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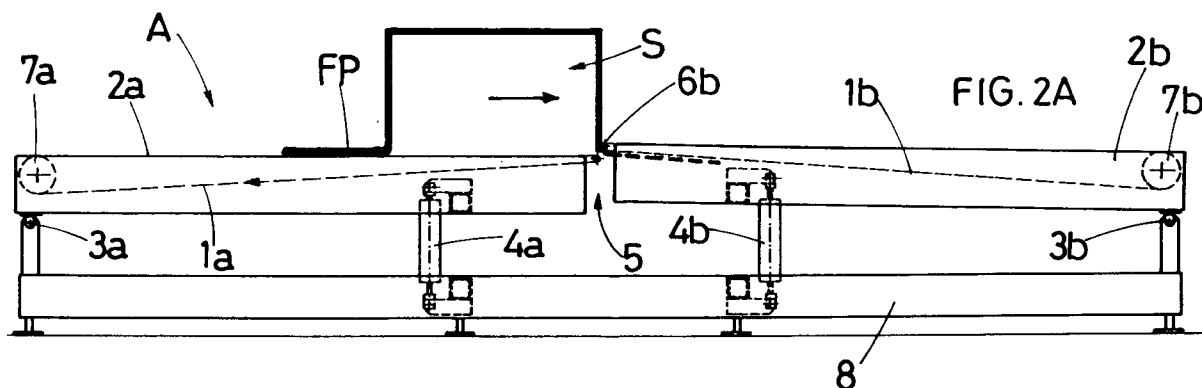
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**I-60035 Jesi (Ancona) (IT)**(54) **Machine for automatically bending the flaps of cardboard packaging cartons.**

(57) This invention concerns a machine for automatically bending the flaps of cardboard packaging cartons consisting of two operating stations, the first for bending the transverse flaps and the second for

bending the side flaps characterized in that the bending of said flaps occurs without their being completely removed from the underlying supporting surface.


**EP 0 543 786 A1**

This design patent application concerns a machine for automatically bending the sides of cardboard packaging cartons.

The problem which the machine according to the invention intends to resolve is the automatic bending of the flaps of cardboard packaging cartons, namely the flaps which are bent to close the top and bottom of the carton in which the product is packaged. The machine in question specifically resolves the problems encountered by furniture manufacturers in packaging parallelepiped furniture units or furniture of other shapes which can be packaged in a carton consisting of four perpendicular side walls, such as the cabinets of modern fitted kitchens.

The packaging station for these items generally consists of a work surface on which the furniture unit is placed; the preformed packaging carton is then pulled from top to bottom over the unit, with the bottom obviously open; once the carton has been fitted completely over the furniture unit the four bottom flaps of the carton are pressed open on the above work surface.

It is quite obvious that the operator or alternatively the automatic machines sometimes used for turning over and sealing the cartons, will have no problem in bending the four top flaps of the carton but just as obvious that it is impossible to bend the four bottom flaps if the bottom of the furniture unit is not lifted from the resting surface. To date, the operations which the machine according to the invention performs automatically, have always been carried out by hand with the use of work tables which tip  $90^\circ$  so as to position the furniture unit sideways or backwards, thereby placing it on a second work surface adjacent to the first so that after lowering the work table on which the furniture was initially placed the operator can then bend the four bottom flaps  $180^\circ$ .

The purpose of this invention is to design an automatic machine for bending the four bottom flaps of the packaging box without having to place the furniture sideways, and without having to remove the base of the furniture from the work surface.

Another purpose of this invention is to design a linear machine having compact transverse dimensions along which the package undergoes successive operations while moving in the same rectilinear direction. The machine according to the invention consists of two work stations, the first thereof for turning over the pair of opposing flaps hereinafter referred to as "transverse" in that their rotation axis is transverse with respect to the direction in which the automatic product packaging line moves; the second station bends the other pair of opposing flaps hereinafter referred to as "side flaps" in that their rotation axis is parallel and

therefore laterally displaced with respect to the longitudinal position of the device for closing and sealing the filled packages.

The first station consists of two identical aligned conveyor belts which can not only reverse their forward direction but can also be inclined slightly in a sub-horizontal direction; it is important to note that the first belt is pivoted on a horizontal pin positioned at the beginning of the belt while the second belt rotates around a pin positioned at its exit.

At the first station the two "transverse" flaps close in rapid succession, first the front and then the back flap, following the movement of the packaging and sealing line. The second of the first pair of said conveyor belts is initially slightly slanted at the top so that the front transverse flap of the box moving forward on the first belt, which is perfectly horizontal in this phase, fits under the entrance of the second belt.

When the front transverse flap is completely under the second belt, the latter automatically oscillates downwards into a slanted position under the horizontal line; the lowering of the second belt rotates the front flap by  $90^\circ$  so that the same positions itself on a vertical plane over the opening which separates the end of the first belt from the beginning of the second belt.

Continuing the pulling action of the first belt, the carton carried on the belt is pushed on to the second belt which, on receiving the carton, tips the front "transverse" flap over by another  $90^\circ$  and in this way closes the flap under the back wall of the furniture item, without being removed from the underlying conveyor belt.

By reversing the direction of the two conveyor belts, the back "transverse" flap can be closed with the same operations as described previously.

This first operating cycle consequently involves the transfer of the package from the first to the second conveyor belt and a subsequent backward passage from the second to the first conveyor belt.

At this point the two conveyor belts, both kept in a perfectly horizontal position and moving in the same direction, carry the half-closed package (the two "side" flaps are still open) towards a second operating station, perfectly aligned to the previous station so that the half-closed package exiting the first station can be fed directly into the second station without any intermediate intervention.

The second operating station consists of two identical adjacent belts translating vertically and alternatively so that the package half-rests temporarily on only one of the two adjacent conveyor belts.

By lowering of a belt "side" flap positioned on the same side as the lowered belt can be rotated  $180^\circ$  and inwards; each "side" flap is turned over

by means of a relevant adequately shaped jointed arm which intervenes when the corresponding conveyor belt disengages from the bottom of the half – closed package.

In order to support the package when its "side" flaps are turned over, the device according to the invention features two side supporting and center – ing edges in which the package is channelled and stopped after its transfer from the first to the second operating stations. For major clarity, the description of the invention continues with reference to the enclosed tables intended for purposes of illustration and not in a limiting sense,

where:

- fig. 1 is a plan view of the first operating station of the automatic machine in question;
- figs 2A and 2B are two side views of the first operating station of the automatic machine in question illustrating the bending phases of the front and rear transverse flaps respectively;
- fig. 3 is a plan view of the second operating station of the machine according to the invention;
- figs. 4 and 5 are two side views of the station in fig. 3.

With reference to figs. 1, 2A and 2B, the first operating station (A) consists of two identical conveyor belts (1a and 1b) supported by two identical frames (2a and 2b), which oscillate with respect to horizontal pivoting pins (3a and 3b) positioned respectively at the beginning of the first belt (1a) and at the end of the second belt (1b).

Two identical jacks (4a and 4b) are used to oscillate the two frames (2a and 2b); said jacks (4a and 4b) are positioned symmetrically with respect to the vertical plane of symmetry passing through the transverse opening (5) which separates the exit of the first belt from the entrance of the second belt.

Attention is drawn to the fact that the end rollers on which the belts (1a and 1b) are wound have a different diameter; in particular, the two rollers (6a and 6b) positioned before and after the opening (5) respectively are much smaller than the two rollers (7a and 7b) placed at the entrance of the first belt (1a) and at the exit of the second belt (1b), respectively.

The difference in size means that the respective overlying half – sections of the belts are not parallel but converging and almost incident at the above rollers (6a and 6b) where they are spaced by a distance equal to that of the smaller diameter of the rollers (6a and 6b). In figs. 2A and 2B, the number 8 indicates the floor base supporting the pivoting pins (3a and 3b) and the jacks (4a and 4b).

It is easier to understand the complete operating cycle described in the introduction by re –

ferring to figures 1 and 2A illustrating the initial phase of the cycle during which the front "transverse" flap (FA) of the carton (S) is fitted under the entrance of the second conveyor (1b), in other words under roller (6b).

As clearly illustrated in fig. 1, as the carton (s) moves forward on the conveyor (1a) towards the belt (1b), the same is slightly lifted so that the front "transverse" flap (FA) tends spontaneously to fit under the belt (1b).

When the flap (FA) is completely inserted under the belt (1b), thanks to the action of the jack (4b), the belt is lowered slightly under the horizontal level thereby rotating the front "transverse" flap (FA) 90° downwards so that the same moves into a vertical position on the plane of symmetry passing through the opening (5).

At this point the carton (S), pushed forward by the belt (1a) is transferred on belt (1b) moving in the same direction as belt (1a); as the carton (S) passes over the opening (5), the corresponding front flap (FA) is gradually rotated a further 90° until it is completely turned over by effect of its interference with the entrance of belt (1b). Once the carton (S), together with its rear "transverse" flap (FP) has passed on to belt (1b), sensors transmit a signal which reverses the direction of the belts (1a and 1b), lifts the first belt (1a) and levels belt (1b), as illustrated in fig. 2B, in order to repeat the operating cycle in reverse order, thereby overturning said back "transverse" flap (FP) so that the same closes.

As shown in figures 3, 4 and 5, the second bending station consists of a pair of identical adjacent conveyor belts (9a and 9b) whose frames (10a and 10b) are supported in a perfectly horizontal position by respective shelves (11a and 11b), which are an integral part of the corresponding supporting trolleys (12a and 12b) which can be run in alternating vertical strokes by jacks (13a and 13b).

Each trolley (12a and 12b) is in fact hooked at the base of the rod of two jacks having a vertical axis (13a and 13b), which are in turn suspended at the centre of the cross – piece of a portal carrying structure (14a and 14b) whose columns act as tracks for the idle running wheels (15a and 15b) of the above trolleys.

Two retaining edges (16a and 16b) are provided to support the box laterally and are also used to centre the carton in that the axis of symmetry of the latter is taken to the central opening (17) which separates the two adjacent belts (9a and 9b).

These supporting and centering edges (16a and 16b) are supported externally by respective supporting frames (18a and 18b) which perform horizontal transverse translations so that they are drawn and separated reciprocally.

In order to automatically centre the carton (S) these frames (18a and 18b) are moved simultaneously by means of two opposing pairs of pantographs (19a and 19b) joined by a connected cable (20); two jacks (21a and 21b) are provided, one for closing the pantographs (19a and 19b) simultaneously together with that of the sides (16a and 16b), while the other jack simultaneously opens the above pantographs and with them that of the edges (16a and 16b). On the external wall of each edge (16a and 16b) a pendulum arm is pivoted with respect to a horizontal axis (22a and 22b), terminating at the bottom with a blade (23a and 23b). The arms (22a and 22b) are operated by the respective jacks (24a and 24b) so that the blades (23a and 23b) intervene alternatively only when the corresponding belt (9a and 9b) has been drawn away from the bottom of the carton so that it no longer interferes with the closing of the "side" flap, which can be done only by overturning the same towards downwards and inwards by 180°.

Once both the "side flaps" (FL) have been closed in succession, the conveyor belts (9a and 9b) having assumed a coplanar position, start moving again at the same time. The carton (S) with all the bottom flaps closed is then loaded on a standard track consisting of two sets of conveyor rollers (25) between which is installed a standard taping head (28), that is a device which automatically applies the adhesive sealing tape over the touching sections of the two "side" flaps.

As the carton (S) moves over the set of conveyor rollers (25), it is kept in line by two side tracks (27a and 27b) supported by the edges (16a and 16b); once sealing has been completed, said edges are drawn away by the two jacks (21a and 21b), and the device is now ready to receive a new carton for closing.

It has now been explained more clearly how the machine in question can automatically close the four flaps of the box while the same is never removed from the underlying work surface.

It is also evident that the above two stations positioned successively produce a substantially linear machine whose compact transverse dimensions facilitate its installation in areas used for goods packaging.

Finally, it should be noticed that a machine which can automatically perform the same operations as the above can be used with two stations identical to station (A) or with two stations identical to station (B) providing that a third intermediate station is used at which the half-closed package from the first station is suitably positioned to enter the second station.

This third intermediate station consists substantially of a standard motor driven sorting platform which can rotate the half-closed package

90°, if the stations are positioned in line with each other, or can translate the package in two perpendicular directions if the stations are perpendicular to each other.

Even if this description refers only to the packaging of furniture, the same machine can be used just as efficiently for closing cartons containing other types of products whose shape allows them to be packaged in parallelepiped cartons.

## Claims

1. A machine for automatically bending the flaps of cardboard packaging cartons consisting of two operating stations, the first for bending the front (FA) and back (FP) "transverse" flaps and the second for bending the "side" flaps (FL) characterized in that:

- the first station (A) consists of two identical conveyor belts (1a and 1b) supported by two identical frames (2a and 2b), oscillating with respect to horizontal pivoting pins (3a and 3b) positioned at the beginning of the first belt (1a) and at the end of the second belt (1b), respectively; the inclination of the above frames can be changed as required, by means of two identical jacks (4a and 4b), symmetrically positioned with respect to the plane of vertical symmetry passing through the transverse opening (5) which separates the exit of the first station from the entrance of the second station; thereby also being provided that the winding rollers (6a and 6b) of the belts (1a and 1b) placed before and after the opening (5) respectively are considerably smaller than the two rollers (7a and 7b), placed respectively at the entrance of the first belt (1a) and at the exit of the second belt (1b); a supporting floor base (8) is also provided for the pivoting pins (3a and 3b) and for the jacks (4a and 4b), characterized in that the second station (B) consists of:

- a pair of identical adjacent conveyor belts (9a and 9b) whose frames (10a and 10b) are maintained in a perfectly horizontal position by relevant shelves (11a and 11b) the same being an integral part of the supporting trolleys (12a and 12b) which can be operated to run in alternating vertical strokes by their relevant jacks (13a and 13b) suspended at the centre of the cross-piece of a supporting portal structure (14a and 14b) whose columns act as a guide track for the idle running wheels (15a and 15b) of the above trolleys;

- two retaining and centering edges (16a and 16b) supported externally by respective supporting frames (18a and 18b) operated to translate horizontally by corresponding pairs of

pantographs (19a and 19b) joined together by means of a connection cable (20) which is stretched by two jacks (21a and 21b), one for simultaneously closing the pantographs (19a and 19b) and with them that of the edges (16a and 16b), and the other for simultaneously opening the above pantographs and with them that of the edges (16a and 16b); - two pendulum arms (22a and 22b) hinged externally and at the centre of the edges and terminating at the bottom with a shaped blade (23a and 23b) operated by their relevant jacks (24a and 24b) so that the blades (23a and 23b) intervene alternatively only when the corresponding belt (9a and 9b) is drawn away from the bottom of the carton; - two sets of conveyor rollers (25) between which a common taping head (26) is installed.

2. A machine for automatically bending the flaps of cardboard packaging cartons characterized in that the same consists of two identical stations each consisting of a station similar to the first station (A) according to claim 1; a third intermediate station being provided consisting of a motor driven sorting platform for rotating or translating the half-closed package from the first station in order to carry it in the correct position to the entrance of the second station.

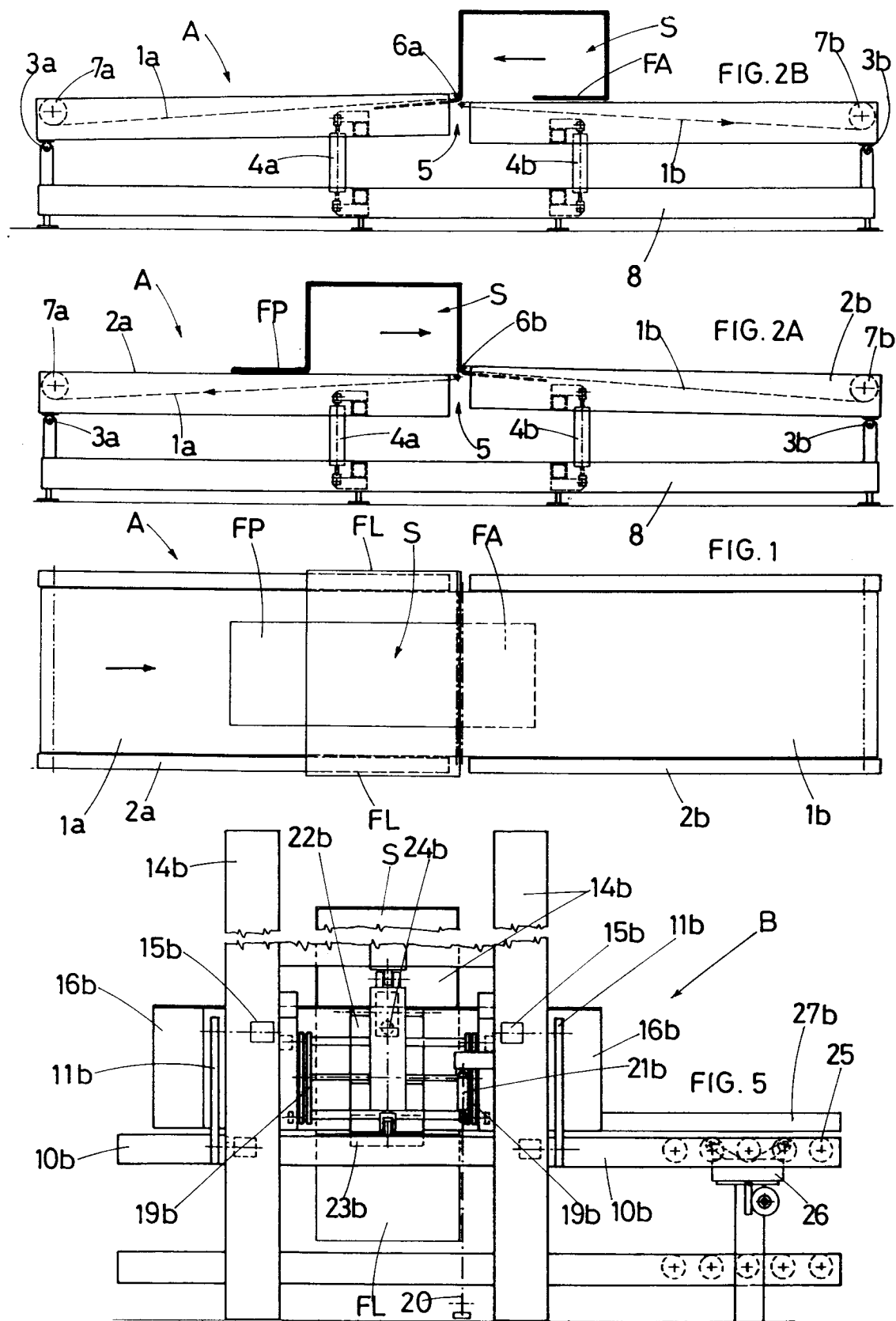
3. A machine for automatically folding the flaps of cardboard packaging cartons characterized in that the same consists of a station similar to the second station (B) according to claim 1; a third station being provided consisting of a sorting platform for rotating or translating the half-closed package from the first station in order to carry it in the correct position to the entrance of the second station.

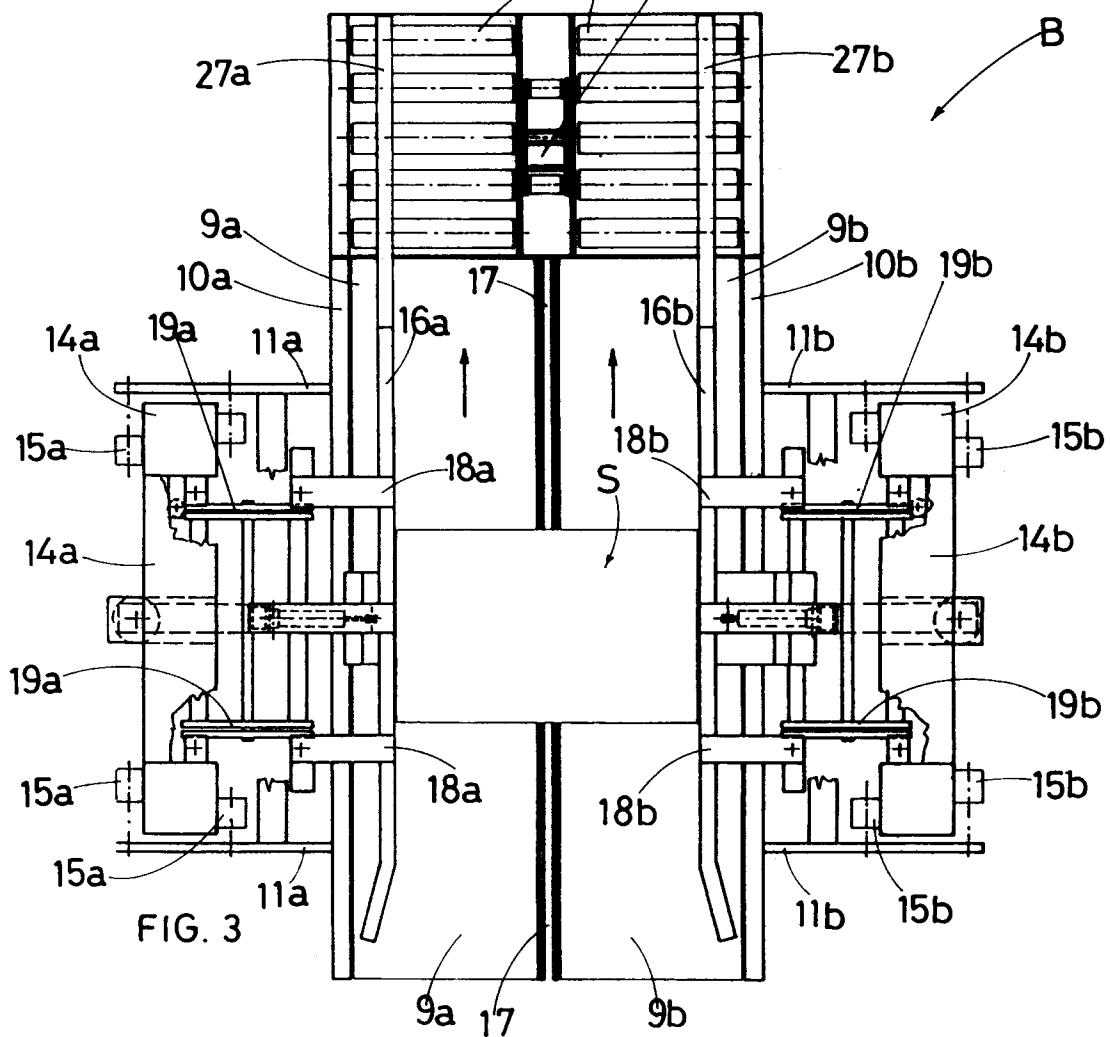
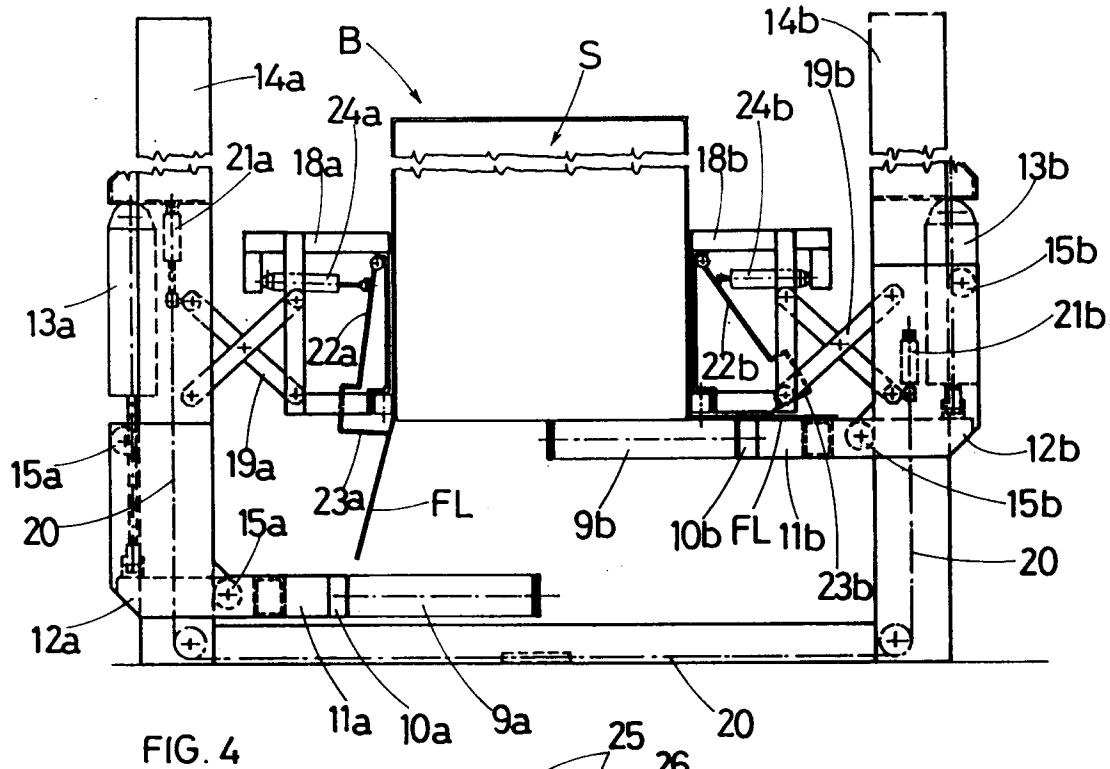
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## EUROPEAN SEARCH REPORT

Application Number

EP 92 83 0635

| 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.5) |
| Y<br>A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | US-A-2 252 435 (LUST)<br>* claim 1; figures 1-3 *<br>---                      | 1,3<br>2                                          | B31B5/74                                      |
| Y<br>A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | GB-A-2 235 153 (FRITO-LAY INC)<br>* claim 1; figure 1A *<br>---               | 1,3<br>2                                          |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | US-A-2 898 820 (KEELY)<br>* claim 1; figure 1 *<br>---                        | 1-3                                               |                                               |
| A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | EP-A-0 373 275 (NIPPON FLUTE CO LTD)<br>* claim 1; figure 2 *<br>-----        | 1-3                                               |                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                                   | TECHNICAL FIELDS SEARCHED (Int. Cl.5)         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                               |                                                   | B31B                                          |
| The present search report has been drawn up for all claims                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                               |                                                   |                                               |
| Place of search<br>THE HAGUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                               | Date of completion of the search<br>15 MARCH 1993 | Examiner<br>KIRSTEN K.R.M.                    |
| <b>CATEGORY OF CITED DOCUMENTS</b><br>X : particularly relevant if taken alone<br>Y : particularly relevant if combined with another document of the same category<br>A : technological background<br>O : non-written disclosure<br>P : intermediate document<br>T : theory or principle underlying the invention<br>E : earlier patent document, but published on, or after the filing date<br>D : document cited in the application<br>L : document cited for other reasons<br>.....<br>& : member of the same patent family, corresponding document |                                                                               |                                                   |                                               |