June 30, 1959 H. W. LA BRANCHE 2,892,294

PACKAGING APPARATUS AND METHOD

Filed March 1, 1957 3 Sheets-Sheet 1

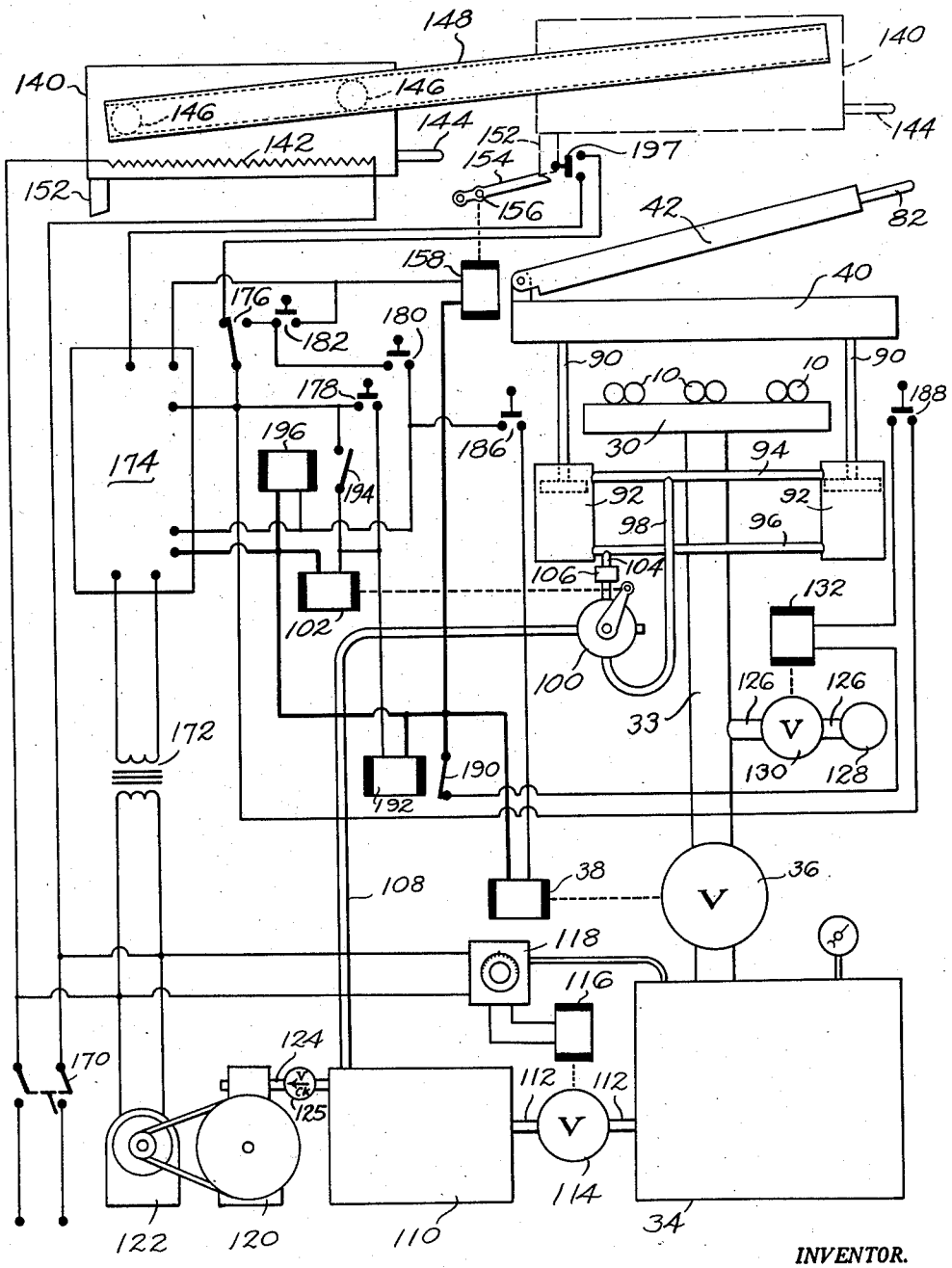


Fig. 1.

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Filed March 1, 1957 3 Sheets-Sheet 2

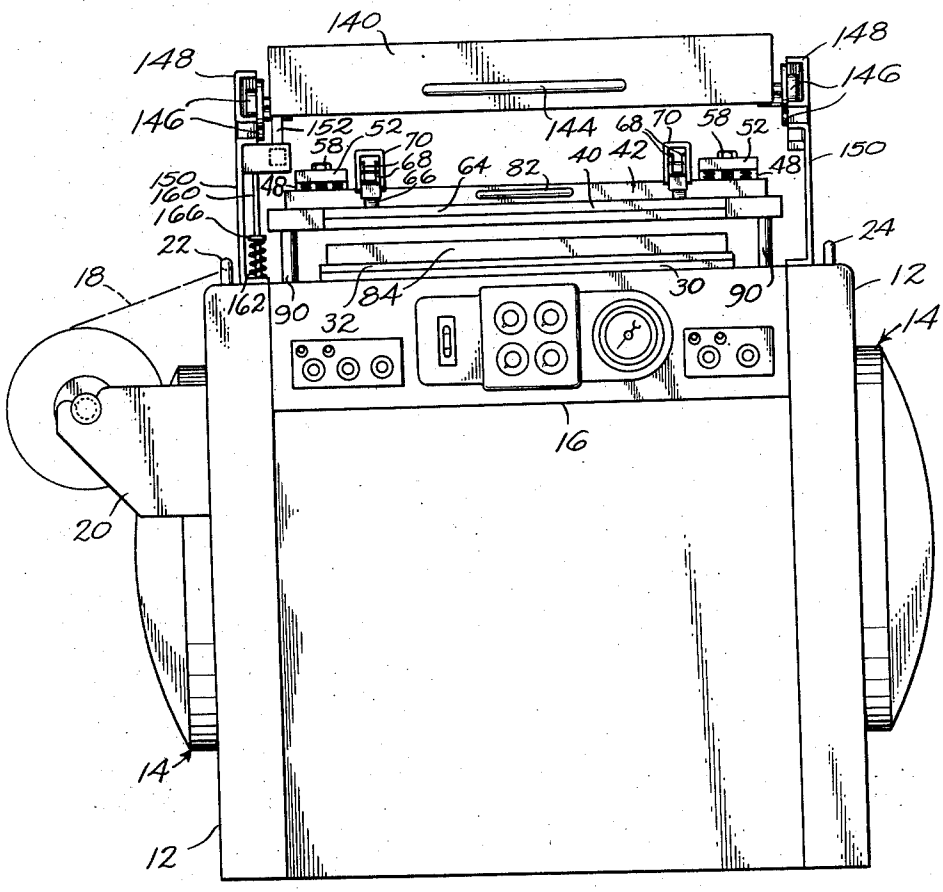


Fig. 2.

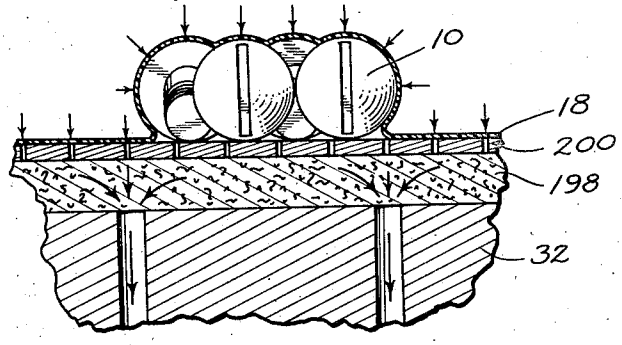


Fig. 7.

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PACKAGING APPARATUS AND METHOD

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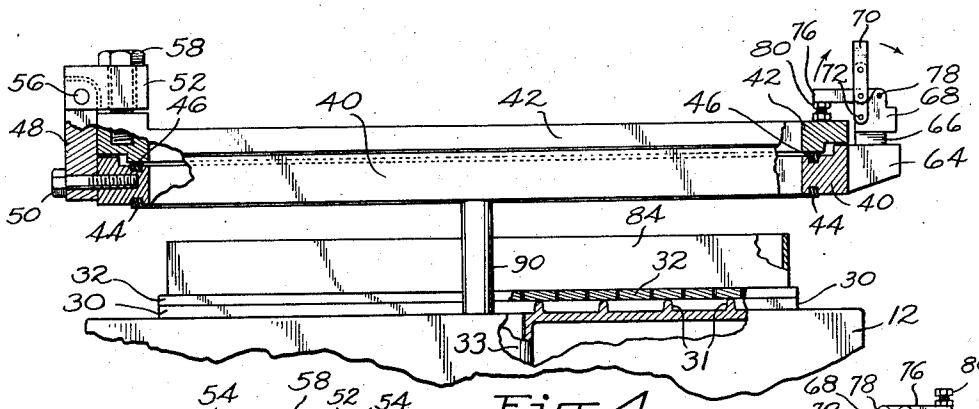


Fig. 4

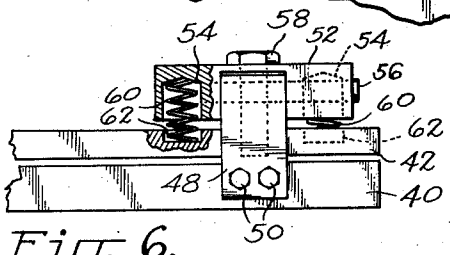


Fig. 6.

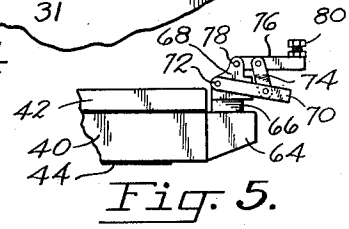


Fig. 5.

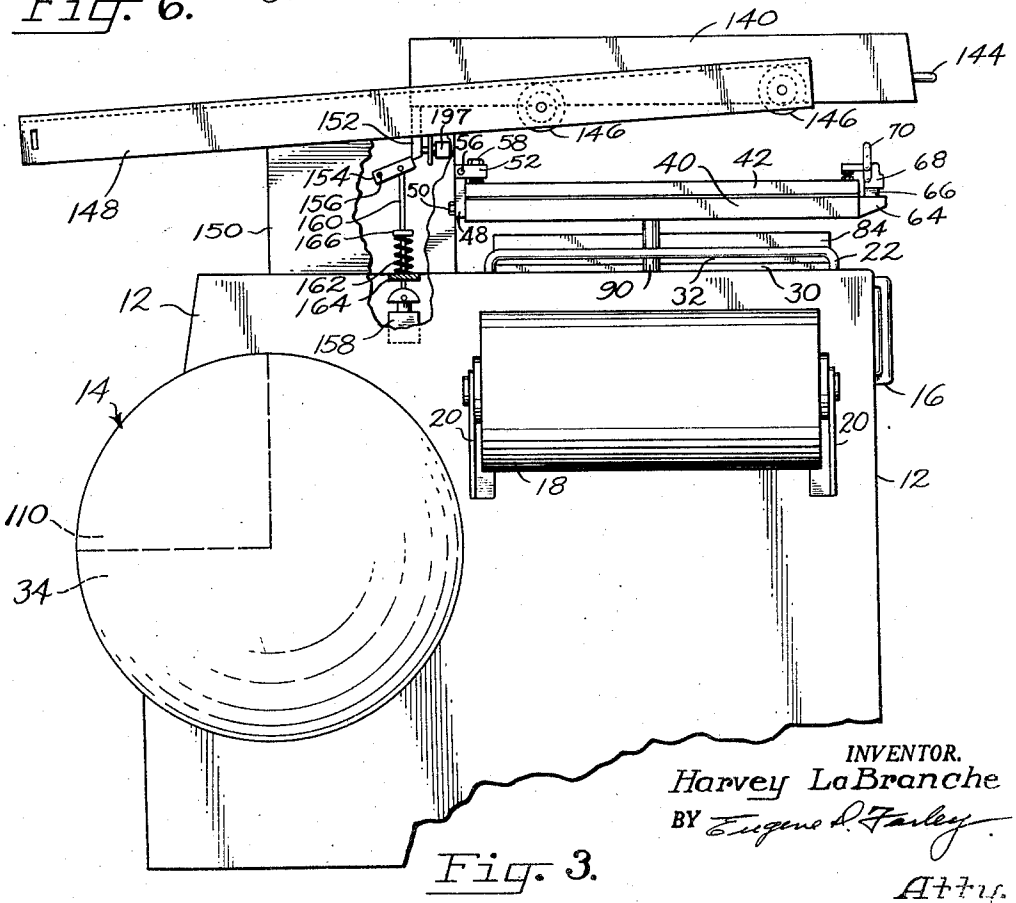


Fig. 3.

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2,892,294

PACKAGING APPARATUS AND METHOD

Harvey W. La Branche, Tacoma, Wash., assignor to Washington Steel Products, Inc., Tacoma, Wash., a corporation of Washington

Application March 1, 1957, Serial No. 643,355

13 Claims. (Cl. 53—112)

This invention relates to apparatus and method for packaging articles in a thermoplastic sheet preliminary to storing, shipping and selling them.

For efficient plant operation the apparatus and method employed for packaging articles in a thermoplastic sheet should meet several important requirements. For example, the apparatus should be adaptable for use with both drape-forming and vacuum-forming techniques. It should be applicable interchangeably to the packaging of large articles and small articles.

Still further, the apparatus should be adjustable to accommodate plastic sheets of varying thickness and physical properties. It should be possible to package the articles on a backing sheet, when desired, in order to lend rigidity and strength to the final package. The apparatus should be operable manually or automatically at the will of the operator in order to operate the apparatus initially on an experimental scale to work out suitable conditions for packaging particular articles with plastic sheets of given properties, and thereafter to set the apparatus for packaging the articles automatically under the predetermined optimum conditions.

It also is desirable to provide apparatus wherein the articles being packaged are clearly visible to the operator and wherein the operator is protected from injury. Furthermore, the rate of plastic pull-down during the forming operation should be controllable so that it will not pull the articles out of position as it is molded about them, nor will it be unduly stretched during the molding operation. Also, it is highly desirable that the vacuum applied be variable to accommodate fragile articles which would not stand full atmospheric pressure during the packaging procedure.

It is the general object of the present invention to provide packaging apparatus and method which meets all of the foregoing requirements but which nevertheless is of simple, inexpensive, construction so that it may be purchased, used, and serviced at low cost.

The manner in which the foregoing and other objects of this invention are accomplished will be apparent from the accompanying specification and claims considered together with the drawings, wherein:

Fig. 1 is a diagrammatic view of the herein described packaging apparatus including a diagram of the electric circuit by which it is operated;

Fig. 2 is a view in front elevation of the herein described packaging apparatus;

Fig. 3 is a view in side elevation of the herein described packaging apparatus;

Fig. 4 is a detail view, partly in section, depicting in side elevation the means employed for positioning the articles and plastic sheet relative to each other for packing the articles with the sheet;

Fig. 5 is a detail view in side elevation of an adjustable clamp employed for holding the plastic sheet in the holding means of Fig. 4;

Fig. 6 is a detail view, partly in section, of means employed for adjusting the clamping assembly to receive plastic sheets of varying thickness; and

Fig. 7 is a fragmentary enlarged sectional view illustrating the manner of applying the presently described packaging apparatus and method to the packaging of articles on an adhesive covered, porous, backing sheet.

Generally stated, the herein described packaging apparatus comprises a perforated support for the articles, clamping means for clamping a thermoplastic sheet across the articles, heating means positioned on the side remote from the articles for softening the sheet, means for moving the softened sheet and the articles relative to each other for draping the sheet about the articles, differential air pressure means communicating with the perforations on the support for applying differential air pressure, preferably vacuum, to the softened draped sheet, thereby forming it about the articles and means for cooling the soft, formed sheet about the articles to form the final rigid package.

Application of the foregoing apparatus makes possible the effectuation of a novel packaging method which comprises placing a thermoplastic sheet across the articles to be packaged, softening the sheet, draping the softened sheet about the articles, and then applying differential air pressure to form the softened, draped sheet about the articles to form the final package. It also makes possible effectuation of a method applicable where a rigid package is required and comprising the steps of placing the articles to be packaged on a porous backing sheet such as a sheet of cardboard or other fibrous material having thereover a perforated layer of thermosensitive adhesive, superimposing a thermoplastic sheet above the articles and the backing sheet, heat softening the thermoplastic sheet, and molding the plastic sheet about the articles while pressing it against the adhesive on the backing sheet, thereby encasing the articles and adherently uniting the packaging sheet to the backing sheet.

Considering the foregoing in greater detail and with particular reference to the drawings:

The forming chamber

The herein described packaging apparatus and method may be applied to the covering or packaging of a wide variety of items. It may be applied, for example, to the packaging of such items as knives, can openers, bottle caps, hinges, drawer pulls, door knobs, clusters of screws and nails, etc. In the presently described embodiment it is illustrated in connection with the packaging of a plurality of screws **10** arranged in clusters.

The articles are packaged in apparatus mounted in a housing **12** which is built around and rigidified by a compartmented vacuum tank **14**. An instrument panel **16** is located at the front of the apparatus. A roll of the thermoplastic sheet material **18** is rotatably mounted in brackets **20** on one side of the apparatus, guides **22, 24** being placed on opposite sides of the apparatus for guiding the plastic sheet. The apparatus thus is made operable from either direction by mounting brackets **20** on one side or the other, as required by the direction of material flow in the plant.

The articles to be packaged are located over a vacuum box **30**, the floor of which is provided with discontinuous spacers **31** which support a perforated plate **32**. The perforations in this plate are arranged in any desired pattern as required to form the plastic sheet about the articles. Also, the plate may either be flat, as where a general purpose packaging operation is contemplated, or provided with locating projections suitable for use in placing specific articles in proper position on the plate.

Vacuum box **30** communicates with a conduit **33** (Fig.

1). This conduit communicates with vacuum tank **34**, which is one of the compartments of tank **14**, through a two-way valve **36** operated by solenoid **38**.

The sheet clamping unit

Thermoplastic sheet **18** may be clamped across articles **10** as they rest on plate **32** by means of an assembly, the construction of which is particularly apparent from a consideration of Figs. 4–6. Thus it comprises a lower rectangular frame member **40** and a registering upper rectangular frame member **42**. A sealing ring **44** made of rubber or other suitable material is provided on the under surface of lower frame member **40**. Another sealing ring **46** is provided on the upper surface thereof. Accordingly when the clamping frame is placed on the top of housing **12**, a sealed vacuum molding chamber is formed which is defined by plate **32**, lower clamping frame member **40**, and plastic sheet **18**.

The upper clamping frame member **42** is hinged to the lower member by an assembly which permits adjustment of the space between the two frame members to accommodate plastic sheets of varying thickness. Accordingly, there are provided two or more spaced standards **48** bolted onto lower frame member **40** by means of bolts **50**. A cross piece **52** having on its underside a pair of spaced recesses **54** is pivotally connected to each standard by means of pivot pin **56**.

A bolt **58** penetrates an opening in cross piece **52** and is threaded into the top of upper frame member **42**, a sliding fit being present between the shank of the bolt and the bore of the opening through the cross piece. Compression springs **60** are contained in recesses **54** in the cross piece and in registering recesses **62** in upper frame member **42**. Accordingly it will be apparent that the upper frame member is forced against lower frame member **40** by compression springs **60**, while bolts **58** prevent horizontal motion of the upper frame relative to the lower frame. The arrangement thus provided adjusts to accommodate varying thicknesses of plastic material between the frames by further compression of springs **60**. Accordingly, sufficient pressure is exerted against the lightest materials to form an air seal between the plastic sheet and sealing ring **46**. Heavier material compresses the springs further, developing greater sealing pressure.

The front side of the clamping frame is provided with latching means which also may be adjusted to accommodate plastic sheets of varying thickness. The construction of the latch employed is illustrated particularly in Figs. 2, 4 and 5.

Each latch is mounted on an extension **64** of lower frame member **40**. It includes a base **66** upon which are mounted a pair of spaced plates **68**.

A U-shaped lever arm **70** is pivotally connected to the plates by means of pin **72**. Lever arm **70** is connected through pivoting links **74** to a bar **76** which is pivotally mounted between plates **68** by means of pin **78**. A bolt **80** is threaded into the outer end of bar **76**.

The relationship of lever arm **70**, links **74** and bar **76** is such that when the assembly is shifted from the position of Fig. 5 to that of Fig. 4, a toggle action occurs which holds the head of bolt **80** firmly against the upper surface of upper frame member **42**, thus clamping it against the lower frame member. In addition, by adjusting bolt **80** the degree of pressure, or the spacing between the two frame members, may be adjusted to accommodate plastic sheets of varying thickness.

The clamping frame assembly also includes a handle **82** and a mold box segment **84**. The latter is rectangular in shape and may be placed on plate **32** inside frame sections **40**, **42** when it is desired to provide a mold box of substantial depth. This may be desirable, for example, when the plastic sheet is to be drawn into female molds placed on plate **32**.

The vacuum system

Means are provided for reciprocating the clamping frame assembly between an elevated position wherein it is spaced apart from plate **32**, which supports the articles to be packaged, and a lowered position wherein it is in sealing engagement with the plate and forms a mold box about the articles. To this end, it may be supported on the piston rods **90** of vacuum operated cylinders **92**.

These cylinders are connected to a source of vacuum by a system including conduit **94** which interconnects the cylinders above the pistons therein, and a conduit **96** which interconnects the cylinders below the pistons. Conduit **94** connects with a conduit **98** which leads to a four-way valve **100** operated by means of a solenoid **102**. Conduit **96** connects with a conduit **104** which includes one-way throttle valve **106** and also connects with four-way valve **100**. Valve **100** is connected to a source of vacuum by means of conduit **108** which communicates with vacuum tank **110**. This tank in turn is one of the compartments of tank **14** about which the frame of the apparatus is built.

Tank **34**, which exhausts vacuum chamber **30**, and tank **110**, which drives cylinders **92**, are interconnected through line **112**. This line includes a valve **114** operated by solenoid **116** and adjusted by switch **118**. Tanks **34**, **110** thus may be evacuated by a common vacuum pump **120** driven by motor **122** and communicating with tank **110** through conduit **124**, which includes check valve **125**.

The foregoing arrangement makes it possible to apply full vacuum to cylinders **92** while applying only a partial vacuum to vacuum chamber **30**, as may be required by the fragile character of articles **10** being packaged which may not be able to withstand full atmospheric pressure. It also makes possible, by setting valve **114**, variation of the vacuum pressure applied to chamber **30** to suit the needs of various classes of articles.

Still further, inclusion of throttle valve **106** in the line to cylinders **92** makes possible retracting the cylinders at a relatively slow rate while advancing them rapidly. This is desirable since if the cylinders are retracted too rapidly, articles **10** on the supporting plate may be jarred out of position. Still further, the herein described vacuum circuit insures that the clamping frame assembly will have a uniform, positive action over a prolonged period of operation in spite of the fact that variable degrees of vacuum may be applied to vacuum chamber **30**.

Means also are present for introducing air into vacuum chamber **30** at the conclusion of a forming cycle. The air thus introduced may be at atmospheric or elevated pressure, as desired. It is introduced through conduit **126** which connects conduit **33** with a source of air **128**. A two-way valve **130** operated by means of solenoid **132** is included in the line for turning the air supply on and off at the proper time.

The heating assembly

The heating assembly employed for heat-softening the plastic sheet clamped in the clamping frame is indicated at **140**. It mounts a heating element **142** and is provided with a handle **144**.

The heater is reciprocatable between a retracted position, wherein it is removed from the vacuum forming unit, and an advanced position, wherein it is stationed opposite the clamping frame unit thereof for softening the plastic. To this end a plurality of flanged wheels **146** are rotatably mounted on the sides of the heater. These rides in tracks **148**.

Tracks **148** may comprise a pair of opposed channel irons mounted on brackets **150** extending upwardly from housing **12** of the unit so that the heater may be advanced against the force of gravity and then permitted to return to its retracted position gravitationally. To maintain it in its advanced position for a desired period of time it is provided with a finger **152** which engages a latch **154** when the heater is advanced. Latch **154** is pivotally

mounted on a pin **156** and may be released by the action of a solenoid **158**.

The construction of latch **154** is illustrated in greater detail in Fig. 3. It is connected to rod **160** which in turn is connected to solenoid **158**. A compression spring **162** encircles the rod and bears against a perforated plate **164**, in which the rod slides, and against a washer **166**, which is rigid to the rod. Hence as the heater is advanced, finger **152** engages latch **154**. However, after an appropriate time interval, the latch may be opened by operation of solenoid **158** against the force of spring **162**. Then after the solenoid is de-energized, the spring returns the latch to its advanced position.

The electric control circuit

The electric control circuit by means of which the various units described above may be operated is illustrated in Fig. 1. The circuit is connected to the house line through master switch **170**. Closing this switch energizes a transformer **172** which in turn energizes an automatic timing unit **174**. Suitable circuits are included for manual and automatic operation. These are selected by means of manual-automatic switch **176** and include a manual frame lock switch **178**. The manual circuit includes a manual vacuum switch **180**, a manual heater release switch **182**, microswitches **186**, **188** which are operated by opening and closing of the clamping frame assembly and a switch **190** operated by solenoid **192**.

The circuit for automatic operation includes the foregoing switches with the exception of manual switches **180**, **182**. It includes also switch **194** operated by solenoid **196**, and a microswitch **197** which is opened and closed by the action of finger **152**.

General operating cycle

The basic operating sequence of the herein described packaging apparatus is as follows:

Articles **10** to be packaged are placed on vacuum chamber **30**. They may be placed directly on perforated plate **32** or, if it is desired to include a backing sheet in the package assembly, they may be placed on a porous, fibrous sheet **198** having thereover a perforated layer **200** of thermosensitive adhesive (Fig. 7). Backing sheet **198** may comprise, for example, a sheet of ordinary cardboard of suitable thickness, the inherent porosity of the cardboard being adequate for the present purposes.

If articles are to be produced or packaged which require a female mold, mold box extension **84** may be inserted between plate **32** and lower clamping frame member **40**.

Next, the opening between the clamping frame members **40**, **42** may be adjusted to suit the thickness of the plastic by adjustment of bolts **80**. Plastic sheet **18** then is clamped between the frame members and heater **140**, which is maintained continuously energized, advanced until it lies above the clamping unit. After the plastic has been softened, the clamping unit is retracted, draping the softened material over the articles.

Vacuum box **30** then may be evacuated, forming the plastic about the articles. Heating may be continued as long as desired to activate thermosensitive plastic **200** on the porous backing sheet, if such is employed. The heater then is retracted. After the plastic is cool, the vacuum supply may be disconnected from vacuum box **30**, atmospheric air or air under pressure admitted thereto for cleanly separating the plastic sheet with its enveloped packaged articles from plate **32** and the clamping frame elevated. The plastic sheet then may be cut off at the infeed side and the clamping frame opened to complete the packaging cycle.

Manual operation

In the usual plant operation it is highly desirable to have available plastic packaging apparatus which may be operated manually as well as automatically. Manual operation is desirable, for example, during the experimental period which may be required for working out the vacuum and time sequences to be used for packaging articles of a particular class with a thermoplastic sheet of designated thickness and properties. Also, it may be desirable where only a few items of a given class are to be packaged and it is desired to avoid adjustment of a pre-set automatic timing cycle.

The manual operation of the apparatus may be varied as required for drape-vacuum forming, drape forming only, or vacuum forming only. In all three of these situations the clamping frame opening is adjusted, vacuum valve **114** is set by adjusting switch **118**, the master switch is closed, automatic-manual switch **176** is set on "manual," and the articles are loaded on the platen.

Closing master switch **170** energizes heater **142**; motor **122**, which drives the vacuum pump **120**; and solenoid **116** and switch **118** which determine the setting of vacuum valve **114**, which, in turn, determines the vacuum in tank **34** communicating with the vacuum chamber **30**, full vacuum being always applied to tank **110** which communicates with vacuum cylinders **90**, **92**, driving the reciprocating clamping frame. Closing the master switch also energizes timer **174** through which the various circuits of the unit are energized.

With the master switch closed, the heater energized, the articles loaded on perforated plate **32**, and plastic sheet **18** clamped in the clamping frame, the heater is advanced up inclined tracks **148** until it registers with the clamping frame. It is latched in this position by solenoid-operated latch **154**. Microswitch **197**, however, is inoperative because of the manual setting of switch **176**.

After the plastic has become soft, as determined by visual observation or by the lapse of a predetermined time interval, manual vacuum switch **180** is closed. This has several consequences.

First, it energizes solenoid **196**, closing contacts **194**, energizing solenoid **102**. This solenoid adjusts four-way valve **100** to a setting in which vacuum is applied to line **96** through throttle valve **106**. As a result, the cylinders are retracted at a predetermined speed, drawing the clamping frame and softened plastic downwardly and draping the plastic over the articles.

Microswitches **186**, **188** are closed by the frame as it seats to form an air tight inclosure around the articles. Microswitch **186** energizes solenoid **38**, operating valve **36** so as to admit vacuum to the chamber **30** of an intensity determined by the setting of pressure switch **118**. The vacuum thus tucks the plastic around the articles, and sucks it into firm engagement with thermosensitive adhesive **200** on backing sheet **198**, if a backing sheet has been employed.

A secondary result of closing manual vacuum switch **180** is to energize solenoid **192**, which operates to open contacts **190** in the circuit of solenoid **132**. Thus when microswitch **188** is closed by the action of lowering the frame, it is rendered inoperative.

At this point, manual heater release switch **182** may be closed. This switch, being in series with solenoid **158**, releases latch **154** so that heater **140** can gravitate downwardly to its rest position, removed from the packaging location.

After the plastic has cooled, manual vacuum switch **180** is opened. This instantly de-energizes solenoid **192** so that contacts **190** are closed, completing the circuit through solenoid **132** since microswitch **188** is still held closed by the lowered clamping frame. Solenoid **132** operates valve **130** so that air at atmospheric or superatmospheric pressure is admitted to the vacuum chamber.

At the same time, solenoid **196** is de-energized, allowing contacts **194** to open, which de-energizes solenoid **102**. The four-way valve **100** is thereby returned to its original position wherein conduits **98** and **94** are connected to vacuum tank **110**. As a result, piston rods **90** of cylinders **92** are advanced and the clamping frame

assembly with its burden of packaged items is elevated, the plastic being stripped cleanly from the surface of plate 32 by the action of the air.

As the clamping frame rises, it opens microswitch 188. This de-energizes solenoid 132 and cuts off the supply of air after the desired stripping effect has been obtained. It also opens microswitch 186, which, however, is of no effect since it is de-energized. The unit then may be cut off at the infeed side and the bars opened. This completes the cycle.

The foregoing sequence may be adapted for manual operation where it is desired to drape-form the softened plastic only, without the application of vacuum. In this case, the preliminary operations described above in connection with the drape-vacuum forming sequence are first carried out with the exception that it is unnecessary to adjust vacuum switch 114 since no vacuum is employed. The heater is retained in its advanced position until the plastic has been softened to the desired degree. Frame lock switch 178 then is closed.

This has the following actions. It energizes solenoid 102, operating four-way valve 100 and applying vacuum slowly through throttle valve 106 to cylinders 92. This retracts the clamping frame at a relatively retarded rate, and drapes the softened plastic over the articles. The lowered frame closes microswitch 186, which is de-energized since switch 180 is open. Further, the lowered frame closes microswitch 188, but solenoid 192 is energized, which opens switch 190, in series with microswitch 188, so that air valve 130 is not yet affected.

When the draping operation is complete, manual heater release switch 182 is closed. This energizes solenoid 158, releases latch 154, and permits the heater to roll downwardly to its remote station.

After the plastic has had an opportunity to cool, manual frame lock switch 178 is opened. This de-energizes solenoid 192, closing switch 190 and accordingly air is admitted to chamber 30 since microswitch 188 still is maintained closed.

Also, opening switch 178 de-energizes solenoid 102 so that valve 100 is returned to its former position, interconnecting conduit 98 with vacuum tank 110. As a consequence, the clamping frame is elevated, opening microswitch 186 (inoperative) and microswitch 188. Opening the latter switch cuts off the flow of stripping air. Thereafter the plastic sheet is cut off at the infeed side, the frame opened, and the packaged assembly removed.

It may be desired to adapt the manual cycle to vacuum forming only, in which case it is particularly desirable to include mold box insert 84 in the unit. In this case, the preliminary operations of closing the switch 120 and adjusting the vacuum control switch 188 first are carried out. The mold box insert 84 is then installed.

Manual frame lock switch 178 next is closed. This initiates the cycle described before. It energizes solenoid 102, adjusting valve 100 and retracting the clamping frame until it is in tight abutment with frame insert 84 to form a mold box of increased depth. It closes microswitch 186 which again is inoperative because switch 176 is on manual. It closes microswitch 188 which likewise is inoperative since at the same time solenoid 192 opens switch 190, with which microswitch 188 is in series. Hence air valve 130 is not actuated.

The articles next are loaded into the frame after which the plastic sheet is clamped in place. The heater is advanced to latched position. When the plastic is sufficiently soft, manual vacuum switch 180 is closed. This energizes solenoid 38 through closed microswitch 186 and hence vacuum valve 36 is operated to admit the predetermined degree of vacuum to vacuum chamber 30. Accordingly, the softened plastic is sucked down over the articles being packaged.

After the desired time interval has elapsed, vacuum switch 180 is opened to cut off the vacuum. Heater release switch 182 is also opened to back off the heater and cool the plastic. Frame lock switch 178 next is opened whereupon the reverse cycle occurs. Solenoid 192 is de-energized, closing switch 190 and actuating air valve 130 to admit air to the vacuum chamber. Solenoid 102 is de-energized, shifting four-way valve 100 back to the position in which the clamping frame is raised. Switches 186 (inoperative) and 188 remain closed by the action of mold box 84. To stop the flow of air, frame lock switch 178 is reclosed, energizing solenoid 192 and opening contacts 190 in the circuit of solenoid 132.

Automatic operation

Where it is desired to operate the herein described apparatus automatically, as where a large number of identical articles are to be packaged in the same plastic under identical operating conditions, the following sequence may be employed.

First the adjustable clamping frame opening is set to suit the thickness of plastic used. Then adjustable vacuum valve 114 is set so that the vacuum in tank 34 will be at the desired value. Master switch 170 is closed, energizing heating element 142, vacuum pump 120, vacuum-adjusting solenoid and switches 116, 118 and timer 174.

Automatic-manual switch 176 is set in automatic position. Articles then are loaded on the platen and the plastic sheet clamped in place.

Next the heater is advanced to latched position. This closes microswitch 197 which now is operative since switch 176 is in automatic position. As soon as microswitch 197 is closed, the automatic timing sequence is initiated.

After the plastic has become soft, the timer automatically energizes solenoid 196 which closes switch 194. This switch has the same action as has manual vacuum switch 180 described above. Thus it energizes solenoid 196, closing contacts 194, which energize solenoid 102. Four-way valve 100 is shifted to the position in which vacuum is applied at a controlled rate to cylinders 92 through throttle valve 106. Accordingly the clamping frame lowers, draping the softened plastic over the articles. Contacts 194 also energize solenoid 192, opening switch 190 so that air can not be applied through valve 130.

As the clamping frame descends, it closes microswitches 186 and 188. The latter is ineffective at this time since switch 190 with which it is in series is open. However, closure of microswitch 186 energizes a circuit including solenoid 38 so that vacuum valve 36 is opened, applying vacuum to the sheet. This sucks down the softened draped sheet so that it envelopes the articles.

After the plastic is molded and the application of heat has been continued to the desired extent, the timer energizes solenoid 158. This releases latch 154 which permits automatic gravitational retraction of heater 140.

The timer then de-energizes solenoid 196, opening switch 194. The reverse sequence then occurs, four-way valve 100 acting to extend piston rods 90 of cylinders 92 and raise the clamping frame. Contemporaneously solenoid 192 is de-energized, closing switch 190 and energizing a circuit including solenoid 132. This operates valve 130 so that a blast of air is admitted to the vacuum forming chamber.

As the clamping frame continues to rise, microswitches 186, 188 are opened. Opening the latter cuts off the air blast. The cycle thus is completed, the plastic sheet being ready for trimming and removal from the clamping frame.

Thus it will be apparent that by the present invention I have provided method and apparatus for packaging articles with a plastic sheet which has many outstanding advantages. It is adaptable to the packaging of articles of different heights, with plastic of varying thickness. A backing sheet may or may not be used. Various types

of adhesive may be used on the backing sheet, if employed, with no decrease in adhesive qualities.

The apparatus is readily adaptable to experimental use. The operator is protected while loading. The plastic roll may be used either from the right or left side to suit the layout of a given production line.

In addition, the vacuum applied is adjustable to accommodate fragile articles which will not stand full atmospheric pressure. The rate of frame pull down is controllable so as not to force the parts out of position during the downstroke of the clamping frame, the stretch of heavy plastic also being controlled.

Still further, the products are clearly visible at all times. Drape or vacuum forming techniques may be employed. A minimum amount of costly plastic need be trimmed off. Finally, the machine is of simple, inexpensive construction and may be easily dis-assembled for effective servicing.

It is to be understood that the form of my invention herein shown and described is to be taken as a preferred example of the same and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. In apparatus for packaging articles in a thermoplastic sheet, wherein the apparatus includes a perforated support for articles to be packaged, a sheet supporting frame disposed adjacent the article support and movable toward and away from the latter, heating means disposed adjacent the frame on the side thereof remote from the article support and adapted to heat and soften a thermoplastic sheet supported in the frame, and vacuum means communicating with the perforations in the article support for wrapping a softened sheet about an article: the combination therewith of vacuum control valve means for controlling vacuum to the article support, and actuating means for the vacuum control valve means and operable by the frame upon movement of the latter toward the article support to open the vacuum means to the article support and wrap the sheet about the article.

2. The combination of claim 1 wherein the actuating means for the vacuum control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable by the frame.

3. In apparatus for packaging articles in a thermoplastic sheet, wherein the apparatus includes a perforated support for articles to be packaged, a sheet supporting frame disposed adjacent the article support, heating means disposed adjacent the frame on the side thereof removed from the article support and adapted to heat and soften a thermoplastic sheet supported in the frame, and vacuum means communicating with the perforations in the article support for wrapping a softened sheet about an article: the combination therewith of air pressure means communicating with the perforations in the article support for stripping the sheet and wrapped article from the article support, air pressure control valve means for controlling air pressure to the article support, and actuating means for the air control valve means and operable upon completion of the wrapping of the article to introduce air pressure to the article support and strip the sheet therefrom.

4. The combination of claim 3 wherein the actuating means for the air pressure control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable upon completion of the wrapping of the article.

5. In apparatus for packaging articles in a thermoplastic sheet, wherein the apparatus includes a perforated support for articles to be packaged, a sheet supporting frame disposed adjacent the article support and movable toward and away from the latter, heating means disposed adjacent the frame on the side thereof remote from the article support and adapted to heat and soften a thermoplastic sheet supported in the frame, and vacuum means communicating with the perforations in the article support for wrapping a softened sheet about an article: the combination therewith of vacuum control valve means for controlling vacuum to the article support, actuating means for the vacuum control valve means and operable by the frame upon movement of the latter toward the article support to open the vacuum means to the article support and wrap the sheet about the article, air pressure means communicating with the perforations in the article support for stripping the sheet and wrapped article from the article support, air pressure control valve means for controlling air pressure to the article support, and actuating means for the air control valve means and operable upon completion of the wrapping of the article to introduce air pressure to the article support and strip the sheet therefrom.

6. The combination of claim 5 wherein the actuating means for the vacuum control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable by the frame, and wherein the air pressure control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable upon completion of the wrapping of the article.

7. In apparatus for packaging articles in a thermoplastic sheet, wherein the apparatus includes a perforated support for articles to be packaged, a sheet supporting frame disposed adjacent the article support, heating means disposed adjacent the frame on the side thereof remote from the article support and adapted to heat and soften a thermoplastic sheet supported in the frame, and vacuum means communicating with the perforations in the article support for wrapping a softened sheet about an article: the combination therewith of inclined support means for the heating means and arranged for retracting the heating means by gravity from its position adjacent the sheet supporting frame, latch means releasably securing the heating means against retraction, and actuating means for the latch means and operable to release the latter to effect retraction of the heating means.

8. The combination of claim 7 wherein the actuating means for the latch means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable to release the latch and effect retraction of the heating means.

9. In apparatus for packaging articles in a thermoplastic sheet, wherein the apparatus includes a perforated support for articles to be packaged, a sheet supporting frame disposed adjacent the article support and movable toward and away from the latter, heating means disposed adjacent the frame on the side thereof remote from the article support and adapted to heat and soften a thermoplastic sheet supported in the frame, and vacuum means communicating with the perforations in the article support for wrapping a softened sheet about an article: the combination therewith of vacuum control valve means for controlling vacuum to the article support, actuating means for the vacuum control valve means and operable by the frame upon movement of the latter toward the article support to open the vacuum means to the article support and wrap the sheet about the article, air pressure means communicating with the perforations in the article support for stripping the sheet and wrapped material from the article support, air pressure control valve means for controlling air pressure to the article support, actuating means for the air control valve means and operable upon completion of the wrapping of the article to introduce air pressure to the article support and strip the sheet therefrom, inclined support means for the heating means and arranged for retracting the heating means by gravity from its position adjacent the sheet supporting frame, latch means releasably securing the heat means against retraction, and actuating means for the latch

means and operable to release the latter to effect retraction of the heating means.

10. The combination of claim 9 wherein the actuating means for the vacuum control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable by the frame, and wherein the actuating means for the air pressure control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable upon completion of the wrapping of the article, and wherein the actuating means for the latch means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable to release the latch and effect retraction of the heating means.

11. The combination of claim 9 including reciprocative fluid pressure operating means supporting the frame for moving the latter toward and away from the article support, fluid pressure control valve means for controlling fluid pressure to the operating means, and actuating means for the fluid pressure means operable to control the reciprocation of the fluid pressure operating means.

12. The combination of claim 11 wherein the actuating means for the reciprocative fluid pressure control valve means comprises electrical actuating means having an electric circuit, and switch means in the electric circuit operable to control the reciprocation of the fluid pressure operating means.

13. The combination of claim 12 including timed control means for controlling automatically and sequentially the operation of the actuating means for the fluid pressure control valve means, the air pressure control valve means and the latch means.

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