June 28, 1966 T. E. FORD 3,257,769

PACKAGING METHOD FOR APPLYING SHRINKABLE COVERS

Filed Feb. 7, 1963 3 Sheets-Sheet 1

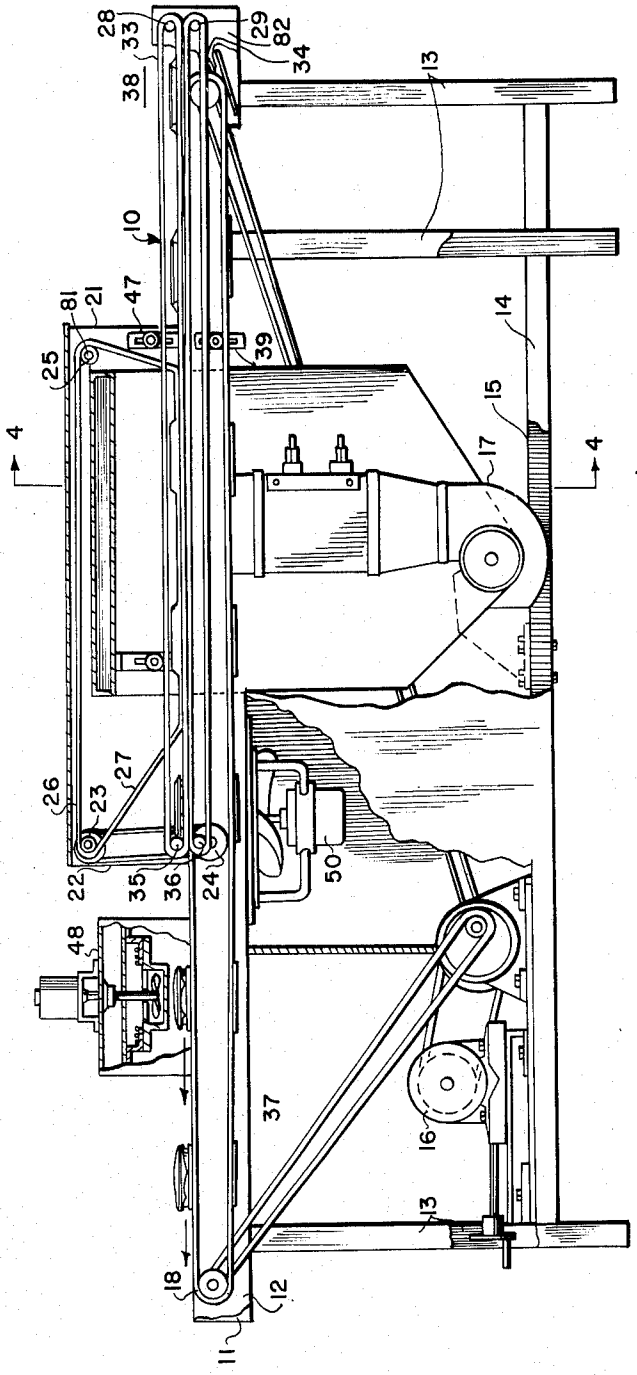


Fig. 1

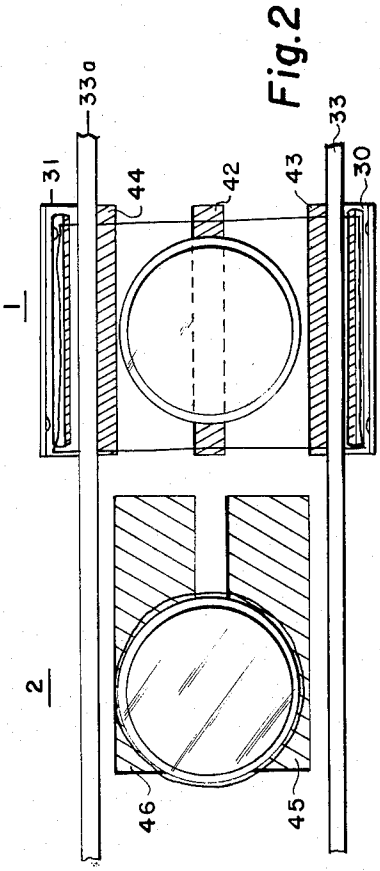


Fig. 2

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PACKAGING METHOD FOR APPLYING SHRINKABLE COVERS

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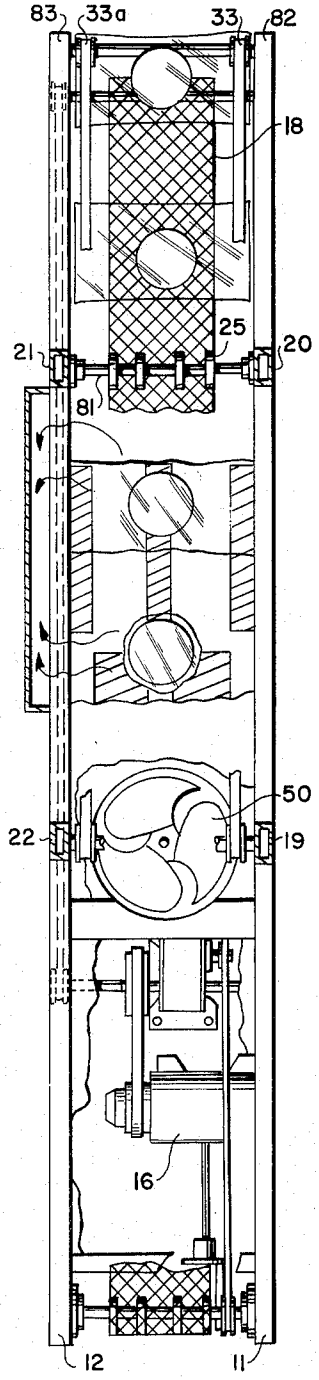


Fig. 3

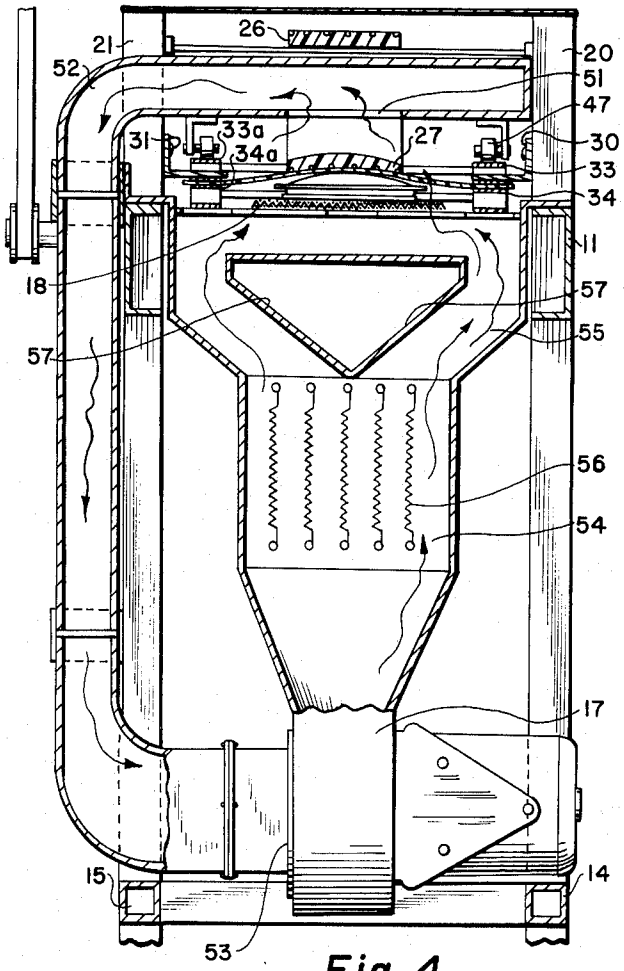


Fig. 4

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PACKAGING METHOD FOR APPLYING SHRINKABLE COVERS

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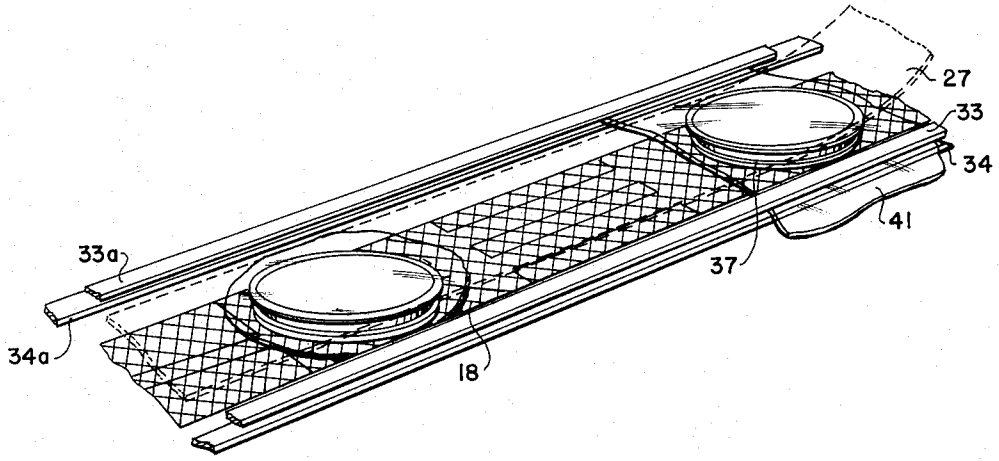


Fig. 5

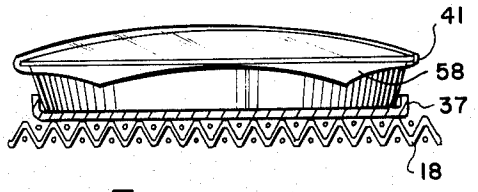


Fig. 6

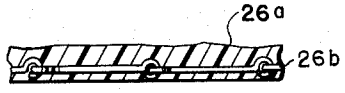


Fig. 7

United States Patent Office 3,257,769 Patented June 28, 1966

3,257,769

PACKAGING METHOD FOR APPLYING SHRINKABLE COVERS

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Filed Feb. 7, 1963, Ser. No. 256,943
4 Claims. (Cl. 53—42)

This invention relates to an automatic machine for applying covers to pies, pans of raised biscuits, sliced luncheon meats, tray packaged fruits, and vegetables. In an application, Serial No. 81,191, filed by William T. Snow, Jr., et al., a machine was disclosed which applies covers to pans, trays, or backing boards containing or supporting such products. The Snow device is not entirely automatic in that the covering film, before sealing, had to be manually placed over the goods to be packaged. For convenience and brevity, such goods will hereafter be called "pies" and their pans, trays, or supports will hereafter be called "pans," and such meaning is intended in the following specification and claims.

The present invention is an improvement upon the Snow device. It provides means automatically to feed the covering film into the correct position to cover the pie, releases the film covering from the conveying means, shrinks the covers into sealing relationship with the rim of the pan and delivers the sealed product as a completed package at the takeoff station. Inasmuch as these means in the preferred example, hereinafter set forth, are designed to be used in conjunction with and in substitution for certain parts of the Snow device, the entire disclosure of the United States application Serial No. 81,191, filed January 6, 1961, now Patent No. 3,120,728, is incorporated herein by reference.

The improvement by which the automatic functioning of the pie covering machine can be secured depends upon the discovery that films which have high shrink energy can be gripped frictionally at their lateral margins and that when such a film is subjected to heat in areas adjacent to those margins, the extreme shrink of the film snaps the sheet out from its frictional engagement and throws the film rather forcibly toward its center. In consequence, it is possible to pinch the film between pairs of upper and lower moving belts, cause these to transport the film and lay it in proper position over the pie. Then when hot air, flowing upwards through special, marginal oven vents, strikes the under surface of the film, the film is heated, shrinks near its lateral margins, pulls itself free of its support and "tacks" itself beneath the margin of the pie pan adjacent the transverse radius of the pie.

Thereafter, with slight modification, the invention disclosed by Snow et al. completes the sealing of the cover about the rim of the pie pan.

The primary objects of this invention are to make the sealing and packaging of bakery products and grocery items an entirely automatic procedure and to provide apparatus for such operations. These and other objects and advantages will become apparent from the specifications and from the accompanying drawings wherein

FIGURE 1 is a side elevation of the machine with some parts broken away and certain of the parts in section for better illustration;

FIGURE 2 is a top plan view of the oven openings;

FIGURE 3 is a top plan view of the machine with certain parts broken away for better illustration;

FIGURE 4 is a vertical section of the apparatus taken on line 4—4 of FIGURE 1;

FIGURE 5 is a detail perspective view of the holding and transport belts which apply the covering to the containers;

FIGURE 6 illustrates the completed, covered pie as it nears the takeoff station; and

FIGURE 7 is a magnified cross section of the overhead pressure belt preferably used in the invention.

The packaging apparatus **10**, comprises two (or more) elongated beam members **11** and **12**, supported upon a plurality of legs **13—13**, five of which are shown in FIGURE 1. Two (or more) subsidiary beams **14** and **15**, stretch longitudinally between the outside legs and offer support for the drive motor **16**, and the oven fan and fan housing **17**. A foraminous conveyor belt **18**, is supported between the beams **11** and **12**, and is operatively connected to be driven from the motor **16**, or other suitable power source.

A plurality of vertical supports **19**, **20**, **21** and **22**, are secured to the upper frame members **11** and **12**. These are shown in FIGURES 1 and 3. Drive roll **23**, which derives its power by connection between it and the roll **24**, of the foraminous belt, is journalled between the supports **19** and **22**. Journalled between supports **20** and **21** is a shaft **81** upon which are mounted idler rolls **25** which in turn support a slack running heat resistant belt **26**. As best seen in FIGURE 7, the belt **26** actually is comprised of a wide belt of heat-resistant rubber **26*a*** and a narrower belt formed of wire links **26*b***. The wire belt runs underneath the rubber. It is essentially the same length and is equally slack. Its function is to prevent the exceedingly slack rubber belt from slipping. Inasmuch as both belts run together and act as a unit, they will hereafter be referred to as "slack belt **26**." The lower flight **27**, of the belt is extremely slack. It normally falls into contact with the foraminous belt **18**, and so rests and presses upon any article passing between belt **18**, and itself.

Journalled in and extending transversely between stanchions at the end of beams **11** and **12** are a pair of drive rolls **28**, **29** which secure power from the common power source, e.g., motor **16**. These rolls drive two pairs of endless carrier belts **33–34** and **33*a*–34*a*** which run over the ilder rolls **35** and **36** journalled between supports **19** and **22**. The carrier belt pairs lie on either side of and thus do not interfere with the travel of the slack belt **26**. Suitable gears, drive belts, etc. are provided as necessary to drive the foraminous conveyor **18**, slack belt **26** and belt pairs **33–34**, **33*a*–34*a*** at essentially the same speed and in such manner that the pans, film cover sheet and the slack belt lying thereover travel in the same direction.

Instead of merely placing the pie plate at random on the foraminous belt as in the Snow device, foraminous belt **18** carries at spaced intervals a number of pie pan holders **37** or jigs each adapted to receive a pie plate.

The jigs **37**, are loaded with pies at a loading station **38**, located at far right end of FIGURE 1. The pie loader is not part of the invention but may be a sweep-arm device operated by a Geneva cross motion and timed so that a pie is loaded with each arrival of successive jigs at station **38**.

A sheet-feed device, not part of this invention, takes sheets from a supply stack located on the right end of the machine and delivers single sheets to the nip between the carrier belt pairs in such a manner that each lateral edge of the sheet is gripped between a pair of carrier belts while the leading and trailing edges of the sheet remain free.

Foraminous belt **18**, slack belt **26**, and the carrier belt pairs all run at the same surface speed, and since the sheet feeder is timed to insert a sheet in the nip at the proper time sequence, a pie on jig **37**, and the covering sheet **41**, enter the oven together, with the sheet extended above and completely covering each pie (see FIGURE 5).

Pressure shoes **30** and **31**, supported from the wall of the oven (see FIGURE 4) and extending for a distance

corresponding to the length of slots **43** and **44** (see FIGURE 2), create an extra pinch pressure between the in-running adjacent flights of the belts **33–34** and **33*a*–34*a*** as the belts move by these slots. Belt tensioning devices such as idlers **39** and **47** (FIGURE 1) may be provided to adjust the bite of the belt pairs.

FIGURE 2 shows in detail the openings in the oven floor through which hot air is blown upwards against the under surface of the covering sheet of film. As seen in this figure together with FIGURE 5, the slack belt **26**, drapes over the pie and forces the sheet of film **41**, into contact with the rim of the pan at the leading and trailing points on its periphery. Consequently, the top of the pie is shielded from heat and only the margins of the covering film **41**, which are exposed beyond the rim of the pan are heated by the up-flowing hot air. The shrinkage which follows as a consequence of heating, locks the sheet **41**, or tacks it under the pan rim at its leading and trailing points.

As the heating continues in the first oven stage, the lateral shrinkage in the exposed areas rises. Then, as the extra pressure between the belts relaxes, since the belts have now moved beyond the pressure shoes **30–31**, the inward pull is now so large that the sheet is pulled toward the center of the oven from between each pair of carrier belts, actually snapping rather forcibly as it leaves their grip. The area which was held between the belts and hence is substantially unshrunk snaps against the pie plate and beneath the rim. The continuing shrinkage shrinks the lateral marginal areas of the sheet, which are now free, into a "lock-under" or tacking position beneath the rim of the pan adjacent its transverse diameter.

The advance of the carrier then carries the pie to position **2** in the oven where the under side of the sheet is exposed to the air entering through the wide openings **45** and **46**. As a consequence of this heating, the entire exposed area of the cover shrinks in under the rim of the pie plate. The carrier then moves the pie over the outlet of the cooling fan **50**, and then through the heating oven **48**, which directs hot air on the top surface of the covered pie and shrinks the cover tightly over its entire extent.

In order for this equipment to be operative and permit the release of the covering material from between the carrier belts, shrinkable films having high shrink energy are necessary. Such film may include various types of heat-shrinkable, plastic films in thickness between ½ and 5 thousandths of an inch. Among such may be mentioned stretched films of rubber hydrochloride, stretched films of vinylidene chloride polymers, stretched films of polystyrene and films of analogous materials which have the necessary mechanical characteristics. But, because of its low cost and of its high tensile strength and very high shrink energy, I prefer to use irradiated polyethylene, which, subsequent to irradiation, has been stretched in both directions at least 350%. Irradiated, biaxially oriented polyethylene has high shrink energy, i.e., from 100 to 500 p.s.i. at 96° C. Shrink energy is the force of contraction at a given temperature when the material is restrained and, more specifically, it is the measurable tension in a fully mono-directionally restrained strip of film when the film is heated to the specified temperature.

I have used, successfully, as the base material of the film Alathon 14, having an average molecular weight of 20,000, a density of 0.914 and a melt index of 1.8—which has been irradiated to an extent of about 12 megarads and then has been stretched biaxially 350% in both lateral and longitudinal directions—the finished thickness of the film was 1½ mils. This material possesses the shrink energy of about 150 p.s.i. in both directions at 96° C. The irradiation may be accomplished in a conventional manner, e.g., by the use of electron beam generator such as the 2,000,000 volt General Electric Resonant Transformer Unit, or a Van de Graaff Electron Accelerator operating at approximately 2,000,000 volts with a power output of 500 watts. Other radiation sources, such as Cobalt 60, may be employed provided equivalent total dosage is given. Biaxial orientation may be accomplished by forcing air into a heated tube of polyethylene to form a bubble which is then trapped between two sets of pinch rolls. As the air enters, the tube of polyethylene undergoes both radial and longitudinal stretching to accommodate the air bubble. Trapped between the pinch rolls, the bubble "rides" through the whole length of the extrusion, stretching the polyethylene both laterally and longitudinally and simultaneously thinning the extrusion to film thickness.

If a round pie is to be covered, square sheets of such material as has been described are preferred, for then, the four corners do not entirely disappear into the peripheral seal, but leave four pull tabs **58** (FIGURE 6) which in the case of 8- and 10-inch pies, are large enough to be grasped between the thumb and forefinger. Any one of these may be pulled to loosen and remove the covering.

Save for the oven floor with its special apertures, the general design of the oven follows the re-circulating hot-air design disclosed in the Snow et al. application. Space must be left between the oven wall and the carrier belts to provide a passage for the upward flow of air between the belts and the oven walls in the initial heating stage. (The air-flow pattern is shown by the arrows in FIGURE 4.) Thereafter, the air flows upward and escapes through the oven roof vent **51**, into the duct **52**, which leads to the fan intake **53**. From the fan the air is forced upward through the heating chamber **54**, which receives its heat from the electric heating coils **56**. From there it passes into a plenum chamber **55**, where the flow divider **57**, directs its flow towards the several apertures in the oven floor, thus completing the circuit.

The remaining path of the pie through the apparatus also follows the Snow et al. design. As soon as the pie leaves the oven, it is bottom-colled by passing over the cold air flow directed through the foraminous belt **18**, by the cooling fan **50**. Cooling chills the peripheral seal and makes it possible for the seal later to withstand the pull which is developed when the entire pie covering is top-shrunk as the pie passes through the final heating chamber **48**.

The apparatus has a high throughput and delivers securely sealed pies and other pan or tray packaged products without the need of a special operator.

I claim:

1. The method of applying a film covering to a pan-supported pie which comprises frictionally engaging a sheet of high shrink energy film along its lateral edges, supporting the engaged film over a pie, heating the film along its exposed area adjacent its lateral margins to cause the film to pull free of its frictional engagement and shrink into tight contact with restricted areas of the pan, then heating the entire area of film exposed beyond the pan margin to shrink the film into sealing engagement with the periphery of the pan, cooling the peripheral seal, and subsequently heating the entire exposed covering to shrink the film against the pie.

2. The method according to claim **1** wherein the heat is first directed against the under side of the sheet in areas adjacent the engaged margins and along the median line of said sheet.

3. The method according to claim **1** wherein the engagement of the film covering with the pan is first established at tack points by directing an upward flow of heated gas against restricted areas of the film and the peripheral seal is completed by the subsequent exposure of the unengaged film to heat.

4. The method of applying a film covering to a pan-

supported pie which includes engaging at least each lateral margin of a covering sheet of heat-shrinkable film between two frictional engaging elements and thereby supporting the sheet closely above the pie, heating the exposed surface of the sheet adjacent its marginal areas to cause the sheet to shrink transversely and pull free of its frictional engagement, continuing the heating until the sheet tacks itself under the rim of the pie pan and subsequently heating the remaining exposed areas of the sheet to seal the cover about the entire periphery of the pan.

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