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(54) Paper separation and feed mechanism for a document printer

Papieraufnahme- und Transporteinrichtung für einen Dokumentdrucker

Mécanisme de séparation et d'avance du papier pour une imprimante

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(56) References cited:
US-A- 4 395 034

• **IBM TECHNICAL DISCLOSURE BULLETIN vol.**
24, no. 12, May 1982, pages 6346 - 6347 W.D.
CLARK 'Single-sheet bypass feed control'

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Description

This invention relates generally to input paper cassettes or trays for document printers and more particularly to an improved paper separation and feed mechanism for document printers such as electrophotographic or laser printers.

Background Art

In the field of electrophotographic document printing, it has been a common practice to equip the input paper tray or cassette of the printer with a paper pick roller near the top wall of the cassette. This pick roller is movable into and out of contact with a stack of paper within the cassette to drive the top sheet or sheets of paper stacked in the cassette toward the print area within the printer housing. It has further been a common practice to provide, in combination, a paper feed roller and a paper separation roller in the paper path extending between the output of the paper cassette and the print area or print engine within the printer housing. Conventionally, the paper feed roller is positioned on the top side of the sheets of paper being fed to the print area of the printer and is rotated in a counterclockwise direction. The paper separation roller is positioned on the bottom side of the sheets of paper being fed into the printer housing and is also rotated in the counterclockwise direction.

Thus, the feed roller operates to drive the top sheet of paper into the printer housing, whereas the separation roller operates to drive all sheets of paper received beneath the top sheet back toward the paper cassette and thereby separate these lower sheets from the single top sheet of paper on which it is desired to print text or graphics within the printer housing. The operation of the above described input paper drive mechanism is a result of the inherent inability of the pick roller in the input paper cassette to always drive only the top sheet out of the paper cassette under all environmental conditions, thereby resulting in the above requirement for the paper separation roller as described.

The above prior art paper drive mechanism is characterized by several distinct disadvantages, among which include the cost and maintenance associated with the paper feed and paper separation rollers and more importantly the fact that there is no completely reliable way to avoid periodic paper jams from occurring at the paper feed roller/separation roller interface.

The IBM Technical Disclosure Bulletin, Volume 24, No. 12, May 1982, pages 6346 to 6347, discloses a special purpose paper cassette for a copying machine having a specific design for separating the usual stack of paper from single side copies which are established by the copying machine and fed back to the paper cassette. By effecting a separation of the single side copies from the supply of paper, this special purpose cassette can be used for duplex copying of the sheets. In the prior paper cassette, the stack of paper is separated from a single side copy to be duplexed by a leaf spring fastened

to the roof of the chamber of the paper cassette. As it is specifically highlighted in the sentence bridging pages 6346 and 6347 of this reference, this spring has no effect when normal copying is being conducted. In other words, this spring has no influence on the feeding and separating operation when normal copying is carried out. Thus, a copying machine designed for use with this prior art paper cassette necessarily comprises picker rolls and separation rolls which in combination with each other effect the paper separating operation. Further, a paper feed mechanism according to the preamble of claim 1 is known from said Disclosure Bulletin.

US-A-4,395,035 discloses a standard paper cassette for copiers or printers having separating pall members engaging the uppermost sheets at their opposite corners of their leading end and for temporarily restraining the sheet from advancing to buckle the sheet causing the uppermost sheet only to pass over the pall members under the influence of the resilient force of the sheet resulting from the buckling.

Disclosure of Invention

In accordance with the present invention, it has been discovered that the above combination feed roller/separation roller in the paper path between the input paper tray and the printer housing can be completely eliminated and replaced by the use of thin, flexible paper separation fingers or guide members which extend from the top cover of the paper cassette and downwardly at a chosen angle with respect to the plane of the major surface of the top sheet of paper being fed from the paper stack within the cassette. These thin, flexible fingers operate to generate a drag or reverse force vector on the sheets of paper beneath the top sheet being driven by the pick roller. This drag or reverse force vector prevents these lower sheets from being driven out of the paper cassette by the pick roller, but is insufficient to retain the top sheet on the stack within the paper cassette when driven by the pick roller.

Accordingly, the general purpose and principal object of the present invention is to provide a new and improved paper separation and feed mechanism of the type described which operates to completely replace the feed roller/separation roller mechanism of the prior art and thereby eliminates the above various described disadvantages associated therewith.

Another object of this invention is to provide a new and improved paper separation and feed mechanism of the type described which is reliable in operation to ensure that only the top sheet of paper within the paper stack of a paper cassette is fed into the adjoining printer housing at one time when driven by a pick roller.

Another object of this invention is to provide a new and improved paper separation and feed mechanism of the type described which is economical and straightforward in construction and is easily retrofittable into paper cassettes of existing document printers. These objects

are achieved by a paper feed mechanism according to the characterising part of claim 1.

In accordance with the present invention, the above objects are accomplished by the provision of an input paper cassette for a document printer which includes a top cover having a plurality of thin, flexible fingers extending downwardly from the paper exit end of the paper cassette and in the direction of paper stacked within the cassette at a certain angle with respect to the plane of the paper. These thin, flexible fingers create a small drag or reverse force on the stack of paper and thereby prevent more than the top sheet of paper from being driven at one time out of the paper cassette by the pick roller operating in frictional contact and drive with the top sheet. In a preferred embodiment of the invention, the paper cassette includes a paper receiving support member being operatively raised in a closed loop control fashion as sheets are removed from the cassette to position the top sheet on the stack of paper to a horizontal plane approximately at the location of the ends of the thin, flexible fingers.

In one embodiment of the invention, a pair of thin, flexible spring steel fingers are adhesively attached to the underside of the top cover of the paper cassette.

In a second embodiment of the invention, the thin, flexible fingers include a U-shaped end configuration having a geometry to fit into a corresponding pair of slots within the top cover of the paper cassette.

In yet a third embodiment of the invention, a pair of thin, flexible fingers have a U-shaped end configuration designed to fit on the edge of the top cover of the paper cassette.

The above brief summary of the invention, together with its novel features and attendant advantages will become more readily apparent from the following description of the accompanying drawings.

Brief Description of the Drawings

Figure 1A is an isometric view of a paper cassette constructed in accordance with a first embodiment of the invention.

Figure 1B is a cross sectional view of the thin flexible drag finger which is attached to the paper cassette cover in Figure 1A.

Figure 2 is an elevational view of the paper cassette of Figure 1A taken along lines 2-2 thereof.

Figure 3 is a cross sectional view showing how the paper cassette in Figure 1A fits into an electrophotographic printer housing.

Figures 4A and 4B are isometric and cross sectional views, respectively, of slot mounted flexible drag fingers of a second embodiment of the present invention.

Figure 5 is a cross sectional view of an edge mounted flexible drag finger in accordance with yet a third embodiment of the present invention.

Figure 6 is a partially cut-away isometric view of a fourth embodiment of the invention wherein a thin flexible

strip extends from one side of the pick roller which is located on top of the paper stack within the cassette.

Detailed Description of the Drawings

Referring now to Figure 1, there is shown a first embodiment of the invention wherein a paper cassette is designated generally as 10 and includes one or more thin flexible fingers 12 and 14 extending from the undersurface of a top cover member 16 of the cassette 10. The cassette cover 16 is constructed to fit on top of the main cassette housing 18 having a cut-away opening 20 configured in the front wall 22 of the housing 18 to facilitate handling. The front edge 24 of the top cover 16 is shorter than the length dimension of the housing 18 so as to leave an open area in the front end of the cassette which is bounded by a cut-away section 26 within the front wall 22. The top sheet of paper will pass beneath and in contact with the thin finger-like members 12 and 14 and into the main printer housing and along a print path described more specifically below with reference to Figure 6.

Referring now to Figure 1B, there is shown a cross sectional view of one of the thin finger members 12 and 14 having a horizontal section 28 and an angled section 30 which is typically configured at an angle of about 15° - 20° with respect to horizontal. Each of these fingers has a tip portion 32 which is operative to make contact with the moving surface of a top sheet of paper being fed out of the paper stack and into the printer housing.

Referring now to Figure 2 which is taken along lines 2-2 of Figure 1, this cross sectional view shows how the thin finger member 14 is adhesively secured to the undersurface 34 of the top cover 16 in a first embodiment of the invention.

Referring now to Figure 3, the apparatus shown in this figure illustrates the positional relationship between the paper cassette 10 and a printer housing 36 having a front wall 38 therein with an opening 40 for receiving the paper cassette 10 at a slight downward angle with respect to horizontal and extending into the printer housing 36. The paper cassette 10 in Figure 3 is shown with a stack of paper 42, the top sheet 44 of which is being singularly fed along a paper path or platform 46 and between a photoconductive drum 48 and a transfer roller 50 in a known manner. When a developed image is transferred from the surface of the photoconductive drum 50 and onto the underside of the sheet of paper 46, the sheet of paper 46 is then fed typically between a pair of fuser rollers 52 and 54 and then along the inner surface of a paper guide member 56, through an opening 58 in the back wall 60 and then into an output paper tray 62.

The apparatus shown in Figure 3 will also typically include a cam member 64 positioned as shown about a pivot point 66 to exert a downward force on the paper stack 42. The apparatus in Figure 3 further includes a feed roller 68 positioned near the left hand end of the paper stack 42 for driving the top sheet of paper 44 along the path 46, 48, and 50 as previously indicated. Each of the thin downwardly angled paper finger members (e.g.,

14) makes frictional contact as indicated with the top sheet of paper 44, thereby creating enough frictional drag in the plane of the paper so as to prevent any sheet other than the top sheet from being fed onto the paper platform and guide member 46 during the printing of each sheet between the photoconductive drum 48 and the transfer roller 50.

The stack of paper 42 will typically rest within the cassette 10 on a lower shelf member 70 which is gently urged upwardly by the force of a rotating arm 72 which pivots about an axis of rotation 74 so as to create an upward thrust vector into the D-roller 68. This force produces enough dynamic friction between the D-roller 68 and the top surface of the top sheet of paper 44 so as to drive the top sheet of paper 44 onto the paper guide or platform 46, while being insufficient as a result of the operation of the finger members 12 and 14 to drive any other sheets out of the stack 42 and onto the platform 46 during the printing of each sheet.

Referring now to Figures 4A and 4B, there is shown a second embodiment of the invention wherein the pair of downwardly extending finger members are in the form of the hook-shaped or U-shaped members 76 and 78 having their hook or U-shaped ends 80 and 82 configured to fit into the openings or slots 84 and 86, respectively, in the cassette cover. This configuration is shown in greater detail in Figure 4B, and the ends of the two drag finger members 76 and 78 again extend downwardly at an angle of approximately 15° - 20° with respect to horizontal.

Referring now to Figure 5, there is shown yet a third embodiment of the invention wherein each of the finger members (e.g., 88) has a U-shaped section 90 configured to fit on the edge section 92 of a cassette cover and also has a downwardly angled end section 94. This angled end section 94 is designed to come into direct contact with the top sheet of paper in the paper stack at the tip 96 of the end section 94.

Referring now to Figure 6, there is shown yet a fourth embodiment of the invention wherein a pair of downwardly extending drag fingers (e.g., 122) are secured to each of the two inwardly protruding members (e.g., 120) attached to the two lever arms 112 and 114. The two lever arms are mechanically linked by a rod 108 which is extended as shown through a D-roller 102 which rests on the stack of paper within the cassette. Each of the lever arms 112 and 114 pivots about an axis of rotation (e.g., 106) in a known manner.

The rod 108 extending through the D-roller 102 is belt driven at 118 by a motor 116, and as in previous embodiments the tips of the drag fingers 122 create frictional drag on the top sheet of paper in the paper stack so as to allow only one sheet of paper at a time to be passed between the photoconductive drum 124 and the transfer roller 126 and then between the two output fuser rollers 128 and 130.

Claims

1. Paper feed mechanism for a document printer having an input paper cassette (10) including a top cover (16), said mechanism comprising a pick roller (68) driven in frictional contact with a top sheet (44) of a stack of paper (42) contained in said cassette (10), said mechanism further comprising retaining means for preventing other sheets than the top sheet (44) of the paper at a time from being driven out of said paper cassette (10) by said pick roller (68), characterized in that said retaining means is exclusively formed by a plurality of thin, flexible fingers (12,14) extending downwardly from a paper exit end (24) of said top cover (16) and in the direction of paper stacked within said paper cassette (10) at a certain angle (30) with respect to the plane of said paper and making contact with said top sheet (44) for creating a small drag force and a reverse force vector on said stack of paper (42), said plurality of thin, flexible fingers (12,14) eliminating the separation roller in a feed roller and separation roller mechanism in the paper path of the document printer.
2. The mechanism defined in claim 1 wherein said thin, flexible fingers (12, 14) are adhesively attached to the bottom side (34) of said top cover (16).
3. The mechanism defined in claim 1 wherein said thin, flexible fingers (12, 14; 76,78) have a U-shaped end configuration designed to fit into a corresponding pair of slots (84, 86) within said top cover (16).
4. The mechanism defined in claim 1 wherein said thin, flexible fingers (12, 14; 94) have a U-shaped end configuration (90) designed to fit on the paper exit edge (92) of said top cover (16).
5. The mechanism defined in claim 1 or 2 wherein a paper receiving support member is operatively raised (72, 74) within said cassette (10) as sheets are removed from said cassette to thereby raise the top sheet (44) of the stack of sheets (42) to a horizontal plane approximately at the location of the ends of said thin, flexible fingers (12, 14).
6. The mechanism defined in claim 1 wherein said thin, flexible fingers (122) extend from a lever arm (112, 114) above said stack of paper (42).

Patentansprüche

1. Papierzufuhrmechanismus für einen Dokumentdrucker mit einer Eingabepapierkassette (10), die eine obere Abdeckung (16) aufweist, wobei der Mechanismus eine Aufnahmewalze (68) aufweist, die in Reibungskontakt mit einem obersten Blatt (44) eines Papierstapels (42), der in der Kassette (10)

enthalten ist, angetrieben wird, wobei der Mechanismus ferner eine Rückhalteeinrichtung zum Verhindern aufweist, daß zu einem Zeitpunkt andere Blätter als das oberste Blatt Papier (44) durch die Aufnahmewalze (68) aus der Papierkassette (10) 5 getrieben werden,

dadurch gekennzeichnet, daß

die Rückhalteeinrichtung ausschließlich durch eine Mehrzahl von dünnen, flexiblen Fingern (12, 14) gebildet ist, die sich von einem Papieraustrittsende (24) der oberen Abdeckung (16) nach unten und in der Richtung eines Papiers, das in der Papierkassette (10) gestapelt ist, bezüglich der Ebene des Papiers in einem bestimmten Winkel (30) erstrecken, wobei dieselben mit dem obersten Blatt (44) 10 zum Erzeugen eines kleinen Bremskraft- und eines Gegenkraft-Vektors auf den Papierstapel (42) einen Kontakt herstellen, wobei die Mehrzahl von dünnen, flexiblen Fingern (12, 14) die Trennungswalze in einem Zufuhrwalzen- und Trennungswalzen-Mechanismus in dem Papierweg des Dokumentendruckers beseitigt. 15 20

2. Der Mechanismus gemäß Anspruch 1, bei dem die dünnen, flexiblen Finger (12, 14) klebstoffmäßig an der Unterseite (34) der oberen Abdeckung (16) befestigt sind. 25
3. Der Mechanismus gemäß Anspruch 1, bei dem die dünnen, flexiblen Finger (12, 14; 76, 78) eine U-förmige Endkonfiguration aufweisen, die entworfen ist, um in ein entsprechendes Paar von Schlitzten (84, 86) in der oberen Abdeckung (16) zu passen. 30
4. Der Mechanismus gemäß Anspruch 1, bei dem die dünnen, flexiblen Finger (12, 14; 94) eine U-förmige Endkonfiguration (90) aufweisen, die entworfen ist, um auf die Papieraustrittskante (92) der oberen Abdeckung (16) zu passen. 35 40
5. Der Mechanismus gemäß Anspruch 1 oder 2, bei dem ein Papieraufnahmeträgerbauglied wirksam innerhalb der Kassette (10) angehoben wird (72, 74), während Blätter von der Kassette entfernt werden, wodurch das oberste Blatt (44) des Blattstapels (42) in eine horizontale Ebene etwa an der Position der Enden der dünnen, flexiblen Finger (12, 14) gehoben wird. 45
6. Der Mechanismus gemäß Anspruch 1, bei dem sich die dünnen, flexiblen Finger (122) von einem Hebelarm (112, 114) über dem Papierstapel (42) erstrecken. 50

Revendications 55

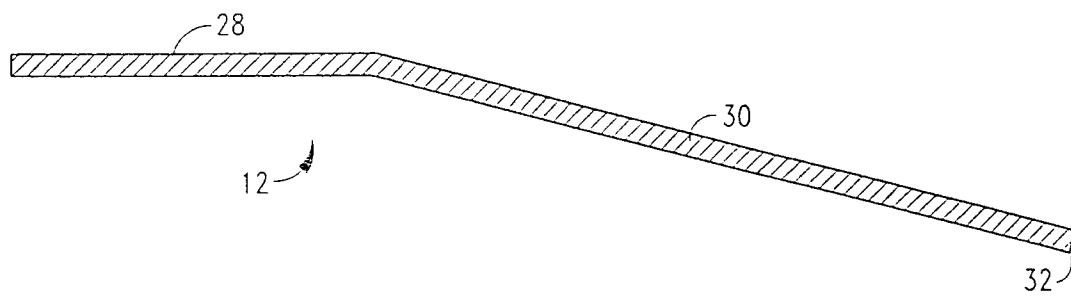
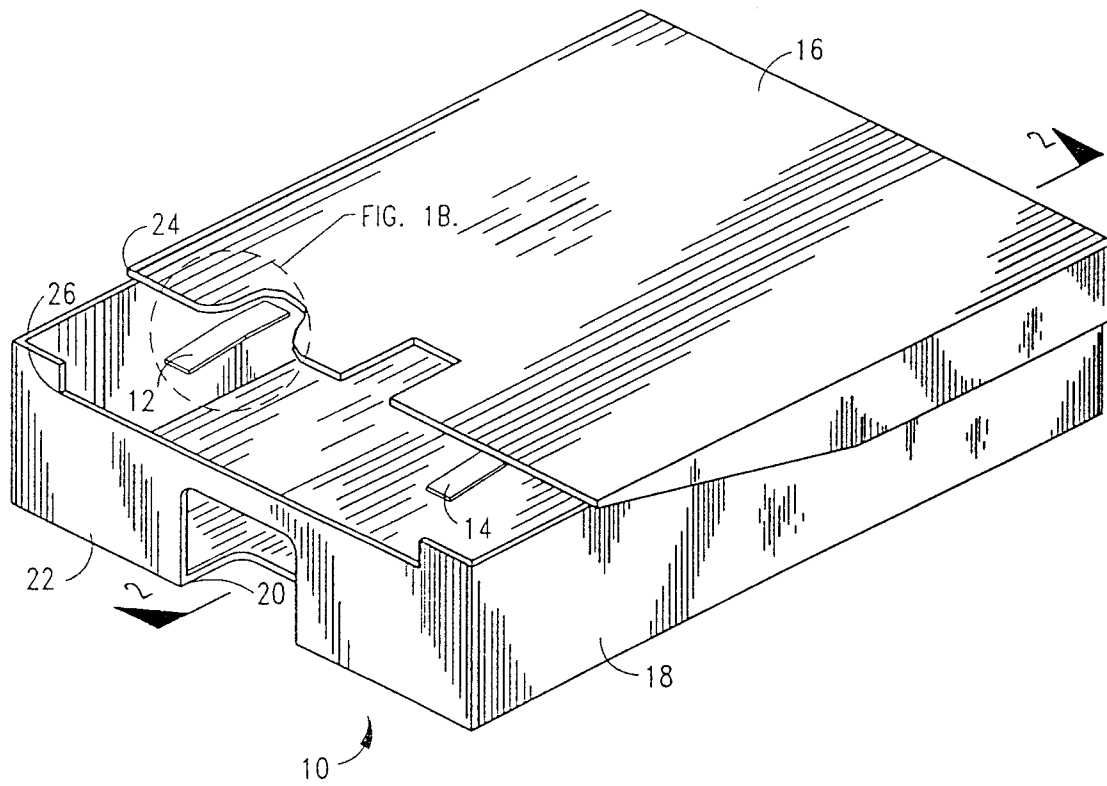
1. Mécanisme d'avance du papier pour une imprimante de documents comportant une cassette (10) d'alimentation en papier incluant un couvercle supé-

rieur (16), ledit mécanisme comprenant un galet de prélèvement (68) entraîné en contact de friction avec une feuille supérieure (44) d'une pile de papier (42) contenue dans ladite cassette (10), ledit mécanisme comportant en outre des moyens de retenue pour empêcher que des feuilles, autres que la feuille de papier supérieure (44) seule, ne soient entraînées hors de ladite cassette à papier (10) par ledit galet de prélèvement (68),

caractérisé,

par le fait que lesdits moyens de retenue sont exclusivement formés par une pluralité de doigts fins, flexibles (12, 14) qui s'étendent vers le bas depuis une extrémité (24) de sortie du papier dudit couvercle supérieur (16) et dans la direction du papier empilé dans ladite cassette à papier (10) sous un certain angle (30) par rapport au plan dudit papier et font contact avec ladite feuille supérieure (44) pour créer un léger vecteur de force de traînée et de force inverse sur ladite pile de papier (42), ladite pluralité de doigts fins, flexibles (12, 14) supprimant le galet de séparation dans un mécanisme à galet d'avance et galet de séparation sur le chemin du papier de l'imprimante de documents.

2. Mécanisme défini dans la revendication 1, dans lequel lesdits doigts fins, flexibles, (12, 14) sont fixés par adhésif à la face inférieure (34) dudit couvercle supérieur (16).
3. Mécanisme défini dans la revendication 1, dans lequel lesdits doigts fins, flexibles (12, 14, 76, 78) ont une configuration d'extrémité en forme de U conçue pour s'ajuster dans une paire correspondante de fentes (84, 86) prévues dans ledit couvercle supérieur (16).
4. Mécanisme défini dans la revendication 1, dans lequel lesdits doigts fins, flexibles (12, 14; 94) ont une configuration d'extrémité en forme de U (90) conçue pour s'ajuster sur le bord (92) de sortie du papier dudit couvercle supérieur (16)
5. Mécanisme défini dans la revendication 1 ou 2, dans lequel un élément support de réception du papier monte (72, 74) de façon fonctionnelle dans ladite cassette (10) au fur et à mesure que des feuilles sont enlevées de ladite cassette pour faire monter de ce fait la feuille supérieure (44) de la pile de feuilles (42) et l'amener à un plan horizontal approximativement situé à la position des extrémités desdits doigts fins, flexibles (12, 14).
6. Mécanisme défini dans la revendication 1, dans lequel lesdits doigts fins, flexibles (122) s'étendent, depuis un bras de levier (112, 114) au-dessus de ladite pile de papier (42).



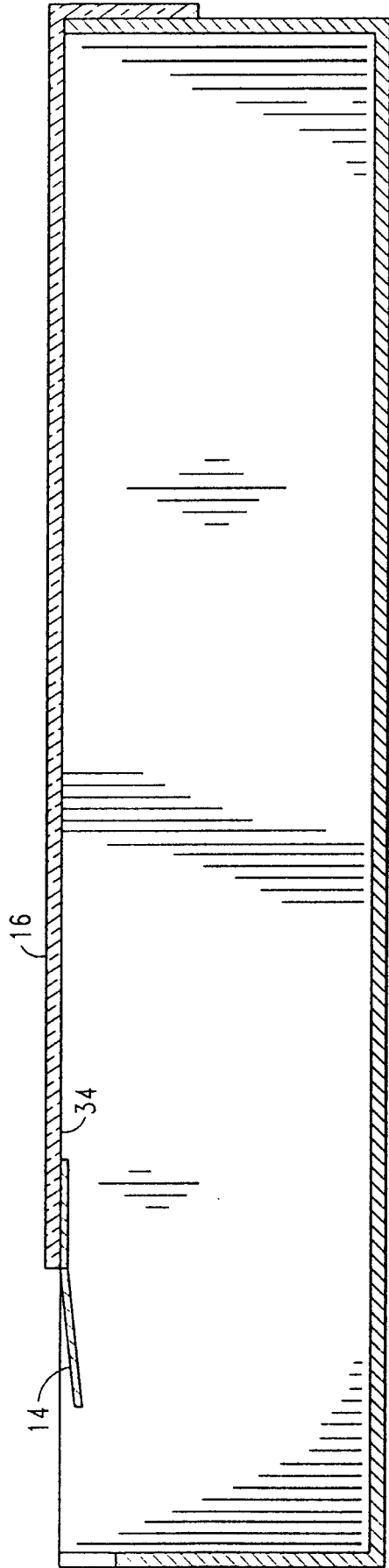


FIG. 2.

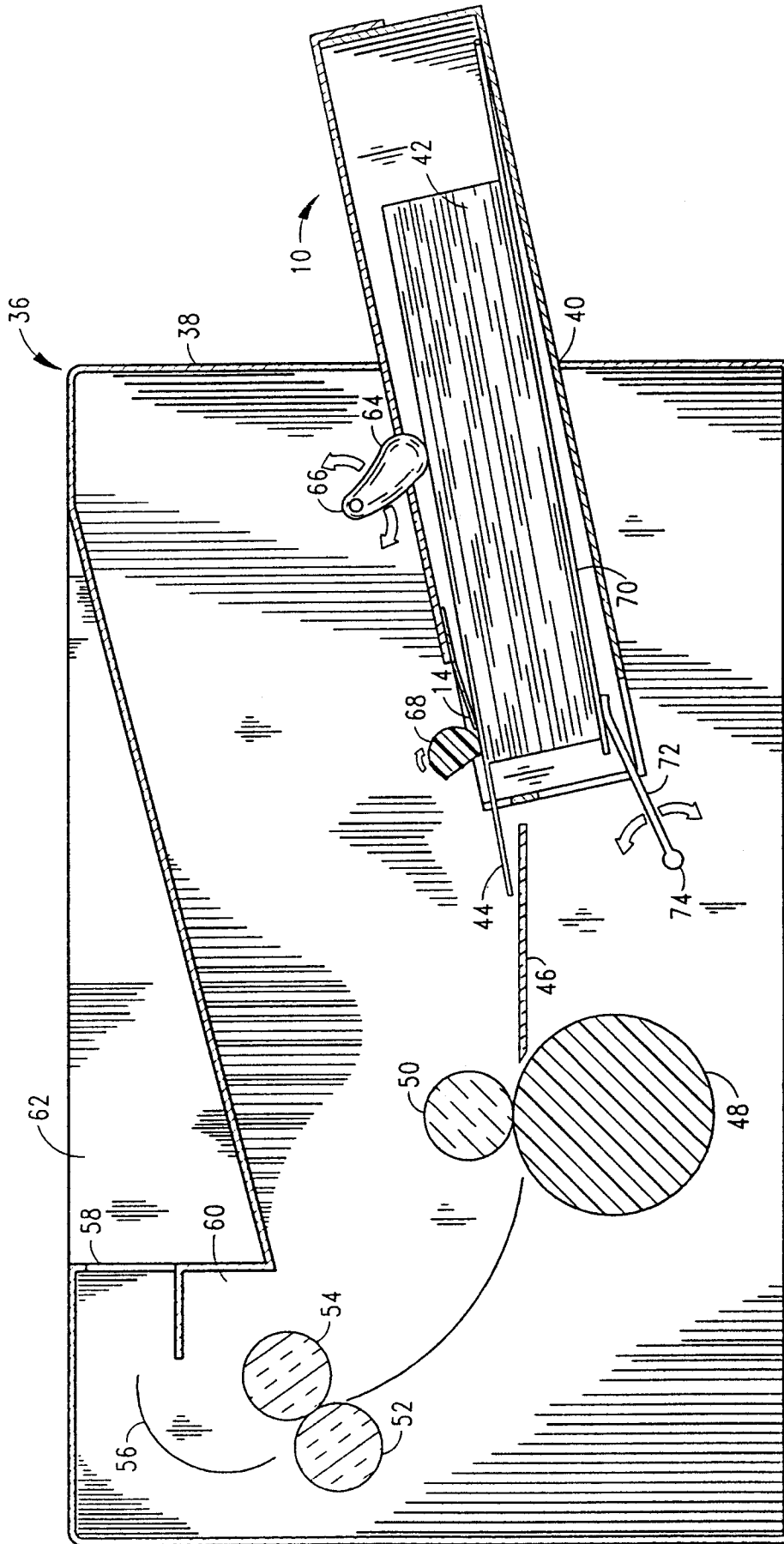


FIG. 3.

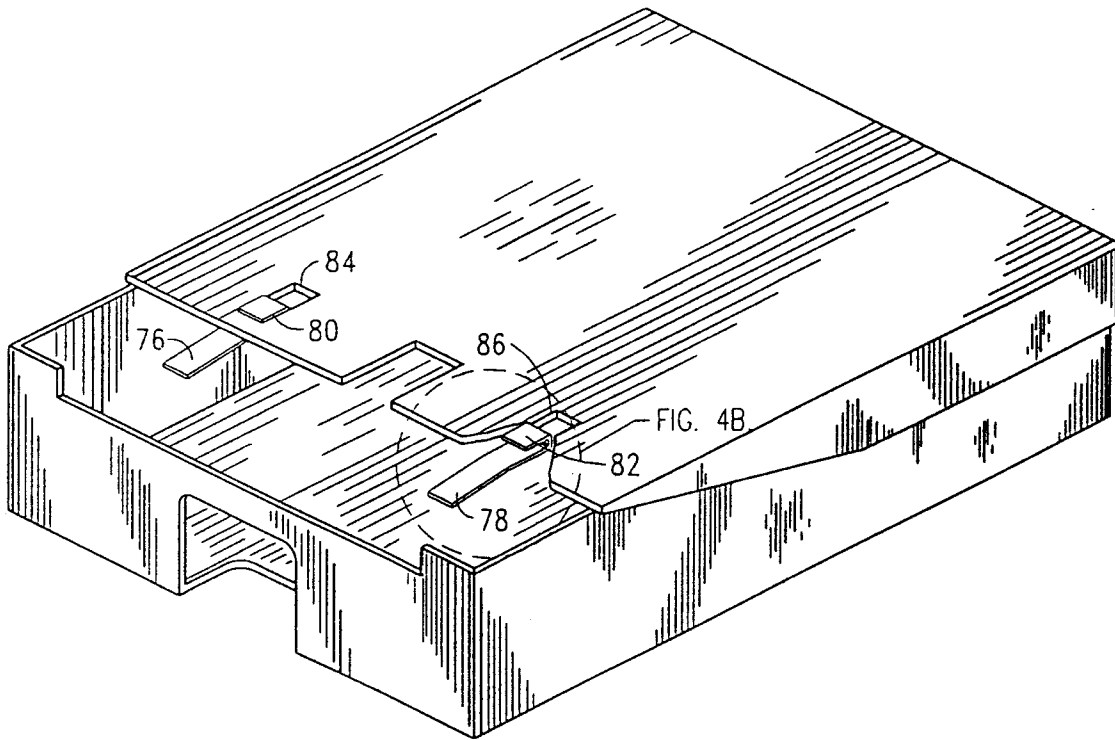


FIG. 4A.

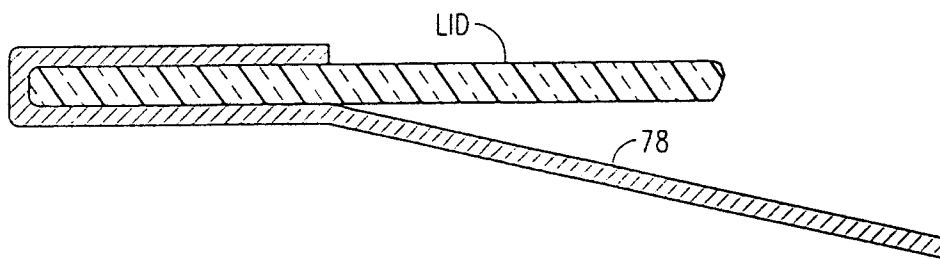


FIG. 4B.

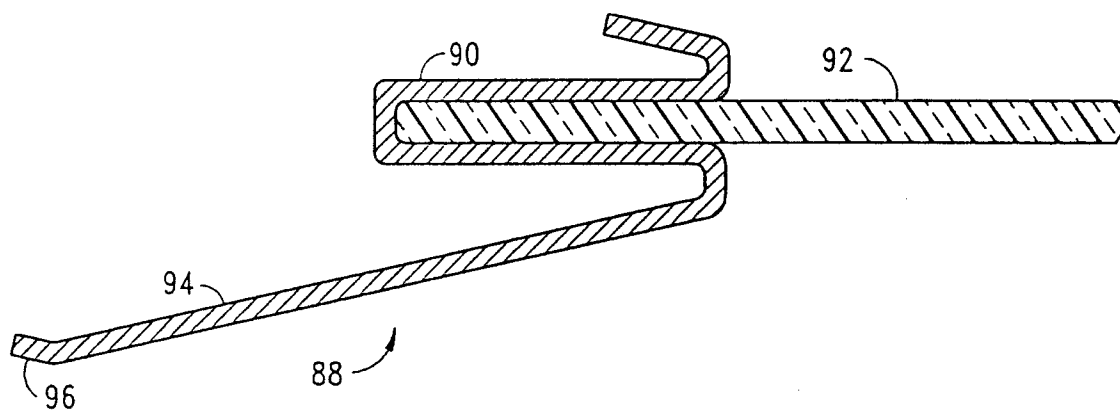


FIG. 5.

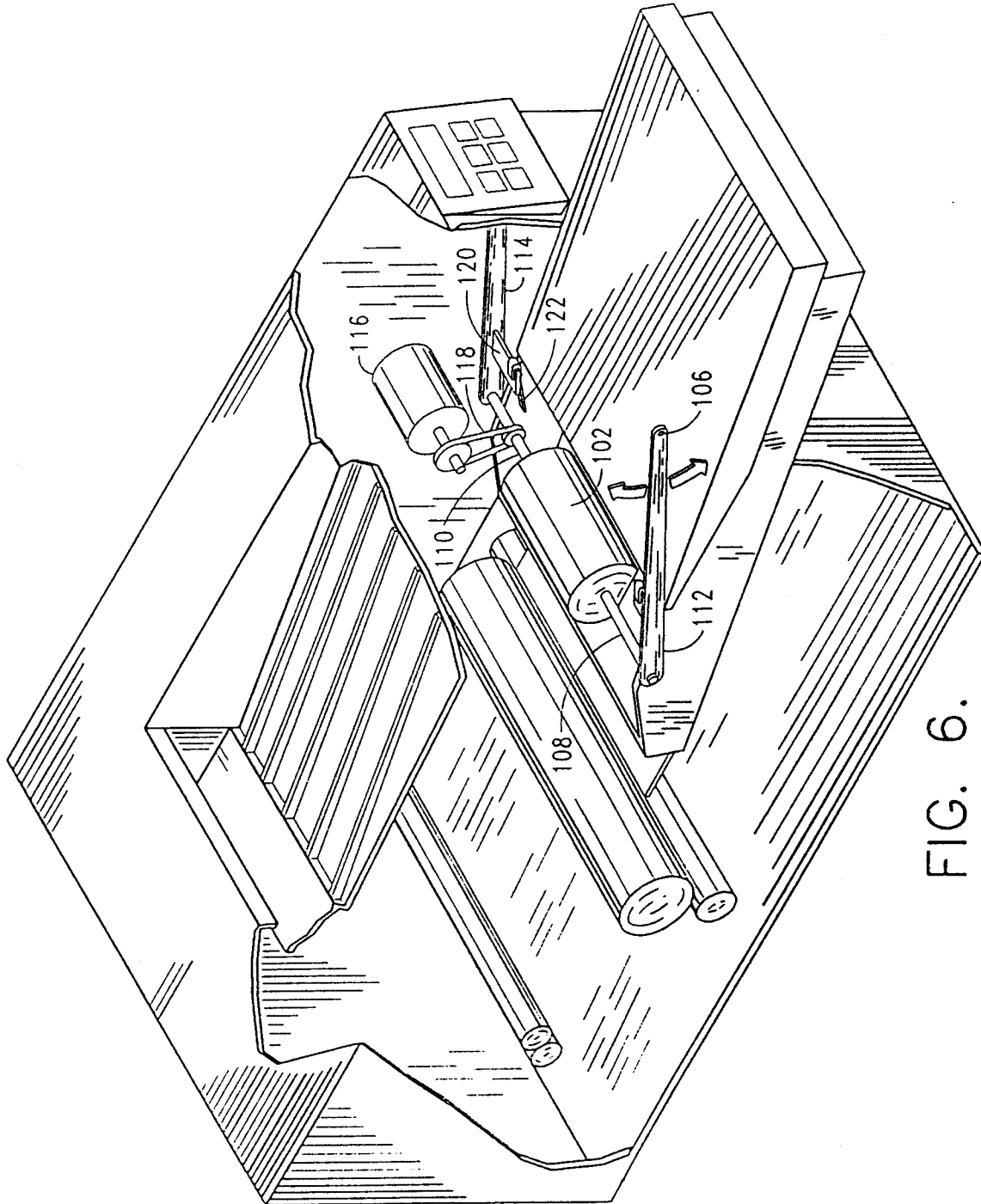


FIG. 6.