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Description

A great many wrapping machines are known in the art but wrapping machines for such products as paper towels and napkins, rolls of tissue, and the like for wrapping individual products or groups of products have not been able to achieve the high speeds which are now needed to wrap economically the output of other machines now available for producing the products. Either it has been necessary to provide an undue number of wrapping machines and to divide product streams among them or other machinery must be operated at the speeds previous wrapping machines could sustain. One reason for such limitations has been changes in the directions of movement of a product as it was being wrapped. Such a change imposes an upper limit on wrapping speed, particularly if the change is a deviation from the direction of movement of the product and then a return to the previous path. Stopping and starting of the product or great changes in speed impose similar limitations. U.S. Patent Specification No. 3,507,089 discloses one prior art wrapping machine.

In order to speed the flow of products through the wrapping machine it was necessary to devise a number of novel mechanisms and to interconnect them in such a way that either a single product or a group of products could be oriented with respect to the path through the wrapping machine and passed along that path with substantially continuous motion while being wrapped.

The invention provides apparatus for wrapping a series of products as they move on a conveyor along a substantially linear product path, comprising means for feeding wrapping sheets in timed relationship to the products to be wrapped, means for moving the leading edge of each wrapping sheet across the product path ahead of its corresponding product whereby the sheet is drawn across the front of and around the product by product travel so that the original leading edge of the wrapping sheet becomes a second trailing edge, and means for securing together the trailing edges of the wrapping sheet at the rear of the product characterized in that the means for feeding the wrapping sheets in timed relationship to the products to be wrapped is effective to feed each wrapping sheet alongside its corresponding product in the same direction as the product travel with a leading edge and a substantial proportion of the wrapping sheet ahead of the product prior to moving the leading edge across the product path. One particular advantage of this apparatus is that it enables the product to move in a substantially straight line during wrapping and substantially at a single speed which allows very high wrapping speeds. In addition, the apparatus has the advantage of producing a seal to secure the wrapper at the generally narrow rear face of the product or product group rather than on the generally broad top face, permitting a heater package with better arrangement of the text which appears on the wrapper.

The invention is advantageously used in conjunction with a novel transfer mechanism to move articles or groups of articles from a conveyor standing at any angle to the wrapping machine to the first conveyor of the wrapping machine. This transfer mechanism is claimed *per se* in our copending European Patent Application No. 81303965.8 (published as Serial No. 480104) and comprising a handling apparatus for articles wherein a handling arm is movable in a cyclic path that passes through an article handling zone, the arm movement being controlled by a linkage which comprises pivot means pivotally mounting the handling arm on a first rotary member, cam means fast to the handling arm, a cam follower mounted on a second rotary member in sliding engagement with the cam means, and drive means for rotating the first and second rotary members to drive the pivot means and the cam follower around mutually eccentric circular paths, wherein the circular paths and the shape of the cam means are inter-related to maintain the handling arm at a fixed angle of presentation during its arcuate path through the handling zone, then to cause it to rotate about the pivot means in the opposite sense to the rotation of the first rotary member to retard its tip speed, then to move laterally from the path of articles to be handled, and then to rotate about the pivot means in the same sense as the rotation of the first rotary member before it again approaches the article handling zone to repeat the cycle. When used in conjunction with the wrapping machine of the present invention the handling arms operate in the included angle between an infeed conveyor and the wrapping machine conveyor. By appropriate design of the cam means the handling arms are able to pick up an article or group of articles from the infeed conveyor and change their direction of movement to that of the wrapping machine either with or without a change in the orientation of the articles and without disturbance of a group of articles which are to be wrapped together, after which the handling arm retracts in a path that carries it sideways and out of the way of the wrapping machine, thereafter extending itself behind another product or group of products on the infeed conveyor to repeat the cycle without having to start and stop the product group for the direction change.

In addition, a variation of the same handling apparatus advantageously serves as a tucker in a wrapping machine according to the present invention, to make an end fold in which the tucker arm moves out and sideways as it retracts, to avoid pulling out the fold just made. The parts are essentially the same as those of the transfer mechanisms excepting cam shaped. One preferred means for drawing the wrapping sheet across the product path in the apparatus of the present invention comprises a pair of

vacuum wheels positioned on opposite sides of the product path to grip opposite sides of each sheet by suction and, by rotation of the vacuum wheels, to draw the wrapping sheet across the product path before releasing the gripped sides of the sheet. Preferably the vacuum wheels are toed out slightly from each other to grasp each wrapping sheet and draw it across the product path while pulling laterally on it to impart a slight transverse tension to keep it smooth and allow as little sagging or billowing as possible. A vacuum port open between the vacuum wheels assists by reducing air pressure ahead of fast moving products and behind the wrapping. Wrapping sheet transport belts may be angled.

Another novel and preferred feature for guiding the leading edge of the wrapping sheet as it is drawn across the path of the product comprises a belt having a portion of increased thickness for gripping the sheet more firmly as the sheet and the belt portion of increased thickness pass through the nip of cooperating rollers, that belt being driven in timed relationship with the feeding of the wrapping sheets and with the movement of the products along the product path so that the belt portion of increased thickness engages the leading edge of each wrapping sheet as it is stripped from the vacuum wheels and releases the sheet, by movement out of the nip of the cooperating rollers, as the product engages that portion of the wrapping sheet which is in the product path.

Drawings

Figs. 1 through 11 are a series of perspective views showing the sequence of steps in the wrapping process.

Fig. 12 is a top plan view showing my novel article transfer device between an infeed conveyor and a wrapping machine conveyor.

Fig. 13 is a top plan view of a tucker mechanism to form an end fold in the wrapper and showing the trajectory of the tip of the tucker arm, particularly the way it tilts to the side as it backs out of the fold using mechanism similar to Fig. 12.

Fig. 14 is a side elevational view showing the portion of my machine in which pre-cut sheets of wrapping approach the product conveyor from above and are disposed alongside the product with the leading edge of the wrapper very substantially ahead of the leading edge of the product to be wrapped and further showing that portion of the machine in which a novel array of vacuum wheels and belts move the wrapper down across the front of the product as the product passes by a lower slot in the conveying section to leave the wrapper disposed along the top, front, and bottom of the product as it moves to the right in the drawing.

Fig. 15 is a fragmentary top plan view of the slot section where the wrapper is passing downwardly.

Fig. 16 is a vertical cross-sectional view through the slot section.

Fig. 17 is a fragmentary top plan view showing additional details of the belts and rollers in the slot section.

Fig. 18 is a detail of two rollers and associated belts in the slot section.

Fig. 19 is a fragmentary top view of a portion of the vacuum wheel and a belt associated with it as the wrapper moves downwardly in the slot section.

Fig. 20 is a side elevational view of a chain driven paddle conveyor which takes over from the belt conveyor just after the slot section.

Fig. 21 is a detail view of the same conveyor showing groups of products being pulled together and a wrapper being tightened by a novel configuration of parts and materials in this section of the conveyor.

Fig. 22 is a fragmentary view similar to Fig. 21.

Fig. 23 is a lateral cross-sectional view showing cooperating paddles of upper and lower paddle conveyors and air jets which assist in making end folds.

Fig. 24 is a side elevational view of the mechanism that carries the support arms.

Fig. 25 is a bottom plan view of the mechanism that carries the support arms.

Fig. 26 is a side elevational view of the section of my machine in which the end folds are made and in which the rear seals are accomplished.

Fig. 27 is a side view similar to Fig. 14 but in a plane through the vacuum wheels to show superimposed timing belts carrying the side margins of the wrapper sheet. Not shown is the support mechanism to toe out the lower belt slightly to smooth the sheet laterally.

Fig. 28 is a top plan view of the slot section of my machine where the wrapper is transferred across the product path.

Description

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structure. While the best known embodiment has been described, the details may be changed without departing from the invention, which is defined by the claims.

The machine of this invention has a number of sections which cooperate to achieve the overall result. Each of the sections will be described very generally and will then be described in greater detail. Unless the context indicates otherwise the word "product" refers either to a single article, such as a roll of paper tissue or towelling, or to a single group of articles to be wrapped in one wrapper.

First of all is the direction changing mechanism (Fig. 12) which brings the product to be wrapped from an infeed conveyor extending from a different direction to conveying means in the wrapping machine which thereafter trans-

port the product continuously in a single direction. The direction changing means are unique in their mode of action in that although they change the direction of product movement, they do not change the orientation of the product, and do not significantly change its speed, utilizing a mechanical motion believed to be unique and which may be utilized in other devices, such as my tucker.

After entering the wrapper machine proper through the direction changing mechanism, the product passes beneath a wrapping film supply section (Fig. 14) fed from a roll of wrapping material from which sheets of wrapping film are cut and supplied to lie in a horizontal plane above the product supported by conveying structure that will be described later. (Fig. 1.) The wrapping film is supplied in a specific relationship to the product such that an amount of film sufficient to wrap the forward side, bottom and part of the back of the product extends ahead of the product as it moves down the conveyor, the remainder extending above and behind the product. The wrapper is carried between pairs of belts moving beside the product at the same speed.

As the product and wrapping film proceed down the conveyor from the film supply area the lower wrapper carrying belts turn on vacuum wheels so the edge of the wrapping film is brought downward ahead of the product (Fig. 14) by engagement with the vacuum wheels which are rotating on either side of the product with axes that are not quite transverse to the conveyor but are skewed or toed outward slightly to create a slight outward pull on the wrapping film as it moves downwardly in contact with the vacuum rolls. The vacuum wheels must grip lightly to prevent wrinkles. As the forward edge moves downwardly it is stripped from the vacuum wheels by belts which nip it lightly and assure its continued travel vertically downward as it leaves the vacuum roll. A large number of belts and rolls in this vertical slot smooth and control the wrapper. As the product moves over the slot area in which the wrapping film was pulled downwardly, the film is pulled taut at the forward edge of the product and is withdrawn from its downward extension into the slot to cover the bottom surface of the product as the product advances so that the film now extends in a horizontally disposed U from behind the product at the top around the top, front, bottom, to behind the product at the bottom (Fig. 2).

Previous to this point both the film and the product have been conveyed on belts but the product now enters a portion of the conveyor (Figs. 20—23) comprising stationary upper and lower rails with paddles moving behind the product to advance it and to fold the wrapper back of the product. These paddles fold the upper film down over the back of the product (Fig. 3) and because they are advancing the product hold the film tightly. As shown in Figs. 21—22, at this stage when groups of articles make up a product to be wrapped, there may be a droop in the wrapping film between products of a group, either because the group has separated slightly or for other reasons. To produce a neat smooth wrap the articles should touch or even compress together. In my machine, with the upper portion of the film held tightly against the back of the product by the advancing paddles (Figs. 3 and 21—22) the friction of the passage of the products and film along the conveyor bars cause very slight drag on the film. The upper stationary bars of the conveyor are selected from material and finish having slightly less friction than the lower stationary bars of the conveyor, with the result that with the film nipped between the advancing paddles of the conveyor and the back of the product, and greater friction on the lower portion of the film than the upper portion of the film, the film is gradually pulled around the lower side of the product a tiny amount which snugs the articles in the group tightly together and pulls the wrapping film tightly about them. (Fig. 21—22.)

It is a major objective of this invention to wrap products by moving them linearly without stopping in a manner such that the products to be wrapped are wrapped tightly by the film to produce a package which is compact and free of wrinkles. A secondary but still major objective is to seal the package so produced on a narrow edge which in the direction of product travel in my machine is a rear surface, particularly where multiple articles are wrapped. The rear surface being one of the narrow surfaces of the package this permits maximum printed display area on the broad surfaces of the package which is not defaced by a seal. In this machine the objective is achieved regardless of the number of articles in a package, the number typically ranging from one or two 11 inch rolls of toweling through one, two, or four rolls of toilet tissue. Other articles may be wrapped.

During this period support fingers (Figs. 3—5 and 23—25) approach the product at the side and move up to support that portion of the film that extends sidewardly or transversly from the product. In the same section of the machine the paddle type conveyor that has previously been described as coming down in back of the product from above to nip the film against the product to allow tightening travels upwardly at a slight angle to the product path while a lower chain carrying upwardly extending paddles travles from below at a slight upward angle to the product path so that as the upward paddle is withdrawn, the lower paddle moves upwardly to take its place, folding the film upwardly around the back of the product at the same time. (Figs. 4, 23 and 26.) Both the lower paddles and the upper paddles are discontinuous so that a mechanism can later come in to make a first attachment of the lower film to the upper film to retain the tight configuration of the wrapping about the product at a later time. If the wrapper

is plastic film as generally described throughout, the mechanism is a tack welding wheel to bond the plastic. Other wrapper stock and sealing means are possible.

Before this time the laterally extending fingers are withdrawn from supporting the upper film (Figs. 3—5). An air-jet (Fig. 6) pushes the upper film downwardly at the ends of the package to make the first end fold. A tucker (Fig.s 7, 11, and 13) makes an end fold and the package then moves into a conventional end folding section of the machine which folds the remaining side portions of the film to make end folds. The tack-welding is then accomplished (Fig. 8) between the paddles of the lower paddle conveyor, which then withdraw downward. The product moves between belts that engage the ends of the product (Fig. 9) which serve to convey the product down the product path as a full back seal bar comes in to permanently seal the back seam. The package then moves between end sealing belts (Fig. 10) producing a completely sealed product while the package continues its path.

As shown in Fig. 11, the sealing is effected in just the same way if the product group includes more than one product. Fig. 11 may represent the wrapping either of two rolls of towel or four rolls of toilet tissue. Thus, Figs. 1 through 10 schematically represent the steps in applying the film to the product to form a complete package while Fig. 11 represents a view like that of Fig. 7 where more than one product is involved in the axial direction of product flow.

The linear path of product flow is the path extending horizontally from one end to the other end of the wrapping machine. The product moves without substantial deviation in direction or speed while it is being wrapped. The linear product path could be other than horizontal, but as the preferred form is here described the path is level. The reason for having a generally linear product path is to allow very high speed wrapping of the product, at a rate much higher than accomplished by previous machines which do not have a linear product path or which started and stopped the product or substantially changed its speed during the course of wrapping. While linear flow and generally uniform movement of the product are important to high speed wrapping, they are by no means sufficient, as is shown in this application. Many innovative details were necessary to solve the problems of high speed wrapping, in addition to the general concept.

The basic axis of the machine will be taken to be the product path. To the right and the left of the product path the directions will be referred to as side, lateral or transverse. The remaining directions at right angles to the product path will be referred to as up and down. In the event of a machine oriented otherwise than horizontally, right and left side, lateral or transverse directions will be taken to be directions lateral to the first conveyor and (generally) aligned with the axes of the vacuum wheels, while up and down would refer to directions at right angles to those.

Looking now at Fig. 12, the wrapping machine proper begins with a direction changing mechanism 50 operating to move articles 53 from conveyor 51 which is an infeed conveyor, toward conveyor 52 which is the first element in the conveyors defining a linear product path on which products will be wrapped. Operating in the angle between the two conveyors is my direction changing mechanism 50 which could operate between conveyors in other mechanism as well. The direction changing mechanism includes L-shaped arms 54 secured to shafts 55 extending through respective bearings in rotating member 56 which is rotated about a bearing 57. A cam plate 58 having a cam slot or track 59 is rigidly secured to the top of each shaft 55. A cam follower roller 60 enters each cam track or slot 59 from a second rotating member 61 driven to rotate around a bearing at center 62. Belts 63 and 64 which may desirably be timing belts drive rotating members 56 and 61 about their respective centers 57 and 62 at equal rotational speeds.

The action of L-shaped arms 54 is to synchronize behind product 53 on infeed conveyor 51 enclosing the back and end of the product. The precise shape of the arm might vary with product type and shape and cam shape but should prevent separation of articles making up a product to be wrapped as products are swept in an arc from conveyor 51 to linear product path 92 without change in product orientation. As applied to rolls of paper, rolls with axes along conveyor 51 now have axes directed laterally of product path 92 as they are placed between upper and lower belts. Arms 54 retard respecting products 53 and withdraw to the side, then move at high acceleration to come behind a product on infeed conveyor 51 and synchronize with it to repeat the cycle. The number of arms and exact cam shape may vary, and of course cams and cam followers could be reversed, with appropriate design changes, here or in the tucker of Fig. 13.

Fig. 14 and 27 shown the manner in which successive wrappers or sheets 91, which are desirably plastic wrapping film, are fed by a more or less conventional cutting and feeding mechanism 90 to overlie the linear product path 92 shown as a directional arrow. Wrapper 91 is supported at each side margin between opposed timing belts 158, 159 (Fig. 27). In the plane of Fig. 14 upper conveyor belts 93 and 94 are visible. These extend over pulleys having different paths in order to provide a smooth transport of the wrapper or sheet 91 and the product 53. Similar belts are visible at the left end of the drawing. These belts define the linear product path 92 for product 53 as it approaches the wrapper 91 being fed with its forward edge well ahead of product 53 as shown at the left and center of Fig. 14, and in Fig. 27.

At the center of Fig. 14 vacuum wheels 95, each rotating with its upper surface tangent to wrapper or sheet 91, are each provided with a lowered pressure in its interior and openings in its surface of a size and number appropriate to grip the particular wrapper 91 and transfer the front edge of the wrapper across the product path 92 and down at right angles to the product path. Stationary internal baffles (not shown) direct the vacuum, so that no vacuum is applied in the zone where the wrapper 91 is stripped from the wheels 95.

Because the wrapper is across the product path 92 and the lower conveyor belts partially block the space below, product 53 tends to push air ahead of it and billow out the wrapper 91 from its proper path. A vacuum or lower pressure pipe 190 is desirably provided between vacuum wheels 95 to decrease this tendency.

The belts that carry the side margins 91c of wrapper 91 are best seen in Fig. 27 which is similar to Fig. 14 but in a plane outside product path 92. Belt 158 is the upper wrapper conveyor belt and belt 159 is the lower wrapper conveyor belt. Both are desirably timing belts with flat backs in contact with one another, separated only by sheet 91. They extend from wrapper supply area 90 over idler 160 to lie along the top side of linear product path 92. At each vacuum wheel 95, upper belt 158 goes straight on a short distance before returning. Lower belt 159 extends in an appropriate groove in its vacuum wheel 95 and then to an idler to eventually return to film supply unit 90. Film 91 adheres to vacuum wheels 95 and is later stripped from them by belts 156 that run downward from grooves 157 in vacuum wheels 95.

Film 91 is further prevented from billowing out by slight outward movement of belt 159 and of vacuum wheels 95, but not belt 158, with respect to the product path 92 to cause moderate lateral smoothing movements against film 91, but not large forces. As described elsewhere, belt 98 is built up in thickness to guide film 91 downward while edge 91a moves downward, and keep it away from the upwardly moving surface of roller 106. Edge 91c of the film is grasped and pulled downward lightly by belts 97 and rollers 110 and 111 on both sides of the slot until product 53 passes from conveyor belts 52 to conveyor belts 99 and 100 (Figs. 14, 16, and 18). Belts 156 only extend a short distance below vacuum wheel 95. The wrapper 91 is stripped (Fig. 19) from the vacuum wheels 95 by belts 156 which are round belts smaller than grooves 157 in the vacuum wheels which guide the forward edge of sheet 91 tangent to the vacuum wheel in a downward direction with respect to product path 92 rather than having the sheet adhere to the vacuum wheels 95. Belts 156 are not visible in Fig. 14 but the downward path of sheet 91 is visible, as are belts 97 and 98 which also assist in guiding sheet 91 in its downward path in the slot between conveyor belts 52 and 100 which form a part of product path 92. Upward moving belt 99 does not touch wrapper 91 as it moves downwardly into the slot but does touch it as product 53 passes the slot and begins drawing wrapper 91 out of the slot. Belt 101 takes up the conveying function further down linear product path 92. Corresponding belts 94, 102 serve as upper conveying belts and are continuous rather than being interrupted at the slot area. Fig. 19 is a detailed view of the surface of one vacuum wheel, a slot 157, and belt 156 which is smaller than the slot underlying wrapper sheet 91 while the sheet adheres to the vacuum wheel. Figs. 16, 17 and 18 are additional detail views of the slot area. Figs. 16 and 17 are respectively side and top views. The objective is to strip sheet 91 from the vacuum wheels 95 by means of belts 156 and thereafter to continue the motion of sheet 91 away from product path 92 at a convenient angle which will usually be something approximating a right angle without wrinkling, bunching, stretching or tearing until, and only until, product 53 begins to cross the slot between the belts on one side such as belts 97 and the belts on the other side such as belt 98. In order to achieve this a number of important details cooperate. As best shown in Fig. 15, vacuum wheel 95 are not precisely parallel to conveyor belt 52. The edge of each vacuum wheel 95 tangent to the slot between conveyor belts 52 and 100 lies a small distance farther from conveyor belt 52 than the back edge of the vacuum wheel 95. At the opposite sides of the machine the vacuum wheels 95 are toed out in the opposite directions so that as the two sheets turn in unison at the speed of sheet 91 a given point on the surface of each wheel 95 is moving laterally very slightly with respect to sheet 91 and tending to smooth it. Round belts 97 are used at intervals along the slot on the left side (Fig. 15 and 28) and belt 98 on the right. These belts and sheet 91 pass between rollers 110 and 111 (Fig. 14, 16, and 18) arranged to pull downwardly on sheet 91 with a very low coefficient of friction to guide sheet 91 smoothly into the slot during the period when product 53 is approaching the slot. Roller 111 is relieved for belt 98.

As shown in Fig. 18 belts 97 ride on grooved roller 110 almost opposed to smooth roller 111 on opposite sides of the slot, with wrapper 91 between, as best shown in Fig. 14. Small belts are able to turn on a much smaller radius, than conveyor belts such as 52 and 100 which are heavier and require larger pulleys. Thus small belts provide a much narrower and more precise slot. They may also be made of material which does not pull unduly on wrapper sheet 91 when product 53 crosses over the slot and begins withdrawing the wrapper 91 from the slot in opposition to its previous motion into the slot, but which keeps it taut and smooth.

Another mechanism used to assure smooth movement of wrapper sheet 91 into and out of the slot is a very special portion of belt 98 best shown at Figs. 16 and 17. Belt 98 is provided with a built up portion 103 having a leading edge 104 and a trailing edge 105 extending along the flat outer side of the belt for a short distance as seen in Fig. 16. Fig. 17 shows that the body of belt 98 is supported on a small sheave 108 on a spindle 109 on which the two rollers 106 that serve as sheaves for belts 96 are mounted. As clearly shown in Fig. 17 this allows belt 98 to be mounted so that the back of the belt does not extend as far as the surface of roller 106 and therefore can never touch sheet 91. However, built up portion 103 extends the belt radially beyond the periphery of rollers 106 out to the edges of belt 96. Furthermore, as shown in Fig. 16, sheave 108 and shaft 109 that support belt 98 between rollers 106 are mounted further to the right with respect to the right side of the slot than roller 111 which deflects belt 98 back towards the film 91 so that its furthest leftward extension is just below the top of the slot. Belt 98 is timed so that leading edge 104 of built up portion 103 of belt 98 arrives at the slot generally simultaneously with the front edge of wrapper sheet 91. In that respect Fig. 16 is inaccurate in that for clarity wrapper sheet 91 has been shown farther down in the slot than it would in fact be at the time when thickened portion 103 of belt 98 is in the position shown. During the time when thickened portion 103 is in contact with wrapper 91 it pushes wrapper 91 against descending belts 97 on the left side of the slot assisting wrapper 91 in downward movement. At the time when product 53 reaches the position shown at the center of Fig. 14 the thickened portion of belt 98 has traveled downwardly until trailing edge 105 of thickened portion 103 is clear of roller 111 and is no longer able to push sheet 91 against the descending belts on the other side of the slot. Thus at the moment when product 53 is crossing the slot and beginning to pull sheet 91 upwardly, assisted by belt 99, which rotates upwardly rather than downwardly but touches wrapper 91 only at the edge of the slot as best shown in Fig. 14, upward forces are exerted on sheet 91 by the movement of product 53 as it is conveyed by belts 94 and 100 and by belt 99. However, belts 97 and rollers 110 and 111 still exert a small downward force at their respective locations all across the slot (the parts not shown in Fig. 15 and Fig. 17 are mirror images of the parts that are shown) so that wrapper sheet 91 is dragged downward by light forces while it is being moved upward by the movement of product 53 to keep it smooth. As seen at the right side of Fig. 14 the net result is to transform the forward edge of wrapper sheet 91 into a second trailing edge at the bottom of the product 53. The same result would be obtained with a different sized wrapper sheet 91 (Fig. 11) if two rolls of paper 53 were wrapped with one ahead of the other, such as kitchen towels, or if four rolls of toilet tissue were being wrapped. Other configurations are practical and other product shapes than cylinders are practical whether one article or more than one article comprise each wrapped product. As also shown at the right side of Fig. 14 conveyor belts 94 and 100 which define the upper and lower sides of the linear product path in this area give way to belts 101 and 102 which feed products 53 with the wrapper in a U shape about the top, front and bottom into the next section of the linear product path. Figs. 20—22 are to the right of Fig. 14 in the direction of linear product path 92. Product 53 is inserted by belts 101 and 102 between fixed upper surface 120 and lower surface 121 which in my preferred machine comprise at least a pair of upper bars and a pair of lower bars with surfaces that touch wrapper 91 under light pressure which in the case of a compressible product such as rolls of paper may be provided by positioning the bars to compress the product lightly. I have found that in actual practice wrapper 91 may not be as tight around product 53 as is desirable for a smooth wraping, particularly if as shown in Figs. 21 and 22 product 53 comprises more than one article. The articles which make up product 53 may not be in contact as shown at the left of Fig. 21 and wrapper sheet 91 may sag between the articles as shown at the left sides of both Fig. 21 and Fig. 22.

However, surface 120 is arranged to supply less drag against wrapper sheet 91 than surface 121, either by selection of materials, surface finish, area of contact, or whatever method appears best for a particular product. In my preferred machine surface 120 has a lower coefficient of friction with sheet 91 than surface 121 has with sheet 91. It will be remembered that surfaces 120 and 121 are stationary, rather than being moving conveyor belts like belts 101 and 102. Accordingly the job of propelling products 53 along linear path 92 has been taken over by paddles 122. They serve as propelling members, being mounted to enter path 92 at timed intervals behind product 53. As shown in Figs. 20 and 21 this is achieved in the preferred machine by mounting paddles 122 on a chain 123. As shown at the center of Fig. 20 a paddle 122 secures the trailing top edge of wrapper 91 against the rear of product 53 as it propels product 53 down the path 92. The higher friction at surface 121 than at surface 120 causes wrapper 91 to migrate around product 53 toward surface 121 until it is stopped from doing so by the fact that the trailing top edge is secured by paddle 122 and therefore tightness of the wrapper around product 53 is assured. As shown in Fig. 21 this is so even if the articles making up product 53 to be wrapped are not touching as they enter between surfaces 120 and 121 or in the more likely case that wrapper 91 sags between the articles so that as shown

at the right side of Figs. 21 and 22 wrapper 91 will be taut and smooth as it progresses between surface 120 and 121.

As also shown in Fig. 20 a sprocket 124 changes the direction of chain 123 so that paddles or first propelling members 122 rise slightly as they travel between portions of surface 120 which are separate bars.

Looking now at Figs. 3, 4, 5, and 6 and at Fig. 26 it will be seen that in addition to the upper chain 123 carrying paddles 122 there is a similar lower chain carrying paddles 125. This chain is like chain 123 and is arranged to have a run parallel to it in the inclined portion so that paddles 125 begin propelling product 53 in timed relationship to paddles 122 and as paddles 122 rise out of the way paddles 125 raise between surface 121 to continue to propel product 53 and at the same time to smoothly raise the trailing edge of wrapper sheet 91 against the rear of product 53 as shown in Fig. 20 and Fig. 4.

In order to assist in distinguishing the edges of wrapper sheet 91 the forward edge of the sheet has been labeled 91a, the rearward edge 91b and the sides 91c. It will be noted that the same relationships obtain whether product 53 is a single article or whether as shown in Figs. 21 and 22 it comprises at least two articles 43a and 53b. It will be further noted that product 53 could be divided axially as well, so that product 53a might consist of two rolls of toilet tissue or three rolls of toilet tissue with no change in any of the parts or methods described except that there might need to be more of some parts to support the separate parts adequately and there might need to be additional belts in the slot to guide edge 91a of sheet 91 adequately.

Returning to the description of the machine itself, as best shown in Figs. 3, 4, and 5 and at Figs. 23 through 25 pairs of fingers 130 are arranged to enter the tube forming by sides 91c of wrapper 91 at the bottom of the tube, to progress in timed relationship to product 53. As the horizontal portions of fingers 130 move along they move first into product path 92 to the position shown in Fig. 3. They then rise relative to product 53 as they travel to successive positions shown in Figs. 4 and 5 causing the wrapper edges 91c to regain their circular form if it is distorted for any reason. As may be seen in Fig. 5 the fingers 130 are beginning to withdraw axially as they progress along with product 53. Looking now at Figs. 23, 24, and 25 it will be seen that each pair of laterally extending fingers 130 is mounted by a vertical extension to a block 131 carried on rod 132 which is part of a chain 133. Looking at Fig. 24 the vertical movements of the fingers 130 described in Figs. 3, 4 and 5 are produced by the alignment of the respective sprockets 134, 135 and 136. Looking at Fig. 25 in which we are looking upward at a bottom plan view of the mechanism driving fingers 130 as seen from product path 92 it will be observed that blocks 131 slide laterally on rods 132 under the urging of lower cam tracks 137 shown at the top of Fig. 25 which control the motion of blocks 131 while they are on the lower run of the chain, and upper cam tracks 138 shown at the lower side of Fig. 25 which return blocks 131 to their starting position while they are on the upper run of chain 133. For clarity of illustration only the lower cam tracks 137 have been shown at the top of Fig. 25 although both lower cam tracks 137 and upper cam tracks 138 are present. Likewise at the bottom of Fig. 25 only upper cam tracks 138 are shown although both lower cam tracks 137 and upper cam tracks 138 are present respectively adjacent the lower and upper runs of chain 133. In Fig. 23, at the left and right sides, the block 131 in full lines shows the position when fingers 130 are closest to product 53 while the dashed lines show the extent of its movement laterally without showing its movement vertically.

As shown in Fig. 23 and in Fig. 6, as fingers 130 withdraw laterally from product 53 to give less support to margins 91c of the wrapper sheet 91 a jet 140 pushes margins 91c downwardly to begin the process of forming end folds for product 53 from side margins 91c of shape 91. I find that this is simpler than a mechanical motion for the same purpose.

Not discussed previously is the fact that both first propelling members 122 and second propelling members 125 are in fact 3 separate propelling members lying in a single plane to act as a single propelling member 122 or 125. In Fig. 25 propelling members 122 are connected by member 122a. Similar members connect each paddle 122 and each paddle 125 leaving openings between them for a reason which will be discussed in a moment.

As shown in Figs. 7 and 26, fingers 130 have been withdrawn and air-jets 140 have commenced folding the sides 91c of the wrapper sheets 91. Fig. 13 shows the tucker (visible in Fig. 7 at 71), and a preferred trajectory for the tip of the L-shaped arm. The tucker is a modified form of my direction changing device of Fig. 12. Tucker 70 has L-shaped arms 71 clamped to shafts 72 extending through bearings in rotating member 73 driven to rotate around a center shaft 74. Each shaft 72 carries a cam plate 75 having a cam track 76. A second rotating member 77 carries a cam follower 78 which enters cam track 76. Second rotating member 77 is driven to rotate around shaft 79. As in Fig. 12 timing belts 80 and 81 assure that the rotational speed of members 73 and 77 will be equal though any drive that assure equal speed will be appropriate. Throughout my mechanism the timing of the parts is important and it will be understood without specific mention that wherever synchronism is important the belts are timing belts and the drives of the various mechanisms are so connected as to insure synchronism.

In Fig. 13 the track of the tip of L-shaped arm

71 is shown as a dot and dash line. The product path is not shown in Fig. 13 structurally but is between the tucker arms 71. Arm 71 stops as it reaches the Fig. 7 or Fig. 11 position as shown by the cusp of the path in Fig. 13. It then turns slightly to form a greater angle with the end of product 53, reducing drag on wrapper 91. As shown by the dot and dash line the tip of arm 71 slows down in relation to the product and retreats backward and to the side to clear the product and to get out of the way. As shown in Fig. 13 there are only two such arms 71 per side operated to fold wrappers on successive products. Other numbers of arms are possible if properly synchronized to make the second fold.

The cam track 59 or 76 is shaped to achieve the described path.

A generally conventional folding mechanism 141 completes the folding of the sides of wrapper 91 to form the ends of the package for product 53. During this period a sealing mechanism 142 comprising a spider carrying heated wheels 143 (Fig. 8 and 26) enters each of the spaces between propelling members 125 to form a first seal at the rear edge of the package. As may be seen in Fig. 11 it is particularly important to make the seal at this point where product 53 consist of a multiplicity of articles 53A, 53b, 53c, 53d, because it leaves the broad sides of wrapper 91 clear and unobstructed by the damage caused by sealing the edges, for decoration or advertising while keeping the wrapper tight.

As shown in Figs. 26 and 9, as the arrangement of the sprockets on which propelling members 125 are carried withdraws the propelling members, belts 146 hold the end folds and convey products 53. A second sealing means 144 has full width end sealing bars 145 to form a full back seal. Because the sealers rotate while the motion of product 53 is linear, sealers 143 and 144 catch up to product 53 only during fastest horizontal motion, seal, then lose relative speed. At the same time belts 146 assist in maintaining the end folds until the wrapped product 53 is inserted between end sealing and conveying belts 147 which are heated at the point of initial contact to form the end seals. If necessary they may be cooled further along the product path 92 to produce a completely wrapped product 53 containing one or more articles 53a, 53b, 53c, 53d, etc.

A prototype machine which has been built and tested demonstrates the validity of the concepts expressed and proves for the first time that I am aware that product packaging speeds very much higher than those previously obtainable may be obtainable in my machine. Some of the inventions and inventive concepts here described were first arrived at during the building and testing of this machine. The machine as described is a complete and operative embodiment and is the best embodiment known. The end folding plates 141 which form the flaps of the end fold have not been fully described because they are previously known. The same is true of the various drives which drive the various parts in timed relationship to one another. For instance extensive use is made of timing belts which are lighter and cheaper than gears but which are capable of moving the parts in the required relationship.

In many cases only one side of my machine has been described because the parts are duplicated on the other side.

Claims

1. Apparatus for wrapping a series of products (53) as they move on a conveyor (52) along a substantially linear product path, comprising means (90) for feeding wrapping sheets (91) in timed relationship to the products (53) to be wrapped, means (95) for moving the leading edge (91*a*) of each wrapping sheet (91) across the product path ahead of its corresponding product (53), whereby the sheet is drawn across the front of and around the product by product travel so that the original leading edge (91*a*) of the wrapping sheet becomes a second trailing edge, and means for securing together the trailing edges (91*a*, 91*b*) of the wrapping sheet (91) at the rear of the product (53), characterized in that the means (90, 93) for feeding the wrapping sheets (91) in timed relationship to the products (53) to be wrapped is effective to feed each wrapping sheet (91) alongside its corresponding product (53) in the same direction as the product travel with a leading edge (91*a*) and a substantial proportion of the wrapping sheet (91) ahead of the product (53) prior to moving the leading edge (91*a*) across the product path.

2. Apparatus according to claim 1, wherein the means (90) for feeding the wrapping sheets (91) in timed relationship to the products (53) to be wrapped comprise means for presenting each individual sheet horizontally above and overlying the corresponding product (53), and the means (95) for moving the leading edge of each sheet across the product path comprise means for moving that edge downwardly across and beneath the product path.

3. Apparatus according to claim 1 or claim 2, wherein the means (90) for feeding the sheets (91) in timed relationship to the products (53) to be wrapped comprise, on each side of the product path and displaced from the product path, a pair of belts (158, 159) for gripping edge margins of the wrapping sheet therebetween and transporting the sheets parallel to the product path, with the belt (159) of each pair that is nearer to the product path extending over a direction changing pulley (95) at substantially the point at which the leading edge of each wrapping sheet is drawn across the product path.

4. Apparatus according to any preceding claim, wherein the means (95) for drawing the

wrapping sheets (91) across the product path comprise a pair of vacuum wheels (95) positioned on opposite sides of the product path to grip opposite sides of each sheet (91) by suction and, by rotation of the vacuum wheels (95), to draw the wrapping sheet (91) across the product path before releasing the gripped sides of the sheet.

5. Apparatus according to claim 4, wherein the axes of rotation of the vacuum wheels (95) are slightly skewed so that rotation of the vacuum wheels (95) to draw each wrapping sheet (91) across the product path also exerts a slight transverse tension on the sheet.

6. Apparatus according to claim 4 or claim 5, further comprising means (156) for stripping each sheet (91) from the vacuum wheels (95) and means (97, 98) for guiding the leading edge of the sheet in a path generally transverse to the product path until product travel draws the sheet around the product.

7. Apparatus according to claim 6, wherein the means for guiding the leading edge of each sheet in the path generally transverse to the product path comprise belts (97, 98) passing around rollers (108, 110, 111) for gripping the sheet against cooperating surfaces, the belts (97, 98) and cooperating surfaces being designed to grip the sheet (91) sufficiently lightly for the sheet to be withdrawn therefrom by product travel when the product engages that portion of the sheet (91) which is in the product path.

8. Apparatus according to claim 7, wherein the cooperating surfaces are surfaces of complementary belts (97, 98).

9. Apparatus according to claim 7 or claim 8, wherein at least one of the belts (98) for guiding the leading edge of each sheet in the path generally transverse to the product path includes a portion (103) of increased thickness for gripping the sheet more firmly as the sheet (91) and the belt portion (103) of increased thickness pass through the nip of cooperating rollers (108, 110, 111), that belt (98) being driven in timed relationship with the feeding of the wrapping sheet (91) and with the movement of the products (53) along the product path so that the belt portion (103) of increased thickness engages the leading edge (91*a*) of each wrapping sheet (91) as it is stripped from the vacuum wheels (95) and releases the sheet, by movement out of the nip of the cooperating rollers (110, 111), as the product (53) engages that portion of the wrapping sheet (91) which is in the product path.

10. Apparatus according to any preceding claim, further comprising suction means (190) alongside the product path at the position at which each product (53) engages that portion of the corresponding wrapping sheet (91) which extends across the product path, the suction means (190) acting to draw air from the space in front of each product as it closes with the wrapping sheet, to avoid creation of an air cushion between the product and the wrapping sheet.

11. Apparatus according to any preceding claim, further comprises fixed surfaces (120, 121) on opposite sides of the product path ahead of the position at which each product (53) engages the portion of each wrapping sheet (91) which extends across the product path, for frictionally engaging the wrapping sheet (91) as it is drawn around the product by product travel, first propelling means (122) driven to enter the product path from one of the said sides, to push a first trailing edge (91*b*) of the sheet (91) onto a trailing edge of the product and to propel the product between the fixed surfaces (120, 121), and second propelling means (125) driven to enter the product path from the opposite one of the said sides, to push the other trailing edge (91*a*) of the sheet (91) to overlap the first trailing edge (91*b*) and to propel the product between the fixed surfaces.

12. Apparatus according to claim 11 wherein the fixed surfaces (120, 121) are fixed bars extending parallel to the product path, the bars (120) on the side of the product path from which the first propelling means (122) enters having a lower coefficient of friction than those (121) on the opposite side.

13. Apparatus according to claim 11 or claim 12, wherein the paths of the first and second propelling means (122, 125) are inclined, relative to the product path, so that the first propelling means (122) withdraws from the product path as the second propelling means (125) extends progressively further into the product path.

14. Apparatus according to any of claims 11 to 13, wherein each propelling means 122, 125) is a paddle that is discontinuous over the width of the product, and a sealing mechanism (142) is provided to engage the overlapped trailing edges (91*a*, 91*b*) of each wrapping sheet (91) in zones between adjacent portions of the discontinuous paddles (122, 125), and to secure together the overlapped edges in such zones.

15. Apparatus according to any preceding claim, further comprising means (130, 71, 141) for folding side margins of each wrapping sheet (91) around the corresponding product (53) and securing them together as the product moves along its substantially linear product path.

16. Apparatus according to claim 15, wherein the means (130, 71, 141) for folding the side margins of each wrapping sheet (91) include air jets (140) positioned to blow on opposite sides of each wrapping sheet (91) to form first portions of the side margin folds.

17. Apparatus according to claim 16, wherein the means (130, 71, 141) for folding the side margins, of each wrapping sheet (91) further comprises side margin supporting fingers (130) movable by guide means (131, 132, 137, 138) alongside the product path to support the side

margins of each wrapper (91), the guide means (131, 132, 137, 138) carrying the fingers (130) away from the product path to withdraw the fingers (130) from between the side margins before the side margins are folded in to become end folds of the product wrapping.

18. Apparatus according to any preceding claim, further comprising a full width sealing mechanism (144, 145) for securing together overlapped edges of each wrapping sheet (91) over the full width of the product (53).

19. Apparatus according to claim 18, wherein the full width sealing mechanism (144, 145) is effective to propel the products (53) along a final stage of the product path.

Patentansprüche

1. Vorrichtung zum Umwickeln von aufeinanderfolgenden Produkten (53), während sie sich auf einem Förderer (52) auf einem im wesentlichen linearen Produktweg bewegen, mit einer Zuführeinrichtung (90) zum zeitlich abgestimmten Zuführen von Einwickelbögen (91) zu den einzuwickelnden Produkten (53), mit einer Einrichtung (95) zur Bewegung des vorderen Endes (91a) jedes Einwickelbogens (91) kreuzend den Produktweg vor dem zugehörigen Produkt (53), wodurch der Bogen über die Vorderseite und um das Produkt durch das sich vorwärts bewegende Produkt gezogen wird, so daß das anfänglich vordere Ende (91a) des Einwickelbogens zu einem zweiten hinteren Ende wird, und mit einer Verbindungseinrichtung zur Verbindung der beiden hinteren Enden (91a, 91b) des Einwickelbogens (91) hinter dem Produkt (53), dadurch gekennzeichnet, daß die Zuführeinrichtung (90, 93) zur zeitlich abgestimmten Zuführung der Einwickelbögen (91) zu den einzuwickelnden Produkten (53) jeden Einwickelbogen (91) entlang dem zugehörigen Produkt (53) in derselben Richtung mit dem vorderen Ende (91a) zuführt, in der sich das Produkt (53) vorwärts bewegt und daß sich ein wesentlicher Anteil des Einwickelbogens (91) vor dem Produkt (53) befindet, bevor das vordere Ende (91a) den Produktweg kreuzt.

2. Vorrichtung nach Anspruch 1, in der die Zuführeinrichtung (90) zur zeitlich abgestimmten Zuführung der Einwickelbögen (91) zu den einzuwickelnden Produkten jeden einzelnen Bogen horizontal oberhalb des zugehörigen Produkts (53) liegend zuführt und daß die Einrichtung zur Bewegung des vorderen Endes jedes Bogens kreuzund mit dem Produktweg dieses Ende abwärts über den Produktweg und unter ihn bewegt.

3. Vorrichtung nach Anspruch 1 oder 2, in der die Zuführeinrichtung (90) zum zeitlich abgestimmten Zuführen der Einwickelbögen (91) zu den einzuwickelnden Produkten (53) auf jeder Seite des Produktweges und versetzt zu diesem ein Paar Riemen (158, 159) zum Ergreifen von Endabschnitten der Einwickelbögen zwischen ihnen und zum Transportieren der Bögen parallel zum Produktweg aufweisen, wobei die Riemen (159) jedes Paars, der dem Produktweg näher liegt, über eine Richtungsänderungsscheibe (95) an etwa dem Punkt läuft, an dem die vordere Kante jedes Einwickelbogens über den Produktweg gezogen wird.

4. Vorrichtung nach einem der vorstehenden Ansprüche, bei der die Einrichtung zum Ziehen der Einwickelbögen (91) über den Produktweg ein Paar Vakuumräder (95) aufweist, die auf entgegengesetzten Seiten des Produktweges angeordnet sind und entgegengesetzte Seiten jedes Bogens (91) saugend ergreifen sowie, aufgrund der Rotation der Vakuumräder (95), die Einwickelbögen (91) über den Produktweg ziehen, bevor sie die ergriffenen Seiten des Bogens wieder loslassen.

5. Vorrichtung nach Anspruch 4, in der die Rotationsachsen der Vakuumräder (95) leicht schräggestellt sind, so daß bei der Rotation der Vakuumräder (95) zum Ziehen jedes Einwickelbogens (91) über den Produktweg auch eine leichte Querspannung auf den Bogen ausgeübt wird.

6. Vorrichtung nach Anspruch 4 oder 5 mit einer zusätzlichen Trennvorrichtung (156) zum Trennen jedes Bogens (91) von den Vakuumrädern (95) und mit einer Führungseinrichtung (97, 98) zum Führen der vorderen Endes des Bogens auf einem Weg, der im wesentlichen quer zum Produkt-weg steht, bis das fortbewegte Produkt den Bogen um das Produkt zieht.

7. Vorrichtung nach Anspruch 6, indem die Führungseinrichtung zum Führen des vorderen Endes jedes Einwickelbogens in einen Weg, der im wesentlichen quer zum Produktweg liegt, über Rollen (108, 110, 111) laufende Riemen (97, 98) aufweist, mit denen die Bögen gegen zusammenwirkende Oberflächen ergriffen werden, wobei die Riemen (97, 98) und zusammenwirkenden Oberflächen so ausgebildet sind, daß sie den Bogen (91) ausreichend leicht ergreifen, so daß der Bogen von ihnen durch das fortbewegte Produkt weggezogen werden kann, wenn das Produkt den Teil des Bogens (91) erfaßt, der in dem Produktweg liegt.

8. Vorrichtung nach Anspruch 7, indem die zusammenwirkenden Oberflächen Oberflächen von sich ergänzenden Riemen (97, 98) sind.

9. Vorrichtung nach Anspruch 7 oder 8, in der wenigstens einer die Riemen (98) zur Führung der vorderen Endes jedes Bogens in dem im wesentlichen quer zum Produktweg stehenden Weg einen Abschnitt (103) mit vergrößerter Stärke aufweist, um den Bogen fester zu ergreifen, wenn der Bogen (91) und der Riemenabschnitt (103) mit verstärkter Dicke durch den Spalt von zusammenwirkenden Rollen (108, 110, 111) läuft, wobei der Riemen (98) zeitlich abgestimmt mit der Zuführung des Einwickelbogens (91) und mit der Bewegung des Produktes entlang dem Produktweg angetrieben wird, so daß der Riemenabschnitt (103) mit größerer Dicke das vordere Ende (91a) jedes Einwickelbogens (91) beaufschlagt, wenn es

von den Vakuumrädern (95) gelöst wird und den Bogen durch Bewegung aus dem Spalt der zusammenwirkenden Rollen (110, 111) heraus losläßt, wenn das Produkt (53) gegen den Abschnitt des Einwickelbogens (91) läuft, der sich in dem Produktweg befindet.

10. Vorrichtung nach einem der vorstehenden Ansprüche, mit einer Absaugeinrichtung (119) entlang dem Produktweg an der Stelle, an der jedes Produkt (53) gegen den Abschnitt des zugehörigen Einwickelbogens (91) läuft, der sich über den Produktweg erstreckt, wobei die Absaugeinrichtung (119) Luft aus dem Raum vor jedem Produkt absaugt, wenn es gegen den Einwickelbogen läuft, um die Ausbildung eines Luftkissens zwischen dem Produkt und dem Einwickelbogen zu verhindern.

11. Vorrichtung nach einem der vorstehenden Ansprüche, in der feste Oberflächen (120, 121) auf entgegengesetzten Seiten des Produktweges vor der Stelle vorgesehen sind, an der jedes Produkt (53) gegen den Abschnitt des betreffenden Einwickelbogens (91), der sich über den Produktweg erstreckt, läuft, um reibend auf den Einwickelbogen (91) einzuwirken, wenn er um das Produkt während des Produktvorschubs gezogen wird, mit ersten Vorschubmitteln (122), die von einer der Seiten in den Produktweg einlaufen und ein erstes hinteres Ende (91b) des Bogens auf die Rückseite des Produktes drücken und das Produkt zwischen den festen Oberflächen (120, 121) vorwärtsschieben, und mit zweiten Vorschubmitteln (125), die in den Produktweg von der anderen Seite einlaufen, um das andere hintere Ende (91a) des Bogens (91) mit dem ersten hinteren Ende (91b) überlappen zu lassen und das Produkt zwischen den festen Oberflächen vorzuschieben.

12. Vorrichtung nach Anspruch 11, in der die festen Oberflächen (120, 121) feststehende Stangen sind, die sich parallel zum Produktweg erstrecken, wobei die Stangen (120) auf der Seite des Produktweges, von der die ersten Vorschubmittel (122) einlaufen, einen geringeren Reibungskoeffizienten aufweisen als die Stangen (121) auf der entgegengesetzten Seite.

13. Vorrichtung nach Anspruch 11 oder 12, bei der die Wege der ersten und zweiten Vorschubmittel (122, 125) relativ zum Produktweg geneigt sind, so daß die ersten Vorschubmittel (122) aus dem Produktweg in dem Maße verschwinden, wie die zweiten Vorschubmittel (125) zunehmend in den Produktweg einlaufen.

14. Vorrichtung nach einem der Ansprüche 11 bis 13, in der die Vorschubeinrichtungen (122, 125) durch eine über die Breite des Produktes diskontinuierliche Schaufel gebildet sind und in der ein Verschlußmechanismus (142) vorgesehen ist, der auf die überlappenden hinteren Enden (91a, 91b) jedes Einwickelbogens (91) in den Zonen zwischen benachbarten Abschnitten der diskontinuierlichen Schaufeln (122, 125) einwirkt und überlappten Enden in diesen Zonen miteinander verbindet.

15. Vorrichtung nach einem der vorstehenden Ansprüche, mit einer Falteinrichtung (130, 71, 141) zum Einfalten von Seitenabschnitten jedes Einwickelbogens (91) um das zugehörige Produkt (53) und zu ihrer Befestigung bei der Fortbewegung des Produktes auf seinem im wesentlichen linearen Produktweg.

16. Vorrichtung nach Anspruch 15, indem die Einfaltvorrichtung (130, 71, 141) zum Einfalten der Seitenabschnitte jedes Einwickelbogens (91) Luftdüsen (140) aufweist, die auf entgegengesetzte Seiten jedes Einwickelbogens (91) blasen, um erste Teile der Seitenabschnitte einzufalten.

17. Vorrichtung nach Anspruch 16, in der die Einfaltvorrichtung (130, 71, 141) zum Einfalten der Seitenabschnitte jedes Einwickelbogens (91) ferner Stützfinger (130) für die Seitenabschnitte aufweist, die durch Führungen (131, 132, 137, 138) entlang dem Produktweg bewegbar sind, um die Seitenabschnitte jedes Bogens (91) zu stützen, wobei die Führungen (131, 132, 137, 138) die Finger (130) von dem Produktweg webgewegen und die Finger (130) aus den Seitenabschnitten herausziehen, bevor die Seitenabschnitte eingefaltet werden, um Endeinschläge für die Produktverpackung darzustellen.

18. Vorrichtung nach einem der vorstehenden Ansprüche mit einem Verschlußmechanismus (144, 145) zum Verbinden der überlappten Enden jedes Einwickelbogens (91) über die volle Breite des Produktes (53) miteinander.

19. Vorrichtung nach Anspruch 18, in der der über die volle Breite wirksame Verschlußmechanismus (144, 145) die Produkte (53) über einen Endabschnitt des Produkteweges vorschiebt.

Revendications

1. Appareil pour envelopper une série de produits (53) à mesure qu'ils progressent sur un convoyeur (52) le long d'un chemin de produits pratiquement linéaire, comprenant des moyens (90) pour amener des feuilles d'enveloppement (91) selon un rythme réglé aux produits (53) à envelopper, des moyens (95) pour déplacer le bord menant (91*a*) de chaque feuille d'enveloppement (91) en travers du chemin de produits en avant du produit correspondant (53), ce grâce à quoi la feuille est tirée en travers du devant du produit et autour de ce dernier par la progression du produit de façon que le bord menant initial (91*a*) de la feuille d'enveloppement devienne un deuxième bord mené, et des moyens pour fixer ensemble les bords menés (91*a*, 91*b*) de la feuille d'enveloppement (91) à l'arrière du produit (53), caractérisé en ce que les moyens (90, 93) pour amener les feuilles d'enveloppement (91) selon un rythme réglé aux produits (53) à envelopper sont agencés pour amener chaque feuille d'enveloppement (91) le long du produit correspondant (53) dans

la même direction que la progression des produits, avec un bord menant (91*a*) et une fraction substantielle de la feuille d'enveloppement (91) en avant du produit (53), avant le déplacement du bord menant (91*a*) en travers du chemin de produits.

2. Appareil selon la revendication 1, dans lequel les moyens (90) pour amener les feuilles d'enveloppement (91) selon un rythme réglé aux produits (53) à envelopper comprennent des moyens pour présenter individuellement chaque feuille horizontalement à une hauteur supérieure au et juste au-dessus du produit correspondant (53) et les moyens (95) pour déplacer le bord menant de chaque feuille en travers du chemin de produits comprennent des moyens pour déplacer ce bord vers le bas, en travers et au-dessous du chemin de produits.

3. Appareil selon la revendication 1 ou la revendication 2, dans lequel les moyens (90) pour amener les feuilles (91) selon un rythme réglé aux produits (53) à envelopper comprennent, de chaque côté du chemin de produits et décalées par rapport au chemin de produits, une paire de courroies (158, 159) pour saisir entre elles des bords latéraux de la feuille d'enveloppement et transporter les feuilles parallèlement au chemin de produits et celle (159) des courroies de chaque paire qui est la plus proche du chemin de produits passe sur une poulie de changement de direction (95), pratiquement au point en lequel le bord menant de chaque feuille d'enveloppement est tiré en travers du chemin de produits.

4. Appareil selon l'une quelconque des revendications précédentes. dans lequel les moyens (95) pour tirer les feuilles d'enveloppement (91) en travers du chemin de produits comprennent une paire de roues à dépression (95) placées sur des côtés opposés du chemin de produits pour saisir des côtés opposés de chaque feuille (91) par succion et, par rotation des roues à dépression (95), pour tirer la feuille d'enveloppement (91) en travers du chemin de produits avant de libérer les côtés ainsi saisis de la feuille.

5. Appareil selon la revendication 4, dans lequel les axes de rotation des roues à dépression (95) sont légèrement inclinés de façon que la rotation des roues à dépression (95) destinée à tirer chaque feuille d'enveloppement (91) en travers du chemin de produits exerce aussi une légère traction transversale sur la feuille.

6. Appareil selon la revendication 4 ou la revendication 5, comprenant en outre des moyens (156) pour détacher chaque feuille (91) des roues à dépression (95) et des moyens (97, 98) pour guider le bord menant de la feuille selon un chemin généralement transversal par rapport au chemin de produits, jusqu'à ce que la progression du produit tire la feuille autour du produit.

7. Appareil selon la revendication 6, dans lequel les moyens pour guider le bord menant de chaque feuille selon un chemin généralement transversal par rapport au chemin de produits comprennent des courroies (97, 98) passant autour de rouleaux (108, 110, 111) pour saisir la feuille contre des surfaces associées, les courroies (97, 98) et surfaces associées étant conçues de manière à saisir la feuille (91) assez légèrement pour que la feuille puisse en être retirée par la progression du produit lorsque le produit arrive au contact de celle des parties de la feuille (91) qui se trouve sur le chemin de produits.

8. Appareil selon la revendication 7, dans lequel les surfaces associées sont des surfaces de courroies complémentaires (97, 98).

9. Appareil selon la revendication 7 ou la revendication 8, dans lequel l'une au moins des courroies (98) destinées à guider le bord menant de chaque feuille selon un chemin généralement transversal par rapport au chemin de produits comprend une partie surépaissie (103) pour saisir la feuille plus fermement lorsque la feuille (91) et la partie de courroie surépaissie (103) passent dans l'intervalle entre rouleaux associés (108, 110, 111), cette courroie (98) étant entraînée un rythme réglé, par rapport à l'amenée de la feuille d'enveloppement (91) et à la progression des produits (53) le long du chemin de produits, de telle sorte que la partie de courroie surépaissie (103) prenne contact avec le bord menant (91*a*) de chaque feuille d'enveloppement (91) lorsqu'elle est détachée des roues à dépression (95) et libère la feuille, par son mouvement hors de l'intervalle entre les rouleaux associés (110, 111), lorsque le produit (53) arrive au contact de celle des parties de la feuille d'enveloppement (91) qui se trouve sur le chemin de produits.

10. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre des moyens de succion (190) le long du chemin de produits, à l'endroit où chaque produit (53) arrive au contact de celle des parties de la feuille d'enveloppement correspondante (91) qui s'étend en travers du chemin de produits, les moyens de succion (190) agissant de manière à aspirer de l'air de l'espace situé en avant de chaque produit lorsqu'ils s'approche de la feuille d'enveloppement, de manière à éviter la formation d'un matelas d'air entre le produit et la feuille d'enveloppement.

11. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre des surfaces fixes (120, 121) sur des côtés opposés du chemin de produits, en avant de l'endroit où chaque produit (53) arrive au contact de celle des parties de chaque feuille d'enveloppement (91) qui s'étend en travers du chemin de produits, pour prendre contact à frottement avec la feuille d'enveloppement (91) lorsqu'elle est tirée autour du produit par la progression du produit, un premier moyen de propulsion (122) entraîné de façon à pénétrer sur le chemin de produits en partant de l'un des susdits côtés, de manière à pousser un premier bord mené (91*b*) de la feuille (91) sur un

bord mené du produit et à faire avancer le produit entre les surfaces fixes (120, 121), et un second moyen de propulsion (125) entraîné de façon à pénétrer sur le chemin de produits en partant de celui des susdits côtés qui est opposé au précédent, de manière à pousser l'autre bord mené (91*a*) de la feuille (91) jusqu'à ce qu'il recouvre le premier bord mené (91*b*) et à faire avancer le produit entre les surfaces fixes.

12. Appareil selon la revendication 11, dans lequel les surfaces fixes (120, 121) sont des barres fixes disposées parallèlement au chemin de produits, celles des barres (120), qui sont situées sur le côté du chemin de produits à partir duquel pénètre le premier moyen de propulsion (122), ayant un plus faible coefficient de frottement que celles (121) qui sont situées sur le côté opposé.

13. Appareil selon la revendication 11 ou la revendication 12, dans lequel les chemins des premier et second moyens de propulsion (122, 125) sont inclinés, par rapport au chemin de produits, de façon que le premier moyen de propulsion (122) s'écarte du chemin de produits lorsque le second moyen de propulsion (125) s'engage progressivement d'avantage dans le chemin de produits.

14. Appareil selon l'une quelconque des revendications 11 à 13, dans lequel chaque moyen de propulsion (122, 125) est une palette qui est discontinue selon la largeur du produit et un mécanisme de scellement (142) est prévu pour prendre contact avec les bords menés en recouvrement (91*a*, 91*b*) de chaque feuille d'enveloppement (91), dans des zones situées entre parties voisines des palettes discontinues (122, 125) et pour fixer ensemble dans de telles zones les bords en recouvrement.

15. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre des moyens (130, 71, 141) pour plier les bords latéraux de chaque feuille d'enveloppement (91) autour du produit correspondant (53) et pour les fixer ensemble lorsque le produit progresse le long de son chemin de produits pratiquement linéaire.

16. Appareil selon la revendication 15, dans lequel les moyens (130, 70, 141) pour plier les bords latéraux de chaque feuille d'enveloppement (91) comprennent des jets d'air (140) situés de façon à souffler sur des côtés opposés de chaque feuille d'enveloppement (91) afin de former des premières parties des plis des bords latéraux.

17. Appareil selon la revendication 16, dans lequel les moyens (130, 71, 141) pour plier les bords latéraux de chaque feuille d'enveloppement (91) comprennent en outre des doigts (130) de support des bords latéraux, déplaçables par des moyens de guidage (131), 132, 137, 138) le long du chemin de produits, pour supporter les bords latéraux de chaque feuille d'enveloppement (91), les moyens de guidage (131, 132, 137, 138) portant les doigts (130) à l'écart du chemin de produits de façon à retirer les doigts (130) d'entre les bords latéraux avant que les bords latéraux ne soient pliés vers l'intérieur pour devenir les plis terminaux de l'enveloppe du produit.

18. Appareil selon l'une quelconque des revendications précédentes, comprenant en outre un mécanisme de scellement en toute largeur (144, 145) pour fixer ensemble les bords en recouvrement de chaque feuille d'enveloppement (91) sur toute la largeur du produit (53).

19. Appareil selon la revendication 18, dans lequel le mécanisme de scellement en toute largeur (144, 145) est agencé pour faire avancer les produits (53) le long d'une étape finale du chemin de produits.

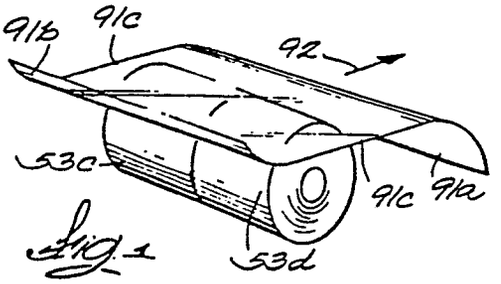

Fig. 1

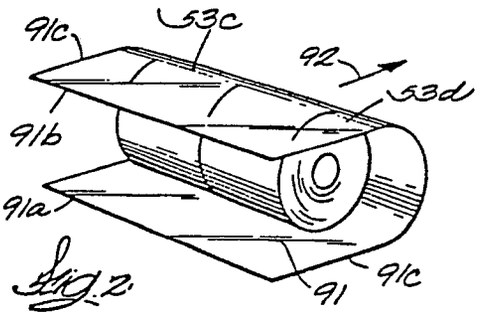

Fig. 2

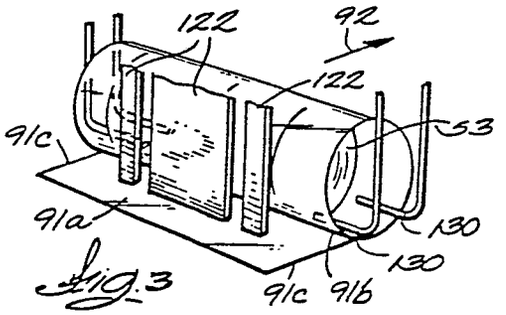

Fig. 3

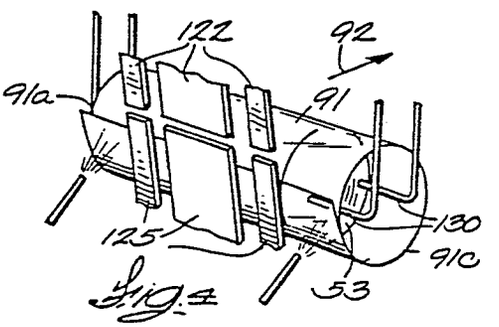

Fig. 4

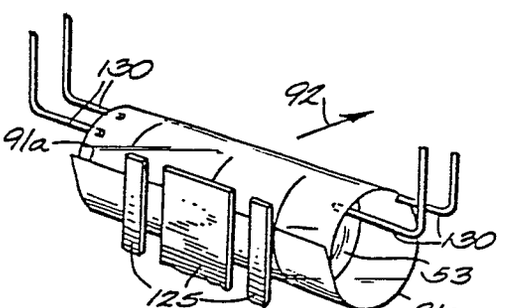

Fig. 5

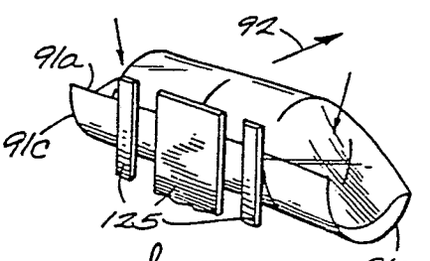

Fig. 6

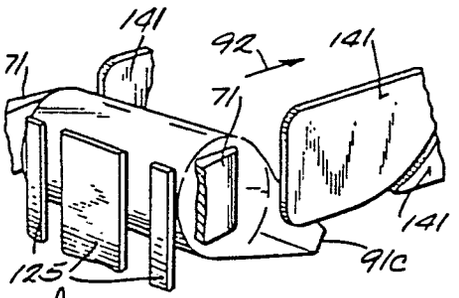

Fig. 7

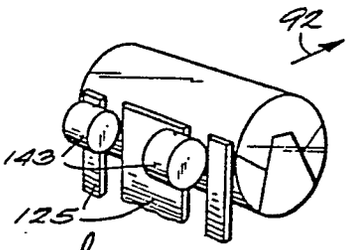

Fig. 8

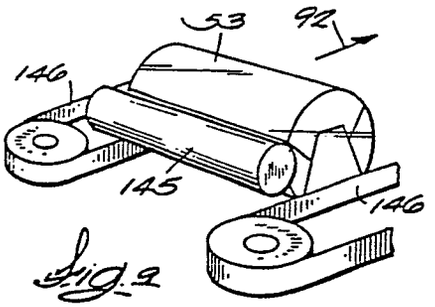

Fig. 9

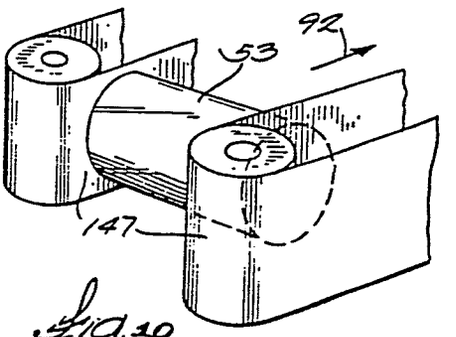

Fig. 10

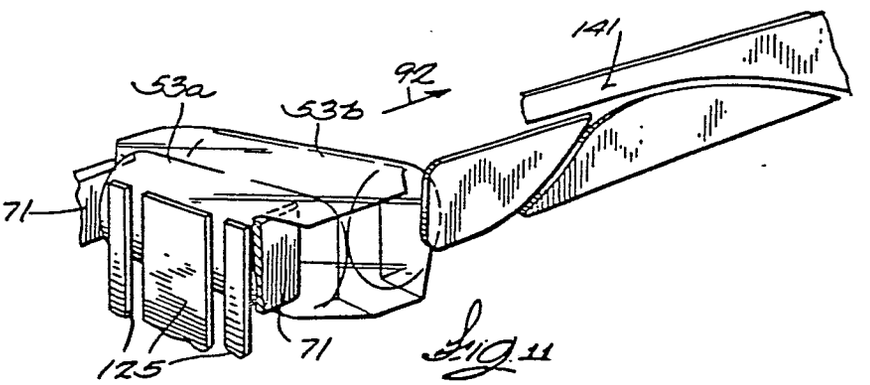

Fig. 11

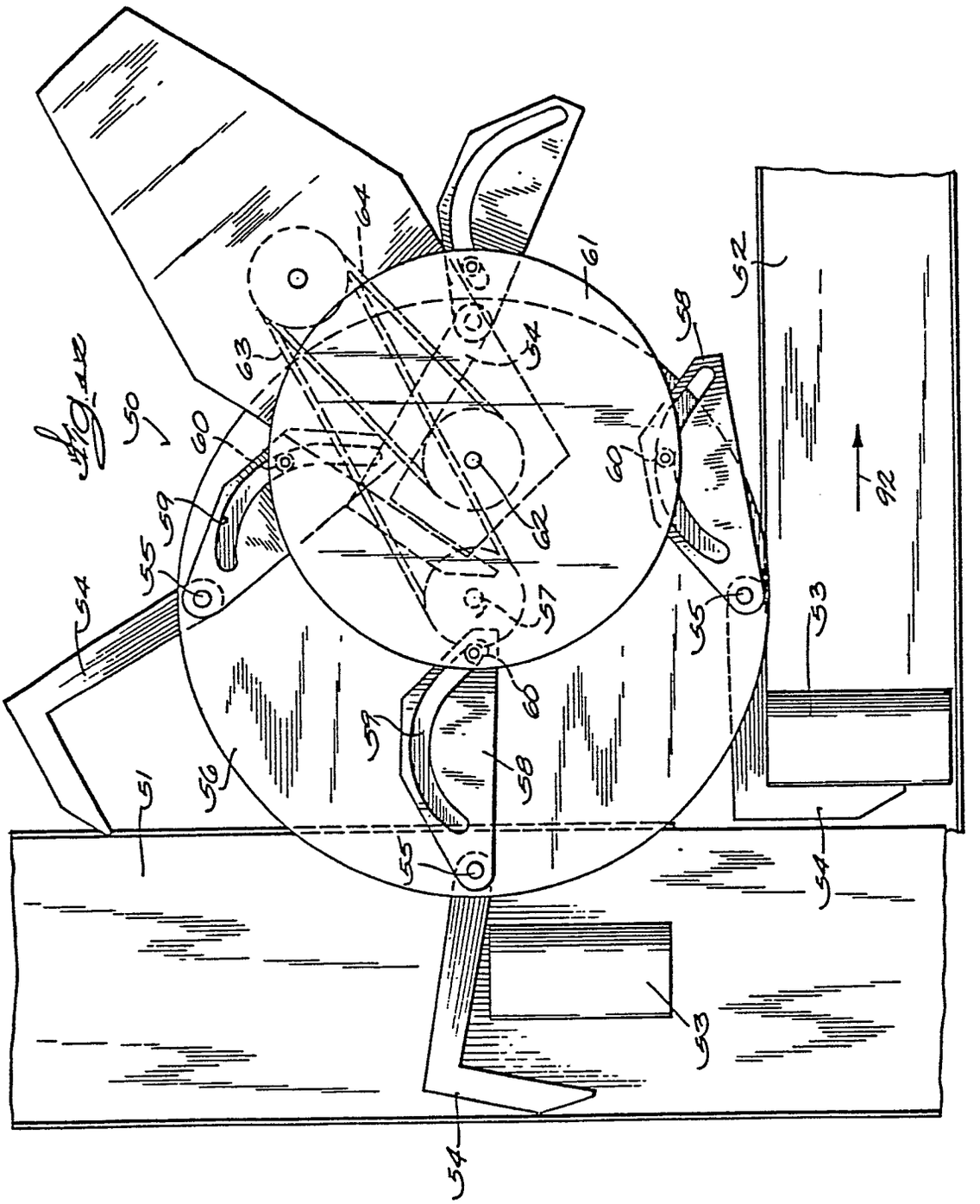
Fig. 4
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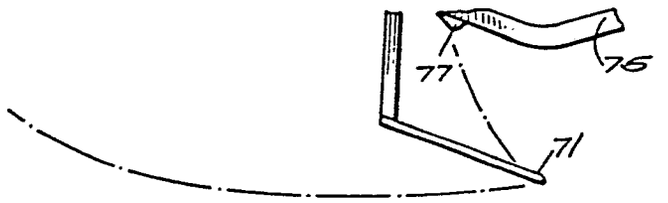


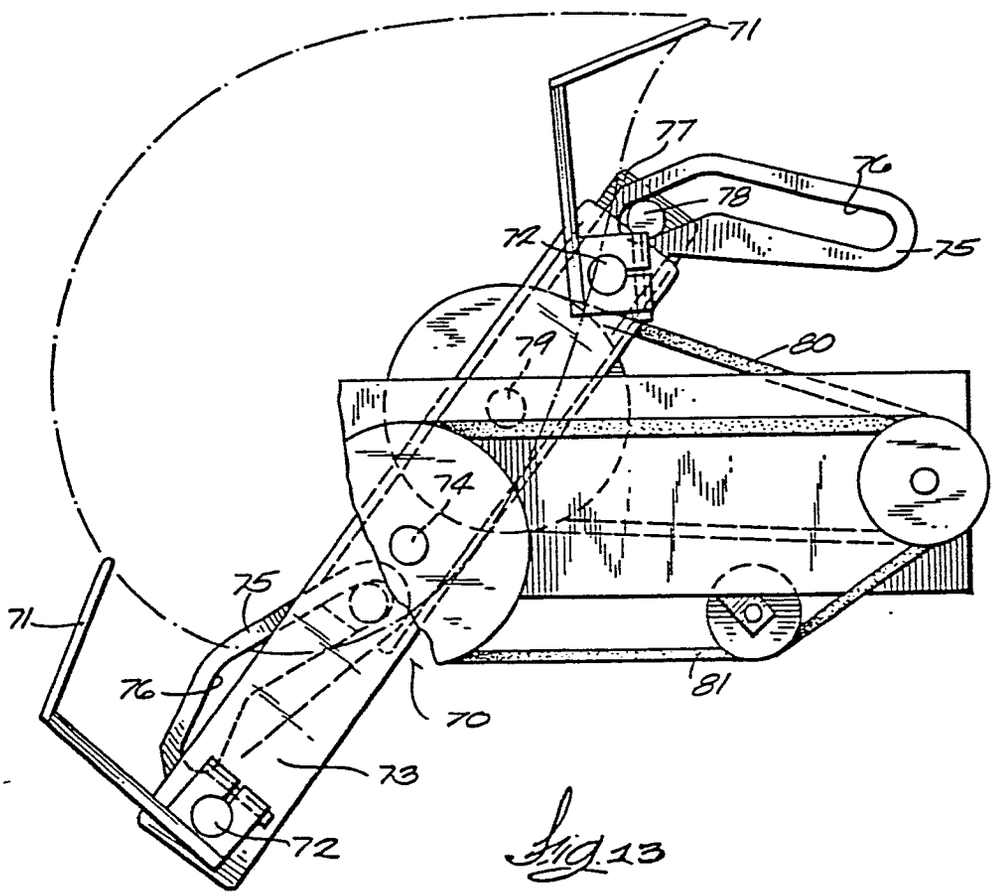


Fig.13

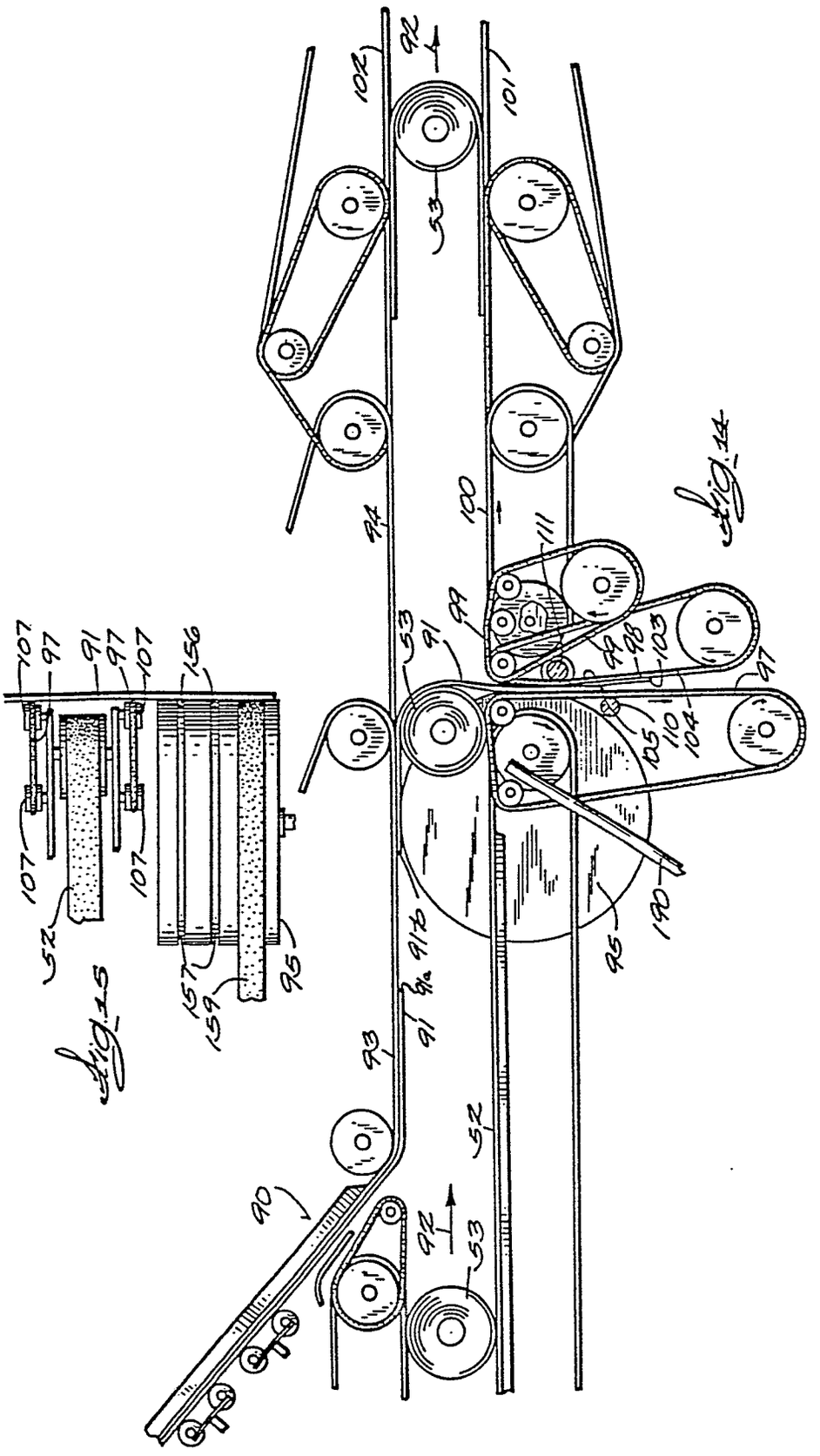
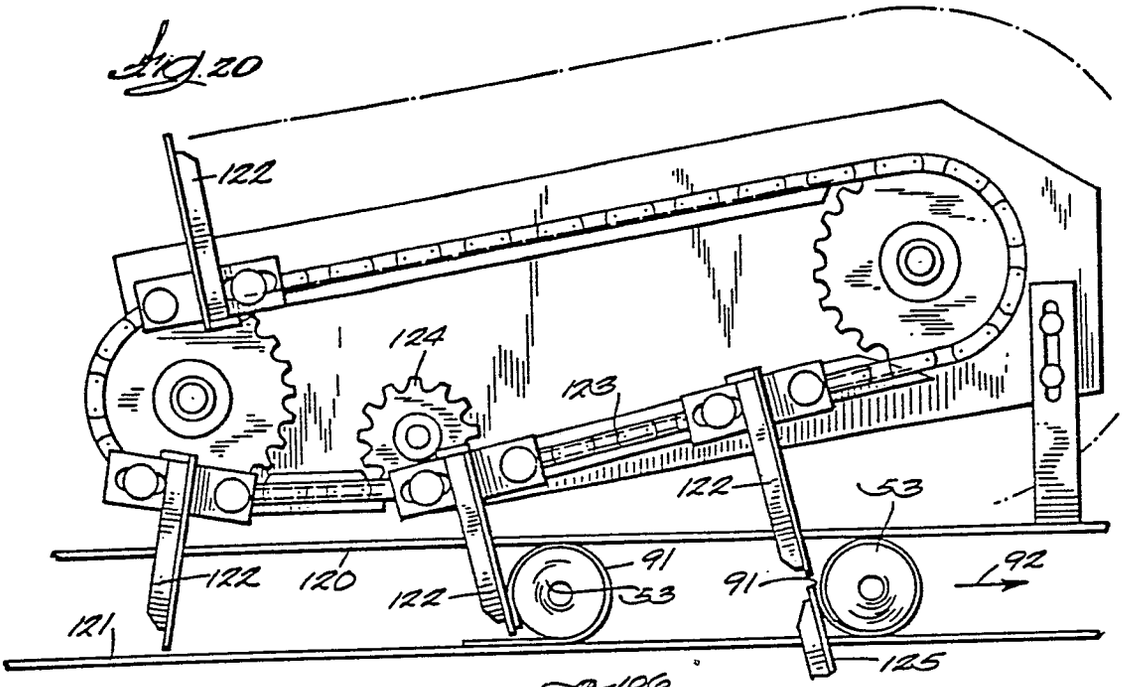
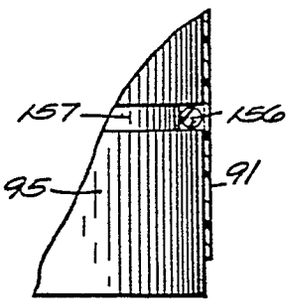


Fig. 14

Fig. 15

Fig.20





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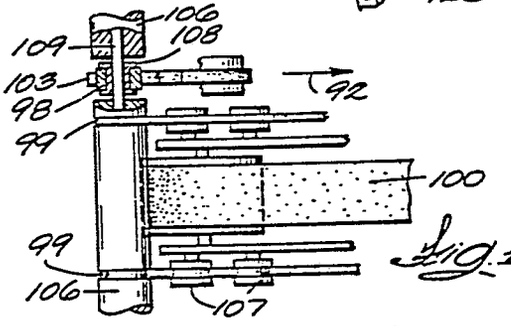

Fig.17

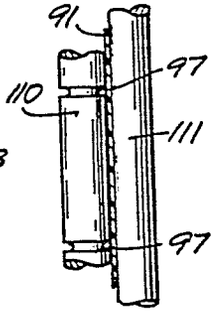

Fig.18

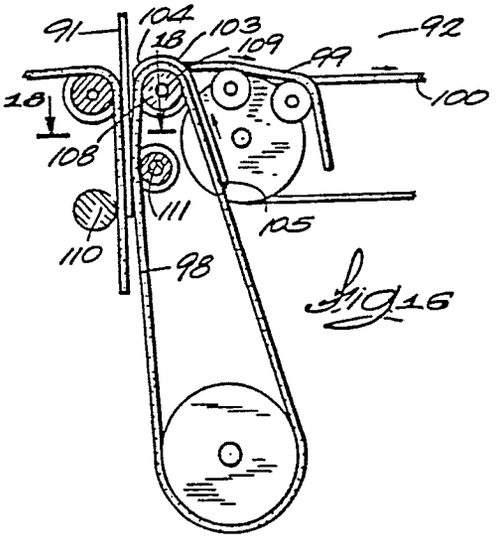

Fig.16

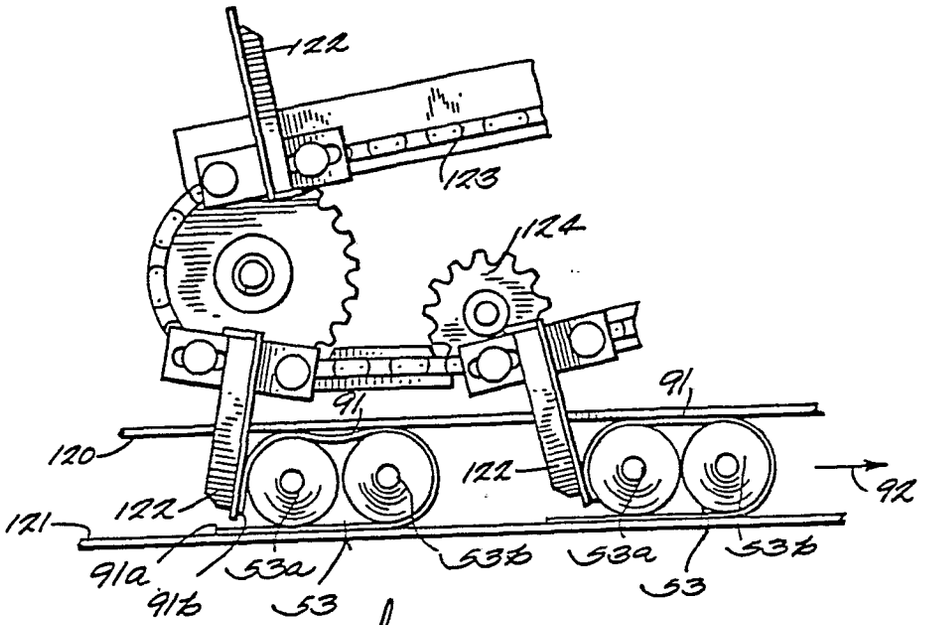
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Fig. 2.1

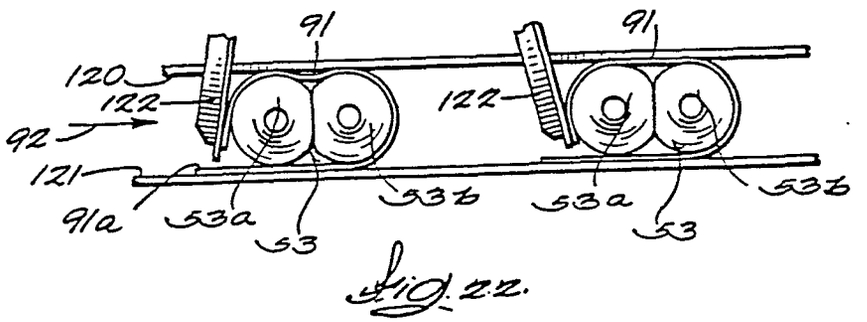
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Fig. 2.2.

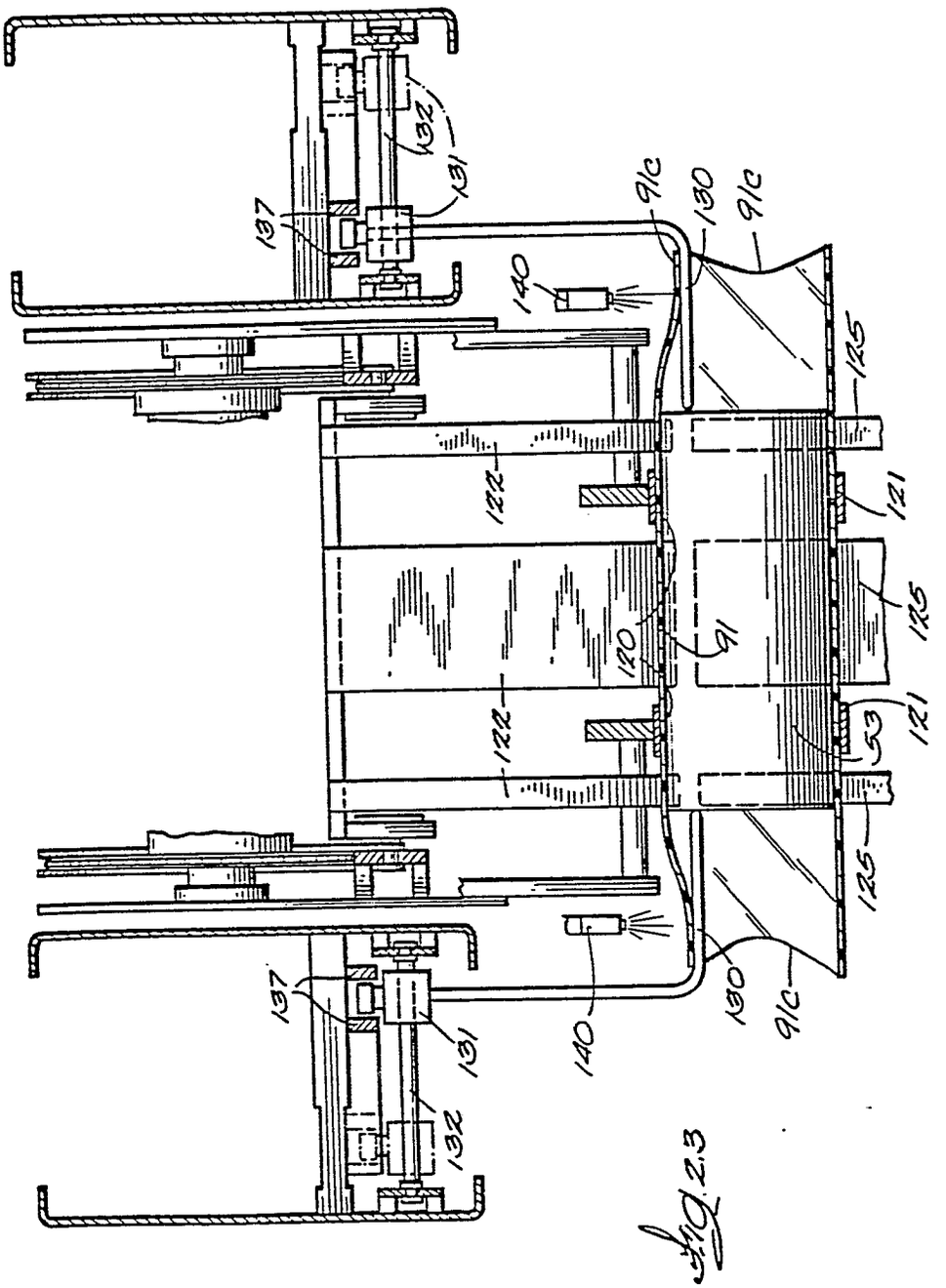
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Fig. 2,3

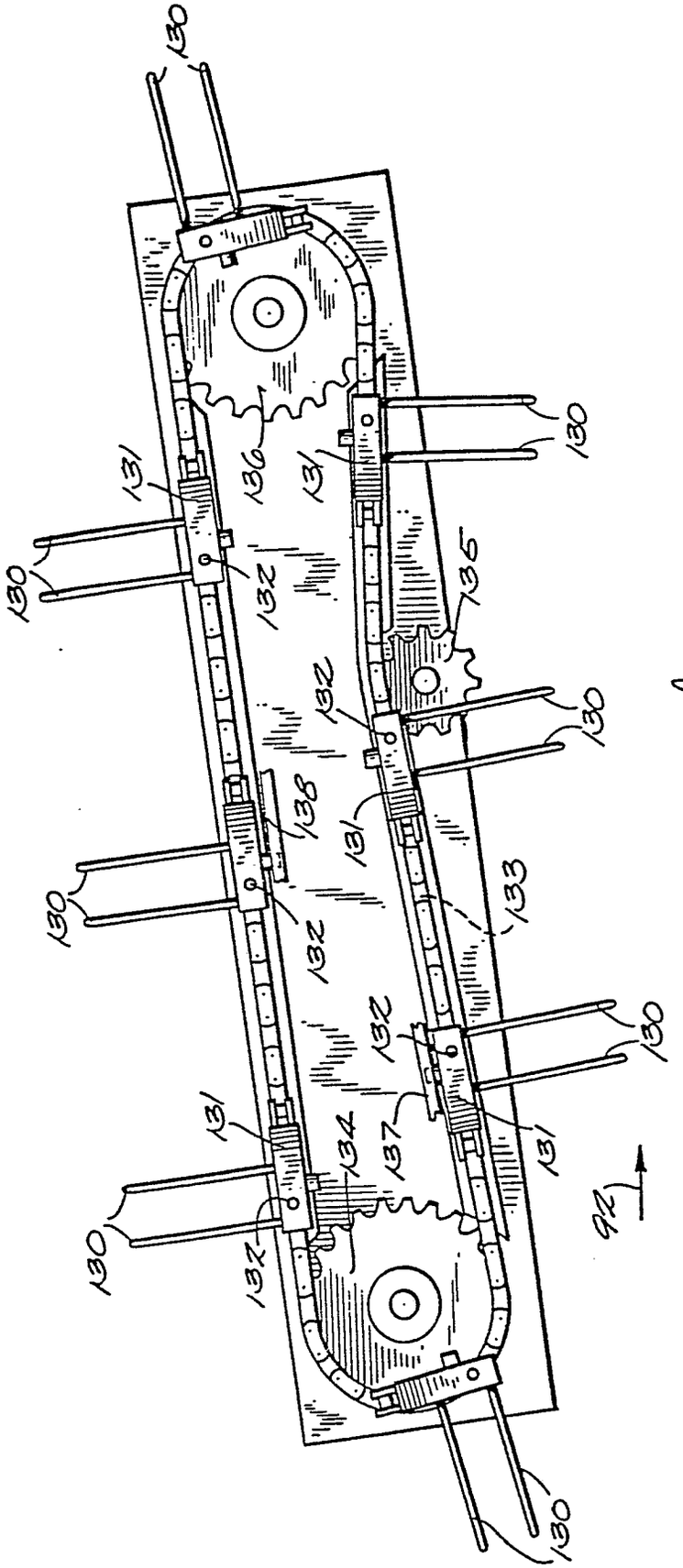
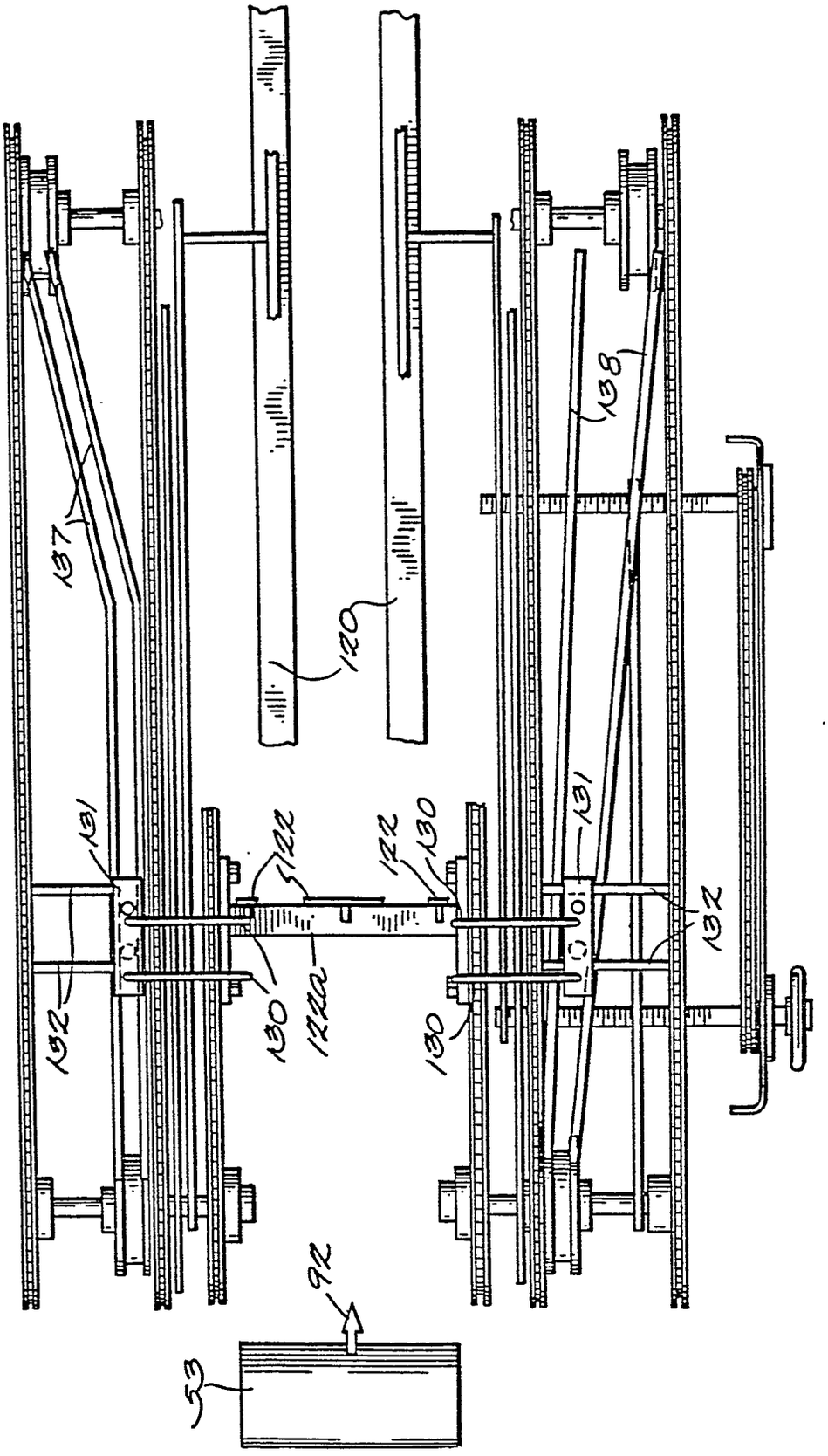


Fig.12.4

Fig. 25



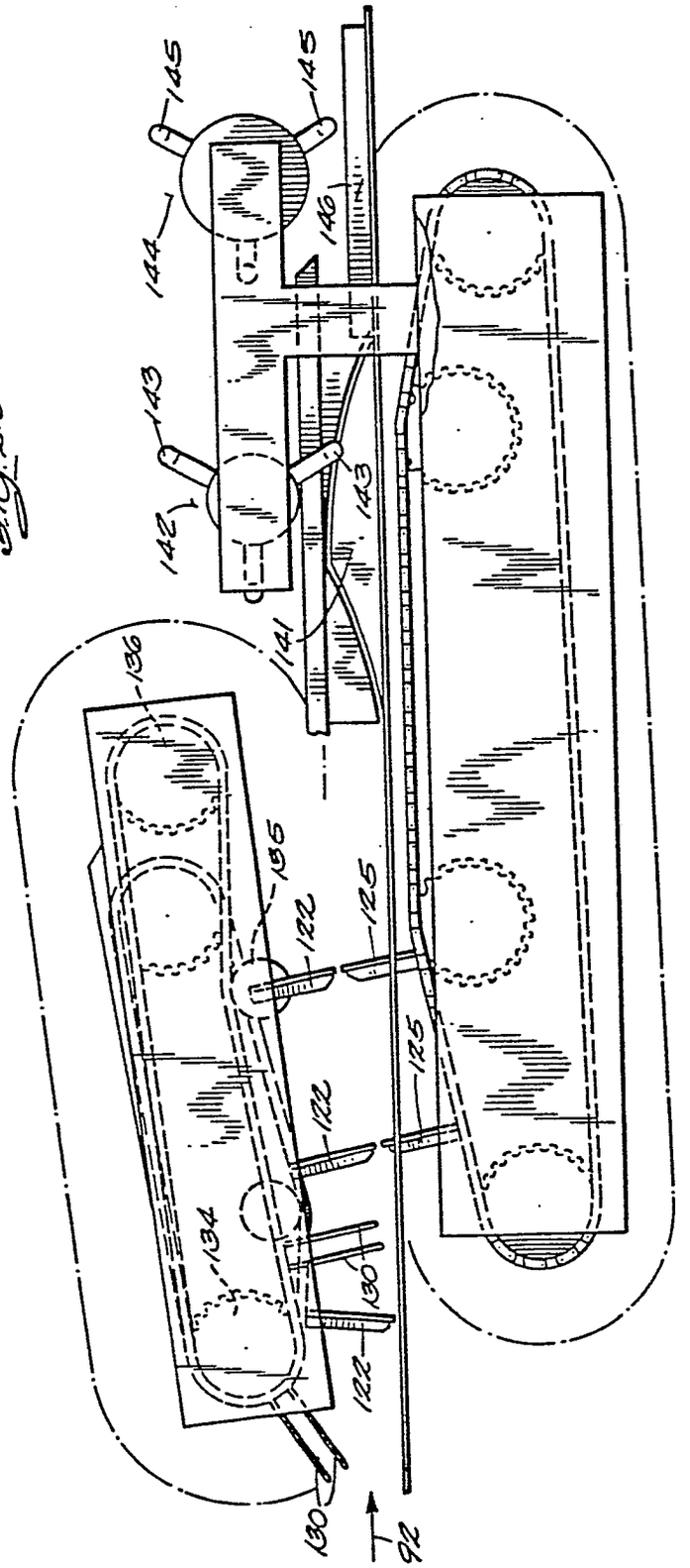

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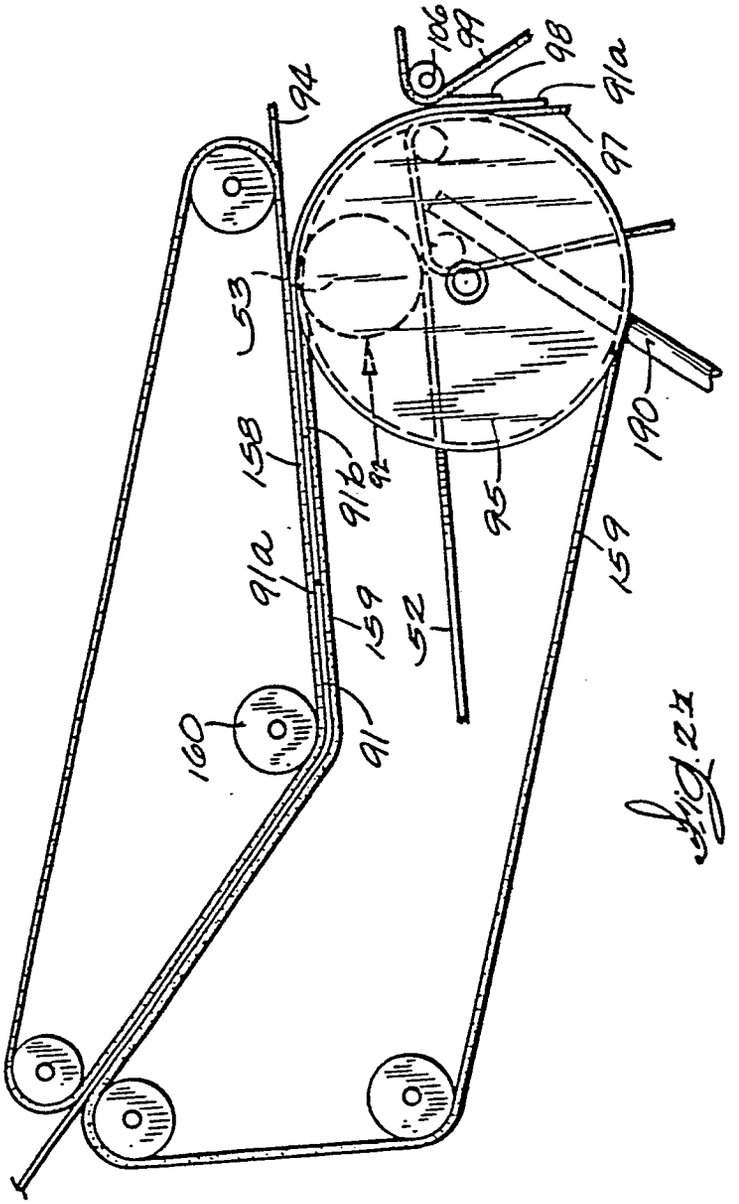
Fig. 2:6



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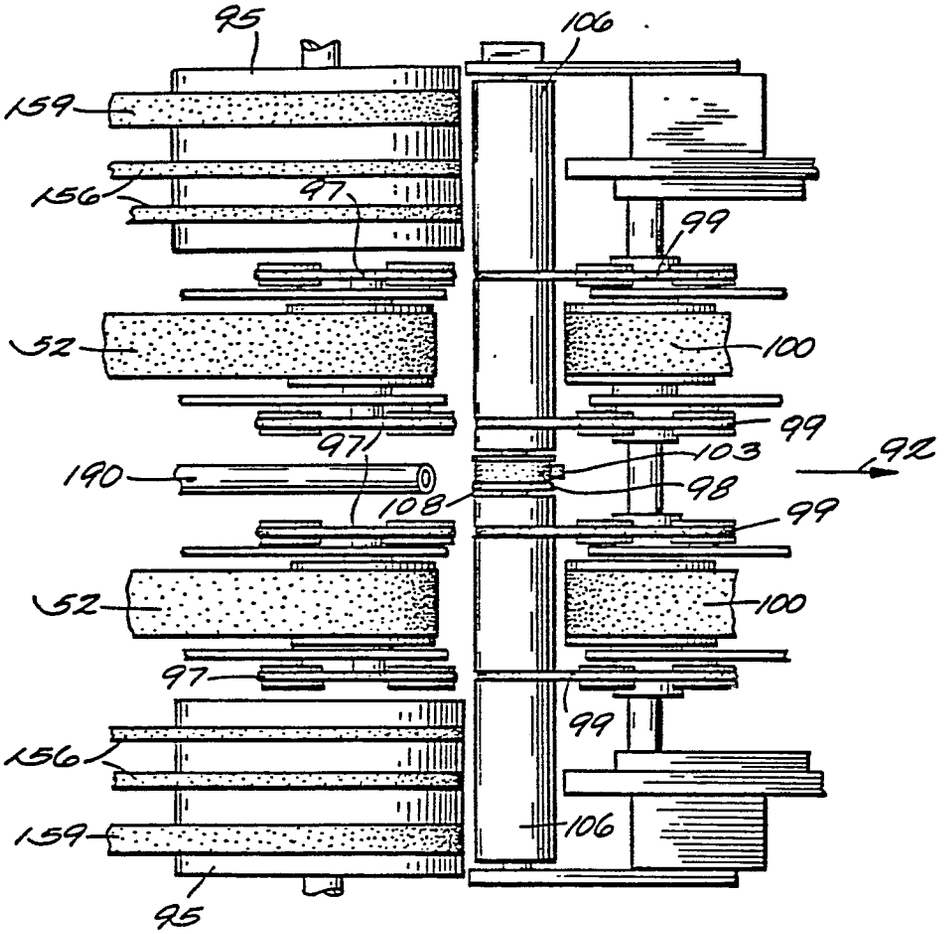
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Fig. 28