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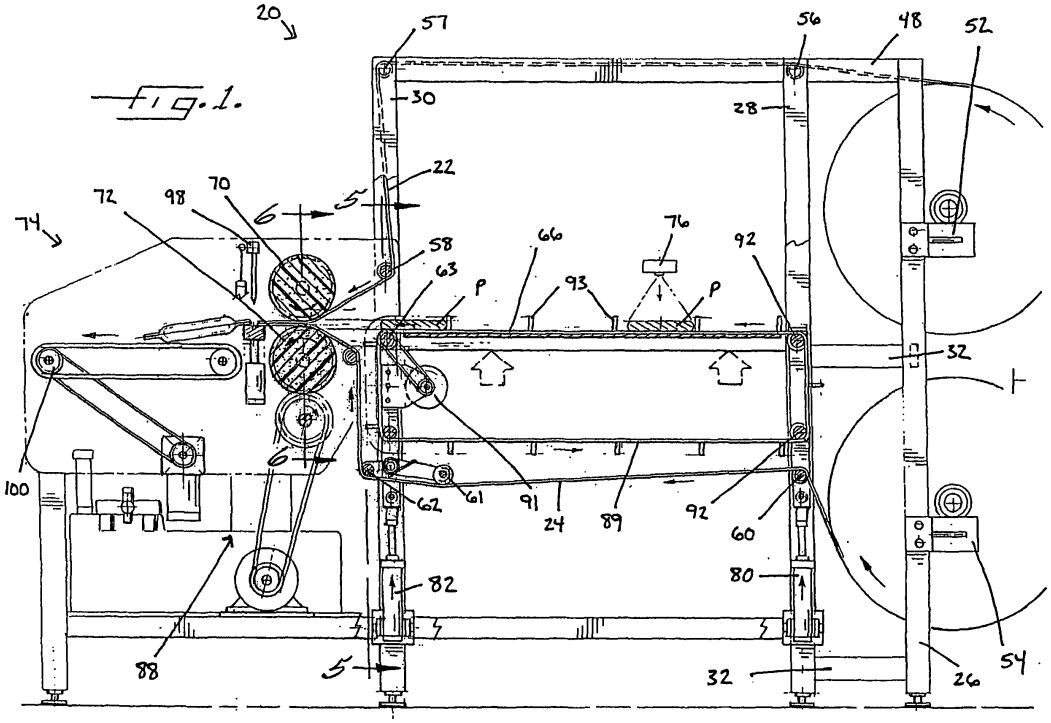
(54) Adjustable infeed bed for packaging apparatus

(57) An apparatus (20) for packaging an object (P), the apparatus (20) having an adjustable infeed bed (40) to center the object (P) before a nipping operation. The packaging apparatus (20) includes a pair of opposing rollers (70,72) and an adjustable infeed bed (40). The pair of opposing rollers (70,72) pushes together sheets of packaging material against each other and the object or product (P) to be package. In order to accommodate objects of various heights, the infeed bed (40) is adjustable so as to line up the center of the object to the center of the rollers (70,72). To determine the proper adjustment to the infeed bed, the packaging apparatus (20) may also include a height detector (76) for measuring a height dimension for an object.



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Description

FIELD OF INVENTION

[0001] The present invention relates to machines and methods for packaging objects using flexible or semi-flexible sheet materials, wherein an object is disposed between two portions of sheet material and the two portions are sealed together about the periphery of the object to form a package.

BACKGROUND OF THE INVENTION

[0002] Flexible packaging has long been used to package products such as books, compact discs, cassette tapes, and a host of other types of objects to provide protection when shipping or mailing the objects, and in some cases to hermetically seal the objects from the outside environment. Web-handling machines have been developed to automate the process of packaging objects in flexible packaging materials. Dual-web machines bring a pair of webs into generally parallel confronting relation with each other and feed a product, or a group of products, between the webs. Longitudinal or side seals are then effected to seal the webs together along their side edges, and transverse or cross seals are similarly made ahead of and behind the packaged product(s), thus forming a package containing the product(s). The package is severed from the remainder of the webs to complete the process. Single-web machines work similarly, except a single web is either supplied to the machine as a C-fold, or a flat web is manipulated and folded into a C-fold configuration, the objects to be packaged are inserted between the two opposing portions of the C-folded web, and one longitudinal seal and two cross seals are formed.

[0003] Single-web machines typically include a longitudinal seal device such as a pair of rollers or the like forming a nip through which the overlying longitudinal edges of the opposing web portions pass to effect a longitudinal seal on one side of the package. Dual-web machines include a similar longitudinal seal device through which the opposite longitudinal edges of the web portions pass to effect an opposite longitudinal seal. The longitudinal seal devices can apply pressure alone where cold seal materials are employed, or can apply pressure and heat in the case of heat-seal materials. The longitudinal seal devices are spaced apart by a distance corresponding to the width of the web material. Typically this distance is fixed, such that the machine is able to handle only one width of material.

[0004] With conventional machines, a problem that frequently arises is that the packaged object is not centered between the pair of rollers or the like that form the nip in the thickness direction of the object, i.e., in a direction normal to the surfaces of the web portions. If the object is offset in the thickness direction toward one roller, the frequent result is that the overlying longitudinal edges of the web portions are not properly aligned with each other; the edge (or both edges in the case of a dual-web machine) of the web portion toward which the object is offset tends to be pulled transversely inward toward the longitudinal centerline of the web portion because the web portion must curve outward to a greater extent than the other web portion. This results in package edges that are unsightly.

[0005] Another problem with many types of flexible packaging machines of the above-noted type is that the web materials tend to become wrinkled as a result of being forced to bend and curve around the contour of the object being packaged. In some cases, no attempt is made to eliminate the wrinkling, and the result is that packages are made that are not very aesthetically pleasing. The problem tends to become worse as the height or thickness of the packaged object increases, since the web material is forced to curve and bend to a greater extent. Furthermore, different types of web materials behave differently with respect to wrinkling. Therefore, the conventional machines are not well suited to packaging a variety of objects of different thicknesses, sizes, and shapes, since a machine set-up that may minimize wrinkling for one object configuration and/or one type of web material may not work well for a different object configuration and/or different web material.

[0006] In light of the above considerations, a more versatile packaging machine and method are needed, able to handle various object configurations, including varying heights.

BRIEF SUMMARY OF THE INVENTION

[0007] The present invention addresses the above needs and achieves other advantages by providing an apparatus for packaging an object, with an adjustable infeed bed to center the object before a nipping operation. In general, the apparatus includes a pair of opposing rollers that form a nip, an adjustable infeed bed, and a height detector. Two opposing packaging material sheets are passed through the nip with an object disposed therebetween, and the sheets of packaging material are sealed together around the object to form a package. The infeed bed receives an object to be packaged and feeds it into the nip between the sheets. The infeed bed is adjustable for centering the object in its height direction relative to the nip based on the measurement from the height detector.

[0008] In other aspects of the present invention, the adjustable infeed bed may have an upstream end and downstream end. In some embodiments, the downstream end is adjustable relative to the opposing rollers, while in other embodiments, both the downstream and upstream ends are adjustable to the rollers. The apparatus may further include at least one actuator such as a pneumatic cylinder, hydraulic cylinder, electric motor or the like for adjusting the infeed bed. The infeed bed may have at least two positions for centering the object between the rollers. In one embodiment, the adjustable

infeed bed may include a conveying belt for advancing the object toward the opposing rollers. Alternatively, the adjustable infeed bed may include an upper surface arranged to support one of the packaging material sheets in such a manner that the sheet supports and advances the object toward the rollers.

[0009] In at least one embodiment, each roller includes a resiliently compliant roller portion that is deformed by the object between the packaging material sheets. The resiliently compliant roller portion has a tendency to return to its undeformed shape. This tendency exerts pressure on the packaging material to closely conform to the object being packaged.

[0010] In another embodiment, the present invention provides an apparatus for packaging an object. The apparatus includes a pair of opposing rollers, a web supply system, and an adjustable infeed bed. The rollers together form a nip. The web supply system supplies a pair of generally opposing web portions of flexible packaging materials into the nip, so that an object placed between the web portions passes through the nip along with the web portions. The facing surfaces of the web portions have a sealing material for sealing the web portions together as the portions pass through the nip and form a package around the object. The adjustable infeed bed is for advancing the object to the rollers so that the object is fed into the nip between the web portions. The position of the infeed bed relative to the rollers is adjustable in order to adjust the position of the object relative to the nip in a height direction of the object.

[0011] The infeed bed has a downstream end and an upstream end. In one embodiment, the infeed bed includes at least one actuator such as a pneumatic cylinder or the like for adjusting the position of the downstream end relative to the rollers. In other embodiments, the infeed bed may further include at least one actuator, such as a pneumatic cylinder or the like for adjusting the upstream end relative to the rollers. Also, the apparatus may further comprise a height detector for measuring the height of the object to determine the proper adjustment to the infeed bed.

[0012] According to another embodiment of the invention, a method is provided for packaging an object or product. The method includes advancing a pair of packaging material sheets along two paths that converge into and through a nip formed by two opposing rollers, determining a dimension of an object to be packaged in a height direction, centering the object relative to the nip in the height direction, feeding the centered object in the nip between the two packaging material sheets, and sealing the sheets together around the object. The method may also include measuring the height of the object with a height detector.

[0013] In yet another embodiment of the invention, a method of packaging an object includes placing the object on an infeed bed, adjusting the position of the infeed bed so that a center of the object in a height direction thereof is substantially aligned with a nip formed by a pair of opposing rollers, advancing the obj ect along the infeed bed to the opposing rollers and between two portions of a packaging material, and advancing the object and the portions through the nip and enclosing the object between the portions to form a package. The method may also include measuring the height of the object. For example, the height may be determined with a height detector, Furthermore, the method may include a step of sending a signal from the height detector to a controller and activating one or more pneumatic cylinders or the like to adjust the infeed bed based on the signal sent to the controller.

[0014] The present invention has several advantages. The adjustable infeed bed allows the packaging to accommodate objects of various heights. More specifically, the infeed bed aligns or centers each object relative to the rollers based on the object's height. The centering results in a more symmetric and aesthetic package and reduces any stress variances within the package. Also, the height detector can provide the necessary information to set the infeed bed in an automatic fashion.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING(S)

[0015] Having thus described the invention in general terms, reference will now be made to the accompanying drawings, which are not necessarily drawn to scale, and wherein:

Figure 1 is a side view of a packaging apparatus in accordance with one embodiment of the invention, partially broken away to display the adjustable infeed bed;

Figure 2 is a side view of the packaging apparatus as shown in Figure 1 with the adjustable infeed bed in a comparatively lower position for a taller object than in Figure 1;

Figure 3 is a perspective view of the downstream end of the infeed bed according to one embodiment of the present invention;

Figure 4 is a cross-section view the infeed bed taken along line 4-4 of Figure 3;

Figure 5 is another cross-section view of the packaging apparatus taken along line 5-5 of Figure 1; and

Figure 6 is yet another cross-section of the packaging apparatus taken along line 6-6 of Figure 1.

DETAILED DESCRIPTION OF THE INVENTION

[0016] The present inventions now will be described more fully hereinafter with reference to the accompanying drawings, in which some but not all embodiments of the inventions are shown. Indeed, these inventions may be embodied in many different forms and should not be construed as limited to the embodiments set forth herein; rather, these embodiments are provided so that this disclosure will satisfy applicable legal requirements. Like

numbers refer to like elements throughout.

[0017] A packaging apparatus 20 in accordance with one embodiment of the invention is shown in Figures 1 and 2. The apparatus 20 is of the dual-web type for advancing a first or upper web 22 and a second or lower web 24 in generally parallel opposing relation with a product P disposed between the webs 22, 24 and sealing the webs 22, 24 together to capture the product P therebetween. The packaging apparatus 20 includes a main frame having a plurality of spaced vertical support columns. More specifically, the main frame has three pairs of vertical columns 26, 28, 30. Each pair 26, 28, 30 has a column on one side of a longitudinal axis of the apparatus 20, and a corresponding support column on the opposite side of the longitudinal axis. One or more transverse members are rigidly connected between each pair of support columns 26, 28, 30. Upper and lower longitudinal members 32 are rigidly connected between the support columns of 26 and 28 on the same side of the longitudinal axis. The frame also includes a pair of upper longitudinal members 48. The upper ends of the vertical support columns 26, 28, 30 on one side of the longitudinal axis rigidly connect to one of the upper longitudinal members 48, as shown in Figures 1 and 2. Similarly, the upper ends of the vertical support columns 26, 28, 30 on the other side of the longitudinal axis rigidly connect to the other upper longitudinal member which is not visible in the drawings. As described in more detailed below, an infeed bed 40 is positioned between two pairs of the vertical support columns 28, 30.

[0018] The upstream columns 26 support web mounts 52, 54 that respectively support supply rolls of the webs 22, 24 in a rotatable manner. The upper web 22 is drawn from its supply roll and advanced over a guide 56 supported between the two upper longitudinal members 48 then over and around a guide 57 also supported between the upper longitudinal members 48 and spaced longitudinally downstream from the first guide 56, then downward to a guide 58 supported between the columns 30 and then toward a pair of rollers 70, 72 discussed in more detail below.

[0019] The lower web 24 is drawn from its supply roll and advanced over a lower guide 60 supported between columns 28 then under a downstream guide and web tensioner 61 pivotally supported by columns 30 then under and around a guide 62 supported by columns 30, then around a guide 63 also supported by columns 30 and then toward the pair of rollers 70.

[0020] In general, according to the illustrated embodiments the lower web 24 traverses a path under the infeed bed 40 and then toward and into the pair of rollers 70, 72. However in an alternative embodiment, not shown, the path of the lower web 24 may proceed over, rather than under, the infeed bed 40. More specifically, the lower web 24 can advance along a general planar upper surface 66 of the infeed bed 40.

[0021] As shown in Figures 1 and 2 and as stated above, the apparatus 20 includes a pair of rollers 70, 72 that are rotatably mounted in the main frame at a downstream end thereof. The rollers 70, 72 form a nip through which the webs 22, 24 are advanced with the product P to be packaged disposed therebetween. As best seen in Figure 6, one or both of the rollers 70, 72 comprises a resiliently deformable material at least over a medial portion 85 of the roller's length, such that the passage of the product P through the nip deforms the roller(s) 70, 72 and the restoring force of the resiliently deformable material presses the webs 22, 24 toward each other so that the packaging material from the webs 22, 24 conforms closely to the product P and helps to push out the air that otherwise would be trapped between the product and material. The webs 22, 24 advantageously have cold seal or cohesive material on their facing surfaces such that the application of pressure by the rollers 70, 72 causes the webs 22, 24 to adhere to each other but not to the product P. The end portions 87 of each of the rollers 70, 72 advantageously comprise a generally non-deformable or substantially less-deformable material for firmly gripping the opposite edge portions of the webs 22, 24. As seen in Figures 1 and 2, the rollers 70, 72 advantageously are rotatably driven for advancing the webs 22, 24 through the apparatus 20, thus comprising a web drive system. Alternatively, a separate web drive system can be employed if desired.

[0022] As best seen in Figures 1 and 2, the apparatus 20 may also have a housing 74 to shield or cover the rollers 70, 72. The housing 74 preferably is pivotable relative to the main frame about hinges (not shown) for access to internal parts of the machine when required for maintenance and the like.

[0023] As mentioned above, the infeed bed 40 has a generally planar upper surface 66. This surface 66 supports a conveying mechanism for advancing the product P to be packaged to the rollers 70, 72. For example, the conveying mechanism may be a conveyor belt 89 that rotates around the infeed bed 40, as best seen in Figure 3. More specifically the conveyor belt 89 rotates around a general perimeter of the infeed bed 40. The belt 89 is driven by a motor 91 that drives one of four belt guides 92 proximate to each corner of the infeed bed 40. The belt 89 may also have a series of dividers or pushers 93 that extend generally perpendicular to the belt 89. The pushers 93 facilitate the advancement of the product or products P along the belt 89.

[0024] Alternatively, in embodiments where the lower web 24 runs along the upper surface 66 of the infeed bed 40, the lower web 22 will function as a conveyor and advance the product P to the rollers 70, 72. The product P may be placed on the conveying mechanism either manually by an operator or automatically by another conveyor belt (not shown) that leads to the infeed bed 40.

[0025] Preferably, the center of the product P in its height direction is aligned with the nip formed by the rollers 70, 72. This facilitates a more symmetric package, reduces misalignment between the edges of the two webs 22, 24, and reduces any stress variation within the

packaging material. Advantageously, the position or orientation of the infeed bed 40, and more specifically the upper surface 66, is adjustable relative to the rollers 70, 72. The position or orientation of the upper surface 66 is adjusted so that the center the product P in the height direction is aligned or lined up with the nip between the rollers 70, 72. This adjustability allows for the packaging apparatus 20 to accommodate a variety of products P of differing heights.

[0026] In order to determine the proper adjustment to the upper surface 66, the apparatus 20 may also have a height detector 76 for measuring the height of the product P. Based on the height of the product P, the proper adjustment to the upper surface 66 may be determined. The height detector 76 can comprise various types of devices, including but not limited to an optical distance-measuring device such as a laser distance-measuring device. The height detector 76 is preferably mounted above the infeed bed 40 and is positioned and aimed down onto the upper surface 66, as illustrated in Figures 1 and 2.

[0027] Adjusting the upper surface 66 can be accomplished in several ways. For example purposes only, and not as a limitation, the adjusting of the upper surface 66 may be accomplished by one or more hydraulic or pneumatic cylinders controlled by suitable fluid valves. Alternatively, an electric motor driving a suitable mechanism (e.g. gears, chains, etc.) may be used. One skilled in the art would appreciate that various methods and structures are available to adjust the upper surface 66, including examples not mentioned herein.

[0028] In the illustrated embodiment, the infeed bed 40 is adjusted by two pairs of pneumatic cylinders 80 (only one is visible in Figure 1 and 2) and 82 (as shown in Figure 3). More specifically one pair 80 is located at the upstream end of the infeed bed 40 and the other pair 82 is located at the downstream end of the infeed bed 40. Figure 1 illustrates the pneumatic cylinders 80 and 82 having adjusted the infeed bed 40 to a raised position for a relatively thin product P. Alternatively, Figure 2 illustrates the pneumatic cylinders 80 and 82 having adjusted the infeed bed 40 to a lowered position for a relatively thick product P.

[0029] In particular, as shown in Figure 5, each pneumatic cylinder 80, 82 is rigidly attached between one of the vertical columns 28, 30 of the main frame and rigidly attached to the infeed bed 40. Also each cylinder 80 and 82 is slidably attached to a guide rail, for example see the pair of rails 83 in Figure 5. The guide rails are supported by a corresponding vertical column for additional support. The position of the infeed bed 40 is adjusted by the extending or retracting the cylinders 80 and 82.

[0030] In some embodiments, the position of the entire upper surface 66 may be adjusted according to the height of the product P. Alternatively, in other embodiments, an upstream end of the upper surface 66 may be fixed and serve as a pivot point about which the infeed bed 40 pivots to adjust a downstream end of the upper surface 66.

[0031] The apparatus 20 may also include a controller 88 comprising a microprocessor. The controller 88 is programmed to control the various motors and actuators of the apparatus 20 that effect movement of the moving parts such that the movements are properly synchronized with respect to determining the height of the product P, adjusting the infeed bed 40, and advancing the web of materials 22, 24 and the product P to and through the rollers 70,72.

[0032] The operation of the apparatus 20 is now explained with primary reference to Figures 1 and 2. Rolls of upper and lower webs 22, 24 are mounted in the web mounts 52, 54, respectively. The upper web 22 is threaded through the machine by advancing the web over and around the guides 56, 57, 58 and then through the nip between rollers 70, 72. The lower web 24 is threaded by advancing the web under and around the guides 60, 61, 62, 63 and then through the nip. To begin a packaging sequence, a product P is placed on the conveying mechanism on the upper surface 66. A cycle start button is pressed, which causes the controller 88 to execute a series of operations as follows: the controller 88 causes the height detector 76 to measure the height of the product P, the signal from the detector 76 is relayed back to the controller, and based on the height of the product P, the controller 88 activates the various motors or actuators to cause the infeed bed 66 to be adjusted, if necessary, in order to center the product P to the nip between the rollers 70, 72 before the product P is advanced into the nip. Either simultaneously with the adjusting of the infeed bed 40 or after the adjustment is completed, the controller 88 causes the various motors to drive the rollers 70, 72 to advance the webs 22, 24 and the product P up to and through the nip to produce a package, which is cut off by the cutoff device 98 and conveyed by an out-feed conveyor 100 to the machine discharge. The process generally as described above is repeated for each subsequent package.

[0033] The present invention has several advantages. The adjustable infeed bed 40 allows the packaging of objects or products P of various heights in a consistent manner. More specifically, the infeed bed 40 substantially aligns or centers each object relative to the rollers 70, 72 based on the object's height. The centering produces a more symmetric and aesthetic package and reduces any stress variances within the package. The height detector 76 can provide the necessary information to set the infeed bed 40 properly.

[0034] Many modifications and other embodiments of the inventions set forth herein will come to mind to one skilled in the art to which these inventions pertain having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Therefore, it is to be understood that the inventions are not to be limited to the specific embodiments disclosed and that modifications and other embodiments are intended to be included within the scope of the appended claims. Although

specific terms are employed herein, they are used in a generic and descriptive sense only and not for purposes of limitation.

Claims

1. An apparatus for packaging an object, comprising:

   a pair of opposing rollers forming a nip arranged to receive a pair of opposing packaging material sheets with an object disposed therebetween, the rollers exerting pressure on the sheets to adhere the sheets to each other around said object so as to form a package;
   a height detector configured to measure a height of the object; and
   an adjustable infeed bed upstream of the nip for supporting the object, said infeed bed being adjustable in position in a height direction of the object based on the height measured by the height detector so that the object is approximately centered to the opposing rollers.

2. The apparatus of Claim 1, wherein the adjustable infeed bed has an upstream end and a downstream end and the downstream end is adjustable relative to the opposing rollers.

3. The apparatus of Claim 2, wherein both the upstream end and downstream end are adjustable relative to the opposing rollers.

4. The apparatus of Claim 1, 2 or 3, wherein the adjustable infeed bed includes a conveying belt for advancing the object toward the opposing rollers.

5. The apparatus of any one of the preceding Claims, wherein the adjustable infeed bed has at least two positions for centering the object relative to the rollers.

6. The apparatus of any one of Claims 1-4, wherein the adjustable infeed bed has a range of positions for centering the object relative to the rollers.

7. The apparatus of any one of the preceding Claims, wherein the adjustable infeed bed includes an upper surface for supporting one of the packaging material sheets and the sheet supports and advances the object toward the rollers.

8. The apparatus of any one of the preceding Claims, wherein each of the rollers includes a resiliently compliant roller portion that is deformed by the object between the packaging material sheets, the resiliently compliant roller portion tending to return to its undeformed shape thereby exerting pressure on the packaging material sheets to closely conform to the object.

9. An apparatus for packaging an object, comprising:

   a pair of opposing rollers forming a nip therebetween,
   a web supply system for supplying a pair of generally opposing web portions of flexible packaging material into the nip so that an object to be packaged when placed between the web portions is passed through the nip along with the web portions, the web portions having sealing material for sealing the web portions together;
   a height detector configured to measure a height of the object; and
   an adjustable infeed bed for supporting the object as the object is advanced to the rollers, said infeed bed being adjustable relative to the rollers based on the height measured by the height detector so that the object is aligned to the rollers.

10. The apparatus of Claim 9, wherein the adjustable infeed bed includes a downstream end, an upstream end, and at least one actuator for adjusting the position of the downstream end relative to the rollers.

11. The apparatus of Claim 10, wherein the adjustable infeed bed includes at least one actuator for adjusting the upstream end relative to the rollers.

12. A method for packaging an object comprising:

   advancing a pair of packaging material sheets in opposing relation toward a nip defined between two opposing rollers, with an object disposed between the sheets;
   measuring a height of the object with a height detector and producing a height measurement;
   adjusting a position of the object in a height direction thereof based on the measurement from the height detector; and
   advancing the sheets and object through the nip so as to seal the packaging material together around the object.

13. A method of packaging an object comprising:

   placing an object to be packaged on an infeed bed;
   measuring the height of the object with a height detector;
   sending a signal from the height detector to a controller and activating one or more actuators to adjust the infeed bed based on the signal sent to the controller so that a center of the object is substantially aligned with a nip between a pair of opposing rollers; and

advancing the object and two portions of packaging material through the nip between the opposing rollers and enclosing the object between the portions to form a package.

14. The method of Claim 13 further comprising:

severing the package from the rest of the packaging material.

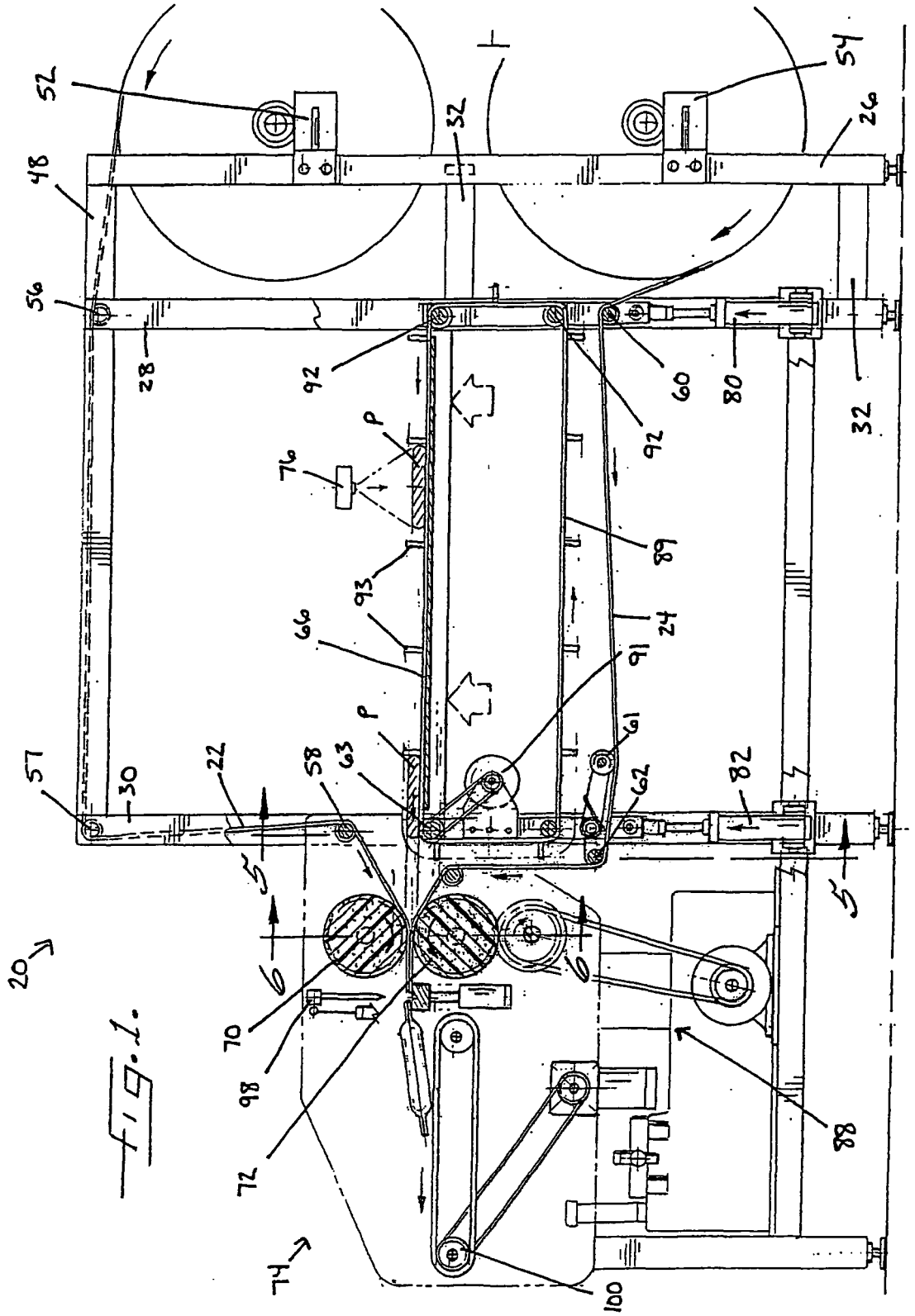
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Fig. 1.

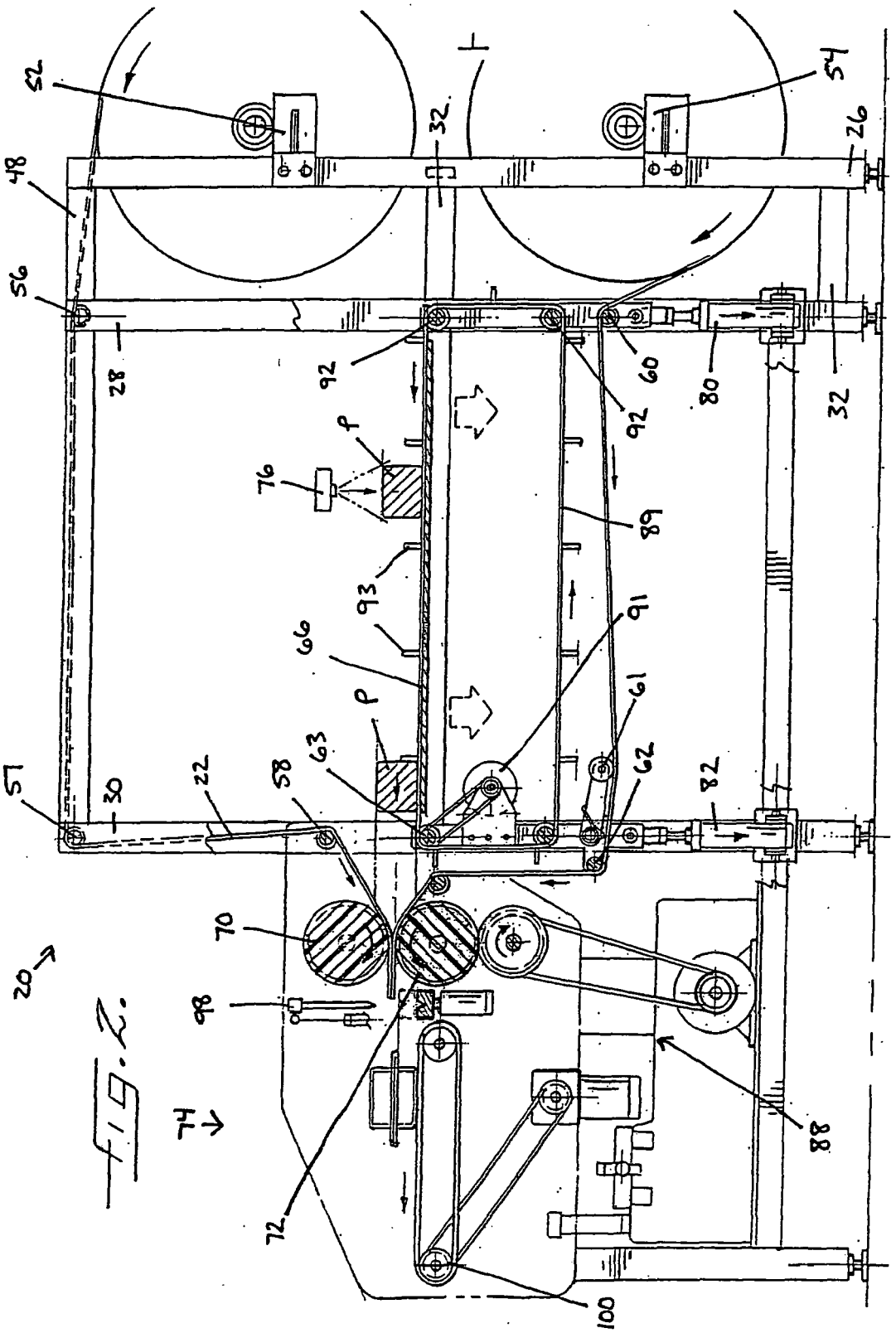
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FIG. 2.

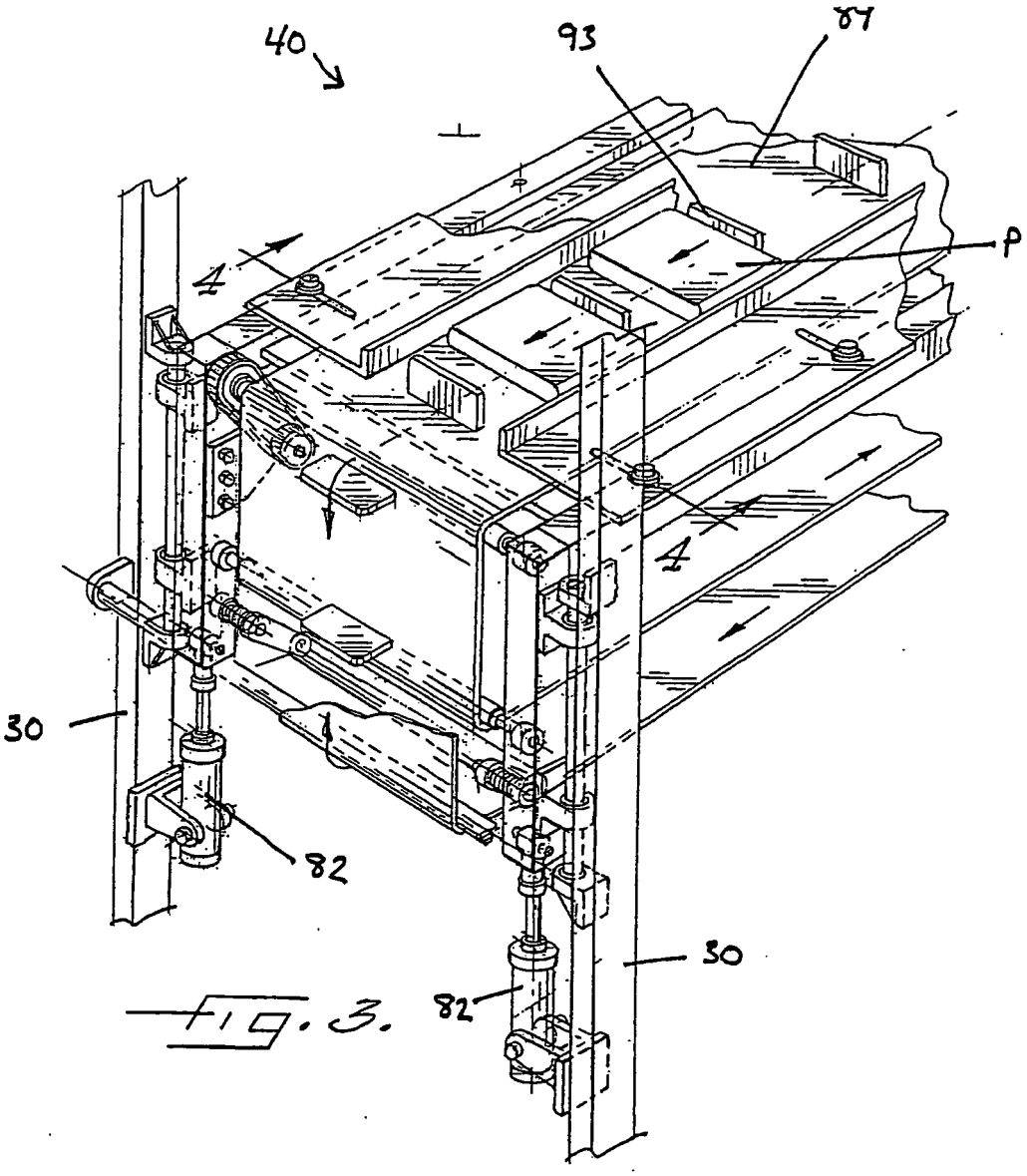

Fig. 3.

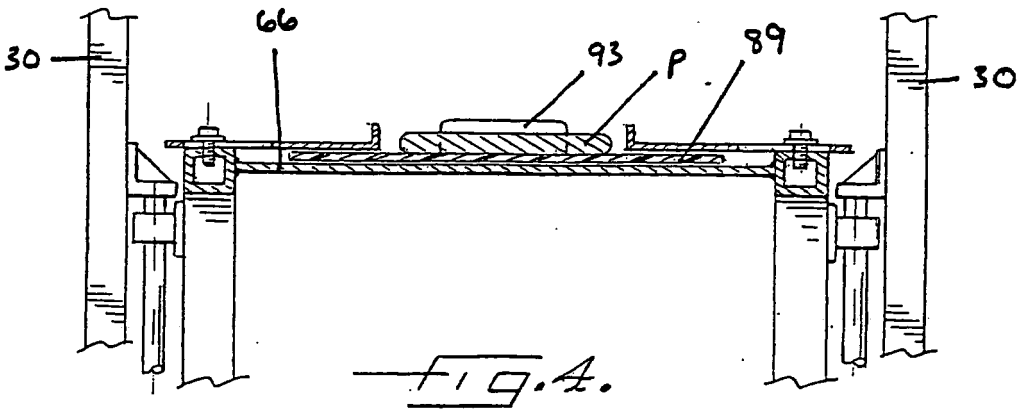

Fig. 4.

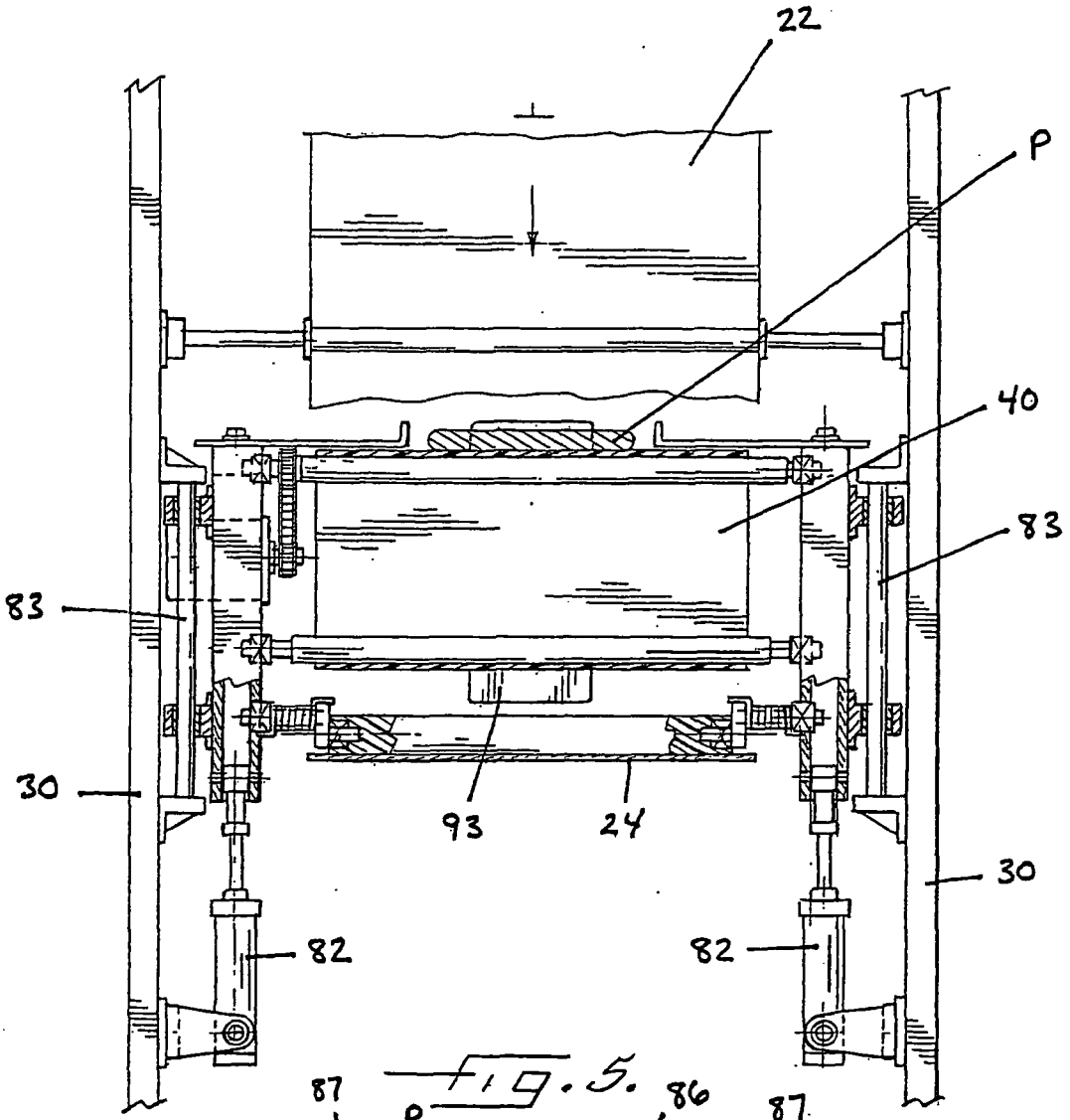

Fig. 5.

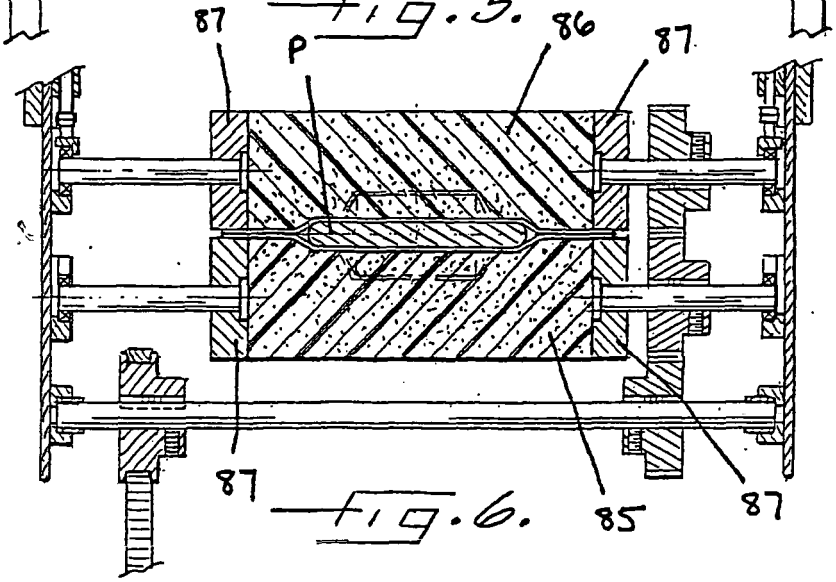

Fig. 6.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 25 1709

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	EP 1 396 428 A (SEALED AIR CORPORATION ; SEALED AIR CORPORATION) 10 March 2004 (2004-03-10) * the whole document *	1-14	INV. B65B9/02 B65B51/12 B65B49/06
Y	US 2 597 042 A (STOKES JOHN S ET AL) 20 May 1952 (1952-05-20) * column 2, lines 45-49 * * column 9, line 67 - column 10, line 41; figures *	1-14	
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TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	15 June 2006	Vigilante, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 06 25 1709

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15-06-2006

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