2012

PATENT ATTORNEYS

EXAMINATION

PAPER E

The New Zealand Law and Practice
relating to Interpretation and Criticism of Patent
Specifications

Regulation 158 (1) (e)

Duration: 4 hours (plus 10 minutes for reading)

When considering answers to the questions in this year's examinations, no account is to be taken of any provisions of the Patents Bill, or any other Bill that may be before the New Zealand Parliament.

Facts

Client Jeff is in the manufacturing business and a few years back began contract manufacturing for others. Business has gone very well, including one sizeable contract from Customer Phil who makes high quality engine parts. Because the quality and timeliness of Jeff's service was so remarkable, Customer Phil demanded that Jeff expand his offerings. One of Phil's demands was that Jeff contract manufacture and package a range of Phil's engine parts that are precision machined and need to be handled gently to avoid damage. To try to meet Phil's growing needs, Jeff and Phil agreed to purchase new equipment together. Jeff and Phil visited an international trade show hosted in Hamilton on 10 February 2011 and saw Supplier Chris' apparatus. Chris' apparatus was a conveyor able to carry pistons that need to be handled gently. The apparatus relied on spacers placed on the conveyor between pistons to convey them without damage. Jeff saw that Chris' apparatus could be used with differently shaped and sized engine parts without the need for substantial modifications. Jeff explained his needs, particularly in relation to a variety of Phil's engine parts, and suggested several alternative spacer designs to Chris. With encouragement from Phil, Jeff agreed to purchase three units of the conveying apparatus on the spot. The basic structure of the conveying apparatus purchased by Jeff and Phil is shown in document **D1**, a sketch produced by Jeff and Phil while Chris demonstrated the apparatus. Chris mentioned that he'd taken steps to protect the apparatus through his company, Chris' Conveying Capers Limited. After several months, it became clear that Chris could not deliver. Phil came to Jeff with a suggestion to produce their own apparatus. Contractor Ryan is an entrepreneurial PhD design student frequently called on by Jeff to help out with project work. Ryan was given document **D1** and asked to expand on Jeff's ideas to produce engineering drawings for their device and Ryan delivered document **D2**.

Engineer Greg manufactured the apparatus of document **D2**. Jeff comes to you before starting commercial production using the apparatus of document **D2** to ensure IP issues are handled properly. Jeff provides you with documents **D1** and **D2**. You locate complete specification NZ 123456 (**D3**) filed by Chris' Conveying Capers Limited, and its related provisional specification (**D4**). A quick search by your trainee also locates prior art documents **D5 to D7**. You must now advise Jeff.

Documents

D1 Description of Chris' apparatus demonstrated at the trade show.

D2 Description of Jeff's apparatus.

D3 Complete after provisional specification NZ 123456 owned by Chris' Conveying Capers Limited, filed 25 February 2011 and accepted and published on 28 May 2012.

D4 Provisional specification NZ 123456 filed on 1 March 2010.

D5 US 4,227,606

D6 US 4,605,121

D7 Registered Design NZ 22333 (expired)

Questions

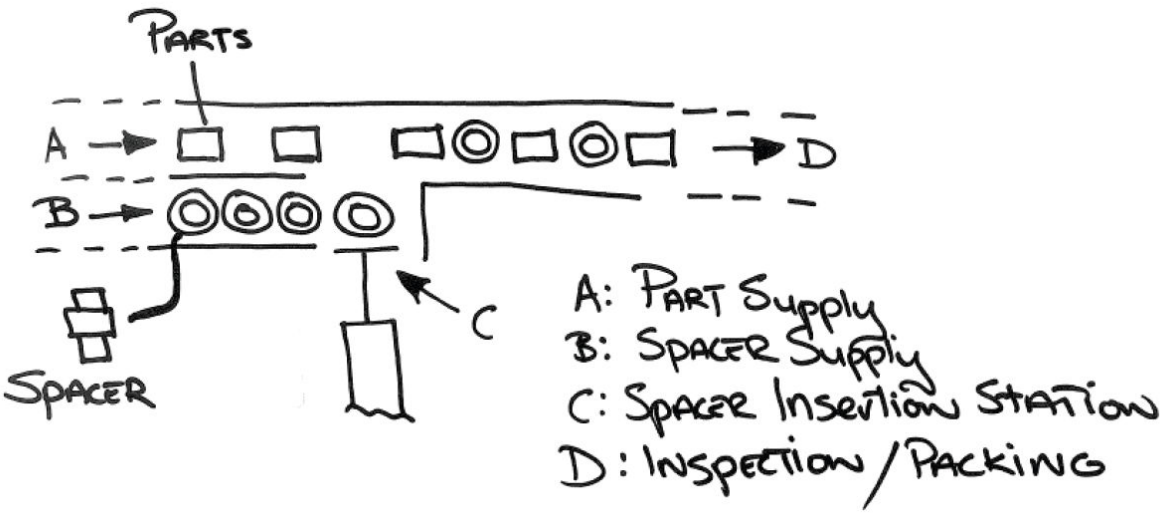
(1) Will commercial production using Jeff's apparatus as shown in D2 infringe the claims of NZ 123456? **(30 marks)**

(2) Comment on the validity of NZ 123456 and anything Chris' Conveying Capers Limited could do to strengthen its position? **(50 marks)**

(3) What else would you tell Jeff? **(20 marks)**

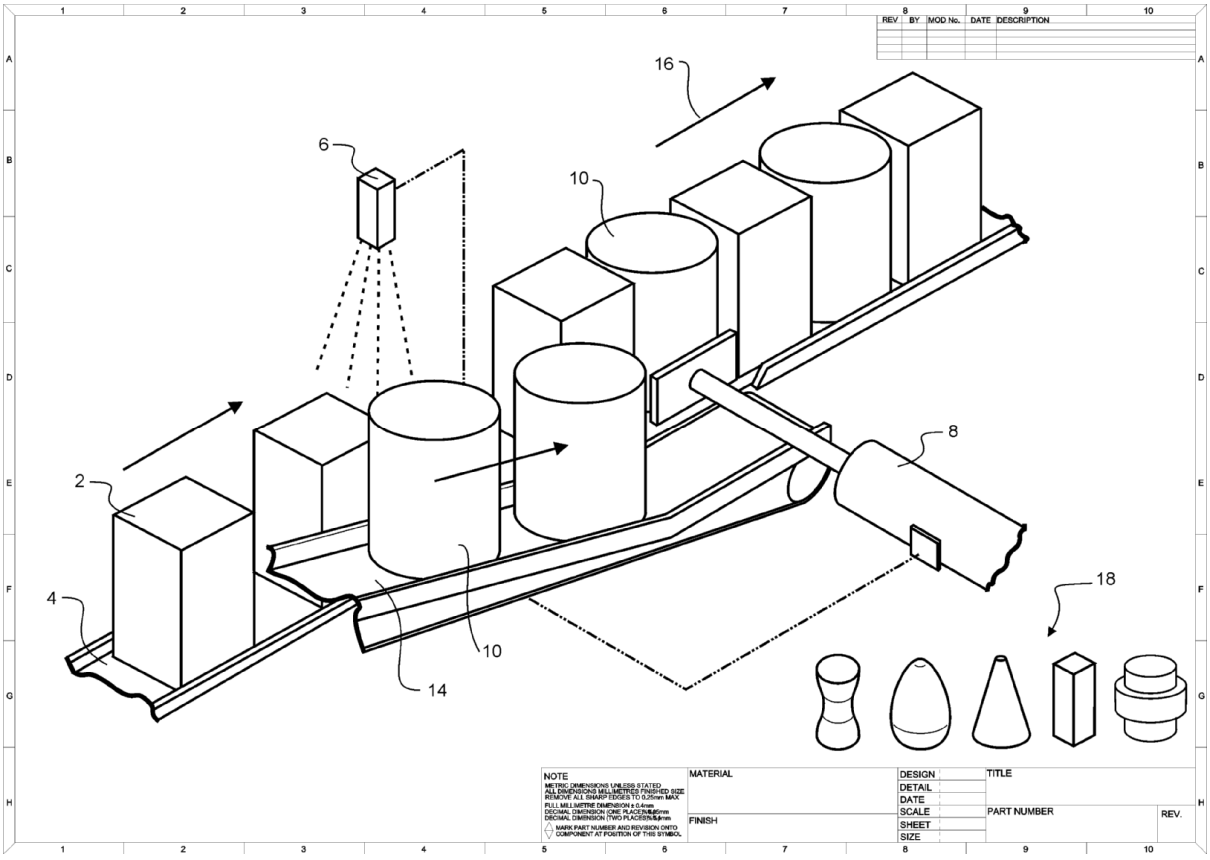
D1

Description of Chris' apparatus demonstrated at the trade show.



D2

Description of Jeff's apparatus.



As articles 2 travel along the main conveyor line 4, a sensor 6 detects the passing of each article 2 and a pusher mechanism 8 introduces a spacer 10 from second conveyor 14 into the gap between articles 2. Alternative spacer shapes are shown at 18. The spacer shape is dictated by the article shape and is chosen for an entire run and then changed as necessary.

D3 Complete specification of NZ 123456

Number: 123456

Dated: 1 March 2010

PATENTS FORM No. 5

PATENTS ACT 1953

COMPLETE SPECIFICATION

CONVEYING APPARATUS AND METHOD

We, **Chris' Conveying Capers Limited**, a New Zealand company, having its registered office at Auckland, New Zealand, hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

D3 Complete specification of NZ 123456

FIELD OF THE INVENTION

The present invention relates to a spacer for separating articles being conveyed on a conveyor surface. More particularly, an apparatus and method is provided for maintaining protective separation between articles freely disposed on the conveyor surface, as said articles are being conveyed in single file along a conveyor path.

BACKGROUND OF THE INVENTION

It is known in the prior art to convey articles along a conveyor, and the problem of maintaining any necessary separation between these articles being conveyed has been solved in different ways.

However, these prior art devices are not generally directed to an economical, simple, and efficient apparatus and method for maintaining adequate separation between freely disposed articles on a conveyor, especially where portions of the articles should not touch any other object.

SUMMARY OF THE INVENTION

In accordance with one preferred embodiment of the present invention, apparatus is provided for conveying a series of articles along a conveyor path freely disposed on a conveyor surface while maintaining protective separation between adjacent ones of articles in the series. An endless conveying surface has an upper run extending along the path and has guide members associated therewith, the guide members in combination with the surface defining the path, which is dimensioned for accepting articles in a series in single file therein. Means is provided for receiving these articles onto the upper run of the conveying surface in contact therewith, and means is further provided for buffering adjacent articles in single file, each from the other, the buffering means being relatively inelastic and noncompressible. The buffering means is introducible to the conveyor receiving means in freely disposed contact with the conveying surface, and the buffering means abuts adjacent articles on either side of the buffering means in a manner nondestructive to said articles. Also provided is means for introducing at least one of the buffering means to said receiving means in alternation with each said article in the series, thereby providing a procession of articles alternated with at least one buffering means in single file along said conveyor path.

D3 Complete specification of NZ 123456

In one particularly preferred embodiment, the buffering means includes a generally cylindrical member formed along a cylinder axis with a diameter sufficient to separate immediately adjacent upstream and downstream articles. The cylindrical member has a generally flat first surface substantially perpendicular to the cylinder axis for supporting the member upright on the surface generally perpendicular to the conveying direction.

In a further particularly preferred embodiment, the buffering means includes cylindrically shaped means formed along a cylindrical axis, this buffering means including a plurality of cylindrical contours disposed about the cylindrical axis, with selected ones of the contours having smaller diameters than other contours. The other contours are for contacting adjacent articles upstream and downstream of said buffering means, but not at said defined portions. At least one of the selected contours corresponds to but does not contact the defined portions. In this manner, particularly sensitive areas of the articles being conveyed may be restricted against contact not only with other articles but with the spacer itself.

Also provided in accordance with one preferred embodiment of the present invention is a method of conveying a series of articles along a conveyor path freely disposed on a conveyor surface while maintaining protective article-to-article separation. The method comprises the steps of introducing each article one at a time in a series to the conveyor surface; alternating the introduction of the articles with introduction to said conveyor surface of at least one relatively noncompressible and inelastic protective means, such as cylindrically shaped spacer means, freely disposed between adjacent articles in said series for separating said adjacent articles from each other; and conveying this series of articles alternated with protective means on either side thereof along said conveyor. The articles are free to contact the protective means, but not any other article in the series.

Also provided in accordance with one preferred embodiment of the present invention is a spacer for maintaining separation between articles being conveyed in a series on a conveyor surface along a conveyor path. The spacer preferably comprises at least one generally cylindrical member formed along a cylindrical axis, said member having one end surface positionable on said conveyor surface to carry said spacer along said path in a generally upright orientation, said end surface corresponding to

at least a portion of a plane perpendicular to said axis, said member further comprising at least one outer surface perpendicular to said end surface for abutting both upstream and downstream adjacent articles to maintain protective separation of adjacent articles in the series, said outer surface further including a first cylindrical surface having diameter d_1, and also a second cylindrical surface having diameter d_2, wherein $d_1 > d_2$, said first cylindrical surface for abutting said articles and said second cylindrical surface being restrained by said first cylindrical surface from abutting said article..

The present invention provides apparatus for conveying a series of articles freely disposed in single file along a conveyor surface, while maintaining protective separation between adjacent articles in the series.

The present invention also provides a spacer for use between adjacent articles in a series of articles being conveyed along a conveyor path to provide protective separation between articles.

The present invention also provides a shaped spacer for use between articles being conveyed to provide protective separation between adjacent articles, while not permitting any contact against certain defined areas of said articles.

Further objects and advantages of the present invention will become apparent from the following description of the drawings and the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 1A show a perspective view of the apparatus of the present invention;

FIG. 2 shows a side view of a section of the apparatus of FIGS. 1 and 1A; and

FIGS. 3A and 3B show top and side views respectively of the spacer of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to FIGS. 1, 1A, and 2, apparatus indicated generally at 10 is shown for conveying a series of articles such as pistons 12, 14, 16, and 18 along conveyor 20 freely disposed on conveyor surface 22 along a path and in a direction indicated by arrow 24.

D3 Complete specification of NZ 123456

Pistons 12, 14, 16, and 18, which could be any suitable or desired articles, objects, or workpieces, are freely disposed on conveyor surface 22, in that there are no cleats or other such transversely disposed members fixed to or associated with said conveyor or conveyor surface for maintaining protective separation between adjacent pistons. A plurality of buffering means of the present invention such as spacers 28, explained more fully in detail below, are alternated as indicated at 28, 30, and 32 between pistons 12, 14, 16, and 18 to maintain protective separation therebetween. Spacers 28, 30, and 32 are supportable on surface 22 in a freely disposed manner for freely contacting pistons both upstream and downstream thereof to avoid piston to piston contact as described below.

With specific reference now to FIG. 1, endless conveying surface 22 has an upper run indicated generally at 34, with the return run (lower run) not being shown. It should be understood that an endless conveyor surface is a looped surface similar in design and function to an escalator surface and such devices are well known. Conveying surface 22 extends along a path indicated by arrow 24 and has guide members such as rails 36, 38 and 40, 42 associated therewith, which in combination with surface 22 define path 24. The path 24 is dimensioned, such as for example in width indicated at 44, for accepting pistons such as at 12, 14, 16, and 18 in a series in single file. Width 44 is chosen so that the upwardly pointing coupling ends such as 46 and 48 of pistons 12 and 14 fit therebetween. Also, each piston has a pair of diametrically opposed lips, such as lips 50 and 52, which depend in a direction towards coupling ends 46 and 48. Guide rails 40 and 42 are spaced apart a predetermined distance corresponding to approximately width 44, so as to engage piston lips 50 and 52 to further guide pistons 12, 14, 16, and 18 along path 24 in a series in single file on surface 22. Rails 36, 38 and 40, 42 are terminated in the region indicated generally at 54 to provide an opening or means for receiving pistons onto upper runs 34 of conveyor 20 in contact with conveyor surface 22. These pistons or other articles can be inserted as indicated by arrow 56 manually or by a suitable device or mechanism (not shown), which forms no part of the instant invention.

Buffering means, such as the spacers indicated generally at 28 (FIGS. 1 and 2) and more specifically at 30, 32, (FIG. 2) 58, 60, and 62 (FIG 1), are positioned for protectively separating adjacent articles in the single file, such as for example

pistons 12 and 14, from each other and preventing article to article contact, which contact is undesirable for the pistons herein described because of the resultant damage from marring or scuffing. As will be described more fully hereinbelow, spacers such as 28 are formed from a relatively inelastic and noncompressible material such as polyethylene, which is subjected to compressive forces along the direction of path 24 due to normal line pressure. The spacers 28 are relatively nondeformable; otherwise, under normal line pressure, the spacers 28 might deform in a direction transverse to and outwardly of path 24, which could result in frictional engagement of guide rails 40 and 42 with undesirable braking action and increased line pressure. However, spacers 28 are relatively soft compared to the articles such as pistons being conveyed to avoid damage from the normal contact between spacers and articles. Suitable materials for spacer 28 other than polyethylene include, by way of example only, polyurethane. Therefore, spacers 28 can abut articles on either side, specifically such as pistons 12 and 14 on either side of spacer 28, in a manner nondestructive to either piston.

As shown in FIG. 1, the apparatus of the present invention also preferably includes a pusher mechanism such as at 70 operable under the direction of a controller such as for example routine programmable controller 71, which introduces at least one of said spacers such as spacer 62 from a suitably disposed supply 72 of spacers after each piston to alternate in the manner of piston-spacer-piston-spacer-piston and so on for the spacers in single file. This pusher mechanism 70 operates in a timed relationship relative to the introduction of each piston by means of inputs from routine sensor 73, such as for example a photoelectric sensor, along line 75 to controller 71. In this manner, a procession of articles with spacers between each article is provided as represented by the following series shown in FIG. 2: piston 12, spacer 28, piston 14, spacer 30, piston 16, spacer 32, piston 18, and so on.

With reference now to FIG. 3A, it is seen that spacer 28 is described in more detail. Inasmuch as all spacers are substantially identical, the perspective view of spacer 28 in FIG. 1 along with the top and side views of substantially identical spacer 28 in FIGS. 3A and 3B provide a full description of the preferred buffering means of the present invention.

By way of example only with respect to spacer 28, spacer 28 is a generally cylindrical member 74 with a cylindrically shaped contour 75 formed about and along cylinder axis 76 and having three sections, a first section of diameter d_1 indicated at 78 sufficient to separate an immediately upstream article such as piston 12 from an immediately downstream article such as piston 14. Cylindrical member 74 has a generally flat surface 79 perpendicular to cylindrical axis 76 for supporting cylindrical member 74 upright on conveying surface 22 as shown in FIG. 2 in a direction generally perpendicular to surface 22 as well as path or conveying direction 24. It should be understood that other spacer shapes are contemplated.

Member 74 also preferably has portions of lesser diameter d_2 indicated at 84 on either end indicated at 80 and 82 with diameters less than d_1 with corresponding cylindrically shaped contours 86 and 88 formed about and along axis 76.

The utility of reduced diameter portions 86 and 88 resides in avoiding any contact with ring portions 90, 92, 94, and 96 of piston head portions 98, 100, 102, and 104. The piston heads have flat end surfaces 106, 108, 110, and 112, which ride on the conveyor surface 22. The outer surface portions of pistons corresponding to ring portions 90, 92, 94, and 96 are preferably restricted from contact even with the spacers, the spacers being shaped as shown in FIGS. 3A and 3B to avoid such contact. Pistons also have stem portions 99, 101, 103, and 105 for pistons 12, 14, 16, and 18 respectively.

By forming reduced diameter portions 80 and 82 on opposing ends of spacer 28 with cylindrical member 74 being symmetrical about any place in which cylindrical axis 76 lies, spacer 28 can be placed on conveyor surface 22 with either flat end 79 or 81 in contact therewith.

Using the apparatus shown in FIGS. 1, 1A, 2, 3A, and 3B, a method is provided of conveying a series of articles such as pistons 12, 14, 16, and 18 along a path indicated by arrow 24, the articles being freely disposed on surface 24, while maintaining protective article-to-article separation. The articles such as pistons 12, 14, 16, and 18 are introduced one at a time in a series to conveyor surface 22 in the receiving area 54 of conveyor 20. The introduction of each piston is alternated with the introduction of at least one relatively noncompressible and inelastic protective means such as spacers 28, 30, and 32, which are freely disposed between adjacent

pistons 12, 14, 16, and 18 as shown in FIG. 2 for separating these pistons from each other. This introduction is accomplished by pushing the spacers one at a time from a supply 72 thereof onto the conveyor surface 22 in timed relationship to the introduction of each piston. The series of pistons with said spacers alternated therebetween, wherein there is at least one spacer on either side of each piston (except for first and last pistons in the series, where either the leading and/or trailing spacers may be optional), is conveyed along conveyor path 24, the pistons being free to abuttingly contact adjacent spacers but not any other article in the series.

It should be understood that various changes and modifications to the preferred embodiments described above will be apparent to those skilled in the art. Such changes and modifications can be made without departing from the spirit and scope of the present invention, and it is therefore intended that such changes and modifications be covered by the following claims.

D3 Complete specification of NZ 123456

WHAT WE CLAIM IS

1. Apparatus for conveying a series of articles along a conveyor path freely disposed on a conveyor surface while maintaining protective separation between adjacent ones of said articles in said series, said apparatus comprising:

(a) a conveying surface extending along said path and having guide members associated therewith, said guide members in combination with said surface defining said path dimensioned for accepting said articles in a series in single file therein;

(b) means for receiving said articles onto said conveying surface in contact therewith;

(c) means for buffering adjacent articles in said single file each from the other, said buffering means being relatively inelastic and noncompressible and introducible to said receiving means, said buffering means being adapted for abutting adjacent articles on either side of said buffering means in a manner nondestructive to said articles; and

(d) means for introducing at least one of said buffering means to said receiving means in alternation with each said article, in said series; thereby providing a procession of articles alternated with at least one buffering means in single file along said conveyor path.

2. The apparatus of claim 1, wherein said buffering means comprises at least one means supportable on said conveying surface for freely contacting articles both upstream and downstream of said buffering means to restrain adjacent articles in said series from contacting each other.

3. The apparatus of claim 1 or 2, wherein said buffering means includes a generally cylindrical member formed along a cylinder axis and having a diameter sufficient to separate immediately adjacent upstream and downstream articles and having a generally flat first surface substantially perpendicular to said cylinder axis for supporting said member upright on said surface generally perpendicular to the conveying direction.

D3 Complete specification of NZ 123456

4. The apparatus of claim 2, wherein said contacting means includes a second surface comprising a cylindrically shaped surface formed about said axis of said cylindrical member.

5. The apparatus of claim 2, wherein each said article has an outer surface with a defined portion thereof to be restricted against contact with either another article or said buffering means, and said buffering means is shaped to abut said outer surface at at least one point, but not at any point on said defined portion.

6. The apparatus of claim 5, wherein said buffering means includes cylindrically shaped means formed along a cylindrical axis, said means including a plurality of cylindrical contours disposed about said cylindrical axis, selected ones of said contours having smaller diameters than other ones of said contours, said other ones of said contours for contacting adjacent articles upstream and downstream of said buffering means but not at said defined portions, at least one of said selected ones of said contours matching but not contacting said defined portions.

7. The apparatus of claim 1, wherein said buffering means includes cylindrically shaped means formed along a cylindrical axis and wherein said cylindrical means is symmetrical about any plane in which said cylindrical axis lies.

8. The apparatus of claim 1, wherein said introducing means includes at least one means for pushing said buffering means from a supply thereof onto said conveyor surface one at a time in timed relationship to the introduction of each said article.

9. A method for conveying a series of articles along a conveyor surfacewhile maintaining protective article-to-article separation, said method comprising the steps of:

(a) moving an article from an article storage zone onto said conveyor surface;

(b) moving a noncompressible and inelastic protective means from a supply storage zone directly adjacent the article;

(c) alternatingly repeating steps (a) and (b) to provide a continuous series of articles with noncompressible and inelastic protective means alternatingly dispersed between each article, for protecting and separating said articles; and

(d) conveying said series of articles alternated with said protective means on either side thereof along said conveyor surface, said articles being free to contact said protective means but not any other article in said series.

10. The method of claim 9, wherein said alternating step includes the step of interjecting said protective separating means after each one of said articles in said series of said articles.

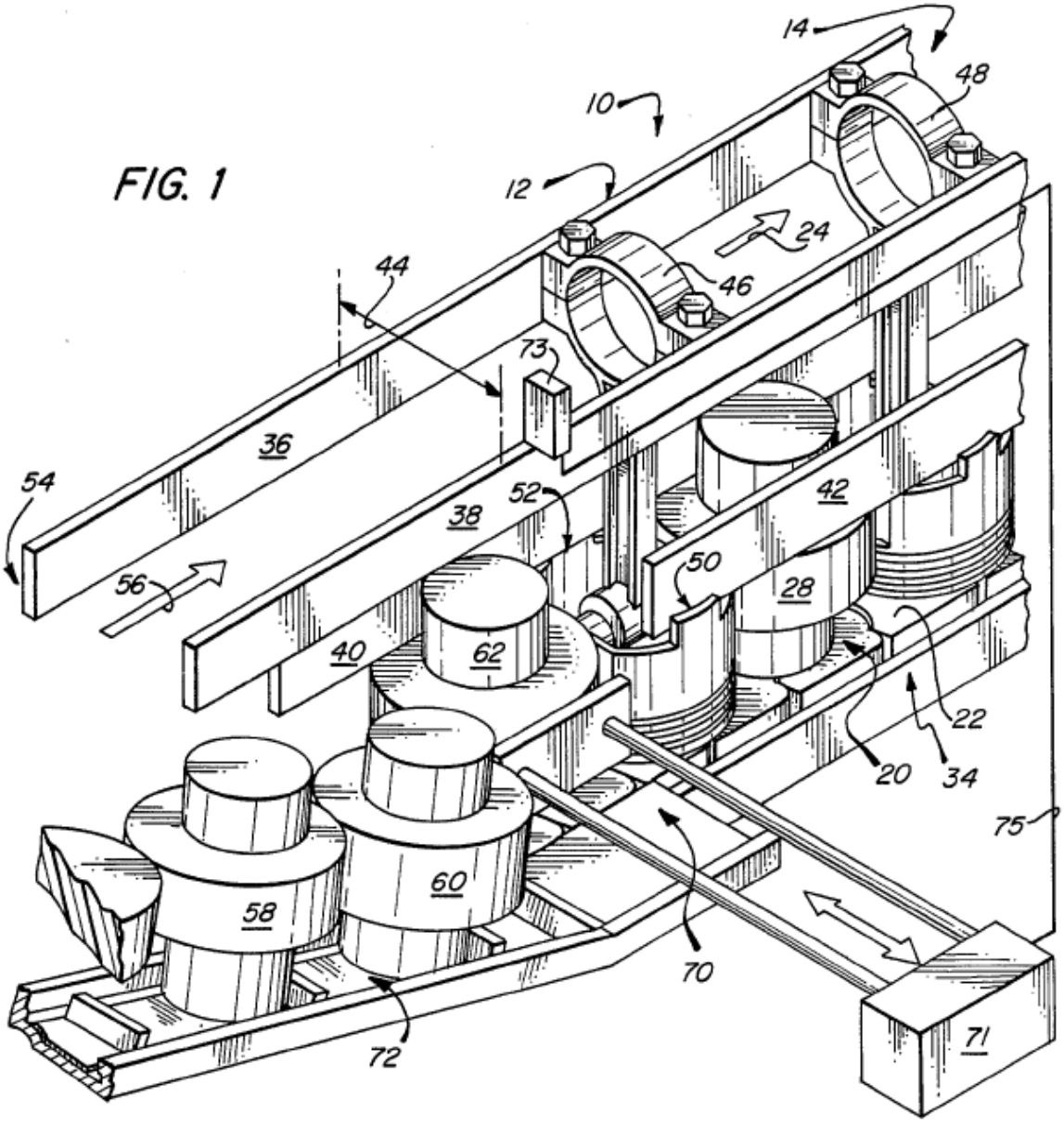
11. The method of claim 10, wherein said interjecting step includes the step of inserting said protective means one at a time from said supply storage zone thereof onto said conveyor surface at an entry area of said conveyor surface in said alternating fashion with said articles.

12. A spacer for maintaining separation between articles being conveyed in a series on a conveyor surface along a conveyor path, said spacer comprising at least one generally cylindrical member formed along a cylindrical axis, said member having one end surface positionable on said conveyor surface to carry said spacer along said path in a generally upright orientation, said end surface corresponding to at least a portion of a plane perpendicular to said axis, said member further comprising at least one outer surface perpendicular to said end surface for abutting both upstream and downstream adjacent articles to maintain protective separation of adjacent articles in the series, said outer surface further including a first cylindrical surface having diameter d_1, and also a second cylindrical surface having diameter d_2, wherein $d_1 > d_2$, said first cylindrical surface for abutting said articles and said second cylindrical surface being restrained by said first cylindrical surface from abutting said article.

13. The method of claim 9 wherein the protective means comprises a spacer of claim 12.

14. The apparatus of claim 1 wherein the means for buffering adjacent articles comprises a spacer of claim 12.

FIG. 1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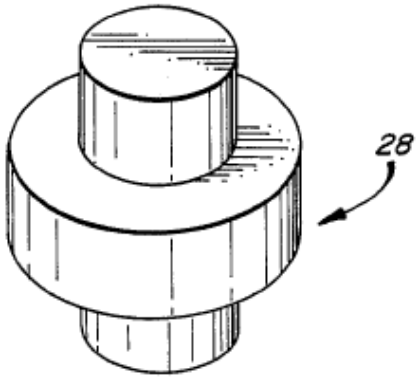
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FIG. 1A

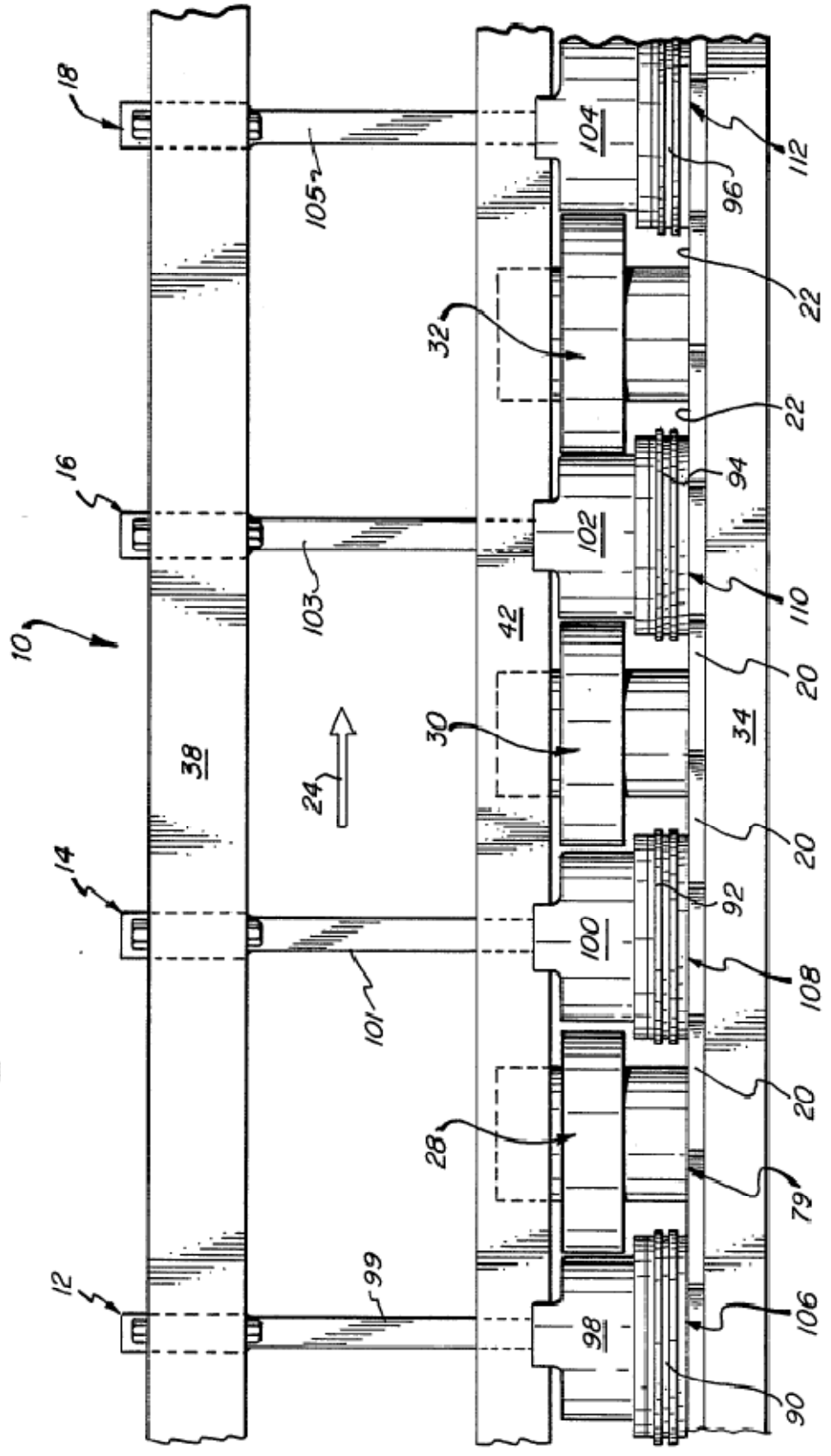
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FIG. 2

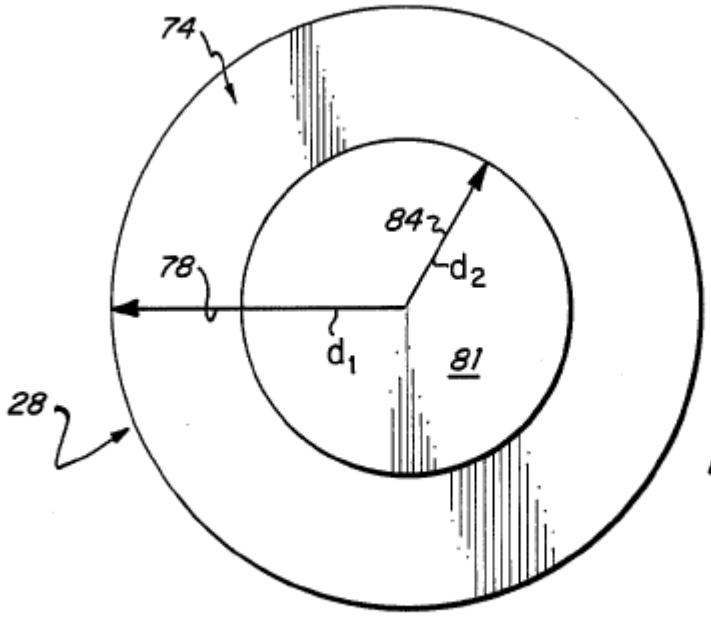

FIG. 3A

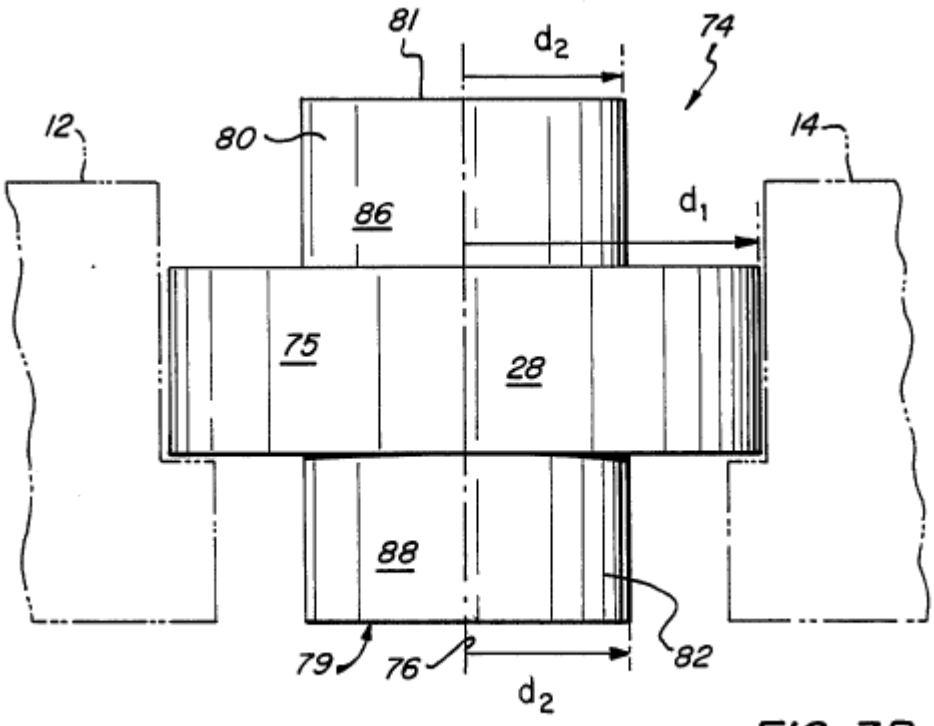

FIG. 3B

PATENTS FORM No. 4

PATENTS ACT 1953

PROVISIONAL SPECIFICATION

CONVEYING APPARATUS AND METHOD

We, **Chris' Conveying Capers Limited**, a New Zealand company, having its registered office at Auckland, New Zealand, hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

D4 Provisional specification of NZ 123456

FIELD OF THE INVENTION

The present invention relates to a spacer for separating pistons being conveyed on a conveyor surface. More particularly, an apparatus and method is provided for maintaining protective separation between pistons freely disposed on the conveyor surface, as said pistons are being conveyed in single file along a conveyor path.

BACKGROUND OF THE INVENTION

It is known in the prior art to convey articles along a conveyor, and the problem of maintaining any necessary separation between these articles being conveyed has been solved in different ways.

However, these prior art devices are not generally directed to an economical, simple, and efficient apparatus and method for maintaining adequate separation between freely disposed articles on a conveyor, especially where portions of the articles should not touch any other object.

SUMMARY OF THE INVENTION

In accordance with one preferred embodiment of the present invention, apparatus is provided for conveying a series of pistons along a conveyor path freely disposed on a conveyor surface while maintaining protective separation between adjacent ones of pistons in the series. An endless conveying surface has an upper run extending along the path and has guide members associated therewith, the guide members in combination with the surface defining the path, which is dimensioned for accepting pistons in a series in single file therein. Means is provided for receiving these pistons onto the upper run of the conveying surface in contact therewith, and means is further provided for buffering adjacent pistons in single file, each from the other, the buffering means being relatively inelastic and noncompressible. The buffering means is introducible to the conveyor receiving means in freely disposed contact with the conveying surface, and the buffering means abuts adjacent pistons on either side of the buffering means in a manner nondestructive to said pistons. Also provided is means for introducing at least one of the buffering means to said receiving means in alternation with each said piston in the series, thereby providing a procession of pistons alternated with at least one buffering means in single file along said conveyor path.

D4 Provisional specification of NZ 123456

In one particularly preferred embodiment, the buffering means includes a generally cylindrical member formed along a cylinder axis with a diameter sufficient to separate immediately adjacent upstream and downstream pistons. The cylindrical member has a generally flat first surface substantially perpendicular to the cylinder axis for supporting the member upright on the surface generally perpendicular to the conveying direction.

In a further particularly preferred embodiment, the buffering means includes cylindrically shaped means formed along a cylindrical axis, this buffering means including a plurality of cylindrical contours disposed about the cylindrical axis, with selected ones of the contours having smaller diameters than other contours. The other contours are for contacting adjacent pistons upstream and downstream of said buffering means, but not at said defined portions. At least one of the selected contours corresponds to but does not contact the defined portions. In this manner, particularly sensitive areas of the pistons being conveyed may be restricted against contact not only with other pistons but with the spacer itself.

Also provided in accordance with one preferred embodiment of the present invention is a method of conveying a series of pistons along a conveyor path freely disposed on a conveyor surface while maintaining protective piston-to-piston separation. The method comprises the steps of introducing each piston one at a time in a series to the conveyor surface; alternating the introduction of the pistons with introduction to said conveyor surface of at least one relatively noncompressible and inelastic protective means, such as cylindrically shaped spacer means, freely disposed between adjacent pistons in said series for separating said adjacent pistons from each other; and conveying this series of pistons alternated with protective means on either side thereof along said conveyor. The pistons are free to contact the protective means, but not any other piston in the series.

Also provided in accordance with one preferred embodiment of the present invention is a spacer for maintaining separation between pistons being conveyed in a series on a conveyor surface along a conveyor path. The spacer preferably comprises at least one generally cylindrical member formed along a cylindrical axis, said member having one end surface positionable on said conveyor surface to carry said spacer along said path in a generally upright orientation, said end surface corresponding to

at least a portion of a plane perpendicular to said axis, said member further comprising at least one outer surface perpendicular to said end surface for abutting both upstream and downstream adjacent articles to maintain protective separation of adjacent pistons in the series, said outer surface further including a first cylindrical surface having diameter d_1, and also a second cylindrical surface having diameter d_2, wherein $d_1 > d_2$, said first cylindrical surface for abutting said pistons and said second cylindrical surface being restrained by said first cylindrical surface from abutting said article.

The present invention provides apparatus for conveying a series of pistons freely disposed in single file along a conveyor surface, while maintaining protective separation between adjacent pistons in the series.

The present invention also provides a spacer for use between adjacent pistons in a series of pistons being conveyed along a conveyor path to provide protective separation between pistons.

The present invention also provides a shaped spacer for use between pistons being conveyed to provide protective separation between adjacent pistons, while not permitting any contact against certain defined areas of said pistons.

Further objects and advantages of the present invention will become apparent from the following description of the drawings and the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 1A show a perspective view of the apparatus of the present invention;

FIG. 2 shows a side view of a section of the apparatus of FIGS. 1 and 1A; and

FIGS. 3A and 3B show top and side views respectively of the spacer of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

With reference now to FIGS. 1, 1A, and 2, apparatus indicated generally at 10 is shown for conveying a series of pistons 12, 14, 16, and 18 along conveyor 20 freely disposed on conveyor surface 22 along a path and in a direction indicated by arrow 24.

D4 Provisional specification of NZ 123456

Pistons 12, 14, 16, and 18 are freely disposed on conveyor surface 22, in that there are no cleats or other such transversely disposed members fixed to or associated with said conveyor or conveyor surface for maintaining protective separation between adjacent pistons. A plurality of buffering means of the present invention such as spacers 28, explained more fully in detail below, are alternated as indicated at 28, 30, and 32 between pistons 12, 14, 16, and 18 to maintain protective separation therebetween. Spacers 28, 30, and 32 are supportable on surface 22 in a freely disposed manner for freely contacting pistons both upstream and downstream thereof to avoid piston to piston contact as described below.

With specific reference now to FIG. 1, endless conveying surface 22 has an upper run indicated generally at 34, with the return run (lower run) not being shown. It should be understood that an endless conveyor surface is a looped surface similar in design and function to an escalator surface and such devices are well known.

Conveying surface 22 extends along a path indicated by arrow 24 and has guide members such as rails 36, 38 and 40, 42 associated therewith, which in combination with surface 22 define path 24. The path 24 is dimensioned, such as for example in width indicated at 44, for accepting pistons such as at 12, 14, 16, and 18 in a series in single file. Width 44 is chosen so that the upwardly pointing coupling ends such as 46 and 48 of pistons 12 and 14 fit therebetween. Also, each piston has a pair of diametrically opposed lips, such as lips 50 and 52, which depend in a direction towards coupling ends 46 and 48. Guide rails 40 and 42 are spaced apart a predetermined distance corresponding to approximately width 44, so as to engage piston lips 50 and 52 to further guide pistons 12, 14, 16, and 18 along path 24 in a series in single file on surface 22. Rails 36, 38 and 40, 42 are terminated in the region indicated generally at 54 to provide an opening or means for receiving pistons onto upper runs 34 of conveyor 20 in contact with conveyor surface 22. These pistons can be inserted as indicated by arrow 56 manually or by a suitable device or mechanism (not shown), which forms no part of the instant invention.

Buffering means (spacers) indicated at 28 (FIGS. 1 and 2), 30, 32 (FIG. 2), 58, 60, and 62 (FIG. 1), are positioned for protectively separating adjacent pistons in the single file, such as for example pistons 12 and 14 (FIG. 1), from each other and preventing piston to piston contact, which contact is undesirable for the pistons

herein described because of the resultant damage from marring or scuffing. As will be described more fully hereinbelow, spacers 28 are formed from a relatively inelastic and noncompressible material such as polyethylene, which is subjected to compressive forces along the direction of path 24 due to normal line pressure. The spacers 28 are relatively nondeformable; otherwise, under normal line pressure, the spacers 28 might deform in a direction transverse to and outwardly of path 24, which could result in frictional engagement of guide rails 40 and 42 with undesirable braking action and increased line pressure. However, spacers 28 are relatively soft compared to the pistons being conveyed to avoid damage from the normal contact between spacers and pistons. Suitable materials for spacer 28 other than polyethylene include, by way of example only, polyurethane. Therefore, spacers 28 can abut pistons on either side, specifically such as pistons 12 and 14 on either side of spacer 28, in a manner nondestructive to either piston.

As shown in FIG. 1, the apparatus of the present invention also preferably includes a pusher mechanism such as at 70 operable under the direction of a controller such as for example routine programmable controller 71, which introduces at least one of said spacers such as spacer 62 from a suitably disposed supply 72 of spacers after each piston to alternate in the manner of piston-spacer-piston-spacer-piston and so on for the spacers in single file. This pusher mechanism 70 operates in a timed relationship relative to the introduction of each piston by means of inputs from routine sensor 73, such as for example a photoelectric sensor, along line 75 to controller 71. In this manner, a procession of pistons with spacers between each piston is provided as represented by the following series shown in FIG. 2: piston 12, spacer 28, piston 14, spacer 30, piston 16, spacer 32, piston 18, and so on.

With reference now to FIG. 3A, it is seen that spacer 28 is described in more detail. Inasmuch as all spacers are substantially identical, the perspective view of spacer 28 in FIG. 1 along with the top and side views of substantially identical spacer 28 in FIGS. 3A and 3B provide a full description of the preferred buffering means of the present invention.

Spacer 28 is a generally cylindrical member 74 with a cylindrically shaped contour 75 formed about and along cylinder axis 76 and having three sections, a first section of diameter d_1 indicated at 78 sufficient to separate an immediately upstream piston12

from an immediately downstream piston 14. Cylindrical member 74 has a generally flat surface 79 perpendicular to cylindrical axis 76 for supporting cylindrical member 74 upright on conveying surface 22 as shown in FIG. 2 in a direction generally perpendicular to surface 22 as well as path or conveying direction 24.

Member 74 also preferably has portions of lesser diameter d_2 indicated at 84 on either end indicated at 80 and 82 with diameters less than d_1 with corresponding cylindrically shaped contours 86 and 88 formed about and along axis 76.

The utility of reduced diameter portions 86 and 88 resides in avoiding any contact with ring portions 90, 92, 94, and 96 of piston head portions 98, 100, 102, and 104. The piston heads have flat end surfaces 106, 108, 110, and 112, which ride on the conveyor surface 22. The outer surface portions of pistons corresponding to ring portions 90, 92, 94, and 96 are preferably restricted from contact even with the spacers, the spacers being shaped as shown in FIGS. 3A and 3B to avoid such contact. Pistons also have stem portions 99, 101, 103, and 105 for pistons 12, 14, 16, and 18 respectively.

By forming reduced diameter portions 80 and 82 on opposing ends of spacer 28 with cylindrical member 74 being symmetrical about any place in which cylindrical axis 76 lies, spacer 28 can be placed on conveyor surface 22 with either flat end 79 or 81 in contact therewith.

Using the apparatus shown in FIGS. 1, 1A, 2, 3A, and 3B, a method is provided of conveying a series of pistons 12, 14, 16, and 18 along a path indicated by arrow 24, the pistons being freely disposed on surface 24, while maintaining protective piston-to-piston separation. The pistons 12, 14, 16, and 18 are introduced one at a time in a series to conveyor surface 22 in the receiving area 54 of conveyor 20. The introduction of each piston is alternated with the introduction of at least one relatively noncompressible and inelastic protective means such as spacers 28, 30, and 32, which are freely disposed between adjacent pistons 12, 14, 16, and 18 as shown in FIG. 2 for separating these pistons from each other. This introduction is accomplished by pushing the spacers one at a time from a supply 72 thereof onto the conveyor surface 22 in timed relationship to the introduction of each piston. The series of pistons with said spacers alternated therebetween, wherein there is at least one spacer on either side of each piston (except for first and last pistons in the

series, where either the leading and/or trailing spacers may be optional), is conveyed along conveyor path 24, the pistons being free to abuttingly contact adjacent spacers but not any other piston in the series.

FIG. 1

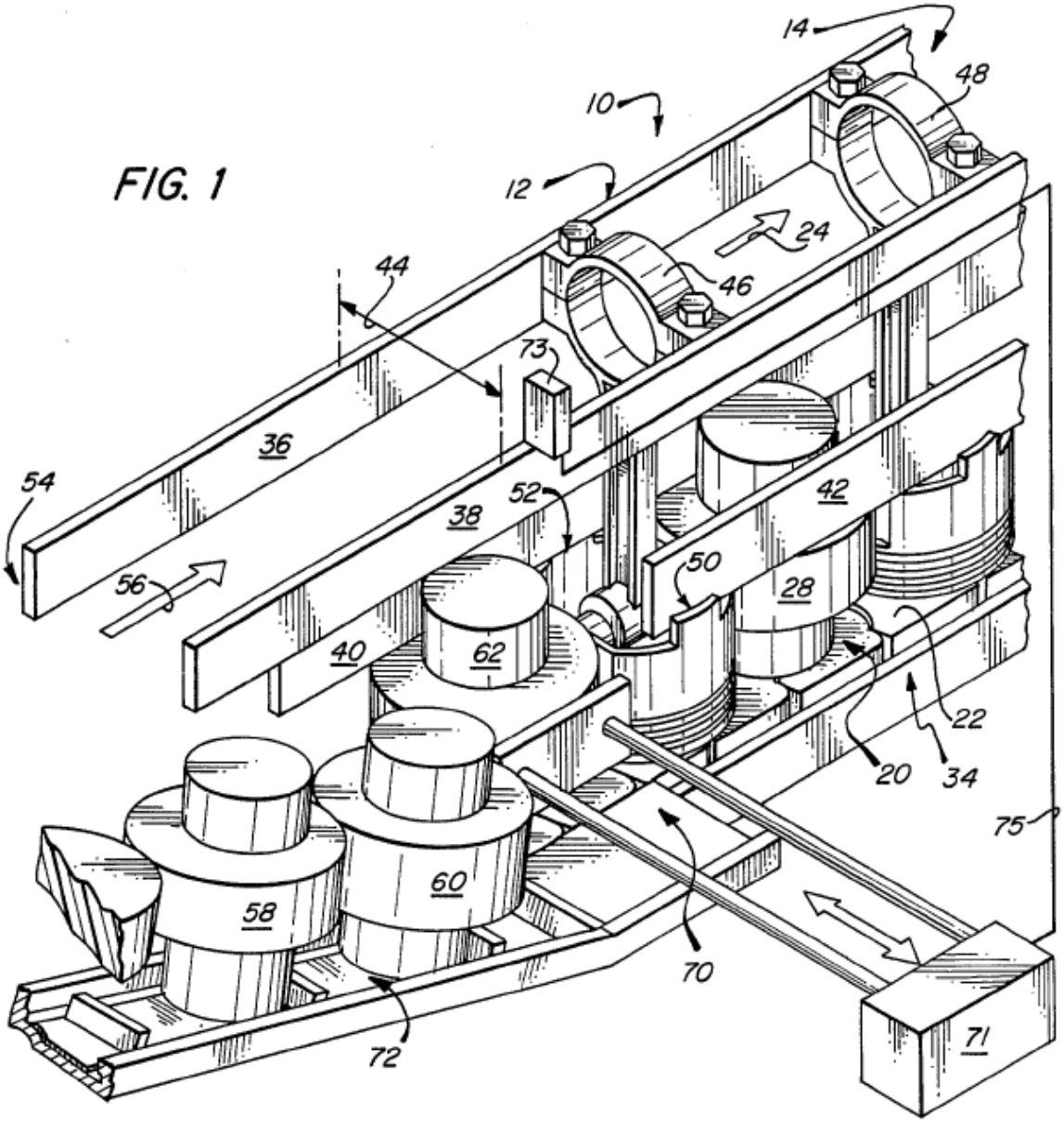
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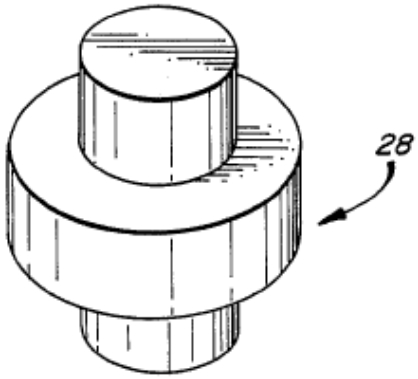
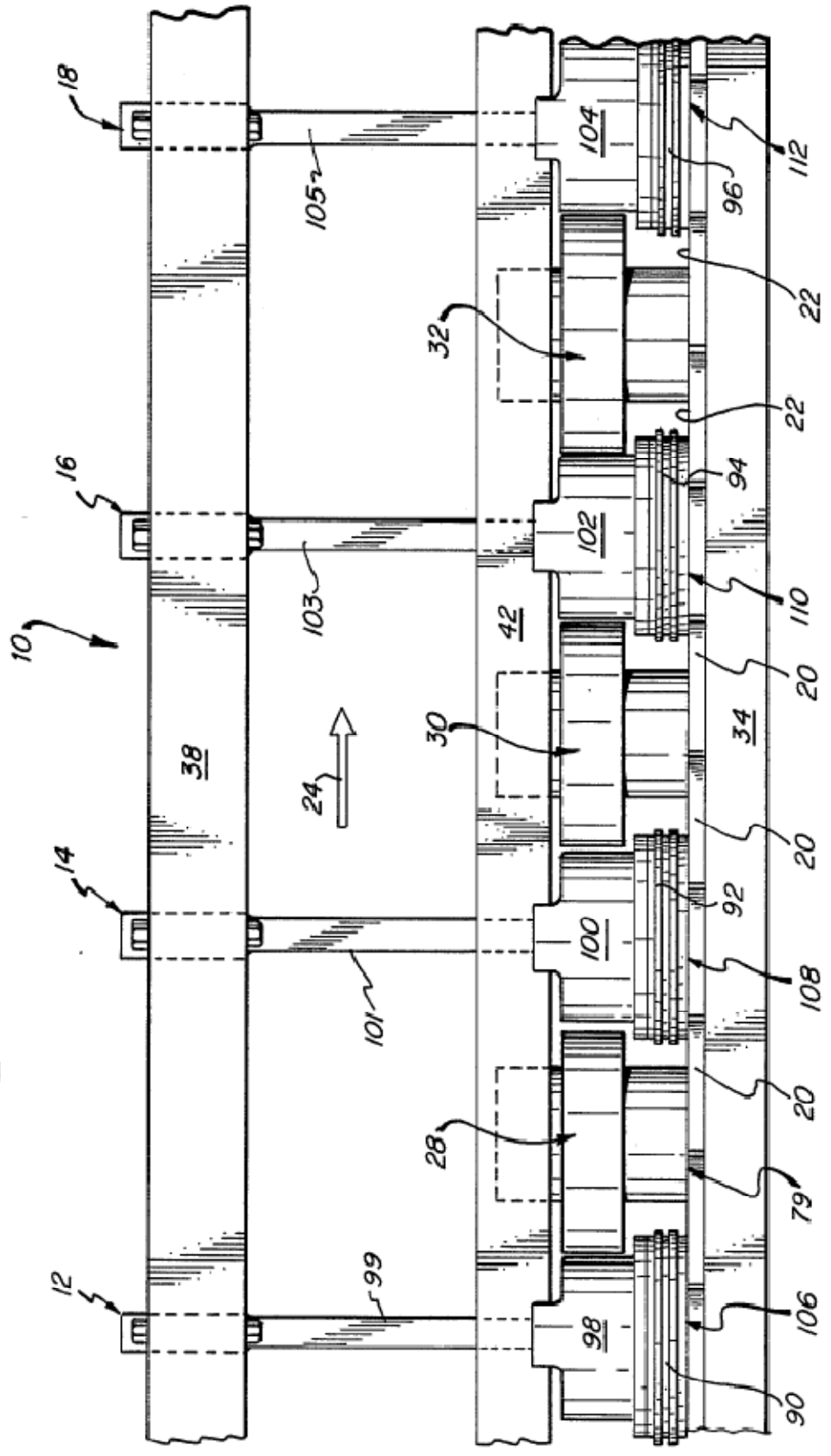
FIG. 1A


28


18
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103
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110
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14
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106
90

FIG. 2

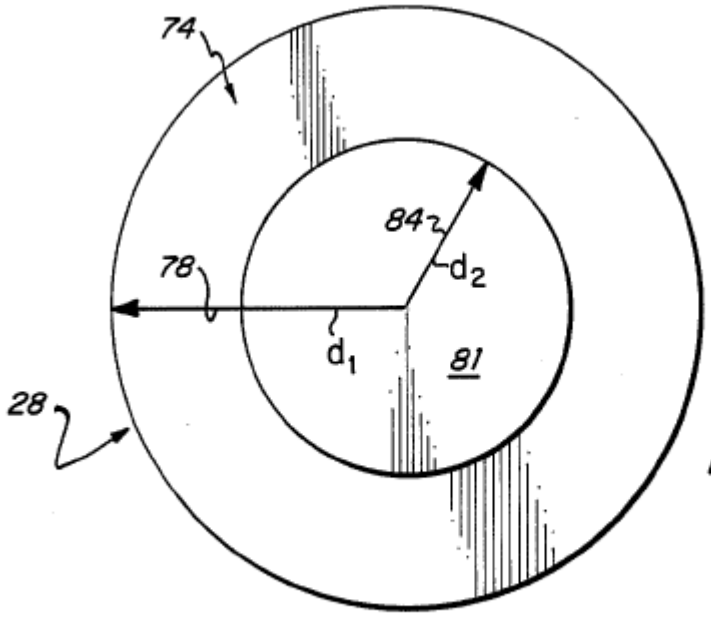

FIG. 3A

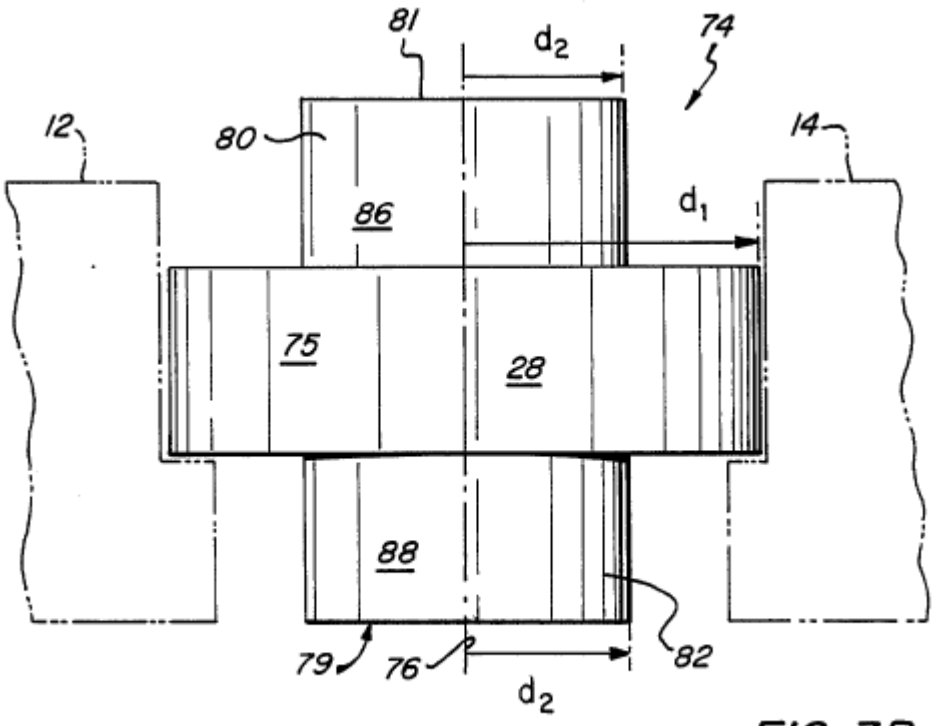

FIG. 3B

D5

United States Patent [19]

Bogatzki

[11] 4,227,606

[45] Oct. 14, 1980

[54] APPARATUS FOR SPACING ARTICLES MOVING IN A LINE

[76] Inventor: Hans U. Bogatzki, Ferdinand-Hodler-Strasse 24, Zurich, Switzerland

[21] Appl. No.: 15,788

[22] Filed: Feb. 27, 1979

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 862,439, Dec. 20, 1977, abandoned.

[51] Int. Cl.[3] B65G 47/28

[52] U.S. Cl. 198/459; 198/792

[58] Field of Search 198/459, 461, 792

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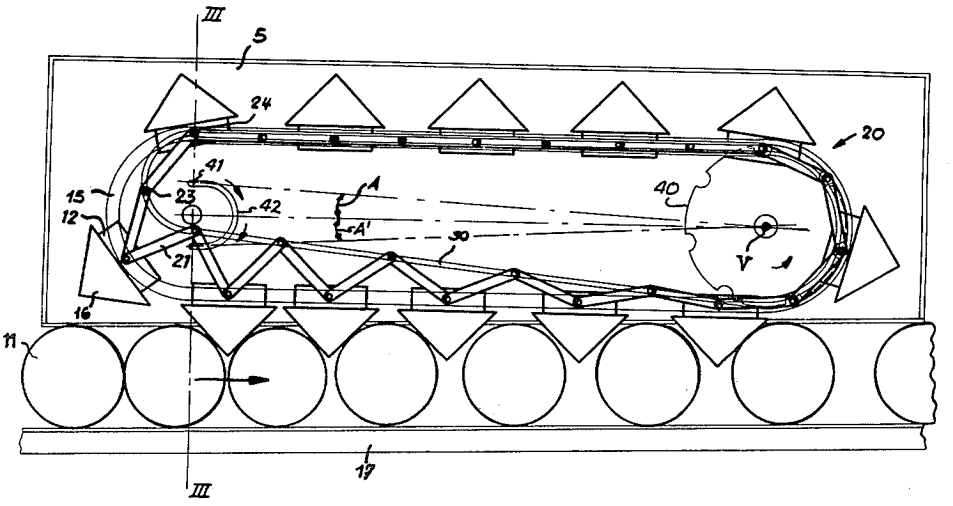
Primary Examiner—Jeffrey V. Nase

Attorney, Agent, or Firm—Frishauf, Holtz, Goodman & Woodward

[57] ABSTRACT

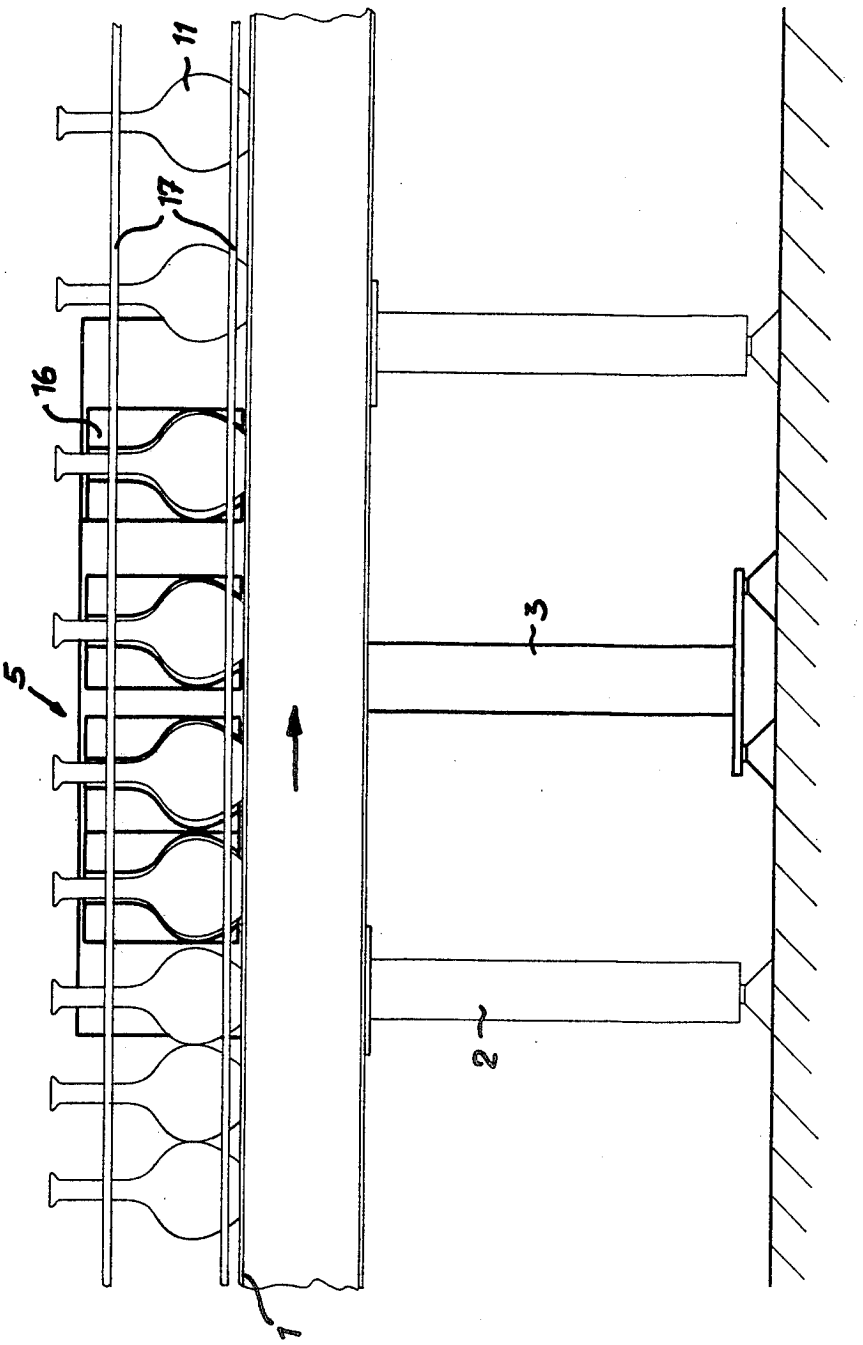
The apparatus includes two partially parallel endless rail and trolley systems. The first rail and trolley system guides spacing members so that they approach the moving articles and move along their direction for a distance sufficient to space them. The spacing members are interconnected by articulated connecting arms, which pivot at the spacing members and also at an intermediate pivot point. The intermediate pivot points are guided along the second rail system. Adjustment of the path of the second rail and trolley system relative to the first rail and trolley system where the spacing members operate on the articles permits the adjustment of the spacing operation performed by the spacing members.

13 Claims, 9 Drawing Figures



U.S. Patent Oct. 14, 1980 Sheet 1 of 4 4,227,606

FIG. 1



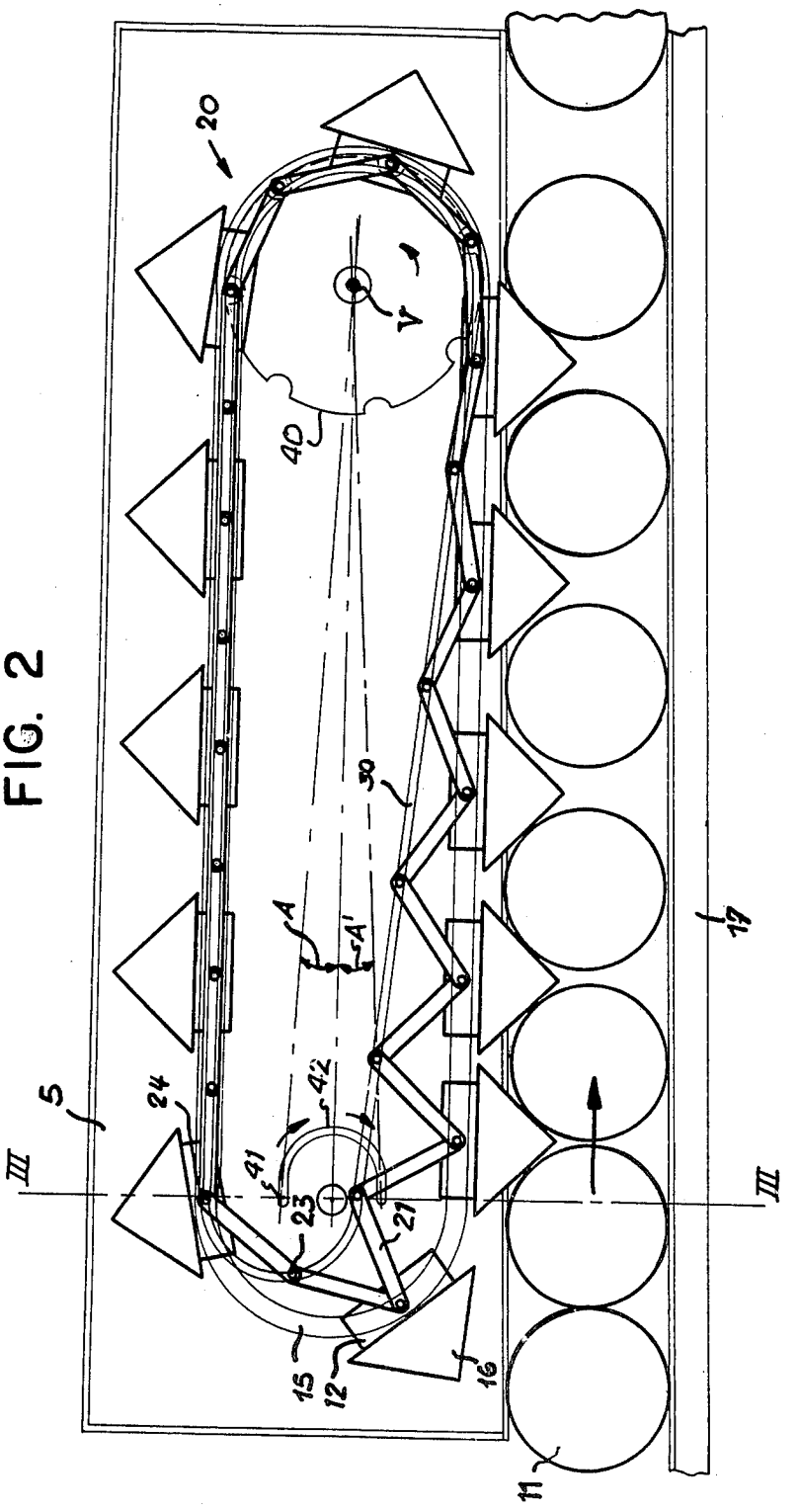


FIG. 2

FIG. 2A

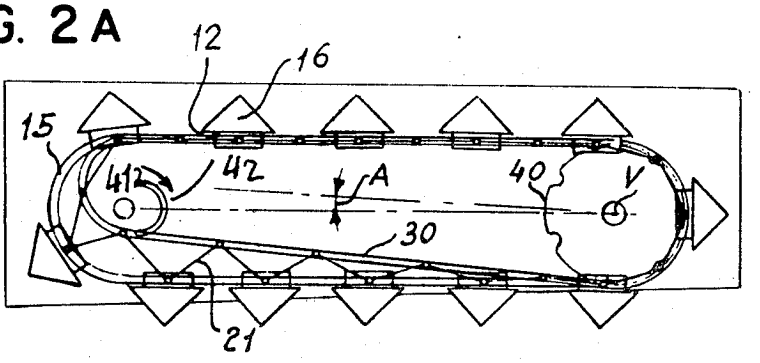


FIG. 2B

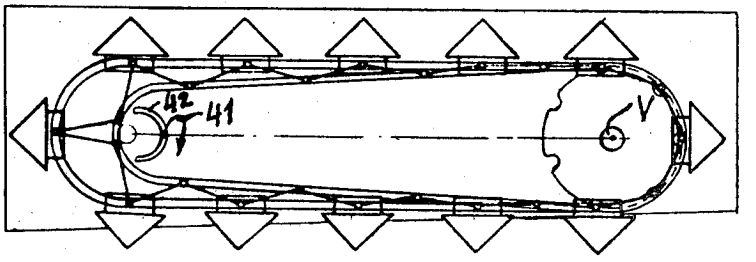


FIG. 2C

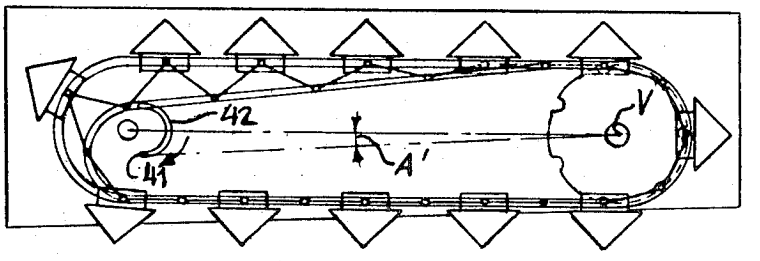


FIG. 5A

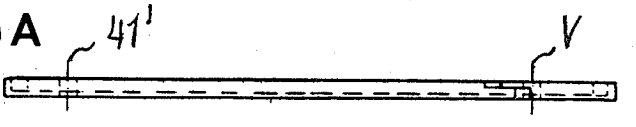


FIG. 5B

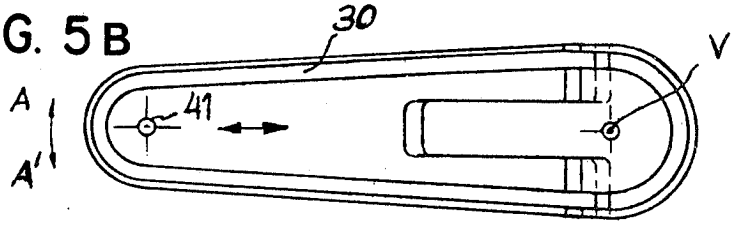
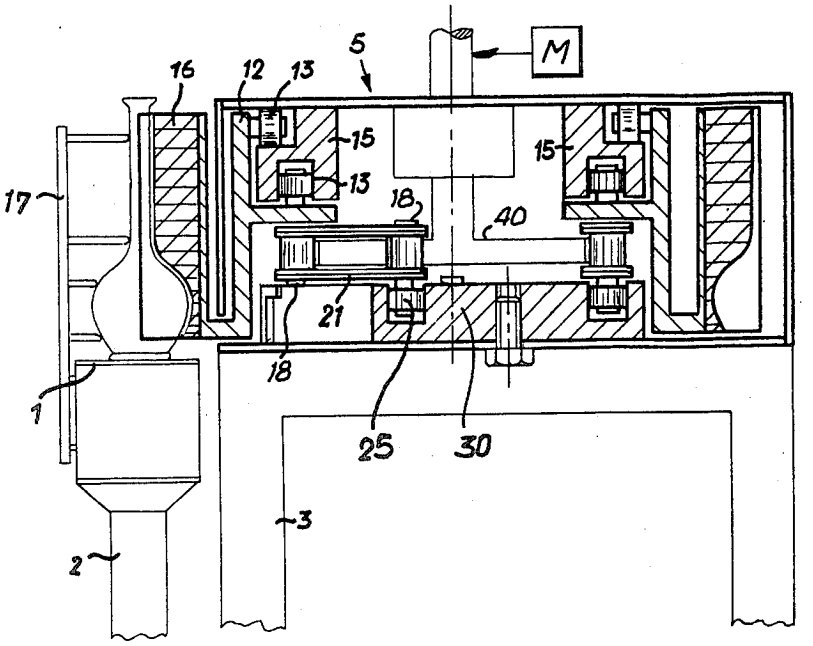


FIG. 3


M
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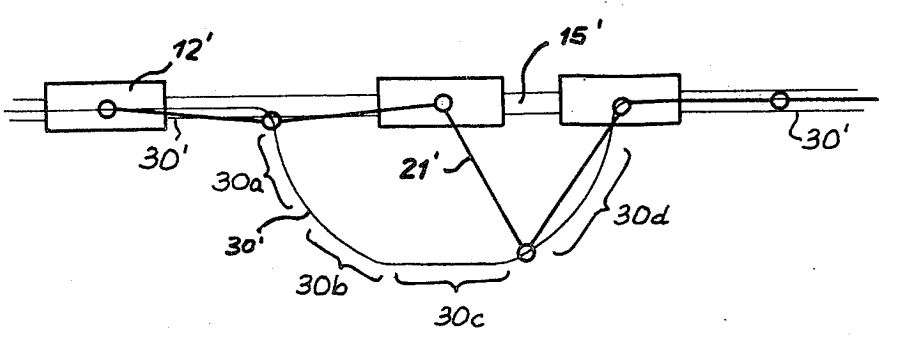
18
1
25
30
3
2

FIG. 4


12'
15'
30'
30'
21'
30a
30'
30d
30b
30c

APPARATUS FOR SPACING ARTICLES MOVING IN A LINE

This application is a Continuation-in-Part of my application Ser. No. 862,439, filed Dec. 20, 1977, (claiming priority of Swiss application 16'311/76 of December, 1976) now abandoned.

The present invention relates generally to apparatus for producing uniform gaps between mass-produced individual articles conveyed in a line on a conveyor belt or the like to at least one further processing station. It relates particularly, but not exclusively, to separating means of such apparatus which are adjustable parallel to the direction of movement of the articles of the line on the conveyor belt and which engage the articles.

BACKGROUND AND PRIOR ART

In the manufacturing and processing of mass-produced articles in the consumer goods industry, there is generally used a plurality of processing systems and/or machines in series. The individual articles, such as glasses, bottles, cans, boxes, etc., move from one processing station to the next on conveyor belts. On such conveyor belts, the articles are generally already separated and stand one behind the other, but their spacing is extremely non-uniform. This non-uniform spacing is prejudicial to the requirement that the articles be supplied synchronously to the further processing station, that is to say with an identical spacing, because production sequences or treatment processes in the individual machines are usually accomplished during uniform time cycles which translate into uniform cyclic spacing distances along the moving line. Therefore, the articles must be supplied individually in accordance with the required cyclic spacing, which, of course, must be greater than the article diameter along the line. The transfer to and from the conveyor belts or machine mechanisms causes serious problems arising from different article shapes and different processing speeds, which problems make the complete production sequence more fault-prone.

In order to at least partly control these problems, it is common to use an apparatus of the above-described type with a feed screw as an essential component. The articles are taken up by this feed screw, are separated by the increasing spacing course, and then transferred at uniform time intervals to the production machine. In spite of the fact that this system is used in almost all production processes, it cannot be considered ideal.

As the screw takes up the article and transports it, the point of engagement of the article must be very precisely determined, particularly with tall and small diameter articles, so that the article is not overturned. This is particularly the case at high speeds and when articles arrive singly. The reason for this is that due to the special characteristics of the screw design, an article which is supplied in an irregular manner can be struck in such a way by the beginning thread of the screw helix that the article is jerked abruptly which in the case of high, small diameter products generally leads to wobbling, overturning, and consequent interruption of the entire production sequence. In the case of flat, large diameter articles, a screw cannot be used, because the large screw diameter required for handling the articles exceeds the article height, so that the screw rotation axis would be located above the product height. Articles with complicated configurations can often not be gripped at the ideal contact point by the screw. This can lead to a passing under or knocking down of the article. Furthermore, when a feed screw is dirty or worn, the constant abrasion of the articles by it can lead to scratches or damage to the articles. This applies particularly in the case of labelled or bright objects. In the case of thin or elastic articles which are not supplied in a regular manner, deformation or damage can be caused by the advancing start of the screw. It is also disadvantageous that at high production speeds the advancing first thread of the feed screw momentarily acts as a barrier, so that individually fed-in articles cannot be picked up, and it is only after the build up of a so-called backlog or a dynamic pressure that the articles can be taken up by the screw. Since, as stated, this problem occurs particularly at high production speeds, each article strikes a stationary column of articles at high speed. This is particularly disadvantageous in glassworks, due to the danger of breakage. Experience in glassworks has shown that all forms of impacts, scratches, etc. occurring just after manufacture reduce the strength of the glasses to a considerable extent. Finally, it is disadvantageous that different screws have to be fitted for different diameters and heights of the articles handled.

It is also known to separate and to synchronously transfer individual articles by means of a feed star. However, even this relatively much-used system has significant disadvantages. For example, the distribution of small-diameter articles over large distances is not possible. In addition, at high speed the star ends act as a wall and lead to the overturning of individually arriving articles, or even to a jamming of them between the star and facing guide wall.

It has also been proposed to separate articles by means of belts moving at a higher speed than the conveyor belt and which thus spread the articles apart. However, this system has the disadvantage that non-uniform spacings of the fed articles still remain non-uniform.

THE INVENTION

It is an object to provide an apparatus for producing identical spacings between mass produced articles moved on a conveyor belt which makes it possible to space a moving line of individual articles of all shapes and types at hitherto unachieved production speeds either towards or away from the direction of movement of the conveyor belt and with identical reciprocal spacings as desired for the working cycle of a further processing station.

Accordingly, there is provided a separating means including a plurality of article spacing members movable in a direction parallel to the conveying path of the articles and intended for the instantaneous engagement of one article in each case. The spacing members are supported by guidance means on an endless first rail system which returns them to their starting point, the latter being interconnected by means of a motor-driven rotary articulated member chain system whose articulated connecting arm members are alternately connected in articulated manner. In each case, there is one articulated arm member with one spacing member between it and the adjacent spacing member. At the articulated pivot point between adjacent spacing members, the articulated members are supported on a second rail system whose course differs from the first rail system.

As a result of these measures, it is now possible to vary as desired the spacings between the individual

spacing members, and consequently between the articles operated on by the spacing members between the inlet and the outlet of the apparatus, as a function of the relative course of the first and second rail systems located between these two points. This is naturally a function of the length of the articulated connecting arms. In addition, an increased spacing between the spacing members at the inlet can be obtained if the rail system of this point coincides with the reversal point of the spacing members. Such an arrangement leads to a reduction of problems in feeding-in of the articles.

In order to further improve the variability, the arrangement can be such that the first and second rail systems are adjustable relative to one another in their guidance planes. This can be achieved by the second rail system being adjustable in its guidance plane and/or through the second rail system being at least partly interchangeable for varying its course.

As a result of these measures, it would be possible, if desired, to slow down the spacing members to zero speed and then accelerate them again with practically any desired acceleration mode.

This permits a simple and rapid changeover of the apparatus to virtually all possible articles. To this end, it is advantageous for the spacing members to carry interchangeable spacing heads.

Tests with such an apparatus have shown that articles, and in particular bottles, can now be processed at a production rate of about 1,000 items per minute and above with virtually no backlog, whereas hitherto only 100 items per minute could be so processed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a side view of an apparatus according to a preferred embodiment of the invention with a conveyor belt;

FIG. **2** is a plan view of the apparatus of FIG. **1**;

FIGS. **2***a*, **2***b* and **2***c* are plan views of the apparatus of FIG. **1** which illustrate different adjustment positions.

FIG. **3** is a cross-section through the apparatus of FIGS. **1** and **2**;

FIG. **4** is a diagrammatic view of a fragment of an apparatus in accordance with the invention and so designed that its individual spacing members come to a momentary halt as they pass by;

FIGS. **5***a* and **5***b* are a side view and a top view, respectively, of the second rail system.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The drawings show an apparatus for producing identical spacings between bottles **11** conveyed on a conveyor belt **1**. Conveyor belt **1** rests on a conventional frame **2** and can be driven in a known and not shown manner. The articles, in this case bottles **11**, which can for example be arriving directly from a glass bottle mold, are generally individually placed in a known manner on the conveyor belt **1**, which generally maintains a constant conveying speed. The bottles **11** follow one another in a close row or with widely varying spacings and pass over a predetermined conveying zone to a further processing station not shown.

Since it is desired that such further processing stations, such as measuring, coding, sealing, labelling and similar stations operate at high speed, the articles, i.e. in this case bottles, must naturally be supplied at a corresponding speed and with a corresponding appropriately matched uniform spacing, i.e. synchronously. This is brought about in accordance with the present invention by the apparatus **5** which is associated with the conveyor belt **1** at a desired location.

The apparatus **5** comprises a machine frame **3** and a plurality of spacing members **12**, each of which serves to instantaneously engage one bottle **11**. Spacing members **12** are supported by means of guidance means in the form of rollers **13** (FIG. **3**) on an elongated endless rail system **15**, whose course can be seen from FIG. **2**. It has a generally straight section adjacent belt **1**, and two turn-around loops at the ends. The individual spacing members **12** form a trolley with interchangeable spacing heads **16** suitably connected to spacing members **12** which are advantageously adapted to the shape of the articles **11** conveyed, as shown in detail in FIG. **3**. Preferably, the connection is pivotable, and/or yielding to form a floating attachment for self-alignment with articles **11**. The devices **16** cooperate with an opposite rail **17** which engages the other side of the bottle **11**.

As can be seen particularly from FIGS. **1** and **2**, the trolleys **12** are here moved from left to right in a direction generally parallel to conveyor belt **1** conveying direction in a track or a rail system **15**. The rail system **15** includes two parallel straight track sections which are interconnected by curved sections. The curved sections are located in the inlet and/or outlet of the arrangement. Thus, this first rail system **15** is symmetrical.

It is pointed out that the spacing members **12**, which are in this case constructed as trolleys, can also be curved sides or slides guided over blocks, in which case the rail system must be constructed accordingly.

The attachment of the rail system to the machine frame **3** can also be effected in any practicable manner and requires no further explanation here. It is also clear that it is desireable to firmly fix the apparatus **5** to the selected location on the conveyor belt or its frame **2**.

The individual trolleys **12** are interconnected by a rotary articulated member system **20**, which can be in the form of a hollow bolt chain. System **20** has articulated members **21** (FIG. **2**) which are alternately connected in articulated manner at point **24** with a trolley **12**, at a point **23** between two adjacent trolleys **12** and there further connected with an adjacent articulated member **21**. The joints at points **23**, **24** are hereby formed by means of suitable pivots **18**, as shown in FIG. **3**. At the articulated pivot points **23** between two adjacent trolleys **12**, articulated members **21** are also supported by means of rollers **25** (FIG. **3**) in an elongated endless second rail system **30** whose course diverges from the first system.

According to FIG. **2**, the return track of the second rail system **30** is parallel to the return track section of the first rail system **15**. The forward movement track section approaches the forward movement track section of the first rail system **15** at an angle and is closest to rail system **15** in the outlet area. As a result, with a continuous drive **40**, e.g. a sprocket at one end, the individual trolleys in the system assume different relative speeds and respective spacings, depending on the angular position of the associated articulated members **21**.

By suitable shaping of the respective rail systems **15**, **30**, a very large regulating range can be obtained for the relative speeds and spacings provided by the apparatus.

In principle, it is firstly possible to adjust the first rail system **15** and the second rail system **30** in their guidance planes relative to one another. Advantageously, the second rail system **30** carrying the articulated mem-

bers 21 is made adjustable in its guidance plane. For example, FIG. 2 shows an angular range A, A' by means of which an adjustment can be carried out around the displacement point V which varies the spacing and speed of the incoming trolley. In addition, rail system 30 can comprise interchangeable sections 30*a*-30*d* (FIG. 4) in order to obtain any desired guidance path. FIG. 4 also shows a path 30', which makes it possible to instantaneously stop trolley 12' on its rail 15', in the general manner explained above.

FIGS. 2*a* to 2*c* show various positions of track system 30 (FIG. 5*b*) with respect to the track system 15. The track system 30 preferably is an integral element pivotable about a pivot point V which is coaxial with the drive sprocket wheel 40. Drive sprocket wheel 40, itself, is driven by a motor M. The unit 30 can be controlled by engagement of a pivot pin 41 (FIG. 5*b*), having a pivot axis 41' (FIG. 5*a*) in a curved adjustment track section 42 formed or secured to the frame of the apparatus beneath the rail unit 30. FIG. 2*a* shows engagement of the pin 41 at the topmost end of adjustment rail 42, which places the deflection of the unit 30 at the uppermost position, that is, with angle A. In the position shown in FIG. 2*b*, the pin 41—which may be movable longitudinally in the track section 30—is in the center position of the track section 42 and the angle A is zero. FIG. 2*c* illustrates the position with the pin 41 at the lowermost end of the guide track 42, the angle A' now is negative with respect to angle A (FIG. 2*a*). Thus, a single track section of the general guidance path outline as seen in FIG. 5*b* can be used to obtain a plurality of spacing distances, and hence movement characteristics, thus providing a versatile apparatus which can be easily matched to requirement of the specific articles to be transported.

The second rail system can be a unitary element, that is, a unitary constructional track arrangement which, as shown in FIG. 5*a*, is built in form of a plate-like or frame element with a track 30 therearound, as seen in FIG. 5*b*, the unitary element being a separate unit which can be replaced as a separate element in the entire apparatus to vary the track length and track spacing and, upon proper placement of the pin 41, its relative adjustment position. The track 30 can, however, also be constructed in sections or parts, with parts and sections interchangeable. A portion of the interchangeable zone is shown in FIG. 4 at 30*a*, 30*b* . . . 30*d* so that the speed-distance relationship of the individual spacing members 12' or trolleys can be individually matched to the size of the articles and the transport requirements of the overall system.

I claim:

1. Apparatus for uniformly spacing from each other articles (11) in a moving line (1) of such articles for facilitating processing of the articles at a processing station, the apparatus comprising:

a first elongated, endless rail system (15) having a first rail system section adjacent the article line (1) and running along generally parallel to the direction of movement of the line,

a plurality of article spacing members (16) guided along the first rail system,

articulated connecting arms (21) interconnecting the article spacing members, the connecting arms pivoting at each spacing member (16) and at an intermediate pivot point (23) between the spacing members,

a second elongated, endless rail system (30, 30') having a second rail system section adjacent the first rail system section and non-parallel to the first rail system section, the first and second rail systems (15, 30) being adjustable relative to one another in their guidance plane, and including turn-around loop sections at their respective ends;

pivot guide means (25) for guiding the intermediate pivot points of the articulated connecting arms along the second rail system section;

drive means (40) for driving the article spacing members (16) along the first rail system section and engaging said article spacing members adjacent one turn-around loop of the first endless rail system;

and wherein said second rail system (30, 30') comprises a unitary structural element defining an elongated endless pivot guide means closed by end loops, each end loop having a center point (V, 41'), the diameter of the pivot guide means at the region of the end loops of the elongated endless guide means being different, the center point of one of said end loops being pivotably connected to said unitary structure, and fixed with respect to said first rail system (15), the center point of the other of said end loops being movable and shiftable with respect to said first rail system to permit selective positioning of the second rail system with respect to the first rail system.

2. The apparatus defined in claim 1, wherein the orientation of the first rail system is fixed and the orientation of the second rail system section with respect to the first rail system section is adjustable.

3. The apparatus defined in claim 1, wherein the pivot guide means are rollers (25) located at the intermediate pivot points and engaged in said second rail system (30).

4. The apparatus defined in claim 3, wherein the articulated connecting arms are connecting members of a hollow-bolt chain system.

5. The apparatus defined in claim 4, wherein the spacing members are guided along the first rail system by rollers.

6. The apparatus defined in claim 1, wherein the direction of movement of the articles in the line, the first rail system section, and the second rail system section are all substantially in the same plane.

7. The apparatus defined in claim 6, wherein the first rail system section is angled so that it approaches the moving line of articles in the direction of movement of the articles.

8. The apparatus defined in claim 1, wherein the second rail system (30, 30') comprises a unitary replaceable unit.

9. An apparatus according to claim 1, wherein the article spacing members are trolleys.

10. An apparatus according to claim 1, wherein the article spacing members carry interchangeable distributing or driving devices (16).

11. An apparatus according to claim 1, wherein the second rail system (30') is constructed at least partly in interchangeable manner (30*a*-*d*) to permit modification of its course.

12. The apparatus according to claim 1, wherein the diameter of the pivot guide means (30, 30') at the end loops are different, and the movable center point is at the position of the smaller one of said diameters.

13. The apparatus according to claim 12, further comprising a positioning track (42), and means (41) in engagement with said positioning track and with the second rail system (30, 30') to guide and define the shifting movement of the shiftable center point (41') of the second rail system (30, 30').

* * * * *

United States Patent [19]

Wahren

[11] **Patent Number: 4,605,121**

[45] **Date of Patent: Aug. 12, 1986**

[54] **ARRESTING BUFFER FOR OBJECTS ON CONVEYORS**

[75] Inventor: **Mats E. Wahren**, Vadstena, Sweden

[73] Assignee: **EWAB Ejvin Wahren AB**, Vadstena, Sweden

[21] Appl. No.: **692,353**

[22] Filed: **Jan. 16, 1985**

[30] **Foreign Application Priority Data**

Nov. 9, 1984 [SE] Sweden 8402948

[51] **Int. Cl.**[4] **B65G 37/00**

[52] **U.S. Cl.** **198/803.01**; 198/465.1

[58] **Field of Search** 198/648, 795, 472, 803.01, 198/465.1, 465.2; 267/140, 153

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Primary Examiner—Joseph E. Valenza

Assistant Examiner—Kyle E. Shane

[57] **ABSTRACT**

A conveyor (1) for objects (6) conveyed between assembly or processing stations includes a base member (3) with a central trough defined by side walls (4,4), with a continuously traveling conveying means (2) at the bottom of the trough, and carriers (7) for conveying the objects (6). The carriers are guided in the trough, are glidable against the conveying means and conveyed by it and have arresting buffers (9) arranged in the trough between them. The buffers comprise elastic rings which are compressed in the conveying direction of the conveying means between a carrier stationary in an assembly or processing station and a further carrier moving towards this carrier. On compression, the ring (9) is expanded transversely against the side walls (4,4) of the trough, causing the moving carrier to be elastically braked while the braking force is taken up in the side walls via friction of the rings against them, to prevent harmful impact against the stationary pallet.

11 Claims, 11 Drawing Figures

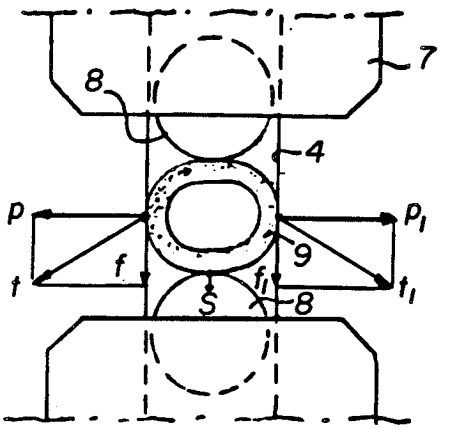


FIG. 1

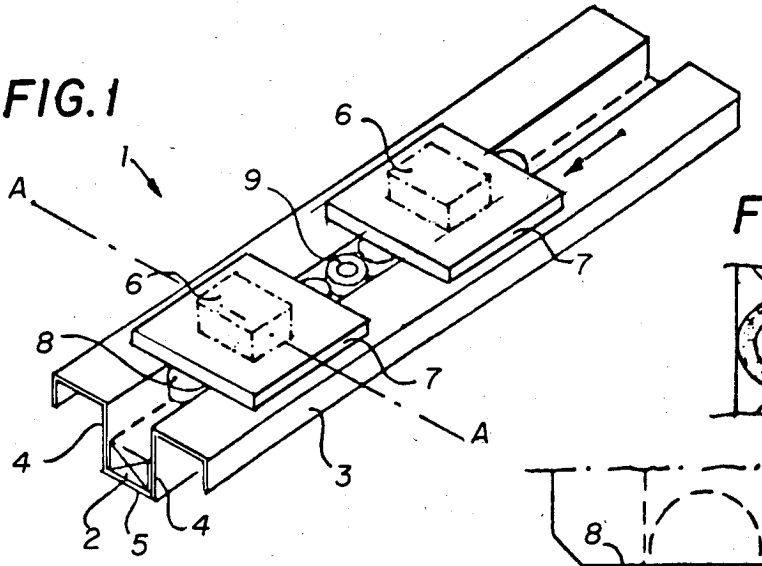


FIG. 9

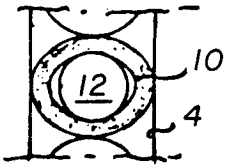


FIG. 8

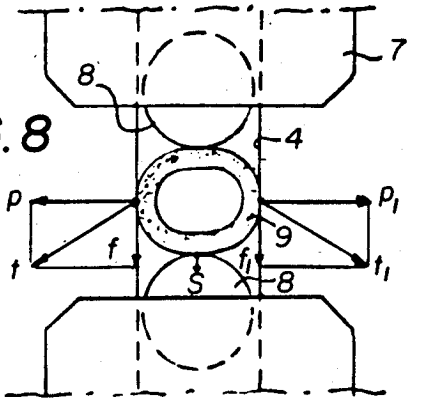


FIG. 2

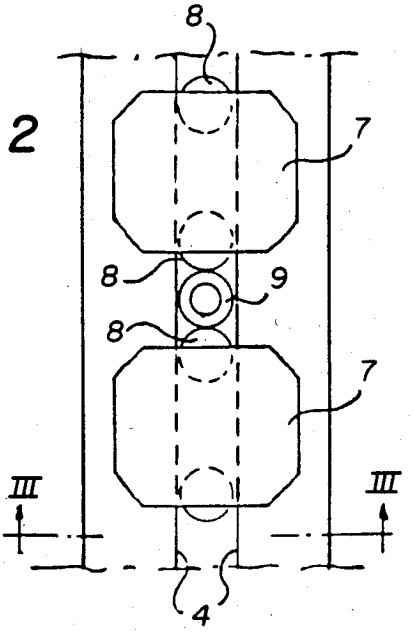
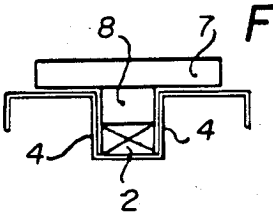


FIG. 3



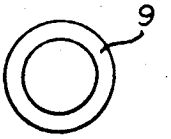


FIG. 4

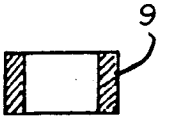


FIG. 5

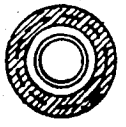


FIG. 6

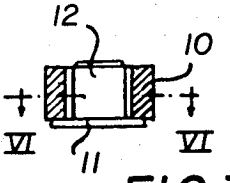


FIG. 7

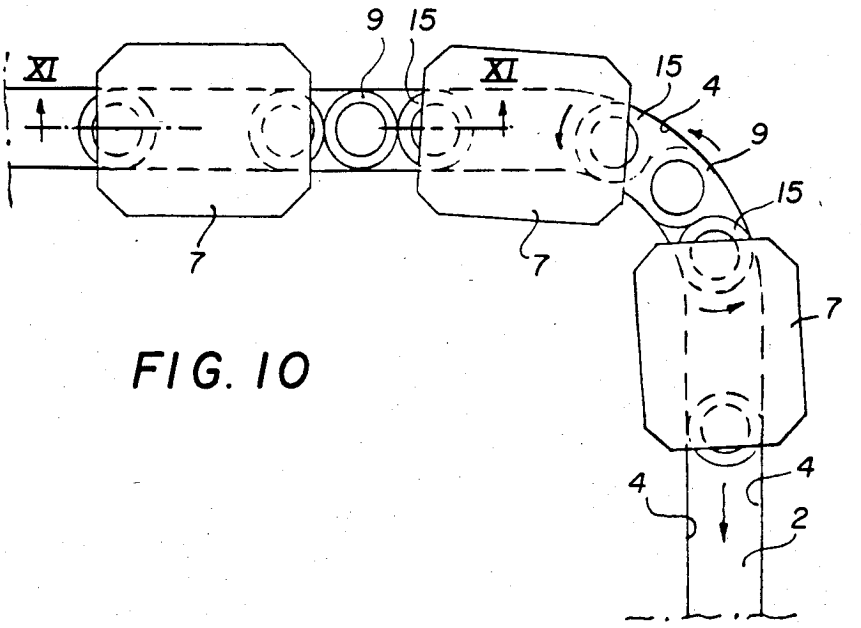


FIG. 10

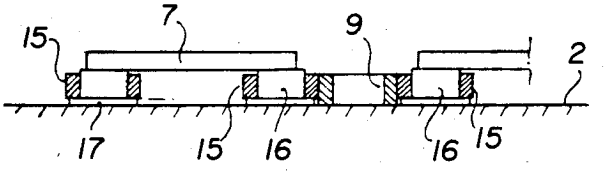


FIG. 11

ARRESTING BUFFER FOR OBJECTS ON CONVEYORS

FIELD OF THE INVENTION

The present invention relates to an arresting buffer for objects conveyed between assembly or processing stations on conveyors including a continuously moving conveying means, which is guided in its movement between parallel walls on either side of the conveying means, the conveyed objects being arrested by stops at selected stations and kept stationary thereat a predetermined time for assembling or processing while gliding against the conveying means.

BACKGROUND OF THE INVENTION

In mass production, preferably of small objects such as occurs in the automobile industry, conveyors are used to an increasing extent for moving the objects between different assembly or processing stations. A conveyor system of the kind in question is very flexible and has, inter alia, the advantage that the station may be arranged in the manufacturing facility without necessarily being dedicated to a discontinuously operating, usually straight-line conveyor, as with a so-called transfer line. These flexible conveyors have a continuously moving conveying means which can be guided rectilinearly and in curves for reaching the stations in question, and after a given assembly operation or processing they move the object further to the next station. The conveying means may be of the flexible link type, which is guided in a trough defined by vertical side walls. The objects are glidably supported on the conveying means either directly or by means of carriers or pallets, which in turn are effectively supported on the conveying means and are guided in the trough forming part of the conveyor. The conveying means and the carriers, or their supporting surfaces if the carriers are carried thereby, are made from material providing sufficient friction for the object to accompany the movement of the conveying means, while allowing gliding movement on the conveying means without excessive loss of power when the carrier and its objects are stationary. When the carrier or pallet arrives at a station, stops are triggered which stop the carrier and maintain it in a desired position for a working operation on the object. The object is retained on the carrier with clamping means or the like appropriate to the purpose.

In many cases the conveying means has relatively high velocity, in certain cases up to 70 meters per minute or more. Since there are difficulties in practice with regard to coordinating the processing time at each station so that each carrier is kept exactly the same length of time in each station, certain variations in the conveying flow of objects may result in that one or more carriers may collect behind a stationary carrier at a particular station. The following carrier or carriers must then be arrested while awaiting their turn for processing in the station in question. In such case, a carrier should not directly strike, with high velocity a stationary carrier having its objects processed, since this could detrimentally affect the processing carried out at the station. The following carrier should therefore be braked so that a problematic shock reaction is avoided. To minimize such shock reaction it is known to simply provide the carriers with rubber buffers. Such an arrangement is however not sufficient for damping the shock between the carriers. Also, for chain conveyors provided with link rollers it is known to arrange special friction bands for braking the link rollers.

These known arrangements are however, not satisfactory or they require a conveyor having a special and complicated implementation.

SUMMARY OF THE INVENTION

The invention has as one of its objectives the provision, in a conveyor of the kind mentioned, of an arresting buffer in the form of a braking device which effectively takes up and dampens a shock which otherwise will occur when a following carrier strikes a stationary carrier at the processing station. The arresting buffer or braking device of the invention is characterized in that it includes elastic members which glidably accompany a conveying means of a conveyor and which are located between the objects to be worked on or the carriers which carry the objects, the elastic members on compression in the conveying direction, caused by a moving carrier or object approaching a stationary one, expanding laterally against the guiding walls of the conveying means so that the following object or carrier is braked elastically, the braking force being taken up in the guide walls due to the frictional enagement therewith.

By this arrangement there is achieved an elastic buffer action as well as translation of the primary braking force to the guide walls due to the frictional engagement of the arresting buffer with said walls. A minor portion of the absorbed kinetic energy from the following object or pallet may be applied to the stationary pallet, but the force acting here is insignificant compared to the force which causes lateral expansion of the arresting buffer. Hence, no shock effect is experienced by the stationary object.

The arrangement described is preferably used in conveyors with carriers which rest against the conveying means by way of support blocks which are guided between the walls which also guide the conveying means.

The elastic buffer comprises an elastic means preferably in form of a cylindrical ring which glidably rests on the conveying means between two objects or carriers, and has outer dimensions such that when it is compressed in the conveying direction it expands laterally to develop the necessary braking frictional forces against the side walls. The arresting buffer can thus comprise an elastic ring or an elastic ring provided with a core suitably arranged glidably to rest on the conveying means. The elastic member is usually freely movable between the objects, but may also be connected to a carrier with a certain freedom of movement relative to the carrier for unhindered lateral expansion.

When the conveying means follows a curve, a further improved braking action in the curve is provided by modified guide rings, preferably of the same material as the arresting buffer, the rings being rotatably mounted about the support blocks that guide the carrier on the conveyor. During braking the arresting buffer will be compressed between two such guide rings to prevent their rotation, whereby an effective braking frictional force is developed between the guide rings and the side walls in the curve region of the conveyor. It will be understood that further dampening during braking is obtained by virtue of the elasticity of the guide ring itself.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention, in various embodiments, will now be described in detail and with reference to the accompanying drawings, in which

FIG. 1 is a perspective view of a conveyor with carriers and shows one embodiment of the arresting buffer of the invention.

FIG. 2 is a plan of the conveyor shown in FIG. 1.

FIG. 3 is a section along line III—III in FIG. 2.

FIGS. 4 and 5 illustrate an annular arresting buffer in accordance with the invention.

FIGS. 6 and 7 illustrate a further embodiment of an arresting buffer, FIG. 6 being a section along the line VI—VI in FIG. 7.

FIG. 8 illustrates in plan a deformed arresting buffer of the type shown in FIGS. 4 and 5, between two carriers, during elastic force take-up on engaging the side walls of the conveyor.

FIG. 9 illustrates the corresponding deformation of an arresting buffer in accordance with the embodiment of FIGS. 6 and 7.

FIG. 10 is a plan view of a further embodiment of the invention, the carriers being provided with rotatably mounted guide rings placed around the supporting block, the conveyor extending in a curve.

FIG. 11 is a section along the line XI—XI in FIG. 10.

DISCLOSURE OF THE INVENTION

A conveyor for carriers is generally denoted by the numeral 1 in FIG. 1. The conveyor includes a base member 3 in the form of a metal section with a central trough defined by two side walls 4, 4 and a bottom 5. From the upper edges of the side walls there are horizontal extensions which terminate in downwardly extending reinforcing flanges. A conveying means 2 runs along the bottom of the trough in engagement with the bottom 5 and with clearance to the side walls 4. The conveying means extends upwards to approximately half the height of the side walls. The carriers or pallets 7, 7 are guided in the central trough by support blocks 8 rigidly connected to the carriers and resting on the conveying means 2 to accompany it in its travel. The carriers 7 are formed as horizontal plates with a clearance from the underlying horizontal extensions of the conveyor 1. There is also a small clearance between the support blocks 8 and the side walls 4, 4. The conveying means 2 comprises links which enable the conveying means to be guided in relatively tight curves, and it is made from a material such as an acetal resin (sold under the trade name DELRIN)* with suitable properties for gliding against the steel base member 2. The support block 8 can be made from steel, for example.

*DELRIN is the registered trademark of E. I. Du Pont De Nemours and Co.

Objects 6, schematically denoted by dot-dash lines and shown as blocks are removably clamped to the carriers 7.

The support blocks 8 normally project somewhat beyond the carriers in the conveying direction. An arresting buffer in the form of an elastic ring 9, which may be made of a material such as urethane, is arranged between two support blocks 8 of adjoining carriers in the manner shown in FIGS. 1, 2 and 8. This ring has a cylindrical shape and is of a diameter such that a small clearance is provided between its outer circumference and the side walls 4, 4. The height of the ring corresponds to the vertical distance between the upper side of the means 2 and the height of the side walls of the base member 3. The ring 9 is made from elastic material with the property of being able to attenuatingly take up deformation forces, particularly in a direction at right-angles to the axis of the ring.

The system functions in the following way.

The object 6 illustrated to the left as viewed in FIG. 1 is assumed to be stationary in an assembly or processing station, schematically denoted by the line A—A. The conveying means 2 travels in the direction of the arrow in FIG. 1, taking with it the right hand carrier 7 and its object 6. The movable carrier 7 is moved in the direction of the arrow by the conveying means until it is hindered in its movement via ring 9, by the stationary carrier 7. By virtue of the kinetic energy of the moving carrier, a force is applied to the ring 9 in the conveying direction which compresses the ring in the conveying direction and simultaneously expands it transversely, as illustrated in FIG. 8. The ring 9 is thus pressed against the opposing side walls 4,4 of the conveyor with the opposingly directed transverse forces p, p_1. The ring is simultaneously urged somewhat forward in the conveying direction to develop corresponding frictional forces f, f_1. Since the lateral forces p, p_1 are not developed until a certain counterforce can be applied to the forward portion of the ring, the ring will apply a small force s against the stationary carrier via its support block 8. However, inasmuch as this force s is small compared with the developed lateral forces p, p_1 and the respective frictional f, f_1, as well as being developed gently and elastically in the initial stages of the deformation of the ring, its effect on the stationary carrier may be ignored. The actual braking force will be taken up by the side walls 4,4, against which the resultant force t, t_1 from the ring 9 is applied.

The braking action against the moving carrier or pallet may be controlled by suitably selecting the clearance between the outer circumference of the ring and the walls 4,4. This clearance should preferably be as small as possible, bearing in mind that a sufficient clearance should be provided for practical reasons, so that the ring will not unintentionally bind against the conveyor side walls.

If desired, more than one ring may be used as an arresting buffer, e.g. two rings in tandem. Braking in that case can be effected even more gently, with further reduction of the effect of the moving carrier on the stationary carrier.

The arresting buffer may also be implemented as illustrated in FIGS. 6 and 7. In this case the elastic ring 10 is arranged around an inner core 12, which is terminated at its bottom by a footplate 11 which engages the conveying means 2. The core 12 and footplate 11 are as in the case of the support block 8, made from a material with suitable gliding properties enabling the arresting buffer to glide relative to the conveying means 2. The diameter of the core 12 is less than the inner diameter of the elastic ring 10, so that there is a clearance between these parts. On compression in the conveying direction, the ring 10 expands, as in the case of ring 9, against the opposing side wall 4,4 of the trough. Both the compression and lateral expansion of the ring as illustrated in FIG. 9 are determined by the clearance between the core 12 and the interior diameter of the ring. This arrangement makes possible some control of the braking force by adjusting the clearance between ring and core. The arresting buffer in this embodiment otherwise

works in principle in the same way as described for the embodiment of FIG. 8.

As mentioned hereinbefore, the arresting buffer may either be freely movable between the objects or carriers or may be connected to a carrier. In the latter case the connection may take the form of a hook one end of which is rigidly connected to the carrier, the opposite free end extending freely down into ring 9 or into an opening in the core 12. The buffer in the latter case accompanies the carrier without its deformation potential being in any way adversely affected.

FIG. 10 illustrates an embodiment of the invention having an especially effective action when the conveyor follows a curve. In this case modified guide rings 15 are rotatably mounted about modified support blocks 16. As with the previously described embodiments, the diameter of each guide ring is such that the ring has a small clearance to the side walls 4,4 for guiding the carrier 7. At its bottom end each support block is terminated by a radial flange 17 so that the block rests on the conveying means 2 and guide ring 15 rests on the flange without engaging the conveying means. The outer circumference of the guide ring extends beyond the periphery of the flange and thus constitutes an impact surface for the carrier in the transport direction (see FIG. 11). An annular arresting buffer 9 is arranged between each carrier, as already described. When the carriers 7,7 are conveyed, one after the other through a curve, the guide rings 15,15, as well as the intermediate arresting ring 9, will rotate in the direction of the arrows illustrated on the figure, as a result of frictional engagement with the outer side wall 4 in the region of the curved section of the guide trough. The carriers are conveyed on the conveyor means 2 in the direction of the arrow shown on the figure. When the first carrier in the conveying direction shown in FIG. 10 is stopped at a predetermined station along the conveying direction, the following carrier on approaching the first carrier will exert a pressure against the buffer ring 9, causing it to expand in the transverse direction of the conveyor, ring 9 thus ceasing to rotate. The guide ring 15 forced against buffer ring 9 will thus also be prevented from rotating and will become wedged between the buffer ring 9 and the outer wall 4 of the trough. A similar situation also occurs for the guide ring 15 on the opposite side of the buffer ring 9, this ring 15 being acted on by the minor force s discussed above. This effect is relatively small, however. By virtue of the friction created between the outer side wall 4 and the respective rings 9 and 15 there is thus obtained an increased braking action against the following carrier 7. Any augmented dampened braking action is obtained by the intrinsic elasticity of the guide ring 15.

The guide rings 15 are suitably made from the same elastic material as the buffer rings 9, preferably urethane. The modified support blocks 16, as with the previously described embodiment, can be made from steel and are fixed to the carrier plate 7. Since there is greater friction between a urethane guide ring 15 and the wall 4 than between a steel support block 8 steel and said wall, it will be clear that braking action in the curved zone is increased when such guide rings 15 are used. Apart from this increased braking action, the arrangement with special guide rings such as ring 15 has the advantage that the carrier glides more easily through a curve while the guide rings rotate against the outer curve wall 4 so that the wear which would occur between a fixed steel support block and wall 4 is eliminated. The invention thus enables a carrier to be conveyed with less resistance through a curve, while at the same time enabling more effective braking of the carrier by virtue of the coaction between the buffer ring 9 and guide ring 15. In conveying carriers through a curve with the arrangement according to FIG. 10, no disadvantage results from the engaging rotating rings 9 and 15 since the friction of urethane-urethane element is considerably less than the friction which would occur if urethane-metal elements were used.

What is claimed is:

1. A braking system for a conveyor for objects conveyed by the conveyor to and stopped at assembly or processing stations for a work performing operation on the objects, said conveyor including a continuously moving conveying means, the movement of which is guided in a trough defined by parallel side walls, said braking system comprising support block means supporting the objects for movement on the conveying means, and elastic ring means freely disposed between adjacent support block means for gliding movement of the ring means on the conveying means, said ring means being compressed in the conveying direction of said objects by the support block associated with the trailing object when the trailing object reaches the station whereat the object to be worked on is stopped, said elastic ring means being laterally expanded from a circular into an oval form for functionally engaging said side walls and thereby braking the movement of the trailing object to minimize its impact on the object being worked on.

2. A system according to claim 1, wherein the objects rest on carriers guided by said support block means between the side walls of the conveyor, the support block means glidably resting on the moving conveying means.

3. A system according to claim 1, wherein the elastic ring means comprises a cylindrical means having a diameter to provide a clearance between it and the side walls when the elastic ring means are unstressed.

4. A system according to claim 1, wherein the elastic ring means is a ring arranged about a core and engages the conveying means, the diameter of the core being less than the inner diameter of the elastic ring means.

5. A system according to claim 1, wherein the elastic ring means is directly connected to a carrier guided by said support block means.

6. A system according to claim 1, wherein the support block means are guided between the side walls of the conveyor via cylindrical guide rings rotatably carried about and by the support block means, the elastic ring means being expanded for braking between said guide rings.

7. A braking system according to claim 1, wherein said support block means support the objects for movement with the conveying means when the objects are moving between stations and comprising a material to enable gliding of said objects relative to said conveyor when said objects are stopped at a station for a work performing operation thereat.

8. A conveyor for objects conveyed between work performing stations serviced by the conveyor and comprising a base member having a central trough defined by side walls, a conveying means continuously movable within said trough for conveying objects to a work performing station whereat the object to be worked on is stopped, arresting buffers in said trough between said objects and comprising elastic rings the axes of which

are perpendicular to the direction of movement of said conveying means, said elastic rings being subjected to compressive forces in said direction of movement of said conveying means when a trailing object reaches a stationary object, said elastic rings on being subjected to said compressive forces expanding laterally from a circular to an oval form to frictionally engage said side walls producing thereby a braking action which prevents interference with the work performing operation on said stationary object.

9. A conveyor according to claim **8**, wherein the arresting buffers comprise elastic members having cylindrical contours and a diameter to provide a clearance between the elastic members and the guide walls when the elastic members are unstressed.

10. A conveyor according to claim **8**, wherein the support blocks are guided between the guide walls of the conveyor via cylindrical guide rings rotatably carried about and by the support blocks, said arresting buffers comprising elastic rings expanded for braking between said guide rings.

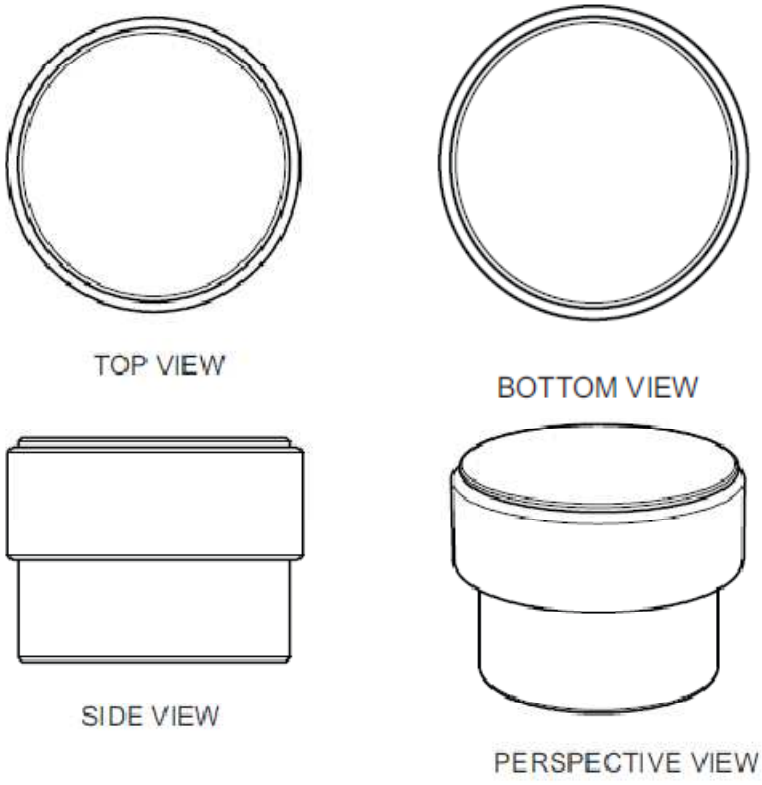
11. The conveyor of claim **8**, wherein said objects are supported on support block means for movement with the conveying means when the objects are moving between stations and being made of a material to enable gliding of said objects relative to said conveying means when said objects are stopped at a station for a work performing operation thereat.

* * * * *

D7 – New Zealand registered design NZ 22333 (expired)

IP Number	22333
Title	A door stop
Filed Date	17 April 1995
Status	Expired
Registered on	17 April 1995
Final Expiry Date	17 April 2010

The novelty resides in the features of shape and configuration as shown in the accompanying representations.



Perspective view