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(54) PACKAGE WRAPPING METHOD AND APPARATUS

(71) I, HENRY LOWELL BYLAND, a citizen of the United States of America of 160 Bent Grass Drive, Roswell, Georgia 30075, United States of America, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:-

The present invention relates to methods and apparatus for automatically wrapping each of a series of articles in plastics, especially open trays filled with food products to be secured and protected in the tray.

Automatic wrapping machines have found wide use in providing a thin, clear, and tough plastics film to a variety of articles, large and small. A major use of such machines is found in retail food stores, wherein plastics or fibre trays are filled with meat or vegetable products and sealed on all sides by a thin plastics wrap. The wrap contains the contents and protects them against contamination and also facilitates handling and sale of the product. Such wrapping of produce is done at the retail site, and machines are frequently operated by relatively inexperienced personnel, thus requiring that the machines be simple to use and safe, as well as efficient and quick in operation.

Generally, prior art devices have employed at least one elevator in the folding, wrapping, and sealing processes. In these machines, the package or tray starts at one level and is at some point lifted to a higher level for folding or stretching the film over the article. U.S. Patent No. 3,378,990, issued to the present inventor, is representative of modern, compact semi-automatic wrapping machines. U. S. Patent No. 3,791,101 discloses placing the film curtain across the path of advance of a package, whereby motion of the package from one support surface to the next wraps the front, bottom, and top of the package in the plastic film for subsequent formation of a lap seam on the rear of the package.

According to the present invention there is provided a method of automatically wrapping in a sheet plastics film a tray filled with contents comprises the sequential steps: (a) feeding said film between rollers driven in synchronization with tray travel and supporting said film at upper and lower edges thereof transversely to a path of advance of said tray; (b) preventing said film from wrinking at its vertical edges and from prematurely catching upon said tray by directing a stream of air wider than said film onto said film from a side of advance of said tray; (c) advancing said tray horizontally into said film, and simultaneously releasing a bottom edge of said film to be drawn up and captured between a bottom of said tray and a support surface on which said tray is carried as the tray advances entirely past the initial position of said film; (d) lowering the top edge of said film down behind said tray to drape said contents of said tray with said film; and (e) inserting a tucker and undersealer device between said surface and said tray, simultaneously folding said top edge of said film beneath said tray and joining said film to itself in a lap joint, thereby forming a pair of tubes to each side of said tray.

A preferred embodiment of the invention will now be described by way of example with reference to the accompanying drawings.

FIGS. 1-6 are each schematic side elevation views, partially sectioned, showing sequential operation stages in the wrapping of a tray; and

FIGS. 7-9 are each schematic end views taken on a section through the end folding station and showing other steps in the wrapping of a tray.

In FIG. 1 is shown a generally schematic view of an automatic wrapping machine for carrying out the method of this invention. Beginning at the left end of the Figure, a feed

table 10 is provided extending in the horizontal direction and receiving slidably and reciprocably thereon a pair of longitudinally-spaced feed fingers 11. The fingers 11 retract into the feed table 10 on their leftward movements, so that successive packages 12 placed on the table 10 will be passed to the right. A package sensing switch finger 87 is attached to the table 10 forwardly of a rest position of the second of the feed fingers 11.

An article 12 to be wrapped comprises a shallow tray 13 comprised of pressed fibre, or plastics, or any similar material capable of holding its own shape. The tray 13 is generally rectangular in shape having four sides and a bottom, although the inventive method is equally applicable to round or other-shaped packages. Placed in the tray 13 is a mass of contents 14, which may be meat, vegetables, or other articles which are desired to be wrapped. Although the article 14 is shown rounded like a pie or a patty of ground meat, the method is equally applicable to irregularly-shaped articles such as whole chickens, squash, or machine parts.

A film clamp and support lever 15 extends vertically with respect to the feed table 10 and just beyond a right end thereof. A film feed sensing switch finger 88 senses package length and signals proper film length for wrapping thereof. A photoelectric control may be employed instead. The clamp 15, also shown in plan view in FIG. 7, carries a plurality of clamping fingers 16 on an upper transverse bar thereof, the fingers 16 being adapted to grasp and retain andupper edge 17 of a plastics film 18. The film clamp 15 is vertically reciprocable with respect to a pair of film feed rollers 19 located beneath the feed tables 10 and just beneath a fixed pair of film guide fingers 20. The plastics film 18 extends to the clamp fingers 16 through the feed rollers 19 and the guide fingers 20, with the rollers 19 applying a tension to the film 18 toward a lower edge 21 of the film 18. A pair of film cut knives 22 is provided on either side of the film 18 to sever the film sheet and to form the lower edge 21 thereof at a proper point in the machine operation sequence. Plastics film is supplied to the feed rollers 19 from a roll of film, not shown, within the machine.

Arranged upwardly from the feed table 10 is a blower 25 which is supported by a wall 26 of the machine in any convenient manner to direct a wide stream of air across the entire surface of the plastics film 18 from the side from which the package 12 advances thereinto. As shown in end view on FIG. 7, the film blower 25 has an air outlet 28 which is wider than the width of the plastics film 18 in a transverse direction. Although the blower 25 is shown as a self-contained centrifugal blower, any suitable source of a stream of air 27 may be employed.

Located on the opposite side of the film clamp and support 15 from the feed table 10 is a series of transversely-extending package support rollers 30 arranged with their upper circumferences substantially at the place of the feed table 10. The support rollers 30 are spaced slightly apart in the longitudinal direction to permit free, idling rotation thereof. Each roller 30 is spring-biassed to the position of FIGS. 1-3, but is vertically downwardly cammable in cooperation with movement of an undersealer device 35. A second air blower 51 is positioned beneath the rollers 30 to direct air upwardly against the underside of the package at the front thereof.

The girth wrap folder and undersealer device 35 is normally positioned beneath the feed table 10. The folder and undersealer 35 comprises a platen 36 having a pair of electric heaters 37 in an upper surface thereof. A Teflon (Registered Trade Mark) coated fiberglass curtain 38 is affixed at one end of the machine frame at a clamp 39 and at its other end to a tension roller 40 carried on the movable platen 36. The curtain 38 extends beneath the feed table 10, around a nose 41 of the platen 36, and along an undersurface thereof to the tension roller 40. The roller 40 applies a constant end-wise tension to the curtain 38. The platen 36 is movable to the position shown in FIG. 4 by an appropriate cam linkage which simultaneously depresses successive individual support rollers 30 as the nose 41 of the platen 36 moves to the right. Portions of curtain 38 do not move horizontally once unrolled past the nose 41 of the platen 36, permitting application of heat from the elements 37 to the film 18 and tray 13 with no sliding contact between such movable elements and the bottom of a package 12.

Located beneath the support rollers 30 and between the first and second such rollers from the left, is a vertically reciprocable package fence 45. The fence 45 is connected to cooperate with the forwardmost of the feed fingers 11, extending upwardly behind an advanced package 12 and then allowing retraction and leftward movement of the feed finger 11 without interference.

A heated roller 86 is positioned at the end of the series of rollers 30. This roller, comprising a heating element inside an aluminum tube, assures proper finish of the lap seal.

Further to the right of the rollers 30, 86 in the machine mechanism of FIG. 1 is an end folding, tucking, and sealing station 50. The station 50 comprises package support rollers 73 having tops located in the same plane as the feed table 10 and the tops of the support rollers 30. As shown in FIGS. 1 and 7, three horizontal bars extend longitudinally of the machine from a vertical bar 52 on either side of the package track. A lower bar 53 has an

inclined leading edge 54 which forms a front tucker for the lower portion of the semi-wrapped package. The next upward bar 55 is an end folder and is fitted with a friction edge 56, comprising a strip of rubber or similar material along an upper, inner edge thereof. A rear tucker bar 57 is pivotally mounted upon each end folder bar 55 at a pivot point 58 and is controlled by a cam linkage to gather rear portions of the plastics film 18 in the end tucking process. An upper bar 59 is a package guide bar, spaced from the first bar 53 to lie alongside the package as end wrapping is completed as shown in FIGS. 5, 8, and 9. The two sets of bars 53, 55, 59 and the package support rollers 73 are adjustably spaceable laterally from one another to accommodate different package widths.

An overhead feed finger 60 is selectively lowerable to engage the rear of the package 12 after girth wrapping and to feed it forwardly over the support rollers 30, through the end tucking and folding station 50, and over additional rollers 62 to a heated conveyor belt at the right end of the machine.

As shown in FIGS. 8 and 9, a pair of end underfolders and sealers 65 are provided on an underside of the end folding and sealing station 50. The end underfolder-sealer devices are much like the girth wrap folder and undersealer device 35 in having a platen 66 with heated bars 67 in the upper surface thereof. A Teflon-coated fibreglass curtain 68 is attached to the machine frame at 69 and is tensioned by a tension roller 70 carried on the lower rear surface of the platen 66. The curtain 68 extends about a nose 71 of the platen 66. Friction bars 72 just forwardly of the nose 71 of each of the underfolder sealers 65 stretch the film tightly at the ends as the underfolders and sealers 65 advance. The underfolder sealers 65 each have a cam surface 89 on an end thereof.

The end underfolder platens 66 are movable inwardly toward one another beneath the package 12, displacing longitudinally-extending package support rollers 73 with the cams 89 to permit the heating elements 67 to press against the undersurface of the tray.

The heated conveyor belt 75 comprises an endless loop 76 of material such as silicone-rubber, fibre glass or Teflon-coated fibreglass. A series of heaters 77 are provided either transversely as shown or longitudinally under the belt 76 to ensure a tight sealing of the plastic film 18 to itself on the bottom of the tray 13. A package pressure wheel 78 is pivotally mounted with respect to the heated conveyor 75 by a pivot link 79. The wheel 78 is covered with a soft silicone rubber rim 80. The weight of the wheel 78 atop the package 12 assures that proper contact is made between the package 12 and the conveyor 76 to seal any loose edges or fringes of plastic wrap. The conveyor 75 is driven through one of the end rollers 81 thereof.

The tray 13 filled with contents 14 of meat, vegetables, or other articles, is placed on the feed table 10 of the wrapping machine forwardly of one of the feed fingers 11. A width adjustment is made to the transverse spacing of the end bars 53, 55, 59 of the folding device 50 to accommodate the particular width of tray 13 employed. Also, a selection of correct width of plastics film 18 may be made from a number of available rolls. Generally a large number of similar-width trays 13 may be wrapped at one time, minimizing the need to change the width adjustments. Heater controls are turned on if required and adjusted for proper temperature depending upon the particular sort of film 18 employed.

A main drive motor of the machine will cause the feed fingers 11 to move to the right across the top of the feed table 10. As the feed fingers 11 begin moving forward, and if the package switch 89 is closed, the clamping fingers 16 on the film support 15 close over the end 17 of the plastics film 18 in or just above the film guide fingers 20 upwardly of the film feed roller 19. The lever 15 is raised to the position shown in FIG. 1, forming a curtain with the film 18 across the path of advance of the package 12. The film blower 25 causes a blast or stream of air to billow the film curtain ahead of the advancing package 12 to prevent folds from forming in the film. As the package 12 is advanced into and through the curtain, the blast of air also causes moving air to be kept between the tray and its contents to reduce snagging between the film and the package. As the package 12 advances more film is fed by feed rollers 19 actuated by sensing finger 88.

After the correct amount of film is fed, the knives 22 are actuated by a spring-release tripped by a limit switch actuated by the package feed. The knife action forms a lower edge 21 on the exposed plastic film 18. As the package 12 continues to advance onto the support rollers 30, the lower edge 21 of the film 18 is, as shown in FIG. 2, pressed by the rollers 30 upon the tray 13. The end 21 is maintained in position by the air blower 51. The film 18 is then pulled taut between the bottom of the tray 13 and the pressure on the film 18 at the clamp fingers 16. When the feed fingers 11 reach their forward-most position, the package fence 45 rises above the level of the support rollers 30 to prevent rearward motion of the package 12 under the tension of the film 18, and the fingers 11 are withdrawn to the left. The air blower 25 may be, although in automatic operation usually is not, shut off after the package 12 is advanced to its forward-most position.

Between FIGS. 2 and 3, the film clamp and support lever 15 falls beneath the level of the feed table 10, carrying the upper end 17 of

the plastic film 18 down behind the package 12. The clamp fingers 16 are released from the film 18 and travel further downwardly to engage an upper edge 17a of a next sheet of plastic film 18a to be drawn from the feed rollers 19 in or just above the guide fingers 20.

As shown in FIG. 4, in the next steps of the process, the package fence 45 is withdrawn vertically downwardly, and the folder and undersealer platen 36 is extended from the rest position of FIG. 3 to the plane of the top of the feed table 10 and the package roller 30. As the platen 36 is inserted between the leftmost rollers 30 and the bottom of the tray 13, the end 17 of the plastic film 18 is engaged and folded about the rear side of the tray 13 and tucked flat beneath the tray. Full forward movement of the heated platen 36 forms a lap seal between the edge 17 of the wrap and the edge 21, which is captured between the edge 17 and the tray 13. The heating elements 37 transfer heat through the fibreglass curtain 38 to seal the film 18 to itself at this lap joint. Since the curtain 38 does not move horizontally after it passes by end or nose 41 of the platen 36, the film 18 is not disturbed by the substantially vertical falling away of the support rollers 30 and the immediate replacing thereof by the heated platen 36.

As the girth wrapping and undersealing is completed, platen 36 returns leftwardly and support rollers 30 return to their raised positions again supporting the package 12. The overhead feed finger 60 drops down behind the package 12. This feed finger 60 engages the rear of the package 12 and slides it forwardly over the support rollers 30, over the heated roller 86, and into the end folding, tucking, and sealing station 50. Simultaneously, as shown in FIG. 5, the film clamp and support lever 15 rise above the level of the feed table 10. If the clamp fingers 16 have been closed by the sensing device 87 which detects a package on the table 10 forwardly of the right feed finger 11, the process of FIGS. 1-4 will be repeated for such package.

The girth-wrapped package 12 as it lay on the package support rollers 30 just before movement by the overhead feed finger 60 had a completed girth wrap thereabout, with the plastics film 18 formed as a tube thereabout and extending to either side of the package 12. As the package 12 is moved forwardly by the overhead feed finger 60 into the end folding, tucking, and sealing station 50, the underside front surfaces of the tube ends of the film 18 are tucked upwardly against the sides of the tray 13 by the inclined forward portion 54 of the front tucker bar 53. The package 12 then comes to a stop in the station 50 as shown in FIG. 5, and the rear tucker 57 pivots downwardly about the pivot point 58 to gather forwardly any trailing film 18. The end tucker and folder assemblies 52 then descend, to the positions of FIGS. 5 and 8, flattening the tube ends of the film 18 and folding them downwardly along either side of the tray 13. The friction edges 56 on the end folder bars 55 engage the film 18 and pull it downwardly over the top of the package 12 and the contents 14 therein. The package 12 is then held laterally in the position of FIGS. 5 and 8 by the package guide bars 59 and supported vertically upon the package support rollers 73.

The end underfolder-sealers 65 are moved laterally inwardly, engaging the flattened tube ends of the film 18 and driving them inwardly and upwardly against the undersurface of the tray 13 and the girth wrap of plastics film 18 thereover. The cam surfaces 89 displace pivotally the longitudinally-extending support rollers 73 as the end underfolder-sealers are plunged beneath the tray 13. The underfolder-sealers 65 are withdrawn after the film 18 has been adhered to itself beneath the tray 13 leaving the tray 13 again supported by the support rollers 73.

As a final step in the wrapping of the package 12, the overhead feed finger 60 moves the enclosed package 12 from the end folder station 50 across the rollers 62 to the heated conveyor belt 75. The belt 75 flattens any loose portions of plastics film 18 which had not been completely adhered to the tray 13 and subjects the entire bottom of the tray 13 to heating by the elements 77 positioned under the conveyor belt 76. The pressure roller wheel 78 assures firm contact between the bottom of the tray 13 and the belt 76 and heating element 77 for good heat flow. Where shrink film is used, a shrink tunnel 85 as shown schematically in FIG. 6 is placed about the heated conveyor 75.

WHAT I CLAIM IS:

1. A method of automatically wrapping in a sheet of plastics film a tray filled with contents, comprising the sequential steps: (a) feeding said film between rollers driven in synchronization with tray travel and supporting said film at upper and lower edges thereof transversely to a path of advance of said tray; (b) preventing said film from wrinkling at its vertical edges and from prematurely catching upon said tray by directing a stream of air wider than said film onto said film from a side of advance of said tray; (c) advancing said tray horizontally into said film, and simultaneously releasing a bottom edge of said film to be drawn up and captured between a bottom of said tray and a support surface on which said tray is carried as the tray advances entirely past the initial position of said film; (d) lowering the top edge of said film down behind said tray to drape said contents of said tray with said film; and (e) inserting a tucker and undersealer device between said surface and said tray, simultaneously folding said top

edge of said film beneath said tray and joining said film to itself in a lap joint, thereby forming a pair of tubes to each side of said tray.

2. A method as claimed in claim 1, wherein between steps (c) and (d) a package fence is raised behind said tray to prevent backwards movements thereof as said top edge of said film is lowered and tightened, and said fence being lowered between steps (d) and (e).

3. A method as claimed in claim 1, further comprising between steps (d) and (e) a step of directing a second stream of air onto the bottom of said tray and said bottom edge of said film and maintaining this stream during step (e), to maintain said bottom edge against said tray during formation of the lap joint by the tucker and undersealer device.

4. A method as claimed in claim 1, further comprising the sequential steps following step (e): (f) retracting said tucker and undersealer device; (g) advancing said tray horizontally to an end folding station; (h) tucking a lower portion of each film tube adjacent said tray upwardly against a corresponding one of said tray sides; (i) folding each of said film tubes downwardly past said tray sides; and (j) tucking said film tubes flat beneath said tray bottom.

5. A method as claimed in claim 4, wherein step (i) further includes stretching said film tightly over said tray contents.

6. A method as claimed in claim 4, further comprising after the step (j) the further step: (k) advancing said tray horizontally from said end folding station to a heated conveyor surface.

7. A method as claimed in claim 6, further comprising the step of advancing the tray horizontally through a shrink tunnel.

8. A method of automatically wrapping in a plastics film a rectangular tray filled with irregular contents, comprising the sequential steps: (a) forming a curtain of a length of said plastics film across a path of advance of said tray by supporting said film at top and bottom edges thereof; (b) blowing a stream of air onto a side of said film in said advance direction; (c) advancing said tray into said curtain while the air is blowing and onto a surface extending in the tray advance direction, continuing to feed film until enough film is fed to satisfy the package size and to trigger a cut-off knife, and releasing the severed bottom edge of said curtain, thereby to engage a front edge of said tray and a bottom portion thereof above said surface with said film; (d) lowering said curtain across and down behind said tray; (e) tucking said film from behind said tray beneath the underside of said tray above said surface, forming a lap seal by sealing said film to itself, a pair of film tubes on either side of said tray being formed thereby; (f) advancing said package along said surface to an end folding and tucking station; (g) folding a lower portion of said film tubes to the lower sides of said tray; (h) lowering and flattening said film tubes downwardly across the sides of said tray; and (i) tucking and sealing said flattened film tubes beneath and to the bottom of said tray above a retracted support surface thereof.

9. A method as claimed in claim 8, wherein the stream of air blown in steps (b) and (c) is sufficiently strong to prevent said film from wrinkling at its edges as said tray is advanced into said film and to form an air gap between said film and said tray as said tray advances.

10. A method as claimed in claim 8, wherein step (e) thereof is accomplished by retracting said surface downwardly as a tucking and sealing element is passed between said surface and the bottom of said tray.

11. A method as claimed in claim 10, further comprising simultaneously with step (e) directing a second stream of air against an underside of said tray and said bottom edge of said film thereagainst to maintain said film in flat contact with the underside of said tray.

12. A mechanism for automatically wrapping a tray in a sheet of plastics film comprising: first means for supporting said film at upper and lower edges thereof transversely to a path of advance of said tray; second means for preventing said film from wrinkling at its vertical edges and from prematurely catching upon said tray, said second means directing a stream of air wider than said film onto said film from a side of advance of said tray; third means for advancing said tray horizontally into said film; fourth means for simultaneously releasing a bottom edge of said film to be drawn up and captured between a bottom of said tray and a support surface on which said tray is carried as the tray advances entirely past the initial position of said film; fifth means for lowering the top edge of said film down behind said tray to drape said contents of said tray with said film; and sixth means for inserting a tucker and undersealer device between said surface and said tray and for simultaneously folding said top edge of said film beneath said tray and joining said film to itself in a lap joint, thereby forming a pair of tubes on each side of said tray.

13. A method of automatically wrapping a tray substantially as herein described with reference to the accompanying drawings.

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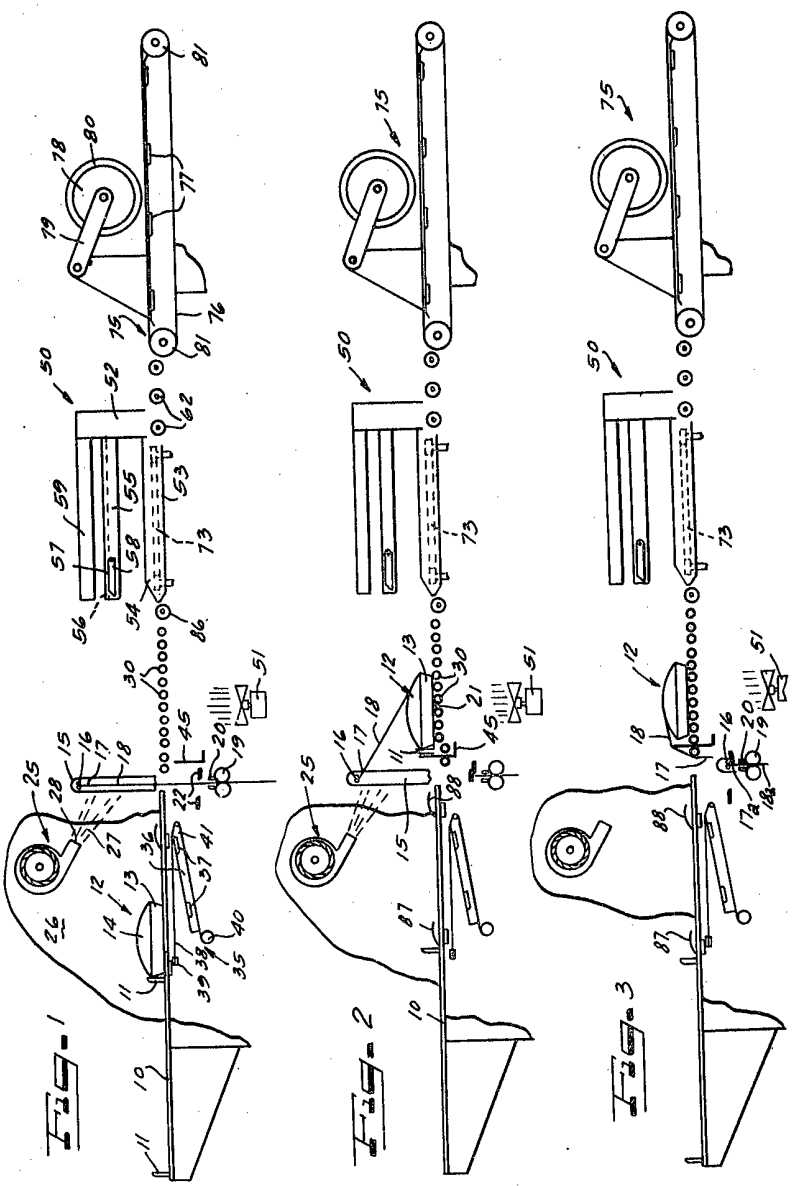
1581274 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1



1581274 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 2

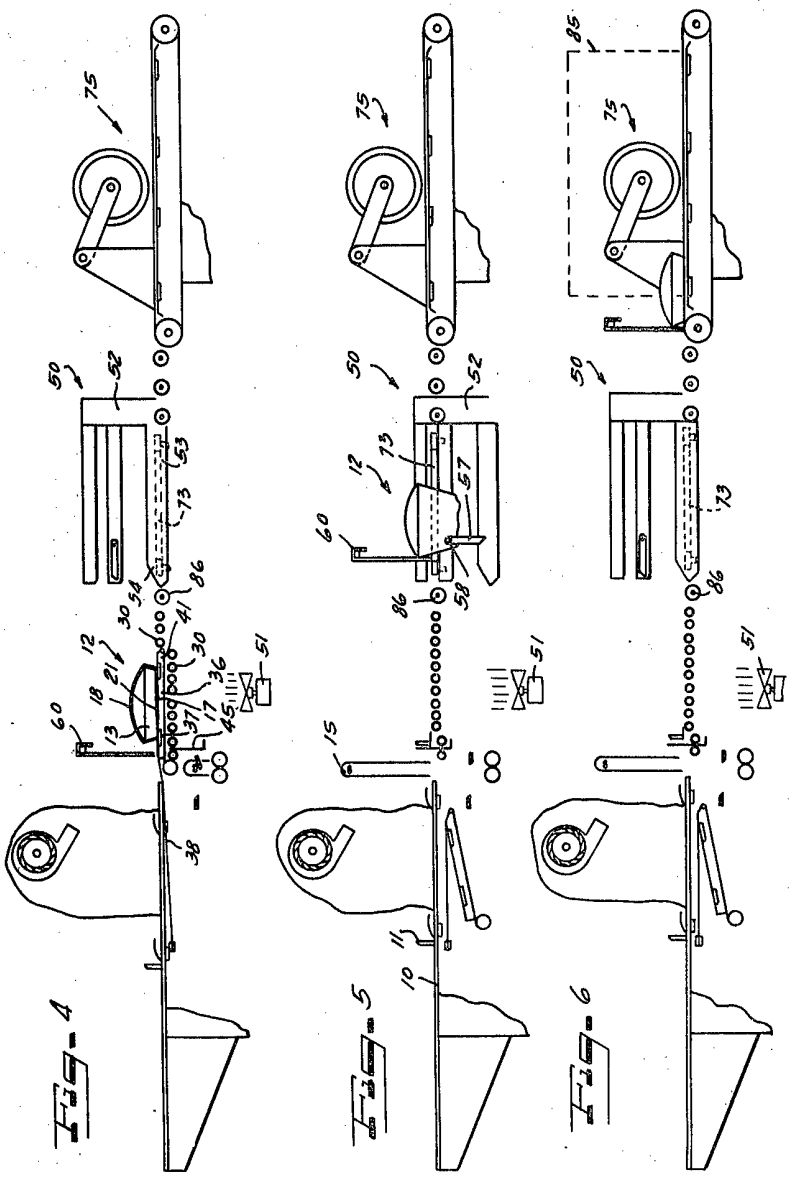


Fig-7

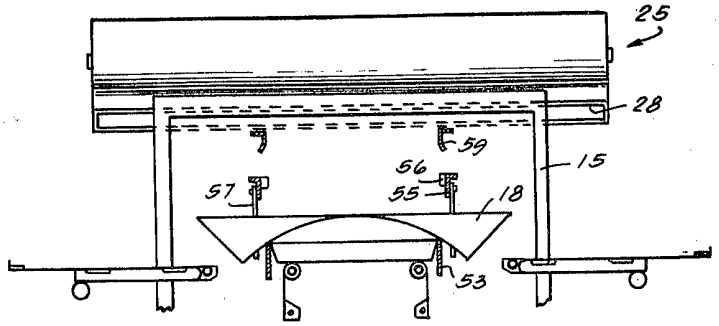


Fig-8

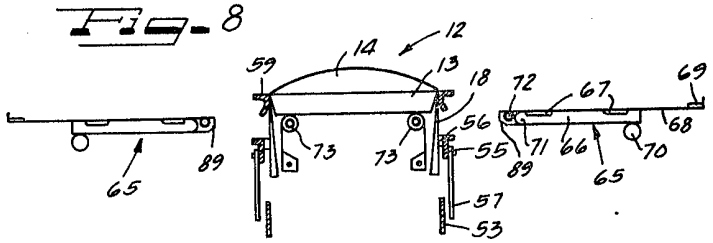


Fig-9