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(54) Fabric handling apparatus.

(57) Fabric handling apparatus comprises a table (1) on which layers of fabric may be stacked, the table being vertically movable relative to the upper run of a conveyor (2). A pickup device (3) is mounted above the table for picking up an uppermost one of the fabric layers when the table is raised to engage the stack with the pickup device. The conveyor comprises two spaced chains, and in the pickup position the fabric layers extend through space between the chains. After picking the uppermost layer the table may be lowered and the conveyor is then driven to move a support section (11, 12) of the conveyor below the pickup device and between the layer held thereby and the uppermost fabric layer of the remaining stack. Movement of the support surface completes separation of the picked layer from the stack and transport that layer to a further work station (15).

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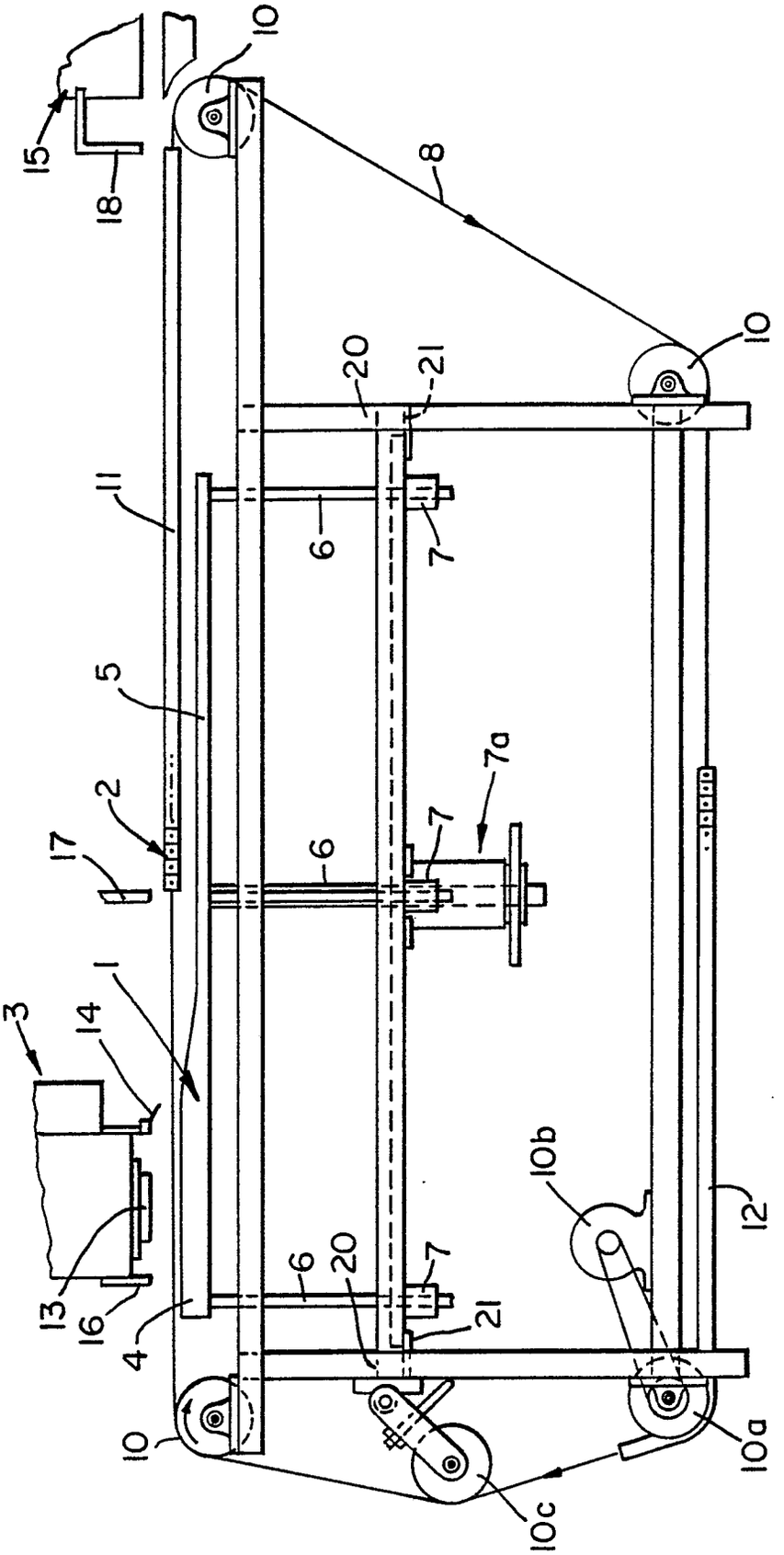
FIG. 1.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11
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7a
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10b
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10a
10c

FABRIC HANDLING APPARATUS

This invention relates to fabric handling apparatus, and to a method of handling layers of fabric.

In mass-production methods now used in the clothing industry it is common to form a stack of fabric layers, the stack then being cut simultaneously by any one of a number of methods in order to produce garment parts of the required shape. The parts then have to be separated from the stack for assembly into the garments, and the separated parts have to be conveyed to further handling or processing equipment, for example to a sewing machine. Our European patent application EP-A-0165019 describes a device for separating and picking up individual layers of fabric from a stack of layers, and other systems for doing this have been proposed in the past.

The present invention concerns itself with the further handling of fabric layers once separation from the stack has been initiated.

According to the present invention fabric handling apparatus comprises a table on which layers of fabric may be stacked, a pickup device mounted above the table for picking up an uppermost one of the fabric layers in the region of an edge thereof, means for effecting relative vertical movement between the table and the pickup device between a pickup position and a separation position wherein there is space between the pickup device and the fabric layers on the table, conveying means, and means for driving the conveying means into said space, and then along a path extending over and above the table.

From another aspect of the invention a method of handling fabric layers comprises arranging a stack of layers on a table, causing relative vertical movement between the table and a pickup device mounted above the table to cause the pickup device to engage the uppermost fabric layer in the region of an edge thereof, causing the pickup device to pick up and hold the uppermost fabric layer, vertically separating the pickup device and the table with the remaining fabric layers thereon, driving conveying means into the space between the pickup device and along a path extending over and above the table to complete separation of the uppermost fabric layer from the remaining layers, and releasing the uppermost fabric layer from the pickup device.

The essence of the invention lies in the concept of initiating separation of the uppermost layer by use of a pickup device, to create space between the edge of the layer so picked and the layer immediately below, and driving conveying means into that space and over the remaining fabric layers on the table so that the conveying means positively completes the separation of the picked layer and automatically deposits that layer in an appropriate position on the conveying means. Handling is thus considerably facilitated.

The conveying means may take any one of a number of convenient forms. In one preferred embodiment the conveying means may be a flexible support surface extending between two endless conveyor belts running around a closed loop. The spacing between the belts is greater than the width of the table so that the table may be lifted between the belts in order to cause engagement between the pickup device and the uppermost fabric layer on the table, such action being taken while the flexible support surface lies in a position on the conveyor loop where it will not interfere with movement of the table. The table may conveniently be stepped so that it has a higher section in the region of the pickup device and a lower section downstream of the higher section in the direction of movement of the flexible support surface. By utilising such arrangement two or more spaced flexible support surfaces may be mounted on the conveyor belts. It is preferred that the relative vertical movement between the table and the pickup device is effected by vertical movement of the table, although clearly it is possible to move the pickup device.

The apparatus may also include adjustable restraint means projecting above the level of the table for positioning around the edges of a stack of fabric layers on the table.

It is not essential for the conveying means to be in the form of the aforesaid flexible support surfaces, and other forms of conveying means are possible. For example, the conveying means may be one or more individual support plates movable between the pickup station and another work station under the control of any suitable handling equipment.

Apparatus according to the invention may be fully automated and will then include appropriate sensors and control systems for ensuring that operations are carried out in the required sequence.

In order that the invention may be better understood a specific embodiment of fabric handling apparatus in accordance thereof will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a schematic side elevation of the apparatus with some parts omitted;

Figure 2 is an end elevation corresponding to Figure 1;

Figure 3 is a schematic plan of the system with other parts omitted; and

Figure 4 is a section taken on the line IV-IV of Figure 3.

Referring to the drawings these show a fabric handling system comprising a table 1 on which layers of fabric may be stacked, a conveyor system shown generally as 2 and a pickup device shown generally as 3. The table has a high level section 4 and a lower level section 5, and it is supported by vertical pillars 6 slidable in guides 7. A screw system, a ram or other suitable means 7a is associated with the table for causing bodily vertical movement thereof as required.

The conveyor system comprises two endless belts or chains 8, 9 passing in a closed loop around rollers or sprocket wheels 10. Sprocket wheels 10a are driven by a motor 10b to move the conveyor in the direction shown by the arrows.and sprocket wheels 10c are chain tensioning wheels. Two flexible support surfaces 11, 12 are mounted between the chains and spaced apart around the length of the chains, each surface being, for example, in the form of a series of slats pivoted at their ends to the respective chains. The support surface 11 is omitted from Figure 3 in order to show detail of the table 1.

The width of the table 1 is less than the distance between the two chains 8, 9 as is shown in Figures 2 and 3. Accordingly, the table may be raised from the lowermost position shown in solid lines in Figure 4, through the position shown in Figure 1, to a position shown in chain lines in Figure 4 wherein the high level part 4 of the table passes between the chains 8 and 9 to lie above the level of those chains. As the table is raised the uppermost one of a number of layers of fabric supported by the table will be brought into engagement with a pickup head 13 of the pickup device 3. The pickup device further includes a sensor 14, preferably a pressure-sensitive sensor such as a suitable microswitch for providing a control signal to prevent upward overtravel of the table 1. The pickup device may be of any suitable form, but is preferably as described in EP-A-0165019.

At the delivery end of the conveying system there is positioned a further work station for example in the form of a sewing machine indicated schematically at 15. Position sensors 16, 17 and 18 are associated with the apparatus, for providing signals to a control system controlling the sequence of operation of the various parts.

Figures 3 and 4 show the construction of the table 1 in more detail. A base 19 is located below the table to be substantially co-extensive therewith, the base being secured to a framework 20 of the apparatus by support plates 21. The base carries the guides 7 in which the vertical pillars 6 secured to the table 1 may slide, and the lifting means 7a is also secured to the base. The table has a plurality of parallel slots such as 22 extending across the width of the table as shown in Figure 3, and a plurality of similar slots are also formed in the base 19, each slot in the table being in vertical alignment with a corresponding slot in the base. A plurality of fingers such as 23 extend vertically through aligned slots in the base and in the table, and each finger is releasably engageable with the base by an appropriate lock nut arrangement such as 24. The lock nut arrangement is such that when a finger is required to be moved it need merely be grasped above the level of the table 1 and rotated slightly in order to free the lock nut, whereupon the finger can be moved in its associated grooves to a fresh position, and there tightened to secure it in that position. Thus, a plurality of fingers may be located and adjusted in appropriate grooves to lie at selected positions around the boundary of a stack 25 of fabric pieces such as indicated in dotted lines in Figure 3. The fingers will thus act as restraint means that will project above the level of the table during the whole range of movement of the table, and will prevent the stack of fabric pieces from falling over during table movement. It will be noted from Figure 4 that the fingers 23a at the upstream end of the table are shorter than the remaining fingers 23, in order to prevent interference with the pickup means.

Operation of the system is as follows, assuming the start position shown in Figure 1 but with the table 1 in its lowered position with a stack of fabric layers thereon, the fingers 23 positioned around the stack and with the two support surfaces 11 and 12 of the conveyor system empty. The conveyor is driven clockwise from the position shown until the leading edge of the support surface 12 arrives below the detector 16, when a control signal is given to control stopping of the conveyor system. Immediately thereafter the table 1 is raised until the uppermost fabric layer is moved into contact with the pickup device 13, upward movement of the table being stopped on receipt of an appropriate signal from the sensor 14. The table is then lowered, and it will be seen that an edge of the uppermost fabric layer will be held by the pickup device 13 as the table descends. A space will thus be created between part of the uppermost fabric layer and the layers remaining on the table. After lower-

ing of the table the conveyor system is again driven in a clockwise direction and the support surface 12 moves between the uppermost fabric layer and the next layer in order to complete separation of the two layers and deposit the uppermost layer on the support surface. It will be seen that as the support surface is travelling away from the fabric edge held by the pickup device 13 the fabric will be slightly tensioned from that device and will thus be laid on the support surface in a wrinkle-free condition. As the trailing end of the support surface 12 moves from underneath the sensor 17 a further vertical movement of the table to pick up a second layer of fabric may be initiated, if it can be achieved without the stack interfering with the support surface 12. As the leading end of the support surface 12 reaches the sensor 18 a signal is generated to control stopping of the conveyor, and the fabric layer from the support surface may then be taken in any suitable manner to the sewing machine or other work station 15.

Once the first fabric layer has been removed from the support surface 12 further clockwise movement of the conveyor will bring the leading edge of support surface 11 to below the sensor 16, and the conveyor is then stopped if the table 1 has not already returned to its lowered position. Once this position is reached further movement of the conveyor is permitted so that the second fabric layer is laid onto support surface 11 and is then moved to the next work station 15. The cycle is then repeated until all fabric layers have been removed from the stack. A further stack may then be loaded onto the table.

In a modified form, the apparatus may be provided with two or even more pickup stations, so that the conveying means may have a first fabric layer deposited thereon at a first station, and then be moved to a second or subsequent station where a further layer of fabric may be laid over the uppermost fabric layer carried by the conveying means. In this manner a series of different garment parts may be overlaid one on another in their required relative positions and the assembly conveyed by the conveying means to a further work station, for example a sewing machine for stitching the parts together. In such a multi-station system it will be desirable for providing the conveying means with clamping elements so that an individual fabric layer, once laid on the conveying means, may be positively clamped in position relative to the conveying means before or during transfer to the subsequent pickup station.

It will be appreciated that the system shown has only been schematically illustrated, and the design detail of the various parts thereof will be apparent to those skilled in the art. It will also be apparent that many changes may be made to the apparatus as described.

Claims

1. Fabric handling apparatus comprising a table on which layers of fabric may be stacked, a pickup device mounted above the table for picking up an uppermost one of the fabric layers in the region of an edge thereof, means for effecting relative vertical movement between the table and the pickup device between a pickup position and a separation position wherein there is space between the pickup device and the fabric layers on the table, conveying means, and means for driving the conveying means into said space, and then along a path extending over and above the table.

2. Apparatus according to claim 1 in which the conveying means comprises a flexible support surface extending between two endless conveyor belts running around a closed loop, the support surface being of lesser length than the conveyor belts and the belts being spaced apart by a distance greater than the width of the table in order that at least part of the table may be lifted into free space between the belts.

3. Apparatus according to claim 1 or claim 2 in which the conveying means has two or more flexible support surfaces spaced apart along the length of the conveyor belts.

4. Apparatus according to any one of the preceding claims in which the table is stepped to have a higher section in the region of the pickup device and a lower section lying downstream of the higher section in the direction of movement of the conveying means.

5. Apparatus according to any one of the preceding claims in which the table is mounted for vertical movement towards and away from the pickup device, and guide means are provided for guiding the table in its vertical path.

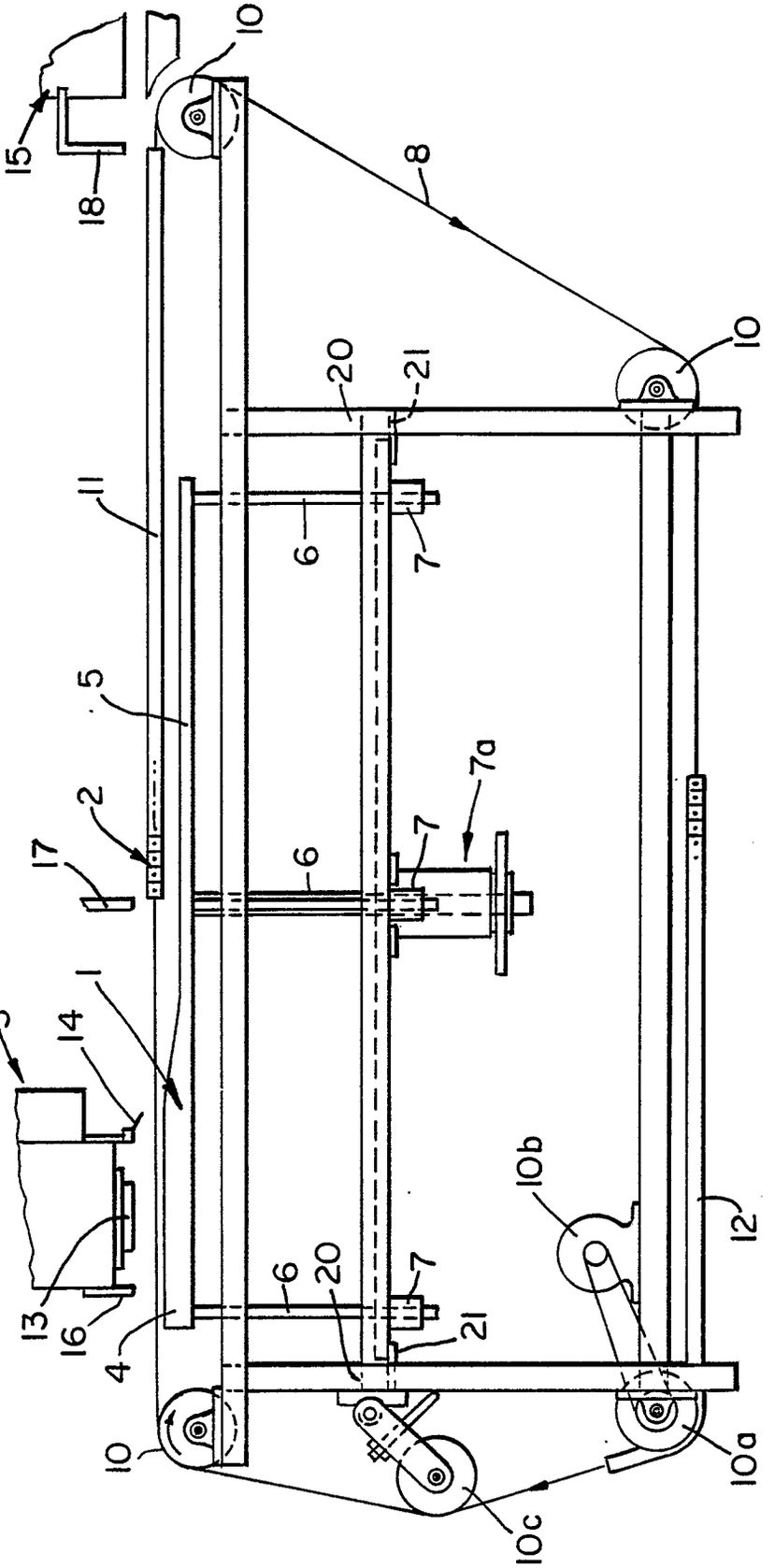
6. Apparatus according to any one of the preceding claims, and including adjustable restraint means projecting above the level of the table for positioning around the edges of a stack of fabric layers on the table.

7. Apparatus according to claim 6 and including a base, above which the table is supported, both the base and the table having a plurality of slots therein, each slot in the table being in vertical alignment with a corresponding slot in the base, and the adjustable restraint means comprise a plurality of fingers, each finger extending vertically through aligned slots in the base and in the table, and being releasably engageable with the base so that it can be released for movement along its respective slots and secured in any required position in its respective slots.

8. Apparatus according to claim 7 in which the slots comprise a plurality of parallel slots extending across the width of the base and the table transversely to the direction of movement of the conveying means.

9. A method of handling layers of fabric comprising arranging a stack of layers on a table, causing relative vertical movement between the table and a pickup device mounted above the table to cause the pickup device to engage the uppermost fabric layer in the region of an edge thereof, causing the pickup device to pick up and hold the uppermost fabric layer, vertically separating the pickup device and the table with the remaining fabric layers thereon, driving conveying means into the space between the pickup device and along a path extending over and above the table to complete separation of the uppermost fabric layer from the remaining layers, and releasing the uppermost fabric layer from the pickup device.

FIG. 1.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7a
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17
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7
21
10b
12
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10a
10c

FIG. 2.

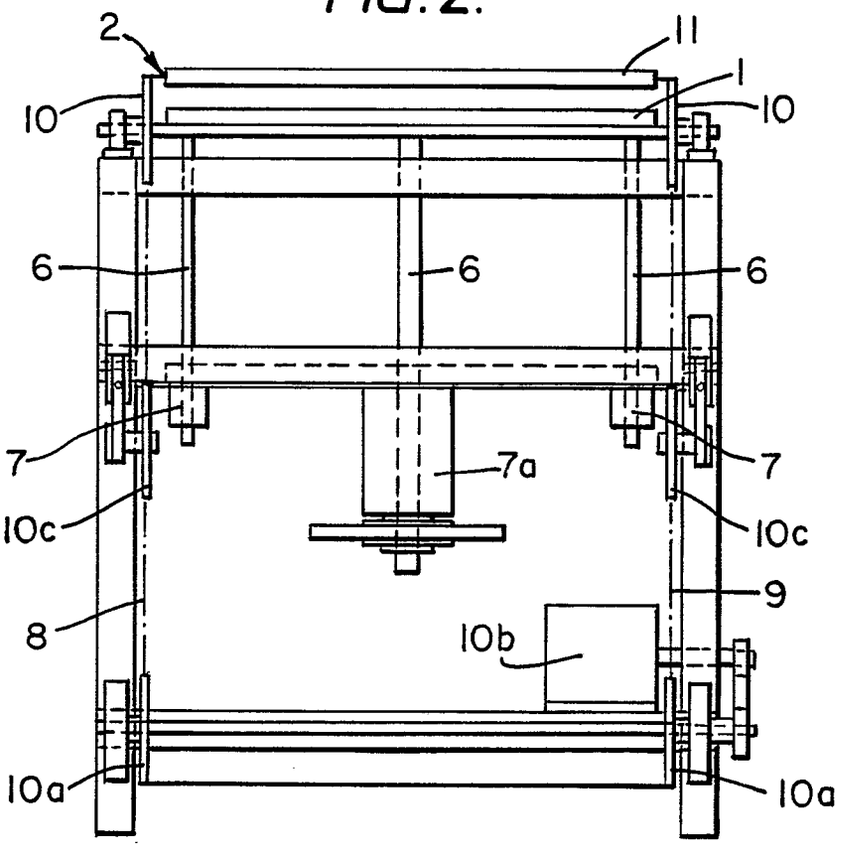
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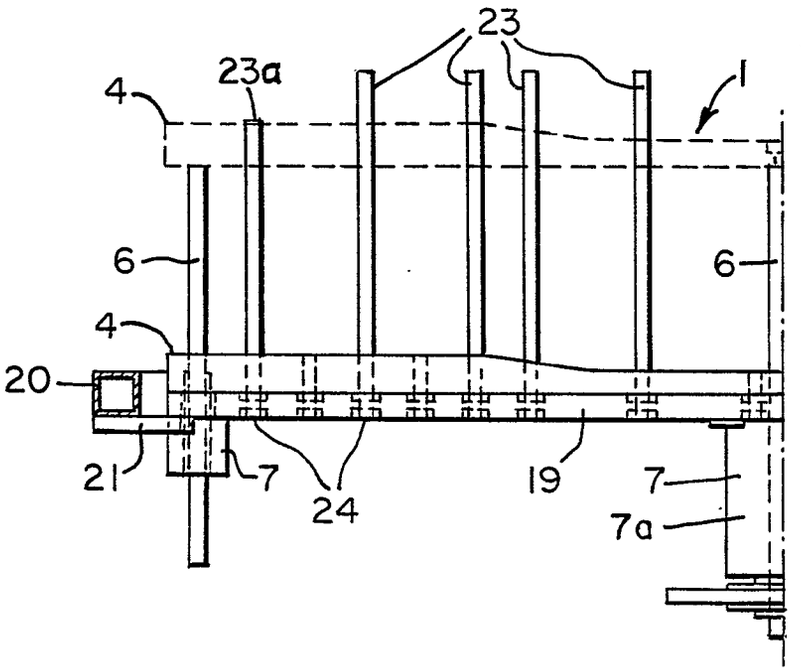
FIG. 4.


23
23a
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24
19
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7a

FIG. 3.