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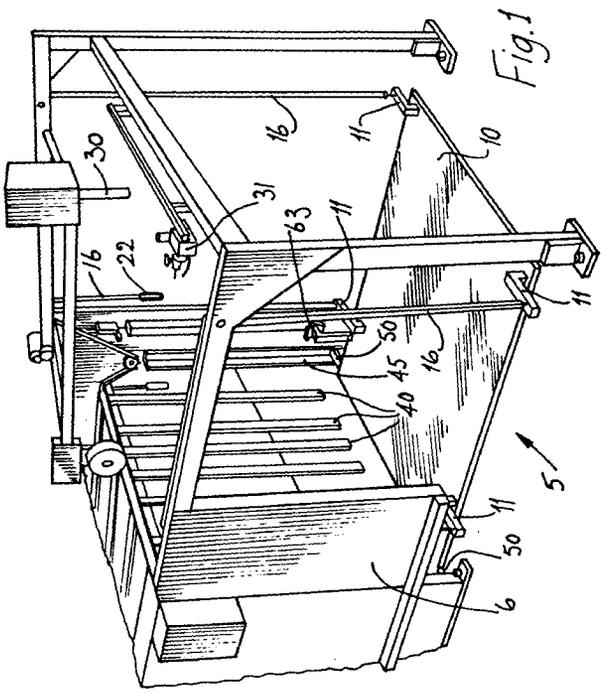
(54) Book manufacture

(57) A pallet 2 with a stack 3 of printed sheets in position is loaded onto a support platform 10 having four lifting lugs 11 located adjacent the corners of the pallet 2. A drive shaft 15 drives separate drive chains 16, one connected to each lifting lug 11. A free end 21 of each chain 16 is provided with a counterweight 22 to ensure that the chain 16 is in contact with the associated sprockets over which the chain 16 is trained. A segment shaped guide 25 is positioned over a main driven sprocket to ensure that the chain is retained in positive engagement. Guide means for guiding the stack 3 into an aligned position on the support platform 10 is provided by guide strips 40 and side angle shaped guide arms 45 including a lower inturned portion. Manufacturing efficiency is optimised.



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Description

The invention relates to a method for manufacturing books. In particular, the invention relates to a method and apparatus for manufacturing books.

There are several steps involved in conventional methods for manufacturing books from printed sheets. Each step in the process involves operation of equipment in a batch manner. For example, stacks of sheets are printed off and then transferred to a folding unit for folding. One of the problems with conventional book manufacturing systems is the amount of handling required during the manufacturing process. It is also essential to operate each of the items of equipment at maximum efficiency.

It is an object of the invention therefore to provide a method and apparatus for efficient manufacture of books.

According to one aspect, the invention provides a method for manufacturing books including the steps of :-

loading a pallet of printed sheets onto a support platform having lifting points on the platform adjacent the corners of a pallet;

guiding the stack into an aligned position on the support platform for delivery of single sheets from the top of the stack to a folding unit; and

lifting the support platform upwardly by operating a lifting means to pull the lifting points upwardly in synchronisation with the operation of the folding unit to present a sheet from the stack for folding.

In a particularly preferred embodiment of the invention the support platform includes guide bars, the guide bars engaging a secondary guide means as the support platform is lifted to guide the stack into the aligned position.

Preferably the support platform is lifted upwardly by a drive means which drives a drive train comprising a separate drive chain connected to each lifting point, and the method includes the step of driving the drive means and hence each drive chain in synchronisation with the operation of the folding unit.

In a preferred embodiment of the invention each drive chain is trained over sprockets driven by the drive means, an end of the drive chain being connected to an associated lifting point and the other end of the chain being preferably counterweighted and free to rise and fall as the support platform is raised and lowered.

In one embodiment of the invention, the method includes the steps of detecting the end of the stack, and in response stopping the drive means and the folding unit.

Preferably, the method includes the step, after completion of the stack, of returning the support platform to a lowered pallet receiving position.

In one embodiment of the invention, the method includes the steps of :-

printing sheets of paper;

stacking the sheets on a pallet;

folding the sheets as the sheets are delivered to a folding unit from a stack;

gathering the folded pages to form a book;

applying a cover; and

binding the book.

In a preferred embodiment of the invention, the method includes the step of wrapping the stack with a plastics film after printing and stacking to retain a substantially constant humidity of the paper sheets prior to delivery to the support platform for the folding unit.

Preferably the books are bound by applying a hot melt adhesive and the method includes the step of curing the adhesive prior to packing the books.

Most preferably the books are cured by leading them along a circuitous conveyor prior to packaging.

In one embodiment of the invention, the method includes the steps, after binding, of :- trimming the book; weighing each book; comparing the book weight with a check weight; and rejecting any books not conforming to the check weight.

Preferably the method includes the steps of :- collecting waste paper generated in the book manufacturing process; shredding the waste paper; compacting the shredded waste paper; and recycling the compacted waste paper.

The invention also provides an apparatus for use in the method of the invention, the apparatus comprising :-

a support platform for receiving a pallet of a stack of printed sheets, the support platform

having lifting points adjacent the corners of a pallet;

drive means for driving a drive train extending between the drive means and the lifting points;

the drive train comprising a separate drive chain connected to each lifting point;

guide means for aligning a stack for delivery of single sheets to a folding unit; and

lifting means for pulling the lifting points and hence the support platform upwardly in synchronisation with the operation of the folding unit, the drive chains being operated substantially simultaneously by the drive means.

In a preferred embodiment of the invention the support platform includes guide bars for engagement with secondary guide means as the support platform is lifted.

The secondary guide means preferably comprises a pair of side guide arms including a lower inturned portion in which the guide bars run.

In a preferred arrangement, each drive chain is trained over sprockets driven by the drive means, an end of the drive chain being connected to an associated lifting point and the other end of the chain being free to rise and fall as the support platform is raised and lowered. Preferably, the free end of each drive chain is counterweighted.

In a particularly preferred embodiment of the invention, chain engagement means are provided over at least some of the sprockets to ensure engagement of the chain with the sprockets.

In one embodiment of the invention, the apparatus includes switch means for disabling the drive means when the support platform is raised and/or lowered beyond preset positions.

The invention also provides books whenever manufactured using the method of the invention and/or utilising the apparatus of the invention.

The invention will be more clearly understood from the following description thereof, given by way of example and with reference to the accompanying drawings in which :-

Fig. 1 is a perspective view of an apparatus for presenting stacks of printed sheets to a folding machine;

Fig. 2 is a perceptive view of the apparatus of Fig. 1 with a stack of sheets in position;

Fig. 3 is a perspective view from one side of the apparatus of Figs. 1 and 2;

Fig. 4 is a side elevational view of the apparatus in use;

Fig. 5 is a plan view of the apparatus;

Fig. 6 is a perspective view of a stack of sheets used in the method and apparatus of the invention;

Fig. 7 is a side view of a detail of the apparatus;

Fig. 8 is a perspective cross-sectional view of the detail of the apparatus;

Figs. 9(a) and 9(b) are cross-sectional views along the lines IX-IX in Fig. 8 with a support platform of the apparatus in different positions of use; and

Fig. 10 is a side view of another detail of the apparatus.

In a method for manufacturing books according to the invention, large sheets of paper are first printed using conventional printing techniques. The printed sheets are then stacked on a pallet 2 which holds a stack 3 of typically several hundred printed sheets. To ensure that optimum condition of the paper is retained and hence to optimise manufacturing efficiency, the stack of sheets 3 is preferably wrapped with a plastics film pending the further steps in the method of the invention.

The pallet 2 with the stack 3 in position is then loaded onto an apparatus according to the invention indicated generally by the reference numeral 5 which delivers single printed sheets to a folding unit, only portion 6 of which is illustrated. The sheets are folded in the folding unit and then the folded pages are gathered to form a book to which a cover is applied. The book is then bound, in this case by applying a hot melt adhesive. The adhesive is cured by passing the book along a circuitous conveyor to a quality checking and packing station.

As one of the quality control procedures each book is individually weighed, after trimming, and the weight is compared with a check weight to ensure that the book has the correct number of pages.

During the operation of the method of the invention waste paper is generated at several stages, for example, during trimming. The waste is collected, shredded, compacted and recycled.

In more detail, the apparatus 5 according to the invention comprises a support platform 10 for receiving a pallet 2 of a stack 3 of printed sheets. The support platform 10 has four lifting points provided by lifting lugs 11 which are located in use adjacent the corners of a pallet 2 as will be particularly apparent from Fig. 2. The apparatus 5 also includes lifting means for pulling the lifting lugs 11 upwardly in synchronisation with the operation of the folding unit 6.

The lifting means comprises drive means provided by a drive shaft 15 for driving a drive train extending between the drive shaft 15 and the lifting lugs 11. The drive train comprises a separate drive chain 16 connected to each lifting point 11, the drive chains 16 being operated substantially simultaneously by the drive shaft 15 for controlled and accurate lifting of the support platform 10 and hence presenting a sheet from the top of the stack 3 to the folding unit 6. Each of the drive chains 16 is trained over a number of sprockets 18 which are driven by the drive shaft 15. An end 20 of each drive chain 16 is mounted to an associated lifting lug 11 and the other end 21 of the chain 16 is a free end which is provided with a counterweight 22 to retain the chain 16 in position and ensure that the chain remains in contact with the sprockets 18. In addition, a segment-shaped chain engagement 25 means is positioned over at least the main driven sprockets, to ensure that the chain 16 is retained in positive contact with the sprockets of the sprocket wheel. In this way, the drive is optimised to ensure that all the lifting points 11 and hence the support platform and top row sheet 2 in the stack 3 is presented to the

folding unit in such a way that the folding unit is synchronised with the presentation of the sheets so that the folding unit operates at optimum operating conditions.

The uppermost sheet in the stack 3 is separated from the stack by a separator unit 30. A control unit 31 having a sheet engaging extension arm 32 monitors the delivery of sheets to the folding unit from the stack and ensures that the drive shaft 15 is driven in synchronisation with the operation of the folding unit.

The apparatus 5 also includes a guide means for guiding the stack into an aligned position on the support platform 10 for delivery of single sheets from the top of the stack 3 to the folding unit 6. The guide means is provided by guide strips 40 against which the stack 3 is engaged. The guide means also includes secondary guide means provided by a pair of side angle-shaped guide arms 45 which include a lower inturned portion 46 as illustrated particularly in Figs. 9(a) and 9(b). The platform 10 includes projecting bars 50 which run in the guide arms 45. The arrangement is such that when a pallet 2 with a stack 3 is loaded by means of a forklift truck onto the platform 10, the stack 3 is not pushed against the guide bars 40. On lifting of the platform 10, the bars ride up along the lower portion 46 of the guides 45 which causes the stack 3 to move inwardly against the guides 40. In this way, the stack 3 is presented to the folding unit in a consistent and optimum manner at all times.

As will be particularly apparent from Fig. 10, switch means is provided by upper and lower limit switches 59,60 which are operated by a switch arm 63 carried by the platform 10. The switches 59,60 cause the drive means to be disabled when the platform 10 is raised and/or lowered beyond preset positions.

The method and apparatus of the invention particularly allows a folding unit to be loaded with stacks of printed sheets for folding in a highly efficient and optimum manner for folding. Minimum handling is required and a high level of efficiency and quality is achieved with the folding unit as the sheets are always presented to the folding unit in a consistent manner. Manufacturing efficiency is thereby optimised.

Many variations on the specific embodiment of the invention described will be readily apparent and accordingly the invention is not limited to the embodiments hereinbefore described which may be varied in detail.

Claims

1. A method for manufacturing books including the steps of :-

   loading a pallet (2) of a stack (3) of printed sheets onto a support platform (10) having lifting points (11) on the platform (10) adjacent the corners of a pallet (2);

   guiding the stack (3) into an aligned position on the support platform (10) for delivery of single sheets from the top of the stack (3) to a folding unit (6); and

   lifting the support platform (10) upwardly by operating a lifting means (15,16,18) to pull the lifting points (11) upwardly in synchronisation with the operation of the folding unit (6) to present a sheet from the stack (3) for folding.

2. A method as claimed in claim 1 wherein the support platform (10) includes guide bars (50), the guide bars (50) engaging a secondary guide means (45) as the support platform (10) is lifted to guide the stack (3) into the aligned position.

3. A method as claimed in claim 1 or 2 wherein the support platform (10) is lifted upwardly by a drive means (15) which drives a drive train comprising a separate drive chain (16) connected to each lifting point (11), and the method includes the step of driving the drive means (15) and hence each drive chain (16) in synchronisation with the operation of the folding unit (6).

4. A method as claimed in claim 3 wherein each drive chain (16) is trained over sprockets (18) driven by the drive means (15), an end (20) of the drive chain (16) being connected to an associated lifting point (11) and the other end (21) of the chain (16) being preferably counterweighted (22) and free to rise and fall as the support platform (10) is raised and lowered.

5. A method as claimed in claim 4 including the step of guiding the chain (16) over at least some of the sprockets (18) with a chain engagement means (25) to ensure engagement of the chain (16) with the sprockets (18).

6. A method as claimed in any preceding claim including the steps of detecting the end of the stack (3), and in response stopping the drive means (15) and the folding unit (6).

7. A method as claimed in claim 6 including the step, after completion of the stack (3), of returning the support platform (10) to a lowered pallet receiving position.

8. A method as claimed in any preceding claim including the steps of :-

   printing sheets of paper;

   stacking the sheets on a pallet (2);

folding the sheets as the sheets are delivered to a folding unit (6) from a stack (3);

gathering the folded pages to form a book;

applying a cover; and

binding the book.

9. A method as claimed in claim 8 including the step of wrapping the stack (3) with a plastics film after printing and stacking to retain a substantially constant humidity of the paper sheets prior to delivery to the support platform (10) for the folding unit.

10. A method as claimed in claim 8 or 9 wherein the books are bound by applying a hot melt adhesive and the method includes the step of curing the adhesive prior to packing the books, preferably the books are cured by leading them along a circuitous conveyor prior to packaging.

11. A method as claimed in any of claims 8 to 10 including the steps, after binding, of :- trimming the book; weighing each book; comparing the book weight with a check weight; and rejecting any books not conforming to the check weight.

12. Apparatus (5) for use in the method as claimed in any preceding claim comprising :-

a support platform (10) for receiving a pallet (2) of a stack (3) of printed sheets, the support platform (10) having lifting points (11) adjacent the corners of a pallet (2);

drive means (15) for driving a drive train (16,18) extending between the drive means (15) and the lifting points (11);

the drive train (16,18) comprising a separate drive chain (16) connected to each lifting point (11),

guide means (40, 45) for aligning a stack (3) for delivery of single sheets to a folding unit (6); and

lifting means (15,16,18) for pulling the lifting points (11) and hence the support platform (10) upwardly in synchronisation with the operation of the folding unit (6), the drive chains (16) being operated substantially simultaneously by the drive means (15).

13. Apparatus as claim in claim 12 wherein the support platform (10) includes guide bars (50) for engagement with secondary guide means (45) as the support platform (10) is lifted

14. Apparatus as claim in claim 13 wherein the secondary guide means (45) comprising a pair of side guide arms (45) including a lower inturned portion (46) in which the guide bars (50) run.

15. Apparatus as claimed in any of claims 12 to 14 wherein each drive chain (16) is trained over sprockets (18) driven by the drive means (15), an end (20) of the drive chain (16) being connected to an associated lifting point (11) and the other end (21) of the chain (16) being preferably counterweighted (22) and free to rise and fall as the support platform (10) is raised and lowered.

16. Apparatus as claimed in claim 15 wherein chain engagement means (25) are provided over at least some of the sprockets (18) to ensure engagement of the chain (16) with the sprockets (18).

17. Apparatus as claimed in any of claims 12 to 16 including switch means (59,60) for disabling the drive means (15) when the support platform (10) is raised and/or lowered beyond preset positions.

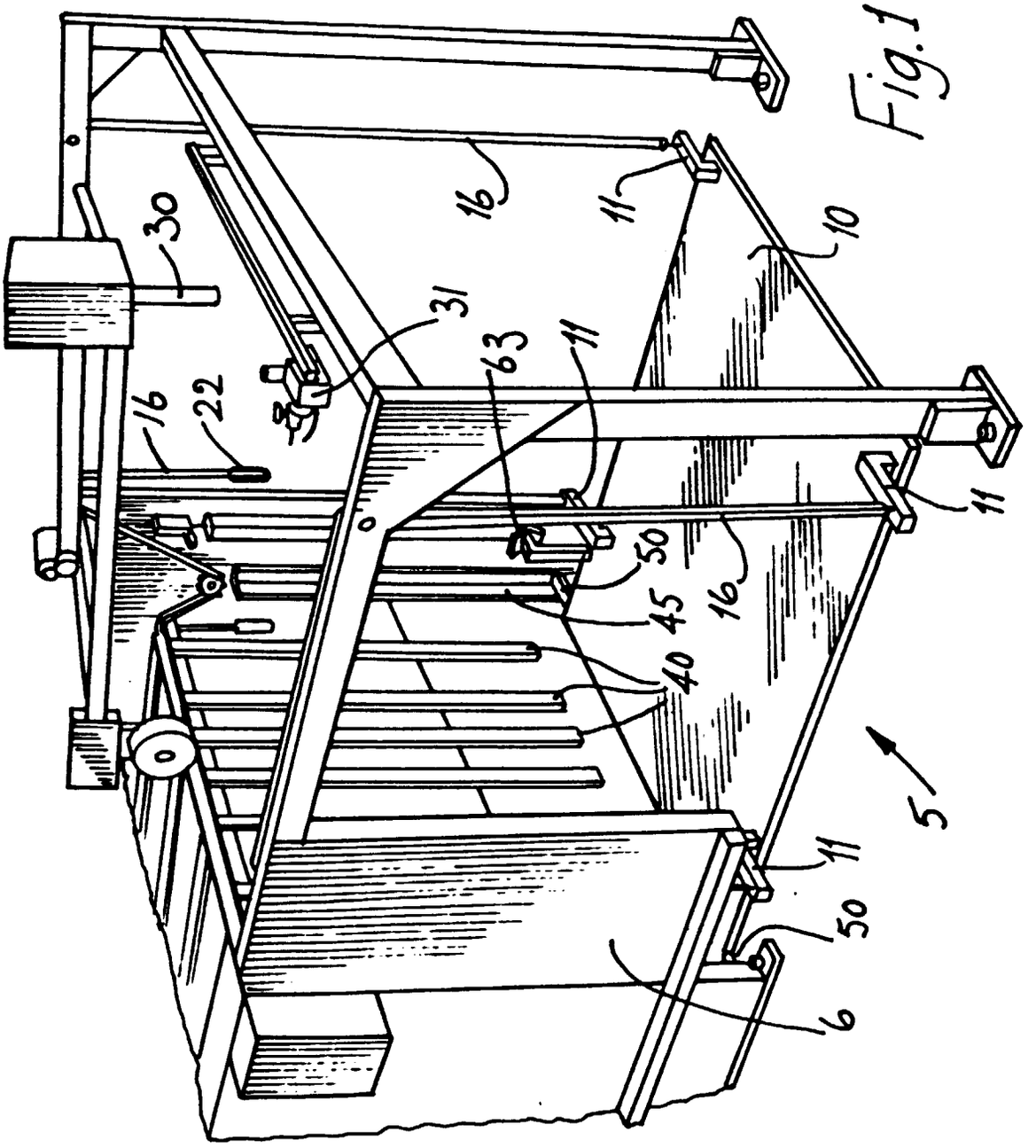

Fig.1

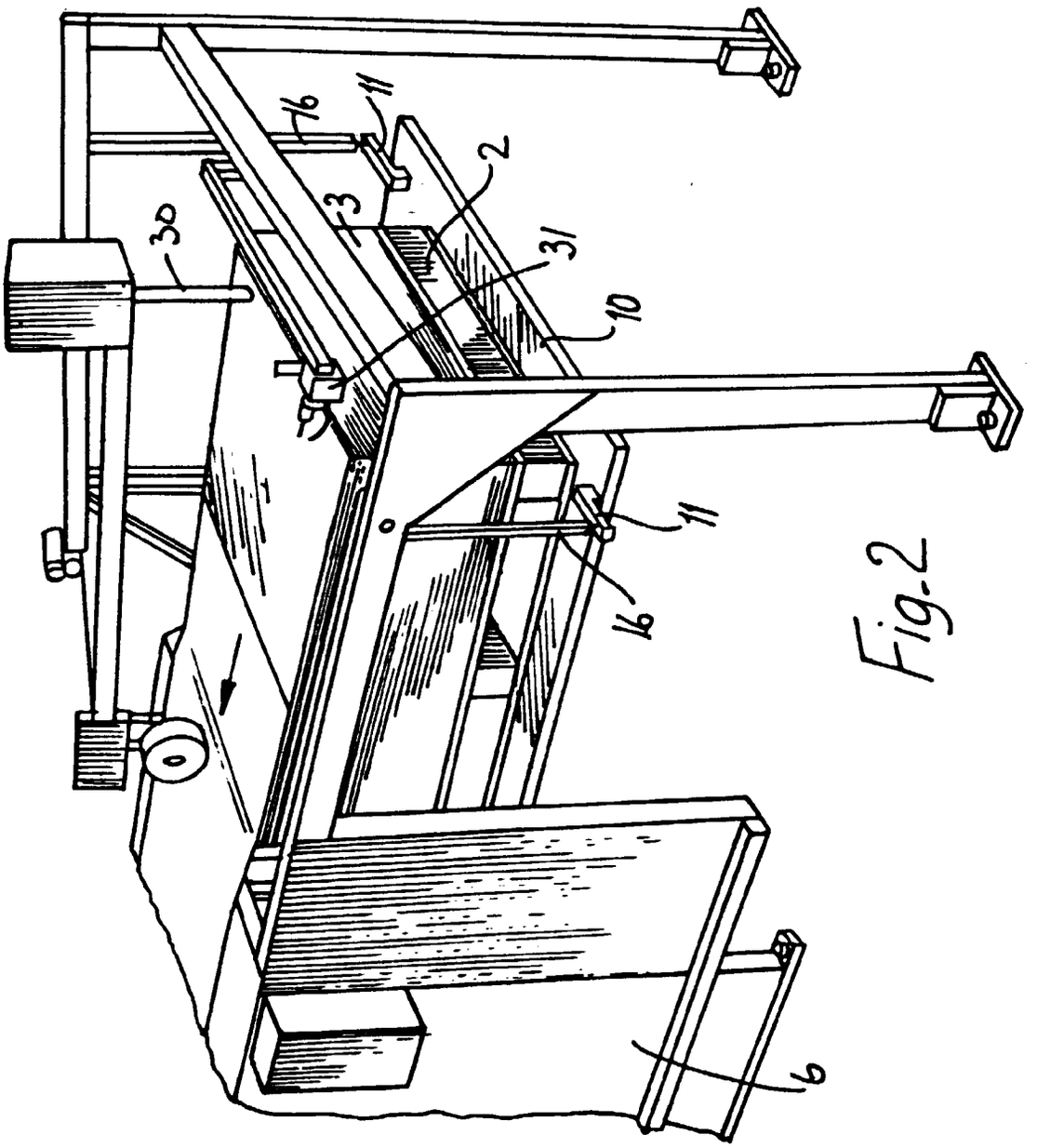

Fig.2

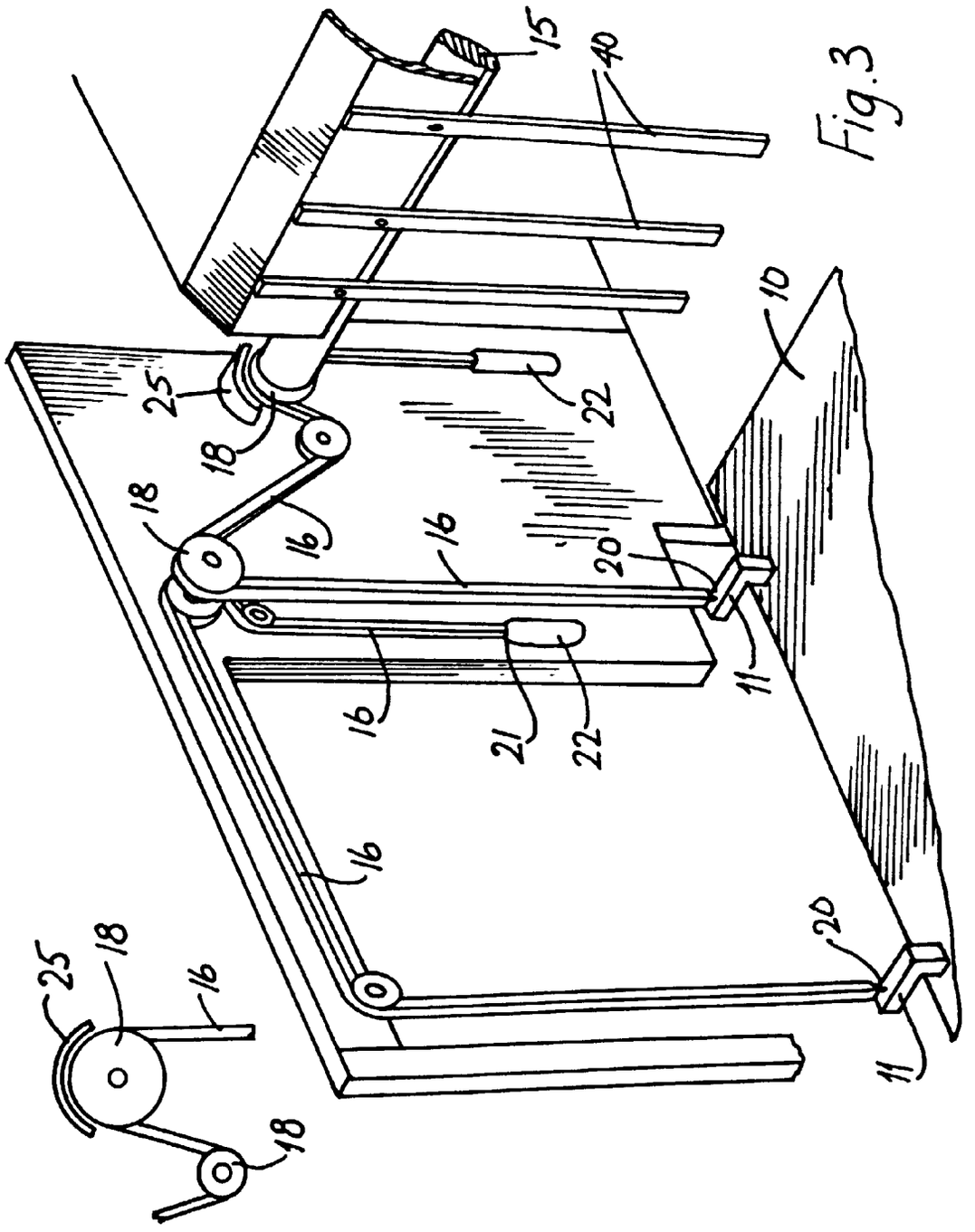

Fig.3

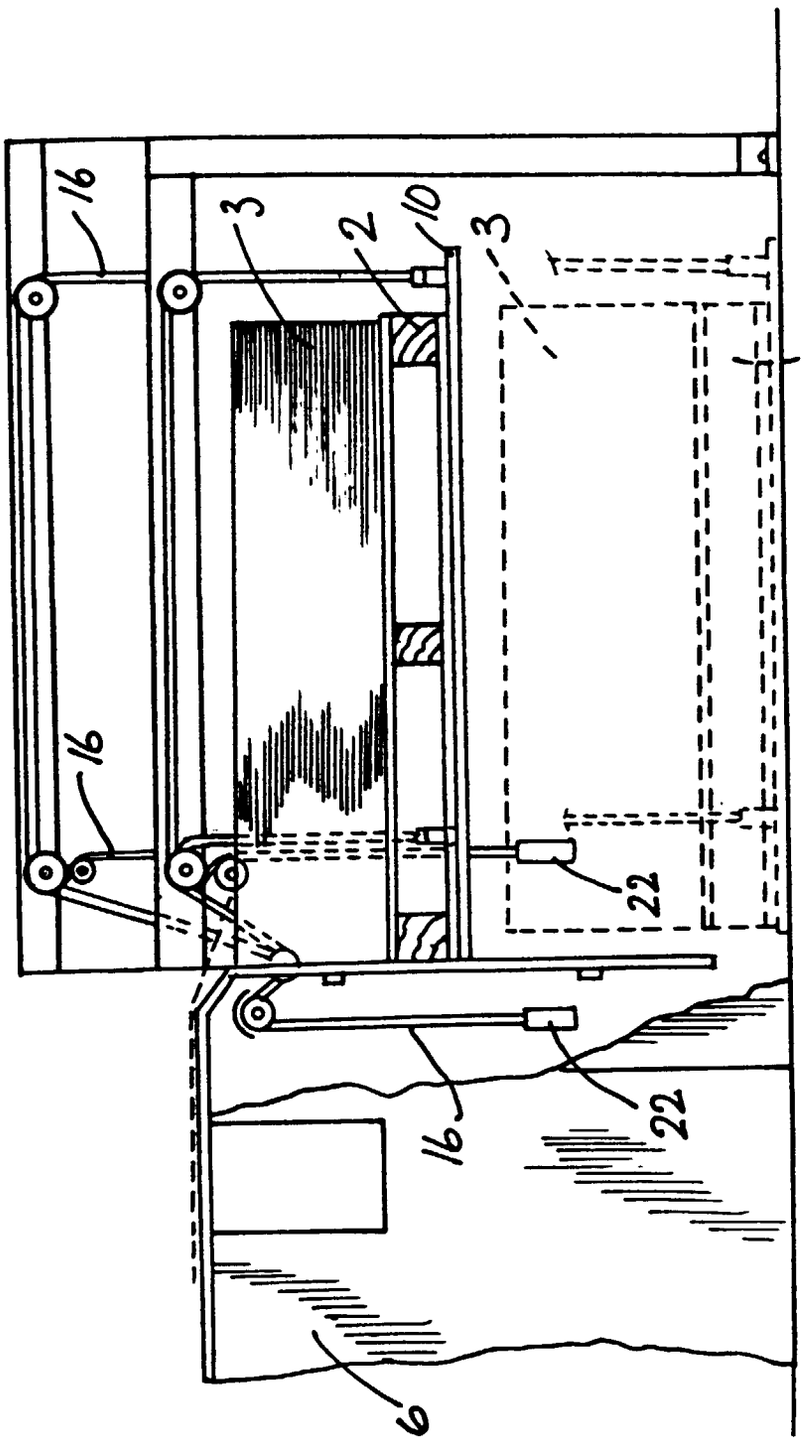

Fig. 4

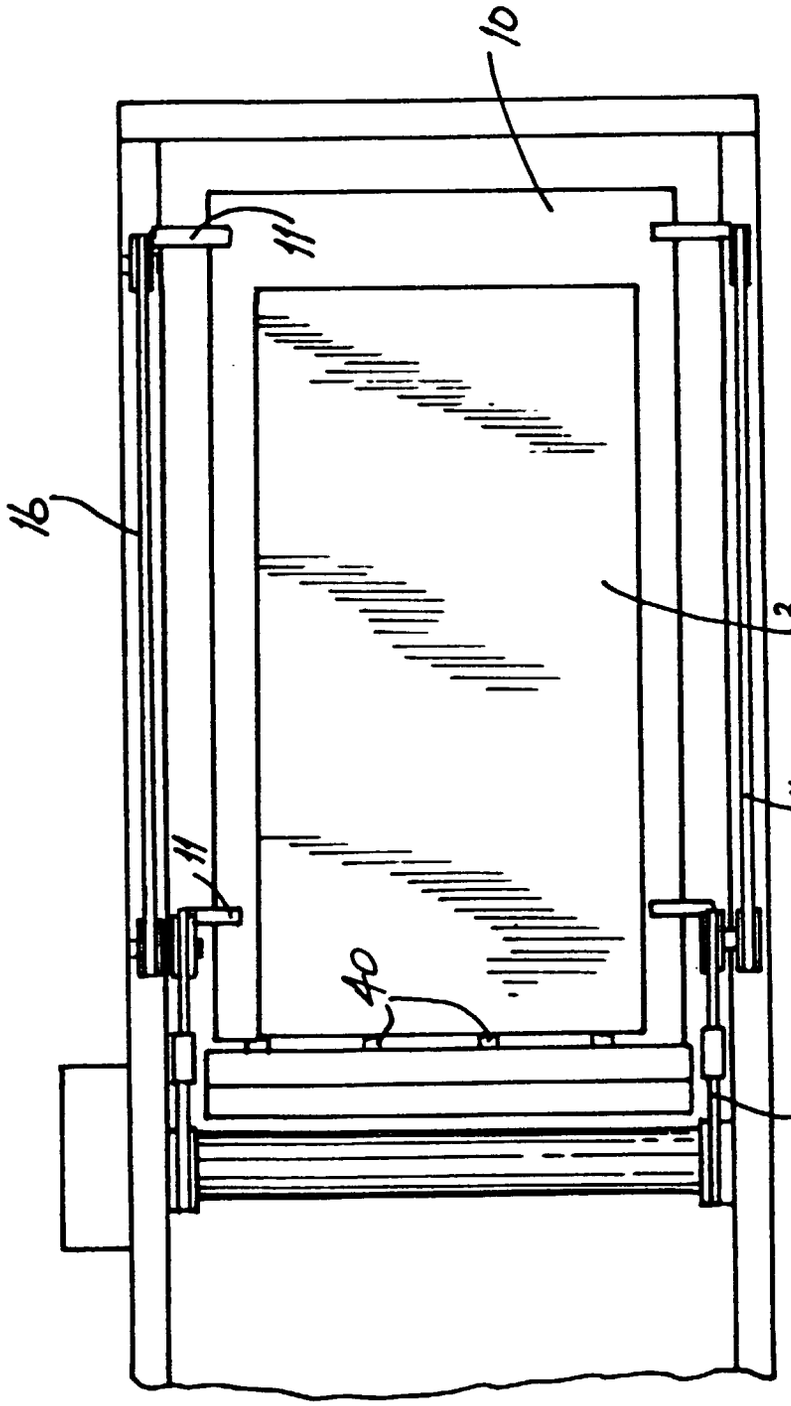

Fig. 5

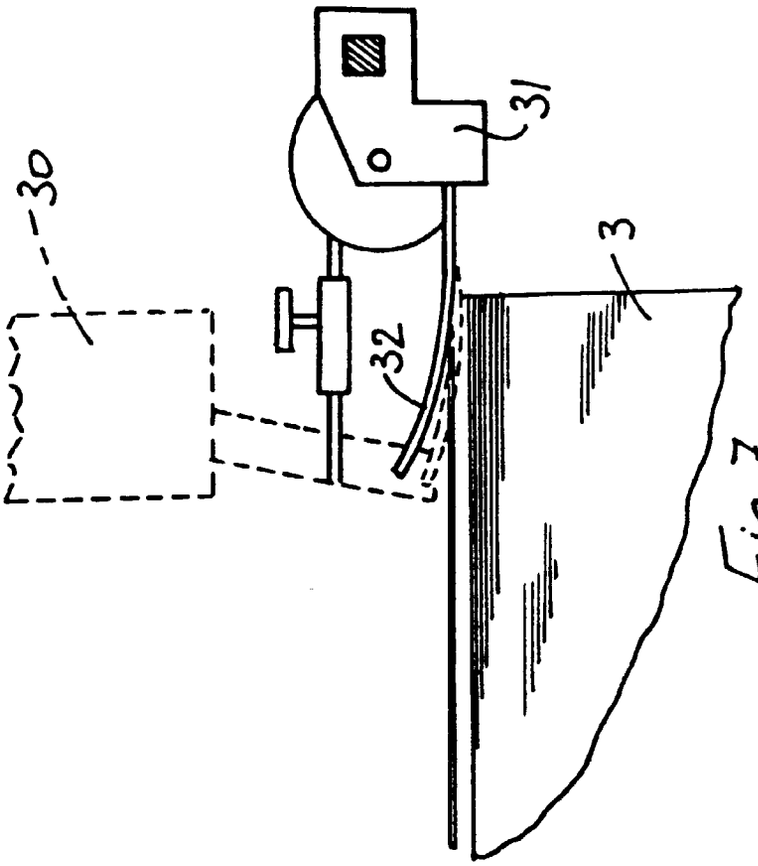

Fig. 7

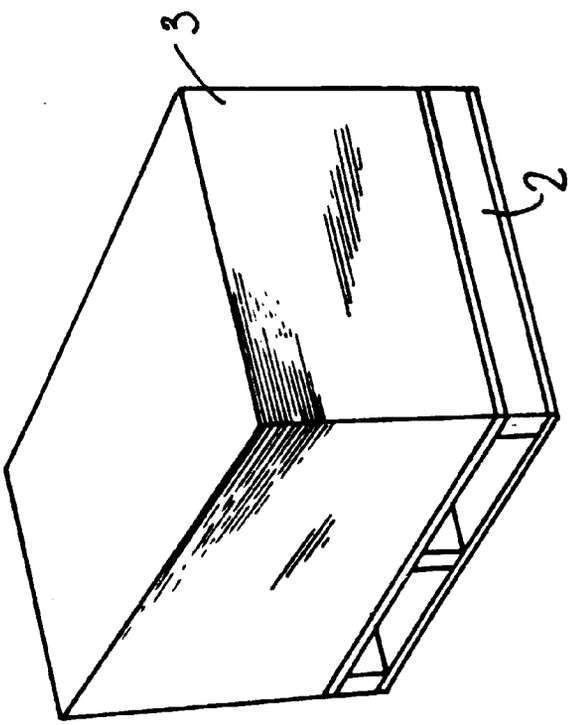

Fig. 6

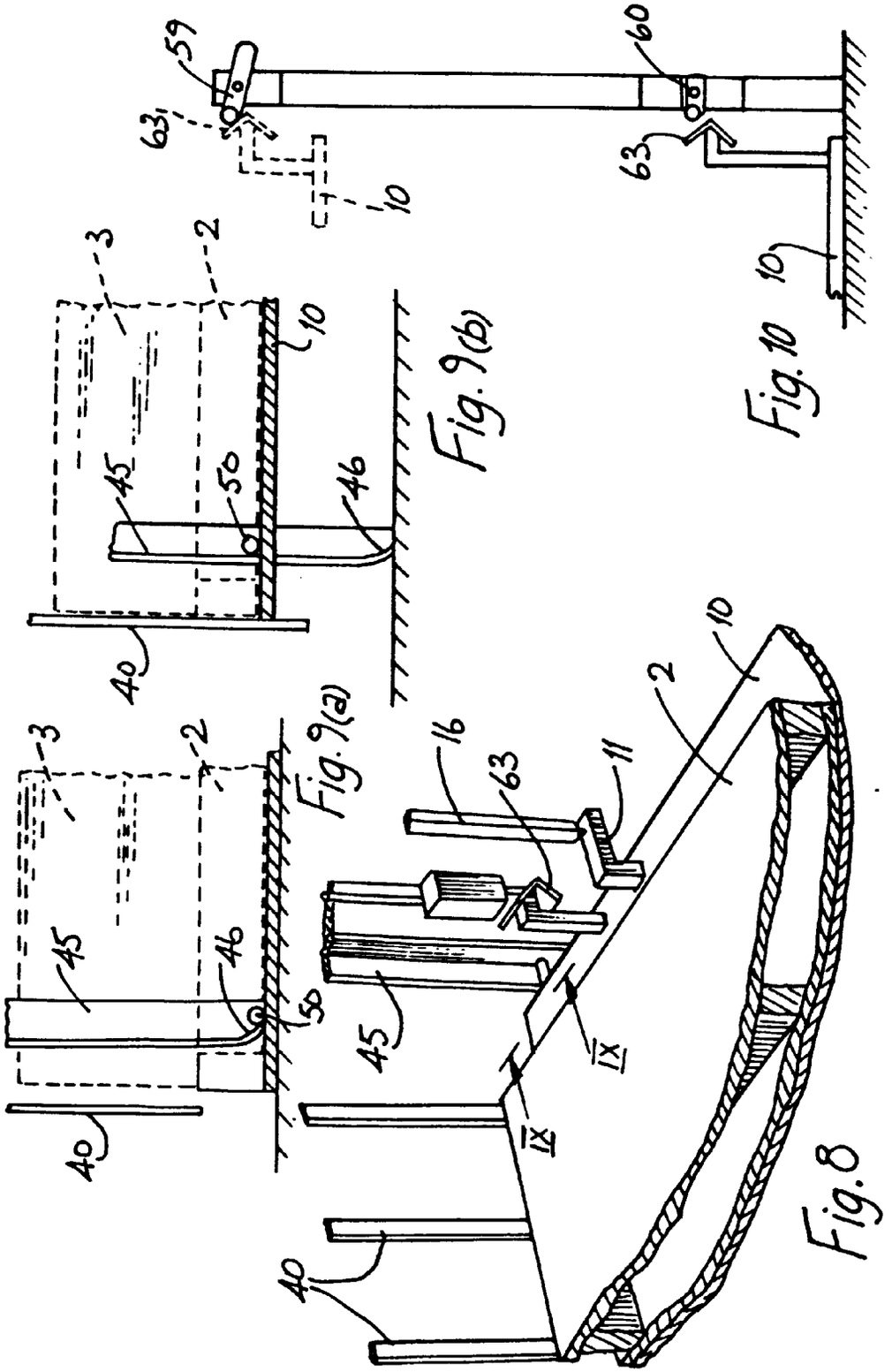
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Fig. 10
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Fig. 9(b)
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Fig. 9(a)
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Fig. 8