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(54) **Bladder-based bookbinding press and plant and bookbinding method**

(57) A bookbinding press (100) is proposed. The press is used for pressing a bookbinding article (105), which has a first side and a second side opposite to each other. The press includes a first head (150a) for acting on the first side of the bookbinding article, and a second head (150b) for acting on the second side of the bookbinding article. Actuation means (155a,155b) is provided

for selectively enabling and disabling the first and second heads. In the solution according to an embodiment of the invention, the actuation means includes inflatable means (205), means (210) for inflating the inflatable means, and means (230) for deflating the inflatable means; the inflatable means enables the first and second heads when inflated and disabled the first and second heads when deflated.

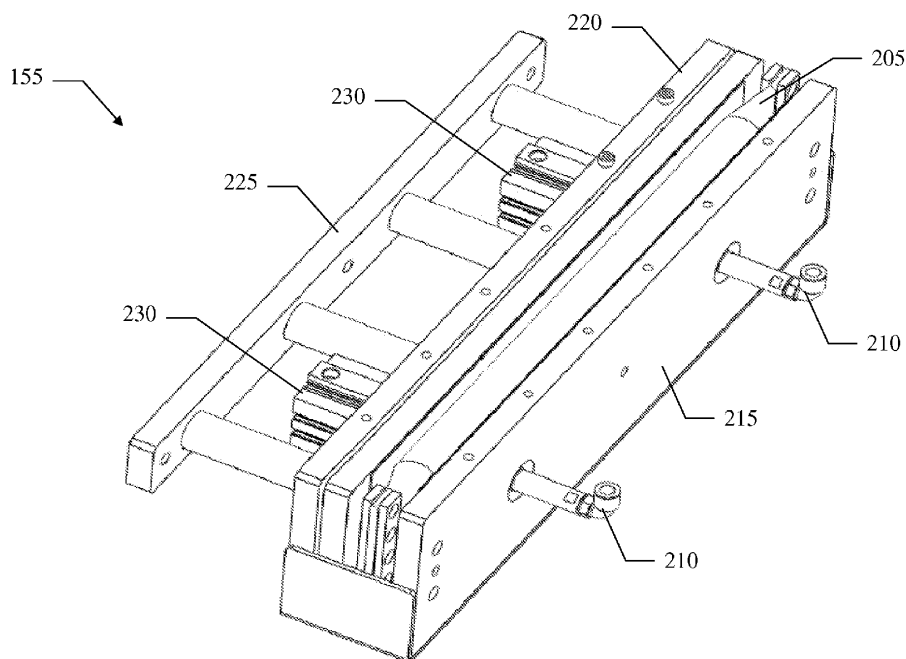


FIG.2B

Description

[0001] The solution according to one or more embodiments of the present invention relates to the bookbinding field. More specifically, this solution relates to bookbinding presses.

[0002] Bookbinding presses are commonly used for pressing bookbinding articles, such as book blocks (each one formed by a block of signatures sewn together). Indeed, the signatures of the book block are normally larger in correspondence to their spines. As a consequence, it is necessary to press the signatures among them so as to obtain a definitive bending thereof. This allows making books very compact (with a reduced occupation of space and a particularly pleasant aesthetic aspect). Moreover, the same operation also facilitates the adhesion of possible glue applied to the signatures.

[0003] The known presses are generally provided with a support plane for the book block to be pressed; the book block is arranged in vertical, with its spine resting on this plane. The press then includes two pressing jaws, which are arranged at opposite sides of the support plane. Once the book block has been positioned onto the support plane, the pressing jaws are closed (by means of respective actuators) so as to exert the desired pressure in correspondence to the spine of the book block.

[0004] The press may be either of manual type or of automatic type. In the case of manual press, an operator places each book block onto the support plane, and then removes it after its pressing. In the case of automatic press, instead, the support plane is provided with a feeding platform (for example, with pushing pegs). The platform transports each book block to be pressed to the center of the press, where it is stopped in order to allow its pressing; the platform then unloads the pressed book block to the opposite side of the press.

[0005] Typically, as described in document US-B-3731617 (the entire disclosure of which is herein incorporated by reference), the press is also provided with two clamping jaws. Each clamping jaw projects above a corresponding pressing jaw, to which it is fixed through one or more springs. In this way, when the pressing jaws are closed, the book block is firstly reached by the clamping jaws above its spine, and then by the pressing jaws in correspondence to its spine (while the springs of the clamping jaws are compressed). The clamping jaws prevent the inner signatures of the book block to raise during its pressing, thereby compromising the integrity thereof.

[0006] A problem of the known presses consists of the actuation of its jaws (either the clamping ones or the pressing ones). Indeed, the correct operation of each press requires the application of a very high force to the jaws (of the order of some hundreds of Kg). Therefore, the actuators have a relatively complex structure (in order to provide the required force). For example, the actuators may be made with hydraulic systems (capable of providing a pressure of the order of 40-60bar); however, such actuators are expensive and complex. Alternatively, it is

possible to use pneumatic cylinders, which are coupled with a force multiplier - for example, a toggle or eccentric mechanism (which converts a long stroke of the cylinders at low force into a high force with short stroke); in this case, the actuators are cumbersome and delicate.

[0007] Moreover, the jaws (when opened) should be maintained at such a distance to allow the passage of the book block between them without any interference. Therefore, a certain stroke of the jaws is required before they can reach the book block (when closed). This involves risks of misalignment of the book block on the platform (with the jaws opened), and reduces the yield of the press (because of the dead time required to move the jaws to be closed).

[0008] In its general terms, the solution according to one or more embodiments of the present invention is based on the idea of using an inflatable structure to actuate the press.

[0009] Particularly, one or more aspects of the solution according to specific embodiments of the invention are set out in the independent claims, with advantageous features of the same solution that are set out in the dependent claims, whose wording is herein incorporated *verbatim* by reference (with any advantageous feature provided with reference to a specific aspect of the solution according to an embodiment of the invention that applies *mutatis mutandis* to every other aspect thereof).

[0010] More specifically, an aspect of the solution according to an embodiment of the invention provides a bookbinding press. The press is used for pressing a bookbinding article (for example, a book block), which has a first side and a second side opposite to each other. The press includes a first head for acting on the first side of the bookbinding article, and a second head for acting on the second side of the bookbinding article. Actuation means is provided for selectively enabling and disabling the first and second heads. In the solution according to an embodiment of the invention, the actuation means includes inflatable means (for example, a bladder), means for inflating the inflatable means, and means for deflating the inflatable means; the inflatable means enables the first and second heads when inflated and disables the first and second heads when deflated.

[0011] Another aspect of the solution according to an embodiment of the invention provides a bookbinding plant including one or more of these presses.

[0012] A further aspect of the solution according to an embodiment of the invention provides a corresponding method for pressing bookbinding articles.

[0013] The solution according to one or more embodiments of the invention, as well as further features and the advantages thereof, will be best understood with reference to the following detailed description, given purely by way of a non-restrictive indication, to be read in conjunction with the accompanying drawings (wherein, for the sake of simplicity, corresponding elements are denoted with equal or similar references and their explanation is not repeated). In this respect, it is expressly in-

tended that the figures are not necessarily drawn to scale (with some details that may be exaggerated and/or simplified) and that, unless otherwise indicated, they are merely used to conceptually illustrate the structures and procedures described herein. Particularly:

FIG. 1 shows a simplified representation of a book-binding press according to an embodiment of the invention,

FIG.2A-FIG.2B show simplified representations of an actuator of the press according to an embodiment of the invention in different operative conditions, and FIG.3A-FIG.3B show front views of the press according to an embodiment of the invention in different operative conditions.

[0014] With reference in particular to FIG. 1, a simplified representation of a bookbinding press 100 according to an embodiment of the invention is shown.

[0015] The press 100 is used to compress bookbinding articles, such as a book block 105. The book block 105 is formed by a block of signatures sewn together (in correspondence to respective spines). The book block 105 is supplied to the press 100 by a sewing machine (not shown in the figure) being arranged vertically lengthways, with its spine turned downwards.

[0016] The press 100 includes a bearing frame 110. A support plane 115 (fixed to the frame 110) is used to receive the book block 105 (with the spine resting thereon); the support plane 115 has a size higher than a maximum length and a maximum width of the book blocks to be pressed (for example, 30x60cm). The support plane 115 extends longitudinally between two lateral blocks 120a and 120b. The lateral block 120a is fixed to the frame 110 (beside the support plane 115). The lateral block 120b is instead mounted on the frame 110 through a linear regulating system 125 (for example, of the screw/thread type), which is driven by an electric motor 128. In this way, the lateral block 120b may be moved from a free edge of the support plane 115 inwards, so as to form a channel over it with a variable width (defined by the distance between the lateral blocks 120a and 120b). Two pairs of restraining bars 130a and 130b (adjustable in height) are fixed over the lateral blocks 120a and 120b, respectively, in order to maintain the book block 105 straight.

[0017] Each lateral block 120a, 20b includes an endless transporting belt 135a,135b; the belt 135a,135 is arranged vertically, facing the support plane 115 (over it along its whole length). An electric motor 140 rotates the belts 135a and 135b according to a feeding direction of the book block 105 (counter-clockwise and clockwise, respectively, looking from the top). A photocell (not shown in the figure) detects an entering of the book block 105 into the press 100; an encoder 145 measures a position of the book block 105 along the support plane 115, and controls the motor 140 (and then the belts 135a, 135b) accordingly.

[0018] Each lateral block 120a,120b further includes a head 150a,150b for acting on a corresponding side of the book block 105, which head extends along a prevalent central portion of the lateral block 120a, 120b (at least equal to the maximum length of the book blocks to be pressed). An actuator 155a,155b selectively enables and disables the head 145a,145b (as described in detail in the following).

[0019] The operation of the press the 100 is controlled by a programmable logic controller (PLC) of the sewing machine (not shown in the figure).

[0020] Before the execution of a job involving the processing of a batch of book blocks of the same type, the position of the lateral block 120b is regulated (through the motor 128), so that the distance between the lateral blocks 120a and 120b is equal to the width of the book blocks to be processed. During the actual execution of the job, the book blocks are then supplied in succession to the press 100 (by the sewing machine). As soon as a generic book block 105 reaches the press 100, it is seized by the belts 135a,135b that transport it along the support plane 115 (avoiding any risk of its misalignment). The photocell detects the entering of the book block 105 into the press 100; when the encoder 145 determines that the book block 105 has reached the center of the support plane 115 (according to its length and the speed of the belts 135a,135b), the motor 140 stops the belts 135a, 135b. At this point, the actuators 155a and 155b enable the heads 150a and 150b, respectively, so as to compress the book block 105 (as described in detail in the following). Once the pressing of the book block 105 has been completed, the actuators 155a and 155b disable the heads 150a and 150b, respectively (so as to free the book block 105). The belts 135a,135b are then caused to start again (through the motor 140) for unloading the (pressed) book block 105 to the opposite end of the press 100 (for example, supplying it to further machines, not shown in the figure, which complete a correspondent book).

[0021] Considering now FIG.2A-FIG.2B, there are shown simplified representations of a generic actuator of this press (simply denoted with the reference 155) according to an embodiment of the invention in different operative conditions.

[0022] Starting from the FIG.2A, the actuator 155 is based on a bladder 205, made of a flexible material (for example, rubber); the bladder 205 (for example, shaped like a cushion being closed at its longitudinal ends by corresponding pairs of plates) extends along the whole length of the corresponding head, not shown in the figure (for example, with a length of 50-70cm, a height of 20-40cm, and a width of 1-3cm). Two input tubes 210 connect the bladder 205 to a compressor, not shown in the figure.

[0023] The bladder 205 is housed between a fixed plate 215 and a mobile plate 220 facing to each other. The fixed plate 215 is integral with the frame of the press, not shown in the figure; the mobile plate 220 is instead

mounted on the frame of the press so as to be slidable horizontally. A bar 225 (with a length substantially equal to that of the mobile plate 220) is fixed to the mobile plate 220 at the opposite side of the fixed plate 215 (through four horizontal columns); the bar 225 is connected to the corresponding head for driving it according to the position of the mobile plate 220 (as described in detail in the following). Two pneumatic pistons 230 (fixed to the frame of the press) act on the mobile plate 220 for pushing it towards the fixed plate 215.

[0024] In the condition shown in the figure, the bladder 205 is deflated (with the air inside it at the ambient pressure - i.e., approximately 1bar). Therefore, the mobile plate 220 is close to the fixed plate 215; in this way, the bar 225 maintains the corresponding (disabled) head retracted.

[0025] Passing to the FIG.2B, the bladder 205 is inflated by inserting compressed air into it through the tubes 210 (for example, with a pressure of 5-7bar). As a consequence, the bladder 205 expands thereby exerting a corresponding force onto the plates 215 and 220. Therefore, the mobile plate 220 is moved away from the fixed plate 215; in this way, the bar 225 extracts the corresponding head (thereby enabling it).

[0026] The solution according to an embodiment of the invention allows obtaining the required high force (for pressing the block book) with a limited pressure inside the bladder 205 (thanks to its large surface); for example, a bladder 205 with a surface of 400cm² allows obtaining (with a pressure of 6bar) a force of 2,400Kg. As a consequence, it is possible to use a simple and economic compressor. Moreover, such structure is not cumbersome and it is reliable.

[0027] Once the pressing of the book block has been completed, the bladder 205 is deflated by removing the air from its inside through the tubes 210 (down to bring it back to the ambient pressure). As a consequence, the bladder 205 shrinks thereby allowing the mobile plate 220 to return towards the fixed plate 215; in this way, the bar 225 retracts the corresponding head (thereby disabling it), so as bring the actuator 155 back to the condition of the FIG.2A.

[0028] For this purpose, the tubes 210 are advantageously provided with fast exhausting connectors, which enlarge automatically in presence of a depression (at the side of the compressor) for facilitating the deflation of the bladder 205. As a further improvement, in such phase there are also actuated the pistons 230, which push the mobile plate 220 towards the fixed plate 215; in this respect, it should be noted that the pistons 230 may be little and simple (since they should provide a limited force, only necessary to push the air outside the bladder 205). In this way, the deflation of the bladder 205 is facilitated, and the disabling of the corresponding head is made faster (with a positive effect on the yield of the press).

[0029] Front views of the press 100 according to an embodiment of the invention in different operative conditions are shown in FIG .3A-FIG.3B.

[0030] Starting from the FIG.3A, each head 150a,150b includes a carriage 350a,305b slidable horizontally with respect to the frame 110. A pressing jaw 310a,310b is fixed to the carriage 305a,350b, so as to be just above the support plane 115. The pressing jaw 310a,310b has an outer end connected to the corresponding actuator 155a,155b, and a free inner end that faces a corresponding side of the book block 105 in correspondence to its spine. A clamping jaw 315a,315b is fixed above the pressing jaw 310a,310b through a series of springs (not shown in the figure), distributed along the length of the support plane 115. The clamping jaw 315a,315b extends inside the corresponding belt 135a,135b, with an inner free end thereof that contacts the same in correspondence to the support plane 115.

[0031] In the condition shown in the figure, the heads 150a,150b are disabled. Particularly, the bar of each actuator 155a,155b maintains the corresponding pressing jaw 310a,310b retracted outwards the press 100. In this way, the pressing jaw 310a,310b is spaced apart from the book block 105. At the same time, the clamping jaw 315a,315b is slightly pressed against the corresponding belt 135a,135b thereby compressing its springs accordingly; therefore, the elastic reaction force exerted by such springs onto the clamping jaw 315a,315b pushes the same against the corresponding belt 135a,135b. In this way, the belts 135a,135b are maintained slightly pressed against the book block 105 for dragging it along the support plane 115 (with the springs distributed along the clamping jaws 315a,315b that provide a uniform pressure).

[0032] Passing to the FIG.3B, when the heads 150a,150b are enabled, the bar of each actuator 155a,155b pushes the corresponding pressing jaw 310a,310b inwards the press 100. Therefore, the clamping jaw 315a,315b is pressed with greater force against the corresponding belt 135a,135b and then against the book block 105, up to compress its springs completely; in this way, the clamping jaws 315a,315b exert a corresponding force onto the book block above its spine (loading the belts 135a,135b in a symmetrical way thanks to the central position along them of the book block 105). At the same time, the pressing jaw 310a,310b reaches the book block 105 (in correspondence to its spine), and it is then pressed with force against the same; in this way, the pressing jaws 310a,310b compress the book block 105 in correspondence to the spine (with the clamping jaws 315a,315b that prevent the inner signatures of the book block 105 to raise during its pressing).

[0033] In the above-described structure according to an embodiment of the invention, the clamping jaws 315a,315b are integrated with the belts 135a,135b; this reduces the space occupied by the press 100 and avoids dirtying problems of the book block 105 during its pressing. Moreover, this allows acting on the book block 105 without any movement of the clamping jaws 315a,315b (since they are already in contact with the belts 135a,135b for their normal operation); in this way, it is possible to obtain

a greater yield of the press 100 (thanks to the absence of any dead time for moving the clamping jaws 315a, 315b).

[0034] Once the pressing of the book block 105 has been completed, the heads 150a, 150b are disabled, with each actuator 155a, 155b that retracts the corresponding pressing jaw 310a, 310b outwards the press 100. In this way, the pressing jaw 310a, 310b is moved away from the book block 105 thereby freeing it. At the same time, the clamping jaw 315a, 315b as well is moved away from the book block 105, thereby reducing the compression of its springs and then the push exerted by the clamping jaw 315a, 315b against the corresponding belt 135a, 135b (bringing the press 100 back to the condition of the FIG. 3A).

[0035] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many logical and/or physical modifications and alterations. More specifically, although this solution has been described with a certain degree of particularity with reference to one or more embodiments thereof, it should be understood that various omissions, substitutions and changes in the form and details as well as other embodiments are possible (for example, with respect to numerical values and compositions). Particularly, different embodiments of the invention may even be practiced without the specific details set forth in the preceding description to provide a more thorough understanding thereof; conversely, well-known features may have been omitted or simplified in order not to obscure the description with unnecessary particulars. Moreover, it is expressly intended that specific elements and/or method steps described in connection with any embodiment of the disclosed solution may be incorporated in any other embodiment as a matter of general design choice.

[0036] Particularly, similar considerations apply if the press has a different structure or includes equivalent components, or it has other operative characteristics - for example, with the screw/thread system that is driven manually according to the size of the book blocks to be pressed. In any case, every component thereof may be separated into more elements, or two or more components may be combined together into a single element; moreover, each component may be replicated to support the execution of the corresponding operations in parallel. It is also pointed out that (unless specified otherwise) any interaction between different components generally does not need to be continuous, and it may be either direct or indirect through one or more intermediaries.

[0037] Moreover, the press may be used for pressing any other bookbinding article (for example, books after the application of the covers, signatures still to be sewn, either in blocks or individually); likewise, the heads may have a different structure (for example, with heating coils).

[0038] Nothing prevents providing a single actuator that acts on a corresponding head (with the other head

that is fixed).

[0039] The bladders may be made of any other material and/or with any other shape (for example, tube-like); moreover, they may be inflated to a different pressure (also with a gas different from the air).

[0040] Each actuator may act on the corresponding head in a different way; for example, in an alternative implementation the air is inserted (through suitable valves) into a rigid chamber provided with a plunger connected to the head.

[0041] Each actuator may be provided with equivalents means for facilitating the deflation of its bladder (for example, replacing the pistons with springs that are compressed during its inflation) - even if such feature is not strictly necessary.

[0042] The press may also be used out-of line (with manual book block loading/unloading and actuation of the heads); in this case, the press will not be provided with any transporting belt of the book blocks.

[0043] The possibility of having the heads (which press the book blocks) and the belts (which transport them through the press) completely independent is not excluded.

[0044] Moreover, it is also possible to maintain the clamping jaws slightly spaced apart from the belts when the heads are disabled.

[0045] Nothing prevents having the pressing jaws as well acting on the book block through the corresponding belts (in addition or in alternative to the clamping jaws).

[0046] Moreover, the clamping jaws may be mounted on the pressing jaws in another way (for example, with a layer of elastic material); in any case, the clamping jaws may be independent of the pressing jaws (with two distinct actuators, either equal or different to each other).

[0047] It should be noted that the above-described actuators may also be used in a press with a standard transport system of the book blocks (for example, platform-based); *vice-versa*, the above-described transport system may be used in a press with standard actuators (for example, of hydraulic type or based on pneumatic cylinders).

[0048] The proposed press lends itself to be used in any other bookbinding system (for example, connected to the output of a casing machine). Moreover, the press may also be used as by-pass for book blocks that do not have to be pressed (for example, when formed by a reduced number of signatures); in such case, the transport belts are made to turn continuously thereby transporting the book blocks through the press without stopping for their pressing.

[0049] Similar considerations apply if the same solution is implemented with an equivalent method (by using similar steps with the same functions of more steps or portions thereof, removing some steps being non-essential, or adding further optional steps); moreover, the steps may be performed in a different order, concurrently or in an interleaved way (at least in part).

Claims

1. A bookbinding press (100) for pressing a bookbinding article (105) having a first side and a second side opposite to each other, the press including:

a first head (150a) for acting on the first side of the bookbinding article,
a second head (150b) for acting on the second side of the bookbinding article, and
actuation means (155a, 155b) for selectively enabling and disabling the first and second heads,

characterized in that

the actuation means includes inflatable means (205), means (210) for inflating the inflatable means, and means (230) for deflating the inflatable means, the inflatable means enabling the first and second heads when inflated and disabling the first and second heads when deflated.

2. The press (100) according to claim 1, wherein the inflatable means (205) includes a first inflatable element (205) for acting on the first head (150a), and a second inflatable element (205) for acting on the second head (150b).

3. The press (100) according to claim 2, wherein each inflatable element (205) is a bladder.

4. The press (100) according to claim 2 or 3, further including a support frame (110), wherein for each inflatable element (205) the actuation means (155a, 155b) includes a fixed abutment (215) integral with the frame and a movable abutment (220) slidably mounted on the frame, the inflatable element being arranged between the fixed abutment and the movable abutment to force the movable abutment away from the fixed abutment when inflated and to allow the movable abutment to return towards the fixed abutment when deflated, the movable abutment acting on the corresponding head (150a, 150b).

5. The press (100) according to claim 4, wherein the means for deflating (230) includes means for biasing the movable abutment (220) towards the fixed abutment (215).

6. The press (100) according to any claim from 1 to 5, further including transport means (135a, 135b) for transporting the bookbinding article (105) across the press (100), the transport means including a first belt (135a) for acting on the first side of the bookbinding article and a second belt (135b) for acting on the second side of the bookbinding article.

7. The press (100) according to claim 6, wherein each head (150a, 150b) is configured to act at least in part

on the bookbinding article (105) through the corresponding belt (135a, 135b).

8. The press (100) according to claim 7, wherein the head (150a, 150b) is configured to exert a first force on the belt (135a, 135b) when disabled for allowing the belt to transport the bookbinding article (105), and wherein the head is configured to exert a second force higher than the first force on the belt when enabled for pressing the bookbinding article.

9. The press (100) according to claim 8, wherein each head (150a, 150b) includes a pressing jaw (310a, 310b) for pressing the bookbinding article (105) close to a spine thereof to compact the bookbinding article, and a clamping jaw (315a, 315b) for pressing the bookbinding article in a central area thereof to prevent a deformation of the bookbinding article during the compacting thereof, the clamping jaw acting on the bookbinding article through the corresponding belt (135a, 135b).

10. The press (100) according to claim 9, wherein the actuation means (155a, 155b) is configured to act on at least one of the pressing jaws (310a, 310b), each clamping jaw (315a, 315b) being resiliently mounted on the corresponding pressing jaw.

11. A bookbinding plant including at least one press (100) according to any claim from 1 to 10.

12. A method for pressing a bookbinding article (105) having a first side and a second side opposite to each other in a bookbinding press (100), the method including the step of:

selectively enabling and disabling a first head (150a) and a second head (150b) of the press for acting on the first side and on the second side, respectively, of the bookbinding article,

characterized in that

the step of selectively enabling and disabling includes:

inflating and deflating, respectively, inflatable means (205), the inflatable means enabling the first and second heads when inflated and disabling the first and second heads when deflated.

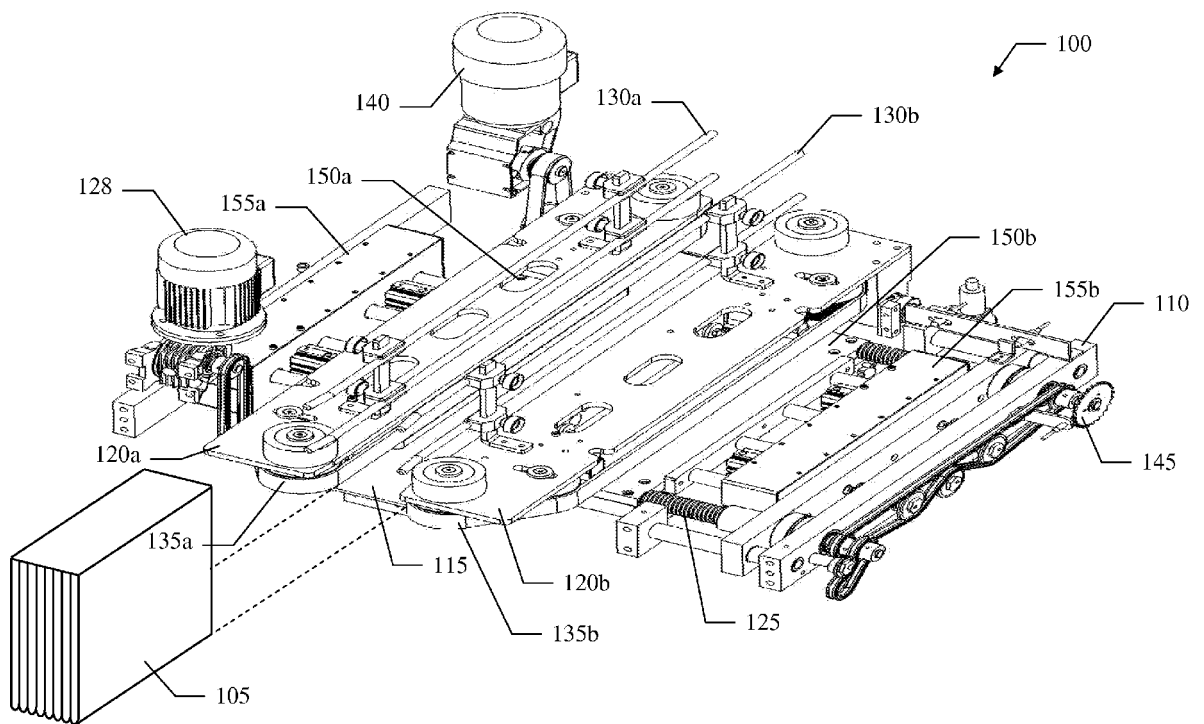


FIG.1

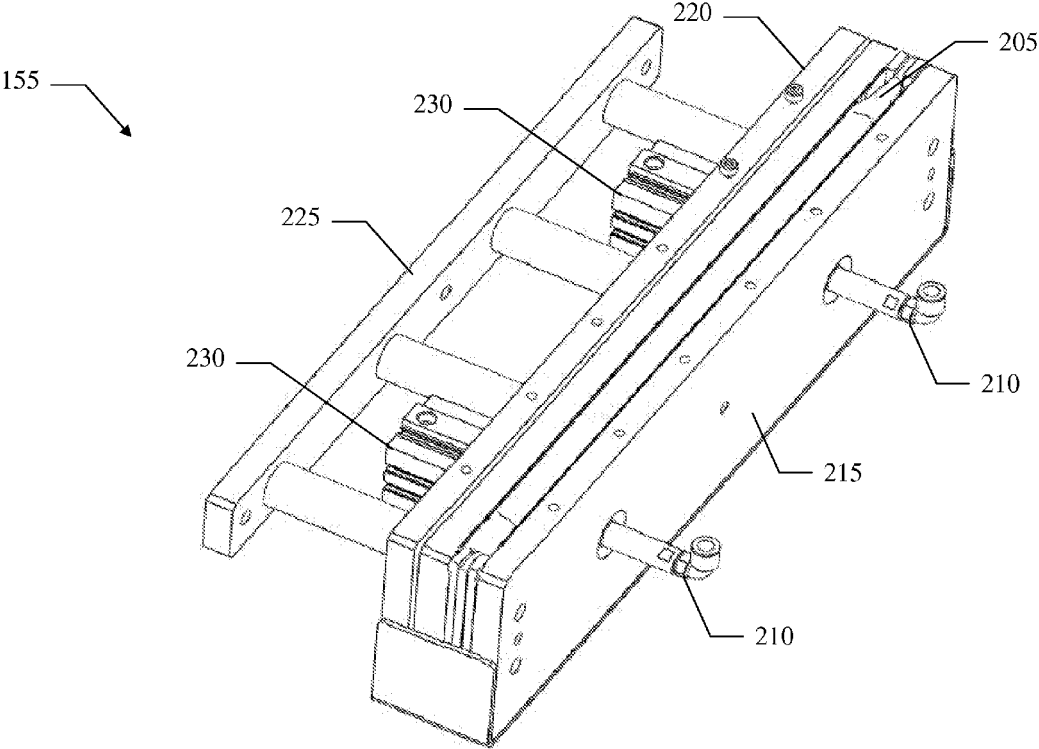


FIG.2A

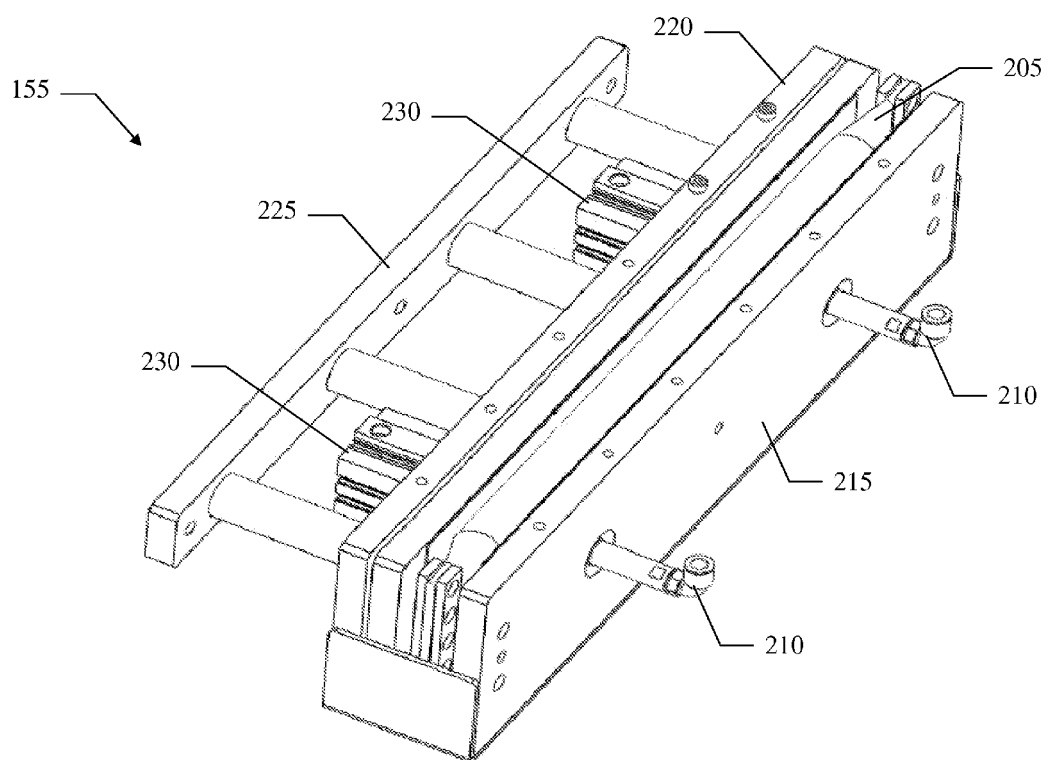
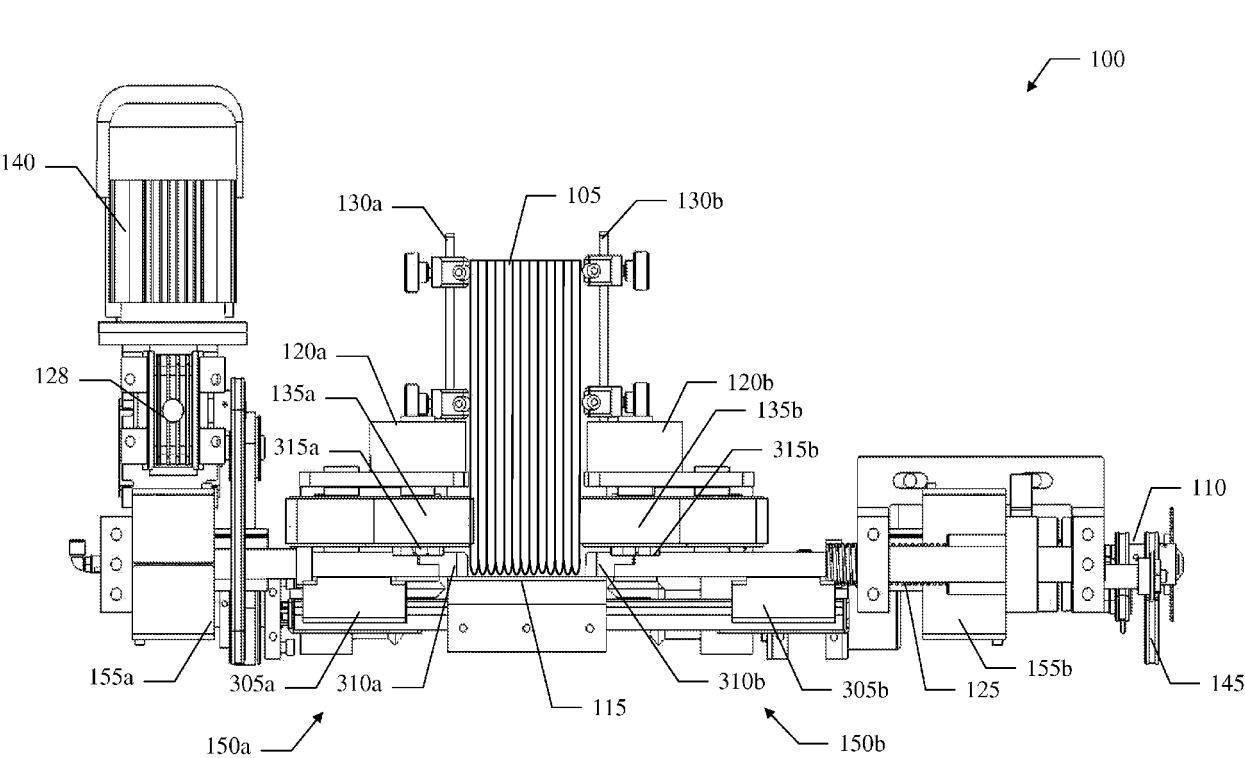


FIG.2B



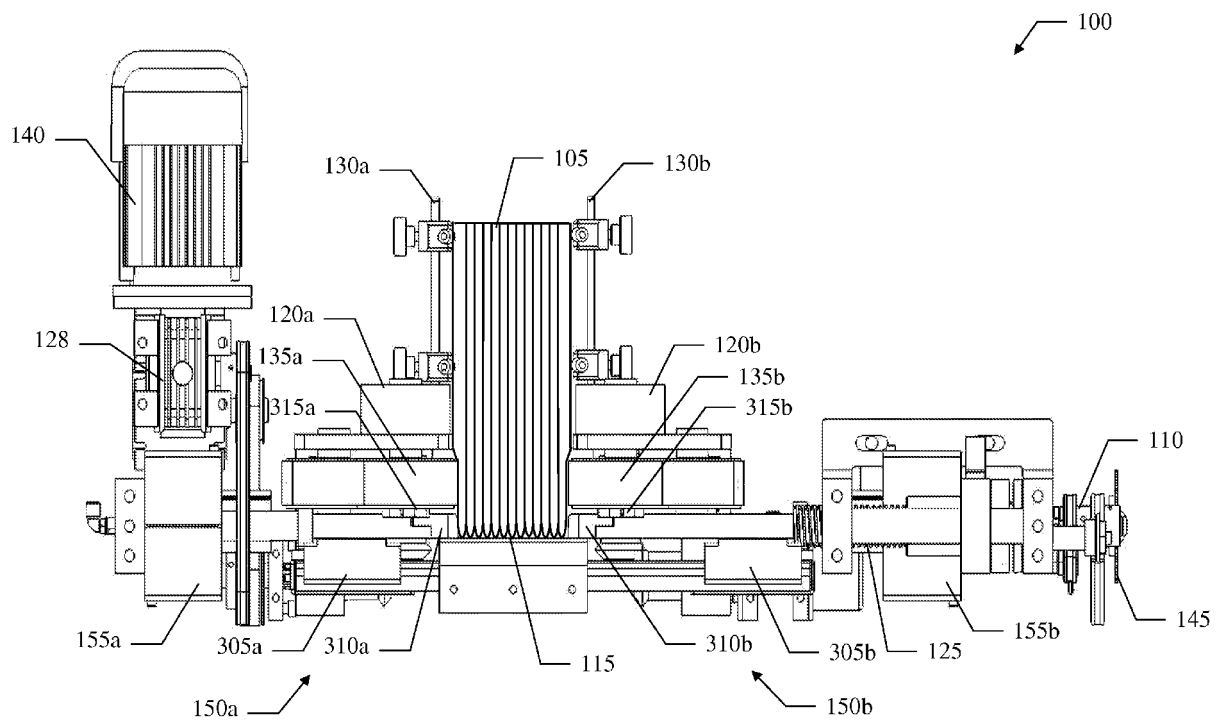


FIG.3B



EUROPEAN SEARCH REPORT

Application Number
EP 11 15 6175

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 3 731 617 A (HALL L) 8 May 1973 (1973-05-08) * page 4, line 4 - page 8, line 30; figure 9 *	1-12	INV. B42C13/00
A	DE 34 17 870 A1 (HUNKELER AG JOS [CH]) 22 November 1984 (1984-11-22) * page 3, line 21 - page 5, line 10; figures 1,2 *	1-12	
A	EP 1 410 925 A2 (HEIDELBERGER DRUCKMASCH AG [DE] GOSS INT AMERICAS INC [US]) 21 April 2004 (2004-04-21) * paragraph 19 - sentence 30; figures 1-8 *	1-12	
A	DE 25 46 944 A1 (POEHL ANDREAS P I) 1 September 1977 (1977-09-01) * page 16, last paragraph - page 17, paragraph first; claim 1; figure 8 *	1-12	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 4 May 2011	Examiner Zacchini, Daniela
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

2
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 11 15 6175

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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REFERENCES CITED IN THE DESCRIPTION

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