

[54] METHOD FOR EVACUATING PACKAGES

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[*] Notice: The portion of the term of this patent subsequent to Sept. 3, 1991, has been disclaimed.

[22] Filed: June 19, 1974

[21] Appl. No.: 480,907

Related U.S. Application Data

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[52] U.S. Cl. 53/22 B; 53/112 B

[51] Int. Cl.² B65B 31/02

[58] Field of Search 53/22 B, 86, 112 B

[56] References Cited

UNITED STATES PATENTS

3,832,824 9/1974 Burrell 53/22 B

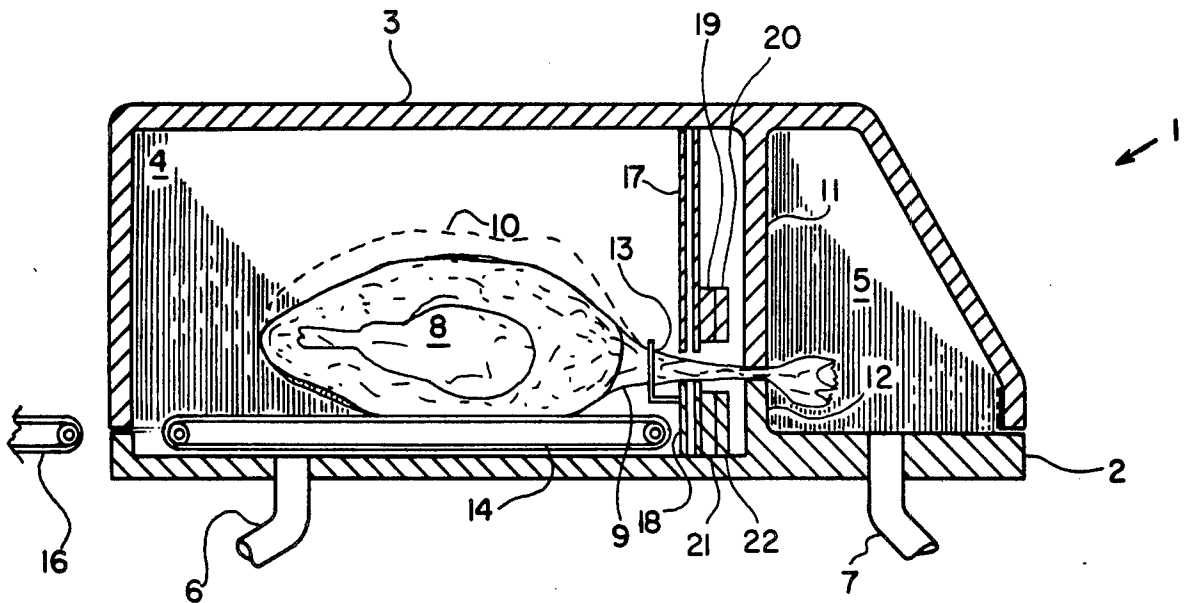
Primary Examiner—Travis S. McGehee

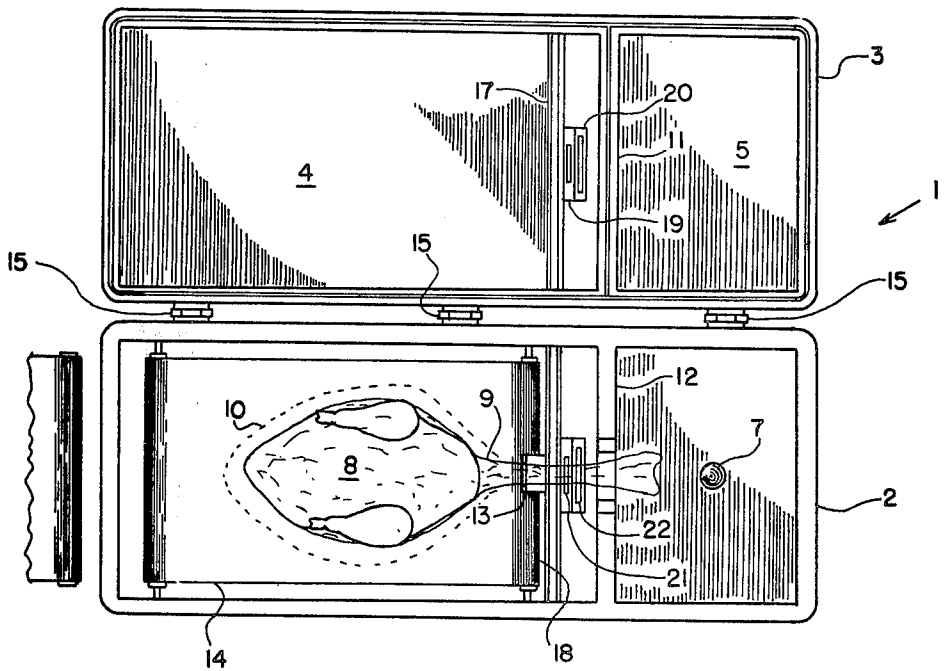
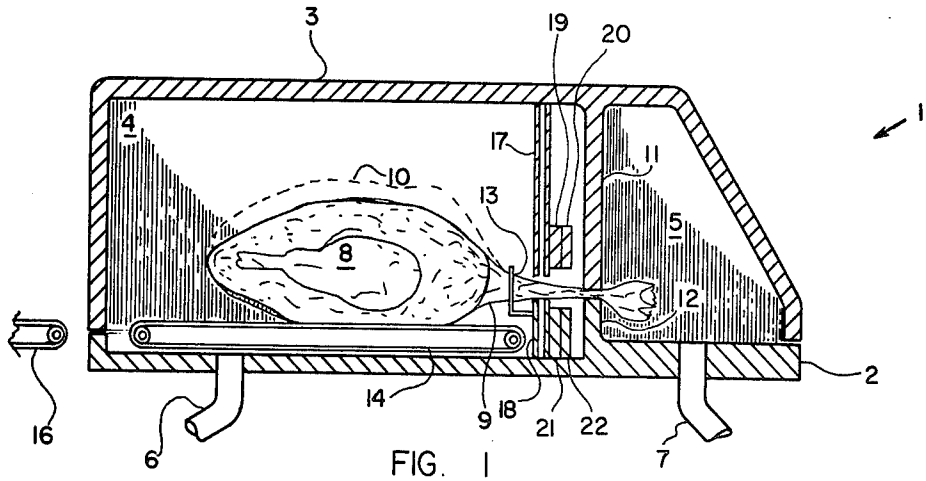
Attorney, Agent, or Firm—John J. Toney; William D. Lee, Jr.; Richard G. Jackson

[57] ABSTRACT

A filled flexible receptacle such as a thermoplastic bag containing a food product is evacuated by placing the filled portion of the bag in a first vacuum chamber; extending the neck of the bag into a second and adjacent chamber; evacuating the first chamber thereby causing the bag to balloon outwardly away from the product; and, while the first chamber is being evacuated, evacuating the second chamber and, consequently, evacuating the interior of the ballooned bag; thereafter, when evacuation of the bag is complete, elevating the pressure in the first chamber to collapse the bag firmly around the product and immediately closing the bag thereby making an evacuated package.

3 Claims, 8 Drawing Figures





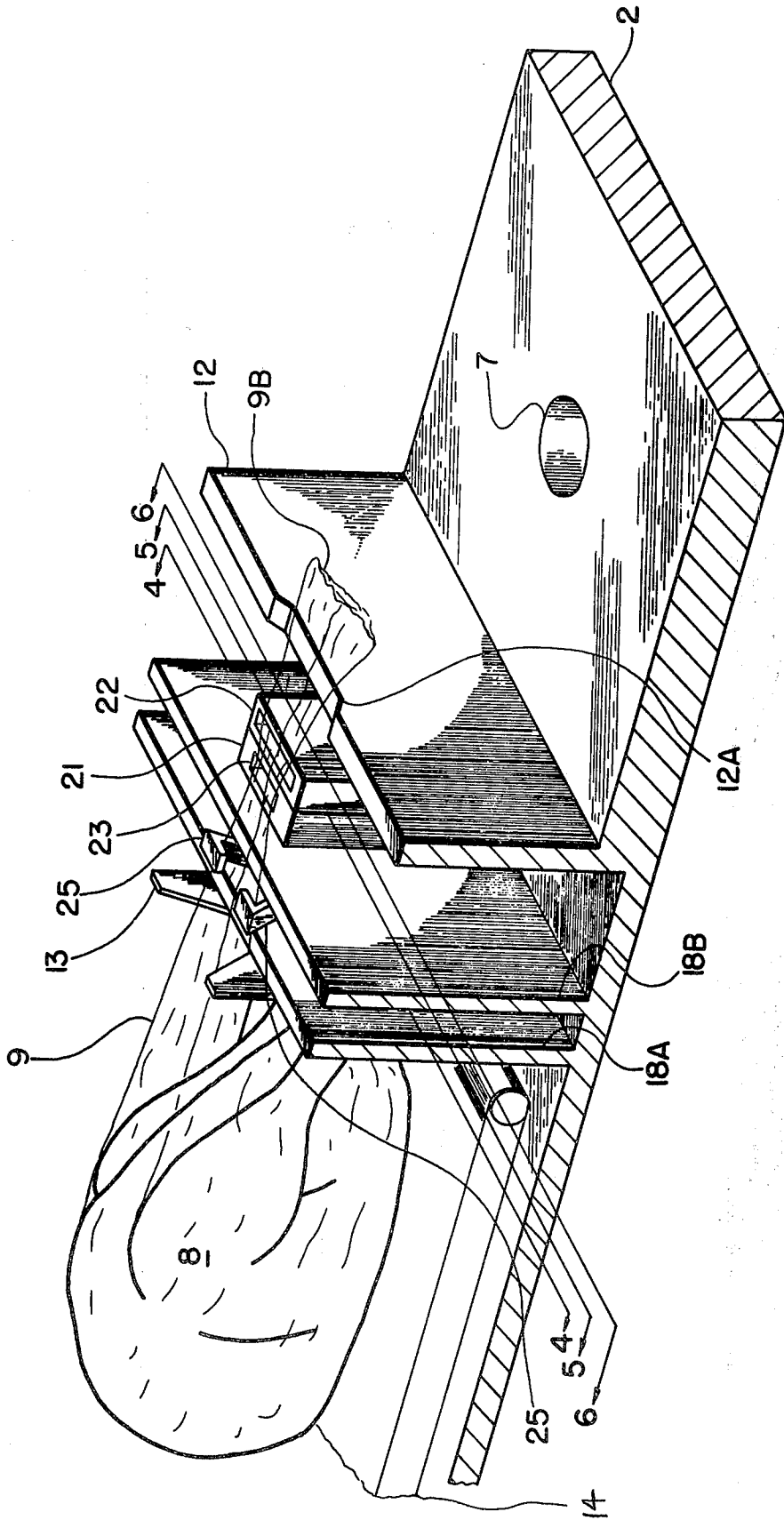


FIG. 3

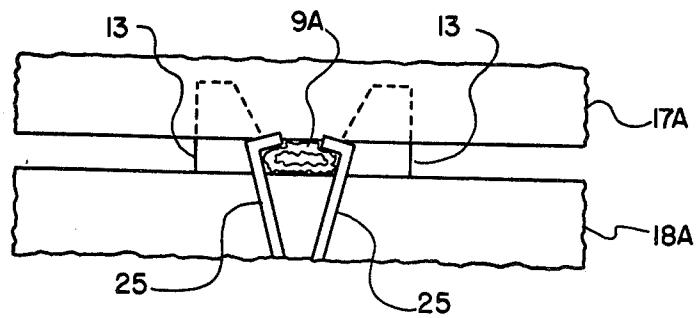


FIG. 4

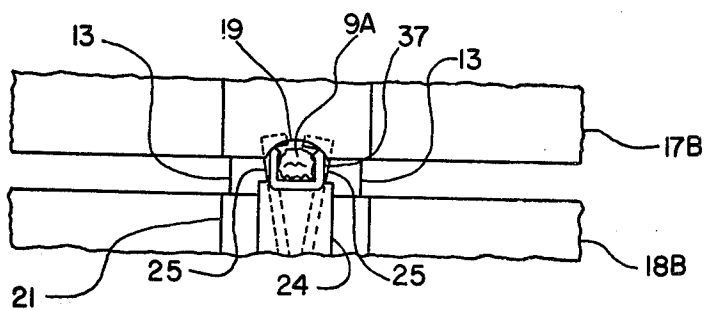


FIG. 5

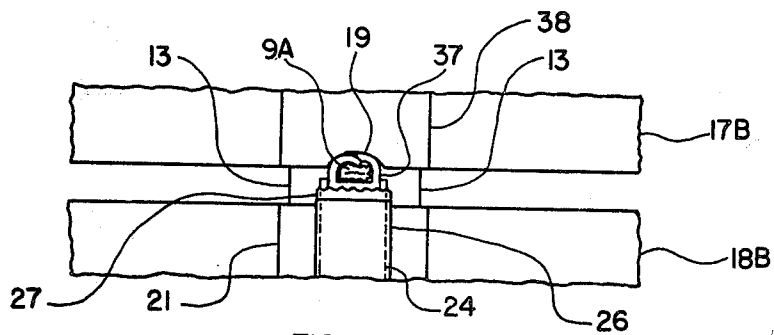


FIG. 6

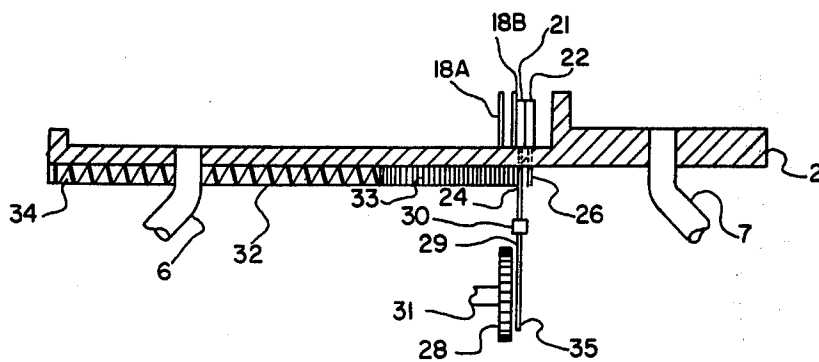


FIG. 7

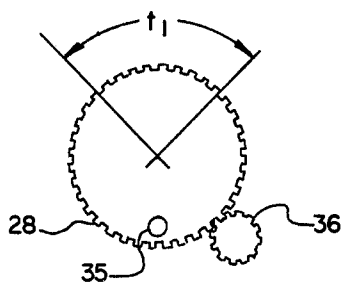


FIG. 8

METHOD FOR EVACUATING PACKAGES

This is a continuation of application Ser. No. 375,300 filed June 29, 1973.

FIELD OF THE INVENTION

This invention relates to a method and apparatus for evacuating receptacles, especially impervious, flexible receptacles such as thermoplastic bags and pouches. The invention has particular application in the vacuum packaging of fresh and frozen food products such as beef, poultry, ham, cheese, etc.

BACKGROUND OF THE INVENTION

A number of methods are available in the prior art for packaging food products such as meat and poultry in flexible containers such as thermoplastic packages and bags. In some processes the product is placed in a bag, a vacuumizing nozzle is then inserted into the bag, the mouth of the bag is gathered around the nozzle while the vacuum acting through the nozzle withdraws the air from the bag, and after evacuation is completed the bag is either clamped shut with a metal clip or heated welded shut. In this method complete evacuation of the bag is difficult to obtain because the meat product is usually damp and tends to cling to the bag wall so that surface crevices in the meat will form a pocket with the bag wall which blocks the passage of air out of the bag during the vacuumizing process. Accordingly, it is one object of the present invention to provide a method and apparatus for satisfactorily evacuating bags filled with meat products and the like.

Rather than insert a nozzle into a filled, impervious pouch or bag, other prior art methods employ a vacuum chamber into which a filled bag is placed in open condition. Subsequent evacuation of the chamber also evacuates the bag; and, before the chamber is opened, the bag is sealed or closed within the chamber. An apparatus for carrying out such a process is disclosed in U.S. Pat. No. 2,790,284 issued on Apr. 30, 1957 to P. B. Hultkrans. However, the immediately foregoing method still does not solve the problem of evacuation of a bag filled with a crevice containing product such as meat or poultry. Accordingly, it is another object of the present invention to provide a method and apparatus whereby a package filled with a product which tends to cling to the package wall may be evacuated and closed within a vacuum chamber.

Another prior art method and apparatus for evacuating a filled bag within a vacuum chamber is disclosed in U.S. Pat. No. 3,714,754 issued on Feb. 6, 1973 to Edward L. Holcombe et al. In the Holcombe et al. patent, the bag loaded with a product is placed in a vacuum chamber and the neck of the bag is clamped over an extractor which can withdraw vacuum from the bag independently of the vacuum applied within the chamber. However, this method requires the manual locating of the bag neck around the extractor tube and the manual clamping of the bag neck thereto. Accordingly, it is another object of the present invention to provide an independent means for evacuating a bag within a vacuum chamber which requires a minimum of manual handling and locating of the bag within the vacuum chamber.

The foregoing and other objects are achieved by the process and apparatus described below.

SUMMARY OF THE INVENTION

In one aspect, the present invention is a process of evacuating filled receptacles such as thermoplastic bags, pouches, and the like by placing the filled portion of the bag in a first vacuum chamber, extending the neck of the bag into a second and adjacent vacuum chamber, evacuating the first chamber thereby causing the bag to balloon outwardly away from the product; and, while said first chamber is being evacuated, evacuating the second chamber and, consequently, evacuating the interior of the balloned bag; thereafter when evacuation of the bag is complete, elevating the pressure in the first chamber to collapse the bag firmly around the product and immediately closing the bag thereby making an evacuated package.

In another aspect, the present invention is a process of evacuating and closing flexible, impervious receptacles such as pouches, bags, and the like which have at least one opening and contain at least one product, the process comprising the steps of confining the product containing a portion of the receptacle within a first region, confining a portion of the receptacle which contains the opening in a second region so that the interior of said receptacle is in communication with the second region through said opening of the receptacle, reducing the pressure within said first region and, subsequently, reducing the pressure within said second region so that the interior of the receptacle is evacuated, elevating the pressure in the first region, and, thereafter, closing the opening to make an evacuated package.

In still another aspect, the present invention is an apparatus for evacuating and closing flexible, impervious receptacles such as pouches, bags, and the like which have at least one opening and contain at least one product and the apparatus comprises a first vacuum chamber with a second vacuum chamber adjacent to it and an aperture connecting the two chambers for passing the portion of the receptacle containing an opening therethrough. Means to evacuate the first and second chambers and means to close the package when its evacuation is completed are included in the apparatus. Also, the closing means for the apparatus may be either a clip applying device or a heat seal apparatus located within one of the vacuum chambers.

The invention may be better understood by reference to the drawings described below and the following Description of the Preferred Embodiment.

DESCRIPTION OF THE DRAWINGS

In the drawings which are appended hereto and made a part of this disclosure;

FIG. 1 is a side elevational representation of a preferred apparatus according to the present invention in which the vacuum chambers of the apparatus are closed and a chamber wall is removed to show the interior arrangement;

FIG. 2 is a top plan view of the apparatus shown in FIG. 1 with both of said vacuum chambers open;

FIG. 3 is an isometric representation of a section of the lower portion of both of said vacuum chambers showing a filled package ready to be evacuated;

FIG. 4 is a representation in partial section showing the gathering arms of the preferred closing means of the preferred apparatus;

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FIG. 5 shows in partial section a clip being applied to a bag neck which has been gathered by the gathering arms shown in FIG. 4;

FIG. 6 shows the clip of FIG. 5 being closed around the gathered bag neck as the clip is forced into the clip anvil;

FIG. 7 is a sectional schematic side representation of the base of the vacuum chambers of the preferred embodiment showing the clip magazine and the clip punch and driving wheel; and,

FIG. 8 is a front elevational representation of the drive and timing wheel shown in FIG. 7.

DEFINITIONS

As used herein, the terms listed below will be understood to have the meaning set forth beside each term:

"Receptacle" means any container for receiving an article or product to be packaged in the receptacle and includes bags and pouches.

"Bag" means a receptacle or container constructed from tubular stock by sealing one end of the tube. A bag may be pleated or gusseted.

"Pouch" means a receptacle or container constructed from sheet stock. A single or multiple sheets may be used; and, commonly a pouch may be made by folding a single sheet and sealing the free edges of the sheet together.

"Aperture" means a hole in a wall that may be of any shape and includes slot, oval, circular, rectangular, and irregular shaped holes. An aperture may be formed by joining two wall sections that have indentations in one or both of the surfaces so joined.

"Vacuum" means a pressure level lower than atmospheric pressure and may be expressed in lbs./sq.in. or in inches of Hg. A "high" vacuum means a very low pressure level.

"Heat shrinkable" means that the particular material referred to will shrink upon the application of heat.

"Heat sealable" means that the particular material referred to can be welded to itself under the influence of temperature and pressure.

"Opening" in a receptacle means a passageway from the exterior of the receptacle to the interior; and, in the case of a bag, the "opening" can be the bag's mouth and the part of the bag containing the "opening" would be the bag's neck.

PREFERRED EMBODIMENT

In FIG. 1, a double chamber vacuumizing apparatus 1 is shown in a side elevational representation with the side wall of the apparatus cut away so that the interior arrangement may be clearly seen. Also, reference will be made to FIG. 2 which is a top plan view of the apparatus of FIG. 1 with the hinged cover or head 3 being open. The cover 3 is hinged to base member 2 which is divided by lower chamber divider wall 12 which cooperates with the upper divider wall 11 to separate apparatus 1 into the two chambers or regions 4 and 5. The first and larger region or chamber 4 is the product chamber in which the portion of a bag or receptacle 9 containing a product 8 is placed on product conveyor 14. The receptacle opening or bag neck is extended into the second and smaller region 5 which serves as the receptacle or bag evacuation chamber. The second chamber 5 is evacuated through vacuum port 7 and the first chamber 4 is evacuated through vacuum port 6.

Looking now at FIG. 3, the extension of the neck of bag 9 from the first chamber 4 into the second chamber

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5 can be more clearly seen. The operator of the apparatus 1 receives the bag 9 filled with a product 8 and places the bag on the conveyor 14 and brings the neck of the bag down through the bag neck guide 13 and extends the neck of the bag across walls 18a and 18b of the gathering arm track 18, across plunger housing 21, cutter housing 22, and the recess 12a in wall 12 so that the opening 9b of the package is located in the second region or chamber 5 just above the evacuation port 7. The recess 12a in the wall 12 forms the lower half of the aperture in the wall which divides chambers 4 and 5 and this aperture and wall is completed when the cover 3 is rotated into the position shown in FIG. 1 so that a corresponding recess in wall 11 forms the upper half of the divider wall aperture.

Once the chamber is closed evacuation of chamber 4 begins through vacuum port 6. Any conventional vacuum pump which is well known in the art may be used and be connected to vacuum port 6 to evacuate chamber 4. As vacuum is applied the chamber will be evacuated very rapidly, in the order of two to three seconds to a low level of pressure or around 27 inches of Hg. and further reduction in pressure takes a significantly longer period of time. The bag neck sufficiently fills the aperture between chambers 4 and 5 so that very little air is leaked from the second region 5 into the first region 4 during this phase of evacuation. In this initial phase, the bag 9 will balloon outwardly as shown by dotted lines 10 because of the difference in pressure between the interior of the bag 9 and the chamber 4. This outward expansion or ballooning of the bag also occurs in the bag's neck region and the expanded neck further seals the aperture between chambers 4 and 5. While the bag is ballooned into shape 10, evacuation of the second region or chamber 5 is begun. This will usually be of the order of ½ sec. after the beginning of the evacuation of chamber 4. Chiefly because of its smaller size, the evacuation of the second chamber 5 proceeds at a more rapid rate than that of first chamber 4 and overtakes the vacuum level in first chamber 4 thus causing the ballooned bag 10 to begin to collapse back onto product 8. The second chamber 5 will reach a vacuum level of 28 inches of Hg. or lower depending on the period of time vacuum is supplied through port 7. As the vacuum level in the second chamber 5 is reduced below that in chamber 4 and the bag 9 begins to collapse back upon the product 8, atmospheric pressure is restored in chamber 4 by stopping the vacuum pumping action through port 6 and venting the chamber to the atmosphere by valve means which are not shown. This sudden increase in the pressure differential between the inside and outside of the bag will cause the bag to collapse rather rapidly and suddenly driving out any remaining air. Immediately as this takes place, the bag is clipped and closed as will be described more fully hereinafter.

Once the bag is clipped and closed, the excess bag neck material is trimmed off and the head or cover 3 is opened and conveyor 14 will start up and deliver the sealed bag to conveyor 16 while the operator is preparing to place another filled bag within apparatus 1 to begin the process again.

When, as described above, the bag balloons outwardly to the shape 10 the bag wall is separated from the product 8 and any crevices or cavities in the product are exposed to the space which now exists between product 8 and the expanded bag wall 10. Thus, when evacuation of the second chamber 5 begins, a continu-

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ous passageway exists whereby a substantial portion of the surface of the product 8 is brought directly under the influence of the vacuum being drawn through second chamber 5.

A preferred package or bag closing and sealing means is illustrated in FIGS. 3 - 7. FIG. 4 is a view in partial section looking along the direction of lines 4-4 of FIG. 3. This view is from between walls 18a and 18b of the lower gathering arm guide track 18 and between walls 17a and 17b of the upper gathering arm track 17. In FIG. 4 bag neck 9a is shown partially compressed between the bag neck guide 13 and walls 17a and 18a. Gathering arms 25 move inwardly towards each other to further compress the bag neck 8 into the shape shown in FIG. 5. As the gathering arms 25 have moved more closely together to wedge the bag neck 9a into a smaller space, plunger 24 drives clip 37 up around the gathered bag neck 9a and forces the clip towards anvil 19. Further motion of the plunger forces the clip into the anvil 19 and bends it into the shape shown in FIG. 6 securely around the bag neck 19 thereby closing and sealing same. As this is completed cutter arm 26 with serrated cutter blade 27 is driven upwardly to cut off the excess bag material which extends beyond clip 37. The clip 37 is taken from the group of clips 33 contained in clip magazine 32 shown in FIG. 7. The clips 33 are urged forward in the magazine 32 under the influence of clip spring 34 and are delivered to plunger 24 immediately below plunger housing 21. Plunger 24 is connected to plunger crank arm 29 at pivot 30, and crank arm 29 is driven by timing wheel 28 to which it is connected by crank pin 35.

Cutter arm 26 is driven upwardly through cutter housing 22 to sever the excess bag neck material and the drive means for cutter arm 26 is not shown but may be a pneumatically operated cylinder or an electrically driven solenoid, both of which drive means are well known in the art.

An alternate method and means for closing a package or bag after evacuation is to remove the bag neck guide 13 shown in FIG. 3 and widen the aperture opening 12a to correspond to the width of the flattened bag neck. The clip applying means may be eliminated in this alternate closure means and a sealing bar may be substituted for the blade 27 with the sealing bar being the same width as the aperture 12a. Bar 27 may be electrically resistance heated and a pressure backing member may be substituted for the cutter track 38 as shown in FIG. 6 so that when the arm 26 is driven upwardly after the evacuation of the bag the heated bar 27 will contact the flattened bag neck 9a and press same against the pressure backing member 38. The bar would dwell sufficiently long in its position of pressing the bag neck against the backing member 38 until the bag is sealed to itself. Of course, for this alternate method and means to be employed the bag material must be of a type that will weld to itself under the influence of heat and the thermoplastic materials such as polyethylene, ethylene vinyl acetate copolymers, saran, and the like with the appropriate coatings and surface treatments are suitable for this purpose.

FIG. 8 is a frontal view of the plunger drive wheel 28 which is driven by pinion 36 which, in turn, is driven by a conventional electrical motor which is not shown. Crank pin 35 is connected to plunger crank 29 and at the beginning of each cycle crank pin 35 is at bottom dead center of the wheel. The time represented by t_1 is the time from the beginning of the clip's engagement

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with the anvil to the end of the engagement as the plunger withdraws. Referring also to FIG. 7, timing cams may be placed on shaft 31 on which wheel 28 is mounted and these cams can be used to control such functions as the venting of the chambers to atmosphere as the clipping and cutting cycle is completed.

Referring now to FIGS. 1 - 8, a semi-automatic operation of the foregoing described apparatus according to the process of the present invention will be described. In the following description valves, cams, a timer, vacuum pump, pressure sensor, etc. are mentioned. None of these are shown in the drawings and each is a conventional item whose use and application is familiar to those skilled in the packaging machinery arts. The packaging cycle begins when the operator manually places a filled bag into first chamber 4 and extends the neck into second chamber 5. The operator then closes the chambers with cover 3 and the closing actuates a microswitch which starts a timer and opens the valve to port 6 so that a vacuum pump can evacuate chamber 4. At a predetermined time, preferably of the order of $\frac{1}{2}$ or $\frac{3}{8}$ of a second after the evacuation of the first chamber has begun depending on the size of the chamber and power of the vacuum pump, the evacuation of the second chamber is started by the timer opening the valve connecting port 7 with the vacuum pump. During this time ballooning of the bag 9 to shape 10 will have occurred. When the pressure in the first chamber reaches a preset level, preferably about 26 or 27 in. Hg., a pressure sensor in the first chamber shuts off the vacuum in the first chamber and simultaneously sends a signal through a delay timer to the electric drive motor for pinion 36. At this point, the timing and drive wheel 28 is at the position shown in FIG. 8 with the crank pin at bottom dead center. The timed signal can be preset for any given duration and is preferably about $1\frac{1}{2}$ seconds which means that wheel 28 will start to make one complete revolution at the end of that preset period of time. Timing cams are located on the supporting shaft or axle 31 of wheel 28 and as wheel 28 rotates in a counterclockwise manner (FIG. 8) one of the cams will actuate a valve causing the first chamber to vent to atmosphere prior to reaching time span t_1 . Venting the first chamber to atmosphere causes the bag 9 to collapse or, rather, be violently pushed against the product since the bag interior is at the pressure level of the second chamber which now will have reached lower than 28 in. Hg. This violent collapsing of the bag drives out any residual air in the bag immediately before the gathering and clipping cycle begins with time span t_1 . During t_1 , the bag neck is gathered and the clipper plunger 24 drives clip 37 into position around the gathered bag to seal and close same. Following withdrawal of the plunger and trimming of the bag neck at the end of t_1 , a second cam shuts off the vacuum to the second chamber and vents that chamber to the atmosphere. The cover 3 may now be raised and while the operator is getting another filled bag ready, conveyor 14 moves the completed package to exit conveyor 16.

It is to be understood that the present invention is not limited to bags and pouches but can be applied generally to any receptacle whose walls will flex outwardly under the influence of a pressure differential and will conform to a wall aperture. Furthermore, as set forth above, the shape of the wall aperture may be made to conform to the shape of the receptacle opening and to the closing and sealing method desired.

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One particularly desirable package results from the process and apparatus of this invention when a meat or poultry product is enclosed in a heat shrinkable, essentially gas impervious, thermoplastic bag. After the meat product has been sealed in the bag and the resulting package conveyed out of the apparatus, the package is passed through either a hot water bath or through a hot air tunnel to shrink and further tighten the bag material around the product. The tight grip of the shrunken material protects the product from pinhole leakage because the material is so firmly pressed against the product that even when a hole or cut occurs the hole is essentially sealed by the adjacent or exposed portion of the product so that no air can enter the package.

I claim:

1. In the process of evacuating filled thermoplastic bags, pouches, and the like, the improvement which comprises:

- a. providing adjacent first and second vacuum chambers with an aperture connecting said chambers;
- b. placing the filled portion of the bag in the first vacuum chamber,
- c. extending the neck of the bag into the second and adjacent vacuum chamber, said bag neck passing through said aperture whereby the mouth of said bag is unrestrained and open within the second chamber,
- d. evacuating the first chamber; and, subsequently,

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- e. evacuating the second chamber at a more rapid rate than said first chamber is evacuated, thereby evacuating said bag,
- f. stopping the evacuation of the said chambers when the evacuation of the second is completed,
- g. closing and sealing said bag; and,
- h. removing said sealed bag from said first chamber.

2. The process of claim 1 wherein said sealed bag is removed from said first chamber and delivered to a conveying means.

3. A process of evacuating and closing flexible, impervious receptacles such as pouches, bags and the like which have at least one opening and contain at least one product comprising the steps of:

- a. confining the product containing portion of said receptacle within a first region;
- b. confining a portion of the receptacle which contains said opening in a second region so that the interior of said receptacle is in communication with said second region through said opening;
- c. reducing the pressure within said first region thereby causing at least a part of said receptacle to move outwardly away from contact with said product; and, subsequently,
- d. reducing the pressure within said second region to evacuate the interior of said receptacle so that the receptacle again contacts the product; and,
- e. closing said opening thereby making an evacuated, sealed, package.

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