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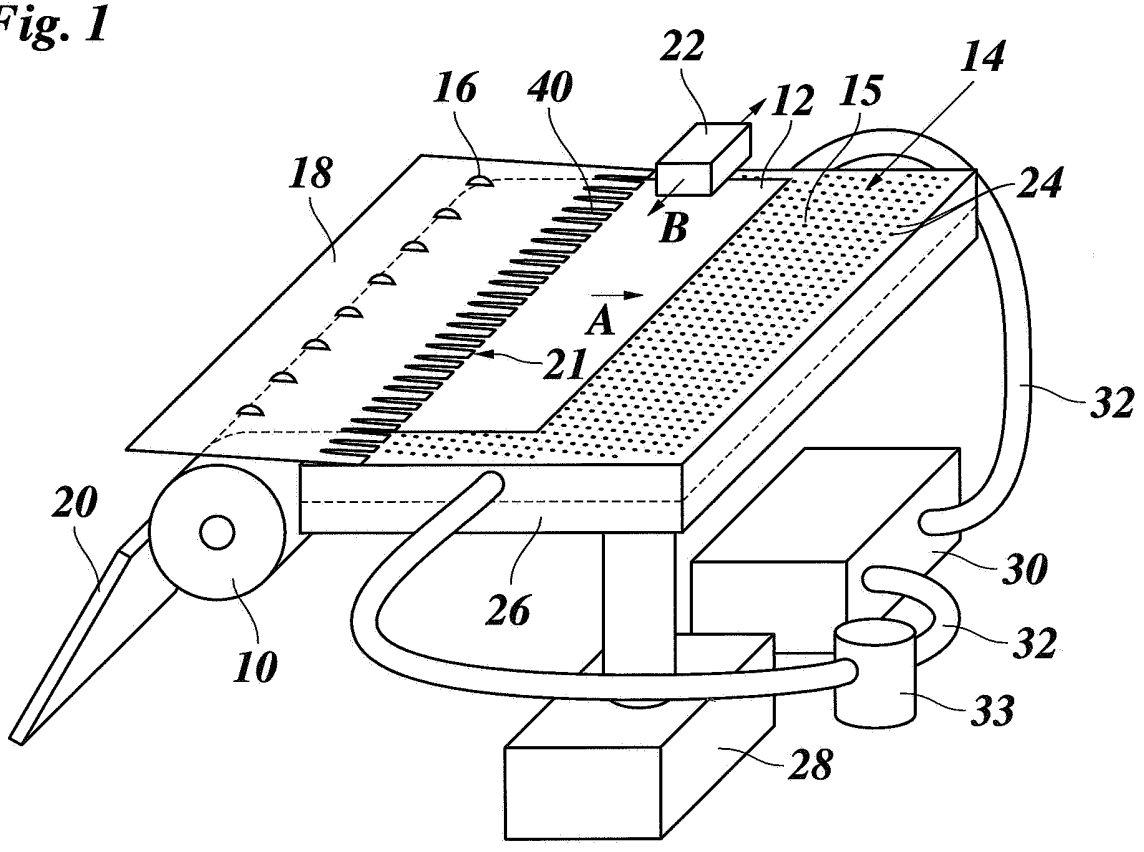
(54) Sheet handling device with print surface and feed plate

(57) A sheet handling device for a printer or copier, comprising a print surface (15) for supporting a first surface of a sheet (12), a feed plate (18) having an edge (21) being adjacent to the print surface (15), and a feed mechanism (10, 16) for feeding the sheet (12) to the print surface (15) through a gap between the edge (21) of the feed plate (18) and the print surface (15), wherein the edge (21) of the feed plate (18) has notches (40) being arranged such that at the edge (21), the notches (40) provide space for the sheet (12) at a second surface of the sheet (12).

Fig. 1



EP 1 661 726 A1

Description

[0001] The invention relates to a sheet handling device for a printer or copier, comprising a print surface for supporting a first surface of a sheet, a feed plate having an edge being adjacent to the print surface, and a feed mechanism for feeding a sheet to the print surface through a gap between the edge of the feed plate and the print surface.

[0002] In printers in which paper sheets or similar image receiving sheets are used as recording media, a tendency of the paper to cockle may sometimes constitute a serious problem. The cockling phenomenon is related to the fact that paper and similar materials tend to absorb humidity from ambient air and to expand and contract in accordance with their humidity content. Typically, the expansion and contraction is not isotropic and is particularly pronounced in a direction in which the fibers of the paper are predominantly oriented. When there exists a gradient in humidity within the paper, then the more humid portion of the paper will expand more than the drier portion, which inevitably leads to the production of cockles or wrinkles.

[0003] Once cockles have developed in the paper during the transport of the paper towards the sheet support plate, a further expansion or contraction of the paper may lead to an expansion of the cockles, so that the height of the cockles also grows.

[0004] In a typical setup of an ink jet printer, especially a large format printer, the paper is intermittently advanced over a flat sheet support plate, while a carriage moves back and forth across the paper, and ink jet printheads mounted on the carriage are energized to eject droplets of ink onto the paper so as to form a printed image. Since the carriage moves with relatively high velocity, the ink droplets ejected onto the paper undergo a certain aberration and are deposited on the paper in a somewhat dislocated position. The amount of dislocation is proportional to the flight distance of the ink droplets. Thus, when cockles are present in the paper, the flight distance is non-uniform and, accordingly, the dislocation of the spots of ink on the paper also becomes non-uniform, so that the quality of the printed image is deteriorated. The larger the height of the cockles is, the more pronounced is this deteriorating effect.

[0005] When the ink jet print printheads are positioned very close to the surface of the paper to minimize the dislocation, the printheads might even touch large cockles or bumps of the paper, so that the quality of the printed image is also deteriorated.

[0006] It is an object of the invention to provide a sheet handling device which feeds a sheet to the print surface in a basically flat, lowly or not at all cockled configuration, and to provide a printer comprising such sheet handling device.

[0007] According to the invention, this object is achieved by a sheet handling device of the type indicated above, wherein the edge of the feed plate comprises notches being arranged such that, at the edge, the notches provide space for the sheet at a second surface of the sheet.

[0008] The notches are separate from each other and are arranged to guide the sheet mainly at those parts of the edge that are between the notches. Thereby, the notches govern the positions at which cockles or wrinkles develop. By adapting the size and the positions of the notches to the material and thickness of the sheets, to their tendency to produce cockles or wrinkles, and to the humidity gradients and temperatures that are to be expected, the notches may be arranged to favor certain smaller cockle sizes over larger cockle sizes.

[0009] At a conventional feed plate with an edge that forms a straight line, an expansion of the sheet material at a certain region of the sheet might lead to the development of a large bump. However, the feed plate of the invention will regulate the forming of cockles, and the expansion of the material of the sheet will be distributed over several smaller bumps or cockles. Thereby, the height of the cockles or bumps is reduced considerably.

[0010] Generally, the height of the cockles is related to their lateral extension. By reducing the lateral extension and thus the height of the cockles, the disadvantages of cockling mentioned above are reduced.

[0011] Useful details of the invention are indicated in the dependent claims.

[0012] Preferably, the notches are arranged in a regular pattern. Thereby, the effect of the notches is uniformly distributed. For example, a repeat distance of the notches may be the same for all neighboring notches, so that a cockle size corresponding to the repeat distance is favored.

[0013] Preferably, the feed mechanism comprises sheet transport rollers that are distributed over the width of the feed plate. For example, the sheet transport rollers are accommodated in slots of the feed plate.

[0014] In a preferred embodiment, the sheet transport rollers and the notches are positioned such that, at lateral positions of the sheet transport rollers, there is a larger distance between neighboring notches than an average distance. Thereby, the flattening effect of the transport rollers is accounted for which suppress the occurrence of cockles at the positions of the transport rollers and thereby favors the development of cockles between the positions of the transport rollers.

[0015] For example, a distance between neighboring notches varies in a regular pattern. For example, the notches are grouped into pairs, each pair being arranged between the lateral positions of the transport rollers. Additionally or alternatively, the size and/or shape of the notches may vary in a regular pattern.

[0016] A preferred embodiment of the invention will now be described in conjunction with the drawings, in which:

Fig. 1 is a schematic perspective view of a hot melt ink jet printer;

Fig. 2 is a schematic view of a paper sheet, illustrating

the occurrence of large cockles after the sheet has been moved past an edge of a conventional feed plate; and

Fig. 3 is a schematic view of a paper sheet, illustrating the occurrence of smaller cockles after the sheet has passed an edge of a feed plate of the sheet handling device of Fig. 1.

[0017] As is shown in Fig. 1, a hot melt ink jet printer comprises a platen 10 which is intermittently driven to rotate in order to advance a sheet 12, e. g. a sheet of paper, in a direction indicated by an arrow A over the top surface of a sheet support plate 14, the top surface forming a print surface 15. A number of transport rollers 16 that are distributed over the width of the feed plate 18 are accommodated in slots 19 (Fig. 3) of the feed plate 18 and are rotatably supported in the feed plate 18. The transport rollers 16 intersect the feed plate 18 and form a transport nip with the platen 10, so that the sheet 12, which is supplied from a reel (not shown) via a guide plate 20, is transported along a sheet transport slot that is formed by the feed plate 18 and the print surface 15 of the sheet support plate 14. Then, the sheet 12 is paid out through a gap formed between an edge 21 of the feed plate 18 and the surface of the sheet support plate 14. At the edge 21, the feed plate 18 forms an angle of, for example, less than 10° with the print surface 15.

[0018] A carriage 22 which includes a number of hot melt ink jet printheads (not shown) is mounted above the sheet support plate 14 so as to reciprocate in the direction of arrows B across the sheet 12. Thus, by energizing the printheads, a number of pixel lines of an image are printed in each pass of the carriage 22. Then, the sheet 12 is advanced by a step of appropriate length in the direction indicated by the arrow A, so that the next pixel lines can be printed.

[0019] The print surface 15 of the sheet support plate 14 has a regular pattern of suction holes 24 which pass through the plate and open into a suction chamber 26 that is formed in the lower part of the plate 14. The suction chamber is connected to a blower 28 which creates a subatmospheric pressure in the suction chamber, so that air is drawn-in through the suction holes 24. As a result, the sheet 12 is sucked against the flat surface of the support plate 14.

[0020] The sheet support plate 14 is temperature-controlled in order to control the cooling rate and the solidification of the hot melt ink that has been deposited on the paper. The sheet support plate 14 is temperature-controlled by means of a temperature control system 30 which circulates a temperature control fluid, preferably a liquid, through the plate 14. The temperature control system includes a circulating system with tubes 32 that are connected to opposite ends of the plate 14. One of the tubes passes through an expansion vessel 33 containing a gas buffer for absorbing temperature-dependent changes in the volume of the liquid. As will be readily understood, the temperature control system 30 includes heaters, temperature sensors, heat sinks, and the like for controlling the temperature of the fluid, as well as a pump or other displacement means for circulating the fluid through the interior of the sheet support plate 14.

[0021] On its way from the guide plate 20, past the platen 10 and past the feed plate 18 to the print surface 15, the sheet 12 will inevitably be exposed to ambient air and, as a result, will absorb humidity, especially when the relative humidity RH of the ambient air is high.

[0022] When the humidity content of the paper increases, it tends to expand, in particular in the direction in which the fibers in the paper are predominantly oriented. Typically, this is the direction transverse to the longitudinal direction of the web. When the sheet 16, after having expanded in this way, reaches, for example, the sheet support plate 14 and is, for example, heated to the temperature of the sheet support plate 14, part of the water contained in the paper will be evaporated, and the paper shrinks again in width direction of the sheet. Thus, since a humidity gradient is present in the paper, the accompanying reduction in width of the sheet leads to the production of cockles. This has exaggeratedly been illustrated in Figs. 2 and 3.

[0023] Generally, when the sheet 12 comes into contact with the print surface 15, the sheet might be exposed to a different temperature or a different relative humidity of the ambient air at the sheet support plate 14. Thereby, new cockles may develop, or those cockles which have already been present in the sheet may expand further.

[0024] To control the distribution and the development of the cockles in the sheet 12 in order to prevent larger cockles from existing, the feed plate 18 comprises notches 40.

[0025] As a comparative example, Fig. 2 shows a part of a conventional feed plate 42 having an edge 44 that forms a straight line. Large cockles or bumps 46 may occur in the sheet 12 that is to be printed.

[0026] Due to the notches 40 of the feed plate 18 of the invention, the occurrence of large bumps 46 is prevented, and smaller cockles 48 (Fig. 3) are favored. This is due to the fact that the notches provide space for the sheet, so that the occurrence of small cockles 48 is favored at the positions of the notches 40.

[0027] As is shown in Fig. 1, the notches 40 are arranged in a regular pattern. However, as is shown in Fig. 3, a smaller distance and a larger distance between neighboring notches alternate. Thereby, the notches 40 are grouped into pairs. Regarding the lateral positions of the slots 19 that accommodate the sheet transport rollers 16 (Fig. 1), the slots 19 are arranged in coincidence with the larger distance between the notches 40. Thus, each pair of notches 40 is arranged between the lateral positions of neighboring transport rollers 16.

Claims

1. A sheet handling device for a printer or copier, com-

prising a print surface (15) for supporting a first surface of a sheet (12), a feed plate (18) having an edge (21) being adjacent to the print surface (15), and a feed mechanism (10, 16) for feeding the sheet (12) to the print surface (15) through a gap between the edge (21) of the feed plate (18) and the print surface (15), said print surface (15) comprising suction holes (24) for sucking the sheet (12) against the print surface (15), **characterized in that** the edge (21) of the feed plate (18) comprises notches (40) being arranged such that, at the edge (21), the notches (40) provide space for the sheet (12) at a second surface of the sheet (12).

2. The sheet handling device according to claim 1, wherein the notches (40) are arranged in a regular pattern.

3. The sheet handling device according to any one of the preceding claims, wherein the feed mechanism (10, 16) comprises sheet transport rollers (16) that are distributed over the width of the feed plate (18).

4. The sheet handling device according to claim 3, wherein the sheet transport rollers (16) and the notches (40) are positioned such that, at lateral positions of the sheet transport rollers (16), there is a larger distance between neighboring notches (40) than an average distance.

5. The sheet handling device according to any one of the preceding claims, wherein the print surface (15) is formed by a sheet support plate (14) and the suction holes (24) pass through the sheet support plate (14).

6. A printer comprising the sheet handling device according to any one of the preceding claims.

7. The printer according to claim 6, the printer being an hot-melt ink jet printer.

Fig. 1

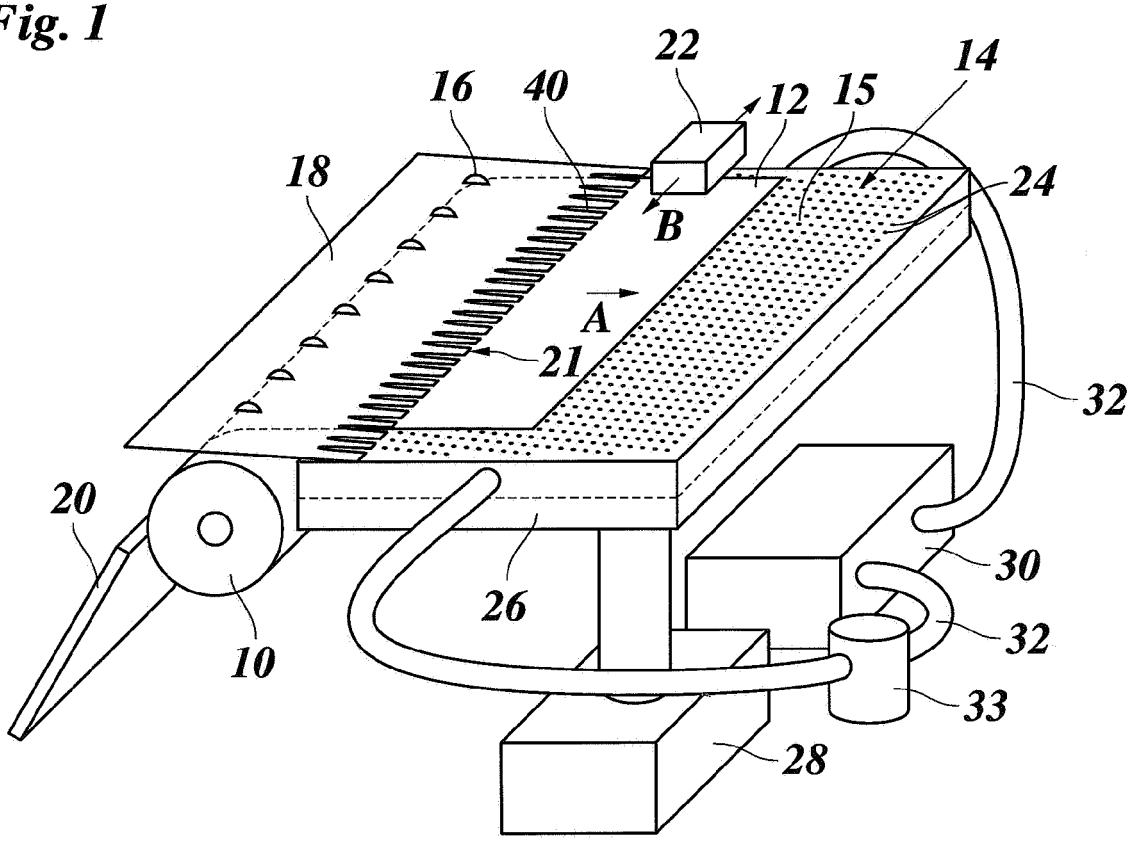


Fig. 2

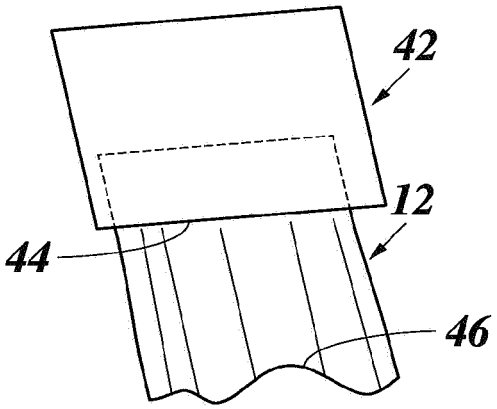
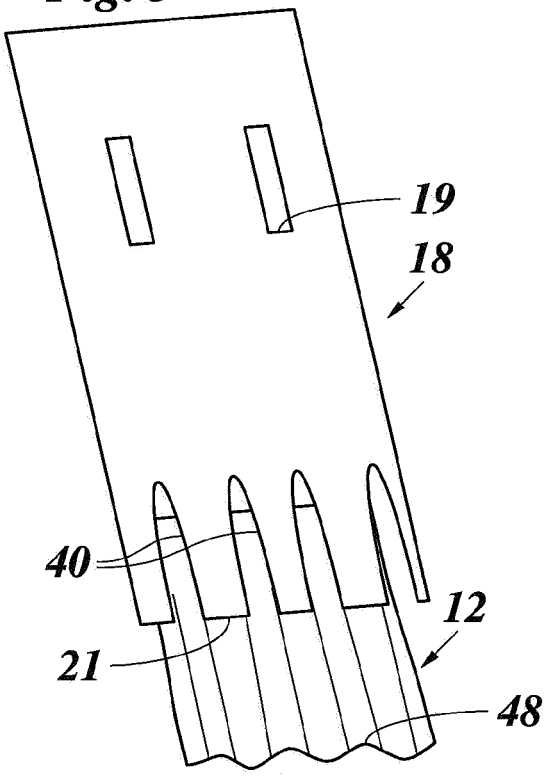


Fig. 3



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EUROPEAN SEARCH REPORT

Application Number
EP 05 11 1022

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 471 189 A (SIEMENS NIXDORF INFORMATIONSSYSTEME AKTIENGESELLSCHAFT) 19 February 1992 (1992-02-19) * column 3, line 49 - line 52; figures 2-4 *	1-3,5-7	B41J13/14 B41J11/06 B41J11/00 B41J2/175
A	EP 1 123 809 A (OCE-TECHNOLOGIES B.V) 16 August 2001 (2001-08-16) * abstract *	3,5-7	
A	EP 0 729 842 A (HEWLETT-PACKARD COMPANY) 4 September 1996 (1996-09-04) * column 9, line 35 - column 10, line 42; figure 6 *	3,6,7	

TECHNICAL FIELDS SEARCHED (IPC)

B41J

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	14 March 2006	Wehr, W

CATEGORY OF CITED DOCUMENTS

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14-03-2006

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0471189 A	19-02-1992	DE 9010495 U1	14-11-1991
EP 1123809 A	16-08-2001	JP 2001260441 A	25-09-2001
		NL 1014351 C2	14-08-2001
		US 2001020959 A1	13-09-2001
EP 0729842 A	04-09-1996	DE 69609217 D1	17-08-2000
		DE 69609217 T2	30-11-2000
		JP 9512506 T	16-12-1997
		WO 9626839 A1	06-09-1996

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