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(54) **Multi-mode paper feeding mechanism incorporating a dual feed rate roller system.**

(57) A paper handling mechanism is described that can feed both cut sheets and continuous forms. This multi-mode paper handling capability is achieved by using a dual feed rate roller system. A single feed roller (30) is constructed of a compressible material and deflected by separate idler rollers (32, 36) along the input and output paths (22, 24) to produce different feed rates. By constructing the feed roller (30) out of a compressible material a high feed rate is obtained with a low feed force. Thus, precise paper feeding of both cut sheets and continuous forms is achieved with a mechanism fitting within a confined space and having small number of moving parts.

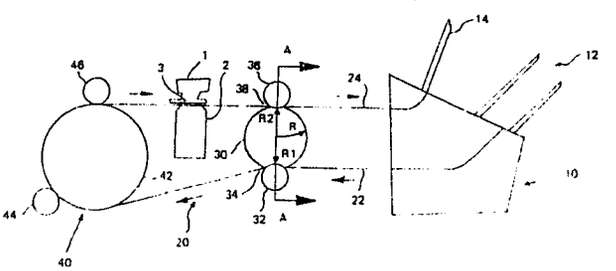

FIG. 1

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MULTI-MODE PAPER FEEDING MECHANISM INCORPORATING A DUAL FEED RATE ROLLER SYSTEM

The invention relates to a paper handling device for feeding cut sheets and continuous forms using a dual feed rate roller system wherein a single compressible feed roller is compressed by different amounts and thus transports the paper at different speeds along the input and output paths.

In the past, computer printers were separated into two categories; one category of printer provided a high quality textual output known as a letter quality printer while the other type of printer was used primarily for data processing purposes where there was little need for a quality output. The two categories of printer employed entirely different paper handling mechanisms. The letter quality printers were designed to handle cut sheets whereas the data processing printers were set up for continuous forms. As the computer printer art has progressed, printers have become available that combine the functions of both letter quality printing as well as data processing. This has created the problem of designing a paper handling mechanism that can feed both cut sheets and continuous forms.

Recently, two solutions to this problem have been proposed. United States Patent No. 4,569,610 describes a printer having a document transport system with alternate paths for feeding either cut sheets or continuous forms. A disadvantage of this printer is that the continuous forms should be removed before operating in the sheet feed mode; otherwise, continuous forms are fed while in the sheet feed mode wasting paper. Another proposal is described in an application for United States patent, Serial No. 807,519, which describes a printer having removable paper feed modules. Different paper feeding modules have to be manually installed depending upon the type of paper to be handled, presenting an inconvenience to the operator. These disadvantages of the prior art have been overcome by the present invention.

One objective of the invention is to provide a paper handling mechanism that can selectably feed either cut sheets or continuous form.

Another object of this invention is to provide a paper handling mechanism that can feed both continuous forms and cut sheets that is both simple to build and easy to use.

These and other goals have been achieved by this invention.

This invention provides an all purpose paper feeding mechanism that can handle both cut sheets and continuous forms. This flexibility is achieved by using a dual feed rate roller system wherein a feed roller constructed of a compressible material is pressed upon by separate idler rollers with different deflections to produce different feed rates. The feed rates being related to the deflection in a non-linear relationship, thus a large deflection results in a small change in feed rate. In this manner the paper travels at a higher feed rate in the output path than in the input path. This maintains a high paper tension as the paper passes through a print station.

The paper handling mechanism of the preferred embodiment is intended for use with a computer printer where the printer has means for recording information including a platen and print head. The print head and platen are disposed from one another in a predetermined spaced relationship defining a print station therebetween. The paper handling mechanism of the invention has a first means for storing blank record media, second means for storing record media having information recorded thereon and a paper path for conveying blank record media from the first means through the print station to the second means. The paper path has an input path and an output path.

The mechanism also comprises a compressible feed roller in contact with first and second solid idler rollers. The first solid idler roller is disposed adjacent the input path and the second solid idler roller is disposed adjacent the output path. The first solid idler roller is directed against the compressible feed roller deforming said compressible feed roller to a reduced radius R1 and the second solid idler roller is directed against the compressible feed roller deforming said feed roller to a reduced radius R2. The reduced radius R1 is less than the reduced radius R2 so that record media travel along the output path at a feed rate greater than record media travel along the input path.

In another embodiment, the improvement to a paper feed mechanism for delivering a record media to a print station and then conveying the record media to a bin means comprises a paper path having a sheet input path, a forms input path and an output path. The sheet input path has means for receiving sheets and the output path has means for transporting printed record media to the bin means for storing said printed record media.

A compressible feed roller is adjacent to both the sheet input path and the output path and has an uncompressed radius R. The compressible feed roller and a first solid idler roller define an input nip therebetween for driving sheets of record media along the sheet input path to a high friction roller means downstream of said input path. The first idler roller is compressed against the compressible feed roller to reduce the uncompressed radius R to a reduced input radius R1. The first solid idler

roller and the compressible feed roller of input radius R1 are in driven relationship to drive said record media along said sheet input path at a feed rate slightly greater than or equal to the feed rate of the high friction roller means.

The high friction roller means meters and transports said record media along said paper path to the print station. Backup roller means, associated with the high friction roller means, maintains said record media in driven relationship with the high friction roller means. Backup roller positioning means moves said backup roller in and out of contact with said high friction roller means. The backup roller positioning means has an engaged position wherein said backup roller is in driven relationship with the high friction roller and a disengaged position wherein said backup roller is not in driven relationship with said high friction roller.

The backup roller positioning means further defines a sheet input path when the positioning means is in the engaged position and defines a forms input path when said positioning means is in the disengaged position.

Tractor means are provided for feeding continuous forms to said forms input path.

A second solid idler roller, downstream of the high friction roller and print station, in combination with the compressible feed roller defines an output nip therebetween. The second solid idler roller is directed against the compressible feed roller to reduce the uncompressed radius R to an output radius R2. Input radius R1 is less than output radius R2. The second solid idler roller and the compressible feed roller of output radius R2 are in driven relationship to drive said record media along said output path at a feed rate greater than the feed rate of said high friction roller means to maintain tension of said record media as it passes through the print station and is directed to said bin means.

For a better understanding of the invention, reference is had to the following description taken in connection with the accompanying drawings wherein like reference numerals are used throughout to designate like parts:

Figure 1 shows the dual feed rate roller system of the invention;

Figure 2 is an enlarged view taken generally along the line A-A of Figure 1;

Figure 3 illustrates the preferred embodiment of the dual feed rate roller system;

Figure 4 illustrates the invention configured for feeding cut sheets;

Figure 5 illustrates the invention configured for feeding continuous forms;

Figure 6 is a backup roller positioning mechanism engaged for feeding cut sheets; and

Figure 7 is a backup positioning mechanism configured to feed cut sheets.

Referring now to Figure 1, the dual feed rate roller system is there depicted. Means for recording information on record media is shown comprising a print head 1 and a platen 2. The print head can be of any type such as a wire matrix, ink jet or other suitable device for generating characters. The platen is a fixed bar constructed of aluminum or other suitable material. Print head 1 and platen 2 are disposed in a predetermined spaced relationship and between them define a print station 3. The print head and platen are part of a printer (not shown) configured for the paper handling mechanism of this invention.

Separator 10 is shown with two paper bins 12 for storing blank record media and an output tray 14 for storing record media having information recorded thereon. Record media such as cut sheets, labels, envelopes or the like are transported from bins 12 to input path 22 and are returned to tray 14 along output path 24. Input path 22 and output path 24 form parts of paper path 20.

Downstream of separator 10 is compressible feed roller 30 in contact with first solid idler roller 32. Feed roller 30 and idler roller 32 are disposed adjacent input path 22 and define an input nip 34 therebetween. Feed roller 30 is constructed of a micro-cellular urethane material of a low durometer as measured using the standard Shore A method. In the preferred embodiment, the compressible material of feed roller 30 has a durometer of 20 while materials having a durometer up to 40 have been shown to work.

Compressible feed roller 30 has an uncompressed radius R. The action of solid idler roller 32 pressing against feed roller 30 deforms or deflects feed roller 30 to an input radius R1. After passing through input nip 34, record media travel along paper path 20 to high friction roller means 40. High friction roller means 40 comprises metering roller 42 and backup rollers 42 and 44. High friction roller means 40 accurately meters record media to print station 3.

Input radius R1 is selected so that record media travel along said input path at a rate equal to or slightly greater than the rate at which record media are fed to the print station 3 by high friction roller means 40.

Solid idler roller 36 is pressed against compressible feed roller 30 adjacent the output path 24 and defines an output nip 38 therebetween. The action of solid idler roller 36 against feed roller 30 deforms feed roller 30 to an output radius R2 less than or equal to uncompressed radius R. Output radius R2 is selected to be greater than input radius R1. Since feed roller 30 turns on a single shaft (not shown) at a constant angular velocity the

linear velocity of record media passing through input nip 34 is greater than the linear velocity of record media passing through output nip 38. The higher feed rate at the output nip 38 is accomplished with idler roller 36 applying a lower feed force against feed roller 30 than the feed force applied by idler roller 32. The combination of high feed rate and low feed force has the synergistic effect of holding record media taut as it passes through print station 3 without disrupting the metering effect of high friction roller means 40.

After passing through output nip 38, record media pass along output path 24 and are conveyed to separator 10 where they are stored in output tray 14.

Referring now to Figure 2, an enlarged view of the dual feed rate rollers is shown. Solid idler rollers 32 and 36 are shown to be on fixed shafts 52 and 54 eliminating the need for spring loading.

Referring to Figure 3, the preferred embodiment of the dual feed rate roller is depicted. Compressible feed roller 30 comprises a central roller 31 and supporting side rollers 33 and 35 for maintaining central roller 31 in contact with the record media (not shown) against the idler rollers 32 and 36. By minimizing the width of central roller 31, input nip 34 and output nip 38 are also minimized which reduces the drive force required to rotate shaft 50. Supporting side rollers 33 and 35 need not be constructed of the same compressible material as central roller 31, however, in the preferred embodiment they are constructed of the same material. Idler rollers 32 and 36 are constructed of acetal, nylon or other similar hard material. In the preferred embodiment, four dual feed rate rollers are arrayed on shaft 50.

A multi-mode paper feeding mechanism configured in the sheet feed mode is shown in Figure 4 and is shown in the continuous forms feeding mode in Figure 5. In Figure 5, the feeding mechanism has paper path 20 including sheet input path 22, continuous forms path 23 and output path 24.

Referring now to Figure 6. The backup roller positioning means is shown configured in the sheet feed mode. When in the sheet feed mode, backup roller 46 is in contact with high friction roller 42 to transport and meter record media along the paper path through the print station 3. Rocker arm means 202 for guiding the record media is positioned to define a sheet input path.

Rocker arm means 202 is positioned by cam means 204 which has two positions, rest position 206 for sheet feed mode and detent position 208 for forms feed mode (see Figure 7). When cam means 204 is in rest position 206, rocker arm means 202 defines the sheet input path and backup roller 46 presses the record media (not shown) against the high friction roller 42 to meter said record media. Cam means 204 is positioned by either an actuating knob (not shown) or other suitable mechanical or electronic means well known to those skilled in the art.

Cam means 204 is connected to clutch linkage 210 for shifting idler gear 212 into and out of engagement with drive gear 200. Idler gear 212 is in constant engagement with tractor gear 214 of tractor means 100. Referring now to Figure 7 cam means 204 is in detent position 208 and idler gear 212 is driven by drive gear 200 and drives tractor gear 214 which feeds continuous form along the forms input path.

Roller 42 is driven by drive gear 200. Drive gear 200 is driven by a step motor (not shown), or other suitable means.

It is intended that all matter contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. While the invention has been particularly shown and described with reference to the preferred embodiment, it will be understood by those skilled in the art that changes in form and detail may be made without departing from the spirit and scope of the invention.

Claims

1. A paper feeding mechanism in combination with a printer, said printer having means for recording information on record media, the means for recording information including a platen and a print head for generating characters, the print head being disposed in a predetermined spaced relationship from the platen to define a print station therebetween, the paper feeding mechanism comprising:

first means for storing blank record media;

second means for storing record media having information recorded thereon;

a paper path for conveying said blank record media form said first means through said print station to said second means;

said paper path further comprising an input path and an output path;

a compressible feed roller in contact with first and second solid idler rollers, said first solid idler roller being disposed adjacent said input path and said second solid idler roller being disposed adjacent said output path;
said first solid idler roller being directed against said compressible feed roller deforming said com-

pressible feed roller to an effective radius R1 and said second solid idler roller being directed against said compressible feed roller deforming said compressible feed roller to an effective radius R2;

said effective radius R1 being less than effective radius R2 so that record media travel along said exit path at a feed rate greater than said record media travel along said input path.

2. The paper feeding mechanism of Claim 1 wherein the compressible feed roller has a width less than or equal to the width of the solid idler rollers.

3. The paper feeding mechanism of Claim 1 wherein the compressible feed roller is substantially narrower than the solid idler rollers.

4. The paper feeding mechanism of Claim 1 wherein the compressible feed roller further comprises a central member for contacting said record media and said solid idler rollers, and side supporting means not in contact with said solid idler rollers for supporting said central member.

5. The paper feeding mechanism of Claim 4 wherein the central member of said compressible feed roller is substantially narrower than said solid idler rollers.

6. The paper feeding mechanism system of Claim 4 wherein the central member of said compressible feed roller is less than or equal to one half the width of the solid idler rollers.

7. In a paper feed mechanism for delivering a record medium to a print station and then conveying said record medium to a storage means, the improvement comprising:

a paper path having a sheet input portion and an output portion;

said sheet input portion of the paper path having means for receiving the record medium;

a compressible feed roller and a first solid idler roller, said feed roller and said idler roller defining an input nip therebetween for driving said record medium along said sheet input path to a high friction roller means for metering said record medium;

said compressible feed roller having an uncompressed radius R;

said high friction roller means being downstream of said sheet input path to transport said record medium along said paper path to the print station;

a second solid idler roller and said compressible feed roller downstream of said print station, said feed roller and said idler roller defining an output nip therebetween;

said first solid idler roller being compressed against said compressible feed roller to reduce said uncompressed radius R to an input radius R1;

said second solid idler roller being compressed against said compressible feed roller to reduce said uncompressed radius R to an output radius R2;

said effective input radius R1 being less than output radius R2;

said first solid idler roller and said compressible feed roller of input radius R1 being in driven relationship to drive said record medium along said sheet input path at a feed rate slightly greater than or equal to the feed rate of said high friction roller means;

said second solid idler roller and said compressible feed roller of output radius R2 being in driven relationship to drive said record medium along said output path at a feed rate greater than the feed rate of said high friction roller means to maintain tension of said record medium as it passes through the print station and to direct said record medium to said storage means.

8. The paper feed mechanism of Claim 7 wherein said paper path has a forms input path in addition to said sheet input path and said output path and further comprising:

backup roller means associated with said high friction roller means for maintaining said record medium in driven relationship with said high friction roller means;

backup roller positioning means for moving said backup roller toward or away from said high friction roller means, said backup roller positioning means having an engaged position wherein said backup roller is in driven relationship with said high friction roller and a disengaged position wherein said backup roller is not in driving relationship with said high friction roller;

said backup roller positioning means further defining a sheet input path when said positioning means is in the engaged position and defining a forms input path when said positioning means is in the disengaged position;

tractor means for feeding continuous forms to said forms input path;

actuating means for controlling said backup roller positioning means to engage and disengage said

backup roller,

said actuating means also for controlling said tractor means and to activate and deactivate said tractor means.

9. A dual feed rate roller system comprising:

a paper path having an input path and an output path;

a compressible feed roller of radius R;

a first idler roller adjacent said input path and directed against said compressible feed roller deflecting said compressible feed roller to an input radius R1;

said first idler roller and said compressible feed roller defining an input nip therebetween for driving record media along said input path;

a second solid idler roller adjacent said output path and directed against said compressible feed roller deflecting said compressible feed roller to an output radius R2;

said input radius R1 being less than output radius R2;

said second solid idler roller and said compressible feed roller defining an output nip therebetween for driving said record media along said output path at a higher feed rate than said record media travels along said input path; and

said second solid idler roller being directed against said compressible feed roller with a lower feed force than said first solid idler roller is directed against said compressible feed roller.

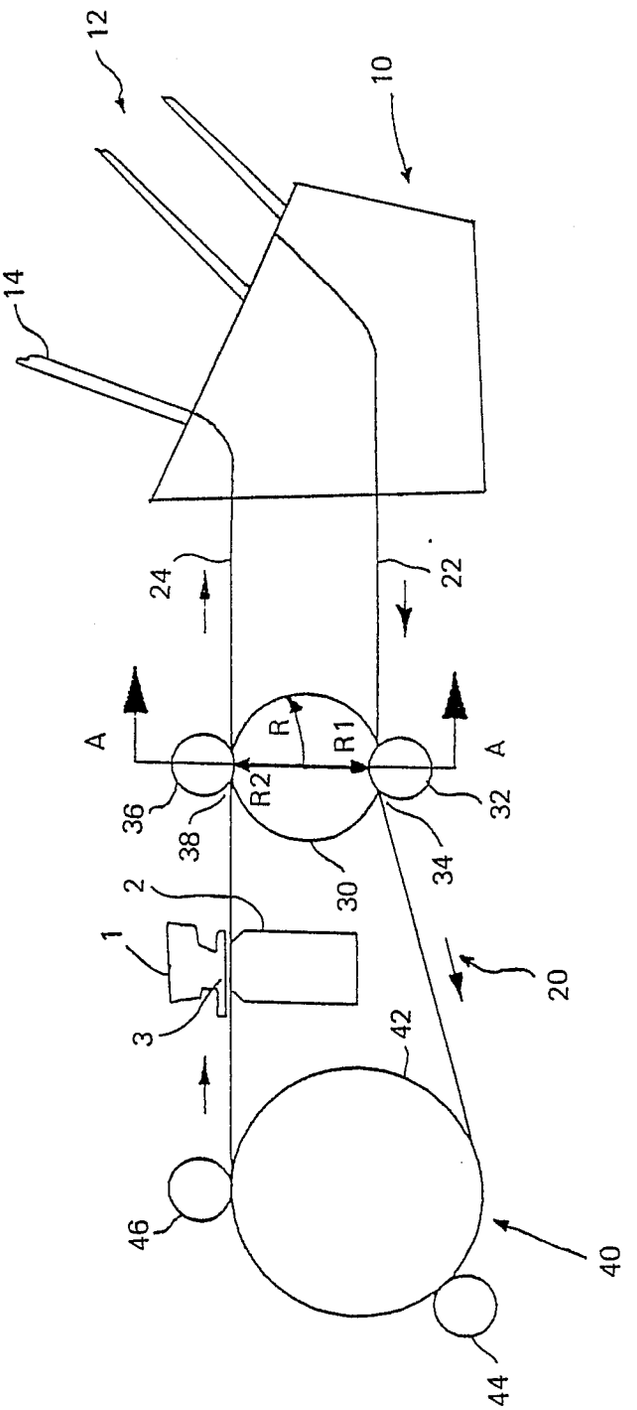

FIG. 1

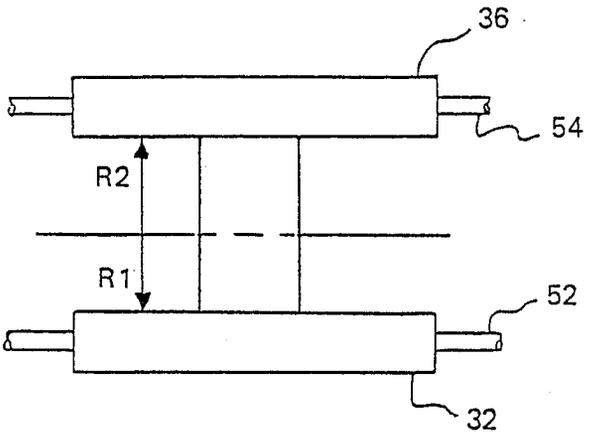

FIG. 2

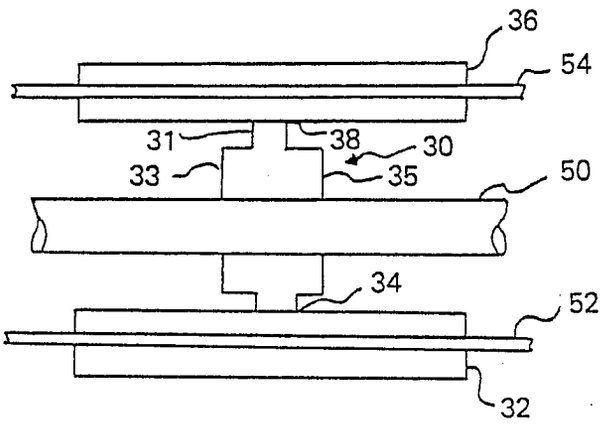

FIG. 3

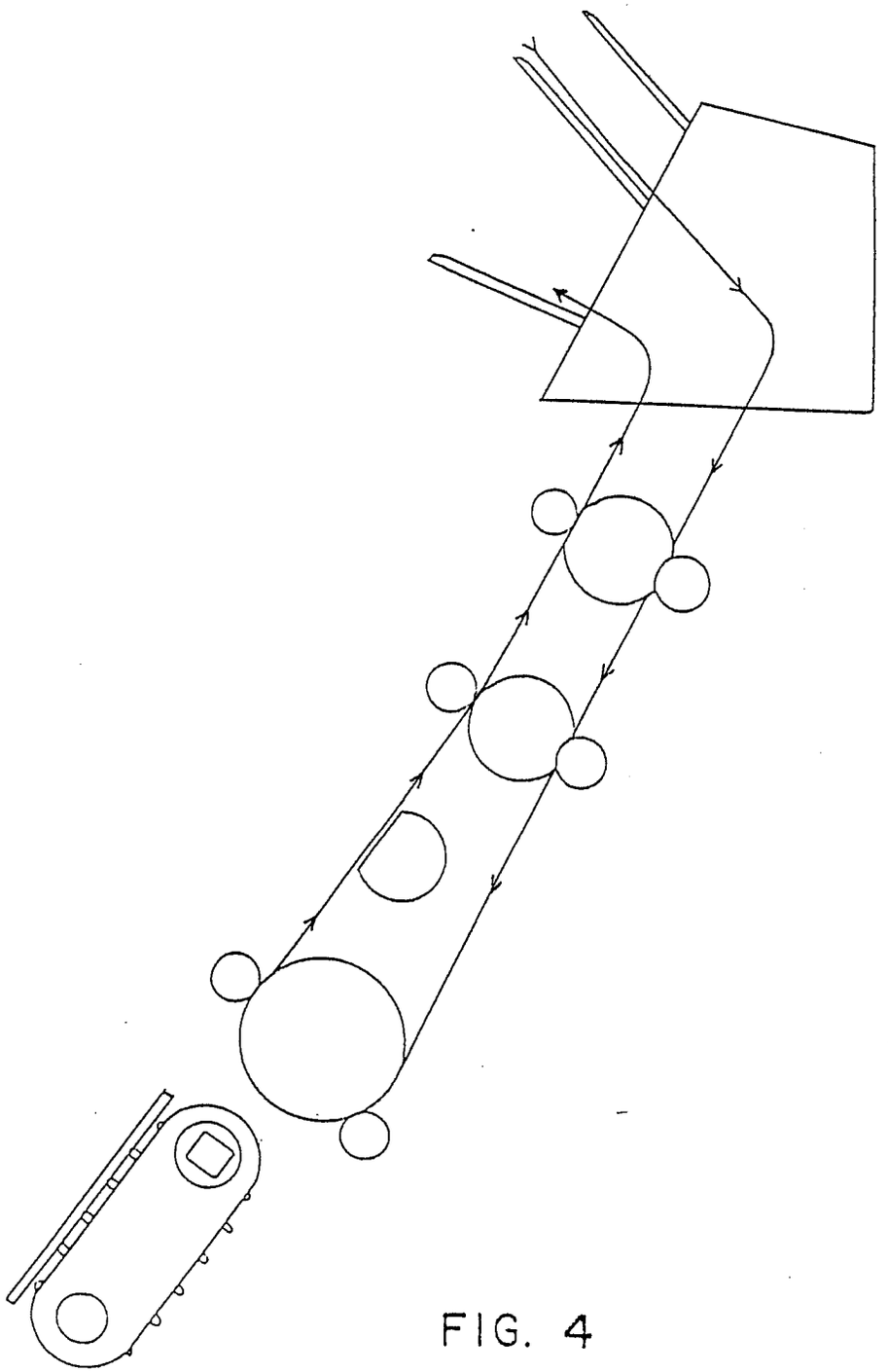

FIG. 4

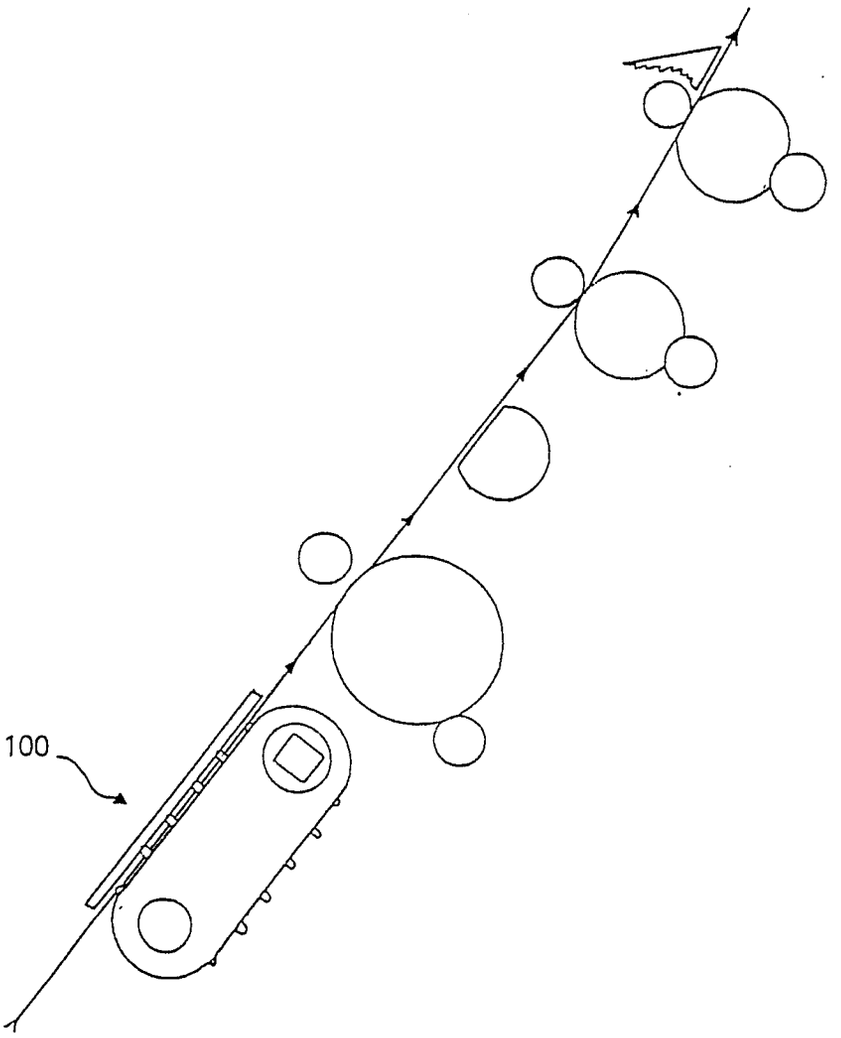

FIG. 5

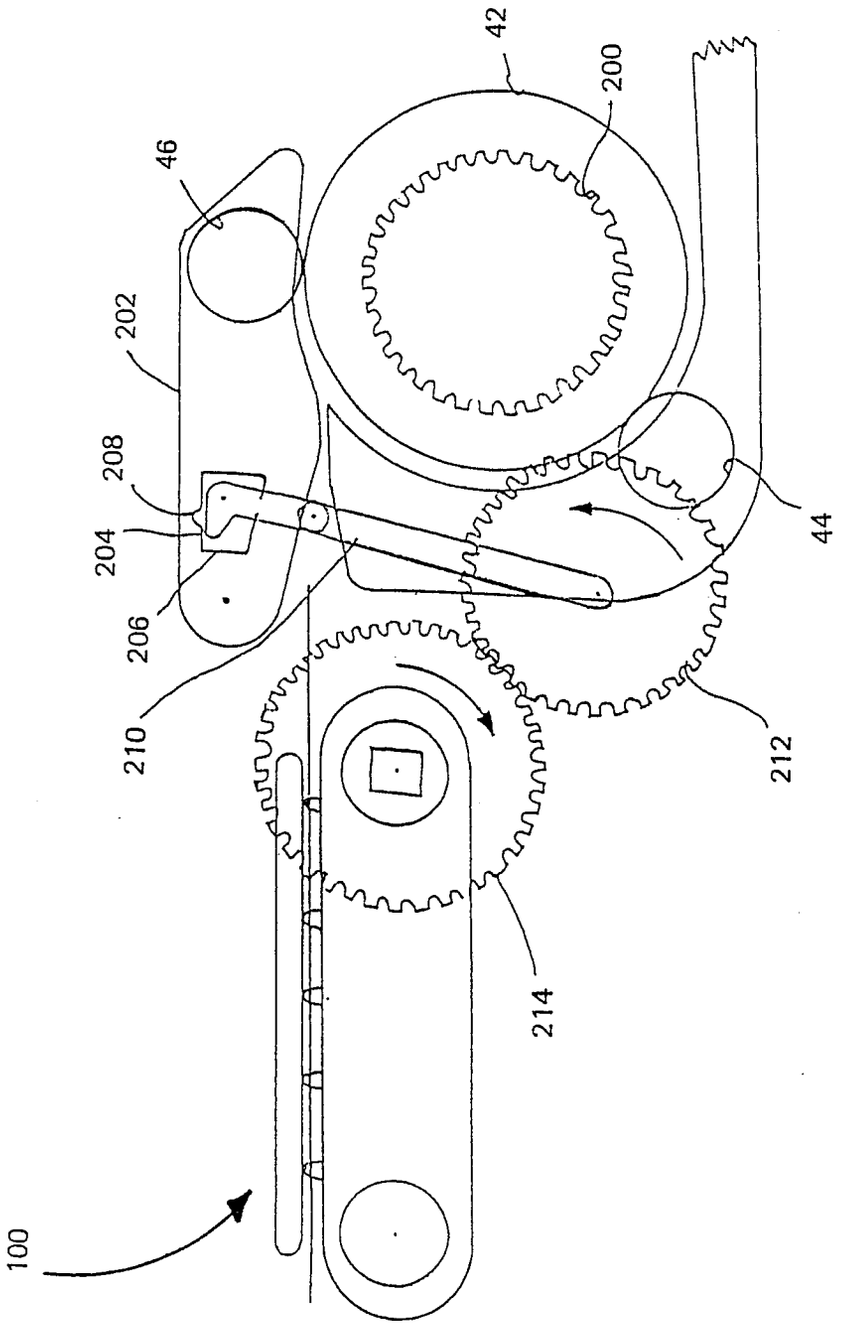

FIG. 6

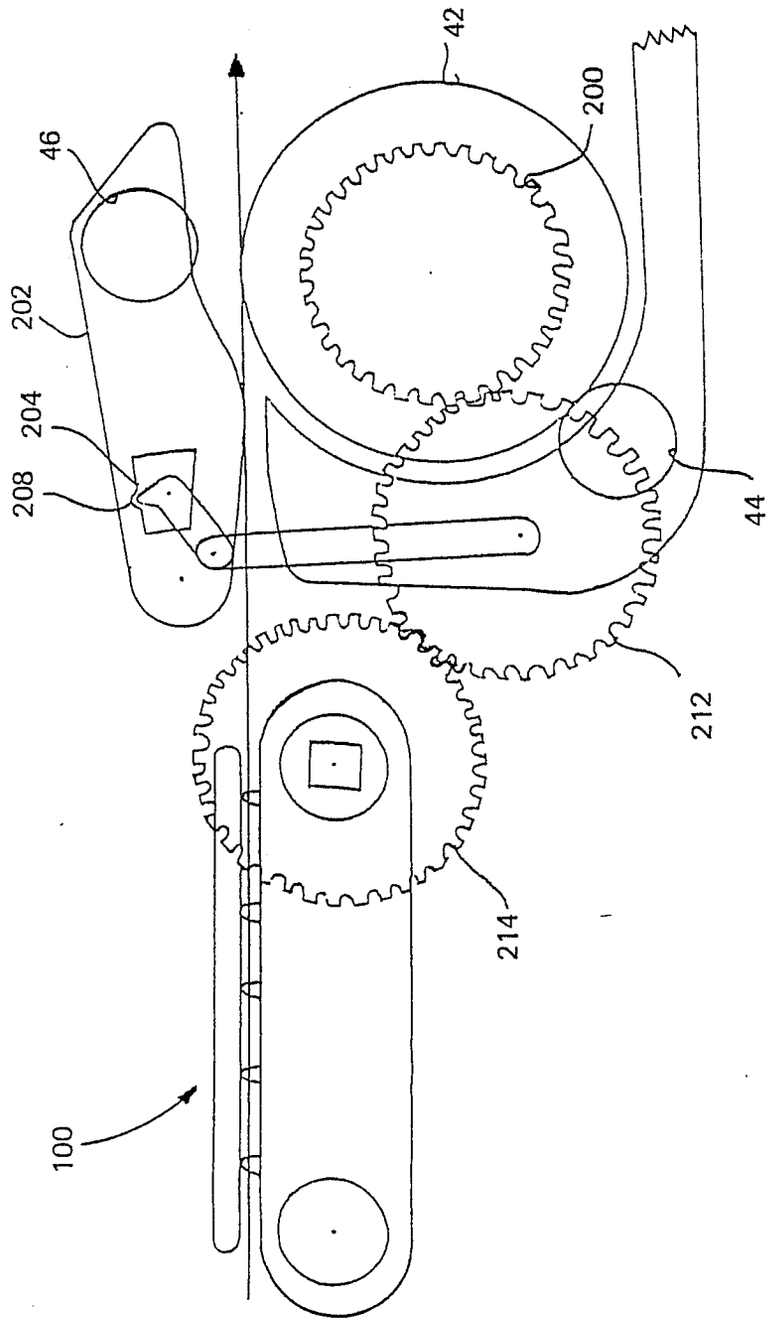

FIG. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application number

EP 87112785.8

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl 4)
A	EP - A1 - 0 038 415 (NIXDORF) * Fig. 2; abstract * --	1,7,8,9	B 41 J 11/00 B 41 J 13/03 B 65 H 5/06
A	DE - A1 - 3 318 117 (INTERNATIONAL STANDARD ELECTRIC) * Fig. 1; page 9, lines 9-13 * --	1,7,9	
A	US - A - 4 346 880 (ROLLER) * Fig. 1,3; abstract * ----	1,7,9	

TECHNICAL FIELDS SEARCHED (Int. Cl.4)

B 41 J
B 41 L
B 65 H
G 01 D
G 06 K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
VIENNA	16-11-1987	MEISTERLE

CATEGORY OF CITED DOCUMENTS

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