

Description

The present invention relates to a sheet feeding mechanism for a printing apparatus.

A sheet feeding mechanism for a printing apparatus which feeds or discharges print sheets with two confronting roller units generally has a structure wherein the group of rollers constituting one of the two confronting roller units is not biased by an independent loading device. Specifically, as shown in Fig. 1 (which is taken from Japanese Patent Unexamined Publication No. 197339/1986), bias rollers 31 forming a second roller unit 30 arranged so as to confront drive rollers 29 forming a first roller unit 28 are biased by no independent loading device. Even in cases where the group of rollers constituting one of these two confronting roller units is biased by an independent loading device, the rollers have not been driven thereby. That is, as shown in Fig. 2 (taken from Japanese Patent Unexamined Publication No. 285841/1987), each of bias rollers 35 forming a second roller unit 34 arranged so as to confront drive rollers 33 forming a first roller unit 32 is biased by an independent loading device, but they are not driven thereby.

Document EP-A-0 372 248 also discloses a sheet feeding mechanism comprising a pair of opposing roller units including an independent loading means arranged such that one of said roller unit pair receives a bias from said loading means.

Document JP-A-61018652 discloses a sheet feeding mechanism for feeding sheets to a printing apparatus having two roller units which comprise a first opposing pair of cylindrical rollers and an alternately arranged second opposing pair of rollers including a cylindrical roller and a conical roller. However, this system provides an intentional one-sided skew when feeding a sheet and therefore has only limited applicability.

Document EP-A-0 224 171 discloses an automatic document feeder for copying machines which comprises two drive shafts and two rollers integrally rotating with said drive shafts respectively; and where said two rollers rotate in pressure contact with each other in order to feed the documents to the copying machine. However this system does not give the correct accuracy which a printer normally requires. The above-described sheet feeding mechanisms entail the problem of not providing a feeding force to one of the surfaces of the print sheet if the rollers in one of the pair of rollers are idle. Even if both rollers of the pair of rollers are driven, since neither roller is biased by an independent loading device, the pressure contact force applied to the print sheet is not uniform. When a copy sheet is used as a print sheet, because the two surfaces of the sheet have dissimilar properties, dislocation tends to occur between the front and back surfaces of the sheet when the

sheet is fed or discharged, or the sheet feeding force is not stably applied at the roller unit section, thus causing such problems as slanted sheet feeding and out-of-pitch printing.

The invention has been made to overcome the above problems, and therefore has an object the provision of a sheet feeding mechanism for a printing apparatus capable of achieving accurate sheet feed performance free from slanted sheet feeding, dislocation between pages in printing on copy sheets, out-of-pitch printing, and the like.

This object is solved by the sheet feeding mechanism of independent claim 1. Further advantageous features of this feeding mechanism are evident from dependent claims 2 to 7, the description and figures 1 to 8. The claims are intended to be understood as a first non-limiting approach of defining the invention in general terms.

In accordance with the above and other objects, the invention provides a sheet feeding mechanism for a printing apparatus which feeds or discharges print sheets with two confronting roller units, each of which is composed of rollers and a shaft, having a pair of confronting roller units capable not only of applying a driving-like sheet feed force to both front and back surfaces of a copy sheet, but also of maintaining a constant pressure contact force from each roller. Further, the shafts of the pair of confronting roller units are driven so that the sheet feed forces is stable. In addition, the pressure contact force is produced by a structure wherein each roller is biased by independent loading.

According to the above structure of the invention, a drive force is applied to both the front and back surfaces of the print sheet with the pressure contact force being applied uniformly from each roller to the print sheet. Thus, the sheet feed force acting on the print sheet becomes stable, allowing a correct, highly reliable sheet feed operation to be performed without sheet dislocation, out-of-pitch printing, or inclined printing in the copy sheet.

Figs. 1 and 2 are diagrams showing a conventional sheet feeding mechanism;

Fig. 3 is a sectional view showing the main body of a printing apparatus constructed in accordance with a preferred embodiment of the invention;

Fig. 4 is a perspective view showing the construction of a sheet discharge roller section viewed from the position of an arrow IV shown in Fig. 3;

Fig. 5 is an enlarged view of Fig. 4 taken along a line V-V in Fig. 4;

Fig. 6 is a partially enlarged view of Fig. 4 without a sheet discharge unit frame;

Fig. 7 is an enlarged sectional view showing a sheet discharge bias roller section;

Fig. 8 is a transverse sectional view showing the

sheet bias roller section .

Preferred embodiments of the invention will be described with reference to the accompanying drawings.

Fig. 3 is a sectional view generally showing a printing apparatus to which an embodiment of a sheet feeding mechanism of the invention is applied. In Fig. 3, reference numeral 1 indicates a platen having a push tractor 2 for feeding a continuous sheet and a cut sheet feeder 3 for feeding a cut sheet, both arranged upstream in a sheet feed direction (indicated by an arrow A in Fig. 3). The sheet fed by these components passes between a sheet feed roller 4 and a sheet bias roller 5 and is printed at the upper position of the platen 1 by a print head 7 mounted on a carriage 6.

Downstream of the platen 1 are sheet discharge feed rollers 8 forming a first roller unit and sheet discharge bias rollers 9 forming a second roller unit. Each sheet discharge bias roller 9 is rotated integrally with a sheet bias roller shaft 10, which is a second drive shaft. The sheet discharge bias roller shaft 10 is supported by a sheet discharge unit frame 11 at both ends thereof. The sheet discharge unit frame 11 is arranged so as to be oscillatable clockwise by the attracting force of a solenoid 13 engaged with an end 11-a of the sheet discharge unit frame 11 with a sheet discharge unit pivot shaft 12 as a pivot. The sheet discharge unit frame 11 is also biased counterclockwise by coil springs 14, 25 (see Fig. 4).

Fig. 4 is a diagram of a sheet discharge roller section viewed substantially from a position indicated by an arrow IV shown in Fig. 3. The sheet discharge feed roller 8 is disposed at a position confronting the sheet discharge bias roller 9, and six pairs of similar rollers are arranged along the length of a sheet discharge feed roller shaft 15. Each sheet discharge bias roller 9 rotates in synchronism with the sheet discharge bias roller shaft 10 while being self-aligned by a joint bush 16, as will be described later.

The sheet discharge bias roller shaft 10 is driven by a rotating force provided by a transmission gear 17 fixed on the sheet discharge feed roller shaft 15 through a transmission gear 18 fixed on itself. The sheet discharge bias roller shaft 10 also has bias rollers 21, 22 assembled at positions confronting receiving rollers 19, 20 assembled on the sheet discharge feed roller shaft 15 with the distance between the sheet discharge feed roller shaft 15 and the sheet discharge bias roller shaft 10 maintained constant. At both ends of the sheet discharge unit frame 11 are disposed the coil springs 14, 25 mounted so as to support the sheet discharge bias roller shaft 10 through bearings 23, 24.

Fig. 5 is an enlarged view of the sectional view taken along a line V-V shown in Fig. 4. A bias force F applied from the sheet discharge bias roller 9 to the sheet discharge feed roller 8 is provided by a sheet

discharge unit lever 26 (see Fig. 6) mounted so as to be rotatable around the sheet discharge unit pivot shaft 12. The sheet discharge unit pivot shaft 12 has a sheet discharge lever spring 27 assembled, with arms 27-a, 27-b of the sheet discharge-lever spring 27 being in contact with the discharge unit frame 11 and the discharge unit lever 26, respectively.

Fig. 6 is a partially enlarged view of Fig. 4 without the sheet unit frame 11. A load applied from the sheet discharge lever spring 27 is transmitted to the sheet discharge bias roller 9 through the sheet discharge unit lever 26 so that the bias force is applied to the sheet discharge feed roller 8.

Fig. 7 is a detailed sectional view of the sheet discharge bias roller section shown in Fig. 6. The sheet discharge bias roller 9 has a front end portion 16-a of the joint bush 16 inserted thereto so that the front end portion 16-a can rotate integrally with the sheet discharge bias roller 9. The joint bush 16 has a self-aligning structure so as to absorb the oscillation (mainly vertical oscillation) of the sheet discharge bias roller 9. The joint bush 16 rotates integrally with the sheet discharge bias roller shaft 10.

Fig. 8 is a detailed view showing the relationship between the sheet discharge bias roller 9 and the joint bush 16. The sheet discharge bias roller shaft 10 is a shaft whose diameter is different from the sheet discharge bias roller 9 so as to obtain a predetermined clearance C between the sheet discharge bias roller 9 and itself.

The operation of the above embodiment will now be described in detail.

In Fig. 3, a print sheet fed by the cut sheet feeder 3 or the push tractor 2 is printed by the print head 7 and then discharged past the sheet discharge unit section. Since each sheet discharge bias roller 9 in the sheet discharge unit section has a load applied independently from its corresponding sheet discharge lever spring 27, a uniform load is applied to the print sheet from each roller.

Even in the case where the sheet discharge bias roller 9 is dislocated vertically due to irregularities on the surface of the print sheet, changes in the thickness of the print sheet, or passage of perforations of the print sheet, the resulting oscillation of the sheet discharge bias rollers 9 is not transmitted to the sheet discharge bias roller shaft 10 owing to the presence of the clearance C between the sheet discharge bias roller 9 and the sheet discharge bias roller shaft 10, as is apparent from Fig. 7. Therefore, the engagement between the transmission gears 17, 18 in Fig. 4 is stable, and the rotating force of the sheet discharge bias roller shaft 10 is stably transmitted to each sheet discharge bias roller 9 through its corresponding joint bush 16, thereby allowing each sheet discharge feed roller 8 and each sheet discharge bias roller 9 to be provided with the drive force stably.

According to the invention, a sheet feed force is

applied to both the front and back surfaces of the copy sheet so as to drive the print sheet. The stable and uniform application of the bias force from each roller to the print sheet advantageously allows copy sheets to be fed correctly and reliably, preventing sheet dislocation, out-of-pitch printing, and inclined printing.

Claims

1. A sheet feeding mechanism comprising: a first drive shaft (15); a first roller unit, including a plurality of feed rollers (8) which rotate integrally with said first drive shaft (15); a second drive shaft (10); a second roller unit including a plurality of biasing rollers (9) which rotate integrally with said second drive shaft (10) while in pressure contact with said feed rollers (8), said second roller unit confronting said first roller unit; and a plurality of independent loading means (26, 27), wherein each of said biasing rollers (9) receives a load applied by a respective one of said independent loading means (26, 27) so that each of said feed rollers (8) receives a pressure contact force therefrom, characterized in that said biasing rollers (9) have an inner diameter that is greater than an outer diameter of said second drive shaft (10) thereby forming a gap (c) between said biasing rollers (9) and said second drive shaft (10), such that said biasing roller (9) is moveable in a direction perpendicular to said second shaft (10) through the distance of said gap (c).
2. The sheet feeding mechanism of claim 1 further comprising: a joint bush (16) having one end (16b) fixed to said second drive shaft (10) and a second end (16a) attached to a respective one of said biasing rollers (9).
3. The sheet feeding mechanism of one of claims 1 or 2 further comprising a unit frame (11), ends of said second shaft (10) being rotably supported by end portions of said unit frame at a first side of said frame, and a pivot shaft (12) upon which said unit frame is pivotally mounted, said pivot shaft (12) being parallel to said second shaft (10).
4. The sheet feeding mechanism of one of claims 1 to 3, wherein said independent loading means comprises arm means (26) contacting said biasing roller (9) and spring means (27) for biasing said arm means (26) into contact with said biasing roller (9).
5. The sheet feeding mechanism of claim 4, wherein

said arm means (26) has a projecting portion (26a) received in a groove (9a) in said biasing roller (9) and/or said spring means (27) has a portion wound around said pivot shaft (12).

6. The sheet feeding mechanism of one of claims 3 to 5, further comprising a solenoid (13) coupled to a second side of said unit frame (11) opposite said first side for pivoting said unit frame (11) around said pivot shaft (12), and second spring means (14; 25) attached to said unit frame (11) for biasing said unit frame such that said biasing rollers (9) of said second unit are respectively pressed against said feeding rollers (8).

Revendications

1. Alimentateur de feuilles comportant : un premier arbre d'entraînement (15) ; un premier ensemble de rouleaux comprenant une pluralité de rouleaux d'alimentation (8) qui tournent en formant une seule pièce avec ledit premier arbre d'entraînement (15) ; un second arbre d'entraînement (10) ; un second ensemble de rouleaux comprenant une pluralité de rouleaux presseurs (9) qui tournent en formant une seule pièce avec ledit second arbre d'entraînement (10) en étant en contact avec pression contre lesdits rouleaux d'alimentation (8), ledit second ensemble de rouleaux étant situé en face dudit premier ensemble de rouleaux ; et une pluralité de moyens d'application de force indépendants (26, 27), chacun desdits rouleaux presseurs (9) recevant une force appliquée par un moyen d'application de force respectif desdits moyens d'application de force indépendants (26, 27), de façon telle que chacun desdits rouleaux d'alimentation (8) soit soumis à un contact avec pression de la part de ceux-ci, caractérisé en ce que lesdits rouleaux presseurs (9) ont un diamètre intérieur qui est supérieur au diamètre extérieur dudit second arbre d'entraînement (10) un intervalle (c) étant de ce fait formé entre lesdits rouleaux presseurs (9) et ledit second arbre d'entraînement (10), de façon telle que lesdits rouleaux presseurs (9) peuvent se déplacer dans une direction perpendiculaire audit second arbre (10) sur une distance égale audit intervalle (c).
2. Alimentateur de feuilles selon la revendication 1, comportant en outre : un manchon d'accouplement (16) dont une (16b) des extrémités est fixée audit second arbre d'entraînement (10) et dont une seconde extrémité (16a) est fixée à un rouleau presseur respectif desdits rouleaux presseurs (9).



applied to both the front and back surfaces of the copy sheet so as to drive the print sheet. The stable and uniform application of the bias force from each roller to the print sheet advantageously allows copy sheets to be fed correctly and reliably, preventing sheet dislocation, out-of-pitch printing, and inclined printing.

Claims

1. A sheet feeding mechanism comprising: a first drive shaft (15); a first roller unit, including a plurality of feed rollers (8) which rotate integrally with said first drive shaft (15); a second drive shaft (10); a second roller unit including a plurality of biasing rollers (9) which rotate integrally with said second drive shaft (10) while in pressure contact with said feed rollers (8), said second roller unit confronting said first roller unit; and a plurality of independent loading means (26, 27), wherein each of said biasing rollers (9) receives a load applied by a respective one of said independent loading means (26, 27) so that each of said feed rollers (8) receives a pressure contact force therefrom, characterized in that said biasing rollers (9) have an inner diameter that is greater than an outer diameter of said second drive shaft (10) thereby forming a gap (c) between said biasing rollers (9) and said second drive shaft (10), such that said biasing roller (9) is moveable in a direction perpendicular to said second shaft (10) through the distance of said gap (c).
2. The sheet feeding mechanism of claim 1 further comprising: a joint bush (16) having one end (16b) fixed to said second drive shaft (10) and a second end (16a) attached to a respective one of said biasing rollers (9).
3. The sheet feeding mechanism of one of claims 1 or 2 further comprising a unit frame (11), ends of said second shaft (10) being rotably supported by end portions of said unit frame at a first side of said frame, and a pivot shaft (12) upon which said unit frame is pivotally mounted, said pivot shaft (12) being parallel to said second shaft (10).
4. The sheet feeding mechanism of one of claims 1 to 3, wherein said independent loading means comprises arm means (26) contacting said biasing roller (9) and spring means (27) for biasing said arm means (26) into contact with said biasing roller (9).
5. The sheet feeding mechanism of claim 4, wherein

said arm means (26) has a projecting portion (26a) received in a groove (9a) in said biasing roller (9) and/or said spring means (27) has a portion wound around said pivot shaft (12).

6. The sheet feeding mechanism of one of claims 3 to 5, further comprising a solenoid (13) coupled to a second side of said unit frame (11) opposite said first side for pivoting said unit frame (11) around said pivot shaft (12), and second spring means (14; 25) attached to said unit frame (11) for biasing said unit frame such that said biasing rollers (9) of said second unit are respectively pressed against said feeding rollers (8).

Revendications

1. Alimentateur de feuilles comportant : un premier arbre d'entraînement (15) ; un premier ensemble de rouleaux comprenant une pluralité de rouleaux d'alimentation (8) qui tournent en formant une seule pièce avec ledit premier arbre d'entraînement (15) ; un second arbre d'entraînement (10) ; un second ensemble de rouleaux comprenant une pluralité de rouleaux presseurs (9) qui tournent en formant une seule pièce avec ledit second arbre d'entraînement (10) en étant en contact avec pression contre lesdits rouleaux d'alimentation (8), ledit second ensemble de rouleaux étant situé en face dudit premier ensemble de rouleaux ;
et une pluralité de moyens d'application de force indépendants (26, 27), chacun desdits rouleaux presseurs (9) recevant une force appliquée par un moyen d'application de force respectif desdits moyens d'application de force indépendants (26, 27), de façon telle que chacun desdits rouleaux d'alimentation (8) soit soumis à un contact avec pression de la part de ceux-ci, caractérisé en ce que lesdits rouleaux presseurs (9) ont un diamètre intérieur qui est supérieur au diamètre extérieur dudit second arbre d'entraînement (10) un intervalle (c) étant de ce fait formé entre lesdits rouleaux presseurs (9) et ledit second arbre d'entraînement (10), de façon telle que lesdits rouleaux presseurs (9) peuvent se déplacer dans une direction perpendiculaire audit second arbre (10) sur une distance égale audit intervalle (c).
2. Alimentateur de feuilles selon la revendication 1, comportant en outre : un manchon d'accouplement (16) dont une (16b) des extrémités est fixée audit second arbre d'entraînement (10) et dont une seconde extrémité (16a) est fixée à un rouleau presseur respectif desdits rouleaux presseurs (9).



3. Alimentateur de feuilles selon l'une des revendications 1 ou 2, comportant en outre un cadre unitaire (11), les extrémités dudit second arbre (10) étant supportées de façon rotative par des parties d'extrémité dudit cadre unitaire, d'un premier côté dudit cadre et par un axe de pivotement (12) sur lequel est monté de façon pivotante ledit cadre unitaire, ledit axe de pivotement (12) étant parallèle audit second arbre (10).
4. Alimentateur de feuilles selon l'une des revendications 1 à 3, dans lequel lesdits moyens d'application de force indépendants comprennent des moyens formant bras (26) qui sont en contact avec ledit rouleau presseur (9) et des moyens formant ressorts (27) destinés à pousser lesdits moyens formant bras (26) jusqu'à arriver en contact avec ledit rouleau presseur (9).
5. Alimentateur de feuilles selon la revendication 4, dans lequel ledit moyen formant bras comporte une partie en saillie (26a) logée dans une rainure (9a) dudit rouleau presseur (9) et/ou ledit moyen formant ressort (27) comporte une partie enroulée autour dudit axe de pivotement (12).
6. Alimentateur de feuilles selon l'une des revendications 3 à 5, comportant en outre un solénoïde (13) accouplé à un second côté dudit cadre unitaire (11) situé à l'opposé dudit premier côté, destiné à faire pivoter ledit cadre unitaire (11) autour dudit axe de pivotement (12), et un second moyen formant ressort (14 ; 25) fixé audit cadre unitaire (11) afin de pousser le cadre unitaire de façon telle que lesdits rouleaux presseurs (9) dudit second ensemble sont respectivement poussés contre lesdits rouleaux d'alimentation (8).

Patentansprüche

1. Blattzuführmechanismus mit:
einer ersten Antriebswelle (15), einer eine Mehrzahl von sich gemeinsam mit der ersten Antriebswelle (15) drehenden Zuführwalzen (8) aufweisenden ersten Walzeneinheit, und einer zweiten Antriebswelle (10),
mit einer eine Mehrzahl von Vorspannwalzen (9) aufweisenden zweiten Walzeneinheit, die sich gemeinsam mit der zweiten Antriebswelle (10) drehen und sich dabei in Druckkontakt mit den Zuführwalzen (8) befinden, wobei die zweite Walzeneinheit der ersten Walzeneinheit gegenüberliegend angeordnet ist, und
mit einer Mehrzahl von unabhängigen Belastungsmitteln (26, 27), wobei auf jede der Vorspannwalzen (9) jeweils von einer der unabhängigen Belastungsmitteln (26, 27) eine Kraft der-

art ausgeübt wird, daß auf jede der Zuführwalzen (8) eine Andruckkraft wirkt, dadurch gekennzeichnet, daß die Vorspannwalzen (9) einen inneren Durchmesser aufweisen, der größer ist als ein äußerer Durchmesser der zweiten Antriebswelle (10), wobei ein Spalt (c) zwischen den Vorspannwalzen (9) und der zweiten Antriebswelle (10) derart ausgebildet ist, daß die Vorspannwalze (9) in eine zur zweiten Welle (10) senkrechten Richtung durch diesen Spalt (c) bewegbar ist.

2. Blattzuführmechanismus nach Anspruch 1, der desweiteren eine Verbindungsbuchse (16) aufweist, deren eines Ende (16b) an der zweiten Antriebswelle (10) und deren zweites Ende (16a) an der jeweiligen Vorspannwalze (9) befestigt ist.
3. Blattzuführmechanismus nach einem der Ansprüche 1 oder 2, der desweiteren einen Rahmen (11) aufweist, wobei die Enden der zweiten Welle (10) drehbar von den Endabschnitten des Rahmens an einer ersten Seite des Rahmens gelagert sind, sowie eine Zapfenwelle (12), auf der der Rahmen drehbar gelagert ist, wobei die Zapfenwelle (12) sich parallel zur zweiten Welle (10) erstreckt.
4. Blattzuführmechanismus nach einem der Ansprüche 1 bis 3, bei dem die unabhängigen Belastungsmittel Arme (26) aufweisen, die mit den Vorspannwalzen (9) in Berührung stehen, sowie ein Federmittel (27), das die Arme (26) so vorspannt, daß diese in Berührung mit den Vorspannwalzen (9) stehen.
5. Blattzuführmechanismus nach Anspruch 4, bei dem die Arme (26) einen vorspringenden Abschnitt (26a) aufweisen, der in eine in der Vorspannwalze (9) ausgebildeten Nut (9a) eingreift und/oder das Federmittel (27) einen Abschnitt aufweist, der um die Zapfenwelle (12) herum gewickelt ist.
6. Blattzuführmechanismus nach einem der Ansprüche 3 bis 5, der desweiteren einen Solenoid (13) aufweist, der mit einer der ersten Seite gegenüberliegenden zweiten Seite des Rahmens (11) gekoppelt ist, um den Rahmen (11) um die Zapfenwelle (12) zu verschwenken, sowie ein zweites Federmittel (14; 25), das an dem Rahmen (11) zur Ausübung einer Vorspannkraft auf den Rahmen derart befestigt ist, daß die Vorspannwalzen (9) der zweiten Einheit entsprechend gegen die Zuführwalzen (8) gedrückt werden.