Oct. 17, 1967 S. LOVAS ET AL 3,347,011

PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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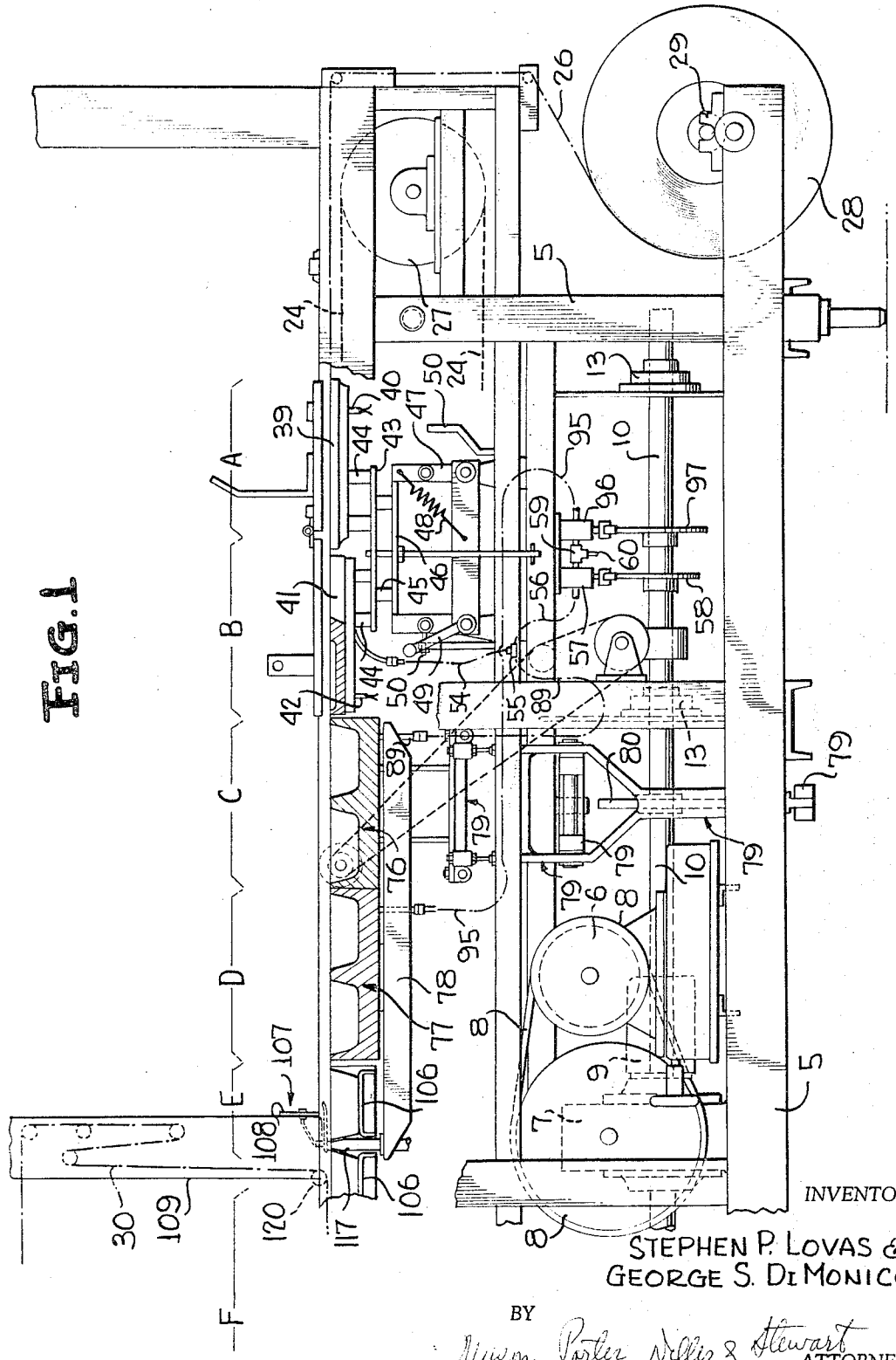


FIG. 1

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PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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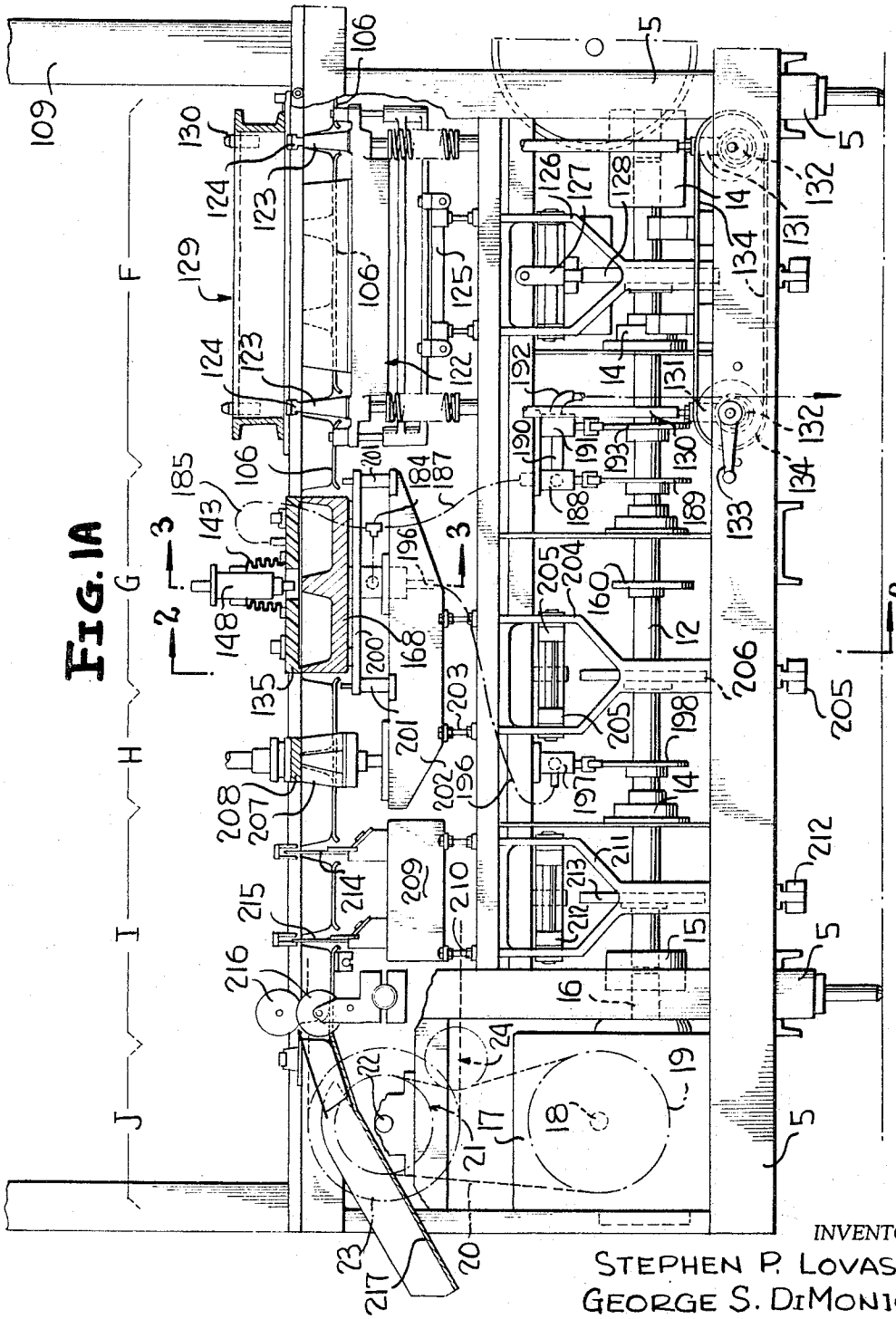


FIG. 1A

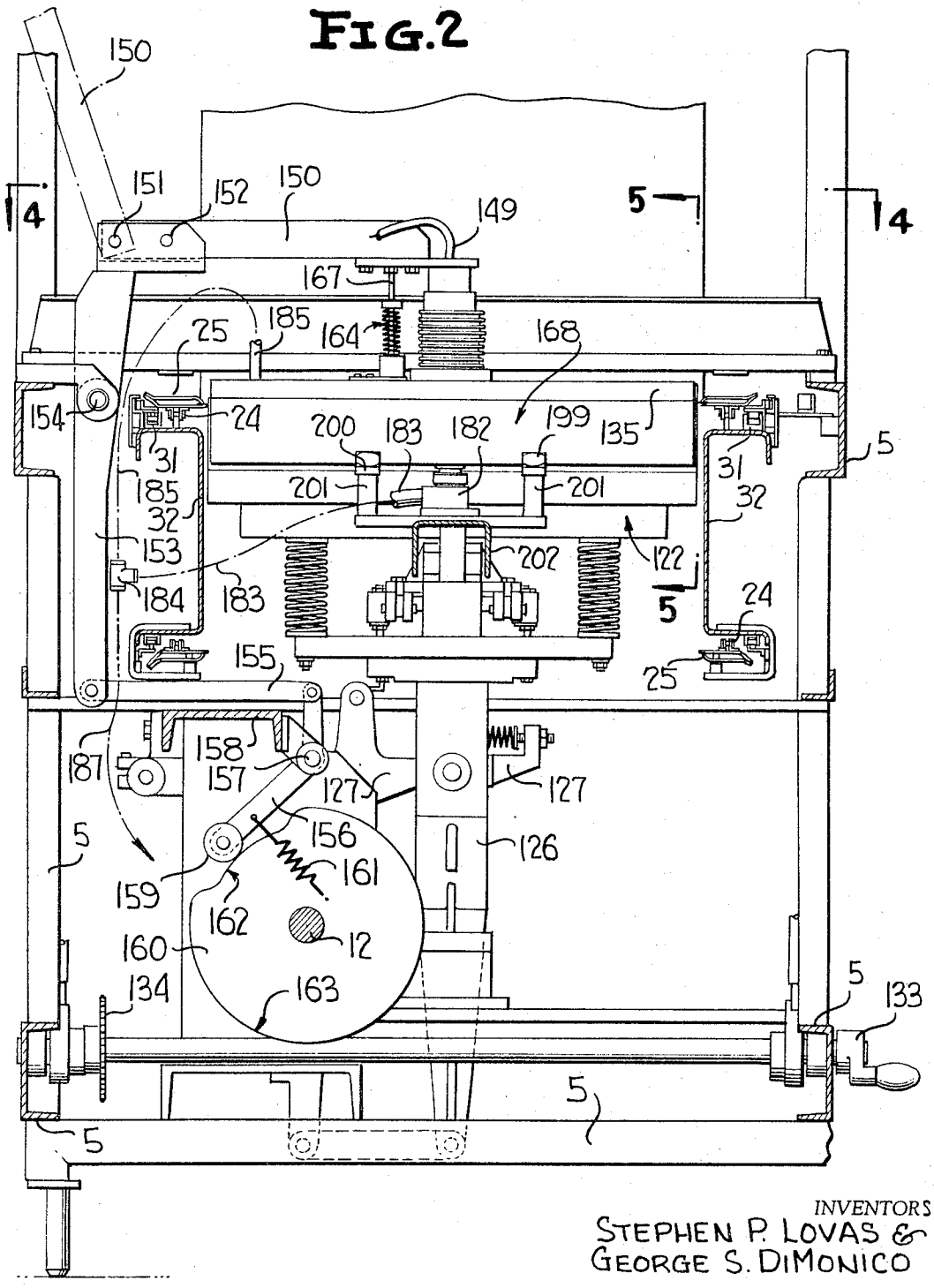
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PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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FIG. 2



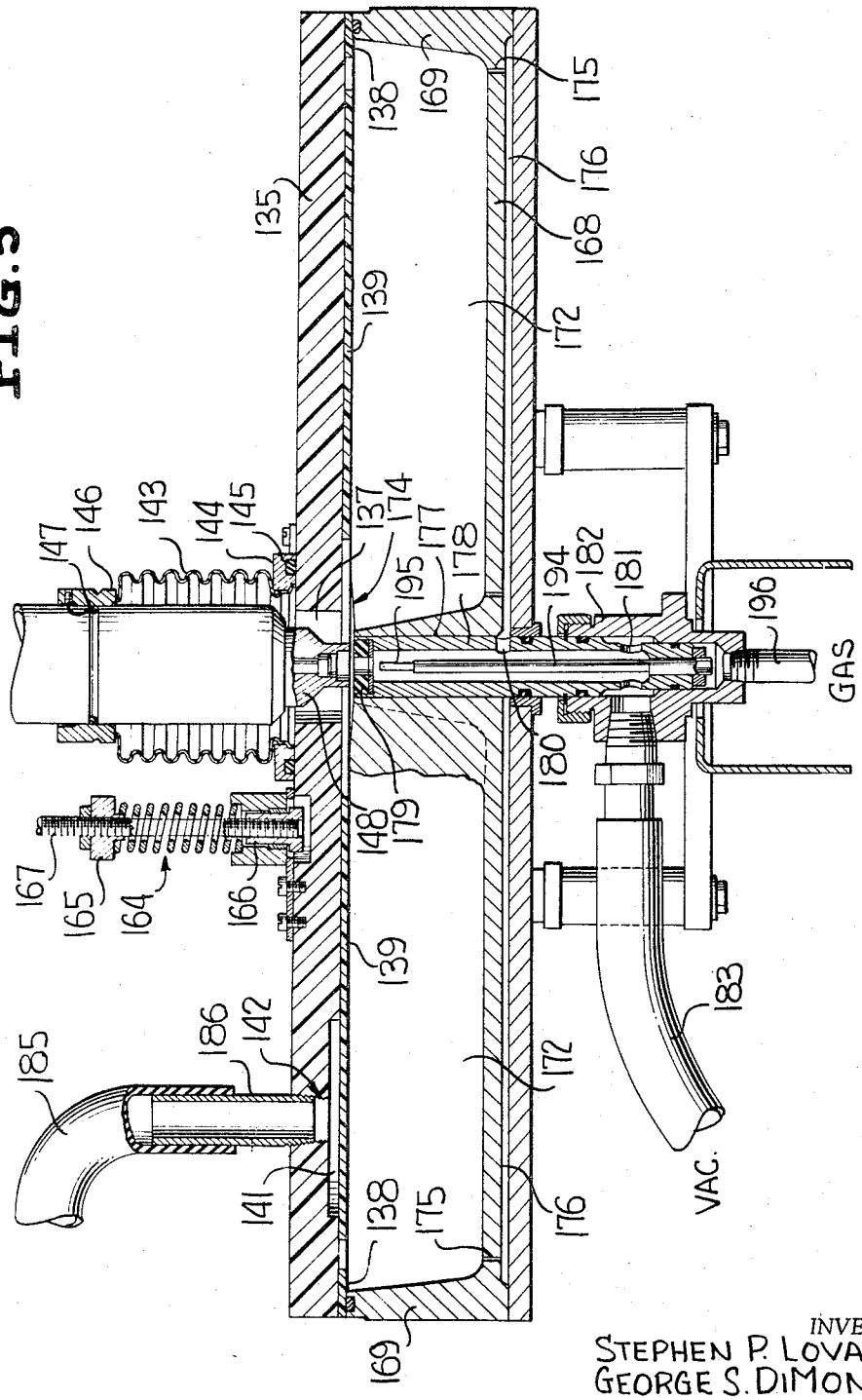
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FIG. 3



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FIG. 4

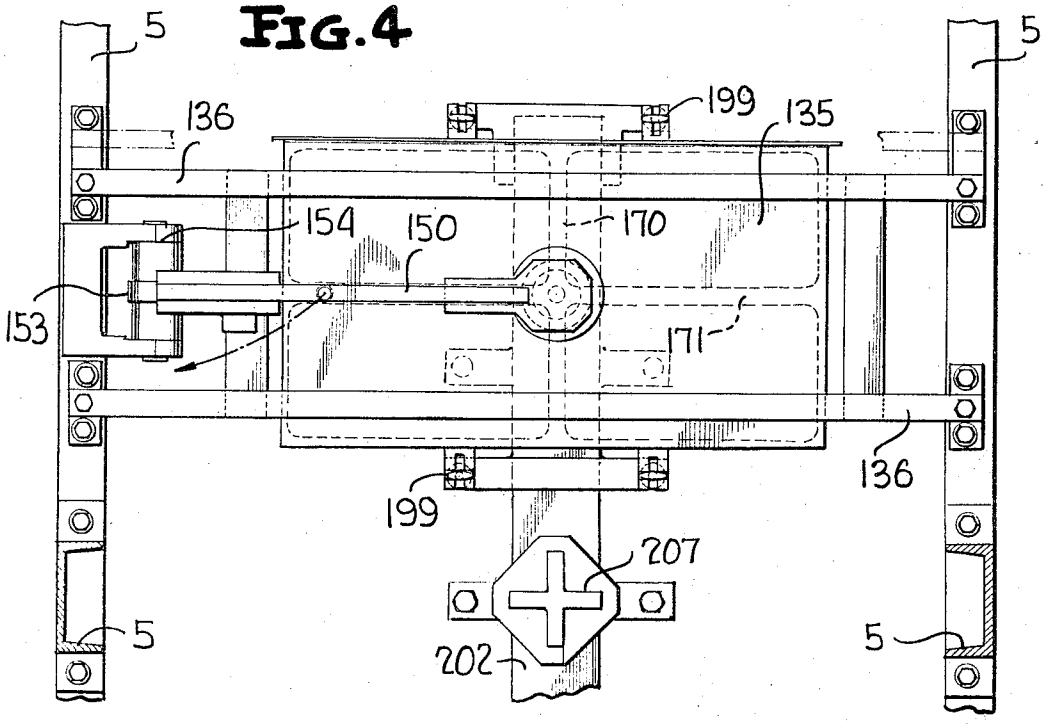
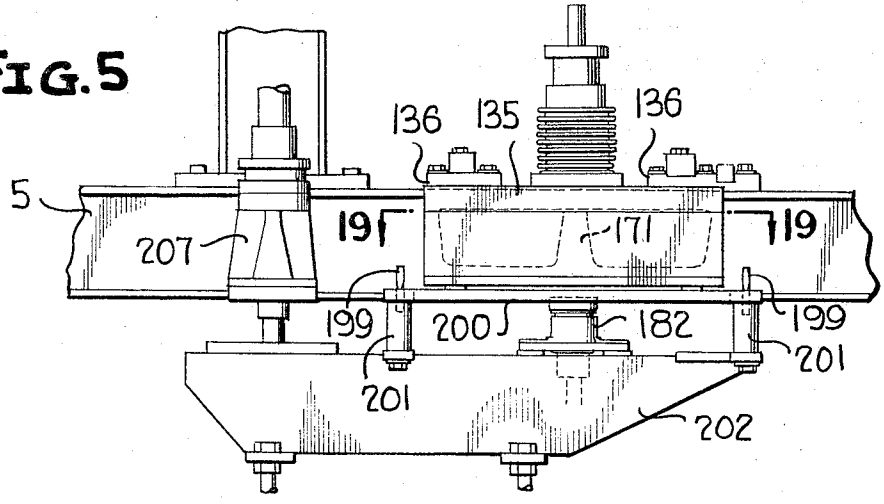


FIG. 5



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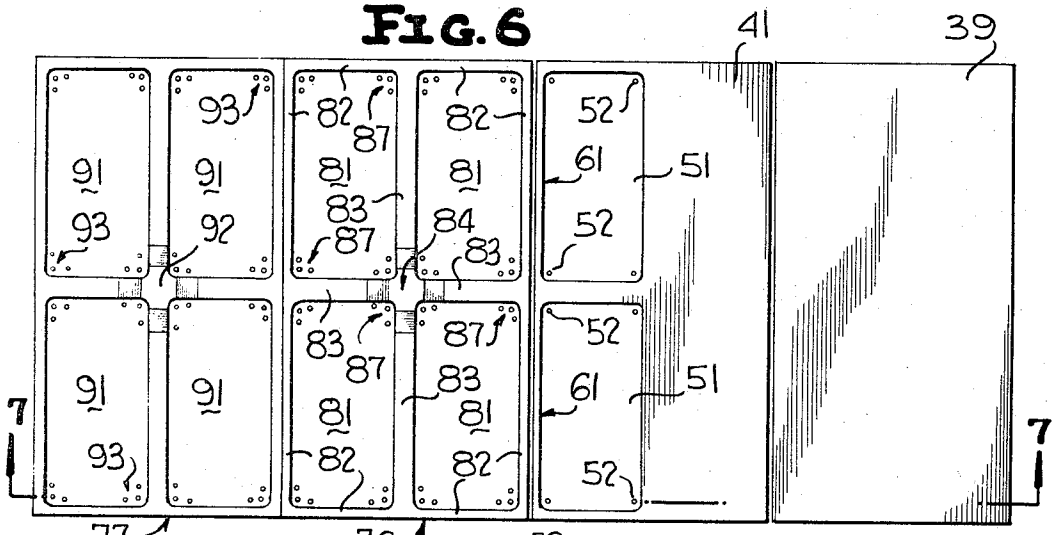
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FIG. 6



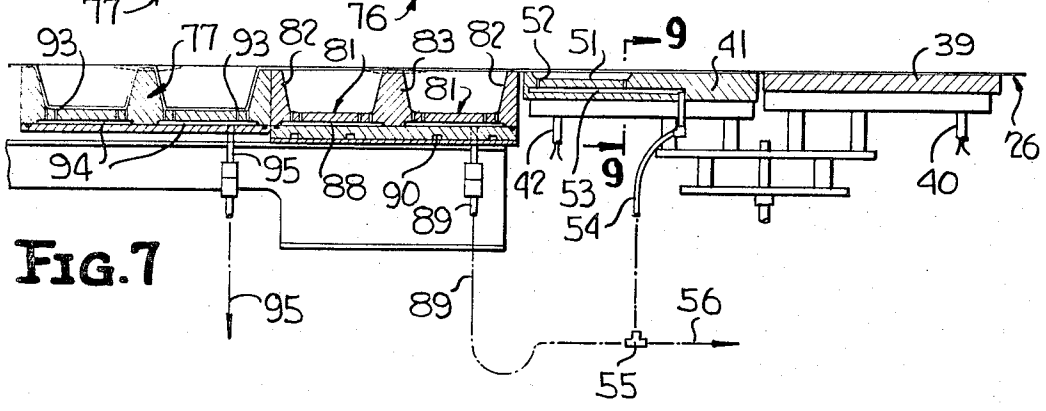


FIG. 7

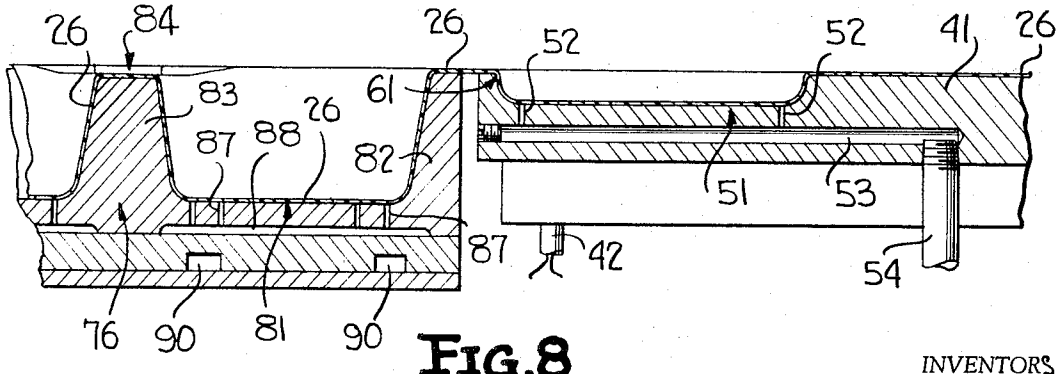


FIG. 8

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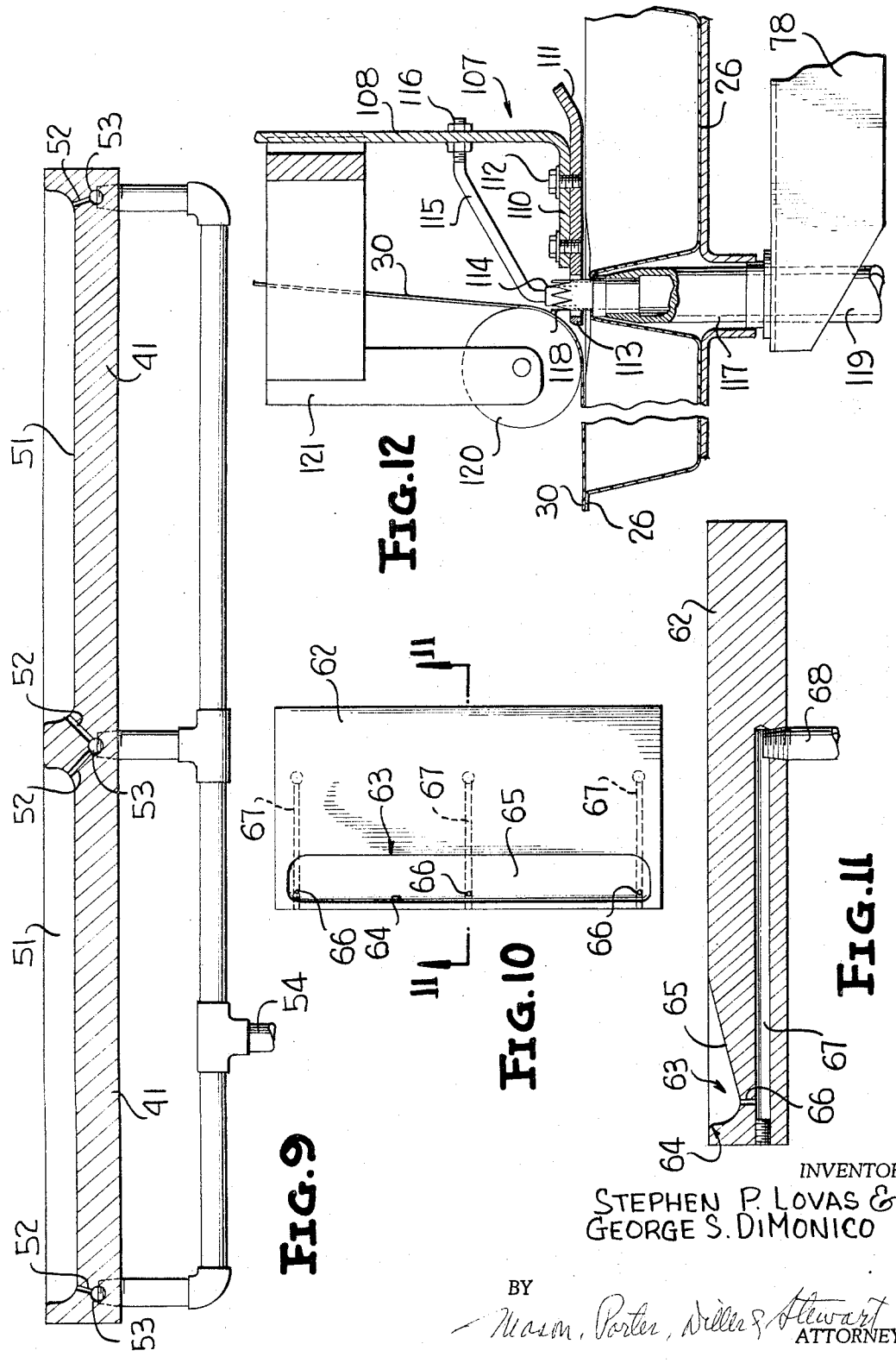


FIG. 9

FIG. 10

FIG. 11

FIG. 12

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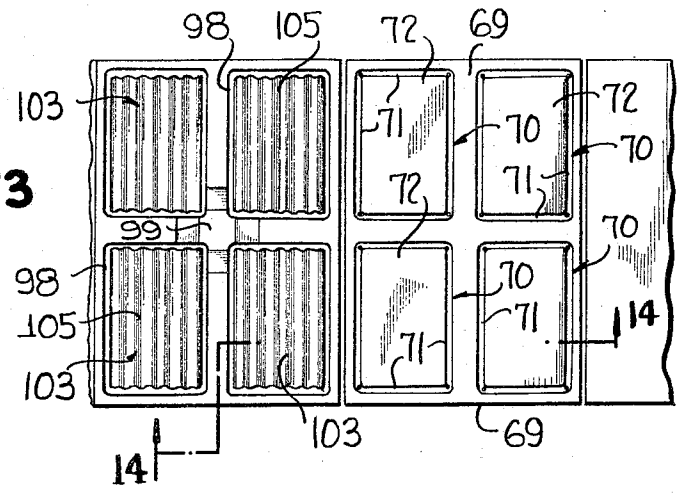


FIG. 13

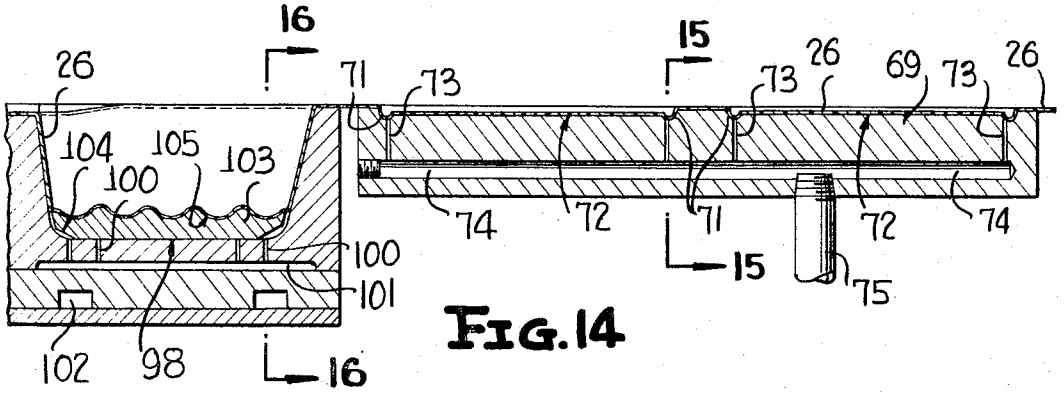


FIG. 14

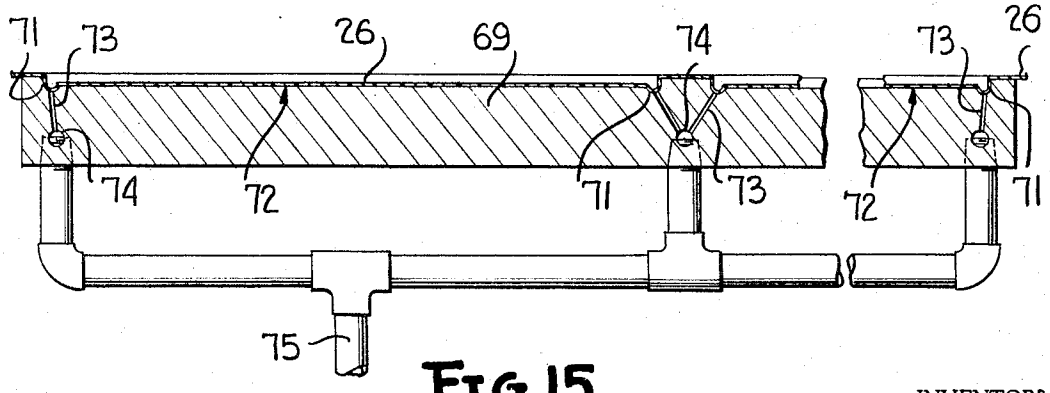


FIG. 15

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PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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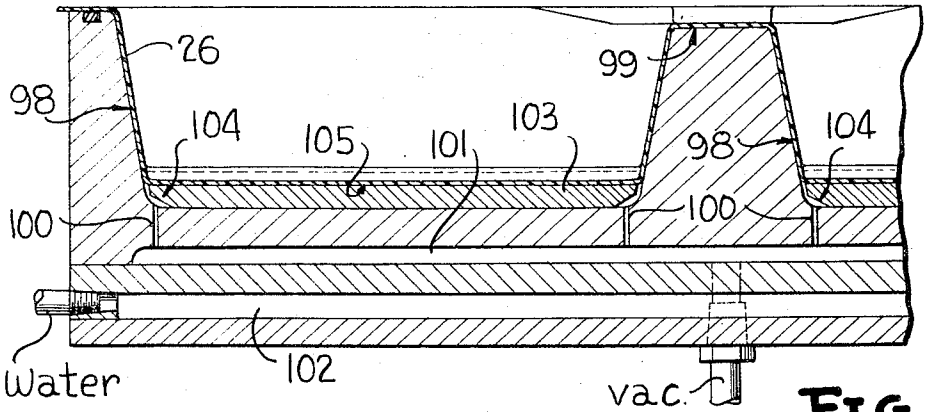


FIG. 16

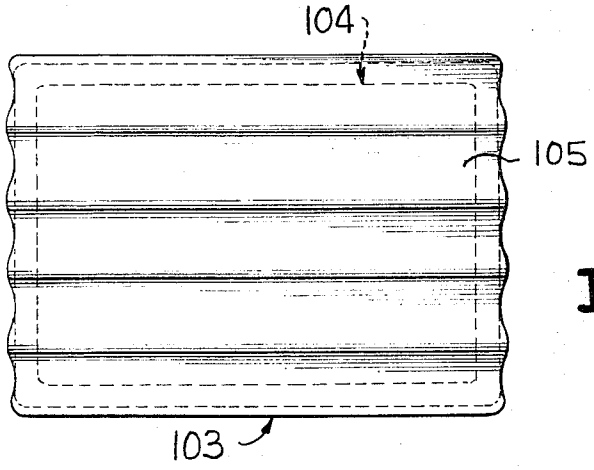
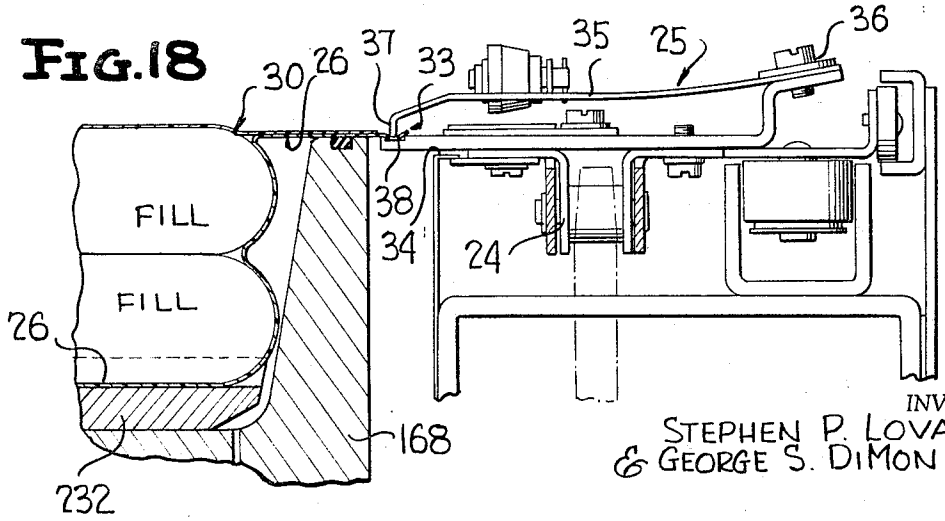


FIG. 17

FIG. 18



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PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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FIG. 19

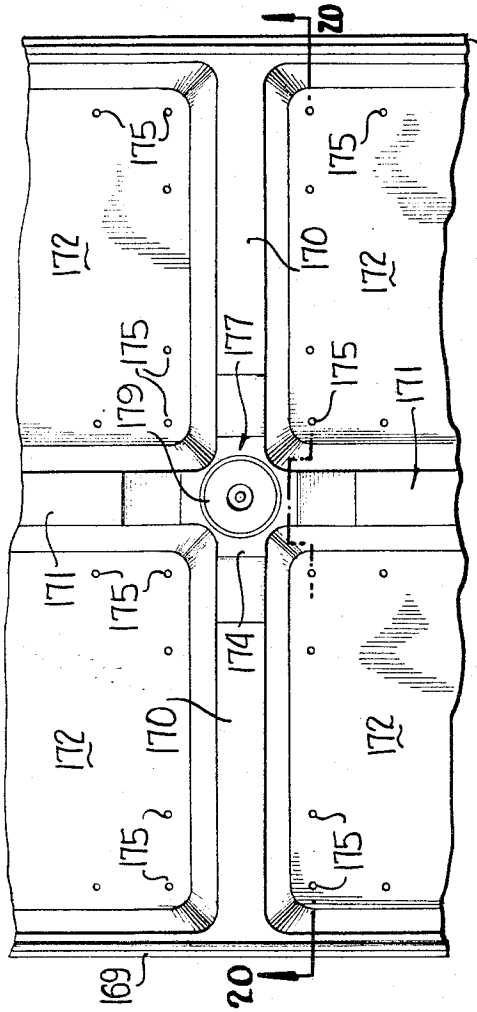


FIG. 20

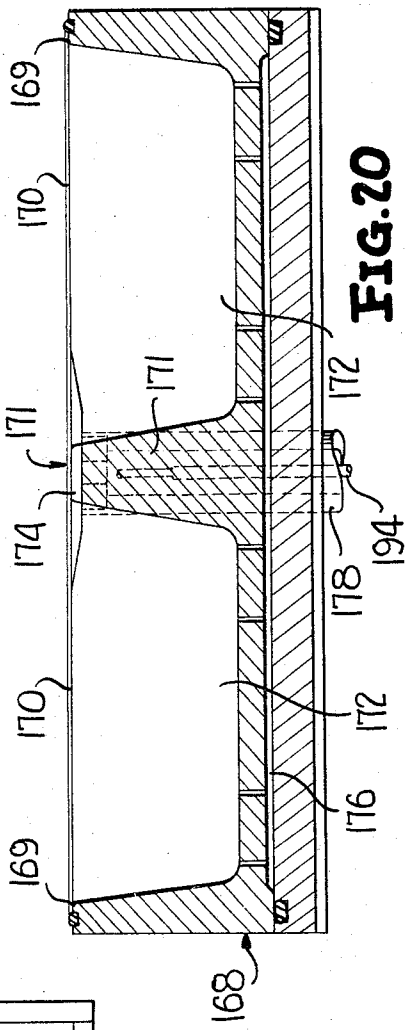
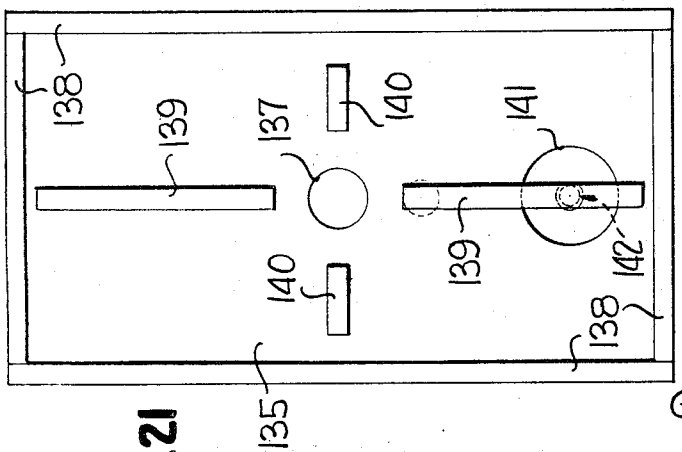


FIG. 21



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FIG. 22

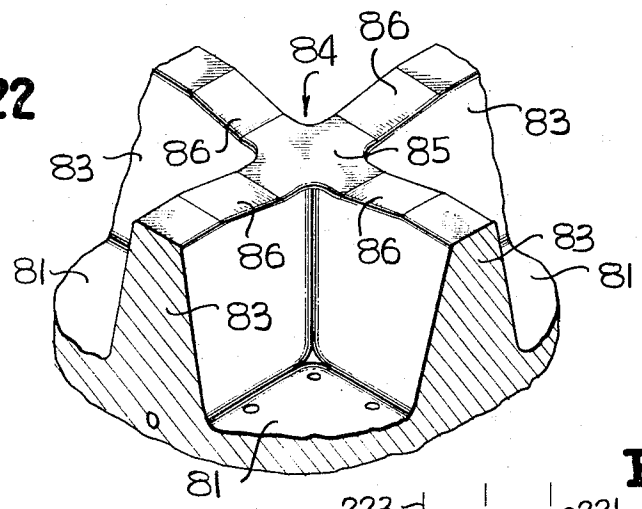


FIG. 23

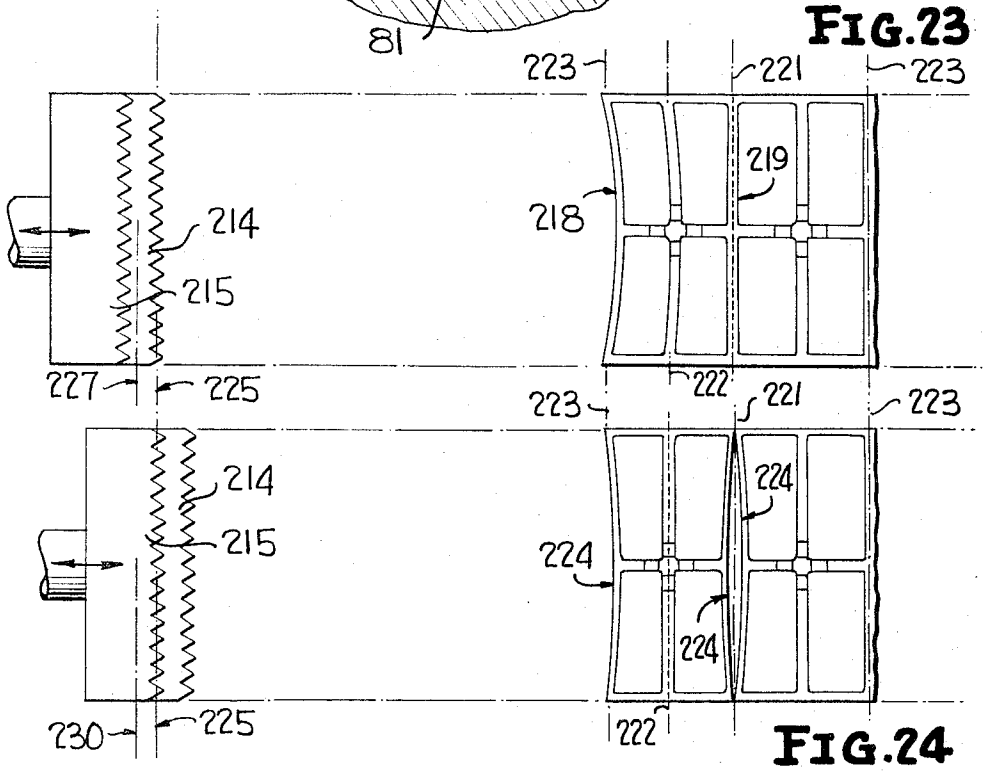
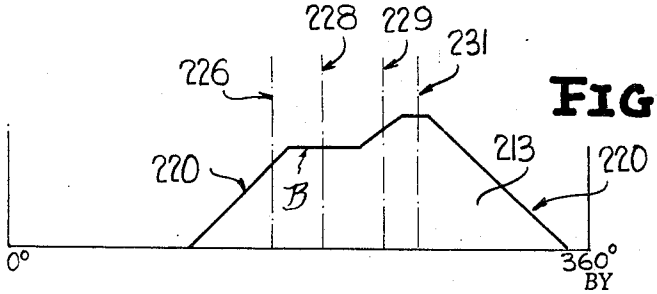


FIG. 24

FIG. 25



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United States Patent Office

3,347,011

Patented Oct. 17, 1967

3,347,011

PACKAGING MACHINE AND METHOD OF FORMING PACKAGES

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Filed Feb. 4, 1964, Ser. No. 342,430
40 Claims. (Cl. 53—22)

ABSTRACT OF THE DISCLOSURE

A method and machine for the vacuum packaging of products in flexible plastic pockets formed from continuous rolls of heat sealable webs wherein a first web is drawn from a roll and moved step-by-step by margin gripping conveyor means, heated, differential pressure molded at one station into pocket clusters each divided by wall portions depressed at a centrally intersecting point, the molded pockets being held by differential pressure action and cooled at a succeeding station in the molded shape and against memory relaxation, fill being deposited in the molded and held pockets, an evacuating orifice being formed at the depressed intersection point, a cover web then being applied over the filled pockets and heat sealed thereover except at the intersecting point, an enclosing chamber then being formed about a there presented filled pocket cluster at another station, the pockets being there interiorly evacuated through the evacuating orifice and the chamber being evacuated about the enclosed cluster, followed by ring sealing of the cluster about its orifice, followed by a venting of the chamber to atmosphere to cause the pockets to conform in shape to the fill therein, after which, and at another station, completing heat sealing is performed at the previously non-sealed intersection point, followed at succeeding positions by dividing of the clusters into individual packages by transverse and longitudinal cutting of the heat sealed webs.

The invention disclosed herein relates to packaging machines which are used for the vacuum packaging of products in flexible plastic pockets formed from continuous rolls of heat sealable plastic films or webs, and it primarily seeks to provide certain new and useful improvements in the machine structures and packaging methods disclosed in our application for Letters Patent of the United States, Ser. No. 245,288, filed Dec. 17, 1962 and which eventuated into U.S. Letters Patent 3,303,628 on Feb. 14, 1967.

In general, the previously known and now improved machine and packing method referred to above involved the use of a lower web or film fed step-by-step from a supply roll, being gripped at its side edges by clamps mounted on parallel endless chains, first over heater means to be conditioned for formation of fill receiving pockets therein, then over pocket forming mold means wherein desired pocket clusters are vacuum formed, each cluster comprising four cavities or pockets arranged in side-by-side pairs. After the cluster pocketed web is moved a step or cluster increment past the forming position or station it comes to rest over a holding mold in which its pockets are received and again subjected to vacuum action to finalize or set the shaping of the cluster of pockets. Since the web is supported only by the edge gripping chain clamps, the forming and holding molds are vertically reciprocated to be alternately presented in their effective, raised position or in their lowered, out-of-the-way position free of the molded fill receiving pockets of the web so as to permit step advancement of the web.

Fill is next deposited in the formed pockets. Thereafter an upper thermoplastic web is delivered from a supply roll and laid over the filled cluster pockets of the lower web, after which the webs are sealed together, except at the central point of the presented cluster at which the vacuumization of the cluster pockets is to be performed, by seal bar means reciprocable towards and from the webs and opposing seal cushion means. The thus partially sealed cluster of packages is then separated from the rest of the webs by transverse cutting, evacuation of the packages of the cluster is accomplished, a ring sealing operation about the evacuation orifice is performed to hold the evacuated condition, and then at another step feed station the final cruciform sealing of the remaining unsealed central portion of the package cluster is effected. Thereafter, additional transverse and longitudinal cutting is performed to complete the division of the package cluster into four individual packages, the edge clamping of the pocketed web being released only after completion of the package division, and the thus freed individual packages then being delivered from the machine. Alternate provision is made for forming the evacuation orifice at the center of each pocket cluster before the cover web is laid on, or at the evacuation station as beforementioned, along with other detailed arrangements and modifications unnecessary to mention herein.

It is a purpose of the present invention to improve structural features of the mentioned known machine, and procedural steps performed in said machine, said improvements having to do with the web gripping chain clamps, the heating of the web prior to pocket formation, better controlling of the pocket clusters and better communication between pockets at contiguous corners thereof, greater efficiency in the formation of the evacuating orifices, improved structures and practices providing for more efficient evacuation of the packages and also the gassing thereof when such is to be performed, and also improved cutting of the webs during division of the package clusters into individual packages.

An object of the invention is to provide novel method and means for holding the web, by fluid pressure action, intimately against and in all-over surface contact with a hot plate just prior to the formation of the desired fill receiving pockets therein at the molding station.

Another object is to provide novel method and means for forming shallow pockets in the web during the preheating thereof, said pockets being placed so that they will provide prestretched, tension release areas conforming to the pocket arrangements to be molded and from which said pocket arrangements will be formed.

Another object of the invention is to provide novel method and means for presenting holding shoulders at the web preheating station and effective to prevent objectionable drawing of web material from the heating station and into the pocket forming mold cavities as the vacuum shaping is in progress in said cavities.

Another object of the invention is to provide novel method and means for forming the package pockets in clusters each defined in part by a peripheral wall portion and by other wall portions which intersect centrally to provide contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the particular cluster through the contiguous corners thereof, thus to provide an efficient pocket evacuating and gassing channel.

Another object of the invention is to provide a novel method and means for forming an evacuating and gassing orifice centrally of each cluster wall intersection depression or channel.

Another object of the invention is to provide novel

method and means forming a chamber type enclosure for each successively presented package cluster, the pocketed web and the cooperating or overlying flat cover web being gripped between a vertically reciprocable pocket receiving holder or mold having cavities conforming to the package pockets and an overlying flat closure plate confining the cover web against free movement away from the pocketed web and the fill therein.

Another object of the invention is to provide novel method and means of the character stated wherein each package cluster is presented at the evacuation station after it has been moved from a preliminary heat sealing station where the cluster has been heat sealed about its peripheral wall portion and over its other wall portions except at the orificed, depressed portion or evacuation channel, the chamber type enclosure having provision for applying gripping and seal setting pressure on the still tacky heat sealed portions during the evacuation of the package cluster through the orificed evacuation channel.

A further object of the invention is to provide novel method and means for simultaneously evacuating all packages of a cluster through its orifice and evacuation channel, as well as the area of the cover web beneath the flat enclosure plate and beneath the packages in the package pocket receiving or holding cavities of the enclosure.

Yet another object of the invention is to provide novel method and means of the character stated wherein a ring seal is provided about each package cluster orifice after package evacuation, followed by venting of the enclosure above and beneath the package to atmosphere and then an opening of the enclosure.

Another object of the invention is to provide a novel method and means of the character stated wherein the package cluster sealing is completed over the location of the ring seal and the remaining unsealed portions at the evacuating depression by a heat sealer conforming in shape to said depression, followed by division of the package cluster into individual packages.

A still further object of the invention is to provide a novel method and means of the character stated wherein in the division of the evacuated and completely sealed package cluster into individual packages the division is accomplished by making a first cut across the transverse peripheral wall portion defining the trailing end of the last evacuated package cluster to separate said cluster from the remainder of the webs, a later second cut across the transverse wall portions between a leading pair of pockets of the cluster and the trailing pair of packages when composed of four packages in side-by-side pairs, and then by longitudinal cutting to divide said leading and trailing pairs of packages into individual packages.

Yet another object of the invention is to provide improved web edge gripping clamp means, each clamp including a base portion to receive thereover an edge of the web to be gripped and including a shouldered groove extending over the web opposing surface of the base and in the direction of the length of the web, and a gripping jaw disposed to press the web edge into the groove so that the wrap-over contact of the web with the groove shoulder will assure against inadvertent release of the web from the clamp grip.

With the above and other objects in view that will hereinafter appear, the nature of the invention will be more clearly understood by reference to the following detailed description, the appended claims and the several views illustrated in the accompanying drawings.

In the drawings:

FIGURES 1 and 1A together comprise a somewhat schematic side elevation illustrating the improved arrangement of machine structures, parts being broken away and in section.

FIGURE 2 is a vertical cross section taken on the line **2—2** on FIGURE 1A and illustrating the arrangement of the parts at the package cluster enclosure or package evacuating station.

FIGURE 3 is an enlarged fragmentary vertical cross section taken on the line **3—3** on FIGURE 1A.

FIGURE 4 is an enlarged fragmentary plan view illustrating the package cluster enclosure or package evacuating station illustrated in FIGURE 2, the cruciform seal also being shown, and the web clamping and supporting chains and the laterally adjustable supporting rails therefor being omitted.

FIGURE 5 is a fragmentary side elevation of the package cluster enclosure or package evacuating means and the cruciform seal means shown in FIGURE 4.

FIGURE 6 is a plan view illustrating an improved arrangement of heating means for conditioning the web for the vacuum forming of fill receiving pockets therein.

FIGURE 7 is a vertical longitudinal sectional view taken on the line **7—7** on FIGURE 6.

FIGURE 8 is an enlarged fragmentary vertical longitudinal section showing a portion of the preheating and shaping means and a portion of the forming mold of FIGURES 6 and 7.

FIGURE 9 is an enlarged vertical cross section taken on the line **9—9** on FIGURE 7.

FIGURE 10 is a plan view of a modified form of web heating and preshaping or holding plate.

FIGURE 11 is a vertical cross section taken on the line **11—11** on FIGURE 10.

FIGURE 12 is an enlarged vertical longitudinal sectional view illustrating the means for punching an evacuating orifice at the central depressed wall intersection of a pocket cluster.

FIGURE 13 is a view similar to FIGURE 6 illustrating another modified arrangement of web heating and preshaping plate and a cooperating portion of a modified arrangement of forming mold.

FIGURE 14 is an enlarged fragmentary longitudinal sectional view taken on the line **14—14** on FIGURE 13.

FIGURE 15 is an enlarged vertical cross sectional view taken on the line **15—15** on FIGURE 14.

FIGURE 16 is an enlarged fragmentary vertical cross sectional view taken on the line **16—16** on FIGURE 14.

FIGURE 17 is a detail plan view of one of the filler plates shown in FIGURES 13, 14 and 16 and intended for preshaping the bottom of a fill receiving pocket as it is vacuum formed in the forming mold.

FIGURE 18 is an enlarged fragmentary cross sectional view illustrating a modified form of chain carried web edge clamping means.

FIGURE 19 is an enlarged fragmentary plan view illustrating the central or intersecting wall portion of the bottom or mold part of the package cluster enclosure, the view being taken on the line **19—19** on FIGURE 5.

FIGURE 20 is a vertical longitudinal section taken on the line **20—20** on FIGURE 19.

FIGURE 21 is an inverted plan view of the top plate or cover of the package cluster enclosure, the view being taken on the line **19—19** on FIGURE 5.

FIGURE 22 is a fragmentary perspective view illustrating one of the central or intersecting wall portions of a forming mold or holding mold such as is shown in FIGURES 6, 8, 13 or 16.

FIGURE 23 is a schematic view showing a section of pocketed web and illustrating in exaggerated manner the tendency of the free end of the web to deform by shrinkage, the relation of the successively active transverse cutting knives to the cutting lines also being illustrated, and cut lines indicating the first of the successive transverse cuts incidental to the cutting of the clusters into individual packages also being shown.

FIGURE 24 is a schematic view similar to FIGURE 23 and showing the second cut in progress and the manner in which the succession of transverse cuts brings about a balancing of the web cluster shrinkage and the assurance of a straight line division of side-by-side pairs of the cluster pockets.

FIGURE 25 is a schematic view illustrating the cam

action effective to bring about the desired successive step division of the pocket clusters as illustrated in FIGURES 23 and 24.

In this disclosure, the general arrangement of frame structure, film or web roll support and feed, work station and drive means follows the disclosure in our hereinabove mentioned prior application now U.S. Letters Patent 3,303,628 issued Feb. 14, 1967. Flexible heat sealable vacuum packaging films as therein disclosed, specifically polyethylene laminated to Mylar with the Mylar facing outwardly in each instance may be employed in the machine of this disclosure, or other heat sealable films of forming type may be employed. Certain phases of the invention are directed to problems encountered when films are employed which shrink or develop tension upon heating, this being true of so-called bi-oriented films, that is; films which have been prestretched to some degree in both longitudinal and transverse directions during their making with forming type, high clarity Mylar. Preferably, both films basically are saran coated polyester. The top or package cover film should have a one and one-half mil polythylene coating on its inner or heat sealing surface and the lower film should have a two mil polythylene coating on its upper or heat sealing side, this because of the fact that the lower film is the one to have pocket clusters formed therein. These films serve well the pocket forming and packaging purposes and constitute high-barrier films assuring relatively long shelf life in the completed package.

In the example of embodiment of the invention herein disclosed, the machine frame structure is generally designated **5** and supports thereon a driving motor **6** arranged to drive a speed reducer **7** of any approved type through driving pulley and belt means generally designated **8**. See FIGURE 1. The speed reducer is drive-coupled at **9** with the right cam shaft **10**, and also is drive-coupled at **11** with the left cam shaft **12**.

The cam shaft **10** is rotatable in bearings **13** supported on the frame, and the cam shaft **12** is similarly supported in bearings **14**. The cam shaft **12** is coupled at **15** with the drive shaft **16** of an indexing unit **17** of any approved type, and the power output shaft **18** of the unit **17** carries the driver sprocket **19** which is chain coupled at **20** to impart rotation to the driver sprocket **21** on the cross shaft **22** whereon the chain driving sprockets **23** are mounted, thereby to impart intermittent or step-by-step movement to the chains **24**. See FIGURES 1A, 1, 2 and 18. The chains **24** carry the clamps **25** which grip the margins of the lower web **26** to move the same through the machine, said chains passing over the previously mentioned driver sprockets **23** as indicated in FIGURE 1A, and over the idler shaft carried sprockets **27** indicated in FIGURE 1.

The lower web **26** is drawn off a supply roll **28** supported at **29** on the frame and is the web which is to have fill receiving pockets formed therein as hereinafter described. The pockets, after being formed and filled, are covered by an upper or cover web **30** which is also drawn off from a supply roll (not shown) and delivered into position over the lower web with the filled pockets therein as indicated in FIGURES 1 and 12.

The structure and mounting of the lower web gripping and moving chains is best illustrated in FIGURES 1, 1A, 2 and 18. The chains travel over guide means **31** along each side of the frame structure as shown in FIGURE 2, said guides being supported by the laterally adjustable support members **32** as shown in FIGURE 2. It will apparent by reference to FIGURES 1 and 1A that the effective, upper flights of the chains, moving from right to left in said figures, first pass a first web preheating station A, then a second preheating and holding station B, a pocket cluster forming station C, a pocket holding and filling station D, a lower web orificing station E, a cover web applying and initial sealing station F, a package evacuating station G, a final sealing station H, a filled and evacuated package cluster separating station I and an individual package discharge station J.

During the clamp controlled travel of the lower web **26**, its margins **33** project laterally beyond the upper or cover web **30** in the manner clearly illustrated in FIGURE 18 and overlie the bases **34** of the clamps generally designated **25**, said bases being opposed by the spring clamp portions or upper jaws **35** which are anchored at their outer ends on the bases as at **36**. The other or free end **37** of each spring clamp portion **35** opposes an upwardly opening recess or slot **38** in the clamp base, said slot providing a wrap lock shoulder serving to securely hold the web margin against pulling out of the clamp.

At station A, the lower web **26** being carried by the chains passes over and in contact with a preheater plate **39**, the web **26** passes through station B and over a heating and holding plate located at said station and generally designated **41**, the same being similarly heated by rod type heaters serviced by conducting means indicated at **42**. The preheating and heating and holding devices or plates **39** and **41** are secured on a common carrier **43** through insulators **44**, and the carrier is mounted at **45** on a platform **46**. See FIGURES 1 and 7. The platform **46** is supported on toggle link supports **47** spring biased at **48** to the plate elevated position illustrated in FIGURE 1, and the links are subject to being manually shifted to a toggle break, plate lowered position by manipulation of a swingable hand lever **49**. Stop means **50**—**50** are provided to fix the raised or effective and lowered or ineffective positions of the plates **39** and **41**.

FIGURES 6 to 9 show in greater detail the preheating and preheating and holding devices positioned at stations A and B and the relation they bear to the last encountered pocket cluster forming or molding and holding devices at stations C and D. The preheating and holding plate generally designated **41** is here shown as equipped with two shallow holding pockets **51** arranged side-by-side and each having at least one evacuating orifice **52** at each corner thereof and communicating through chambering **53** in the plate with a duct **54**. The duct **54** is connected with a T **55** which is in turn connected through a duct **56** with the valve **57** illustrated in FIGURE 1 and which is operable by a rotary cam **58** carried by the shaft **10**. The valve **57** also is connected at **59** with a vacuum source **60** which may be a vacuum pump (not shown).

It will be apparent that the shallow pockets **51** present holding shoulders **61**, and the purpose of these shoulders will be described in greater detail hereinafter.

In the modified form of preheating and holding plate means illustrated in FIGURES 10 and 11, there is provided a plate **62** having a single transverse pocket **63** formed therein, the same presenting a holding shoulder **64** and having a gradually and upwardly sloping bottom **65**. Evacuating orifices **66** are provided in the pocket **63** and communicate through chambering **67** with a duct **68** for connection with the previously mentioned control valve means and vacuum source.

In another modified form of preheating and holding means provision also is made for preshaping portions of the lower web which are to be formed into the fill receiving pockets. This plate structure is best illustrated in FIGURES 13 through 15 wherein the preheating, holding and preforming plate is generally designated **69** and is equipped with a cluster of four shallow pockets **70** generally corresponding in placement to the positions of the fill receiving pockets to be molded at station C. Each pocket **70** is defined by a peripheral groove or depression **71** about its center or relatively higher floor portion **72**, and each such groove **71** is provided at each corner with an evacuating orifice **73** communicating through chambering **74** with an evacuating duct **75** for connection with the previously mentioned vacuum control valve and vacuum source.

Preheating and holding means as previously described

and shown in FIGURES 6 to 9, 10 and 11 and 13 to 15 are particularly desirable where the packaging involves the use of webs or films which shrink and develop tension upon heating. This is true of so called bi-oriented films, that is; films which have been prestretched to some degree in both longitudinal and transverse directions during their making with forming type, high-clarity Mylar.

The two side-by-side pockets **51—51** of FIGURES 6 to 9 provide shallow recesses which may be evacuated in the manner stated and which present advance shoulders or holding edges **61** directed toward the forming mold at station C. Like the holding mold at station D the shoulders **61—61** and cavities **51—51** hold the last formed cluster of cavities from distorting or losing intended shape by memory action when the action of the forming mold exerts strong stretching forces on the hot web as it is being drawn. Prior to the provision of such holding pockets, the forming operation at station C pulled some web or film from over the heater plate, and upon release of the forming vacuum, the web tended to return to the heater plate from whence it came, or in other words shrunk back. This caused deformation of the cavities. However, with the addition of the holding and preheating pockets above described, the hot web is easily sucked down to the bottom of the heater plate pockets before the web over the forming cavities produces much forming strain, even though the vacuum timing for both the preheating and holding devices and forming mold are of the same value. This order of forming in two stages is largely due to the fact that the web is hottest over the hot plate, and also the web gains still more heat as it draws into the hot cavity, as against the web losing heat as it draws into contact with the water cooled forming mold at station C.

Successful holding in the manner stated is attributed to two important effects, namely the combined action of vacuum in the heater-holding pockets, and frictional wrap effect around holding shoulders such as those presented at **61** and **64** as previously described. This is accomplished in the structure shown in FIGURE 10 and 11 wherein the sloping bottom is provided, but it is to be understood that in this form the recess or cavity should not be too narrow so as to get a stronger total vacuum pull, and it has been found that the sloping or tapering depth helps to prevent telltale lines which might remain in the formed web.

An extra stretching effect is added in the web in the preheater pocket areas which, even though the web practically snaps back into a flat plane when the vacuum is released, there is enough stretch in these areas to temporarily release the tension in the remainder of the web over the heater plates which would otherwise cause a degree of cavity distortion. This tension release effect lasts long enough to enable the newly formed web cavities or pockets to be advanced to the holding mold station D.

The four shallow cavities **72** in the final stage hot plate illustrated in the form of FIGURES 13 to 15 permit tight drawing of the web into positive overall contact with the hot surfaces of the plate. This is extremely important in the provision of uniform heating and avoidance of streaky hot spots caused by local stretching imperfections in formed cavities or pockets. It is known that materials such as nylon-polyethylene have a tendency to become limp and wavy upon heating and lacking of means for stretching the film to the desired flat condition. Thus they contact the hot plate surface in spotty and random places, causing the streaky hot spots and local imperfections referred to. The hot spots (hot as related to the underheated cooler portions of the web) are eliminated in the practicing of the herein disclosed invention by the vacuum sucking down of the entire web into the shallow cavities for uniform overall contact with the hot plate. It has been pointed out previously that a material such as Mylar-polyethylene required vacuumizing recesses for a holding feature only because of its characteristic shrinking when heated, and although four cavities are not necessary for its proper heating, the four cavities do not hamper its proper heating. Therefore, this four pocket arrangement can be universally used with any material. It is to be noted that the peripheral channel **71** in each of the shallow pockets of FIGURES 13 to 15 helps to maintain a vacuum supply to all areas of the web until the last possible moment when the web finally tends to seal over the evacuating holes **73** in each corner. This minimizes the possibility of leaving air entrapped in central portions of any one of the cavities, as illustrated in FIGURES 14 and 15.

Whenever film is being formed which does not develop tension upon heating, no heater pockets should be used. At such times the evacuated pockets intended for the described tension release effect may be filled by the laying in of loose filler plates of aluminum or other acceptable material, thus to present upwardly a planar, unpocketed surface.

Reference is now made to FIGURES 1 and 6 through 8 and stations C and D whereat are located the pocket shaping mold generally designated **76** and the pocket holding mold generally designated **77**. Both molds **76** and **77** are supported on a vertically reciprocable platform or carrier **78** operable by lifting and lowering devices generally designated **79** including upright lifter bracket means and horizontally disposed supporting linkage as disclosed in our previously mentioned presently pending patent application, or any other acceptable lifting and lowering means may be employed. The lifting and lowering devices here generally illustrated and designated **79** are actuated by the rotary cam **80** on the shaft **10**, as illustrated in FIGURE 1.

The forming or shaping mold best illustrated in FIGURES 1, 6 to 8 and 22 provides a cluster of four molding pockets **81** arranged in two side-by-side pairs. The pockets are defined by peripheral upstanding wall portions **82** and centrally intersecting wall portions **83**. At the intersection of the wall portions **83** there is provided a cruciform depression generally designated **84** and defined by a central, depressed planar portion **85** and four downwardly sloping depressions **86** extending from the full height positions of the wall portions **83** down to the lower central planar portion **84**. Each pocket **81** is shown as having three evacuating orifices **87** in each corner and communicating with chambering **88** beneath the pockets and which in turn connects through the duct **89** with the previously mentioned T **55** and the duct **56** leading to the valve **57** and the vacuum source **60**. The mold **76** also has chambering **90** which is to be understood as connected with a cooling water supply (not shown).

The pockets **91** in the holding mold **77** are defined by peripheral and intersecting portions as are the previously described molding pockets **81** and include the cruciform depression **92** and corner orifices **93**. The evacuating corner orifices **93** communicate with the underlying chambering **94** which in turn is connected through the evacuating duct **95** with the T **59** and vacuum source **60** through the control valve **96** which is actuated by the rotary cam **97** on the shaft **10**.

In FIGURES 13, 14 and 16, a modified arrangement of forming mold is shown. The pockets **98** in this modified mold also are defined by peripheral and intersecting walls providing the cruciform central depression **99** as previously decribed. The corner disposed evacuating orifices **100** also are provided and communicate with the bottom chambering **101** for the purposes previously described. The mold also includes the coolant circulating chambering at **102**. However, the pockets in this modified mold each has a shaping bottom or filler block **103** laid therein, the same being shaped as at **104** to be spaced away from adjacent upstanding wall portions of the mold to avoid interference with the drawing of a vacuum in the pockets **98** through the corner orifices **100**. The filler blocks **103** have upwardly presented shaped surfaces as

indicated at **105**, these surfaces being defined in accordance with the fill to be placed in the packages, being irregular or otherwise shaped to conform at least generally to the fill or portions thereof which are to engage the bottom of the package, and therefore the bottom of the pockets to be vacuum drawn or shaped in the mold cavities, as clearly illustrated in FIGURE 14. One of the filler blocks **103** is shown in detail plan view illustrated in FIGURE 17.

It is to be understood that the package pockets may be filled mechanically or by hand at the holding station D, and while passing therefrom to and through the evacuation orifices punching station E and to and through the initial or partial heat sealing station F toward the evacuation and gassing station G, the pockets previously formed in the mold **76** and held in the molded shape in the mold **7**, but now otherwise unsupported except for being clamped to the chains **24, 25** are supported on stationary supporting devices **106**.

At station E, the orifice punching means generally designated **107** is located, this means being best illustrated in FIGURES 1 and 12. At this position, a supporting bracket **108** is suitably mounted on a super structure portion **109** of the machine framing and includes a horizontally turned portion **110** to which a presser foot or stripper **111** is removably secured at **112**. The foot **111** has an aperture **13** extending therethrough and disposed to receive therein a plunger **114** which is suspended stationarily on a carrier **115** which is secured at **116** to the bracket **108**. The previously described vertically reciprocable platform or carrier **78** has an end portion extending under the evacuation orifice punching station as illustrated in FIGURE 12, and this platform end portion carries a sleeve mounting and punched disk receiving tube **117**. At the top end of this tube is mounted a sharp angled toothed cutter sleeve **118** which is sized to freely telescope over the stationary plunger **114** as shown in FIGURE 12. It will be apparent by reference to FIGURE 12 that each cluster of molded pockets will include the depressed cruciform portion molded over the intersecting mold wall portions best illustrated in FIGURE 22, and this depressed cruciform portion will come to rest at the punch station centered over the axis of the tube **117** and the punch sleeve **118** carried thereby. Thus each time the platform **78** rises, it will cause the sharp angled teeth of the sleeve **118** to punch through the web, in this particular example disclosure at the cruciform depressed portion of the web, the presser foot or stripper **111** preventing objectionable movement of the web upwardly or objectionable deformation of the perforated web portion, and the disk thus punched out of the web will be forced downwardly through the punching end of the sleeve **118** to fall into and through the tube **117** and the communicating discharge tube portion **119** for collection in a waste trough or the like (not shown).

Just beyond the position at which the evacuating orifice is punched at each rest interval of the bottom or pocketed web movement the previously mentioned cover web **30** is laid over the now filled pockets by a guide roller **120** which is shown as supported at **121** on the machine framing.

In our previously mentioned patent application, now U.S. Letters Patent 3,303,628 there were disclosed method and means for providing the initial sealing of the cover web over the filled pockets of the underlying web either by a succession of steps, or in a single step. See for example FIGURES 54 and 55 of said pending application for a simple one step procedure, and FIGURES 35 to 42 for alternate multi-step procedures. The present invention embraces such modes of procedure or any other sealing method or means which will satisfactorily bring about the herein stressed initial sealing over of the peripheral walls or perimeter of each cluster of package pockets and over the intersecting wall portions except the cruciform depression wherein the cover web is not to be adhered to the underlying web portions. At station F herein, there are somewhat schematically shown the sealing means and actuating devices shown in our prior application disclosure, and it is to be understood that the seal bars and the cushion seals against which they work will be placed according to the seal procedure or sequence selected for a particular installation, but the actuator means and supporting devices may be the same in all cases and preferably will include overload release means such as was previously disclosed, or an equivalent thereof.

In this schematic showing at station F, the seal bar general assembly is indicated at **122** with the sealing bars **123** thereon vertically reciprocable opposite overlying and opposing cushion seals **124**. The supporting means generally indicated at **125** includes the lifter bracket **126** also forming a part of the actuator devices and including the overload release means illustrated in part at **127** and which is directly acted upon by the rotary cam **128** mounted on the shaft **12**. See also FIGURE 2. As disclosed in our previously mentioned pending application, the seal cushions are carried by support means generally designated **129** and are displaceable or subject to being raised from the lowered, effective position of FIGURE 1A whenever it is desired that the seal bars are not to press the overlying web portions thereagainst. The support means **129** is carried on rods **130** which are subject to being lifted and lowered by means generally designated **131** and including eccentrics **132** operable by hand crank means **133** and connecting motion imparting devices **134**.

Attention is now directed to station G (FIGURE 1A) and to FIGURES 2 through 5 and 19 through 21 whereat a transparent Plexiglas flat rectangular chamber cover **135** is stationarily mounted at **136** on the frame sides **5**, said cover having a central opening **137**, peripheral reinforcing and pressure applying strips **138**, transversely extending and spaced reinforcing and pressure applying strips **139** and longitudinally extending and spaced reinforcing and presser straps **140**. The cover **135** also is equipped with a shallow clearance **141** overlying one of the transversely extending straps **139**, and a tap **142** leading downwardly thereinto, the purpose of which will be described hereinafter.

A sylphon bellows **143** having a seal ring **144** secured at its lower end engages over the cover opening **137** with its O ring seal **145** contacting the top face of the cover about the opening. At its upper end the bellows is secured to a ring **146** which is secured at **147** and sealed about a ring sealer **148**, the latter being served with heating current through suitable lead means **149** and carried at the free end of an arm **150** as shown in FIGURE 2. The arm **150** is pivoted at **151** and releasably locked at **152** as a bell crank arm on the upper end of a rocker arm **153** which is pivoted intermediate its upper and lower ends at **154** on the framing. At its lower end the arm **153** is link connected at **155** to one end of a bell crank lever **156**. The lever **156** is pivoted intermediately of its ends at **157** on the frame piece **158** and carries a follower roller **159** at its other or lower end. The follower roller **159** is disposed to be engaged by a rotary actuator cam **160** mounted on the shaft **112**. The lever **156** is biased by an anchored spring **161** toward the cam **160** but is disposed not to contact the same in its dwell recess **162**, but only on its dwell periphery **163**, thereby to assure proper lifting action by said dwell portion, but release by the recess dwell **162** so that the ring seal **148** will be applied in web sealing contact only at the predetermined controlled pressure, hereinafter described.

A variable resistance compression spring means generally designated **164** is provided and interposed between the evacuating chamber cover **135** and the undersurface of the ring sealer carrying arm **150**, as clearly illustrated in FIGURES 2 and 3 of the drawings. It will be apparent

that by varying the spacing of the upper and lower nuts **165** and **166** by threading along the thrust rod **167** which engages the arm **150**, the amount of downward pressure exerted by the unit on the cover can be varied.

The evacuating chamber bottom **168** is similar to the previously described shaping or forming mold **76** shown in FIGURES 1 and 6 to 8 and has peripheral or perimeter walls **169** and intersecting longitudinal and transverse wall portions **170** and **171** respectively defining a cluster of four pockets **172** arranged in two pairs side-by-side. See FIGURES 19 and 20. The perimeter wall means may be equipped with an O seal **173** opposed to the cover **135**, and the previously stressed cruciform depression **174** is provided at the intersection of the wall portions **170** and **171**. Corner orifices **175** are provided in the pockets and communicate with the vacuum chamber **176** to permit evacuation of the pockets beneath the packages therein, and at said wall intersection, the mold or chamber bottom is provided with a central bore **177** as best shown in FIGURES 3 and 19. The bore **177** receives an evacuating tube or fitting **178** which is recessed to carry a cushion seal ring **179**, the opening through which communicates through the cruciform recess **174** into the four contiguous corners of the pockets **172**. The tube **178** also has side openings **180** communicating with the vacuum chambering **176**, and side openings **181** opening into a fitting **182** to which a vacuum line **183** is connected. The vacuum line **183** connects with a T **184** as shown in FIGURES 1A and 2. A vacuum line **185** connects with the T **184** and at **186** with the tap **142** in the vacuum chamber cover **135**, as shown in FIGURE 3. The T **184** also connects through a vacuum line **187** with a vent control valve **188** disposed as indicated in FIGURE 1A to be operable by a rotary cam **189** mounted on the shaft **12**. The lines or ducts **183**, **185**, **187** connect through the valve **188** and at **190** with a vacuum control valve **191** and a vacuum source line **182**, the valve **191** being disposed to be operable by a rotary cam **193** mounted on the shaft **12** as shown in FIGURE 1A.

The tube or fitting **178** supports a gassing tube **194** with its discharge end **195** well below the cushion seal ring **179**, as shown in FIGURE 3, and a gas line or duct **196** is connected to the fitting **182** to deliver gas to and through the tube **194** whenever it is desired to direct gas into the interiors of packages within the chamber **135**, **168** under control of the gasing valve **197** shown in FIGURE 1A as disposed for being actuated by the rotary cam **198** on the shaft **12**.

The evacuated chamber assembly is removably attached by quick turn screw connectors **199** and the support means **200** atop supporting uprights **201** on a vertically reciprocable platform or carrier **202**, as illustrated in FIGURES 2, 4 and 5. The platform or carrier **202** is mounted at **203** on the supporting and lifting and lowering devices best shown in FIGURE 1A and including the upright lifting bracket **204** and the horizontal linkage **205**, the same being operable by the rotary cam **206** mounted on the shaft **12**. The same platform **202** carries the cruciform seal **207** opposes the stationarily mounted cushion seal **208**.

Another platform or carrier **209** is provided, as shown in FIGURE 1A, and is mounted at **210** on the supporting and lifting and lowering devices including the upright lifting bracket **211** and the horizontal linkage **212**, the same being operable by the rotary cam **213** mounted on the shaft **12**. Mounted on the platform **209** are two transversely disposed and longitudinally spaced cutter blades or knives **214** and **215**. It will be apparent by reference to an illustration in FIGURE 1A and in the schematic illustration in FIGURES 23 and 25 that the transverse cutting device **214** first encountered by the connected and sealed packages, or nearest the cruciform seal or final sealing devices **207**, **208** has its upper or cutting extremity disposed at a higher level than is the like portion of the cutting device **215**. By reason of this arrangement, and the form of the cam **213** the cutting devices **214** and **215** act successively in cutting connected pairs of packages from the webs, as hereinafter described in greater detail.

After the package pairs, still gripped at their lateral margins by the conveyor chains are moved past the cutting devices **214**, **215** they are moved past rotary cutter devices **216** which divide the package pairs into individual packages which then pass down the delivery chutes **217** as illustrated at the extreme left in FIGURE 1A. Immediately after passing through the longitudinally effective package pair dividers or rotary cutters **216**, the chain clamps **25** are released by any suitable means such as were disclosed in our previously mentioned pending patent application, thus to release the individual packages to pass down over chute **217** as above mentioned.

FIGURES 23 to 25 illustrate schematically the advantages in providing the illustrated placement of the transverse cutting knives **214** and **215** and the operating sequence thereof effective to assure the cutting apart of packages squarely in the center of the transverse seal lines despite the curvature of the lines. The distortion illustrated in a somewhat exaggerated but very illustrative degree in FIGURE 23 is the result of tension forces created by the evacuation around irregular products. See for example the shape conformation about the fill in FIGURE 18. As shown, the curvature of the packages or transverse seals is greatest as indicated at **218**, namely at the unsupported end of the previously cut webs. It will be apparent in FIGURE 23, however, that the transverse seal just two seals or package spacings from the cut end extremity, namely at **219**, is acceptably straight. By orienting the levels of the effective or top edges of the transverse cutters, or timing the cuts made thereby so that the cutter **214** cuts before the cutter **215**, and then controlling the action according to the diagram in FIGURE 25 so that there is a rest (plateau or dwell at B) after the cutter **214** makes its cut and before the cutter **215** so functions, an isolated cluster of packages is allowed to assume a symmetrical condition as shown in FIGURE 24 at **224—224**, with the central transverse seal, which is to be next cut by the cutter **214** at **222**, in an ideal straight condition.

The nature of the cutting edges of the cutters or knives **214** and **215** is shown at the left in the schematic illustrations in FIGURES 23 and 24, and it will be apparent by reference to FIGURE 1A that the cutters, in making their cuts, enter receiving slots in narrow striker bars closely overlying the web line and as disclosed in our before mentioned prior pending patent application.

In FIGURE 25 a portion of the effective profile of the cutter controlling cam **213** is indicated schematically at **220**. In FIGURES 23 and 24 the lines **221** and **222** indicate the positions of the cutters **214** and **215** respectively. The spacings between the line **221** and the lines **223** each indicate the length, or extent along the feed line, of a cluster of four packages. The symmetrical spring back of the leading and trailing edges of each cluster following cutting thereof from the webs at **221** is indicated in exaggerated fashion at **224—224** in FIGURE 24. At the left in each of FIGURES 23 and 24 the line **225** indicates the web line at the time the cutting edge of the particular cutter is passing therethrough. FIGURE 23 illustrates the relative locations of the cutters and the web conditions at the time of the **226** line position on the schematic cam illustration of FIGURE 25, the line **227** on FIGURE 23 illustrates the relative position of the webs with respect to the cutters at the **228** line position on said FIGURE 25, FIGURE 24 illustrates the relative locations of the cutters and the web conditions at the time of the line **229** position on said FIGURE 25, and the line **230** on FIGURE 24 illustrates the relative position of the webs with respect to the cutters at the line **231** position on said FIGURE 25.

Operation

In briefly recapulating the operation of the machine, attention is directed principally to FIGURES 1 and 1A. The bottom web 26 gripped by the chains 24, 25 is moved step-by-step, first over the preheating plate 39 at station A, and then over the preheating and holding of preforming plate 41 at station B. As previously described, the second preheating means at station B may take the form of the shallow pocket plate of FIGURES 6 to 9, or of the pocketed plate 62 of FIGURES 10 and 11, or the plate 69 of FIGURES 13 to 15. In each instance holding shoulder means of the nature of the shoulders 61 or 64 are provided, and in the drawing of the web down into the plate pocketing by evacuation, provision for tension relief is made, as well as a measure of preshaping which will greatly facilitate the deep drawing and final shaping of the pockets or cavities intended to receive fill at station C. In addition, the drawing of the web tightly against the plate by the vacuum action also assures more uniform overall heating, and this is particularly true in the employment of the plate 69 of FIGURES 13 to 15 wherein the drawing down of the film into overall surface contact with the plate assures perfect preheating and the avoidance of the provision of wavy spots.

As each web section is advanced a feed step into position over the forming mold 76 at station C the controls function to evacuate the pockets in the forming mold and draw the web into the intended shape of the pockets which are arranged in a cluster of four, and in this shaping of each pocket cluster a cruciform depression is formed at the center of the cluster as indicated at 84 in FIGURES 8 and 22, this depression opening simultaneously into the four contiguous corners of the mold or the pockets therein. As previously stated, the forming mold is water cooled at 90 so that the vacuum formed shape will be substantially set by action of the colant.

The forming mold 76 and the holding mold 77 next following the station D are vertically reciprocated so that they may move down away from the vacuum shaped web pockets each time the pocketed web is advanced a step, and each vacuum formed cluster of pockets, moving away from the forming station C, comes into position over the holding station D so that when the platform or support 78 carrying the forming and holding molds 76 and 77 again rises, the pockets in said mold will again receive the vacuum formed web pockets. This accomplished, the previously described evacuation of the pockets of the holding mold 77 takes place and this second vacuum action on the formed pockets assures retention of the desired finalizing shaping of the pockets. During these procedures, the previously mentioned holding shoulder means and pocketing of the heating and preshaping plate means serve to prevent undesirable web deformation or displacement and resultant deformation or displacement of the formed pockets, as previously described.

Filling of the web pockets, now finalized in shape, takes place manually or by employment of any suitable mechanical means at station D, and on the next advance step of a cluster of pockets in the web 26, the cruciform depression at the center of the cluster is brought to rest centered at the evacuating orifice punching station E, in line with the axis of the punching sleeve 118 as shown in FIGURE 12. Thus when the platform 78 is again raised to place the forming and holding molds 76 and 77 in their effective, elevated position, the punch sleeve is moved upwardly to the position illustrated in FIGURE 12, causing it to pierce the web 26 as the punch sleeve 118 passes through the aperture 113 in the stationary foot 111. At this position, the upper or cover web 30 is laid over the filled pockets in the lower web in the manner illustrated in FIGURE 12, and in the next advance step of the bottom web and its last formed and evacuation orificed pocket cluster, said pocket cluster will be presented at the initial sealing station F where the properly placed sealing bars 123 will be moved upwardly against the lower web between the pockets of the cluster and in opposition to the cushion seals 124. This serves to seal the cover web 30 onto the pocketed bottom web 26 about the perimeter of the cluster and also over the longitudinal and transverse intersecting wall portions of the cluster excepting only the cruciform depressed portion which has been molded by the surfaces 85 and 86 clearly illustrated in FIGURES 8 and 22. As previously described, this initial, tacky sealing on of the cover web may be performed in a single step, or in a succession of steps.

After the abovementioned initial sealing is accomplished, the filled and covered package cluster is advanced to the evacuating station G, the package cluster being aligned directly beneath the stationary cover or plate 135 of the evacuating chamber means. It has been explained that the bottom 168 of the evacuating chamber which is pocketed to conform to the shape of the presented package cluster cavities or pockets has been lowered to permit the step movement of the pocketed web 26, and this chamber bottom 168 carried by the platform 202 is now raised to enclose the cluster of packages in the pockets of the chamber bottom 168 and against the undersurface of the chamber cover plate 135, as clearly illustrated in FIGURE 3. The premolded cruciform depression in the web 26 at the contiguous corners of the pockets therein is received in the conforming recess or depression 174 of the chamber bottom, directly beneath the opening 137 through the chamber cover 135 into the bellows 143.

With the package cluster in place in the evacuating chamber, and the chamber closed, as illustrated in FIGURE 3, the valve 191 will be actuated to evacuate the chamber above the package cluster through the line 185 and the clearance 141 and in the bellows 143, and simultaneously the chamber portion beneath and surrounding the pockets of the cluster through the openings 180, the chambering 176, the orifices 175 through the tube 178 and the vacuum line 183, and at the same time the interior of each filled pocket of the cluster will be evacuated through said tube 178 and vacuum line 183, and simultaneously, through the channel or passageways provided by the cruciform depression 174 in the bottom web, well spaced below the overlying cover web 30.

After this evacuation of the interiors of all filled pockets of the cluster is completed and after the initial sealing of the package cluster as a unit by effective application of the ring seal 148 over the evacuated orifice in the lower web, the venting valve 188 will be actuated to vent the chamber 168, 135 to atmosphere above and below, or in other words exteriorly of the evacuated cluster pockets. This venting will have the effect of immediately causing the web portions enclosing the fill to conform to the shape of the fill, as illustrated in FIGURE 18.

As previously described, the pockets of each cluster may be preshaped by the pocket inserts 103 of FIGURES 13 and 14, or otherwise shaped insert surfaces formed in accordance with the particular nature of the fill being packaged, and with such preshaping or premolding of the pockets in conformity with the particular fill being packaged, the conformity of the packaging webs to the shape of the fill upon venting of the evacuating chamber can be accomplished without the setting up of objectionable tensions in the webs. Filler plates 232 conforming to the shaping of the premolding plates 103 shown in FIGURES 13, 14 and 15 preferably are employed in the evacuating chamber as indicated in FIGURE 18.

When gas is to be introduced into the package the same is delivered directly into the packages or pockets through the four contiguous corners of each cluster through the gassing tube 194, 195 and the duct 196 under control of the valve 197, this introduction being rapid and efficient and accomplished with a minimum of gas, in a large measure because of the provision of the cruciform channel, or depression 174.

The evacuating chamber cover 135 preferably takes the

form of a thick transparent plastic plate which may be of the nature of Plexiglas so that the evacuating action can be readily viewed. This plate being of large area is subject to quite a pressure load during evacuation, and the reinforcing strips **138**, **139** and **140** are provided to prevent any objectionable deflection of the plate. These strips serve another purpose in applying pressure to the previously tacky initial peripheral and transverse-longitudinal seals, thereby to finalize and set the seals. Moreover, the contact of the strips with the cover web prevents any pulling up of the cover web portions in any manner for tending to tug and pull at the seals and tend to make them inefficient.

It will be apparent from the foregoing that the vacuumizing is simultaneous and to the same degree above and below the package cover web, and the mentioned venting to atmosphere which follows after the evacuation also is simultaneous and rapid above and below the webs, or about the evacuated packages.

The bellows **143** serves as a means for containing the vacuum above the cover web and around the circle seal **148** and allows for movement of the seal from without the vacuum. The spring means generally designated **164** in FIGURE 3 and disposed beside the bellows serves to counteract the additional sealing force that is developed by the vacuumizing process. When full vacuum is applied, the spring bias of the whole linkage which is in a direction causing sealing, the bellows spring tendency or rate preventing sealing, and the high vacuum causing heavy sealing, produces a net effect of a too great sealing force. Hence there is a purpose of the counteracting spring assembly **164** to adjustably reduce the sealing force to the proper value.

It should be understood that when the main vacuum valve takes the form of a two-way valve, it must be shut off during injection of gas, when such is being practiced, and it is necessary to provide the separate vent valve to bring the evacuating chamber back to atmospheric pressure after circle sealing, this being necessary to permit ready opening of the chamber, as well as the causing of the package webs to conform to the fill, and the venting should be accomplished very completely and rapidly so that there will be no tendency for the evacuating chamber parts **135** and **168** to cling together and prevent rapid machine cycling.

Prior to the venting action above referred to, it is to be understood that the circle seal **148** is applied about the evacuating orifice and against the cushion seal ring **179** in order to initially seal the packages of the cluster as a unit. After this has been completed, and the evacuation chamber has been opened and the bottom thereof lowered on its platform **202**, the thus still partially sealed cluster is next moved into position at the final sealing station H, and centered beneath the cruciform seal **207** which conforms in shape to the only portion of the cluster remaining unsealed. Then when the platform **202** is again raised to enclose the next package cluster then presented at the evacuation station G, the cruciform heat sealer **207** is pressed against the cruciform center portion of the lower web to press the same and the overlying cover web against the overlying cushion seal **208** to complete the sealing of the package cluster.

Thereafter the transverse cutting of the package clusters into package pairs takes place in the manner previously described at **214** and **215**, and then the rotary slitting cutters **216** act to divide the package pairs into individual packages, the chain clamps **25** at this time being released to allow the individual packages to be delivered from the machine over the chute **217**.

While preferred and alternative combinations and subcombinations of method steps and part arrangements embodying the invention have been disclosed herein, it is to be understood that variations in such steps and part arrangements may be made without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A method of forming packages which comprises, feeding a heat sealable web, heating the web to prepare it for molding of pockets therein, successively molding clusters of pockets in the web with each cluster being defined in part by a peripheral wall portion and by other wall portions intersecting centrally to provide contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the particular cluster through the contiguous corners thereof, depositing fill into the pockets of each cluster, applying a heat sealable cover web over the filled pocket clusters to lie flat over and spaced from each said depressed intersecting wall portion, heat sealing the cover web over each pocket cluster about the peripheral wall portion thereof and over said other wall portions except adjacent each said depressed portion, evacuating the pockets of each cluster simultaneously through an orifice provided in its said depressed portion and then completing the heat sealing at each said depressed portion.

2. A method as defined in claim **1** wherein the orifice at each cluster intersecting wall portion depression is formed therein prior to the laying on of the cover web.

3. A method as defined in claim **1** wherein completion of the sealing at each pocket cluster wall portion intersection is performed at least in part by application of a heat sealer conforming in shape to the particular wall portion intersection depression.

4. A method as defined in claim **1** wherein completion of the sealing at each pocket cluster wall portion intersection is performed in two stages, first by a ring seal about the particular orifice, and second by application of a heat sealer conforming in shape to the particular wall portion intersection depression portion remaining unsealed.

5. A method of forming packages as defined in claim **1** wherein the web to-be-heated and pocket-cluster-molded is fed step-by-step over a heater plate and is held in all-over surface contact with said plate by fluid pressure application at each rest interval in the web feeding and prior to each of a succession of pocket cluster moldings therein.

6. A method of forming packages as defined in claim **1** wherein the web to-be-heated and pocket-cluster-molded is fed step-by-step over a heater plate and is held in all-over surface contact with said plate by fluid pressure application at each rest interval in the web feeding and prior to each of a succession of pocket cluster moldings therein, and each said molding is accomplished by vacuum-pressure shaping of the web into a cluster pocketed mold.

7. A method of forming packages as defined in claim **1** wherein the web to-be-heated and pocket-cluster-molded is fed step-by-step over a heater plate and is held in all-over surface contact with said plate by fluid pressure application at each rest interval in the web feeding and prior to each of a succession of pocket cluster moldings therein, and each said molding is accomplished by vacuum-pressure shaping of the web into a cluster pocketed mold, and wherein completion of the sealing at each pocket cluster wall portion intersection is performed in two stages, first by a ring seal about the particular orifice, and second by application of a heat sealer conforming in shape to the particular wall portion intersection depression portion remaining unsealed.

8. The method defined in claim **1** wherein the evacuation of the cluster pockets is followed by a gassing of said pockets also through the same orifice and depressed portion, and wherein completion of the sealing at each pocket cluster wall portion intersection is performed in two stages, first by a ring seal about the particular orifice, and second by application of a heat sealer conforming in shape to the particular wall portion intersection depression portion remaining unsealed.

9. A method of forming packages as defined in claim 1 wherein the web to-be-heated and pocket-cluster-molded is fed step-by-step over a heater plate and is held in all-over surface contact with said plate by fluid pressure application at each rest interval in the web feeding and prior to each of a succession of pocket cluster moldings therein and coincidental to the formation in the web of shallow pockets conforming in shape generally to the shape and positions of the pockets to be molded in the web.

10. A method of forming packages as defined in claim 1 wherein the web to-be-heated and pocket-cluster-molded is fed step-by-step over a heater plate and is held in all-over surface contact with said plate by fluid pressure application at each rest interval in the web feeding and prior to each of a succession of pocket cluster moldings therein and coincidental to the formation in the web of shallow pockets conforming in shape generally to the shape and positions of the pockets to be molded in the web, and each said molding and shallow pocket forming being by vacuum drawing into molding pockets.

11. In a method of forming packages, the steps of feeding a heat sealable web step-by-step and horizontally while gripping the same at its marginal edges only, vacuum forming shallow pockets in a cluster of four over a pocketed hot plate to prepare the web for subsequent formation of deep pockets therein and for assuring all-over surface contact with said plate over the whole area of the web thereover, successively and at another position molding deep pocket clusters from the shallow pocket clusters with each said cluster defined in part by a peripheral wall portion and by longitudinal and transverse wall portions intersecting centrally to provide four contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the cluster through the contiguous corners thereof, depositing fill into the pockets of each deep pocketed cluster, applying a heat sealable cover web over the filled pocket clusters to lie flat over and spaced from each said depressed intersecting wall portion, heat sealing the cover web over each filled pocket cluster about the peripheral wall portion thereof and the longitudinal and transverse wall portions excepting the depressed intersecting wall portion, evacuating the pockets of each said filled cluster simultaneously through an orifice provided in its said depressed portion, and then completing the heat sealing at each depressed portion.

12. The method defined in claim 11 with the added steps of cutting each evacuated pocket cluster from the remainder of the web and into four individual packages by making a first cut across the transverse peripheral wall portion defining the trailing end of the last evacuated pocket cluster, a later second cut across the transverse wall portions between a leading pair of pockets and the trailing pair of pockets of the cut away cluster, and then longitudinally cutting to divide said leading and trailing pairs of pockets of said evacuated cluster to provide four individual packages.

13. A method as defined in claim 4 further characterized in that the package cluster is enclosed between a pocketed chamber conforming to the pockets of the cluster and which is closed by a flat cover, the chamber being evacuated simultaneously with the evacuation of the package cluster therein both above the cover web and beneath the packages in the pockets prior to the ring sealing and then vented to atmosphere above the cover web and beneath the packages in the pockets after said ring sealing to cause the cover web and pocketed web portions encasing the fill to conform to the shape of the fill.

14. In a method of forming packages, the steps of feeding a heat sealable web step-by-step and horizontally while gripping the same at its marginal edges only, heating a web portion over a hot plate to prepare the web portion for subsequent formation of deep pockets therein intended to receive fill presenting irregularly contoured external surface portions opposed to the fill containing web material, advancing the heated web portion from the hot plate to a pocket forming station and there vacuum forming deep pockets in the heated web portion and shaped to conform generally to the irregular surface portions to be presented therein, placing the fill in the pockets with its irregular surface portions generally opposing the comparable irregularly molded receiving surfaces in the pockets, covering the pockets with a covering web, partially heat sealing the webs together while leaving an evacuating opening and passageway, evacuating the pockets within an enclosure and also the enclosure exteriorly of and about the package, completing the heat sealing of the evacuated pockets, and venting the enclosure to bring about pressure conformity of the fill encasing web material without material tensioning of said web material because of said prior irregular molding of pocket surfaces intended to receive irregularly contoured external surface portions of the fill.

15. In a package forming machine, means for feeding a heat sealable web, means for successively molding clusters of pockets in the web with each cluster defined in part by a peripheral wall portion and by other wall portions intersecting centrally to provide contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the particular cluster through the contiguous corners thereof, the pockets of the clusters opening upwardly so that fill can be deposited therein, means for forming an evacuating orifice in the central molded depressed portion of each cluster of pockets, means for applying a heat sealable cover portion over the filled pockets of each cluster to lie flat over and spaced from its depressed intersecting wall portion, means for heat sealing each said cover portion over the pocket cluster covered thereby about the peripheral wall portion thereof and over said other wall portions except adjacent said depressed portion, means for evacuating the pockets of each thus covered pocket cluster simultaneously through its evacuating orifice and its depressed portion spaced away from the cover portion at the contiguous corners of the pockets, and means for completing the heat sealing of each filled and covered pocket cluster at its depressed center portion.

16. In a package forming machine, means for feeding a heat sealable web, means for successively molding clusters of pockets in the web with each cluster defined in part by a peripheral wall portion and by other wall portions intersecting centrally to provide contiguous pocket corners, the pockets of the clusters opening upwardly so that fill can be deposited therein, means for applying a heat sealable cover web over the filled pockets of each cluster, means for also molding one of the webs to provide therein recesses each shaped and disposed to be effective in communicating simultaneously into all of the contiguous pocket corners of a covered pocket cluster, means for forming evacuating orifices in one of the webs and disposed for cooperation with said recesses in said simultaneous communication with continguous pocket corners, means for heat sealing the cover web over each pocket cluster covered thereby about the peripheral wall portion thereof and over said other wall portions except at the location of said recesses, means for evacuating the pockets of each covered pocket cluster simultaneously through the particular orifice and cooperating recess, and means for completing the heat sealing of each pocket cluster at the location of the particular orifice and recess.

17. Package forming machine structure as defined in claim 16 wherein the heat seal completing means includes a ring sealer to seal about the particular orifice and another sealer to seal over the area of the particular recess.

18. Package forming machine structure as defined in claim 15 wherein the heat seal completing means includes a ring sealer to seal about the particular orifice and another sealer to seal over the area of the particular recess.

19. Package forming machine structure as defined in claim 15 wherein the web feeding means moves intermittently to feed the web in increments of the successively

molded clusters and includes devices for clamping the web at its margins and thus supporting the same and the formed pocket clusters as they are moved along step-by-step, and wherein the evacuating means includes a vacuumizing chamber comprising a stationary cover plate and a vertically reciprocable chamber bottom pocketed in conformity to the shaping of the pocket clusters and effective to receive each pocket cluster at the evacuating station and embrace it against said plate, the chamber pocketing also being defined by wall portions including a central depression receiving and conforming to the depression molded in each pocket cluster, and evacuating duct means for simultaneously communicating with the interiors of all packages of a cluster through the evacuating orifice and said molded pocket cluster depression.

20. Package forming machine structure as defined in claim **15** wherein the web feeding means moves intermittently to feed the web in increments of the successively molded clusters and includes devices for clamping the web at its margins and thus supporting the same and the formed pocket clusters as they are moved along step-by-step, and wherein the evacuating means includes a vacuumizing chamber comprising a stationary cover plate and a vertically reciprocable chamber bottom pocketed in conformity to the shaping of the pocket clusters and effective to receive each pocket cluster at the evacuating station and embrace it against said plate, the chamber pocketing also being defined by wall portions including a central depression receiving and conforming to the depression molded in each pocket cluster, and evacuating duct means for simultaneously communicating with the interiors of all packages of a cluster through the evacuating orifice and said molded pocket cluster depression, and other duct means opening into the chamber through the plate above the package cluster and into the chamber pockets beneath the package cluster therein.

21. Package forming machine structure as defined in claim **20** wherein the means for completing the heat sealing of each pocket cluster includes a vertically reciprocable ring sealer operable through an opening in the chamber plate and projecting through a sylphon bellows secured at one end to the reciprocable ring sealer and in sealing engagement at its other end on the chamber plate about said opening therein.

22. Package forming machine structure as defined in claim **20** wherein the means for completing the heat sealing of each pocket cluster includes a vertically reciprocable ring sealer operable through an opening in the chamber plate and projecting through a sylphon bellows secured at one end to the reciprocable ring sealer and in sealing engagement at its other end on the chamber plate about said opening therein, the ring sealer being reciprocable by cam means operable to move the ring sealer away from its seal contact position and spring means biasing the ring sealer toward the cam and said seal contact position, and there also being included an adjustable value spring means disposed to controllably counteract the combined effect of said biasing spring means and the effect of evacuation on the pressure engagement of the bellows on the ring sealer.

23. Package forming machine structure as defined in claim **15** wherein the web feeding means moves intermittently to feed the web in increments of the successively molded clusters and includes devices for clamping the web at its margins and thus supporting the same and the formed pocket clusters as they are moved along step-by-step, and wherein the evacuating means includes a vacuumizing chamber comprising a stationary cover plate and a vertically reciprocable chamber bottom pocketed in conformity to the shaping of the pocket clusters and effective to receive each pocket cluster at the evacuating station and embrace it against said plate, the chamber pocketing also being defined by wall portions including a central depression receiving and conforming to the depression molded in each pocket cluster, and evacuating duct means for simultaneously communicating with the interiors of all packages of a cluster through the evacuating orifice and said molded pocket cluster depression, said cover plate having thereon strip means disposed to reinforce it against objectionable deflection during evacuation and for engaging over still tacky initial seals at the pocket cluster perimeter and other wall portions for setting said seals.

24. Package forming machine structure as defined in claim **19** wherein means for completing the heat sealing of each pocket cluster includes a ring sealer operable through an opening in the chamber plate, and another sealer operable at another station and movable with the chamber bottom in position for engaging and sealing over the area of the particular pocket cluster depression which was not sealed while in the evacuating chamber means.

25. Package forming machine structure as defined in claim **19** wherein the evacuating duct means includes a tube movable with the reciprocable chamber bottom and carrying a cushion ring at its open upper end and disposed to support the central molded depression of each pocket cluster with its evacuating orifice centered thereon, and there also being included a gassing tube positioned in said first mentioned tube with its delivery end disposed below the level of said cushion ring and through which gas may be directed into the packages of a cluster within the chamber.

26. Package forming machine structure as defined in claim **19** wherein the evacuating duct means includes a tube movable with the reciprocable chamber bottom and carrying a cushion ring at its open upper end and disposed to support the central molded depression of each pocket cluster with its evacuating orifice centered thereon, and wherein the heat seal completing means includes a ring sealer operable through an opening in the chamber cover plate and in opposition to said cushion ring.

27. Package forming machine structure as defined in claim **19** wherein the evacuating duct means includes a tube movable with the reciprocable chamber bottom and carrying a cushion ring at its open upper end and disposed to support the central molded depression of each pocket cluster with its evacuating orifice centered thereon, and wherein the heat seal completing means includes a ring sealer operable through an opening in the chamber cover plate and in opposition to said cushion ring and another sealer movable with the chamber bottom and disposed to seal over the area of the particular pocket cluster depression but at a station beyond the evacuating chamber position.

28. Package forming machine structure as defined in claim **19** wherein the means for successively molding clusters of pockets in the web includes a pocketed mold the pockets in which have bottom molding surfaces conforming generally in shape to bottom shaping of fill to be deposited in the molded pockets, thereby to provide for a preshaping of the molded pocket bottoms to substantially conform to the fill portion which is to engage thereover.

29. Package forming machine structure as defined in claim **19** wherein the means for successively molding clusters of pockets in the web includes a pocketed mold the pockets in which have bottom molding surfaces conforming generally in shape to bottom shaping of fill to be deposited in the molded pockets, thereby to provide for a preshaping of the molded pocket bottoms to substantially conform to the fill portion which is to engage thereover, and wherein the evacuating chamber bottom pockets also have bottom surfaces conforming generally to the shaping of the package fill and the preshaped package bottoms engaged therewith.

30. Package forming machine structure as defined in claim **19** wherein the means for successively molding clusters of pockets in the web includes a pocketed mold the pockets in which have bottom molding surfaces conforming generally in shape to bottom shaping of fill to be deposited in the molded pockets, thereby to provide for a preshaping of the molded pocket bottoms to substantially

conform to the fill portion which is to engage thereover, and wherein the evacuating chamber bottom pockets also have bottom surfaces conforming generally to the shaping of the package fill and the preshaped package bottoms engaged therewith, said bottom molding surfaces in the pocketed mold and said bottom surfaces in the evacuating chamber bottom being provided on filler plates laid in the mold and chamber bottoms in position for having evacuation of the pockets in which they are laid take place thereabout.

31. In a package forming machine, means for feeding a heat sealable web, means for successively molding clusters of pockets in the web with each cluster defined in part by a peripheral wall portion and by other wall portions intersecting centrally to provide contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the particular cluster through the contiguous corners thereof, the pockets of the clusters opening upwardly so that fill can be deposited therein, means for forming an evacuating orifice in the central molded depressed portion of each cluster of pockets, means for applying a heat sealable cover portion over the filled pockets of each cluster to lie flat over and spaced from its depressed intersecting wall portion, there also being included means for vertically reciprocating the pocket cluster molding means between an elevated pocket molding position and a lowered out-of-the-way position permitting feeding away of the web and the pockets molded therein, said evacuating orifice forming means including a punch means movable upwardly and downwardly with the pocket cluster molding means.

32. In a package forming machine, means for feeding a heat sealable web, means for successively molding clusters of pockets in the web with each cluster defined in part by a peripheral wall portion and by other wall portions intersecting centrally to provide contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the particular cluster through the contiguous corners thereof, the pockets of the clusters opening upwardly so that fill can be deposited therein, means for forming an evacuating orifice in the central molded depressed portion of each cluster of pockets, means for applying a heat sealable cover portion over the filled pockets of each cluster to lie flat over and spaced from its depressed intersecting wall portion, there also being included means for vertically reciprocating the pocket cluster molding means between an elevated pocket molding position and a lowered out-of-the-way position permitting feeding away of the web and the pockets molded therein, said evacuating orifice forming means comprising a stripper foot closely overlying the web and having an aperture therethrough, a punch sleeve movable upwardly and downwardly with the pocket cluster molding means and through said foot aperture, and a punch sleeve cuttings displacing plunger mounted over the foot aperture and disposed to be telescoped by said sleeve.

33. Machine structure as defined in claim **22** wherein there are also included a common carrier for the pocket cluster molding means and the punch sleeve, and means for delivering punch cuttings away from the punch sleeve.

34. Machine structure as defined in claim **32** wherein the punch sleeve terminus disposed to telescope the plunger is provided with sharp angled punching teeth.

35. In a package forming machine, means for feeding a heat sealable web step-by-step and horizontally while gripping the same at its marginal edges only, means for molding pocket clusters in the web with each cluster defined by a peripheral wall portion and by longitudinal and transverse wall portions intersecting centrally to provide four contiguous pocket corners and with a depressed portion at each cluster wall portion intersection opening into all pockets of the cluster through the contiguous corners thereof, said pockets opening upwardly so that fill can be deposited therein, means for applying a heat sealable cover web over filled pocket clusters, means for providing an evacuating orifice in one of the webs at the location of each said depressed portion, means for heat sealing the cover web over each filled pocket cluster about all wall portions except over the depression, evacuating chamber means for enclosing each pocket cluster fed thereto, means for evacuating the chamber about the pocket cluster therein and also the pockets of each filled cluster through its orifice and depression, heat sealer means engageable with the webs about the orifice to seal the cluster pockets from the exterior at the orifice, means for venting the chamber to cause the cluster pockets to conform to the shape of the fill, and means for completing the heat sealing over the area of the cluster center depression.

36. Machine structure as defined in claim **35** including means for cutting each evacuated pocket cluster into side-by-side pairs of pockets on substantially straight transverse lines despite distortion of the webs due to the last evacuation and conformation of the webs to the fill shape incidental to venting, said last named means comprising a cutter for making a first cut across the transverse peripheral wall portion defining the trailing end of the last evacuated pocket cluster to separate the last evacuated pocket cluster from the remainder of the webs, and a cutter for making a later second cut across the transverse wall portions and now sealed depression area between a leading pair of pockets and the trailing pair of pockets of the cut away pocket cluster.

37. Machine structure as defined in claim **36** wherein the first and second cutters comprise cutter blades successively projected across the webs.

38. Machine structure as defined in claim **36** wherein the first and second cutters comprise cutter blades successively projected across the webs and mounted on a common carrier.

39. Package forming machine structure as defined in claim **16** wherein the web feeding means includes a pair of parallel spaced driven endless chains and clamps thereon disposed to grip the web at marginal edge portions, each said clamp including opposing separable gripper jaws one of which has a groove formed therein extending in the direction in which the web is fed and presenting a wrap lock shoulder and the opposing jaw including a portion disposed to press a web marginal edge portion in said groove to securely hold said web marginal edge portion adjacent said wrap lock shoulder and against pulling out of the clamp.

40. Package forming machine structure as defined in claim **19** and wherein said web feeding means includes a pair of parallel spaced driven endless chains and clamps thereon disposed to grip the web at marginal edge portions, each said clamp including opposing separable gripper jaws one of which constitutes a base jaw disposed to underlie the web marginal edge and having a groove formed therein extending in the direction in which the web is fed and presenting a wrap lock shoulder and the opposing jaw including a downwardly projecting end portion disposed to press the marginal edge portion of the web overlying said groove against the base jaw adjacent said wrap lock shoulder and secure it against pulling out of the clamp.

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