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(54) **Packing machine and method for producing rigid packets, each comprising at least two containers one inside the other**

(57) A packing machine (19) for producing rigid packets and having: a first packing unit (20) for producing inner containers (3) by folding inner blanks (17) around corresponding articles; a second packing unit (21) for producing outer containers (4) by folding outer blanks (18) around corresponding inner containers (3); and a transfer unit (22) that feeds the inner containers (3), along

a feed path (P) and by means of a feed line, from the first packing unit (20) to the second packing unit (21); the transfer unit (22) is equipped with a compensating conveyor (66), which is connected to the feed line, is perpendicular to the feed path (P), is able to contain a reserve of inner containers (3), and is movable in an insertion direction (D1) to transfer an inner container (3) from the reserve to the feed line and vice versa.

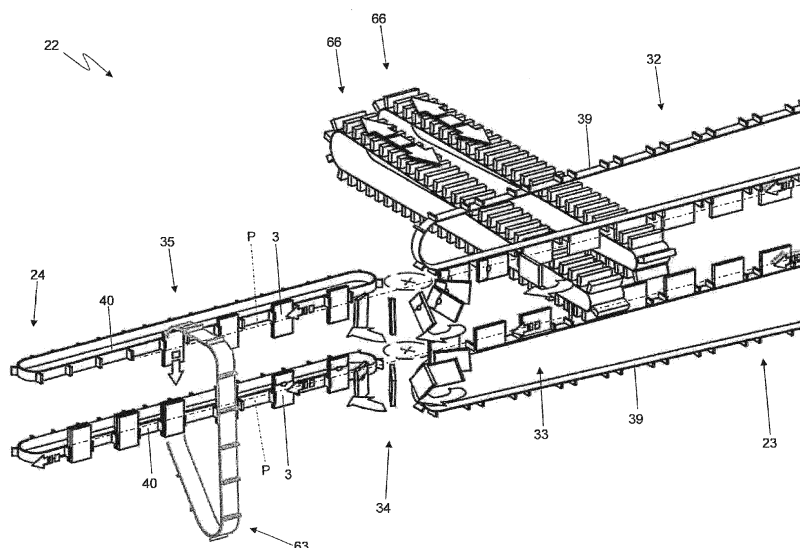


Fig. 13

Description

TECHNICAL FIELD

[0001] The present invention relates to a packing machine and method for producing rigid packets, each comprising at least two containers, one inside the other.

[0002] The present invention finds advantageous application in the manufacture of rigid cigarette packets, to which the following description will make explicit reference, but without any loss of generality.

PRIOR ART

[0003] Traditionally, the rigid cigarette packet consists of the so-called "rigid packet with hinged lid", which comprises a set of cigarettes wrapped in foil and a single container with a hinged lid that is made by folding a single blank around the set of cigarettes.

[0004] In recent years, various types of new-generation rigid cigarette packets have been proposed that are different from the traditional hinged-lid packet, each comprising at least one inner container that is made by folding an inner blank around the set of cigarettes and an outer container that surrounds the inner container and is made by folding an outer blank around the inner container. For example, patent application WO2006021581A1 describes a rigid cigarette packet with slide opening by means of a rotational movement, patent application WO2007031484A1 describes a rigid cigarette packet with slide opening by means of a translatory movement, patent applications IT2000BO00245, IT2006BO00020 and IT2006BO00420 describe a rigid cigarette packet with book-like opening (in this case, at least two inner containers are provided and are held together by the outer container), and patent application EP2017198A1 describes a rigid cigarette packet with swing opening (in this case, at least two inner containers are provided and are held together by the outer container). The only common characteristic of these new-generation rigid cigarette packets is that it is necessary to use two different blanks that must be folded in sequence (i.e. first of all, the inner blank must be folded around the set of cigarettes and then, after completing the folding of the inner blank, the outer blank is folded around the previously folded inner blank).

[0005] At present, the packing machines used to make the above-described types of new-generation rigid cigarette packets are equipped with a first packing unit on which the inner blanks are folded around the inner packages (each of which is formed by a foil-wrapped set of cigarettes) to form the inner containers, a second packing unit on which the outer blanks are folded around the inner containers, and a transfer unit that receives the inner containers from the first packing unit and feeds the inner containers to the second packing unit.

[0006] It has been observed that problems can arise in feeding the inner containers from the first packing unit

to the second packing unit, especially in the case where the cigarette packet has a group composed of two inner containers inserted inside the outer container. In fact, a reject device is normally provided along the drying conveyor of the first packing unit to remove defective inner containers from the drying conveyor; following removal of a defective inner container from the drying conveyor, a corresponding "gap" is formed in the transfer unit, or rather an empty position, left vacant by the previously rejected inner container. In some situations, particularly in the case where the cigarette packet has a group composed of two inner containers inserted in the outer container, feeding a "gap" to the second packing unit (i.e. the non-feeding of an inner container) can be problematic as it can cause the production of an incomplete cigarette packet, which must necessarily be rejected.

DESCRIPTION OF THE INVENTION

[0007] The object of the present invention is to provide a packing machine and method for producing rigid packets, each comprising at least two containers, one inside the other, this packing machine and method being devoid of the above-described drawbacks and, at the same time, simple and inexpensive to implement.

[0008] According to the present invention, a packing machine and method for producing rigid packets, each comprising at least two containers, one inside the other, are provided in accordance with that claimed in the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0009] The present invention will now be described with reference to the attached drawings, which illustrate some non-limitative embodiments, where:

- Figure 1 is a front perspective view, in an open configuration, of a rigid cigarette packet with translatory slide opening and provided with a single inner container housed in an outer container;
- Figure 2 is a schematic view of part of a packaging line where the cigarette packet in Figure 1 is produced;
- Figure 3 is a schematic perspective view, with parts removed for clarity, of a packing machine forming part of the packaging line in Figure 2 and made in accordance with the present invention;
- Figure 4 is a schematic perspective view, with parts removed for clarity, of an initial portion of a first packing unit of the packing machine in Figure 3;
- Figure 5 is a schematic perspective view, with parts removed for clarity, of an end portion of the first packing unit of the packing machine in Figure 3;
- Figure 6 is a schematic perspective view, with parts removed for clarity, of a transfer unit of the packing machine in Figure 3;
- Figure 7 is a schematic perspective view, with parts

removed for clarity, of a second packing unit of the packing machine in Figure 3;

- Figures 8 and 9 are two different schematic perspective views, with parts removed for clarity, of the transfer unit in Figure 6;
- Figures 10 and 11 are, respectively, a schematic front view and a schematic plan view, with parts removed for clarity, of the transfer unit in Figure 6;
- Figure 12 is a front perspective view, in an open configuration, of a different rigid cigarette packet with translatory slide opening and provided with two side-by-side inner containers housed in an outer container;
- Figure 13 is a schematic perspective view, with parts removed for clarity, of a different embodiment of the transfer unit in Figure 6 adapted for the manufacture of the cigarette packet in Figure 12; and
- Figure 14 is a schematic perspective view of the inner containers that are fed by the transfer unit in Figure 13.

PREFERRED EMBODIMENTS OF THE INVENTION

[0010] In Figure 1, reference numeral 1 indicates, in its entirety, a rigid cigarette packet with slide opening by means of a linear movement.

[0011] The packet 1 of cigarettes shown in Figure 1 comprises a wrapped group 2 of cigarettes, or rather a set of cigarettes wrapped in foil, and a rigid outer casing made of cardboard or similar, housing the wrapped group 2 and comprising, in turn, a rigid inner container 3, inside which the wrapped group 2 is directly positioned, and a rigid outer container 4, which houses the inner container 3 in a sliding manner to enable the inner container 3 to slide with respect to the outer container 4 with a linear movement between a closed position (not shown), in which the inner container 3 is completely inserted inside the outer container 4, and an open position (shown in Figure 1), in which the inner container 3 is partially extracted from the outer container 4 to provide a user with direct access to the wrapped group 2.

[0012] The containers 3 and 4 of the packet 1 of cigarettes shown in Figure 1 are respectively obtained from corresponding blanks 17 and 18, of known type and shown in Figures 5 and 7, respectively.

[0013] Figure 2 partially shows a packaging line 14 that produces packets 1 of cigarettes of the above-described type and shown in Figure 1. As shown in Figure 2, the packaging line 14 comprises a cigarette packing machine 19 that produces the packets 1 of cigarettes, a cellophane wrapping machine 15 that applies a transparent plastic wrapper around each packet 1 of cigarettes, and a feed channel 16 that transfers the packets 1 of cigarettes from the packing machine 19 to the cellophane wrapping machine 15.

[0014] As shown in Figure 3, the packing machine 19 comprises a packing unit 20 that produces inner containers 3 by folding blanks 17 around corresponding wrapped

groups 2 of cigarettes, a packing unit 21 that produces the outer containers 4 by folding blanks 18 around corresponding inner containers 3, and a transfer unit 22 that receives the inner containers 3 from the packing unit 20 as input at an input station 23 and outputs the inner containers 3 to the packing unit 21 at an output station 24.

[0015] As shown in Figure 4, the packing unit 20 comprises a conveyor 25 for forming groups 26 of cigarettes that is equipped with a plurality of pockets, each of which receives a corresponding group 26 of cigarettes from the outlet of the hopper 13. In addition, the packing unit 20 comprises a packing conveyor 27 equipped with two straight packing lines, parallel to each other and side by side, on which wrapping sheets 28 cut from a continuous strip are fed by a feed device 12 and then folded around groups 26 of cigarettes to form wrapped groups 2 of cigarettes.

[0016] As shown in Figure 5, the packing unit 20 comprises a transfer wheel 29, which receives wrapped groups 2 of cigarettes from the packing conveyor 27, and a packing wheel 30, which receives the wrapped groups 2 of cigarettes from the transfer wheel 29 and blanks 17 from a feed device 11 and then folds the blanks 17 around the wrapped groups 2 of cigarettes to form the inner containers 3. In addition, the packing unit 20 comprises a drying conveyor 31, which is equipped with two straight drying lines, parallel to each other and side by side, which receive inner containers 3 from the packing wheel 30 and feed the inner containers 3 to the input station 23 of the transfer unit 22.

[0017] Each drying line of the drying conveyor 31 is formed by fixed walls that define a "tunnel" along which the inner containers 3 are pushed: each time a "new" inner container 3 is added at the tail end by a pusher at the entrance of the drying conveyor 31, the "new" inner container 3 pushes the queue of all the other inner containers 3 already present on the drying conveyor 31, causing expulsion of the inner container 3 located at the head of the queue from the drying conveyor 31, which is then "taken" by the transfer unit 22. A rejection device 10 is connected to the drying conveyor 31 for removing defective inner containers 3 from the drying conveyor 31.

[0018] As shown in Figure 6, the transfer unit 22 transfers the inner containers 3 from the input station 23 to the output station 24 and orients the inner containers 3 (and, in the embodiment shown in Figures 13 and 14, also a group of inner containers 3) at four handling stations 32-35, arranged in series between the input station 23 and the output station 24. The transfer unit 22 comprises four handling stations 32-35 that can be individually activated or deactivated (completely or even partially) depending on the desired orientation operations and/or grouping of the inner containers 3. In other words, only part of the four handling stations 32-35 can be activated (and therefore the remaining part of the four handling stations 32-35 is deactivated) to perform all and only the desired operations of orientation and/or grouping of the inner containers 3. For example, in the embodiment

shown in Figure 6, only handling stations 33 and 34 are active (i.e. effectively perform an operation on the inner containers 3), while the other handling stations 32 and 35 are deactivated (i.e. do not perform any operation on the inner containers 3).

[0019] As shown in Figure 7, the packing unit 21 comprises a packing wheel 36, which receives inner containers 3 from the output station 24 of the transfer unit 22 and blanks 18 from a feed device 9 and then folds the blanks 18 around the inner containers 3 to form the outer containers 4 and so complete manufacture of the packets 1 of cigarettes. In addition, the packing unit 21 comprises a drying conveyor 37, which is equipped with two straight drying lines, parallel to each other and side by side, which receive packets 1 of cigarettes from the packing wheel 36 and feed the packets 1 of cigarettes to an output station 38 of the packing machine 19. In the output station 38 of the packing machine 19, the packets 1 of cigarettes are passed to the feed channel 16 for being fed to the cellophane wrapping machine 15.

[0020] Each drying line of the drying conveyor 37 is formed by fixed walls that define a "tunnel" along which the packets 1 of cigarettes are pushed: each time a "new" packet 1 of cigarettes is added at the tail end by a pusher at the entrance of the drying conveyor 37, the "new" packet 1 of cigarettes pushes the queue of all the other packets 1 of cigarettes already present on the drying conveyor 37, causing expulsion of the packet 1 of cigarettes located at the head of the queue from the drying conveyor 37, which is then "taken" by the feed channel 16.

[0021] It is important to observe that the packing unit 21 is entirely similar to the end portion of the packing unit 20 shown in Figure 5; the evident similarities between the two packing wheels 30 and 36, between the drying conveyors 31 and 37 and between the feed devices for the blanks 17 and 18 should be noted. Thanks to this similarity, it is possible to simplify the manufacture of the two packing units 20 and 21, as many parts are the same or at least very similar.

[0022] As shown in Figures 8 and 9, the transfer unit 22 comprises two horizontal feed lines, parallel to each other and side by side (in particular, arranged vertically, one above the other), each of which preferably feeds a succession of inner containers 3 along a straight feed path P, which extends between the input station 23 and the output station 24, with a stepwise movement (i.e. a movement that cyclically alternates between a motion step and a stationary step).

[0023] Each feed line comprises two belt conveyors 39 and 40, which are arranged in series arranged and separated from each other by the handling station 34, each of which comprises a belt and a plurality of partitions that extend perpendicular from the belt to define respective seats 41 (shown in Figure 9) for the inner containers 3. In the lower belt conveyor 39, the inner containers 3 rest on (and therefore are supported from below by) the belt of the belt conveyor 39; whereas the upper belt conveyor 39 comprises a static supporting surface (not shown) on

which the inner containers 3 rest and slide (and are therefore supported by it from below) while they are pushed along the feed path P. Each belt conveyor 40 comprises a static supporting surface (not shown) on which the inner containers 3 rest and slide (and are therefore supported by it from below) while they are pushed along the feed path P.

[0024] As shown in Figure 9, the handling station 35 comprises a group-forming device 63 positioned cross-wise to the two feed lines and which groups together an inner container 3 of the upper feed line and an inner container 3 of the lower feed line by moving one inner container 3 in a direction perpendicular to the two feed paths P, to move the inner container 3 from the upper feed line to the lower feed line. When the group-forming device 63 is in operation, downstream from the group-forming device 63, the lower feed line feeds a succession of groups, each composed of two inner containers 3, to output station 24, while again downstream from the group-forming device 63, the upper feed line does not feed any inner container 3 to the output station 24 (as shown in Figures 13 and 14). Obviously, the embodiment in Figures 13 and 14 contemplates that in each packet 1 of cigarettes, the outer container 4 encloses a group composed of two inner containers 3, as shown in Figure 12.

[0025] As shown in Figures 8-11, the transfer unit 22 comprises a pair of compensating conveyors 66, each of which is connected to a corresponding feed line at an interchange station, is perpendicular to the feed path P and contains a reserve of inner containers 3 (indicatively capable of holding approximately 20-30 inner containers 3). Each compensating conveyor 66 advances in steps in an insertion direction D1 (shown in Figure 11) to transfer an inner container 3 from the reserve to the feed line and advances in steps in a pickup direction D2 (shown in Figure 11), opposite to the insertion direction D1, to transfer an inner container 3 from the feed line to the reserve.

[0026] Each compensating conveyor 66 is a belt conveyor and comprises a belt equipped with a plurality of partitions that extend perpendicular from the belt to define respective seats 67 for the inner containers 3. In particular, the compensating conveyor 66 connected to the upper feed line is located "below" the inner containers 3 travelling along the feed path P and therefore the bottom of the inner containers 3 rests on the belt of the compensating conveyor 66; whereas the compensating conveyor 66 connected to the lower feed line is located "above" the inner containers 3 travelling along the feed path P and therefore the bottom of the inner containers 3 rests on a static supporting surface (not shown), on which they slide when moving. Each seat 67 of a compensating conveyor 66 is positioned perpendicular to the feed path P and is open on two sides so that inner containers 3 can pass right through it when the compensating conveyor 66 is stationary.

[0027] According to a possible embodiment shown in Figure 11, the transfer unit 22 comprises a collection bin

68 for inner containers 3 located beneath the compensating conveyors 66 at a first end of the compensating conveyors 66 close to the feed lines. In addition, according to a possible embodiment shown in Figure 11, the transfer unit 22 comprises a collection bin 69 for inner containers 3 located beneath the compensating conveyors 66 at a second end of the compensating conveyors 66, opposite to the first end, and "at a distance" from the feed lines.

[0028] Collection bin 68 is normally used to collect inner containers 3 that must be rejected (i.e. removed from the feed paths P because they are defective) and have been identified by a control station (not shown) located upstream from the transfer unit 22; to reject an inner container 3 from the corresponding feed path P, when the inner container 3 to be rejected is in a seat 67 of a compensating conveyor 66, the compensating conveyor 66 is made to advance a step to push the inner container 3 out of the feed path P and consequently make the inner container 3 fall by gravity into the underlying collection bin 68. According to one possible embodiment, the upper compensating conveyor 66 (i.e. the compensating conveyor 66 connected to the upper feed line) could be equipped with an ejector device located near the collection bin 68 and able to "help" the inner containers 3 fall from the upper compensating conveyor 66 to the underlying collection bin 68. It is important to note that every time a compensating conveyor 66 advances a step to push an inner container 3 out of the feed path P and consequently make the inner container 3 fall by gravity into the underlying collection bin 68, at the same time, the compensating conveyor 66 adds a new inner container 3 to the feed path P that takes the place of the inner container 3 just rejected and comes from the corresponding reserve of inner containers 3 (obviously, unless the reserve of inner containers 3 is completely empty).

[0029] According to one possible embodiment, collection bin 68 could be divided into a reject zone, where rejected inner containers 3 are sent, and a sample zone, where small quantities (a few units) of inner containers 3 picked for sample-based quality control are sent. In this embodiment, collection bin 68 is normally fitted with a motorized movable partition, which is moved to direct the inner containers 3 that fall by gravity from the feed lines into either the reject zone or the sample zone.

[0030] Collection bin 69 is normally used to collect a number of samples of inner containers 3 (for example, the first 50 inner containers 3 produced at the beginning of a new production shift or after a change in format) to be used for sample-based quality control. To collect samples of inner containers 3, each compensating conveyor 66 is made to advance in the pickup direction D2 for a certain period of time in order to pick the desired inner containers 3 from the feed paths P and consequently make the inner containers 3 fall by gravity into the underlying collection bin 69. According to one possible embodiment, the upper compensating conveyor 66 (i.e. the

compensating conveyor 66 connected to the upper feed line) could be equipped with an ejector device located near the collection bin 69 and able to "help" the inner containers 3 fall from the upper compensating conveyor 66 to the underlying collection bin 69.

[0031] As shown in Figure 11, the compensating conveyor 66 comprises a leading end sensor 75 located at a first end of the compensating conveyor 66, close to the feed line and able to detect (normally optically) the presence/absence of an inner container 3; in addition, the compensating conveyor 66 comprises a trailing end sensor 76 located at a second end of the compensating conveyor 66, opposite to the first end, and able to detect (normally optically) the presence/absence of an inner container 3.

[0032] As shown in Figures 9-11, the transfer unit 22 comprises a feed device 70 that is located at the output station 24 and feeds the inner containers 3 from each feed line to the packing unit 21.

[0033] Last of all, the packing machine 19 comprises a control unit 74 (schematically shown in Figure 3) that controls the operation of all the parts of the packing machine 19.

[0034] The operation of the compensating conveyors 66 will now be described.

[0035] At all times, the control unit 74 determines a first number N1 of inner containers 3 that constitute a first reserve of a first compensating conveyor 66, and determines a second number N2 of inner containers 3 that constitute a second reserve of a second compensating conveyor 66. Calculating the numbers N1 and N2 of inner containers 3 is simple as, starting from the initial number of inner containers 3 when the packing machine 19 is started, it is sufficient to decrement this initial number by one unit every time an inner container 3 is taken from the reserve and increment this initial number by one unit every time an inner container 3 is added to the reserve.

[0036] According to a preferred embodiment, the numbers N1 and N2 of inner containers 3 that constitute the reserves of the compensating conveyors 66 are counted whenever the packing machine 19 is restarted; in fact, when the packing machine 19 is stopped, an operator could manually change the number of inner containers 3 that constitute the reserves of the compensating conveyors 66. To count the number N1 or N2 of inner containers 3 constituting the reserve of each compensating conveyor 66, the compensating conveyor 66 is made to move in the pickup direction D2 until the trailing end sensor 76 detects the presence of an inner container 3 and is then made to move in the insertion direction D1 until the leading end sensor 75 detects the presence of an inner container 3; in this way, the control unit 74 determines precisely the "head" and the "tail" of the reserve and can therefore calculate the number N1 or N2 of inner containers 3 constituting the reserve in a simple manner.

[0037] According to a preferred embodiment, where each packet 1 of cigarettes comprises a single inner container 3 housed in the outer container 4, in the event of

stoppage of the packing machine 19 due to stoppage of the cellophane wrapping machine 15 located downstream from the packing machine 19, the compensating conveyor 66 is completely filled with inner containers 3 by advancing a number of steps in the pickup direction D2. When the packing machine 19 is stopped, it would be necessary, as far as possible, to complete all of the packets 1 of cigarettes that have been commenced (which would otherwise be rejected upon restarting due to the glue drying) by using all of the inner containers 3 that are downstream from the drying conveyor 37 (or rather all of the inner containers 3 that are in the packing unit 21 and the transfer unit 22); however, the completion of all the packets 1 of cigarettes that have been commenced might not be possible as the feed channel 16 might not be able to absorb all of the packets 1 of cigarettes, and therefore by adding at least part of the inner containers 3 onto the compensating conveyors 66, it is possible to reduce the overall number of packets 1 of cigarettes that must be completed and consequently added to the feed channel 16.

[0038] In the embodiment shown in Figures 12, 13 and 14 and where, as previously described, in each packet 1 of cigarettes, the outer container 4 encloses a group composed of two inner containers 3, the group-forming device 63 in the handling station 35 is consequently activated to group together an inner container 3 from the upper feed line and an inner container 3 from the lower feed line, by moving an inner container 3 in a direction perpendicular to the two feed paths P, to move the inner container 3 from the upper feed line to the lower feed line. Thus, downstream from the group-forming device 63, the lower feed line feeds a succession of groups, each composed of two inner containers 3, to the output station 24, while again downstream from the group-forming device 63, the upper feed line does not feed any inner container 3 to the output station 24.

[0039] In use, the control unit 74 detects an empty seat 41, i.e. from which an inner container 3 has been rejected, on a first feed line (which can be the upper feed line or the lower feed line, indifferently). In the case of an empty seat 41 present on the first feed line, when the empty seat 41 is in the interchange station, the control unit 74 advances a first compensating conveyor 66 in the insertion direction D1 to insert a replacement inner container 3 previously stored on the first compensating conveyor 66 onto the first feed line, so that the two feed lines together supply the group-forming device 63 (i.e. the packing unit 21) with two inner containers 3; or, alternatively, in the case where there is an empty seat 41 on the feed line, when the empty seat 41 is at the interchange station, the control unit 74 advances a second compensating conveyor 66 in the pickup direction D2 to remove an inner container 3 from a second feed line and store it on the second compensating conveyor 66, so that the two feed lines together supply the group-forming device 63 (i.e. the packing unit 21) with two empty seats 41.

[0040] The choice of the action to perform (i.e. adding

an inner container 3 via the compensating conveyor 66 or taking an inner container 3 via the second compensating conveyor 66) depends on the filling level of the compensating conveyors 66 (i.e. on the numbers N1 and N2 of inner containers 3 that constitute the reserves) and is intended to try to keep (as far as possible) the compensating conveyors 66 in an intermediate situation of balance, neither too empty nor too full.

[0041] The packing unit 21 can receive a complete group composed of two superimposed inner containers 3 from the transfer unit 22 (and in this case, the packing unit 21 will form an outer container 4 by folding a blank 18 around the group of two inner containers 3), or the packing unit 21 can receive a "gap" from the transfer unit 22, i.e. the complete absence of inner containers 3 (and in this case, the packing unit 21 does not form any outer container 4 and also avoids feeding a blank 18 by temporarily blocking the feed device 9). Therefore, the packing unit 21 is able to optimally manage both the reception of a complete group composed of two superimposed inner containers 3, and the reception of a "gap", i.e. the complete absence of inner containers 3. Contrariwise, the packing unit 21 is unable to optimally manage the reception of just a single inner container 3 (i.e. an incomplete group composed of just one inner container 3), as the single inner container 3 must be surely rejected and also because it can give rise to blockage during the various manoeuvres, as it can assume "strange" positions due to "wobbling" inside a pocket intended for two superimposed inner containers 3.

[0042] Thanks to the presence of the two compensating conveyors 66 that operate as described above, it is possible to ensure that the packing unit 21 receives from the transfer unit 22 either a complete group composed of two superimposed inner containers 3 or a "gap", i.e. the complete absence of inner containers 3, without ever receiving an incomplete group composed of just one inner container 3.

[0043] According to a possible embodiment, the control unit 74 determines (as previously described) the first number N1 of inner containers 3 that constitute the first reserve of the first compensating conveyor 66 and determines the second number N2 of inner containers 3 that constitute the second reserve of the second compensating conveyor 66. Furthermore, the control unit 74 compares the first number N1 and second number N2 with a safety threshold WPL (indicatively, the safety threshold WPL is in the range between 3 and 7), and activates the compensating conveyors 66 to remove inner containers 3 from the feed lines when the first number N1 and/or second number N2 are/is below the safety threshold WPL and until the first number N1 and second number N2 are above the safety threshold WPL. In this way, under normal conditions it is guaranteed that the numbers N1 and N2 of inner containers 3 that constitute the reserves of the compensating conveyors 66 are always above the safety threshold WPL.

[0044] According to a possible embodiment, the con-

trol unit 74 determines (as previously described) the first number N1 of inner containers 3 that constitute the first reserve of the first compensating conveyor 66 and determines the second number N2 of inner containers 3 that constitute the second reserve of the second compensating conveyor 66. Furthermore, the control unit 74 compares the first number N1 and second number N2 with an intermediate threshold LPD (indicatively, the intermediate threshold LPD is in the range between 14 and 20), and, by acting on the packing unit 20, temporarily stops (for example, for a number of inner containers 3 equal to the difference between the intermediate threshold LPD and the safety threshold WPL) the manufacture of inner containers 3 fed by the feed line connected to the compensating conveyor 66 when the number N1 or N2 of inner containers 3 constituting the reserve is above the intermediate threshold LPD. In particular, the control unit 74 acts on the two hoppers 13 (of the total four hoppers 13) of the packing unit 20, the groups 26 of cigarettes of which, once provided with wrapping sheet 28, are inserted on the feed line connected to the compensating conveyor 66 where the number N1 or N2 of inner containers 3 constituting the reserve is above the intermediate threshold LPD; the control unit 74 temporarily disables the two hoppers 13 of the packing unit 20 so as to create "gaps" (i.e. the absence of groups 26 of cigarettes) that arrive on the feed line connected to the compensating conveyor 66 where the number N1 or N2 of inner containers 3 constituting the reserve is above the intermediate threshold LPD (obviously, the feed device 12 is also temporarily stopped to not pointlessly feed wrapping sheets 28). In this way, when the "gaps" arrive on the feed line, the compensating conveyor 66 can partially empty itself to fill these gaps and therefore the number N1 or N2 of inner containers 3 constituting the reserve returns to being abundantly below the intermediate threshold LPD (but always above the safety threshold WPL).

[0045] According to a possible embodiment, the control unit 74 determines (as previously described) the first number N1 of inner containers 3 that constitute the first reserve of the first compensating conveyor 66 and determines the second number N2 of inner containers 3 that constitute the second reserve of the second compensating conveyor 66. Furthermore, the control unit 74 compares the first number N1 and second number N2 with a warning threshold LRF and, by acting on the packing unit 20 (in particular on the rejection device 10 of the packing unit 20) and regardless of defects, causes a predetermined number (for example, 2-7) of rejects of the inner containers 3 fed by the feed line connected to the compensating conveyor 66 where the number N1 or N2 of inner containers 3 constituting the reserve is above the warning threshold LRF. Alternatively, the control unit 74 compares the first number N1 and second number N2 with a warning threshold LRF and, by acting on the compensating conveyor 66 where the number N1 or N2 of inner containers 3 constituting the reserve is above

the warning threshold LRF and regardless of defects, causes a predetermined number (for example, 2-7) of inner containers 3 to be rejected from the feed line, with the rejected inner containers 3 being simultaneously replaced with the same number of inner containers 3 from the reserve.

[0046] According to a possible embodiment, the control unit 74 determines (as previously described) the first number N1 of inner containers 3 that constitute the first reserve of the first compensating conveyor 66 and determines the second number N2 of inner containers 3 that constitute the second reserve of the second compensating conveyor 66. Furthermore, the control unit 74 compares the first number N1 and second number N2 with an overflow threshold FLT and stops the packing machine 19 if the first number N1 and/or the second number N2 are above the overflow threshold FLT. It is important to underline that the actions taken by the control unit 74 when the intermediate threshold LPD and, subsequently, the warning threshold LRF are exceeded should ensure that the first number N1 or the second number N2 never arrive to the overflow threshold FLT; therefore, reaching the overflow threshold FLT indicates the presence of a problem (perhaps not fully identified) that advises stopping the packing machine 19 to avoid more serious trouble.

[0047] The above-described packing machine 19 has numerous advantages.

[0048] In particular, thanks to the presence of the compensating conveyors 66, it is possible to optimise the transfer of inner containers 3 from packing unit 20 to packing unit 21 through the transfer unit 22, according to the previously described methods.

Claims

1. A packing machine (19) for producing rigid packets, each comprising at least two containers (3, 4), one inside the other; the packing machine (19) comprising:

a first packing unit (20) for producing inner containers (3) by folding inner blanks (17) around corresponding articles;

a second packing unit (21) for producing outer containers (4) by folding outer blanks (18) around corresponding inner containers (3); and

a transfer unit (22), which receives the inner containers (3) from the first packing unit (20) at an input station (23) and feeds the inner containers (3), along a feed path (P) and by means of a feed line, to the second packing unit (21) at an output station (24);

the packing machine (19) being **characterized in that** the transfer unit (22) comprises a compensating conveyor (66), which is connected to the feed line at an interchange station, is per-

- pendicular to the feed path (P), is able to contain a reserve of inner containers (3), is movable in an insertion direction (D1) to transfer an inner container (3) from the reserve to the feed line, and is movable in a pickup direction (D2), opposite to the insertion direction (D1), to transfer an inner container (3) from the feed line to the reserve.
2. A packing machine (19) according to claim 1, wherein the compensating conveyor (66) is a belt conveyor and comprises a first belt fitted with a plurality of first partitions perpendicular to the first belt to define respective first seats (67) for the inner containers (3).
 3. A packing machine (19) according to claim 2, wherein the feed line comprises at least one belt conveyor (39; 40) equipped with a second belt and a plurality of second partitions perpendicular to the second belt to define respective second seats (41) for the inner containers (3).
 4. A packing machine (19) according to claim 3, wherein, at the interchange station, the first seat (67) on the compensating conveyor (66) is completely superimposed over a second seat (41) on the feed line so that at the interchange station, an inner container (3) is housed simultaneously inside a first seat (67) on the compensating conveyor (66) and a second seat (41) on the feed line.
 5. A packing machine (19) according to claim 2, 3 or 4, wherein each first seat (67) on the compensating conveyor (66) is positioned perpendicular to the feed path (P) and is open on two sides, so that the inner containers (3) travelling along the feed path (P) can pass right through it when the compensating conveyor (66) is stationary.
 6. A packing machine (19) according to any of claims 1 to 5, wherein the compensating conveyor (66) is able to reject a defective inner container (3) by pushing the defective inner container (3) off the feed path (P) by advancing one step in the insertion direction (D1), which is perpendicular to the feed path (P).
 7. A packing machine (19) according to claim 6, wherein the transfer unit (22) comprises a first collection bin (68) for inner containers (3), located beneath the compensating conveyor (66) at a first end of the compensating conveyor (66) close to the feed line.
 8. A packing machine (19) according to any of claims 1 to 7, wherein the transfer unit (22) comprises a second collection bin (69) for inner containers (3), located beneath the compensating conveyor (66) at a second end of the compensating conveyor (66), opposite to the first end, and at a distance from the feed line.
 9. A packing machine (19) according to claim 8, wherein the compensating conveyor (66) is able to collect sample inner containers (3) in the second collection bin (69) by advancing a number of steps in the pickup direction (D2).
 10. A packing machine (19) according to any of claims 1 to 9, wherein, in the event of stoppage of the packing machine (19) caused by stoppage of an overwrapping machine downstream from the packing machine (19), the compensating conveyor (66) is completely filled with inner containers (3) by advancing a number of steps in the pickup direction (D2).
 11. A packing machine (19) according to any of claims 1 to 10, wherein, whenever the packing machine (19) is restarted, the number (N1, N2) of inner containers (3) that constitute the reserve of the compensating conveyor (66) is counted.
 12. A packing machine (19) according to claim 11, wherein:
 - the compensating conveyor (66) comprises a leading end sensor (75) located at a first end of the compensating conveyor (66), close to the feed line, and able to detect the presence/absence of an inner container (3);
 - the compensating conveyor (66) comprises a trailing end sensor (76) located at a second end of the compensating conveyor (66), opposite to the first end, and able to detect the presence/absence of an inner container (3); and
 - to count the number (N1, N2) of inner containers (3) that constitute the reserve of the compensating conveyor (66), the compensating conveyor (66) is moved in the pickup direction (D2) until the trailing end sensor (76) detects the presence of an inner container (3) and is moved in the insertion direction (D1) until the leading end sensor (75) detects the presence of an inner container (3).
 13. A packing machine (19) according to any of claims 1 to 12 and comprising:
 - two feed lines that feed two respective successions of inner containers (3) along two straight feed paths (P) parallel to each other; and
 - two compensating conveyors (66), each of which is connected to a corresponding feed line at an interchange station.
 14. A packing machine (19) according to claim 13, wherein:

the two feed lines are located one above the other and are vertically aligned;
 a compensating conveyor (66) connected to the lower feed line is located beneath the inner containers (3) travelling along the feed path (P) and the bottom of the inner containers (3) consequently rests on the belt of the compensating conveyor (66); and
 the compensating conveyor (66) connected to the upper feed line is located over the inner containers (3) travelling along the feed path (P) and the bottom of the inner containers (3) consequently rests on a static supporting surface, on which they slide when moving.

15. A packing machine (19) according to claim 13 or 14, wherein:

each outer container (4) contains a group of two inner containers (3);
 the transfer unit (22) comprises a group-forming device (63) positioned crosswise to the two feed lines at a corresponding handling station (35) and which groups together an inner container (3) from a first feed line and an inner container (3) from a second feed line by moving one inner container (3) in a direction perpendicular to the two feed paths (P), to move the inner container (3) from the first feed line to the second feed line; and
 downstream from the group-forming device (63), the second feed line supplies the output station (24) with a succession of groups, each comprising two inner containers (3), while downstream from the group-forming device (63), the first feed line supplies no inner containers (3) to the output station (24).

16. A packing machine (19) according to claim 15 and comprising a control unit (74), which:

detects an empty seat (41), i.e. from which an inner container (3) has been rejected, on a first feed line;
 upon detecting an empty seat (41) on the first feed line, and when the empty seat (41) is located at the interchange station, activates a first compensating conveyor (66) to insert a replacement inner container (3) previously stored on the first compensating conveyor (66) onto the first feed line, so that the two feed lines together supply the group-forming device (63) with two inner containers (3); or, alternatively,
 upon detecting an empty seat (41) on the first feed line, and when the empty seat (41) is located at the interchange station, activates a second compensating conveyor (66) to remove an inner container (3) from a second feed line and store

the inner container (3) on the second compensating conveyor (66), so that the two feed lines together supply the group-forming device (63) with two empty seats (41).

17. A packing machine (19) according to claim 16, wherein the control unit (74):

determines a first number (N1) of inner containers (3) that constitute the first reserve of the first compensating conveyor (66);
 determines a second number (N2) of inner containers (3) that constitute the second reserve of the second compensating conveyor (66);
 compares the first number (N1) and second number (N2) with a safety threshold (WPL); and
 activates the compensating conveyors (66) to remove inner containers (3) from the feed lines when the first number (N1) and/or second number (N2) are/is below the safety threshold (WPL) and until the first number (N1) and second number (N2) are above the safety threshold (WPL).

18. A packing machine (19) according to claim 16 or 17, wherein the control unit (74):

determines a first number (N1) of inner containers (3) that constitute the first reserve of the first compensating conveyor (66);
 determines a second number (N2) of inner containers (3) that constitute the second reserve of the second compensating conveyor (66);
 compares the first number (N1) and second number (N2) with an intermediate threshold (LPD); and
 temporarily stops production, by acting on the first packing unit (20), of the inner containers (3) fed by the feed line connected to the compensating conveyor (66) on which the number (N1, N2) of inner containers (3) constituting the reserve is above the intermediate threshold (LPD).

19. A packing machine (19) according to claim 16, 17 or 18, wherein the control unit (74):

determines a first number (N1) of inner containers (3) that constitute the first reserve of the first compensating conveyor (66);
 determines a second number (N2) of inner containers (3) that constitute the second reserve of the second compensating conveyor (66);
 compares the first number (N1) and second number (N2) with a warning threshold (LRF); and
 causes, by acting on the first packing unit (20) and regardless of defects, the rejection of a predetermined number of inner containers (3) fed

by the feed line connected to the compensating conveyor (66) on which the number (N1, N2) of inner containers (3) constituting the reserve is above the warning threshold (LRF).

20. A packing machine (19) according to any of claims 16 to 18, wherein the control unit (74):

determines a first number (N1) of inner containers (3) that constitute the first reserve of the first compensating conveyor (66);
 determines a second number (N2) of inner containers (3) that constitute the second reserve of the second compensating conveyor (66);
 compares the first number (N1) and second number (N2) with a warning threshold (LRF);
 and
 causes, by acting on the compensating conveyor (66) on which the number (N1, N2) of inner containers (3) constituting the reserve is above the warning threshold (LRF) and regardless of defects, the rejection of a predetermined number of inner containers (3) from the feed line and the simultaneous replacement of the rejected inner containers (3) with the same number of inner containers (3) from the reserve.

21. A packing machine (19) according to any of claims 16 to 20, wherein the control unit (74):

determines a first number (N1) of inner containers (3) that constitute the first reserve of the first compensating conveyor (66);
 determines a second number (N2) of inner containers (3) that constitute the second reserve of the second compensating conveyor (66);
 compares the first number (N1) and second number (N2) with an overflow threshold (FLT);
 and
 stops the packing machine (19) when the first number (N1) and/or second number (N2) are/is above the overflow threshold (FLT).

22. A packing method for producing rigid packets, each comprising at least two containers (3, 4), one inside the other; the packing method comprising the steps of:

producing inner containers (3) by folding inner blanks (17) around corresponding articles on a first packing unit (20);
 producing outer containers (4) by folding outer blanks (18) around corresponding inner containers (3) on a second packing unit (21); and
 transferring the inner containers (3) by means of a transfer unit (22), which receives the inner containers (3) from the first packing unit (20) at an input station (23) and feeds the inner con-

tainers (3), along a feed path (P) and by means of a feed line, to the second packing unit (21) at an output station (24);

the packing method being **characterized by comprising** the further step of employing a compensating conveyor (66), which is connected to the feed line at an interchange station, is perpendicular to the feed path (P), contains a reserve of inner containers (3), is movable in an insertion direction (D1) to transfer an inner container (3) from the reserve to the feed line, and is movable in a pickup direction (D2), opposite to the insertion direction (D1), to transfer an inner container (3) from the feed line to the reserve.

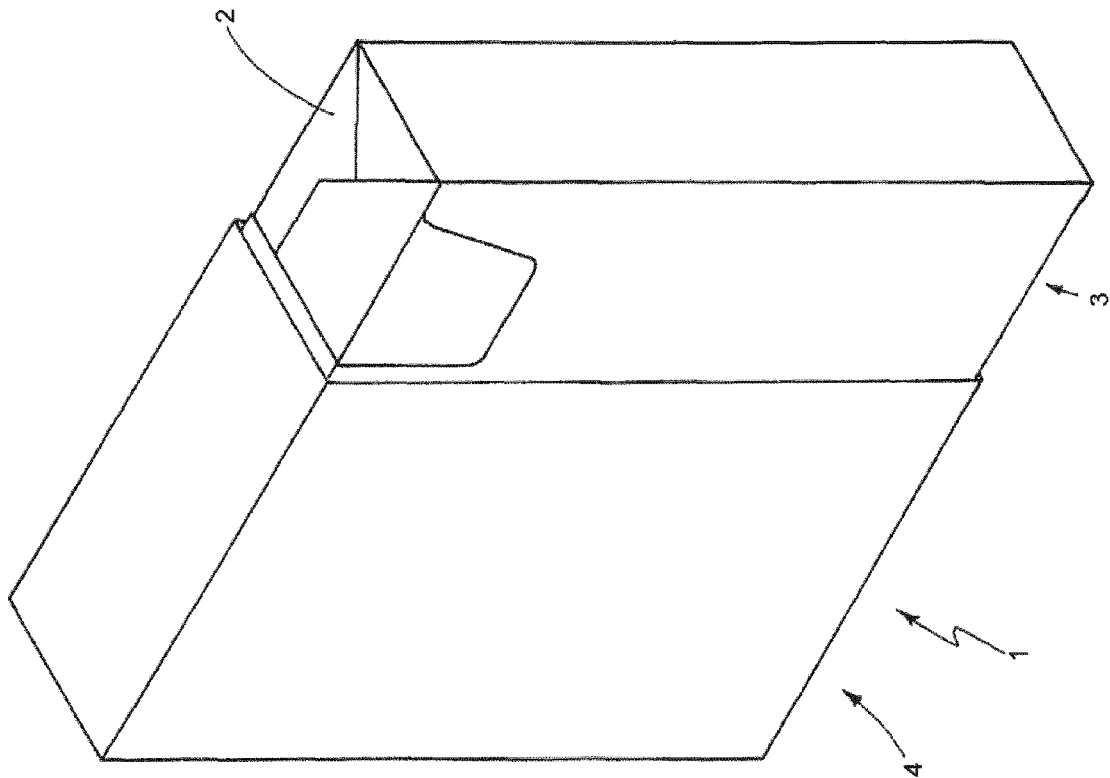


Fig. 1

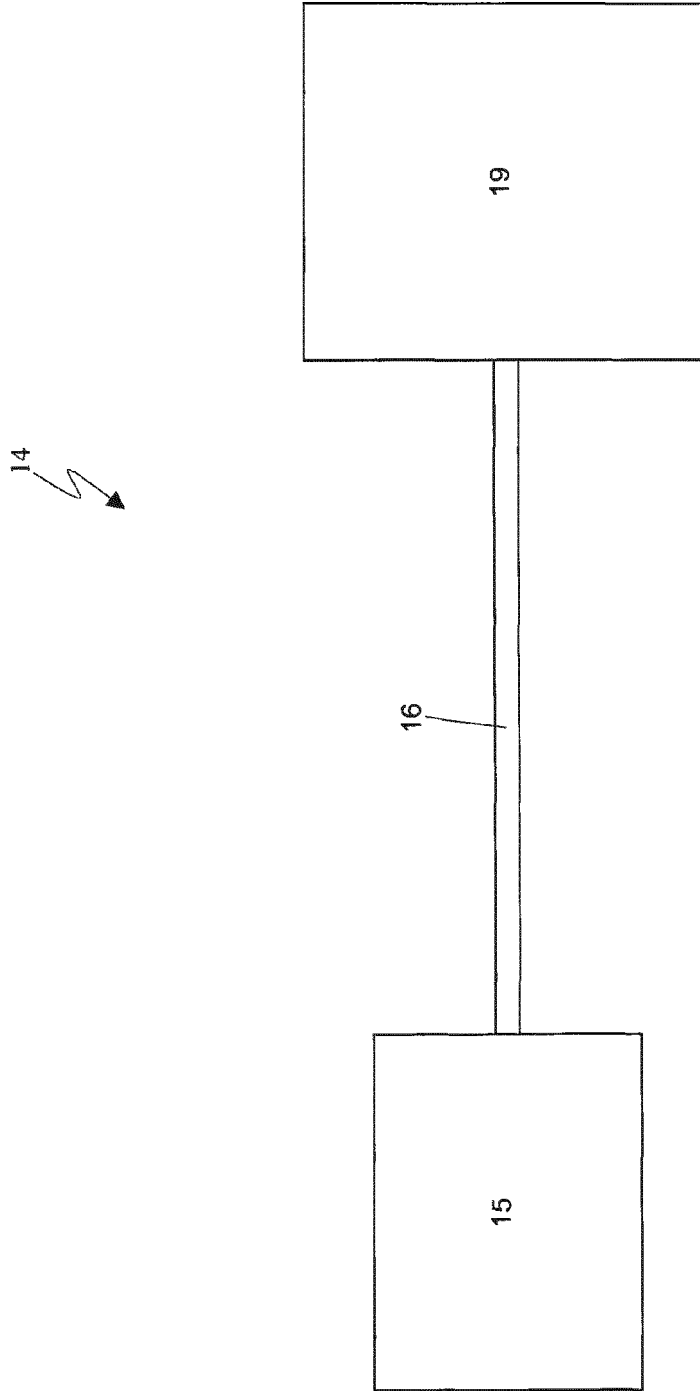


Fig. 2

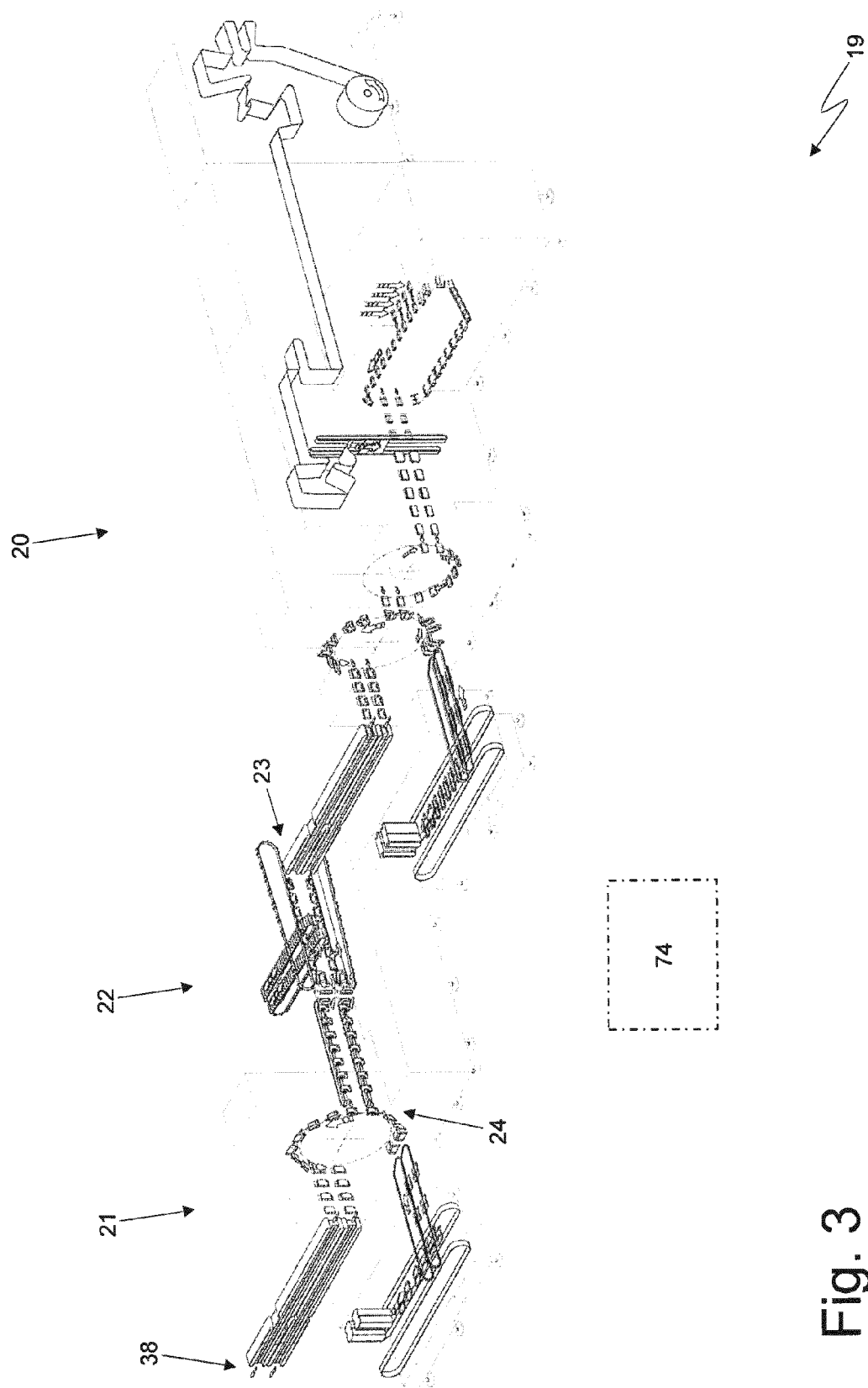


Fig. 3

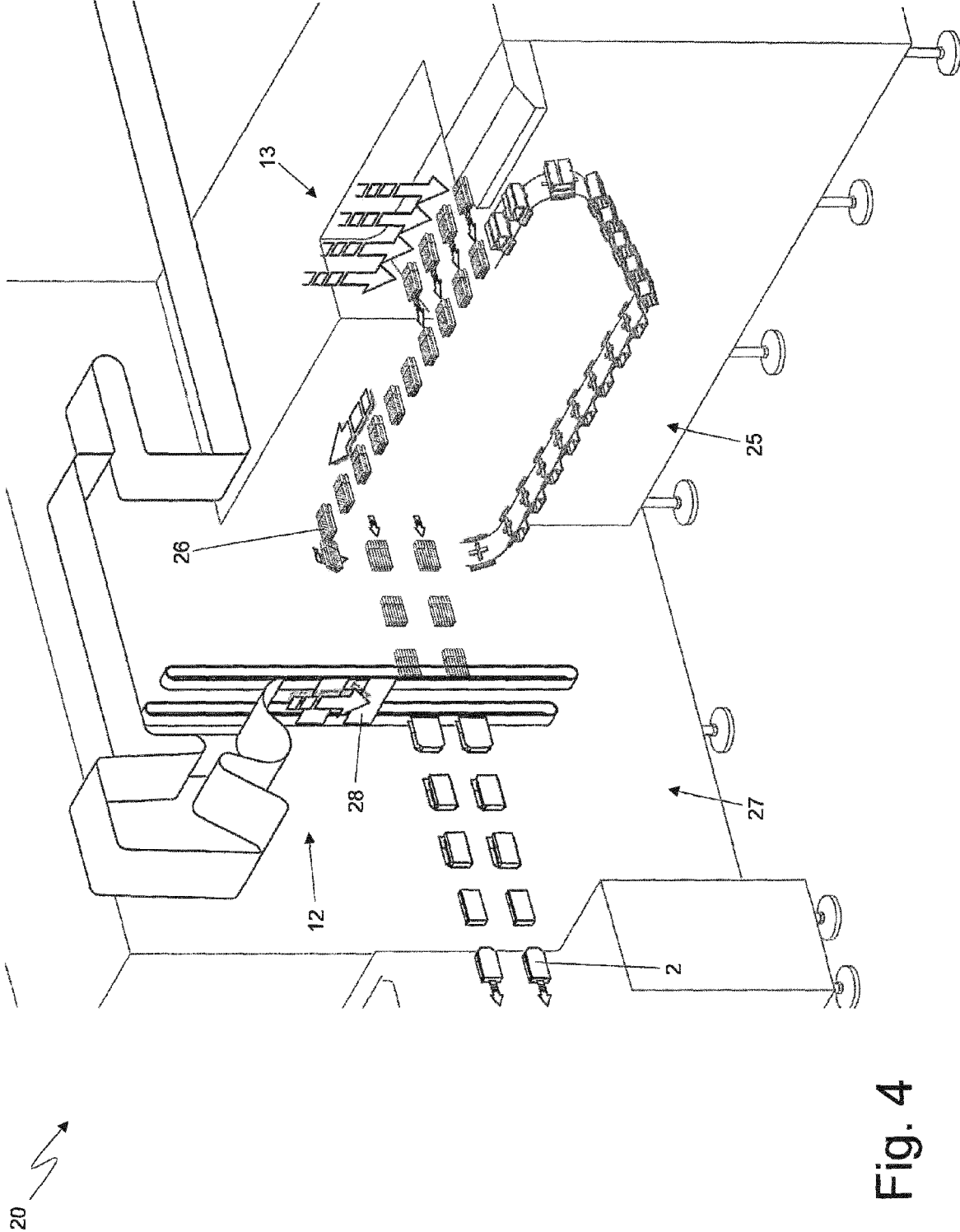


Fig. 4

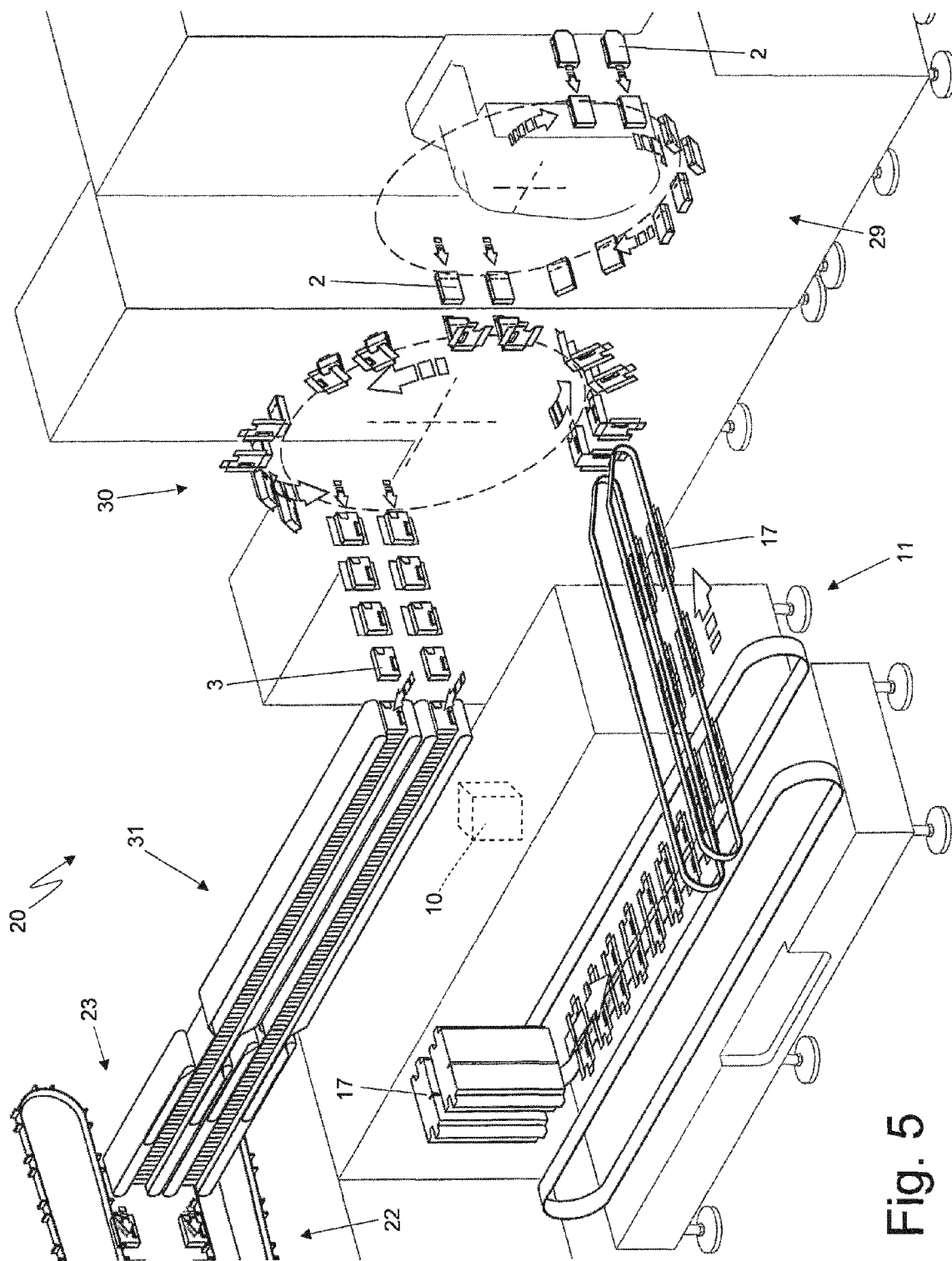


Fig. 5

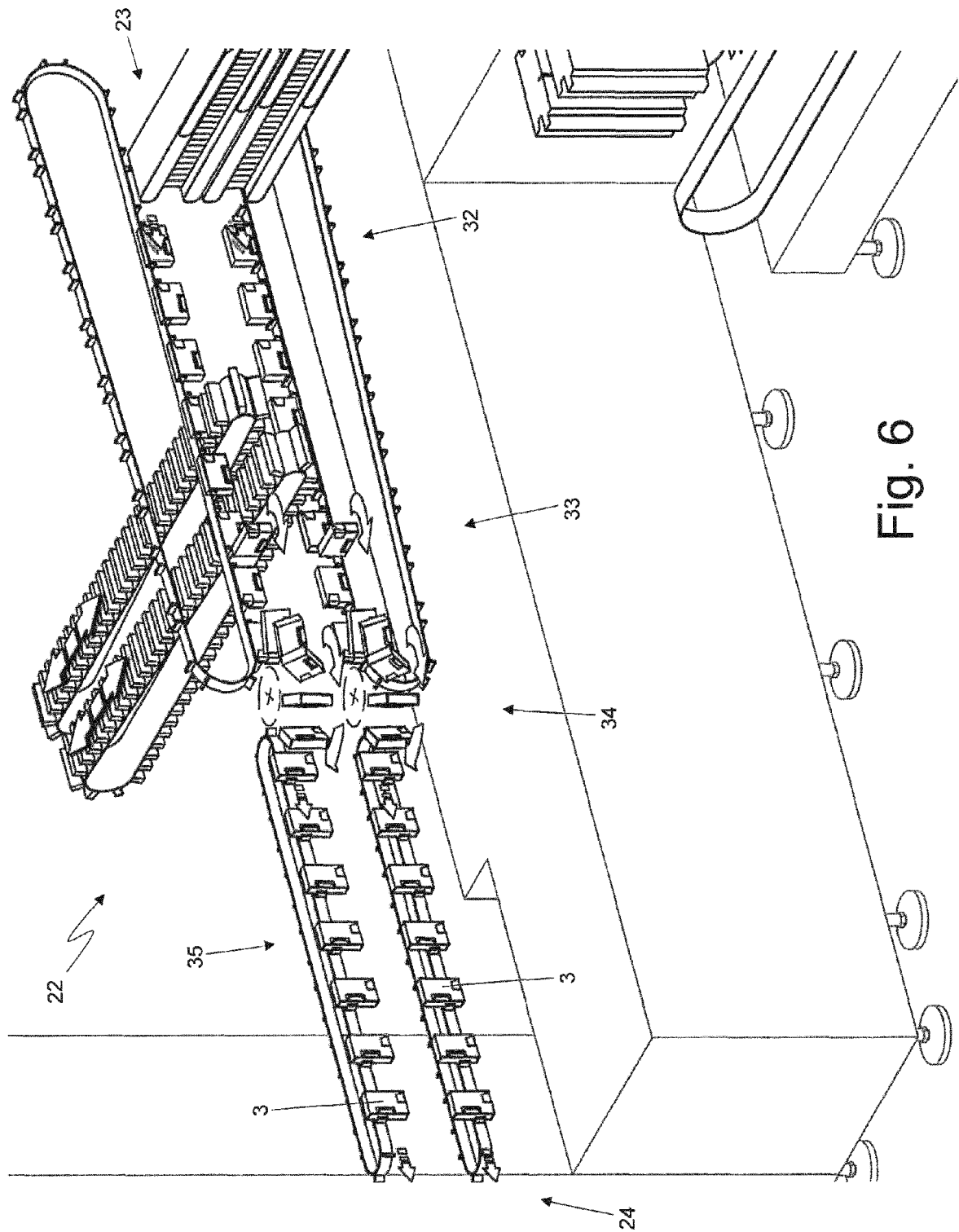


Fig. 6

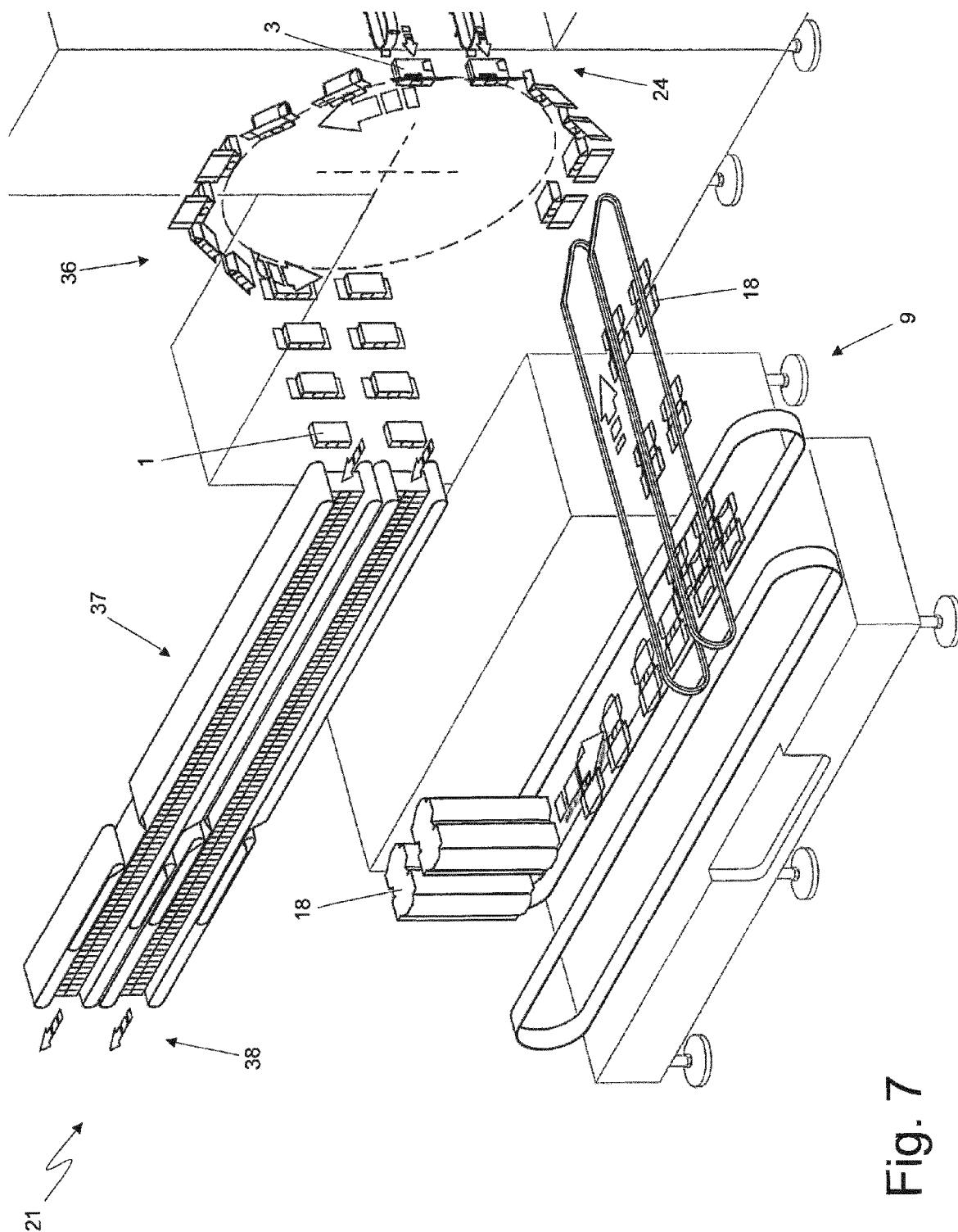


Fig. 7

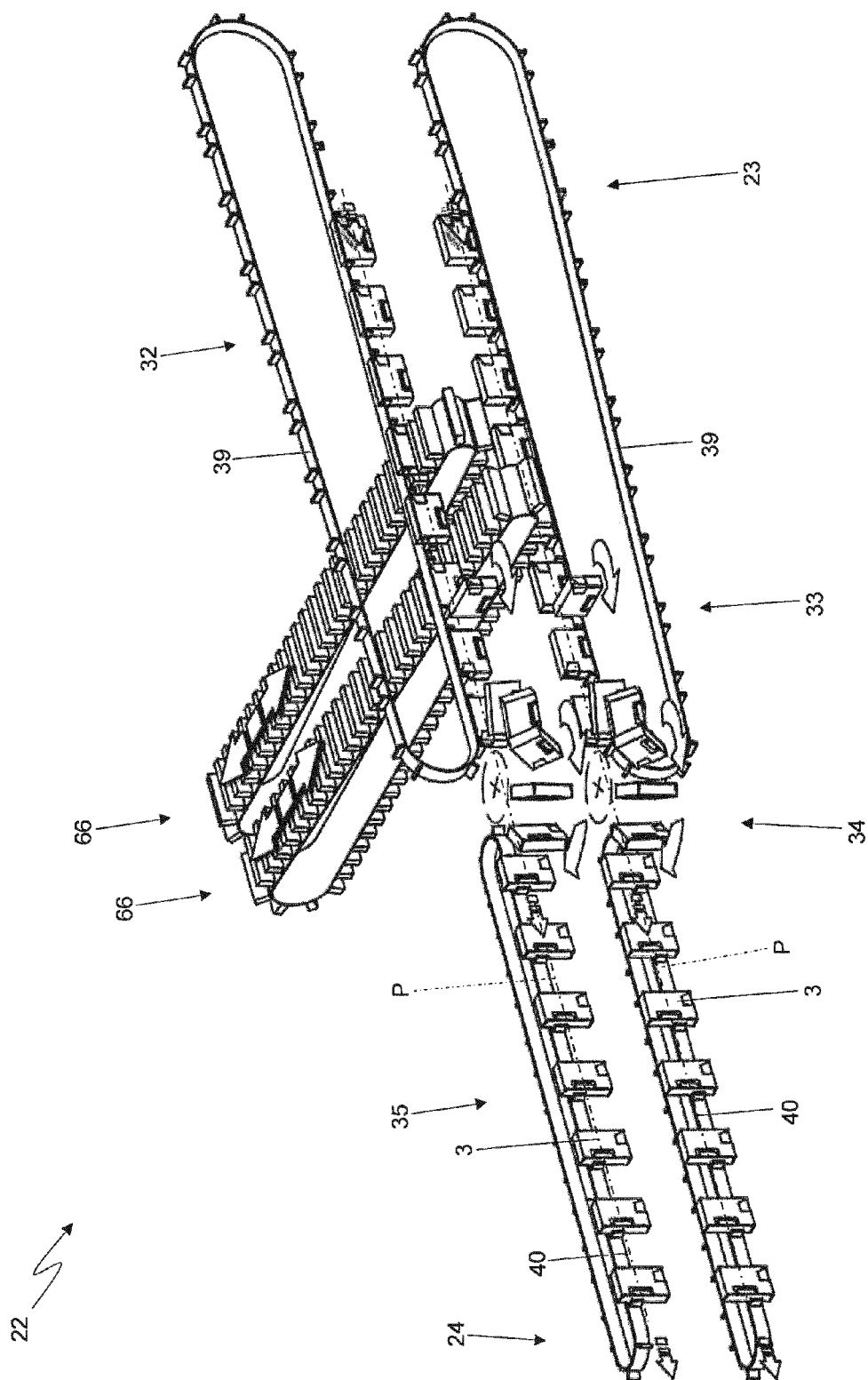


Fig. 8

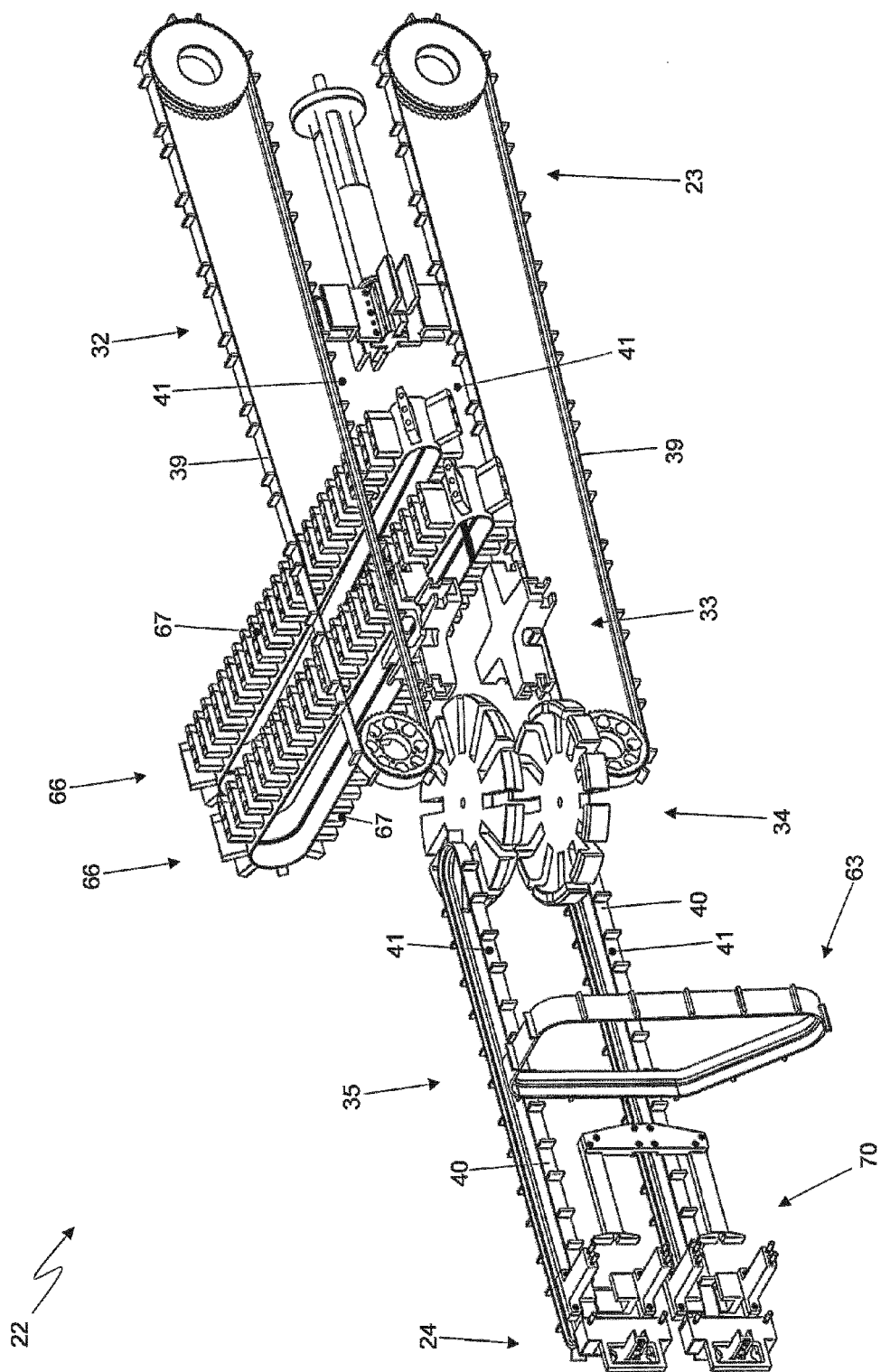


Fig. 9

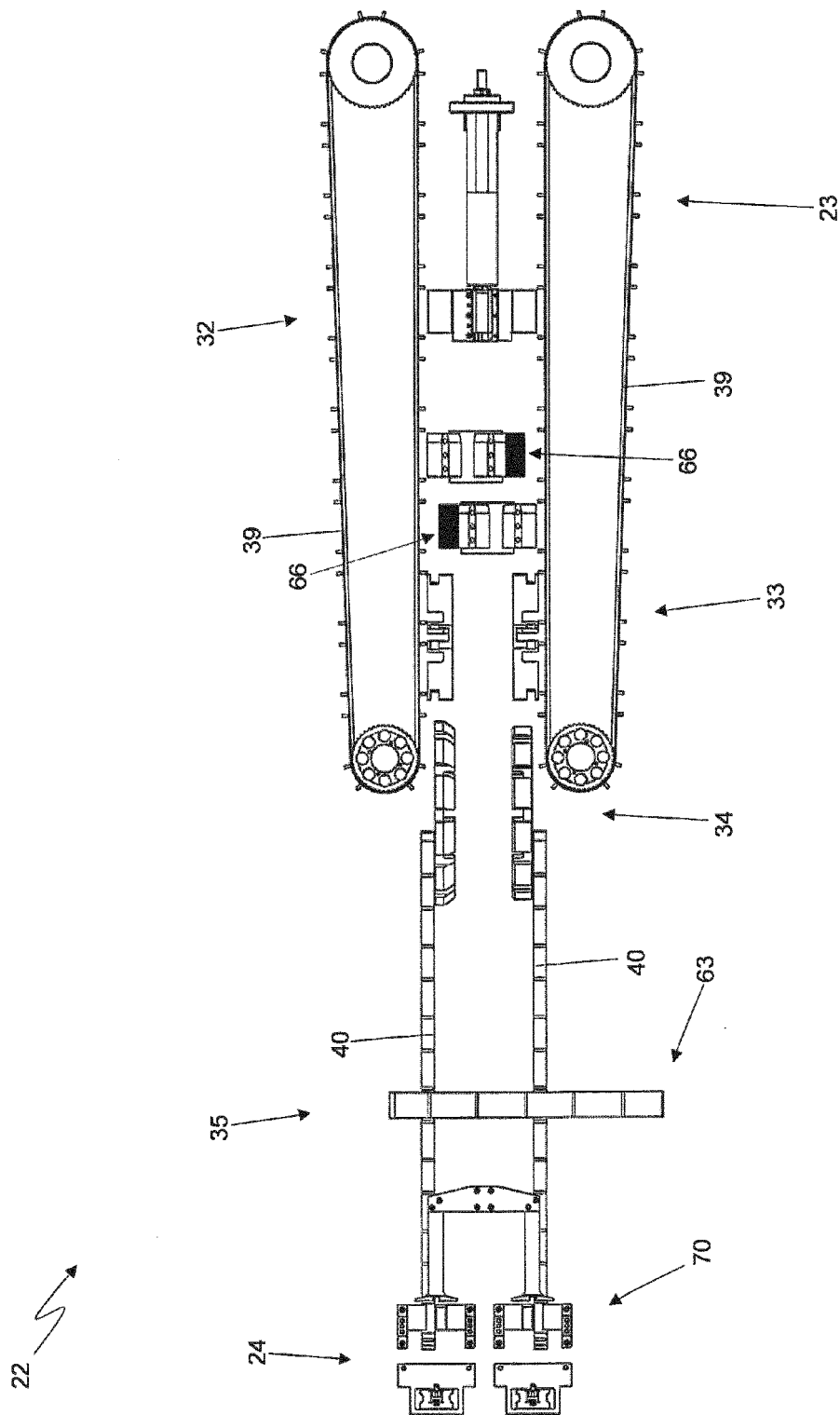


Fig. 10

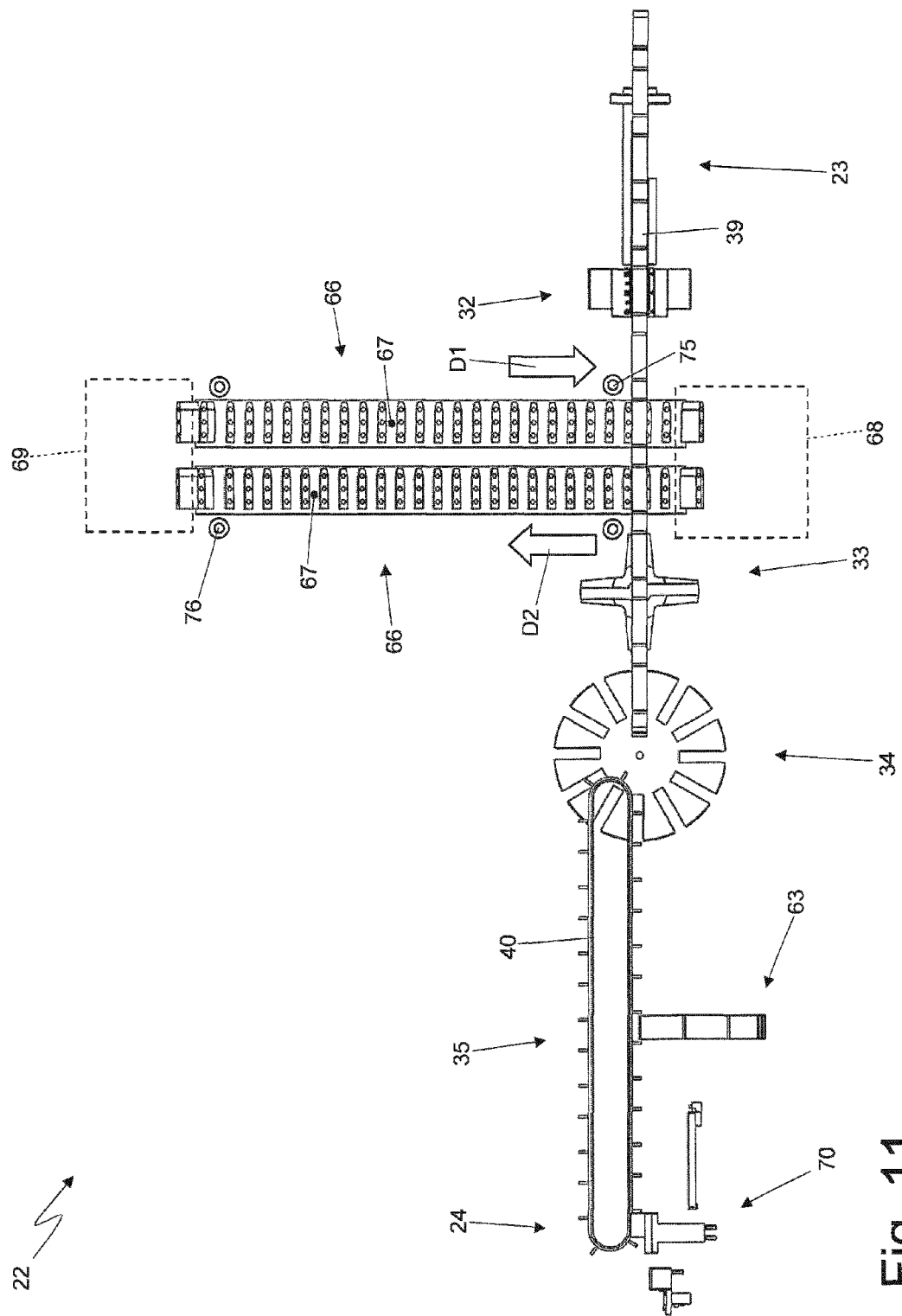


Fig. 11

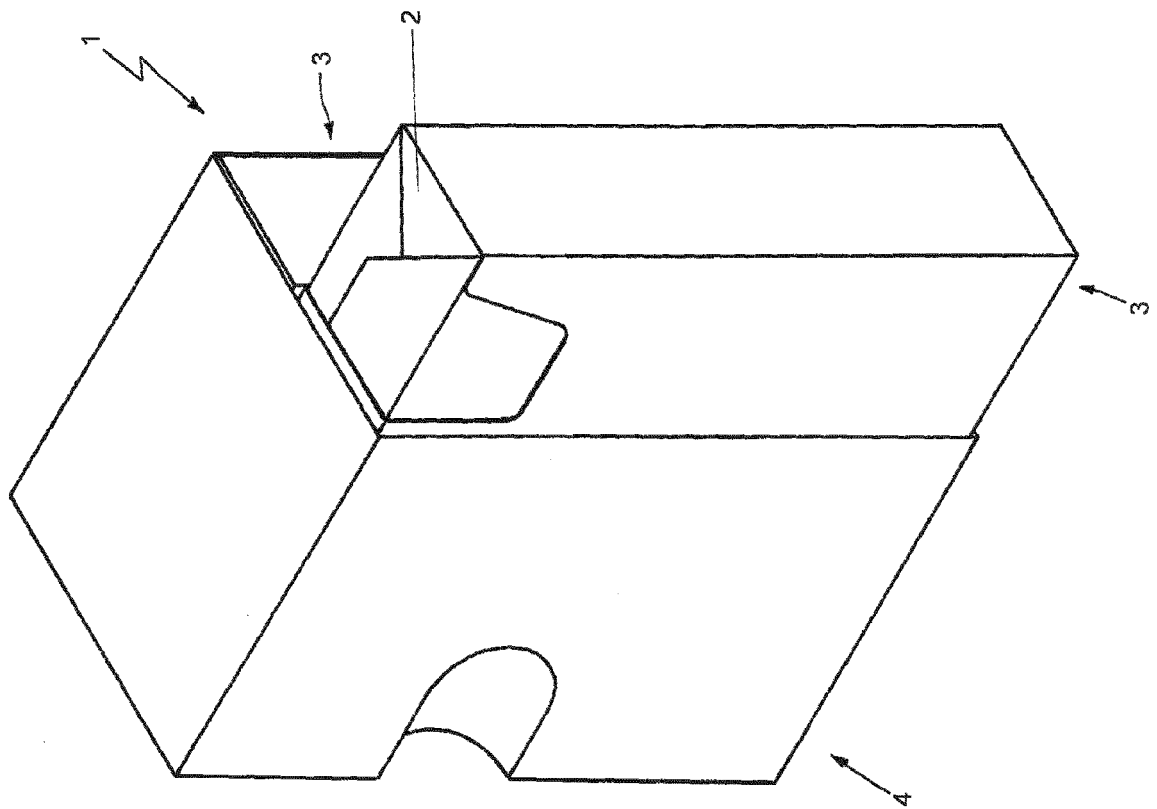


Fig. 12

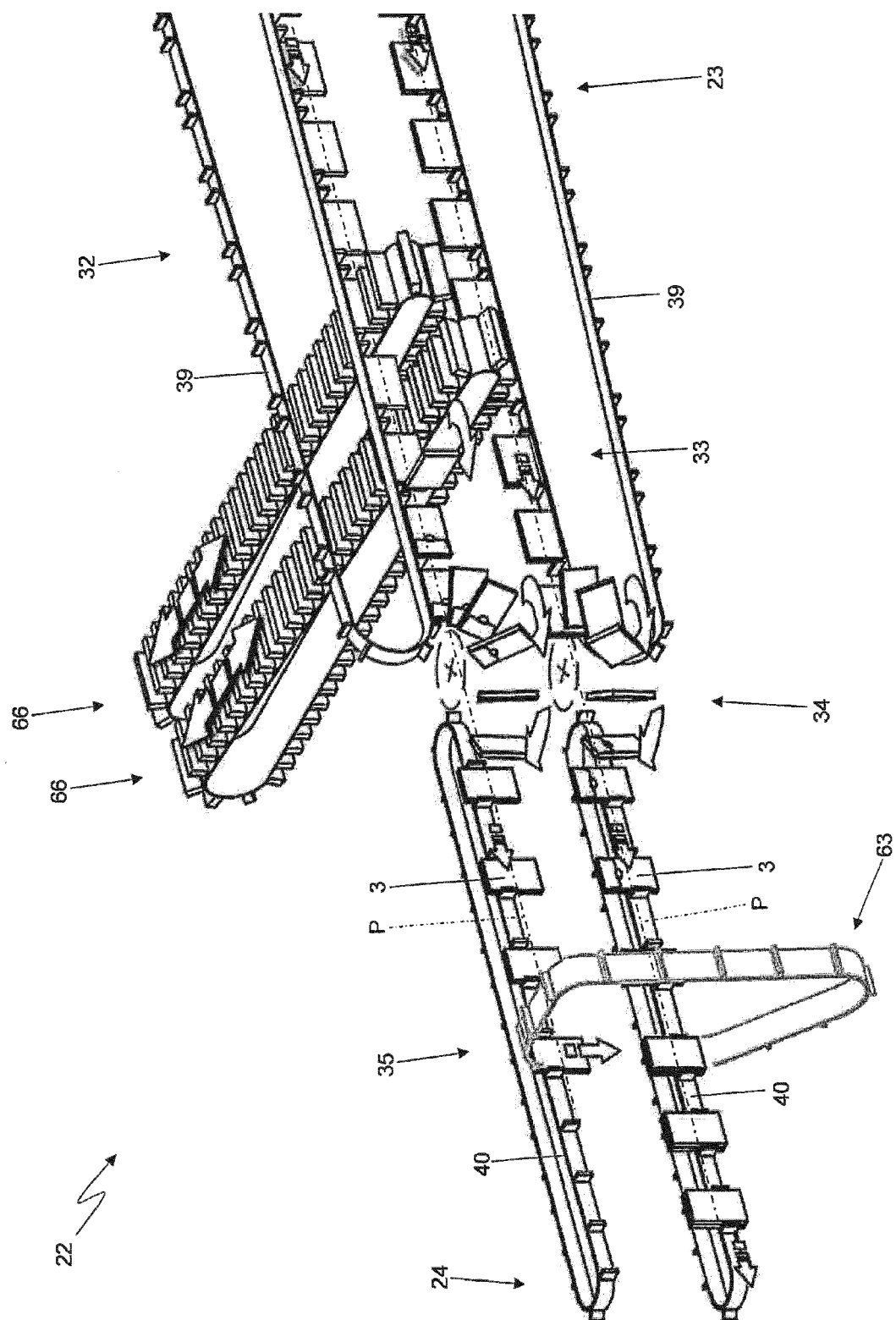


Fig. 13

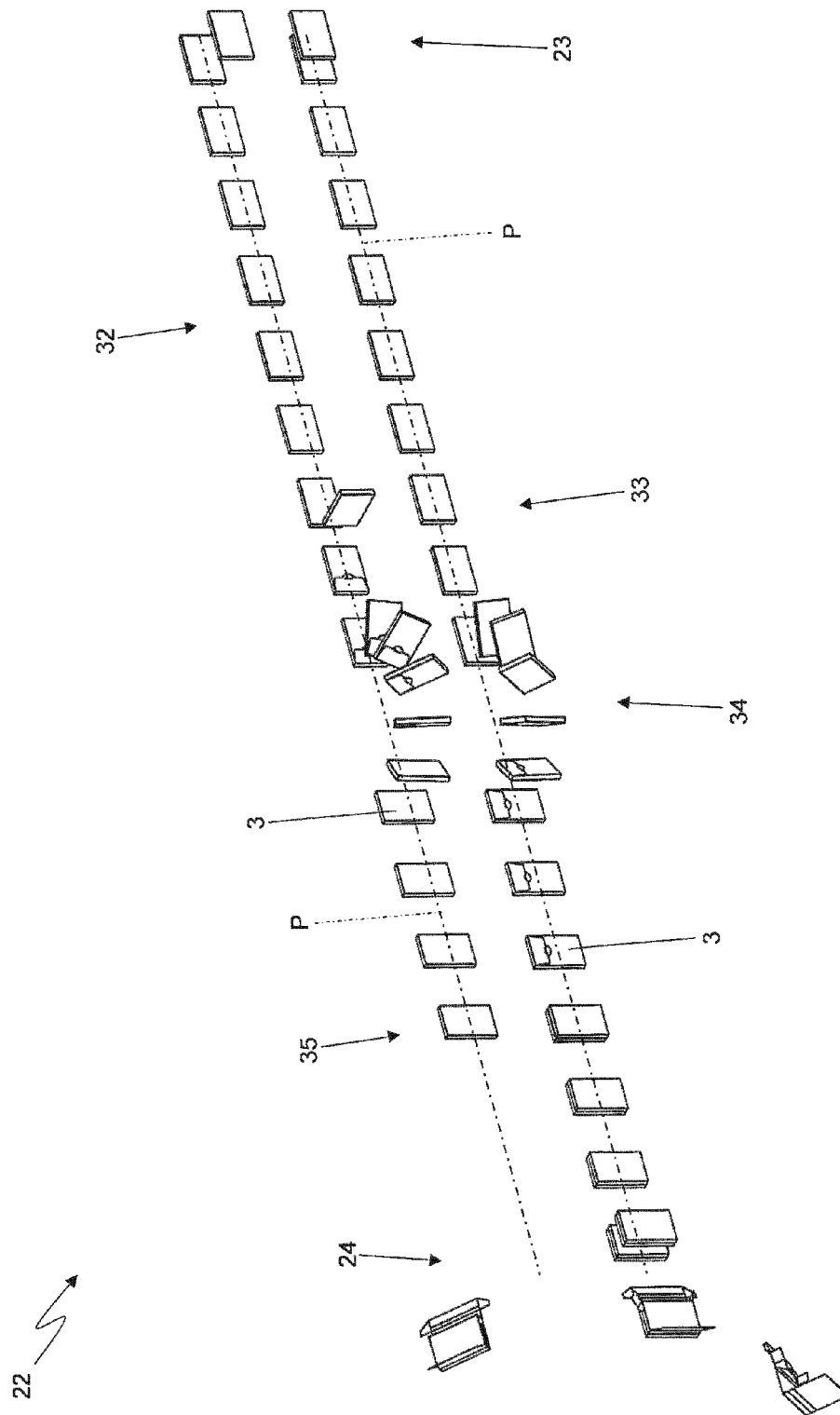


Fig. 14



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Place of search Munich		Date of completion of the search 14 May 2013	Examiner Schelle, Joseph
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