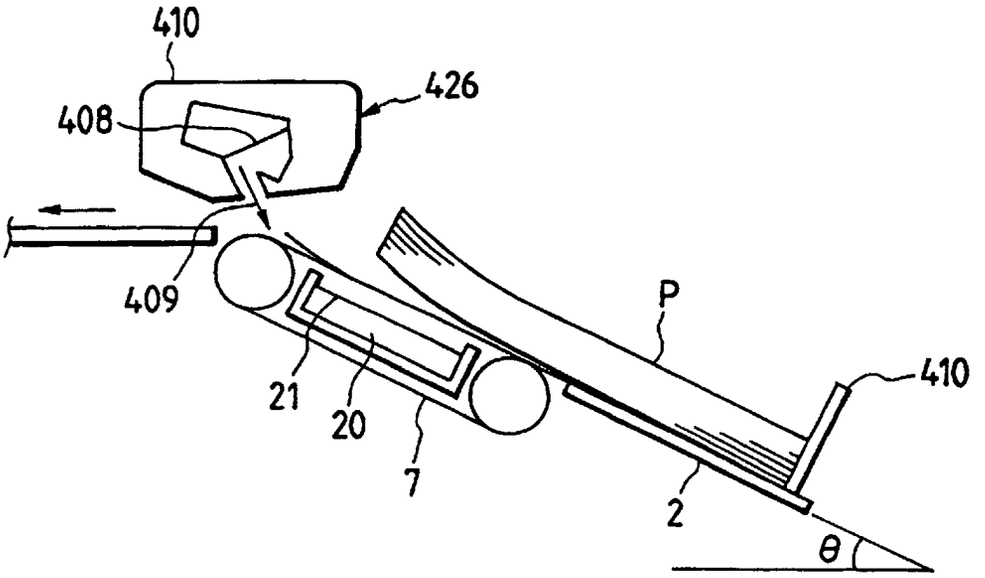


FIG. 5

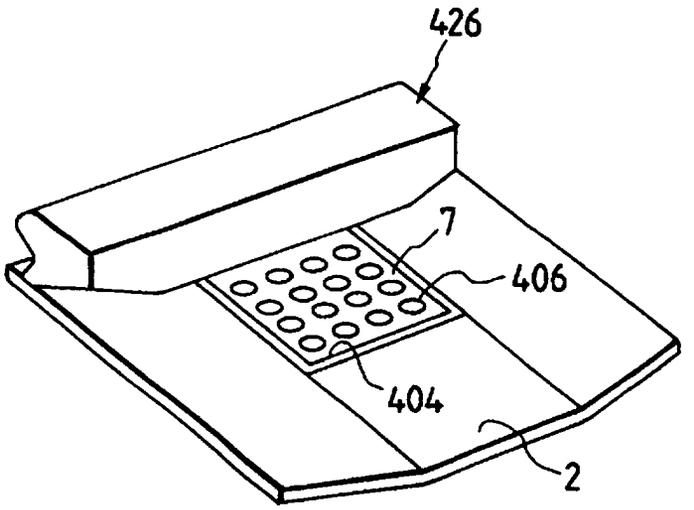


FIG. 6

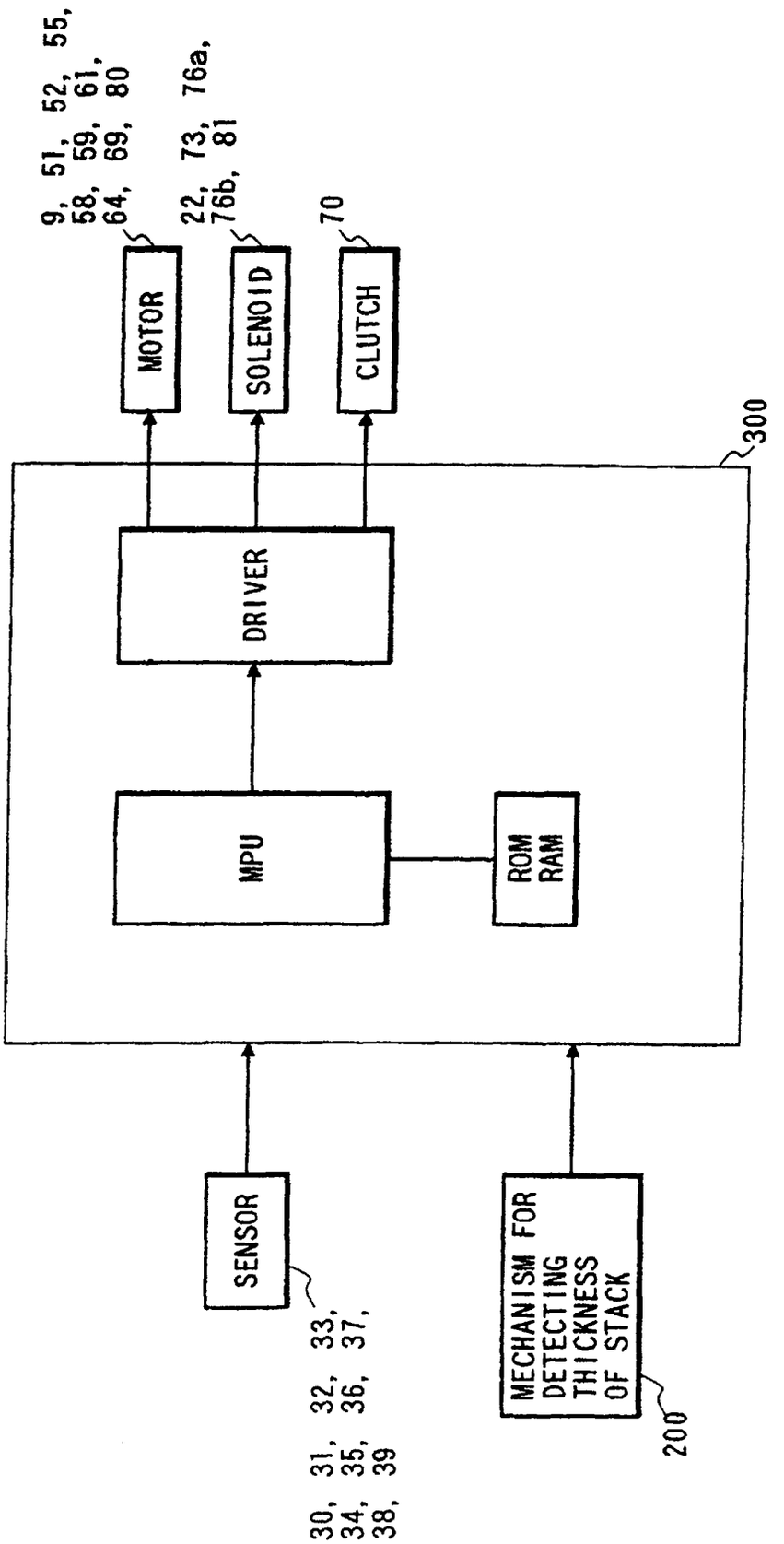
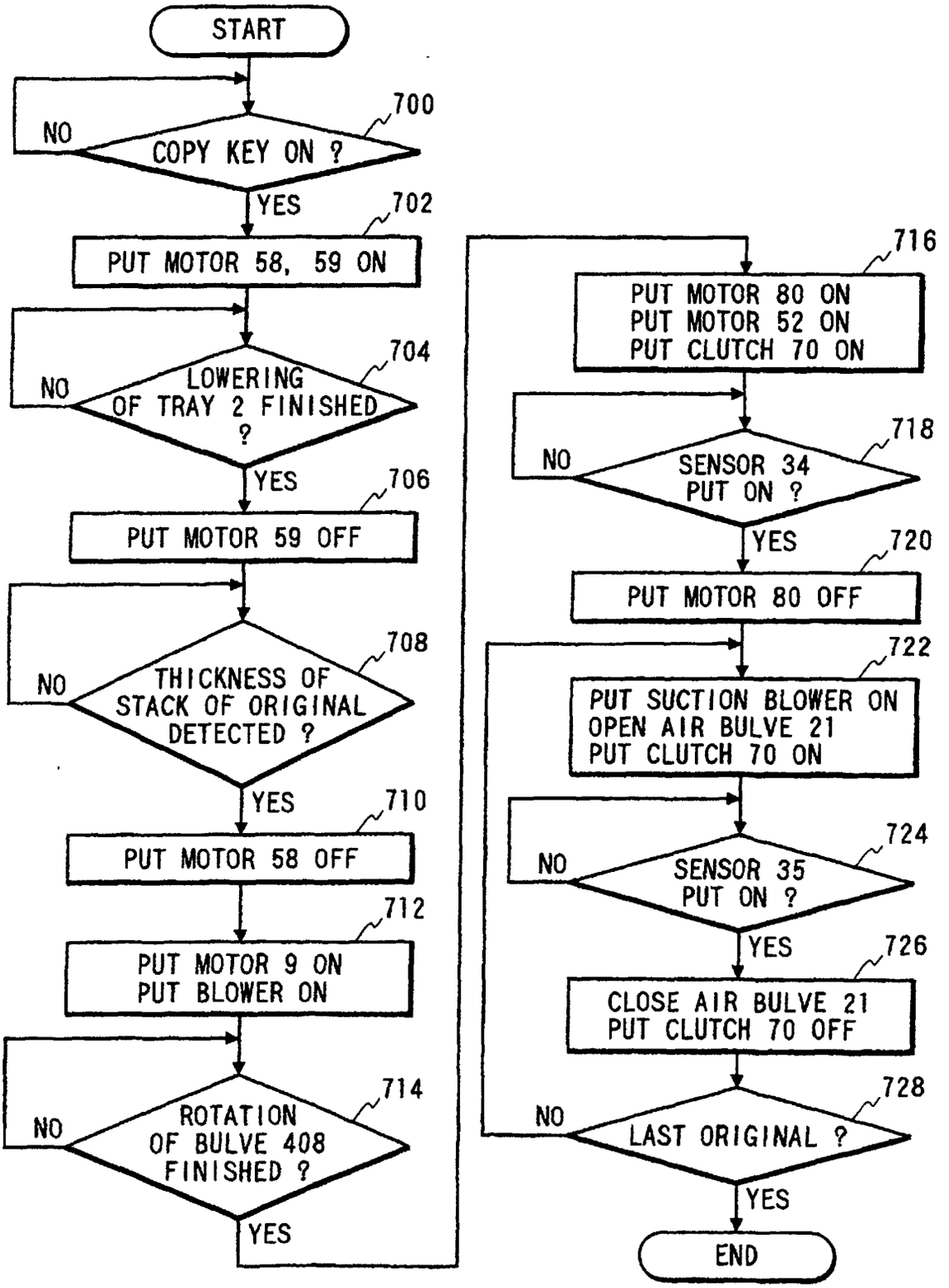

9, 51, 52, 55,
58, 59, 61,
64, 69, 80
22, 73, 76a,
76b, 81
70
MOTOR
SOLENOID
CLUTCH
300
DRIVER
MPU
ROM
RAM
SENSOR
30, 31, 32, 33,
34, 35, 36, 37,
38, 39
MECHANISM FOR
DETECTING
THICKNESS
OF STACK
200

FIG. 7


START
700
NO
COPY KEY ON ?
YES
702
PUT MOTOR 58, 59 ON
704
NO
LOWERING OF TRAY 2 FINISHED ?
YES
706
PUT MOTOR 59 OFF
708
NO
THICKNESS OF STACK OF ORIGINAL DETECTED ?
YES
710
PUT MOTOR 58 OFF
712
PUT MOTOR 9 ON
PUT BLOWER ON
714
NO
ROTATION OF BULVE 408 FINISHED ?
YES
716
PUT MOTOR 80 ON
PUT MOTOR 52 ON
PUT CLUTCH 70 ON
718
NO
SENSOR 34 PUT ON ?
YES
720
PUT MOTOR 80 OFF
722
PUT SUCTION BLOWER ON
OPEN AIR BULVE 21
PUT CLUTCH 70 ON
724
NO
SENSOR 35 PUT ON ?
YES
726
CLOSE AIR BULVE 21
PUT CLUTCH 70 OFF
728
NO
LAST ORIGINAL ?
YES
END

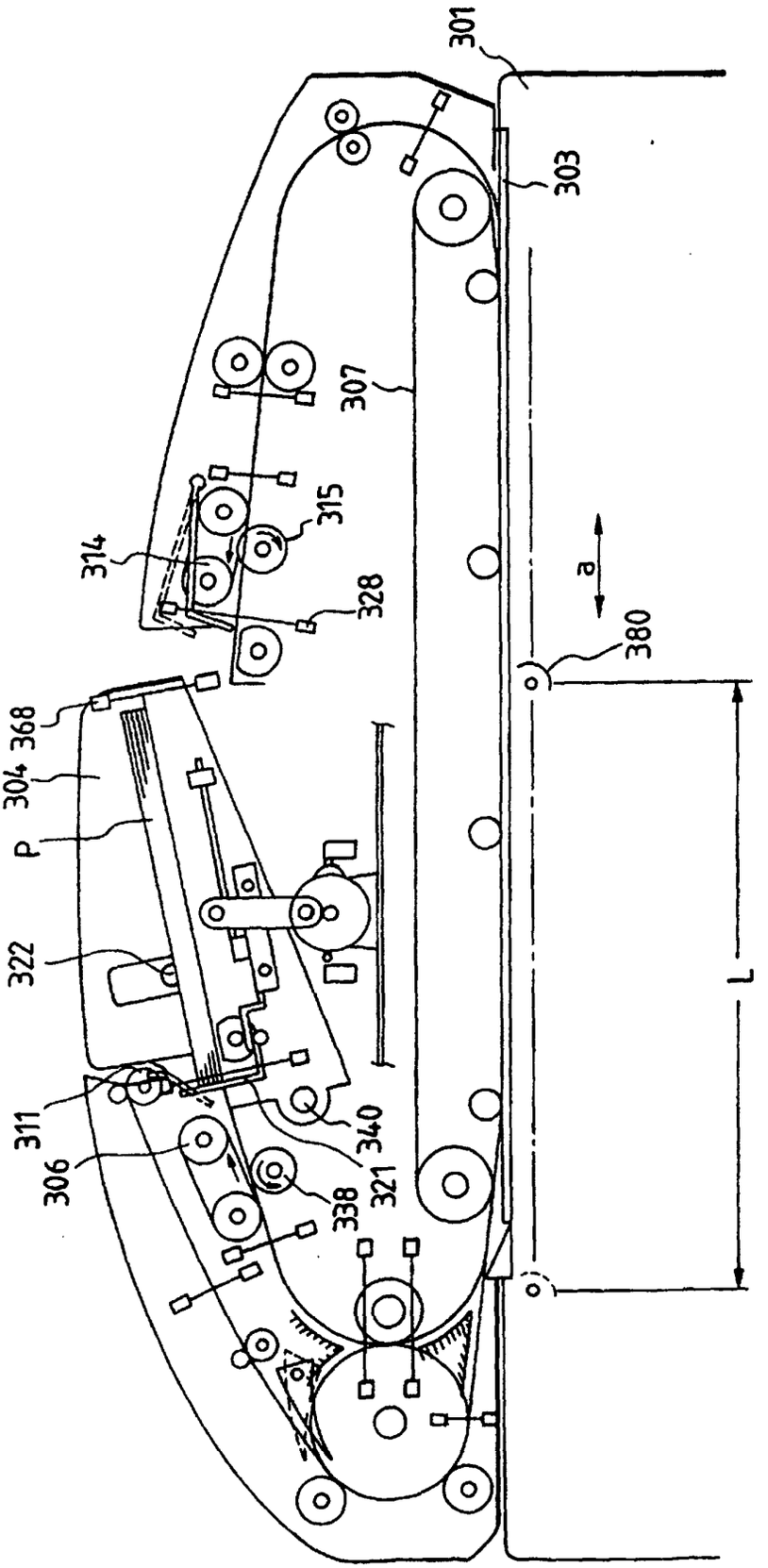



FIG. 8
PRIOR ART