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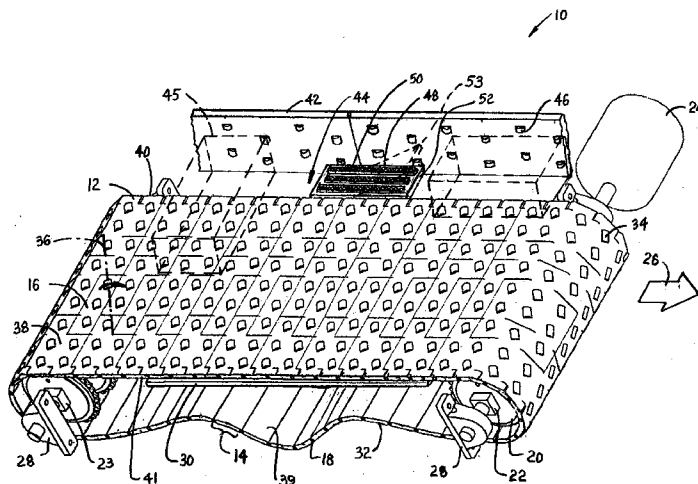


FIG. 1

(57) Abstract: A case turning conveyor and a method for turning cases. The conveyor includes a conveyor belt having article-supporting rollers rotating about axes oblique to the direction of travel of the belt. A side rail is spaced from the side of the conveyor belt across a gap. A retarding surface disposed in the gap provides a horizontal or upwardly ramped high-friction contact area to a portion of the bottom of a case registered against the side rail. Another portion of the bottom of the case remains in contact with the rotating oblique rollers. The retarding surface slows the advance of the portion of the case it engages relative to the portion atop the rollers, which causes the case to rotate into a different orientation.

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BOTTOM CASE TURNER**BACKGROUND**

The invention relates generally to power-driven conveyors and, more particularly, to a
5 case turner using a conveyor belt with rollers rotating about axes oblique to the direction of
belt travel to convey cases to a retarding surface engaging portions of the bottoms of the
cases to cause them to rotate.

Many conveying applications require that conveyed articles, such as cases, be rotated
90° and aligned single file for downstream processing or inspection. For cases having a
10 generally rectangular footprint, with a minor axis and a longer major axis, it is often desirable
to rotate cases being conveyed with their minor axes aligned with the conveying direction
(the “hard way”) through an angle of 90° so that the major axes are aligned with the direction
of belt travel (the “easy way”). One way to achieve this is with an obstruction extending into
the conveying path of articles conveyed atop a belt having rollers arranged to rotate about
15 axes oblique to the conveying direction as the belt advances, as described in U.S. Patent No.
7,111,722, “Angled-Roller Belt Conveyor,” issued to Ronald H. Burch and assigned to the
assignee of this application. The obstruction intercepts each article to be rotated and forms a
pivot about which the intercepted articles are rotated by the action of the rotating oblique
rollers against the bottom of the article. Because the obstruction contacts the side of the
20 article as it pivots, the obstruction can scratch or mar any labeling on the side of the article,
which may be undesirable in some instances. Furthermore, the obstruction blocks a portion of
the conveying path. Another way to turn cases in a 90° conveyor turn is described in U.S.
Patent No. 5,924,549, “Container Turning Device,” issued to Robert F. Risley and also
assigned to the assignee of this application. A frictional ramp with a stop bump is positioned
25 at the inside of the entrance of a turn in a flat-belt conveyor system. Cartons on a frusto-
conical conveyor belt in the turn ride partly on the belt and partly on the ramp, which causes
the cartons to rotate from the easy way to the hard way, or vice versa, as they also make the
90° turn.

Thus, there is a need for a conveyor that can turn cases on straight carryways without
30 one or another of the shortcomings of conventional technology.

SUMMARY

This need or other needs are overcome by a conveyor embodying features of the invention. In one aspect, a conveyor includes a conveyor belt advancing along a conveying path in a direction of belt travel. The belt has an article-conveying surface that extends in width from a first side to a second side. The conveyor belt includes a plurality of article-supporting rollers that rotate in a direction to push a supported article toward the first side of the conveyor belt as the conveyor belt advances in the direction of belt travel. A retarding surface disposed at the first side of the conveyor belt receives and engages a first portion of the bottom of the article while a second portion of the bottom of the article is supported by some of the article-supporting rollers. The retarding surface slows the advance in the direction of belt travel of the first portion relative to second portion to cause the article to pivot as it is conveyed in the direction of belt travel.

In another aspect of the invention, a conveyor includes a conveyor carryway including a bearing surface and a conveyor belt supported on the carryway. The belt advances in a direction of belt travel and includes an article-conveying surface extending in width from a first side to a second side. The conveyor belt also includes a plurality of article-supporting rollers in rolling contact with the bearing surface. The rollers extend above the article-conveying surface and rotate about axes oblique to the direction of belt travel as the belt advances to push supported articles toward the first side of the conveyor belt. A side rail spaced apart from the first side of the conveyor belt across a gap receives articles pushed across the belt. A retarding surface, disposed at a position along the conveyor in the gap at the first side of the conveyor belt, forms a high-friction contact area supporting first portions of the bottoms of the articles while second portions of the bottoms of the articles are supported by some of the article-supporting rollers. The retarding surface slows the advance in the direction of belt travel of the first portions relative to the second portions to cause the articles to pivot as they are conveyed in the direction of belt travel.

Another aspect of the invention is a method for turning a case. According to the method, a case is conveyed on a conveyor belt advancing in a direction of belt travel. A first portion of the bottom of the case is supported on rollers in the conveyor belt that are rotating in a direction to push the supported case toward a first side of the conveyor belt. A second portion of the bottom of the case is frictionally engaged to retard the advance of the second portion in the direction of belt travel relative to the advance of the first portion.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features and aspects of the invention, as well as its advantages, are better understood by reference to the following description, appended claims, and accompanying drawings, in which:

- 5 FIG. 1 is a pictorial view of a conveyor embodying features of the invention, including a frictional pivot;
- FIG. 2 is a top plan view of the conveyor of FIG. 1; and
- FIG. 3 is a top schematic representation of the operation of the conveyor of FIG. 1.

10

DETAILED DESCRIPTION

One version of a conveyor embodying features of the invention is shown in FIGS. 1 and 2. The conveyor 10 includes a conveyor belt 12, in this case, an oblique-roller belt, such as the Series 400 Angled Roller™ belt manufactured and sold by Intralox, L.L.C., of Harahan, Louisiana, U.S.A. Such a belt is also described in U.S. Patent No. 6,494,312, which is

15 incorporated by reference. The belt is a modular plastic belt consisting of a series of rows 14 of belt modules 16 having leading and trailing hinge eyes interleaved with the trailing and leading hinge eyes of adjacent rows and interconnected by hinge pins 18 installed in lateral passageways formed by the aligned interleaved hinge eyes between adjacent rows. Each row is formed of one or more modules. If more than one module forms each row, the modules are

20 preferably arranged in a bricklay pattern for strength. Consecutive rows pivot about the hinge joints between rows as the belt articulates about sprockets 20, which are mounted on a drive shaft 22 and an idler shaft 23. A motor 24 coupled to the drive shaft rotates the shaft and the sprockets to drive the belt in a direction of travel 26. Bearing blocks 28 support the drive and idler shafts at opposite ends. The conveyor is conventionally supported in a frame, which is

25 omitted from the drawings for clarity. The conveyor also includes a carryway 30, which may be realized as a pan or a set of parallel, longitudinal wearstrips underlying the belt along the conveying portion of the belt path. The belt makes its return trip along a lower returnway 32, which typically would include support rollers or shoes.

The belt includes rollers 34 arranged to rotate about axes 36 oblique to the

30 longitudinal direction of belt travel 26. Salient portions of the rollers extend above an outer, top article-conveying surface 38 and below an inner, bottom surface 39 of the belt along the carryway. As the belt advances along the carryway, the salient portions of the rollers extending below the bottom surface of the belt roll on the carryway, which forms a bearing

surface for the rollers. For rollers whose axes are about 60° or more from the direction of belt travel, a flat bearing surface suffices. For angles of less than about 60°, a bearing surface formed by carryway rollers underlying the belt is preferred to prevent sliding contact between the belt rollers and the bearing surface. The rotation of the rollers perpendicular to their oblique axes of rotation as the belt is driven in the direction of belt travel directs articles supported on the rollers to a first side 40 of the belt. As one example, the rollers are realized as generally cylindrical rollers, each with a central bore that receives an axle defining the axis 36 about which the roller rotates as the belt is driven.

As shown in FIGS. 1 and 2, the belt extends in width from the first side 40 to a second side 41. A side rail 42 spaced from the first side 40 of the belt across a gap 44 serves two functions: (a) as a registration surface against which articles conveyed on the belt are registered; and (b) as a pivot at which a conveyed article, such as a case 45, can pivot 90°. Rollers 46 in the side rail extend toward the belt to provide low-friction, scratch-resistant contact with the sides of cases, if needed to protect labeling. The width of the gap is preferably less than the minor axis of the smallest case to be rotated. Positioned in the gap between the side rail and the first side of the belt at a fixed position along the carryway is a retarding surface 48, which may be realized as parallel strips 50 of rubber or elastomer mounted to a base 52, such as three rows of an Intralox® Diamond Friction Top conveyor belt. Although the gap is shown as open, except for the retarding surface, it could be filled with, as one example, rollers, such as freely rotatable rollers in roller-top belts to provide low-friction support for cases advancing along the side rail in the direction of belt travel. The top surface of the rubber strips may be textured, in a raised diamond pattern, for example, to provide a high-friction contact area supporting a portion of the bottom of a case conveyed atop the strips. Besides rubber strips, any surface material or surface characteristic that slows the advance of a case's side closer to the side rail relative to the side away from the side rail may be used to form the retarding surface. To further slow the case's advance at the side rail, the base of the retarding surface may form a ramp 53, as shown intentionally exaggerated in phantom lines in FIG. 1. The level of the upwardly ramped retarding surface increases in the direction of belt travel from a level at or below the top surface of the belt to a level above the top surface of the belt at the downstream end of the ramp. A ramped retarding surface can be shorter in the direction of belt travel than a horizontal retarding surface, which effects a 90° case rotation in a shorter distance and in less time.

The operation of the conveyor as a case turner is depicted in FIG. 3. A case 45 shown with a generally rectangular footprint has a long major axis 56 and a shorter minor axis 57. In the example shown, the case enters the upstream end 58 of the conveyor belt 12 the “hard way,” i.e., with its minor axis parallel to the direction of belt travel 26. The case is then pushed, with little or no rotation, toward the side rail 42 by the rotation of the obliquely arranged belt rollers rolling on the bearing surface in the direction indicated by arrow 60 as the belt advances along the carryway in the direction of belt travel 26. As shown, the short side 62 of the case, conveyed along the first side of the conveyor belt, is registered against the side rail. When the bottom of the case encounters the retarding surface 48, the forward progress of the side 62 of the case against the side rail is slowed by the frictional contact with a portion of the case’s bottom. In the meantime, the portion of the case atop the rotating belt rollers continues to be pushed in the direction indicated by arrow 60. The component of force 61 acting on the bottom of the case in the direction of belt travel causes the case to pivot at the retarding surface generally about its original leading corner 64 closer to the side rail. The momentum of the case as it hits the retarding surface and the component of force in the direction of belt travel provided by the rollers to the bottom of the case cause the original leading corner to continue to advance, albeit at a slowed speed, along the retarding surface as the case is pivoted at the side rail. Eventually, the case clears the retarding surface and is conveyed against the side rail the “easy way,” i.e., with its major axis parallel to the direction of belt travel—rotated 90° from its original orientation. Thus, the rotated package 45' exits the downstream end 59 of the conveyor registered against the side rail the “easy way.”

Although the invention has been described with reference to a preferred version, other versions are possible. For example, the case turner may be used to rotate cases 90° from the “easy way” to the “hard way.” As another example, the retarding surface may be selectively activated (raised and lowered, for instance) into and out of contact with the bottoms of cases to rotate only selected cases. For such operation, the case turner would be equipped with a controller to control an actuator according to a predetermined sequence or according to case-orientation information gathered from one or more upstream sensors. So, as these few examples suggest, the scope of the claims is not meant to be limited to the version described in detail.

What is claimed is:

CLAIMS

1. A conveyor comprising:
a conveyor belt advancing along a conveying path in a direction of belt travel and
including an article-conveying surface extending in width from a first side to a
5 second side;
wherein the conveyor belt includes a plurality of article-supporting rollers at the
article-conveying surface rotating in a direction to push a supported article
toward the first side of the conveyor belt as the conveyor belt advances in the
direction of belt travel;
10 a retarding surface disposed at the first side of the conveyor belt to receive and engage
a first portion of the bottom of the article while a second portion of the bottom
of the article is supported by some of the article-supporting rollers;
wherein the retarding surface slows the advance in the direction of belt travel of the
first portion relative to second portion to cause the article to pivot as it is
15 conveyed in the direction of belt travel.
2. A conveyor as in claim 1 wherein the retarding surface includes a high-friction
material contacting the first portion of the bottom of the article.
3. A conveyor as in claim 1 wherein the retarding surface includes parallel strips of
high-friction material.
- 20 4. A conveyor as in claim 1 wherein the retarding surface is textured.
5. A conveyor as in claim 1 wherein the elevation of the retarding surface increases in
the direction of belt travel from a level at or below the article-conveying surface to a
level above the article-conveying surface.
6. A conveyor as in claim 1 further comprising a side rail spaced apart from the first side
25 of the conveyor belt across a gap and wherein the retarding surface is disposed in the
gap.
7. A conveyor comprising:
a conveyor carryway including a bearing surface;
a conveyor belt supported on the carryway and advancing in a direction of belt travel
30 and including an article-conveying surface extending in width from a first side
to a second side;
wherein the conveyor belt includes a plurality of article-supporting rollers in rolling
contact with the bearing surface, the rollers extending above the article-

conveying surface and arranged to rotate about axes oblique to the direction of belt travel to push supported articles toward the first side of the conveyor belt; a side rail spaced apart from the first side of the conveyor belt across a gap to receive articles pushed across the belt;

5 a retarding surface disposed at a position along the conveyor in the gap at the first side of the conveyor belt and forming a high-friction contact area supporting first portions of the bottoms of the articles while second portions of the bottoms of the articles are supported by some of the article-supporting rollers; wherein the retarding surface slows the advance in the direction of belt travel of the
10 first portions relative to the second portions to cause the articles to pivot as they are conveyed in the direction of belt travel.

8. A conveyor as in claim 7 wherein the retarding surface includes parallel strips of high-friction material.

9. A conveyor as in claim 7 wherein the retarding surface is textured.

15 10. A conveyor as in claim 7 wherein the elevation of the retarding surface increases in the direction of belt travel from a level at or below the article-conveying surface to a level above the article-conveying surface.

11. A method for turning a case, comprising:

conveying a case on a conveyor belt advancing in a direction of belt travel;
20 supporting a first portion of the bottom of the case on rollers in the conveyor belt rotating in a direction to push the supported case toward a first side of the conveyor belt;

frictionally engaging a second portion of the bottom of the case to retard the advance of the second portion in the direction of belt travel relative to the advance of
25 the first portion.

12. The method of claim 11 further comprising:

registering the conveyed articles against a side rail before frictionally engaging the second portion of the bottom of the case.

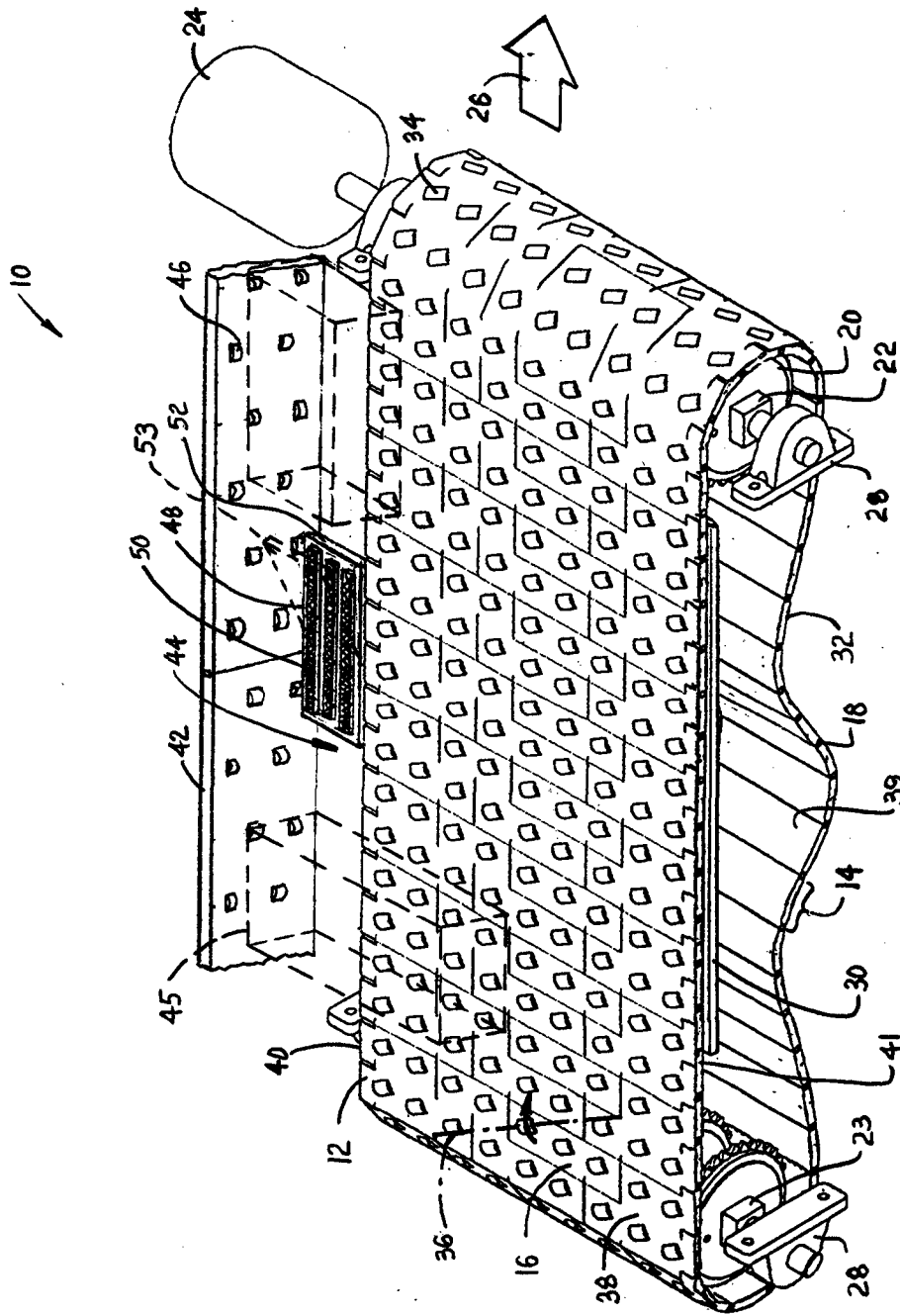


FIG. 1

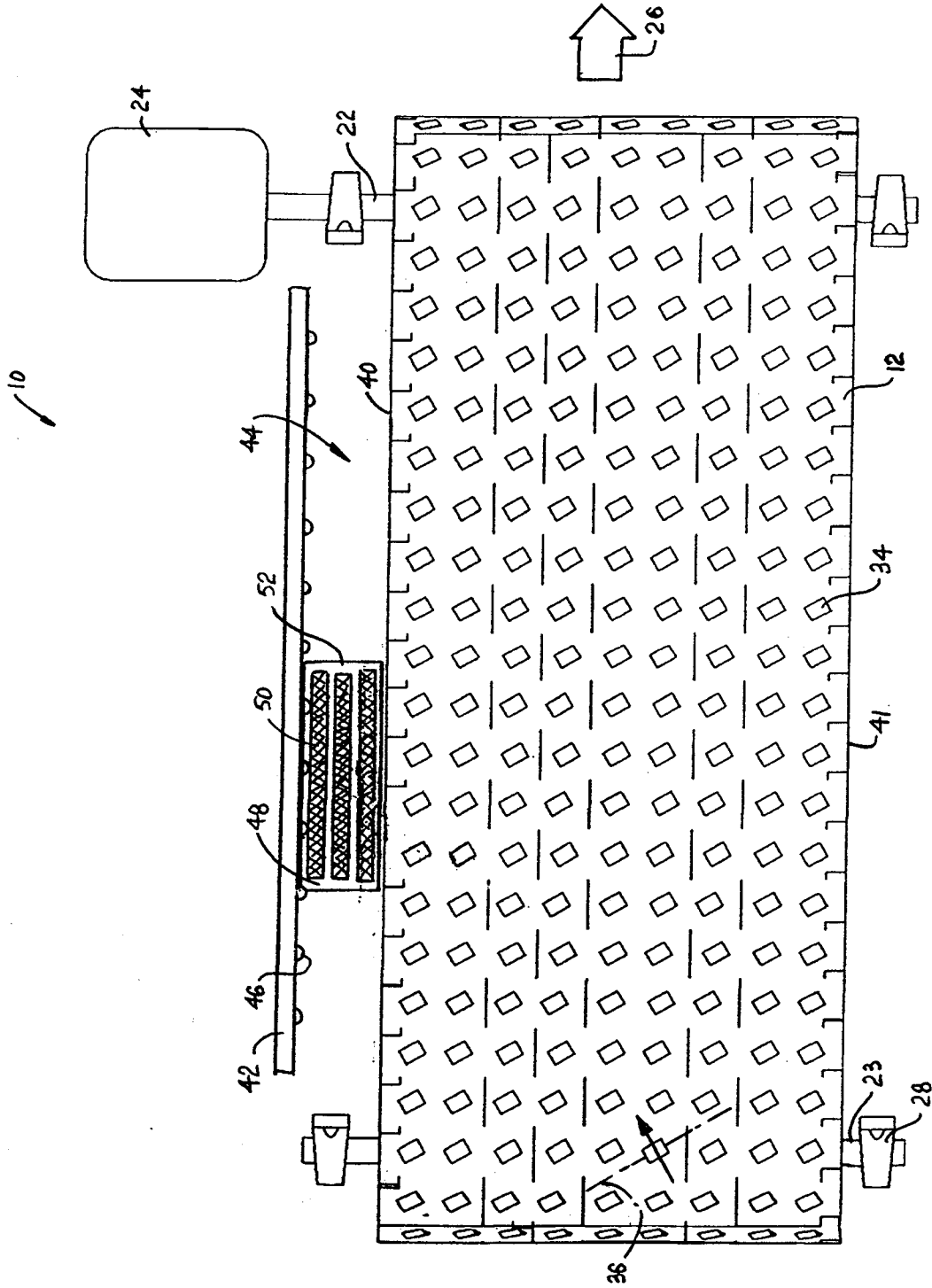


FIG. 2

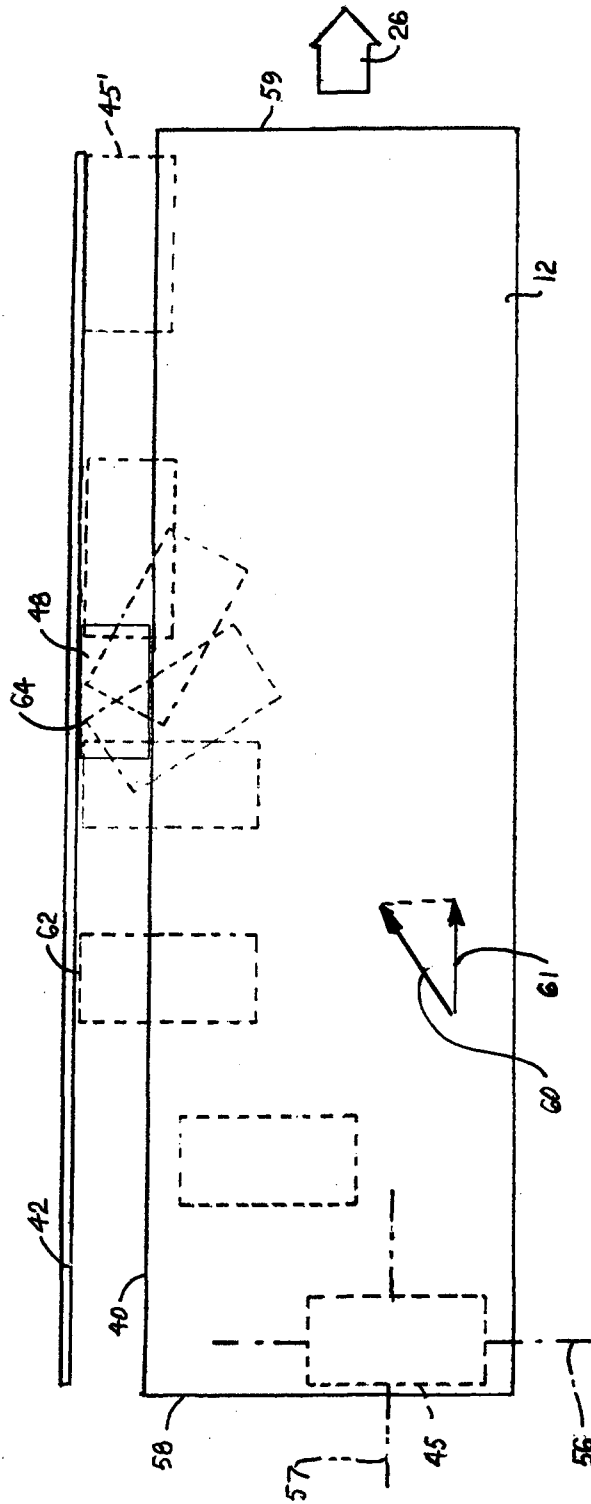


FIG. 3

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US 08/82721

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - B65G 47/24 (2008.04)

USPC - 198/411

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)

IPC(8): B65G 47/24 (2008.04)

USPC: 198/411

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
USPC: 198/411, 416, 779; - and generally all classes as limited by search terms below

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
PubWEST(USPT,PGPB,EPAB,JPAB); Google Scholar;

Search Terms Used: conveyor, turn, retarding, hold, surface, rollers, change, orientation, oblique angle, across, width

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 7,111,722 B2 (Burch) 26 September 2006 (26.09.2006); fig 1,3A-3E; col 2 ln 48-65;col 3 ln 7-15, 45-61; col 4 ln 2-20	1-12
Y	US 5,924,549 A (Risley) 20 July 1999 (20.07.1999); fig 1, 2; col 4 ln 15-16; col 5 ln 20-24, 50-58	1-12
Y	US 5,989,126 A (Kilbert et al.) 23 November 1999 (23.11.1999); Abstract, fig 1, col 4 ln 2-14	2-4, 7-10

Further documents are listed in the continuation of Box C.

* Special categories of cited documents:

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"P" document published prior to the international filing date but later than the priority date claimed

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"&" document member of the same patent family

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