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(54) Title: MEANS HAVING AN INCLINED SURFACE IN CORRUGATED BOARD PRODUCTION

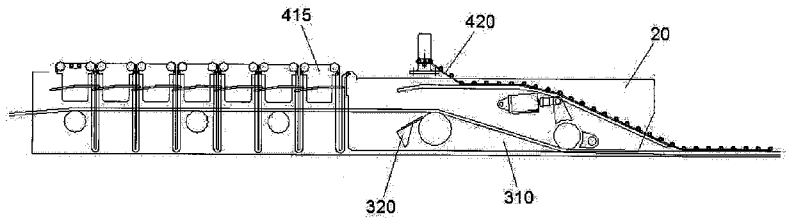

Figure 3

(57) Abstract: The present invention is a device for heating a layer of paper/board during a corrugation board production process. A means having an inclined surface (20) is movable along the length of the device. A plurality of pressure applying means (40) in a chain formation fixed at one end to a bar that moves up when machine stops and down when machine runs, and at the other end to a second bar equipped with a tensioner that allows chains tension adjustment. The means having an inclined surface (20) controls the rising and lowering of the pressure applying means (40) and by extension the amount of contact between the board and a heating device.

MEANS HAVING AN INCLINED SURFACE IN CORRUGATED BOARD PRODUCTION

FIELD OF INVENTION

This invention relates to a means having an inclined surface used during the production of corrugated board.

BACKGROUND OF INVENTION

In the production of corrugated board, the segment of a corrugator line (machine producing corrugated board from paper rolls) between the double glue machine and the slitter scorer is known as the double baker. The function of the double baker is to press the single facer (comprised of one flat paper call liner and one corrugated paper call fluting paper) into contact with one or two other single facer and with the outer liner (the flat paper that will be on the outside of the box), to pull the board throughout the machine, and finally to dry the glue as well as the board.

History of double-baker technology:

The first corrugator lines were produced before the 2nd world war. The double baker of the times used steel rolls to press a cotton belt into contact with the board. Under the board, steel chests heated with steam produced the heat necessary to dry the glue and the layers of paper. This original technology still exists and is used in many existing machines.

In the early 80', Langston produced a machine using an air hood to press down on the belt. This technology disappeared at the end of the decade because it was not improving

the board dryness sufficiently.

In 1993, two new technologies arrived into the market, one from Simon Handling System (SHS) and one from Interfic.

The SHS product was known as SHORT PRESS. With this technology, the weight rolls are replaced with a pressure system comprising an airbag inserted into an aluminium box. The bottom part of the box is closed by flat stainless steel chains. When the airbag is inflated, it presses down on the flat chains. The chains press on the belt and the belt on the board. This system gives a larger surface of pressure with less specific (per square cm) pressure. The advantages of this system are:

- better heat transfer
- less board crush (higher board calliper and stronger boxes)
- better production control (every unit can be controlled independently and pressure can be adjusted.

The Interfic product is called THERMOBAR. With this technology, the weight rolls are replaced with a pressure system composed of ski-like stainless steel plates (shoes). Those plates are attached to a bar that can be moved up and down by the mean of 2 air cylinders. Between the bar and the shoes is a spring. When the bar moves down, it compresses the springs and therefore presses the shoes press on the belt and the belt on the board. This system gives a larger surface of pressure with less specific (per square cm) pressure. The advantages of this system are:

- better heat transfer
- less board crush (higher board calliper and stronger boxes)
- better production control (every unit can be controlled independently)

However, these technologies are not without disadvantages. Chief among them is the sensitivity of the machine due to the many combined factors of machine length, heating temperature, board material, belt speed, etc. A slight variation in even one of the factors may cause a huge drop in productivity.

Yet another problem is that the heating section is only adjustable to a minimum distance of around 600mm. This makes it hard to fine tune small areas and edges, and is the main cause of warping of the board.

SUMMARY OF INVENTION

The present invention relates to a device for heating a layer of paper/board during a corrugation board production process. A means having an inclined surface is movable along the length of the device. A plurality of horizontally stationary pressure applying means, preferably in a chain formation move up and down in relation to the board moving along the length of the device. The means having an inclined surface controls the rising and lowering of the pressure applying means and by extension the amount of contact between the board and a heating device. The chain formation is fixed at an entrance to a bar that moves up when machine stops and down when machine runs, and at the other end of the device to a second bar equipped with a tensioner that allows chains tension adjustment.

The present invention relates to a material supplying means for supplying sheets of the board layer combination; an adhesive producing means for applying an adhesive to at least one sheet of the board layer combination to join them together; a plurality of heating means (30) located on a lower side of the board (100); characterized in that a pressure applying means (40) for applying pressure to the upper side of the board and extending along the direction of the moving corrugated board, and fixed along a length of the device (10), the flexible pressure applying means (40) being longer than the length of the heating means (30) and being fixed at each end; and a means having an inclined

surface (20) mounted below the pressure applying means (40) movable forward and backward along the length of the device (10) to move at least a part of the flexible pressure applying means to increase or decrease the length of contact between the board (100) and the heating means (30), wherein the movement of the means having an inclined surface (20) relative to the flexible pressure applying means (40) determine the amount of time the board (100) is in contact with the heating means (30).

This invention further relates to a side frame running substantially the length of the device and supporting the means having an inclined surface in a slidable fashion wherein the means having an inclined surface is designed to divert the motion of the pressure applying means such that the pressure applying means move a distance away from the heating means. The means having an inclined surface further comprises a layer of felt to reduce noise, friction and wear.

This invention also relates to a method of heating material during a corrugated board production process comprising the steps of: adding adhesive to at least one sheet of a paper/board layer combination; running the at least one sheet of paper/board layer combination over a heating device; rolling on a layer of paper onto the least one sheet of paper/board layer combination; and heating the layers of paper/board such that the paper/board dries substantially wherein a means having an inclined surface moves along the length of the heating device and a plurality of pressure applying means cause contact of the board with the heating device. The relative motion of the means having an inclined surface to the pressure applying means control the amount of contact between the board and the heating device, and hence the heat transferred to the paper/board layer combination.

While existing systems can adjust the heating distance (distance from the first contact to the last pressure point) at about every 600mm, the heating distance of this system is adjustable to +/- 10mm. The pressure application of this system is flexible across machine width to reduce delamination.

The pressure system used in this invention are, flat stainless steel chains loaded with ballast bars (steel bars cut at the require shape). A means having an inclined surface is used to move these stainless steel chains up and down. The means having an inclined surface consists in a trolley-style unit that can move backward and forward over the hot plates sliding on a side frame. The front part of the means having an inclined surface is inclined in a "slide" shape to let the chains "climb up" from hot plates level to storage level. The centre part is flat and the rear part is slightly bent to let the chains move freely from storage area to means having an inclined surface. The entire surface of the means having an inclined surface is covered with a felt lagging to reduce noise, friction and wear.

The means having an inclined surface can be stopped at any position on the machine. Its movements are controlled by a Programmable Logic Control (PLC). On auto mode, it can re-position itself according to the board type (manually input), the machine speed (given by an encoder) and /or the temperature of the board under the means having an inclined surface (measured by a non contact thermo-sensor). The PLC constantly recalculates the optimum position of the means having an inclined surface.

BRIEF DESCRIPTION OF DRAWINGS

Figure 1 shows an inner frame in an embodiment of this invention.

Figure 2 shows a means having an inclined surface in an embodiment of this invention.

Figure 3 shows a cross section of an overall view of an embodiment of this invention.

Figure 4 shows a side frame in an embodiment of this invention.

Figure 5 shows a pressure applying means in an embodiment of this invention.

Figure 6a to 6c show the sequence of the method in an embodiment of this invention.

DETAILED DESCRIPTION OF INVENTION

It should be noted that the following detailed description is directed to an apparatus and method for an improved corrugated board production process and is not limited to any particular size, shape or configuration of any individual parts of the device or the device as a whole.

Referring to Figure 1, there is shown an inner frame (200) in an embodiment of this invention and comprising a rear section (210) which is bent slightly downwards to allow pressure applying means (40) to move freely from storage area to a means having an inclined surface (20). The centre section (220) is flat and the front section (230) of the inner frame (200) is inclined in a "slide" shape to let the chains "climb up" from heating means (30) level to storage level.

Referring to Figure 2, there is shown a means having an inclined surface (20) in an embodiment of this invention comprising a plurality of inner frames (200) as described above, the inner frames (200) arranged perpendicular to a width of the means having an inclined surface (20) and together with a hollow pipe (250) running parallel to the width of the means having an inclined surface (20) forming a frame to support the rest of the means having an inclined surface (20). The means having an inclined surface (20) is a trolley-style unit that can move backward and forward over the length of the device, sliding on a side frame. The front part of the means having an inclined surface (20) is inclined in a "slide" shape to let the chains "climb up" from hot plates level to storage level. The centre part is flat and the rear part is slightly bent to let the chains move freely from storage area to the means having an inclined surface (20). The entire surface of the means having an inclined surface (20) is covered with a felt lagging (260) to reduce

noise, friction and wear.

In Figure 3, a cross section view is seen of the means having an inclined surface (20) raising the level of paper/board during the corrugation process. The top chain (420) feeds a length of chain to cover the top part of the paper/board. At the lower end of the machine is a hot plate carpet (310) transferring thermal energy onto the paper/board. A scraper (320) is located further down the length of the machine. Even further down is a plurality of top chain supporters (415) comprising of height-adjustable weights that control the pressure applied to the paper/board.

The means having an inclined surface (20) can be stopped at any position on the machine. Its movements are controlled by a PLC. On auto mode, it can re-position itself according to the board type (manually input), the machine speed (given by an encoder) and /or the temperature of the board under the means having an inclined surface (20) (measured by a non contact thermo-sensor). The PLC constantly recalculates the optimum means having an inclined surface (20) position.

Figure 4 shows a side frame in an embodiment of this invention. The means having an inclined surface (20) slides along this side frame (25) in a direction along the length of the corrugated board production line.

Figure 5 shows a pressure applying means (40), preferably comprising a plurality of weights joined together into a chain formation. Each weight is joined to another weight at the side using a roller joint (410) to form a single plane of pressure applying means. A ballast controlled by a PLC is used to activate the vertical movement of the pressure applying means (40) which contact the corrugated board in production.

In Figures 6a through 6c, there is shown a sequence of steps describing the method of this invention. Figure 6a has the means having an inclined surface (20) located at a distal end of the machine along with the top chain (420) that feeds a length of chain to

cover the top part of the paper/board being corrugated. At the lower end of the machine is a hot plate carpet (310) transferring thermal energy onto the paper/board. A scraper (320) is located further down the length of the machine. Even further down is a plurality of top chain supporters (415) comprising of height-adjustable weights that control the pressure applied to the paper/board.

As the means having an inclined surface (20) moves to a proximal end of the machine, it is shown in Figure 6b that the means having an inclined surface (20) raises the level of paper/board along the production line. The top chain supporters (415) apply pressure onto the paper/board located immediately below. The top chain supporters (415) are moved along the same direction as the means having an inclined surface (20) and in this way are fanned out along the production line. The top chain (420) continues to feed out length of chain along the production line. This provides for an even distribution of heat and pressure on the length of paper/board.

Figure 6c shows the last stage in this process whereby the means having an inclined surface (20) is at the extreme proximal end of the machine and the top chain supporters (415) are spaced out along the length of paper/board. The top chain (420) is fully fed out. After this stage, the means having an inclined surface (20) is returned to the extreme distal position along the machine, the top chain supporters (415) are contracted close to each other again, and the length of chain is pulled back towards the said distal end. The entire process can then be repeated over again.

While several particularly preferred embodiments of the present invention have been described and illustrated, it should now be apparent to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention. Accordingly, the following claims are intended to embrace such changes, modifications, and areas of application that are within the spirit and scope of this invention.

CLAIMS

1. A device (10) for heating material during a corrugated board (100) production process comprising:

a plurality of heating means (30) located on a lower side of the board (100);

a pressure applying means (40) for applying pressure to the upper side of the board and extending along the direction of the moving corrugated board, and fixed along a length of the device (10), the flexible pressure applying means (40) being longer than the length of the heating means (30) and being fixed at each end; and

a means having an inclined surface (20) mounted below the pressure applying means (40) movable forward and backward along the length of the device (10) to move at least a part of the flexible pressure applying means to increase or decrease the length of contact between the board (100) and the heating means (30),

wherein the movement of the means having an inclined surface (20) relative to the flexible pressure applying means (40) determine the amount of time the board (100) is in contact with the heating means (30).

2. A device (10) according to claim 1, wherein the pressure applying means (40) able to lower and rise in sections such that only a desired section of board (100) may be made to contact the heating means (30).

3. A device (10) according to claim 1 or 2, further comprising a side frame (25) running substantially the length of the device (10) and supporting the means having an inclined surface (20) in a slidable fashion.

4. A device (10) according to claim 3, wherein the side frame (25) is provided with a means to move the means having an inclined surface (20) along the length of the device (10).

5. A device (10) according to any of the preceding claims, wherein the means having an inclined surface (20) is designed to divert the motion of the pressure applying means (40) such that the pressure applying means (40) move a distance away from the heating means (30).

6. A device (10) according to claim 5, wherein the front of the means having an inclined surface (20) is inclined to raise the pressure applying means (40) away from the heating means (30).

7. A device (10) according to any of the preceding claims, wherein the pressure applying means (40) is fixed at one end to a bar (72) that moves up when machine stops and down when machine runs, and at the other end of the device to a second bar (74) equipped with a tensioner that allows chains tension adjustment.

8. A device (10) according to any of the preceding claims, wherein the means having an inclined surface (20) further comprises a layer of material (21) to reduce any or a combination of noise, friction and wear.

9. A device (10) according to claim 8, wherein the layer of material (21) is felt.

10. A device (10) according to any of the preceding claims, wherein the motion of the means having an inclined surface (20) along the device (10) is controlled by a programmable logic control (PLC) device (70).

11. A device (10) according to claim 10, wherein the PLC device (70) is able to determine the optimum means having an inclined surface (20) position based on the device speed and/or the temperature of the board (100) under the means having an inclined surface (20).

12. A device (10) according to any of the preceding claims, wherein a pressure exerted by the pressure applying means (40) on the board (100) can be controlled along the width of the device (100).

13. A method of heating material during a corrugated board (100) production process comprising:

adding adhesive to at least one sheet of a paper/board layer combination;

running the at least one sheet of paper/board layer combination over a heating means (30);

rolling on a layer of paper onto the least one sheet of paper/board layer combination; and

heating the layers of paper/board such that the paper/board dries substantially

wherein a means having an inclined surface (20) moves along the length of the heating device and a plurality of pressure applying means (40) cause contact of the board (100) with the heating means (30).

14. A method according to claim 15, wherein the relative motion of the means having an inclined surface (20) to the pressure applying means (40) control the amount of contact between the board (100) and the heating means (30).

AMENDED CLAIMS
received by the International Bureau on 29 April 2009 (29.04.09)

1. A device (10) for heating material during a corrugated board (100) production process comprising:

a plurality of heating means (30) located on a lower side of the board (100);

a pressure applying means (40) for applying pressure to the upper side of the board and extending along the direction of the moving corrugated board, and fixed along a length of the device (10), the flexible pressure applying means (40) being longer than the length of the heating means (30) and being fixed at each end; and

a means having an inclined surface (20) mounted below the pressure applying means (40) movable forward and backward along the length of the device (10) to move at least a part of the flexible pressure applying means to increase or decrease the length of contact between the board (100) and the heating means (30),

wherein the movement of the means having an inclined surface (20) relative to the flexible pressure applying means (40) determine the amount of time the board (100) is in contact with the heating means (30).

2. A device (10) according to claim 1, wherein the pressure applying means (40) able to lower and rise in sections such that only a desired section of board (100) may be made to contact the heating means (30).

3. A device (10) according to claim 1 or 2, further comprising a side frame (25) running substantially the length of the device (10) and supporting the means having an inclined surface (20) in a slidable fashion.

4. A device (10) according to claim 3, wherein the side frame (25) is provided with a means to move the means having an inclined surface (20) along the length of the device (10).

5. A device (10) according to any of the preceding claims, wherein the means having an inclined surface (20) is designed to divert the motion of the pressure applying means (40) such that the pressure applying means (40) move a distance away from the heating means (30).

6. A device (10) according to claim 5, wherein the front of the means having an inclined surface (20) is inclined to raise the pressure applying means (40) away from the heating means (30).

7. A device (10) according to any of the preceding claims, wherein the pressure applying means (40) is fixed at one end to a bar (72) that moves up when machine stops and down when machine runs, and at the other end of the device to a second bar (74) equipped with a tensioner that allows chains tension adjustment.

8. A device (10) according to any of the preceding claims, wherein the means having an inclined surface (20) further comprises a layer of material (21) to reduce any or a combination of noise, friction and wear.

9. A device (10) according to claim 8, wherein the layer of material (21) is felt.

10. A device (10) according to any of the preceding claims, wherein the motion of the means having an inclined surface (20) along the device (10) is controlled by a programmable logic control (PLC) device (70).

11. A device (10) according to claim 10, wherein the PLC device (70) is able to determine the optimum means having an inclined surface (20) position based on the device speed and/or the temperature of the board (100) under the means having an inclined surface (20).

12. A device (10) according to any of the preceding claims, wherein a pressure exerted by the pressure applying means (40) on the board (100) can be controlled along the width of the device (100).

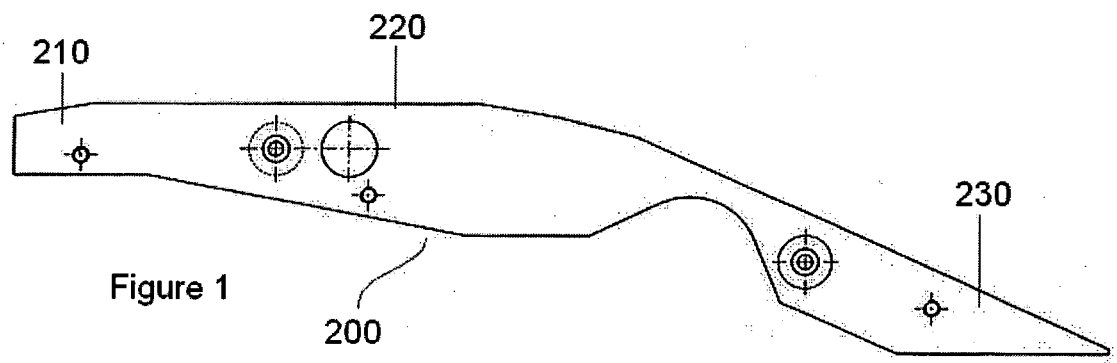

Figure 1

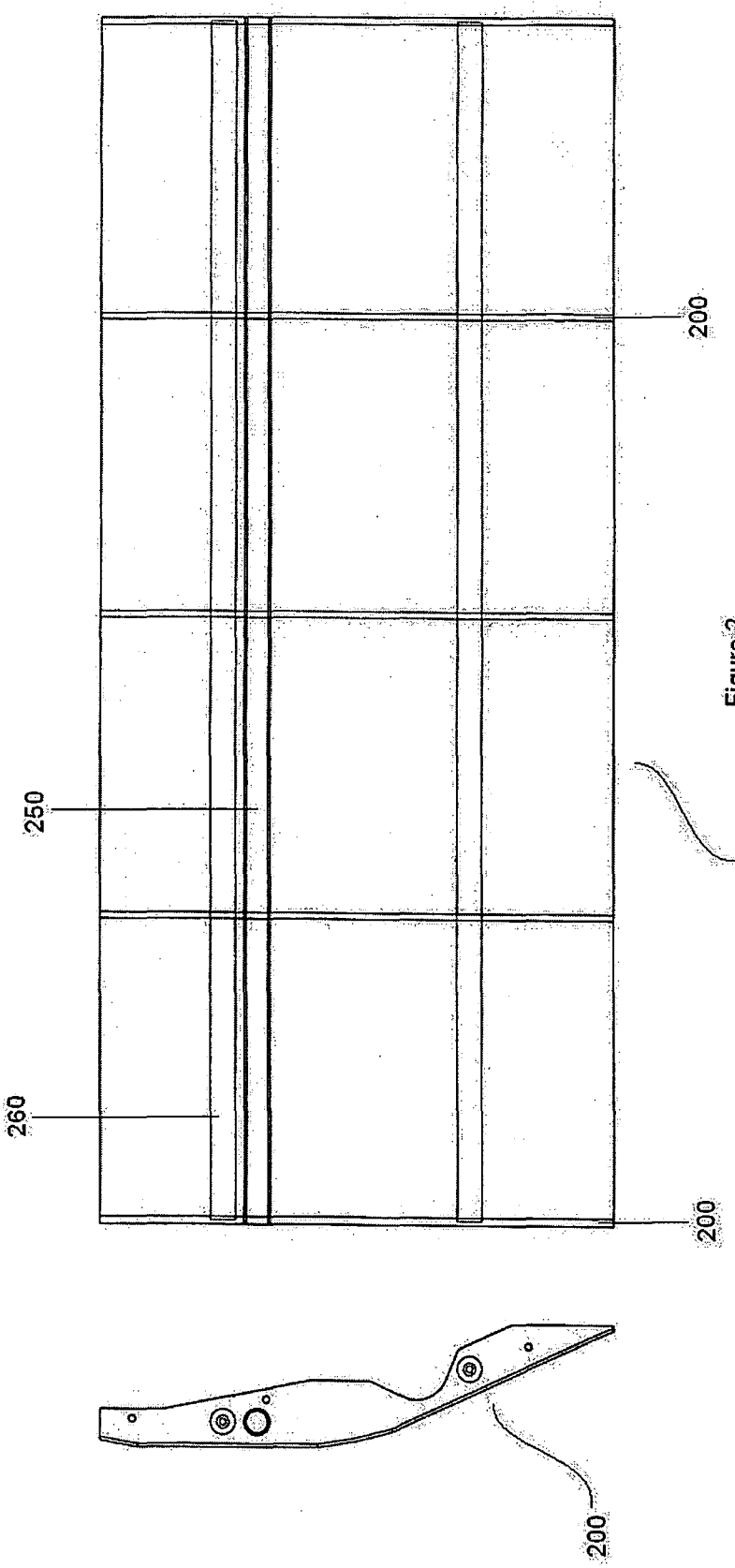

Figure 2

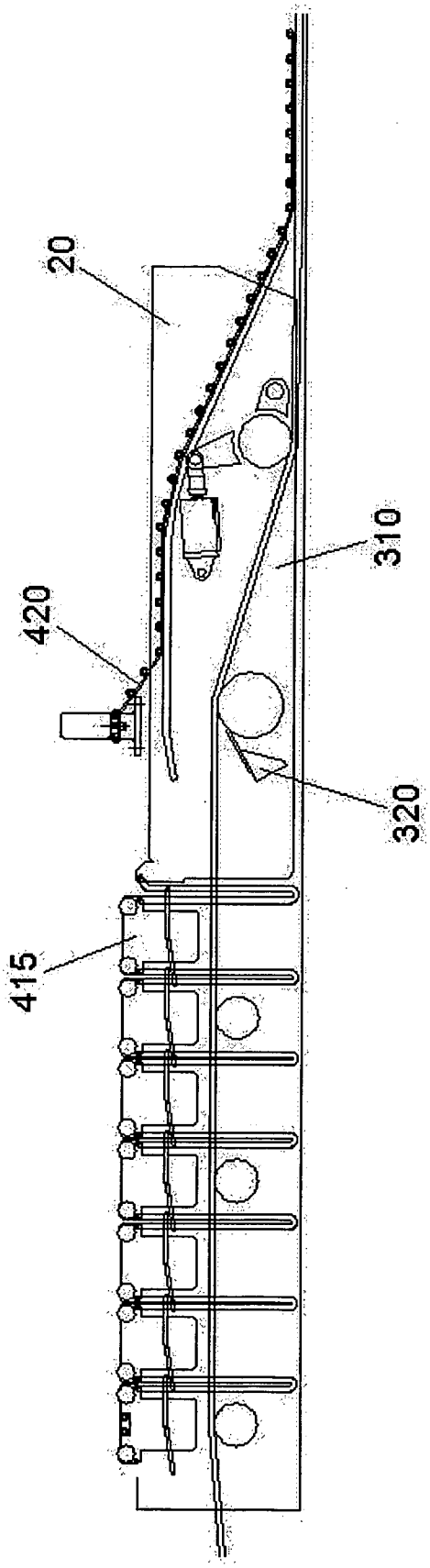

Figure 3

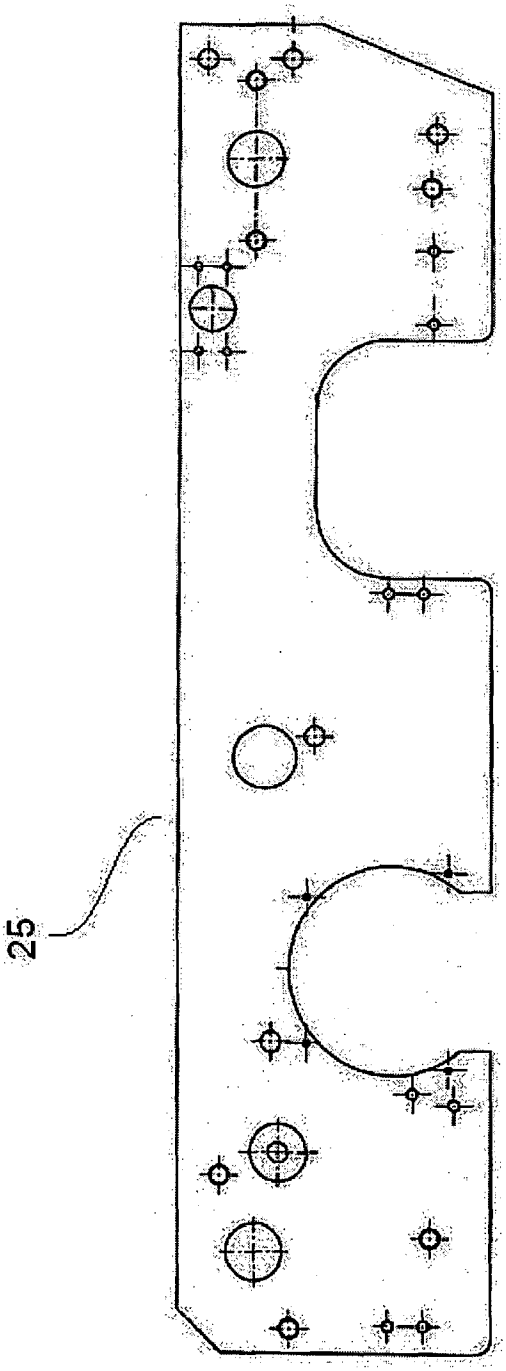

Figure 4

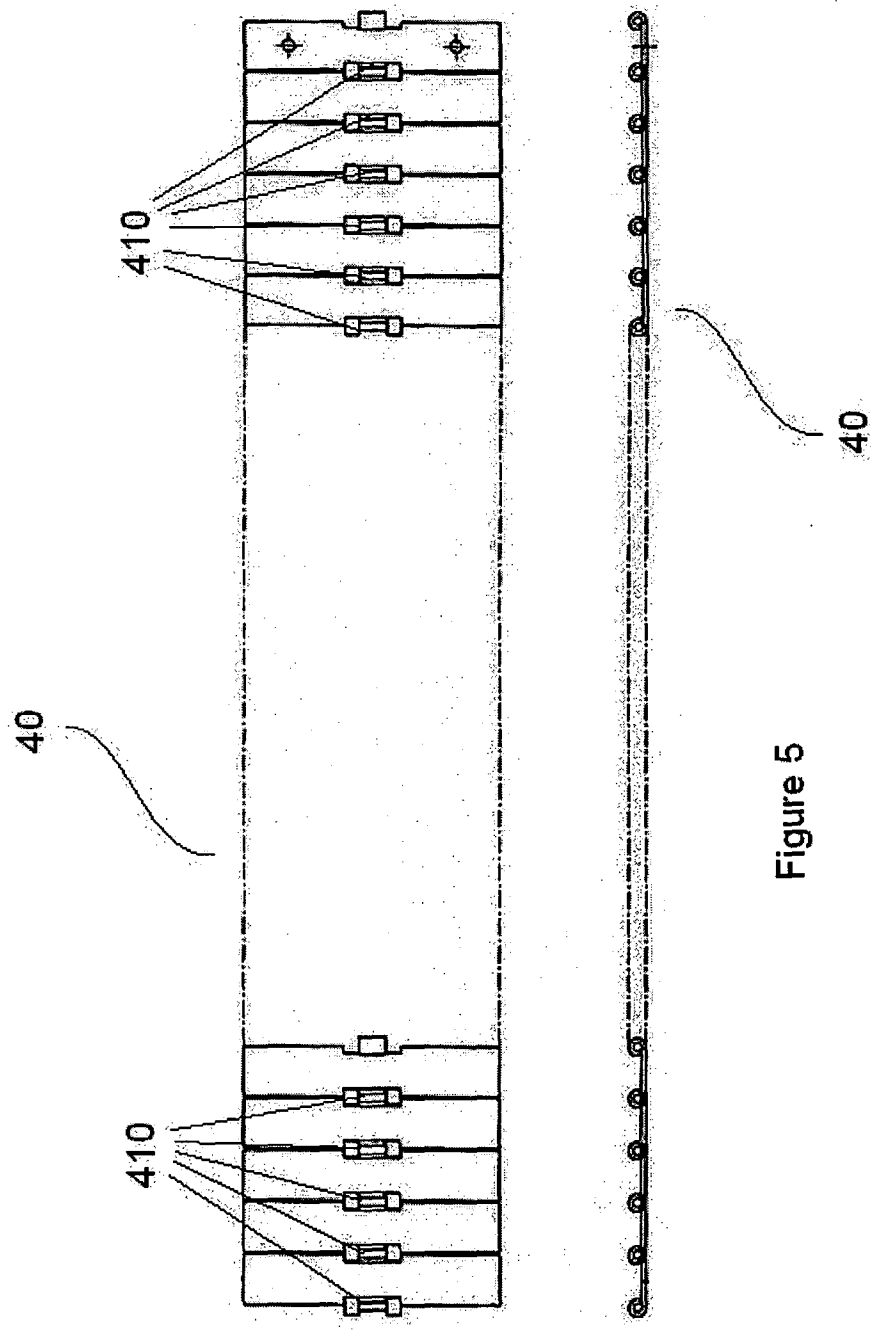

Figure 5

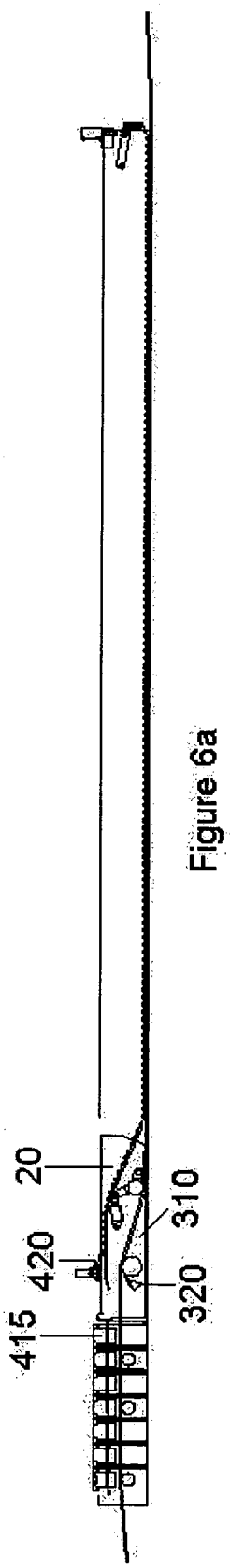

Figure 6a

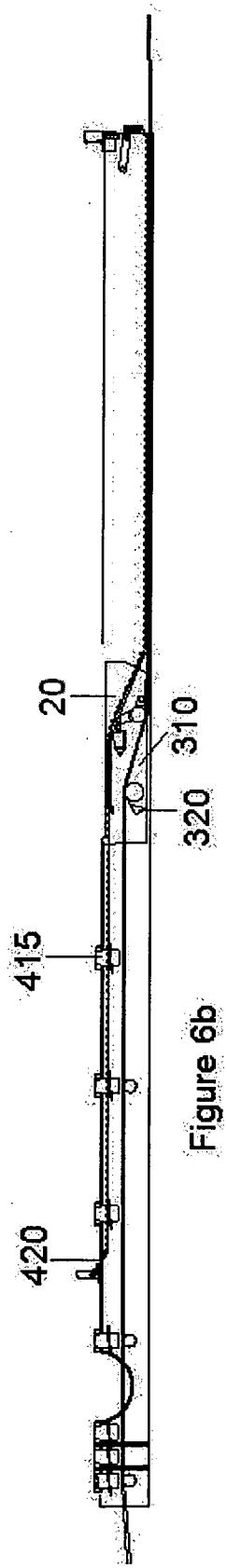

Figure 6b

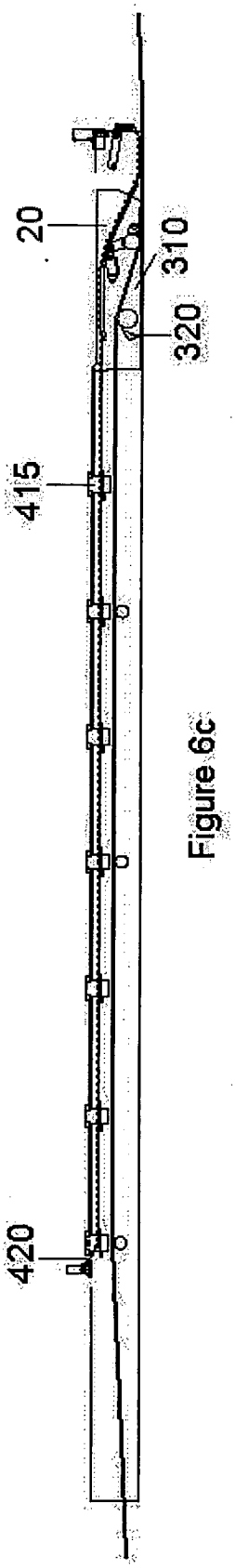

Figure 6c

INTERNATIONAL SEARCH REPORT

International application No
PCT/MY2008/000165

A. CLASSIFICATION OF SUBJECT MATTER
INV. B31F1/28
ADD. F26B13/10

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B31F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 3 948 718 A (MOSBURGER HANS) 6 April 1976 (1976-04-06) column 1, line 60 column 4, line 36 - column 5, line 5; figures 5,5a	13,14
A		1-12
A	US 5 890 301 A (MARSCHKE CARL R [US]) 6 April 1999 (1999-04-06) the whole document	1-14
A	US 2007/131357 A1 (WU KUAN-SHIUNG [TW]) 14 June 2007 (2007-06-14) the whole document	1-14

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"P" document published prior to the international filing date but later than the priority date claimed

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Date of the actual completion of the international search	Date of mailing of the international search report
17 February 2009	04/03/2009

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Sundqvist, Stefan

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3948718 A	06-04-1976	DE 2310613 A1	12-09-1974
		ES 423029 A1	01-10-1976
		FR 2219841 A1	27-09-1974
		GB 1463622 A	02-02-1977
		IT 1018133 B	30-09-1977
		JP 1106866 C	30-07-1982
		JP 50047794 A	28-04-1975
		JP 56048303 B	14-11-1981
		SU 646885 A3	06-02-1979
		SU 720997 A3	08-03-1980
US 5890301 A	06-04-1999	NONE	
US 2007131357 A1	14-06-2007	TW 293843 Y	11-07-2006