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

(11) **EP 2 080 565 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
22.07.2009 Bulletin 2009/30

(51) Int Cl.:
B07C 5/38 *(2006.01)* ***B65G 17/06*** *(2006.01)*

(21) Application number: **09151034.7**

(22) Date of filing: **21.01.2009**

(84) Designated Contracting States:
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 TR
Designated Extension States:
AL BA RS

(30) Priority: **21.01.2008 EP 08001010**

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(54) **System for sorting elongated products, and a corrugated belt conveyor.**

(57) A system for sorting elongated products with a longitudinal axis, for instance vegetables such as cucumbers (P), comprising a detection system for detecting and/or defining at least one characteristic of each product, an endless sorting conveyor (1) with elongated carrier units, wherein the carrier units (2) are tiltable about an axis parallel to the longitudinal axis, wherein carried along products (P) are released downwards in accordance with the characteristic mentioned, at least two discharge devices (4) for discharging, in accordance with the characteristic mentioned, the products released onto these discharge devices (4), a control for controlling the velocities of the sorting conveyor, the discharge devices and the releasing and collecting, collecting units provided with a said discharge device, which collecting units are configured for taking over and at least maintaining over a well defined path the orientation and the order of the products in a the sorting conveyor (1) during collection of the products after release from the carrier units (2). Also disclosed is a corrugated belt conveyor with bend.

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Description

[0001] The present invention relates to a system for sorting elongated products with a longitudinal axis, for instance vegetables such as cucumbers, comprising:

- a detection system for detecting and/or defining at least one characteristic of each product;
- an endless sorting conveyor with elongated carrier units, for conveying in a conveying direction T the products with their longitudinal axis at right angles to the conveying direction, wherein the carrier units are tiltable about an axis parallel to the longitudinal axis, wherein carried along products are released downwards in accordance with the characteristic mentioned,
- at least two discharge devices for discharging, in accordance with the characteristic mentioned, the products released onto these discharge devices, and
- a control device for controlling the velocities of the sorting conveyor, the discharge devices and releasing and collecting.

[0002] Such a system is known from, for instance, EP810963. Herein, it is elucidated how such products, for instance carrots, are supplied in bulk and are then distributed on a feed conveyor, and thereupon, on a sorting conveyor. More particularly, singulation of these products is described while the cross rollers, calculated over different paths in the conveying direction, are accordingly driven. Upon release, the products conveyed in the cross direction, for instance vegetables such as carrots, are collected in so-called V-troughs running underneath in which the products are located one behind the other in longitudinal direction. Such a discharge device not only has a complex structure, but also takes up much space.

[0003] Further, in this field of technology, discharge devices having the form of substantially horizontally disposed turning tables are known. These turning tables turn with one half under the sorting conveyor so that, at a particular moment in time, the products released on these tables appear from under this sorting conveyor to, from thence, be manually processed further. In particular with higher sorting speeds, this processing requires many operators for rapid and accurate processing of the feed.

[0004] In order to remedy, or at least reduce, the above-mentioned shortcomings, the invention provides a system of the type described in the preamble, comprising:

- collecting units provided in a discharge device mentioned, which collecting units are configured for taking over and maintaining over at least a well defined path the orientation and the order of the products in the sorting conveyor during collection of the products after release from the carrier units.

[0005] In further elaborations, the system can be characterized in that:

a discharge device comprises an endless corrugated belt conveyor which is formed by somewhat raised corrugations of a resilient material, wherein the collecting units are formed by spaces between the raised corrugations;
a discharge device has a discharge conveying direction which corresponds with the conveying direction T, so that upon said releasing, collecting and conveying of the products, the collecting units are moved in the conveying direction T;
the corrugated belt conveyor is designed to convey the products, with this collecting and conveying, over a distance of at least three collecting units in the conveying direction T;
the corrugated belt conveyor is designed to convey the products, with this collecting and conveying, in the conveying direction T during a period of time that elapses upon movement of at least three collecting units along a particular position;
the sorting conveyor and the at least one discharge device are synchronized such that products released from directly successive carrier units are collected in directly successive collecting units of the at least one discharge device; and/or
each elongated carrier unit of the sorting conveyor comprises a cup tiltable about its axis.

[0006] The present invention further relates to a corrugated belt conveyor for conveying products in a conveying direction T, comprising:

- an endless belt with a forward part and a return part and with a particular width, wherein the forward part defines a conveying face and, in use, travels in the conveying direction T;
- collecting units defined by spaces between corrugations formed at regular intervals in the endless belt which is manufactured from resilient material and which corrugations extend at right angles to the conveying direction T.

[0007] Such a belt is known from, for instance, JP2004075381.

[0008] More particularly, such a conveyor is used for bridging height differences. It is not clear in any manner how, with this, a bend in a plane other than the vertical plane shown can be traversed.

[0009] In order to solve this problem, the corrugated belt conveyor according to the present invention comprises;

- an endless chain, whose length substantially corresponds with the length of the endless belt and which runs parallel to the endless belt and is connected with the endless belt approximately halfway the width

thereof, while the endless chain is bendable in at least two mutually perpendicular planes;

- an upstream part which extends in a first conveying direction T1;
- a downstream part which extends in a second conveying direction T2;
- a bend connecting the upstream part with the downstream part such that the first conveying direction T1 includes an angle with the second conveying direction T2, while the bend has a radius whose center is located in an imaginary plane in which also the conveying face extends.

[0010] Although from DE3923442 it is known how granular material can be conveyed along paths having both height differences and bends, it is not clear how elongated products, for instance vegetables such as cucumbers, can be moved with such a conveyor.

[0011] In the following, the invention is elucidated further on the basis of a Figure, wherein

Fig. 1 gives an isometric view of an exemplary embodiment of the system according to the invention, and

Fig. 2 gives an isometric view of a particular aspect of the system according to the invention.

[0012] In the different Figures, the same parts or constituents have the same indications or reference numerals.

[0013] In Fig. 1, elongated products P, for instance cucumbers, are conveyed with part of a sorting conveyor 1 in a conveying direction T. More particularly, this sorting conveyor 1 comprises elongated carrier units 2, such as cups in the exemplary embodiment shown also having a suitable elongated shape, and, further, tiltable about a shaft 3.

[0014] Such sorting conveyors 1 with cups are known from, for instance, EP108445. Herein, it is described in detail in which manner the cups are constructed, are provided in an endless conveyor having endless chains on both sides, are tiltable, and are used in particular for weighing products carried along to thus classify the products. Further, in this field of technology, variants with openwork cups are known for optical classification. By tilting the cups in time, the products are released at locations intended thereto to thus compose sortings of these products.

[0015] In Fig.1 is further represented a part of a discharge device 4 having collecting units 5, also elongated, in which the products are collected after tilting of and release from the cups 2. For this discharge device 4, directions D1 and D2 with a bend B therebetween are indicated for an upstream part and a downstream part of the discharge device 4. In this exemplary embodiment, the situation is represented in which products P in successive cups 2 are released into collecting units 5 which are also successive.

[0016] It will be clear to all skilled in the art that the movements of the sorting conveyor 1 on the one hand and of the discharge device 4 on the other hand are synchronized for collecting the products P in a suitable manner at the location of a collecting unit 5. This synchronisation depends on the distances and velocities and is set in a known manner. Not only collecting in directly successive collecting units 5 can be set, but also well-chosen intervals can be used. This may be of importance with the further processing (not shown) of the products P, for instance with a robot, or with a system of robots, which need a well-defined workspace. Furthermore, it can be included the control that as not each successive carrier unit 2 of the sorting conveyor 1 is loaded, upon loading, each time a successive collecting unit 5 of the intended discharge device 4 is ready to be filled, while the control of the velocity of the discharge device 4 will also comprise its halting and accelerating. In particular this successive collecting and filling of the collecting units will be highly suitable for the further processing of the products P, for instance batch-wise picking up and then placing in boxes or crates. Such controls for gearing speeds and operations to each other are generally known in the field of technology of sorting.

[0017] In the situation according to Fig. 1, the directions T and D1 are represented, each located in an associated substantially horizontal plane, and mutually parallel in one vertical plane. It will be clear that, with correct synchronization, a well-chosen mutual angle in this vertical plane is also possible for maintaining the order and orientation of the products P upon collection thereof. For the second conveying direction D2, in a similar manner, a well defined angle can be selected in a vertical plane.

[0018] Furthermore, for the discharge device 4, a collecting path will be chosen that is sufficiently long for maintaining orientation and order upon collection of the products P, for instance over a distance of a few collecting units 5, or also during a particular period of time at the velocities that will be used. Preferably, such a path will be short to save space for a following discharge device 4 or even for one following that.

[0019] In the exemplary embodiment shown according to Fig. 2, for the discharge device 4 a corrugated belt conveyor is shown which comprises, *inter alia,* an endless belt of resilient material having corrugations 40 therein. Suitable resilient materials for such a use are known. More particularly, an endless chain 41 is represented which can be bent not only perpendicularly to the axis of the links, but also in a plane at right angles thereto. The chain may be included in a curved guide. Such chains are known per se. Thus, paths which are at angles to each other can be travelled, represented in the Figures with the first conveying direction D1 and the second conveying direction D2, with which, in a suitable manner, space can be saved and/or utilized. Such a corrugated belt conveyor can also be used for just conveying, while the space between two neighbouring corrugations 40 can be indicated with the term conveying unit instead of col-

lecting unit.

[0020] In Fig. 2, it is further indicated how such a chain 41 is connected, approximately in the middle, with the corrugated belt, for instance at the location of cross strips which are secured at their centers M to the chain and which furthermore, over the width of the corrugated belt at the location of the bottom of the collecting units, or, as the case may be, conveying units, are connected to this corrugated belt, for instance by means of screws or, also, glue.

[0021] It will be clear to the skilled person that further possibilities and modifications can be indicated in this exemplary embodiment. For instance, the ends of the collecting units, or, in case of just conveying, the conveying units, can be provided with protrusions, for instance also from resilient material, to prevent the products P from falling from the units. Even several protrusions can be attached to the bottom part of the collecting units, or conveying units, to thus effect a division into sections. In another embodiment, the corrugated belt can be used having a surface of brushes, a corrugated mat can for instance be considered here.

[0022] In yet another embodiment, several discharge conveyors can be provided side by side, while they are mutually provided such that in cross direction, side by side, alternately, a corrugation and a collecting unit are located, whereby side by side sections are obtained. Although the described use is directed towards elongated objects, with this, also differently formed products such as apples, paprikas or still other products can be processed.

[0023] Further minor changes and variations are understood to fall within the protective scope of the appended claims.

Claims

1. A system for sorting elongated products with a longitudinal axis, for instance vegetables such as cucumbers, comprising:

   - a detection system for detecting and/or defining at least one characteristic of each product,
   - an endless sorting conveyor with elongated carrier units, for conveying in a conveying direction T the products with their longitudinal axis at right angles to the conveying direction, wherein the carrier units are tiltable about an axis parallel to the longitudinal axis, wherein carried along products are released downwards in accordance with the characteristic mentioned,
   - at least two discharge devices for discharging, in accordance with the characteristic mentioned, the products released onto these discharge devices, and
   - a control device for controlling the velocities of said sorting conveyor, said discharge devices and said releasing and collecting,
   - collecting units provided in said discharge device, which collecting units are configured for taking over and at least maintaining over a well defined path the orientation and the order of the products in the sorting conveyor during collection of the products after release from the carrier units.

2. A system according to claim 1, wherein a said discharge device comprises an endless corrugated belt conveyor which is formed by somewhat raised corrugations of a resilient material, wherein the collecting units are formed by spaces between the raised corrugations.

3. A system according to claim 1 or 2, wherein a said discharge device has a discharge conveying direction which corresponds with said conveying direction T, such that upon said releasing, collecting and conveying of the products, the collecting units are moved in said conveying direction T.

4. A system according to claim 3, wherein the corrugated belt conveyor is designed to convey products, with said collecting and conveying, over a distance of at least three collecting units in the said conveying direction T.

5. A system according to claim 2 or 3, wherein the corrugated belt conveyor is designed to convey the products, with said collecting and conveying, in said conveying direction T during a period of time that elapses upon movement of at least three collecting units along a particular position.

6. A system according to any one of the preceding claims, wherein the sorting conveyor and said at least one discharge device are synchronized such that products, released from directly successive carrier units are collected in directly successive collecting units of said at least one discharge device.

7. A system according to any one of the preceding claims, wherein each elongated carrier unit of the sorting conveyor comprises a cup tiltable about an axis.

8. A corrugated belt conveyor for conveying products in a conveying direction, comprising:

   - an endless belt with a forward part and a return part and with a particular width, wherein the forward part defines a conveying face and, in use, travels in the conveying direction T;
   - collecting units defined by spaces between corrugations formed at regular intervals in the endless belt which is manufactured from resilient

material and which corrugations extend at right angles to the conveying direction;
- an endless chain whose length substantially corresponds with the length of the endless belt and which runs parallel to the endless belt and is connected to the endless belt approximately halfway the width thereof, wherein the endless chain is bendable in at least two mutually perpendicular planes;
- an upstream part which extends in a first conveying direction D1;
- a downstream part which extends in a second conveying direction D2;
- a bend which connects the upstream part with the downstream part such that the first conveying direction D1 includes an angle with the second conveying direction D2, wherein the bend has a radius whose center is located in an imaginary plane in which also the conveying face extends.

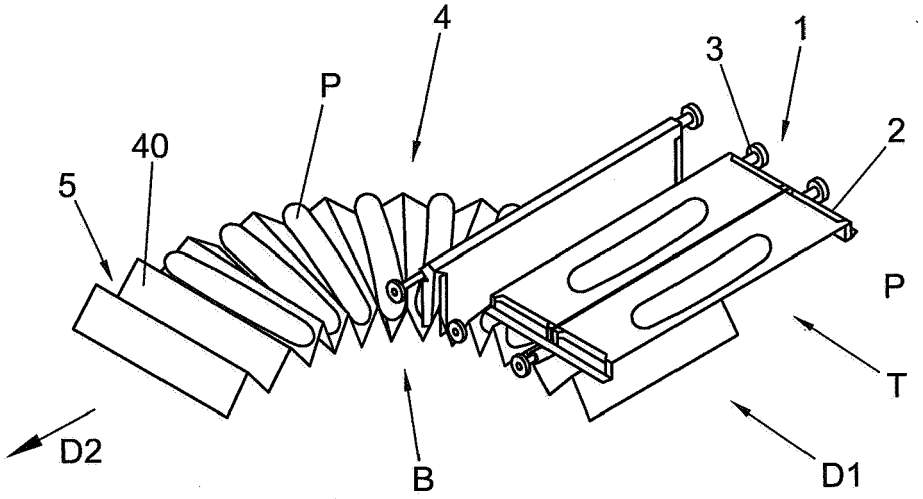

FIG. 1

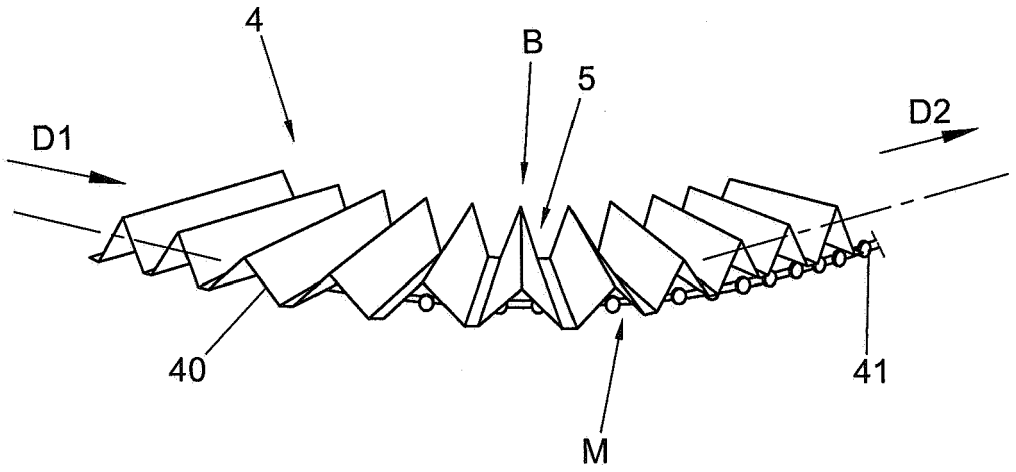

FIG. 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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- JP 2004075381 B **[0007]**
- DE 3923442 **[0010]**
- EP 108445 A **[0014]**