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(54) A book binding system

(57) A book binding system (100) including a feeding station (110-125) for providing stacks of signatures (130) in sequence, at least one sewing machine of the signatures (135a-135b), a distribution station (140,145a-145b,170a-170b,175a-175b) for distributing the stacks of signatures to each sewing machine, wherein the distribution station includes a friction-type conveying element (140) for conveying the stacks of signatures from the feeding station to the at least one sewing machine along an open path and, for each sewing machine, stopping means (145a-145b) for stopping a stack of signatures in proximity of the sewing machine and means (170a-170b,175a-175b) for unloading from the conveying element and providing to the sewing machine the stopped stack of signature.

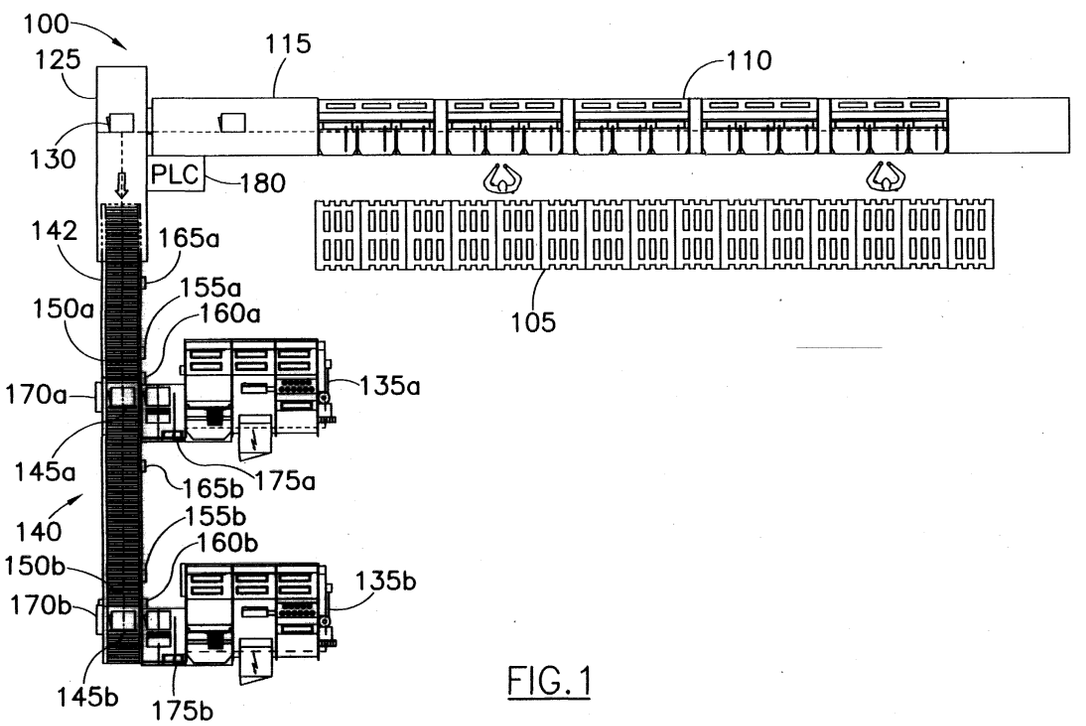

FIG. 1

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Description

[0001] The present invention relates to a book binding system.

[0002] Book binding systems are commonly used for making sewed books. A book binding system generally consists of a feeding station that supplies stacks of signatures in sequence to a sewing machine, which sews the signatures to each other in order to form the books. The sewing machine has an operating speed that is lower than the one of the feeding station; therefore, several sewing machines operating in parallel are very often employed in the book binding systems. In this case, the sewing machines are connected to the feeding station through a station that distributes the stacks of signatures to each sewing machine.

[0003] A known solution consists of arranging a sorting machine downstream the feeding station. The sorting machine moves the stacks of signatures transversally to a feeding direction thereof, so as to split the stacks of signatures provided by the feeding station into several parallel lines. The stacks of signatures of each line are then placed on a corresponding roller bed, arranged transversally to the feeding direction, which conveys the stacks of signatures to the associated sewing machine.

[0004] A drawback of this solution consists in the fact that the structure described above is not able to serve a high number of sewing machines efficiently; in fact, in the case of more than three sewing machines the moving operation carried out by the sorting machine may bring about a skew of the signatures, with consequent malfunctioning of the whole book binding system. Moreover, the roller beds of each sewing machine (arranged transversally to the feeding direction of the stacks of signatures) make this structure very cumbersome.

[0005] A different known solution consists of providing a ring that causes a series of conveying boxes for the stacks of signatures to rotate continually; the feeding station and the sewing machines are arranged around the ring, suitably spaced apart. Every time a sewing machine needs a stack of signatures, a full box is stopped in front of the sewing machine, which withdraws the stack of signatures from it. The feeding station directly loads the empty boxes when they transit in proximity of it.

[0006] The structure described above is extremely expensive, so that the required investment is justified only when a high number (at least three) of sewing machines is foreseen. Moreover, also in this case the book binding system needs considerable resources in terms of space.

[0007] It is an object of the present invention to overcome the above-mentioned drawbacks. In order to achieve this object, a book binding system as set out in the first claim is proposed.

[0008] Briefly, the present invention provides a book binding system including a feeding station for providing stacks of signatures in sequence, at least one sewing machine of the signatures, a distribution station for distributing the stacks of signatures to each sewing machine, wherein the distribution station includes a friction-type conveying element for conveying the stacks of signatures from the feeding station to the at least one sewing machine along an open path and, for each sewing machine, stopping means for stopping a stack of signatures in the proximity of the sewing machine and means for unloading from the conveying element and providing to the sewing machine the stopped stack of signature.

[0009] Moreover, the present invention also provides a distribution station for use in this book binding system and a corresponding method for distributing the stacks of signatures.

[0010] Further features and the advantages of the book binding system according to the present invention will be made clear by the following description of a preferred embodiment thereof, given purely by way of a non-restrictive indication, with reference to the attached figures, in which:

Fig.1 is a schematic block diagram of the book binding system,

Fig.2a and 2b depict a detail of the book binding system in side view and plan view, respectively.

[0011] With reference in particular to Fig.1, there is shown a system 100 that is used in a book binding plant for making sewed books. Each book is obtained sewing together a series of signatures (in a pre-set number); each signature consists of a large printed sheet that is folded up one or more times (so as to form the pages of the book).

[0012] The signatures are carried near the book binding system 100 using a series of pallets 105. The signatures are grouped into homogeneous sets, each one consisting of signatures of a same type (i.e., forming the same pages of the book). One or more operators take the signatures from the pallets 105 and place them on a collecting machine 110. The collecting machine consists of a series of boxes, each one loaded with the signatures of a corresponding type. The signatures are caused to fall one by one on a conveying element (not shown in the figure); the conveying element picks up the signatures in blocks, each one defining a book.

[0013] The blocks of signatures are provided to a connection channel 115, which conveys the blocks of signatures to a stacking machine 125. The stacking machine 125 picks up and places several blocks of signatures (for instance some tens) one upon the others, so as to form corresponding stacks of signatures 130. The stacks of signatures 130 are output in sequence, for instance at a speed of the order of a hundred of stacks of signatures per minute. As described in detail in the following, the stacks of signatures 130 are then distributed to one or more sewing machines 135a,135b (two of which shown in the figure); typically, each sewing ma-

chine 135a,135b has an operating speed that is lower than the one of the stacking machine 125, for instance of the order of some tens of stacks of signatures per minute.

[0014] Similar considerations apply if the book binding system has a different structure, for instance if the collecting machine 110, the channel 115 and the stacking machine 125 are replaced by another equivalent feeding station, if the sewing machines are in a different number, if the stacking machine and the sewing machines have a different operating speed, and the like.

[0015] In the book binding system 100, in addition to the known structure described above, there is provided a straight friction-type roller bed 140, on which the stacks of signatures 130 supplied by the stacking machine 125 are placed. The friction-type roller bed 140 consists of a series of friction-type rolls 142 arranged transversally to a longitudinal axis thereof. Each roll is formed by a shaft on which a series of small bushes are fitted. The shaft drags the bushes in rotation by frictional force, which bushes then causes the stacks of signatures 130 to move towards the sewing machines 135a-135b; however, an obstacle arranged along the friction-type roller bed 140 is able to stop the stacks of signatures 130 (with the bushes that idle on the corresponding shafts).

[0016] The stacking machine 125 is arranged near a beginning of the friction-type roller bed 140 (according to a moving direction of the stacks of signatures 130), while the sewing machines 135a,135b are placed along the friction-type roller bed 140, at its side; particularly, a last sewing machine 135b is placed near an end of the friction-type roller bed 140. The friction-type roller bed 140 is partitioned into two sectors 140a and 140b (for example, each one with a length of 2-5m); the sector 140a extends from the stacking machine 125 to the sewing machine 135a, while the sector 140b extends from the sewing machine 135a to the sewing machine 135b.

[0017] Each sector 140a,140b is provided with a respective stop element (or time-marker) 145a,145b; the stop element 145a,145b is movable between a working position in which it stops a stack of signatures 130 in the proximity of the sewing machine 135a,135b and a non-working position in which it allows the stacks of signatures 130 to pass by. A further stop element 150a,150b is used in a similar way for stopping the stacks of signatures 130 upstream the respective sewing machine 135a,135b. Particularly, each stop element 150a, 150b directly stop a first stack of signatures 130 (which rests against the stop element 150a,150b); a further stack of signatures 130 is stopped by the first stack of signatures 130 and so on, so as to form a line of compacted stacks of signatures 130 (for instance about ten).

[0018] A sensor 155a,155b detects the presence of a stack of signatures 130 stopped by the respective stop element 145a,145b; the sensor 155a,155b outputs a corresponding presence electric signal, which is for instance asserted at a logical level 1 and deasserted at a logical level 0. A further sensor 160a,160b verifies that the stacks of signatures 130 are separated from each other in the proximity of the stop element 150a,150b (when in the non-working position); the sensor 160a, 160b outputs a corresponding separation signal, which is asserted when no presence of stacks of signatures 130 is detected. Finally, a sensor 165a, 165b arranged near a beginning of the section 140a,140b verifies a filling of the line of stacks of signatures; the sensor 165a, 165b outputs a corresponding full signal, which is asserted when the presence of a stack of signatures 130 is consecutively detected for a pre-set period of time (for instance 5 seconds).

[0019] A push element 170a,170b discharges the stack of signatures 130 stopped by the respective stop element 145a,145b from the friction-type roller bed 140; particularly, the push element 170a,170b causes the stack of signatures 130 to move transversally to the longitudinal axis of the friction-type roller bed 140. The stack of signatures is then loaded into a pivoting box 175a,175b, which is arranged at the side of a loading zone of the respective sewing machine 135a,135b.

[0020] The operation of the book binding system 100 is managed by a programmable logic controller (PLC) 180, which in particular receives the presence signals, the separation signals and the full signals provided by the sensors 155a-155b, the sensors 160a-160b and the sensors 165a-165b, respectively.

[0021] With reference now to Figg.2a and 2b jointly, there is shown in greater detail the structure of the section 140a (similar considerations apply to the section 140b). Particularly, the stop element 145a consists of a series of vertical pegs 205a, which are operated by a pneumatic actuator 210a. When the stop element 145a is in the working position, the pegs 205a are lifted above the friction-type rolls 142, so as to form an obstacle for the stacks of signatures 130; conversely, when the stop element 145a is in the non-working position, the pegs 205a are lowered under the friction-type rolls 142, so as not to interfere with the moving of the stacks of signatures 130. Likewise, the stop element 150a consists of a series of vertical pegs 215a, which are operated by a pneumatic actuator 220a (with the pegs 215a lifted and lowered in the working position and in the non-working position of the stop element 150a, respectively).

[0022] The shaft of each friction-type roll 142 is coupled through a respective drive belt 230a to a single drive shaft 235a, which is operated by a corresponding electric motor 240a. The drive shaft 235a has a non-constant section, with a diameter that is bigger in proximity of the stop element 150a. In this way, the friction-type rolls 142 on which there is placed the first stack of signatures 130 directly stopped by the stop element 150a rotate at a speed higher than the one of the other friction-type rolls 142. Consequently, when the stop element 150a is lowered, the first stack of signatures 130 is caused to advance faster than the following stacks of signatures 130 and therefore it is separated from them.

[0023] The push element 170a consists of a rake 245a, which is caused to slide along a guide 250a (through a belt coupled to an electric motor, not shown in the figure). The pivoting box 175a is operated by a pneumatic actuator 255a; particularly, the pivoting box 175a rotates between a lowered position in which it is placed at the side of the friction-type rolls 142 (for receiving a stack of signatures 130 pushed by the rake 245a) and a lifted position in which it is placed at the side of a loading reservoir 260a of the sewing machine. The sewing machine is further provided with pliers 265a, which are caused to slide along a guide 270a (through a belt coupled to an electric motor, not shown in the figure); the pliers 265a grab the stack of signatures 130 loaded in the pivoting box 175a and place it in the loading reservoir 260a.

[0024] Considering all the figures jointly, when the book binding system 100 is operating the stop elements 145a,145b are lowered and the stop elements 150a, 150b are lifted. The PLC 180 controls the stop elements 150a,150b so as to supply the lines of stacks of signatures 130 associated with each sewing machine 135a, 135b by turns (for instance with a round-robin policy), substantially distributing the stacks of signatures in a uniform manner among the different sewing machines 135a, 135b.

[0025] Particularly, every time it is desired to supply the line of stacks of signatures 130 of a sewing machine (such as the sewing machine 135b), the stop elements associated with the preceding sewing machines (the stop element 150a in the example at issue) are lowered, so that the stacks of signatures of the respective line are caused to advance. The first stack of signatures 130 directly resting against the stop element 150b advances at a speed higher than the one of following stacks of signatures 130, so as to be spaced apart. As soon as the respective sensor 160a does not detect the presence of any stack of signatures 130, the corresponding separation signal is asserted. As a consequence, the stop element 150a is lifted, so as to stop the following stacks of signatures 130. The first stack of signatures 130 then lines up at the following line (associated with the sewing machine 135b), while the stacking machine 125 directly supplies the line of the first sewing machine 135a.

[0026] Each time the stacks of signatures present in the reservoir of a sewing machine (for instance the sewing machine 135a) fall below a pre-set level, the sewing machine 135a outputs a corresponding request signal that is supplied to the PLC 180. As a consequence, the pliers 265a grab the stack of signatures 130 loaded in the pivoting box 175a (as described in the following); the pliers slide along the guide 270a and place the stack of signatures 130 in the loading reservoir 260a. The pivoting box 175a is then lowered to be at the side of the friction-type rolls 142.

[0027] If the respective line of stacks of signatures 130 is not empty (presence signal output by the sensor 155a asserted), the stop element 150a is lowered and then raised again for causing the first stack of signatures 130 to pass in a way analogous to the preceding one. At the same time, the stop element 145a is lifted, so as to stop the stack of signatures 130 in front of the push element 170a. The rake 245a is caused to slide along the guide 250a, so as to push the stack of signatures 130 toward the pivoting box 175a (and it is then withdrawn immediately). The pivoting box 175a is then raised again, in order to be ready to satisfy a next request of the sewing machine 135a.

[0028] Similar considerations apply if the stop elements are replaced by other equivalent means, if the push elements have a different structure, if the pivoting boxes are replaced by other equivalent means, and the like. More generally, in the book binding system of the present invention, there is provided a friction-type conveying element for conveying the stacks of signatures from the feeding station to one or more sewing machines along an open path and, for each sewing machine, stopping means for stopping a stack of signatures in the proximity of the sewing machine and means for unloading from the conveying element and providing to the sewing machine the stopped stack of signature.

[0029] The solution of the present invention is extremely economic, since it does not require any sorting machine and uses a very simple conveying element. This even makes the use of a single sewing machine advantageous from an economic point of view.

[0030] The book binding system described above is particularly flexible, since it allows the number of sewing machines to grow with the simple addition of a new module to a pre-existing structure. This solution makes it possible at the beginning to buy a system comprising a single sewing machine and then to expand the same as the production needs increase.

[0031] The structure of the present invention is particularly compact, since it uses a single conveying element of small dimensions.

[0032] It should also be noted that a distribution station (formed by the friction-type roller bed with the relative stop elements, push elements and pivoting boxes) leads itself to be made and sold even separately from the feeding station and the sewing machines, in order to be used in book binding systems already existing.

[0033] The particular embodiment of the book binding system described above offers further advantages. For instance, the straight friction-type roller bed is extremely simple and inexpensive. The stop elements upstream each sewing machine and the particular mechanism that produces a different speed of rotation of the friction-type rolls allow the stacks of signatures to be separated in a very efficient way. Moreover, the push elements and the corresponding pivoting boxes make it possible to unload the stacks of signatures from the friction-type roller bed quickly and in a simple manner, and at the same time they make it possible to supply the stacks of signatures to the sewing machines without requiring any

change to their structure.

[0034] Alternatively, the friction-type roller bed is arranged along a different open path, it is replaced by another equivalent friction-type element, the stacks of signatures are stopped in proximity of each sewing machine in a different manner, other devices are used for unloading the stacks of signatures from the friction-type roller bed and for supplying them to the sewing machines, and the like.

[0035] Preferably, each sector 140a,140b of the friction-type roller bed 140 may be operated independently (through the respective electric motor 240a). In this way, every time a sector 140a,140b is full (full signal output by the sensor 165a,165b asserted), the respective electric motor 240a,240b is switched off. This avoids pressing of the stacks of signatures on the preceding stacks of signatures, which might cause an overlapping or a skewing of the signatures.

[0036] Likewise considerations apply if the friction-type roller bed is partitioned in a different way, for instance using more sectors for each sewing machine, and so on; however, the book binding system of the present invention leads itself to be implemented even with a sole friction-type roller bed that is operated in a single way.

[0037] Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the book binding system described above many modifications and alterations all of which, however, are included within the scope of protection of the invention as defined by the following claims.

Claims

1. A book binding system (100) including a feeding station (110-125) for providing stacks of signatures (130) in sequence, at least one sewing machine of the signatures (135a-135b), a distribution station (140,145a-145b,170a-170b,175a-175b) for distributing the stacks of signatures to each sewing machine,

   characterized in that

   the distribution station includes a friction-type conveying element (140) for conveying the stacks of signatures from the feeding station to the at least one sewing machine along an open path and, for each sewing machine, stopping means (145a-145b) for stopping a stack of signatures in proximity of the sewing machine and means (170a-170b, 175a-175b) for unloading from the conveying element and providing to the sewing machine the stopped stack of signature.

2. The book binding system (100) according to claim 1, wherein the conveying element includes a straight frictiontype roller bed (140).

3. The book binding system (100) according to claim 2, further including, for each sewing machine, further stopping means (150a,150b) for stopping the stacks of signatures provided by the feeding station upstream the sewing machine.

4. The book binding system (100) according to claim 3, wherein the further stopping means is movable between a working position, in which they stop a first stack of signatures directly and following stacks of signatures through the first stack of signatures, and a non-working position, in which they allow passing of the stacks of signatures, the book binding system (100) further including means (230a-240a) for separating the first stack of signatures from the further stacks of signatures when the further stopping means is in the non-working position.

5. The book binding system (100) according to claim 4, wherein the friction-type roller bed includes a plurality of friction-type rolls (142) on which the stacks of signatures are placed, the separation means including means (230a-240a) for operating the rolls on which the first stack of signatures is placed at a first speed and for operating the rolls on which the following stacks of signatures are placed at a second speed lower than the first speed.

6. The book binding system (100) according to any claim from 1 to 5, wherein the unloading means (170a-170b,175a-175b) includes a push element (170a-170b) acting transversally to the conveying element.

7. The book binding system (100) according to any claim from 1 to 6, wherein the conveying element (140) includes a plurality of sectors (140a-140b) and means (240a,180) for operating each sector independently.

8. The book binding system (100) according to any claim from 1 to 7, wherein the unloading means (170a-170b,175a-175b) includes a pivoting box (175a-175b) movable between a first position in which it is placed at the side of the conveying element and a second position in which it is placed at the side of a loading reservoir (260a) of the sewing machine.

9. A distribution station (140,145a-145b,170a-170b, 175a-175b) for use in the book binding system (100) according to one claim from 1 to 8, the distribution station including said conveying element (140) and, for each sewing machine, said stopping means (145a-145b) and said unloading means (170a-170b,175a-175b).

10. A method of distributing stacks of signatures (130)

to at least one sewing machine of the signatures (135a-135b), the method including the steps of:

providing stacks of signatures in sequence through a feeding station (110-125),
conveying the stacks of signatures from the feeding station to the at least one sewing machine along an open path through a friction-type conveying element (140),
stopping a stack of signatures in proximity of a sewing machine, and
unloading from the conveying element and providing to the sewing machine the stopped stack of signature.

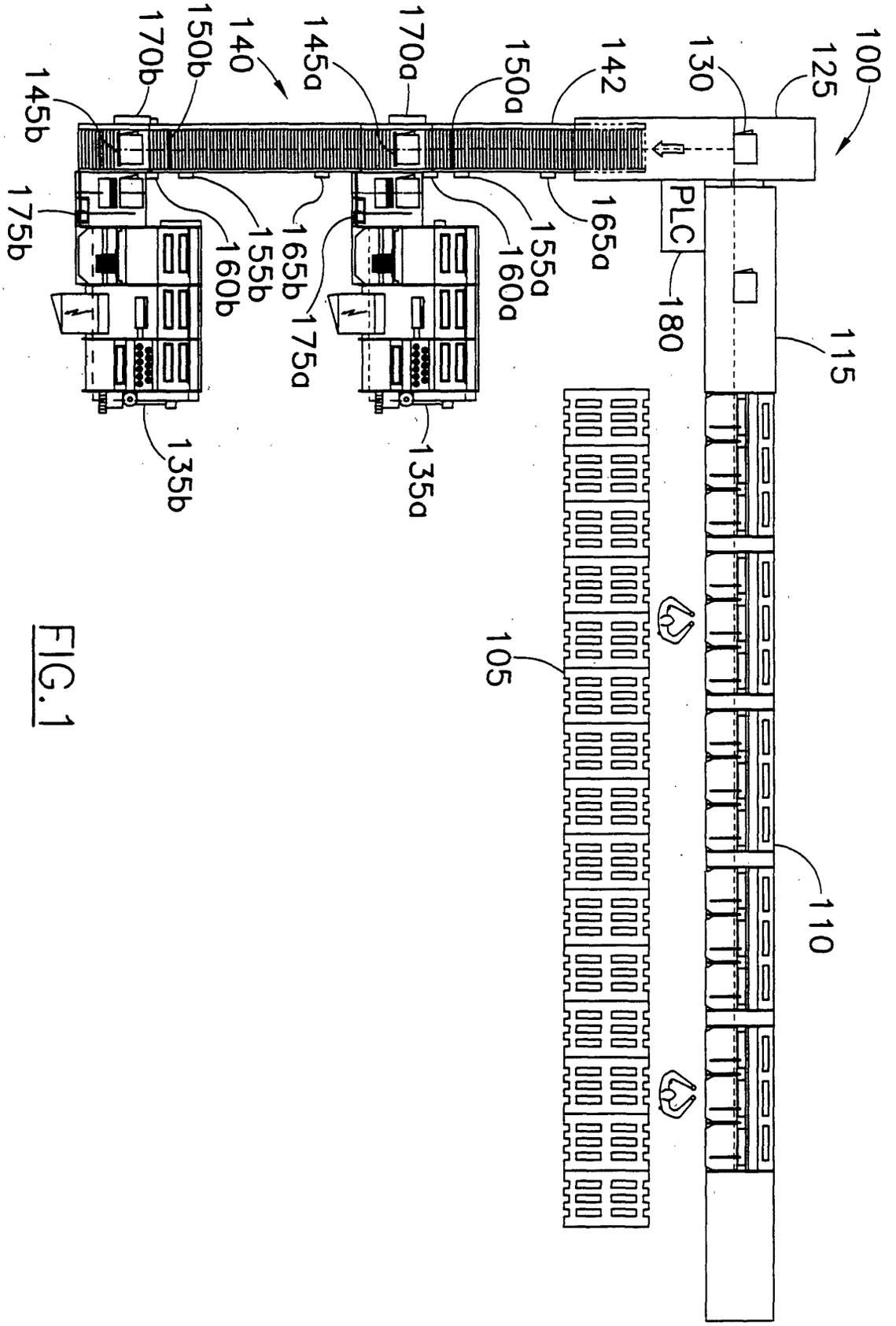
100
125
130
142
150a
170a
145a
140
150b
170b
145b
175b
155b
160b
165b
175a
155a
160a
165a
PLC
180
115
135b
135a
105
110

FIG. 1

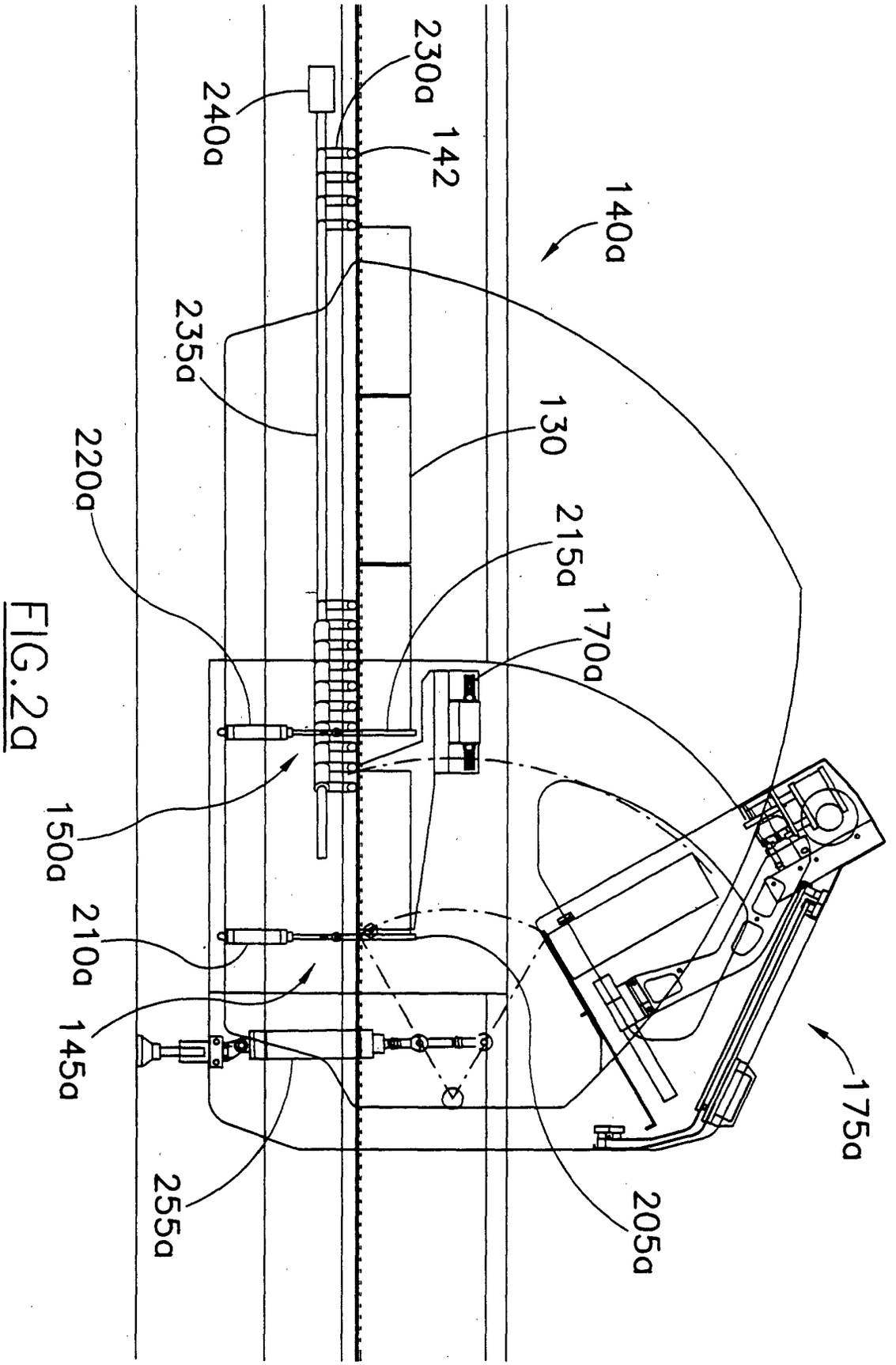
230a
240a
142
140a
235a
130
220a
215a
170a
150a
210a
145a
255a
205a
175a

FIG.2a

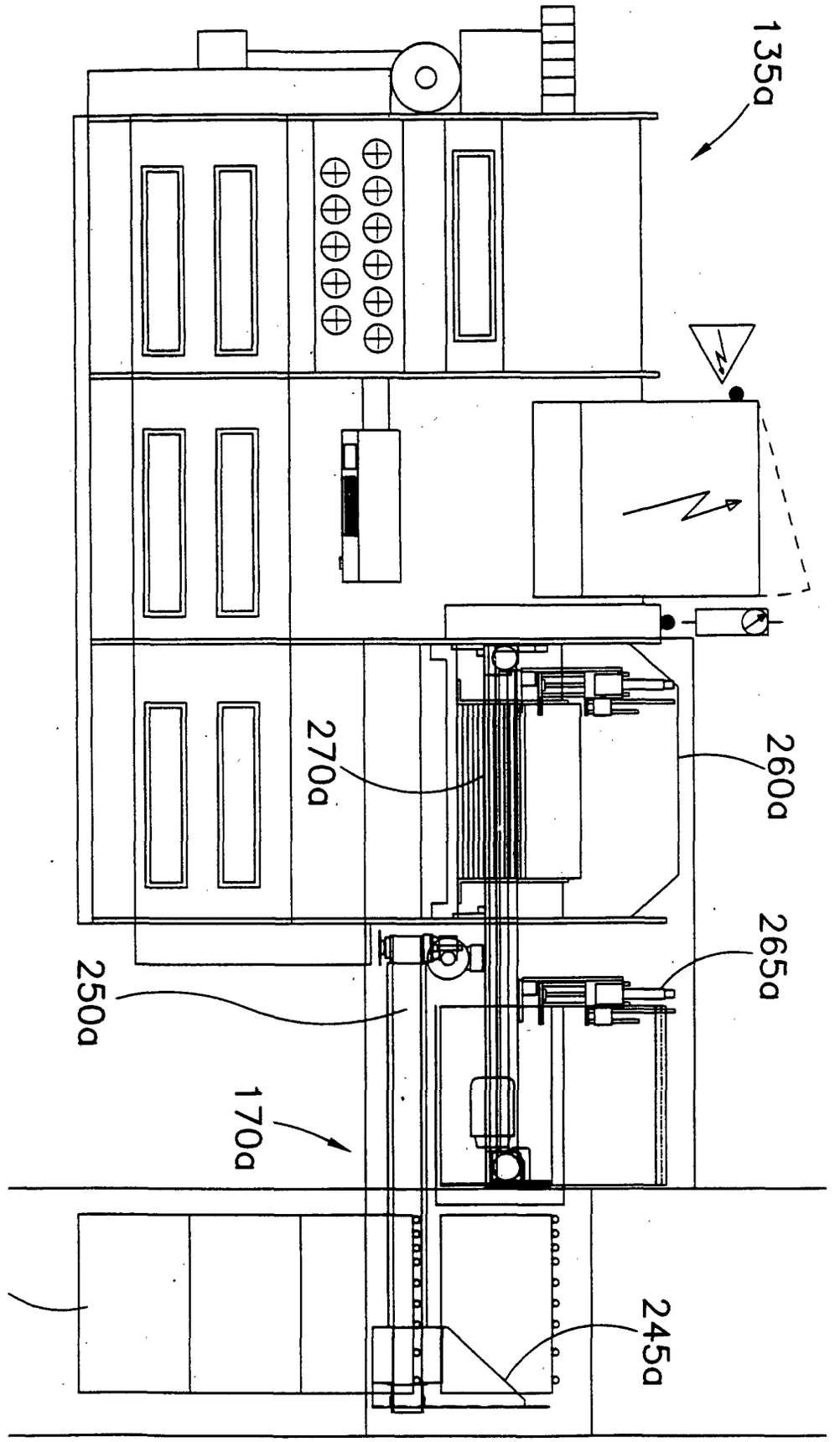

FIG.2b