April 5, 1966 H. D. SWARTZ 3,244,576

APPARATUS FOR MANUFACTURING FLEXIBLE BAGS WITH NOZZLE

Filed Feb. 4, 1963 3 Sheets-Sheet 1

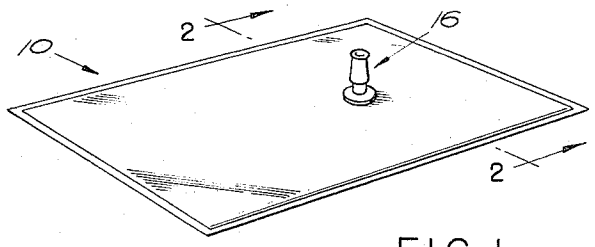

FIG. 1

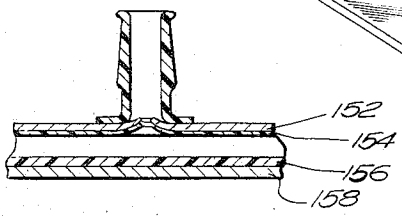

FIG. 10

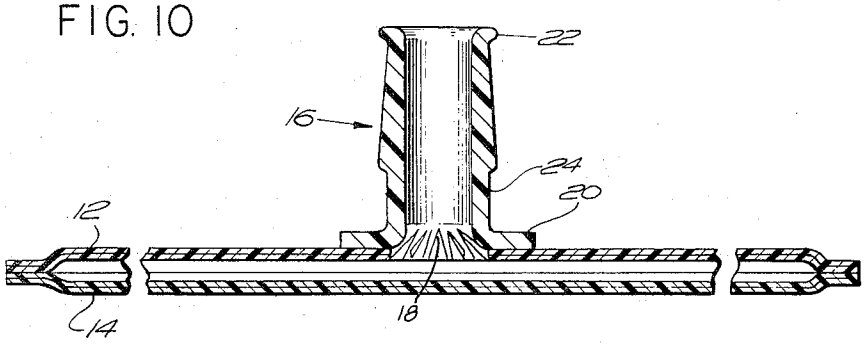

FIG. 2

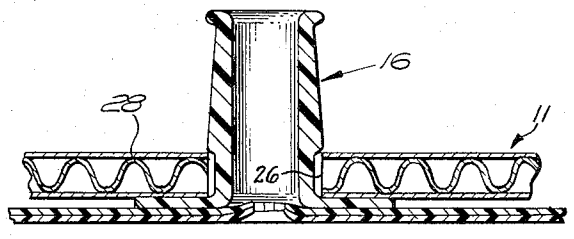

FIG. 3

INVENTOR.
HENRY D. SWARTZ
BY
Morse & Altman
ATTORNEYS

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Filed Feb. 4, 1963 3 Sheets-Sheet 2

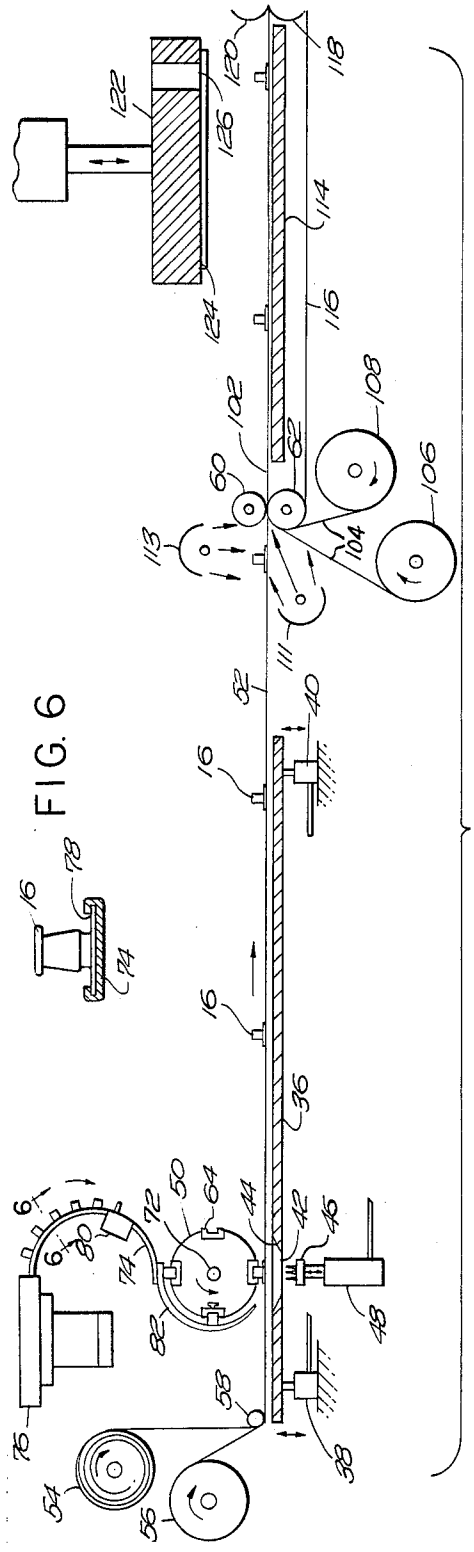

FIG. 6

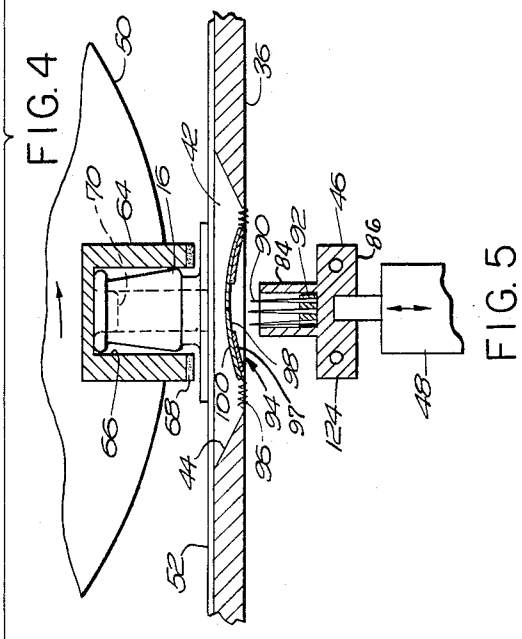

FIG. 5

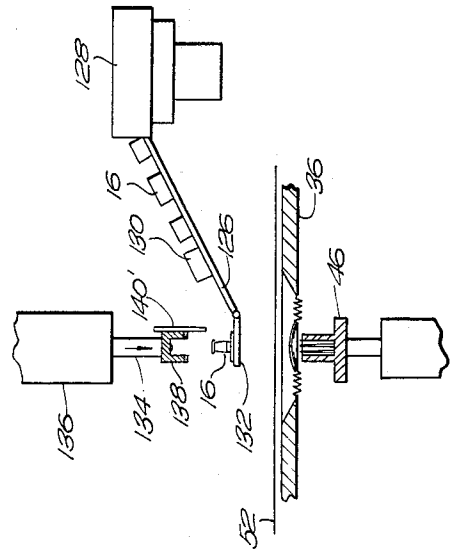

FIG. 7

FIG. 4

INVENTOR.
HENRY D. SWARTZ
BY
Morse & Altman
ATTORNEYS

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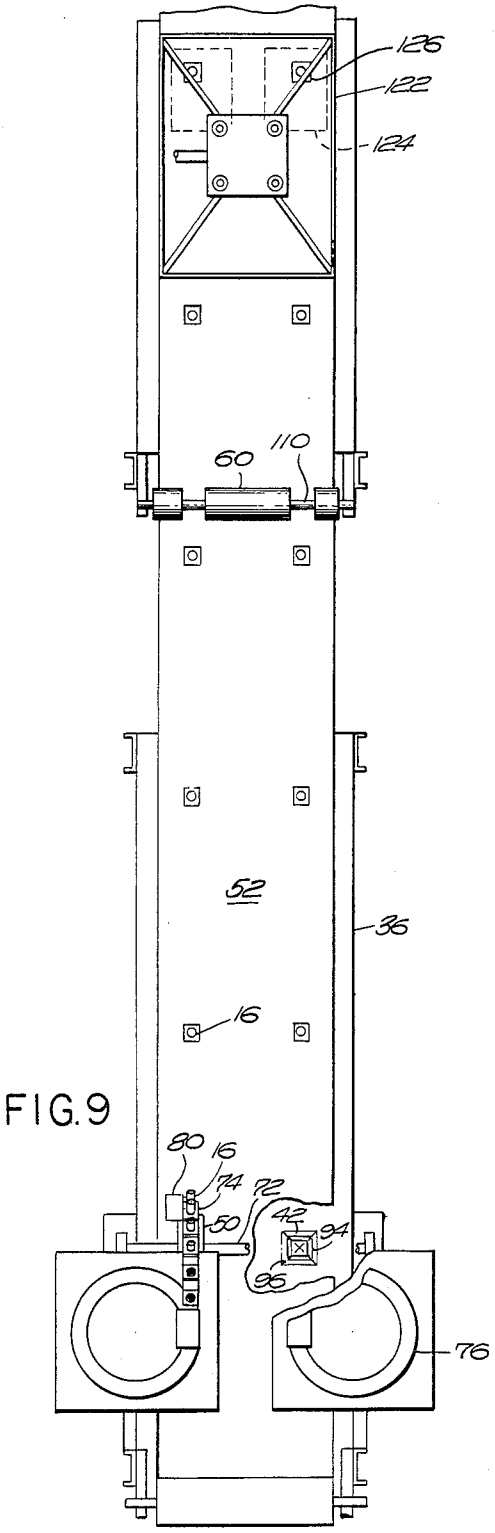

FIG. 9

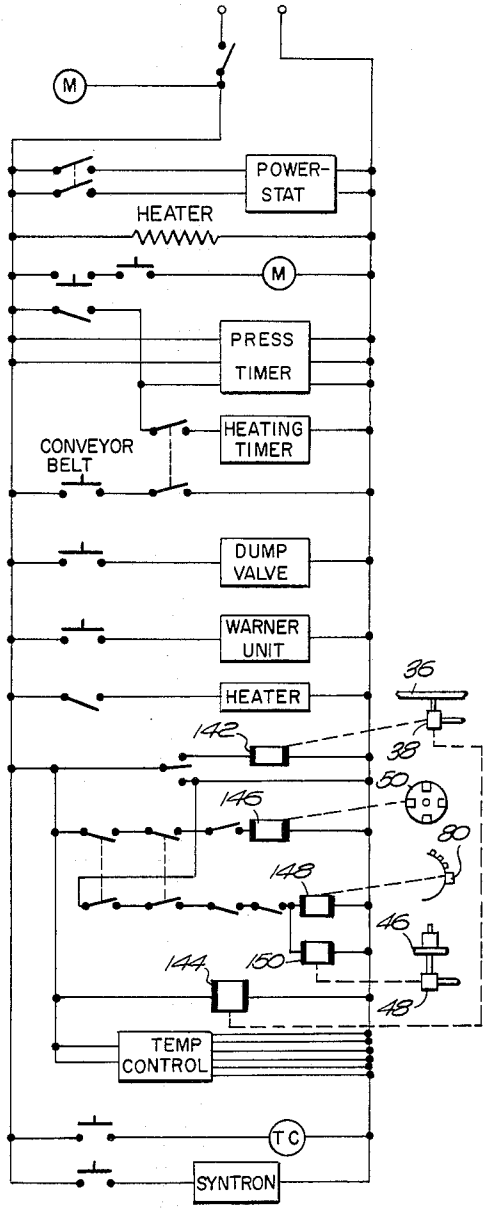

FIG. 8

INVENTOR.
HENRY D. SWARTZ
BY Morse & Altman
ATTORNEYS

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APPARATUS FOR MANUFACTURING FLEXIBLE BAGS WITH NOZZLE

Henry D. Swartz, Brookline, Mass., assignor to Thermoplastic Industries, Inc., Brockton, Mass., a corporation of Massachusetts

Filed Feb. 4, 1963, Ser. No. 256,013
8 Claims. (Cl. 156—513)

This invention relates generally to the manufacture of flexible bags and more particularly is directed towards a new and improved method and apparatus for manufacturing heat sealable flexible bags having semi-rigid nozzles attached thereto.

In the packaging industry there is a growing interest in the use of rigid containers such as drums, paperboard cartons and the like lined with liquid impervious bags for shipping various types of bulk materials. This technique has been found to be particularly useful in the packaging, shipping and dispensing of milk since the liner bags may be purchased in a sterile condition and because of their low cost may be discarded after being once used. Packages of this type have the advantage of being light in weight, collapsible and require no cleaning.

While bag lined containers have been found to be particularly useful in shipping, storing and dispensing liquid and granular materials, certain difficulties have been encountered in their manufacture. For example, bag liners of the above sort are presently made for the most part by unsterile hand assembly methods which are slow and inefficient. In addition whatever equipment is involved in producing the bag liners does not enjoy a high rate of productivity and is generally unsuited for completely automatic production.

Accordingly it is an object of the present invention to provide an improved method for manufacturing flexible bags having semi-rigid nozzles attached thereto.

Another object of this invention is to provide an improved apparatus for manufacturing flexible bags of various types having rigid or semi-rigid nozzles attached thereto.

More particularly this invention features a novel bag forming process which involves simultaneously applying and sealing a nozzle to one panel of a bag while forming an opening in register with the valve and subsequently applying a second panel overlying the first and bonding the two along their marginal edges to form the completed bag.

This invention also features a novel apparatus for mass producing flexible bags having rigid or semi-rigid nozzles attached thereto. The apparatus employs one or more nozzle applying mechanisms adapted to deliver nozzles to selected location on a web of heat sealable sheet material which is intermittently advanced over a platen. The platen is mounted for reciprocation in a direction normal to the plane of the web and is also formed with an opening for each of one or more heated sealing dies mounted on the opposite side of the platen each in register with an opening and a nozzle applying mechanism. Each die is provided with a cutting element and is adapted to reciprocate through an opening and against the flanged portion of a nozzle, simultaneously piercing the web and heat sealing the nozzle to the web about the pierced opening. From the platen the web with the applied nozzle is carried forwardly where a second web is brought into face to face contact with it and the two webs are bonded together along a line which defines the marginal edges of the bag. The formed bag is thereupon separated from the remaining portion of the web.

But these and other features of the invention, along

with further objects and advantages thereof, will become more fully apparent from the following detailed description of the invention, with reference being made to the accompanying drawings, in which

FIGURE 1 is a view in perspective of a bag liner of the sort which may be made in the practice of this invention;

FIGURE 2 is a cross sectional view taken along the line 2—2 of FIGURE 1;

FIGURE 3 is a detail view similar to FIGURE 2 but showing the bag in use as a liner for a corrugated carton;

FIGURE 4 is a view in side elevation partly in section and somewhat schematic of a bag making apparatus made according to the invention;

FIGURE 5 is a detail view in side elevation partly in section showing the nozzle applying station;

FIGURE 6 is a cross-sectional view taken along the line 6—6 of FIGURE 4;

FIGURE 7 is a view in side elevation partly in section showing a modification of the loading station;

FIGURE 8 is a schematic diagram of the control system for the apparatus shown in FIGURE 4;

FIGURE 9 is a top plan view of the apparatus shown in FIGURE 4; and

FIGURE 10 is a cross-sectional view of a modified bag liner.

Referring now to the drawings, the reference character **10** generally indicates a flexible bag having particular utility as a liner for a corrugated paper-board carton **11** or other rigid container such as a drum, pail or box such as might be used in the shipping and storage of liquids such as milk or dry granular materials. The bag is formed from a pair of panels **12** and **14** and each panel may comprise any number of plies or strata of a suitable heat sealable film such as polyethylene or other sheet material which is typically strong, liquid-impervious and heat sealable.

The panel **12** has bonded thereto a rigid or semi-rigid tubular nozzle **16** in register with an opening **18** formed through the panel **12**. The nozzle **16** normally has a generally cylindrical configuration at its upper portion and its outer end is formed with a bead **22** for snapping engagement with a suitable cap (not shown). The tubular portion preferably is dimensioned to fit snugly within a circular opening **26** formed in a wall **28** of a corrugated box as suggested in FIGURE 3. The lower portion of the nozzle is formed with an annular flange **20**. The under side of the flange **20** is firmly bonded to the outer surface of the panel **12** as by heat sealing for example and extends about the opening **18** formed through the panel **12**.

Referring now more particularly to FIGURES 4 and 5, the apparatus for producing these bags will now be described. As shown in FIGURE 4, the apparatus is generally organized about a horizontal platen **36** mounted for vertical reciprocation by means of pneumatic cylinders **38** and **40**. For the sake of clarity the framework for supporting various portions of the machine has been omitted. The platen **36** is generally rectangular in plan and is formed with an opening **42** characterized by inclined edges **44**.

Mounted directly below the opening **42** is a heated sealing die **46** adapted for vertical reciprocation through the opening **42** by means of a pneumatic cylinder **43**. Mounted directly above the opening **42** is an indexing wheel **50** which is adapted to apply a nozzle **16** to the upper surface of a web **52**. The web **52** may comprise one or more plies of a heat sealable film such as polyethylene or the like and is fed from one or more supply rolls **54, 56**. The webs from both supply rolls are brought into face to face contact under roll **58** to form a double wall web which is advanced intermittently over the upper

surface of the platen **36**. In place of the two supply rolls **54** and **56** a single roll or pair of rolls of tubular film may be supplied to provide the double or quadruple wall construction which has been found to be stronger than a single wall of the same total thickness.

A pair of feed rolls **60** and **62** are disposed on opposite sides of the web **52** and are adapted to advance the web along the platen. It will be understood that, in operation, the web is advanced along the platen in cycles with the web being halted at predetermined points so that a nozzle **16** may be applied to the web at equally spaced intervals.

As indicated previously, each nozzle is positioned by means of the indexing wheel **50** which employs four nozzle holding cups **64** distributed evenly about the periphery of the wheel. Each cup **64** has cylindrical side walls **66** of a depth generally corresponding to the length of the neck of the nozzle. The outer annular edge of each cup is provided with a resilient gasket **68** of a suitable heat resistant material such as silicon rubber or the like. Each cup is also provided with a base portion having a central boss **70** which is adapted to protrude into the open end of each nozzle for the purpose of positioning the nozzle properly within the cup.

The indexing wheel **50** is rotated about a shaft **72** indexing 90 degrees each time it is actuated. The nozzles are transferred to the indexing wheel from a curved track **74** mounted directly above each wheel with the nozzles being fed on to the track from a vibratory feeder **76**. The track **74**, as seen in FIGURE 6, is formed with inwardly curved edges which define channels **78** to accommodate the flanges of the nozzles and to prevent their falling from the track. The bowl feeder **76** delivers each nozzle onto the track in an upright position and the nozzles accumulate thereon by means of a solenoid actuated release **80** which is adapted to dispense the nozzles one by one down to the end of the reversely curved track. At the end of the track **74** the side edges are cut away so that the nozzle is free to drop in an inverted position into a cup **64** which has been brought into register with the dispensing end of the track. Upon indexing the wheel **50** carries the nozzle down to horizontal position where it is held in its cup by means of a curved guide **82** which extends from the discharge end of the track to a point near the base of the wheel **50**. On the next indexing of the wheel **50** the nozzle is carried down on to the web **52** where it is bonded in position by means of the heating die **46** reciprocating into engagement with the under side of the web to bear up against the flange of the nozzle and thereby bond the parts in a heat sealed union.

Referring more particularly to the heating die **46**, as shown in FIG. 5, it will be noted that the die is formed with a tubular cylindrical upper portion **84** and a flanged base portion **86** in which heating elements **88** are mounted. It will be understood that the upper annular edge of the portion **84** will bear against the underside of the web **52** directly in register with the flange **20** of the nozzle **16** which is being bonded to the web.

Mounted within the die **46** is a group of cutting elements **90** which extend above the upper annular edge of the die and are adapted to pierce through the web **52** in order to provide the necessary opening between the nozzle and the interior of the finished bag. As shown, each cutting element comprises a tapered blade with the several blades arranged radially and with their points substantially meeting at a central apex. The cutting elements are mounted in an asbestos block **92** which in turn is mounted within the central opening extending through the die. In practice, the asbestos block insulates the cutting elements from direct contact with the heating die although the elements are sufficiently close to the die as to be heated to a certain extent. Preferably, the cutting elements normally do not exceed a temperature of 200° F. By employing cutting elements that are maintained at a moderately elevated temperature to pierce the web, a much improved cutting operation is provided. The warm blades are more efficient than the cold cutting elements previously employed because of the fact that the elements disclosed herein are of a temperature sufficient to bead and easily separate the film with very little pressure. In addition, the cutting elements insure that no dry film flecks or residue will be present to contaminate the materials which will ultimately fill the completed bag. Using cold blades results in a highly abrasive action which requires frequent sharpening or replacement of the blades.

Also shown in FIGURE 5 is a floating diaphragm **94** which is mounted to the platen by springs **96** within the opening **42**. The diaphragm **94** preferably comprises a rigid concave element **97** formed with a central opening **98**, and over the top of which is applied a layer of teflon coated glass cloth **100**. The coated glass cloth is slit in the region spanning the opening **98** and serves to provide a relative cool, non-sticking surface against which the web **52** will be sandwiched by the die **46** and the resilient gasket **68** of the cup **64**. It will be appreciated that the diaphragm will build up very little, if any, residual heat between cycles so that each operation of the machine will take place under substantially identical conditions.

In operation, the web **52** is advanced over the platen **36** by the drive rollers **60** and **62** for predetermined distance corresponding to the size of the bag that is to be manufactured. When the advance of the web **52** is completed, the indexing wheel **50** will bring a nozzle **16** into position over the opening **42**. Following this the platen **36** will be reciprocated upwardly carrying the web **52** into contact with the flange of the nozzle. Thereupon the heating die **46** will be reciprocated upwardly through the opening **42** to pierce the web and seal the nozzle in place. Next, the heating die and platen will reciprocate downwardly and both the web **52** and the indexing wheel **50** will be advanced to their next positions.

From the nozzle-applying station, the web **52** will be then advanced to a bag-forming station where the manufacture of the bag is completed. In fabricating the completed bag, a web **102** is formed from plies **104** which are unwound from feed rolls **106** and **108** mounted below the web **52**. As shown in FIGURE 4, the plies **104** are brought into face to face contact with the underside of the web **52** by passing the plies **104** over the roller **62**. The upper roller **60**, as best shown in FIGURE 9, bears against the upper side of the web **52** and is formed with peripheral grooves **110** to accommodate the nozzles **16** which are carried between the rollers **60** and **62**. An ultra-violet lamp **111** may be located in such a position as to sterilize the surfaces of the webs which are being brought into face to face contact. Another ultra-violet lamp **113** may be located so as to sterilize the nozzles which are passing along the apparatus.

From the bite of the rollers **60** to **62**, the overlaying webs **52** and **102** are carried onto a fixed platen **114**. A conveyor belt **116** is looped over the platen **114** and driven by means of the roller **62** and a roller **118**. A roller **120** is mounted directly over the roller **118** and serves to carry the superimposed webs along with the moving belt **116**.

Mounted for reciprocation over the belt and the platen **114** is a die **122** which is adapted to reciprocate vertically against the webs. The die **122** is provided with heated sealing elements **124** having a configuration conforming to the outline of the desired finished bag. Each die is also provided with an opening **126** to accommodate the nozzle **16** which extends above the level of the webs. It will be understood that, as the superimposed webs are carried by the belt over the platen into a predetermined position where the nozzle is in register with the opening **126**, the die **122** will reciprocate down against the superimposed webs, sealing them to one another about their peripheral margins. When the sealing operation is com-

pleted the die will reciprocate upwardly and the finished bag advanced along the belt. In practice, the die **122** will also separate the individual bags from the remaining portion of the webs from which they were formed.

In FIGURE 7 there is shown a modification of the nozzle dispensing arrangement, and in this embodiment individual nozzles **16** are delivered down an inclined chute **126** from a vibratory bowl feeder **128** in cooperation with a timed release mechanism **130**. Hinged to the lower end of the chute **126** is a spring-loaded shelf **132** normally extending into horizontal position above the opening **42** and in register with the die **46**. Mounted directly above the shelf **132** is a plunger **134** which is adapted to reciprocate vertically by means of a pneumatic cylinder **136**. At the lower end of the plunger is a cup **138** similar to the cup **64** shown in the principal embodiment. Mounted to the cup **138** on the side facing the chute **126** is a stripping plate **140** which serves to meet the shelf **132** in advance of the cup **138** to bias the shelf **132** down and out of the way as the cup picks up the nozzle **16** and deposits it on the web **52**. The heating die **46** reciprocates upwardly through the opening **42** to seal the nozzle and the web together.

The plunger and inclined chute arrangement may also be employed in conjunction with the application of nozzles to semi-completed bags. In this case a continuous flat surface would be employed to support the bag and there would be no need of a reciprocating die **46**. In such an arrangement, the partly formed bag will be manufactured by the method and apparatus described herein with the exception that an annular flange of heat sealable material will be applied to the web **52** in place of the nozzle **16**. This will lower shipping costs since bags having relatively long nozzles are quite expensive to ship by reason of the volume required to accommodate the nozzles. By shipping the bags formed with a flat annular flange the shipping space required is substantially reduced since the bags can be folded flat and the semi-rigid nozzles shipped in a separate container. Once they have arrived, the nozzles can be attached by a device similar to that shown in FIGURE 7 with the modification of providing heating means for the cup **138** and providing a flat surface in place of the open platen **36**.

Typically the flat annular flange should be relatively thick on the order of .060" for example, in order to insulate the back wall of the bag from the heating element, which will be applied to the top of the bag. The attached nozzle could then have a flange on the order of .020" for example, which is relatively thin in relation to the flange.

In FIGURE 8 there is shown a schematic diagram for operating the apparatus of the principal embodiment when employing a single nozzle feeding station. As shown, a number of solenoids are employed to actuate various parts of the apparatus. For example a solenoid **142** is employed in conjunction with a solenoid **144** to actuate pneumatic cylinders **38** and **40** and reciprocate the platen **36**. Similarly, a solenoid **146** is employed to actuate the indexing wheel **50**, and a solenoid **148** actuates the nozzle release **80**. Finally, a solenoid **150** is employed to actuate the pneumatic cylinder **48** for reciprocating the die **46**.

It will be appreciated that the invention described herein is particularly useful in that flexible bags with attached semi-rigid nozzles may be manufactured under completely automatic conditions with no hand assembly operations whatsoever. This permits bags intended to hold edible goods to be manufactured under completely sterile conditions. To this end it is desirable to employ as far as practical non-toxic aluminum in those parts which contact the bag components, for example, the rollers and the chutes for transferring the nozzles from the vibratory bowl feeders.

Another very useful advantage of this invention lies in the fact that it is now possible to manufacture bags in which the walls may be made from various materials and the thicknesses of the wall may also be varied so that a single bag may have one wall made from a material of one thickness and the opposing wall made of a different material which is of a different thickness. Also, as suggested in FIGURE 10, each wall may have a number of plies each of a different thickness and each of a different material. For example, ply **152** may be .003" thick, ply **154** may be .001", ply **156** may be .005" thick, and ply **158** may be .006" thick. It is only necessary that the interfacing surfaces of opposing walls be mutually compatible for heat sealing operations. By this arrangement a great many different bags may be manufactured for many different purposes. It is also possible to manufacture bags with a number of nozzles attached thereto.

While the invention has been described with particular reference to the illustrated embodiment it will be understood that numerous modifications thereto will appear to those skilled in the art. For example, the indexing wheel may be made to accommodate any selected number of nozzles with appropriate changes to the indexing mechanism. It will also be understood that the above description and accompanying drawings should be taken as illustrative of the invention and not in a limiting sense.

Having thus described my invention, what I claim and desire to obtain by Letters Patent of the United States is:

1. Apparatus for mass producing flexible bags having at least one semi-rigid nozzle attached thereto, comprising a platen formed with an opening therethrough, means feeding a first web of heat sealable material over one surface of said platen, nozzle applying means mounted opposite said opening and located adjacent said one surface of said platen, said nozzle applying means being adapted to deposit a heat sealable nozzle to one surface of said first web, an annular heating element mounted on the opposite end of said platen and in alignment with said opening and said nozzle applying means, web piercing means carried by said heating element, means mounting said heating element and said piercing means for reciprocation through said opening to pierce said web and heat seal a nozzle to said web, means feeding a second web of heat sealable material into face to face contact with the opposite surface of said first web and means for heat sealing both of said webs along a line forming the margin of said bag.

2. Apparatus according to claim **1**, wherein said nozzle applying means comprises a wheel mounted adjacent said one surface of the platen and generally tangential to said first web, said wheel being provided with nozzle holding means and being adapted to index about its axis to bring individual nozzles into register with said platen opening.

3. Apparatus according to claim **2**, including a vibratory bowl feeder adapted to contain a supply of heat sealable nozzles and dispense them individually to the nozzle holding means on said wheel.

4. Apparatus according to claim **1**, wherein said nozzle applying means includes an inclined chute mounted above said platen, a platform hinged to the lower end of said chute opposite to said opening, means for delivering nozzles one by one down said chute and a plunger mounted above said platform and adapted upon reciprocation to transfer a nozzle on said platform to said web.

5. Apparatus for mass producing flexible bags having a semi-rigid nozzle attached thereto, comprising a generally flat platen, means mounting said platen for reciprocating said platen in a direction normal to the plane of said platen, said platen being formed with an opening therethrough, a first supply of heat sealable sheet material disposed at one side of said platen, means for guiding and advancing a section of said material over one surface of said platen and said opening, a transfer wheel rotatably mounted opposite said opening and substantially tangential to said one surface of said platen, a plurality

of nozzle holding members evenly distributed about said wheel, feeding means for automatically delivering a nozzle to each of said holding members, indexing means for rotating said wheel to align a holding member and its nozzle with said opening, an annular heating element mounted on the opposite side of said platen and in alignment with said opening, said nozzle holding member and said nozzles, sheet piercing means disposed within said heating element, means mounting said heating element and said piercing means for reciprocation through said opening to pierce said sheet and heat seal said nozzle to said sheet, a second supply of heat sealable sheet material, means for guiding and advancing a section from said second supply into face to face contact with the opposite surface of the section from said first supply having a nozzle sealed thereto and means for simultaneously cutting and heat sealing both of said sections together along a line forming the margin of said bag.

6. Apparatus for mass producing flexible bags having at least one semi-rigid nozzle attached thereto, comprising a platen, said platen being adapted to reciprocate in a direction normal to the plane of said platen, said platen being formed with an opening therethrough, means for intermittently feeding a first web of heat sealable material over one surface of said platen, intermittently actuated nozzle applying means mounted opposite said opening and adjacent said one side of said web, said applying means being adapted to deposit a heat sealable semi-rigid nozzle to said one surface of said first web, a heating

die mounted on the opposite side of said platen and in alignment with said opening, and a nozzle deposited on said first web, web piercing means carried by said die, means mounting said die and said piercing means for intermittent reciprocation through said opening to pierce said web and heat seal said nozzle to said web, means for intermittently feeding a second web of heat sealable material into face to face contact with the opposite surface of said first web and means for heat sealing both of said webs together along a line forming the margin of said bag.

7. Apparatus according to claim 6 wherein said web piercing means are mounted in thermal proximity to said die.

8. Apparatus according to claim 6 including control means for advancing said first web over said platen, stopping said web, actuating said nozzle applying means, reciprocating said platen, said die and said web piercing means towards and away from said nozzle applying means to seal said nozzle to said web and pierce said web, advancing said first web and said second web into face to face contact, stopping said webs, actuating said means for sealing said webs together and again advancing said webs.

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EARL M. BERGERT, *Primary Examiner.*

DOUGLAS J. DRUMMOND, *Examiner.*