

Description

Field of the Invention

The present invention relates to a sheet feeding apparatus comprising the features as defined in the preamble clause of claim 1. Such a sheet feeding apparatus may be used for a sheet feeding system of an image reading equipment such as a scanner, facsimile or the like, and is known, for example, from US-A-4801134.

Related Background Art

An image reading equipment using a conventional sheet feeding apparatus of this kind is shown in Fig. 1.

In Fig. 1, an image reading equipment 100 includes a first feeding means 105 comprising an entrance roller 102, a feed roller 103 and a separating roller 104, and a second feeding means 107 comprising a feed conveying roller against which a reading means 106 is urged, these first and second feeding means being disposed along an original feeding direction (through which an original 101 as a sheet is fed) at upstream and down stream sides, respectively. Incidentally, the reference numeral 108 denotes an original detecting sensor arranged between the first feeding means 105 and the second feeding means 107.

In a sheet feeding apparatus 109 so constructed, the original 101 is fed out toward the downstream side by rotating the feed roller 103 in an anticlockwise direction, and the a leading end of the original 101 is abutted against a contacting portion a between a contact glass S of an image sensor of contact type (constituting the reading means 106) and the second feeding means 107, and then the original is further fed to form a loop in the original for correcting the skew feed of the original, and thereafter, the reading and ejection of the original is effected by conveying the original by rotating the second feeding means 107 in an anticlockwise direction. During this operation, the separating roller 104 is always driven in an anti-clockwise direction through a torque limiter (not shown) to prevent the double-feed of the originals.

However, in the conventional sheet feeding mechanism utilizing the friction of the rollers, the loop in the original (sheet) can often not be formed in accordance with the conditions of the material of the original, the coefficient of friction of the rollers and the change thereof, the urging force acting on the friction roller and/or the distance between the friction roller and a sheet outlet.

Further, in such sheet feeding mechanism, the feed roller 103 incorporates a one-way clutch therein for transmitting a driving force of the feed

roller to only one direction (original feeding direction, during the feeding of the original). However, conventional one-way clutches transmit a little driving force even to a reverse direction (to which the driving force should not be transmitted) (i.e., original returning direction, during the conveying of the original for reading). Further, the separating roller 104 is always driven through the torque limiter in the original returning direction.

Consequently, before the conveying roller of the second feeding means 107 is driven in the original feeding direction to pinch the leading end of the original and to convey the original for the reading thereof, the feed roller 103 and/or separating roller 104 often causes the leading end of the original to move back from a position where the leading end has been abutted against the contacting portion a, thus arising a erroneous feeding or poor feeding.

In order to prevent such poor feeding, a technique in which, when the original is fed by the rotation of the feed roller 103, the conveying roller 107 is also driven, and the feed roller 103 is stopped after the conveying roller 107 has pinched the leading end of the original has been proposed. However, in this case, there arose a problem that the skew feed of the original occurred because the posture of the original could not be corrected before the conveying of the original.

SUMMARY OF THE INVENTION

The present invention aims to eliminate the above-mentioned conventional drawbacks, and has an object to provide a sheet feeding apparatus which can prevent the application of a force in the sheet returning direction until a second feeding means can positively convey a sheet fed by a first feeding means.

In order to achieve the above object, the present invention provides a sheet feeding apparatus of the type as defined above which further comprises the features as defined in the characterizing clause of claim 1.

Advantageous, further developments of the subject matter of invention are defined in the sub-claims.

With such an arrangement it is possible that the first feeding rotary means can be driven in the sheet feeding direction until the second feeding rotary means positively pinches the sheet fed by the first feeding rotary means. Accordingly, the sheet can be positively received from the first feeding rotary means to the second feeding rotary means regardless of the material of the sheet, the friction of coefficient of the first feeding rotary means and/or the change in such friction of coefficient, with the result that the sheet abutted against

the second feeding rotary means is prevented from moving back, thus avoiding the poor feeding of the sheet.

Further, by the use of normal and reverse rotations of a first reversible driving force, it is also possible to positively receive the sheet from the first feeding rotary means to the second feeding rotary means, by driving the first and second feeding rotary means, and by stopping the first feeding rotary means until the second feeding rotary means can positively convey the sheet fed by the first feeding rotary means.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic front sectional view of a conventional sheet feeding apparatus;

Figs. 2 to 7F shows a sheet feeding apparatus according to a preferred embodiment of the present invention, where Fig. 2 is a schematic perspective view, Figs. 3 and 4 are elevational sectional views, Fig. 5 is a perspective view of a transmission portion of a rotary shaft, Fig. 6 is a perspective view showing a clutch spring in the transmission portion, and Figs. 7A to 7F are schematic sectional views showing the operation of the apparatus;

Fig. 8 is an elevational sectional view of a sheet feeding apparatus according to a second embodiment of the present invention;

Figs. 9A to 9F are schematic sectional view showing the operation of the apparatus of Fig. 8; Figs. 10A to 10C are explanatory views showing the operation of a sheet feeding apparatus according to a third embodiment of the present invention;

Figs. 11A to 11C are explanatory views showing the operation of a sheet feeding apparatus according to a fourth embodiment of the present invention;

Figs. 12A to 12C are explanatory views showing the operation of a sheet feeding apparatus according to a fifth embodiment of the present invention; and

Fig. 13 is an elevational sectional view showing an alternative example of a gear train for driving rollers 205 and 206.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will now be explained in connection with embodiments thereof with reference to the accompanying drawings.

First of all, a preferred embodiment shown in Figs. 2 to 7 will be described.

Fig. 2 is a perspective view of a main portion of a sheet feeding apparatus according to the pre-

ferred embodiment, and Figs. 3 and 4 are elevational sectional views of a driving mechanisms of the sheet feeding apparatus.

In Figs. 2 to 4, a rotary shaft 10 fitting a gear 19 thereon is rotatably supported by a parallel frame 6 through a sleeve portion 19a of the gear 19. And, as shown in Fig. 5, the rotary shaft 10 has a pin 10a which is loosely received in a notch 19a' formed in the sleeve 19a. The other end of the rotary shaft 10 is rotatably supported by the frame 6 through a bearing 19b, and a gear 52 is attached to the other end of the rotary shaft through a spring clutch 53. The gear 52 is so arranged that a driving force from a driving source (described later) is not transmitted to a sheet feeding direction (shown by the arrow A) for feeding an original P as a sheet and the driving force can be transmitted to a reverse direction (shown by the arrow B in Fig. 2). Further, the gear 19 is drivingly connected to a gear 23 fixedly mounted on an output shaft 21a of a motor 21 acting as the driving source attached to the frame 6, through a gear 26 and a larger gear portion 25a of a gear 25, whereby the gear 19 receives the driving force from the motor 21.

Further, feed rollers 5 and a pair of levers 11 are mounted on the rotary shaft 10, and a pulley 27 is fixed to the shaft 10. More particularly, the feed rollers 5 are connected to the rotary shaft 10 through a one-way clutch 29, so that the feed rollers 5 can receive the driving force from the motor 21 in the sheet feeding direction A. In the reverse direction opposite to the sheet feeding direction, the driving force from the motor is not transmitted to the feed rollers by the presence of the one-way clutch 29.

A rotary shaft 12 is rotatably mounted on the levers 11 substantially in parallel with the rotary shaft 10. An entrance roller 13, pulley 30 and friction rollers 31 are fixedly mounted on the rotary shaft 12. Compression springs 32 are disposed between the pulley 30 and the friction roller 31 and between the entrance roller 13 and the friction roller 31, respectively, so that the friction rollers 31 are urged against the levers 11 by the compression springs 32. Further, the pulley 30 and the pulley 27 are connected to each other by a timing belt 33 so that the driving force is transmitted from the rotary shaft 10 to the entrance roller 13. The left (Fig. 3) friction roller 31, pulley 30, entrance roller 13 and right friction roller 31 are engaged by each other through engagement portions (not shown), respectively, so that the pulley 30, entrance roller 13 and friction rollers 31 can be rotated altogether. Accordingly, when the rotary shaft 10 is rotated in a direction shown by the arrow in Fig. 2, the levers 11 are rotated in the clockwise direction to separate the entrance roller 13 from the original; whereas, when the rotary shaft 10 is rotated reversely,

the levers 11 are rotated in the anti-clockwise direction to urge the entrance roller 13 against the original.

Further, a rotary shaft 40 is rotatably supported by the frame 6 through bearings 40a and is spaced apart from the rotary shaft 10 by a predetermined distance. A gear 22 is connected to one end of the rotary shaft 40 through a spring clutch 28 (refer to Fig. 6) so that the strong driving force is transmitted to a sheet (original) returning direction (shown by the arrow B in Fig. 2). A slipping torque of the spring clutch 28 (slipping torque of the spring clutch 28 in a loosing direction) has a torque value greater than a value of a torque required to rotate separating rollers 46 (described later) in the sheet (original) feeding direction A. The gear 22 is connected to a smaller gear portion 25b of the gear 25 through a gear 24. The spring clutch 28 can rotate the separating rollers 46 even in the original feeding direction, other than the case when the rotary shaft 40 is rotated in the original returning direction by a gear train 49 and the like.

Further, on the rotary shaft 40, a drum 42 is fixedly mounted, and a pulley 43 and two support plates 41 are rotatably mounted. The drum 42 is connected to the pulley 43 through a spring clutch 44. The support plates 41 rotatably support a rotary shaft 45 substantially in parallel to the rotary shaft 40. A pair of separating rollers 46 and a pulley 47 are fixedly mounted on the rotary shaft 45. The pulley 47 is connected to the pulley 43 through a timing belt 48 so that these pulleys are driven in the original returning direction by the spring clutch 44 with a predetermined allowable or tolerance value (slipping torque). The separating rollers 46 are urged upwardly to be pressed against the feed rollers 5 by means of springs (not shown).

Incidentally, a gear 49 fixedly mounted on the other end of the rotary shaft 40 is connected to a gear 52 through gears 50 and 51. The feed rollers 5, entrance roller 13 and separating rollers 46 constitute a first feeding means X.

Accordingly, the separating rollers 46 receive the driving force in the anti-clockwise direction (Fig. 7) through the gears 23, 25, 24, 22 and the spring clutch 28 when the motor 21 is rotated in the normal direction (Fig. 3), and receive the driving force in the clockwise direction through the gears 23, 25, 26, 19, rotary shaft 10, spring clutch 53 and gears 52, 51, 50, 49 when the motor is rotated in the reverse direction, and (since the force transmitted from the gear train 52, 51, 50, 49 to the rotary shaft 40 is greater than the force transmitted from the gear train 24, 22 and spring clutch 28 to the rotary shaft 40) is always driven in the original returning direction B with a predetermined allowable value (slipping torque of the spring clutch 44). However, when a given time is elapsed after the

motor has been changed from the normal rotation to the reverse rotation, that is to say, when the driving force is transmitted from the gear 19 to the rotary shaft 10 in a driving force transmitting path to the separating rollers 46 during the reverse rotation of the motor 21, since the gear 19 has a given play angle θ , the driving force is not transmitted to the rotary shaft 10, and the gear 19 is rotated in the original feeding direction by the slipping torque of the spring clutch 28 through the gears 23, 25, 24 and 22. Thereafter, when the pin 10a is engaged by the lateral surface of the notch 19a' the driving force is transmitted from the gear 19 to the rotary shaft 10, with the result that the rotary shaft 40 (separating rollers 46) is rotated in the original returning direction through the gear train 52, 51, 50, 49 by overcoming the slipping torque of the spring clutch 28.

A second feeding means comprising a conveying roller 64 is rotatably mounted on the frame 6 at a downstream side of the feed rollers 5 and the separating rollers 46 with respect to the original feeding direction A. A gear 61 is connected through a one-way clutch 62 to a rotary shaft 63 to which the conveying roller 64 is fixed, which gear 61 is meshed with the gear 24. An image sensor 70 of contact type acting as a reading means is pressed against the conveying roller 64 along a reading line. Incidentally, the spring clutch 53 is designed that the driving force from the driving source is not transmitted to the original feeding direction and is transmitted to the reverse direction.

Next, the operation of the sheet feeding apparatus according to the illustrated embodiment will be explained.

When the single motor 21 is rotated in the normal direction (shown by the arrow in Fig. 3) in response to a sheet feeding command signal from a controller (not shown), the entrance roller 13 and feed rollers 5 are rotated in the directions shown by the arrows in Fig. 7A, and at the same time the entrance roller 13 is lowered. Further, although the separating rollers 46 tend to rotate in the original returning direction (anti-clockwise direction), in this case, they are rotated in the direction shown by the broken arrow by following the rotation of the feed rollers 5, against the slipping torque of the spring clutch 44.

In Fig. 7B, the entrance roller 13 abuts against an uppermost original P on a sheet stack stored on a support and feeds out the original P from the support. If two or more originals P are fed out, the separating rollers 46 are rotated in the anti-clockwise direction by the slipping force of the spring clutch 44 to return the original other than the uppermost one P.

In Fig. 7C, a leading end of the uppermost original P fed by the feed rollers 5 is abutted

against a contacting portion a formed between the conveying roller 64 (now stopped) and the image sensor 70 of contact type. Further, on the basis of a detection signal from an original end detecting sensor S_1 arranged between the feed rollers 5 and the conveying roller 64, the original P is still fed until it forms a loop therein, thereby correcting the posture (particularly, the skew-feed) of the original. In this case, the separating rollers 46 are being rotated in the clockwise direction by following the rotation of the feed rollers 5 for feeding the original P to the right. Also, in this case, the original P sometimes cannot form the loop therein in accordance with the conditions of the material of the original P, surroundings and/or the feeding force of the feed rollers 5, and keeps a straight condition (shown by the broken straight line in Fig. 7C).

In Fig. 7D, after the feeding of the original is finished, the single motor 21 is rotated in the reverse direction to rotate the conveying roller 64 in the direction shown by the arrow, thereby pinching the original between the image sensor 70 and the conveying roller 64. When the motor 21 starts to be rotated in the reverse direction, since the force for rotating the rotary shaft 40 through the gear train 23, 25, 24, 22 and the spring clutch 28 is greater than the force required for rotating the gear train 49-52, spring clutch 53 and the rotary shaft 10, the separating rollers 46 are rotated in the direction shown by the broken arrow by a predetermined time period (time period required for engaging the side wall of the notch 19a' against the pin 10a), thereby further pushing the original to the right. Further, although the feed rollers 5 do not receive the driving force by the action of the clutch 29, they are rotated in the anti-clockwise direction by following the movement of the original P. Now, the driving force is not transmitted to the entrance roller 13.

Accordingly, regardless of the material of the original, the coefficient of friction of the separating rollers 46 and the change in the urging force of the separating rollers, the original P can positively be received from the feed rollers 5 and separating rollers 46 to the conveying roller 64, thus preventing the poor feeding of the original which will be caused when the original is moved back to separate from the contacting portion a. Thereafter, when a predetermined time is elapsed, although the rotary shaft 40 tends to rotate reversely through the gear train 52, 51, 50, 49, it is rotated in the clockwise direction by following the movement of the original P.

In Fig. 7E, the reading operation is initiated while conveying the original P by the rotation of the conveying roller 64 with pinching the original between the image sensor 70 and the conveying roller 64. In this case, the feed rollers 5 (which do

not receive the driving force, in this condition) are rotated by following the movement of the original P, and the separating rollers 46 (which tend to rotate reversely) are also rotated by following the movement of the original P. The entrance roller 13 is rotated in the direction shown by the arrow in response to the clockwise rotation of the rotary shaft 10 and is retarded (lifted) from the original P.

In Fig. 7F, when a trailing end of the original P has passed through between the feed rollers 5 and the separating rollers 46, the separating rollers 46 are rotated in the original returning direction as shown by the arrow, and the feed rollers 5 are rotated by following the rotation of the separating rollers 46. Further, after the trailing end of the original P has passed through between the image sensor 70 and the conveying roller 64, the reading operation of the original is finished.

Thereafter, when a predetermined time is elapsed after the trailing end of the original has passed through the sensor S_1 , the single motor 21 is rotated in the normal direction again to restore the condition shown in Fig. 7A. In this way, the feeding and reading the original P can be repeated.

Incidentally, with respect to the gear 19 provided in the driving transmission portion, it is possible to give the same function to a front stage of the gear 19 regarding the motor 21 or the driving force may be interrupted by using an appropriate solenoid.

Next, another or second embodiment of the present invention will be explained with reference to Figs. 8 and 9. Incidentally, the explanation regarding the same elements as those shown in Figs. 1 to 5 will be omitted.

The characteristic or feature of this second embodiment is that the design of a spring clutch 28 is changed so that the driving force in the normal direction is not transmitted to the separating rollers 46. To this end, in the construction of the spring clutch 28, a slipping torque (slipping torque of the spring clutch 28 in a loosening direction) is selected or set to have a value lower than the torque required for rotating the separating rollers 46 in the original feeding direction.

Consequently, when the gear 22 is rotated in the reverse direction, the rotation of this gear is transmitted to the rotary shaft 40 to rotate the separating rollers 46 in the reverse direction; but, when the gear 22 is rotated in the normal direction, the rotation thereof is not transmitted to the rotary shaft 40.

Accordingly, although the separating rollers 46 are rotated reversely when the motor 21 is rotated in the normal direction, when the motor 21 is rotated in the reverse direction, the separating rollers 46 are temporarily stopped since the gear train 52, 51, 50, 49 is not rotated due to the play θ

between the gear 19 and the rotary shaft 10 and the rotary shaft 40 is not rotated by the action of the spring clutch 28.

Fig. 9 shows the above-mentioned operation, wherein Figs. 9A-9C, 9E and 9F correspond to Figs. 7A-7C, 7E and 7F, respectively, but Fig. 9D differs from Fig. 7D.

The sheet (original) feeding operation regarding the second embodiment will be explained with reference to Fig. 9.

In Fig. 9A, when the single driving source (motor 21) is rotated in the normal direction in response to a sheet feeding command signal, the entrance roller 13 and feed rollers 5 are rotated in the directions shown by the arrows, and at the same time the entrance roller 13 is lowered by a rocking mechanism. Further, although the separating rollers 46 tend to rotate in the original returning direction, in this case, they are rotated in the direction shown by the broken arrow by following the rotation of the feed rollers 5, due to the presence of the spring clutch.

In Fig. 9B, the entrance roller 13 abuts against the uppermost original P on the sheet stack stored on the support and feeds out the original P from the support. If two or more originals P are fed out, the separating rollers 46 return the original other than the uppermost one P through the action of the spring clutch.

In Fig. 9C, a leading end of the uppermost original P fed by the feed rollers 5 is abutted against a contacting portion formed between the conveying roller 64 (now stopped) and the image sensor 70 of contact type. Further, on the basis of the detection signal from the original end detecting sensor S₁ arranged between the feed rollers 5 and the conveying roller 64, the original P is still fed until it forms a loop therein, thereby correcting the posture of the original. In this case, the original P sometimes cannot form the loop therein in accordance with the conditions of the material of the original P, surroundings and/or the feeding force of the feed rollers 5, and keeps a straight condition (shown by the broken straight line in Fig. 9C).

In Fig. 9D, after the feeding of the original is finished, the single driving source is rotated in the reverse direction to rotate the conveying roller 64 in the direction shown by the arrow, thereby pinching the original between the image sensor 70 and the conveying roller 64. In this case, the entrance roller 13, feed rollers 5 and separating rollers 46 are stopped. The time duration when these rollers are stopped corresponds to a time duration when the gear 19 is slipping on the rotary shaft 10.

In Fig. 9E, the reading operation is initiated while conveying the original P by the rotation of the conveying roller 64 with pinching the original between the image sensor 70 and the conveying

roller 64. In this case, the feed rollers 5 (which do not receive the driving force, in this condition) are rotated by following the movement of the original, and the separating rollers 46 (which tend to rotate reversely through the gear 19, rotary shaft 10, gear train 52, 51, 50, 49 and rotary shaft 40) are also rotated by following the movement of the original. The entrance roller 13 is rotated in the direction shown by the arrow and is retarded (lifted) from the original by the action of the rocking mechanism.

In Fig. 9F, when a trailing end of the original P has passed through between the feed rollers 5 and the separating rollers 46, the separating rollers 46 are released from the restraintment and are rotated in the original returning direction and the feed rollers 5 are rotated by following the rotation of the separating rollers 46. Further, after the trailing end of the original has passed through between the image sensor 70 and the conveying roller 64, the reading operation of the original is finished.

Thereafter, when the single driving source is rotated in the normal direction again, the condition shown in Fig. 7A is restored. In this way, the feeding and reading the original P can be repeated.

Next, a third embodiment of the present invention will be explained with reference to Fig. 10.

The characteristic of this third embodiment is that a sheet feeding apparatus is arranged in the sheet conveying line and can be stopped temporarily, wherein the motor Mo is commonly used.

In Fig. 10A, a second pair of rotatable rollers 205, 206 are stopped by the action of a clutch (not shown), regardless of the rotation of the motor Mo. A first pair of rotatable rollers 203, 204 are being rotated in the sheet feeding direction. Thus, a loop is formed in a sheet P. Incidentally, the rollers 205, 206 may be rotated in a sheet returning direction, which can be effected by a gear train shown in Fig. 13. More particularly, in Fig. 13, a clutch 62' is engaged and disengaged, opposite to the engagement and disengagement of a clutch 62. Accordingly, a gear 61 is rotated when the gear 25 is rotated in the clockwise direction; whereas, a gear 61' is rotated when the gear 25 is rotated in the anti-clockwise direction.

In Fig. 10B, when the motor Mo is rotated reversely, the second pair of rollers 205, 206 are rotated in the sheet feeding direction. In this case, since the driving force is not transmitted to the first pair of rollers 203, 204 due to the presence of relation between the notch 19a' and the pin 10a as similar to that shown in Fig. 5, these rollers 203, 204 are rotated in the anti-clockwise direction by following the movement of the sheet P.

In Fig. 10C, when the motor is further rotated, the pin 10a is engaged by the notch 19a' to couple the roller 203 to the motor Mo, thus rotating the first pair of rollers 203, 204 in the clockwise direc-

tion. In this point, since the sheet P is positively pinched by the second pair of rollers 205, 206, the feeding of the sheet can be performed smoothly.

Next, a fourth embodiment of the present invention will be explained with reference to Fig. 11.

The characteristic of this fourth embodiment is that a sheet feeding apparatus is arranged in the sheet conveying line and are rotated in the sheet feeding direction, wherein the motor Mo is commonly used.

In Fig. 11A, a second pair of rotatable rollers 205, 206 are stopped by the action of a clutch (not shown), regardless of the rotation of the motor Mo. A first pair of rotatable rollers 203, 204 are being rotated in the sheet feeding direction. Thus, a loop is formed in a sheet P.

In Fig. 11B, when the motor Mo is rotated reversely, the second pair of rollers 205, 206 are rotated in the sheet feeding direction. In this case, although the driving force is not transmitted to the first pair of rollers 203, 204 due to the presence of relation between the notch 19a' and the pin 10a as similar to that shown in Fig. 5, since the rotation of the roller 205 is transmitted to the roller 203 through a clutch 28, these rollers 203, 204 are rotated in the anti-clockwise direction.

In Fig. 11C, when the motor is further rotated, the pin 10a is engaged by the notch 19a' to couple the roller 203 to the motor Mo, thus rotating the first pair of rollers 203, 204 in the clockwise direction by overcoming the rotational force of the clutch 28. In this point, since the sheet P is positively pinched by the second pair of rollers 205, 206, the feeding of the sheet can be performed smoothly.

Next, a fifth embodiment of the present invention will be explained with reference to Fig. 12. The characteristic of this fifth embodiment is that a sheet feeding apparatus is arranged in the sheet conveying line and discrete and independent motor M₁ and M₂ are provided.

In Fig. 12A, the motor M₂ is stopped, and thus, a second pair of rotatable rollers 305, 306 are not rotated. The motor M₁ is being rotated in the anti-clockwise direction, whereby a feed roller 303 among a first pair of rotatable rollers is rotated in the sheet feeding direction. A motor M₃ is being rotated in the anti-clockwise direction, whereby a separating roller 304 among the first pair of rollers is rotated in the sheet returning direction. In this way, only one sheet P₁ is separated from the sheet stack and is fed in the sheet feeding direction until a loop is formed in the sheet after a leading end of the sheet has been abutted against the second pair of rollers 305, 306 (now stopped).

Incidentally, in this case, the second pair of rollers 305, 306 may be rotated in the sheet feeding direction by rotating the motor M₂ in the anti-clockwise direction. By rotating these rollers 305,

306 in this way, the leading end of the sheet is apt to be inserted into the nip between the rollers 305 and 306 even when the leading end portion of the sheet is curled.

In Fig. 12B, the motor M₂ starts to rotate in the anti-clockwise direction to start the conveying of the sheet. In this case, the motor M₃ is rotated in the clockwise direction for a very short time to rotate the separating roller 304 in the sheet feeding direction. The motor M₁ is stopped, and thus, the feed roller 303 is rotated in the anti-clockwise direction by following the movement of the sheet.

In Fig. 12C, the motor M₂ continues to rotate in the anti-clockwise direction and the motor M₁ is still stopped. The motor M₃ is rotated in the anti-clockwise direction to rotate the separating roller 304 in the sheet returning direction, whereby the uppermost sheet P₁ can be fed smoothly and the second and other sheets are prevented from double-feeding together with the uppermost sheet.

Incidentally, while various examples were explained as mentioned above, the rollers 205, 206 of Figs. 10 and 11, and the rollers 305, 306 of Fig. 12 may be regist rollers, for example, arranged at an upstream side of a photosensitive member of a copying machine, or may be conveying rollers which can take the timing and remove the skew-feed during the feeding of the sheet.

Claims

1. A sheet feeding apparatus, comprising:

- first rotary means (5, 13, 46) for feeding a sheet material,
 - second rotary means (64) disposed downstream of said first rotary means as viewed in a sheet supply direction (A) for further feeding the sheet material,
 - a driving source (21) for rotating said first and second rotating means, and
 - transmitting means (19, 10, 63) for transmitting rotation from said driving source to said first and second rotary means upon engaging thereof and interrupting the rotation upon disengagement thereof,
- characterized in that

- said transmitting means (19, 10, 63) is constructed to be engaged to transmit the rotation for rotating said first rotary means (5, 13, 46) in the sheet supply direction (A), but not to transmit the rotation to said second rotary member (64), when said driving source (21) is rotated in one direction,
- said transmitting means is also constructed to transmit the rotation for rotating said second rotary means in the sheet feeding direction, but not to transmit the



tion. In this point, since the sheet P is positively pinched by the second pair of rollers 205, 206, the feeding of the sheet can be performed smoothly.

Next, a fourth embodiment of the present invention will be explained with reference to Fig. 11.

The characteristic of this fourth embodiment is that a sheet feeding apparatus is arranged in the sheet conveying line and are rotated in the sheet feeding direction, wherein the motor Mo is commonly used.

In Fig. 11A, a second pair of rotatable rollers 205, 206 are stopped by the action of a clutch (not shown), regardless of the rotation of the motor Mo. A first pair of rotatable rollers 203, 204 are being rotated in the sheet feeding direction. Thus, a loop is formed in a sheet P.

In Fig. 11B, when the motor Mo is rotated reversely, the second pair of rollers 205, 206 are rotated in the sheet feeding direction. In this case, although the driving force is not transmitted to the first pair of rollers 203, 204 due to the presence of relation between the notch 19a' and the pin 10a as similar to that shown in Fig. 5, since the rotation of the roller 205 is transmitted to the roller 203 through a clutch 28, these rollers 203, 204 are rotated in the anti-clockwise direction.

In Fig. 11C, when the motor is further rotated, the pin 10a is engaged by the notch 19a' to couple the roller 203 to the motor Mo, thus rotating the first pair of rollers 203, 204 in the clockwise direction by overcoming the rotational force of the clutch 28. In this point, since the sheet P is positively pinched by the second pair of rollers 205, 206, the feeding of the sheet can be performed smoothly.

Next, a fifth embodiment of the present invention will be explained with reference to Fig. 12. The characteristic of this fifth embodiment is that a sheet feeding apparatus is arranged in the sheet conveying line and discrete and independent motor M₁ and M₂ are provided.

In Fig. 12A, the motor M₂ is stopped, and thus, a second pair of rotatable rollers 305, 306 are not rotated. The motor M₁ is being rotated in the anti-clockwise direction, whereby a feed roller 303 among a first pair of rotatable rollers is rotated in the sheet feeding direction. A motor M₃ is being rotated in the anti-clockwise direction, whereby a separating roller 304 among the first pair of rollers is rotated in the sheet returning direction. In this way, only one sheet P₁ is separated from the sheet stack and is fed in the sheet feeding direction until a loop is formed in the sheet after a leading end of the sheet has been abutted against the second pair of rollers 305, 306 (now stopped).

Incidentally, in this case, the second pair of rollers 305, 306 may be rotated in the sheet feeding direction by rotating the motor M₂ in the anti-clockwise direction. By rotating these rollers 305,

306 in this way, the leading end of the sheet is apt to be inserted into the nip between the rollers 305 and 306 even when the leading end portion of the sheet is curled.

In Fig. 12B, the motor M₂ starts to rotate in the anti-clockwise direction to start the conveying of the sheet. In this case, the motor M₃ is rotated in the clockwise direction for a very short time to rotate the separating roller 304 in the sheet feeding direction. The motor M₁ is stopped, and thus, the feed roller 303 is rotated in the anti-clockwise direction by following the movement of the sheet.

In Fig. 12C, the motor M₂ continues to rotate in the anti-clockwise direction and the motor M₁ is still stopped. The motor M₃ is rotated in the anti-clockwise direction to rotate the separating roller 304 in the sheet returning direction, whereby the uppermost sheet P₁ can be fed smoothly and the second and other sheets are prevented from double-feeding together with the uppermost sheet.

Incidentally, while various examples were explained as mentioned above, the rollers 205, 206 of Figs. 10 and 11, and the rollers 305, 306 of Fig. 12 may be regist rollers, for example, arranged at an upstream side of a photosensitive member of a copying machine, or may be conveying rollers which can take the timing and remove the skew-feed during the feeding of the sheet.

Claims

1. A sheet feeding apparatus, comprising:

- first rotary means (5, 13, 46) for feeding a sheet material,
- second rotary means (64) disposed downstream of said first rotary means as viewed in a sheet supply direction (A) for further feeding the sheet material,
- a driving source (21) for rotating said first and second rotating means, and
- transmitting means (19, 10, 63) for transmitting rotation from said driving source to said first and second rotary means upon engaging thereof and interrupting the rotation upon disengagement thereof,

characterized in that

- said transmitting means (19, 10, 63) is constructed to be engaged to transmit the rotation for rotating said first rotary means (5, 13, 46) in the sheet supply direction (A), but not to transmit the rotation to said second rotary member (64), when said driving source (21) is rotated in one direction,
- said transmitting means is also constructed to transmit the rotation for rotating said second rotary means in the sheet feeding direction, but not to transmit the



- rotation to said first rotary means, when said driving source is rotated in the other direction, and
- prohibiting means (10a, 19a, 29) for temporarily preventing transmission of the rotation to said first rotary means in a sheet returning direction (B) by said transmitting means upon start of the rotation of said driving source in the other direction.
2. A sheet feeding apparatus according to claim 1, wherein said prohibiting means (10a, 19a, 29) comprises a temporary decoupling means (10a, 19a) for releasing a connection between said driving source (21) and said transmitting means (19, 10, 63) for said first rotary means.
 3. A sheet feeding apparatus according to claim 2, wherein said temporary decoupling means (10a, 19a) comprises a coupling means having a play portion (19'a) and disposed between said driving source (21) and said transmitting means (19, 10, 63).
 4. A sheet feeding apparatus according to claim 3, wherein said coupling means comprises a gear (19) rotated by a motor (21), and a rotary shaft (10) attached to said gear with a play (10a, 19'a) therebetween.
 5. A sheet feeding apparatus according to any one of claims 1 to 4, wherein
 - said first rotary means (5, 13, 46) has a feed rotary member (13) and a separating rotary member (5, 46), and
 - said separating rotary member is temporarily stopped and thereafter rotated in the sheet returning direction, when said driving source (21) is rotated in the other direction.
 6. A sheet feeding apparatus according to any one of claims 1 to 5, wherein said prohibiting means (10a, 19a, 29) comprises a coupling means (29) for connecting said driving source (21) and said transmitting means (19, 10, 63) for said first rotary means (5, 13, 46) in sheet feeding direction (A).
 7. A sheet feeding apparatus according to claim 5 or 6, wherein said separating rotary member (5, 46) is temporarily rotated in sheet feeding direction (A) and thereafter rotated in sheet turning direction (B), when said driving source is rotated in the other direction.
 8. A sheet feeding apparatus according to any one of claims 5 to 7, wherein
 - said transmitting means has a first system (28, 40) adapted to be engaged to rotate said separating rotary member (5, 46) reversely when said driving source (21) is rotated in said one direction, and
 - a second system (10, 53) adapted to be engaged to rotate said separating rotary member (5, 46) reversely when said driving source is rotated in the other direction,
 - said temporary decoupling means (10a, 19'a) is disposed between said driving source and said second system, for temporarily releasing a connection between said driving source and said second system at the beginning of the rotation of said driving source in the other direction, and
 - said first system rotates said separating rotary member in sheet feeding direction at the beginning of the rotation of said driving source in the other direction.
 9. A sheet feeding apparatus according to any one of claims 5 to 8, wherein
 - said separating rotary member (5, 46) is adapted for separating and feeding sheet materials one by one, and
 - a control means is provided for rotating said feed rotary member in sheet feeding direction and said separating rotary member in sheet returning direction and for stopping said second rotary means (64), during the separating and feeding of the sheet material, and for said second rotary means in sheet feeding direction after the separating and feeding of the sheet materials has been finished, and for rotating said separating rotary member in sheet feeding direction for a very short time at the beginning of the rotation of said second rotary means in sheet feeding direction.
 10. A sheet feeding apparatus according to claim 9, wherein
 - said feed rotary member (13) is stopped after separating and feeding of the sheet material has been finished, said feed rotary member being provided with a clutch (44) for permitting the rotation of said feed rotary member in the sheet feeding direction by the movement of the sheet material, and
 - said separating rotary member (5, 46) is so constructed that it is rotated in the



sheet returning direction at a timing when the sheet material is pinched by said second rotary means (64).

11. A sheet feeding apparatus according to any one of the preceding claims, wherein the transmitting means (19, 10, 63) is further adapted to rotate said second rotary means (64) in sheet returning direction, when said driving source (21) is rotated in said one direction. 5 10
12. A sheet feeding apparatus according to any one of the preceding claims, comprising a rotation control means for rotating said feed rotary member (13) in sheet feeding direction and said separating rotary member (5, 46) in sheet returning direction and for rotating said second rotary means (64) reversely, during the separating and feeding of the sheet material, and for said second rotary means in sheet feeding direction after the separating and feeding of the sheet materials has been finished, and for rotating said separating rotary member in sheet feeding direction for a very short time at the beginning of the rotation of said second rotary means in sheet feeding direction. 15 20 25
13. Image forming apparatus, comprising:
 - a sheet feeding apparatus according to any one of the preceding claims, and
 - image forming means for forming an image on the sheet fed out from the feeding means of the feeding apparatus. 30 35

Patentansprüche

1. Blattzuführvorrichtung mit

- einer ersten Dreheinrichtung (5, 13, 46) zum Zuführen eines blattförmigen Materials, 40
- einer zweiten Dreheinrichtung (64) die stromabwärts der ersten Dreheinrichtung, gesehen in der Blattzuführrichtung (A) angeordnet ist, zur weiteren Zuführung des blattförmigen Materials, 45
- einer Antriebsquelle (21) zum Drehen der ersten und zweiten Dreheinrichtung und
- einer Übertragungseinrichtung (19, 10, 63) zum Übertragen der Drehung von der Antriebsquelle zur ersten und zweiten Dreheinrichtung durch Eingriff mit dieser und zur Unterbrechung der Drehung durch Nichteingriff mit dieser, 50

dadurch gekennzeichnet, daß

- die Übertragungseinrichtung (19, 10, 63) so aufgebaut ist, daß sie in Eingriff kommt, um die Drehung zum Drehen der

ersten Dreheinrichtung (5, 13, 46) in Blattzuführrichtung (A) zu übertragen, aber die Drehung der zweiten Dreheinrichtung (64) nicht zu übertragen, wenn die Antriebsquelle (21) in eine Richtung gedreht wird,

- die Übertragungseinrichtung auch so aufgebaut ist, daß sie die Drehung zum Drehen der zweiten Dreheinrichtung in Blattzuführrichtung überträgt, aber die Drehung auf die erste Dreheinrichtung nicht überträgt, wenn die Antriebsquelle in die andere Richtung gedreht wird, und
- einer Verhinderungseinrichtung (10a, 19a, 29) zum zeitweiligen Verhindern einer Übertragung der Drehung an die erste Dreheinrichtung in eine Blattrücklaufrichtung (B) durch die Übertragungseinrichtung nach Beginn der Drehung der Antriebsquelle in die andere Richtung.

2. Blattzuführvorrichtung nach Anspruch 1, wobei die Verhinderungseinrichtung (10a, 19a, 29) eine zeitweilig wirkende Entkopplungseinrichtung (10a, 19a) zum Unterbrechen einer Verbindung zwischen der Antriebsquelle (21) und der Übertragungseinrichtung (19, 10, 63) für die erste Dreheinrichtung aufweist.

3. Blattzuführvorrichtung nach Anspruch 2, wobei die zeitweilig wirkende Entkopplungseinrichtung (10a, 19a) eine Kupplungseinrichtung, die einen Spielabschnitt (19a') hat, und zwischen der Antriebsquelle (21) und der Übertragungseinrichtung (19, 10, 63) angeordnet ist, aufweist.

4. Blattzuführvorrichtung nach Anspruch 3, wobei die Kupplungseinrichtung ein durch einen Motor (21) gedrehtes Zahnrad (19) und eine am Zahnrad mit einem Spiel (10a, 19a') dazwischen angebrachte Drehwelle (10) aufweist.

5. Blattzuführvorrichtung nach einem der Ansprüche 1 bis 4, wobei

- die erste Dreheinrichtung (5, 13, 46) ein Zuführ-Drehglied (13) und ein Separierungs-Drehglied (5, 46) hat und
- das Separierungs-Drehglied zeitweilig angehalten und danach in Blattrücklaufrichtung gedreht wird, wenn die Antriebsquelle (21) in die andere Richtung gedreht wird.

6. Blattzuführvorrichtung nach einem der Ansprüche 1 bis 5, wobei

die Verhinderungseinrichtung (10a, 19a, 29) eine Kupplungseinrichtung (29) zum Verbinden



der Antriebsquelle (21) und der Übertragungseinrichtung (19, 10, 63) für die erste Dreheinrichtung (5, 13, 46) in Blattzuführvorrichtung (A) aufweist.

7. Blattzuführvorrichtung nach Anspruch 5 oder 6, wobei das Separierungs-Drehglied (5, 46) zeitweilig in Blattzuführvorrichtung (A) und danach in Blattrücklaufrichtung (B) gedreht wird, wenn die Antriebsquelle in die andere Richtung gedreht wird.

8. Blattzuführvorrichtung nach einem der Ansprüche 5 bis 7, wobei

- die Übertragungseinrichtung ein erstes System (28, 40) hat, das so ausgebildet ist, daß es zur umgekehrten Drehung des Separierungs-Drehgliedes (5, 46) im Eingriff steht, wenn die Antriebsquelle (21) in eine Richtung gedreht wird, und
- ein zweites System (10, 53), das so ausgebildet ist, daß es zur entgegengesetzten Drehung des Separierungs-Drehgliedes (5, 46) im Eingriff steht, wenn die Antriebsquelle in die andere Richtung gedreht wird,
- wobei die zeitweilig wirkende Entkopplungseinrichtung (10a, 19a') zwischen der Antriebsquelle und dem zweiten System zum zeitweiligen Trennen einer Verbindung zwischen der Antriebsquelle und dem zweiten System zum Beginn der Drehung der Antriebsquelle in die andere Richtung angeordnet ist, und
- das erste System das Separierungs-Drehglied zu Beginn der Drehung der Antriebsquelle in die andere Richtung in Blattzuführrichtung dreht.

9. Blattzuführvorrichtung nach einem der Ansprüche 5 bis 8, wobei

- das Separierungs-Drehglied (5, 46) so ausgebildet ist, daß es blattförmiges Material Stück für Stück trennt und zuführt, und
- eine Steuereinrichtung zum Drehen des Zuführungs-Drehgliedes in Blattzuführrichtung und des Separierungs-Drehgliedes in Blattrücklaufrichtung und zum Anhalten der zweiten Dreheinrichtung (64) während des Trennens und Zuführens des blattförmigen Materials und für das zweite Drehglied in Blattzuführrichtung, nachdem das Trennen und Zuführen des blattförmigen Materials beendet ist, und zum Drehen des Separierungs-Drehgliedes in Blattzuführrichtung für eine sehr kurze Zeit zu Beginn der Drehung der

zweiten Dreheinrichtung in Blattzuführrichtung vorgesehen ist.

10. Blattzuführvorrichtung nach Anspruch 9, wobei

- das Zuführ-Drehglied (13) angehalten wird, nachdem die Trennung und Zuführung des blattförmigen Materials beendet ist, wobei das Zuführ-Drehglied mit einer Kupplung (44) versehen ist, die eine Drehung des Zuführ-Drehgliedes in Blattzuführrichtung infolge der Bewegung des blattförmigen Materials erlaubt, und
- das Separierungs-Drehglied (5, 46) so aufgebaut ist, daß es zu einem Zeitpunkt, wenn das blattförmige Material durch die zweite Dreheinrichtung (64) ergriffen ist, in Blattrücklaufrichtung gedreht wird.

11. Blattzuführvorrichtung nach einem der vorangehenden Ansprüche, wobei die Übertragungseinrichtung (19, 10, 63) weiter so ausgebildet ist, daß sie die zweite Dreheinrichtung (64) in Blattrücklaufrichtung dreht, wenn die Antriebsquelle (21) in die eine Richtung gedreht wird.

12. Blattzuführvorrichtung nach einem der vorangehenden Ansprüche, mit einer Drehsteuereinrichtung zur Drehung des Zuführ-Drehgliedes (13) in Blattzuführrichtung und des Separierungs-Drehgliedes (5, 46) in Blattrücklaufrichtung und zum Drehen der zweiten Dreheinrichtung (64) in Gegenrichtung während der Separierung und Zuführung des blattförmigen Materials, und für die zweite Dreheinrichtung in Blattzuführrichtung, nachdem die Trennung und Zuführung des blattförmigen Materials beendet ist, und zum Drehen des Separierungs-Drehgliedes in Blattzuführrichtung für eine sehr kurze Zeit zu Beginn der Drehung der zweiten Dreheinrichtung in Blattzuführrichtung.

13. Bilderzeugungsvorrichtung mit

- einer Blattzuführvorrichtung nach einem der vorangehenden Ansprüche und
- einer Bilderzeugungseinrichtung zur Erzeugung eines Bildes auf dem aus der Zuführeinrichtung der Zuführvorrichtung zugeführten Blatt.

Revendications

1. Appareil d'alimentation en feuilles, comportant:
- des premiers moyens tournants (5, 13, 46) destinés à faire avancer une feuille,
 - des seconds moyens tournants (64) disposés en aval desdits premiers moyens



- tournants, tels que considérés dans un sens (A) d'alimentation en feuilles, pour faire avancer davantage la feuille,
- une source d'entraînement (21) destinée à faire tourner lesdits premiers et seconds moyens tournants, et
 - des moyens de transmission (19, 10, 63) destinés à transmettre une rotation de ladite source d'entraînement auxdits premiers et seconds moyens tournants lorsqu'ils sont engagés et à interrompre la rotation lorsqu'ils sont dégagés,
- caractérisé en ce que
- lesdits moyens de transmission (19, 10, 63) sont construits de façon à être engagés pour transmettre la rotation afin de faire tourner lesdits premiers moyens tournants (5, 13, 46) dans le sens (A) d'alimentation en feuilles, mais à ne pas transmettre la rotation audit second élément tournant (64), lorsque ladite source d'entraînement (21) est en rotation dans un premier sens,
 - lesdits moyens de transmission sont également construits de façon à transmettre la rotation pour faire tourner lesdits seconds moyens tournants dans le sens d'alimentation en feuilles, mais à ne pas transmettre la rotation auxdits premiers moyens tournants, lorsque ladite source d'entraînement est en rotation dans l'autre sens, et
 - des moyens d'empêchement (10a, 19a, 29) destinés à empêcher temporairement une transmission de la rotation auxdits premiers moyens tournants dans un sens (B) de retour de feuilles par lesdits moyens de transmission lors du commencement de la rotation de ladite source d'entraînement dans l'autre sens.
2. Appareil d'alimentation en feuilles selon la revendication 1, dans lequel lesdits moyens d'empêchement (10a, 19a, 29) comprennent des moyens de désaccouplement temporaire (10a, 19a) destinés à interrompre une liaison entre ladite source d'entraînement (21) et lesdits moyens de transmission (19, 10, 63) pour lesdits premiers moyens tournants.
3. Appareil d'alimentation en feuilles selon la revendication 2, dans lequel lesdits moyens de désaccouplement temporaire (10a, 19a) comprennent des moyens d'accouplement ayant une partie à jeu (19'a) et disposés entre ladite source d'entraînement (21) et lesdits moyens de transmission (19, 10, 63).
4. Appareil d'alimentation en feuilles selon la revendication 3, dans lequel lesdits moyens d'accouplement comprennent une roue dentée (19) qu'un moteur (21) fait tourner, et un arbre tournant (10) relié à ladite roue dentée avec un jeu (10a, 19'a) entre eux.
5. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 4, dans lequel
- lesdits premiers moyens tournants (5, 13, 46) comportent un élément tournant (13) d'alimentation et un élément tournant (5, 46) de séparation, et
 - ledit élément tournant de séparation est arrêté temporairement et est ensuite mis en rotation dans le sens de retour de feuilles lorsque ladite source d'entraînement (21) est en rotation dans l'autre sens.
6. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 1 à 5, dans lequel
- lesdits moyens d'empêchement (10a, 19a, 29) comprennent des moyens d'accouplement (29) destinés à relier ladite source d'entraînement (21) et lesdits moyens de transmission (19, 10, 63) pour lesdits premiers moyens tournants (5, 13, 46) dans le sens (A) d'alimentation en feuilles.
7. Appareil d'alimentation en feuilles selon la revendication 5 ou 6, dans lequel ledit élément tournant (5, 46) de séparation est mis temporairement en rotation dans le sens (A) d'alimentation en feuilles et est ensuite mis en rotation dans le sens (B) de retour de feuilles lorsque ladite source d'entraînement est en rotation dans l'autre sens.
8. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 5 à 7, dans lequel
- lesdits moyens de transmission comprennent un premier système (28, 40) conçu pour être engagé afin de faire tourner ledit élément tournant (5, 46) de séparation en sens inverse lorsque ladite source d'entraînement (21) est en rotation dans ledit premier sens, et
 - un second système (10, 53) conçu pour être engagé afin de faire tourner ledit élément tournant (5, 46) de séparation en sens inverse lorsque ladite source d'entraînement est en rotation dans l'autre sens,



- lesdits moyens de désaccouplement temporaire (10a, 19'a) sont disposés entre ladite source d'entraînement et ledit second système, pour rompre temporairement une liaison entre ladite source d'entraînement et ledit second système au commencement de la rotation de ladite source d'entraînement dans l'autre sens, et
 - ledit premier système fait tourner ledit élément tournant de séparation dans le sens d'alimentation en feuilles au commencement de la rotation de ladite source d'entraînement dans l'autre sens.
9. Appareil d'alimentation en feuilles selon l'une quelconque des revendications 5 à 8, dans lequel
- ledit élément tournant (5, 46) de séparation est destiné à séparer et faire avancer des feuilles une par une, et
 - des moyens de commande sont prévus pour faire tourner ledit élément tournant d'alimentation dans le sens d'alimentation en feuilles et ledit élément tournant de séparation dans le sens de retour de feuilles, et pour arrêter lesdits seconds moyens tournants (64), pendant la séparation et l'avance de la feuille, et pour faire tourner lesdits seconds moyens tournants dans le sens d'alimentation en feuilles après que la séparation et l'avance des feuilles se sont achevées, et pour faire tourner ledit second élément tournant dans le sens d'alimentation en feuilles pendant un temps très court au commencement de la rotation desdits seconds moyens tournants dans le sens d'alimentation en feuilles.
10. Appareil d'alimentation en feuilles selon la revendication 9, dans lequel
- ledit élément tournant (13) d'alimentation est arrêté après que la séparation et l'avance de la feuille se sont achevées, ledit élément tournant d'alimentation étant pourvu d'un embrayage (44) destiné à permettre la rotation dudit élément tournant d'alimentation dans le sens d'alimentation en feuilles sous l'effet du mouvement de la feuille, et
 - ledit élément tournant (5, 46) de séparation est construit de manière à tourner dans le sens de retour de feuille à un moment où la feuille est pincée par lesdits seconds moyens tournants (64).
11. Appareil d'alimentation en feuilles selon l'une quelconque des revendications précédentes, dans lequel
- les moyens de transmission (19, 10, 63) sont en outre conçus pour faire tourner lesdits seconds moyens tournants (64) dans le sens de retour de feuille lorsque ladite source d'entraînement (21) est en rotation dans ledit premier sens.
12. Appareil d'alimentation en feuilles selon l'une quelconque des revendications précédentes, comportant
- des moyens de commande de rotation destinés à faire tourner ledit élément tournant (13) d'alimentation dans le sens d'alimentation en feuilles et ledit élément tournant (5, 46) de séparation dans le sens de retour de feuille et à faire tourner lesdits seconds moyens tournants (64) en sens inverse, pendant la séparation et l'avance de la feuille, et à faire tourner lesdits seconds moyens tournants dans le sens d'alimentation en feuilles après que la séparation et l'avance des feuilles ont été achevées, et à faire tourner ledit élément tournant de séparation dans le sens d'alimentation en feuilles pendant un temps très court au commencement de la rotation desdits seconds moyens tournants dans le sens d'alimentation en feuilles.
13. Appareil de formation d'images, comportant :
- un appareil d'alimentation en feuilles selon l'une quelconque des revendications précédentes, et
 - des moyens de formation d'images destinés à former une image sur la feuille extraite des moyens d'alimentation de l'appareil d'alimentation.