May 3, 1966 J. D. WINTERS ETAL 3,248,843

APPARATUS AND METHOD FOR SEALING CARTONS

Filed Jan. 14. 1963 3 Sheets-Sheet 1

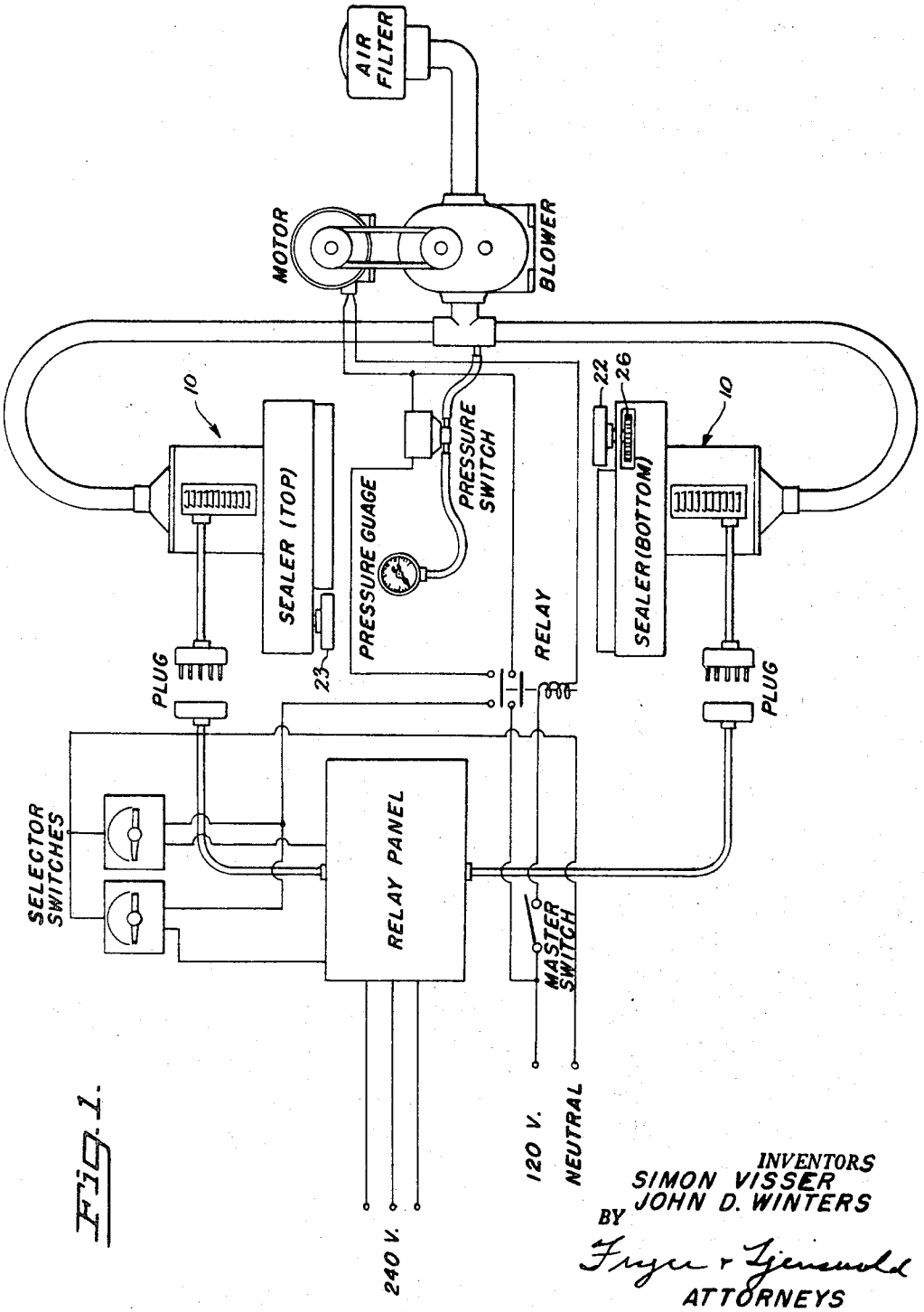


Fig. 1.

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Fig. 2.

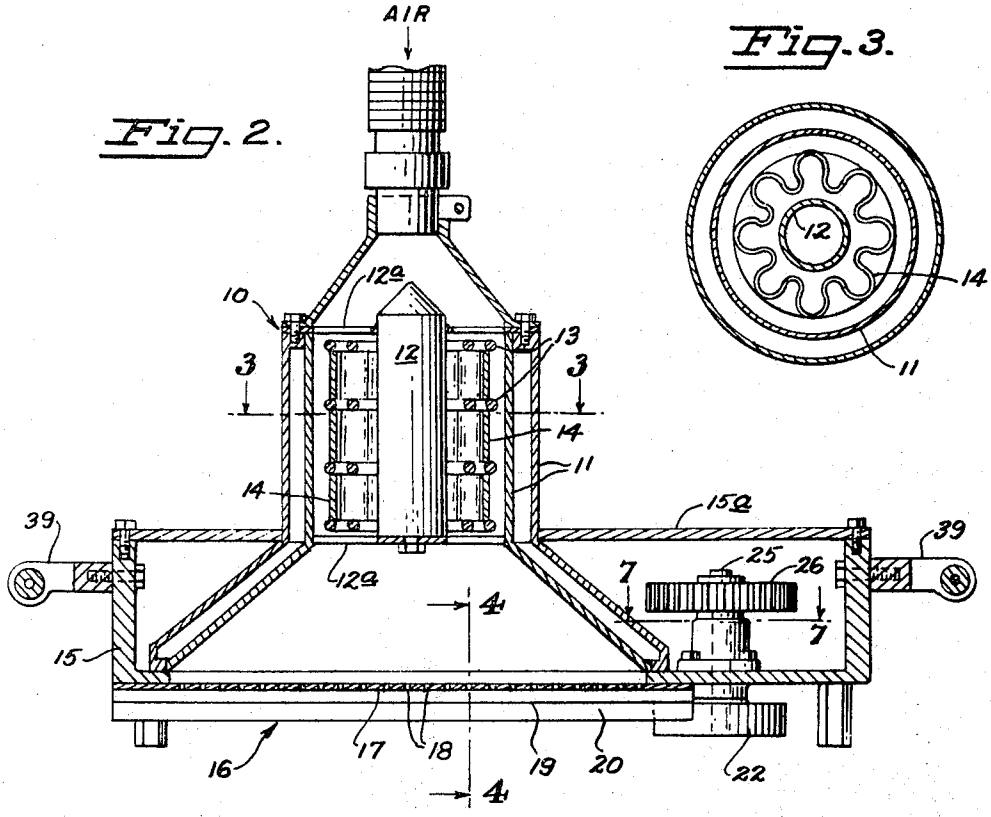


Fig. 3.




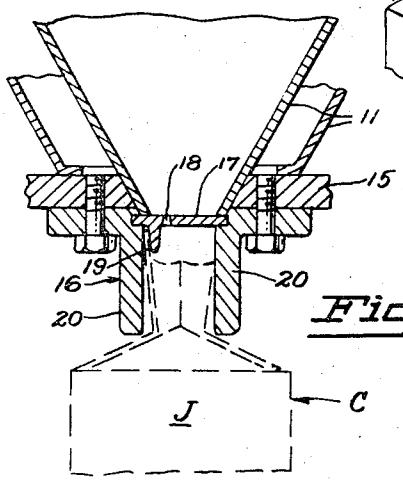


Fig. 4.

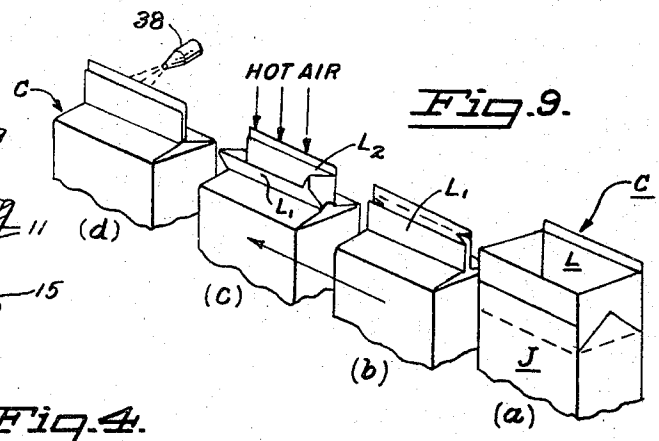


Fig. 9.

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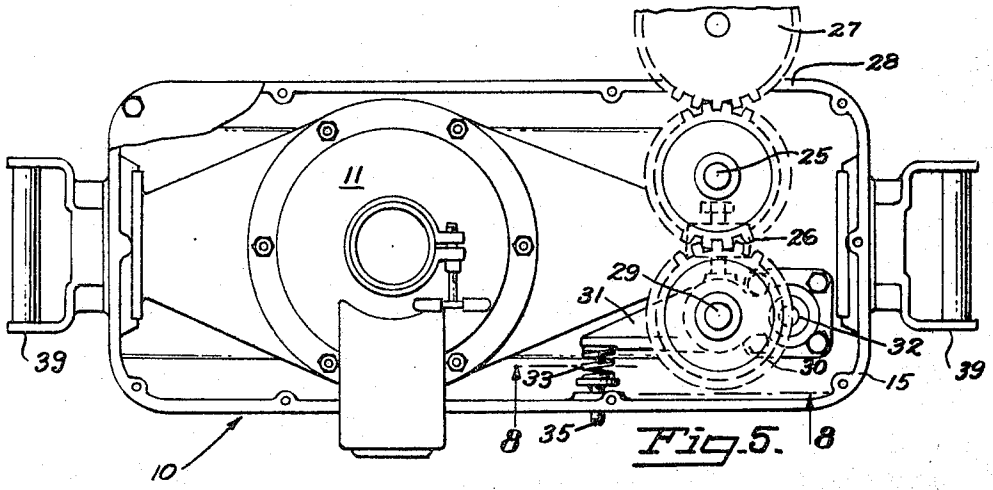


Fig. 5.

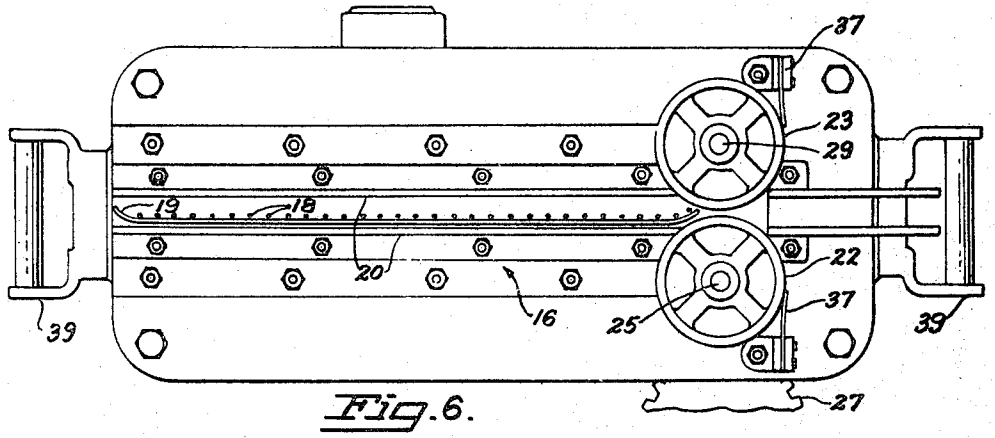


Fig. 6.

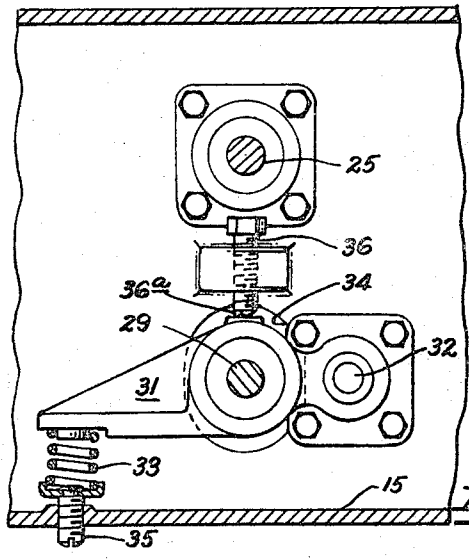


Fig. 7.

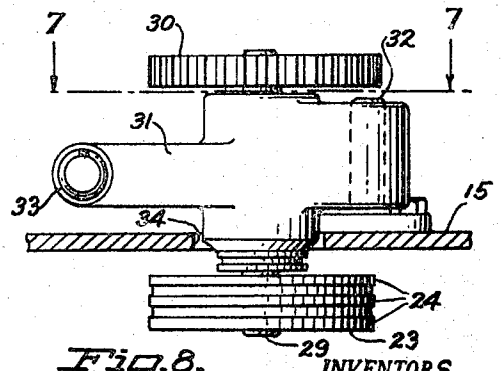


Fig. 8.

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United States Patent Office

3,248,843
Patented May 3, 1966



3,248,843

# APPARATUS AND METHOD FOR SEALING CARTONS

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Filed Jan. 14, 1963, Ser. No. 251,205
10 Claims. (Cl. 53—39)

This invention relates to an apparatus and method for sealing packages such as cartons and more particularly relates to the utilization of a heated fluid for sealing cartons of the type used for packaging frozen foods.

The prime object sought in the majority of packaging operations is to produce an efficient package at a low cost. In producing paperboard frozen food cartons, for example, such cartons are generally subjected to a plate freezing process which applies a substantial hydraulic pressure to the cartons after they are sealed. Such pressure is used to compress the carton to its final dimensions. Should the sealed ends not be sufficiently strong to withstand these pressures, the carton would obviously fail. Also, the complexities which are inherent with the packaging of a syruped food product, such as strawberries, have heretofore demanded a highly skilled machine operator to achieve an efficient operation. These and additional problems which this invention has sought to overcome are hereinafter more fully discussed.

This invention provide a heat sealing principle which may be substituted, pursuant to selected sealing applications, in lieu of conventional principles. For example, in certain applications it has proven desirable to substitute the apparatus and method of this invention for those disclosed at station E in FIG. 1 of Patent No. 3,060,654, issued on October 30, 1962, to A. R. Lubersky et al. for a "Carton Setting-Up Machine." In accordance with novel concepts herein, opposed end flaps of a carton, having a heat sensitive adhesive selectively preformed hereon, are moved adjacent to a discharge of heated fluid, preferably hot air. The hot air is uniformly directed onto the adhesive to effect an instantaneous tackiness thereof whereafter pressure is applied to the flaps to bond them together. The hereinafter more fully discussed hot air apparatus or sealer comprises guide means arranged to precisely guide the sealed flaps of the carton adjacent an apertured bar through which the hot air is adapted to eject. Sealing means, preferably in the form of opposed pressure rollers, thereafter apply a predetermined pressure to the flaps to form an efficient seal.

In accordance with the above discussion, an object of this invention is to provide an apparatus and method for expeditiously producing an efficient package at a low cost.

Another object of this invention is to provide a non-complex apparatus and method for achieving the utmost in structural integrity of a sealed carton.

A further object of this invention is to provide an apparatus and method wherein hot air is utilized for efficiently sealing a carton.

A still further object of this invention is to provide a hot air sealer which is durable in construction, highly efficient in operation, substantially reduces operational, replacement and maintenance costs and may be adapted to conventional carton setting-up machines.

Other and more specific objects of this invention will become apparent from the following description taken



in connection with the accompanying drawings wherein:

FIG. 1 schematically illustrates an integrated heat sealer control system which may be employed to utilize the novel heat sealing concepts of this invention;

FIG. 2 is a cross-sectional and elevational view of one of the heat sealers employed in the system illustrated in FIG. 1;

FIG. 3 is a cross-sectional view taken on line 3—3 in FIG. 2;

FIG. 4 is a sectional view taken on line 4—4 in FIG. 2 with a partially formed carton illustrated by phantom lines therein;

FIG. 5 is a top plan view of the heat sealer of FIG. 2;

FIG. 6 is a bottom plan view of the heat sealer of FIG. 2;

FIG. 7 is a view taken on line 7—7 in FIGS. 2 and 8 with parts removed for clarification purposes;

FIG. 8 is a view taken on line 8—8 in FIG. 5; and

FIG. 9 is a perspective view illustrating the sequential steps of a typical carton sealing operation.

The integrated control system of FIG. 1 comprises substantially identical sealers **10** which function to seal the top and bottom ends of a carton in the sequential manner shown in FIG. 9. The various individual components therein illustrated, except for the sealers **10**, do not comprise novel aspects of this invention and therefore, only a brief explanation is made thereon.

Actuation of the appropriate selector and master switches effects controlled movement of the cartons to the sealers by suitably arranged carton carrying means (not shown) in a manner similar to that described in the above mentioned Patent No. 3,060,654. The illustrated blowers are then made operative to supply a controlled quantity of preconditioned air to the sealers wherein a bank of resistance heaters are effective to heat the air within a predetermined temperature range for sealing purposes. A hot blast of air is then imparted into heat sensitive adhesive portions of the carton end flaps and thereafter the cartons are suitably sealed by applying a predetermined pressure thereto. In certain applications, it has proved desirable to subject the sealed carton end to a cooling means for purposes hereinafter more fully explained. Sealer **10** will hereinafter be generally described as comprising hot air discharge means, carton flap guide means and sealing means.

Referring now to FIGS. 2–8, each sealer has a discharge means for discharging a heated fluid, preferably air, onto formed carton flaps. The discharge means comprises a hollow casing **11** which may be suitably insulated to prevent undue heat transfer therethrough. The casing is arranged to receive air from the blower through a first opening in the manner shown. The blower may be of the conventional type which is adapted to supply up to forty cubic feet of air per minute, for example. A vertically arranged supporting core **12** is suitably secured to the casing by rods or other suitable means **12***a* and mounts an air heating means shown in the form of a plurality of stacked heating elements **13**. The heating elements are of the conventional resistance type. The core preferably constitutes a stainless steel constituent which prevents a short circuiting of the cold air, i.e., cold air is prevented from passing through the center of the heating elements without adequate heating.

The adjacent heating elements are suitably separated by stacked spacers **14** which form passages therewith for the guidance of air therethrough in a non-turbulent

manner. The spacers further function as heat radiating surfaces. The elements are adapted to be connected to the relay panel of the integrated control system by suitable plug connections (FIG. 1). As more clearly shown in FIG. 3, the spacers are formed in a convoluted manner to afford the utmost in structural support to the heating elements as well as provide the above-mentioned heated air passages.

As more clearly shown in FIG. 4, the casing **11** tapers downwardly to form a chamber portion which may be suitably attached to the lower portion of a base **15** by conventional welding techniques or the like. The base has a detachable cover **15***a* which facilitates servicing of various sealer elements. A plate **17** having apertures or orifices **18** formed therein is arranged to cover an elongated opening formed whereat the above-described paper chamber portion terminates. As will be hereinafter more fully understood, the apertures are constructed and arranged to form diverging orifices which function to uniformly discharge predetermined amounts of hot air onto critical portions of the adhesive bearing carton flaps which pass thereby.

The carton guide means comprises a vertically arranged rail portion **19** formed on plate **17** which cooperates with vertically arranged and opposed guide wall members **20** to maintain the carton flaps in a predetermined flight. The rail is arranged intermediate the wall members and closely adjacent a first one thereof. Apertures **18** are arranged adjacent the rail and intermediate the rail and a second of the wall members.

Referring more particularly to FIGS. 5–8, the sealing means for applying sealing pressure to the opposed carton flaps, after they have completed their run through the above-described guide means, comprises two pressure rollers **22** and **23** arranged adjacent an end of the guide means. One or both of the rollers may have ridges formed on the periphery thereof, as shown at **24** on roller **23**, for example, so as to provide a concentrated pressure thereat for sealing purposes.

Roller **22** is keyed or otherwise suitably attached to a first end of a shaft **25**, rotatably mounted in base **15**, and receives its drive from a first gear **26**, keyed to a second end of shaft **25**. Gear **26** is suitably arranged to mesh with a second or input gear **27** which is in turn operatively connected to a power source of the machine by means of a suitable power train (not shown).

As more clearly shown in FIG. 8, pressure roller **23** is keyed or otherwise suitably attached onto a floating rotatable shaft **29** along with a third gear **30**. Shaft **29** is rotatably mounted within a pivotal member **31** which is in turn mounted for limited swinging movements on the base at a first end thereof. Such swinging movements are made about a stub shaft **32**, secured to base **15**.

A compression spring member **33** is arranged between second end of member **31** and base **15** to urge gears **6** and **30** into mesh relationship. It should be understood that the gear teeth formed on gears **26** and **30** are suitably designed to compensate for slight pivotal movement of member **31**, a portion of which is arranged to extend through an enlarged aperture **34** formed in member **15**.

Referring to FIG. 7, a biasing means, shown in the form of an adjustment screw **35**, is adjustably mounted in base **15** so as to selectively impart a predetermined force to the second end of member **31** to urge the rollers **22** and **23** together. Thus, a predetermined sealing pressure may be constantly maintained. Also, stop means in the form of an adjustment screw **36** may be suitably mounted on base **15** and arranged to abut member **31** at an end **36***a* thereof. This stop means functions to maintain a predetermined minimum distance between rollers **23** and **24**.

In practical applications, such a predetermined distance is largely determined by the thickness of the carton flaps.



It should be understood that together, the above-described biasing and stop means may be considered a means for maintaining a minimum predetermined distance between the roller and for also maintaining a predetermined sealing pressure.

Stationary blade members **37** may be suitably positioned adjacent the peripheries of the sealing rollers to scrape off any residue adhesive which tends to adhere thereto subsequent to the sealing operation. Also, in certain carton set-up applications, it may prove desirable to employ a cooling means such as the spray nozzle illustrated at **38** in FIG. 9. Such a cooling means may be advantageously employed to rapidly cool the adhesive to effect an instantaneous setting thereof. The cooling constituent utilized therewith may comprise water vapor, cooled air or the like. Also, a plurality of suitably arranged heat absorbing rollers may be provided for this function.

From the above description, it should be noted that a very compact and portable hot air sealer is provided which may be readily adapted to different machines, such as the one described in the above-mentioned Patent No. 3,060,654. It should be further noted that manual transportation of the sealer is facilitated by handles **39**. Also, the sealer may be readily serviced, when necessary.

*Method for sealing a carton*

FIG. 9 illustrates the basic stages or steps which adhesively treated end flaps of a carton pass through during a particular sealing operation. In general, such steps comprise guiding the flaps adjacent a discharge of a heated fluid, uniformly discharging the heated fluid thereon to render the adhesive tacky and forcing the flaps together to bond them into sealing relationship. Although the method is herein discussed in connection with a lined carton, it should be understood that the novel concepts thereof may be employed to seal adhesively treated flaps of an unlined carton or the like.

As shown in FIG. 9*a*, a partially formed carton C comprises an outer paperboard jacket J having end flaps of unequal width and an inner liner L attached internally of the jacket. As shown, the carton has been theretofore subjected to suitable carton set-up operations for completely opening the end thereof to be sealed. Selected internal surface portions of the end flaps of the liner have been internally treated with a heat sensitive or hot melt adhesive such as polyethylene. Although polyethylene has proven suitable for many sealing operations, it should be understood that any other suitable hot melt adhesive, such as standard wax, may be used for other applications.

The flight of the carton is made adjacent the hot fluid discharge. The carton flaps are then pressed together, as shown in FIG. 9*b*, after which the heated fluid, preferably hot air maintained at a temperature approximating 500° F. to 1000° F. for a polyethylene adhesive, is discharged onto the flaps. During this period, the widest flap of jacket J is substantially maintained in a plane of the carton flight. The hot air is discharged against the inner surfaces of outer flap portion $L_1$ of liner L in such a manner so as to spread it a predetermined amount, as shown in FIGS. 4 and 9(*c*). As more clearly shown in FIG. 9(*c*), flap portion $L_1$ is arranged to extend past the narrowest end flap of jacket J, in non-attached relationship to facilitate this step.

The discharged air further functions to render the hot melt adhesive, formed on at least one of flap portions $L_1$ and $L_2$, tacky. The flaps are then forced together and subjected to a predetermined amount of sealing pressure by rollers **23** and **24**. As above stated, the predetermined pressure may be maintained by spring **33**.

Because of the extremely fast sealing action afforded by the novel concepts of this invention, carton set-up time is not limited thereby, as is apparent in connection with many conventional methods and machines. In prac-

tical applications, more than 200 cartons per minute have been completed, pursuant the novel concepts herein. However, if so desired, speed capability may be increased by rapidly cooling the adhesive, as for example, by the spray nozzle 38 illustrated in FIG. 9.

It should be further noted that since the heat is applied directly to the adhesive and not indirectly thereto via exterior portions of the carton, control of the carton paper thickness, board dimensions, density, etc., do not constitute critical variables which must be carefully scrutinized in connection with a particular sealing operation. Also, since the adhesive is able to be rendered tacky, i.e. reach its sealing temperature substantially instantaneously and uniformly, the board has little chance to overheat or scorch. In fact, it has been found in practical applications that the paperboard functions to absorb a substantial amount of heat from the adhesive, thus reducing the time required to solidify the partially or completely melted adhesive.

What is claimed is:

1. A heat sealer comprising guide means for guiding the flight of a carton having flaps the inner surfaces of which are in facing relationship, said guide means including a means to support the outer surface of one of said carton flaps, a member arranged closely adjacent to said guide means to hold, in cooperation with said support means, said carton flap in a predetermined flight during carton passage through said guide means, said flap so held having an adhesively treated inner surface, discharge means arranged closely adjacent to said member for discharging a heated fluid directly onto the adhesively treated surface of the carton flap held by said member, and sealing means for applying a predetermined pressure to the carton flaps to effect a sealing thereof between said inner faces.

2. The invention of claim 1 wherein said discharge means comprises a plurality of heating elements arranged on a base of said heat sealer adjacent said guide means and separated therefrom by a plate member having a plurality of apertures formed therein adapted to uniformly discharge the heated fluid onto said carton flaps.

3. The invention of claim 2 wherein said sealing means comprises an opposed pair of pressure rollers rotatably mounted on said base adjacent an end of said guide means and means adjustably mounting one of said pressure rollers on said base for maintaining a minimum predetermined distance between said pressure rollers and for maintaining said predetermined sealing pressure.

4. The invention of claim 3 wherein said one of said pressure rollers is rotatably mounted in a pivotal member which is mounted for limited swinging movements on said base.

5. In a heat sealer having a base with a casing mounted thereon, the combination of a carton flap guide means and carton flap sealing means, said carton flap guide means comprising first and second opposed wall members adapted to guide exterior portions of a formed carton therethrough and a plate member arranged to form a cover at a bottom portion of said casing, said plate member having a rail formed thereon intermediate said wall members and closely adjacent the first one thereof, said sealing means comprising an opposed pair of pressure rollers rotatably mounted on said base adjacent an end of said guide means and means adjustably mounting one of said pressure rollers on said base to maintain a minimum predetermined distance from the other of said pressure rollers and for maintaining a predetermined pressure thereon.

6. A heat sealer comprising a base, discharge means, carton guide means and sealing means, said discharge means comprising a casing attached to said base and having a core member vertically arranged therein, a plurality of stacked heating elements mounted on said core and spacers arranged between adjacent heating elements and forming passages therewith for guidance of air therethrough, said casing constructed and arranged to form a tapered chamber portion terminating in an elongate opening at a lower end thereof, a plate member arrange to cover the elongated opening and having apertur formed therein, said carton guide means arranged at bottom portion of said base, said guide means compri ing vertically arranged and opposed wall members adapte to guide exterior portions of a formed carton ther through, said plate member having a vertically arrange rail formed thereon intermediate said wall members an closely adjacent a first one thereof, said apertures forme in said plate member adjacent said rail and arranged i termediate said rail and a second of said wall membe for discharging air therethrough, said sealing means con prising a first shaft rotatably mounted in said base an having a first pressure roller mounted on a first end ther of adjacent an end of said guide means and a gear moun ed on a second end thereof, a pivotal member pivotall mounted at a first end thereof on said base and having portion thereof arranged to extend through an enlarge aperture formed in said base, a second shaft rotatabl mounted in said pivotal member and having a secon pressure roller mounted on a first end thereof adjacen said first pressure roller and a second gear mounted o a second end thereof arranged to mesh with said first gea biasing means for selectively urging said pressure roller together to maintain a predetermined sealing pressure and stop means for maintaining a predetermined mini mum distance between said rollers whereby carton en flaps may be sealed by sequentially passing them throug said guide and sealing means and closely adjacent sai discharge means.

7. The invention of claim 6 wherein at least one of sai rollers has ridges formed on the periphery thereof fo providing a concentrated pressure thereat for sealing pur poses.

8. A method for sealing the end of a carton forme of a paperboard jacket having end flaps of unequal widtl and a liner secured internally of said jacket, said line having a first flap portion secured to a widest of said en flaps arranged substantially coextensively therewith an a second flap portion opposed to said first flap portio arranged to extend past a narrowest of said end flaps i non-attached relationship, inner surface portions of th opposed flap portions of said liner being treated with polyethylene coating comprising the steps of guiding th flight of said carton adjacent a discharge of hot air, press ing said end flaps together, substantially maintaining th widest flap of said jacket in a plane of said flight, dis charging the hot air onto the second flap portion of sai liner to force it away from the first flap portion of sai liner, subjecting said polyethylene to the hot air at a tem perature selected from the range of from 500° F. t 1000° F. and forcing the flap portions of said liner to gether under a predetermined amount of pressure to bon them into sealing relationship.

9. The invention of claim 8 further comprising the ste of rapidly cooling said polyethylene.

10. In a heat sealer, discharge means adapted to dis charge hot air onto adhesively treated flaps of a carto comprising, a casing having a first opening for receivin air therein and a second, elongated opening, heating ele ments arranged in said casing intermediate said opening and a plate member arranged to cover said elongate opening and having a plurality of aligned apertures forme therein adapted to discharge hot air therethrough, sai heating elements being arranged in stack relationship o a core member attached to said casing with a plurality of spacers constructed and arranged between adjacen heating elements to form passages therewith adapted t conduct heated air therethrough, said plate membe having guide means arranged thereat for guiding carto flaps therethrough, said guide means comprising opposed wall members adapted to guide exterior portions of formed carton therethrough and a rail on said plate mem ber arranged intermediate one of said wall members an

openings formed in said plate member adapted to intain a carton flap in a predetermined flight.

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