

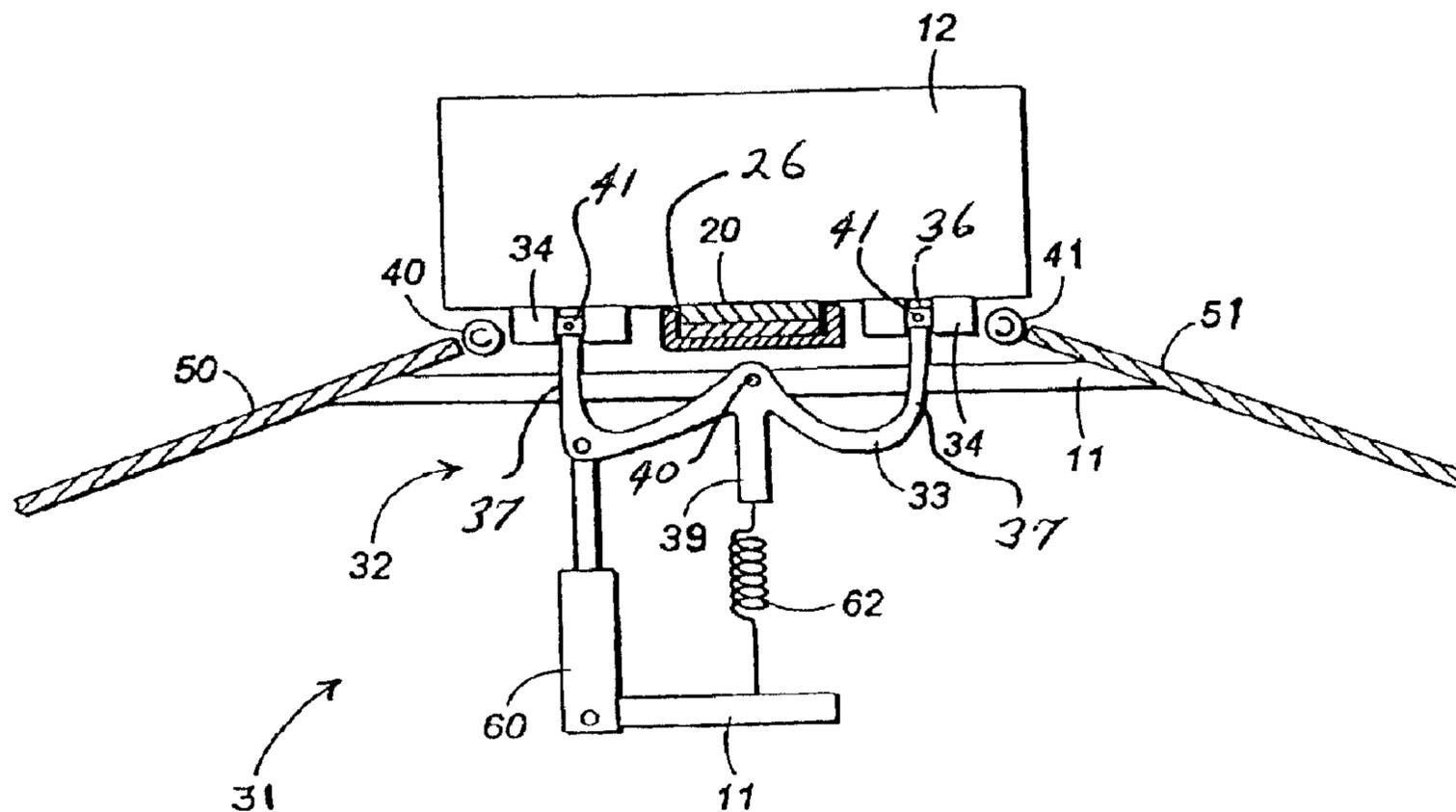


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(54) Title: CONVEYOR HAVING A CUSHIONED BELT AND HIGH SPEED DISCHARGE CAPABILITIES



(57) Abrégé/Abstract:

An automated conveyor sortation and item discharge system for conveying and discharging packages at high speeds. A conveyor assembly includes an elongate crowned conveyor belt (20), which conveys parcels in a longitudinal direction defined across slider beds (18) and across discharge stations. The parcels can take three different routes once they reach the discharge stations. The conveying assembly includes a belt having a deformable surface defined by a soft urethan crowned portion, the crowned portion deforming under the weight of the package when placed thereon, and the deformation being from its undeformed relaxed crowned shape to a deformed shape. The substantially horizontal slider bed is positioned adjacent the deformable belt, the slider belt includes a substantially horizontal planar portion lying in a plane which intersects or lies below the crowned portion of the belt when in the relaxed crowned shape. The soft urethane crowned portion and the deformable belt and the slider bed are configured to combine to support the weight of the package and the cushioned belt is configured to urge the package along the conveying axis while a part of the package is being supported by the slider bed.

CONVEYOR HAVING A CUSHIONED BELT AND HIGH SPEED DISCHARGE CAPABILITIES

ABSTRACT

An automated conveyor sortation and item discharge system for conveying and discharging packages at high speeds. A conveyor assembly includes an elongate crowned conveyor belt (20), which conveys parcels in a longitudinal direction defined across slider beds (18) and across discharge stations. The parcels can take three different routes once they reach the discharge stations. The conveying assembly includes a belt having a deformable surface defined by a soft urethan crowned portion, the crowned portion deforming under the weight of the package when placed thereon, and the deformation being from its undeformed relaxed crowned shape to a deformed shape. The substantially horizontal slider bed is positioned adjacent the deformable belt, the slider belt includes a substantially horizontal planar portion lying in a plane which intersects or lies below the crowned portion of the belt when in the relaxed crowned shape. The soft urethane crowned portion and the deformable belt and the slider bed are configured to combine to support the weight of the package and the cushioned belt is configured to urge the package along the conveying axis while a part of the package is being supported by the slider bed.

CONVEYOR HAVING A CUSHIONED BELT AND HIGH SPEED DISCHARGE CAPABILITIES

This application is a divisional application of Canadian Patent File No. 2,283,308 filed April 16, 1998.

TECHNICAL FIELD

5 This invention relates generally to automated conveying and sorting of items such as packages from one or more loading sites to a variety of output destinations and more particularly relates to a conveying system which can eject packages to either side of a high speed conveyor onto designated output chutes, bins or subsequent conveyors under programmed or manual control.

BACKGROUND OF THE INVENTION

10 Modern high volume package delivery systems often include package conveying systems that accept packages from one or more loading stations and transport the packages to a variety of output destinations such as chutes, bins and subsequent conveyor systems.

15 One of the most conventional types of conveyors is a belt conveyor, which includes the use of an endless flexible belt which passes over at least two cylindrical rollers, one of which is a drive roller. Packages are placed atop the upwardly-directed "working" surface of the belt conveyor and are transported in a generally straight direction from end of

the conveyor to the other. Another type of conveyor is a "roller" conveyor which can include powered or idling rollers which contact, support, and in certain instances propel the bottom of the package along its path.

5 Some conveying systems include diversion features which allow for the discharge of objects from a conveying surface at selected stations located along the path of the conveying surface. Some package diverting systems utilize a
1 0 pusher element mounted relative to a conveying surface which when actuated ejects an adjacently placed package laterally across the conveyor surface to the desired discharge station. Some package diverting systems include the use of diversion elements which lie along the conveyor and provide the diversion forces against the bottom surfaces of the package.

1 5 A modular diverter shoe and slat construction disclosed in U.S. Patent No. 5,127,510 to *Cotter* describes a modular diverter shoe for use in a slat conveyor. A diverter shoe is mounted to each slat so that the shoe may glide across the slat. The movement of the diverter shoe is affected by a guide pin and coaxial bearing which engages a network of guide tracks
2 0 located beneath the conveying surface. When a package is to be diverted, a diverting switch is actuated to switch the guide pins for the diverter shoe adjacent to the package onto a diagonal track, which causes the diverter shoe to move across
2 5 the slat and eject the package.

 Another apparatus for sorting objects is disclosed in U.S. Patent No. 4,732,260 to *Canziani*. In that system, a conveyor belt is described in which each conveyor element has a slit. The pusher elements are slidably inserted into the slits
3 0 and each pusher element is connected to a drive element that extends beneath the conveyor surface. The drive element is attached to rollers and interacts with a series of cams or guide rails located beneath the conveyor. The cams include an electro-pneumatic two-position end portion. In one position,
3 5 the cam engages the drive element rollers and slides the pusher

element. In a second position, the rollers do not engage the guide rails.

U.S. Patent No. 3,768,624, which issued to *Kornylak*, discloses a flexible belt conveyor system. Referring to Fig. 3, a flexible endless belt 6 travels between horizontal surfaces 16 and 18. A spring 20 extends downward from an object 14 to engage a notch in the belt 6. As a result, the object 14 travels with the belt 6 and slides across the surfaces 16 and 18. In another embodiment depicted in Figs. 1 and 2, the traveling belt 6 extends above the edges of a tube 2. A coat hanger hook 12 engages a notch (cleat 10) defined by the belt 6. As a result, the coat hanger hook 12 travels with the belt and slides upon upper portions of the tube 2 that are adjacent to the belt 6.

U.S. Patent No. 2,895,593, which issued to *McKnight et al.*, discloses another flexible belt conveyor. Referring to Figs. 10 and 11, anti-friction projections 61 or 63 can be mounted at either side of the driven belt 11.

U.S. Patent No. 3,857,487, which issued to *Meeusen*, discloses another flexible belt conveyor. Referring to Fig. 3, the surface of the conveyor belt includes resilient pads 4 with deformable projections 5. Articles 2 being conveyed rest upon the pads 4.

U.S. Patent No. 1,781,750, which issued to *Dodge et al.*, discloses a conveyor system for conveying lumber 36. As depicted in Fig. 1, the lumber 36 travels upon multiple flexible belts 12.

U.S. Patent No. 3,138,238, which issued to *De Good et al.*, discloses a conveyor system with a powered diverter. Referring to Figs. 1 and 3, the *De Good et al.* device includes a main powered conveyor 10 and a powered side conveyor 22 extending from a side of the main conveyor 10. A traveling continuous belt 20 drives the rollers 16 (Fig. 1) of the main conveyor 10, and a drive belt 24 causes conveyance of objects upon the side conveyor 22. An object traveling in the

direction defined from left to right on the main conveyor 10 is diverted to the side conveyor 22 by a powered diverter. The powered diverter includes an assembly of diverting wheels 48 (Fig. 3) that are oriented toward the side conveyor 22. The group of diverting wheels 48 are normally positioned below the tops of the rollers 16 of the main conveyor 10 so that objects traveling on the main conveyor 10 are not contacted by the diverting wheels 48. When it is desirable to divert an object from the main conveyor 10 to the side conveyor 22, the diverting rollers 48 are elevated so that they are slightly above the top surfaces of the rollers 16 of the main conveyor 10. The diverting rollers 48 are pushed upward by a device within the box 32 (Fig. 1) which pushes the belt 20 upward underneath the diverting wheels 48. The belt 20 causes the diverting wheels 48 to rotate and drive an object onto the side conveyor 22. The driven belt 24 of the side conveyor 22 draws the diverted object onto the side conveyor 22 and propels the object along the side conveyor 22.

U.S. Patent No. 1,462,511, which issued to *Lister*, discloses another conveyor diverter. Referring to Fig. 1, a side conveyor 37 extends perpendicularly from a main conveyor. Referring to Fig. 8, rollers 36 of the main conveyor are perpendicular to diverting rollers 41 that divert objects from the main conveyor to the side conveyor 37 (Fig. 1). The bed of diverting rollers 41 are in a pivoted configuration in Fig. 8 such that an object (not shown) upon the diverting rollers 41 would roll under the force of gravity across the bed of diverting rollers 41 onto the side conveyor 37 (Fig. 1).

U.S. Patent No. 5,477,955, which issued to *Madden et al.*, discloses a tilting tray conveyor system. Referring to Fig. 2, pivotably mounted trays 60 carry objects. A leg 67 extends from each tray 60. A particular tray 60 is pivoted to discharge an object when a lever 81 pushes the leg 67 of that tray 60 upward.

Although the prior art includes some advantages, a need always exists in the art for an improved conveyor sorting system which allows for high speed travel of packages while still allowing for effective side discharge, without the need for side impact.

SUMMARY OF THE INVENTION

The present invention provides an improved conveyor sorting system which allows for high speed travel of packages while still allowing for effective side discharge, without the need for side impact.

Generally described, the invention relates to a conveying apparatus comprising a belt having an deformable surface defined by a soft urethane portion, and a slider bed positioned adjacent the deformable belt, the cushioned belt and the slider belt configured to combine to support the weight of the packages, and the cushioned belt configured to urge the package along the conveying axis.

The invention further relates to a conveying apparatus comprising a two-layer crowned deformable belt including an upper deformable crowned portion and a lower, less deformable, structural portion, and a slider belt positioned adjacent the cushioned belt, the cushioned belt and the slider belt configured to combine to support the weight of the packages, and the cushioned belt configured to urge the package along the conveying axis.

The invention further relates to a conveying apparatus comprising a conveyor belt with a crowned top, the belt including an elongate substantially straight portion, and a first and second elongate support means positioned on opposing sides of the straight portion of the belt and configured to provide support at a common plane, the belt and the support means configured to combine to support the weight of the

packages, and the cushioned belt configured to urge the package along the conveying axis.

5 The invention further relates to a conveying apparatus for conveying a package having a substantially planar, downwardly-directed lower surface, the conveying apparatus comprising an endless belt having a portion lying along a substantially straight path having a longitudinal path axis, the belt defining an upper surface configured to contact the downwardly-directed lower surface of the package and to transport the package thereon while allowing the package to be tilted laterally thereon from an untilted neutral orientation to a tilted orientation, an ejection member configured to contact and urge the package such that the package is tilted from the neutral to the tilted orientation, and a withdrawal member positioned below the plane of and spaced from the downwardly-directed lower surface when the package is in the neutral orientation, but also positioned to be in frictional contact with a portion of the downwardly-directed lower surface when the package is in the tilted orientation, the frictional contact being sufficient to allow the withdrawal member to assist in the removal of the package from the belt, such that the package can be contacted and urged by the ejection member from the neutral to the tilted orientation and the withdrawal member can assist in the removal of the package from the belt.

1 0

1 5

2 0

2 5

The invention further relates to a conveying apparatus for conveying a package having a substantially planar lower surface, the conveying apparatus comprising an endless belt configured to transport a package along a conveying path, the endless belt having a crowned upper surface allowing the package to be tilted laterally atop the crowned surface such that the lower package surface can be in contact with said crowned surface yet can be tilted from a substantially horizontal to an inclined orientation, a withdrawal member having a frictionally engaging member configured to engage

3 0

3 5

the package only when tilted laterally, and means for tilting the package laterally across the longitudinal axis of the belt such that the withdrawal member frictionally engages a portion of the lower surface of the package and tends to remove the package from atop the conveyor.

5

The invention further relates to a conveying apparatus for conveying a package having a substantially planar, downwardly-directed lower surface including first and second spaced-apart lower surface portions, the conveying apparatus comprising an endless belt having a portion lying along a substantially straight path having a longitudinal path axis, the belt defining an upper surface configured to contact the downwardly-directed lower surface of the package and to transport the package thereon, the belt having a width less than that of the package to allow the package to extend laterally therefrom on both sides of the belt to provide access from below to the lower surface portions of the planar lower surface and to allow the package to be tilted laterally thereon from a neutral orientation to one of two tilted orientations, the orientations being a first and a second tilted orientation, a first ejection member configured to contact and urge the first lower surface portion of the package such that the package is tilted from the neutral to the first tilted orientation, an second ejection member configured to contact and urge the second lower surface portion of the package such that the package is tilted from the neutral to the second tilted orientation, a first withdrawal member positioned below the plane of and spaced from the downwardly-directed lower surface when the package is in the neutral orientation, but also positioned to be in frictional contact with the downwardly-directed lower surface when the package is in the second orientation, the frictional contact being sufficient to allow the withdrawal member to assist in the removal of the package from the belt, a second withdrawal member positioned below the plane of and spaced from the downwardly-directed lower surface when the

1 0

1 5

2 0

2 5

3 0

3 5

5 package is in the neutral orientation, but also positioned to be
in frictional contact with the downwardly-directed lower
surface when the package is in the second tilted orientation, the
frictional contact being sufficient to allow the withdrawal
1 0 member to assist in the removal of the package from the belt,
such that the package can be contacted and urged by the first
ejection member from the neutral to the first tilted orientation
and the first withdrawal member can assist in the removal of
the package from the belt in a first direction, and such that the
package can be contacted and urged by the second ejection
member from the neutral to the second tilted orientation and
the second withdrawal member can assist in the removal of the
package from the belt in a second direction.

1 5 The invention further relates to a conveying apparatus
for conveying a package having a substantially planar,
downwardly-directed lower surface including first and second
spaced-apart lower surface portions, the conveying apparatus
comprising an endless belt having a portion lying along a
substantially straight path having an upstream and downstream
2 0 portion both lying along a longitudinal path axis, the belt
defining an upper surface configured to contact the
downwardly-directed lower surface of the package and to
transport the package thereon, the belt having a width less than
that of the package to allow the package to extend laterally
therefrom to provide access to the lower surface portions of
2 5 the planar lower surface and to allow the package to be tilted
laterally thereon from a neutral position to a first tilted
position, a pair of slider beds on opposite sides of the first
portion of the belt, the slider beds each defining a plurality of
3 0 support portions all lying substantially in a first common
plane, a discharge station having two movable support means
each defining a plurality of support portions all lying
substantially in a second common plane, the movable support
means commonly selectively movable relative to the
3 5 longitudinal axis of the belt such that the plurality of support

portions can be selectively moved from a position in which the first common plane is common to the second common plane to a position in which the first common plane is at an angle to the second common plane.

5 Therefore, the present invention seeks to provide an improved automated conveyor sorting system.

Further, the present invention seeks to provide an improved ejection mechanism for ejecting items from a conveying surface.

10 Other aspects, features and advantages of the present invention will become apparent upon review of the following description of preferred embodiments and the appended drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a top plan view of the conveyor assembly 10 according to the present invention, showing packages moving upwardly along the page.

Fig. 2 is a downstream end, partial cross-sectional view of the apparatus 10 of Fig. 1, showing the belt 20 in cross-section. This view shows the pivoting fork assembly 32 in its "neutral" position, which would allow packages to move thereby without being discharged.

Fig. 3 is a view similar to that of Fig. 2, except that the pivoting fork assembly has been pivoted to one side, the "right" side as the figure is viewed, to a "first" pivoted position.

Fig. 4 is a view similar to that of Fig. 3, except the pivoting fork assembly has been pivoted to its "left" side as the figure is viewed, to a "second" pivoted position.

Fig. 5 is an isolated view of a portion of the crowned belt 20 according to the present invention. It should be understood that this substantially straight portion is part of an endless belt which can be driven and guided by pulleys or other means such as known in the art.

Fig. 6 is a side elevational view illustrating a package 12 atop the crowned belt 20, showing the deformation provided thereby.

DETAILED DESCRIPTION

Reference is now made in more detail to the drawings, in which like numerals refer to like parts throughout the several views.

General Discussion

Referring generally to Figs. 1-6, general discussion of the operation of the conveyor apparatus 10 according to the present invention is now made.

The conveyor assembly 10 includes an elongate crowned conveyor belt 20 which conveys parcels 12 in a longitudinal direction defined across slider beds 18, 19 and across discharge stations such as 30. The parcels (which may also be

referred to as "packages" 12) can take three different routes once they reach the discharge stations. They may be allowed to pass the discharge stations 30 and continue to be conveyed by the crowned conveyor belt 20, or they can be selectively discharged off of the crowned conveyor belt and into discharge chutes 50, 51 located to either side of the substantially straight path of the crowned conveyor belt 20.

Each of the discharge stations 30 includes a selectively indexable pivoting fork assembly 32 which includes a pair of upwardly-directed tines 37. A group of idling rollers 34 are mounted proximate each of the ends of the upwardly-directed tines 37.

The parcels 12 have sliding contact with the slider beds 18, 19 and "rolling contact" with the rollers 34 of the discharge sections 30. When a package is in the desired position, the fork member 32 can be indexed to cause one group of rollers 34, which are already in contact with the bottom surface of the package, to move upwardly and inwardly. This causes the package to tilt about the top of the crowned conveyor belt 20 until the package contacts a withdrawal roller 40 or 41 opposing the conveyor belt from the raised rollers. The withdrawal roller draws the parcels into one of two chutes 50, 51 for sorting purposes.

In the following discussion, a "primary conveying axis" will be referenced. This axis is an imaginary axis which is parallel to the travel axis of all packages as they travel under the sole influence of the crowned conveyor belt 20. This axis will be assumed to be horizontal, although it could be at least slightly inclined under other applications of the present invention.

The Slider Beds

The slider beds 18, 19 are positioned on opposite ends of the discharge station 30 and each define an upwardly-directed substantially horizontal sliding surface. In the preferred

embodiment the slider beds 18, 19 are slick pieces of sheet metal, or the like.

The upper surface of the crowned conveyor belt 20 extends slightly above the plane defined by the top surfaces of the slider beds 18, 19. As described in further detail later, this allows the crowned conveyor belt 20 to pull packages such as 12 in Fig. 1 to slide along the
5 tops of the slider beds 18, 19.

As may be understood, a package preferably does not touch both of the slider beds at the same time as it is being drawn along by the crowned conveyor belt 20; instead, the package preferably tilts to one side as it is positioned atop the crowned conveyor belt 20, such that only one slider bed is being contacted and is providing support.

10 *The Center Belt*

Fig. 5 is an isolated, partially cut-away, pictorial view of the endless crowned conveyor belt 20. The crowned conveyor belt 20 includes a lower structural belt portion 24 and an upper deformable crowned belt portion 22. The term "crowned" is meant to mean that packages, when placed atop the crowned belt and resting on either of the slider beds, do not
15 touch a corner defined by the belt; instead the curved surface of the crowned belt allows it to "roll" along the lower surface of the package. For example, if a package was placed upon the crowned belt such that it only touched one slider bed and a person pushed down on the opposite, non-contacting, side of the package, the crowned surface would laterally "roll" in contact with the undersurface of the package as the package tilted to contact the "other" side.
20 With the "crowned" nature of the belt, no corner would be encountered by the package undersurface.

When in place, the upper deformable belt portion 22 of the crowned conveyor belt 20 fits within an associated guide channel 26 and has a top portion extending above the plane defined by the top surfaces of the slider beds 18, 19.

Referring momentarily also to Fig, 6, the deformable belt portion 22 of the crowned conveyor belt 20 deforms under the weight of a parcel 12 such that portions of the deformable belt portion adjacent to the parcel 12 extend slightly higher than the bottom surface of the parcel 12 to grip the parcel 12. This provides a "gripping" feature which is believed to be advantageous.

The deformable belt 20 is endless in the preferred embodiment, although the portion shown in the Figures is substantially straight and extends between two sets of static slider beds 18 and the discharge station 30. The belt 20 is driven by means known in the art.

The Belt Guide Channel

The belt guide channel 26 is elongate and defines an upwardly-directed cavity configured to accept a length of the crowned conveyor belt 20, such that the upper crowned surface extends upwardly therefrom.

The Discharge Station 30 Generally

Fig. 1 is a top plan view of the discharge station as used in conjunction with the conveyor and the slide beds. The discharge station 30 includes a package tilting assembly 31 and a pair of withdrawal rollers 40, 41.

The tilting assembly 31 includes a pivoting fork assembly 32, a two-way actuator 60 and a return spring 62.

The pivoting fork assembly 32 includes a fork member 33, a pair of parallel support rods 35, four idler roller stub shafts 36 and eight idler rollers 34. It may be understood that more than one tilting assembly may be used in conjunction with one.

The Withdrawal Rollers

The withdrawal rollers are positioned outside of the package tilting assembly 31. These withdrawal rollers 40, 41 are also positioned at the inlets to the discharge chutes 50, 51 and aid in the transfer of parcels 12 onto the discharge chutes 50, 51.

In the preferred embodiment, the withdrawal rollers 40, 41 are rotatably mounted along axes which are substantially horizontal and coparallel with the travel axis of the crowned conveyor belt 20. The withdrawal rollers 40, 41 can be driven to enhance the transfer of parcels 12 onto the discharge chutes 50, 51. As depicted in Fig. 2, the withdrawal rollers 40, 41 do not make contact with the parcels 12 when the fork 33 is not pivoted to a discharge position. As depicted in Figs. 3 and 4, the withdrawal rollers 40, 41 do make contact with the parcels 12 when the fork 33 is pivoted to a discharge position, which results in withdrawal of the package by the withdrawal roller.

The Package Tilting Assembly

The package tilting assembly 31 includes a pivoting fork assembly 32, a two-way actuator 60 and a return spring 62.

Generally described, the package tilting assembly 31 is configured to tilt packages which are atop the crowned conveyor belt 20 such that the packages can engage and be withdrawn by the withdrawal rollers 40.

The pivoting fork assembly 32 includes a fork member 33, a pair of parallel support rods 35, four idler roller stub shafts 36 and eight idler rollers 34.

The fork member 33 is generally W-shaped and is pivotably mounted at pivot 40 relative to the frame 11 of the apparatus 10 of the present invention about an axis which is generally parallel to the primary conveying axis. The fork member 33 includes a pair of upwardly-directed tines 37 and an elongate, downwardly-directed spring mounting member 39.

Fixed at the end of each of the tines is one of two corresponding parallel support rods 35, which have longitudinal axes which are substantially coparallel with the primary conveying axis. The ends of the tines attach to central portions of the parallel support rods 35 as shown

in the Figures, such that the leading and trailing ends of the parallel support rods 35 are oriented respectively upstream and downstream relative to the conveying direction.

5 Attached to the leading and trailing ends of the parallel support rods 35 are the shorter stub shafts 36, which are oriented such that their longitudinal axes are parallel to each other and perpendicular relative to the conveying axis. Two idler rollers 34 are rotatably mounted to each stub shaft 36, one roller 34 at each end. The idler rollers 34 rotate about the longitudinal axis of their associated stub shafts through pivots 41.

10 As discussed in detail later, the pivoting fork assembly 32 performs an ejecting function. For this reason, the pivoting fork assembly could be thought of as having two synchronized "ejection members", each of which includes one tine 37 of the fork member, one parallel support rod 35, two idler roller stub shafts 38 and four idler rollers 34.

15 Also as discussed in detail later, when in their "neutral" locations as shown in Fig. 2, the idler rollers are positioned such that their uppermost surfaces are in the same plane as the top surfaces of the slider beds 18. However, when the pivoting fork assembly 32 is indexed to either side as shown in either of the configurations shown in Figs. 3 or 4, some of the idler rollers go above this plane and some go below the plane. The idler roller stub shafts 36 are pivotably attached relative to the parallel support rods 35, to allow the above-the-plane rollers 34 to remain in contact with the underside of the packages 12. Again as shown in Figs. 3 and 20 4, when the pivoting fork assembly 32 is indexed to either side, the stub shafts pivot at 41 relative to the fork member 33 to accommodate the relative pivoting of the package as it is lifted.

25 As shown in Figs. 2, 3 and 4, a linear force actuator 60 has one end connected to one of the two tines 37 of the fork member 33 and its other end to the frame 11 of the apparatus. This is a double-acting actuator 60 and is configured to cause the pivoting of the pivoting fork

assembly 32 from its "neutral" position shown in Fig. 2 to either of its "first" or "second" pivoted positions shown respectively in Figs. 3 or 4. By expanding, the linear force actuator 60 causes the pivoting fork assembly 32 to pivot from its "neutral" position to its first pivoted position shown in Fig. 3. By contracting, the linear force actuator 60 causes the pivoting fork assembly 32 to pivot from its "neutral" position to its second pivoted position shown in Fig. 4.

The actuator 60 is a dual-action pneumatic cylinder, although other motive means may be provided without departing from the spirit and scope of the present invention.

As shown in Figs. 2, 3 and 4, the fork member 33 includes an elongate spring mounting member 39 which extends downwardly from the pivot point location 40 of the fork member 33. A tensile return spring 62 has one end attached to the lower end of the spring mounting member 39 and its other end attached to the frame 11 of the apparatus 10. Therefore it may be seen that the pivoting fork assembly 32 is biased into its neutral position by the return spring 62, that seeks to maintain the top surfaces of the idler rollers 18 even with the plane defined by the upper surfaces of the static slider beds 18, 19 (Figs. 1 and 2).

Operation

Operation is as follows. A package 12 is placed on the crowned conveyor belt 20 at an upstream location. The package is drawn towards the discharge station 30. At this point, the parcels (which may also be referred to as "packages" 12) can take three different routes once they reach the discharge stations. They may be allowed to pass the discharge station 30 and continue to be conveyed by the crowned conveyor belt 20, or they can be selectively discharged off of the crowned conveyor belt and into discharge chutes 50, 51 located to either side of the substantially straight path of the crowned conveyor belt 20. If they are to be

allowed to pass the discharge station, the actuator 60 is simply not energized and the package slides off the first, "upstream" set of slider beds 18, 19 onto the idler rollers 34 and then off the idler rollers onto the second, "downstream" set of slider beds 18, 19.

5 However, if discharge is desired, the actuator 60 will have to be energized. Actuation of the actuator to index the package tilting assembly 31 from its neutral position in Fig. 2 to its "left discharge" (as viewed) configuration in Fig. 4 is discussed as an example, although the "right discharge" would operate in a similar manner.

10 Referring now to Figs. 2 and 4, upon retraction of the actuator 60, the pivoting fork assembly 32 of the package tilting assembly 31 moves from its "neutral" position shown in Fig. 2 to its pivoted positions shown in Fig. 4. By retracting, the linear force actuator 60 causes the left side idler rollers 34 to be moved downwardly and away from contact with the bottom of the package 12. Conversely, the right side rollers are urged upwardly and slightly to the left, lifting the right side of the package such that it tilts to its left and eventually contacts the left side powered withdrawal roller 40. It may be understood that the downward movement of the left side idler rollers 34 "clears the way" for such tilting, which would not be possible if the left side idler rollers 34 had not moved. This is an important feature of the invention.

15 As noted above, the idler roller stub shafts 36 which support the idler rollers are pivotably attached at 41 relative to the parallel support rods 35, to allow the above-the-plane rollers 34 to remain in contact with the underside of the packages 12. Again referencing Fig. 4, when the pivoting fork assembly 32 is indexed as shown, the stub shafts pivot about pivot 41 relative to the fork member to accommodate the relative pivoting of the package as it is lifted.

Timing

25 The timing of the apparatus may be varied as known in the art to provide suitable discharge characteristics. However,

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for a belt speed of 500 FPM (feet per minute), it is believed that a fork ejection cycle would be in the range of 1 second.

Construction

5 The deformable belt portion 22 of the crowned conveyor belt 20 is preferably made of soft urethane, which slightly deforms during support of typical packages.

The lower structural belt portion 24 of the crowned conveyor belt 20 is preferably made of conventional belt material.

10 The apparatus is configured to accept and manipulate packages being 2 to 3 feet wide, and 2 to 5 feet long.

It should be understood that various alternates are possible without departing from the spirit and scope of the present invention. For example, instead of individual rollers, belted rollers could be used.

Conclusion

20 While this invention has been described in specific detail with reference to the disclosed embodiments, it will be understood that many variations and modifications may be effected within the spirit and scope of the invention as described in the appended claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A conveying apparatus for conveying a flat bottomed package thereon, said conveying apparatus comprising:

a belt having a deformable surface defined by a soft urethane crowned portion, said crowned portion deforming under the weight of said package when placed thereon, said deformation being from its undeformed relaxed crowned shape to a deformed shape; and

a substantially horizontal slider bed positioned adjacent said deformable belt, said slider bed including a substantially horizontal planar portion lying in a plane which intersects or lies below said crowned portion of said belt when in said relaxed crowned shape;

said soft urethane crowned portion and said deformable belt and said slider bed configured to combine to support the weight of said package and said cushioned belt configured to urge said package along said conveying axis while a part of said package is being supported by said slider bed.

2. The conveyor apparatus as claimed in claim 1, wherein said belt is a composite two layer belt with an upper layer comprised of said soft urethane and a lower layer comprising of structural belt material.

3. The conveyor as claimed in claim 1, wherein said deformable belt is configured to deform upon placement of a package thereon, such that two shoulders are provided on the belt which bias against the leading and trailing walls of said package.

4. The conveyor as claimed in claim 1, wherein said belt has a crowned configuration as viewed along its transverse cross-section.

5. A conveying apparatus for conveying a flat bottomed package thereon, comprising:

a two-layer crowned deformable belt including an upper deformable crowned portion and a lower, less deformable, structural portion; and

a substantially horizontal slider bed positioned adjacent said deformable belt, said belt and said slider bed configured to combine to support the weight of said package and said cushioned belt configured to urge said package along said conveying axis.

6. The conveyor as claimed in claim 5, wherein said upper deformable crowned portion belt is composed of soft urethane.

7. A conveying apparatus for conveying a flat bottomed package thereon, said conveying apparatus comprising:

a conveyor belt with a crowned top, said belt including an elongate substantially straight portion, said crowned top deforming under the weight of said package when placed thereon, said deformation being from its undeformed relaxed crowned shape to a deformed shape; and

first and second elongate planar support means positioned on opposing sides of said straight portion of said belt and configured to provide support at a common plane, said plane intersecting or lying below said crowned top of said conveyor belt when said package is not positioned thereon;

said belt and one of said first and second support means configured to combine to support the weight of said package and said cushioned belt configured to urge said package along said conveying axis.

8. The conveyor as claimed in claim 7, wherein said first and second support means are first and second substantially planar slider beds.

9. The conveyor as claimed in claim 7, wherein said first and second support means are first and second idler rollers.

10. The conveyor as claimed in claim 7, wherein said conveyor belt is a cushioned belt made of soft urethane.

11. The conveyor as claimed in claim 10, wherein said conveyor belt is a two layer belt and said cushioning is provided in its upper layer.

12. The conveyor as claimed in claim 7, wherein said belt when deformed by a package defines an engaging shoulder to assist to urge said package along said conveying axis.

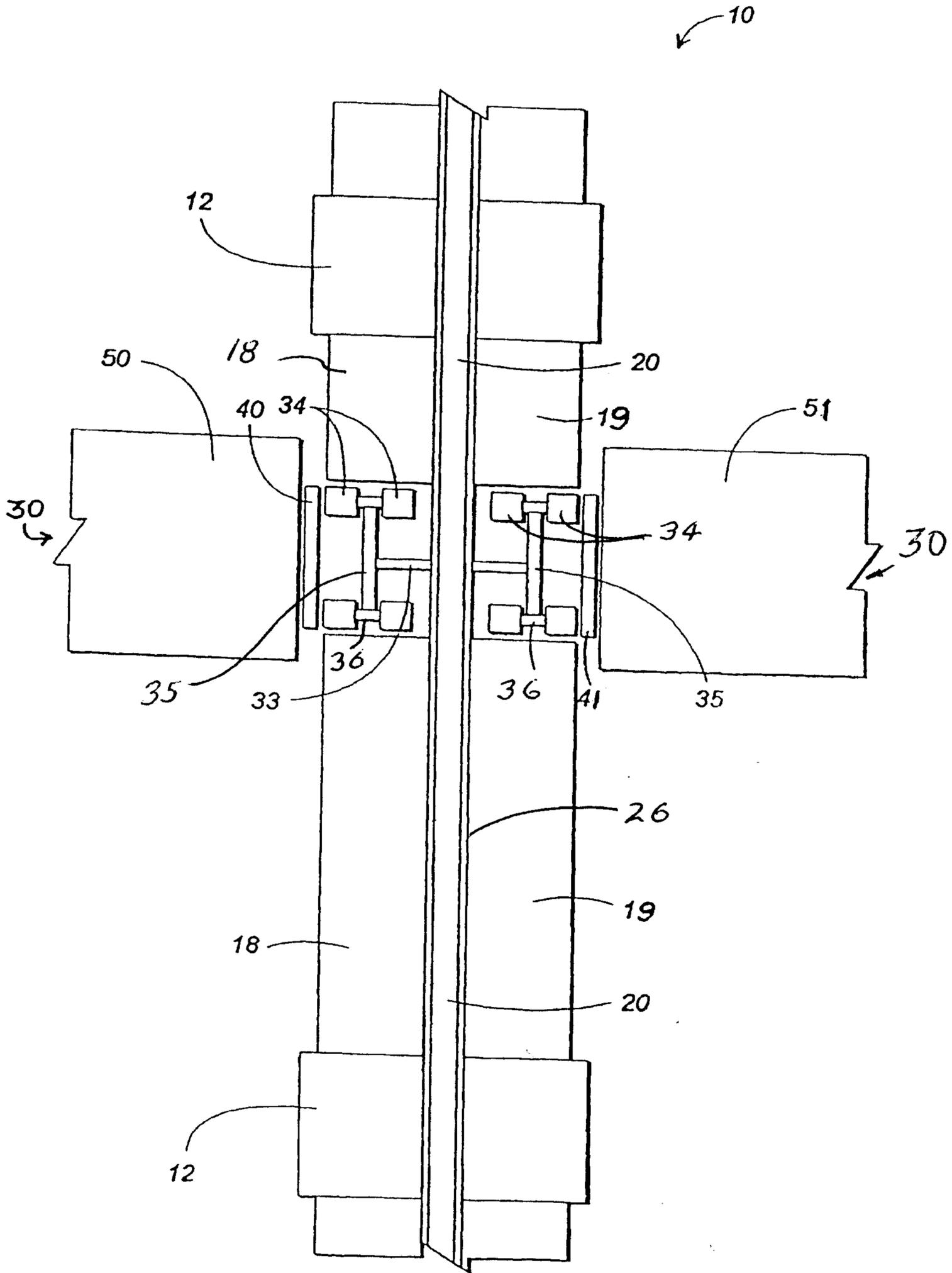


FIG. 1

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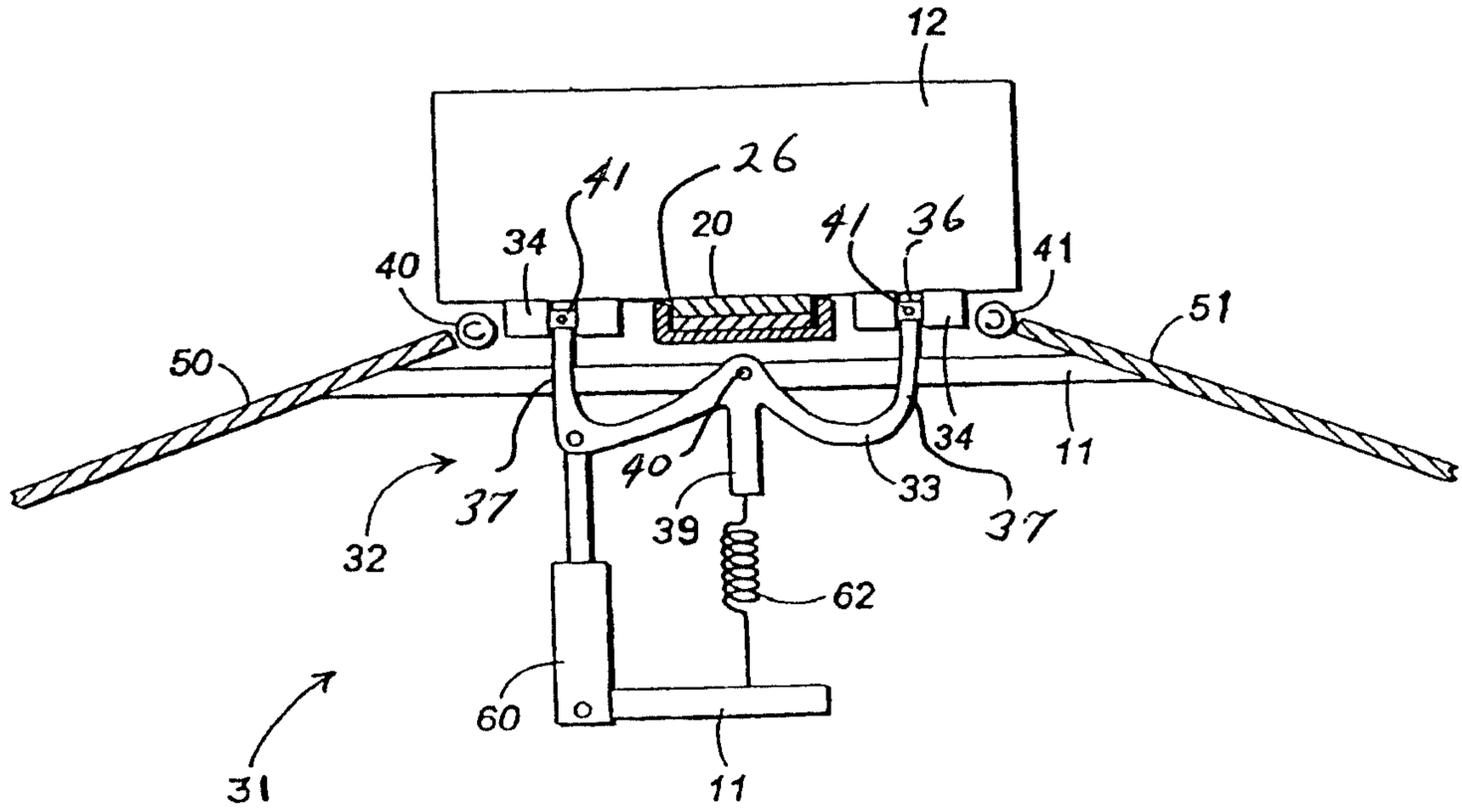


FIG. 2

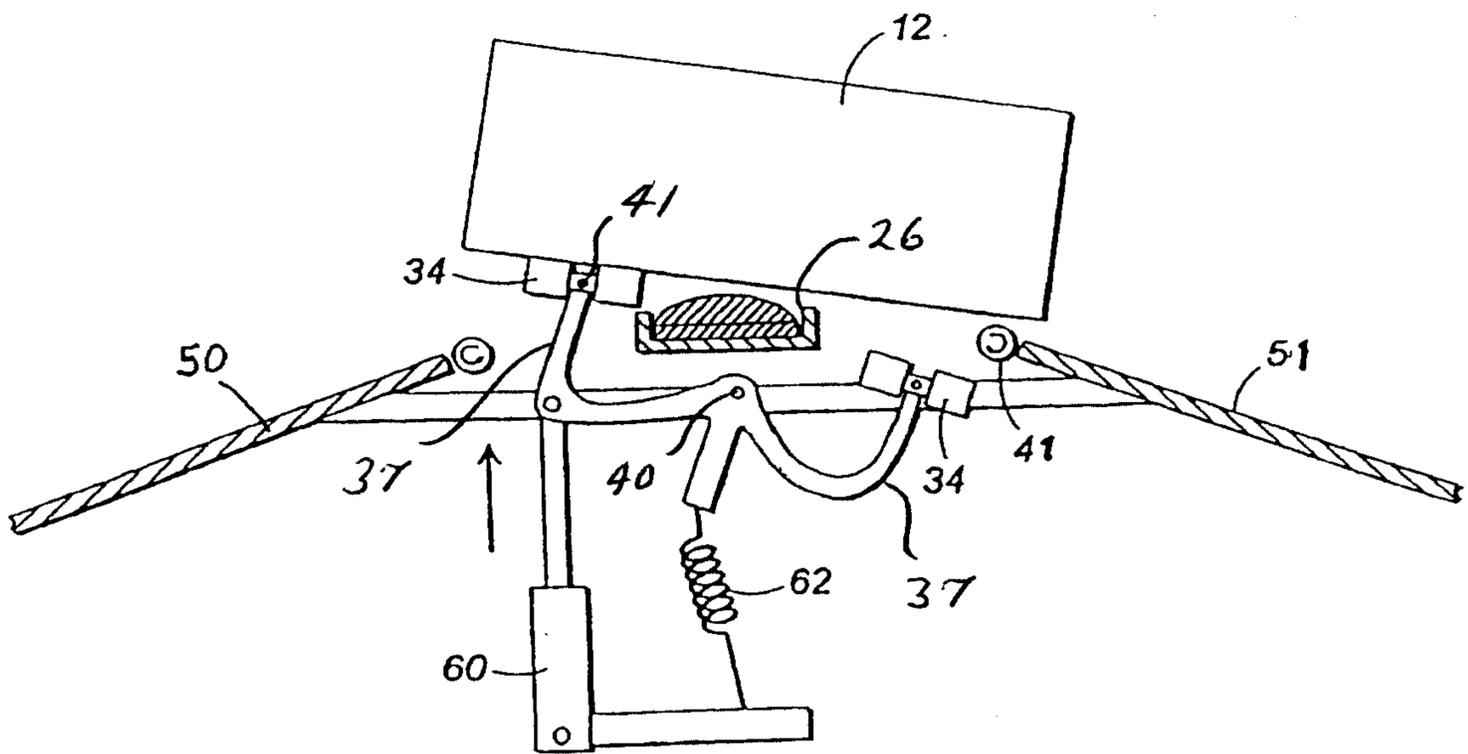


FIG. 3

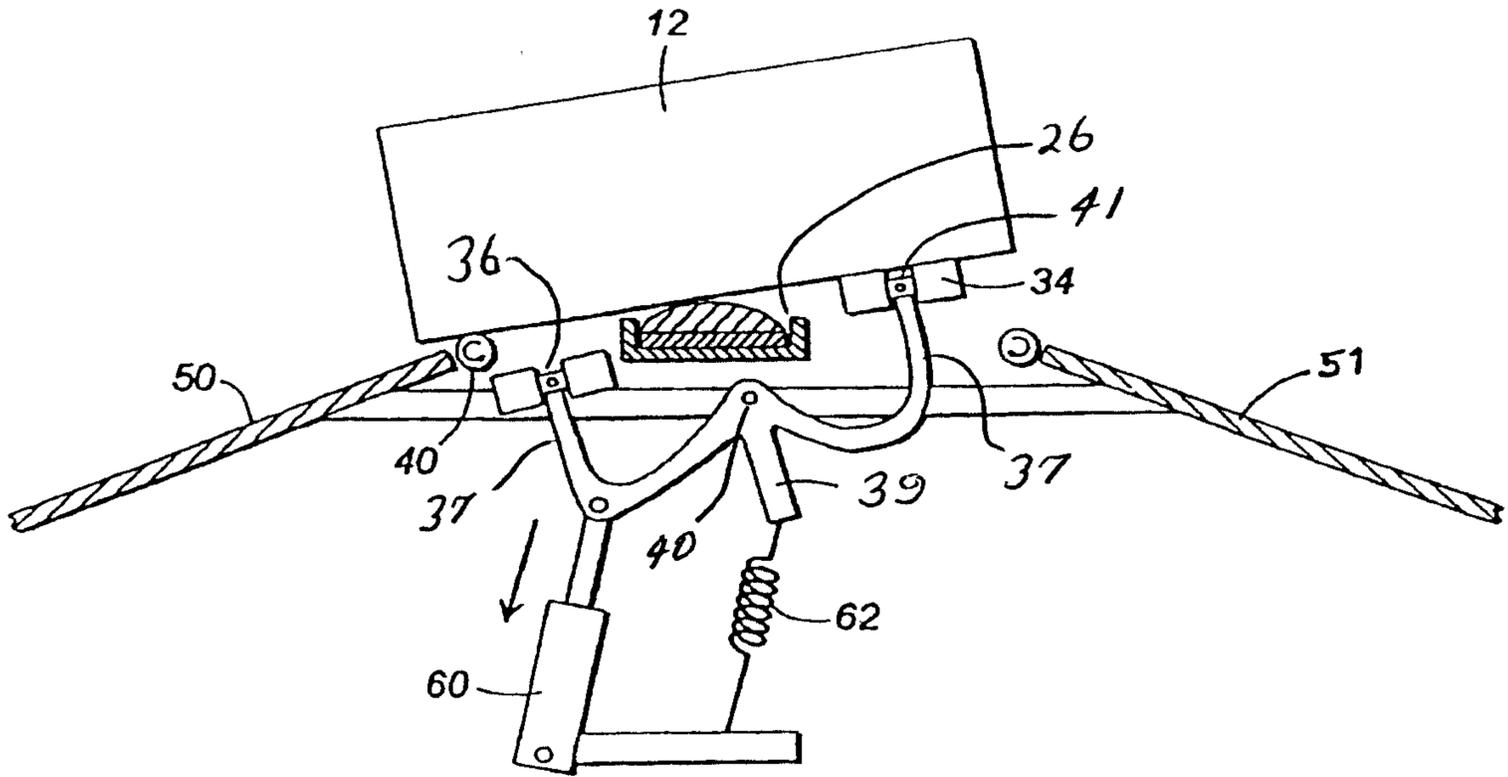


FIG. 4

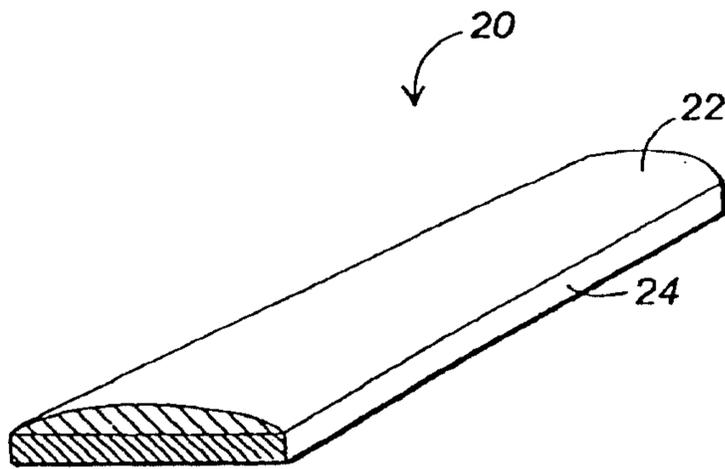


FIG. 5

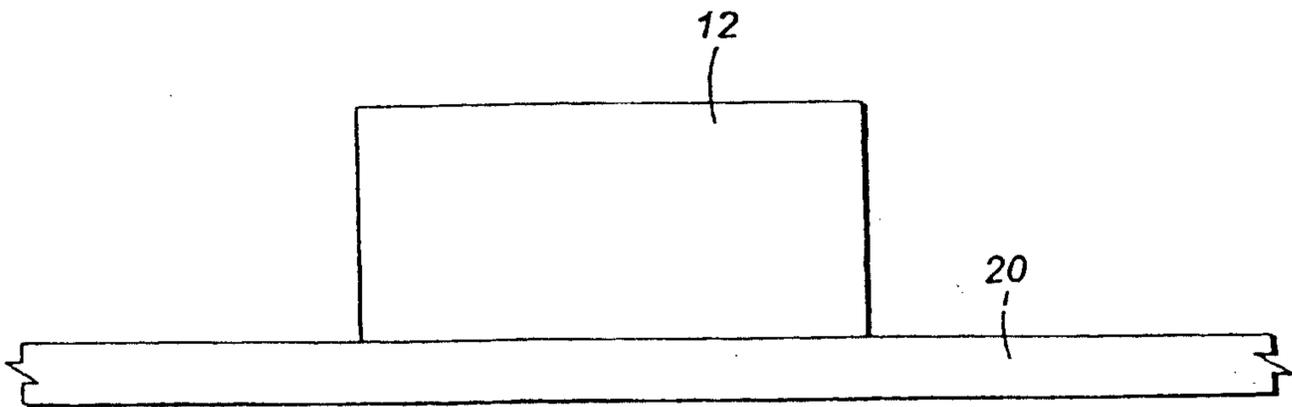


FIG. 6

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