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(54) **A printer as well as a method for controlling such a printer**

Drucker sowie Verfahren zur dessen Steuerung

Imprimante et méthode pour son contrôle

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- **PATENT ABSTRACTS OF JAPAN vol. 0103, no. 15 (M-529), 25 October 1986 (1986-10-25) & JP 61 124448 A (RICOH CO LTD), 12 June 1986 (1986-06-12)**
- **PATENT ABSTRACTS OF JAPAN vol. 0070, no. 10 (P-168), 14 January 1983 (1983-01-14) & JP 57 167042 A (CANON KK), 14 October 1982 (1982-10-14)**

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Description

[0001] The invention relates to a printer comprising a printing unit for printing on a receiving medium of a predetermined type, a plurality of feeders for holding receiving media, establishing means for establishing the type of receiving medium held by each of the said feeders.

[0002] The invention furthermore relates to a method for printing a receiving medium of a predetermined type using a printer having a printing unit and a plurality of feeders for holding receiving media, the method comprising establishing the type of receiving medium held by each of the said feeders.

[0003] From US 4,783,889 such a printer is known. This printer allows automatic changing of paper feed sources when a first paper feed source runs empty. The next paper source is chosen in accordance with the highest priority rank and the largest paper capacity. Thus, a paper feed source with a lower capacity will not by chosen over another source, holding the same paper, and having a higher capacity.

[0004] From US-patent 4,885,613 another printer is known which comprises a plurality of feeders which can hold the same receiving medium, in the form of a roll or sheets, whereby said feeder is selected comprising the largest amount of recording medium remaining thereon.

[0005] In such a printer a disadvantage is that a nearly empty feeder will only be fully emptied if also the other feeders holding the same type of receiving medium have been emptied. In this manner the printer will almost never comprise an empty feeder in which another type of receiving medium, for example receiving sheets having another format, another colour or another thickness can be inserted. The feeders will be used successively since after using one feeder, the amount of receiving sheets remaining therein will become less than the amount of receiving sheets in another feeder so that said other feeder with the larger amount will be selected by the control unit. In case that there are, for example four feeders comprising same type of receiving sheets, all four feeders will be used successively and become empty at almost the same moment. At that moment the operator needs to replenish all feeders at the same time. By using the feeders successively, many feeder changes, involving relatively elaborate operator handling, will occur.

From JP 61 124448 (Ricoh Co. ltd.) a printer Is known which selects a tray with the largest number of remaining sheets of paper. Such a printer is also known from JP 57 167042 (Canon Inc.), which printer preferentially uses the paper source having the largest amount of paper remaining. These printers have the same disadvantages as mentioned here-above.

From US 5,301,936 a printer is known which selects a next paper source in accordance with a priority criterion directed at a preferential feed direction. This selection is not optimised for the number of paper source switchings.

[0006] It is an object of the invention to provide a printer whereby the feeders will be used in a more optimised manner.

[0007] This object is being achieved by a printer according to claim 1 in that the printer comprises means for determining, upon establishing that at least two feeders hold the predetermined type of receiving material, the amount of receiving medium which can be added to each of these at least two feeders up to a predetermined maximum amount, and selecting means for selecting the feeder to which the largest amount receiving medium can be added for feeding the receiving medium to the printing unit.

By feeding receiving sheets out of the feeder to which the largest amount of receiving medium can be added, this feeder will be fully emptied before another feeder will be selected. In this matter only a relatively small number of feeder changes will occur. Since the feeder which is being selected will be fully emptied before another feeder will be selected, said feeder will become available for another type of receiving medium, if necessary. Furthermore, if an operator wants to replenish the feeders, he can add a relatively large amount of receiving sheets to the feeder which is at that moment being selected by the control unit as feeder for feeding receiving sheets to the printing unit.

[0008] The printer according to the invention gives the operator relatively much freedom to decide when he wants to replenish the feeders and which feeders he wants to replenish.

[0009] An embodiment of the printer according to the invention is characterized in that the feeder closest to the printing unit is selected, for example by a control unit, in case there are more feeders to which the same largest amount of receiving medium can be added.

[0010] By selecting the feeder closest to the printing unit, the printer will be able to print relatively fast on the receiving medium.

[0011] In case there are more feeders at the same distance to the printing unit, the lowest feeder is preferably selected.

[0012] Another embodiment of the printer according to the invention is characterized in that the feeder which has the smallest amount of receiving medium therein is selected, for example by the control unit, in case there are more feeders having the same largest amount of receiving medium which can be added.

[0013] By feeders having a different predetermined maximum amount, the feeder which has the smallest amount of receiving medium left therein will be selected. This feeder will be emptied relatively quickly so that it will become available for other types of receiving medium.

[0014] Yet another embodiment of the printer according to the invention is characterized in that the printer comprises level detector means for determining the amount of receiving medium available in the feeders, and also comprises subtraction means for subtracting the available amount from the predetermined maximum amount to obtain the amount of receiving medium which can be added to each feeder.

[0015] In this manner the amount of receiving medium that can be added to each feeder can be determined relatively easy.

[0016] A further embodiment of the printer according to the invention is characterized in that the printer comprises means for measuring the distance between a first level at which the feeder is filled with receiving medium up to the predetermined maximum amount and a second level up to which said feeder is actually filled with receiving medium.

[0017] By measuring said distance, the amount of receiving medium which can be added can relatively easy be determined.

[0018] The amount of receiving medium which can be added to each feeder can be determined relatively accurate or relatively rough in which latter case, there will be a kind of threshold. For example, the amount of sheets can be determined by using increments equal to 100. In the latter case for example, the amount of sheets that can be added is determined as zero sheets, 100-200 sheets, 200-300 sheets etc.

[0019] The invention also relates to a method for printing a receiving medium of a predetermined type using a printer having a printing unit and a plurality of feeders for holding receiving media, the method comprising establishing the type of receiving medium held by each of the said feeders, and, if the predetermined type of receiving material is held by at least two feeders, determining the amount of receiving medium which can be added to each of the said at least two feeders up to a predetermined maximum amount, and selecting the feeder to which the largest amount of receiving medium can be added for feeding the receiving sheet to the printing unit.

[0020] Due to this method a once chosen feeder will be fully emptied before another feeder will be selected unless another empty feeder will be refilled with a very small amount of paper, in case of which this feeder will be selected. In this manner feeders will be emptied relatively fast and become available for other types of receiving media. Furthermore an operator will have a relatively large freedom by replenishing the feeders.

[0021] The invention will further be explained with reference to the drawing in which

fig. 1 shows schematically a set of feeders of a printer according to the invention,
fig. 2 shows a printer according to the invention,
fig. 3 shows schematically a feeder comprising sensing means according to the invention.

[0022] Fig. 1 shows a part of a known printer comprising a printing unit (not shown), a plurality of feeders 1, 2, 3 for feeding receiving sheets 4 to the printing unit and a control unit (not shown) for controlling the printing processes. The printer may comprise a large number of feeders of which only three feeders are being shown. In said three feeders the same type of receiving sheets, for example sheets with an A4-format, 80 grams, white colour are available. In this embodiment, this is established automatically by the printer by using art known sensing means for sensing the type of receiving material. In another embodiment, the type of receiving material is programmed by the operator and stored in a memory, for example a memory of a control unit of the printer. In feeder 1 a predetermined maximum amount of receiving sheets 4 is MAX1, the predetermined maximum amount of feeder 2 is MAX2 and the predetermined maximum amount of feeder 3 is MAX 3. The maximum amount for the feeders 1, 2 is the same so that MAX1 = MAX2, whereby MAX1 is for example 1000 sheets. The predetermined maximum amount MAX3 of feeder 3 is larger than the maximum amounts MAX1, MAX2 and is for example 3000 sheets.

[0023] Fig. 2 shows a printer 5 comprising the three feeders as shown in fig. 1, a printing unit 6, a control unit 7 for controlling the printer 5 as well as a tray 8 in which sheets on which information is printed by printing unit 6 can be stored. Although depicted as one single unit 7, it is clear that the control unit may also consist of several subunits distributed over the printer. Other parts of the printing unit 6 are the imaging belt 20, charging station 21, printhead 22 with control unit 23, developing station 24, intermediate transfer belt 25 and transfer nip 26. Such a printer is described in greater detail in European patent application EP 0 599 374.

[0024] The printer 5 comprises sensing means (not shown) for each feeder 1, 2, 3 which sensing means is provided with level detector means for determining the amount of receiving sheets $\Delta 1$, $\Delta 2$, $\Delta 3$ available in each feeder 1, 2, 3. The sensing means furthermore comprise subtracting means for subtracting the available amount $\Delta 1$, $\Delta 2$, $\Delta 3$ from the predetermined maximum amount MAX1, MAX2, MAX3 to obtain the amount ADD1, ADD2, ADD3 of receiving sheets which can be added to each feeder 1, 2, 3.

[0025] By the feeders as shown in fig. 1, the feeder 1 comprises for example an amount $\Delta 1$ of 300 receiving sheets 4 so that ADD1 is 1000 - 300 = 700. In feeder 2 the available amount $\Delta 2$ is 600 so that ADD2 is 1000 - 600 = 400. In feeder 3 the available amount $\Delta 3$ is 1600 so that ADD3 is 3000 - 1600 = 1400. It is not absolutely necessary to determine the exact amount of receiving sheets 4 but a rough estimation round up to hundreds might work as well.

[0026] By the control unit it will now be determined to which feeder the largest amount of receiving sheets can be added. By the example given above, the feeder 3 will be selected since ADD3 (1400) is larger than ADD2 (400) and ADD1 (700). By selecting feeder 3, several printing processes can be done by using this feeder 3 until feeder 3 is fully emptied. By the control unit it will then be decided to use feeder 1 since ADD1 is 700 larger than ADD2 (400). An operator can be informed about the available amount $\Delta 1$, $\Delta 2$, $\Delta 3$ and/or the amount ADD1, ADD2, ADD3 of receiving sheets which can be added to each feeder, by means of a display (not shown) or by indicator

means (not shown) on each feeder 1, 2, 3 or by opening each feeder 1, 2, 3. The operator can then replenish the feeder 3 with a relatively large amount of receiving sheets. After replenishing the empty feeder 3, the control unit will continue with emptying feeder 1. After feeder 1 is being emptied, the control unit will select feeder 2 since after emptying feeder 1 and replenishing feeder 3 up to the maximum amount MAX3, feeder 2 has the largest amount ADD2 of receiving sheets which can be added. The operator can replenish feeder 1 before feeder 2 is fully emptied or can replenish both feeders 1 and 2 after the feeder 2 is also emptied. Preferably a feeder 1, 2, 3 is not replenished whilst a feeder 1, 2, 3 is being used as feeder for feeding a receiving sheet to the printing unit, to prevent disruption of the printing process. If a feeder is being opened another feeder will be selected temporarily.

[0027] Instead of determining the amount $\Delta 1$, $\Delta 2$, $\Delta 3$ it is also possible to provide the printer with sensing means having means for measuring between a first level LM1, LM2, LM3 at which the feeder 1, 2, 3 is filled with receiving sheets 4 up to the predetermined maximum amount MAX1, MAX2, MAX3 and a second level L1, L2, L3 up to which said feeder 1, 2, 3 is actually filled with receiving sheet 4. Said distance D1, D2, D3 is a measure for the amount of receiving sheets which can be added, whereby the largest distance, in this example D3, corresponds with the largest amount of receiving sheets which can be added.

[0028] Fig. 3 shows another kind of feeder 9 in which the stack of receiving sheets 4 is located on a platform 10 which is movable under spring force in upward direction until the upper sheet 4 is located against a transport roller 11. The level L4 of the platform 10 is being determined by means of the control unit 7 in which also a maximum level LM4 of the platform 10 is being stored. The difference between the maximum level LM4 and L4 provides the control unit 7 with information about the actually amount of receiving sheets in the feeder 9 whilst the level L4 is a direct measure for the amount of receiving sheets which can be added to the feeder 9.

Claims

1. A printer (5) comprising a printing unit (6) for printing on a receiving medium (4) of a predetermined type, a plurality of feeders (1, 2, 3) for holding receiving media (4), establishing means for establishing the type of receiving medium (4) held by each of the said feeders (1, 2, 3) **chararacterized in that** the printer (5) comprises means for determining, upon establishing that at least two feeders (1, 2, 3) hold the predetermined type of receiving material (4), the amount of receiving medium which can be added to each of these at least two feeders (1, 2, 3) up to a predetermined maximum amount, and selecting means for selecting the feeder (1, 2, 3) to which the largest amount of receiving medium (4) can be added, for feeding the receiving medium (4) to the printing unit (6).

2. A printer (5) according to claim 1, **characterized in that** the feeder (1, 2, 3) closest to the printing unit (6) is selected, in case there are more feeders (1, 2, 3) to which the same largest amount of receiving medium (4) can be added.

3. A printer (5) according to claim 1 or 2, **characterized in that** the feeder (1, 2, 3) which has the smallest amount of receiving medium therein is selected in case there are more feeders (1, 2, 3) having the same largest amount of receiving medium (4) which can be added.

4. A printer (5) according to one of the preceding claims, **characterized in that** the printer (5) comprises level detector means for determining the amount of receiving medium (4) available in the feeders, and also comprises subtraction means for subtracting the available amount from the predetermined maximum amount to obtain the amount of receiving medium (4) which can be added to each feeder (1, 2, 3).

5. A printer (5) according to one of the preceding claims, **characterized in that** the printer (5) comprises means for measuring the distance between a first level at which the feeder is filled with receiving medium up to the predetermined maximum amount and a second level up to which said feeder is actually filled with receiving medium.

6. Method for printing a receiving medium (4) of a predetermined type using a printer (5) having a printing unit (6) and a plurality of feeders (1, 2, 3) for holding receiving media (4), the method comprising establishing the type of receiving medium held by each of the said feeders (1, 2, 3), and, if the predetermined type of receiving material (4) Is held by at least two feeders (1, 2, 3), determining the amount of receiving medium which can be added to each of the said at least two feeders (1, 2, 3) up to a predetermined maximum amount, and selecting the feeder (1, 2, 3) to which the largest amount of receiving medium (4) can be added for feeding the receiving sheet to the printing unit (6).

Patentansprüche

1. Ein Drucker (5) mit einer Druckereinheit (6) zum Drucken auf ein Empfangsmedium (4) eines vorbestimmten Typs, mehreren Einzügen (1, 2, 3) zur Aufnahme von Empfangsmedien (4), und einer Bestimmungseinrichtung zur Bestimmung des Typs der in jedem der Einzüge (1, 2, 3) enthaltenen Empfangs-

medien (4), **dadurch gekennzeichnet, daß** der Drucker (5) eine Einrichtung aufweist, die bei Feststellung, daß wenigstens zwei Einzüge (1, 2, 3) den vorbestimmten Typ des Empfangsmaterials (4) enthalten, die Menge an Empfangsmedien bestimmt, die zu jedem dieser wenigstens zwei Einzüge (1, 2, 3) bis zu einer vorbestimmten Maximalmenge hinzugefügt werden kann, sowie eine Auswahleinrichtung zur Auswahl des Einzugs (1, 2, 3), zu dem die größte Menge an Empfangsmedien (4) hinzugefügt werden kann, für die Zufuhr des Empfangsmediums (4) zu der Druckereinheit (6).

2. Ein Drucker (5) nach Anspruch 1, **dadurch gekennzeichnet, daß**, sofern es mehrere Einzüge (1, 2, 3) gibt, zu denen die größte Menge an Empfangsmedien (4) hinzugefügt werden kann, der Einzug (1, 2, 3) ausgewählt wird, der der Druckereinheit (6) am nächsten liegt.

3. Ein Drucker (5) nach Anspruch 1 oder 2, **dadurch gekennzeichnet, daß**, sofern es mehrere Einzüge (1, 2, 3) gibt, die die gleiche größte Menge an Empfangsmedien (4) haben, die hinzugefügt werden kann, der Einzug (1, 2, 3) ausgewählt wird, der die kleinste Menge an Empfangsmedien enthält.

4. Ein Drucker (5) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** der Drukker (5) eine Niveaudetektionseinrichtung aufweist, zur Bestimmung der Menge an Empfangsmedien (4), die in den Einzügen verfügbar ist, und auch eine Subtraktionseinrichtung aufweist, zur Subtraktion der verfügbaren Menge von der vorbestimmten Maximalmenge, um die Menge an Empfangsmedien (4) festzustellen, die zu jedem Einzug (1, 2, 3) hinzugefügt werden kann.

5. Ein Drucker (5) nach einem der vorstehenden Ansprüche, **dadurch gekennzeichnet, daß** der Drukker (5) eine Einrichtung aufweist zur Messung des Abstands zwischen einem ersten Niveau, an dem der Einzug bis zu der vorbestimmten Maximalmenge mit Empfangsmedien gefüllt ist, und einem zweiten Niveau, bis zu dem dieser Einzug tatsächlich mit Empfangsmedien gefüllt ist.

6. Verfahren zum Bedrucken eines Empfangsmediums (4) eines vorbestimmten Typs mit Hilfe eines Druckers (5), der eine Druckereinheit (6) und mehrere Einzüge (1, 2, 3) zur Aufnahme von Empfangsmedien (4) aufweist, welches Verfahren die Bestimmung des Typs der in jedem der Einzüge (1, 2, 3) enthaltenen Empfangsmedien umfaßt und, wenn der vorbestimmte Typ des Empfangsmaterials (4) in wenigstens zwei Einzügen (1, 2, 3) enthalten ist, die Bestimmung der Menge an Empfangsmedien, die zu jedem dieser wenigstens zwei Einzüge (1, 2, 3) bis zu einer vorbestimmten Maximalmenge hinzugefügt werden kann, und die Auswahl des Einzugs (1, 2, 3), zu dem die größte Menge an Empfangsmedien (4) hinzugefügt werden kann, für die Zufuhr des Empfangsbogens zu der Druckereinheit (6).

Revendications

1. Imprimante (5) comprenant une unité d'impression (6) permettant d'imprimer sur un support récepteur (4) d'un type prédéterminé, une pluralité de magasins d'alimentation (1, 2, 3) permettant de contenir des supports récepteurs (4), des moyens d'établissement permettant d'établir le type de support récepteur (4) contenu dans chacun desdits magasins d'alimentation (1, 2, 3), **caractérisée en ce que** l'imprimante (5) comprend des moyens permettant de déterminer, après avoir établi qu'au moins deux magasins d'alimentation (1, 2, 3) contiennent le type prédéterminé de matériau récepteur (4), la quantité de support récepteur pouvant être ajoutée à chacun de ces au moins deux magasins d'alimentation (1, 2, 3) jusqu'à une quantité maximale prédéterminée, et des moyens de sélection permettant de sélectionner le magasin d'alimentation (1, 2, 3) auquel on peut ajouter la plus grande quantité de support récepteur (4) pour alimenter l'unité d'impression (6) en support récepteur (4).

2. Imprimante (5) selon la revendication 1, **caractérisée en ce que** le magasin d'alimentation (1, 2, 3) le plus proche de l'unité d'impression (6) est sélectionné, au cas où il y ait plusieurs magasins d'alimentation (1, 2, 3) auxquels on peut ajouter la plus grande quantité identique de support récepteur (4).

3. Imprimante (5) selon la revendication 1 ou 2, **caractérisée en ce que** l'on sélectionne le magasin d'alimentation (1, 2, 3) contenant la plus petite quantité de support récepteur, au cas où il y ait plusieurs magasins d'alimentation (1, 2, 3) auxquels on puisse ajouter la plus grande quantité identique de support récepteur (4).

4. Imprimante (5) selon l'une quelconque des revendications précédentes, **caractérisée en ce que** l'imprimante (5) comprend des moyens de détection de niveau permettant de déterminer la quantité de support récepteur (4) disponible dans les magasins d'alimentation et comprend également des moyens de soustraction permettant de soustraire la quantité disponible de la quantité maximale prédéterminée pour obtenir la quantité de support récepteur (4) pouvant être ajoutée à chaque magasin d'alimentation (1, 2, 3).

5. Imprimante (5) selon l'une quelconque des revendi-

cations précédentes, **caractérisée en ce que** l'imprimante (5) comprend des moyens permettant de mesurer la distance entre un premier niveau de remplissage du magasin d'alimentation en support récepteur jusqu'à la quantité maximale prédéterminée et un second niveau réel de remplissage dudit magasin d'alimentation en support récepteur.

6. Procédé d'impression d'un support récepteur (4) d'un type prédéterminé utilisant une imprimante (5) comprenant une unité d'impression (6) et une pluralité de magasins d'alimentation (1, 2, 3) permettant de contenir des supports récepteurs (4), le procédé consistant à établir le type de support récepteur contenu dans chacun desdits magasins d'alimentation (1, 2, 3), et si le type prédéterminé de matériau récepteur (4) est contenu dans au moins deux magasins d'alimentation (1, 2, 3), de déterminer la quantité de support récepteur pouvant être ajoutée à chacun desdits au moins deux magasins d'alimentation (1, 2, 3) jusqu'à une quantité maximale prédéterminée et de choisir le magasin d'alimentation (1, 2, 3) auquel la plus grande quantité de support récepteur (4) peut être ajoutée pour alimenter l'unité d'impression (6) en feuilles réceptrices.

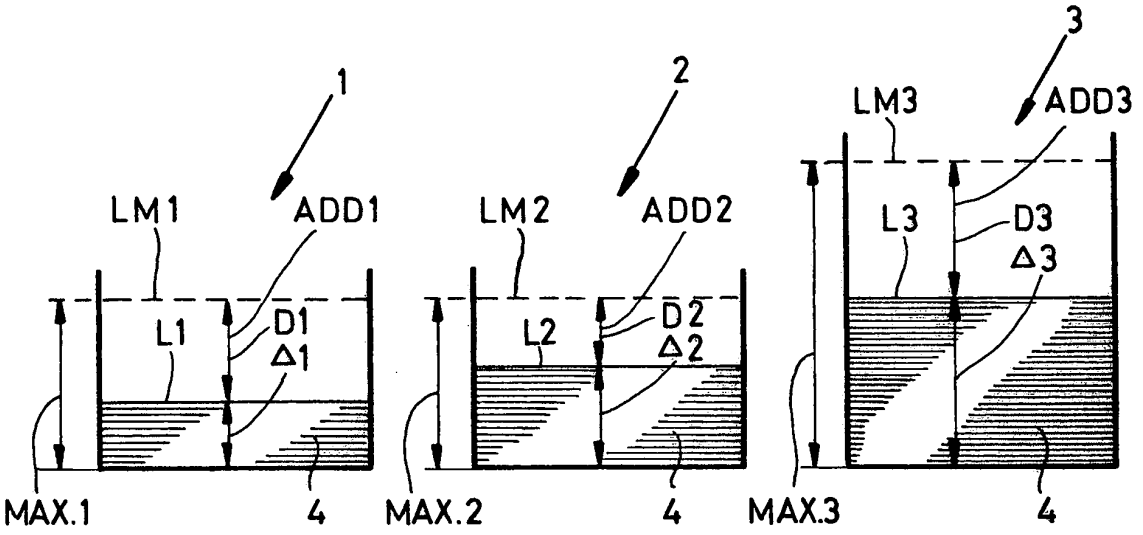
1
2
3
LM1
ADD1
LM2
ADD2
LM3
ADD3
L1
D1
Δ1
L2
D2
Δ2
L3
D3
Δ3
MAX.1
4
MAX.2
4
MAX.3
4

FIG. 1

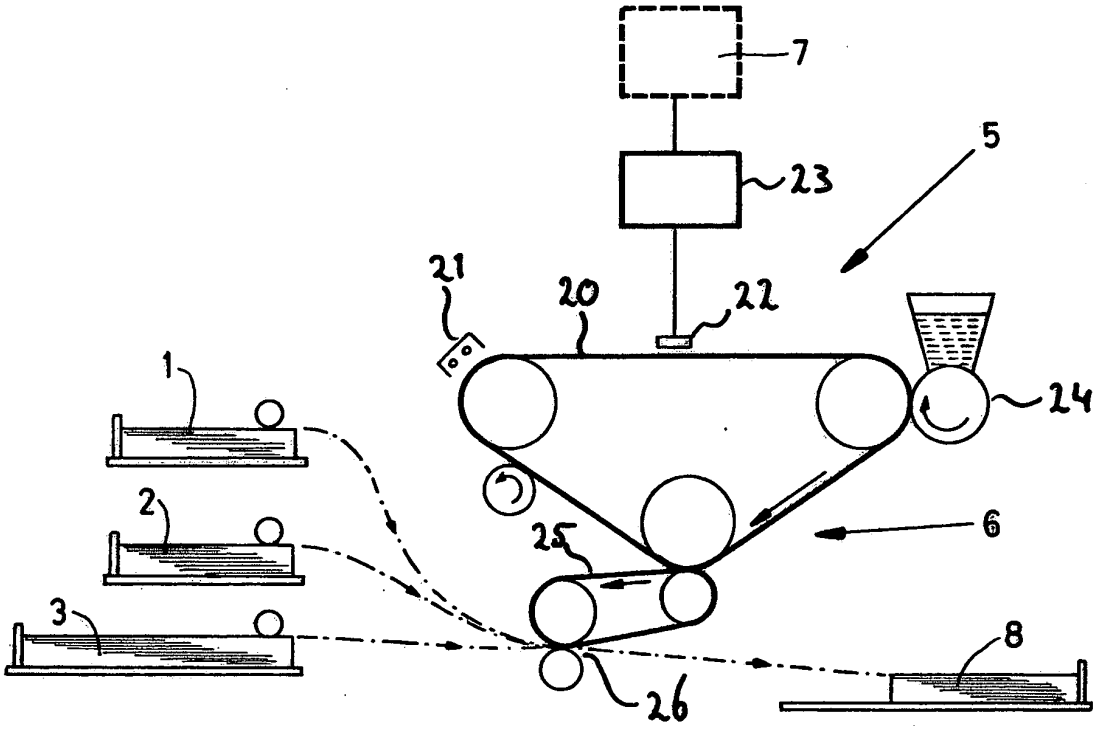
7
23
5
21
20
22
24
1
2
3
25
6
8
26

FIG. 2

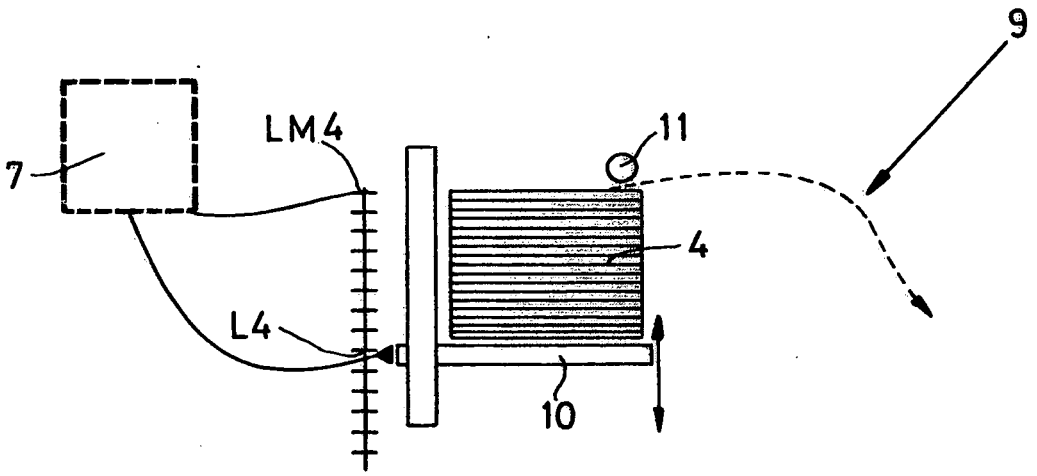

FIG.3

REFERENCES CITED IN THE DESCRIPTION

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