May 27, 1969 G. W. MAIER ET AL 3,445,988

PACKAGING MACHINE FOR FILLING AND CLOSING A RECEPTACLE

Filed Oct. 31, 1966 Sheet 1 of 5

FIG.IA

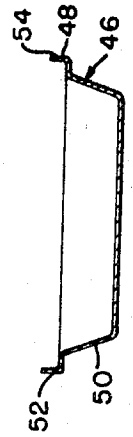

FIG.I

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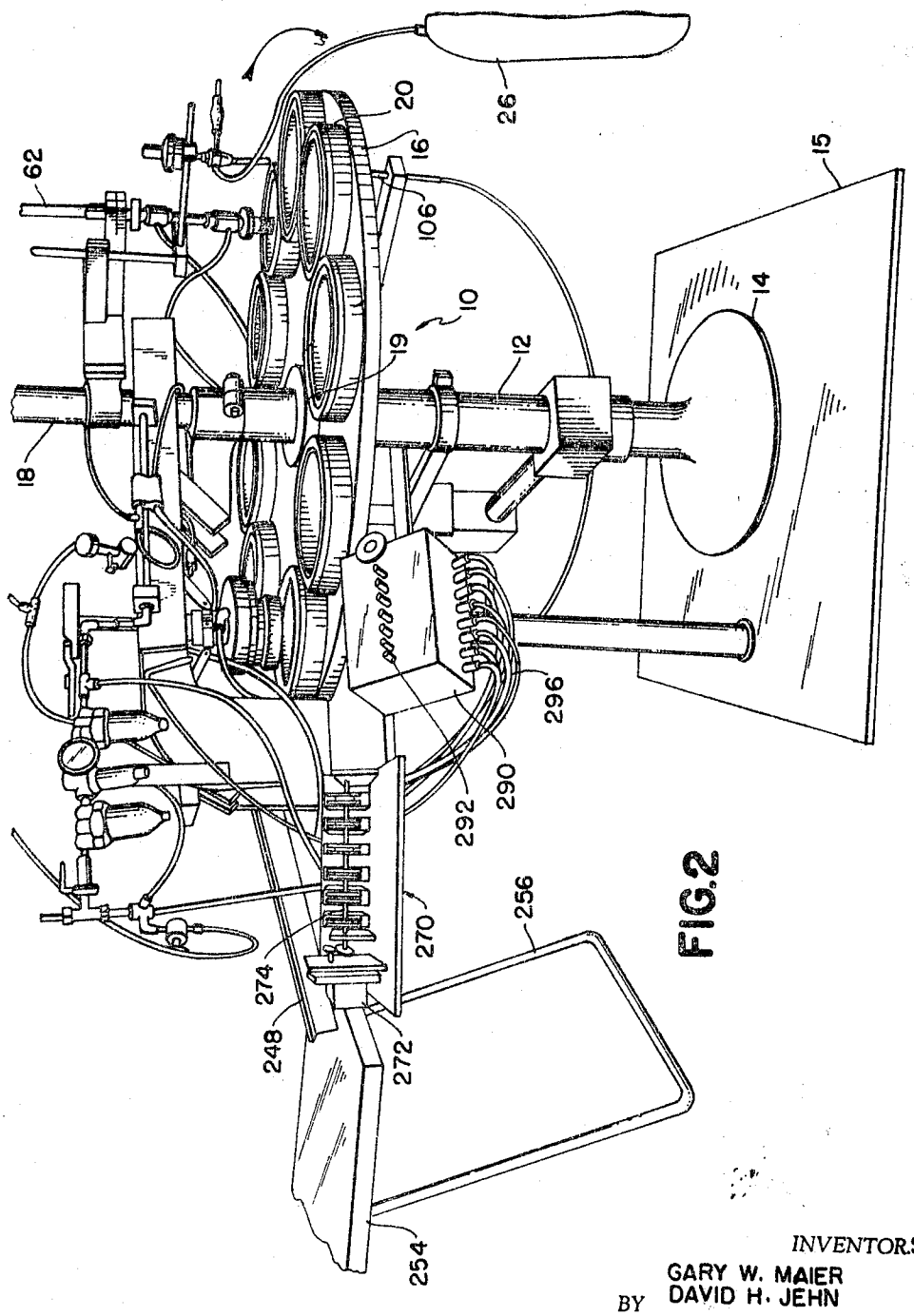

FIG. 2

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PACKAGING MACHINE FOR FILLING AND CLOSING A RECEPTACLE

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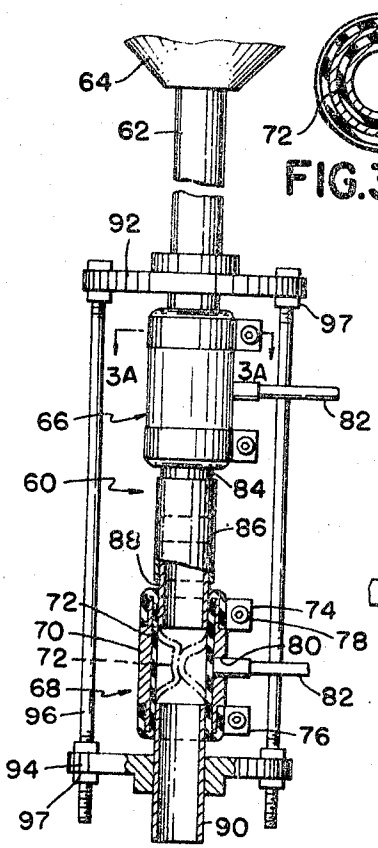

FIG.3

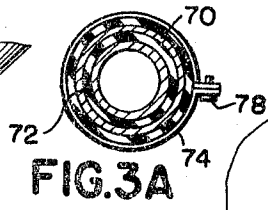

FIG.3A

FIG.9

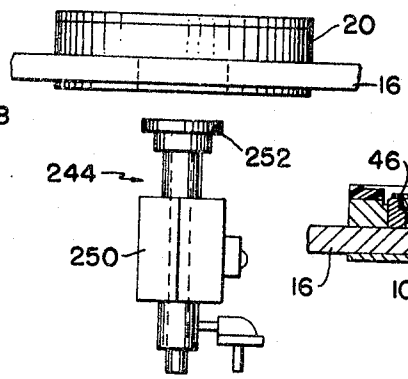

FIG.10

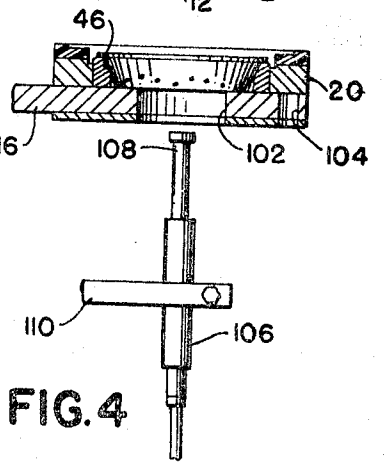

FIG.4

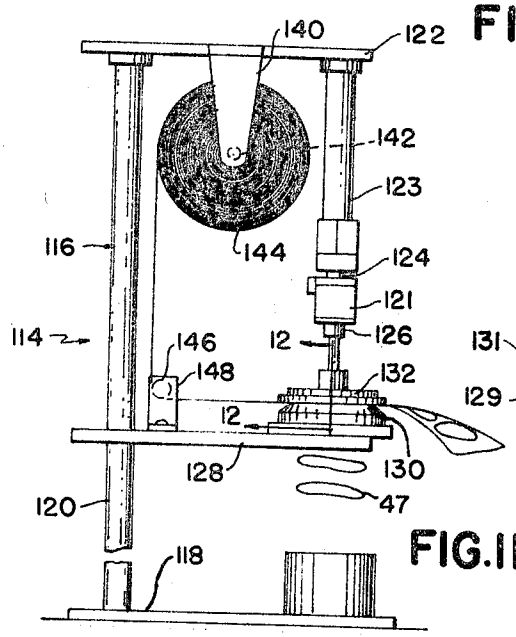

FIG.11

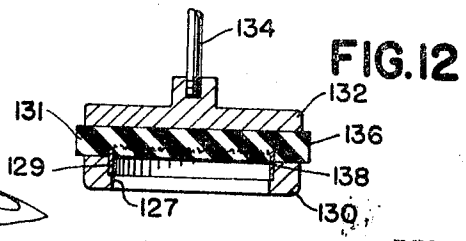

FIG.12

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PACKAGING MACHINE FOR FILLING AND CLOSING A RECEPTACLE

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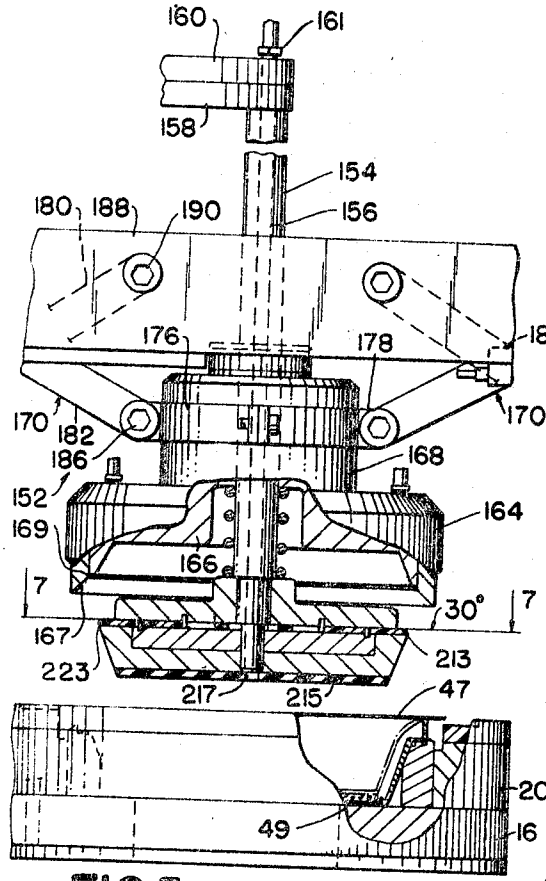


FIG.5

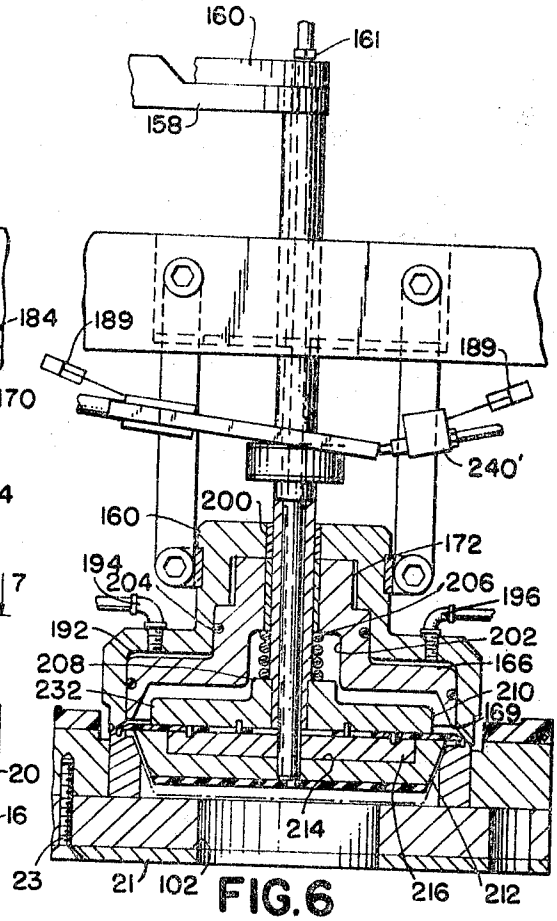


FIG.6

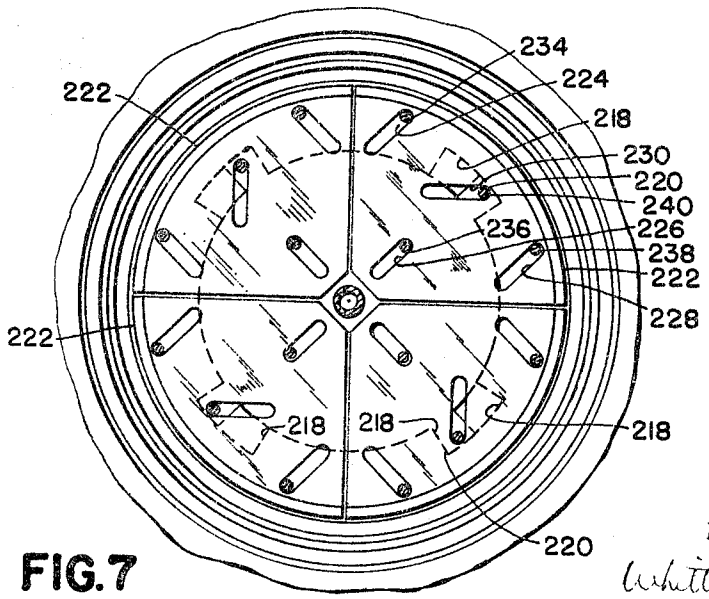
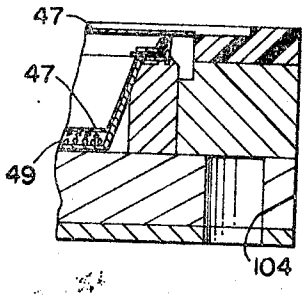


FIG.7

FIG.8



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PACKAGING MACHINE FOR FILLING AND CLOSING A RECEPTACLE

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Sheet 5 of 5

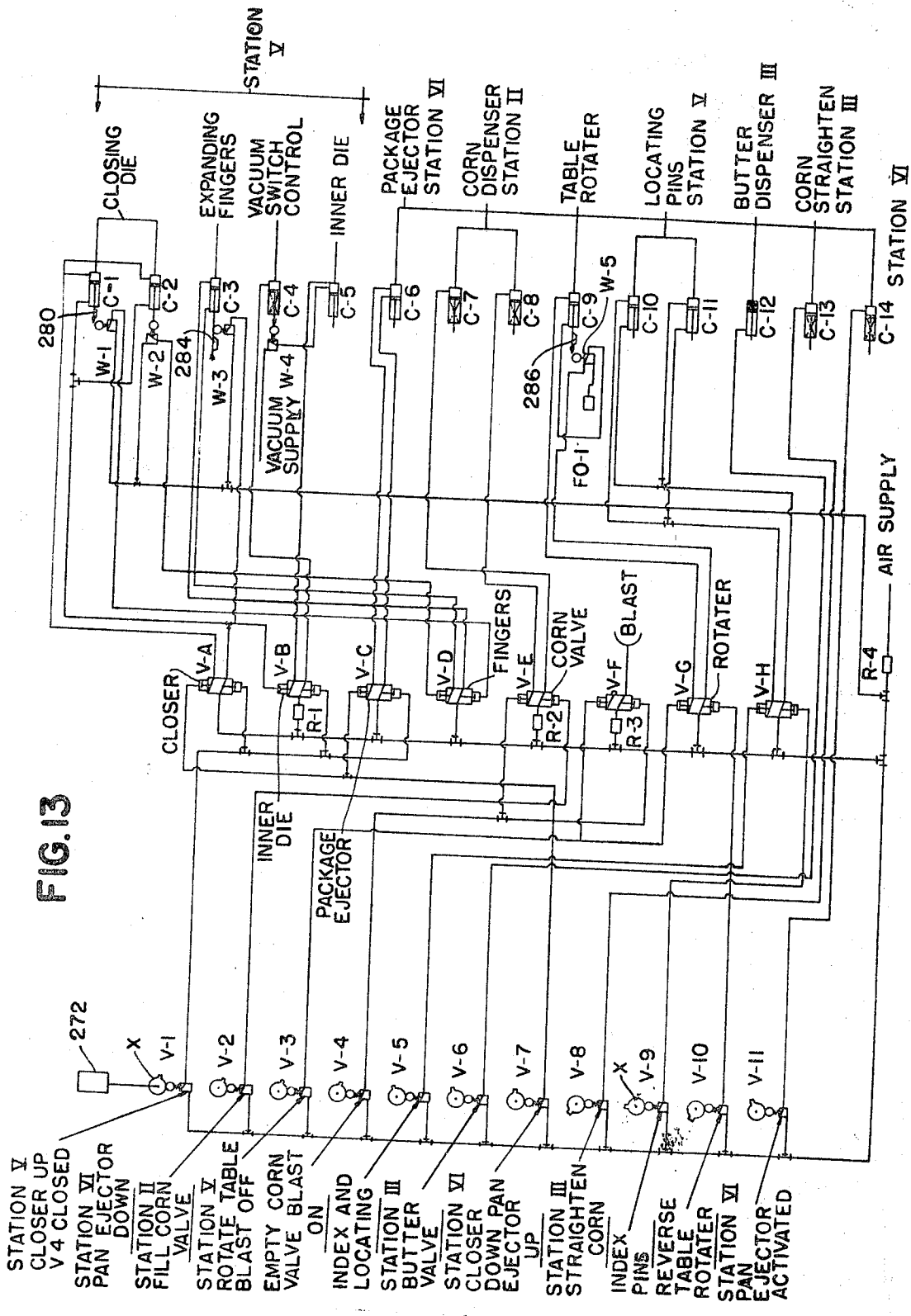

FIG. 13

United States Patent Office 3,445,988 Patented May 27, 1969

3,445,988

PACKAGING MACHINE FOR FILLING AND CLOSING A RECEPTACLE

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Filed Oct. 31, 1966, Ser. No. 590,704
Int. Cl. B65b 1/04, 7/28, 1/30
U.S. Cl. 53—282
12 Claims

ABSTRACT OF THE DISCLOSURE

A packaging machine for dispensing, filling and coverings receptacles automatically, such operations being performed at a plurality of work stations. The packaging machine includes a rotary support having a series of die elements thereon, each die element being adapted to receive an open top receptacle having a rim at a first station; at subsequent stations various operations are performed including measuring and delivering predetermined amounts of the ingredients into the receptacle and for positioning a cover on the receptacle. Thereafter a novel closing die assembly is provided at a station for engaging and clamping the rim and cover together to form a sealed receptacle.

This invention relates to a method and to a packaging machine or apparatus for making a food package of the type for storing and cooking food therein made of aluminum foil or other metal embodying a cooking utensil. More specifically, the food package prepared by the method and apparatus of this invention, is described in the Richard P. Dunn application entitled, "Popcorn Package," Ser. No. 583,590, filed in the U.S. Patent Office on Oct. 3, 1966 and assigned to assignee of record.

Food packages and in particular popcorn packages have been in commercial use in recent years. It is necessary in order to sell such popcorn packages at relatively low costs that they be manufactured economically and efficiently on a production basis. It is further necessary that the method and apparatus utilized in forming the food package meet State and Federal requirements pertaining to the public health, safety and welfare.

In the present invention a packaging machine is provided which includes an indexable turn table or rotary support having thereon a plurality of female die members, as an example, ten in number, such rotary support being indexable through a plurality of stations, as an example, six in number, where certain filling and forming operations are performed in order to provide a closed and sealed package containing a food product. The forming of a food package requires only one revolution of the rotary support.

The apparatus includes a first station where an open top aluminum foil receptacle is placed in the die element. Thereafter the table is indexed to move the receptacle to a second station where a predetermined and measured quantity of the popcorn or other food ingredients is dispensed into the open receptacle. Thereafter the rotary table is indexed to move the open receptacle containing popcorn to the third station where a metered amount of liquid ingredients is dispensed therein. Thereafter the rotary table is indexed to bring the receptacle to the fourth station where a cellophane or other light weight material cover is placed thereon. Thereafter the table is indexed to move the receptacle to a fifth station where a closing die assembly is energized to seal and close the receptacle and thus form a sealed food or popcorn package. Finally, the rotary support is indexed to move the closed package to a sixth station where means are provided for lifting the closed package from the die element and thereafter ejecting the package into a dispensing chute.

It has been found that the operation described heretofore may be fully automatic or semi-automatic depending upon the rate of production required and the cost involved in producing a package according to an automatic or semi-automatic method. It has been found that a popcorn package may be formed in approximately ten seconds when using a fully automatic apparatus while only four seconds are required to make a closed and sealed food package when a semi-automatic method is employed. The packing machine includes electrical, pneumatic and vacuum circuits which are constructed and arranged to provide maximum efficiency regardless of whether the machine is fully automatic or semi-automatic.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings wherein a preferred form of the present invention is clearly shown.

FIGURE 1 is a perspective view of a packaging machine or apparatus and associated containers and equipment.

FIGURE 1A is a vertical sectional view through an open top receptacle of circular outline.

FIGURE 2 is a perspective view of the packaging machine or apparatus looking from another direction and illustrating additional features of the packaging machine.

FIGURE 3 is a fragmentary view, partly in section of a fluid operated diaphragm type valve mechanism for measuring and dispensing a predetermined quantity or volume of certain ingredients, as an example, kernels of corn, into the receptacle.

FIGURE 3A is a sectional view taken on the line 3A—3A of FIGURE 3.

FIGURE 4 is a fragmentary view, partly in section, illustrating a fluid operated tapper or reciprocating piston device for tapping the bottom of the container or receptacle to evenly distribute the kernels or ingredients previously dispensed into the receptacle.

FIGURE 5 is a fragmentary view, partly in section, of the closing head and upper die assembly located at one of the stations of the apparatus, with such assembly in an inoperative raised position.

FIGURE 6 is a fragmentary view, partly in section, of the closing head and upper die assembly and illustrating such closing assembly in an operative position.

FIGURE 7 is a fragmentary view, partly in section, taken substantially on the line 7—7 of FIGURE 5.

FIGURE 8 is an enlarged fragmentary sectional view of portions of the lower die unit or element and the rotary support or table.

FIGURE 9 is a fragmentary elevational view illustrating the fluid cylinder and linkage mechanism associated with the closing head and upper die assembly of FIGURES 5 and 6.

FIGURE 10 is a fragmentary elevational view illustrating a fluid operated piston device for lifting the closed package from the lower die unit or element at the discharge station.

FIGURE 11 is an elevational view of a cellophane cutting apparatus which cuts the covers for the receptacles.

FIGURE 12 is a fragmentary view, partly in section, through the cutter of the cellophane cutting apparatus taken substantially on the line 12—12 of FIGURE 11.

FIGURE 13 is a schematic pneumatic circuit diagram for the automated packaging machine illustrated in FIGURES 1 and 2.

The packaging machine is designated in FIGURES 1 and 2 by the numeral **10** and includes a centrally located lower tubular column or support **12** having a metal base **14**. The base **14** rests upon a rubber or resilient pad or mat **15** which absorbs the shocks created during the operation of the machine **10**. The upper end of the lower col-

umn 12 is provided with a bronze bearing, not shown, and a Teflon bearing, not shown, upon which is mounted the rotary table or support 16. An upper tubular column extension or support 18 having a mounting collar or sleeve 19 is provided which cooperates with the aforementioned bearings, not shown, and helps to support the table 16 and in addition thereto provides support for certain brackets and equipment of the machine 10 as will subsequently appear. The lower column 12 and the upper column 18 remain stationary during the rotation of the table 16 about the aforementioned bearings as will subsequently appear.

Mounteld on top of the rotary table or support 16 are ten female dies or elements 20. It should be appreciated, however, that any number of female dies or die assemblies may be utilized when practicing the present invention. The die elements 20 are circumferentially spaced apart, an equal distance, adjacent the outer periphery of the table 16 as best illustrated in FIGURES 1 and 2.

Associated with the packaging machine 10 is a stainless steel drum or container 22 having a plurality of legs 24. The drum 22 is provided with an agitator 26 having a shaft 28 extending into the interior of the drum 22. The inner end of the shaft 28 is provided with an impeller or blade 30. The agitator 26 is driven by an electric motor 32 which is adapted to be connected to a source of current not shown. Located beneath the container 22 as a separate unit is an electric burner or coil 34 mounted upon a plurality of legs 36. The container 22 is adapted to hold vegetable oil or shortening, salt, butter coloring, and certain other ingredients well known in the art. The mixed ingredients are adapted to be mixed with kernels of corn in the receptacles as will subsequently appear. The heating element or burner 34 maintains the ingredients in the drum 22 at a predetermined temperature and in a liquid state. When the level of the liquid ingredients in drum 22 drops below a certain level, shortening from a heated drum or container 40 is pumped into the drum 22 automatically by means of the pump 42 and conduit 44. The rotating impeller 30 mixes the various ingredients in container 22.

The apparatus or machine 10 includes six stations where certain filling and packaging operations are performed. Station I is a loading station where a receptacle 46 of the type illustrated in FIGURE 1A is placed in the female die element 20 either manually or by means of certain automatic equipment, as an example, a delivery chute having afluid operated gate which permits a receptacle 46 to be introduced into the die element 20 automatically. The receptacle 46 forms one portion of an improved popcorn or food package of the type which is disclosed and described in the copending Richard P. Dunn application, Ser. No. 583,590, filed Oct. 3, 1966, assigned to assignee of record. Such popcorn package essentially comprises the shallow frying vessel, receptacle or pan 46 which is of circular outline in plan and frusto-conical in elevation, i.e., generally trapezoidal in the diametral plane of FIGURE 1A. The material of receptacle 46, for example, aluminum foil, is of sufficient thickness that it is semi-rigid and self-sustaining as to shape when handled prior to and during intended use. The package further includes a flexible cover 47 as best illustrated in FIGURES 5 and 8, preferably of cellophane or other suitably transparent material although a suitable gauge of metal foil or non-transparent material may be employed. The present machine is adapted to place a charge 49 of kernels of corn in the receptacle 46 along with certain liquid ingredients from container 22, such as a suitable frying agent and the usual other ingredients, agents, flavoring or otherwise, such as salt, butter, artificial color, etc. The receptacle 46 includes an integral flange formation 48 at the top of the span side wall 50. The formation 48 includes a generally horizontal rim or ledge portion 52 of substantially radially outward extent above the entire top periphery of the pan side wall 50 and an upright cylindrical rim 54. The rim 54 is subsequently bent and folded at station V to form the package as will subsequently appear.

After the receptacle 46, of the configuration illustrated in FIGURE 1A, is placed in the die element 20 at station I, the rotary table 16 is indexed sequentially in a step by step manner. At station I Ia charge 49 of kernels of corn from hopper 64 are dispensed into the receptacle 46 via a measuring and dispensing valve mechanism 60 as will subsequently be described. Thereafter the table 16 is indexed to station III where the ingredients from drum 22 are dispensed into the receptacle 46 which was previously filled with a charge 49 of kernels of corn. Thereafter the table 16 is indexed to bring the charged receptacle to station IV where the pre-cut cellophane cover 47 is placed over the top of the receptacle 46. Thereafter the table 16 is indexed to move the receptacle 46 from station IV to station V where certain closing mechanism is employed to close the receptacle and seal the contents thereof to form the popcorn or food package as will subsequently be described in detail. Thereafter the table 16 is indexed to bring the closed package at station V to station VI which serves as the discharge station. At such station the closed package is lifted from the corresponding female die element 20 and is ejected from the machine 10 into a discharge chute as will subsequently appear.

Station II includes the measuring and dispensing valve mechanism 60 (FIGURE 3) which is connected by a supply conduit 62 to a hopper or container 64 in which is located kernels of corn. The kernels in hopper 64, as an example, are gravity fed to the valve mechanism 60. The conduit 62, as an example, may be made from stainless steel tubing.

The valve mechanism 60 includes an upper diaphragm type valve 66 and a lower diaphragm type valve 68. Valves 66 and 68 are of identical construction and are pneumatically operated. Valves 66 and 68 are of circular cross-section (FIGURE 3A) and each of such valves includes a tubular housing 70. Located in the housing 70, which may be made from aluminum or other suitable material, is a tubular rubber sleeve, bushing or diaphragm 72, as an example, made from gum rubber. Each sleeve 72 has a length greater than housing 70. The upper and lower ends of the rubber sleeve 72 extends beyond the upper and lower ends respectively of the housing 70 and are reversely bent over the ends of the housing 70 as best illustrated in FIGURE 3. Each valve 66 and 68 includes upper end lower clamps 74 and 76 which engage the exposed end portions of the sleeve 72 and secure all of the parts together as a unit. The ends of each clamp 74 and 76 are connected by means of a nut and bolt 78. The housing 70 is provided with an opening 80 which receives one end of a supply conduit 82. The other end of the conduit 82 is adapted to be connected to a source of air as will subsequently appear.

The lower end of the upper valve 66 is provided with a tubular extension 84 which fits into a removable sleeve 86 made from vinyl or other suitable material. The other end of the vinyl sleeve fits over the upper end of a tubular extension 88. The lower end of extension 88 is received in the resilient sleeve or conduit 72 of the lower valve 68. The lower end of the valve 68 is provided with a tubular extension 90 as shown in FIGURE 3.

The valve mechanism 60 further includes an upper mounting plate 92 and a lower mounting plate 94, each plate being of circular configuration. The conduit 62 extends through a centrally located opening in plate 92 and is sleeved in the upper end of the valve 66. The extension 90 extends through a centrally located opening in the lower mounting plate 94 as best illustrated in FIGURE 3. Each plate 92 and 94 is provided with four circumferentially spaced openings which receive vertically extending support rods 96. The rods 96 maintain the mounting plates 92 and 94 in vertically spaced relation. A bracket 98 illustrated in FIGURE 1, as an example,

secures the valve mechanism **60** to the center post or column **18**.

In operation, a supply of air to the lower valve **68** closes same as is illustrated by the dotted line position of the diaphragm or sleeve **72** in FIGURE 3. The kernels of corn are fed into the measuring and dispensing valve mechanism **60** to form a charge **49** aforesaid. After the valve mechanism is filled, the upper valve **66** is energized and the diaphragm **72** is moved to a closed position to close valve **66**. Simultaneously, the supply of air is cut off from the lower valve **68**. As a result valve **68** opens and the charge **49** of the kernels of corn trapped in the valve mechanism **60** is dispensed through conduit **90** into the receptacle **46** at station II. It should be appreciated that the quantity or volume of the material trapped in the valve mechanism **60** may be varied by changing the length of the vinyl sleeve **86** and by adjusting the position of the rods **96** by turning the nuts **97**. Thereafter the table is indexed so as to move the charged receptacle receptacle **46** to station III.

The table **16** is provided with a centrally located opening **102** below each female die element **20**. In addition a pin locating opening **104** is also provided below each of the female die elements **20** and is used for a purpose to be subsequently described. Station III includes a fluid or pneumatic cylinder **106** having a piston element **108** therein. The cylinder **106** is mounted below table **16** on a bracket **110** appropriately secured, as an example, to the lower column **12**. Prior to dispensing the liquid ingredients at station III, the cylinder **106** is energized and thereby reciprocates the piston **108** which taps the bottom of the receptacle **46** so as to evenly distribute the kernels of corn therein as will readily appear when referring to FIGURE 4.

Station III includes a metering valve means **112** for measuring and delivering a predetermined amount of liquid ingredients from the container **22** to the charged receptacle **46** at station III. The metering valve **112** may, as an example, be in the form of a two-way valve or a four-way valve, such metering valve having a center position and a delivery position. The metering valve **112** is connected by a supply conduit **114** to the delivery side of a pump **115**. The pump **115** is mounted on container **22** and is in fluid communication with the container **22** as best illustrated in FIGURE 1. When the metering valve **112** is in the center position, the pump **115** delivers the liquid from container **22** through the supply conduit **114** and metering valve **112**, in the center position, and then through the return conduit **116** to container **22**. The return conduit **116** is connected between the metering valve **112** and the container **22**. Thus a closed recirculating circuit is provided for the container **22**. When the metering valve **112** is in the delivery position, the pump **115** delivers the liquid ingredients through supply conduit **114** to the open port of the metering valve **112** which in turn meters and dispenses a predetermined quantity or volume into the previously charged receptacle **46**.

After the liquid ingredients have been mixed with the kernals of corn in the charged receptacle **46**, the table is then indexed to move such receptacle to station IV. At such station a cover **47** of the type heretofore described is placed on the top of the receptacle **46** either manually or by means of an automatic dispensing mechanism, such as a vacuum controlled pickup arm which picks up one cover **47** at a time and moves same over the receptacle **47** at station IV.

FIGURES 11 and 12 illustrate and apparatus or machine **114** for cutting the cellophane covers **47**. The appartus **114** includes a frame **116** having a base **118**, a column **120** at one side of the base **118** and an overhanging forwardly extending bracket or support **122** at the upper end of the column **120**. The apparatus **114** further includes a tubular column **123** having a vertically movable spindle **124** therein. The spindle **124** is provided with an adjustable chuck **126**. A pneumatic cylinder **121** is provided for vertically reciprocating the spindle and chuck and the associated female die **132** carried by the chuck **126**.

The apparatus **114** includes an adjustable platform or bed **128** upon which is mounted a male die **130**. The male die **130** has an opening **127** and is provided with a steel rule die **129** having an annular upwardly extending serrated edge **131**. The female die **132** aforesaid is provided with a rod **134** supported by the adjustable chuck **126**. The female die **132** is provided with a rubber insert **136** which is provided with a circular slot **138** arranged on a diameter.

Mounted on the bracket **122** intermediate the column **120** and the column **123** are a pair of spaced apart roll brackets **140** which carries a shaft **142** for supporting a roll of cellophane material **144**. The leading end of the cellophane material **144** extends vertically downwardly and is guided around a guide roll **146** carried by a bracket **148** fixed to the bed **128**. The cellophane material **144** extends across the male die **130**. When the pneumatic cylinder **121** is energized, the female die **132** severs a cover **47** from the material, with each cover **47** falling into a container **150** through the opening **127** and a corresponding opening in the bed **128**. Automatic means, not shown, may be provided for feeding the strip material **144** intermittently across the male die **130** while simulaneously reciprocating the female die **132** in timed relation with the feeding cycle to cut the covers **47**. This same operation may be performed automatic or semi-automatic.

After a cover **47** has been placed on the receptacle at station IV, the table or rotary support **16** is then indexed so as to move the covered receptacle to station V. FIGURES 5–9 inclusive illustrate a closing head or die assembly **152** and other means at station V. The assembly **152** includes a centrally located tubular shaft or element **154** which is provided on the interior thereof with a tubular or hollow shaft or element **156**. The upper end of the outer shaft **154** extends through and is fixedly secured to a stationary bracket **158** mounted on the apparatus **10** and is thus held against movement. The inner shaft **156** extends above the fixed bracket **158** and through a movable lever **160** and is held thereon by a nut **161**. The shaft **156** is fixedly secured to the lever **160** and is movable therewith. A cylinder **162**, as best illustrated in FIGURE 9, is interposed between an arm **164** of the stationary bracket **158** and an intermediate portion of the lever **160**. The cylinder portion of the cylinder **162** is connected to the arm **164** by fastening means **165** while the movable rod portion of the cylinder **162** is connected to lever **160** by fastening means **163**. Thus, when the cylinder **162** is energized, the lever **160** is moved through a range of 12°. As a result thereof the inner shaft **156** is rotated through a range of 12° as will subsequently appear.

The closing head or die assembly **150** includes a hollow upper closing die **164** which has a hollow inner closing die **166** located therein. The outer die **164** is provided at the bottom edge thereof with an annular forming edge **167** having a 30° taper. The inner closing die **166** is provided at the bottom edge thereof with a flat relatively narrow generally horizontal forming edge **169**. The outer closing die **164** is provided wih a tubular collar **168** which movably receives the tubular collar **172** provided on the inner closing die **166**. The inner and outer closing dies **164** and **166** are sleeved over the outer shaft **156** and are movable with the respect thereto as best illustrated in FIGURES 5 and 6. Means are provided for moving the closing dies **164** and **166** with respect to the fixed outer shaft **156** and such means include a pair of pneumatically operated toggle devices **170** to the over center type. An annular clamp **176** is located around the collar **168** and is provided with a pair outwardly extending ears **178**. Each toggle device **170** includes a pair of pivotally connected levers **180** and **182**. The adjacent ends of levers **180** and **182** are pivotally connected by means of a pivot pin or device **184**. The outer end of lever **182** is connected to the ear **178** by means

of a pin **186**, while the outer end of the other lever **180** is fixedly connected to a stationary support bracket **188** by means of a pin or bolt **190** as best illustrated in FIGURES 5 and 6. The support bracket **188** is connected to the frame of the apparatus. Each toggle device **170** is provided with a pneumatic cylinder and piston device or motor **189** for moving the outer closing die **164** from the raised position shown in FIGURE 5 to the closing position of FIGURE 6. When in the closing position the forming edge **167** of the outer die **164** bends the flange **54** of the receptacle **46** inwardly at 30° to form an annular groove in the receptacle **46**. The over center action of the pneumatically operated toggle devices **170** lock the die **164** in operative position.

The outer closing die **164** and the inner closing die **166** have a chamber **192** provided therebetween as best illustrated in FIGURE 6. Chamber **192** is connected to a source of vacuum through the connection **194** and to a source of air through the connection **196** as best illustrated in FIGURE 6. The aligned openings in the collar **168** and **172** are provided with a bushing **200** through which the stationary shaft **154** extends as illustrated in FIGURE 6. The inner closing die **166** is provided with a recess **202** in which is located a spring **204** which surrounds the shaft **154**. The spring **204** is located in the chamber **202** between the abutment surface **206** provided on the inner closing die **166** and the abutment surface **208** provided on the top of the forming die **210**.

The forming die **210** is fixedly connected to the lower end of the fixed shaft **154** and is provided with a centrally located opening through which the inner end of the movable shaft **156** extends. The forming die **210** is provided with a lower housing **212** having a frusto-conical side wall **213** and a flat bottom surface provided with a rubber disk **215** of approximately ⅛" thickness. The disk **215** is provided with a centrally located opening **217** through which a blast of air is directed as will be subsequently described. The housing **212** is provided with a cavity **214** in which is located a movable plate **216** fixed to the shaft **156**. The housing **212** is provided with four circumferentially spaced radially extending keyways **218**, each of which receives a tab **220** extending radially from the plate **216**. It should be observed that the plate **216** is fixedly connected to the rotatable shaft **156**. Thus when the shaft **156** is rotated the plate **216** also rotates and moves the four tabs **220** in their respective grooves **218**.

The forming die **210** further includes on the top surface of the lower housing **212** four relatively thin horizontally extending fingers or disks **222** made from a plastic material such as Teflon. The fingers **222**, in plan view, as shown in FIGURE 7 are each in the form of a quadrant of a circle. The fingers **222** are of identical construction and each finger **222** contains four elongated slots **224**, **226**, **228** and **230**.

Each of the four slots in each finger **222** movably receives an upstanding pin carried by either the movable plate **216** or by the upper housing **232**. The housing **232** is sleeved over and fixed to the outer shaft **154** and rests upon the top surfaces of the fingers **222**. The upper housing **232** carries pins **234**, **236** and **238** which are received in slots **224**, **226** and **228** respectively. Pin **240** is carried by the corresponding tab **220** on plate **216** and is received in slot **230**. With such a construction the four fingers **222** are adapted to be expanded radially upon rotation of the shaft **156** through 12° to urge the outer periphery of the cover **47** into the groove at the top of the receptacle **46** formed by the outer closing die **164**.

With the closing head assembly **152** in the position shown in FIGURE 5 the cylinders **184** are energized to move the three dies **164**, **166** and **212** downwardly. The forming die **212** contacts the cover **47** and urges same downwardly against the bottom and side of the receptacle **46**. Almost simultaneously therewith the outer closing die **164** bends the flange **54** on the receptacle **46** inwardly at 30° to form an endless groove. Almost simultaneously therewith, the cylinder **162** is energized so as to rotate lever **160** and the inner shaft **156** through 12°. As a result thereof the plate **216** carried by the inner shaft **156** is also rotated through a 12° range and the four pins **236** carried thereby engage the corresponding walls of the slots **226** and move the four fingers or disks **222** radially outwardly. As a result of such movement of the outer periphery of the cover **47** is urged into the previously formed groove in the receptacle **46**.

Upon the toggle devices **170** going over center a signal from signal valve **240'** is sent to cylinder **162** to move same in the opposite direction. As a result thereof the lever **160**, shaft **156** and plate **216** are rotated in the opposite direction through 12° to thereby retract the four fingers **222**. Finally when cylinder **162** is returned it operates valve W–3 through lever **160** moving cam **284** and as a result thereof the inner closing die **166** is urged downwardly to engage the upper receptacle flange **54** and urge same against the cover **47** to form a closed and sealed package as shown in FIGURE 8. Thereafter the cylinders **189** are energized in the opposite direction to return the closing head assembly **152** including the toggle devices **170** to the position shown in FIGURE 5.

Station V includes a column or support **242** located below the rotary support **16** directly beneath the closing head assembly **152**. Such column **242** supports the closing head assembly during the closing operation just described.

Thereafter the closed and sealed package is indexed from station V to station VI. Station VI includes a lifting device **244**, a spring return ejecting device **246** and a discharge chute **248**. The lifting device **244** includes, as an example, a pneumatically operated piston and cylinder device **250** having a head **252** which, when energized, is moved through the openings **102** in the rotary support **16** and die element **20** to engage the bottom of the closed package and move same upwardly to a position above the top of the die element **20**.

The ejecting device **246** is in the form of a pneumatically operated cylinder and piston device which is connected to the center post **18** on the inner side of the die element **20**. The device **246** has a head **247** and includes a spring for returning same to an inoperative position. The discharge chute **248** is located on the outer side of the die element **20**. The upper end of chute **248** rests upon the table **16** and the lower end of the chute rests upon a packing table **254** having legs **256**. The ejecting device **246** is energized after the closed package is in a raised position so as to move the head **247** against the package and thus move the package in a generally radially outwardly direction into the discharge chute **248**. Thereafter a person takes the sealed package and places same in a box or container along with other packages for subsequent shipment.

A pneumatically operated piston and cylinder device **260** is mounted beneath the table **16** to control the rotation of table **16**. The device **260** includes a rod **262**, the outer end of which is operatively connected by linkage means **264** to an arm which is connected, as an example, to a sleeve **266** depending from table **16**. The sleeve **266** is mounted on bearings as described heretofore. When cylinder device **260** is energized the rod **262** is stroked through a predetermined distance to move the table through a range of 36°.

The rotary table **16** is provided with ten holes **104** aforesaid, one hole **104** below each die element **20**. The apparatus further includes a table index pin **268** (FIGURE 1) which, when energized, is moved into the opening **104** after the indexing operation as will be described in more detail hereinafter. Thus the pin **268** locks the rotary support **16** in place so as to align the various die elements **20** at the proper positions with respect to the various work stations.

In order to carry out the operations described heretofore the apparatus **10** includes a Mead programmer

designated by the numeral **270** in FIGURE 2. The programmer **270** includes an electrical motor **272** which drives a shaft **274** having thereon a plurality of cams X, totaling eleven in number. Each cam X controls a three-way valve. Such three-way valves are designated V–**1** through V–**11** inclusive in FIGURE 13 which represents a schematic diagram of the pneumatic circuit included in the apparatus **10**.

The apparatus **10** further includes fourteen cylinders or pneumatic motors, some of which have been described heretofore. Such cylinder devices are designated in FIGURE 13 as C–**1** through C–**14** inclusive. Certain ones of the cylinders are provided with four-way control valves designated by the letters V–A through V–H inclusive in FIGURE 13. Such four-way control valves are used to control the direction of air to the cylinders as determined by the automatic programmer **270**. Cylinders C–**1**, C–**2**, C–**3**, C–**4**, and C–**9** have associated therewith three-way valves designated W–**1** through W–**5** respectively. Such three-way valves are used for specific purposes which will be described in detail hereinafter. Valve W–**5** has associated therewith a fixed orifice designated as FO–**1** in FIGURE 13 which is used to choke the exhaust supply in one operation on the machine **10** as will be explained hereinafter.

The apparatus **10** also includes four air regulators designated as R–**1** through R–**4** inclusive in FIGUE 13. Such regulators are adapted to decrease the pressure of the air when required, as is well known in the art.

Rather than designating the various lines and conduits (shown in FIGURE 13 and in FIGURES 1 and 2) which are used to connect the various components of the circuit, it is believed that the operation of the apparatus **10** and the circuit therefor may best be described by defining the individual function of each of the cylinders C–**1** through C–**14** inclusive along with the function of their respective control valves.

The schematic circuit or diagram illustrated in FIGURE 13 includes certain legends which briefly describe the particular functions of the components and which also refers to certain work stations previously described. Referring to FIGURE 13 it will be noted that cylinders C–**1** through C–**5** are all employed at station V. Cylinders C–**1** and C–**2** for closing dies **164** and **166** work together in the operation of securing the cover **47** to the receptacle **46** as described heretofore. Upon receipt of an impulse of air from the valve V–**7** (closer down, pan ejector up), valve V–A (closer) directs the flow of the air to the back ends of cylinders C–**1** and C–**2**. As a result thereof the piston rods in such cylinders are moved to an extended or out position. Such action lowers the closing head assembly **152** from the position illustrated in FIGURE 5 to the position illustrated in FIGURE 6 as described heretofore.

Through the camming mechanism **280** provided on cylinders C–**1** and C–**2**, valve W–**1** located adjacent such cylinders is made operational and directs an impulse of air to valve V–D (fingers **222**) which directs the flow of air to cylinder C–**3** on the back side thereof thereby moving cylinder C–**3** to an extended or out position. Upon reaching their extended position, cylinders C–**1** and C–**2** operate valve W–**2** located adjacent such cylinders which reverses the air flow in valve V–D (fingers) thus returning cylinder C–**3** to an in or retracted position. When cylinder C–**3** is moved to a retracted position it operates a mechanical cam **284** which actuates valve W–**3**. Valve W–**3**, when actuated, directs a pulse of air to control valve V–B for inner die **166** which is C–**5**. This directs the flow of air to cylinder C–**5**. As a result thereof cylinder C–**5** is urged downwardly to provide the final force required in closing and sealing the package.

Cylinder C–**6** controls the package ejector at station VI. Cylinder C–**6** is moved to an extended position when valve V–C receives an impulse of air from valve V–**7** to direct the flow of air to the back side of cylinder C–**6**.

Cylinders C–**1** and C–**2** are returned to their retracted position when valve V–**1** directs a signal to the other side of valve V–A, thereby redirecting the flow of air to the front side of cylinders C–**1** and C–**2**. As a result thereof the piston rods in cylinders C–**1** and C–**2** are moved in the opposite direction thus moving the closing head assembly from the position illustrated in FIGURE 6 to the position illustrated in FIGURE 5.

Cylinder C–**5** for the inner closing die **166** is returned to its original position, not by the pressure of air, but by vacuum. This is accomplished when valve V–**1** directs a signal to valve W–B thereby directing the flow of air to cylinder C–**4** which is operatively connected to vacuum control switch. Cylinder C–**4**, in the form of a spring return air cylinder, upon moving to its extended or out position actuates the valve W–**4** which opens cylinder C–**5** to a source or supply of vacuum.

Cylinder C–**6** is also moved to an end or retracted position when valve W–C receives an impulse of air or a signal from the valve V–**1** and as a result thereof directs the flow of air to the front side of cylinder C–**6**. Such action completes the operational sequence of cylinder C–**6**.

Cylinders C–**7** and C–**8** (corn valve or corn dispenser) work directly opposite from each other at station II. When valve V–**2** sends or directs an impulse of air to one side of the control valve V–E (corn valve) the flow of air is directed to cylinder C–**7** thereby closing such valve and simultaneously exhausting cylinder C–**8**. The reverse of the aforementioned operation between cylinders C–**7** and C–**8** is accomplished when the control valve V–E receives an impulse of air or a signal from valve V–**4** thus changing the direction of the flow of air.

When valve V–**4** is made operational it serves one additional purpose. Such valve V–**4** is effective to operate control valve V–F in such a manner so as to turn on a supply or blast of air which acts to blow the finished package at station V off of the bottom of the closing head assembly **152**.

Cylinder C–**9** which controls the rotation of the table **16** is in turn operated by valve V–**3** which rotates the table **16** in the forward direction and by valve V–**10** which returns the table rotater or cylinder C–**9**. When valve V–**3** directs an impulse of air to valve V–G, the flow of air is directed to the back and of cylinder C–**9**. As a result thereof cylinder C–**9** is moved to an out or extended position. When cylinder C–**9** has nearly completed its extending stroke, valve W–**5** is actuated by means of the mechanical cam **286** provided on the rod of cylinder C–**9**. As a result of such camming action the flow of exhaust air is redirected from the side of the cylinder C–**9** through the fixed orifice FO–**1**, thereby cushioning the movement of the rotary support or table **16**.

The reverse movement of cylinder C–**9** is provided by valve V–**10** which sends a signal or a pulse of air to valve W–G thereby opening the front end of cylinder C–**9** to the flow of air.

Valve V–**3** also directs a pulse of air or signal to the other side of valve V–F thus shutting off the blast of air previously mentioned.

Cylinders C–**10** and C–**11** are mounted and arranged to work directly opposite one another. Such action is controlled by a signal or a pulse of air from valve V–**5** to V–H, and V–**9** thus directing a signal to the other side of valve V–H. Valve V–**5** extends cylinder C–**10** and retracts cylinder C–**11** while valve V–**9** when operational accomplishes the opposite movement. No other components are controlled by valves V–**5** and V–**9**.

Cylinder C–**12** may be classified as an air return spring out air cylinder which is used to meter the amount of shortening, salt and butter flavor used in the popcorn package. Such metering operation is made possible by valve V–**6** which is held operational for a short period of time. As long as valve V–**6** is held operational, a supply of air is sent directly to the front side of cylinder

C–12 thus allowing the liquid solution or ingredients to be dispensed into the receptacle **46** at station III. When valve V–6 is de-activated cylinder C–12 is returned to its original position by means of a spring provided in the cylinder.

Cylinder C–13 is used to properly align the kernels of corn in the bottom of the aluminum recpetacle **46** at station III prior to the addition of the liquid solution or ingredients at such station. Cylinder C–13 is designated as an air operated spring return cylinder which is activated by a pulse of air from valve V–8.

Cylinder C–14 is of the same type as cylinder C–13 and is utilized at station VI to eject the finished package into the discharge chute **248**. This is accomplished through valve V–11 which is held operational for a predetermined period of time thereby directing the flow of air contained therein to cylinder C–14 to activate same.

The apparatus **10** further includes an electrical control box and panel **290** (FIGURE 2) having thereon a series of push buttons **292**, each button having a corresponding light, not shown. One push button is provided to close a corresponding switch, not shown, to in turn energize or operate the following: (a) vibrator, not shown on hopper **64**, (b) rotator, C–**9**, (c) agitator **26**, (d) oil pump **115**, (e) vacuum supply, (f) programmer **270**. The control box **292** is connected to such components by various leads or electrical conduits **296**. The pneumatic circuit also includes various gauges, safety valves and other standard components well known in the art.

Referring once again to FIGURES 5–8 inclusive it should be noted that the four radially movable fingers **222** are each provided with a downwardly tapered surface **223** at the outer periphery thereof. Each of the surfaces **223** is provided with a 30° taper. The outer closing die **164** urges the outer periphery of the cover **47** and part of the flange **54** against such surfaces **223** to complete the sealing and closing operation. The plate **216** of the forming die **212** is, as an example, keyed to the inner shaft **156** by a key and key-way means, not shown. The pins extending through the fingers **222** are made from hardened steel.

FIGURES 5 and 6 illustrate that each die element **20** is secured to the rotary support **16** by means of a ring-like element or member **21** located beneath the table **16** and by a plurality of bolts **23** secured to the member **21**, table **16** and die element **20** in the order mentioned as shown in FIGURE 6.

The drawings and the foregoing specification constitute a description of the improved method and apparatus for filling and closing a package in such full, clear, concise and exact terms as to enable any person skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What we claim as our invention is:

1. A packaging machine having a plurality of stations comprising a rotary support having a series of die elements thereon, each element being adapted to receive an open top receptacle having a rim at a first station, first valve means at a second station for measuring and delivering a predetermined amount of solid ingredients to the receptacle, second valve means at a third station for measuring and delivering a predetermined amount of liquid ingredients to the receptacle, means at a fourth station for positioning a cover on the receptacle, a closing die assembly at a fifth station for fixedly connecting the cover to the receptacle to close and seal same, means at a sixth station for lifting the closed receptacle from the corresponding die element and ejecting same from the machine, and means for indexing said rotary support from station to station in a step by step manner, said closing die assembly including a pair of relatively movable inner and outer closing dies, a forming die and a plurality of expandable fingers on said forming die, said closing die assembly upon operation thereof being moved toward the cover and receptacle, the forming die engaging the cover and moving same towards the bottom and sides of the receptacle, with the outer closing die engaging the rim on the receptacle and turning same inwardly to define an annular groove in the receptacle, and said fingers thereafter expanding and engaging the outer edge of the cover and inserting same into the annular groove of the receptacle, and thereafter said inner closing die engaging and clamping said rim and cover together to close said groove and to thereby form a sealed receptacle.

2. The packaging machine defined in claim **1** wherein said first valve means include an upper diaphragm type valve and a lower diaphragm type valve spaced from said upper valve, said valves being operated sequentially to trap and measure a predetermined amount of solid ingredients therebetween, said valves being operable simultaneously, with one of the valves always opened and the other valve always closed, said lower valve opening after the ingredients have been trapped and measured to permit the solid ingredients to discharge into the receptacle.

3. The packaging machine defined in claim **1** wherein tamping means are provided at said third station engageable with the bottom of the receptacle to evenly distribute the solid ingredients in such receptacle.

4. The packaging machine defined in claim **1** wherein said second valve means includes at least two ports, one port through which a metered amount of the liquid ingredients is injected into the receptacle and the second port which leads to the primary source of the liquid ingridients to permit recirculation thereof.

5. The packaging machine defined in claim **1** wherein said sixth station includes a fluid operated lifting device engageable with the bottom of the closed receptacle for moving same upwardly to a place above the upper surface of the die element.

6. The packaging machine defined in claim **5** wherein said sixth station includes a fluid operated ejecting device engageable with the raised container for removing same from the machine.

7. The packaging machine defined in claim **1** wherein fluid operated locking means are engageable with the rotary support for maintaining same in a locked position after the indexing operation.

8. A packaging machine comprising a support having a die element thereon which is adapted to receive an open top receptacle having a rim, means for measuring and delivering a predetermined amount of ingredients to the receptacle, means for positioning a cover on the receptacle, a closing die assembly located above said support for fixedly connecting the cover to the receptacle to close and seal same, said closing die assembly including a pair of relatively movable inner and outer closing dies, a forming die and a plurality of expandable fingers on said forming die, said closing die assembly upon operation thereof being moved towards the cover and receptacle, the forming die engaging the cover and moving same towards the bottom and sides of the receptacle, with the outer closing die engaging the rim on the receptacle and turning same inwardly to define an annular groove in the receptacle, and said fingers thereafter expanding and engaging the outer edge of the cover and inserting same into the annular groove of the receptacle, and thereafter said inner closing die engaging and clamping said rim and cover together to close said groove and to thereby form a sealed receptacle.

9. A packaging machine comprising a support having a die element thereon which is adapted to receive an open top receptacle having a rim, means for measuring and delivering a predetermined amount of ingredients to the receptacle, means for positioning a cover on the receptacle, a closing die assembly located above said support for fixedly connecting the cover to the receptacle to close and seal same, said closing die assembly including a tubular non-rotatable outer shaft, a tubular rotatable inner shaft in said outer shaft, a pair of relatively mov-

able inner and outer closing dies sleeved over and secured to said outer shaft and having a fluid chamber interposed therebetween for moving such dies relative to one another, a forming die secured to the lower end of said outer shaft and into which said inner shaft extends, a plurality of radially expandable fingers carried by said forming die, and cam operated means interposed between said fingers and said forming die, said cam operated means being actuated upon rotation of said inner shaft to effect radial movement of said fingers, said closing die assembly upon operation thereof being moved towards the cover and receptacle, the forming die engaging the cover and moving same towards the bottom and sides of the receptacle, with the outer closing die engaging the rim on the receptacle and turning same inwardly to define an annular groove in the receptacle, and said fingers thereafter expanding and engaging the outer edge of the cover and inserting same into the annular groove of the receptacle, and thereafter said inner closing die engaging and clamping said rim and cover together to close said groove and to thereby form a sealed receptacle.

10. The packaging machine defined in claim **9** wherein said forming die is provided with a cavity having a plate therein which is secured to said inner shaft, said forming die and said plate being provided with a plurality of pins which are received in slots provided in said fingers whereby rotation of said inner shaft rotates said plate and in turn urges the pins relative to the slots in said fingers to effect radial movement of the fingers.

11. A closing head assembly comprising a tubular non-rotatable outer shaft, a tubular rotatable inner shaft in said outer shaft, a pair of relatively movable inner and outer closing dies sleeved over and secured to said outer shaft and having a fluid chamber interposed therebetween for moving such dies relative to one another, a forming die secured to the lower end of said outer shaft and into

which said inner shaft extends, a plurality of radially expandable fingers carried by said forming die, and cam operated means interposed between said fingers and said forming die, said cam operated means being actuated upon rotation of said inner shaft to effect radial movement of said fingers.

12. The closing head assembly defined in claim **11** wherein said forming die is provided with a cavity having a plate therein which is secured to said inner shaft, said forming die and said plate being provided with a plurality of pins which are received in slots provided in said fingers whereby rotation of said inner shaft rotates said plate and in turn urges the pins relative to the slots in said fingers to effect radial movement of the fingers.

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