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(71) Applicant (for all designated States except US): **MEADWESTVACO PACKAGING SYSTEMS, LLC** [US/US]; Law Department, 11013 West Broad Street, Glen Allen, VA 23060 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **DUPERRAY, Philippe** [FR/FR]; 46 Bis, Rue Jeanne D'arc, F-36000 Chateauroux (FR). **QUIBEL, Olivier** [FR/FR]; 10 Rue De Portail, F-36000 Chateauroux (FR).

(74) Agents: **WARE, Karen, L.** et al.; Meadwestvaco Corporation, 1021 Main Campus Drive, Raleigh, NC 27606 (US).

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(54) Title: APPARATUS, SYSTEM AND METHOD FOR ORIENTATING ARTICLES

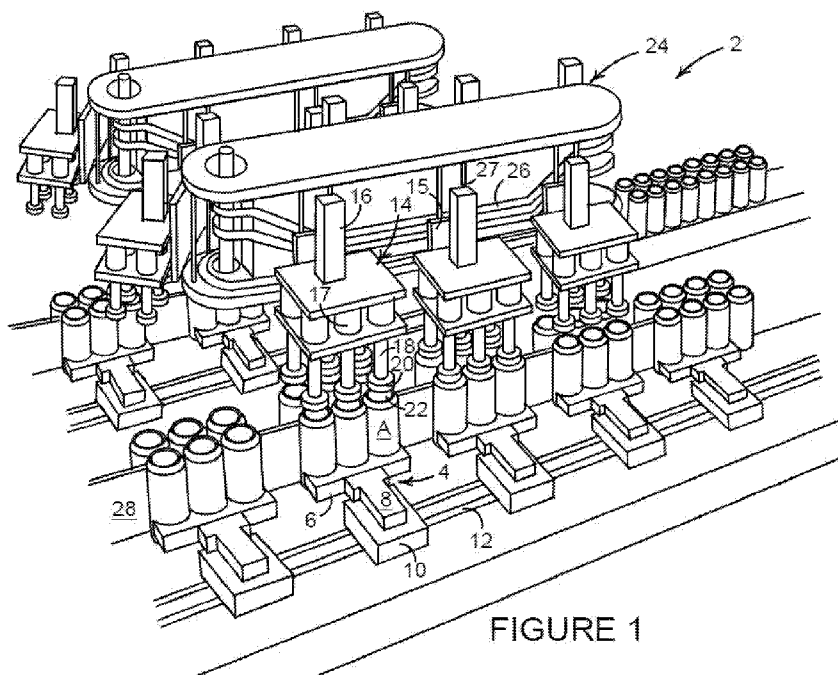


FIGURE 1

(57) Abstract: A subsystem for rotating articles (A), which subsystem (2) comprises a movable rotator assembly (14) that has a rotating member (18) that is releasably engagable with an article (A), as that article (A) is conveyed in a stream through a working reach of the subsystem (2), and which is operable to rotate that article (A) from a first orientation until that article assumes a desired orientation as determined by the sensor, whilst the article is being so conveyed.



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APPARATUS, SYSTEM AND METHOD FOR ORIENTATING ARTICLES

FIELD OF THE INVENTION

The invention relates to an apparatus, system and method for orientating articles, such as cans or bottles. More particularly, though not exclusively, the invention relates to an apparatus and
5 a packaging subsystem that can orientate articles whilst those articles progress through a packaging sequence so as to provide articles that are correctly orientated with respect to their final packaging.

BACKGROUND OF THE INVENTION

It is desirable that various labelling and advertising materials, attached to or printed on the
10 outer surfaces of articles which are to be packaged or displayed, be properly aligned with, for example, apertures or windows defined in the packaging carton, so that that advertising material is optimally visible.

Difficulties arise in the aforementioned alignment, due to the nature of a packaging assembly. For instance, the articles to be packaged are often conveyed in a stream and guided by fixed
15 guides and/or conveyed upon rotating conveyor belts. As the articles are conveyed they will likely be caused to rotate through friction against, for example, a fixed guide, or through vibration in the conveyor belt. Furthermore, it may well be the case that the articles are not aligned with one another when they enter the packaging assembly. All of these factors, among
20 others, make it difficult to achieve the aforementioned alignment between each article in a resulting package, and/or the relevant apertures or windows in the carton.

Where known systems provide mechanisms for rotating the articles, those mechanisms are fixed, and thus require the articles themselves to be brought to a halt so as to be rotated. Thus, these known systems disadvantageously require a reduction in the overall article throughput of the system.

25 Other known systems use fixed guides to rotate the articles, and these fixed guides, as the name suggests, cannot dynamically cause differing levels of rotation in each article to be

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packaged. Thus such systems are limited in terms of their flexibility when it comes to reliably orientating numerous articles through differing amounts of rotation.

The present invention seeks to overcome or at least mitigate the disadvantages of such known subsystems.

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SUMMARY OF INVENTION

A first aspect of the present invention provides a subsystem for rotating articles, which subsystem comprises a movable rotator assembly that has a rotating member that is releasably engagable with an article, as that article is conveyed in a stream through a working reach of the subsystem, and which is operable to rotate that article from a first orientation to a second orientation whilst the article is being so conveyed.

Preferably, a drive means comprising the rotator assembly drives the rotating member via a clutch assembly, with clutch assembly is controllable to engage and disengage the rotating member from the drive means, such that the rotation of the aforesaid article is stoppable when it reaches the aforesaid desired orientation.

Preferably, each rotating member comprises a shaft and a head, which head is engageable with a surface of a corresponding article.

Preferably, the rotator assembly is slidably mounted upon a track, such that alignment between the rotator assembly and the articles is maintainable whilst the articles are conveyed, by moving the rotator assembly along the track.

Preferably, the rotator assembly is additionally mounted so as to enable reciprocating displacement thereof, transverse to the aforesaid motion of the rotator assembly around the track, which reciprocating displacement serves to bring the or each rotating member of the rotator assembly into, and subsequently out of, a engagement with an article.

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Preferably, the rotator assembly further comprises an additional one or more aforesaid rotating members, so as to allow simultaneous rotation of a corresponding additional one or more articles, the articles together forming an array of articles, as that array of articles is so conveyed.

- 5 Preferably, each clutch assembly is operable independently of each other clutch assembly of a given rotator assembly, thereby to allow each article of the aforesaid array to be rotated by a differing amount by disengaging the corresponding rotating member from the drive means at a different point in time.

- 10 Preferably, the subsystem further comprises a moveable retaining member that retains the article in position relative to the corresponding aforesaid rotating member as that article is being so conveyed. Optionally, the articles may be retained in general position by a carton or clip which carton or clip may be held and conveyed.

Preferably, the subsystem further comprises a wall member, between which wall member and the aforesaid retaining member the or each article is positioned, as it is so conveyed.

- 15 A second aspect of the present invention provides a method of rotating articles to be packaged, which method comprises: conveying articles in a stream; engaging a selected one or more of those articles with a movable rotator assembly; rotating those articles from a first orientation to a second orientation whilst those articles are being conveyed in the aforesaid stream; and disengaging those selected one or more articles.

- 20 Preferably, the method further comprises rotating more than one article simultaneously, so as to allow an array of articles to be reorientated at the same time.

Preferably, the method further comprises detecting when a given article has reached the aforesaid second orientation, and at that point ceasing rotation of that article.

- 25 Preferably, the method further comprises guiding the or each article with a moveable retaining member as the or each article is being rotated.

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BRIEF DESCRIPTION OF THE DRAWINGS

An exemplary embodiment of the invention will now be described with reference to the accompanying drawings, in which:

Fig. 1 illustrates a subsystem according to a first embodiment of the present invention and

5 Fig. 2 Illustrates a subsystem according to a second embodiment of the present invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

The present invention provides a subsystem, a preferred embodiment of which being illustrated in Figure 1. The subsystem 2 comprises a number of movable retaining members, such as comb
10 arrangements 4, that operate in conjunction with corresponding rotator assemblies 14 that are mounted on a carousel 24, to achieve the desired rotation of arrays of articles A as they pass through a working reach of the subsystem 2.

Figure 1 illustrates the comb arrangements 4, each of which comprises a comb 6 that is slidably mounted onto a chassis 10, via a connecting arm 8. Each chassis 10 itself is slidably connected
15 to a track 12 which runs, in one embodiment, perpendicular to a stream of arrays of articles A. The arrangement of the connecting arms 8 upon the chassis 10 is such as to allow the comb 6 to be brought into contact with proximate articles A from the arrays of articles A. The track 12 defines an endless circuit, having a return path that allows the comb arrangements 4 to be driven back to a starting position. This return path could take any configuration that does not
20 interfere with the comb arrangements 4 that are in contact with the array of articles A. For example, the return path could be substantially beneath those comb arrangements 4, or alternatively it could be opposed to those comb arrangements 4 such that the combs 6 face in an opposite direction as they follow the return path.

The chassis 10 of each comb arrangement 4 is driven by a drive means (not shown) along the
25 track 12. In one possible embodiment, each comb arrangement 4 is driven by a separate motor, for example a servo motor, or alternatively all of the comb arrangements 4 could be driven by a

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single drive means, such a common drive chain driven by a single motor. The movement of the connecting arm 8 relative to the chassis 10 of any given comb arrangement 4 is controllable. In one embodiment, the subsystem 2 employs a separate cam track (not shown) which is followed by a cam follower (not shown) coupled to the connecting arm 8, and which causes movement of the connecting arm 8 relative to the chassis 10 as the chassis 10 is driven around the track 12. In another embodiment the movement of the connecting arm 8 relative to the chassis 10 is controlled by an independent drive means coupled to or comprised within the comb arrangement 4 (not shown). Optionally, the independent drive means comprises a servo motor (not shown) that extends and retracts the connecting arm 8 relative the chassis 10, in response to electrical controlling signals issued by a controller unit (not shown). In yet a further embodiment, the entire chassis 10 is slidably mounted relative to the drive means, so as to be slidable in the direction of the articles A.

Each comb 6 comprises detents that are complementarily shaped relative to the article A so as to accept a portion of an adjacent article A when it is brought into contact therewith. In this way, when so positioned relative to an array of articles A, the comb 6 acts as a separator member that maintains the position of the articles A of the array of articles A, with which it is in contact, relative to one another. The contact surfaces of the comb 6 are chosen so as not to interfere with rotation of the articles A through friction. This could, for instance, be accomplished through provision of a low-friction surface layer, or alternatively through provision of a mechanical bearing system.

The subsystem 2 also comprises sensors for monitoring the alignment of the articles A. Each comb 6 comprises a sensor (not shown) for determining the correct alignment of each article A with which that comb 6 is in contact. The contact surfaces of each comb 6 are preferably provided with a photo detector that generates a signal that changes in accordance with the perceived surface features (such as colour, texture, reflectivity amongst others) of an immediately proximate portion of an article A. A controller (not shown) receives these generated signals and takes appropriate action to stop rotation of the article A in question when the sensor indicates that the article A is in the desired orientation. In an alternative

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embodiment, the sensors are positioned elsewhere in the subsystem 2, and are able to detect when the desired portion of the surface of the articles A is in the correct orientation.

The subsystem 2 also comprises an overhead carousel 24, to which the rotator assemblies 14 are attached. The carousel 24 defines an endless circuit around which the rotator assemblies 14 are driven, some portion of which circuit is aligned vertically over an array of articles A as they move along in the aforementioned stream. As the rotator assemblies 14 move around the endless circuit in this way, they define a working reach of the subsystem 2. A drive means (not shown) is provided to drive the carousel 24. It is envisaged that there is provided an independent drive means for each of the rotator assemblies 14 mounted upon the carousel 24. An alternative embodiment provides a single drive means to drive the carousel as a single unit, with each rotator assembly 14 moving with the same speed.

The carousel 24 comprises a cam track 26 that is followed by the rotator assemblies 14 as they pass around the carousel. The rotator assemblies 14 are each mounted relative to the carousel 24 such that, by following the cam track 26, they are displaceable in the direction of the articles A. This displacement of the rotator assemblies 14 is achieved by attaching the rotator assemblies 14 to mounting plates 15 of the carousel 24, which mounting plates 15 are each slidably mounted upon rails 27 that are linked to the carousel 24. Thus, as the carousel 24 rotates, the rails 27 are driven around the aforementioned endless circuit, which in turn drives the mounting plates 15 and therefore the rotator assemblies 14 around the endless circuit also. As the rotator assemblies 14 move, they follow the profile of the cam track 26 of the carousel 24 by sliding vertically (in the illustrated embodiment) along the rails 27, thereby causing them to move relative to the arrays of articles conveyed beneath. As a rotator assembly 14 becomes aligned over a selected array of articles A, the cam track 26 follows a downward path that brings that rotator assembly down into contact with those articles A. A subsequent portion of the cam shaft 26 follows an upward path to bring the rotator assembly 14 out of contact with the articles A, before the endless circuit follows a return path that guides the rotator assemblies 14 back to the start point.

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Each rotator assembly 14 comprises a drive means, such as a servo motor 16, connected to shafts 18 that terminate in heads 20. Each head 20 comprises a gripper 22 that is engagable with an upper surface of an article A when it is brought into contact therewith. One possible way in which this engagement may be accomplished could be by providing a gripper 22 that
5 comprises a friction head that abuts a portion of the aforementioned upper surface of a given article A. Alternatively, a suction head, operable to form a vacuum seal with the aforementioned upper surface, could be employed. Other possible engagement solutions would be understood by one skilled in the art and could, for instance, comprise mechanical gripping mechanisms. Once the engagement has been made, rotation of shaft 18, driven by the
10 servo motor 16, results in consequential rotation of that article A. Preferably, sufficient numbers of shafts 18 and corresponding heads 20 are provided so as to allow each article A in any selected array of articles A to be rotated simultaneously. These shafts 18, consequently, need to be arranged in a similar pattern to the articles A of the array of articles A. In the illustrated embodiment, the shafts 18 are arranged in two rows of three, the two rows being
15 disposed side by side, to match the 2 x 3 configuration of the array of articles A.

In a preferred embodiment, a clutch 17 is provided between the servo motor 16 of the rotator assembly 14 and each shaft 18. This clutch 17 is controllable to engage and disengage the shaft 18 from the servo motor 16, and thereby to start and stop rotation of the article A with which the gripper 22 on the end of that shaft 18 is engaged. In an alternative embodiment, no such
20 clutch 17 is provided, and instead all of the shafts are fixed in engagement with the servo motor 16, then all the shafts 18 rotate at the same time, as long as the servo motor 16 drives them. Additional or alternative mechanical linkages between the servo motor 16 and the shafts 18 can be provided, such as gearing to alter the relative rotational speed of a drive shaft of the servo motor 16 and the shaft 18, among others.

25 When in use, arrays of articles A are conveyed, in a stream, into the working reach of the subsystem 2. In the illustrated embodiment, each array of articles A comprises two rows of three articles A, disposed side by side. The two rows are disposed either side of an intermediate wall 28, which acts as a guide for the array, and also aid rotation of the relevant articles A of the

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array of articles A by preventing friction between adjacent articles of the opposing rows when those articles A are rotated by the rotator assemblies 14.

Comb arrangements 4 are disposed either side of the intermediate wall 28, so as to ensure that each article A of the conveyed arrays of articles A are being driven through the working reach of the subsystem 2. As the rotator assemblies 14 are brought down into contact with the upper surfaces of the articles A of an array of articles A, the comb arrangement 4 in contact with that array is used to ensure that the articles A of that array maintain their alignment as they are rotated.

The articles A of each selected array of articles A are rotated until such time as the relevant detectors generate a signal to indicate that the desired orientation of each article A has been reached. At this point, the articles A that are correctly aligned cease to be rotated by the rotator assembly 14. Once all of the articles A of the selected array of articles A have been correctly aligned, the rotator assembly 14 moves upwardly out of contact with the array and follows a return path, leaving that array in contact with the comb arrangement 4, to be conveyed to an exit end of the subsystem 2 for onward processing in, for example, a packaging system.

As can be seen from Figure 1, it is possible to put multiple subsystems 2 side by side so as to allow multiple article streams to be aligned simultaneously.

The subsystem 2 can, in one embodiment, be applied to a packaging system. The articles A of Figure 1 are first formed into a stream before being selected to form an array by movable retaining members. The moveable retaining members convey each array to a subsystem, of the type of subsystem 2 of Figure 1, and then on to a hopper, which hopper disposes a carton blank upon the articles. The array and carton blank then continue to be conveyed through one or more folding stations that form the blank into the set up carton, around the array of articles. The array is then conveyed to an output end of the packaging line.

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The above sets out an exemplary embodiment of a subsystem and an exemplary application of that subsystem within a packaging system. One skilled in the art would readily understand that variations of the features set out above may be effected without departing from the invention concept defined by the claims below.

- 5 Some of these variations are illustrated by a second embodiment shown in Figures 2 and 3. For ease of correlation of technical features of the second embodiment that are similar to those of the first embodiment, similar reference numerals have been used, albeit the reference numerals used for the second embodiment are raised by a factor '100'.

10 In Figure 2, there is shown a subassembly 102, coupled to the output end of a packaging line 134. Only an end section of the packaging line 134 is shown in Figure 2 but it will be understood that the exemplary packaging line 134 shown does not introduce any limitation to the applicability of the present invention to many and various types of packaging machine wherein articles held in a grouped form by a carton or clip are output from the packaging line 134. The articles held in a grouped form by a carton or clip that are output have random orientation in
15 terms of the relative position of the advertising or labelling indicia mounted or printed on them. The subassembly 102 is added as a retro-fitted autonomous section or as an integrated section of a packaging line 134 to address the non-uniformity or random alignment of the positions of articles within the output packages.

20 As such, this embodiment illustrates the applicability of the invention to articles that are already grouped by a carton and/or the applicability of the subassembly 102 to operate on articles at a location different to the tops of the articles (as in the first embodiment). In this second illustrated embodiment the rotatable heads 120 are each operable on a lower section of a grouped article A to cause rotation of that article A, if necessary, to ensure that each article A in the group is uniformly aligned or aligned as desired so that advertising indicia on the article A
25 is optimally positioned. The structure of the heads 120 is similar to that in the first embodiment, however, whereas in the first embodiment the subassembly 2 comprised a means (comb arrangement 4) for grouping, holding and metering articles in a 2x3 array, in the present embodiment, that feature is unnecessary since the articles are grouped in metered 2x3 arrays

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by virtue of being contained in packaged cartons C. The present subassembly comprises a pair of conveyors 136 for holding and conveying successive packaged groups of articles. An optional aspect of subassembly 102 is the metering devices 136, which may take the form of belt conveyors as known in the art, which are utilised here to reduce the spacing between the packaged cartons output from the packaging line 134. In this way, the pitch between one article and the next is made uniform regardless of whether those neighbouring articles form part of the same package or adjacent packages. This enables a head holder 124 comprising multiple heads 120 to act upon the articles in several packages at the same time. In an alternative, non-illustrated embodiment, the metering devices 136 may be omitted and the head holder 124 (rotator assembly) may either operate upon the articles A of only a single package at a time; or alternatively, the heads 120 may be grouped with a spacing in a series of spaced arrays so that the articles A of more than one package, which packages are spaced, can be operated on simultaneously; or alternatively, may comprise heads 120 that are moveable relative to one another that are moveable along a guide track for example so that the articles A of more than one package, which packages are spaced, can be operated on simultaneously.

In the preferred arrangement shown here, the spacing between adjacent articles A is made uniform by the metering devices 136 and this facilitates the use of a sensor 138 that operates as a camera. The camera is operable at a frequency similar or equal to the pitch of the articles A as they are conveyed, in their packages, past the camera 138. The camera takes a snap shot of each article A as it passes the camera and registers the graphical orientation of each article. The data captured by the camera sensor 138 is utilised by a central control means (of the form of a computer unit coupled by wire and/or wirelessly to each camera sensor 138) for calculation of the necessary rotation of the article in that recorded pitch by comparing the snap shot image with what the article snap shot image should be. By registering the required rotation of each article in each pitch for a sequence of articles, the control means is then able to activate each head 120 so that each head operates independently to accurately adjust the position of an article. In other words, at the start of a sequence, there are 36 heads 120 that can each be engaged with an article A. The camera sensors 138 each record the position of 18 articles and feed this data to the control unit. A calculation is performed by the control unit for each article

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in the positions 1 to 36. The calculation determines the amount of rotation in +or- degrees that is required to adjust each article. This angle of rotation (which optionally is positive or negative to indicate clockwise or anticlockwise) is then converted into a time interval 't' based upon the angular velocity of the heads 120. As such the amount of adjustment in degrees is converted to a time period 't' for which the head 120 must be in rotational engagement with an article in order to affect the required rotational adjustment. For example a rotational adjustment of +90° will be affected by a head with an angular velocity of 360°per second, engaging an article for 0.25s and moving in a clockwise direction. The above described clutching mechanism is adaptable so that each head 120 is rotatable in either a clockwise or anti-clockwise direction. In this way the maximum rotation of any article can be limited to 180° (30° in a clockwise direction albeit equivalent to, being quicker than a 330° rotation in an anticlockwise direction).

The array of 2 x 18 articles that have each been imaged are conveyed downstream of the camera sensors 138 and the head holder 124 moves into vertical alignment with that group of articles as they are conveyed. The head holder is moved beneath and in vertical registry with the group such that each head 120 can be engaged with a corresponding article, the head holder 124 (or rotator assembly) is moveable by support means (not shown) that enable the whole head assembly 124 to move downstream in synchrony with the moving stream of articles such that there is no relative linear movement between the article stream and the head assembly 124.

Each head 120 is independently moveable in a transverse or vertical direction by the same method as described in respect of the first embodiment. Here however, the control means issues command signals to the auto-clutching mechanism of each head 120 so that each head 120 is engaged with its corresponding article A for the required time period as calculated (for example 0.25s). In this arrangement, each head 120 is disengageably couplable to a drive means (which may or may not be the same drive means for each of the heads, though preferably a single drive means is used), so that each head 120 can, without rotational movement, be vertically moved into engagement with an article, then can be coupled to the drive means for the requisite period 't₁' to 't₃₆' and then be disengaged from the drive means

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until all heads 120 are then retracted as a unit and each non-rotating head 120 dis-engaged from its associated article A. The aligned output packages 132 are then out of the subassembly 102 on optional outgoing conveyor 130 as shown and the entire rotator assembly 124, once disengaged from the aligned articles, is returned upstream (by sliding reversibly along a track or using other transfer means as is known in the art, such as an articulated frame member supporting the head assembly 124) faster than the speed of conveyance of articles downstream in order that the rotator assembly 124 meets and couples to a subsequent successive group of 36 articles for alignment. Those successive articles being photographed or monitored in another suitable way, ready for the heads 120 of the head assembly 124 to operate thereon for adjusting the articles in the successive sequence.

In an alternative mechanism to the auto-clutching servo motor mechanism described in connection with the first illustrated embodiment, a wheel disposed either internally or externally of the rotator assembly 124 may be used to provide the rotational movement for each head 120. Such a wheel may be driven by a belt that may be provided as a separate apparatus to the rotator assembly 124 and coupled to that rotator assembly 124 by means of said wheel. Each head 120 being moveable (by a controllable piston for example) into connection with that rotating wheel, for example by means of clutch type plate attached to a lower end of the head shaft, so that the rotational movement of the wheel is translated into rotational movement of the head for the relevant time period 't'. A drive means is required to drive the belt but such drive means may or may not form part of the rotator assembly 124.

It will be noted that each head 120 preferably engages an article for a time greater than the calculated rotation time period 't'. This allows for the head 120 to engage or couple to an article A whilst the head 120 has no rotational velocity and is dis-engaged from the rotational drive means and likewise allows for the head to dis-engage or decouple from an article whilst the head 120 has no rotational velocity and is dis-enaged from the rotational drive means.

In this embodiment, the packaged articles are disposed in paired rows and as such a camera sensor 138 is required on each side of the packages and the head holder 124 is required two rows of heads 120 for operation on each article A in a pair as that pair of articles is conveyed.

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The subassembly 102 (and indeed subassembly 2), in other embodiments, are structured to operate on only a single line of articles disposed in a linear array or package of only a single row of articles.

It will be understood that a sensor of the type described with respect to the first embodiment could alternatively be employed in the second embodiment and vice versa, the aforescribed camera sensor could alternatively be employed in the apparatus of the first embodiment. Indeed, unless otherwise specifically stated, features of the first embodiment may be interchangeable with those of the second embodiment and as such the invention may take forms other than this specifically illustrated. For example, the carousel 24 could be disposed beneath a track 12, which track 12 could be positioned such that articles A are grouped and conveyed by their upper portions and the rotator assemblies 14 could be structured and arranged to upstand from the carousel 24 to operate on the bottoms of articles A, rather than as shown upon their upper portions.

The principle of operation of the first and second embodiments is similar in that each require a measurement of the position of each article to be taken and a rotational adjustment of each article to be calculated and made if necessary. The rotational adjustment is carried out by a rotatable member coupling to the article preferably when the rotatable member is not rotating (i.e. is disengaged from a rotational drive means) and then the rotatable member being engaged with the rotational drive means and rotating for a time interval corresponding to the angular adjustment required. Each rotatable member being selectively engageable and disengageable (using a clutch or other mechanism) with a drive means that preferably supplies the rotational movement for each of the rotatable members whilst also being conveyable in synchrony with the moving articles (such that there is no relative linear movement between the heads 20;120 or rotatable members 20;120 and the articles A) allows for an accurate adjustment and alignment of articles whilst they are conveyed in groups or packages.

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CLAIMS

1. A subsystem for rotating articles, which subsystem comprises a sensor and movable rotator assembly that has a rotating member that is releasably engageable with an article, as that article is conveyed in a stream through a working reach of the subsystem,
5 and which is operable to rotate that article from a first orientation until that article assumes a desired orientation as determined by a sensor, whilst the article is being so conveyed.
2. A subsystem according to claim 1 wherein the rotator assembly comprises more than one rotating member each rotating member being selectively engageable and
10 disengageable with a single drive means which supplies rotational movement to each said rotating member of the rotator assembly.
3. The subsystem according to claim 1 or claim 2, wherein a drive means is operable to drive the rotating member via a clutch assembly, which clutch assembly is controllable to engage and disengage the rotating member from the drive means, such that the
15 rotation of the aforesaid article is stoppable when that article reaches the said desired orientation.
4. The subsystem according to any one of the preceding claims, wherein each rotating member comprises a shaft and a head, which head is engageable with a surface of a corresponding article.
- 20 5. The subsystem according to any one of claims 1 to 4, wherein the rotator assembly is slidably mounted upon a track, such that alignment between the rotator assembly and the articles is maintainable, whilst the articles are conveyed, by moving the rotator assembly along the track in synchrony with the conveyed articles.
- 25 6. The subsystem according to claim 5, wherein the rotator assembly is additionally mounted so as to enable reciprocating displacement thereof, transverse to the aforesaid motion of the rotator assembly on the track, which reciprocating

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displacement serves to bring the or each rotating member of the rotator assembly into, and subsequently out of, engagement with an article.

7. The subsystem according to any one of claims 1 to 6, wherein the rotator assembly further comprises an additional one or more aforesaid rotating members, so as to allow simultaneous rotation of a corresponding additional one or more articles, the articles together forming an array of articles, as that array of articles is so conveyed.

8. The subsystem of claim 7, comprising more than one clutch assembly, wherein each clutch assembly is operable independently of each other clutch assembly of the rotator assembly, thereby to allow each article of the aforesaid array to be rotated by a differing amount by disengaging the corresponding rotating member from the drive means at a different point in time.

9. The subsystem according to any one of claims 1 to 8, further comprising a moveable retaining member that retains the article in position relative to the corresponding aforesaid rotating member as that article is being so conveyed.

10. The subsystem according to claim 9, further comprising a wall member, between which wall member and the aforesaid retaining member the or each article is positioned, as it is so conveyed.

11. A method of rotating articles to be packaged, which method comprises: conveying articles in a stream; engaging a selected one or more of those articles with a movable rotator assembly; rotating those articles from a first orientation until they assume a desired orientation, as detected by a sensor, whilst those articles are being conveyed in the aforesaid stream; and disengaging those selected one or more articles.

12. The method according to claim 11, further comprising rotating more than one article simultaneously, so as to allow an array of articles to be reorientated at the same time.

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13. The method according to claim 11 or claim 12, further comprising detecting when a given article has reached the aforesaid desired orientation, and at that point ceasing rotation of that article.
14. The method according to any one of claims 11 to 13, further comprising guiding the or
5 each article with a moveable retaining member as the or each article is being rotated.
15. A packaging system for packaging articles, which packaging system comprises the subsystem of any one of claims 1 to 10.

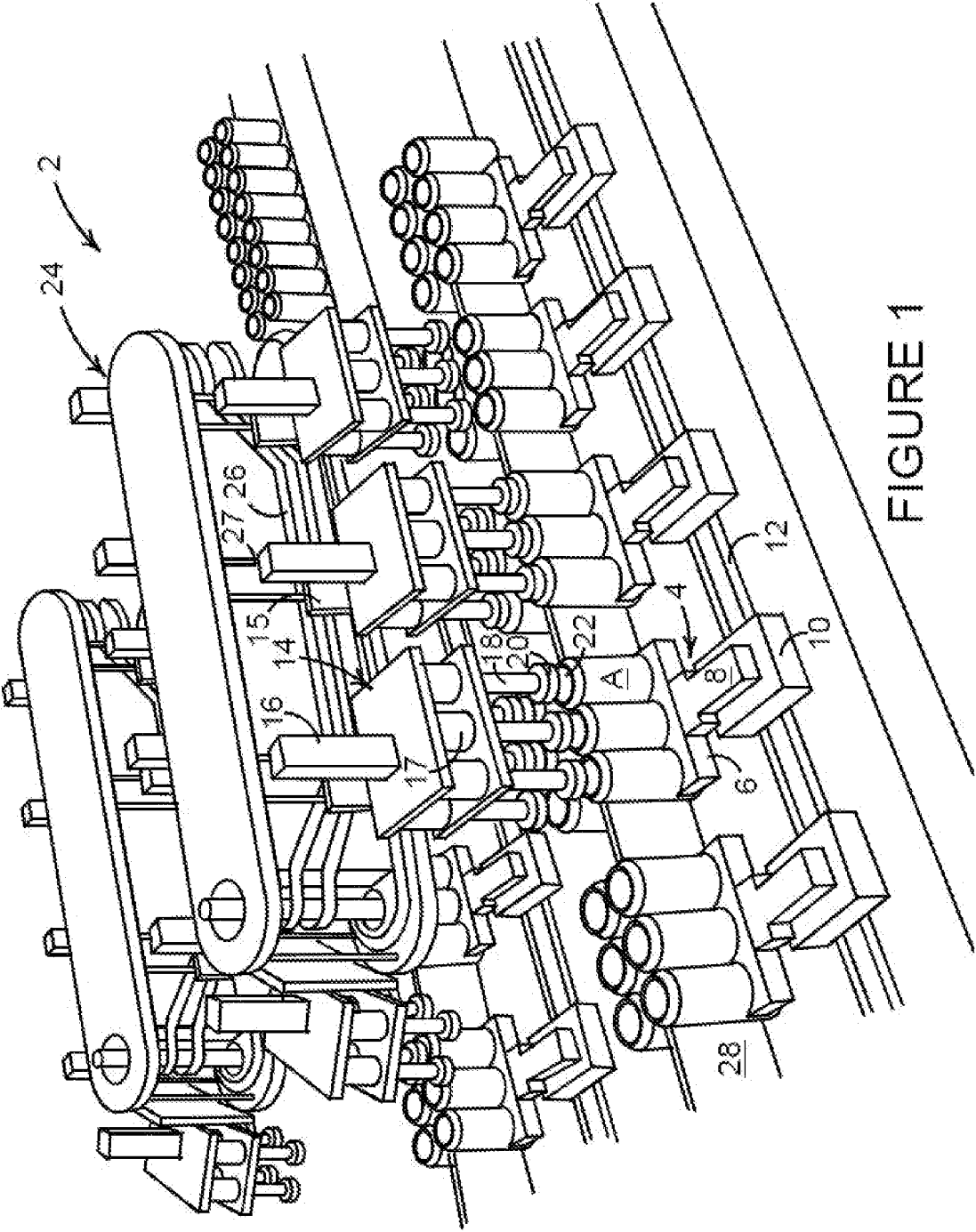


FIGURE 1

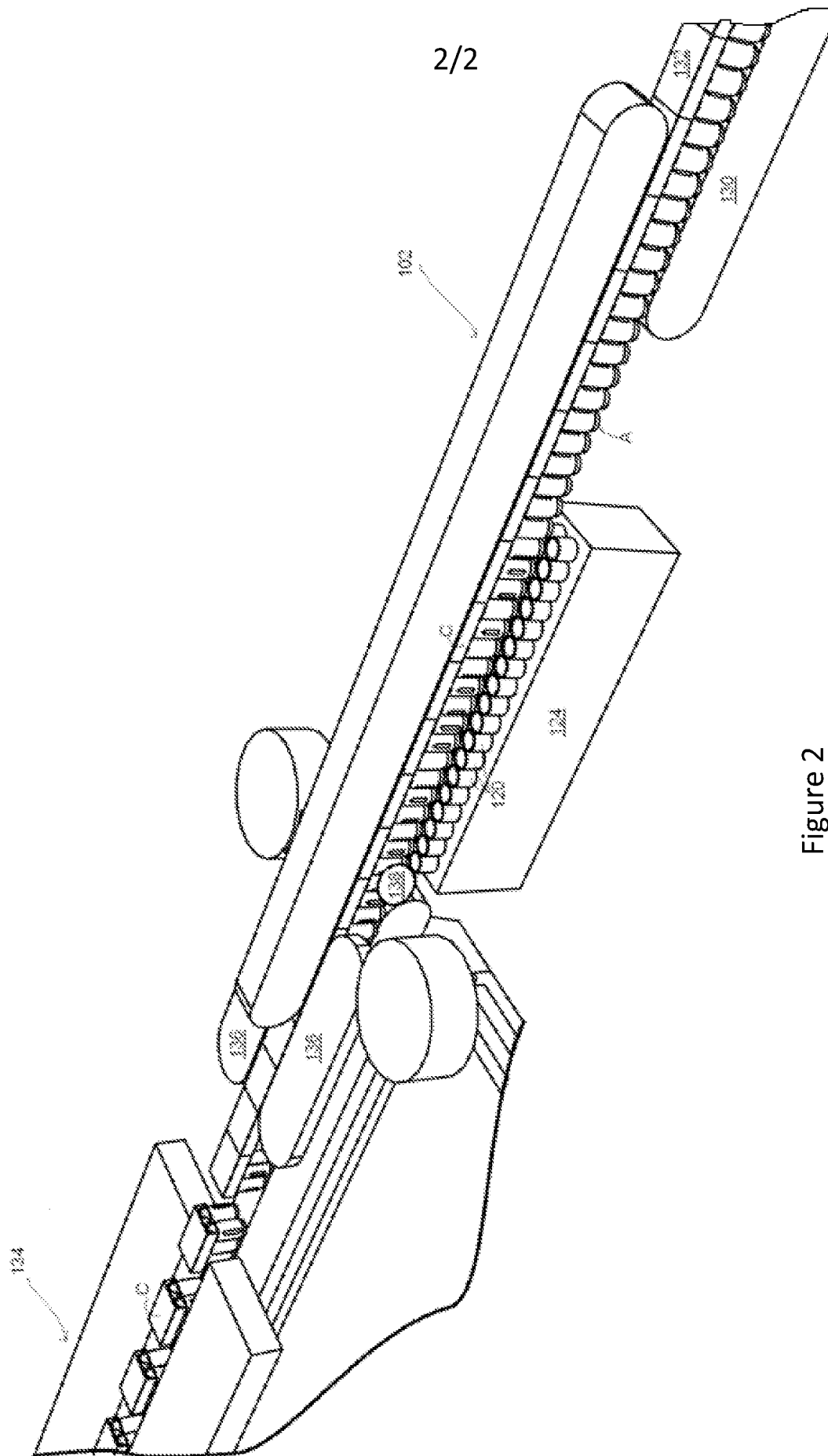


Figure 2

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2009/040840

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65G47/244

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)

B65G B65B B65C

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 practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 183 197 A (GREEFS WAGEN CARROSSERIE [NL]) 6 March 2002 (2002-03-06) column 2, line 34 - column 4, line 53 figures 1-5	1-6, 11, 13, 15
X	US 5 215 180 A (ALLARD STEPHEN J [GB] ET AL) 1 June 1993 (1993-06-01) column 4, line 38 - column 6, line 43 figures 1-10	1-4, 7-9, 11-15

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
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- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

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- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- * & * document member of the same patent family

Date of the actual completion of the international search

15 June 2009

Date of mailing of the international search report

23/06/2009

Name and mailing address of the ISA/
European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Papatheofrastou, M

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2009/040840

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