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(71) Applicant: **Nuovo Scatolificio Valtenna S.r.l.**
63023 Fermo (AP) (IT)

(72) Inventor: **Moretti, Loris**
63023 Fermo (AP) (IT)

(74) Representative: **Baldi, Claudio**
Ing. Claudio Baldi s.r.l.
Viale Cavallotti 13
P.O. Box 187
60035 Jesi (Ancona) (IT)

(54) **System and machine for automatic closing of one-piece cardboard boxes, of the type composed of bottom and lid connected by a common side**

(57) The present invention relates to a system and a machine for the automatic closing of one-piece cardboard boxes, of the type composed of a bottom (F) and a lid (C) connected by a common side (FC4) that acts as hinge; the said system and machine providing that the said boxes travel on a conveyor belt (N1) that takes them to a folding station provided with purely mechanical operating means (2, 3) designed to grab the moving lid (C) or bottom (F) and turn them respectively by 180° over the bottom (F) or lid (C) during the forward movement of the box (A) on the conveyor belt (N1), in such a way to close the box (A) without interrupting its forward movement on the conveyor belt (N1).

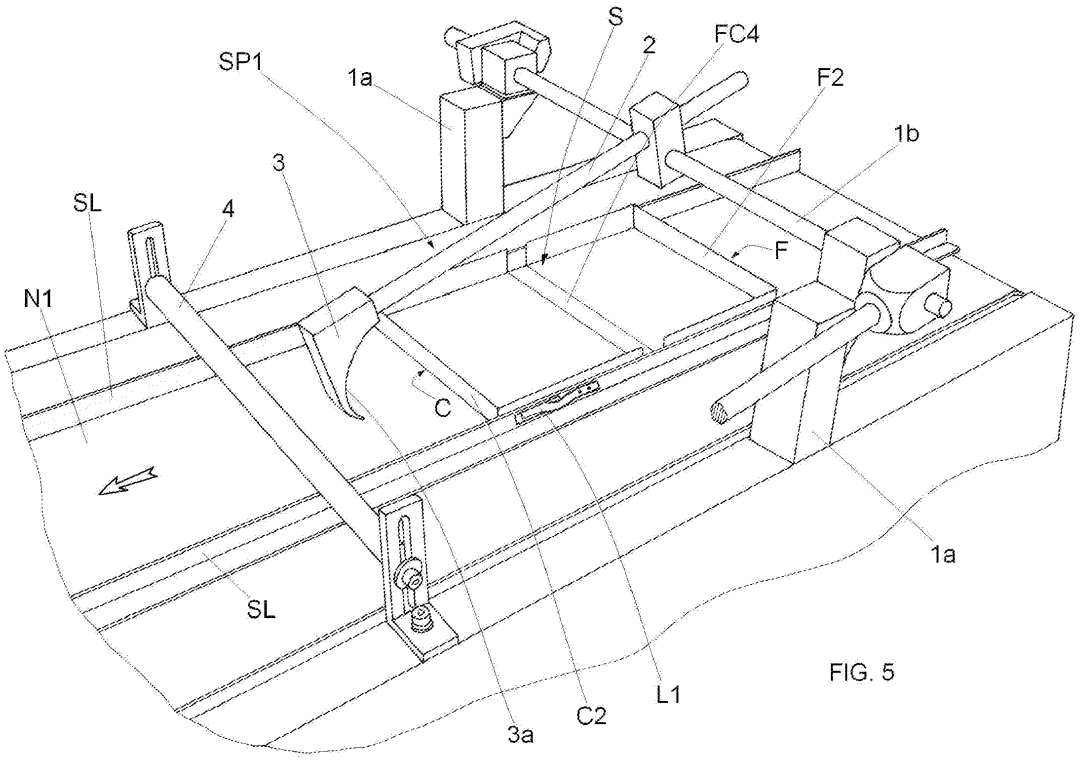

FIG. 5

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Description

[0001] The present patent application for industrial invention relates to a system and machine for automatic closing of one-piece cardboard boxes, of the type composed of a basically identical bottom and lid, connected by a common side that acts as hinge to turn the lid over the bottom.

[0002] More precisely, the said one-piece cardboard box is composed of a first boxed semi-box designed to act as container, and of a second specularly identical boxed semi-box designed to be placed in opposite position above the first semi-box to act as lid.

[0003] In order to better understand and appreciate the advantages offered by the system and folding machine of the invention, reference is made to the technique that is currently used to fold the said boxes of known type, as shown in the enclosed drawings.

- Figure 1 is an axonometric view of the one-piece cardboard box in completely open position;
- Figures 2 to 4 are diagrammatic views of the different configurations assumed by the said box when folded with a traditional folding machine.

[0004] With reference to fig. 1, the one-piece boxes (A) are composed of two boxed semi-boxes (F and C) in specular opposite position, each of them being provided with three lateral and vertical sides (F1, F2, F3 and C1, C2, C3) and connected by a fourth collapsible side (FC4) designed to act as hinge to turn the second boxed semi-box (C) over the first semi-box (F).

[0005] The fourth side (FC4) is bordered by a transversal pair of creases (F5 and C5), each of them bordering the base (F6 and C6) of each boxed semi-box (F and C).

[0006] In order to close the box, the user simply needs to turn the common side (FC4) up, rotating it by 90° upwards and around the first crease (C5), and turning the lid (C) over around the second crease (F5) in such a way to bring the semi-box (C) above the bottom (F), with the three sides (F1, F2 and F3) in external side-by-side position surrounded by the corresponding sides (C1, C2 and C3) of the lid (C).

[0007] Machines are currently available to close the said boxes (A) starting from a semi-finished product composed of the two boxed semi-boxes (F and C) with base (C6 and F6) aligned in coplanar position and also in coplanar position with the three vertical sides (F1, F2, F3 and C1, C2, C3) in upward position.

[0008] Similar cardboard semi-finished products travel towards the folding station on a conveyor belt (N) that moves along a track bordered by two fixed lateral sides that guide the correct regular forward movement of the semi-finished products.

[0009] The folding station (SP) is situated immediately downstream the conveyor belt (N) and comprises a spaced pair of idler rolls (R1) arranged on the same plane as the conveyor belt (N), which receive and support the semi-finished product (S) that comes out of the conveyor belt (N).

[0010] A plane (P) with a transversal edge (ST) that stops the semi-finished product (S) coming out of the conveyor belt (N) is provided downstream the spaced pair of idler rolls (R1).

[0011] The distance (L) between the pair of idler rolls (R1) is approximately equal to half of the length of the semi-finished product (S) and each roll (R1) is positioned in such a way that when the semi-finished product (S) reaches the end of the forward movement against the transversal side (ST), each one of the boxed semi-boxes (C and F) is positioned above the corresponding idler roll (R1) that is in the centre of the bases (C6 and F6).

[0012] Moreover, the folding station (SP) comprises a second pair of idler rolls (R2) under the first pair of idler rolls (R1), which have a lower mutual distance than the distance between the upper pair of idler rolls (R1).

[0013] In any case, when the semi-finished product (S) touches the transversal side (ST), the vertical plane (X-X) passing through the longitudinal axis of the fourth side (FC4) is a symmetrical plane for both pairs of rolls (R1 and R2).

[0014] The folding station (SP) also comprises an actuator (Z) positioned in central position above the pairs of idler rolls (R1), which is designed to drive a folding blade (PA) that lays on a vertical plane into alternate vertical travels.

[0015] It must be noted that the upper dead centre and the lower dead centre of the alternate travels of the blade (PA) are respectively positioned above the pair of idler rolls (R1) and under the pair of rolls (R2).

[0016] As soon as the semi-finished product (S) reaches the end of the forward movement, the actuator (Z) is operated and the blade (PA) intercepts the fourth side (FC4) during its descending travel and drives it downwards.

[0017] By cooperating with the pair of idler rolls (R1), the blade (PA) folds the semi-finished product (S) by an angle of over 90° around the fourth side (FC4), as shown in fig. 3, and simultaneously pushes it downwards until the external sides of the bases (F6 and C6) touch the pair of rolls (R2).

[0018] As soon as the rolls (R2) come in contact with the bases (F6 and C6), the blade (PA) is returned upwards by the actuator (Z), while the rolls (R2) complete the folding operation by additional 90° of the semi-finished product (S), which is ejected under the pair of rolls (R2) in perfectly closed position.

[0019] Finally, it must be noted that on the rolls (R2) a suction device is operated and designed to grab and drag downwards the semi-finished product (S) when the push of the blade (PA) ends.

[0020] An unloading plane (N2) is positioned under the folding station (SP), where the boxes are positioned by the said device in closed vertical position, since the box comes out from the rolls (R2) in vertical position with side

(FC4) facing downwards.

[0021] In view of the foregoing description, it appears evident that the folding modes of known folding machines - where the boxed semi-boxes (C and F) are both turned over, one against the other, until they are both in vertical position - do not allow for positioning the product to be packed in the box (A) before the semi-finished product (S) is folded.

[0022] In fact, if the semi-finished product (S) is taken to the folding station (SP) loaded with a product positioned in the semi-box (F), while moving during the turning over of the semi-boxes (C and F), the product may originate the imperfect closing of the box (A), may be trapped inside the pair of rolls (R1 or R2) or may be grabbed by the blade (PA), thus stopping the folding machine.

[0023] For this reason, it is currently necessary to reopen the closed boxes (A), place the product to be packed in the box and close the box; the opening, loading and closing operations are performed in manual mode, with heavy time losses and high labour costs.

[0024] The purpose of the present invention is to devise a folding and closing system for boxes, such as the ones of the type described above, which allows for loading the product inside the box before folding and closing.

[0025] Another purpose of the present invention is to devise a folding and closing system for boxes that allows for using a cheaper folding machine than the ones that are currently available on the market.

[0026] An additional purpose of the present invention is to devise a folding and closing system for boxes, characterised by quicker actuation than the existing systems, thus allowing for packing a higher number of boxes over the same time period.

[0027] Finally, the purpose of the present invention is to devise a folding machine for the implementation of the innovative system of the present invention.

[0028] These and other purposes have been achieved with the system and folding machine of the invention, whose main characteristics are illustrated in the independent claims.

[0029] The system of the invention uses one conveyor belt only, and more precisely the same conveyor belt that feeds the folding station with semi-finished products (S) in the configuration with both bases (F6 and C6) in mutual coplanar position and also in coplanar position with the common side (FC4), while the sides (F1, F2, F3 and C1, C2, C3) are in upward position.

[0030] According to the system, the lid (C) of the box is faced forwards along the travelling direction of the conveyor belt, and means designed to grab the moving lid (C) and turn it over by 180° above the bottom (F) are provided, in such a way to close the box (A) without interrupting its forward movement on the conveyor belt and without losing the horizontal position of the bottom (F) of the box on the conveyor belt.

[0031] As a matter of fact, for some special products the semi-finished product (S) is moved on the conveyor belt with the bottom (F) facing forwards along the travelling direction, thus turning the bottom over the lid (C) by 180°.

[0032] For instance, this operating mode is possible in case of products that are trapped or stopped on the bottom (F) in a stable way, so that they can be turned over by 180° without losing their exact position on the bottom (F).

[0033] In view of the aforementioned operating modes, the folding system of the invention allows for loading the product to be packed inside the box (A) before folding and closing the semi-finished box (S), with great time and labour savings with respect to the current technique.

[0034] A folding machine has been designed to implement the system of the invention, which is provided with purely mechanical operating means that are automatically actuated because of their interference with the semi-finished product that travels on the conveyor belt, so that the only power that is required and consumed is the power necessary to operate the conveyor belt.

[0035] For major clarity, the description of the machine for the implementation of the system of the invention continues with reference to the enclosed drawings, which are intended for purposes of illustration only and not in a limiting sense, wherein:

- figures 5 to 8 illustrate the sequence of phases used to turn the lid (C) over the bottom (F) in the machine of the invention.

[0036] With reference to fig. 5, the machine for the implementation of the system of the invention comprises a folding station (SP1) fed by a conveyor belt (N1) loaded with the semi-finished products (S) to be folded, with the lid (C) in forward position along the travelling direction of the said belt (N1).

[0037] A portal structure (1 a and 1 b) is provided in the folding station (SP1), which is composed of a pair of identical lateral uprights (1 a), respectively arranged on the sides of the conveyor belt (N1), and of a cross-piece (1b) arranged above the conveyor belt (N1).

[0038] An oscillating rod or rocker arm (2) is centrally fixed on the cross-piece (1 b) in perpendicular position, with the tip facing the travelling direction of the conveyor belt (N1).

[0039] An arched claw (3) is mounted on the tip to hook the front border of the side (C2) of the semi-finished product (S), with the concavity of the claw (3) facing the side from which the semi-finished products (S) are provided.

[0040] The tip of the claw (3) is shaped in such a way to be inserted under the front transversal side (C2).

[0041] With reference to fig. 6, during the forward movement of the semi-finished product (S), when the front side (C2) touches the claw (3), the front side (C2) is raised and starts sliding along the internal profile (3a) of the claw (3) that is raised, thus causing the upward oscillation of the rod (2) that supports it.

[0042] The lid (C) starts to turn over and as soon as it

exceeds the 90° angle - which corresponds to the upper dead point of the oscillating rod (2), as shown in fig. 7 - the tip of the claw (3) tends to push the lid (C) downwards.

[0043] The weight of the rod (2) makes the lid (C) complete the downward movement by additional 90°.

[0044] The belt (N1) is provided with two lateral sides (SL) that act as guide for the correct controlled movement of the semi-finished products (S).

[0045] The sides (SL) are provided with a pair of identical opposite internally protruding tongues (L1), which are designed to slightly bend the sides (F1 and F3) of the bottom (F).

[0046] Because of the tongues (L1), immediately before the lid (C) is closed above the bottom (F), the sides (F1 and F3) of the bottom (F) are pushed by the tongues (L1) inwards, in such a way that the sides (C1 and C3) of the lid (C) are positioned externally.

[0047] The machine of the invention is also provided with a transversal bar (4) in horizontal position with adjustable height, downstream the claw (3), which is fixed to a suitable height from the belt (N1) to allow the box (A) to pass exactly under the bar (4).

[0048] If the rod (2) does not close the lid (C) of the box (A) perfectly, the bar (4) completely pushes down the lid (C) above the bottom (F) when the upper surface (C6) of the lid (C) interferes with the lower profile of the transversal bar (4) during the forward movement of the box (A) on the conveyor belt (N1), as shown in fig. 8.

Claims

1. System and machine for automatic closing of one-piece cardboard boxes (A), of the type composed of a basically identical bottom (F) and a lid (C), connected by a common side (FC4) that acts as hinge, **characterised in that** it provides for:

   - use of a conveyor belt (N1) loaded with open boxes, each of them in the configuration in which both sides of the bases (F6 and C6) of the bottom (F) and the lid (C) are in mutual coplanar position and also in coplanar position with the common side (FC4), while the corresponding sides (F1, F2, F3 and C1, C2, C3) are faced upwards;
   - positioning on the conveyor belt (N1) in such a way that the bottom (F) and the lid (C) follow each other according to the travelling direction of the conveyor belt (N1);
   - use of means (2,3) designed to grab the moving lid (C) or bottom (F) and turn them by 180° respectively over the bottom (F) or the lid (C) during the forward movement of the box (A) on the conveyor belt (N1), in such a way to close the box (A) without interrupting the forward movement on the conveyor belt (N1).

2. Machine for the implementation of the system as claimed in claim 1, **characterised in that** it comprises:

   - a conveyor belt (N1) bordered by a pair of lateral sides (SL) and designed to transport a box (A) in the configuration in which both sides of the bases (F6 and C6) respectively of the bottom (F) and the lid (C) are in mutual coplanar position and also in coplanar position with the common side (FC4), while the corresponding sides (F1, F2, F3 and C1, C2, C3) are faced upwards;
   - a folding station (SP!) provided with means (2,3) designed to grab the lid (C) or bottom (F) of the box (A) that are travelling on the conveyor belt (N1) and turn them by 180° respectively over the bottom (F) or the lid (C), in such a way to close the box (A) without interrupting the forward movement on the conveyor belt (N1).

3. Machine as claimed in the above claim, **characterised in that** the means (2,3) designed to grab the lid (C) or the bottom (F) consist in a rocker arm (2) that oscillates around a horizontal axis in transversal position above the belt (N1), the said rocker arm (2) being provided with a tip facing towards the travelling direction of the belt (N1) and supporting an arched claw (3) on the tip, with concavity facing the pivoting point of the rocker arm (2) .

4. Machine as claimed in the above claim, **characterised in that** the rocker arm (2) is fixed on a cross-piece (1b) designed to rotate around its axis, which is arranged above the conveyor belt (N1) and supported by a pair of lateral uprights (1 a) respectively arranged on the sides of the conveyor belt (N1).

5. Machine as claimed in any of the above claims 2 to 4, **characterised in that** the sides (SL) are provided with means (L1) designed to bend the lateral sides (F1 and F3) of the box (A) inwards.

6. Machine as claimed in the above claim, **characterised in that** the means (L1) designed to bend the lateral sides (F1 and F3) consist in a pair of identical opposite tongues (L1) applied on the lateral sides (SL).

7. Machine as claimed in any of the above claims, **characterised in that** it comprises a bar (4) downstream the folding station (SP1) fixed at a suitable height from the belt (N1) to allow the box (A) to pass in completely folded position.

8. Machine as claimed in the above claim, **characterised in that** the transversal bar (4) is adjustable in height.

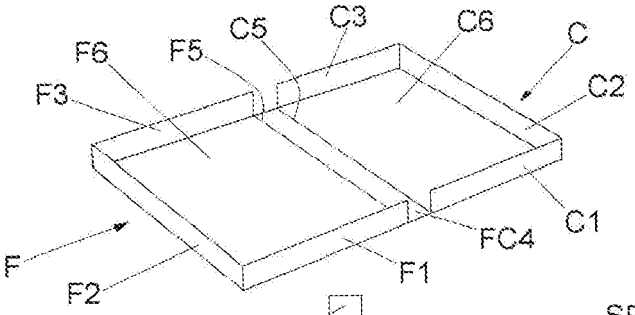

FIG. 1

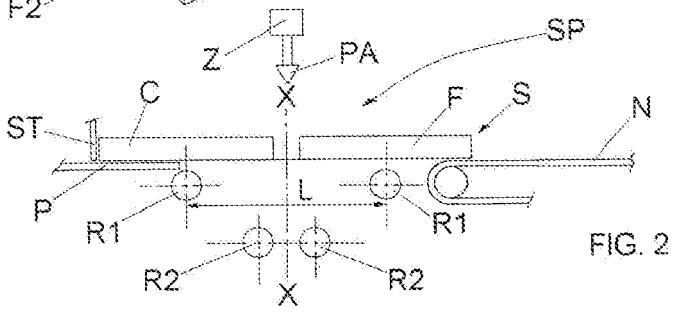

FIG. 2

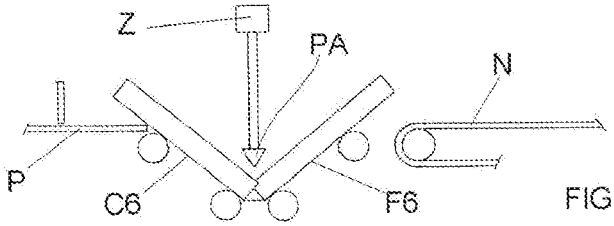

FIG. 3

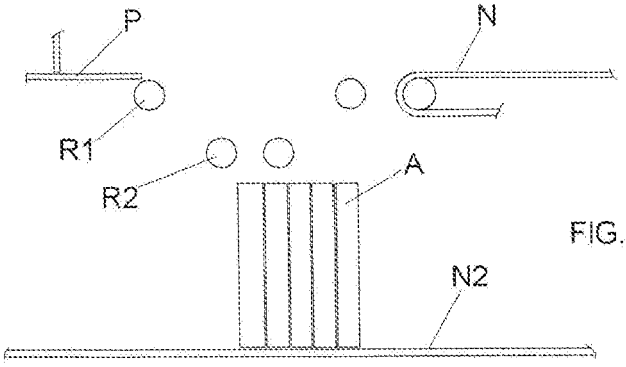

FIG. 4

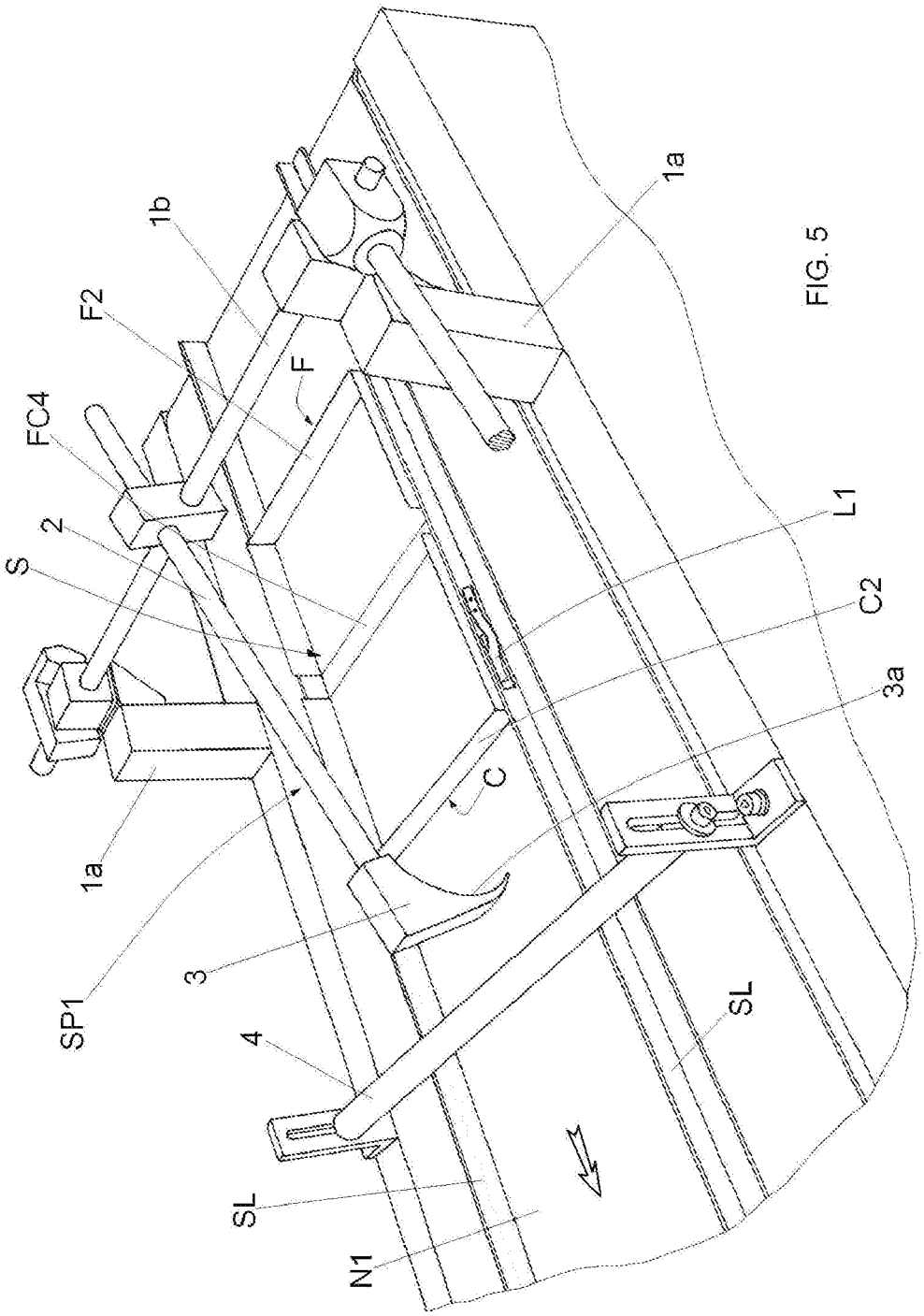

FIG. 5

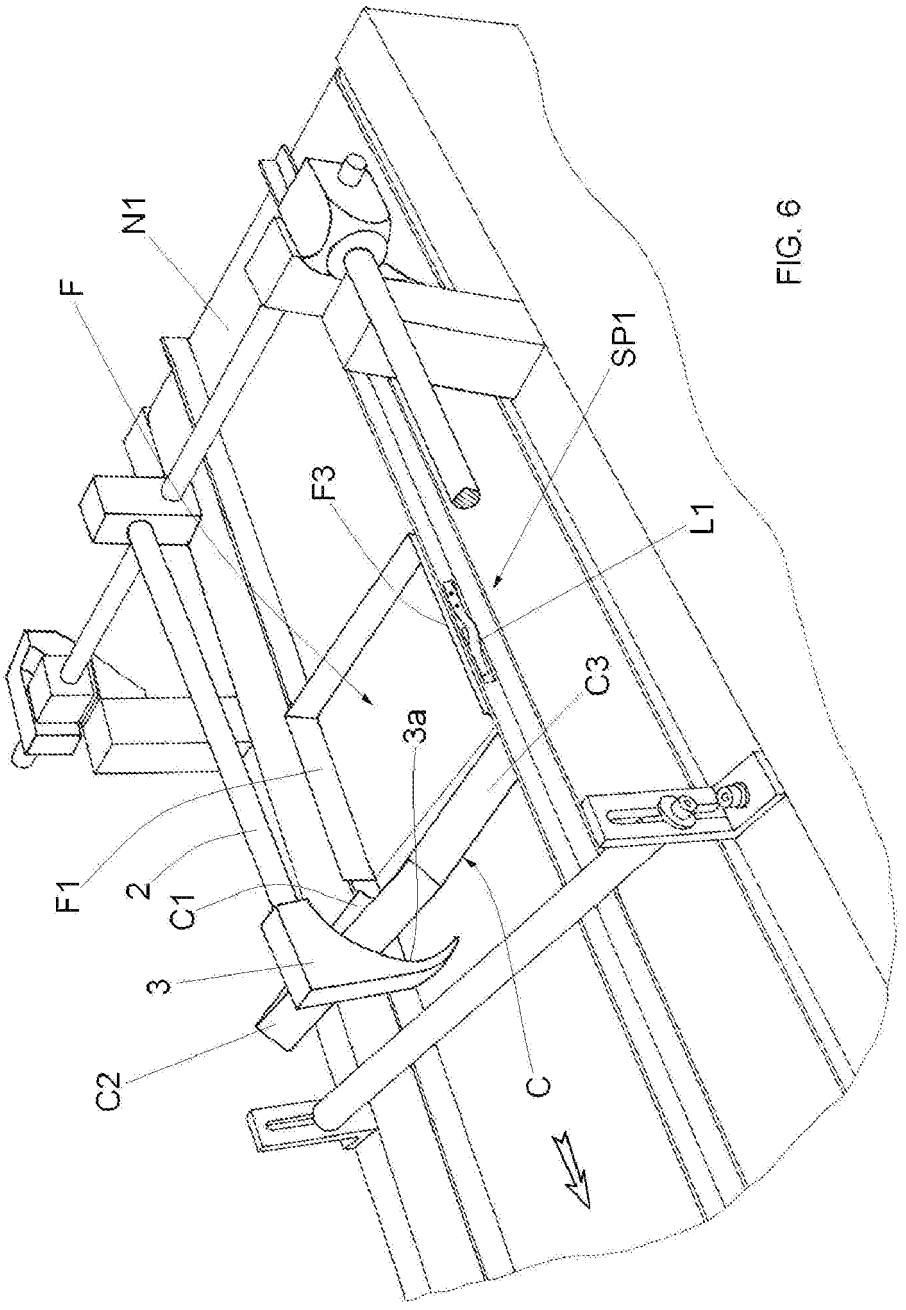

FIG. 6

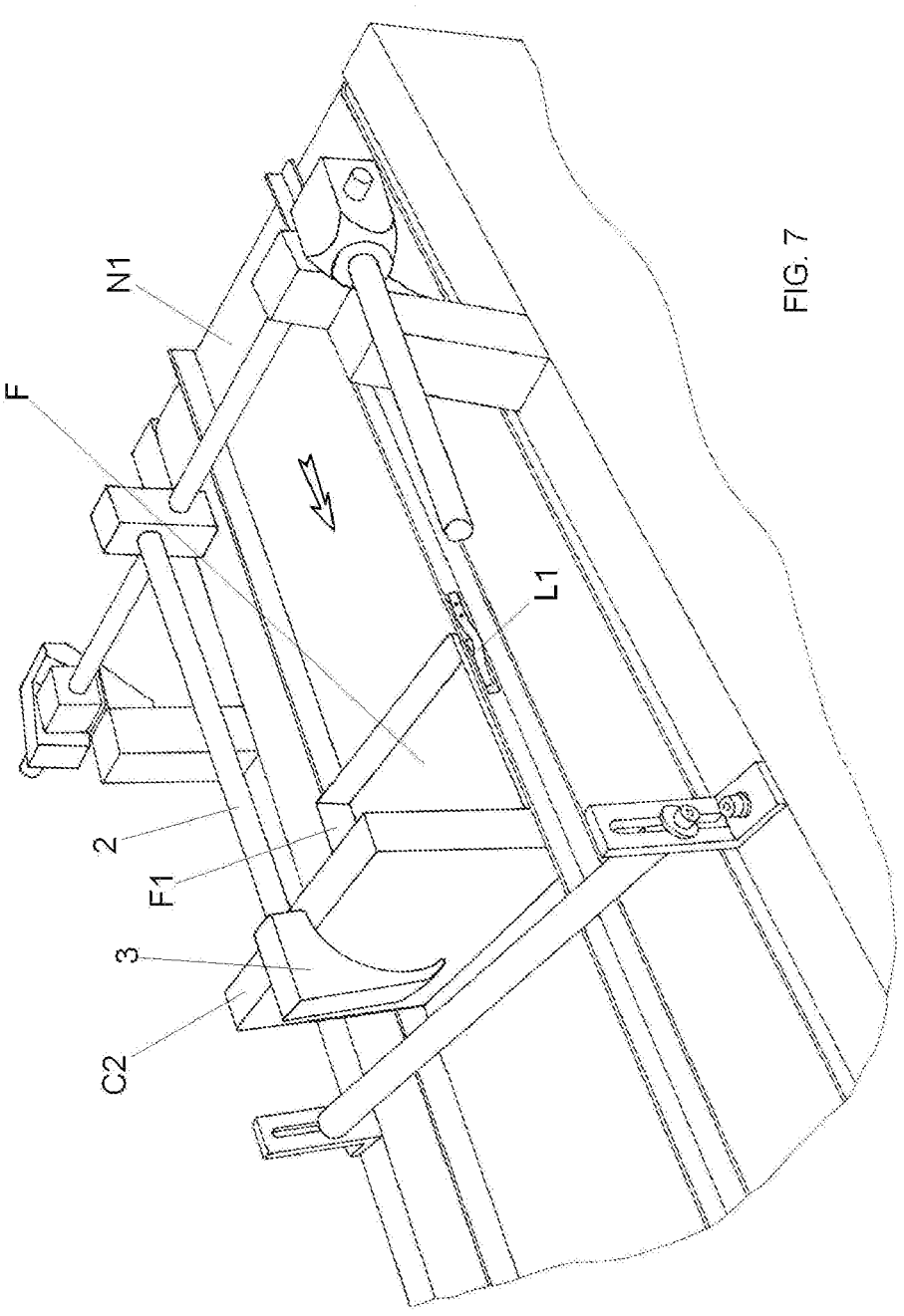

FIG. 7

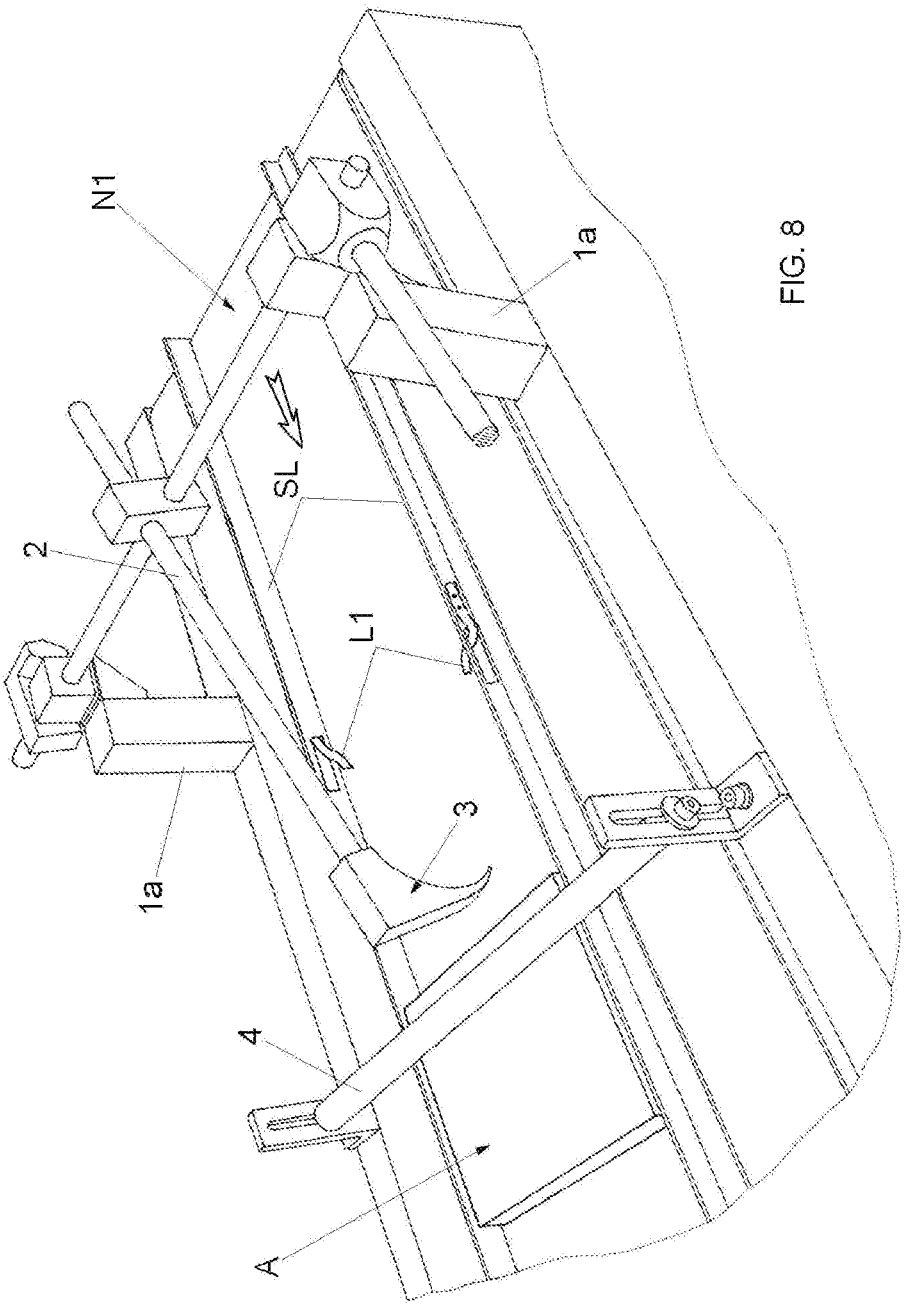

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 9967

DOCUMENTS CONSIDERED TO BE RELEVANT

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TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	2 March 2009	Schelle, Joseph

CATEGORY OF CITED DOCUMENTS

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