Title: CONTINUOUS PROCESSING APPARATUS

Abstract: A continuous processing apparatus which includes: at least one process chamber in which a process is undertaken; a horizontal conveyor system; a plurality of trays on which, in use, items to be processed are placed, wherein the first horizontal conveyor system conveys the trays in a substantially horizontal direction through the process chamber so the items on the trays can be processed; the apparatus characterised in that: the first horizontal conveyor system is configured to deliver the trays to a first vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a first predetermined time, before delivering to at least one further conveyor system being configured to convey the trays or items thereon either: directly or indirectly out of the chamber; or alternately, through the chamber for further processing.
CONTINUOUS PROCESSING APPARATUS

TECHNICAL FIELD

The present invention relates to a continuous processing apparatus. In particular, a continuous processing apparatus adapted to convey items to be processed through a process environment for a predetermined amount of time.

BACKGROUND ART

The present invention has application to many different types of processes and process environments. For example, the present invention may be used in relation to:

- heating;
- curing;
- drying;
- freezing;
- rehydrating, and
- irradiating.

However, it should be appreciated this list should not be seen as limiting, as the present invention may also have application to other processes.

For ease of reference only, the present invention will now be described in relation to freezing. In particular, the automated continuous freezing of items on a production line.

At present, the continuous freezing of items in a production line is effected via the use of a single spiral conveyor belt in a spiral freezer tunnel.
However, spiral conveyor belts are extremely expensive, typically in the region of NJ$250,000, as the belt is made of stainless steel for durability, and especially constructed to allow one side of the belt to shorten when following a curved (i.e. spiral) path.

Spiral freezer tunnels also have a number of other disadvantages which can include:

- Being subject to weight limitations as the length of the spiral dictates the total amount of product that can be frozen. Further, the length of the spiral is limited as a spiral conveyor belt is operated by a single drive which must bear the load of the entire product being processed.

- Being unsuitable for multi-temperature processes having different temperature zones/environments.

- Inefficient use of space within the freezer tunnel, as a spiral belt configuration creates an empty space in the centre of the tunnel/spiral.

- Having a complicated construction.

- Retention times can only be altered via the limited options of either adjusting the speed of the belt, or, increasing the length of the tunnel/belt. Varying the length of the spiral conveyor belt to accommodate different retention times is problematic, as the maximum length of the spiral is limited due to engineering constraints.

- Construction of spiral freezer tunnels and spiral conveyor belt systems is complicated and expensive.

It is an object of the present invention to address the foregoing problems or at least to provide the public with a useful choice.
All references, including any patents or patent applications cited in this specification are hereby incorporated by reference. No admission is made that any reference constitutes prior art. The discussion of the references states what their authors assert, and the applicants reserve the right to challenge the accuracy and pertinency of the cited documents. It will be clearly understood that, although a number of prior art publications are referred to herein, this reference does not constitute an admission that any of these documents form part of the common general knowledge in the art, in New Zealand or in any other country.

It is acknowledged that the term 'comprise' may, under varying jurisdictions, be attributed with either an exclusive or an inclusive meaning. For the purpose of this specification, and unless otherwise noted, the term 'comprise' shall have an inclusive meaning - i.e. that it will be taken to mean an inclusion of not only the listed components it directly references, but also other non-specified components or elements. This rationale will also be used when the term 'comprised' or 'comprising' is used in relation to one or more steps in a method or process.

Further aspects and advantages of the present invention will become apparent from the ensuing description which is given by way of example only.

DISCLOSURE OF INVENTION

According to one aspect of the present invention there is provided a continuous processing apparatus which includes:

- at least one process chamber in which a process is undertaken;
- a first horizontal conveyor system;
- a plurality of trays on which, in use, items to be processed are placed,
wherein the first horizontal conveyor system conveys the trays in a substantially horizontal direction through the process chamber so the items on the trays can be processed;

the apparatus characterised in that:

5 the first horizontal conveyor system is configured to deliver the trays to a first vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a first predetermined time, before delivering to at least one further conveyor system being configured to convey the trays or items thereon either: directly or indirectly out of the chamber; or

10 alternately, through the chamber for further processing.

According to another aspect of the present invention there is provided a continuous processing apparatus substantially as described above which includes:

- At least one process chamber in which a process is undertaken;

- A first horizontal conveyor system;

15 - A plurality of trays on which, in use, items to be processed are placed,

wherein the first horizontal conveyor system conveys the trays in a substantially horizontal direction through the process chamber so the items on the trays can be processed,

the apparatus characterised in that:

20 the first horizontal conveyor system is configured to deliver the trays to a first vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a first predetermined time, before delivering to a second horizontal conveyor system which conveys the trays in a substantially horizontal direction to a second vertical conveyor system configured
to convey the trays in a substantially vertical direction through the chamber for a second predetermined time before delivering the trays or items thereon either: directly or indirectly out of the chamber, or alternatively, through the chamber for further processing.

According to another aspect of the present invention there is provided a continuous processing apparatus substantially as described above wherein the second vertical conveyor system delivers the trays to the first horizontal conveyor system, which then conveys the trays either directly or indirectly out of the chamber; or alternatively, through the chamber for further processing of the items.

According to a yet further aspect of the present invention there is provided an apparatus substantially as described above wherein the apparatus has three or more vertical conveyor systems along which trays are conveyed for processing after being delivered to same by the first or second horizontal conveyor systems.

The process chamber may have a variety of different configurations, depending on what or how the process is to be undertaken and/or the requirements for the process environment. In general, the process chamber may be an at least substantially enclosed space, suitably adapted so that items can be subjected to a desired process.

The processes to which the present invention may have application include, but should not be limited to:

- heating;
- curing;
- drying;
- freezing;
- rehydrating;
- irradiating; or
- a combination thereof.

For ease of reference only, the present invention will now be described in relation to freezing.

The items may be almost any object that one wants to subject to a process as part of an automated production line.

For ease of reference only, the items to be processed may be thought of as being a foodstuff.

The conveyor systems employed by the present invention may have a variety of different configurations without departing from the scope of the present invention.

In general, the conveyor systems may include at least one motor and at least one continuous belt/chain arrangement, or other surface(s) which is/are moved via operation of the motor(s).

Throughout this specification the term 'conveyor belt' refers to a single continuous belt/chain arrangement and associated motor(s). Thus, it should be appreciated that a 'conveyor system' may encompass one conveyor belt or a set of more than one conveyor belt.

In preferred embodiments, the motor(s) employed by the conveyor system(s) may be variable speed motors.

The first horizontal conveyor system may have any configuration capable of conveying the trays in a substantially horizontal direction for collection by the first vertical conveyor system.
In a preferred embodiment, the first horizontal conveyor system may include a conveyor belt, including a continuous chain arrangement.

The second horizontal conveyor system may have any configuration capable of conveying the trays off the first vertical conveyor system.

The first vertical conveyor system may have any configuration capable of collecting trays from the first horizontal conveyor system so the trays can then be vertically conveyed.

In preferred embodiments, the first vertical conveyor system may include at least two conveyor belts adapted to synchronously engage trays so as to be capable of lifting the trays off the first horizontal conveyor system.

In other embodiments, the first vertical conveyor system may include at least two conveyor belts adapted to synchronously receive trays off the end of the first conveyor system.

The second vertical conveyor system may have any configuration capable of collecting trays from the first vertical conveyor system via operation of the second horizontal conveyor system so the trays can then be vertically conveyed. In general, the trays will be conveyed in the opposite vertical direction to the first vertical conveyor system, although this should not be seen as limiting.

In preferred embodiments, the second vertical conveyor system may include at least two conveyor belts adapted to synchronously engage trays presented via the second horizontal conveyor system.

In other embodiments, the second vertical conveyor system may include at least two conveyor belts adapted to synchronously receive trays off the end of the first vertical conveyor system.
The trays may come in a variety of shapes and sizes depending on the items to be processed and type of conveyor system employed.

In general, the tray may be any surface capable of supporting and retaining an item thereon.

In preferred embodiments the first conveyor system may convey a plurality of trays thereon.

In some embodiments the tray may include:

- a base, and

- (optionally) one or more sides extending up from the base,

the tray characterised in that the base includes wheels and a least one engagement protrusion extending from the base.

In some embodiments the tray may be rigid.

In preferred embodiments the tray may be constructed from a material that is substantially flexible and resilient.

In preferred embodiments the engagement protrusion on the tray may be configured to engage with the links of a chain forming part of the first horizontal conveyor system.

In a further preferred embodiment the first horizontal conveyor system may have at least one track positioned substantially on the underside, and substantially adjacent, end portions of the first horizontal conveyor system, to support the wheels of said trays, to allow for the trays to continue to be conveyed by the
continuous chain so as to continuously travel around the first horizontal conveyor system.

The predetermined time the trays are retained in the chamber may be altered via:

- increasing or decreasing the length of one or more of the vertical conveyor systems; and/or

- increasing or decreasing the number of trays carried by one or more of the vertical conveyor systems; and/or

- increasing or decreasing the speed of the conveyor belts used in one or more of the vertical conveyor systems.

Thus, it should be appreciated that, although the predetermined times of the various vertical conveyor systems may be substantially identical for some processes for which the present invention is used: in relation to other processes, the predetermined times of the various conveyor systems may be different with respect to one another.

According to another aspect of the present invention there is provided a method of continuous processing of items through a process chamber characterised by the step of:

- conveying a plurality of trays through the process chamber in at least one substantially vertical direction,

wherein said trays carry the items to be processed in said chamber.

According to a further aspect of the present invention there is provided a method of continuous processing of items through a process chamber characterised by the steps of:
(a) conveying, a plurality of trays in a first substantially horizontal direction through first chamber;

(b) conveying said trays in a first substantially vertical direction within said chamber;

(c) conveying said trays in a second substantially horizontal direction;

(d) conveying said trays in a second substantially vertical direction prior to exiting the chamber or repeating steps b) - d),

wherein said trays carry the items to be processed in said chamber.

The present invention has a number of distinct advantages over the prior art which include:

- Not being subject to weight limitations.
- Being suitable for multi-temperature processes having different temperature zones/environments.
- Efficient use of space within the freezer tunnel, as there is no spiral belt and thus wasted area around the spiral's axis.
- Higher output per m² of floor space than a spiral system.
- Having a relatively simple construction.
- Numerous ways the apparatus can be varied to accommodate different retention times.
- Construction of the freezer and conveyor belt systems is relatively straightforward and inexpensive.
- Being relatively inexpensive to maintain compared to spiral belt processing.
(e.g. freezer) systems.

**BRIEF DESCRIPTION OF DRAWINGS**

Further aspects of the present invention will become apparent from the following description which is given by way of example only and with reference to the accompanying drawings in which:

**Figure 1** is a schematic representation of a side elevation of a preferred embodiment of the present invention;

**Figure 2** is a schematic enlarged representation of a portion of the front elevation of the embodiment shown in Figure 1, showing the first vertical conveyor system;

**Figure 3** is a schematic enlarged representation of a portion of the end elevation of the embodiment shown in Figure 1, showing the second vertical conveyor system;

**Figure 4** is a side view of a tray in accordance with another embodiment of the present invention;

**Figure 5** is a schematic representation of a side elevation of a further embodiment of the present invention;

**Figure 6** is a schematic side elevation of yet another embodiment of the present invention, and

**Figure 7** is a schematic side elevation of the first horizontal conveyor system shown in Figure 1.

**BEST MODES FOR CARRYING OUT THE INVENTION**

With respect to Figure 1 there is provided a continuous processing apparatus as
generally indicated by arrow (1).

For ease of reference only, the preferred embodiment shown in the drawings will now be discussed in relation to a freezer application, although this should not be seen as limiting, other possible uses, for the apparatus of the present invention.

The apparatus (1) is housed within a process chamber (2) configured to act as a freezer via the use of evaporators and fans, generally indicated by arrow (3).

The chamber (2) has apertures (not shown) which allow for a product in-feed, as generally indicated by arrow (4), and for a product out-feed, as generally indicated by arrow (5), to enter/exit the chamber (2).

In general, the product in-feed (4) and product out-feed (5) may be achieved by the use of conveyor systems, chutes, or any other suitable apparatus/arrangement for delivering product to/from the apparatus (1).

The apparatus (1) has a frame (6) which supports via struts (not shown) a first horizontal conveyor system, generally indicated by arrow (7), and a second horizontal conveyor system, generally indicated by arrow (8).

The first horizontal conveyor system (7) utilises two side by side continuous chains (of which only one is visible side on) as generally indicated by arrow (1000). The chains (1000) are driven by a variable speed motor (not shown), in the direction generally indicated by arrow (9). The chain (1000) is used to drive trays (28), (as shown in more detail in figures 2, 4 and 7, discussed later), in the direction indicated by arrows 10a - 10f.

The frame (6) also supports via struts (not shown) a first vertical conveyor system, generally indicated by arrow (11), and a second vertical conveyor system, generally indicated by arrow (12), via struts (not shown).
In operation, product to be frozen (not shown) travels into the process chamber for freezing via product in-feed (4) onto trays (28) that are conveyed by the first horizontal conveyor system (7) until the trays containing product are picked up by the first vertical conveyor system (11) and moved in the direction of arrows (13). The trays move upwardly, in a stack-like manner, via the first vertical conveyor system (11) until they reach the second horizontal conveyor system (8) which has a chain (14) which includes, spaced along its length, a number of nudge protrusions (15). The number of nudge protrusions (15) and the spacing of the nudge protrusions (15) on chain (14) depends on the spacing and number of trays being conveyed by the vertical conveyor (11). The chain (14) of the second horizontal conveyor system (8) moves in a direction substantially indicated by the arrow (16) such that in use the nudge protrusions (15) are able to push against a portion of the top-most tray in the vertical conveyor system (11) so as to move it in direction (17) towards the second vertical conveyor system (12). The conveyor system (12) then moves the trays in a downward direction, generally indicated by arrow (18), until the trays are again picked up by the chains (1000) of the first conveyor system (7) and then moved in the direction (10c) towards the product out-feed (5).

Figure 7 shows a schematic view of a return track (3000) that is used with the first horizontal conveyor system (7) shown in Figure 1. The return track (3000) is supported via legs (3001). As can be seen it is designed to allow the continuous supply of trays (28), (of which only a few are shown to aid clarity), which travel in the direction of arrows (3002, 3003) along said horizontal conveyor system (7) via the chains (1000). When the trays (28) bend to travel around the return track (3000) product is displaced from the tray to: a collection receptacle (not shown) or chute (not shown) or onto a further horizontal conveyor belt system (not shown). In some embodiments a scraper element (not shown) may also assist with displacing items.
With respect to Figures 2 and 3 there is shown a portion of the first vertical conveyor system (11) and second vertical conveyor system (12) respectively.

In relation to Figure 2, it can be seen that the first vertical conveyor system (11) consists of two conveyor belts (20, 21) positioned on either side of the first horizontal conveyor system (4) which each have a continuous chain (22, 23) having a number of support protrusions (24, 25) respectively, spaced along the lengths of continuous chains (22, 23). The support protrusions (24, 25) on each chain (22, 23) are respectively aligned.

The conveyor belts (20, 21) are positioned either side of the first horizontal conveyor system (7) which has two continuous chains (26, 27) (depicted simply as chain (1000) in Figure 1) upon which trays (28) are vertically conveyed in the direction of arrow (1001). The respective conveyor belts (20, 21) are synchronously driven via separate variable speed motors (not shown), in the direction indicated by arrows (29, 30) respectively.

In operation, the first vertical conveyor system (11) uplifts the trays (28) from the chains (26, 27) of the first horizontal conveyor system (7) when an upcoming pair of support protrusions (24a, 25a) engage the wheels (40, 41) on the side of trays (28), via the motion of the respective conveyor belts (20, 21).

In relation to Figure 3 there is shown two conveyor belts (31, 32) of the second vertical conveyor system (12). The second vertical conveyor system (12) is essentially identical to that of the first vertical conveyor system (11), apart from the direction (1002, 1003) in which the chains (33, 34) are driven by motors (not shown). Accordingly, identical elements to those shown in Figure 2 are indicated with the same reference numerals to those used to describe like elements in Figure 2. In operation, the trays (28) in the second vertical conveyor system (12) travel downwardly in the direction of arrow (38).
In relation to Figure 4, there is shown one preferred embodiment of a tray (28). The tray (28) has a base (51) which is substantially rectangular in shape, surrounded via sides (52). The tray (28) also has a set of two wheels (53) located on either side of the base (51). The base (51) also has an engagement protrusion (55) (also shown in Figure 2) which in use is positioned between the links of either drive chain (26, 27) of the first horizontal conveyor system (7) to allow for the tray to be propelled via at least one of said drive chains (26, 27).

With respect to Figure 5 there is shown an alternative embodiment of continuous processing apparatus generally indicated by arrow (100). The apparatus includes a first horizontal conveyor system (101) (having a plurality of trays thereon (not shown)) which receives product from an in-feed line (not shown) and then moves trays in the direction (102). The trays are then picked up via a first vertical conveyor system (103) and moved vertically as shown by arrow (104). At or towards the top the trays are moved off the first vertical conveyor system (103) via a second horizontal conveyor system (105) which has a conveyor belt (106) having a number of nudge protrusions (107) therealong which push the trays off the first vertical conveyor system (104) in the direction (108). The trays are then removed from the process chamber via a third horizontal conveyor system (108).

With respect to Figure 6 there is provided an alternative embodiment of a continuous processing apparatus as generally indicated by arrow (200). The processing apparatus (200) has a heating chamber (201) and a freezing chamber (202). The processing apparatus (200) also has a first horizontal conveyor system (203) having a plurality of trays thereon which receives product from an in-feed line (not shown) and then conveys trays containing product (not shown) in direction (200) to chamber (201) where the trays are then picked up by a first vertical conveyor system (204) and conveyed in an upward direction (205) before being moved in direction (206) via a second horizontal conveyor system (not shown)
which delivers the trays to a second vertical conveyor system (207) which then conveys the trays downwardly in direction (208). The second vertical conveyor system then delivers the trays back to the first horizontal conveyor system (203) which then carries the trays out of the heating process chamber (201) to the freezing chamber (202) at which point the trays are picked up via a third vertical conveyor system (209) which conveys the trays in upward direction (210) until the trays are conveyed via a third horizontal conveyor system (212) in direction in direction (211) to a fourth horizontal conveyor system (213) which is the product off-feed line delivering the processed product on the trays to its desired location (not shown).

Aspects of the present invention have been described by way of example only and it should be appreciated that modifications and additions may be made thereto without departing from the scope of the appended claims.
WHAT I/WE CLAIM IS:

1. A continuous processing apparatus which includes:

   - at least one process chamber in which a process is undertaken;
   - a first horizontal conveyor system;
   - a plurality of trays on which, in use, items to be processed are placed,

   wherein the first horizontal conveyor system conveys the trays in a substantially horizontal direction through the process chamber so the items on the trays can be processed;

   the apparatus characterised in that:

   the first horizontal conveyor system is configured to deliver the trays to a first vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a first predetermined time, before delivering to at least one further conveyor system being configured to convey the trays or items thereon either: directly or indirectly out of the chamber; or alternately, through the chamber for further processing.

2. A continuous processing apparatus substantially as described above which includes:

   - at least one process chamber in which a process is undertaken;
   - a first horizontal conveyor system;
   - a plurality of trays on which, in use, items to be processed are placed,
wherein the first horizontal conveyor system conveys the trays in a substantially horizontal direction through the process chamber so the items on the trays can be processed,

the apparatus characterised in that:

5 the first horizontal conveyor system is configured to deliver the trays to a first vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a first predetermined time, before delivering to a second horizontal conveyor system which conveys the trays in a substantially horizontal direction to a second vertical conveyor system being configured to convey the trays in a substantially vertical direction, through the chamber for a second predetermined time, before delivering the trays or items thereon either: directly or indirectly out of the chamber, or alternatively, through the chamber for further processing.

3. A continuous processing apparatus as claimed in claim 2 wherein the second vertical conveyor system delivers the trays to the first horizontal conveyor system, which then conveys the trays either directly or indirectly out of the chamber; or alternately, through the chamber for further processing of the items.

4. An apparatus as claimed in claim 2 or claim 3 wherein the apparatus has three or more vertical conveyor systems along which trays are conveyed for processing after being delivered to same by the first or second horizontal conveyor systems.

5. A process as claimed in any one of the previous claims wherein the process is selected from the group comprising:
- heating;
- curing;
- drying;
- freezing;
- rehydrating;
- irradiating; or
- a combination thereof.

6. A process as claimed in claims 1-4 wherein the process is freezing.

7. A process as claimed in any one of the preceding claims where the items to be processed are in the nature of a foodstuff.

8. A continuous processing apparatus as claimed in any one of the preceding claims wherein, the first vertical conveyor system has at least two conveyor belts adapted to synchronously engage trays so as to be capable of lifting the trays off the first horizontal conveyor system.

9. A continuous processing apparatus as claimed in any one of claims 1-7 wherein the first vertical conveyor system has at least two conveyor belts adapted to synchronously receive trays off the end of the first conveyor system.

10. A continuous processing apparatus as claimed in any one of claims 2-9 wherein the second vertical conveyor system has a configuration capable of collecting trays from the first vertical conveyor system via operation of the second horizontal conveyor system so the trays can then be vertically conveyed.
11. A continuous processing apparatus as claimed in claim 10 wherein the trays are conveyed on the second vertical conveyor system in the opposite vertical direction to the first vertical conveyor system.

12. A continuous processing apparatus as claimed in any one of claims 2-11 wherein the second vertical conveyor system may include at least two conveyor belts adapted to synchronously engage trays presented via the second horizontal conveyor system.

13. A continuous processing apparatus as claimed in any one of claims 2-11 wherein the second vertical conveyor system may include at least two conveyor belts adapted to synchronously receive trays off the end of the first vertical conveyor system.

14. A continuous processing apparatus as claimed in any one of the preceding claims wherein the horizontal conveyor system(s) has at least one conveyor belt including a continuous chain arrangement.

15. A continuous processing apparatus as claimed in any one of the preceding claims wherein the first conveyor system conveys trays which include:

- a base, and

- (optionally) one or more sides extending up from the base, the tray characterised in that the base includes wheels and at least one engagement protrusion extending from the base.

16. A continuous processing apparatus as claimed in claim 14 wherein the tray includes an engagement protrusion.
17. A continuous processing apparatus as claimed in any one of the preceding claims wherein the tray is the tray is constructed from a material that is substantially flexible and resilient.

18. A continuous processing apparatus as claimed in claim 14 or 15 wherein the engagement protrusion on the tray may be configured to engage with the links of a chain forming part of the first horizontal conveyor system.

19. A continuous processing apparatus as claimed in any one of claims 14-17 wherein the first horizontal conveyor system may have at least one track positioned substantially on the underside, and substantially adjacent, end portions of the first horizontal conveyor system, to support the wheels of said trays, to allow for the trays to continue to be conveyed by the continuous chain so as to continuously travel around the first horizontal conveyor system.

20. A continuous processing apparatus as claimed in any one of the previous claims wherein the predetermined time the trays are retained in the chamber may be altered via:

- increasing or decreasing the length of one or more of the vertical conveyor systems; and/or

- increasing or decreasing the number of trays carried by one or more of the vertical conveyor systems; and/or

- increasing or decreasing the speed of the conveyor belts used in one or more of the vertical conveyor systems.

21. A method of continuous processing of items through a process chamber characterised by the step of:
- conveying a plurality of trays through the process chamber in at least one substantially vertical direction,

wherein said trays carry the items to be processed in said chamber

22. A method of continuous processing of items through a process chamber characterised by the steps of:

(a) conveying, a plurality of trays in a first substantially horizontal direction through first chamber;

(b) conveying said trays in a first substantially vertical direction within said chamber;

(c) conveying said trays in a second substantially horizontal direction;

(d) conveying said trays in a second substantially vertical direction prior to exiting the chamber or repeating steps b) - d),

wherein said trays carry the items to be processed in said chamber.

23. A tray for use with continuous conveyor system as claimed in any one of the preceding claims wherein the first conveyor system conveys trays which include:

- a base, and

- (optionally) one or more sides extending up from the base,

the tray characterised in that the base includes wheels and a least one engagement protrusion extending from the base.

24. A tray for use with a continuous conveyor system as claimed in any one of the preceding claims wherein the tray includes an engagement protrusion.
25. A tray for use with a continuous conveyor system as claimed in any one of
the preceding claims wherein the tray is constructed from a material that is substantially flexible and resilient.

26. A tray for use with a continuous conveyor system as claimed in any one of
the preceding claims wherein the engagement protrusion on the tray may be configured to engage with the links of a chain forming part of the first horizontal conveyor system.
INTERNATIONAL SEARCH REPORT

International application No

PC17NZ2006/000175

CLASSIFICATION OF SUBJECT MATTER
Int C1

B65G 47/56 (2006 01) B65G 47/57 (2006.01) B65G 47/64 (2006.01)
A23B 4/00 (2006.01) A23B 9/00 (2006.01) A23N 12/00 (2006.01)
A23B 5/00 (2006.01) A23L 1/00 (2006.01)
A23B 7/00(2006.01) A23L 3/00 (2006.01)

According to International Patent Classification (IPC) or to both national classification and IPC

B

FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI IPC B65G, A23 & keywords convey, belt, transport, shift, move, transfer, carry, tray, tote, box, carton, package, vertical, upward, lift, raise, elevate, up, down, lower, chamber, room, automatic, continuous, system, process, production, assembly, manufacture or similar terms

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DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
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<tr>
<td>x</td>
<td>US 5473978 A (COLOMBO) 12 December 1995 Whole document</td>
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<td>US 5636722 A (KOOP) 10 June 1997 Whole document</td>
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Date of the actual completion of the international search 19 October 2006
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Name and mailing address of the ISA/AU

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Form PCT/ISA/210 (second sheet) (April 2005)
## DOCUMENTS CONSIDERED TO BE RELEVANT

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This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.

END OF ANNEX