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(54) Horizontal form-fill-seal machine with inert gas injection and heat shrinking

(57) A horizontal form-fill-seal machine has means 19 for evacuating the tube 18 with the articles 10 in it, and means 24 for injecting an inert gas into the evacuated enclosure. The evacuation means may be a flat rectangular nozzle 19 (fig 3) with suction holes 20 down each side. The gas injection means 24 projects from the front of the evacuation means. Heat-sealing bars 25, 26 are carried on guide bars (45, 46, fig 6) which are in turn slidably mounted on guide bars (30, fig 5). The heat sealing bars move in the same direction and at the same speed as the film between two positions, and then return to their original position. This motion can be achieved using a cam mechanism. A plate (91, fig 9) presses excess gas out of each package before the sealing takes place. The plate may be moved by an air cylinder (89, fig 9) and may have a soft porous material on its underside (99, fig 9). After sealing the wrapped package 13 is passed through a heat-shrinking device 104 to tauten the film over the article (fig 10).

FIG.1

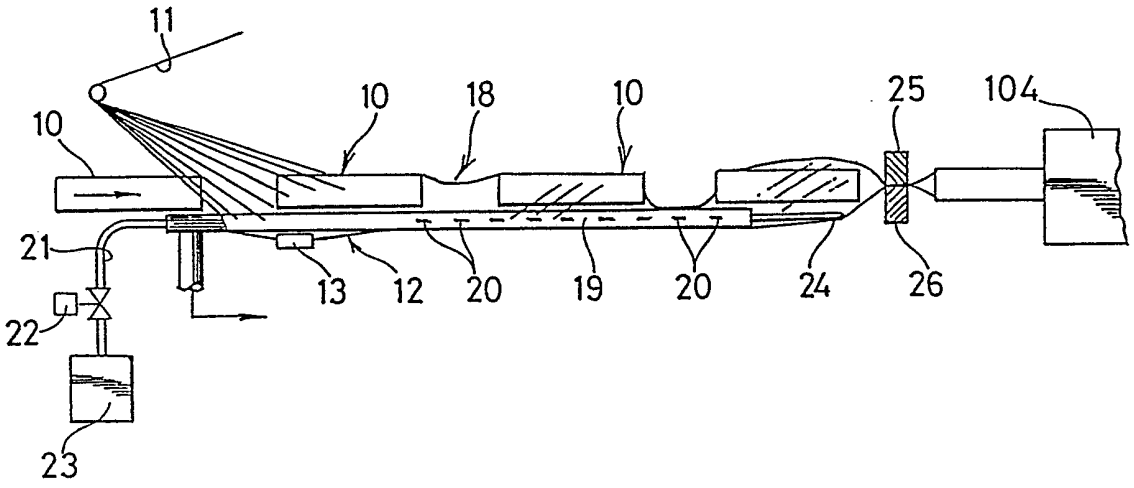

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FIG.1

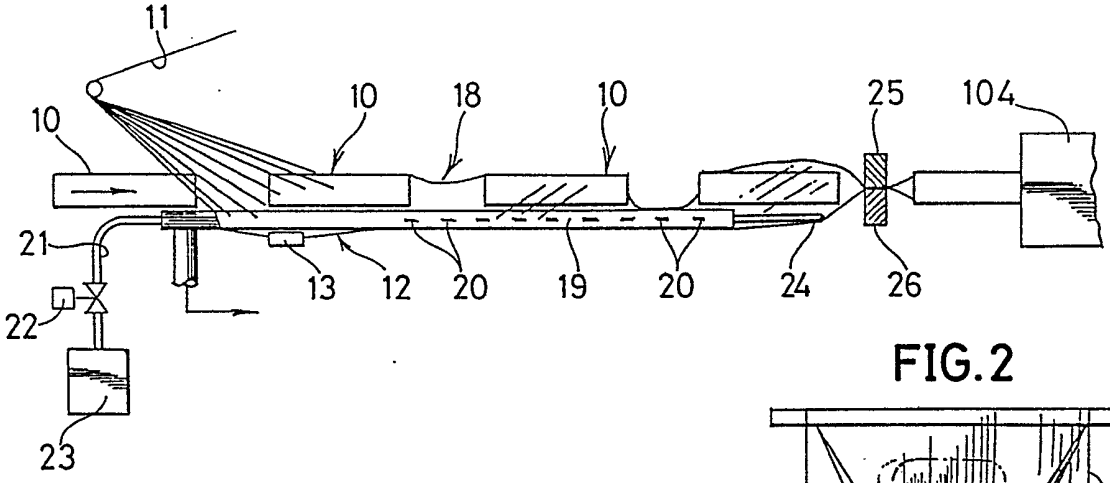


FIG.2

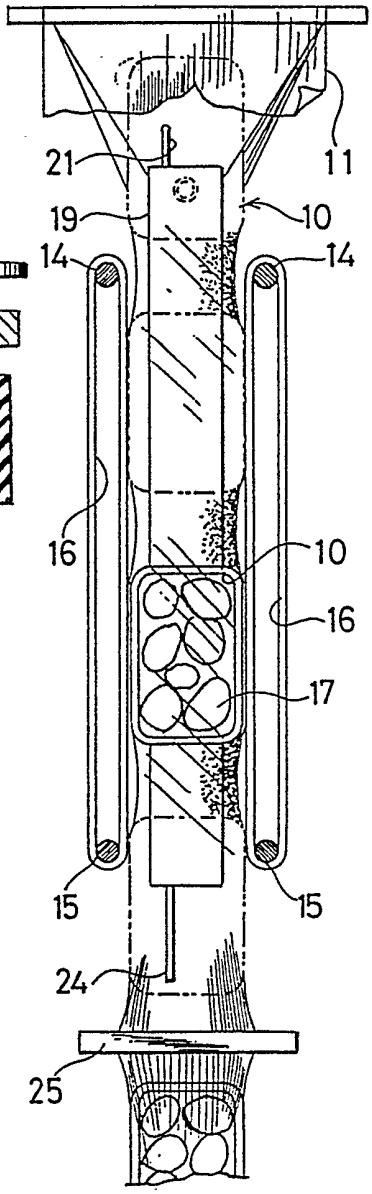
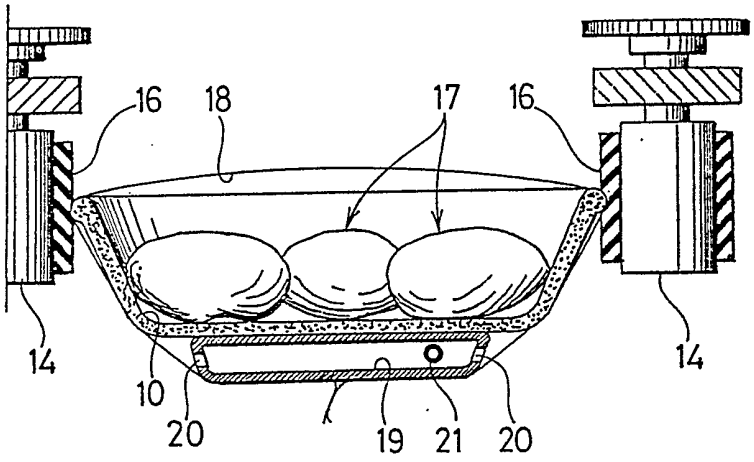


FIG.3



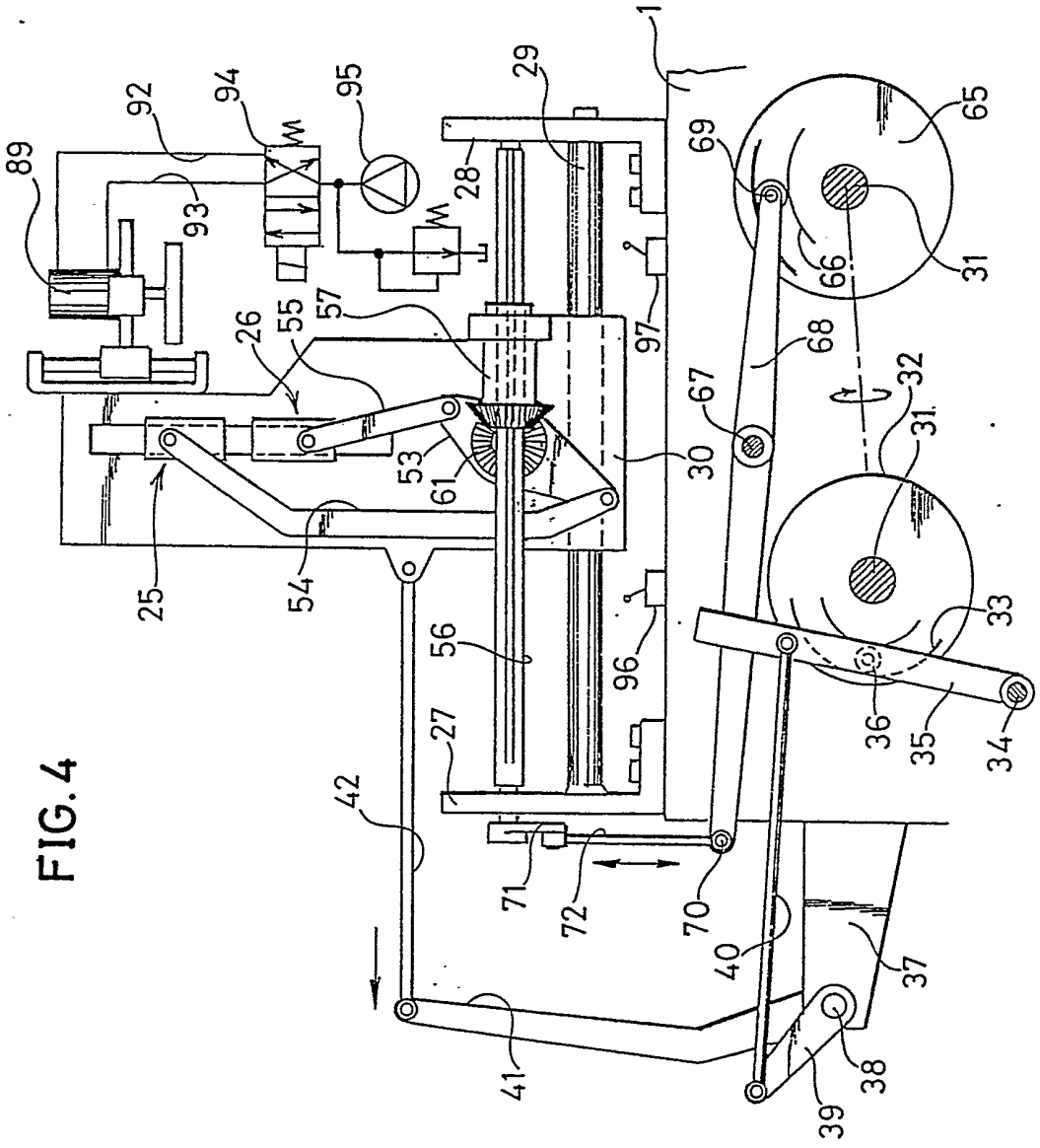

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FIG. 4

FIG.5

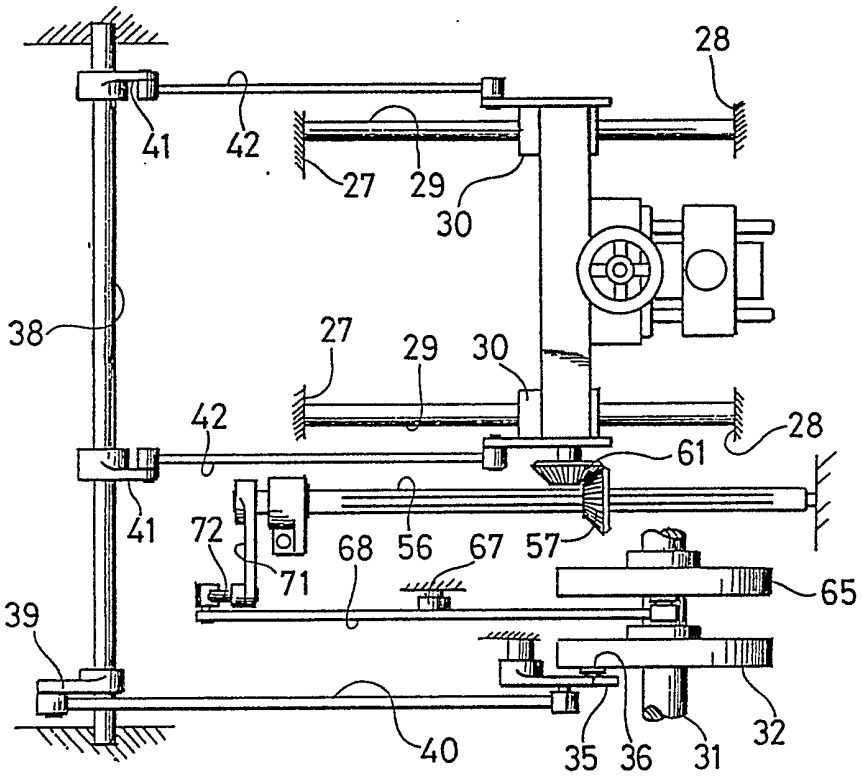
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FIG.6

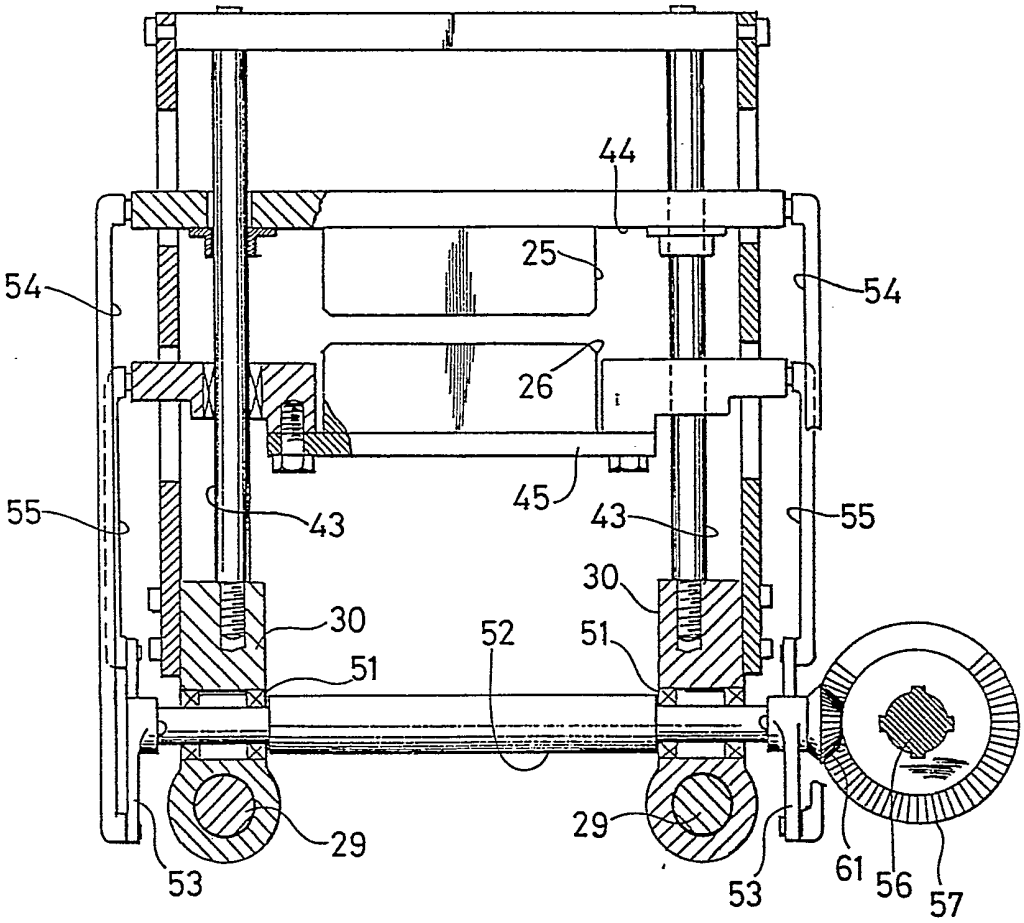

FIG.7

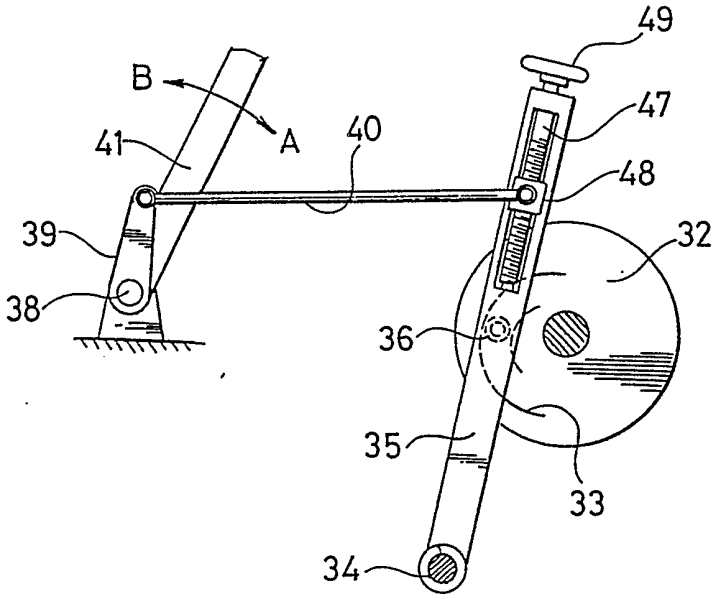
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FIG.8

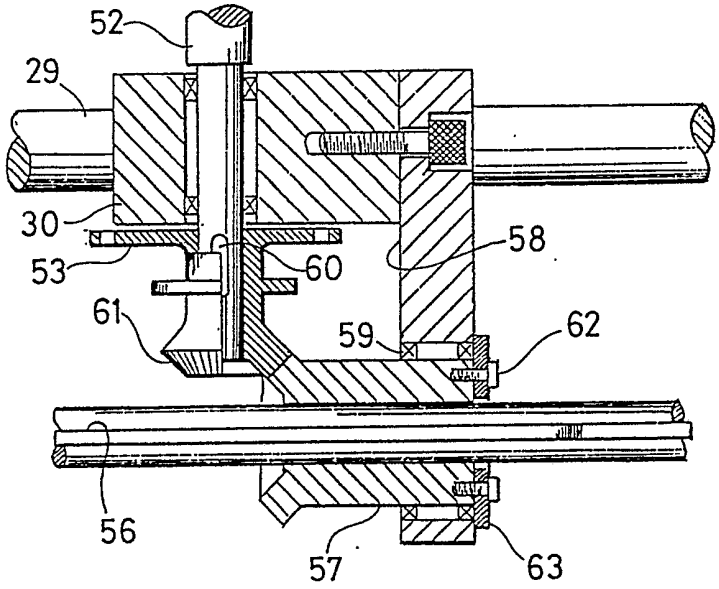
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FIG.9

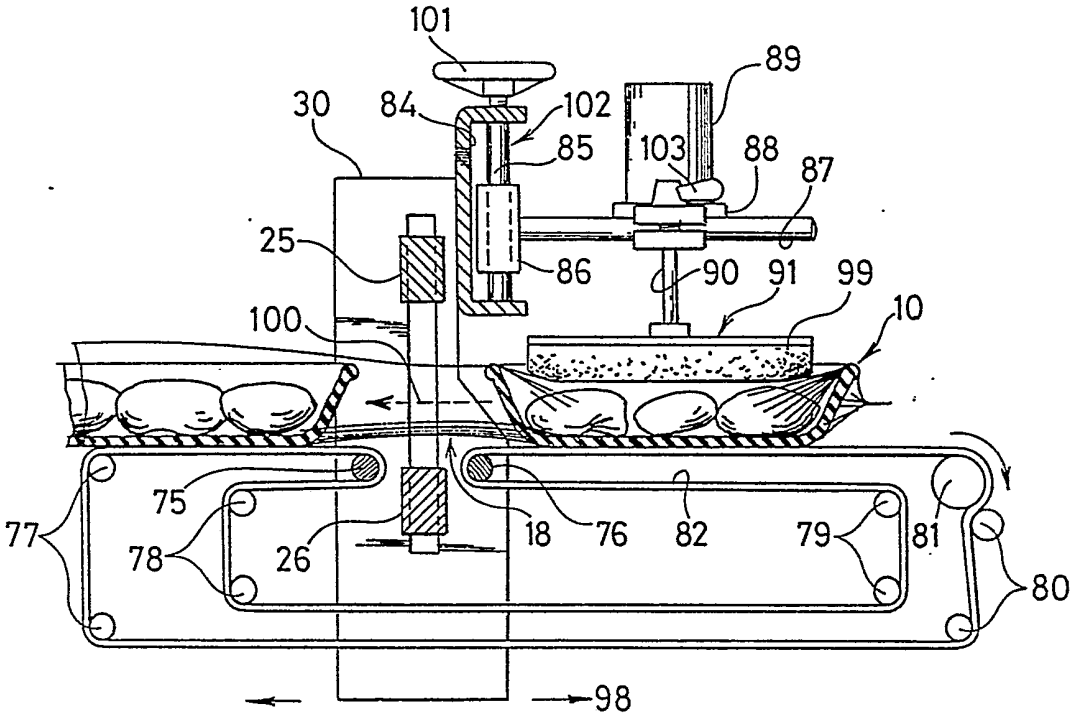
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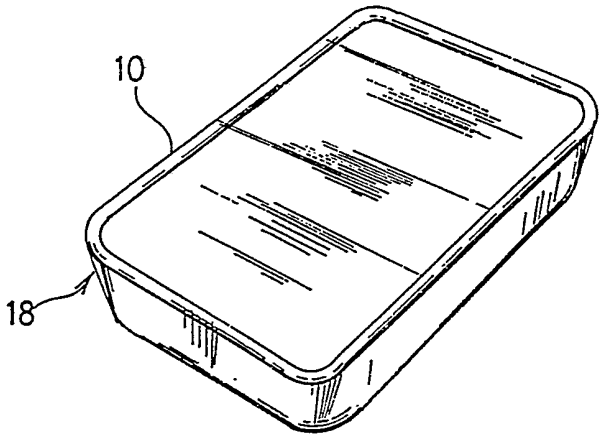
FIG.10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PACKAGING APPARATUS

FIELD OF THE INVENTION

This invention relates to a packaging apparatus in which a perishable foodstuff, such as chicken or beef, after being placed in a tray, is covered with a heat-shrinkable film by placing the film around the tray, the interior of the film covering being then flushed with an inert gas, such as nitrogen, the film being then heated to become shrunk into close contact with the periphery of the tray.

BACKGROUND OF THE INVENTION

There is already known a packaging apparatus of the type in which a film material in a continuous belt form is so supplied as to run along the path of travel of a multiplicity of articles transported in series in equispaced relation, the film material being rolled around the articles into a tubular shape while it is in its course of run, the interior of the film tube is flushed with an inert gas through a nozzle inserted into the film tube, the film being then sealed in such a way that the inert gas is contained in the film tube. Such packaging apparatus is described in U. S. Pat. No. 4,663,915.

However, this known apparatus involves a problem that where a heat-shrinkable film material is used with the apparatus, any attempt to heat-shrink the film after inert gas being contained into the film tube does not result in desired film shrinking because of the internal gas pressure.

To facilitate film shrinking, one conceivable approach is to arrange that the film material is previously formed with small vent holes so that the film may be heated to shrink while the inert gas within the film tube is partially discharged outward through the small vent holes. In the case where this method is employed, however, it is necessary that after the partial discharge of the inert gas through the small vent holes, the holes be closed with a label so as to prevent entry of dust through the small holes into the film tube.

SUMMARY OF THE INVENTION

The invention is intended to solve the foregoing problem with the prior art. Accordingly, it is a primary object of the invention to provide a packaging apparatus which enables the packaging film to go into easy contact with foodstuff-

containing trays without necessity of the packaging film being previously formed with small vent holes.

In order to accomplish this object, according to the invention there is provided a packaging apparatus comprising tube forming means which, while transporting a heat-shrinkable film in a continuous belt form in the longitudinal direction thereof, round the film into a tubular shape with opposite longitudinal side edges of the film being placed one over the other, and continuously welds the superposed side edges together by means of a center sealer, feeder means for feeding a multiplicity of article-containing trays into the tubular film at uniform intervals, frames movable forward in the direction of film feed at same speed as the film, a pair of seal bars supported on said frames and operative to press the film tube from opposite sides and between adjacent trays for sealing off, a vacuum suction nozzle inserted from the feed means side into the tubular film, a gas supply nozzle disposed in said vacuum suction nozzle, said gas supply nozzle projecting at its front end from the tip of said vacuum suction nozzle and terminating at a

location adjacent said seal bars, gas discharge means supported on said frames for applying pressing force from above to the film overlying each tray behind said pair of seal bars as viewed in the direction of film feed and immediately before the film is pressed between said pair of seal bars, and film shrinking means for heating the film in which each tray is sealingly enclosed.

The belt-form film is gradually rounded into a tubular shape as it is transported in the longitudinal direction. The feed means feed into the film tube a multiplicity of trays having articles placed therein, so that the film and trays are transported in integral relation. The vacuum suction tube which is inserted from the tray feed means side into the film tube is operative to evacuate the air within the film tube under its suction force. The tubular film is open at the tray feeder side and, therefore, air may possibly flow through the open end into the film tube. However, when the air in the film tube is abruptly evacuated, the film is sealed in its squeeezed condition because of the pressure difference between the film tube interior and

the exterior. The gas supply nozzle fitted in the vacuum suction nozzle is open at its front end projecting from the tip of the vacuum suction nozzle and, therefore, an inert gas is supplied through the open end into the vacuumized film tube. The gas discharge means which are disposed on the frames forwardly movable at same speed as the film in the direction of film speed are operative to discharge a part of the inert gas present in each tray, at the feeder side through the film tube, by applying pressing force to the film from above immediately before the film tube is sealed by the pair of seal bars disposed on the frames. Thereafter, the tubular film is sealed by means of the pair of seal bars. Each sealed package is heat-shrunk by the film shrinking means. Thereupon, the inert gas present around the tray flows into the gas evacuated space within the tray, so that the film comes into close contact with the periphery of the tray and becomes horizontally taut at the upper side of the tray.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic side view of a packaging apparatus embodying the present invention;

FIG. 2 is a plan view of the apparatus;

FIG. 3 is a fragmentary enlarged sectional view of the apparatus;

FIG. 4 is a side view showing a sealing device;

FIG. 5 is a plan view of the sealing device;

FIG. 6 is a fragmentary enlarged sectional view of the sealing device;

FIG. 7 is an explanatory view showing a crank device for actuating seal bars;

FIG. 8 is an explanatory view showing a power transmission mechanism;

FIG. 9 is a side view showing a gas discharging device; and

FIG. 10 is a perspective view showing a packaged product.

DESCRIPTION OF THE EMBODIMENT

As FIG. 1 shows, a multiplicity of trays 10 are fed forward by a feeder means, such as a belt conveyer (not shown), at equal intervals along a horizontal path. A heat-shrinkable film 11 in a continuous belt form is transported in the longitudinal direction of its run so as to be wrapped about trays 10 into a tubular shape. Longitudinal side edges 12 thus brought in

overlapping relation are continuously welded together by a center sealer 13.

As can be seen from FIGS. 2 and 3, a pair of endless belts 16 disposed in laterally spaced relation and movably carried by pulleys 14, 15 are adapted to hold therebetween trays 10 each having a foodstuff 17 placed therein and transport same integrally with a tubular film 18 covering the trays.

A vacuum suction nozzle 19 of a flat rectangular shape is inserted deep into the tubular film 18 from a portion thereof, i.e., inlet portion of the tubular film, through which trays 10 are fed into the tubular film. The vacuum suction nozzle 19 is formed with a multiplicity of suction holes 20 spaced along opposite sides of the nozzle 19. A vacuum pump (not shown) is connected to an outer end of the vacuum suction nozzle 19. Accordingly, the air present in the tubular film 18 is evacuated through the suction holes 20 under the suction force of the vacuum pump so that negative pressure is produced within the tubular film. A gas supply nozzle 21 formed from an elongate pipe is disposed within the vacuum suction nozzle 19. The gas

supply nozzle 21 is connected at its outer end to a gas bottle 23 through a valve 22, the other end 24 of the gas supply nozzle 21 being extended beyond the extremity of the vacuum suction nozzle 19 and open adjacent seal bars 25, 26 which are to be described hereinafter. A part of the inert gas to be introduced through the gas supply nozzle end 24 into the tubular film 18 for flushing purposes is sucked by the vacuum suction nozzle 19 through the suction holes 20. However, a part of the tubular film 18 is placed under negative pressure and thus tends to close suction holes 20. Therefore, not all the flushing gas introduced through the gas supply nozzle end 24 is so sucked.

As FIGS. 4 to 6 illustrate, on the top of machine frame 1 there are disposed two guide bars 29, 29 in horizontally parallel relation, on which slide blocks 30, 30 are slidably supported respectively. A pivot lever 35 which is pivotally supported at its lower end on the machine frame is engageable through a cam follower 36 with a groove 33 of a groove cam 32 supported through a shaft 31 on one side of the machine frame. A lever 39 mounted to one end

of a shaft 38 supported in a bearing 37 is coupled to the pivot lever 35 through a connecting rod 40. Two pivot links 41, 41 fixed to the shaft 38 are held in engagement with the slide blocks 30, 30 through direct acting links 42, 42. Guide bars 43, 43 are mounted upright on the slide blocks 30, 30 respectively, and two frames 44, 45, upper and lower, are slidably supported at their both ends on the guide bars 43, 43, with the seal bars 25, 26 being fixed to the frames 44, 45.

A shaft 52 is rotatably supported between the two slide blocks 30, 30 through ball bearings 51, 51, and bell-cranks 53, 53 are fixed respectively to opposite ends of the shaft 52. Respective one ends of the bell-cranks 53, 53 are connected to opposite ends of the upper frame 44 through links 54, 54, and respective other ends of the bell-cranks to opposite ends of the lower frame 45 through short links 55, 55. A first bevel gear 57 is slidably supported on a spline shaft 56 which is rotatably supported between the two brackets 27, 28, the first bevel gear 57 being supported through a ball bearing 59 in a bearing 58 formed in slide block

30 as shown in FIG. 8, with the first bevel gear 57 being held in mesh with a second bevel gear 61 fixed through a key 60 to one end of the shaft 52. A plate 63 fixed to an edge face of the first bevel gear 57 through a machine screw 62 serves to prevent the first bevel gear 57 from falling off the ball bearing 59, so that when slide block 30 slides along the guide bar 29, the first bevel gear 57 slides along the spline shaft 56. As FIG. 4 shows, a seesaw lever 68 by which an intermediate shaft 67 is pivotally supported on the machine frame is in engagement at one end 69 with a groove 66 of a second cam 65 supported on the machine from through shaft 31, the other end 70 of the seesaw lever being connected through a link 72 to a lever mounted to one end of the spline shaft 56. The other end 70 of the seesaw lever moves upward and downward as the cam 65 rotates, and when this upward and downward movement is transmitted through the link 72 to the lever 71, the spline shaft 56 and first bevel gear 57 contrarotate relative to each other.

This contrarotation of the first bevel gear 57 relative to the spline shaft is transmitted

to the bell-crank 53 through the second bevel gear 61, so that the pair of seal bars 25, 26, upper and lower, connected to the bell crank through the pair of links 54, 55 are moved toward and away from each other. Thus, when the seal bars 25, 26 advance codirectionally with the tubular film 18, they operate to cause the film to be pressed between them.

As FIG. 9 shows, the slide block 30 is provided with two rotary shafts 75, 76 which are spaced transversely from the seal bars 25, 26 and disposed at opposite locations, and an endless belt 82 carried by a multiplicity of pulleys 77, 78, 79, 80, 81 is held in engagement with the rotary shafts 75, 76 for U-turn movement. The belt 82 rotates under driving power of the drive pulley 81 to transport trays 10 forward, and when the slide block 30 slides in the direction of arrow, the two shafts 75, 76 which are in engagement with the belt 82 also move accordingly. A sectionally C-shaped member 84 is fixed to each slide block 30, with a rod shaped guide 85 fixed between the upper and lower edge portions of the member 84. A slider 85 is slidably mounted on the guide 85,

and two rod-like horizontal guides 87 extend in parallel laterally from the slider 86. An air cylinder 89 is mounted on a plate 88 supported by the horizontal guides 87. A gas discharge plate 91 is fixed to the front end of a piston rod 90 depending from the air cylinder 89. The gas discharge plate 91 has on its underside a soft porous material 99, such as urethane foam.

As FIG. 4 shows two fluidic lines 92, 93 connected to upper and lower chambers of a piston (not shown) within an air cylinder 89 are connected to a pump 95 through a two-position, 4-port type electromagnetic changeover valve 94. On the machine frame 1 are provided two micro-switches 96, 97, which are electrically connected to the electromagnetic changeover valve 94.

The packaging apparatus of the invention operates in the following manner.

As motor (not shown) is driven to rotate cam 32, pivot lever 35 which causes cam follower 36 to engage cam groove 33 is pivoted about pin 34 at its lower end, which pivotal movement is transmitted to lever 39 through connecting rod 40 to pivot interlocking link 41 via shaft 38. Accordingly, two slide blocks 30, 30 slide

forward and back along guide bars 29, 29 respectively. In this case, the slide blocks 30, 30 each slide forward at same speed as tubular film and then slide back away from the direction of film feed. Such forward and return movement is performed repeatedly. Accordingly, in FIG. 1, upper and lower seal bars 25, 26 advance at same speed and in same direction as the tubular film, and then retreat in the opposite direction. As shown in detail in FIG. 7, there is provided a screw rod 47 extending along pivot bar 35, and one end of a connecting rod 40 is held in engagement with slider 48 which engages the screw rod. Therefore, by manipulating a handle 49 to rotate the screw rod 47, slider 48 is displaced along the pivot lever 35 and thus the pivoting range of the pivot link 41 can be adjusted as desired. The groove 33 formed in cam 32 permits the pivot link 41 to move in the direction of arrow A while the cam 32 is in rotation within an angular range of 240 degrees, and permits the pivot link 41 to move in the direction of arrow B while the cam 32 is in rotation within the remaining angular range of 120 degrees. In other words, the pivot link 41 moves in the direction of A

in time 1 and moves in the direction of B in one half of time 1. Therefore, upper and lower seal bars 25, 26 press the tubular film 18 from opposite sides and heat it for a sufficient time period while it advances in same direction as the tubular film, whereas the seal bars retreat in the opposite direction in one half of that time. If an attempt is made to weld the film in a shorter time, there is no way but increasing the temperature of the seal bars, which may likely result in fusion of the welded portion and creation of pin holes in the welded portion when the film is heat-shrunk. Therefore, by allowing sufficient time for advance of seal bars through above described cam arrangement and welding the film at a relatively low temperature, it is possible to inhibit pin hole creation. When the range of advance of each tray to be packaged is changed, slider 48 is moved to adjust the pivot range of the pivot link 41. In this case, it is noted that since cam 32 rotates at a constant speed at all times, there is no change in the time duration for application of pressure by the seal bars 25, 26 even if the pivot range of the pivot link 41 is changed.

When each slide block 30 which is movable forward and back along guide 29 contacts one of the microswitches 96, the gas discharge plate 91 moves downward under the force of discharge fluid from the pump 95 that acts upon the interior of the cylinder 89, whereas when the slide block 30 contacts the other microswitch 97, the gas discharge plate 91 moves upward. In FIG. 9, slide block 30 advances in the direction of arrow 98 at same speed as the rotation speed of the belt 82. Immediately before the tubular film 18 is pressed by the seal bars 25, 26, the film is pressed from above by the porous material 99 on the underside of the gas discharge plate 91 so that surplus inert gas in the tray 10 is forced out backward as shown by dotted arrow 100, the tubular film 18 being then pressed between the seal bars 25, 26 for being welded. Since the quantity of upward and downward stroke of piston rod 90 is not always constant, the position of slider 86 is changed by turning the screw rod 102 by manipulating the handle 10 to adjust the quantity of sink of the porous material 99 into the tray 10 according to the volume of the tray. When the length of each tray 10 is changed, it is

possible to displace the cylinder 89 along horizontal guide 87 by loosening handle nut 103. Any inert gas present between the tubular film 18 and the periphery of the tray 10 may interfere with the film contacting the tray; however, by forcing out the inert gas in the tray to some extent by means of the gas discharge plate 91, as FIG. 1 shows, the inert gas around the tray is absorbed into the tray when the film is subjected to shrinking by heating device 104, and thus the film 18 goes in close contact with the tray 10 and becomes taut as shown in FIG. 10.

What is claimed is:

1. A packaging apparatus comprising tube forming means which, while transporting a heat-shrinkable film in a continuous belt form in the longitudinal direction thereof, round the film into a tubular shape along said longitudinal direction with opposite longitudinal side edges of the film being placed one over the other, and continuously weld the superposed side edges together by means of a center sealer, feeder means for feeding a multiplicity of article-containing trays at uniform intervals into the tubular film, a pair of seal-bar guide means located at opposite sides of the tubular film and forwardly movable at same speed as each of said trays in the direction of film feed between a first position downstream of said tube forming means and a second position downstream of said first position, said guide means being adapted to return to said first position after having reached said second position and before a succeeding tray reaches said first position, a pair of seal bars supported by said pair of seal-bar guide means and operative to press the tubular film from opposite sides and between two

adjacent trays for sealing off one tray from another, a vacuum suction nozzle inserted from the feed means side into the tubular film, a gas supply nozzle disposed in said vacuum suction nozzle, said gas supply nozzle projecting at front end from the tip of said vacuum suction nozzle and terminating at a location adjacent said seal bars, gas discharge means supported on said seal-bar guide means for applying pressing force from above to the film overlying each tray behind said pair of seal bars as viewed in the direction of film feed and immediately before the film is pressed between said pair of seal bars thereby to force out the gas present around the tray so as to reduce the gas to a level equivalent to the volume of the tray, and film shrinking means for applying heat to the film in which each tray is sealingly enclosed.

2. A packaging apparatus as set forth in claim 1, wherein said frames are adapted to be moved forward and back by a cam mechanism.

3. A packaging apparatus as set forth in claim 1, wherein said vacuum suction nozzle comprises a flat tubular element having a multiplicity of suction holes formed therein at its opposite

longitudinal sides.

4. A packaging apparatus as set forth in claim 1, wherein said gas discharge means is supported by a fluidic cylinder through a piston and is adapted to be pressed against the film overlying each tray under a fluidic pressure acting on the interior of said fluidic cylinder.

5. A packaging apparatus as set forth in claim 4, further comprising:

a pump,

a fluidic line interconnecting said pump and said fluidic cylinder,

switch means adapted to be actuated through contact with said forward and backward movable frames, and

changeover valve means provided in said fluidic line and operative in response to a signal from said switch means to cause a fluidic pressure to be supplied into said fluidic cylinder.

6. A packaging apparatus as set forth in claim 4, wherein said gas discharge means has a porous cushion material provided on its face of contact with the film.

7. A packaging apparatus substantially as described herein with reference to and as illustrated in the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9122279.4

Relevant Technical fields

(i) UK Cl (Edition K) B8C: CF12, CW17

(ii) Int Cl (Edition 5) B65B: 31/00, 31/04, 31/06, 51/10, 51/14

Search Examiner

J P STEVENS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

3 FEBRUARY 1992

Documents considered relevant following a search in respect of claims 1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	US 4769974 (DAVIS) See especially Figure 3, column 9 lines 5-62	1
Y	US 4663915 (VAN ERDEN) See especially Figure 6, sealing bars 54, 55 column 7 line 56 - column 8 line 4	1

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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