(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 584 561 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.10.2005 Bulletin 2005/41

(51) Int Cl.[7]: **B65B 35/40**, B65B 5/10

(21) Application number: **05252031.9**

(22) Date of filing: **31.03.2005**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

(30) Priority: **31.03.2004 GB 0407380**

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(54) Packaging apparatus provided with a plurality of packaging lanes.

(57) The invention provides a machine for packaging a product. The machine has a feed end for receiving products to be packaged, a delivery end from which packaged products are discharged, and a plurality of packaging lanes. Each packaging lane is adopted for packaging a row of products so that the machine can simultaneously package a plurality of rows of products.

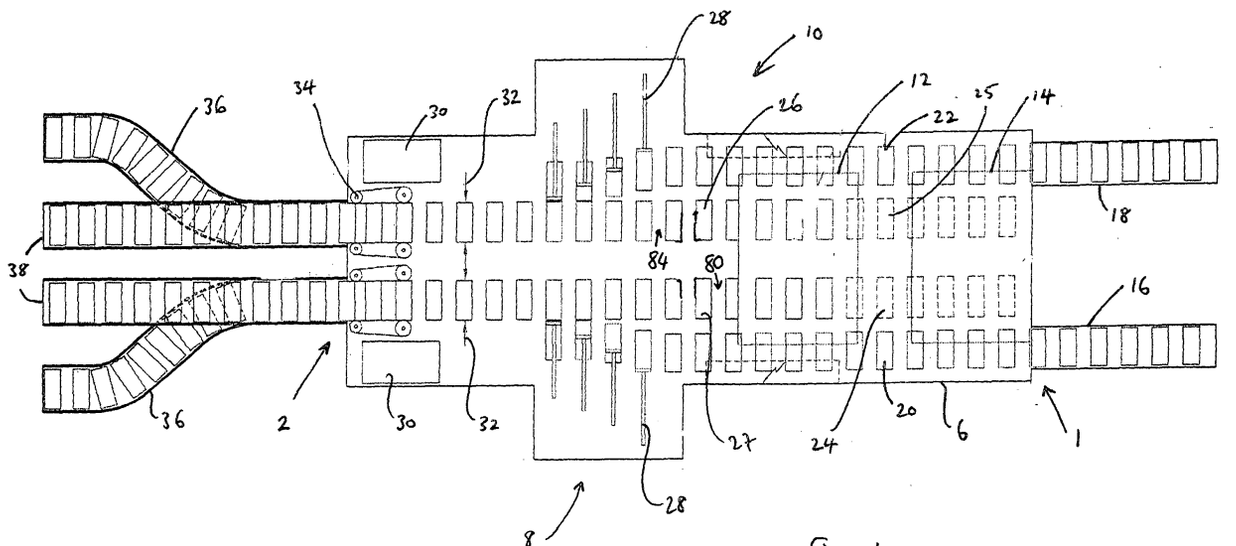

fig. 1

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Description

FIELD OF THE INVENTION

[0001] This invention relates to machines which automatically package products. It is particularly relevant to end-load cartoners and sleevers.

BACKGROUND

[0002] End-load cartoners are machines which load products sideways into boxes and then close and/or seal the boxes. Sleevers are machines which automatically put the cardboard sleeve around the product, e.g. a plastic tray containing a ready meal.

[0003] Known end-load cartoners (e.g. the RSB6 series machine manufactured by Jacob White (Packaging) Ltd) have an input line of products carried on drive chains. A product to be packaged is either manually or automatically placed on to the drive chains, e.g. the product may be put into a bucket for packing in a carton. The cartons in which the product are to be packed are erected from a magazine which holds carton blanks when a sensor detects the presence of a product on the conveyor belt. A blank is drawn from the magazine by vacuum pick off, and is placed in an erected state into a continuously moving flighted chain. The chain and conveyor belt are arranged so that the product is aligned with the carton at the point of loading. A linear sliding pusher arm acts on the product to push it sideways into an open end of the carton. The machine can sense when there is no carton or no product before the loading step, and can perform rejection if necessary.

[0004] After loading, the carton is closed and sealed automatically. Tucking and/or gluing are used to close and seal such cartons. Once closed, the cartons are discharged from the machine by powered side belts.

[0005] There are disadvantages associated with known machines.

[0006] Firstly, a balance needs to be struck between output level (i.e. number of cartons packed per minute) and cost of machine manufacture and maintenance. To achieve a high output level, it is necessary that the conveyor belt and chain in the machine have a high linear speed. However, if high linear speeds are used, the tolerances of the machine parts needs to be much higher because great precision is required at high speed to avoid jams and/or mis-loading. Manufacturing parts to higher tolerances costs more; the benefit of higher output therefore has higher cost associated with it. Moreover, the life expectancy of parts in a machine worked at high speed is less than that of similar parts in a slower machine. Thus, costs relating to maintenance and replacement parts are increased for high speed machines.

[0007] A second disadvantage occurs when a packaging company wishes to package different types of product but does not have factory space for a plurality of packaging machines. To package different products, it is necessary to perform one run of packaging for one product, then stop the machine and re-configure it for the next product, etc. Packaging time (and therefore overall output rate) is reduced by the machine 'down-time', i.e. time when the machine is not operating. This problem has a further important aspect with regard to manufacturers who wish to market items which are collections of a number of different individually packaged boxes. A typical example is cereal selection packs, where a plurality of boxes of different individually wrapped cereals are sold as a unit. To manufacture these with the above-described machine, it is necessary to package each type of product individually and, once all of the different types of product have been packaged, to collate the boxes into the correct combination. The packaging process therefore has two distinct steps which are discrete; a continuous production is not possible.

SUMMARY OF INVENTION

[0008] At its most general, the present invention provides a packaging machine capable of simultaneously packaging two or more product lines. The machine can receive a plurality of different types of product as input and can simultaneously pack those products to produce an output of different types of packaged products. The input lines may be synchronised such that the same number of each different type of product is produced; this facilitates continuous production of a 'selection box' containing different packaged products.

[0009] According to the invention, there is provided a machine for automatically packaging a product having: a feed end for receiving products to be packaged; a delivery end from which packaged products are discharged; and a plurality of packaging lanes, each packaging lane being for packaging a row of products such that the machine can simultaneously package a plurality of rows of products.

[0010] Preferably, each packaging lane includes: packaging input means to provide a row of packets for said row of products, each packet being suitable for packaging a respective product from said row of products; loading means for loading each product into its corresponding packet to form a packaged product; and conveying means for transporting the product and packets through the machine.

[0011] Thus, the machine may resemble a known packaging machine, except that it simultaneously runs a plurality of product conveyors (e.g. conveyor belts or bucketed conveyors (for holding the product), slatted chains, or other types of product translation means known in the art) and has the ability simultaneously to erect and then load a plurality of cartons (or other packet). Indeed, each packaging lane of the present invention may resemble the packaging mechanism of known devices. However, the inventors have found it is preferable to share common components, as explained here-

inafter.

[0012] The machine may have the packaging lanes arranged in any configuration. However, due regard needs to be given to overall size and accessibility.

[0013] The present invention allows one to have the packaging ability of a plurality of machines whilst not requiring the same amount of space as plurality of single-laned machines would take up. The amount of factory floor space taken up by a machine is known as the 'footprint'. The inventors have found that by sharing common components in the plurality of packaging lanes, the footprint of one multiple-laned machine according to the invention is much less than that of a corresponding number of single-laned machines.

[0014] Significantly, the use of multiple packaging lanes enables a reduction in the linear speed of products being transported through the machine whilst maintaining or even increasing the overall rate of throughput of products compared with prior art, single lane arrangements. The handling of products is also simplified.

[0015] Accessibility to the inside of machines is important for maintenance and repair purposes. It is also important to have access to the mechanism in order to fix a jam or mis-loading operation. Such fixing is generally carried out by hand. This means it is desirable to have all elements in the machine within arm's reach of the outside frame.

[0016] The machine may have a plurality of horizontally adjacent packaging lanes. The number of horizontally adjacent lanes may be limited so that they can all be accessed by arm's reach from a side of the machine. Alternatively or additionally, a small gap may be provided between lanes to allow access.

[0017] The machine may have packaging lanes split over two or more vertical levels. Such an arrangement is desirable because it does not affect the overall width of the machine. Therefore, more packaging lanes can be included without increasing the footprint of the machine and without affecting the ease of access to the lanes from the outside frame.

[0018] The machine may have four packaging lanes arranged over two levels in a 2×2 matrix formation. The lanes may be parallel to one another.

[0019] The height of the machine may be another important factor. This is true if one considers the multiple vertical level arrangement; the higher lanes are preferably accessible to an operator standing on the floor, i.e. a ladder is not required. The components of the mechanism which add the most height may be the packaging input means, i.e. the carton erectors. To reduce the overall height of the machine, it is preferable to stagger the location of the packaging input means on different vertical levels, i.e. the packaging input means on one level is preferably horizontally displaced from that on an adjacent, vertically spaced, level.

[0020] Preferably, a single motor is used to drive the conveying means on more than one of the packaging lanes. This is an example of sharing common components. One motor may be used to drive all of the conveying means in the machine. Alternatively some, or even all of the conveying means may be driven by separate motors.

[0021] Preferably, the conveying means comprises the flighted chain and conveyor belt or bucketed conveyor of the known packaging device. The flights may be provided on side walls of the chain. One of the side walls may be laterally movable so that the chain can be adjusted to hold different sizes of packet. The side walls may be independently movable so that the machine can simultaneously package different sizes of product.

[0022] The chain preferably has a overhead rail to prevent the packet from jumping vertically off the chain. To allow better access to the inside of the machine, the overhead rail is preferably movable in the vertical direction.

[0023] In the 'double decker' arrangement, it may also be desirable for the upper chain to be vertically movable to avoid interference between the return flights on the upper chain and the overhead rail of the lower chain when the overhead rail of the lower chain is lifted.

[0024] As with known machines, a guard screen may be present around the loading area to prevent unwanted intrusion into the device during loading. The guard screen may be opened to allow access, e.g. to fix a jam.

[0025] The machine may be provided in a single frame. In other words, the machine would be a unitary device between the feeding in of the product and the discharge of the packaged items.

[0026] The machine may exhibit mirror symmetry about a central vertical plane of the machine. This configuration facilitates keeping the footprint of the machine as small as possible. Preferably, when there are two horizontally adjacent packaging lanes, the loading means of each packaging lane sideways loads products into packets in an opposite direction to the other lane. Thus, the left-hand packaging lane effects loading sideways to the right, and the right-hand packaging lane effects loading to the left.

[0027] Preferably, a single packaging input unit (or carton erector) is used for two or more horizontally adjacent lanes. This is another example of sharing common components. The drive means of the carton erector, i.e. the mechanism which moves the carton blank from the magazine to the flighted chain may be the same for all of the lanes on one horizontal level. This arrangement would also facilitate synchronisation. Thus, the input unit may comprise a plurality of adjacent hold/release mechanisms for holding the carton blanks all movable by a common drive means. The hold/release mechanism may be independently or selectively operable. Thus, if a sensor detects that there is no product to be loaded on one of the lanes, the hold/release mechanism for that lane is preferably deactivated. The hold/release mechanisms may be vacuum suction cups. The selective control may be achieved by having separate control valves.

[0028] Preferably, the machine operates so that the conveying means moves the products at a linear speed of less than 0.63 ms^{-1} (1500 inches per minute). More preferably the linear speed is less than 0.5 ms^{-1} (about 1250 inches per minute). These operating speeds do not require the tolerances of the mechanical parts to be very high, yet because there are a plurality of lanes, the overall output of the machine is high. For example, a four-lane machine with each lane having a product separation of 5 inches operating at 1250 inches per minute produces 1000 packaged items per minute. A single lane device would need a linear speed of 5000 inches per minute to achieve this. In addition to the simple fact of increased output, the fact that the multiple-laned machine operates at a lower speed means the life expectancy of individual parts is higher because less strain is exerted on the mechanism. Moreover, machines that operate at lower speeds are easier to control and cheaper to maintain.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] Embodiments of the invention will now be described with reference to the drawings, in which:

Fig. 1 is a plan view of a cartoning machine that is an embodiment of the invention;
Fig. 2 is a cross-sectional side view of the machine of Fig. 1;
Fig. 3 is a perspective view of a carton erector suitable for use in a machine that is an embodiment of the invention;
Fig. 4 is a perspective view of another carton erector suitable for use in a machine that is an embodiment of the invention;
Fig. 5 is a side view of a staggered arrangement of carton erectors; and
Fig. 6 is an end view of the flighted chains used in the machine of Fig. 1.

DESCRIPTION OF EMBODIMENTS

[0030] Fig. 1 shows a four-lane cartoning machine 10 which is an embodiment of the invention. The machine is operated by programmable logic circuits and other basic components which are the same as those used for known single-lane devices. The following description is confined to the differences between the inventive machine and known machines. A person skilled in the art would understand how to implement the invention from the following information.

[0031] The machine 10 extends between a feed end 1 and a delivery end 2. At the feed end 1, four bucket infeed conveyors arranged in a 2×2 matrix configuration feed the product into the machine 10. The plan view of Fig. 1 shows the upper two conveyors 16, 18. The lower two conveyors (including conveyor 17, see Fig. 2) lie directly below the two upper conveyors 16, 18.

[0032] The upper conveyors 16, 18 respectively carry linear sliding product buckets 20, 22. The buckets 20 on the left hand upper conveyor 16 are slidable to the right, whereas the buckets 22 on the right hand upper conveyor 18 are slidable to the left. The lower two conveyors are configured accordingly.

[0033] The machine 10 contains an upper rotary carton feeder 12 and lower rotary carton feeder 14. The rotary carton feeders provide cartons for packaging the products on the conveyors. The upper rotary carton feeder 12 provides cartons 26, 27 for the buckets 20, 22 carried on the upper two conveyors 16, 18. The lower rotary carton feeder 14 provides cartons 24, 25 for the buckets carried on the lower two conveyors (not shown in Fig. 1).

[0034] Like known machines, when the buckets are fed into the machine 10, sensors (not shown) detect whether or not a product has been loaded into the bucket. If a product is sensed, the rotary carton feeder draws a carton blank from the relevant magazine 40 (see Figs. 2 to 4) and places it in an erect form into the main flights of a conveying chain 80,84.

[0035] To reduce the overall height of the machine 10, the upper rotary carton feeder 12 is provided further along the machine than (i.e. laterally displaced from) the lower rotary carton feeder 14. Thus, cartons are fed from the lower rotary carton feeder 14 first.

[0036] Moreover, each of the carton feeders provides cartons for two lanes. This is discussed in more detail below.

[0037] Each of the upper conveyors 16, 18 (and each of the lower conveyors) has a chain associated with it. Fig. 1 shows that the associated chains are located on the inside of their respective conveyors. As in known machines, the flighted chain is aligned with the conveyor such that, at the loading stage, the bucket is slid sideways up to an open side of the carton.

[0038] Loading takes place in the loading section 8 of the machine 10. Prior to reaching the loading section 8, a second set of sensors (not shown) check for the presence of products and cartons. If either are missing, the linear sliding pusher arms 28 will not be triggered to push the product bucket into its corresponding carton.

[0039] The linear pushing arms are arranged on both sides of the machine 10. As in known devices, there are a plurality of pushing arms. In the present invention, a set of pushing arms is provided for each pair of conveyor and flighted chain. Thus, there are two sets of pushing arms 28 on each side of the device in a tiered arrangement.

[0040] If a 'no load' situation occurs, the product will be rejected on its own lane. Therefore total separation of products is possible even after they have entered the machine.

[0041] Once the cartons are loaded, their remaining open flaps are closed in a known manner. Fig. 1 shows a gluing technique. Glue is supplied from tanks 30 to nozzles 32, which apply the glue to the flaps to seal the

product in the carton. Fig. 1 shows individual glue tanks 30 for each conveyor, but it is also possible to have a common glue tank which provides glue to all the nozzles 32. Closure by tucking is also possible.

[0042] Once the cartons are sealed, they can be ejected out of the delivery end 2 of the machine 10 via paired sets of acceleration belts 34 on to standard modular conveyors belts 36, 38, which can transport the cartons away to their final destination.

[0043] The above-described components of the machine 10 between its feed end 1 and delivery end 2 are contained within a single frame member 6.

[0044] Fig. 2 shows a side view of the machine 10 resting on the ground 4. Here, the 'double decker' arrangement of packaging lanes is clearly visible. Moreover, the lateral staggering of the upper rotary carton feeder 12 and the lower rotary carton feeder 14 can also be seen. The magazines 40 for holding carton blanks prior to use are visible.

[0045] Fig. 3 shows a perspective view of the upper rotary carton feeder 12. The feeder 12 forms the open cartons and deposits them on to the flighted conveying chain for holding the carton and transporting it to the loading area 8.

[0046] Fig. 3 shows how a single rotary carton feeder 12 can load carton blanks 26, 27 on to two horizontally adjacent flighted chain conveyors 80,84 for subsequent loading of two respective lanes of products on conveyors 16,18 (see Fig. 1). The rotary carton feeder 12 has a magazine 40 which holds two sets of carton blanks 42, 44. At the bottom end of the magazine 40, a rotating drive unit 50 is located. The drive unit 50 has two opposed rotating axles 43, 45 which are arranged to rotate about their own axis at the same time as moving about the axis of the drive unit 50.

[0047] Two adjacent sets of vacuum suction cups 46, 47, 48, 49 are located on each axle 43, 45. The two degrees of rotation of the carton feeder 12 are configured so that the vacuum suction cups are aligned to act on the carton blanks when their axle is located adjacent the bottom of the magazine 40 and aligned to place the folded carton blank on to the product when their axle is located adjacent the conveyors. Fig. 3 shows the vacuum suction cups 46, 47 placing the folded carton blanks on the flighted chain conveyors 80,84.

[0048] The axles are operated by a single drive unit, which is provided on one hub of the carton feeder 12. This enables the conveyors to be located closer together, because there is no need to position a drive unit between them. The sets of vacuum suction cups 46, 47, 48, 49 on each axle are still independently controllable however. Each set of suction cups has its own control valve (not shown), hence is independently operable.

[0049] In use, a signal is given to the rotary carton feeder 12 either manually or automatically which turns on the suction to the feeder. The suckers on the rotary carton feeder pull off a single carton 26,27 from the pile of flat cartons in the rotary carton feeder 12. As the carton is placed into the flighted conveyor 80,84 the angle at which the carton hits the flight will cause it to erect open. As the carton subsequently travels through the cartoning machine the carton flaps are held open by conventional mechanisms to help with the loading of product into the carton. Conventional mechanisms can also be employed for closing and sealing of the flaps after the product has been loaded.

[0050] Fig. 4 shows a perspective view of an alternative upper rotary carton feeder 12. In this drawing, the packaging machine is actually a sleever, so a flighted chain for holding the carton prior to loading is not required. Instead, the carton blank is deposited directly on the product, on conveyors 16,18, ready to be folded over it at the loading stage. However, the same reference numbers have been given to parts which have a common function to the machines in Figs. 1 and 3.

[0051] Fig. 4 shows how a single rotary carton feeder 12 can load carton blanks 26,27 on to products 20,22 on two horizontally adjacent conveyors 16,18. In this example, the conveyors 16,18 can be closer together than illustrated in Fig. 1 as there is no need for the chain conveyors 19 between them.

[0052] In an alternative carton erection system (not shown) the flat cartons are loaded vertically above the flighted conveyor. The system sucks or otherwise draws the carton down into the conveyor, again hitting the flights at an angle that will cause the carton to erect.

[0053] Fig. 5 shows the staggered arrangement of two rotary carton feeders 12, 14 (that may be as illustrated in Fig. 3 or Fig. 4) working at different levels. It us clear from this drawing how vertical space is saved by this staggered arrangement.

[0054] Fig. 6 shows a cross-sectional view of the flighted chains for carrying cartons as arranged in the machine in Fig. 1 when viewed down the length of the chain. There are four chains arranged in the 2×2 matrix configuration: two upper chains 80, 84 and two lower chains 82, 86 lying directly beneath them. Each chain comprises the main carton flights 68, 69, 72, 73 and the return flights 70, 71, 74, 75. The outer fixed walls 60, 62 hold one side of each of the chains, whereas the other sides are held by adjustable walls 64, 65, 66, 67. These walls are laterally movable to adjust the width of the chain so that different sizes of cartons can be held.

[0055] Each chain also has a set of overheads 76 located over it. The overheads maintain the vertical position of the carton on the chain, and prevent it from coming off the flights. The overheads are vertically movable by hand to allow access to the chain. This is useful in order to clear a jam. During the loading operation, however, each overhead rail is locked in place by clamp screws (not shown) to prevent them from moving vertically under force from the cartons.

[0056] It is apparent to one skilled in the art that the present invention can include alternatives or additions which are not described in detail above without departing from the scope of the claims.

Claims

1. A machine (10) for packaging a product, the machine comprising:

   a feed end (1) for receiving products to be packaged;
   a delivery end (2) from which packaged products are discharged; and
   a plurality of packaging lanes, each packaging lane being for packaging a row of products such that the machine can simultaneously package a plurality of rows of products.

2. A machine according to claim 1, wherein each packaging lane includes:

   packaging input means (12,14) to provide a row of packets for said row of products, each packet being suitable for packaging a respective product from said row of products;
   loading means (28) for loading each product into its corresponding packet to form a packaged product; and
   conveying means (16,17,18,80,82,84,86) for transporting the products and packets through the machine.

3. A machine according to claim 2 having two or more packaging lanes on vertically spaced levels, wherein the packaging input means (12) of the packaging lane or lanes on one level is horizontally displaced from the packaging input means (14) on an adjacent level.

4. A machine according to claim 2 or claim 3, wherein a single motor runs the conveying means on more than one of the packaging lanes.

5. A machine according to any one of claims 2 to 4, wherein the conveying means (80,82,84,86) includes a conveyor with flights (68,69,72,73), for holding the packets (26,27) located on the side walls (60,62,64,65,66,67) of said conveyor, one of said side walls (64,65,66,67) being laterally movable to allow the conveyor to be adjusted to hold different sized packets (26,27) .

6. A machine according to any one of claims 2 to 5, wherein the conveying means includes a conveyor with an overhead rail (76) for holding the packets (26,27) down on the conveyor, said overhead rail (76) being movable to allow access to the conveyor.

7. A machine according to any one of claims 2 to 6 having two horizontally adjacent packaging lanes, wherein the loading means (28) of said two horizontally adjacent packaging lanes load the products into their respective packets (26,27) sideways in opposite directions.

8. A machine according to any one of claims 2 to 7, wherein a single packaging input unit (12,14) is the packaging input means for two or more horizontally adjacent lanes.

9. A machine according to any one of claims 2 to 8, wherein the conveying means moves the products at a linear speed of less than 6.3 ms^{-1}.

10. A machine according to any one of the preceding claims having two or more horizontally adjacent packaging lanes.

11. A machine according to any one of the preceding claims having two or more packaging lanes vertically spaced from one another.

12. A machine according to any one of the preceding claims, wherein the packaging lanes are parallel to one another.

13. A machine according to any one of the preceding claims having four packaging lanes arranged in a 2 $\times$ 2 matrix configuration.

14. A machine according to any one of the preceding claims, wherein two or more of the packaging lanes are synchronised.

15. A machine according to any one of the preceding claims housed within a single frame (6).

16. A machine according to any one of the preceding claims having mirror symmetry about a central vertical plane.

17. A packaging input unit (12,14) for providing a plurality of rows of packets (26,27) for use in two or more horizontally adjacent packaging lanes, the unit comprising:

   a plurality of adjacent hold/release mechanisms (46,47), each hold/release mechanism being for selectively holding and releasing a packet (26,27);
   drive means (50) for simultaneously moving the hold/release mechanisms (46,47) from a first position to a second position, such that the mechanism can take hold of a packet (42,44) at the first position and release it at the second position.

18. A unit according to claim 17, wherein the hold/release mechanisms (46,47) are independently operable.

19. A unit according to claim 17 or claim 18, wherein a hold/release mechanism comprises a set of vacuum suction cups (46,47).

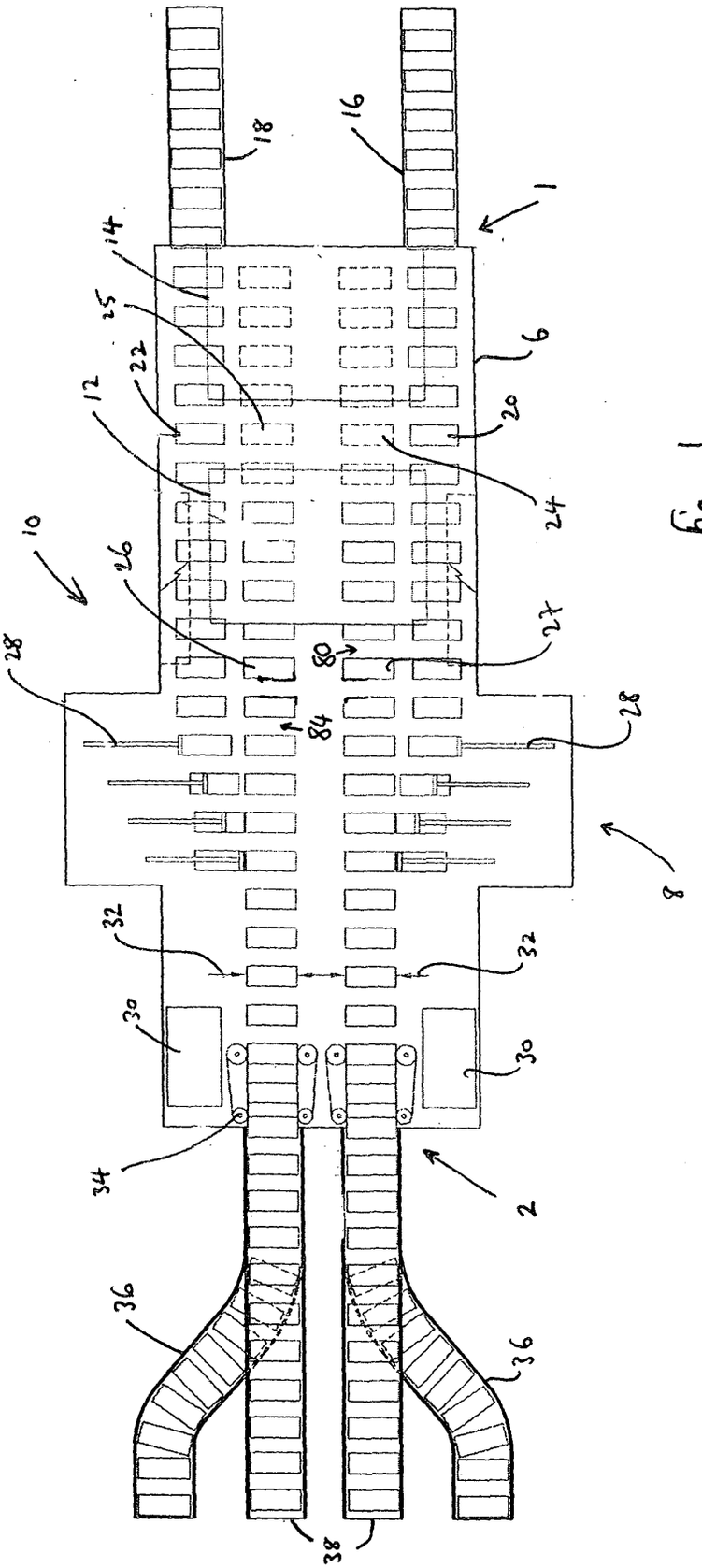
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Fig. 1

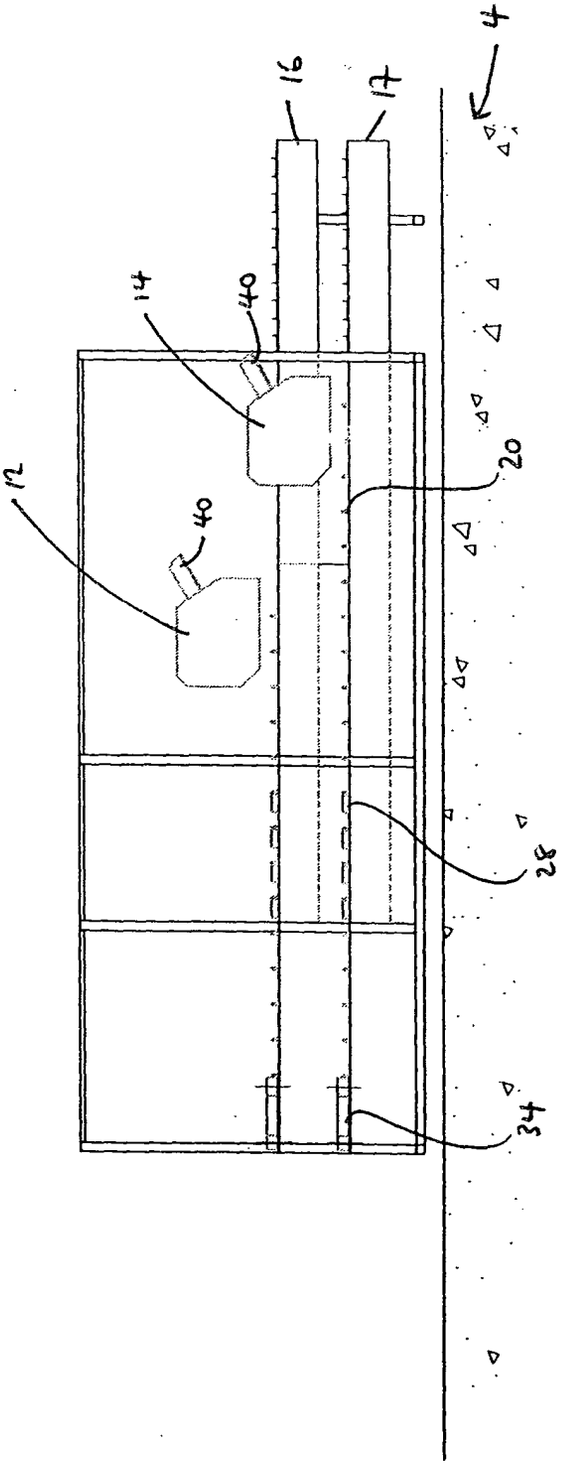


Fig. 2

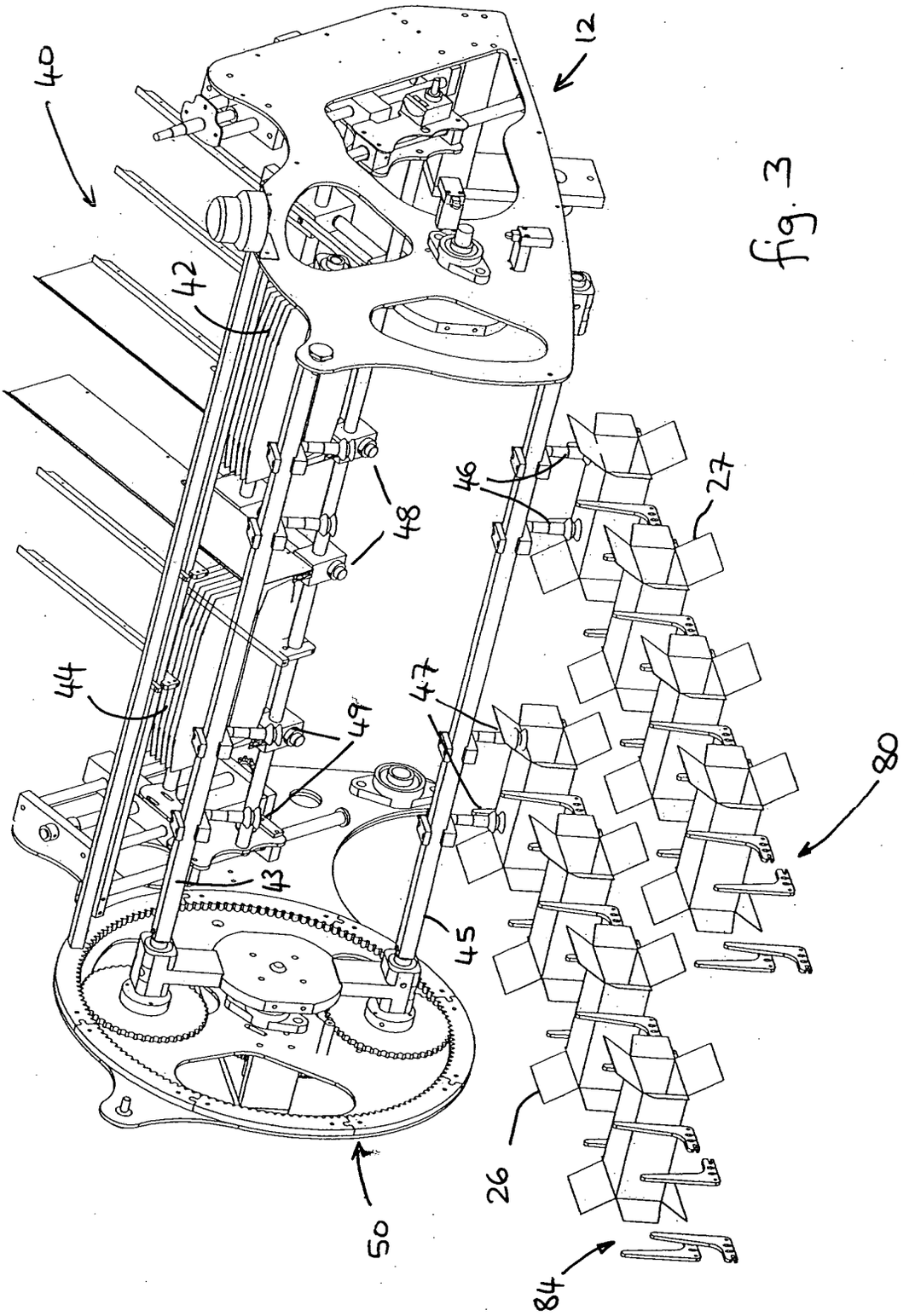


fig. 3

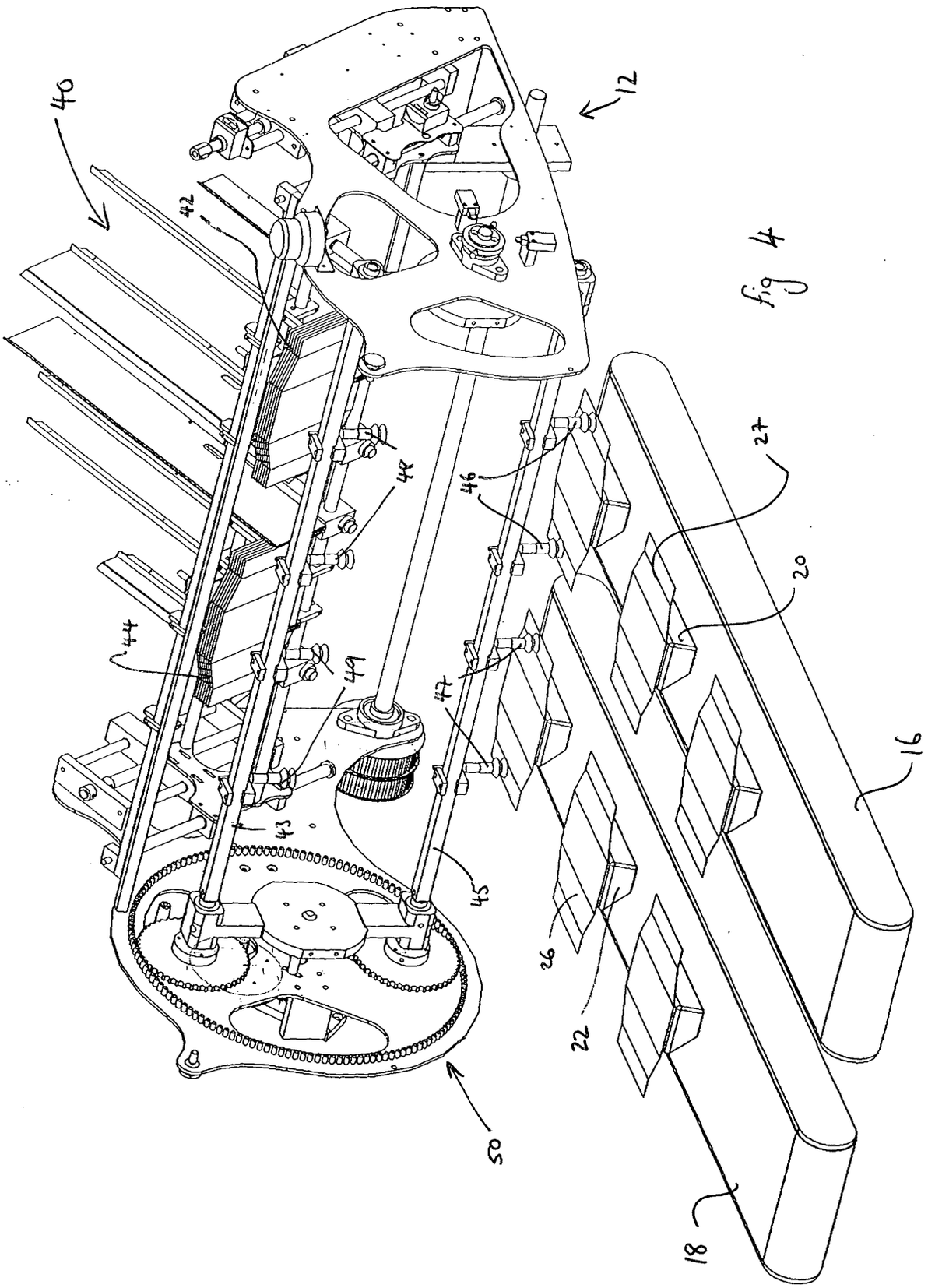


fig 4

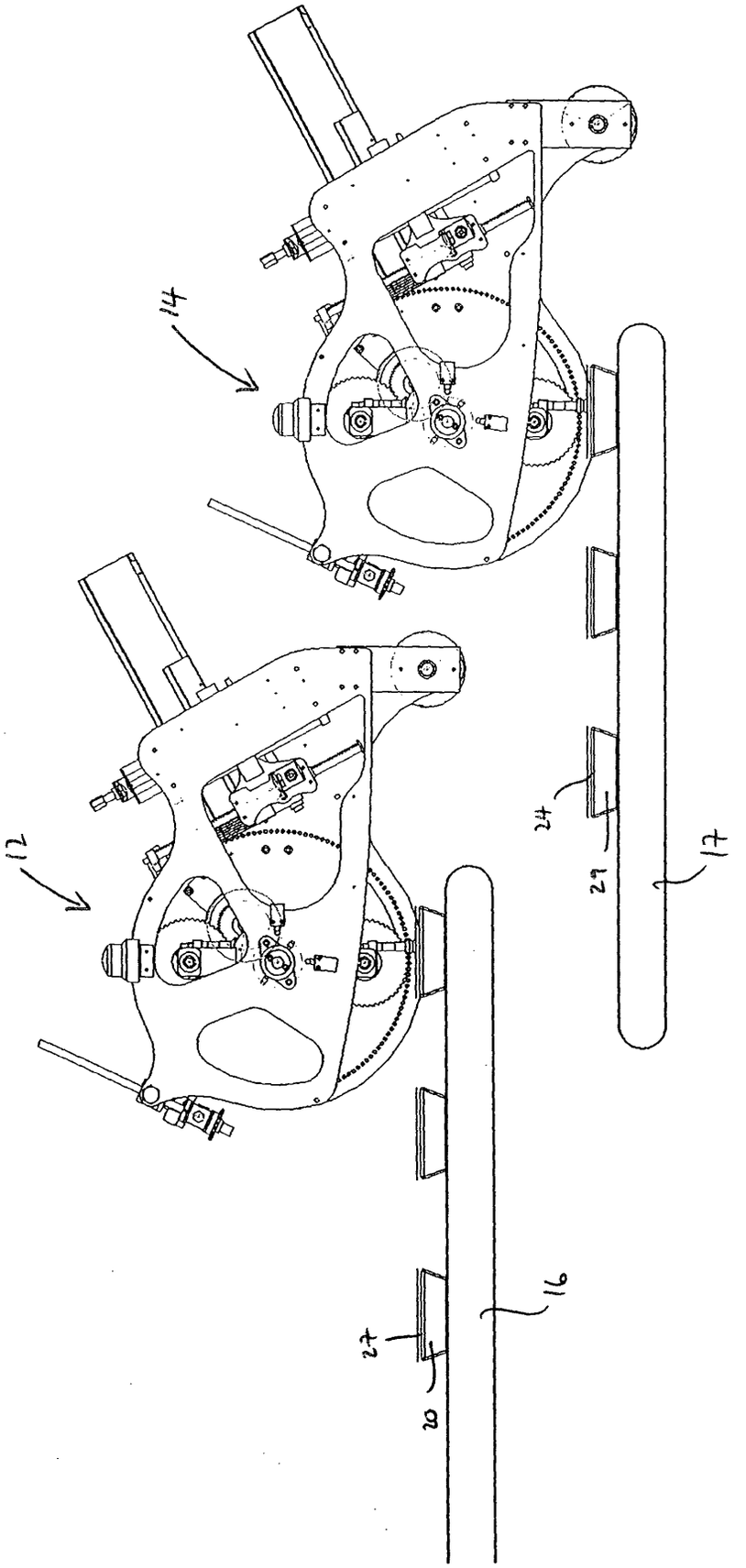


fig. 5

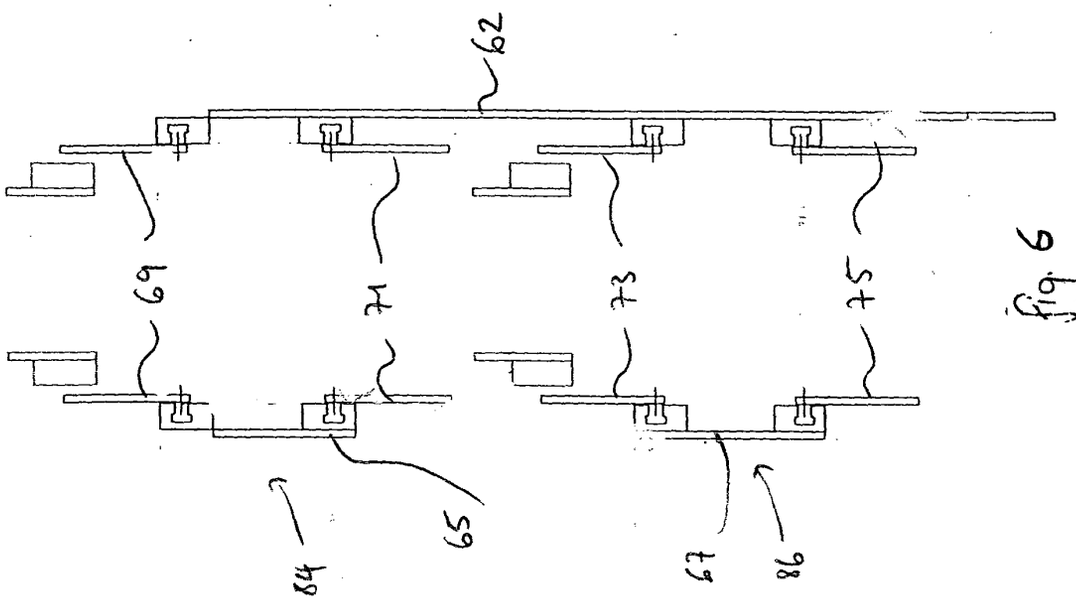
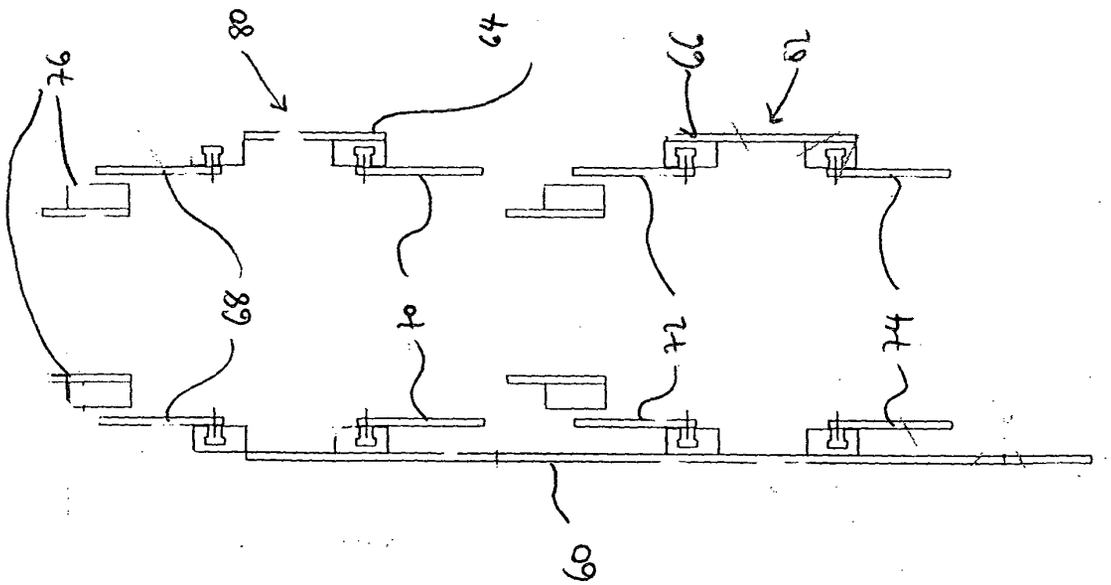


fig. 6



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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 2031

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	EP 0 253 229 A (STAEHLE GMBH BLECHPACKUNGEN) 20 January 1988 (1988-01-20) * column 4, line 1 - line 55; figures *	1,2,7,8, 10,12, 14-16	B65B35/40 B65B5/10
X	US 5 927 053 A (DONOVAN ET AL) 27 July 1999 (1999-07-27) * column 2, line 42 - column 4, line 56; figures *	1,2,8, 10,12, 14-17	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29 July 2005	Jagusiak, A

CATEGORY OF CITED DOCUMENTS

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EPO FORM 1503 03.82 (P04C01)

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