

[54] **DEVICE AND METHOD FOR FORMING AN ACCORDIAN PILE FROM A CONTINUOUS WEB, USING AN AIR CURRENT PARALLEL TO THE WEB**

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[75] Inventors: Robert Eckl, Goggingen; Klaus Walter Janson, Diedorf, both of Germany

Primary Examiner—F. Barry Shay
Attorney—Karl F. Ross

[73] Assignee: Firma Bowe Bohler & Weber KG, Augsburg, Germany

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[52] U.S. Cl..... 270/69, 270/61 F

[51] Int. Cl..... B65h 45/20

[58] Field of Search..... 270/61 F, 69, 79, 270/39, 40

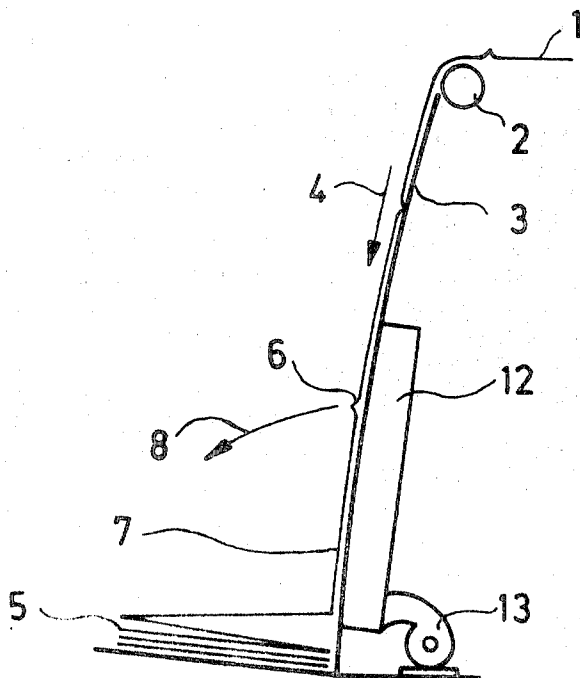
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[57] ABSTRACT

A device for forming an accordion pile from a continuous web has an upright guide plate along which a web formed with equispaced and oppositely directed creases is passed. A support surface is provided below the plate to intercept the web and support the pile. A current of air is caused to flow at high speed parallel to the plate surface between the plate and the web in at least the lower region of the plate to hold very thin webs against the plate as they slide downwardly even at very low speeds. This current of air can be directed in the direction of or transverse to the direction of feed of the web.

8 Claims, 9 Drawing Figures



SHEET 1 OF 2

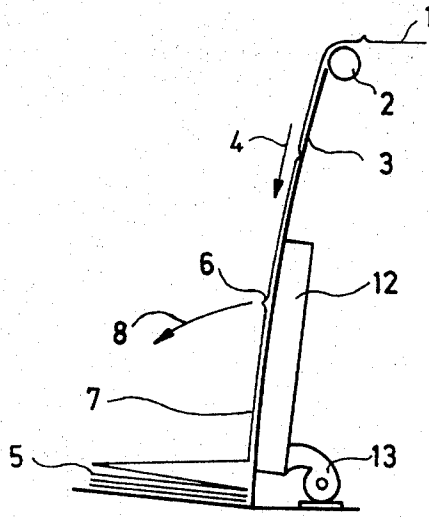


FIG. 1

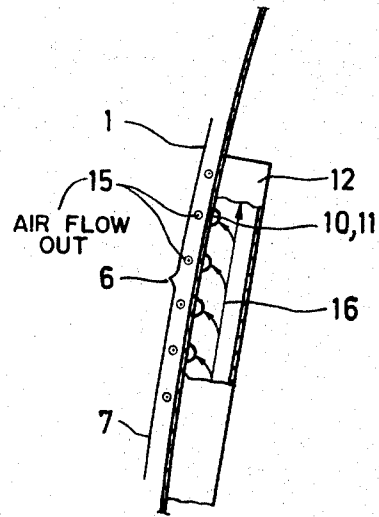


FIG. 2

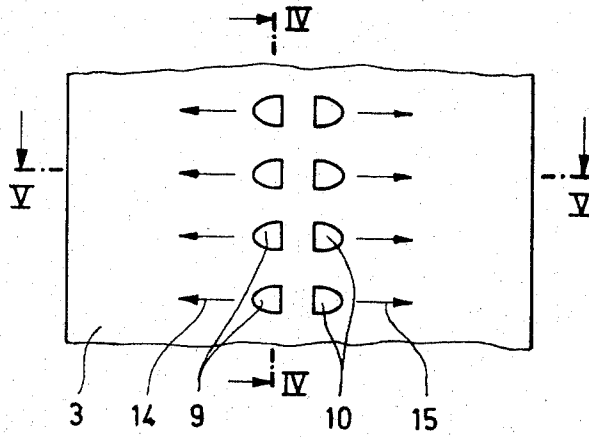


FIG. 3

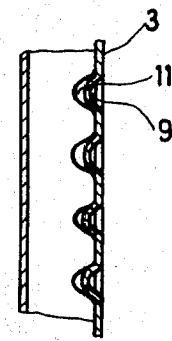


FIG. 4

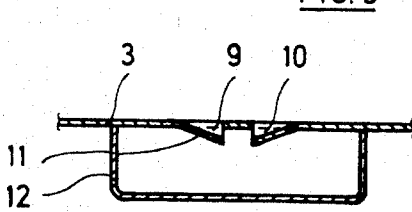


FIG. 5

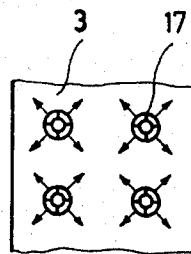


FIG. 6

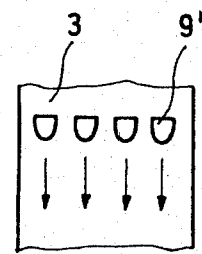


FIG. 7

INVENTORS:
Robert Eckl
Klaus Walter Janson
BY
Karl F. Hall
Attorney

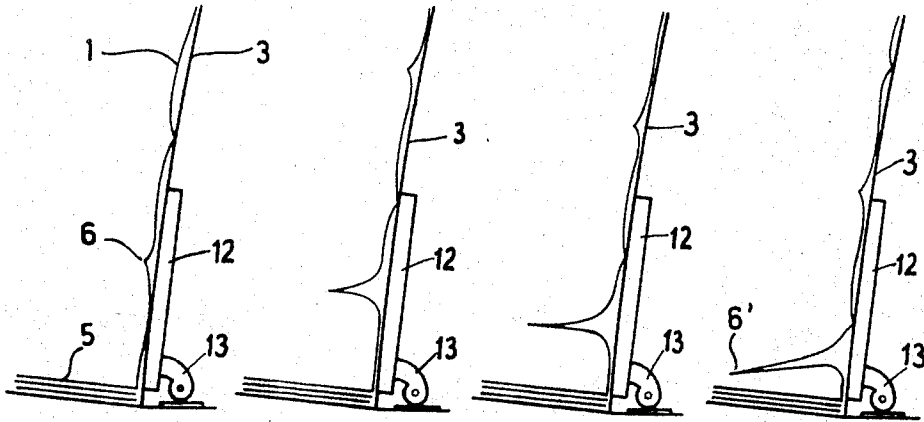


FIG. 8

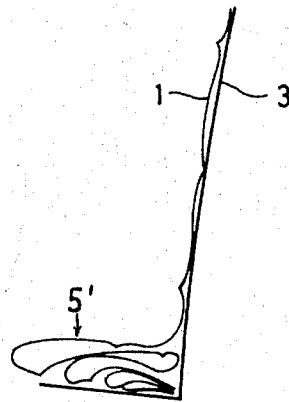


FIG. 9

INVENTORS:
Robert Eckl
Klaus Walter Janson

BY

Karl F. Ross

Attorney

DEVICE AND METHOD FOR FORMING AN ACCORDIAN PILE FROM A CONTINUOUS WEB, USING AN AIR CURRENT PARALLEL TO THE WEB

FIELD OF THE INVENTION

The invention relates to a device for the delivery of a continuous web in the form of an accordion folded pile, the device comprising a guide plate or the like for feeding the web to the pile. Devices of this kind are used in plants of various kinds, such as separators, printers, and the like, in which continuous webs, particularly continuous stationary, are processed.

BACKGROUND OF THE INVENTION

However, the known devices present difficulties when thin paper is to be processed at low or medium speeds. The inadequate stiffness of such webs of paper results in the danger of the individual sections of the web rolling up into an irregular tangle in a very undesirable manner instead of coming to lie one upon the other in the required accordion-folding pattern. The processing of thin paper or of other continuous webs is thus made very difficult, since low or medium speeds cannot be avoided, either upon starting or because of other machines operating at a lower speed to which the speed of the delivery has to be adjusted.

OBJECTS OF THE INVENTION

It is thus an object of an invention to provide the delivery device of a construction, by which the aforementioned disadvantages experienced in the processing of thin paper or similar material are obviated, and in which the accordion folding obtained upon delivery is as satisfactory and reliable as that of accordion folding with thick and correspondingly stiff paper.

SUMMARY OF THE INVENTION

The invention resides in providing flat or sheet-like air current flowing parallel to the surfaces of the web and of the guide plate between the web and the guide plate at least in the lower zone of the guide plate adjacent the pile. The static pressure of the sheet-like flow in its edge zones adjacent the plate and the web is lower than the static pressure in the center of the stream and as a result of this reduced pressure the web is urged by a higher ambient pressure toward the air layer flowing between the web and the plate and thus slides thereon substantially without friction. As a result, the stiffness imparted thereto is sufficient to ensure that, in the zone of its outwardly directed folds, the web contacts the bottom of the pile in the desired manner characteristic of accordion folding. By means of the device of the construction according to the invention, a satisfactory folding is always achieved even at low speeds.

In accordance with the invention, the air flows advantageously between the web and the guide plate in a direction transversely of the direction of conveyance of the web, the air flowing preferably from about the middle of the guide plate outwardly, since stagnation of air in the zone of the pile or at the upper end of the guide plate are thereby avoided.

In one particularly advantageous construction according to the invention, the guide plate is provided with openings for the passage of air. On the side of the plate opposite the web, these openings open out into an air intake connected to a blower. The air intake may

have the form of any suitable air conduit or air duct. It may also function as a high-pressure chamber from which the air flows under an appropriate pressure.

In a simple construction according to the invention, the openings are provided in the form of two rows of holes extending downwardly from about the middle of the guide plate and directed in opposite directions. The area of the guide plate provided with the rows of holes may thus constitute part of the wall of a preferably rectangular air shaft provided to the rear of the guide plate, the air shaft being connected to a blower. A relatively simple construction, which may be produced at low cost, is thus obtained. In accordance with the invention, furthermore, the openings in the guide plate may be of a substantially nozzle-like construction.

In view of the fact that the pile grows gradually to a maximum height during the delivery, it will be understood that the area across which the air current extends reaches to a level slightly beyond the maximum possible height of the pile. In accordance with the invention, this zone extends advantageously upwards to a level above the pile by an amount corresponding at least to the length of a web section corresponding substantially to the length of the pile.

DESCRIPTION OF THE DRAWING

The invention is diagrammatically illustrated by way of example in the accompanying drawing, in which:

FIG. 1 is a side elevation of the device according to the invention;

FIG. 2 shows, on an enlarged scale, a vertical section through a detail of FIG. 1;

FIG. 3 shows a detail of a side view looking from the left at the device shown in FIG. 1 or in FIG. 2;

FIG. 4 is a section along the line IV—IV of FIG. 3;

FIG. 5 is a section along the line V—V of FIG. 3;

FIGS. 6 and 7 show two modifications of FIG. 3;

FIG. 8 shows, by way of example, several phases of the sequence of movement in the delivery according to the invention; and

FIG. 9 illustrates an undesirable delivery of thin paper without application of the invention.

SPECIFIC DESCRIPTION

As illustrated in FIG. 1, a continuous precreased web 1 runs in known manner over a guide roller 2 and along a guide plate 3 in the direction of the arrow 4 downwards to be folded in known manner into an accordion pile 5 as the respective outwardly directed folding edge or crease 6 comes to lie outwardly in the direction of the arrow 8 when the lower edge of the corresponding section 7 of the web strikes against the pile.

In accordance with the invention, an air current flowing parallel to the plate 3 and the surface of the web is generated between the web 1 and the guide plate 3, since, owing to its inadequate stiffness, the respective lower section 7 of thin webs of paper bends below the folding edge 6 and moves outwardly uncontrolled so that the desired movement of the folding edge 6 indicated by the arrow 8, fails to come about. The device according to the invention illustrated in FIGS. 3, 4 and 5 is, for this purpose, provided with two rows of openings 9 and 10 extending from about the middle of the guide plate 3 downwards and opening respectively outwards in the direction of the edges of the plate 3. In this construction, the openings 9 and 10 have been punched into the plate 3 so that as shown in FIG. 3, the

edge zone 11 of each opening, which edge zone is formed by the plate, has substantially the form of a nozzle. The air intake in the form of a rectangular air shaft 12 to which a blower 13 is connected, is provided at the back of the guide plate 3 which back is remote from the web 1, behind the holes 9 and 10. Since the shaft is otherwise closed all round, the air fed by the blower 13 to the air shaft 12 can only escape through the holes 9 and 10 with the result that it flows from the centre outwards to the edges of the plate as indicated, for example, by flow lines 14 and 15 in FIGS. 2 and 3.

The air fed by the blower 13 to the air shaft 12 (indicated by stream lines 16 in FIG. 2) escapes through the holes 9 and 10 to flow parallel to and between the guide plate 3 and the web 1. Owing to the low pressure in the boundary layers of the air current, which boundary layers are adjacent the surfaces of the web 1 and of the guide plate 3, the web 1 is, as mentioned previously, drawn in the direction of the guide plate 3 and thus, resting on the air cushion between the web 1 and the guide plate 3, slides thereon substantially without friction. Since the cross-sectional area met by the air current in the zone of the folding edge 6 is, as it were, larger than the cross-sectional area met by the air current in the remainder of the surface area, the suction in the zone of that edge is correspondingly slightly weaker, and the desired movement indicated by the arrow 8 necessary for an orderly folding is obtained without difficulty. The level up to which the holes 9 and 10 are provided in the guide plate 3 and up to which level air is fed thereto through the air shaft 12 is, as shown in FIGS. 1 and 2, sufficiently high to enable a delivery of a pile 5 of an adequate height while at the same time still ensuring that the lower section 7 of the web is held in position.

FIG. 8 shows several consecutive phases of the movement of the paper, particularly of the movement of the folding edge 6. It will be noted that the folding edge 6 moves from the position shown on the extreme left of FIG. 8 gradually downwards to the left as the section of the web of paper, which section is below the folding edge 6, is held in position on the plate 3 by the air current. The folding edge reaches eventually the position 6' on the extreme right of FIG. 8, so that the two web sections adjacent the edge fall on to the pile 5 in the desired, folded condition.

FIG. 9 shows by way of example an undesired, totally irregular delivery in a confused tangle 5'. As mentioned previously, such an irregular and undesired delivery may result from an inadequate stiffness of thin paper when the web 1 is moved downwardly along the plate 3 at an inadequate speed.

As far as the essence of the invention is concerned by which, in contrast with the conventional devices, a satisfactory delivery even of webs of very thin paper or other continuous webs is obtained, the direction of flow of the air current between the continuous web 1 and the guide plate 3 is basically of no consequence. The important feature of the invention is simply that the air current must flow parallel to the web and to the guide plate. Thus, the air current need not necessarily flow in a direction transversely of the direction of conveyance 4 of the web 1 shown in FIGS. 2 to 5. It may also flow from various positions in various directions as shown in FIG. 6, or it may flow in a single direction upwards or downwards as shown in FIG. 7. The openings 9', shown in FIG. 7, are of a similar kind as those shown in FIGS.

2 to 5. The openings 17 provided in the construction illustrated in FIG. 6 enable the air to escape radially in all directions. It will be understood that corresponding air intakes of a kind similar to those shown in FIGS. 1 to 5 may be provided behind the openings 9', 17. In the constructions shown in FIGS. 6 and 7 a certain degree of stagnation of the air at the upper and/or lower ends of the guide plate 3 has to be expected, since the air which initially does not flow outwards in the direction of the edges of the plate, has to be deflected. It will, however, be appreciated that the basic principle of the invention is not limited to the constructions illustrated in the drawings.

We claim:

1. A device for forming an accordion pile from a web, said device comprising:

an upright guide plate for said web having a substantially vertical surface;

means for feeding said web in a path downwardly along said surface of said plate;

a substantially horizontal support surface below said plate and intercepting said web path, said guide plate reaching downwardly substantially to said support surface; and

means along said guide plate for forming an air current parallel to the surface thereof between said plate and said web, said means forming said air current including a plurality of apertures formed in said guide plate, a source of air under pressure communicating with said apertures for causing air flow therethrough from the side of said plate remote from said surface, and structures associated with said apertures for directing the air outflow thereof along said surface of said guide plate.

2. The device defined in claim 1 wherein said structures and apertures are so constructed and arranged as to direct said current transversely to the direction of feed of said web and to provide said current in the lower region of said plate.

3. The device defined in claim 2 wherein said structures and apertures are so constructed and arranged as to direct said current outwardly from the middle of said plate along said surface of said guide plate.

4. The device defined in claim 3 wherein said source includes a blower operatively connected to said plate at said apertures.

5. The device defined in claim 4 wherein said apertures are disposed in a pair of substantially parallel rows along said plate, the apertures in each row being formed to direct the air away from the apertures in the other row.

6. The device defined in claim 5 wherein said forming means includes an air shaft formed with said apertures and partly constituted by said plate, said air shaft being operatively connected to said blower.

7. The device defined in claim 1 wherein said web is formed with a plurality of equispaced creases, said apertures being provided only in a lower region of said plate, said region having a height corresponding to the distance between creases in said web.

8. A method of forming an accordion pile of a web comprising the steps of:

forming said web with a plurality of alternately directed equispaced creases;

feeding said web downwardly along an upright guide surface;

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intercepting said web at the base of said plate with a transverse support surface; and blowing and forming an air current parallel to said guide surface between said guide surface and said web at a lower region of said guide surface, said current flowing outwardly at the edges of said web

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from between said web and said guide surface to hold said web adjacent said plate and to cause said web to fold accordion fashion at said creases, said region having a height corresponding to the distance between creases of said web.

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