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(54) Device and method for lamination pressing

(57) The invention relates to a system for automatic lamination pressing in which the laminated wood is placed in one of several press sections (3) which are moved in an endless path. The present invention allows automated production of glulam without using e.g. HF fields for the curing of the glue used.

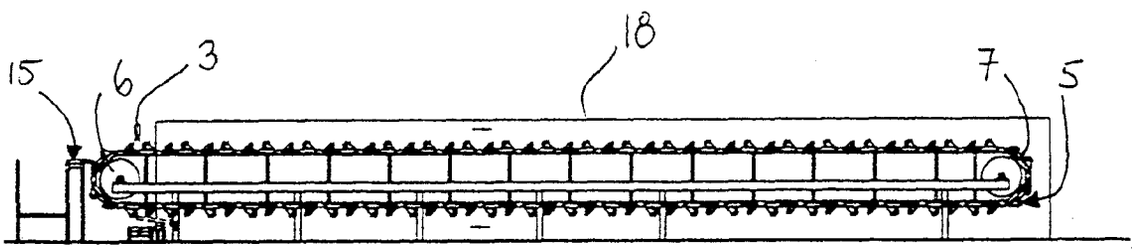

Fig.2

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Description

The present invention relates to a system for lamination pressing in which laminated wood comprising at least two lamellae is placed in a press formed by several press sections which are arranged in an endless path, said press sections constituting a chain link each and together forming a chain constituting the endless path, each press section containing a clamping device for mutual clamping of the lamellae.

The prior art includes a lamination press in which an operator on an operator platform inserts an amount of laminated wood formed by glue-covered lamellae into a triangular lamination press, which means a press having a horizontal rotatable triangular element with a press section on each of the three sides. When a side of the triangular lamination press is filled with an amount of laminated wood formed by glue-covered lamellae, a pressure force is applied to the laminated wood perpendicularly to the glue-covered lamellae to ensure that these are positioned at a plane level. Then a pressing force is applied in the plane of the lamellae to achieve optimum gluing-together of the laminated wood. After this process, the triangular lamination press is rotated 120° and is then again filled by the operator with an amount of laminated wood formed by glue-covered lamellae. To increase the capacity for the manufacture of glulam beams, the lamination press has even been constructed with a hexagonal shape, as appears from Danish Patent Specification No. 170 273, which not only increases the capacity of the press, but also the height.

However, with a system of the type described above it is not possible to insert laminated wood formed by glue-covered lamellae in a continuous process, since conventional curing of the glue used is relatively time-consuming.

The prior art also includes a system in which the curing time is reduced using high frequency electromagnetic fields. This technique, however, has the drawback that the process control devices used in the system are relatively complicated and expensive. Further, the system has the drawback that glulam manufactured with this HF technique is not approved by some authorities, who just approve conventional curing.

US 2 758 618 describes a quite different type of press, viz. a press having a carousel system for pressing laminated pieces of wood. The carousel consists of a plurality of clamps which are moved in an endless path having two long sides. The clamping mechanism is activated on the long sides, and the clamping sections clamp the laminated piece of wood which is sandwiched between the pressing plates of the clamping mechanism. Each of the clamps secures the piece of wood and contributes to advancing it until the clamp has reached the long side, following which it again releases the laminated piece of wood. This system is primarily intended for the production of relatively small objects, since the clamps, when advancing heavy objects, might be twisted. Furthermore, this is a different type of lamination press, since the entire piece of wood is not clamped over its entire length, and it is moreover not the same clamping device which clamps the entire piece.

Accordingly, the object of the present invention is to provide a system for lamination pressing which just requires little mounting space relative to the size of the objects to be produced. Further, the present invention is intended to ensure that the insertion of glue-covered lamellae can take place at a continuous rate, and so that the same lamination pressure is applied to each piece of laminated wood formed by glue-covered lamellae. It is moreover desirable to produce a system for lamination pressing in which the operator has a better working environment without having to pick up and position glue-covered lamellae at an inexpedient height or position.

This object is achieved by a system of the type mentioned in the opening paragraph which is unique in that the endless path encircles two pulley wheels, at least one of the pulley wheels being connected with drive means, and that the endless path between the pulley wheels has an upper run and a lower run along which the press sections are moved.

A system of the type described above with insertion of the glue-covered lamellae into the press sections provides a continuous process which may be controlled in that the wood is taken out at approximately one circuit of the press sections round the endless path. It is thus possible to provide a system in which the amount of press sections in the endless path is adapted to the rate at which the laminated wood formed by the glue-covered lamellae is produced, and is adapted to the time period during which the glue-covered lamellae in the press sections are to be pressed together. Furthermore, a system is achieved in which a satisfactorily good curing may be obtained without using HF technique.

Since each section is to be adapted to the amount of glue-covered lamellae, and since these glue-covered lamellae are to be "dropped" down into each press section, it is also possible to adapt the operator platform for each operator, thereby ensuring that the operator has an optimum working position without too heavy and crooked lifts.

When each press section constitutes a chain link, and the chain links together form a chain and constitute the endless path determined by two pulley wheels, one of which is connected with a drive means, it is ensured that it is possible to feed the press sections in a simple manner in the endless path, since a feeding action at a given point in the chain results in a distinct and predictable movement of the rest of the chain. This makes the feeding and positional determination of the individual press sections simple and reliable.

When, as stated in claim 2, the system, at one pulley wheel, has an insertion point at which means are arranged for preparing and inserting lamellae for the lamination wood into the press sections, a particularly advantageous working situation is achieved for the oper-

ator of the system in the form of an automated insertion operation, which is an advantage particularly in a system for the production of relatively long objects. Thus, it is possible to produce laminated wood in lengths of up to 6 metres in a system according to the invention.

When, as stated in claim 3, the press sections are fed in steps corresponding to the length of a press section, a practical embodiment of the invention is achieved, as the positioning of the lamellae in the press sections may hereby be performed without complicated consideration of the pattern of movement of the press sections.

When, as stated in claim 4, the endless path is completely or partly incorporated in a heating chamber, it is possible to achieve a controlled curing of the glulam which is almost independent of the environment of use. However, the heating chamber may be omitted completely if the actual temperatures of use and atmospheric humidity so permit.

When, as stated in claim 5, at least one of the pulley wheels has recesses for engagement with corresponding means on the press sections, a simple and reliable feeding of the press sections is achieved.

When, as stated in claim 6, at least one clamping device comprises a hydraulically or pneumatically activatable activation device and a pressing mechanism, such as a pressure hose, capable of expanding upon application of pressure, an embodiment of the invention is achieved which is particularly useful for automated operation, since the clamping devices can clamp the glulam without manual intervention.

When, as stated in claim 7, the activation devices of some of or all the press sections are interconnected in a pressure control system, an embodiment of the invention is achieved in which the pressing pressure in the press sections may be controlled simultaneously.

When, as stated in claim 8, the activation device comprises two activation valves which are connected with a two-way valve for clamping and releasing the pressing mechanism in the clamping device, a simple and reliable embodiment of the activation device is achieved.

When, as stated in claim 9, the pressure control system comprises a pressure-carrying main line which is arranged in the endless path and which may be connected with a common pressure-generating unit, an additional advantageous embodiment is achieved, since the possibility of using a common pressure-generating device for all the activation devices permits the overall structure to be manufactured as well as activated in an economically advantageous manner, just as a firm connection of the pressure-generating unit reduces or even eliminates the risk of pressure leakages at e.g. the connection lines.

When, as stated in claim 10, the common pressure-generating unit is a stationary pressure-generating unit which may be connected with the pressure-carrying main line via a connecting device in connection with at least one of the activating devices, and this connecting device comprises a non-return valve which ensures a certain pressure level in the main line, it is possible to provide a continuous pressure in the overall activatable system, it being suitably ensured that it is always possible to connect the stationary pressure-generating unit, no matter how the press sections move in the system, thereby avoiding a pressure drop in the necessary current disconnection and connection of the pressure-generating unit because of the movement of the press sections in the endless path.

When, as stated in claim 11, the pressure-generating unit is constructed as a chain link in the endless path, a simple embodiment of the invention is achieved, since the dimensioning of the selected chain, which is frequently to be made locally, may be performed without having to pay special consideration to this pressure-generating unit, as local engineers can replace a press section, if necessary, in a simple manner in an operating system without considerable changes in the overall system. It should also be noted that exchange of the pressure-generating unit may be made in an uncomplicated manner.

When, as stated in claim 12, the laminated wood is held in the press section for a period of time which substantially corresponds to the period of revolution of the endless path, the system of the invention may be optimized, as all operations in connection with the filling and removal of glulam in/from the press sections may be performed at a specific point in the endless path. Further, optimum utilization of the system is achieved, as it should be intended for rational and economic reasons that all the press sections are utilized fully, but not used for unnecessary retention and pressing of glulam which has cured sufficiently.

When, as stated in claim 13, the pressure-generating unit is currently connected with and disconnected from the connection valves in response to the revolution of the endless path, so that at any time the stationary pressure-generating unit is connected with the activation devices via at least one connection valve, a continuous pressure is achieved in the common activatable system, which is decisive for maintaining an optimum pressure on the glulam lamellae in the press sections during the curing process.

The present invention will be described more fully below with reference to the accompanying drawing, in which

fig. 1 shows a set-up in which a system according to the present invention is provided,

fig. 2 shows a cross-section through a system as shown in figure 1,

fig. 3 shows a press section with glue-covered lamellae and a hydraulic cylinder,

fig. 4 shows the press section shown in figure 3 without glue-covered lamellae,

fig. 5 shows a press section with glue-covered lamellae and a pressure hose,

fig. 6 shows the press section shown in figure 1 with a pressure hose without lamellae,

fig. 7 shows a partial section of the endless path formed by two press sections,

fig. 8 shows the endless path shown in figure 7, seen from below,

fig. 9 shows a partial section through a system according to the present invention in which the glue-covered lamellae are inserted, pressed together and removed, and

fig. 10 schematically shows the pressure control system for the activation of the clamping devices.

Figure 1 shows a set-up in which a system 1 according to the present invention is provided. The set-up is shown with a planing unit 11 through which lamellae 4 are fed via a driven roller path.

At the end of the roller path the lamellae 4 are fed by means of an angular guide 12 to a glue applying unit 13. The glue applying unit 13 is programmed such that no glue is applied to the uppermost lamella 4 in the plurality of lamellae 4 per laminated wood 2 (laminated beam).

The laminated wood 2 is then pulled by pull rollers through the glue applying unit 13 to a belt 15. On the belt, one or two operators manually pick up the lamellae in the desired amount and then insert them as laminated wood 2 into a press section 3 (see figures 3-9).

After the insertion of the laminated wood 2 in the press sections 3, which may alternatively be performed automatically, the press section 3 is fed stepwise in its path and is compressed in the next process in a direction in parallel with the glue grooves by means of a pressing mechanism 8 in the press section 3.

Having been compressed in the pressing mechanisms 8, the wood will be compressed perpendicularly to the glue grooves by means of a pressing mechanism 8 in the form of a pressure hose or hydraulic cylinder or the like. Then the laminated wood 2 in the press sections 3 is fed in stepwise movements in the endless path 5.

The endless path 5 has an upper run and a lower run between the two pulley wheels 6, 7. These runs are substantially parallel and are positioned horizontally in the preferred embodiment of the invention.

After approximately one lap, the finished laminated wood 2 is removed from a press section 3, and the pressing mechanism 8 ceases applying pressure to the laminated wood 2. The removal takes place by means of a remove mechanism 17, which removes the laminated wood 2 and places it on an discharge path 16, see also fig. 9.

Figure 2 shows a system 1 according to the present invention. It appears clearly from the figure that the system may be enclosed by a heating cabinet 18 to reduce the curing time of the glue. It is important to note that the feeding of the press sections 3 in an endless path 5 takes place in steps, and that the period of time during which the stepwise feeding takes place should approximately correspond to the time it takes to feed the desired number of lamellae 4 and insert them on top of one another for the laminated wood 2 in order to achieve optimum utilization of the system 1.

If the curing time is very long, the endless path 5 may be extended, and the system 1 can therefore always be adapted to any manufacturing process depending on the width of the lamellae 4 and the amount of lamellae 4.

Figures 3-6 show two embodiments of the press sections 3 according to the present invention. Figure 3 shows a press section 3 having a pressing mechanism 8 in the form of a hydraulic cylinder. In figure 3, the press section 3 is shown with the lamellae 4, which form the laminated wood 4, inserted. Figure 4 shows the same as figure 3, just without the laminated wood 2.

Each press section 3 may be adjusted individually by an adjustment means 14 in order to adapt the press section to the various embodiments of laminated wood 2 with respect to the thickness of the laminated wood. It is hereby possible to use the same press sections 3 for laminated wood 2 having even great dimensional variations.

Figures 5 and 6 show the same as figures 3 and 4, with the mere exception that the pressing mechanism 8 is here formed by a pressure hose.

Figures 7 and 8 show a press section with pressure hoses and without laminated wood, seen from the side and from below, respectively. It appears from figures 7 and 8 that the endless path 5 is formed by the press sections 3 alone, and that the width of the press sections 3 may individually be adapted to any system, as the endless path 5 may be considered as a chain-like mechanism of varying width adapted to the individual system according to the present invention.

It is shown in detail in figure 9 how the structure of the insertion point to the press sections 3 may be. It is moreover shown how a pressing-down means 19 is located immediately after the insertion of the laminated wood 2 into the press sections 3. It should be noted that the feeding of the press sections 3 in the endless path 5 takes place by means of recesses 20 formed in the pulley wheel 6. The other pulley wheel 7 is likewise formed with recesses 20 for engagement with corresponding means on the press sections 3 in the preferred embodiment. Further, it is contemplated according to the invention that another form of feed may also be

used, e.g. another embodiment of the pulley wheels 6, 7, just as the other pulley wheel 7 may alternatively or additionally serve as a drive wheel.

The endless path 5, in which the press sections 3 move, may be adapted individually to the job concerned and need not extend linearly in parallel, as shown in figure 2, but might in special cases be triangular, quadrangular or the like and have drive wheels at each pulley wheel.

Figure 10 is a schematic view of the pressure control system for the activation of the clamping devices in the press sections 3. A main line 21 is provided along the entire endless path 5 and is connected with the activation devices on each of the clamping devices of the press sections. The activation device comprises a first activation valve 22 for clamping and a second activation device 23 for releasing the pressing mechanism 8 by control of a two-way valve 24. All the valves 22, 23, 24 are connected with the main line 21. When the first activation valve 22 is activated, a pressure pulse is fed from the main line 21 to one side of the two-way valve 24, which causes the two-way valve 24 to open the connection from the pressure-carrying main line 21 to the pressing mechanism 8. Conversely, this connection is shut off when the second activation valve 23 is activated, and the pressing mechanism is relieved of pressure because the two-way valve is pushed into a relief position.

Each press section, in connection with the activation device, is provided with a connecting device 25 which is connected with the main line 21 via a non-return valve 26. When the endless path 5 is fed, the main line 21 is connected with a stationary pressure-generating unit (not shown) via one or more of these connecting devices 25. The connection of the pressure-generating unit with the connecting device may be made without affecting the pressure in the main line 21 because of the arranged non-return valve 26. This ensures a constant pressure in the main line 21 and thereby a constant pressing pressure in the press sections 3 along the entire endless path. This system may be implemented both as a pneumatic system and as a hydraulic system.

It should also be noted that the manner in which the press sections are arranged in the endless path may be implemented in many different ways. In addition to the shown embodiment of the press sections as chain links, the press sections may also be embodied as individual carriages. The individual carriages may thus be moved about in a vertical direction or, as required, be displaced in a vertical direction at specific end points. An advantage of this embodiment is e.g. that the individual carriages may be moved without turning the up/down direction of the carriages, thereby allowing more sensitive equipment of different types to be mounted on the carriages.

Claims

1. A system for lamination pressing in which laminated wood (2) comprising at least two lamellae (4) is placed in a press which is formed by several press sections (3), said press sections (3) being arranged in an endless path (5), said press sections (3) constituting a chain link each and together forming a chain which constitutes the endless path (5), each press section (3) containing a clamping device for mutual clamping of the lamellae (4), **characterized** in that the endless path (5) encircles two pulley wheels (6, 7), at least one of the pulley wheels (6, 7) being connected with drive means, and that the endless path (5) between the pulley wheels (6, 7) has an upper run and a lower run along which the press sections (3) are moved.

2. A system according to claim 1, **character ized** in that at one pulley wheel (6) it has an insertion point at which means (12, 13, 15) are arranged for preparing and inserting lamellae for the laminated wood (2) into the press sections (3).

3. A system according to any one of claims 1 and 2, **characterized** in that it is arranged such that the press sections (3) are fed in steps corresponding to the length of a press section.

4. A system according to any one of claims 1 to 3, **characterized** in that the endless path (5) is entirely or partly incorporated in a heating chamber (18).

5. A system according to any one of claims 1 to 4, **characterized** in that at least one pulley wheel (6) has recesses (20) for engagement with corresponding means on the press sections (3).

6. A system according to any one of claims 1 to 5, **characterized** in that at least one clamping device comprises a hydraulically or pneumatically activatable activation device (22-24) and a pressing mechanism (8), such as a pressure hose, capable of expanding upon application of pressure.

7. A system according to claim 6, **characterized** in that the activation devices (22-24) of some or all of the press sections are interconnected in a pressure control system (21, 25, 26).

8. A system according to claim 6 or 7, **characterized** in that the activation device comprises two activation valves (22, 23) which are connected with a two-way valve (24) for clamping or releasing the pressing mechanism (8) in the clamping device.

9. A system according to any one of claims 6 to 8, **characterized** in that the pressure control system

comprises a pressure-carrying main line (21) which is arranged in the endless path (5) and which may be connected with a common pressure-generating unit.

10. A system according to claim 9, **characterized** in that the common pressure-generating unit is a stationary pressure-generating unit which may be connected with the pressure-carrying main line (21) via a connecting device (25) in connection with at least one of the activation devices (22-24), and that this connecting device (25) comprises a non-return valve (26) which ensures a certain pressure level in the main line (21).

11. A system according to claim 9, **characterized** in that the common pressure-generating unit is constructed as a chain link in the endless path (5).

12. A method of lamination pressing laminated wood (2) in a system according to claims 1 to 11, **characterized** by holding the laminated wood (2) in the press section (3) for a period of time which substantially corresponds to the period of revolution of the endless path (5).

13. A method of lamination pressing in a system according to claims 9 or 10, **characterized** by currently connecting and disconnected the pressure-generating unit with and from the main line (21) in response to the revolution of the endless path (5), so that the stationary pressure-generating unit is connected with it at any time via one or more activation devices (22-24).

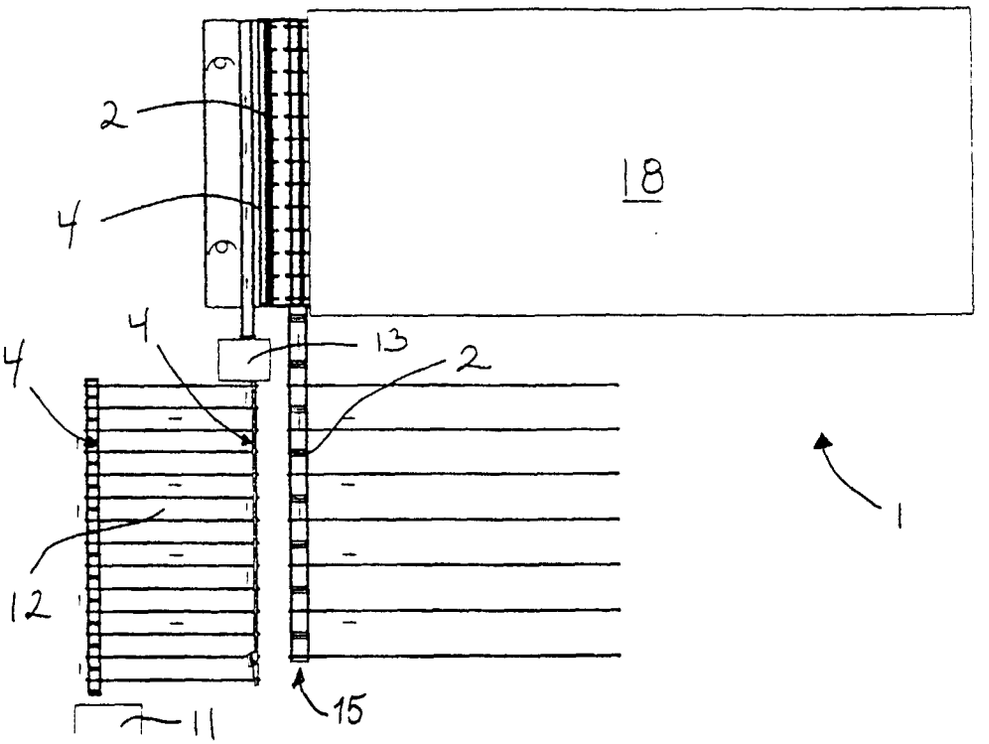

Fig.1

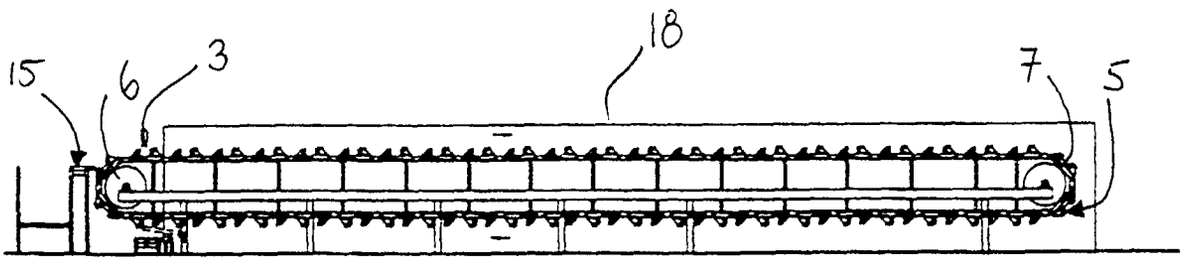

Fig.2

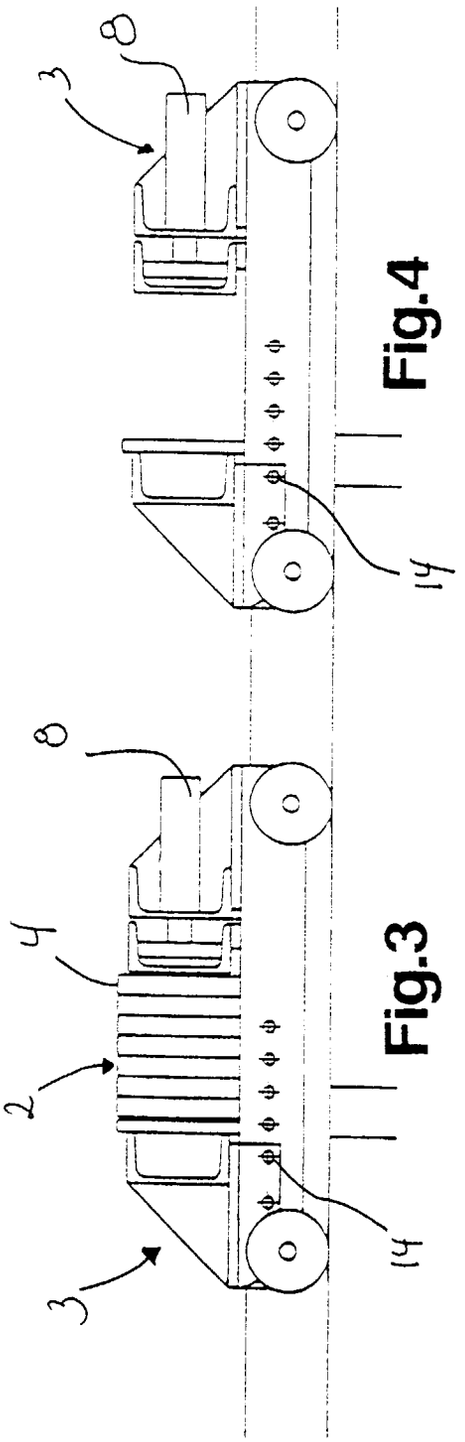

Fig.4

Fig.3

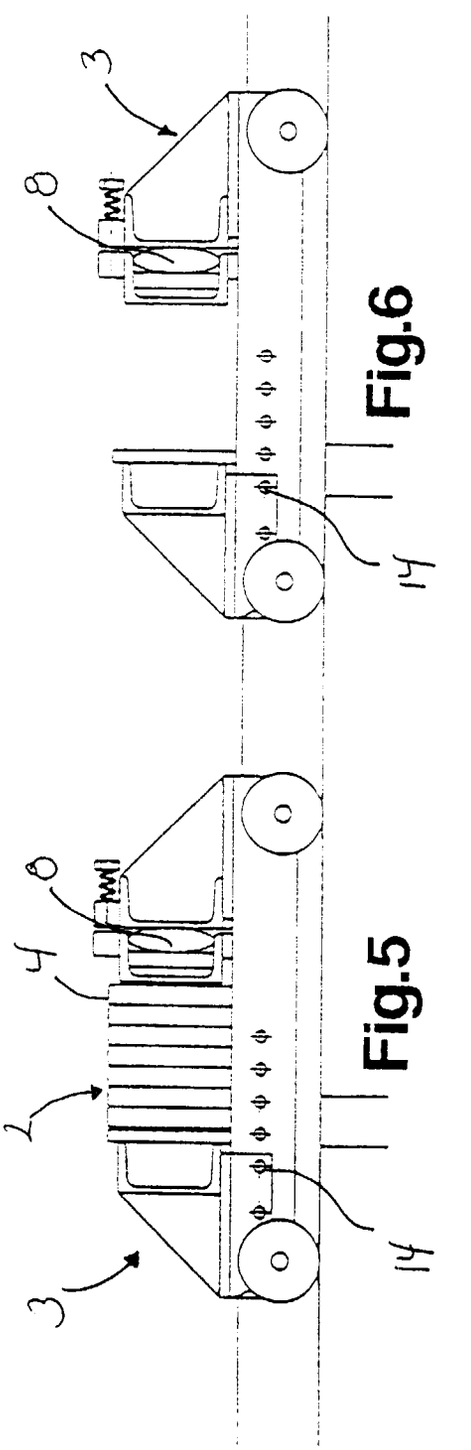

Fig.6

Fig.5

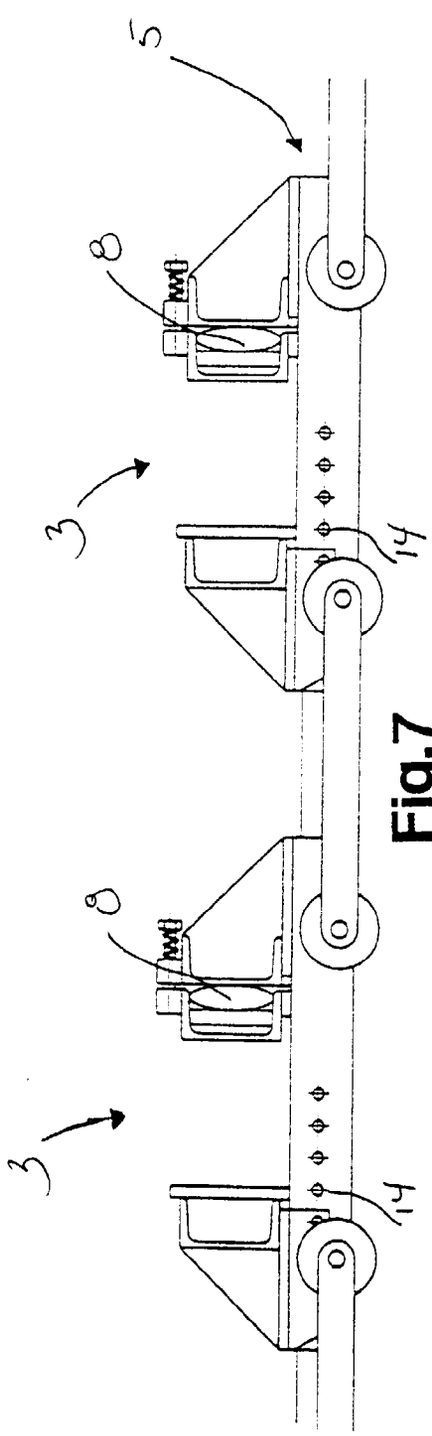

Fig.7

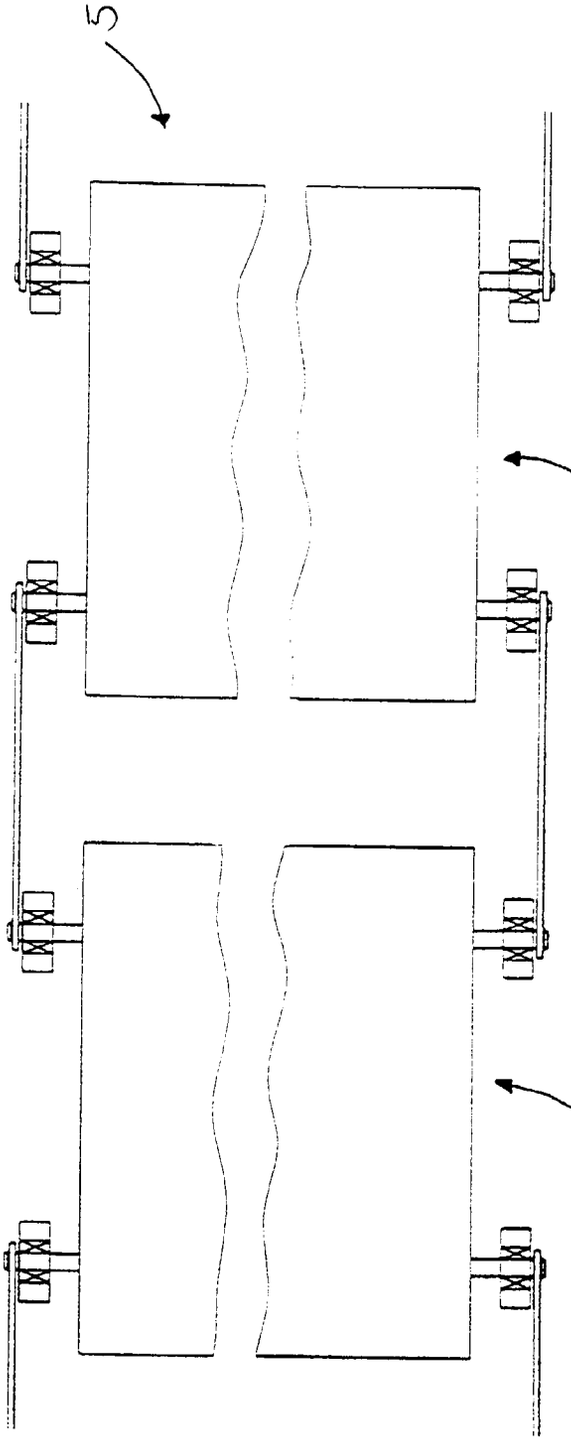

Fig. 8

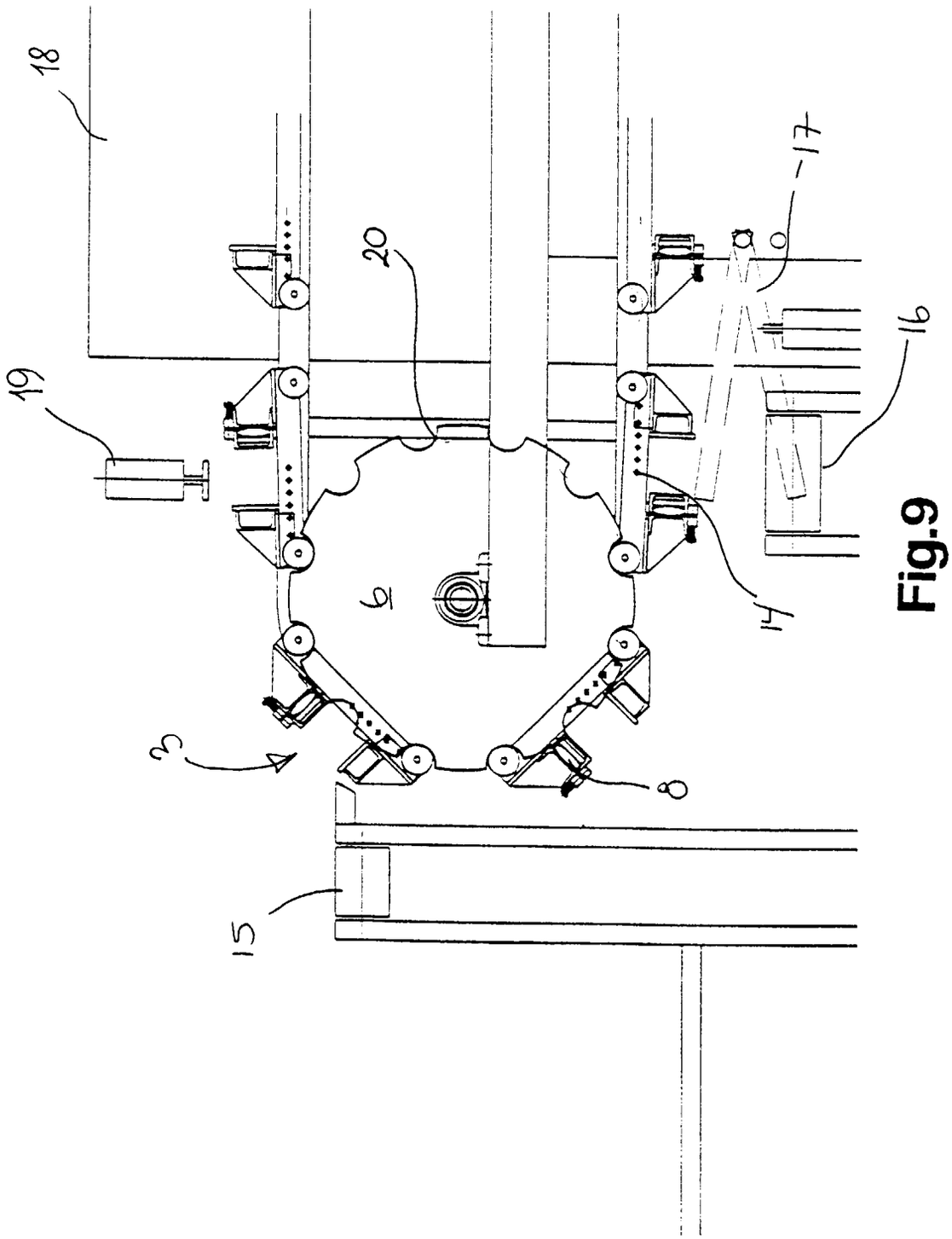

Fig.9

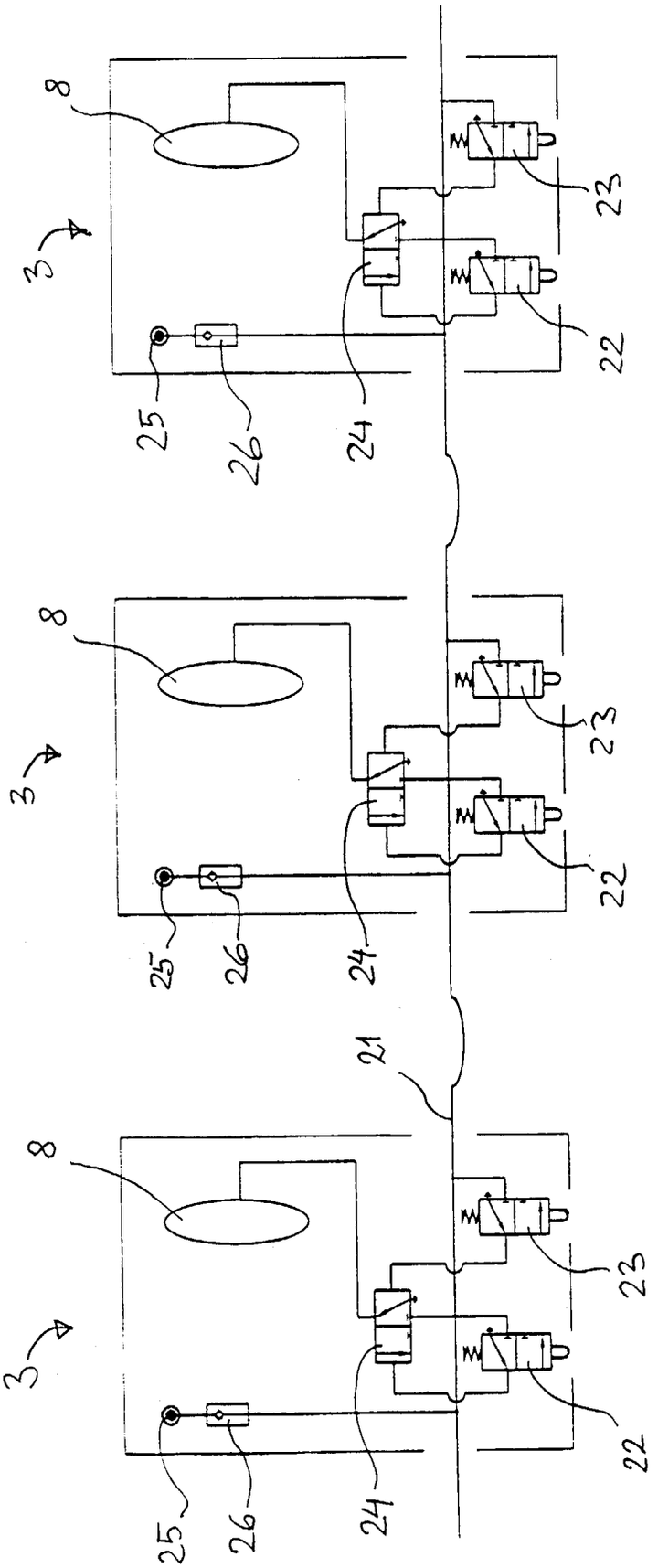

Fig. 10