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

(11) **EP 2 483 168 B9**

(12) **CORRECTED EUROPEAN PATENT SPECIFICATION**

(15) Correction information:
Corrected version no 1 (W1 B1)
Corrections, see
Description Paragraph(s) 22, 45, 55, 58, 66, 78

(48) Corrigendum issued on:
11.06.2014 Bulletin 2014/24

(45) Date of publication and mention of the grant of the patent:
15.01.2014 Bulletin 2014/03

(21) Application number: **10765535.9**

(22) Date of filing: **29.09.2010**

(51) Int Cl.:
B65B 65/00 *(2006.01)*

(86) International application number:
PCT/US2010/050651

(87) International publication number:
WO 2011/041362 (07.04.2011 Gazette 2011/14)

(54) **APPARATUS FOR AND METHOD OF PROCESSING ARTICLES**

VORRICHTUNG FÜR UND VERFAHREN ZUR ARTIKELVERARBEITUNG

APPAREIL ET PROCÉDÉ DE TRAITEMENT D'ARTICLES

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **29.09.2009 GB 0917052**
30.09.2009 GB 0917135

(43) Date of publication of application:
08.08.2012 Bulletin 2012/32

(60) Divisional application:
12194269.2 / 2 565 125

(73) Proprietor: **MeadWestvaco Packaging Systems, LLC**
Richmond, VA 23219-0501 (US)

(72) Inventor: **BONNAIN, Jean-Christophe**
F-36000 Chateauroux (FR)

(74) Representative: **Coulson, Elizabeth Eve et al**
Coulson & Associates
1st Floor Suite
5 Newbold Road
Rugby
Warwickshire CV21 2LQ (GB)

(56) References cited:
WO-A1-2008/099070
WO-A1-2009/097546
DE-B- 1 035 555
GB-A- 1 425 009
US-A1- 2008 245 035

EP 2 483 168 B9

Description

[0001] The invention relates to the automated processing of articles. More specifically, but not exclusively, the invention relates to the packaging of primary articles into one or more outer packaging layers.

BACKGROUND OF THE INVENTION

[0002] In the field of packaging it is required to provide adaptable machines and sub-assemblies that are capable of packaging a variety of types of primary article, for example cans, bottles and yoghurt pots into secondary packages (cartons) that contain or hold together an array of articles in a multipack. It is known to provide such secondary-multipacks to subsequent sub-assemblies for collating a number of multipacks or cartons into a tertiary package for subsequent transportation and shelf stacking at a retail outlet.

[0003] In the interests of economic and efficient packaging, it is required to achieve the highest throughput of packaged primary articles and to ensure that the output of a primary processing line, for example a bottling line is not limited by the speed of operation of secondary packaging and tertiary packaging lines. Higher throughputs can be achieved if machine lines can be run faster; however this is not always possible when manipulation of cartons introduces complexities that limit the run-speed. Additionally, greater linear size of packaging machine is often required where run-speeds are higher. The linear size and/ or floor space of a packaging line, (known as its "foot-print") is an important consideration. Indeed in known systems, the tertiary and secondary packaging lines are often separated because of constraints on the end-to-end length of packaging line that can be accommodated in a single space. For this and other reasons, the secondary packages must be transported from the end of the secondary packaging line to the in-feed of a separate tertiary packaging line. This requires the timing and pitch of the delivered secondary packages to be carefully controlled once they then arrive at a tertiary packaging assembly in order for those secondary packages to be manipulated, collated and packaged into a tertiary package. These additional steps add repetition, complexity, cost, further potential for down-time and error and other disadvantageous characteristics that may result in down time of the tertiary packaging and secondary packaging assemblies and potentially the entire bottling or filling line.

[0004] In WO2008/099070 a device for overpacking at least one object with at least one blank Is disclosed. The device includes a carousel with three workstations distributed about the carousel.

[0005] It is with consideration of these and other disadvantageous aspects of primary article to tertiary carton packaging, that the present invention has been developed. The present invention seeks to provide a number of advantages or improvements in the field of article processing generally and in particular in the field of article processing for packaging.

[0006] Many packaging machines use conveyors that are often described as endless because the conveyor itself is a closed loop. The path of such conveyors is however, often linear, with articles being conveyed in a straight line during a working reach. The term endless circuit is used here to describe the loop-type path of the major processing route. In preferred embodiments, articles are conveyed on an endless conveyor following a closed loop path as they traverse and are processed by the major processing route.

SUMMARY OF INVENTION

[0007] According to a first aspect, the invention provides an apparatus for processing articles, the apparatus comprising:

(i) a major processing route;
(ii) a minor processing route;
(iii) two or more connected workstations positioned along the major processing route for sequentially acting upon articles transported through that major processing route to create a first work product; and
(iv) two or more connected workstations positioned along the minor processing route for sequentially acting upon articles transported through that minor processing route to create a second work product;

wherein, the apparatus comprises a common workstation that is positioned on the major processing route and that is positioned on said minor processing route, said common workstation is operable to act upon articles transported through the major processing route and operable to act upon articles transported through the minor processing route such that said major processing route and said minor processing route intersect and wherein the major processing route comprises a first conveyor operable to transport articles in an endless circuit connecting the two or more workstations positioned along the major processing route, characterised in that the minor processing route comprises a second conveyor operable to transport articles in an endless circuit between the one or more workstations positioned along the minor processing route, in that first conveyor of the major processing route and the second conveyor of the minor processing route have an at least substantially circular shape and in that the radius of the second conveyor of the minor processing route is greater than the radius of the first conveyor of the major processing route and the second conveyor of the minor processing

route is disposed around the major processing route.

[0008] Optionally, the common workstation is operable to transfer the first work product from the major processing route to the minor processing route so that the one or more workstations positioned along the minor processing route are operable to act upon the first work product to create the second work product.

[0009] Preferably, the conveyor of the major processing route has a circular shape and wherein four workstations are positioned along the major processing route.

[0010] Optionally, the conveyor of the minor processing route has a circular shape and wherein three workstations are positioned along the minor processing route. Preferably, the four workstations of the major processing route are each at about 90° apart. Preferably, the three workstations of the minor processing route are positioned such that a first workstation is spaced about 45° from a second workstation; the second workstation is spaced about 45° from a third workstation and the third workstation is spaced about 270° from the first workstation.

[0011] Optionally, the first conveyor and the second conveyor are intermittently operable to transport articles from one workstation to a sequential workstation and once at the sequential workstation the first and second conveyors can be paused in a stationary mode until that workstation has completed acting upon the articles and the articles are then transported from that workstation to a further sequential workstation. Preferably, the first conveyor and second conveyor are both intermittently operable and are synchronised to move and pause at the same time.

[0012] Optionally, the common workstation comprises a robotic mechanism operable to pick-up one or more of said first work products and to place said one or more first work products onto a conveyor of the minor processing route.

[0013] Optionally, one or more of said workstations comprises a robot operable to transport one or more articles from an external article feed mechanism onto a first or second conveyor of the major and minor processing routes respectively.

[0014] Optionally, the apparatus is suitable for packaging one or more primary packaged articles into secondary packages and for collating a plurality of secondary packages into tertiary packages and wherein the first work product is a secondary package and wherein the second work product is a tertiary package. Preferably, the first conveyor comprises one or more forming trays and/or wherein a second conveyor of the minor processing route comprises one or more forming trays. More preferably, the first conveyor comprises four forming trays and wherein the second conveyor comprises eight forming trays.

[0015] Optionally, a first workstation of the major processing route comprises a robotic mechanism operable to transfer one or more secondary carton wrappers from a secondary carton wrapper feed mechanism disposed alongside the major processing route onto the first conveyor or onto a forming tray of the first conveyor or onto primary articles disposed on the first conveyor.

[0016] As a further option, a second workstation of the major processing route comprises a robotic mechanism operable to transfer one or more primary articles from a primary articles feed mechanism disposed alongside the major processing route onto the first conveyor or onto a forming tray of the first conveyor or onto secondary carton wrapper disposed on the first conveyor.

[0017] As yet a further option, a third workstation of the major processing route comprises a mechanism for completing the formation of a secondary carton wrapper about one or more primary articles.

[0018] Even more optionally, a fourth workstation of the major processing route is the common workstation and the common workstation comprises a robotic mechanism operable to pick-up one or more of said secondary packages and to place said one or more secondary packages onto the second conveyor of the minor processing route

[0019] Preferably, a first workstation of the minor processing route comprises a robotic mechanism operable to transfer one or more tertiary carton wrappers from a tertiary carton wrapper feed mechanism disposed alongside the minor processing route onto the second conveyor or onto a forming tray of the second conveyor or onto a secondary package disposed on the second conveyor. More preferably, a second workstation of the minor processing route is the common workstation and the common workstation comprises a robotic mechanism operable to pick-up one or more of said secondary packages from the first conveyor of the major processing route and transfer said one or more secondary packages onto the second conveyor or onto a forming tray of the second conveyor or onto a tertiary wrapper disposed on the second conveyor. preferably, a third workstation of the minor processing route comprises a mechanism for completing the formation of a tertiary package comprising one or more secondary packages.

[0020] According to a second aspect, the invention provides a method of forming a tertiary package, the method comprising:

(i) providing an apparatus preferably, but not exclusively according to any of the preceding paragraphs;
(ii) providing one or more articles to the major processing route;
(iii) operating the two or more connected workstations of the major processing route so that the articles transported through that major processing route are sequentially acted upon to create a first work product;
(iv) providing one or more articles to the minor processing route;
(v) operating the two or more connected workstations of the minor processing route so that the articles transported through that minor processing route are sequentially acted upon to create a second work product; and

(vi) operating a common workstation that is positioned on both the major processing route and on said minor processing route, to act upon articles transported through the major processing route and to act upon articles transported through the minor processing route.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] Exemplary embodiments of the invention will now be described with reference to the accompanying drawings, in which:

Figure 1 shows a flow chart of the various steps carried out by the apparatus according to the illustrated embodiments of the invention

Figure 2 shows schematically a view of a processing apparatus according to a first embodiment of the invention at notional time interval zero;

Figures 3 to 6 show schematically a view of a processing apparatus according to a first embodiment of the invention at notional time intervals one to four respectively;

Figure 7 shows schematically a view of a processing apparatus according to a second embodiment of the invention at notional time interval one;

Figure 8A shows a plan view of the positioning of the workstations of the apparatus of the first two embodiments;

Figure 8B shows a plan view of the positioning of the workstations of the apparatus of third embodiment; and

Figure 9 shows schematically a view of a processing apparatus according to a third embodiment of the invention at notional time Interval one.

[0022] For the ease of understanding of the drawings accompanying the following description, a list of the numbered parts is provided. To distinguish the features of the second and third embodiments from those of earlier embodiments, the reference numerals used in Figures 7 and 9 have been raised by a factor of '100' and '200' respectively.

Table 1.1: Reference Numerals used for the Features Illustrated in Figures 1 to 10

Reference Numerals	**Feature Illustrated**
10, 110, 210	Processing Apparatus
A	Primary Articles
12, 112, 212	Hopper
14, 114, 214	Vacuum Feed Mechanism
16, 116, 216	Article Filling Station
18, 118, 218	Secondary Carton Wrapper Blank
20, 120	Secondary Carton Forming Tray
20a, 20b, 20c, 20d	compartments of Secondary Carton Forming Tray
120a, 120b, 120c, 120d	Compartments of Secondary Carton Forming Tray
22, 122, 222	First robotic pick and place arm (for placing secondary carton wrapper blanks 18, 118, 218 into the compartments (20a, 20b, 20c, 20d, 120a, 120b, 120c, 120d) of the secondary carton forming tray 20, 120. Disposed at station 'B1'
24, 124, 224	Second robotic pick and place device (for placing array of articles A into folded and opened secondary carton wrapper blanks 18, 118, 218 disposed in secondary carton forming tray 20, 120). Disposed at station 'B2'
X	Direction of motion of secondary carton forming trays. Clockwise from B1 to B2 to B3 to B4 to B5.

(continued)

Reference Numerals	Feature Illustrated
Y	Direction of motion of tertiary package forming trays. Anticlockwise from B5 to B4 to B3 to B2 to B1.
A1, A2, A3, A4	2 x 3 grouped array of articles placed into secondary carton wrapper blanks 18, 118, disposed in compartments 20a, 20b, 20c, 20d / 120a, 120b, 120c, 120d of secondary carton forming tray 20; 120.
26, 126	Third robotic pick and place device for placing completed secondary packages 30, 130, into tertiary package forming trays 32, 132 containing creased and folded tertiary package blanks 34, 134.
30, 130	Completed secondary packages
32, 132	Tertiary package forming trays
34, 134	Tertiary package blanks
36, 136	Tertiary package blank hopper
38, 138	Tertiary package blank feeder
40, 140	Support for tertiary package forming trays
42, 142	Out feed for completed tertiary packages
244	Lugs for conveying articles and secondary cartons
46, 146, 246	Support frame
248	Secondary carton finishing means
50, 250	Secondary blank platform
52	Guide on Secondary Carton Forming Tray
58, 158, 258	Major processing line
60, 160, 260	Minor processing line
254	completed tertiary package

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0023] Detailed descriptions of specific embodiments of article processing apparatus are disclosed herein. It will be understood that the disclosed embodiments are merely examples of the way in which certain aspects of the invention can be implemented and do not represent an exhaustive list of all of the ways the invention may be embodied. Indeed, it will be understood that the apparatus described herein may be embodied in various and alternative forms. The figures are not necessarily to scale and some features may be exaggerated or minimised to show details of particular components. Well-known components, materials or methods are not necessarily described in great detail in order to avoid obscuring the present disclosure. Any specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the invention.

[0024] Each of the exemplary apparatus 10, 110, 210, as illustrated and described herein, is structured and arranged to accommodate and process articles A from an incoming stream. A flow chart is provided as Figure 1 which shows an exemplary sequence of operations B1 to B7 that are carried out on the articles A that are supplied to the apparatus 10, 110, 210.

[0025] Upon reading the foregoing description, the benefits of the apparatus 10, 110, 210 will be understood. Whereas these benefits are described with reference to a packaging machine conducting certain specific processing operations relating to packaging, it will readily be understood that the beneficial features of the apparatus could be imparted to other processing applications and other specific processing operations related to other processes could be carried out. As such the embodiments illustrated and described should be understood as being exemplary only and do not provide an exhaustive recitation of the only possible implementations of the invention.

[0026] Examples of an apparatus 10, 110, 210 are shown in Figures 2 to 6, 7 and 9. The apparatus 10 of the first

embodiment illustrated in Figures 2 to 6 is illustrated at different, yet sequential, time intervals. The second and third embodiments of the apparatus 110, 210 shown in Figures 8 and 9 respectively are shown at different time frames of operation.

[0027] Referring to the Figures, the specific operations performed at workstations B1 to B7 in the packaging apparatus 10, 100, 210 of the illustrated embodiments are shown in Table 1.2:

Table 1.2: Operations performed at workstations B1 to B7

Workstation	Operation Performed
B1:	Providing secondary carton wrapper blanks to operative conveyor;
B2/B7:	Providing grouped articles;
B2:	Combining the grouped articles with the secondary carton wrapper blanks;
B3:	Completing the formation of a secondary package from the combined articles and secondary carton wrapper blanks;
B4:	Combining completed secondary packages with a tertiary carton to form tertiary packages;
B5:	Providing tertiary carton wrapper blanks to an operative conveyor; and
B6:	Outputting finished tertiary packages.

[0028] The above sequence of operations B1 to B7 will be described with reference to the first embodiment and relative to the journey taken by a plurality of secondary carton wrappers 18 and article groups A1, A2, A3, A4. Reference is made to Figures 2 to 6 inclusive. Whereas in practice, the apparatus 10 comprises a number of components operating simultaneously and synchronously, the following general description of the apparatus 10 follows the journey of a set of four blanks 18 from the start of the sequence to the end of the sequence; through a major processing route 58 and through a minor processing route 60. As is further described below, the apparatus 10 operates on more than one similar groups of blanks 18 simultaneously and the operations listed above take place simultaneously on different article groups rather than sequentially on a first article group followed by a subsequent article group and so on. In this way, more than one, in this case four products are being worked on at any given time and the output is thereby four times greater than a linear processing machine operating at the same run speed. Thus the apparatus provides for efficient and simultaneous processing of the articles A. The carousel type structure of the apparatus offers a further benefit in that the apparatus is a compact structure having a smaller foot print than a comparable linear machine.

[0029] The articles being packaged A1, A2, A3, A4 may be joined or linked groups of articles such as yoghurt pots which are top loaded into a top gripping secondary package which is affixed by means of a composite top wall. The apparatus described herein is readily adaptable for accommodating other types, number and configuration of articles that may be loaded be a variety of relative movements into secondary cartons of a variety of formats.

[0030] Specific reference is now made to the journey taken by a set of four blanks 18 and group of articles A1, A2, A3, A4. Figure 2 represents a snap shot of the apparatus 10 at a starting time for the journey of the set of four blanks 18. The group of four secondary carton wrapper blanks 18 are supplied to a secondary carton blank platform 50. A hopper or magazine 12 disposed along the major processing route 58 and a feed mechanism 14 are used to achieve this. A group of four secondary carton wrapper blanks 18 are held, momentarily, on the secondary carton blank platform 50.

[0031] In Figure 3 it is shown that the group of four secondary carton wrapper blanks 18 are simultaneously picked, transferred and loaded into separate compartments 20a, 20b, 20c, 20d of a secondary carton forming tray 20 which is disposed on a first conveyor of the major processing route 58. The movement of the group of four secondary carton wrapper blanks 18 is accomplished by a first robotic mechanism 22 comprised in the first workstation B1. The first conveyor is optionally a belt type endless or closed loop conveyor defining a circular path. This is the circuit of the major processing route 58.

[0032] In Figure 4 it is shown that the group of four secondary carton wrapper blanks 18 are folded as they are loaded into the separate compartments 20a, 20b, 20c, 20d of the secondary carton forming tray 20. The folding of the group of four secondary carton wrapper blanks 18 is optionally facilitated by fold lines, pre-creases or demarcation lines on the secondary carton wrapper blanks 18 and/or facilitated by the size and structure of the forming tray 20 and its separate compartments 20a, 20b, 20c, 20d. The secondary carton wrapper blanks 18 have a greater area than the separate compartments 20a, 20b, 20c, 20d and relative movement between the secondary carton wrapper blanks 18 and the framework and sides of the compartments 20a, 20b, 20c, 20d causes the secondary carton wrapper blanks 18 to fold into a part-formed and open position. Guide 53 of the framework of the forming tray 20 facilitates the folding of the secondary carton wrapper blanks 18. The group of four secondary carton wrapper blanks 18 are thus prepared for

combination with groups of articles A1, A2, A3, A4.

[0033] During the loading and folding of the secondary carton wrapper blanks 18 into the separate compartments 20a, 20b, 20c, 20d, the first conveyor of the major processing route 58 is, at least for some of that time, paused in a "stationary-mode" or "pause-mode". After the operations undertaken by workstation B1 are completed, the first conveyor is switched to movement mode or "on-mode".

[0034] The secondary carton forming tray 20 is moved, by the first conveyor of the major processing route 58, in a clock-wise direction (as shown by arrow labelled 'X') towards an article in-feed station (second workstation) B2. The rotation of the apparatus 10 to move secondary carton forming trays 20 between stations B1, B2, B3 and B4 Is illustrated in Figures 5 and 6.

[0035] After or during or before, the secondary carton forming tray 20 (comprising the open and folded set of four secondary carton wrapper blanks 18) is transferred or conveyed to workstation or operating station B2, a group of articles A1, A2, A3, A4 are moved from an article supply stream 16 by a second robotic pick and place device 24. The groups of articles A1, A2, A3, A4 are combined with the open and folded set of four secondary carton wrapper blanks 18 respectively. This operation is illustrated In sequence in Figures 2 to 4. The article supply stream 16 is the second workstation disposed along the major processing route 58 and is disposed in close proximity to the first conveyor so that the second robotic device 24 can transfer the groups of articles in a time scale consistent with the time required for the other workstations B1, B3, B4 of the major processing route 58 to perform their respective operations.

[0036] At least some of the loading of the articles A1, A2, A3, A4 into the secondary carton wrapper blanks 18 in the separate compartments 20a, 20b, 20c, 20d, takes place whilst the first conveyor of the major processing route 58 is held in a "stationary-mode" or "pause-mode". After the articles A1, A2, A3, A4 have been loaded into the secondary carton wrapper blanks 18 (i.e. once sufficient operations undertaken by workstation B2 have been completed such that the "work-in-progress" is ready to move onto the next operating workstation B3), the first conveyor is switched to movement mode or "on-mode". The first conveyor is used to simultaneously transfer working groups from one workstation to the next. As such, the length of time that the conveyor is held in stationary mode at each workstation B1, B2, B3, B4 is the same. The apparatus pauses to simultaneously allow each workstation to perform its operation on a work product and then the apparatus moves to allow each work product to be transferred to the next successive workstation of the major processing route.

[0037] Once the article groups A1, A2, A3, A4 have been combined with the open and folded set of four secondary carton wrapper blanks 18, the secondary carton forming tray 20 is moved in a clock-wise direction (as shown by arrow labelled 'X'), by the first conveyor, towards the workstation B3. At workstation B3, the formation of the secondary packages is completed. A lid portion of the secondary carton wrapper blank is folded and secured to a base of the secondary carton wrapper blank 18. An article group A1, A2, A3, A4, is secured between the lid and base to form a completed secondary package 30.

[0038] The secondary carton forming tray 20 is moved in a clock-wise direction as shown by arrow labelled 'X' towards the final workstation B4 disposed along the major processing route 58. Here the four completed secondary packages 30 are picked, moved and rearranged before being loaded into a tertiary packaging tray 32 by a third robotic pick and place device 26. The four completed secondary packages 30 are optionally also rearranged by the third robotic pick and place device 26 from a linear 4 x 1 array to a square 2 x 2 array as the articles are transferred from the major processing route 58 to a minor processing route 60. The completed and rearranged secondary packages 30 are considered to be the first work product of the apparatus, in other words the first work product is the resulting product after the workstations B1, B2, B3, B4 of the major processing route 58 have completed their respective operations on the articles being processed by the major processing route 58. In this case the articles being processed are the article groups A1, A2, A3, A4 and secondary carton wrapper blanks 18.

[0039] The transfer and rearrangement of the four secondary packages 30 is illustrated in Figures 3, 4 and 5. The secondary carton forming tray 20 is thereby emptied of secondary packages 30 and the empty secondary carton forming tray 20 is returned to the first workstation B1 by the first conveyor of the major processing route 58. The empty tray 20 is returned to workstation B1 after the "pause-mode" of the intermittent operating cycle of the first conveyor is complete and during a fourth "on-mode" in the intermittent operating cycle of the first conveyor. Once the first forming tray 20 is returned to the first workstation B1, by the synchronised movement of the first conveyor, the entire operating sequence carried out by the workstations B1, B2, B3, B4 of the major processing route 58 is repeated on that first forming tray 20. By this time however, three other forming trays have been visiting the first three workstations B1, B2, B3 and as such four work-in-progress products are being acted upon simultaneously. It will be understood that the four workstations B1, B2, B3, B4, provided along the major processing route 58, operate substantially simultaneously and operate on the articles during the stationary period of the first conveyor's intermittent operation cycle.

[0040] Switching between the "pause" and "on" modes is timed to allow the "work-in-progress" at each station to reach a certain level of completeness and then to be moved on to the next successive workstation. During the "on-mode" of the first conveyor's intermittent operation cycle, the four workstations B1, B2, B3, B4 do not act upon the articles being transported through the major processing route 58. This does not necessarily mean that the robotic devices, in-feed

mechanism, and other manipulation and processing devices in each of the respective workstations are completely stationary during the "on mode" of the conveyor. Rather, each or some of the devices at the workstations may be operated during the "on-mode" of the conveyor in order to complete manipulation of a wrapper blank, or to ensure the robotic device is at the start of its processing sequence in readiness for attending to the next process. The mechanisms comprised in the four workstations may be programmed to return to their starting position and to perform certain acts in readiness for operating upon articles being transported through the major processing route 58 as soon as the first conveyor has been switched to "pause mode". For example, during the "on-mode" the first robotic pick and place mechanism 22 of first workstation B1 moves the picking head from a position in vertical alignment with the first conveyor to a position in vertical alignment with the secondary blank platform 50 in readiness for picking a subsequent group of four secondary carton wrapper blanks 18. Likewise, during the "on-mode" the second robotic pick and place device of the second workstation B2 moves the picking head from a position in vertical alignment with the first conveyor to a position in vertical alignment with the article supply 16 in readiness for picking up a subsequent set of four groups of articles A1, A2, A3, A4.

[0041] Equally, each or some of the devices at the workstation may not be operated during the entire "on-mode" or during a portion of the "on-mode" of the conveyor. The timing of the processing apparatus and transfer of the work-piece between one workstation and the next is controlled to ensure that the work-piece(s) (i.e. group of articles being loaded into a carton that is completed and then rearranged) are present at the required workstation for the subsequent step in the work-piece's processing cycle and to ensure that the workstation is positioned and ready for executing the required processing step.

[0042] In close proximity to the major processing route 58 and in intersecting relationship therewith, the minor processing route 60 is provided. In this and other embodiments of the invention, the major and minor routes are adjacent or neighbour one another. The major and minor routes 58, 60 preferably are adjoined by one or more common workstations. The minor processing route 60 comprises three workstations, B5, B4, B6. One of the workstations B4, is common to both the minor processing route 60 and to the major processing route 58. This common workstation B4 marks the intersection, overlap or link between the major processing route 58 and the minor processing route 60. The link or intersection between the major and minor processing routes 58, 60 enables direct cross-over between the two processing lines so that a different sequence of processes can be performed on the first work product directly as it is output from the major processing route 58. In this way the overall apparatus 10 is compact in the area or footprint that it requires; is efficient in the overall time taken to perform the complete two stage processing, and the major and minor processing lines are synchronised which removes any need to re-organise the pitching of the first work products they enter a subsequent processing line. Furthermore, the output of completed tertiary packages is four times greater than a comparable linear processing device. The specific circular or closed loop structure of the major and minor processing routes 58, 60 offers particular benefit in terms of space saving or compactness. Optionally, the major and minor processing routes 58, 60 travel in opposite directions. In other arrangements, both routes may follow a clockwise direction or both routes may follow a counter-clockwise direction.

[0043] In the minor processing line, the tertiary packaging tray 32 referred to above is created simultaneously with the formation of the secondary packages 30 or first work product 30.

[0044] At the first workstation B5 of the minor processing line 60, a tertiary package blank hopper 36, supplies tertiary package blanks 34 to a "second conveyor", the endless conveyor of the minor processing route 60. The tertiary package blank hopper 36 is conveniently located adjacent to the second conveyor of the minor processing route 60 and a tertiary blank feeder 38 comprised in the first workstation B5. The tertiary package blanks 34 are moved from the supply hopper 36 to a tertiary package forming tray 32 held on a movable support 40 coupled to the second conveyor.

[0045] The second conveyor may take many formats, however, in the first illustrated embodiment the conveyor is a chain, coupled to a drive means, such as a servo motor. The movable support 40 is a plate of supportive material, in this case metal, that is affixed to the chain. In other (non-illustrated embodiments) the support 40 is attached on an element in rotation (axis of the major processing line or carrousel 60) and is driven centrally or is attached through a rack-pinion type link. The movable support 40 may, in other embodiments be structured in a manner alternative to a plate, providing that the structure can support a tertiary package forming tray 32 and/or tertiary package blanks 34. In other embodiments where a support 40 for a forming tray 32 is used, the support 40 is formed as a frame work rather than as a solid plate and/or is formed of plastic or metal. In other embodiments, the support 40 integrally incorporates the forming and supporting functionality of the tertiary package forming tray 32. Optionally, in other envisaged embodiments, the individual supports 40 are replaced by a belt having a lug mechanism coupled to the conveyor for moving articles along the belt. The mechanism for transferring articles from station B5 to station B4 and onto station B6 may take a variety of formats.

[0046] As the tertiary package blanks 34 are loaded into the tertiary package forming trays 32 they are folded and formed into tertiary packaging trays 52. The tertiary packaging trays 52 held in the tertiary package forming tray 32 are moved by the second conveyor, by rotation of the movable support 40 in a counter-clockwise direction (labelled as 'Y'), to common workstation B4. This rotation Is illustrated in Figure 5. This sequence is repeated so that a continuous supply of tertiary packaging trays 32 are supplied to common workstation B4 where the completed secondary packages 30 are

rearranged and then loaded into the tertiary packaging trays 32. This operation is illustrated in Figures 2 to 4.

[0047] The second conveyor of the minor processing route also operates on an intermittent cycle switching between a "pause-mode" and an "on-mode". The "pause-mode" of the second conveyor may be similar or the same in time-length as, the "pause-mode" of the first conveyor of the major processing route 58. It is preferred that the second conveyor is operated in synchrony or in coordinated relationship with the first conveyor of the major processing route 58 so that the tertiary packaging trays 34 held in the tertiary package forming tray 32 are moved to the common workstation B4 in readiness for the placement of secondary packages 30 into those tertiary packaging trays 34 by the third robotic pick and place device 26.

[0048] Once the tertiary package tray 32 is loaded with a 2x2 array of secondary cartons 30 the movable support 40 is again rotated in a counter-clockwise direction 'Y'. The loaded tertiary package is conveyed to an output B6, where the completed tertiary packages are removed from the apparatus 10. Optionally, the output station B6 comprises an elevator (see third embodiment) to convey the loaded tertiary package 54/254 out of the plane of the movable supports 40 for coupling to an output conveyor where the second work product 54, i.e. the loaded tertiary packages 54, are removed for palleting and transportation to a sales outlet.

[0049] The aforedescribed sequence of operations B1 to B6 is conducted within a relatively small area or footprint because the workstations B1 to B6 are disposed in close proximity and in this embodiment, in a circular, nested, carrousel fashion. A schematic plan view of the apparatus 10 is shown in Figure 8A. The carrousel comprises two processing lines: the major processing line 58 and the minor processing line 60. The major processing line 58 is a closed circuit or loop and comprises workstations B1, B2, B3 and B4. The major processing line 58 is substantially circular in shape. The minor processing line 60 is also, in this illustrated configuration of apparatus 10, a closed circuit or loop and is circular in shape. Each processing route comprises two or more connected workstations at each of which a processing step, is conducted on a work product. The first work product output by the major processing route is then passed by means of a common workstation to the minor processing route for the creation of a second work product.

[0050] The major processing route 58 has a slightly smaller radius than the minor processing route 60 and as such the major processing route sits within the minor processing route 60. The major processing route as a circumferential path length (from B1 to B1) of about 6 m and the minor processing route has a path length (from B5 to B6) of about 2m. This is equivalent to a linear sequential processing line, where the workstations B1 to B6 are disposed in a straight line, having an end-to end length of at least 8m. In addition, such a linear sequential processing line requires additional conveyors between the output of the first major processing linear route and the second minor linear processing route. In contrast, the apparatus of the present invention only requires a length (as measured between B1 and B3) of about 2.6m to about 4m and a width (as measured between B2 and B4) of about 2.6m to about 3.5m. The dimensions of the apparatus of the present invention compared with those of an equivalent conventional straight-line machine show that the apparatus of the present invention is much more compact than a linear processing line having all of the functions disposed one after another. The apparatus of the present invention has a maximum dimension that is at least 50% smaller than the maximum dimension of the equivalent linearly arranged apparatus. Thus the present apparatus provides a significant saving in terms of the footprint or area required to house the processing equipment.

[0051] In a linear processing line where operations are conducted one after another, a common workstation cannot necessarily or easily be used. Therefore a further workstation would likely be required and the equivalent linear processing line would be even longer than the comparison made above. Furthermore the linear equivalent processing line with more workstations may be more susceptible to down time because of the presence of an additional workstation having the potential to breakdown.

[0052] In the minor processing route or circuit 60, a series of eight tertiary package trays 32 are provided on the second conveying means, the second conveying means transports the tertiary package trays 32 in the direction 'Y'; that is from the tertiary package hopper station B5, to the tertiary tray loading station B4, to the completed tertiary package output B6 and then around to the tertiary package hopper station B5. The workstation B4 operates to move the processed articles between the major processing line 58 and the minor processing line 60. The conveying means of the major processing line 58 and the minor processing line 60 are synchronised or co-ordinated so that as the major processing line 58 rotates 90° in the clockwise 'X' direction, the conveying means of the minor processing line 60 rotates 45° in the anti-clockwise (counter-clockwise) direction 'Y'.

[0053] The degree of rotation required by the first and second conveyors of each of the respective major and minor processing lines 58, 60 is determined by the number of degrees of separation between adjacent workstations of those processing lines 58, 60. In the major processing line 58 four workstations (B1, B2, B3, B4) are each separated from their immediately adjacent workstation by about 90°. As such four secondary carton forming trays 20 are required, one for each station at any given "work time".

[0054] The second conveyor, like the first conveyor, operates on an intermittent time cycle switching between "on-mode" where the conveyor moves and causes movement through the minor and major processing routes respectively and on "off-mode" where the conveyor pauses. In this illustrated embodiment, the processing routes 58, 60 are circular in shape and the conveyor of each processing route can be thought of as affecting a rotation of the articles or trays being

operated on by the apparatus 10. The first conveyor of the major processing route 58 affects about a 90° rotation during its "on-mode". The second conveyor of the minor processing route 60 affects about a 45° rotation during it "on-mode". The number of degrees of rotation is more appropriately applicable in embodiments where the major and or minor processing routes are substantially circular or ring-like.

[0055] In the minor processing line, the three workstations (B5, B4, B6) are not evenly separated from the successive workstation in terms of the spatial rotation cycle of the second conveyor. The first workstation B5 is separated from the common workstation B4 by about 45° and the common workstation B4 is separated from the third workstation B6 also by about 45°; however the third workstation B6 is separated or spaced from the first workstation B5 by about 270° of the second conveyor's spatial cycle. Because of this, eight tertiary package forming trays 32 are required: one tray 32 for each of the three workstations (B5, B4, B6) at any given "work time" and five trays 32 for the intermediate stops made around the circuit from start to finish (eight stations spaced by 45°). By providing additional trays 32, some of which are not utilised when the second conveyor is paused, a simple, neat, compact and synchronised second conveyor means is provided in the minor processing route 60 and the second work product (the completed tertiary package) can be made in close proximity to the formation of the first work product (the completed and arranged secondary packages). The in-feed of the minor processing route 60 is the output of the major processing route 58.

[0056] In Figure 7, a second embodiment of the invention is illustrated, wherein workstation B1 is shown having a different physical format. In this arrangement, the first robotic pick and place device 122 is operable to effect a rotational movement of the pick and place head and as such functionality of the vacuum feed mechanism 14 and secondary blank platform 50 of the first embodiment is incorporated in to the functionality of the first robotic pick and place device 122 and/or dispensed with. The first robotic pick and place device 122 is operable to lift four secondary carton wrapper blanks 118 directly from the hopper or magazine 112 comprising a stack or supply of secondary carton wrapper blanks 118.

[0057] Otherwise, the apparatus 110 of Figure 7 operates in the same manner as the apparatus 10 of the first embodiment. Nevertheless, it is important to note that the illustrated physical formation of the apparatus 10, 110 of the invention may take many and various formats. The exact processing completed by each workstation could comprise a variety of operations as required by the processing to be effected. The invention is described in the context of packaging, but where for example, the processing operations that create a first work product are the assembly of a different type of article for example the assembly of a foodstuff or the assembly of mechanical product for example, the devices provided at the various workstations may take a variety of formats; arrangement; and number. The invention is described in the context of packaging because in this field the cross-over between major and minor processing routes provide particular advantage when dealing with primary packaged articles, secondary packages comprising group of primary packaged articles and tertiary packages comprising a group of secondary packages. However, many automated processing sequences could be executed in a more compact, timely and/or efficient manner by utilising the essence of the present invention.

[0058] In Figure 8B a variation of the first embodiment is illustrated schematically. The sequential workstations B6, B4, B5 of the minor processing route 60 have been reordered and as such the second conveyor operates in a clockwise direction (as indicated by label 'Y'). In figure 8A and 8B it is shown that workstations B1, B2, B3, B4 are separated by an angle 'a12', 'a23', 'a34', 'a41' and that the workstations B5, B4, B6 are separated by an angle 'a54', 'a46' and that the workstations B6, B5, B4 are separated by an angle 'a46', 'a54'. It will be understood that in the various envisaged embodiments of the apparatus of the invention, the first and second conveyors of the major and minor processing routes may operate in the same direction (X=Y); in the opposite direction ($X \neq Y$); at the exact same time; at slightly different times; to convey articles the same number of degrees spatially ('a12', 'a23', 'a34' & 'a41' = 'a54'& 'a46') and to convey articles a different number of degrees spatially ('a12', 'a23', 'a34' & 'a41' # 'a54', 'a46', 'a46' & 'a54').

[0059] In embodiments where the major and or minor processing routes 58, 60 are substantially circular, the angular rotation of the first and second conveyors between workstations may be equal i.e. 'a12'= 'a23'= 'a34'= 'a41'. However, in other embodiments of the invention where the or each of major and minor processing routes 58, 60 are not so shaped, the angular rotation of the first and second conveyors between workstations may not all be equal or none of the angles may be equal. It is envisaged that further processing routes in nested carousel or circular circuit fashion could be used.

[0060] A final illustrated embodiment is provided in Figure 9. Here the major processing route 258 comprises five workstations and is oval in shape. The first conveyor of the major processing route 258 is operable in a "continuous mode" rather than operated in an "intermittent cycle" as in the first illustrated embodiment.

[0061] In this third embodiment, the secondary carton wrapper blanks 218 are of the wrap-around bottom locking type. The oval shape of the major processing route 258 provides a linear stretch during which the manipulation of a bottom panel locking mechanism optionally can be carried out whilst the articles continue to move.

[0062] A workstation B7 supplies articles A1, A2, A3, A4 in regular spaced and timed order onto a surface of the first conveyor. Lug elements 244 of the first conveyor are operable to cause clockwise movement of the articles A1, A2, A3, A4 after they are placed, by a first robotic pick and place device 224, onto the first conveyor.

[0063] At workstation B1, the secondary carton wrapper blanks 218 are provided from a magazine or hopper 212, by a vacuum or other rotary feeder 214 onto a secondary blank platform 250.

[0064] At workstation B2 a second pick and place robotic device 222 is operable to transfer a series comprising four secondary carton wrapper blanks 218 from the secondary blank platform 250, onto articles A1, A2, A3, A4 as the articles A1, A2, A3, A4 are passed through the workstation B2 of the major processing route 258. The secondary blank platform 250 is a linear conveyor (linear in shape of the working reach albeit the linear conveyor comprises an endless belt that rotates in an oval-shaped route through a working reach and then through a return reach).

[0065] The secondary carton platform 250 or linear conveyor moves relative to the feeding mechanism 214 so that a series, in this case, four, secondary carton wrapper blanks 218 are part-formed and momentarily held in position ready for the second pick and place robotic device 222 to pick, transfer and place that group of four secondary carton wrapper blanks onto four adjacent articles A1, A2, A3, A4 passing in front of the secondary carton platform 250. The linear conveyor is timed to receive the series of sequential secondary carton wrapper blanks 218. The linear conveyor is disposed close to a guiding or folding mechanism that causes folding and part-formation of those secondary carton wrapper blanks 218 of the series in readiness the series to be combined with an article A1, A2, A3 or A4 respectively.

[0066] The lugs 244 of the first conveyor mechanism of the major processing route 258, convey articles and articles having a part-folded secondary carton wrapper 218 disposed on top of them to a forming workstation B3 whereat a completing mechanism 248 is provided for locking or securing together the bottom panels of the secondary carton wrapper blank to secure the article A1, A2, A3 or A4 within the secondary wrapper 218 to thereby create a secondary package 230. The secondary carton finishing means 248 may comprise any suitable arrangement of components (static and moveable guides and glue guns etc) required to finish the formation of the secondary package. The secondary package is the work product of the major processing route 258 and is transferred, in a grouped series of four secondary packages in a 2x2 array by the third robotic device 226. The third robotic pick and place device 226 is comprised in workstation B4. Workstation B4 is common to both the major processing route 258 and the minor processing route 260. The workstation B4, acts upon the articles processed by the apparatus 210 by combining the first work product 230 in groups of four with the tertiary package trays 234, to create a second work product, the completed tertiary package 254.

[0067] The minor processing route 260 is a linear shaped route comprising three workstations B5, B4 and B6. The minor processing route 260 comprises a second conveyor, in this case an endless belt conveyor having a linear shaped path. The second conveyor transfers tertiary package blanks 238 provided by workstation B5 in direction 'Y'. A forming mechanism (not shown) comprised in the first workstation B5 provides for the erection of tertiary package trays from the blanks 234. The formed trays are transferred by the second conveyor to common workstation B4 where the robotic pick and place device 226 transfers grouped secondary packages 230 and loads them Into the tertiary package trays and thereby forms the second work product of the minor processing route, namely a completed tertiary package. The completed tertiary packages are optionally output from the apparatus 210 by means of an elevator 254 at the final workstation B6. As such the minor processing line comprises a starting workstation B5 disposed at one end of the linear-shaped (endless belt) second conveyor to a finishing workstation B6 disposed at the other end of the linear-shaped second conveyor.

[0068] In this arrangement, the major processing route 258 is shaped and sized to accommodate the minor processing route 260 within its perimeter. The cross-over between the two processing lines enables the apparatus 210 to have an optimal sized foot print or area and enables the direct input (to the minor processing route) of the first work product as it is output from the major processing route 258. As already described, this feature cuts out complexity in synchronising product pitches.

[0069] It will be understood upon reading the foregoing that various changes may be made without departing from the essence of the invention. For example, the exact shape, size and intersection point of the major and minor processing routes can take many formats. The processing carried out by the various workstations is adaptable for a variety of commercial processing requirements. The number of workstations, nature of the devices and tools contained therein, relative positions of the workstations and relative operation of the conveyors and tools/device of the workstations can all be varied and do not represent an exhaustive list of the features described that can take a variety of formats.

[0070] When the invention is applied in the field of article packaging, the articles manipulated and processed by the apparatus can be bottles, cans, adjoined articles, stacked articles as examples. The articles may not all be uniform and a mixed selection of articles could be combined into a mixed-multi pack or promotional pack. For example, four bottles of beer could be packaged with a promotional glass. Though the illustrated embodiments show adjoined yoghurt pots, it will be understood that this is not limiting.

[0071] Furthermore, when the invention is applied in the field of packaging, then the secondary carton wrapper blanks may not be required. In some embodiments of the invention primary articles are processed by the major processing line and this processing may not include the application of a secondary carton wrapper blank to one or more articles. Likewise, the processing carried out by the minor processing route does not, in other embodiments, include the provision of tertiary carton blanks.

[0072] However, where secondary and/or tertiary carton wrapper blanks are included, these may be of the top-gripping top-loading type, tray type, wrap around type, end loading type and/or fully enclosed type (as a list of non-limiting, non-exhaustive examples). The primary articles might be yoghurt pots, cans or bottles, diary goods, food stuffs, drinks, and

other articles such as media disks, healthcare items and goods or products that would be sold in multiple packs and require further secondary packaging Furthermore, the articles processed in some embodiments of the invention are single articles, collated groups of articles, adjoined groups of articles, stacked articles, stacked adjoined groups of articles, stacked and wrapped articles as examples.

[0073] In embodiments where stacked articles are processed, the second robotic pick and place device 24, 124, 224 is operable sufficiently quickly to pick more than one group of articles, either simultaneously or sequentially, and stack those articles one on top of the other either as or before the articles are placed onto the forming tray and/or secondary carton wrapper blank.

[0074] When the invention is embodied in the field of packaging and takes a format similar to that illustrated in Figures 2 to 7, the tertiary package forming trays 32 may be affixed to the second conveyor by mechanical means, or may be simply rested on top of a platform or frame or plate attached to the second conveyor that may be a chain, belt or other conveying means.

[0075] Optionally, where robotic pick and place mechanisms are used, these are preprogrammed with a specific routine to perform, the timing of which routine is synchronised with movement of the conveyors and in-feed of articles (primary packaged products; secondary and tertiary carton wrapper blanks).

[0076] Optionally a control means is provided to which the components of the workstations and/or the conveyors of the major and minor processing lines and/or any external supply units (12, 16, 34) are coupled. The control means may take the form of a computer processing unit containing and be capable of monitoring the operation of the components of the apparatus and capable of operating the various components so that the right functions are performed at the right time.

[0077] It will be understood that the apparatus of Figures 2 to 7 is operable in an intermittent mode and the apparatus of Figure 9 is operable in a continuous mode. It will be understood that the various features of each of these apparatus may be interchanged and that for example, a four workstation major processing route of circular shape may be operated in a continuous mode. In an apparatus operating in "continuous mode" the robot tools (24, 26, 28) integrate a motion axis parallel to the flow of articles (products and/or cartons etc.). In this way the robotic pick and place devices (24, 26, 28) are operable to move alongside the conveyor and have a component of their motion that is matched to the motion (speed and direction) of the conveyor. As such that there is a component of the device's movement that is the same as the conveyors, so that there is limited or no relative movement between the conveyed articles and the moving device 24, 26, 28, thus enabling the device 24, 26, 28 to operate on the conveyed articles as they are being moved.

[0078] In other optional embodiments of the invention, the major and minor processing routes have a variety of shapes and sizes and/or the number of workstations provided is less or greater than 5 and the apparatus is operable in a continuous motion mode or a pseudo-continuous motion mode or an intermittent mode. By pseudo-continuous it is meant that the articles being processed or the work-in-progress, is operated on by one or more of the workstations when the work-in-progress is being conveyed through the major and/or minor processing route 58, 60 and in other workstations, the articles being processed (or the work-in-progress) is operated on when the work-in-progress is held stationary. For example, the arrangement of Figure 9, is, in other envisaged embodiments, operated and arranged such that the conveyor can be paused and during this "pause mode", the workstation B7 carries out at least some of its article loading operation Then the conveyor is moved and during the "on-mode" the workstation B2 carries out at least some of its secondary carton wrapper blank loading operation. In other words, the individually controllable, programmable and operable devices of the various workstations can be timed to operate in synchrony with moving articles and timed to operate on stationary articles as is required by the specific processing operations being carried out.

[0079] In yet further embodiments of the invention, the mechanisms, devices or tools provided in each of the workstations are altered to meet specific processing requirements. For example, in an embodiment where the major processing route assembles an item, the devices of the workstation may have tool heads for performing functions other than pick, place, move, fold. Indeed, many functions such as heating, pressurizing, screwing, fixing, inserting, baking, joining, testing, to name but a few examples, may be carried out. The apparatus can be set-up to assemble and bake pizzas in the major processing route and then load the cooked pizzas into boxes and close those boxes, in the minor processing route.

[0080] In further embodiments of the invention, the configuration and arrangement of the major and minor processing routes may take many shapes including circular, oval, triangular, trapezoidal-shaped, square-shaped etc. The workstations may be uniformly positioned about the major and/or minor processing routes or may be irregularly positioned.

[0081] Whereas the mechanisms of the workstations have been described as robotic devices and vacuum hoppers etc. these tools are, in other envisaged embodiments replaced by multiple tool heads each performing fewer functions; integrated tool heads each performing more functions; guides rather than operable tool heads and many other devices as per the processing requirements.

[0082] As used herein directional references such as "top", "bottom", "up", "drown", "front", "back", "clockwise", "counter-clockwise" are relative terms and serve in context to described the relative position or movement and should not be taken as necessarily limiting any component to that specific orientation. Particularly where movement is described it will

be understood that the relative movement between components can be achieved in a variety of ways. For example, in the illustrated embodiments of figures 2 to 7, the conveyor moves the work piece, but the relative movement of the work piece and workstations could be accomplished by moving the workstation (say by rotation about an upper support rail along which the robotic tool heads can be moved).

Claims

1. An apparatus (10; 110) for processing articles (A), the apparatus comprising:

   (i) a major processing route (58; 158);
   (ii) a minor processing route (60; 160);
   (iii) two or more connected workstations (B1, B2, B3, B4) positioned along the major processing route (58; 158) for sequentially acting upon articles (A) transported through that major processing route (58; 158) to create a first work product; and
   (iv) two or more connected workstations (B4, B5, B6) positioned along the minor processing route for sequentially acting upon articles transported through that minor processing route to create a second work product;

   wherein, the apparatus comprises a common workstation (B4) that is positioned on the major processing route (58; 158) and that is positioned on said minor processing route (60; 160), said common workstation is operable to act upon articles transported through the major processing route and operable to act upon articles transported through the minor processing route such that said major processing route and said minor processing route intersect and wherein the major processing route comprises a first conveyor operable to transport articles In an endless circuit connecting the two or more workstations positioned along the major processing route, **characterised in that** the minor processing route comprises a second conveyor operable to transport articles in an endless circuit between the two or more workstations positioned along the minor processing route, **in that** the first conveyor of the major processing route and the second conveyor of the minor processing route have an at least substantially circular shape and **in that** the radius of the second conveyor of the minor processing route is greater than the radius of the first conveyor of the major processing route and the second conveyor of the minor processing route is disposed around the first conveyor of the major processing route.

2. An apparatus according to claim 1 wherein the common workstation (B4) is operable to transfer the first work product from the major processing route (58; 158) to the minor processing route (60; 160) so that the one or more workstations (B4, B5, B6) positioned along the minor processing route (60, 160) are operable to act upon the first work product to create the second work product.

3. An apparatus according to claim 1 or 2 wherein four workstations (B1, B2, B3, B4) are positioned along the major processing route (58; 158).

4. An apparatus according to claim 3 wherein three workstations (B3, B4, B5) are positioned along the minor processing route (60; 160).

5. An apparatus according to claim 3 or 4 wherein the four workstations of the major processing route are each at about 90° apart.

6. An apparatus according to claim 5 wherein the three workstations of the minor processing route are positioned such that a first workstation is spaced about 45° from a second workstation; the second workstation is spaced about 45° from a third workstation and the third workstation is spaced about 270° from the first workstation.

7. An apparatus according to any of the preceding claims wherein the first conveyor and the second conveyor are intermittently operable to transport articles from one workstation to a sequential workstation and once at the sequential workstation the first and second conveyors can be paused in a stationary mode until that workstation has completed acting upon the articles and the articles are then transported from that workstation to a further sequential workstation.

8. An apparatus according to claim 7 wherein the first conveyor and second conveyor are both intermittently operable and are synchronised to move and pause at the same time.

9. An apparatus according to any preceding claim wherein the common workstation (B4) comprises a robotic mech-

anism (26) operable to pick-up one or more of said first work products and to place said one or more first work products onto a conveyor of the minor processing route (60; 160).

10. An apparatus according to any preceding claim wherein one or more of said workstations comprises a robot (24) operable to transport one or more articles from an external article feed mechanism (16) onto a first or second conveyor of the major and minor processing routes respectively.

11. An apparatus according to any preceding claim for packaging one or more primary packaged articles into secondary packages and for collating a plurality of secondary packages into tertiary packages and wherein the first work product is a secondary package and wherein the second work product is a tertiary package.

12. An apparatus according to claim 11 wherein the first conveyor comprises one or more forming trays (20) and/or wherein a second conveyor of the minor processing route comprises one or more forming trays (32).

13. An apparatus according to claim 12 wherein the first conveyor comprises four forming trays and wherein the second conveyor comprises eight forming trays.

14. An apparatus according to claim 12 or 13 wherein a first workstation of the major processing route comprises a robotic mechanism (22) operable to transfer one or more secondary carton wrappers (18) from a secondary carton wrapper feed mechanism (12) disposed alongside the major processing route (58; 158) onto the first conveyor or onto a forming tray (20) of the first conveyor or onto primary articles (A) disposed on the first conveyor; wherein a second workstation of the major processing route comprises a robotic mechanism (24) operable to transfer one or more primary articles (A) from a primary articles feed mechanism (16) disposed alongside the major processing route (58; 158) onto the first conveyor or onto a forming tray (20) of the first conveyor or onto a secondary carton wrapper (18) disposed on the first conveyor; wherein a third workstation of the major processing route comprises a mechanism for completing the formation of a secondary carton wrapper about one or more primary articles; and wherein a fourth workstation of the major processing route (B4) is the common workstation and the common workstation comprises a robotic mechanism (26) operable to pick-up one or more of said secondary packages and to place said one or more secondary packages onto the second conveyor of the minor processing route.

15. An apparatus according to claim 14 wherein a first workstation (B5) of the minor processing route comprises a robotic mechanism operable to transfer one or more tertiary carton wrappers (34) from a tertiary carton wrapper feed mechanism disposed alongside the minor processing route onto the second conveyor or onto a forming tray (32) of the second conveyor or onto a secondary package disposed on the second conveyor; wherein a second workstation (B4) of the minor processing route is the common workstation and the common workstation comprises a robotic mechanism (26) operable to pick-up one or more of said secondary packages from the first conveyor of the major processing route and transfer said one or more secondary packages onto the second conveyor or onto a forming tray (32) of the second conveyor or onto a tertiary wrapper disposed on the second conveyor; and wherein a third workstation (B6) of the minor processing route (60; 160) comprises a mechanism for completing the formation of a tertiary package comprising one or more secondary packages.

16. A method of forming a tertiary package, the method comprising:

(i) providing an apparatus according to any of claims 11 to 15 for processing articles;
(ii) providing one or more articles to the major processing route;
(iii) operating the two or more connected workstations of the major processing route so that the articles transported through that major processing route are sequentially acted upon to create a first work product;
(iv) providing one or more articles to the minor processing route;
(v) operating the two or more connected workstations of the minor processing route so that the articles transported through that minor processing route are sequentially acted upon to create a second work product;
(vi) operating a common workstation that is positioned on both the major processing route and on said minor processing route, to act upon articles transported through the major processing route and to act upon articles transported through the minor processing route.

Patentansprüche

1. Vorrichtung (10; 110) zur Verarbeitung von Gegenständen, wobei die Vorrichtung umfasst:

(i) eine Hauptverarbeitungslinie (58, 158);
(ii) eine Nebenverarbeitungslinie (60; 160);
(iii) zwei oder mehrere angebundene Arbeitsstationen (B1, B2, B3, B4), die entlang der Hauptverarbeitungslinie (58, 158) für ein sequentielles Bearbeiten von Gegenständen (A) angeordnet sind, die durch die Hauptverarbeitungslinie (58; 158) transportiert werden, um ein erstes Arbeitsprodukt zu erstellen; und
(iv) zwei oder mehrere angebundene Arbeitsstationen (B4, B5, B6), die entlang der Nebenverarbeitungslinie für ein sequentielles Bearbeiten von Gegenständen angeordnet sind, die durch die Nebenverarbeitungslinie transportiert werden, um ein zweites Arbeitsprodukt zu erstellen;

wobei die Vorrichtung eine gemeinsame Arbeitsstation (B4) umfasst, die auf der Hauptverarbeitungslinie (58, 158) und auf der Nebenverarbeitungslinie (60, 160) angeordnet ist, wobei die gemeinsame Arbeitsstation zum Bearbeiten von Gegenständen, die durch die Hauptverarbeitungslinie transportiert werden, betätigbar ist sowie zum Bearbeiten von Gegenständen, die durch die Nebenverarbeitungslinie transportiert werden, und zwar derart, dass sich die Hauptverarbeitungslinie und die Nebenverarbeitungslinie kreuzen, wobei die Hauptverarbeitungslinie eine erste Fördereinrichtung umfasst, die betätigbar ist, Gegenstände in einem Endlos-Kreislauf zu transportieren, der die zwei oder mehrere Arbeitsstationen verbindet, die entlang der Hauptverarbeitungslinie angeordnet sind, **dadurch gekennzeichnet dass**,
die Nebenverarbeitungslinie eine zweite Fördereinrichtung umfasst, die betätigbar ist, Gegenstände in einem Endlos-Kreislauf zwischen den zwei oder mehreren Arbeitsstationen zu transportieren, die entlang der Nebenverarbeitungslinie angeordnet sind, und wobei die erste Fördereinrichtung der Hauptverarbeitungslinie und die zweite Fördereinrichtung der Nebenverarbeitungslinie zumindest eine im wesentlichen kreisförmige Form haben, und wobei der Radius der zweiten Fördereinrichtung der Nebenverarbeitungslinie größer ist als der Radius der ersten Fördereinrichtung der Hauptverarbeitungslinie und die zweite Fördereinrichtung der Nebenverarbeitungslinie um die erste Fördereinrichtung der Hauptverarbeitungslinie herum angeordnet ist.

2. Vorrichtung nach Anspruch 1, wobei die gemeinsame Arbeitsstation (B4) betätigbar ist, das erste Arbeitsprodukt von der Hauptverarbeitungslinie (58; 158) zu der Nebenverarbeitungslinie (60; 160) zu übertragen, so dass eine oder mehrere Arbeitsstationen (B4, B5, B6), die entlang der Nebenverarbeitungslinie (60; 160) angeordnet sind, betätigbar sind, das erste Arbeitsprodukt zu bearbeiten, um ein zweites Arbeitsprodukt zu schaffen.

3. Vorrichtung nach Anspruch 1 oder 2, wobei vier Arbeitsstationen (B1, B2, B3, B4) entlang der Hauptverarbeitungslinie (58; 158) angeordnet sind.

4. Vorrichtung nach Anspruch 3, wobei drei Arbeitsstationen (B3, B4, B5) entlang der Nebenverarbeitungslinie (60; 160) angeordnet sind.

5. Vorrichtung nach Anspruch 3 oder 4, wobei die vier Arbeitsstationen der Hauptverarbeitungslinie jeweils um etwa 90° Grad versetzt angeordnet sind.

6. Vorrichtung nach Anspruch 5, wobei die drei Arbeitsstationen der Nebenverarbeitungslinie derart anageordnet sind, dass eine erste Arbeitsstation etwa 45° Grad von der zweiten Arbeitsstation beabstandet ist; die zweite Arbeitsstation etwa 45° Grad von einer dritten Arbeitsstation beabstandet ist und die dritte Arbeitsstation etwa 270° Grad von der ersten Arbeitsstation beabstandet ist.

7. Vorrichtung nach einem der vorangegangenen Ansprüche, wobei die erste und zweite Fördereinrichtung intermittierend betätigbar sind, um Gegenstände von einer Arbeitsstation zu einer nachfolgenden Arbeitsstation zu transportieren und die erste und zweite Fördereinrichtung in einen stationären Betriebsmodus bringbar sind, sobald die Gegenstände bei der nachfolgenden Arbeitsstation angekommen sind, und zwar bis jene Arbeitsstation die Bearbeitung der Gegenstände abgeschlossen hat und die Gegenstände sodann von dieser Arbeitsstation zu einer weiteren nachfolgenden Arbeitsstation transportiert werden.

8. Vorrichtung nach Anspruch 7, wobei die erste und zweite Fördereinrichtung jeweils intermittierend betrieben werden können und synchronisiert sind, um sich gleichzeitig zu bewegen und zu pausieren.

9. Vorrichtung nach einem der vorangegangenen Ansprüche, wobei die gemeinsame Arbeitsstation (B4) einen Robotermechanismus (26) umfasst, der betätigbar ist, eines oder mehrere der ersten Arbeitsprodukte aufzunehmen und jenes eine oder mehrere der ersten Arbeitsprodukte auf eine Fördereinrichtung der Nebenverarbeitungslinie (60; 160) anzuordnen.

10. Vorrichtung nach jedem der vorangegangenen Ansprüche, wobei eine oder mehrere der Arbeitsstationen einen Roboter (24) umfassen, der betätigbar ist, einen oder mehrere der Gegenstände von einem äußeren Gegenstands-Zufuhrmechanismus (16) auf eine erste oder zweite Fördereinrichtung der entsprechenden Haupt- oder Nebenverarbeitungslinien zu transportieren.

11. Vorrichtung nach jedem der vorangegangenen Ansprüche zum Verpacken eines oder mehrerer Primär-verpackter Gegenstände in Sekundär-Verpackungen und zum Zuordnen einer Vielzahl von Sekundär-Verpackungen in Tertiär-Verpackungen und wobei das erste Arbeitsprodukt eine Sekundär-Verpackung ist und wobei das zweite Arbeitsprodukt eine Tertiär-Verpackung ist.

12. Vorrichtung nach Anspruch 11, wobei die erste Fördereinrichtung eine oder mehrere Formschalen (20) umfasst und/oder wobei eine zweite Fördereinrichtung der Nebenverarbeitungslinie eine oder mehrere Formschalen (32) umfasst.

13. Vorrichtung nach Anspruch 12, wobei die erste Fördereinrichtung vier Formschalen umfasst und wobei die zweite Fördereinrichtung acht Formschalen umfasst.

14. Vorrichtung nach Anspruch 12 oder 13, wobei eine erste Arbeitsstation der Hauptverarbeitungslinie einen Robotermechanismus (22) umfasst, der betätigbar ist, eine oder mehrere Sekundär-Schachtelhüllen (18) von einem Sekundär-Zufuhrmechanismus für Schachtelhüllen (12), der längsseits der Hauptverarbeitungslinie (58, 158) angeordnet ist, auf die erste Fördereinrichtung zu übertragen oder auf eine Formschale (20) der ersten Fördereinrichtung oder auf Primären Gegenstände (A), die auf der ersten Fördereinrichtung angeordnet sind, wobei eine zweite Arbeitsstation der Hauptverarbeitungslinie einen Robotermechanismus (24) umfasst, der betätigbar ist, einen oder mehrere Primär-Gegenstände (A) von einem Zuführungsmechanismus (16) für Primär-Gegenstände, der längsseits der Hauptverarbeitungslinie (58; 158) angeordnet ist, auf die erste Fördereinrichtung zu übertragen oder auf eine Formschale (20) der ersten Fördereinrichtung oder auf eine Sekundär-Schachtelhülle (18), die auf der ersten Fördereinrichtung angeordnet ist, zu transportieren, wobei eine dritte Arbeitsstation der Hauptverarbeitungslinie einen Mechanismus zum vollständigen Ausbildung einer Sekundär-Schachtelhülle um einen oder mehrere Primär-Gegenständen umfasst, und wobei eine vierte Arbeitsstation der Hauptverarbeitungslinie (B4) die gemeinsame Arbeitsstation ist und die gemeinsame Arbeitsstation einen Robotermechanismus (26) umfasst, der betätigbar ist, eine oder mehrere der Sekundär-Verpackungen aufzunehmen und die eine oder mehreren Sekundär-Verpackungen auf der zweiten Fördereinrichtung der Nebenverarbeitungslinie anzuordnen.

15. Vorrichtung nach Anspruch 14, wobei eine erste Arbeitsstation (B5) der Nebenverarbeitungslinie einen Robotermechanismus umfasst, der betätigbar ist, eine oder mehrere Tertiär-Schachtelhüllen (34) von einem Zuführmechanismus für Tertiär-Schachtelhüllen, der längsseits der Nebenverarbeitungslinie angeordnet ist, auf die zweite Fördereinrichtung zu übertragen oder auf eine Formschale (32) der zweiten Fördereinrichtung oder auf eine Sekundär-Verpackung, die auf der zweiten Fördereinrichtung angeordnet ist; wobei eine zweite Arbeitsstation (B4) der Nebenverarbeitungslinie die gemeinsame Arbeitsstation ist und die gemeinsame Arbeitsstation einen Robotermechanismus (26) umfasst, der betätigbar ist, einen oder mehrere der Sekundär-Verpackungen von der ersten Fördereinrichtung der Hauptverarbeitungslinie aufzunehmen und die eine oder mehrere Sekundär-Verpackungen auf die zweite Fördereinrichtung zu übertragen oder auf eine Formschale (32) der zweiten Fördereinrichtung oder auf eine Tertiär-Hülle, die auf der zweiten Fördereinrichtung angeordnet ist; und wobei eine dritte Arbeitsstation (B6) der Nebenverarbeitungslinie (60, 160) einen Mechanismus für die vollständige Ausbildung der Tertiär- Verpackung umfasst, die eine oder mehrere Sekundär-Verpackungen umfasst.

16. Verfahren zum Ausbilden einer Tertiär-Verpackung, wobei das Verfahren umfasst:

(i) Bereitstellen einer Vorrichtung nach einem der Ansprüche 11 bis 15 zur Verarbeitung von Gegenständen;
(ii) Bereitstellen eines oder mehrerer Gegenstände für die Hauptverarbeitungslinie;
(iii) Betätigen von zwei oder mehreren angebundenen Arbeitsstationen der Hauptverarbeitungslinie, derart, dass die Gegenstände, die durch die Hauptverarbeitungslinie transportiert werden, sequentiell bearbeitet werden, um ein erstes Arbeitsprodukt zu schaffen;
(iv) Bereitstellen eines oder mehrerer Gegenstände für die Nebenverarbeitungslinie;
(v) Betätigen von zwei oder mehreren angebundenen Arbeitsstationen der Nebenverarbeitungslinie, derart, dass die Gegenstände, die durch die Nebenverarbeitungslinie transportiert werden, sequentiell bearbeitet werden, um ein zweites Arbeitsprodukt zu schaffen;
(vi) Betätigen einer gemeinsamen Arbeitsstation, die sowohl an der Hauptverarbeitungslinie als auch an der

Nebenverarbeitungslinie angeordnet ist, um Gegenstände, die durch die Hauptverarbeitungslinie transportiert werden, und um Gegenstände, die durch die Nebenverarbeitungslinie transportiert wurden, zu bearbeiten.

Revendications

1. Appareil (10 ; 110) pour le traitement d'articles (A), l'appareil comprenant :

(i) un parcours de traitement principal (58 ; 158) ;
(ii) un parcours de traitement secondaire (60 ; 160) ;
(iii) deux stations de travail connectées ou plus (B1, B2, B3, B4) positionnées le long du parcours de traitement principal (58 ; 158) pour agir séquentiellement sur des articles (A) transportés sur ce parcours de traitement principal (58; 158) pour créer un premier produit ; et
(iv) deux stations de travail connectées ou plus (B4, B5, B6) positionnées le long du parcours de traitement secondaire pour agir séquentiellement sur des articles transportés sur ce parcours de traitement secondaire pour créer un deuxième produit ;

dans lequel l'appareil comprend une station de travail commune (B4) qui est positionnée sur le parcours de traitement principal (58 ; 158) et qui est positionnée sur le parcours de traitement secondaire (60 ; 160), ladite station de travail commune peut être utilisée pour agir sur les articles transportés sur le parcours de traitement principal et pour agir sur les articles transportés sur le parcours de traitement secondaire de telle manière que ledit parcours de traitement principal et ledit parcours de traitement secondaire se croisent et dans lequel le parcours de traitement principal comprend un premier convoyeur utilisable pour transporter des articles dans un circuit sans fin reliant les deux stations de travail ou plus positionnées le long du parcours de traitement principal, **caractérisé en ce que** le parcours de traitement secondaire comprend un deuxième convoyeur utilisable pour transporter des articles dans un circuit sans fin entre les deux stations de travail ou plus positionnées le long du parcours de traitement secondaire, **en ce que** le premier convoyeur du parcours de traitement principal et le deuxième convoyeur du parcours de traitement secondaire ont une forme au moins substantiellement circulaire et **en ce que** le rayon du deuxième convoyeur du parcours de traitement secondaire est plus grand que le rayon du premier convoyeur du parcours de traitement principal et le deuxième convoyeur du parcours de traitement secondaire est placé autour du premier convoyeur du parcours de traitement principal.

2. Appareil selon la revendication 1, dans lequel la station de travail commune (B4) est utilisable pour transférer le premier produit du parcours de traitement principal (58 ; 158) au parcours de traitement secondaire (60 ; 160) de telle manière que lesdites une ou plusieurs stations de travail (B4, B5, B6) positionnées le long du parcours de traitement secondaire (60 ; 160) sont utilisables pour agir sur le premier produit pour créer le deuxième produit.

3. Appareil selon la revendication 1 ou 2, dans lequel quatre stations de travail (B1, B2, B3, B4) sont positionnées le long du parcours de traitement principal (58 ; 158).

4. Appareil selon la revendication 3, dans lequel trois stations de travail (B3, B4, B5) sont positionnées le long du parcours de traitement secondaire (60 ; 160).

5. Appareil selon la revendication 3 ou 4, dans lequel les quatre stations de travail du parcours de traitement principal sont disposées à environ 90° les unes des autres.

6. Appareil selon la revendication 5, dans lequel les trois stations de travail du parcours de traitement secondaire sont positionnées de telle manière qu'une première station de travail est espacée d'environ 45° d'une deuxième station de travail ; la deuxième station de travail est espacée d'environ 45° d'une troisième station de travail et la troisième station de travail est espacée d'environ 270° de la première station de travail.

7. Appareil selon l'une quelconque des revendications précédentes, dans lequel le premier convoyeur et le deuxième convoyeur sont utilisables de façon intermittente pour transporter des articles d'une station de travail à une station de travail séquentielle et une fois arrivés à la station de travail séquentielle, les premier et deuxième convoyeurs peuvent être arrêtés dans un mode stationnaire jusqu'à ce que cette station de travail ait terminé d'agir sur les articles, puis les articles sont transportés de cette station de travail à une autre station de travail séquentielle.

8. Appareil selon la revendication 7, dans lequel le premier convoyeur et le deuxième convoyeur sont utilisables de

façon intermittente et sont synchronisés pour se déplacer et s'arrêter en même temps.

9. Appareil selon l'une quelconque des revendications précédentes, dans lequel la station de travail commune (B4) comprend un mécanisme robotisé (26) utilisable pour saisir un ou plusieurs desdits premiers produits et pour placer ledit un ou plusieurs premiers produits sur un convoyeur du parcours de traitement secondaire (60 ; 160).

10. Appareil selon l'une quelconque des revendications précédentes, dans lequel une ou plusieurs desdites stations de travail comprend un robot (24) utilisable pour transporter un ou plusieurs articles d'un mécanisme d'alimentation en articles extérieur (16) à un premier ou deuxième convoyeur respectivement du parcours de traitement principal et du parcours de traitement secondaire.

11. Appareil selon l'une quelconque des revendications précédentes pour emballer un ou plusieurs articles emballés primaires en formant des emballages secondaires et pour assembler une pluralité d'emballages secondaires en formant des emballages tertiaires et dans lequel le premier produit est un emballage secondaire et dans lequel le deuxième produit est un emballage tertiaire.

12. Appareil selon la revendication 11, dans lequel le premier convoyeur comprend un ou plusieurs plateaux de formage (20) et/ou dans lequel un deuxième convoyeur du parcours de traitement secondaire comprend un ou plusieurs plateaux de formage (32).

13. Appareil selon la revendication 12, dans lequel le premier convoyeur comprend quatre plateaux de formage et dans lequel le deuxième convoyeur comprend huit plateaux de formage.

14. Appareil selon la revendication 12 ou 13, dans lequel une première station de travail du parcours de traitement principal comprend un mécanisme robotisé (22) utilisable pour transférer une ou plusieurs boîtes en carton secondaires (18) depuis un mécanisme d'alimentation en boîtes en carton secondaires (12) placé le long du parcours de traitement principal (58 ; 158) pour les placer sur le premier convoyeur ou sur un plateau de formage (20) du premier convoyeur ou sur des articles primaires (A) disposés sur le premier convoyeur ; dans lequel une deuxième station de travail du parcours de traitement principal comprend un mécanisme robotisé (24) utilisable pour transférer un ou plusieurs articles primaires (A) depuis un mécanisme d'alimentation en articles primaires (16) placé le long du parcours de traitement principal (58 ; 158) pour les placer sur le premier convoyeur ou sur un plateau de formage (20) du premier convoyeur ou sur une boîte en carton secondaire (18) placée sur le premier convoyeur ; dans lequel une troisième station de travail du parcours de traitement principal comprend un mécanisme pour achever la formation d'une boîte en carton secondaire autour d'un ou de plusieurs articles primaires ; et dans lequel une quatrième station de travail du parcours de traitement principal (B4) est la station de travail commune et la station de travail commune comprend un mécanisme robotisé (26) utilisable pour saisir un ou plusieurs desdits emballages secondaires et pour placer lesdits un ou plusieurs emballages secondaires sur le deuxième convoyeur du parcours de traitement secondaire.

15. Appareil selon la revendication 14, dans lequel une première station de travail (B5) du parcours de traitement secondaire comprend un mécanisme robotisé utilisable pour transférer une ou plusieurs boîtes en carton tertiaires (34) depuis un mécanisme d'alimentation en boîtes en carton tertiaires placé le long du parcours de traitement secondaire pour les placer sur le deuxième convoyeur ou sur un plateau de formage (32) du deuxième convoyeur ou sur un emballage secondaire placé sur le deuxième convoyeur ; dans lequel une deuxième station de travail (B4) du parcours de traitement secondaire est la station de travail commune et la station de travail commune comprend un mécanisme robotisé (26) utilisable pour saisir un ou plusieurs desdits emballages secondaires sur le premier convoyeur du parcours de traitement principal et transférer lesdits un ou plusieurs emballages secondaires sur le deuxième convoyeur ou sur un plateau de formage (32) du deuxième convoyeur ou sur une boîte tertiaire placée sur le deuxième convoyeur ; et dans lequel une troisième station de travail (B6) du parcours de traitement secondaire (60 ; 160) comprend un mécanisme pour achever la formation d'un emballage tertiaire comprenant un ou plusieurs emballages secondaires.

16. Procédé de formation d'un emballage tertiaire, le procédé comprenant :

(i) la fourniture d'un appareil selon l'une quelconque des revendications 11 à 15 pour traiter des articles ;
(ii) la fourniture d'un ou de plusieurs articles sur le parcours de traitement principal ;
(iii) la mise en oeuvre des deux stations de travail connectées ou plus du parcours de traitement principal de manière telle que les articles transportés sur ce parcours de traitement principal subissent séquentiellement

une action pour créer un premier produit ;
(iv) la fourniture d'un ou de plusieurs articles sur le parcours de traitement secondaire ;
(v) la mise en oeuvre des deux stations de travail connectées ou plus du parcours de traitement secondaire de manière telle que les articles transportés sur ce parcours de traitement secondaire subissent séquentiellement une action pour créer un deuxième produit ;
(vi) la mise en oeuvre d'une station de travail commune qui est positionnée à la fois sur le parcours de traitement principal et sur ledit parcours de traitement secondaire, pour agir sur les articles transportés sur le parcours de traitement principal et pour agir sur les articles transportés sur le parcours de traitement secondaire.

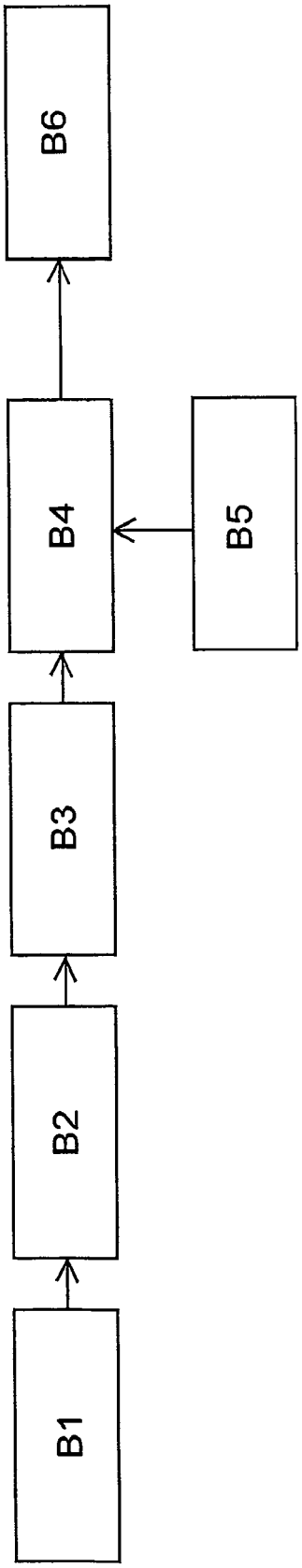

FIGURE 1

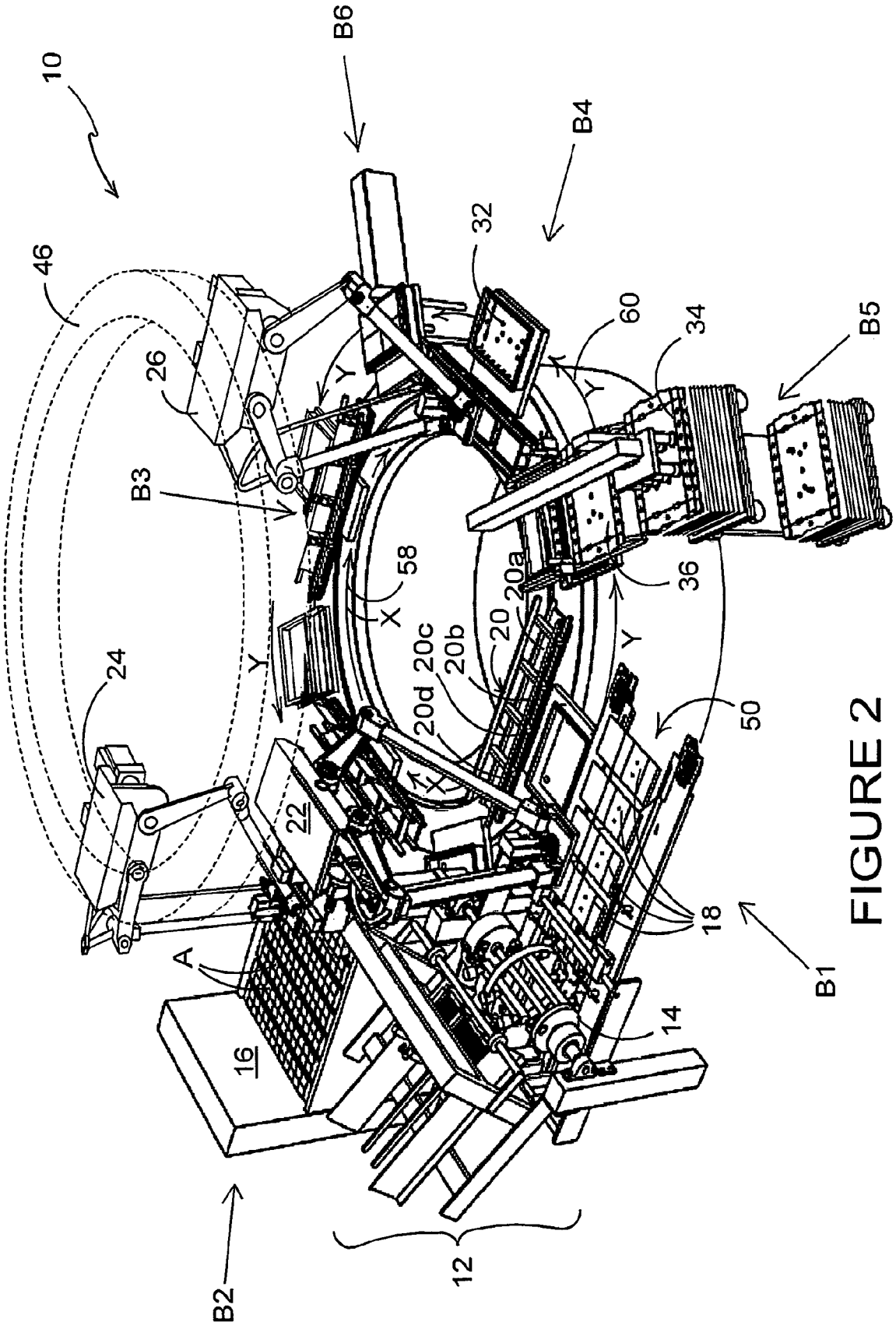
10
B6
B4
32
46
60
34
B5
26
B3
58
36
24
20a
20
20b
20c
20d
50
22
18
B1
A
16
14
12
B2

FIGURE 2

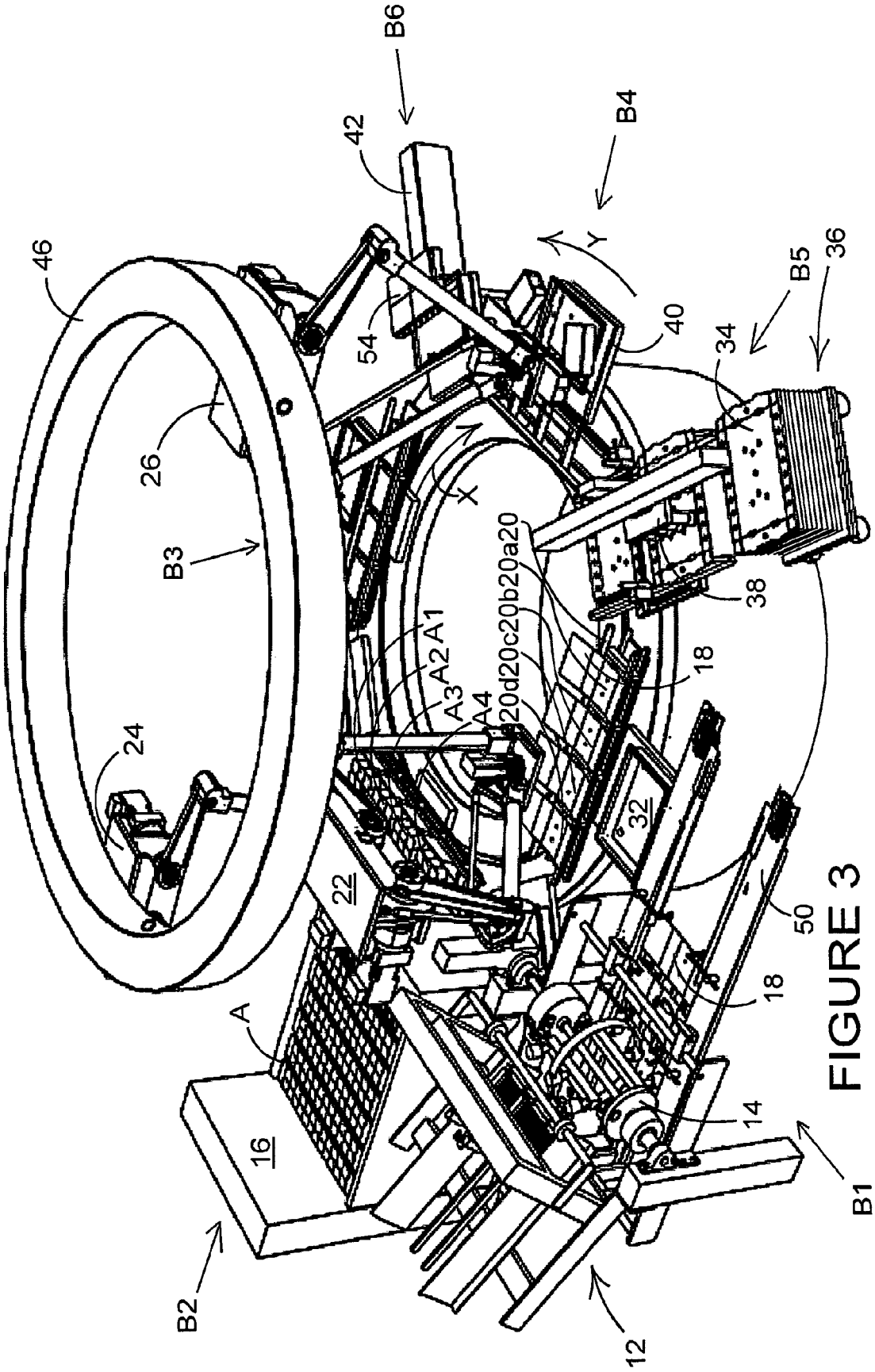
B6
42
B4
Y
46
54
40
B5
36
34
26
X
B3
38
A1
A2
A3
A4
20d20c20b20a20
18
24
32
22
50
18
A
14
16
B1
B2
12

FIGURE 3

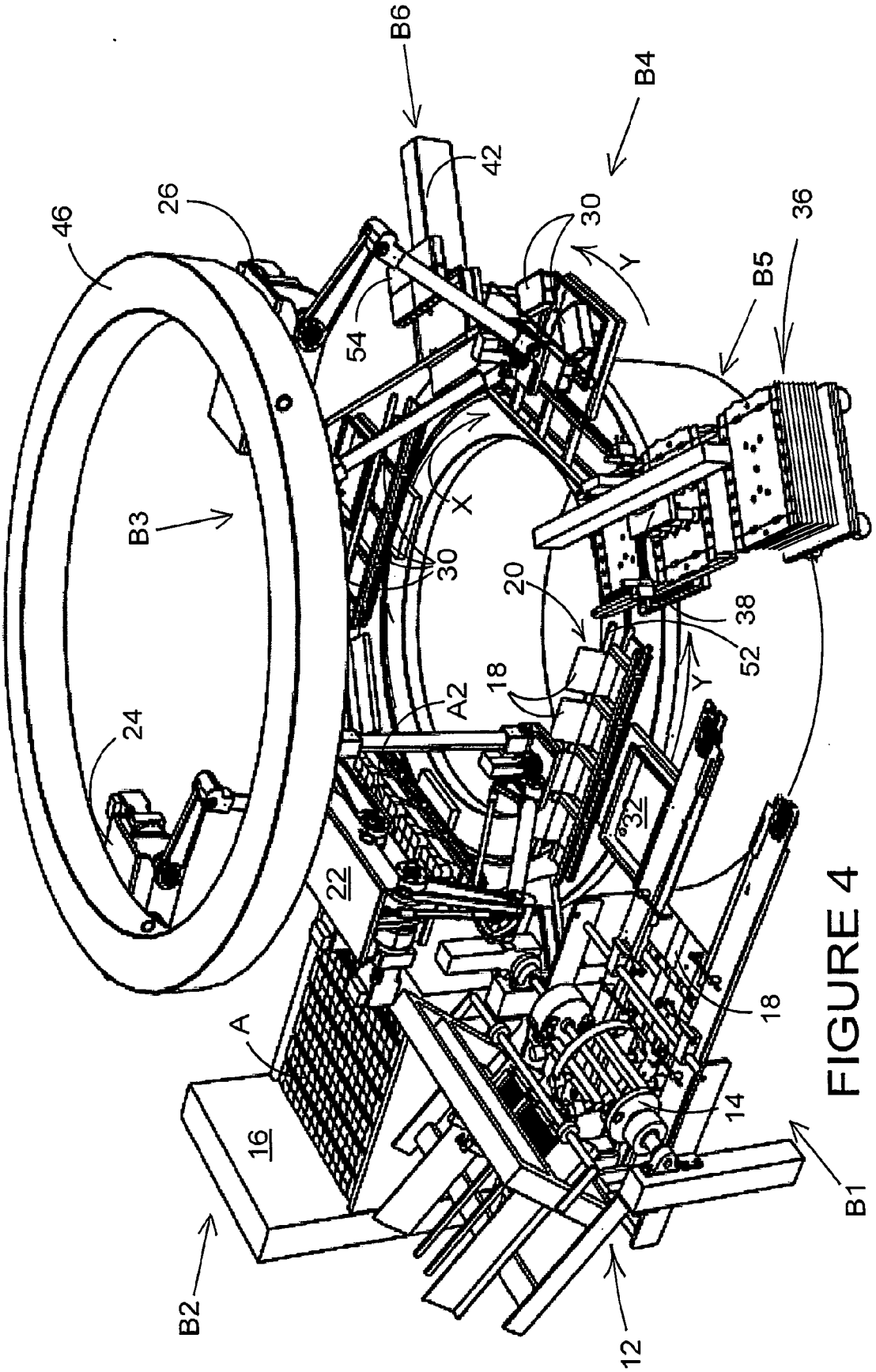
B6
B4
42
26
46
30
36
Y
54
B5
X
B3
30
20
38
52
18
A2
Y
24
32
22
18
A
14
16
B1
B2
12

FIGURE 4

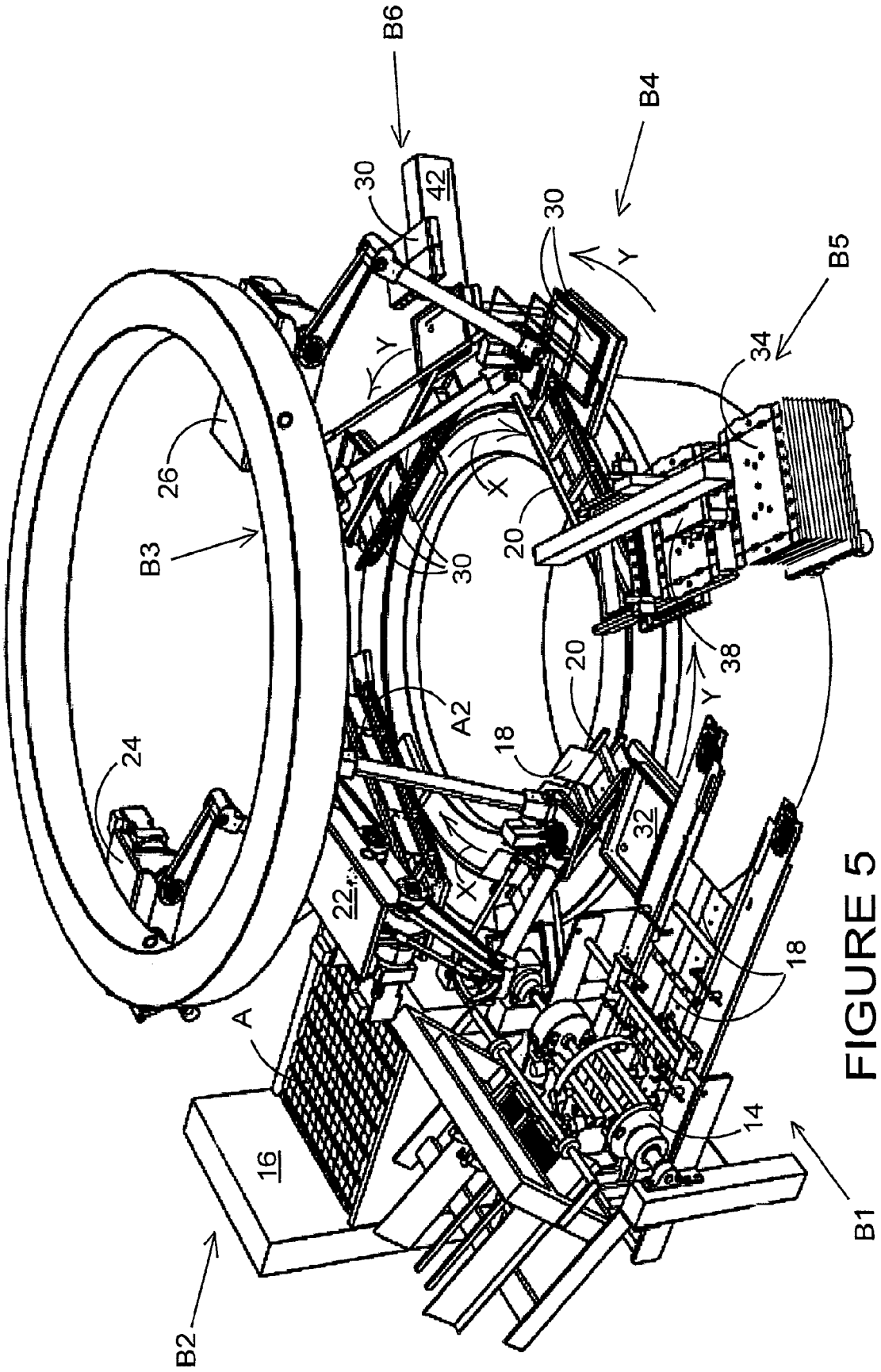

FIGURE 5

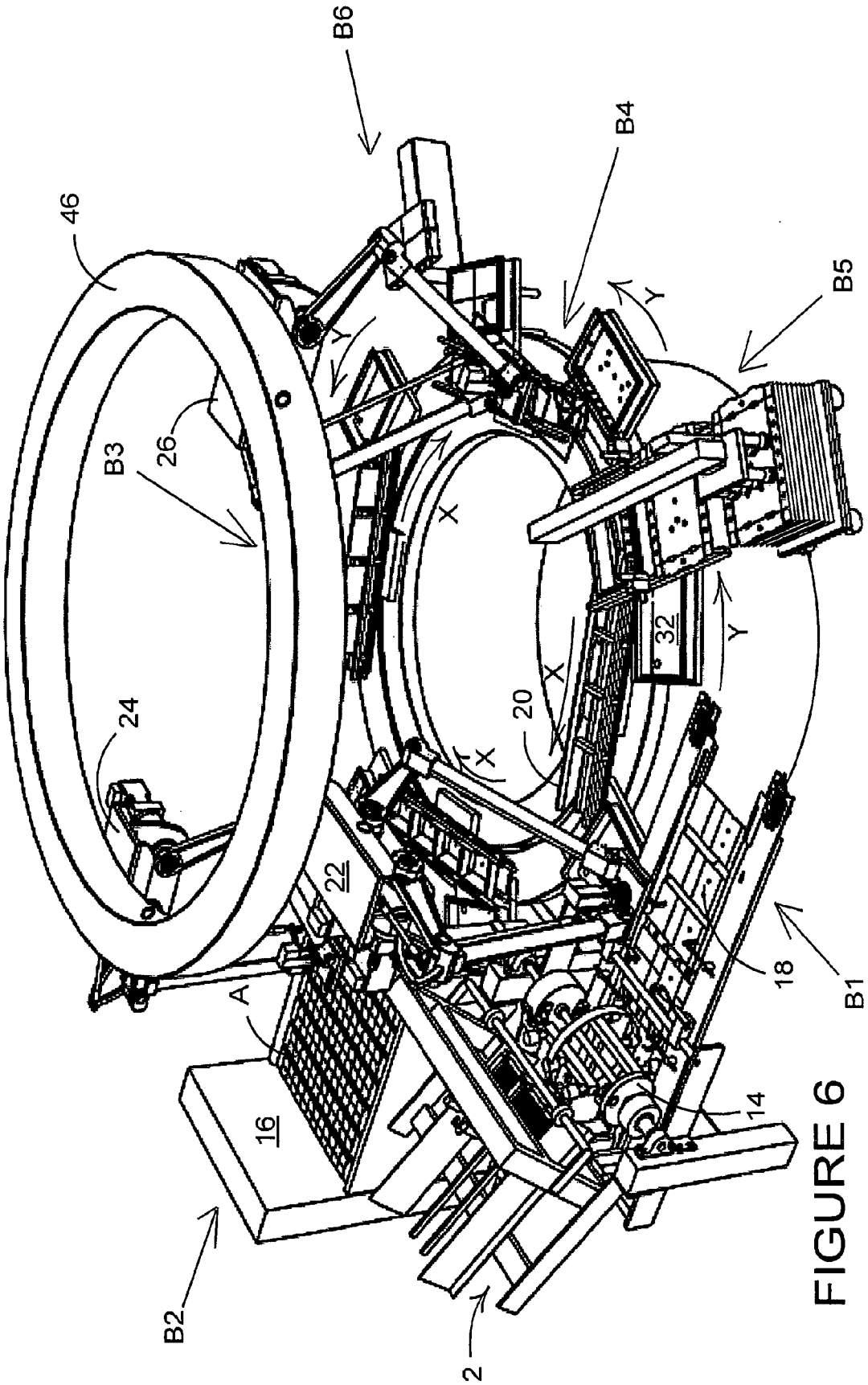

FIGURE 6

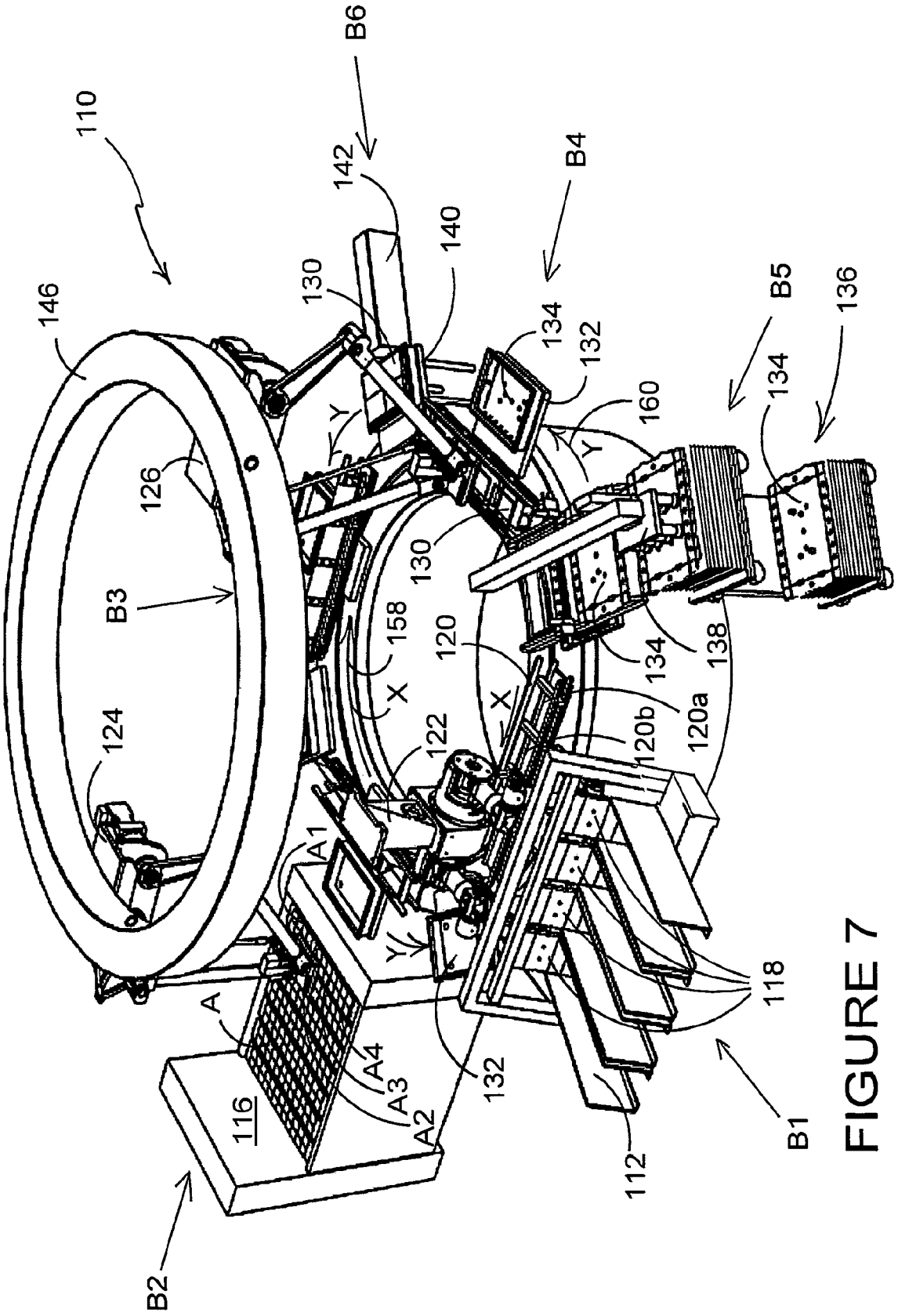
110
146
126
B3
124
B6
142
140
130
B4
134
132
160
B5
136
158
120
120a
120b
138
122
A1
A
A4
A3
A2
116
132
118
112
B1
B2
X
Y

FIGURE 7

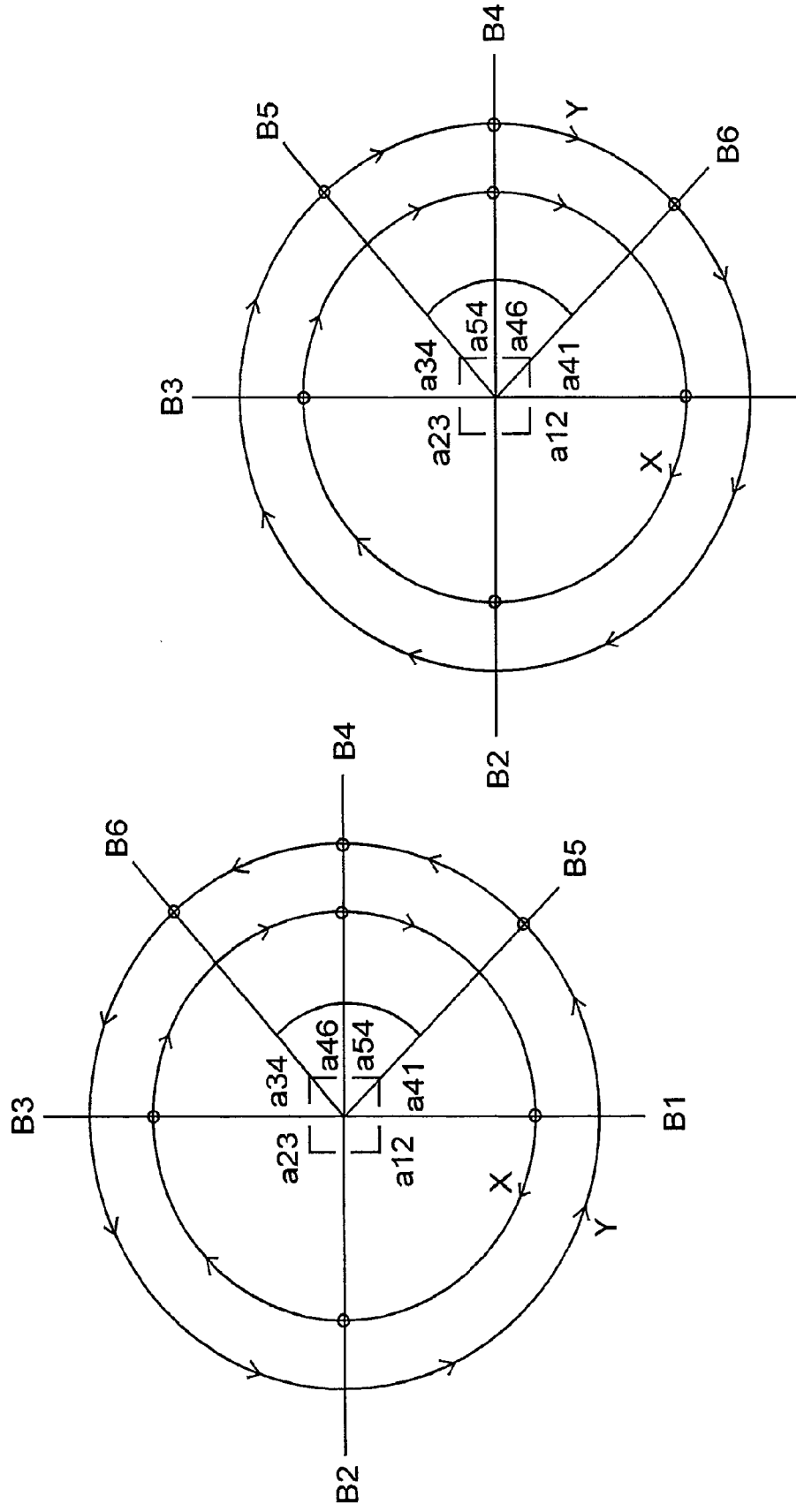

FIGURE 8B

FIGURE 8A

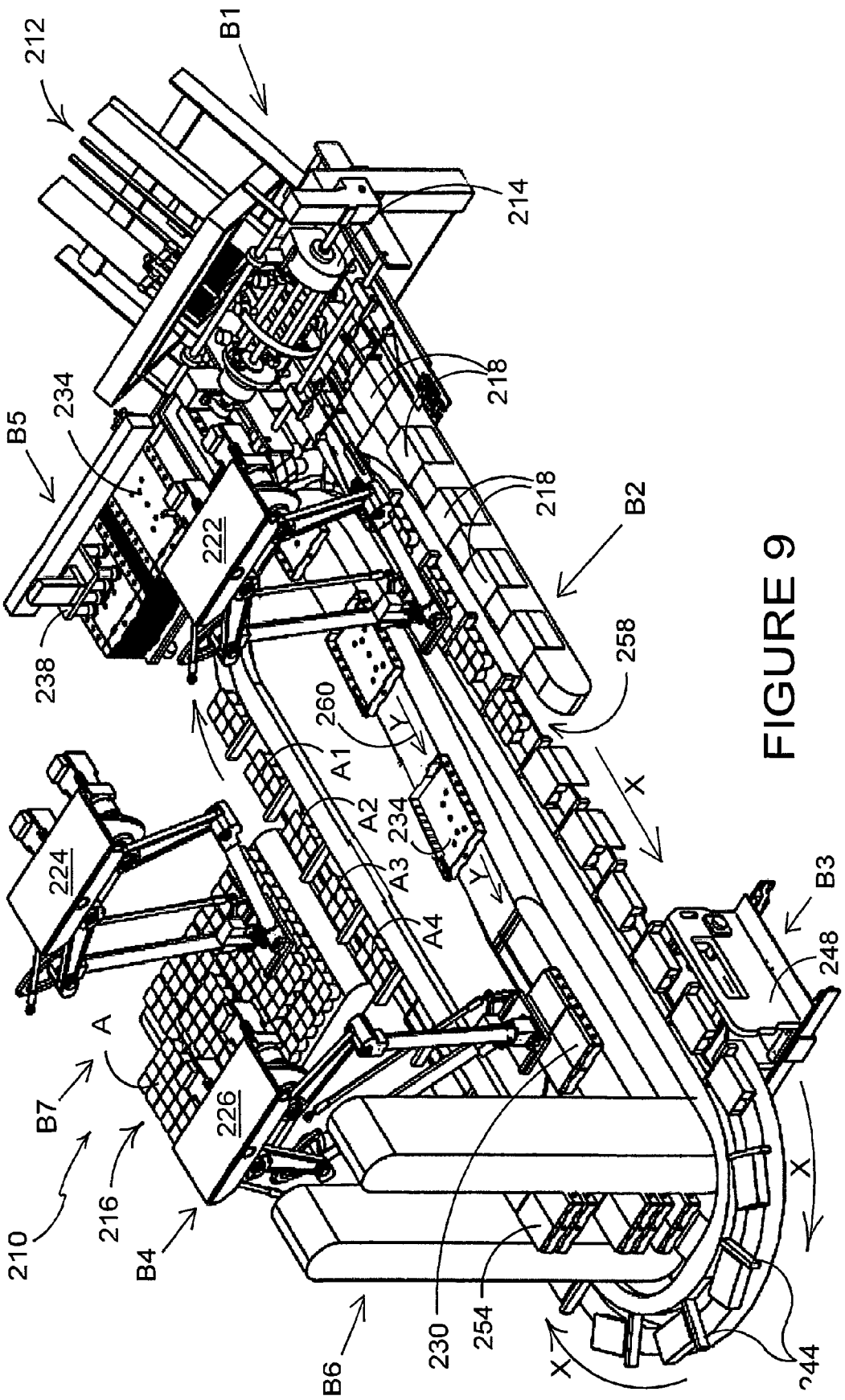
212
B1
214
218
234
B5
222
218
B2
238
258
260
Y
A1
A2
234
A3
A4
X
224
Y
B3
248
A
B7
226
X
210
216
B4
B6
230
254
X
244

FIGURE 9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- WO 2008099070 A **[0004]**